Chapter 2
Getting Started

A few things you should do when you first receive the unit.

About this Manual

IMPORTANT **Motors used must be suitable for Inverter duty.**

Note ***Do not attempt to control motors whose rated current is less than 25% of the drive rated current. Poor motor control problems may occur if you do.***

This manual is intended for use by the installer, user and programmer of the 890 drive. It assumes a reasonable level of understanding in these three disciplines.

Note ***Please read all Safety information before proceeding with the installation and operation of this unit.***

It is important that you pass this manual on to any new user of this unit.

How the Manual is Organised

This Engineering Reference manual is organised into chapters, indicated by the numbering on the edge of each page.

Information for all 890 units is included (890CS Common Bus Supply, 890CD Common Bus Drive, 890SD Standalone Drive).

The manual is more detailed than the relevant QuickStart manual, and so is of use to the unfamiliar as well as the high-end user.

Initial Steps

Use the manual to help you plan the following:

Installation

Know your requirements:

- certification requirements, CE/UL/CUL conformance
- conformance with local installation requirements
- supply and cabling requirements

Operation

Know your operator:

- how is it to be operated, local and/or remote?
- what level of user is going to operate the unit?
- decide on the best menu level for the Keypad (where supplied)

Programming (using the 890 DSE Configuration Tool)

Know your application:

- create/install the most appropriate Application
- enter a password to guard against illicit or accidental changes
- customise the keypad to the application

Equipment Inspection

- ♦ Check for signs of transit damage
- ♦ Check the product code on the rating label conforms to your requirement.

If the unit is not being installed immediately, store the unit in a well-ventilated place away from high temperatures, humidity, dust, or metal particles.

Storage and Shipping Temperatures			
Storage Temperature :	-25°C to +55°C	Shipping Temperature :	-25°C to +70°C

Refer to Appendix E: “Technical Specifications” to check the rating label/product code.
Refer to Chapter 11: “Routine Maintenance and Repair” for information on returning damaged goods.

Packaging and Lifting Details

Caution

The packaging is combustible. Igniting it may lead to the generation of lethal toxic fumes.

- ♦ Save the packaging in case of return. Improper packaging can result in transit damage.
- ♦ Use a safe and suitable lifting procedure when moving the unit. Never lift the unit by its terminal connections.
- ♦ Prepare a clear, flat surface to receive the drive before attempting to move it. Do not damage any terminal connections when putting the unit down.

Chapter 3
Product Overview

An introduction to the 890 range of products, and a quick look at the Keypads and available plug-in Options.

Product Range

The 890 range is designed to control standard 3-phase ac induction motors and brushless servo motors. There are three main types of 890:

890CS Common Bus Supply

The Common Bus Supply connects to AC and provides DC to the Common Bus Drive (s).

890CD Common Bus Drive

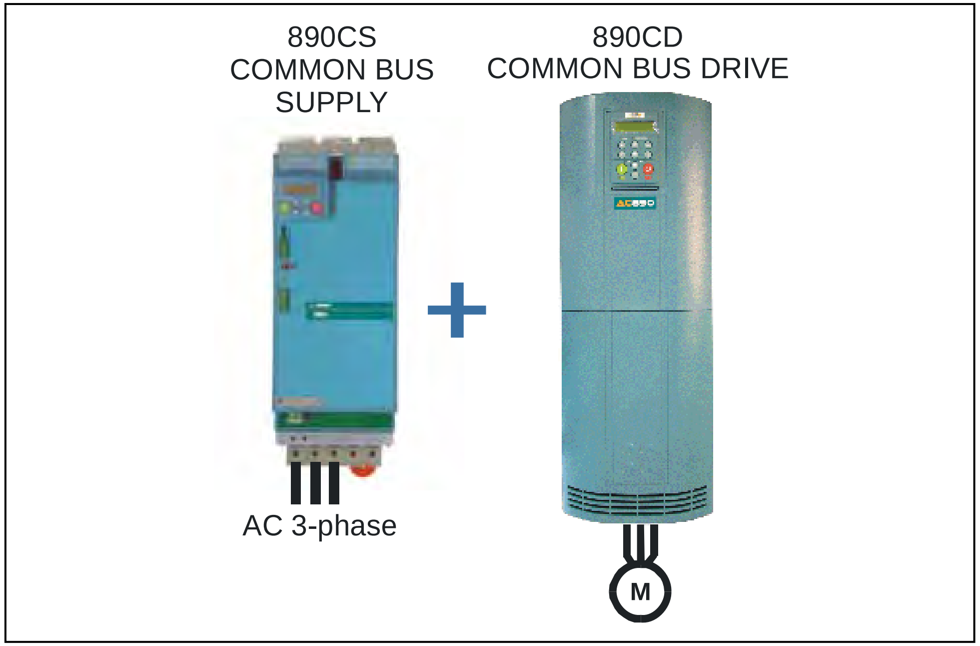
The Common Bus Drive(s) receives DC from the Common Bus Supply. It provides control for the motor.

The figure shows a Frame D Common Bus Supply linked to a Frame E/F Common Bus Drive.

890SD Standalone Drive

The Standalone Drive is AC supplied and provides control for the motor.

The figure shows a Frame E/F Standalone Drive.



Note ***All kW ratings are at 400VAC, all HP ratings are at 460VAC.***

The units are available in the following frame sizes:

890CS Common Bus Supply

FRAME B

32A AC (Frame B1)
nominal full load input current

54A AC (Frame B2)
nominal full load input current

FRAME D

108A AC (Frame D1)
nominal full load input current

162A AC (Frame D2)
nominal full load input current

890CD Common Bus Drive

FRAME E

30 – 55kW
40 – 75 HP

Maximum 87A Constant
Maximum 105A Quadratic
nominal full load output current

FRAME F

55 – 110 kW
75 – 150 HP

Maximum 180A Constant
Maximum 205A Quadratic
nominal full load output current

890CS/890CD Selection

The required rating for the 890CS input stage can be calculated by adding up the sum of the motor currents attached to the associated output stages. Refer to Appendix E: " Electrical Ratings: : 890CS - Calculation"

890SD Standalone Drive

	FRAME E 30 – 55kW 40 – 75 HP Maximum 87A Constant Maximum 105A Quadratic nominal full load output current		FRAME F 55 – 110 kW 75 – 150 HP Maximum 180A Constant Maximum 205A Quadratic nominal full load output current

Functional Diagrams

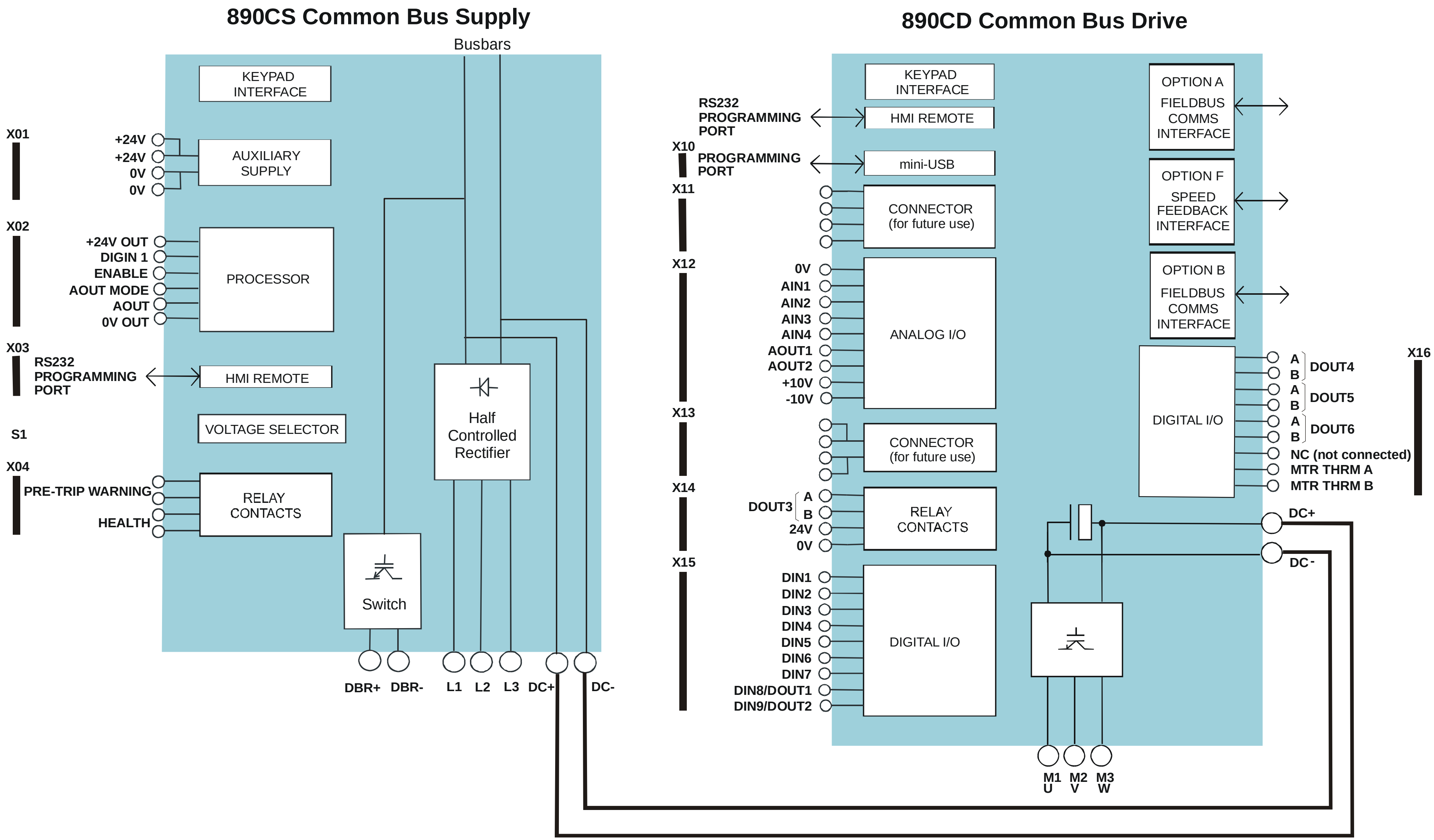


Figure 3.1 Functional Block Diagram of 890CS Common Bus Supply & 890CD Common Bus Drive

890SD Standalone Drive

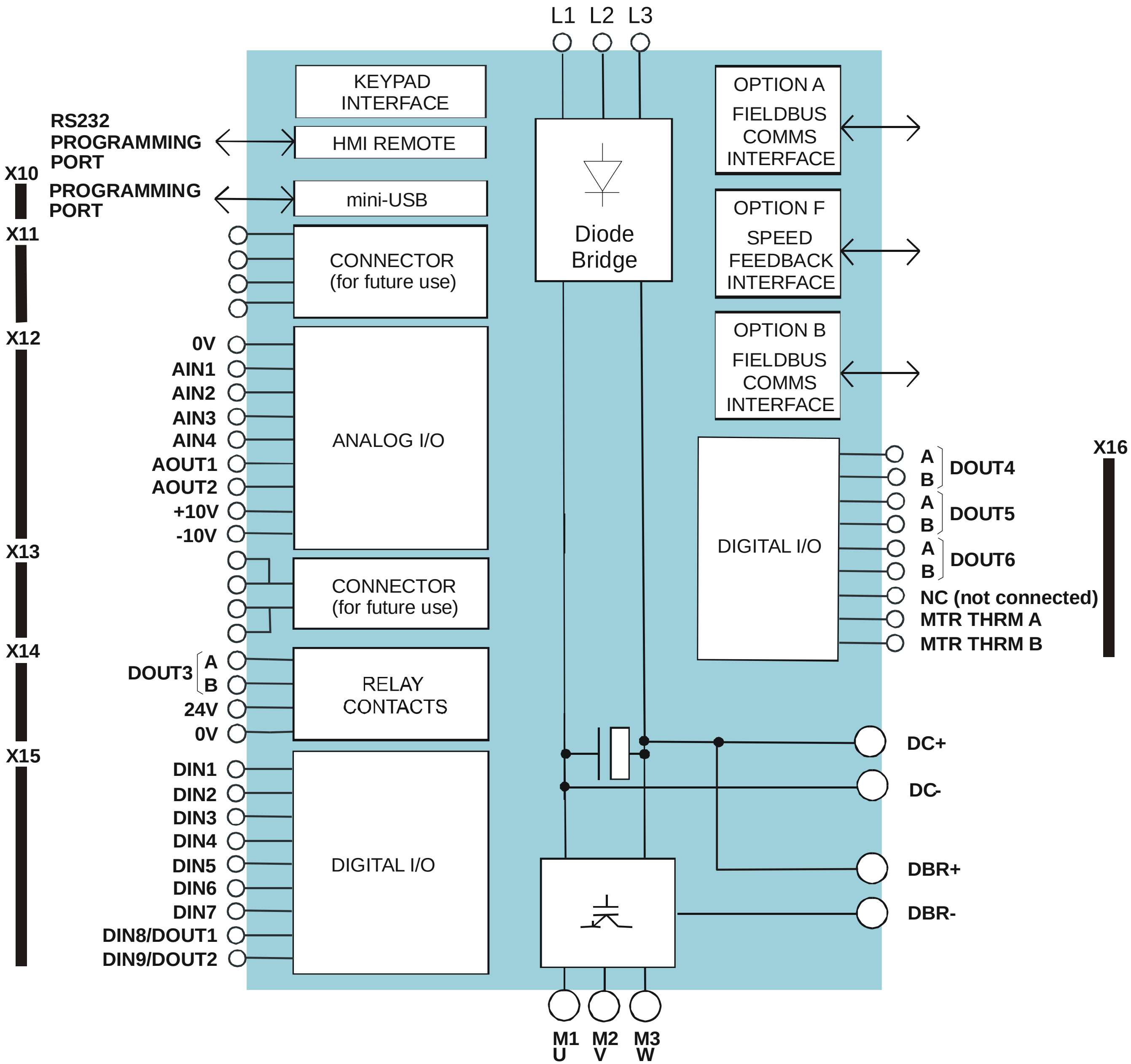


Figure 3.2 Functional Block Diagram of 890SD Standalone Drive

Keypads

The 890CS is fitted with the 6511 Keypad:

It provides Local control of the 890CS. For example, you can start and stop the motor and check on diagnostic information. The 6511 keypad fits to the front of the 890CS. You can also remote-mount the 6511 keypad up to 3 metres away. Another option is to remote-mount a 6901 keypad (as used on our larger 690+ drives).

6511 Keypad

The 890CD and 890 SD units are fitted with the 6901 keypad:

The 6901 keypad provides plain language programming on its larger display, and it also has the ability to upload, store and download parameters. For remote-mounting, you'll need the correct Remote Mounting Kit. Refer to Chapter 8: "The Keypad".

6901 Keypad

3

Option Cards

The 890CD Common Bus Drive and 890SD Standalone Drive can be fitted with a range of Option Cards. They are plugged into the removable Control Board.

- Feedback Board : Resolver type, Encoder type
- Fieldbus Comms - all major protocols

These are easily fitted to the plug-in Control Board.

For full details of the options available refer to Appendix A.

Control Board Access

You can access this board from the front of the unit by removing the lower front cover.

- It contains a Processor that provides a range of analog and digital inputs/outputs, together with their reference supplies.
- It has connections for the range of Option Cards.
- There is a mini USB port for connection to a PC. Use Parker SSD Drives' DSE 890 (Drive Systems Explorer) Configuration Tool to graphically program and configure the drive.

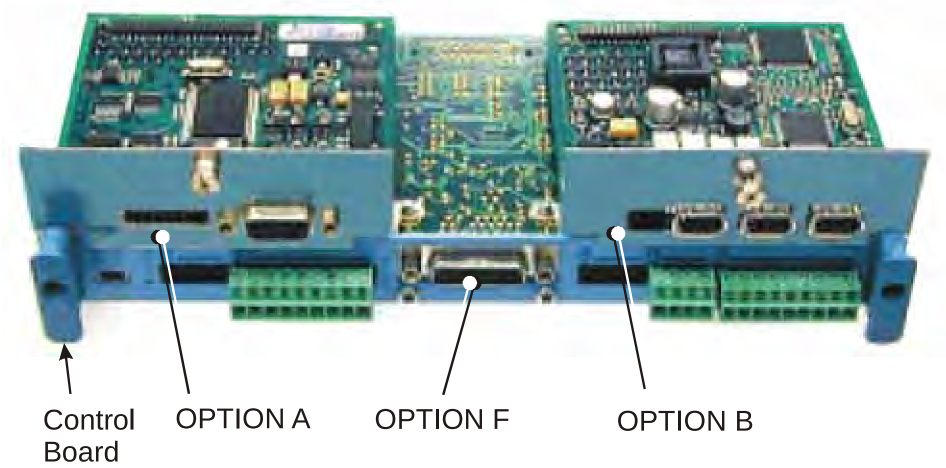


Figure 3.3 Diagram showing Option Cards fitted to the Control Board

Chapter 4

890CS & 890CD Common Bus Units

This chapter describes the mechanical and electrical installation of the Common Bus Units (890CS Common Bus Supply and 890CD Common Bus Drive). It discusses configuring your system, and how to turn the motor for the first time.

Follow the Steps for a successful installation.

Step 1: Mechanical Installation

Install the 890 units and associated equipment into the cubicle. The diagram shows a typical layout using Star Point earthing for EMC compliance. Refer to Appendix C for further information.

KEY

- **A** Analog Clean Earth
- **B** Back plate
- **C** Cubicle
- **E** Dirty Earth
- **F** Filter (optional)
- **G** Star Point Earth
- **H** Brake Resistor (optional)
- **M** Metal Work Earth
- **P** AC Fuse or circuit breaker
- **R** AC Line Reactor (mandatory)
- **S** Signal/Control Screen Earth
- **T** 24V Power Supply
- **V** DC Fuse

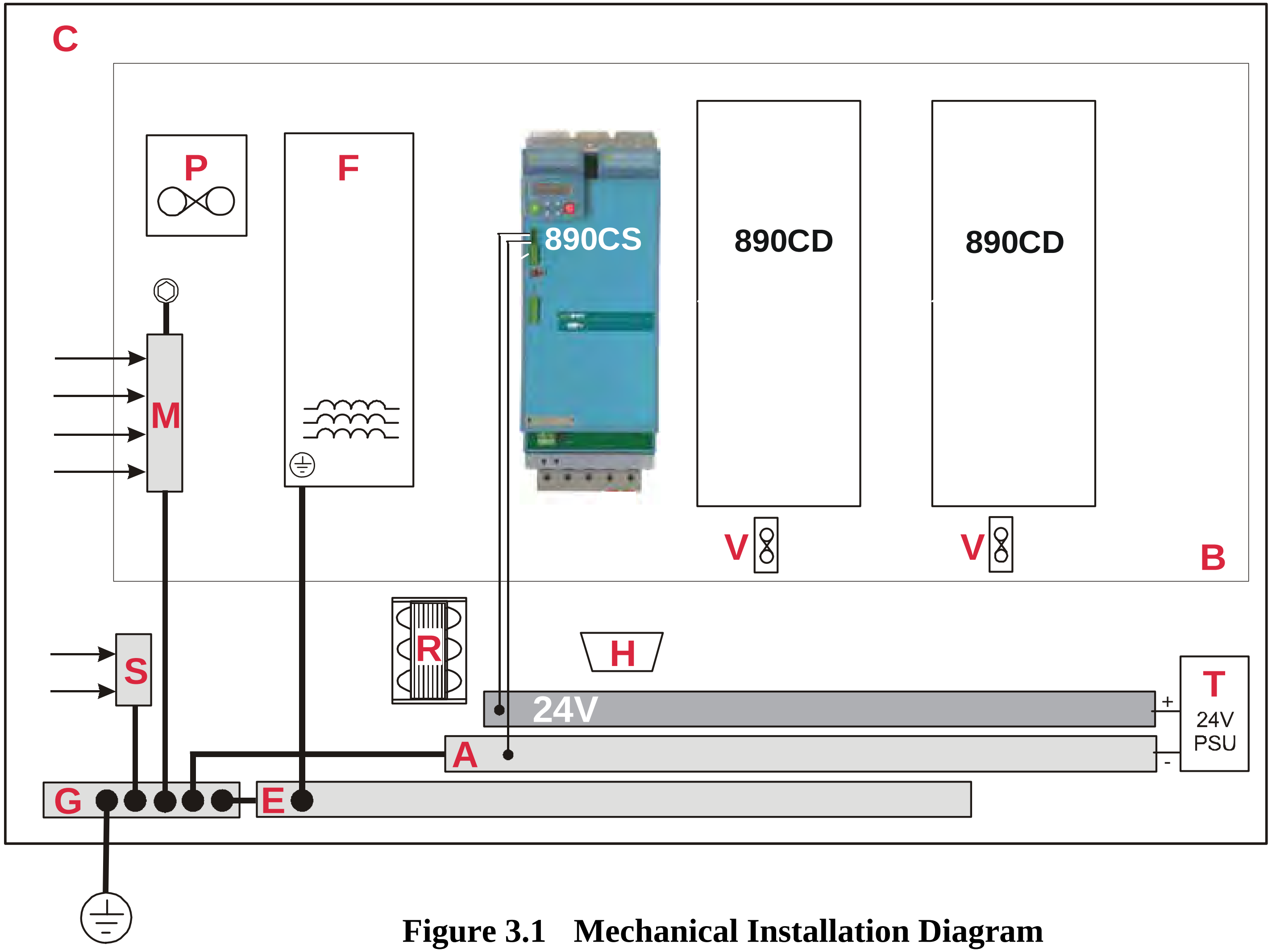


Figure 3.1 Mechanical Installation Diagram

Main Points

- These are cubicle-mounted units. They are not suitable for wall-mounting.
- Mount the units vertically on a solid, flat, normally cool, non-flammable, vertical surface.
- The 890CS can be DIN rail or panel mounted, the 890CD is panel mounted.
- Fit the 890 Installation kit to the bottom of the 890CS unit.
- 890CS units can be mounted side-by-side requiring no (side) air clearance.
- 890CD units do require (side) air clearance.
- Adequate ventilation must be provided.
- Avoid excessive vibration.
- The earth points (D, E, G, M & S) are shown separated - it may be possible to use one large star point without EMC problems, this will depend upon your application.

Note ***Refer to Appendix C for information about EMC compliance.***

Sizing the Enclosure

The enclosure must comply with the European safety standards VDE 0160 (1994)/EN50178 (1998) and will require a tool for opening.

The size of the enclosure will depend on many factors:

- Physical size and number of units
- Ventilation clearances
- Power output, affected by derating due to altitude and ambient temperature

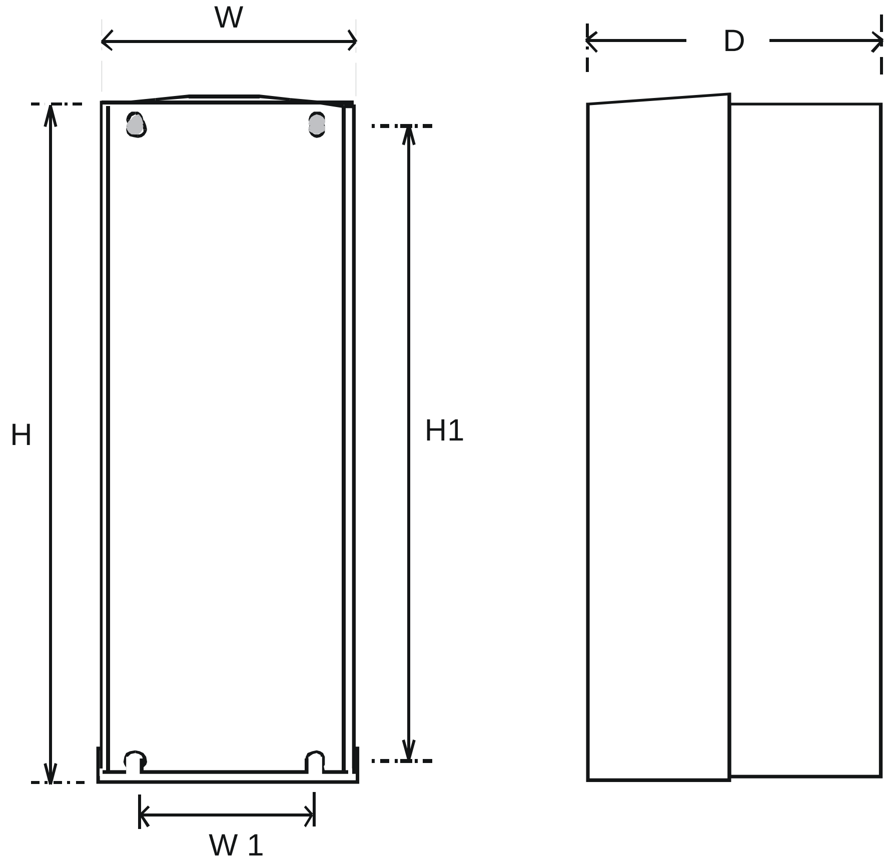
Enclosure/Environmental Information

The information here will help you to specify the enclosure to house the 890(s).

<table>
<tr><th colspan="3">890 Operating Conditions</th></tr>
<tr><td>Operating Temperature</td><td colspan="2">0°C to 45°C (32°F to 113°F)</td></tr>
<tr><td>Product Enclosure Rating</td><td colspan="2">IP20 - UL (c-UL) Open Type (North America/Canada) Type 1
Suitable for cubicle mount only</td></tr>
<tr><td>Cubicle Installation</td><td colspan="2">The 890 must be installed to EN60204 Standard in the cubicle. For USA, the cubicle shall meet the requirements of UL50.</td></tr>
<tr><td rowspan="5">Cubicle Rating</td><td colspan="2">Cubicle to provide the following attenuation to radiated emissions:</td></tr>
<tr><td>EMC Enclosure Standard</td><td>Attenuation to RF in spectrum 30-1000MHz</td></tr>
<tr><td>EN61800-3
2nd Environment</td><td>NONE</td></tr>
<tr><td>EN61800-3
1st Environment Restricted Distribution
EN61000-6-3:2001</td><td>10db</td></tr>
<tr><td>EN61800-3
1st Environment Unrestricted Distribution
EN61000-6-4:2001</td><td>20db</td></tr>
</table>

890 Operating Conditions	
Humidity	Maximum 85% relative humidity at 40°C (104°F) non-condensing
Atmosphere	Non flammable, non corrosive and dust free
Climatic Conditions	Class 3k3, as defined by EN50178 (1998)
Vibration	The product has been tested to the following specification: Test Fc of EN60068-2-6 10Hz<=f<=57Hz sinusoidal 0.075mm amplitude 57Hz<=f<=150Hz sinusoidal 1g 10 sweep cycles per axis on each of three mutually perpendicular axis
Safety	
Pollution Degree	Pollution Degree II (non-conductive pollution, except for temporary condensation)
Europe	When fitted inside an enclosure, this product conforms with the Low Voltage Directive 73/23/EEC with amendment 93/68/EEC, Article 13 and Annex III using EN50178 (1998) to show compliance.
North America/ Canada	Complies with the requirements of UL508C as an open-type drive.

Mounting Dimensions (890CD)

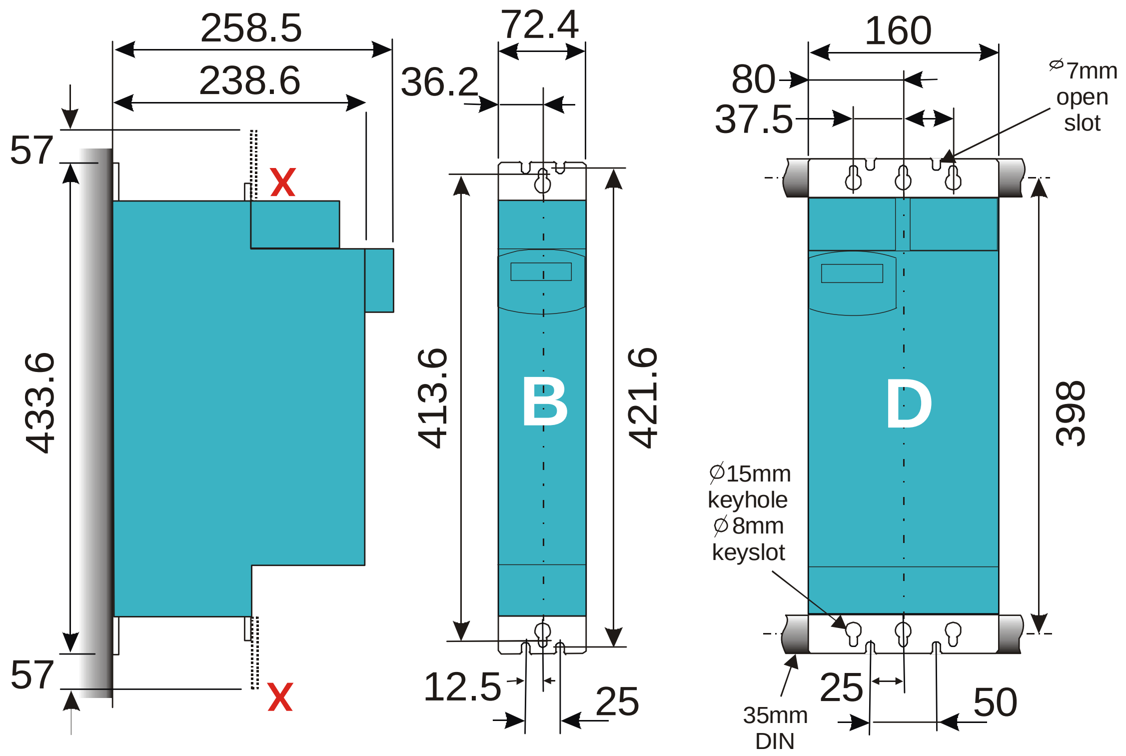


Approximate Frame E shown for illustration purposes

Models	Max. Weight: kg/lbs	H	H1	W	W1	D	Fixings
Frame E	32.5/72	668.6 (26.3)	630.0 (24.8)	257.0 (10.1)	150.0 (5.9)	312 (12.3)	Use M6 fixings
Frame F	41/90.4	720.0 (28.3)	700.0 (27.6)	257.0 (10.1)	150.0 (5.9)	355.0 (14.0)	Use M6 fixings
All dimensions are in millimetres (inches)							

Mounting Dimensions (890CS)

Mount the unit using the keyholes and slots, or fix to a DIN rail (35mm DIN).



Side view *Front view*

Dimensions are in millimetres. **X** *: Power Bracket - 890 Installation Kit*

890CS Weight Frame B 3.5kg/7.5lbs Frame D 8.7kg/19.2lbs

The 890 Installation Kit is supplied with your unit. The kit provides several options for earth/ground connections. It also includes the brackets for DIN rail mounting the unit. Refer to the instructions in the kit and use the appropriate parts.

Cables are considered to be electrically sensitive, clean or noisy. Plan your cable routes to segregate these cables for EMC compliance. Refer to Appendix C: "Certification".

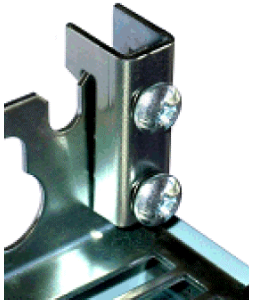
Panel Mount Fixings

Support the unit at the top and bottom with fixings to secure the unit to the panel. Mark and drill the fixing holes into the panel. Refer to the fixing centres given on the previous page. Insert the fixings into the top hole(s) and hang the unit. Insert the bottom fixing(s) and tighten to the required torque.

DIN Rail Mounting

The unit can be DIN rail mounted (35mm DIN).

Convert the unit to accept to DIN rail mounting:



1. Secure the DIN clips from the 890 Installation Kit into the threaded inserts at the top of the unit using the fixings supplied.
2. Hang the unit on the top DIN rail. Fix the DIN clips onto the bottom of the unit and clip onto the DIN rail.
3. Tighten both the top and bottom clips when the unit is in position on the rail.

Shield Bonding Clips

Fit the shield bonding clips to the Control Bracket/Power Bracket. Select slots providing a loose fit. This will then allow the clips to be tightened by hand.

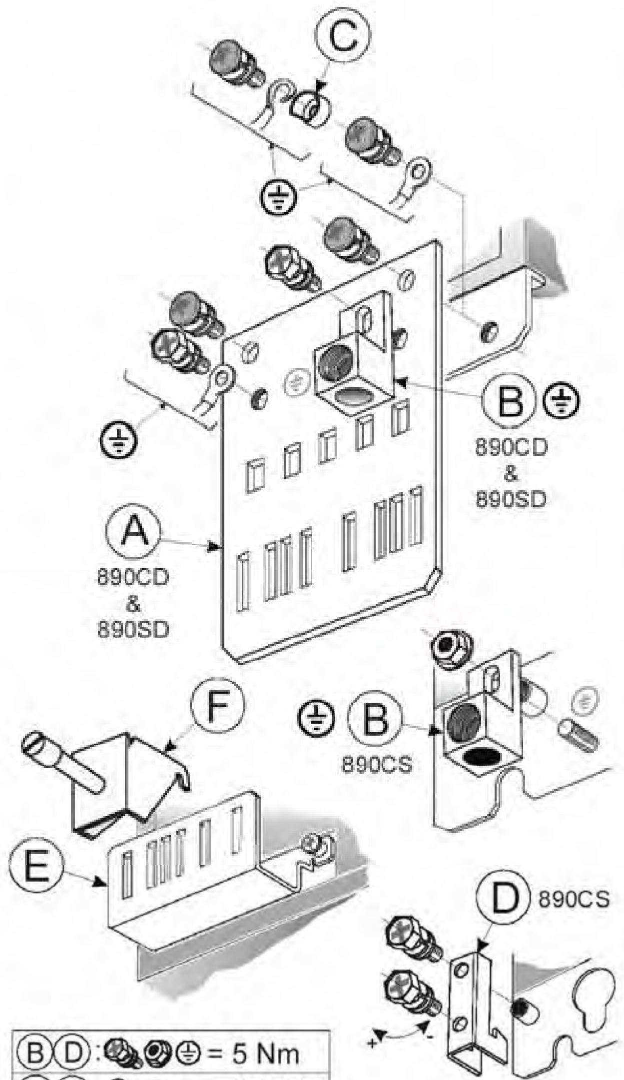
Note ***Do not squeeze the clip sides to produce a fit as this will crimp the sides to the clip's moving soleplate.***

890 Installation Kit

The fitting instructions for the kit used on the 890CS are reproduced below.

890 Installation Kit

Item	Description	SSD Part Number	Qty
	890CS : Common Bus Supply		
B	Ground Terminal M6 small	CI465312	1
	Ground Terminal M6 large	CI470521U001	1
C	Cup Washer M5	FX463522	2
D	DIN Clip	BA465900	4
E	Control Bracket	BA465887	1
	Screw Assembly M4 x 10mm	FY385649	2
	Screw Assembly M5 x 12mm	FY468470U012	8
	Nut Assembly	FZ463232	1
	Busbar Insulation 15mm	BC465938U015	2
	Busbar Insulation 200mm	BC465938U200	1
F	Shield Bonding Clip 8mm ∅	CI465892U008	1
	Screwdriver	JA465841	1
	Allen Wrench	JA465842	1
	890CD : Common Bus Drive		
A	Power Bracket	BA465888	1
B	Ground Terminal M6	CI465312	1
C	Cup Washer M5	FX463522	2
D	DIN Clip	BA465900	4
E	Control Bracket	BA465887	1
	Screw Assembly M4 x 10mm	FY385649	4
	Screw Assembly M5 x 12mm	FY468470U012	10
	Busbar Insulation 200mm	BC465938U200	1
F	Shield Bonding Clip 8mm ∅	CI465892U008	1
	Terminal Wiring Label	GA469181	1
	890SD : Standalone Drive		
A	Power Bracket	BA465888	2
B	Ground Terminal M6	CI465312	2
C	Cup Washer M5	FX463522	2
D	DIN Clip	BA465900	4
E	Control Bracket	BA465887	1
	Screw Assembly M4 x 10mm	FY385649	4
	Screw Assembly M5 x 12mm	FY468470U012	10
F	Shield Bonding Clip 8mm ∅	CI465892U008	1
	Screwdriver	JA465841	1
	Terminal Wiring Label	GA469181	1



B D: = 5 Nm

C A: = 2-3 Nm

F : Shield Bonding Clips

For larger sizes contact SSD Drives.

Part Numbers:

CI465892U014 - 14mm ∅

CI465892U020 - 20mm ∅

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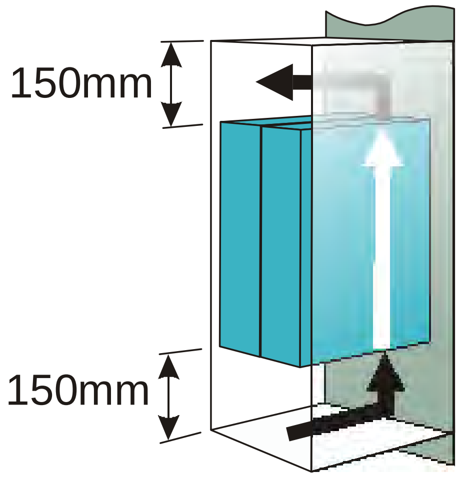
Minimum Air Clearances

The 890 gives off heat in normal operation. The mounting surface for the unit should be normally cool. Allow a free flow of air through the top and bottom ventilation slots and heatsink. Remember that any other equipment may have its own clearance requirements. If you mount next to each other, the clearances should be added to produce an overall clearance value.

890CS : Cubicle-Mount

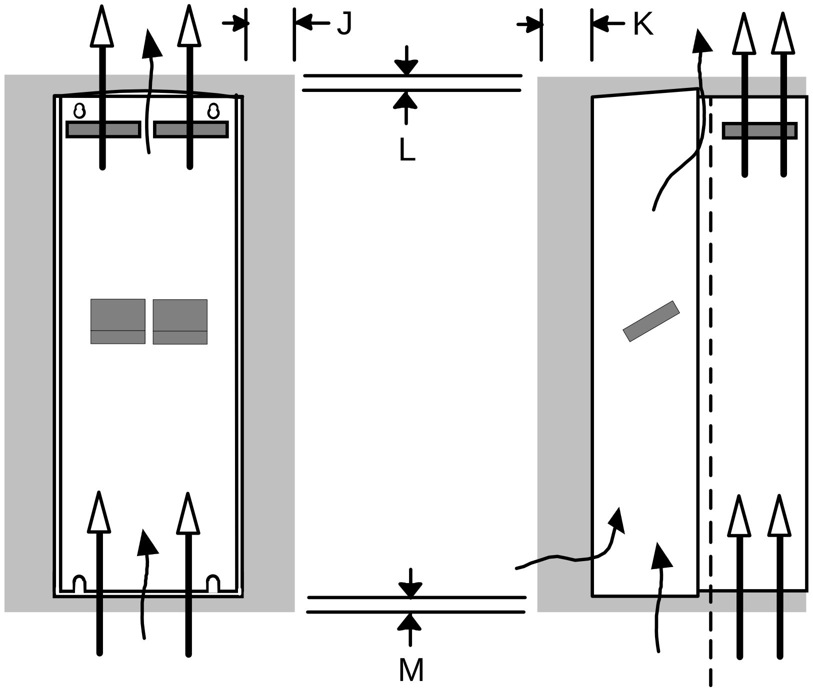
(Europe: IP2x, USA/Canada: Open Type).

890CS units are designed for mounting side-by-side as shown. A minimum of 150mm (6") free-air space must be allowed at the top and bottom of each unit.



890CD Frame E : Cubicle-Mount

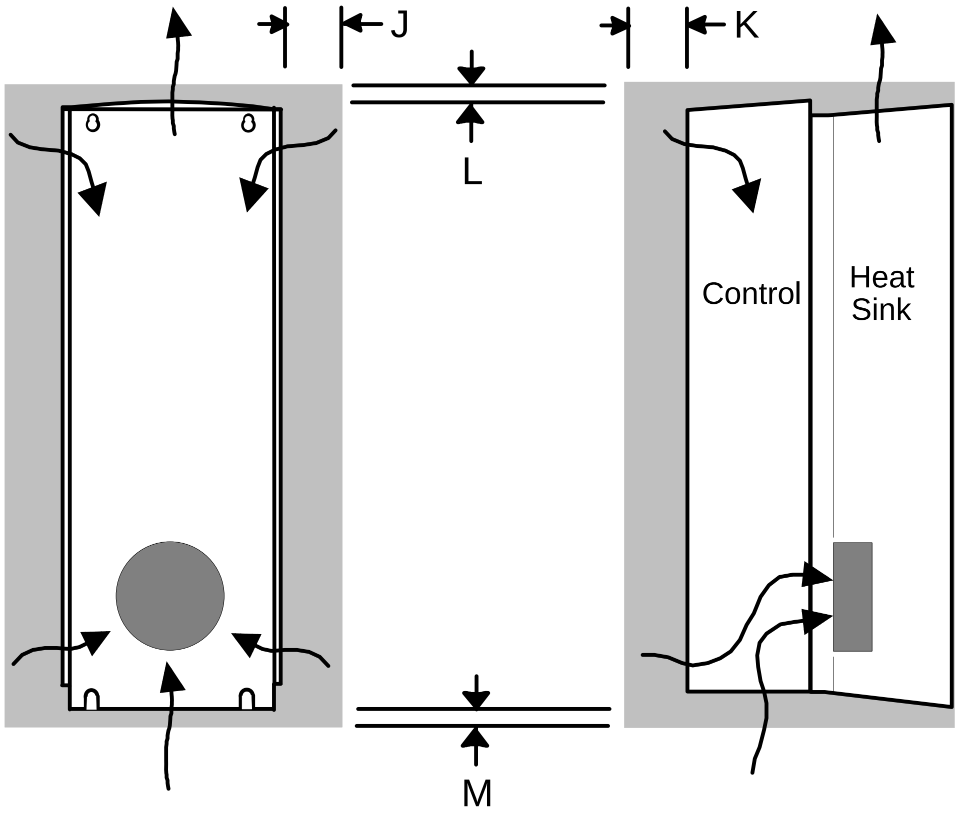
(Europe: IP2x, USA/Canada: Open Type).



Clearances for Standard Product (mm)			
J	K	L	M
0 (zero)	25	70	70

890CD Frame F : Cubicle-Mount

(Europe: IP2x, USA/Canada: Open Type).



Clearances for Standard Product (mm)			
J	K	L	M
0 (zero)	25	70	70

890CD Frame F : Duct Kit

Duct kit, Part Number LA466717U003.

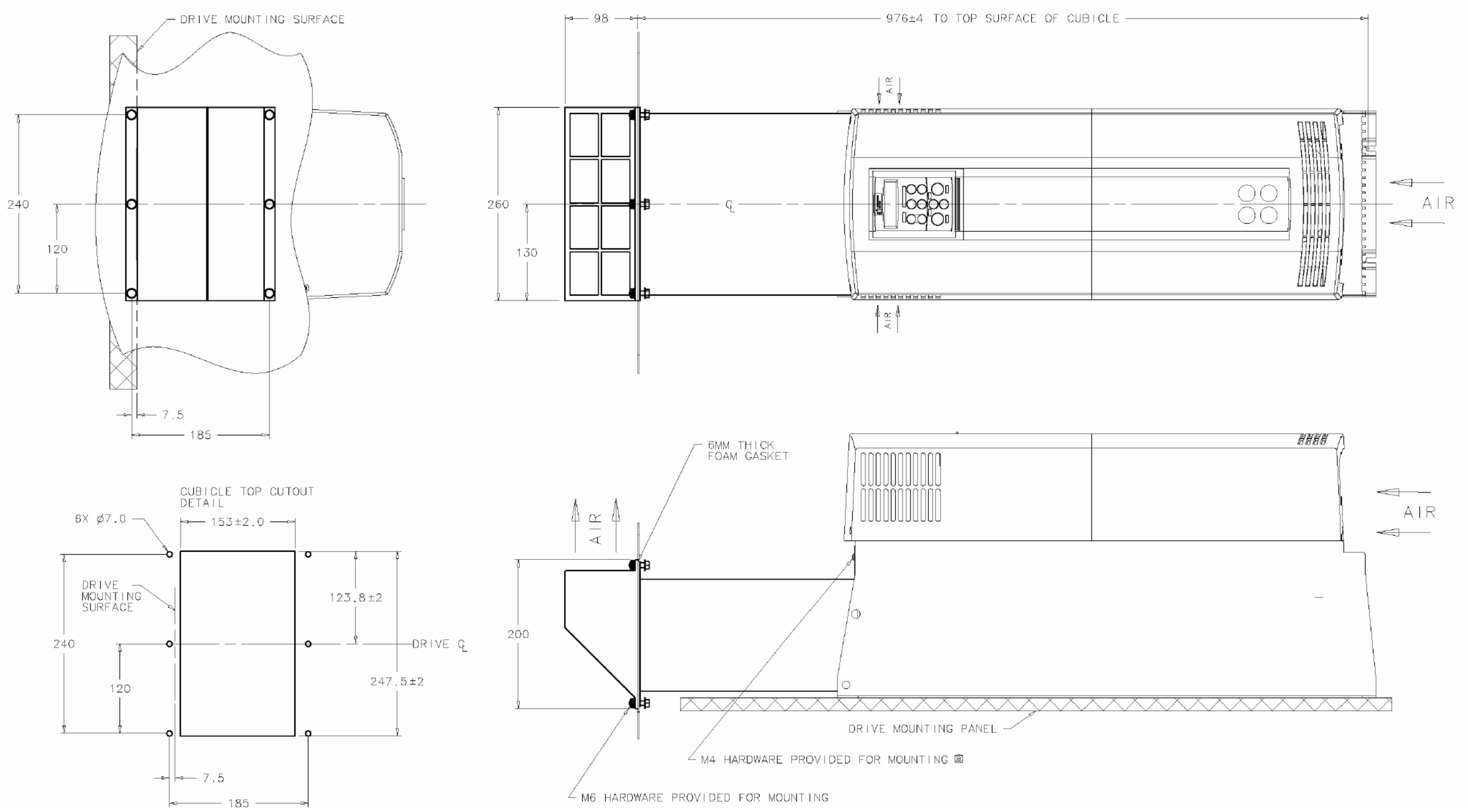
The installation diagram is provided on the following page.

Caution

Protect any equipment in the cubicle from swarf etc.
Ensure all equipment is isolated.

- The duct length determines the vertical position of the drive in the cubicle. Drill the lower mounting panel hole centres for the drive at 976mm from the top of the cubicle. There is a generous tolerance of ±4mm.
- Cut-out the hole for the duct directly above where the drive sits. Project the position of the drive mounting surface inside the cubicle and mark it on the roof. From the drawing, you can calculate that the cut-out is made 8.5mm in front of the drive mounting surface (the centres for the cowling fixing holes will be 7.5mm behind the drive mounting surface). Draw the cut-out shape, check its position, and cut it out.
- Because of the weight of the drive, it may be better to secure the drive in the cubicle first, and lower the duct into the cubicle from above.
- Fix the duct to the drive using the M4 fasteners.
- Fit the gasket between the duct cowling and the top of the cubicle to provide a good seal. Drill through and secure all this with the M6 fasteners.

890CD Frame F : Duct Kit Installation Diagram



Step 2: Connecting Power

In this section we are going to connect the 3-phase supply to the 890CS Common Bus Supply, and connect the 890CD Common Bus Drive(s) via the DC link.

We'll also connect the mandatory AC line reactor, the motor, and the (optional) brake resistor.

WARNING

During commissioning, remove the fuses (or trip the circuit breaker) on your 3-phase supply. Make sure the power is OFF, and that it cannot be switched on accidentally whilst you are working.

Solid-State Short-Circuit Protection

These devices provide Class 10 motor overload protection. The maximum internal overload proection level (current limit) is 150% for 60 seconds in Constant mode, and 110% for 60s in Quadratic mode. Refer to Appendix D: Programming - CURRENT LIMIT for user current limit adjustment information.

An external motor overload protective device must be provided by the installer where the motor has a full-load Ampere rating of less than 50% of the drive output rating; or when the MOTOR STALLED trip is TRUE (TRIPS STATUS::DISABLED WORD 1>>MOTOR STALLED); or when the STALL TIME parameter is increased above 480 seconds.

Each unit must be **permanently earthed** according to EN 50178.

For permanent earthing:

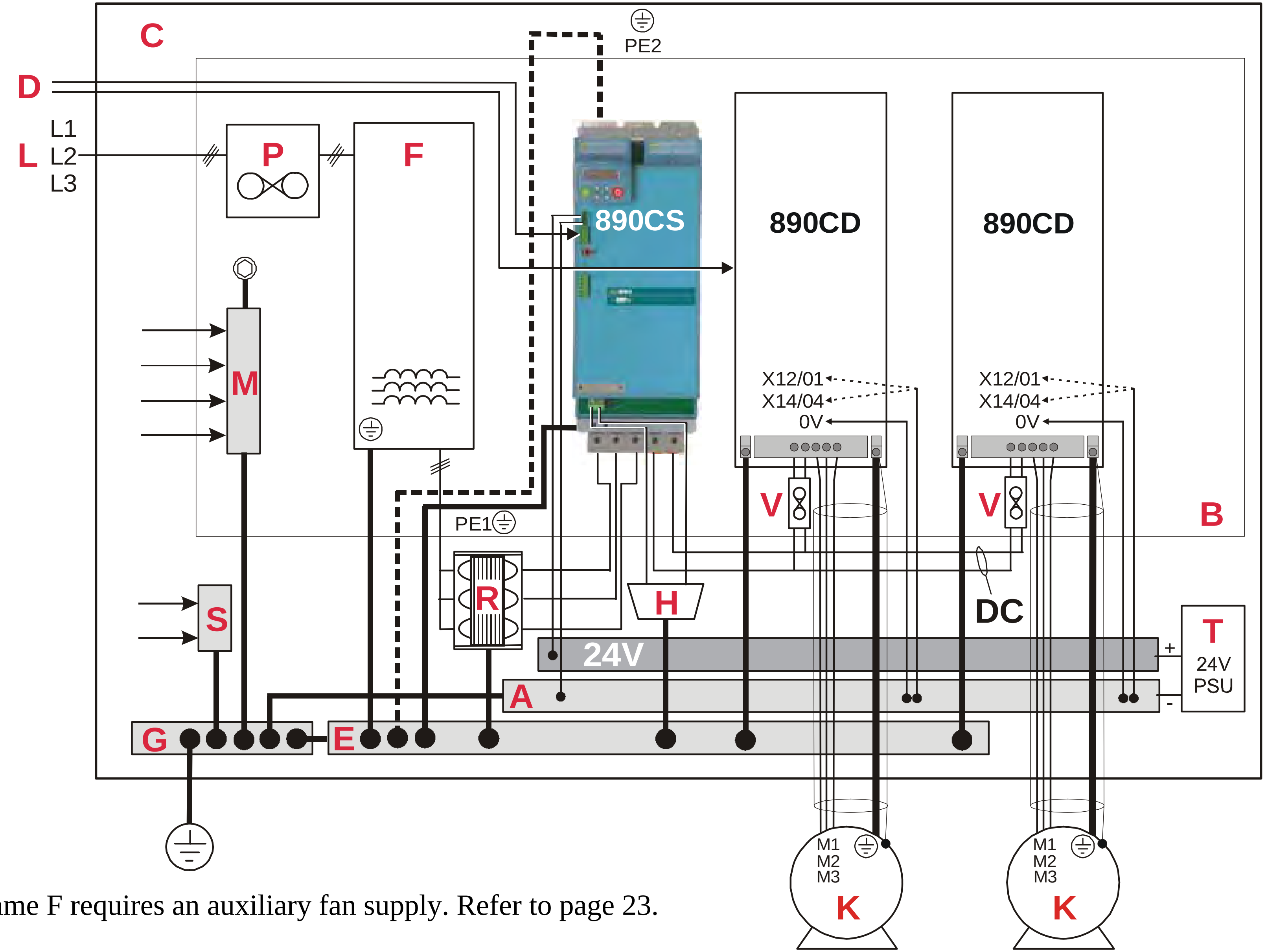
A cross-section conductor of at least 10mm² is required. This can be achieved either by using a single conductor (PE) or by laying a second conductor though separate terminals (PE2 where provided) and electrically in parallel.

Refer to the 890 Installation Kit for earth/ground fixing details on the 890CS. Fit the appropriate parts.

Caution

The 890CS Common Bus Supply is factory-fitted with a safety bung to terminals DC+ and DC- which maintains the IP20 rating.
Remove this bung. These terminals are used.

Wiring Diagram



Note: Frame F requires an auxiliary fan supply. Refer to page 23.

Key to Wiring Diagram

A	Analog Clean Earth	This must be insulated from the back panel. Analog reference X12/01 or digital reference X14/04 must be connected to this busbar, avoiding earth loops.
B	Back-plate	Earth the backplate to the star point (G).
C	Cubicle	The 890 must be mounted inside a cubicle complying with the European safety standards VDE 0160 (1994)/EN50178 (1998).
D	Control Wiring	Control terminals are SELV (Safe Extra Low Voltage), i.e. double-insulated from power circuits. 0.08mm^2 (28AWG) to 2.5mm^2 (12AWG). A 0V reference from X12/01 or X14/04 should be included in the control wiring.
E	Dirty Earth	This must be insulated from the back panel. It is used for all power earths.
F	Filter	Refer to Chapter 6: "Associated Equipment" for the specified filter. This may help to achieve EMC compliance. Refer to Appendix C.
G	Star Point Earth/Ground	The star point connects all earth busbars. Connect the star point to the incoming safety earth (PE). Note the possible requirement for PE2 connections to each drive, refer to page 4-15.
H	Brake Resistor (DC+, EXT: frame B) (DBR+, DBR-: frame D)	External brake resistors for the 890CS are available. Refer to Chapter 6: "Associated Equipment". Ensure wiring is rated for highest system voltage.

Key to Wiring Diagram

J	FireWire™ Connection	A very fast external bus (IEEE 1394a) to connect up to 63 units. You will need the FireWire Option Card for each Common Bus Drive, refer to Appendix A.
K	Motor (M1, M2, M3)	The motor used must be suitable for Inverter duty. Ensure wiring is rated for highest system voltage. Refer to Appendix E.
L	3∅ Power Supply Cable (L1, L2, L3)	Ensure wiring is rated for highest system voltage. Refer to Appendix E.
M	Metal Work Earth	Use the back panel for this earth. It provides earthing points for all parts of the cubicle including doors and panels. Connect cubicle to earth/ground via cubicle PE terminal.
P	Fuse or Type B RCD (AC Input Fuse)	Fuse rating - refer to Appendix E. We don't recommend the use of circuit breakers (e.g. RCD, ELCB, GFCI), but if their use is mandatory, use only a Type B RCD.
R	Line Reactor (mandatory)	**A 3% line reactor MUST be fitted to the 890CS unit.**
S	Signal/Control Screen Earth	This must be insulated from the back panel. Connect any signal/control screened cables which **do not** go directly to the drives.
T	24V Power Supply (mandatory on 890CS)	A 24Vdc power supply.
V	Fuse (DC Supply Fuses)	Protect DC+ and DC- cabling with fuses. Fuse rating - refer to Appendix E.

Power Connections - 890CS Common Bus Supply

The frame B and frame D 890CS units are each available in two power ratings:

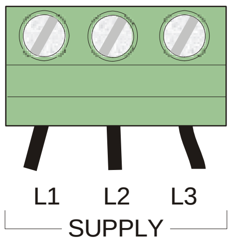
Frame B1 : 32A AC rms Input Current
Frame B2 : 54A AC rms Input Current

Frame D1 : 108A AC rms Input Current
Frame D2 : 162A AC rms Input Current

See the product rating label on the side of the unit to check the power rating. "0032" = 32A etc.

Power Connections - 890CS Common Bus Supply

SUPPLY



Connect 3-phase supply in any order.

Maximum wire sizes:
Frame B1: 10mm^2 / 8AWG, 2.5-3Nm / 1.8-2.2lbf
Frame B2: 16mm^2 / 4AWG, 2.5-3Nm / 1.8-2.2lbf
Frame D1: 50mm^2 / 1/0AWG, 15-20Nm / 11-14.8lbf
Frame D2: 95mm^2 / 4/0AWG, 15-20Nm / 11-14.8lbf

EARTH/GROUND

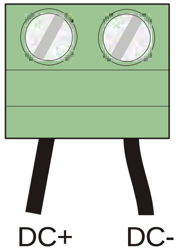
Fix earth connections to ⏚.

Maximum wire sizes:
Frame B1: 10mm^2 / 8AWG
Frame B2: 16mm^2 / 4AWG
Frame D1: 50mm^2 / 1/0AWG
Frame D2: 95mm^2 / 4/0AWG

Refer to the 890 Installation Kit for earth/ground fixing details.
The unit must be **permanently earthed** according to EN 50178

Power Connections - 890CS Common Bus Supply

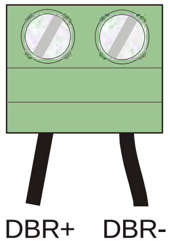
DC+ / DC- Bottom Terminals



Use these terminals to wire the DC Bus.
Use correctly rated wire - refer to Appendix E.

Maximum wire sizes:
Frame B1: $10mm^2$ / 8AWG, 2.5-3Nm / 1.8-2.2lbf
Frame B2: $16mm^2$ / 4AWG, 2.5-3Nm / 1.8-2.2lbf
Frame D1: $50mm^2$ / 1/0AWG, 15-20Nm / 11-14.8lbf
Frame D2: $95mm^2$ / 4/0AWG, 15-20Nm / 11-14.8lbf

EXTERNAL BRAKE RESISTOR - Option



You can connect an external brake resistor between terminals DBR+ and DBR-.

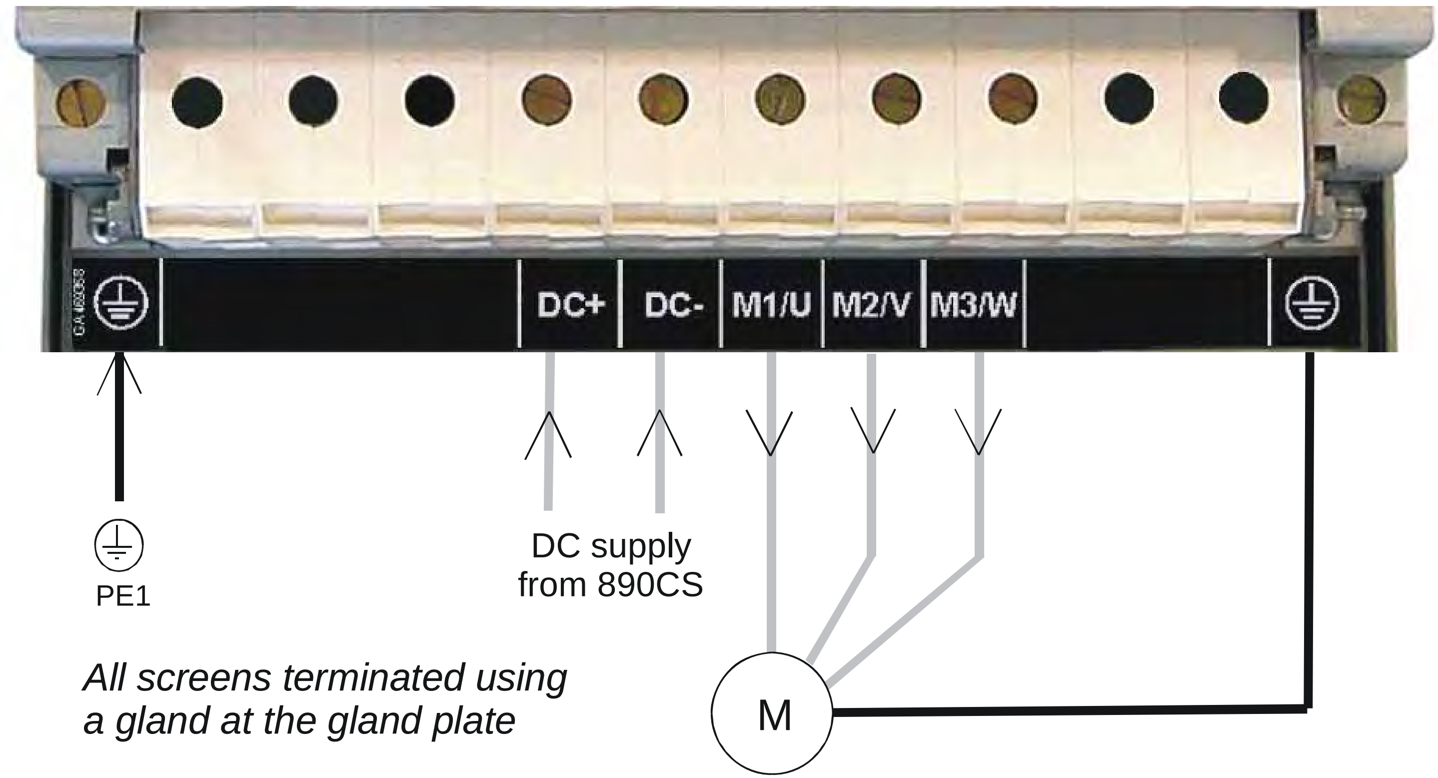
***DO NOT** apply external voltage sources (mains supply or otherwise) to the braking terminals.*

Maximum wire size:
$16mm^2$ / 6AWG 1.2Nm / 0.9lbf

Refer to Chapter 6:"Associated Equipment" for brake resistor selection.

Power Connections - 890CD/890SD

Power Wiring Connections (Frame E)

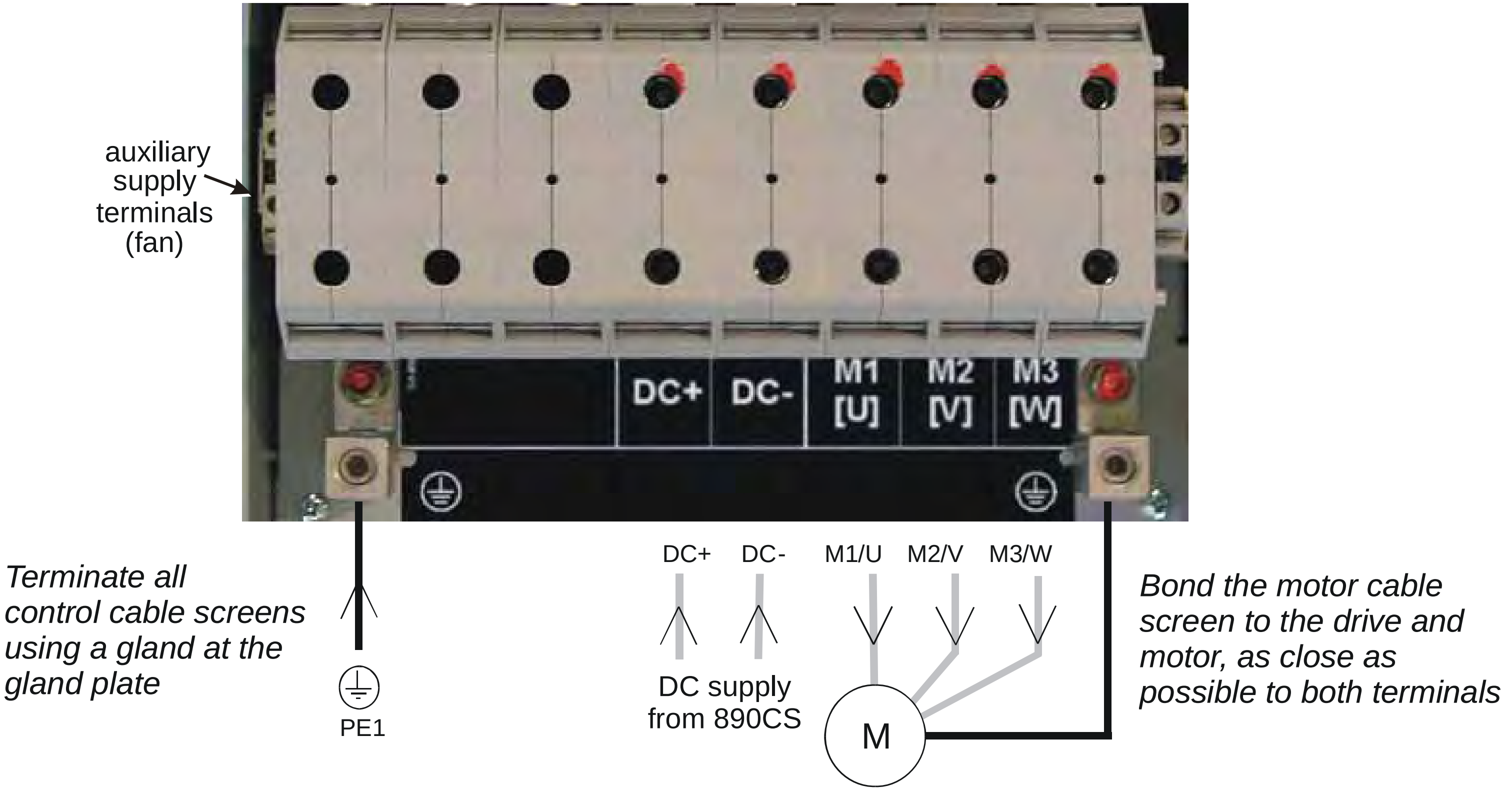


Note ***The standard Frame E terminals are not intended for flat busbar. A Power Terminal adaptor is available to enable wiring with flat busbar, part number BE465483.***

Remove the terminal cover retaining screws and lift off the terminal cover.

Feed the power supply and motor cables into the drive through the metal gland plate using the correct cable entries, and connect to the power terminals. Tighten all terminals to the correct tightening torque, refer to the Terminal Tightening Torques table.

Power Wiring Connections (Frame F)



Note ***For cooling fan details, refer to Appendix E: "Technical Specifications" - Cooling Fans (Frame F).***

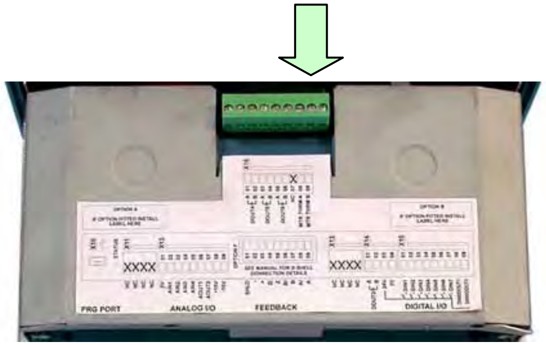
Note ***The standard Frame F terminals are not intended for flat busbar. A Power Terminal adaptor is available to enable wiring with flat busbar, part number BE465483.***

Remove the terminal cover retaining screws and lift off the terminal cover. Feed the motor cables into the cubicle using the correct cable entry glands ensuring the screen is connected.

Feed the power supply and motor cables into the drive through the large aperture in the metal gland plate and connect to the power terminals. Tighten all terminals to the correct tightening torque, refer to Appendix E: "Technical Specifications" - Wire Size tables.

Motor Thermistor Connections

This input (terminal X16) is provided to detect over-temperature in motors fitted with an internal thermistor. There is no polarity to the thermistor connections.



IMPORTANT **This input provides "Basic" insulation only to the SELV control circuits and assumes the motor has "Basic" insulation to the windings/mains circuits.**

The thermistor type supported is PTC `Type A' as defined in IEC 34-11 Part 2. The drive uses the following resistance thresholds:

Rising temperature trip resistance:	1650 to 4000Ω
Falling temperature trip reset resistance:	750 to 1650Ω

If the motor is not fitted with an internal thermistor, you should disable the thermistor trip function either by setting INVERT THERMIST to be TRUE, or by linking the thermistor terminals.

MMI Menu Map

1 SETUP

2 TRIPS

3 I/O TRIPS

INVERT THERMIST

Gland Plate Details

Frame E The gland plate holes accept the following gland sizes:

22.8mm to accept metric M20, PG16 and American ½" NPT cable gland sizes

28.6mm to accept metric M25, PG21 and American ¾" NPT cable gland sizes

47.3mm to accept metric M40, PG36 and American 1¼" NPT cable gland sizes

54.3mm to accept metric M50, PG42 and American 1½" NPT cable gland sizes

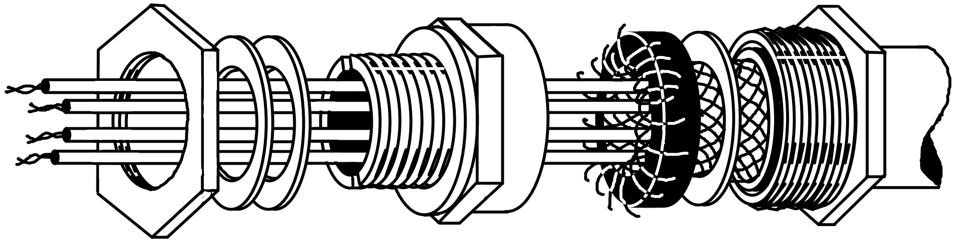
Frame F The gland plate holes accept the following gland sizes:

22.8mm to accept metric M20, PG16 and American ½" NPT cable gland sizes

28.6mm to accept M25, PG21 and American ¾" NPT cable gland sizes

Cable Gland Requirements

Use a metal gland to connect to the internally earthed gland plate. It must be capable of securing a 360 degree screened connection to give EMC compliance. A 360 degree screened connection can be achieved as shown.



360 Degree Screened Connection

Protective Earth (PE) Connections ⏚

The unit must be **permanently earthed** according to EN 50178 - see below. Protect the incoming mains supply using a suitable fuse or circuit breaker (circuit breaker types RCD, ELCB, GFCI are not recommended). Refer to Chapter 6: Circuit Breakers.

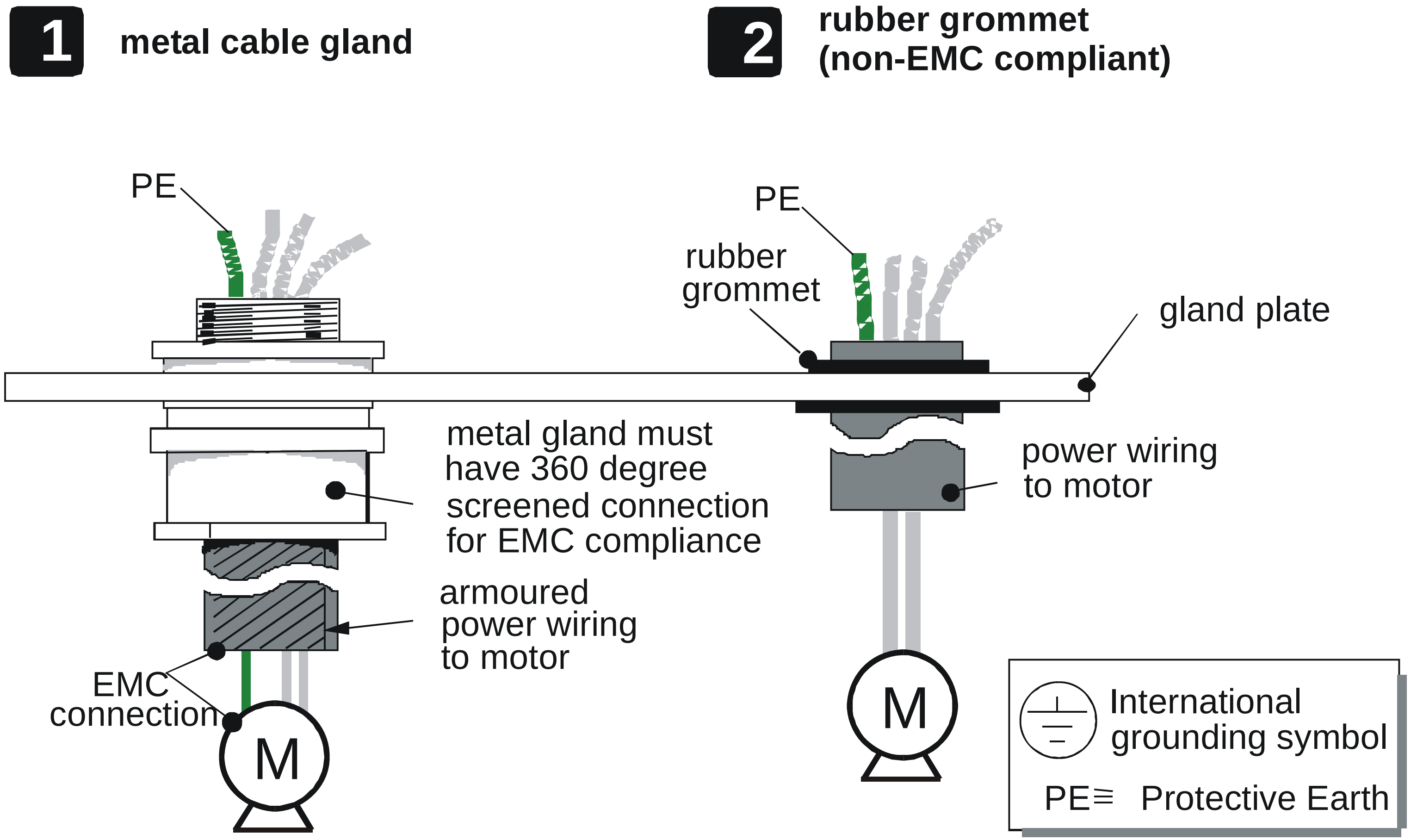
IMPORTANT **The drive is only suitable for earth referenced supplies (TN) when fitted with an internal filter. External filters are available for use on TN and IT (non-earth referenced) supplies.**

For installations to EN 50178 in Europe:

- for permanent earthing, two individual incoming protective earth conductors (<10mm² cross-section) or one conductor (>10mm² cross-section) are required. Each earth conductor must be suitable for the fault current according to EN 60204.

Refer to Appendix C: "Certification".

Motor Connections



Step 3: Control Connections

WARNING

During commissioning, remove the fuses (or trip the circuit breaker) on your 3-phase supply. Make sure the power is OFF, and that it cannot be switched on accidentally whilst you are working.

Main Points

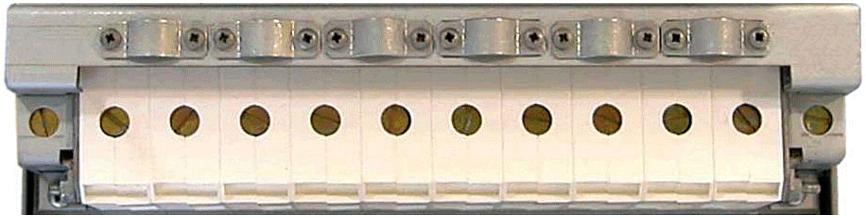
- The 890 is a system product and is designed for Remote mode operation using the analog & digital inputs/outputs and/or FireWire^{TM} connection. The use of the keypad (Local mode) is for configuration purposes.

  Connecting 890CD Common Bus Drives using the FireWire^{TM} Option Cards is recommended for applications requiring high levels of accuracy. Otherwise, use I/O to transfer data from master to slave units.

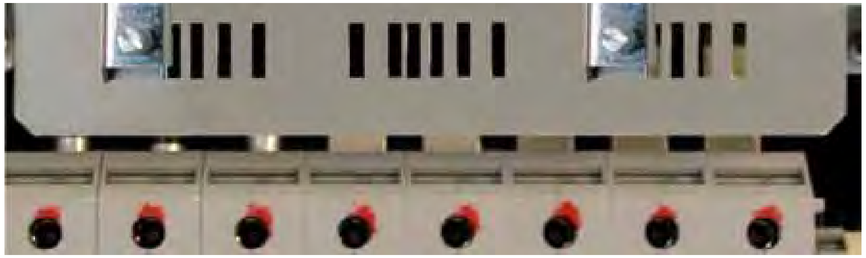
- To access the control board and plug-in Options, remove the lower front cover from the drive. The cover is held in place by two screws on the base of the drive.
- Route control cables into the drive through the gland plate.
- Use screeened control cables to comply with EMC requirements. All screens terminated using a gland at the gland plate. Refer to page 4-25.
- The control terminals will accept a single wire of size 1.5mm^2/16AWG. For two wires per terminal, use smaller gauge wire such as 0.5mm^2/22AWG.
- The control board 0V at X14/04 must be connected to protective (clean) earth outside of the product to meet EMC and safety requirements.

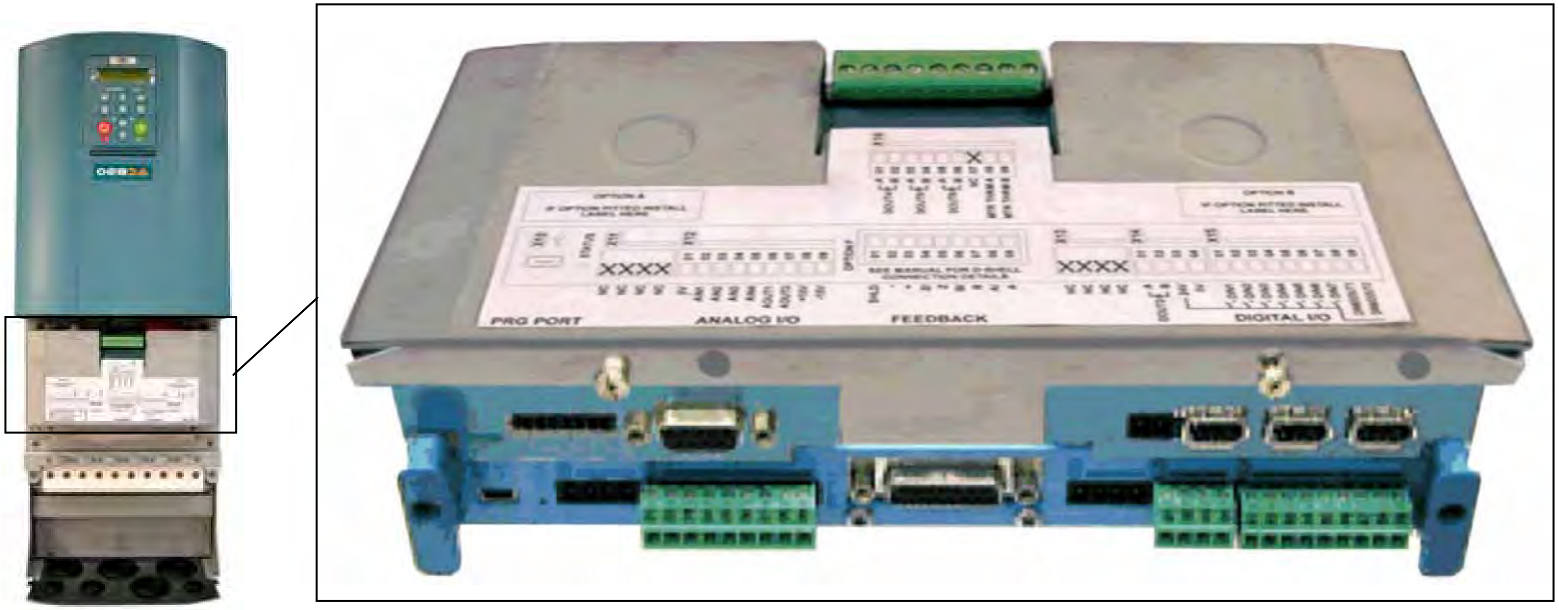
890CS & 890CD Common Bus Units

- **Frame E**: secure control cables using the cable clamps.

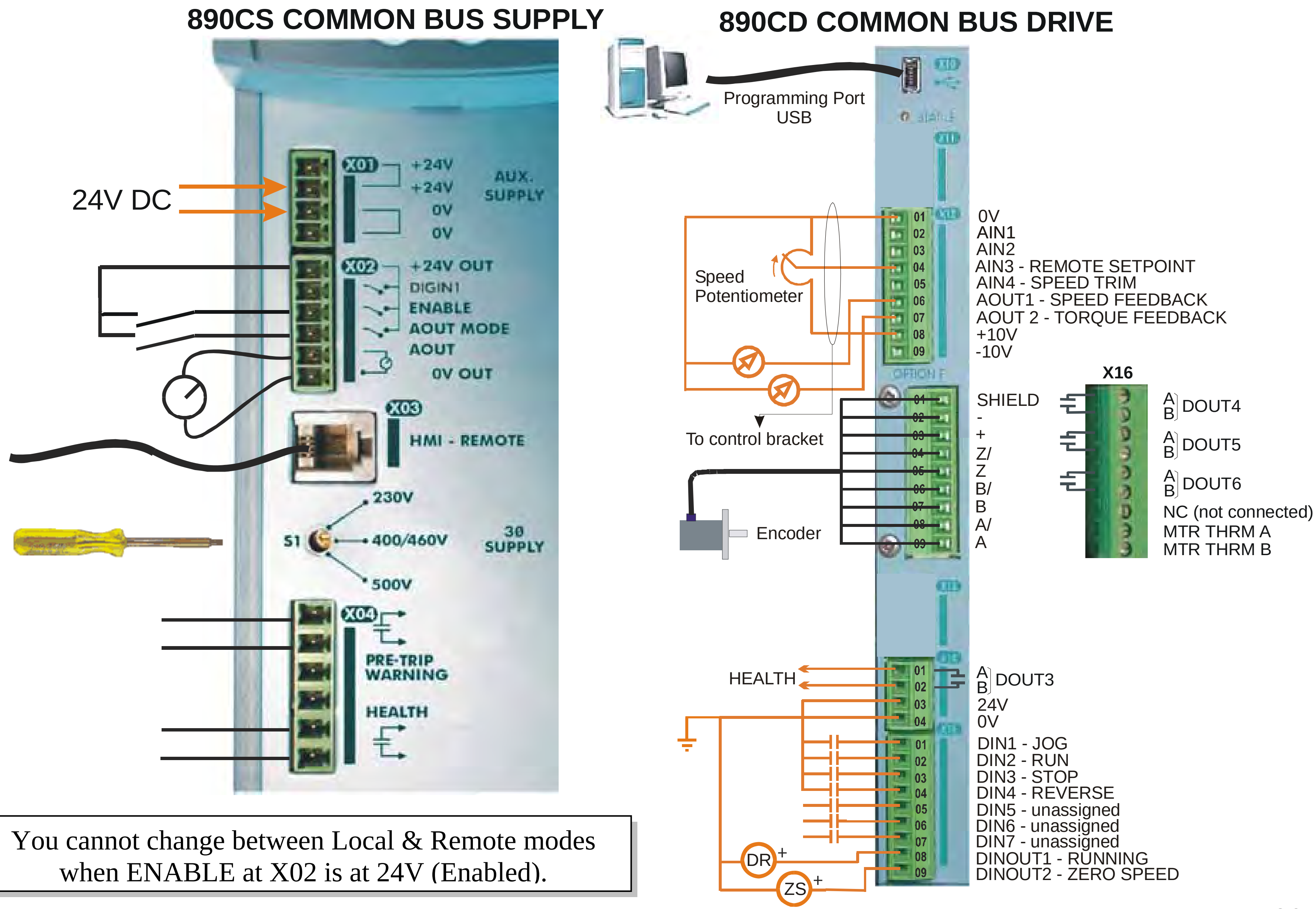


- **Frame F**: secure control cables using the cable clamps.





Control Connection Diagram



You cannot change between Local & Remote modes when ENABLE at X02 is at 24V (Enabled).

890CD Minimum Control Connections

Minimum Connections

- Connect X14/04 to a clean, external earth

Speed Reference

- Connect a 10kΩ potentiometer at terminal X12:

  X12/01 : Low (CCW)
  X12/04 : Wiper
  X12/08 : High (CW)

- Connect the shield to earth/ground to the gland plate.

OR

- External 2-wire speed reference between:

  X12/01 : negative
  X12/04 : positive

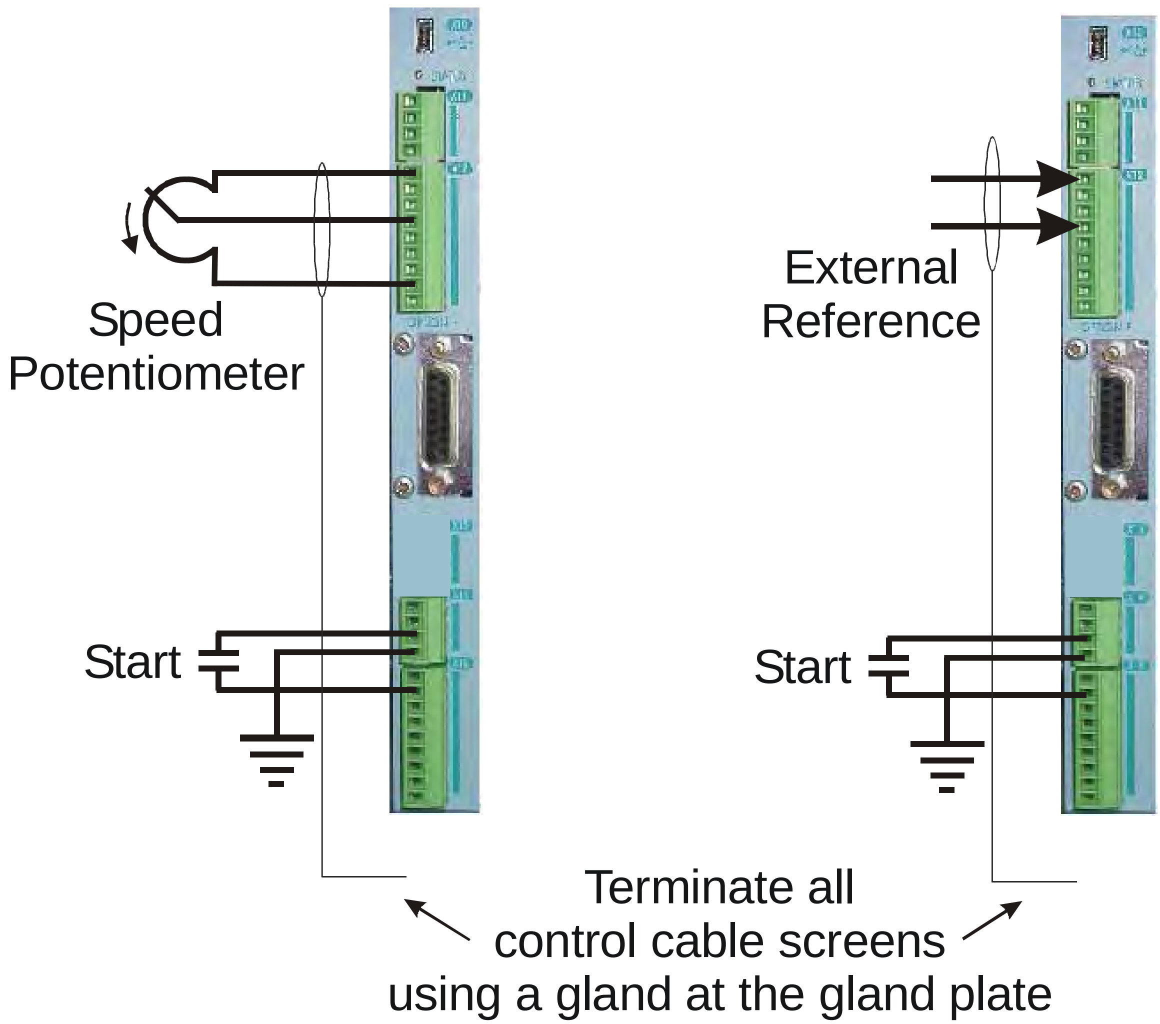
- Connect the shield to earth/ground to the gland plate.

Sequencing

- RUN (maintained contact)

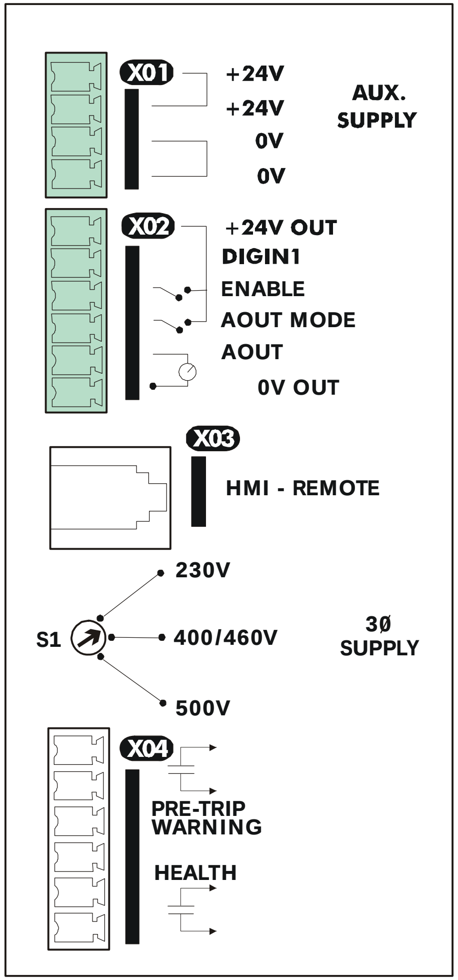
  X14/03 : 24V
  X15/02 : RUN

890CD COMMON BUS DRIVES



Control Connections - 890CS Common Bus Supply

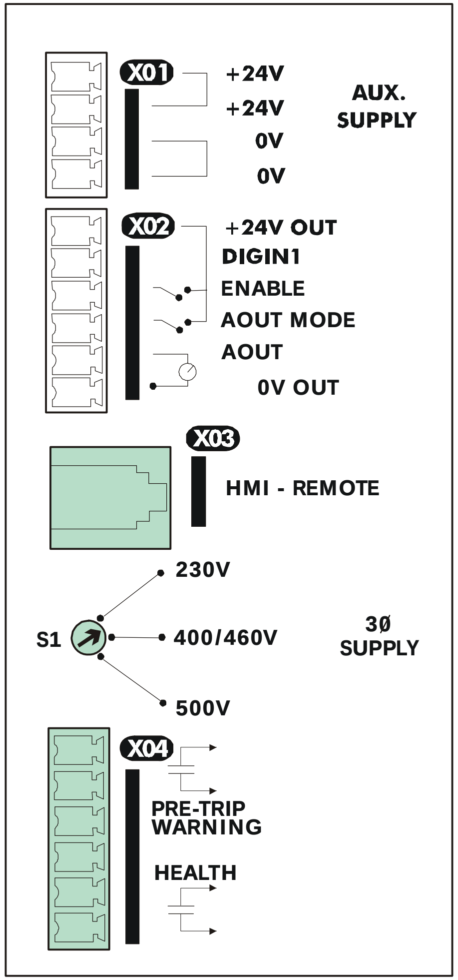
The table below shows the factory defaults.



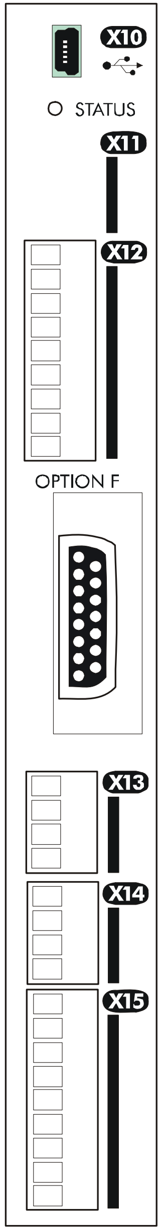
		Name	Range	Description
X01	01	+24V AUX SUPPLY	24V (±10%) 2A	You must supply 24V DC to power the unit. Use a source separate to your 3∅ supply. Use the second set of terminals to daisy-chain to the next drive 890CS if required. The unit is protected against reversal of this supply. See Note.
	02			
	03	0V AUX SUPPLY	0V (24V)	
	04			
X02	01	+24V OUT	24V	A 24V DC supply for the digital I/O of X02.
	02	DIGIN1	-	Future use
	03	ENABLE	0-24V	24V = 890CS Common Bus Supply powers-up to supply DC to connected units.
	05	AOUT MODE	0-24V	0V = Power (kW) , 24V = Current (A). Selects the units for meter connected to AOUT.
	05	AOUT	0-10V	Mode set by AOUT MODE. Meter connection: 0 to 5V is equivalent to 0 to 100%.
	06	0V OUT	0V	0V reference for AOUT

Note ***X01: This Control Supply is necessary at all times to operate the 890CS Common Bus Supply. DO NOT use this 24V for the terminals at X02, only use the 24V supply provided at X02/01.***

890CS & 890CD Common Bus Units



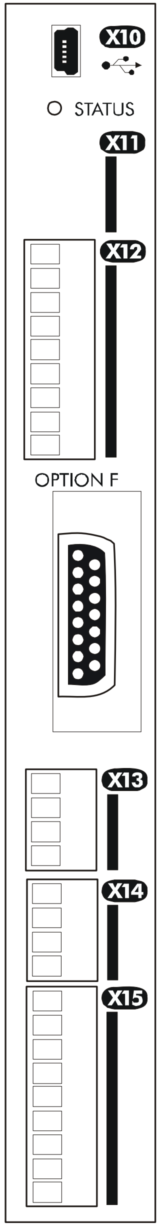
		Name	Range	Description
X03		HMI-REMOTE	-	Keypad port for a remote-mounted Keypad. Refer to Chapter 8: "Remote Mounting the Keypad".
S1		3∅ SUPPLY SELECTION	230V, 400/460V, 500V	Power-down the unit and turn the (10-position) switch "arrow" to point to the correct voltage. The keypad displays the selected voltage when powering-up, and this can checked when configuring using only the 24V DC Control Supply.
X04	01	PRE-TRIP WARNING	24V DC 100V AC 240V AC	Internal, volt-free contacts. Closed = Healthy:
	02			PRE-TRIP WARNING - indicates overload or overtemperature of the Common Bus Supply. It may trip soon unless your system removes the overload condition (by shedding load or powering down on this signal). Refer to Chapter 10: "Trips and Fault Finding".
	03	*not used*		
	04	*not used*		
	05	HEALTH		HEALTH - indicates the health status of the Common Bus Supply. Refer to Chapter 10: "Trips and Fault Finding".
	06			



Control Connections - 890CD Common Bus Drive

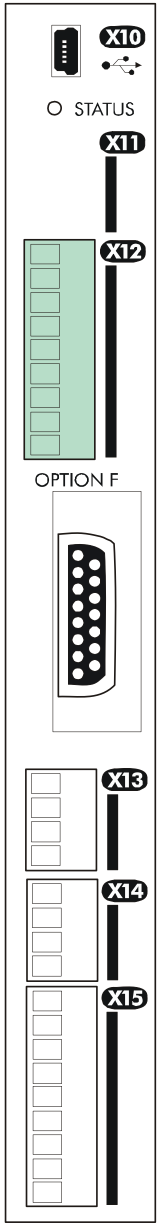
The table below shows the factory defaults.

Mini USB Port			
	Name	**Range**	**Description**
X10	USB		This Mini USB port provides a serial communications link to a host computer running the DSE 890 Configuration Tool. Use an approved USB lead: A to mini-B.



FUTURE USE				
		Name	**Range**	**Description**
X11	**01**			
	02			
	03			
	04			

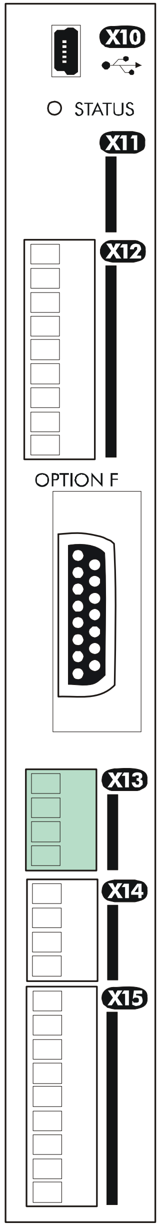
Note **Terminal X11 is for future use.**



ANALOG I/O				
		Name	**Range**	**Description**
X12	**01**	0V		0V reference for analog I/O
	02	AIN1	0-10V, ±10V	Analog Input 1 (default = diff I/P +)
	03	AIN2	0-10V, ±10V	Analog Input 2 (default = diff I/P -)
	04	AIN3	±10V, 0-10V, 0-20mA, 4-20mA	Analog Input 3 (default = remote setpoint I/P) -10V = 100.00% reverse, +10V = 100.00% forward (% maximum speed)
	05	AIN4	±10V, 0-10V, 0-20mA, 4-20mA	Analog Input 4 (default = speed trim I/P)
	06	AOUT1	±10V (10V = 100% speed)	Analog Output 1 (default = speed feedback O/P)
	07	AOUT2	±10V (10V = 200% torque)	Analog Output 2 (default = torque feedback O/P)
	08	+10V REF	+10V (output)	10V reference for analog i/o. Load 10mA maximum
	09	–10V REF	-10V (output)	10V reference for analog i/o. Load 10mA maximum

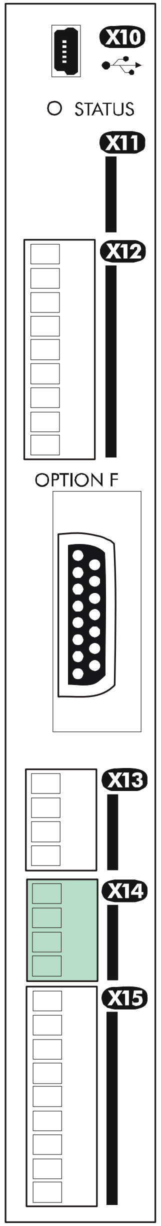
Note ***AIN1 and AIN2 are fitted with a link to ensure no noise pick-up when not in use. These terminals can be used as a differential ±10V input (which we call AIN5), but AIN1 and AIN2 must remain within ±10V relative to 0V. AIN5 has a direct input into the Speed Loop providing a fast speed or torque demand for servos.***

All analog inputs/outputs are configurable using the DSE 890 (Drive System Explorer) Configuration Tool supplied on disk. The table above shows the factory defaults. These analog connections require ±10V DC which is supplied at terminal X12/08 and X12/09 respectively. For further information refer to the DSE 890 Configuration Tool.



FUTURE USE				
		Name	Range	Description
X13	01			
	02			
	03			
	04			

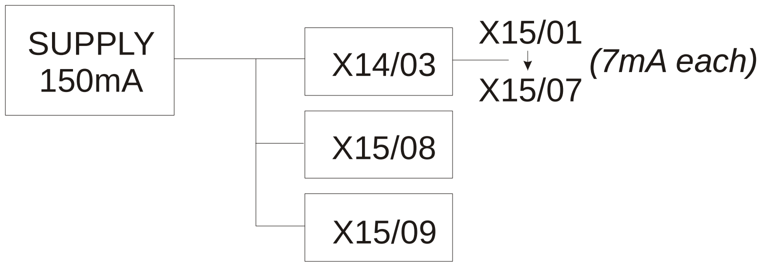
Terminal X13 is for future use.

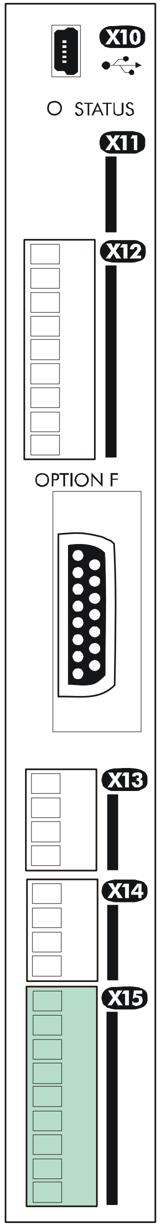


RELAY CONTACTS

		Name	Range	Description
X14	01	DOUT3A	0-24V DC	Relay Output: normally-open, volt-free, 24V DC 1A resistive load or use down to 1mA, 12V levels (DOUT3 closed = HEALTH)
	02	DOUT3B	0-24V DC	Relay Output: normally-open, volt-free, 24V DC 1A resistive load or use down to 1mA, 12V levels (DOUT3 closed = HEALTH)
	03	USER 24V	0-24V DC	24V DC Output, 150mA maximum load
	04	0V	0-24V DC	0V reference for USER 24V output

Note ***The maximum permissible sum of currents from X14/03, X15/08, X15/09 is 150mA. An Alert message will be displayed if exceeded.***



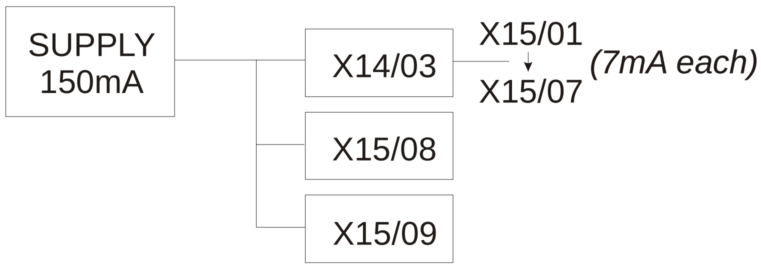


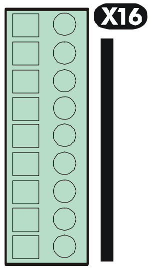
DIGITAL I/O

		Name	Range	Description
X15	01	DIN1	0-24V DC	Digital Input 1 (default = JOG)
	02	DIN2	0-24V DC	Digital Input 2 - (default = RUN)
	03	DIN3	0-24V DC	Digital Input 3 - (default = STOP)
	04	DIN4	0-24V DC	Digital Input 4 - (default = REVERSE)
	05	DIN5	0-24V DC	Digital Input 5 - (default = unassigned). Refer to I/O TRIPS::EXT TRIP MODE for special function.
	06	DIN6	0-24V DC	Digital Input 6 - (default = unassigned)
	07	DIN7	0-24V DC	Digital Input 7 - (default = unassigned)
	08	DIN8/DOUT1	0-24V DC	Digital Input/output 1 - (default = digital output: RUNNING)
	09	DIN9/DOUT2	0-24V DC	Digital Input/output 2 - (default = digital output: ZERO SPEED)

All digital inputs/outputs are configurable using the DSE 890 (Drive System Explorer) Configuration Tool supplied on disk. The table shows the factory defaults. The digital inputs require 24V DC which is supplied at terminal X14/03. For further information refer to the DSE 890 Configuration Tool.

Note ***The maximum permissible sum of currents from X14/03, X15/08, X15/09 is 150mA. The load on X15/08 & X15/09 connects from these pins to X14/04 (0V). An Alert message will be displayed if exceeded.***





DIGITAL I/O				
		Name	**Range**	**Description**
X16	**01**	DOUT4A	0-24V DC	Normally-open relay contacts, A & B.
	02	DOUT4B	0-24V DC	Default function DOUT4 closed = healthy
	03	DOUT5A	0-24V DC	Normally-open relay contacts, A & B.
	04	DOUT5B	0-24V DC	Default function DOUT5 closed = running
	05	DOUT6A	0-24V DC	Normally-open relay contacts, A & B.
	06	DOUT6B	0-24V DC	No default function.
	07	NC		Not Connnected - this terminal is unused
	08	MTR THRM A		Motor thermistor connection, or link to MTR THRM B
	09	MTR THRM B		Motor thermistor connection, or link to MTR THRM A

All digital inputs/outputs are configurable using the DSE 890 (Drive System Explorer) Configuration Tool supplied on disk. The table shows the factory defaults. The digital inputs require 24V DC which is supplied at terminal X14/03. For further information refer to the DSE 890 Configuration Tool.

Relay outputs are volt-free, normally open contacts. Rated to 240V 3A resistive load. Alternatively they may be used down to 1mA, 12V levels.

Step 4: Checking the System

In this section we are going to apply the 24V DC Control Supply. We are then ready to power-up the 890CS unit and receive DC at the 890CD Common Bus Drive via the DC link.

Pre-Operation Checks

Before Applying 24V DC:

If you have already wired the 3-phase supply to the 890CS Common Bus Supply, DISCONNECT IT NOW (remove the supply fuses, or trip the circuit breaker).

Check for damage to equipment.

Check for loose ends, clippings, drilling swarf etc. lodged in the drive and system.

Check all external wiring circuits of the system - power, control, motor and earth connections.

Ensure that other equipment will not be adversely affected by powering up.

Prepare to power-up the unit and system:

Fit the keypads to the front of the units, or connect remotely.

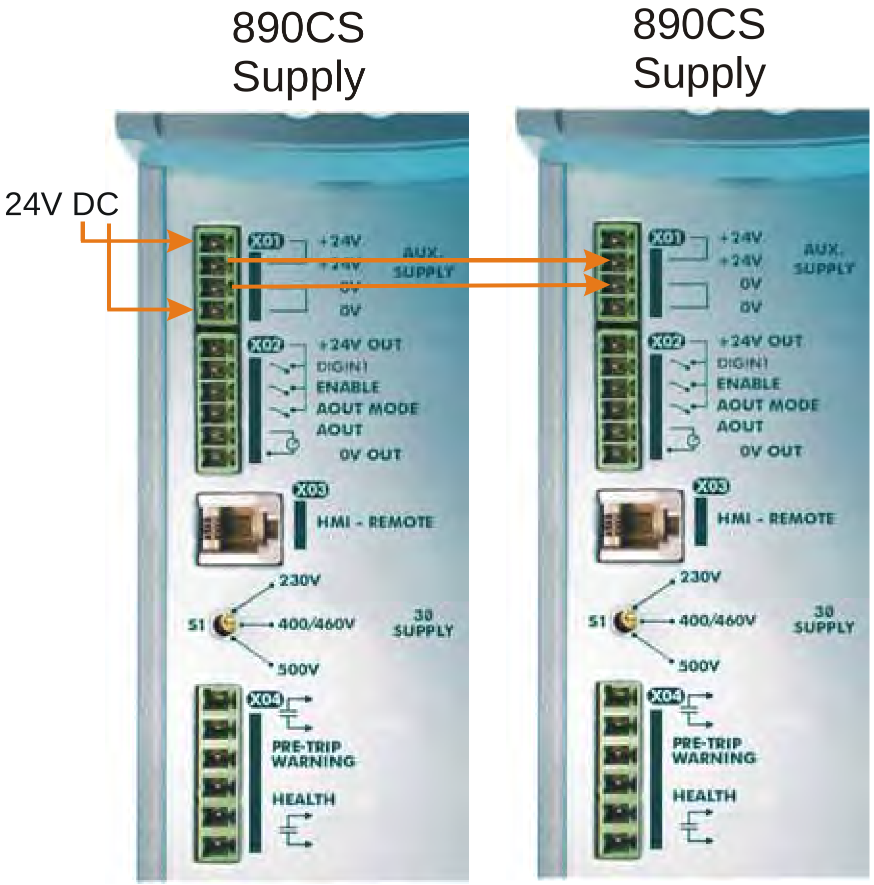
4.1: 890CS 24V DC Control Supply

You must provide an external 0V and +24V DC (±10%) control supply. Each Common Bus Supply can draw 2A, so for example: 3 units = 6A.

Connect 24V DC to terminal X01/01 or X02/02, and 0V (24V) to terminal X01/03 or X01/04 on the 890CS Common Bus Supply. The units are protected against reversal of this 24V DC supply.

Use the spare X01 terminals to daisy-chain the control supply to terminal X01 on another 890CS Common Bus Supply in the system, if required. Up to four 890CS units may be linked in this way.

The diagram shows the control supply daisy-chained between 890CS units.



IMPORTANT **This Control Supply is always required by the 890CS Common Bus Supply.**

Initial Power-Up Conditions

The unit will initialise in Remote Mode from factory conditions.

The Keypad will display the Input Current (%) on the 890CS Common Bus Supply

1. Apply the 24V DC.
2. Check that all keypads are active.

Note ***Because the unit is powering up without the 3-phase connection, the keypad will display a trip indicating that the supply is missing. The trip displays are shown below. Press the E key whenever this message appears to clear it from the screen.***

6511 Keypad

6901 Keypad

890CS :

PHAS

*** TRIPPED ***
SUPPLY LOSS

If the unit is not powering-up with 24V DC: check your supply; check your connections at X01; check the keypad is fitted correctly. If you are still experiencing problems, please contact SSD Drives.

4.2: 890CS Common Bus Supply - Voltage Check

IMPORTANT **You MUST check that the selected voltage of the unit is the same as the 3-phase supply voltage.**

The keypad will display the selected voltage of the unit.

If the voltage is incorrect: remove the 24V, select the required voltage at S1 on the front panel and apply 24V again. Re-check..

The correct voltage setting ensures that suitable voltage levels are used for Overvoltage, Undervoltage and Brake Level detection.

To display the Input Voltage Rating:

Press and hold E to display the software version.

Now press ▲ or ▼ to view the Input Voltage Rating.

Allow the display to time-out or press M to return to the previous screen.

The Welcome Screen displays the input voltage rating at power-up for a short time.

Otherwise, press E repeatedly until the Welcome Screen is displayed.

Allow the display to time-out or press M to return to the previous screen.

Powering-up the System

WARNING
Remove the fuses (or trip the circuit breaker) on your 3-phase supply.
Make sure the power is OFF, and that it cannot be switched on accidentally whilst you are working.

Main Points

1. You **MUST** have performed the Voltage Check on the 890CS Common Bus Supply.
2. Complete all Pre-Operation Checks.
3. Ensure all the set-up parameter values for each 890CD Common Bus Drive have been entered. Refer to "Set-up Parameters", page 4-49.
4. Autotune each drive where necessary.
5. Save your Application.
6. Follow one of the Start-up Routines: Local Mode or Remote Mode.

Pre-Operation Checks

Before Applying Power:

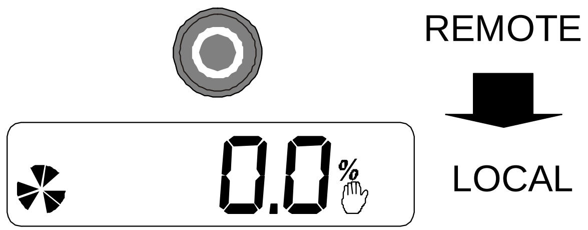
- Read the Safety section at the front of the Manual.
- Ensure that all local electric codes are met.
- Check for damage to equipment.
- Check for loose ends, clippings, drilling swarf etc. lodged in the drive and system.
- Check all external wiring circuits of the system - power, control, motor and earth connections.
- Ensure that unexpected rotation of the motor in either direction will not result in damage, bodily harm or injury. Disconnect the load from the motor shaft, if possible.
- Check the state of the Motor Thermistor and Brake Resistor connectors. Check external run contacts are open. Check external speed setpoints are all at zero.
- Ensure that nobody is working on another part of the system which will be affected by powering up.
- Ensure that other equipment will not be adversely affected by powering up.
- Check motor stator connections are correctly wired for Star or Delta as necessary for drive output voltage.
- Ensure that the SSD_Rail has been correctly installed and securely fastened.
- On the 890CS drive, set the line voltage on rotary switch S1.

Powering-up the Units

1. **Apply the 3-phase supply to the 890CS Common Bus Supply.**
2. Select LOCAL mode operation on the 890CS Common Bus Supply:

Hold the Stop key down until the display spells LOC

Release the key to display the previous menu for example,Local Setpoint



3. Press the key on the 890CS Common Bus Supply to supply DC to the 890CD Common Bus Drive(s) (the drive will not turn the motor).
   - ♦ The red LEDs on the top of each drive unit will light to show DC is present at the busbars.
   - ♦ The diagnostics on the 890CS keypad will indicate power is present - refer to Chapter 8: "The Keypad" - *6511 - Common Bus Supply*.

Initial Power-Up Conditions

The unit will initialise in Remote Mode from factory conditions.

The Keypad will display the Inputr Current (%) on the 890CS Common Bus Supply, and the Remote Setpoint parameter (%) on the 890CD Common Bus Drive.

Configure the 890CD Common Bus Drive

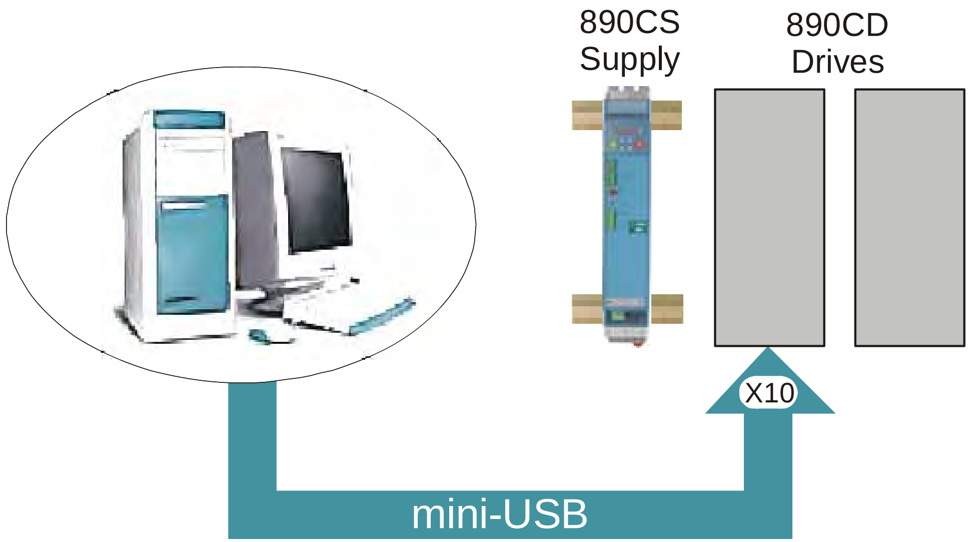
You must now configure each 890CD Common Bus Drive to your application. This is done using the DSE 890 Configuration Tool supplied on the CD, or the keypad.

Using the DSE 890 Configuration Tool

The DSE 890 (Drive System Explorer) Configuration Tool has a full Help system. Insert the DSE 890 disk into your PC and follow the on-screen instructions. Use the tool to set-up the I/O connectivity so that it meets the requirements for each 890CD Common Bus Drive. When connected, enter the set-up parameters as discussed on page 4-49.

Connecting to a PC

Connect the 890CD Common Bus Drive to your PC using an approved mini-USB lead. You can order this lead from Parker SSD Drives: part number CM471050 (3m long) or CM465778 (1m long).



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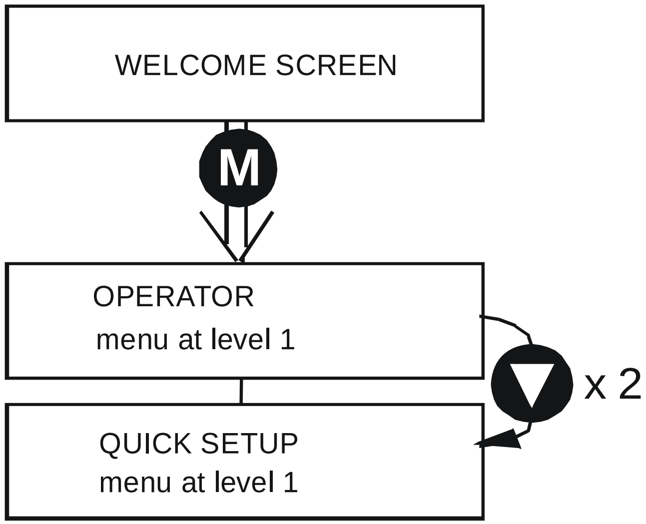
Configuring with the Keypad

Fit the keypad to the front of the unit, or connect remotely. The set-up parameters are stored in the QUICK SETUP menu on the 6901 keypad.

6901 Keypad



How to Edit a Parameter

Press M to enter the QUICK SETUP menu.

Scroll through the parameters using the ▲ and ▼ keys.

Press M to select a parameter for editing.

Increment/decrement the parameter value using the ▲ and ▼ keys.

Press E to exit the parameter.

Set-up Parameters

The drive has several control modes:

Control Modes		
V/Hz	VOLTS / HZ	Set-up as an Open-Loop Drive (V/F Fluxing) - *low performance applications (fan, pump). Simplest method involving no speed feedback and no compensation for load changes.* ***Autotune is not required*.**
SV	SENSORLESS VEC	Set-up using the Sensorless Vector Fluxing Mode - *medium performance applications where the drive uses an electrical model of the motor to automatically compensate for load changes.* The drive must be tuned to the motor in use by matching the motor parameters in the drive to those of the motor being controlled. **You MUST use the Autotune feature after entering your parameter values.**
CLV	CLOSED-LOOP VEC	Set-up using the Closed-Loop Vector Mode - *high performance applications where the drive uses external sensors (encoders) to automatically compensate for load changes.* In this mode, speed feedback signals from the motor shaft encoder are processed to determine the rotational speed of the shaft. A PI algorithm within the software uses this information to produce varying gate drive signals to the drive circuits. These signals cause the drive to output the required voltage and frequency for a particular motor speed. **You MUST use the Autotune feature after entering your parameter values.**

4

Control Modes		
4-Q	4-Q REGEN	Set-up using 4Q Regen active front end (AFG) control mode. Refer to Chapter 7 to correctly set-up the drive for an 890CD/SD 4-Q Regen AFE Application. Autotune is not required.
PMAC	PMAC	Set-up using PMAC (Permanent Magnet AC) servo or torque motor control mode - *a high performance application where the drive uses Resolver or Sin/Cos Encoder motor feedback.* In this mode, speed feedback signals from the motor shaft encoder are processed to determine the rotational speed of the shaft. A PI algorithm within the software uses this information to produce varying gate drive signals to the drive circuits. These signals cause the drive to output the required voltage and frequency for a particular motor speed. Autotune is not required. The Motor Selection Wizard in the 890 DSE Configuration Tool **MUST** be used to correctly set-up the motor and feedback device parameters. Failure to do so may result in damage to the servo motor.

The following is a list of the Set-up parameters you may need to check before starting the drive. Set only the ones marked with "x" for the intended mode of operation.

Note ***Parameters whose values are "product code dependent" will have a typical value for the size of unit. Where possible (or required), enter an application-specific value for improved performance, otherwise use the typical value.***

Note ***"PREF" is a parameter reference number used by the DSE 890 Configuration Tool.***

SET-UP PARAMETERS								
PREF	6511/6901 Display	Default	Brief Description	V/Hz	SV	CLV	4-Q	PMAC
136.02	5 1 CONTROL MODE	0 : VOLTS / HZ 1 : SENSORLESS VEC 2 : CLOSED-LOOP VEC 3 : 4-Q REGEN 4 : PMAC*	Select the operating mode for the drive. * If PMAC control is required, the motor wizard feature in the 890 DSE Configuration Tool **MUST** be used to correctly set-up the motor and feedback device parameters. Failure to do so may result in damage to the servo motor.	x (0)	x (1)	x (2)	x (3)	x (4)

4

SET-UP PARAMETERS								
PREF	6511/6901 Display	Default	Brief Description	V/Hz	SV	CLV	4-Q	PMAC
101.08	S 2 MAX SPEED	product code dependent	The maximum speed clamp and scale factor for other speed parameters (at full process speed)	x	x	x		x
100.02	S 3 RAMP ACCEL TIME	10.0 s	Acceleration time from 0 rpm to MAX SPEED	x	x	x	x	x
100.03	S 4 RAMP DECEL TIME	10.0 s	Deceleration time from MAX SPEED to 0 rpm	x	x	x	x	x
102.01	S 5 RUN STOP MODE	0 : RUN RAMP 1 : COAST 2 : DC INJECTION 3 : STOP RAMP	Selects the stopping mode used by the drive	x	x	x	x	x
103.01	S 6 JOG SETPOINT	10.0 %	Drive speed setpoint whilst jogging (percentage of MAX SPEED)	x	x	x	x	x

SET-UP PARAMETERS								
PREF	6511/6901 Display	Default	Brief Description	V/Hz	SV	CLV	4-Q	PMAC
21.01	S 7 V/F SHAPE	0 : LINEAR LAW 1 : FAN LAW 2 : USER DEFINED	Sets the type of volts to frequency template that is used to flux the motor	x				
70.01	S 8 QUADRATIC TORQUE	0 : FALSE 1 : TRUE	0 : FALSE = Constant Selects between Constant or Quadratic mode of operation	x	x	x		x
27.05	S 9 MOTOR CURRENT	product code dependent	Enter the motor full load current from the motor nameplate	x	x	x	x	
21.03	S 10 FIXED BOOST	product code dependent	Boosts starting torque by adding volts at low speed	x				
82.01	S 11 CURRENT LIMIT	150.00%	Level of motor current as % of FULL LOAD CALIB	x	x	x	x	
27.03	S 12 MOTOR BASE FREQUENCY	product code dependent	Enter the motor nameplate base frequency	x	x	x		

4

4

SET-UP PARAMETERS								
PREF	6511/6901 Display	Default	Brief Description	V/Hz	SV	CLV	4-Q	PMAC
27.04	S 13 MOTOR VOLTAGE	product code dependent	Enter the motor nameplate voltage at base frequency	x	x	x		
27.07	S 14 NAMEPLATE RPM	product code dependent	Enter the motor nameplate full-load rated speed. This is the motor speed in rpm at base frequency minus full load slip.	x	x	x		
27.09	S 15 MOTOR POLES	product code dependent 0 : 2 pole 1 : 4 pole 2 : 6 pole 3 : 8 pole 4 : 10 pole 5 : 12 pole	Enter the number of motor poles from the motor nameplate	x	x	x		
27.08	S 16 MOTOR CONNECTION	product code dependent 0 : DELTA 1 : STAR	Enter the type of motor connection		x	x		

SET-UP PARAMETERS								
PREF	6511/6901 Display	Default	Brief Description	V/Hz	SV	CLV	4-Q	PMAC
71.01	S 17 PULSE ENC VOLTS	product code dependent	Set between 10-20V to match the encoder supply voltage			x		
71.02	S 18 ENCODER LINES	product code dependent	Set to the number of lines used by the encoder			x		
71.03	S 19 ENCODER INVERT	0 : FALSE 1 : TRUE Rotating Autotune sets actual value	Encoder direction :- when TRUE, changes the sign of the measured speed and the direction of the position count.			x		
80.01	S 20 AUTOTUNE ENABLE	0 : FALSE 1 : TRUE	Set TRUE to enable Autotune. Resets to FALSE when complete.	x				
80.02	S 21 AUTOTUNE MODE	0 : ROTATING 1 : STATIONARY 2 : SPD LOOP ROTATING 3 : SPD LOOP STATIONARY	Set the type of Autotune.		x	x		

SET-UP PARAMETERS								
PREF	6511/6901 Display	Default	Brief Description	V/Hz	SV	CLV	4-Q	PMAC
27.06	S 22 MAG CURRENT	product code dependent Rotating Autotune sets actual value	Enter the No-Load Amps from the motor nameplate	x	x	x		
27.14	S 23 STATOR RES	product code dependent Autotune sets actual value	Motor per-phase stator resistance		x	x		
27.15	S 24 LEAKAGE INDUC	product code dependent Autotune sets actual value	Motor per-phase stator leakage inductance		x	x		
27.16	S 25 MUTUAL INDUC	product code dependent Autotune sets actual value	Motor per-phase stator mutual (magnetising) inductance		x	x		
27.17	S 26 ROTOR TIME CONST	product code dependent Autotune sets actual value	The motor model rotor time constant as determined by Autotune		x	x		

SET-UP PARAMETERS

PREF	6511/6901 Display	Default	Brief Description	V/Hz	SV	CLV	4-Q	PMAC
78.01	S 27 SPEED PROP GAIN	20.0	Sets the proportional gain of the loop		x	x		x
78.02	S 28 SPEED INT TIME	100 ms	The integral time constant of the speed loop		x	x		x
1.03	S 29 A1N1 TYPE	0 : -10..+10 V 1 : 0..+10 V	Select the input range and type	x	x	x	x	x
2.03	S 30 AIN2 TYPE	0 : -10..+10 V 1 : 0..+10 V	Select the input range and type	x	x	x	x	x
3.03	S 31 AIN3 TYPE	0 : -10..+10 V 1 : 0..+10 V 2 : 0..20 mA 3 : 4..20 mA	Select the input range and type	x	x	x	x	x
4.03	S 32 AIN4 TYPE	0 : -10..+10 V 1 : 0..+10 V 2 : 0..20 mA 3 : 4..20 mA	Select the input range and type	x	x	x	x	x
97.01	S 33 DISABLED WORD 1	0700 >>	Indicates which trips have been disabled - refer to Chapter 10	x	x	x	x	x

4

SET-UP PARAMETERS								
PREF	6511/6901 Display	Default	Brief Description	V/Hz	SV	CLV	4-Q	PMAC
97.02	S 34 DISABLED WORD 2	0840 >>	Indicates which trips have been disabled - refer to Chapter 10	x	x	x	x	x
31.01	S 35 VIEW LEVEL	0 : BASIC 1 : OPERATOR 2 : ADVANCED	Selects full menu for MMI display	x	x	x	x	x

The Autotune Feature

Note ***You MUST carry out an Autotune if you intend to use the drive in Sensorless Vector Fluxing Mode or Closed-Loop Vector Mode The drive will not perform an Autotune when in Volts/Hz Mode (Open-Loop Drive.) An Autotune is not necessary in this control mode.***

The Autotune feature identifies motor characteristics to allow the drive to control the motor. It loads the values into the parameters below, which are in the QUICK SETUP menu.

PREF	Parameter	Description	Note
71.03	ENCODER INVERT	Encoder direction	Parameter is only set up if drive is configured to run as Closed-loop Vector Not measured by Stationary Autotune
27.06	MAG CURRENT	Magnetising current	Not measured by Stationary Autotune
27.14	STATOR RES	Per phase stator resistance	
27.15	LEAKAGE INDUC	Per phase stator leakage inductance	
27.16	MUTUAL INDUC	Per phase mutual inductance	
27.17	ROTOR TIME CONST	Rotor time constant	This is identified from magnetising current and motor nameplate rpm

For further information on the functions of all parameters, refer to Appendix D: "Programming".

Stationary or Rotating Autotune?

Will the motor spin freely, i.e. not connected to a load, during the Autotune?

- If it can spin freely, use a Rotating Autotune (preferred)
- If it cannot spin freely, use a Stationary Autotune

	Action	Requirements
Rotating Autotune ***Preferred method***	Spins the motor up to the maximum speed set by the user to identify all necessary motor characteristics	Motor must spin freely during Autotune
Stationary Autotune *Only used when the motor cannot spin freely during the Autotune feature*	Motor does not spin during Autotune. A limited set of motor characteristics are identified	You must enter the correct value of magnetising current Do not subsequently operate the drive above base speed In Closed-loop Vector Mode set up the encoder direction parameter

Necessary Data

You **MUST** enter values for the following parameters, found in the QUICK SETUP menu, before an Autotune can be carried out:

MOTOR CURRENT	
MOTOR BASE FREQ	
MOTOR VOLTAGE	(maximum motor output voltage)
NAMEPLATE RPM	(motor nameplate speed)
MOTOR POLES	(the number of motor poles)
ENCODER LINES	(if an encoder is fitted, enter the number of lines used by the encoder)

Performing a Rotating Autotune

Note ***The drive will not perform an Autotune when in Volts/Hz Mode (Open-Loop Drive.) An Autotune is not necessary in this control mode.***

Check that the motor can rotate freely in the forward direction. Ensure also that the motor is unloaded. Ideally, the motor shaft should be disconnected. If the motor is connected to a gearbox this is okay, provided that there is nothing on the output of the gearbox which could load the motor.

1. In the QUICK SETUP menu, set MAX SPEED (S2) to the maximum speed at which you will operate the drive in normal operation. The Autotune will characterise the motor up to 30% above this speed. If you later wish to run faster than this, you will need to carry out another Autotune.

2. Set AUTOTUNE ENABLE (S20) to TRUE, and start the drive . The drive will carry out a Rotating Autotune (indicated by the Run and Stop led's flashing. This may take several minutes, during which the motor will be accelerated to maximum speed and then brought to a stop. When complete, the drive is returned to the stopped condition and the AUTOTUNE ENABLE parameter is reset to FALSE. In Closed-loop Vector mode (with an encoder) the encoder sign has been adjusted by the Autotune feature.

IMPORTANT **Now perform a SAVE CONFIG to save your new settings. Refer to Chapter 8: "The Keypad" - SAVE CONFIG.**

Performing a Stationary Autotune

Note ***The drive will not perform an Autotune when in Volts/Hz Mode (Open-Loop Drive.) An Autotune is not necessary in this control mode.***

Before starting the stationary Autotune, you **MUST** enter the value of magnetising current for the motor. This may be available on the motor nameplate. If not, you may need to contact the motor supplier.

1. In the QUICK SETUP menu, set the AUTOTUNE MODE parameter to STATIONARY (0).
2. Set ENABLE to TRUE, and start the drive . The drive will carry out a stationary Autotune, injecting current into the motor but not turning the shaft. The Run and Stop led's will flash. When complete, the drive is returned to the stopped condition and the AUTOTUNE ENABLE parameter is reset to FALSE.

IMPORTANT **Now perform a SAVE CONFIG to save your new settings. Refer to Chapter 8: "The Keypad" - SAVE CONFIG.**

- If the drive is configured to run in Sensorless Vector mode, set-up is complete.
- If the drive is configured to run in Closed-loop Vector mode, i.e. using an encoder, then the encoder direction must be set up. Refer to "Setting the Encoder Sign" below.

Setting the Encoder Sign (Closed-Loop Vector Mode)

If you have performed a Stationary Autotune in Closed-loop Vector mode, you should check the encoder direction as follows:

Look and listen to the motion of the motor when the drive is running at a speed demand of between 5 - 10%.

As a test, use the **Up** (▲) control key to increase the speed to about double the original figure. Change the direction of rotation using the **FWD/REV** control key.

If ENCODER INVERT is correct, the motor will rotate smoothly and will respond to the changes in speed demand and direction.

If ENCODER INVERT is incorrect, the motor will rotate in a jerky and/or noisy manner. Alternatively, it may rotate smoothly at a very low speed but not respond to changes in speed demand or direction.

- Change the setting of ENCODER INVERT to change the encoder sign.
- Change the direction of rotation back to the original direction. Re-set the speed demand.

The encoder sign is now correct for the original motor direction.

If however the direction of the motor is incorrect at this point, then power down the entire drive, wait for 3 minutes (for the dc link capacitors to discharge) and then swap the motor drive cables M1/U and M2/V. Change the setting of ENCODER INVERT.

The encoder sign is now correct for the new motor direction.

IMPORTANT **Now perform a SAVE CONFIG to save your new settings. Refer to Chapter 8: “The Keypad” - SAVE CONFIG.**

Initial Start-Up Routines

WARNING

Unpredictable motion, especially if motor parameters are incorrect.

Ensure no personnel are in the vicinity of the motor or any connected machinery.

Ensure that no machinery connected to the motor will be damaged by unpredictable motion.

Ensure that the emergency stop circuits function correctly before running the motor for the first time.

The Routines 1 & 2 below will run the drive in the default V/F fluxing control mode (VOLTS / HZ) to begin with using either the Keypad or the Control Terminals.

The 890CS Common Bus Supply must be supplying DC to the 890CD Common Bus Drive(s). This is indicated by the red LEDs displaying at the front of the busbar terminal boxes on the top of the units.

Routine 1: Local Mode

Note ***Refer to Chapter 8: "The Keypad" to familiarise yourself with the keypad and menu structure.***

Local control has a use for commissioning a drive. It is not the expected way to operate a system drive.

On the 890CD Common Bus Drive's keypad:

1. Select Local Mode (refer to Chapter 8: "The Keypad" for details).
2. The drive should be "healthy" now it is powered-up: no flashing trip messages displayed, and the 6901 keypad's HEALTH LED is lit (the RUN LED remains off). The keypad will display the Remote Setpoint parameter.
   If the drive has tripped, the keypad will be flashing a trip message, and the 6901 keypad's HEALTH LED will flash. Refer to Chapter 10: "Trips and Fault Finding" to investigate and remove the cause of the trip.

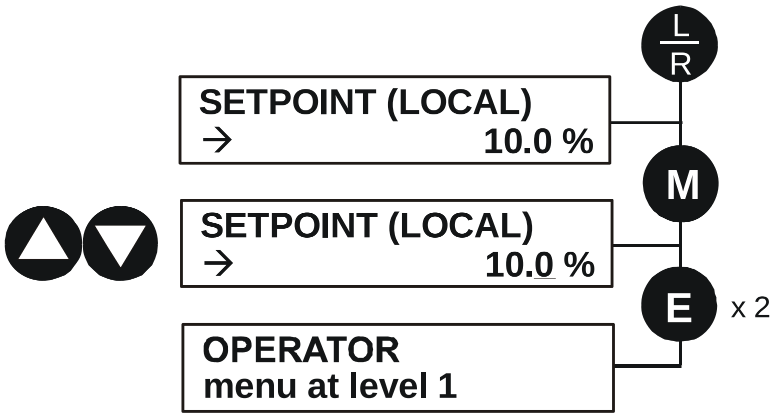
3. Press the Start key . The 6901 keypad's RUN LED will light and the motor will rotate slowly (the RUN LED will flash if the setpoint is at zero). The 6511 keypad will display a rotating symbol.

   *Reverse the motor's direction of rotation either by pressing the FORWARD/REVERSE key on the 6901 keypad, or by swapping two of the motor phases (**WARNING: Disconnect the mains supply first**).*

4. Control the value of the Local Setpoint parameter using the keys.

5. Press the Stop key .

6901 Keypad



Routine 2: Remote Mode

This routine assumes that the drive’s control terminals are wired as shown in "Control Connection Diagram" on page 4-29.

IMPORTANT **Ensure that the speed potentiometer is set to zero.**

On the 890CD Common Bus Drive:

1. The drive should be "healthy" now it is powered-up: no flashing trip messages displayed, and the 6901 keypad's HEALTH LED is lit (the RUN LED remains off).
   If the drive has tripped, the keypad will be flashing a trip message, and the 6901 keypad's HEALTH LED will flash. Refer to Chapter 10: “Trips and Fault Finding” to investigate and remove the cause of the trip.
2. Select Remote Mode - refer to Chapter 8: "The Keypad" for details, or power-down and power up the unit to re-initialise in Remote mode.
3. To Start in Remote Mode, close the "Run" switch on your control panel (applying 24V to DIN2, terminal X15/02 - RUN).
4. Turn the speed potentiometer up a little to apply a small speed setpoint (applying a variable voltage to AIN3, terminal X12/04 - REMOTE SETPOINT). The 6901 keypad's RUN LED will light and the motor will rotate slowly (the RUN LED will flash if the setpoint is at zero). The 6511 keypad will display a rotating symbol.
   *Reverse the motor’s direction of rotation either by pressing the FORWARD/REVERSE key on the 6901 keypad, or by swapping two of the motor phases (**WARNING: Disconnect the mains supply first**).*
5. To Stop in Remote Mode, open the "Run" switch on your control panel (removing 24V from DIN2, terminal X15/02 - RUN).

Chapter 5

890SD Standalone Drive

This chapter describes the mechanical and electrical installation of the 890SD Standalone Drive. It discusses configuring your system, and how to turn the motor for the first time.

Follow the steps for a successful installation.

Step 1: Mechanical Installation

Install the 890 units and associated equipment into the cubicle. The diagram shows a typical layout using Star Point earthing for EMC compliance. Refer to Appendix C for further information.

KEY

- **A** Analog Clean Earth
- **B** Back plate
- **C** Cubicle
- **E** Dirty Earth
- **F** Filter (optional)
- **G** Star Point Earth
- **M** Metal Work Earth
- **P** Fuse or circuit breaker
- **S** Signal/Control Screen Earth

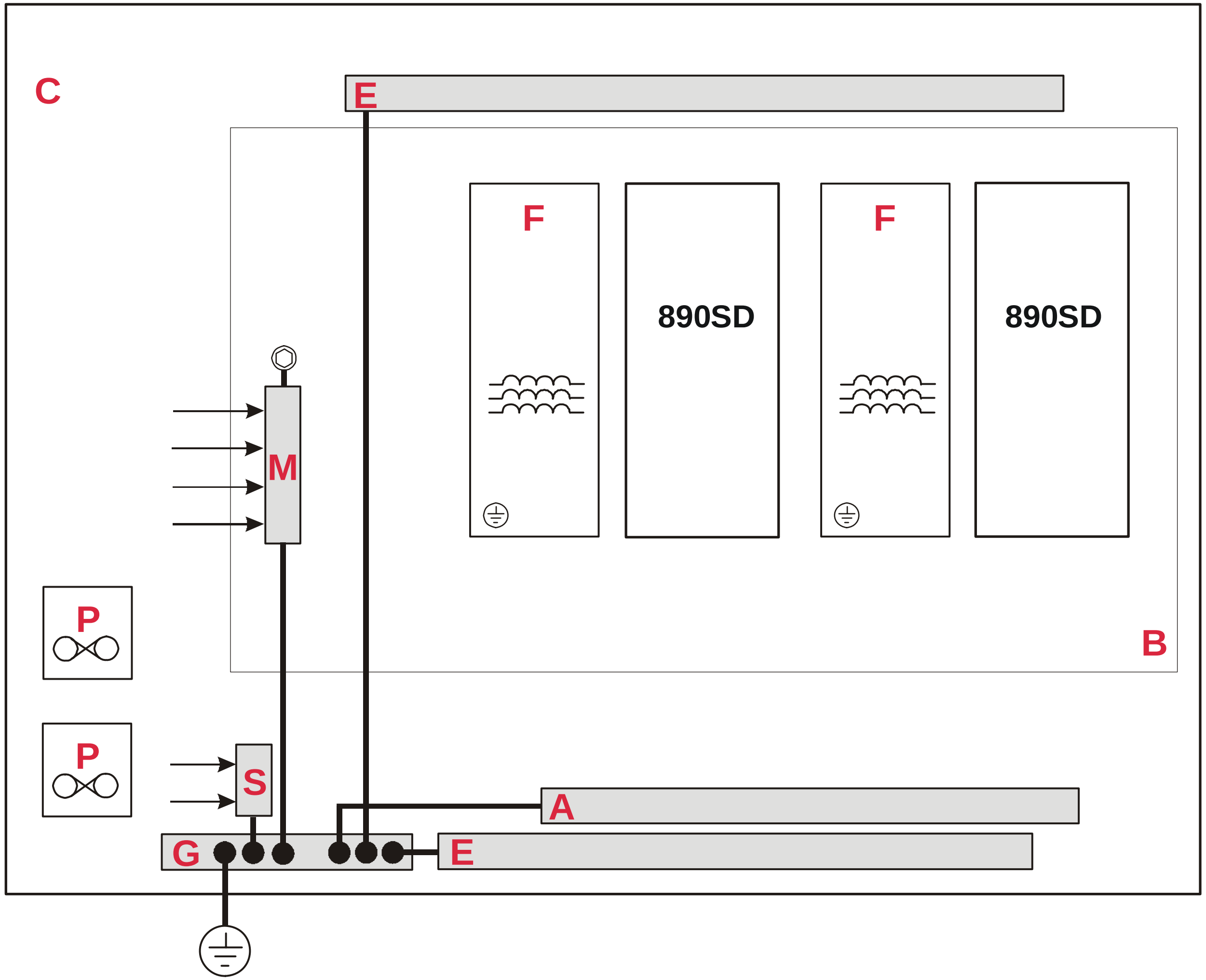


Figure 5.1 A Typical Cubicle Layout (wiring not shown)

Main Points

- ♦ This is a cubicle-mounted unit. It is not suitable for wall-mounting.
- ♦ Mount 890's side-by-side vertically on a solid, flat, normally cool, non-flammable, vertical surface.
- ♦ Adequate ventilation must be provided.
- ♦ Avoid excessive vibration.
- ♦ The earth points (E, G, M & S) are shown separated - it may be possible to use one large star point without EMC problems, this will depend upon your application.

Note ***Refer to Appendix C for information about EMC compliance.***

Sizing the Enclosure

The enclosure should comply with the European safety standards VDE 0160 (1994)/EN50178 (1998) and will require a tool for opening.

The size of the enclosure will depend on many factors:

- ♦ Physical size and number of units
- ♦ Ventilation clearances
- ♦ Power output, affected by derating due to altitude and ambient temperature

Enclosure/Environmental Information

The information here will help you to specify the enclosure to house the 890(s).

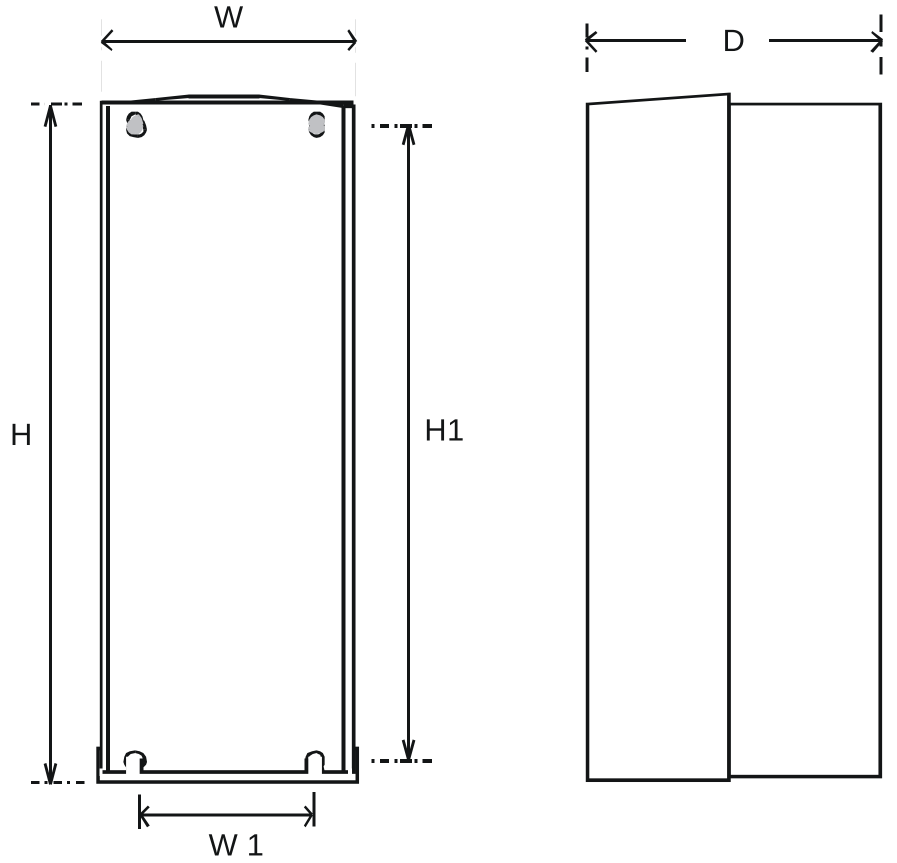
890 Operating Conditions		
Operating Temperature	0°C to 45°C (32°F to 113°F)	
Product Enclosure Rating	IP20 - UL (c-UL) Open Type (North America/Canada) Type 1 Suitable for cubicle mount only	
Cubicle Installation	The 890 must be installed to EN60204 Standard in the cubicle. For USA, the cubicle shall meet the requirements of UL50.	
Cubicle Rating	Cubicle to provide the following attenuation to radiated emissions:	
	EMC Enclosure Standard	*Attenuation to RF in spectrum 30-1000MHz*
	EN61800-3 2nd Environment	NONE
	EN61800-3 1st Environment Restricted Distribution EN61000-6-3:2001	10db
	EN61800-3 1st Environment Unrestricted Distribution EN61000-6-4:2001	20db

890 Operating Conditions	
Humidity	Maximum 85% relative humidity at 40°C (104°F) non-condensing
Atmosphere	Non flammable, non corrosive and dust free
Climatic Conditions	Class 3k3, as defined by EN50178 (1998)
Vibration	The product has been tested to the following specification: Test Fc of EN60068-2-6 10Hz<=f<=57Hz sinusoidal 0.075mm amplitude 57Hz<=f<=150Hz sinusoidal 1g 10 sweep cycles per axis on each of three mutually perpendicular axis
Safety	
Pollution Degree	Pollution Degree II (non-conductive pollution, except for temporary condensation)
Europe	When fitted inside an enclosure, this product conforms with the Low Voltage Directive 73/23/EEC with amendment 93/68/EEC, Article 13 and Annex III using EN50178 (1998) to show compliance.
North America/ Canada	Complies with the requirements of UL508C as an open-type drive.

Panel Mount Fixings

Support the unit at the top and bottom with fixings to secure the unit to the panel. Mark and drill the fixing holes into the panel. Refer to the fixing centres given on the previous page. Insert the fixings into the top hole(s) and hang the unit. Insert the bottom fixing(s) and tighten to the required torque.

Mounting Dimensions (890SD)



Approximate Frame E shown for illustration purposes

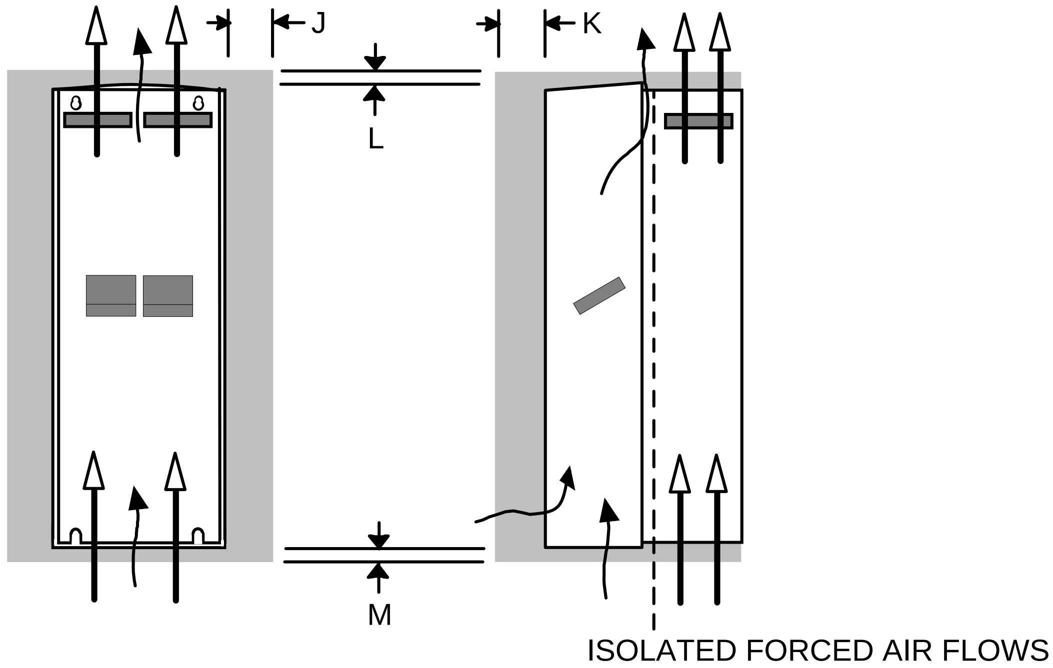
Models	Max. Weight: kg/lbs	H	H1	W	W1	D	Fixings
Frame E	32.5/72	668.6 (26.3)	630.0 (24.8)	257.0 (10.1)	150.0 (5.9)	312 (12.3)	Use M6 fixings
Frame F	41/90.4	720.0 (28.3)	700.0 (27.6)	257.0 (10.1)	150.0 (5.9)	355.0 (14.0)	Use M6 fixings
All dimensions are in millimetres (inches)							

Minimum Air Clearances

The 890 gives off heat in normal operation. The mounting surface for the unit should be normally cool. Allow a free flow of air through the top and bottom ventilation slots and heatsink. Remember that any other equipment may have its own clearance requirements. If you mount next to each other, the clearances should be added to produce an overall clearance value.

890SD Frame E : Cubicle-Mount

(Europe: IP2x, USA/Canada: Open Type).

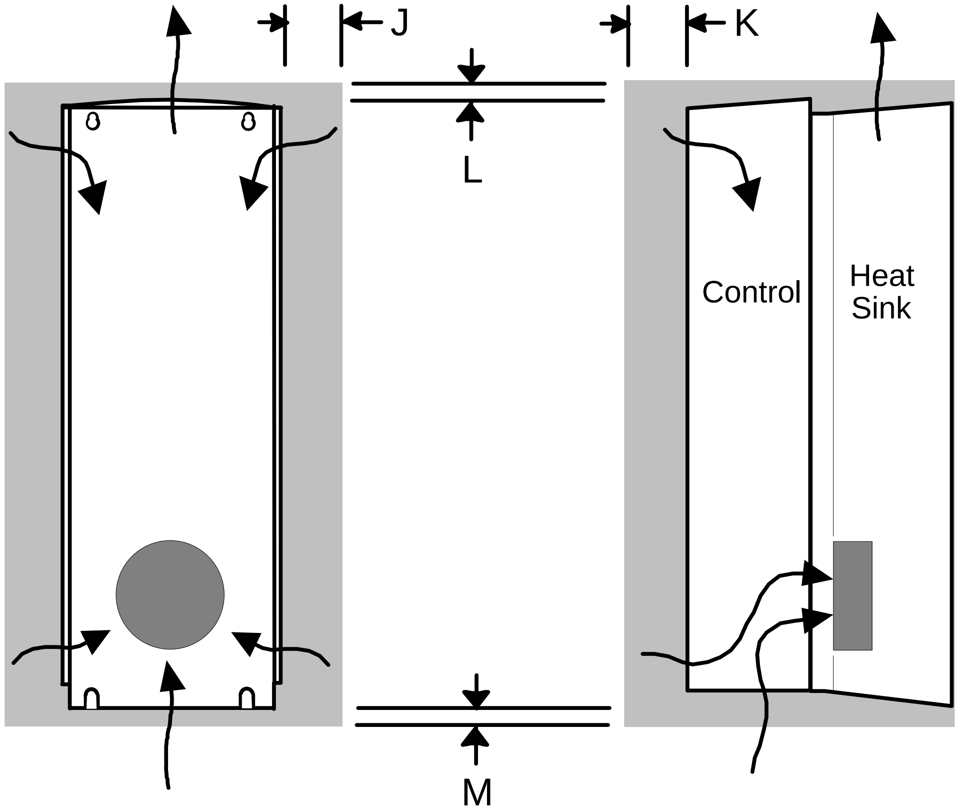


Clearances for Standard Product (mm)			
J	K	L	M
0 (zero)	25	70	70

890SD Frame F : Cubicle-Mount

(Europe: IP2x, USA/Canada: Open Type).

Note ***There is no through panel-mount capability for the 890SD Frame F.***



Clearances for Standard Product (mm)			
J	K	L	M
0 (zero)	25	70	70

890SD Frame F : Duct Kit

Duct kit, Part Number LA466717U003.

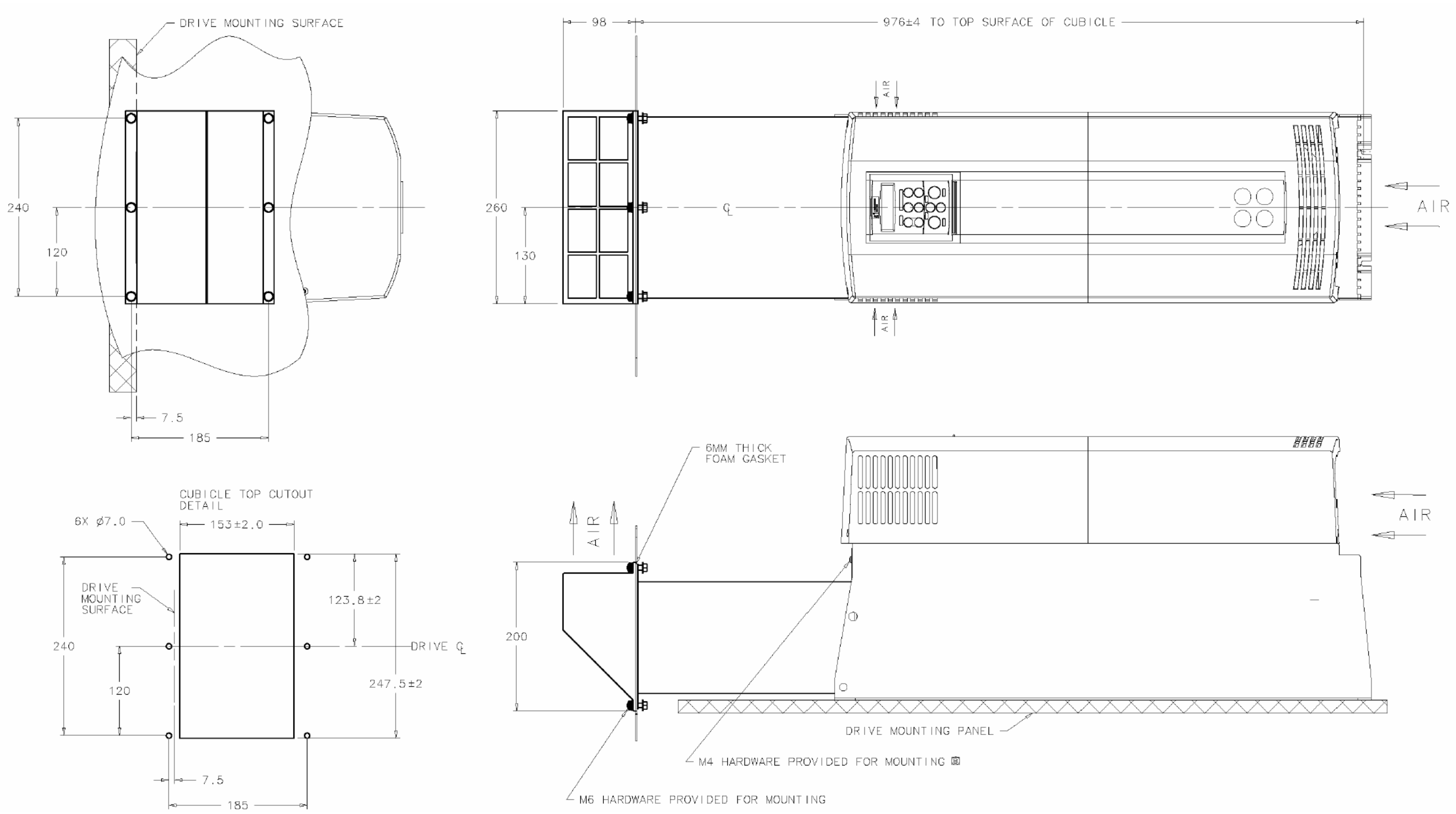
The installation diagram is provided on the following page.

Caution

Protect any equipment in the cubicle from swarf etc.
Ensure all equipment is isolated.

- The duct length determines the vertical position of the drive in the cubicle. Drill the lower mounting panel hole centres for the drive at 976mm from the top of the cubicle. There is a generous tolerance of ±4mm.
- Cut-out the hole for the duct directly above where the drive sits. Project the position of the drive mounting surface inside the cubicle and mark it on the roof. From the drawing, you can calculate that the cut-out is made 8.5mm in front of the drive mounting surface (the centres for the cowling fixing holes will be 7.5mm behind the drive mounting surface). Draw the cut-out shape, check its position, and cut it out.
- Because of the weight of the drive, it may be better to secure the drive in the cubicle first, and lower the duct into the cubicle from above.
- Fix the duct to the drive using the M4 fasteners.
- Fit the gasket between the duct cowling and the top of the cubicle to provide a good seal. Drill through and secure all this with the M6 fasteners.

890SD Frame F : Duct Kit Installation Diagram



Step 2: Connecting Power

In this section we are going to connect the 3-phase supply to the 890SD Standalone Drive(s). We'll also connect the motor and the (optional) brake resistor.

WARNING

During commissioning, remove the fuses (or trip the circuit breaker) on your 3-phase supply.
Make sure the power is OFF, and that it cannot be switched on accidentally whilst you are working.

Solid-State Short-Circuit Protection

These devices provide Class 10 motor overload protection. The maximum internal overload proection level (current limit) is 150% for 60 seconds in Constant mode, and 110% for 60s in Quadratic mode. Refer to Appendix D: Programming - CURRENT LIMIT for user current limit adjustment information.

An external motor overload protective device must be provided by the installer where the motor has a full-load Ampere rating of less than 50% of the drive output rating; or when the MOTOR STALLED trip is TRUE (TRIPS STATUS::DISABLED WORD 1>>MOTOR STALLED); or when the STALL TIME parameter is increased above 480 seconds.

Gland Plate Details

Frame E The gland plate holes accept the following gland sizes:

22.8mm to accept metric M20, PG16 and American ½” NPT cable gland sizes

28.6mm to accept metric M25, PG21 and American ¾” NPT cable gland sizes

47.3mm to accept metric M40, PG36 and American 1¼” NPT cable gland sizes

54.3mm to accept metric M50, PG42 and American 1½" NPT cable gland sizes

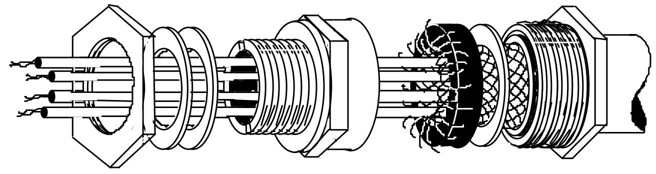
Frame F The gland plate holes accept the following gland sizes:

22.8mm to accept metric M20, PG16 and American ½” NPT cable gland sizes

28.6mm to accept M25, PG21 and American ¾” NPT cable gland sizes

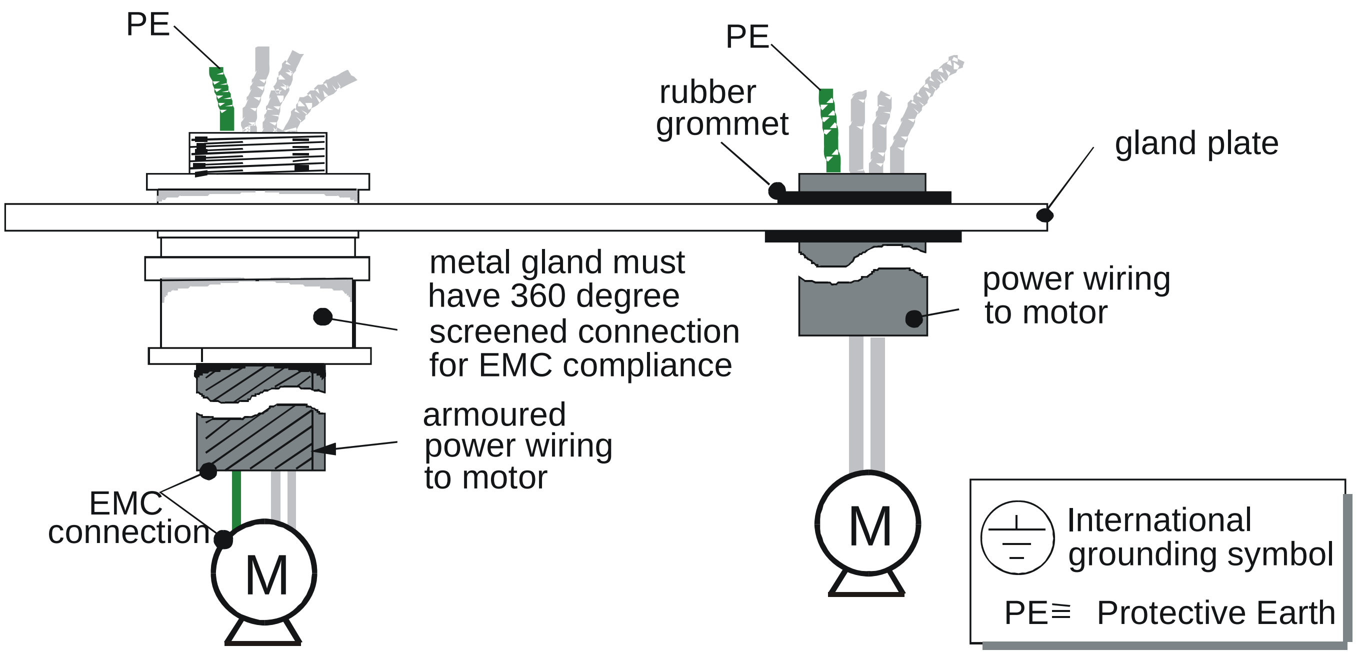
Cable Gland Requirements

Use a metal gland to connect to the internally earthed gland plate. It must be capable of securing a 360 degree screened connection to give EMC compliance. A 360 degree screened connection can be achieved as shown.



1 **metal cable gland**

2 **rubber grommet (non-EMC compliant)**



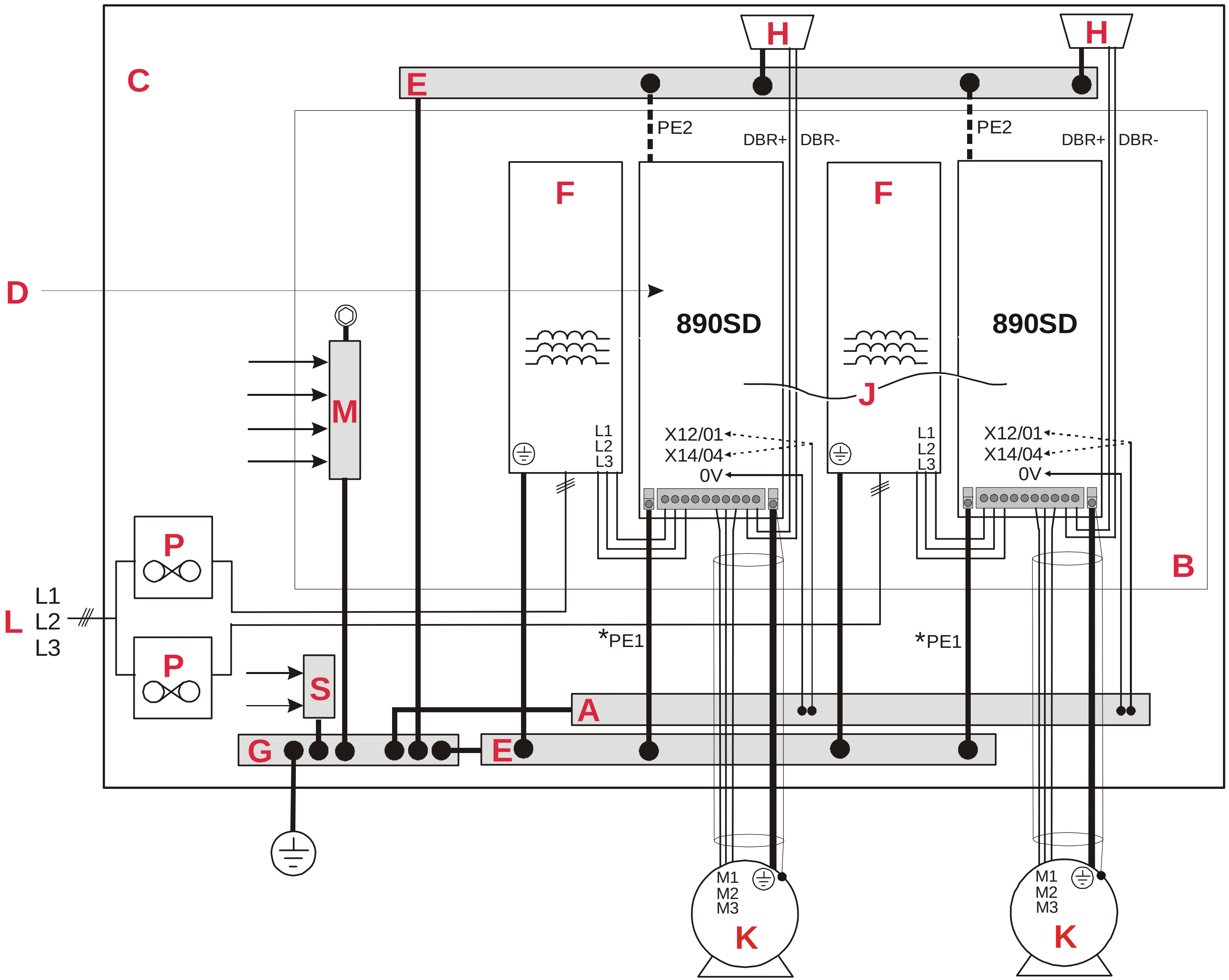
Protective Earth (PE) Connections ⏚

The unit must be **permanently earthed** according to EN 50178 - see below. Protect the incoming mains supply using a suitable fuse or circuit breaker (circuit breaker types RCD, ELCB, GFCI are not recommended). Refer to Chapter 6: Circuit Breakers.

IMPORTANT **The drive is only suitable for earth referenced supplies (TN) when fitted with an internal filter. External filters are available for use on TN and IT (non-earth referenced) supplies.**

Each unit must be **permanently earthed** according to EN 50178. For permanent earthing: A cross-section conductor of at least 10mm² is required. This can be achieved either by using a single conductor (PE) or by laying a second conductor though separate terminals (PE2 where provided) and electrically in parallel. Refer to Appendix C: “Certification".

Wiring Diagram



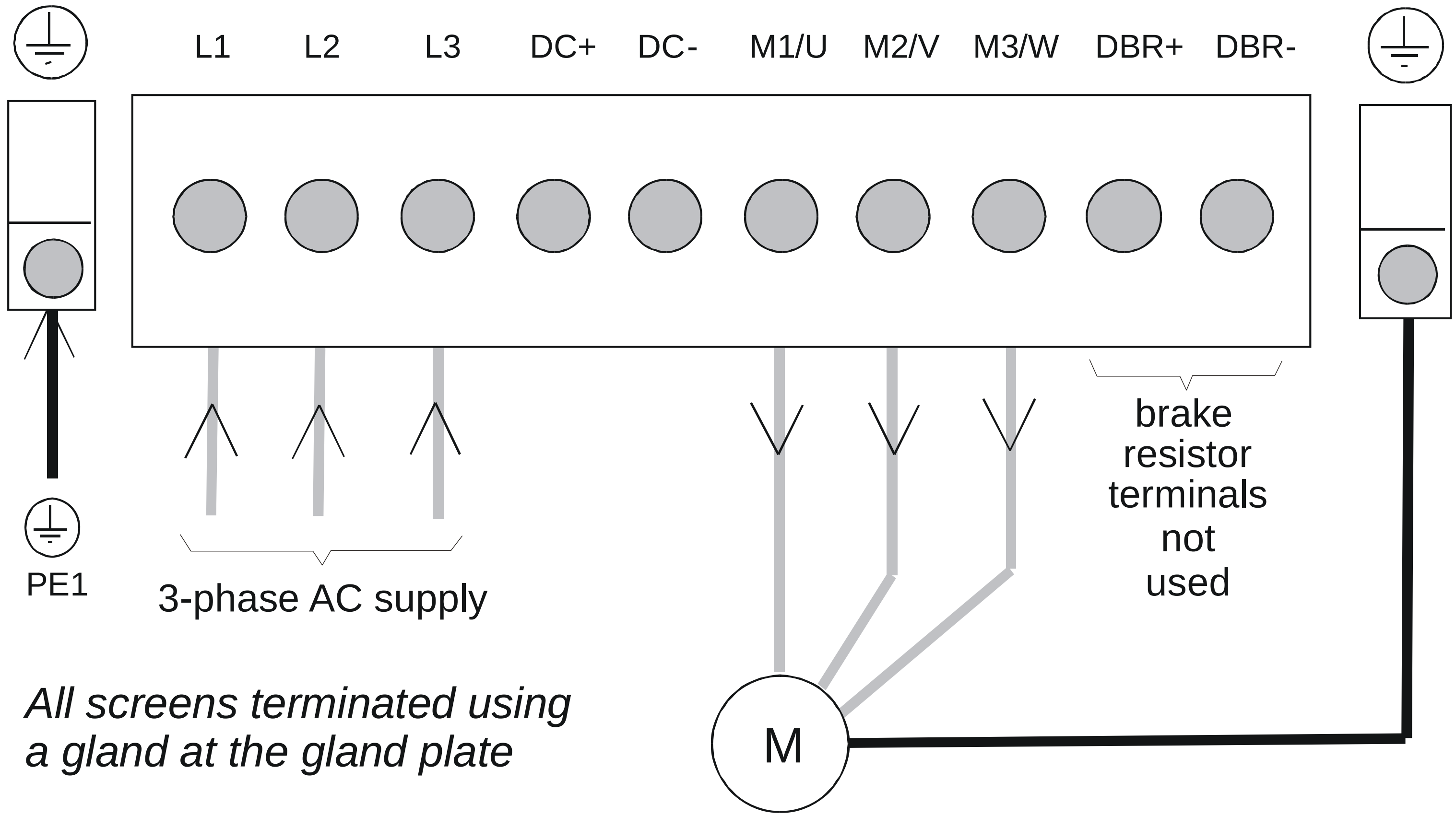
Key to Wiring Diagram

A	Analog Clean Earth	This must be insulated from the back panel. Analog reference X12/01 or digital reference X14/04 must be connected to this busbar, avoiding earth loops.
B	Back-plate	Earth the backplate to the star point (G).
C	Cubicle	The 890 must be mounted inside a cubicle complying with the European safety standards VDE 0160 (1994)/EN50178 (1998).
D	Control Wiring	Control terminals are SELV (Safe Extra Low Voltage), i.e. double-insulated from power circuits. 0.08mm^2 (28AWG) to 2.5mm^2 (12AWG).
E	Dirty Earth	This must be insulated from the back panel. It is used for all power earths.
F	Filter (optional)	Refer to Chapter 6: "Associated Equipment" for the specified filter. This may help to achieve EMC compliance. Refer to Appendix C.
G	Star Point Earth/Ground	The star point connects all earth busbars. Connect the star point to the incoming safety earth (PE). Note the possible requirement for PE2 connections to each drive, refer to page 4-**Error! Bookmark not defined.**.
H	Brake Resistor (DC+, EXT: frames B & C) (DBR+, DBR-: frame D)	External brake resistors are available. Refer to Chapter 6: "Associated Equipment". Ensure wiring is rated for highest system voltage. (890SD Frame D units also have internal brake resistors.)

Key to Wiring Diagram

J	FireWire™ Connection	A very fast external bus (IEEE 1394a) to connect up to 63 units. You will need the FireWire Option Card for each Standalone Drive, refer to Appendix A.
K	Motor (M1, M2, M3)	The motor used must be suitable for Inverter duty. Ensure wiring is rated for highest system voltage. Refer to Appendix E.
L	3∅ Power Supply Cable (L1, L2, L3)	Ensure wiring is rated for highest system voltage. Refer to Appendix E.
M	Metal Work Earth	Use the back panel for this earth. It provides earthing points for all parts of the cubicle including doors and panels. Connect cubicle to earth/ground via cubicle PE terminal.
P	Fuse or Type B RCD	Fuse rating - refer to Appendix E. We don't recommend the use of circuit breakers (e.g. RCD, ELCB, GFCI), but if their use is mandatory, use only a Type B RCD.
S	Signal/Control Screen Earth	This must be insulated from the back panel. Connect any signal/control screened cables which **do not** go directly to the drives.

Power Wiring Connections (Frame E)

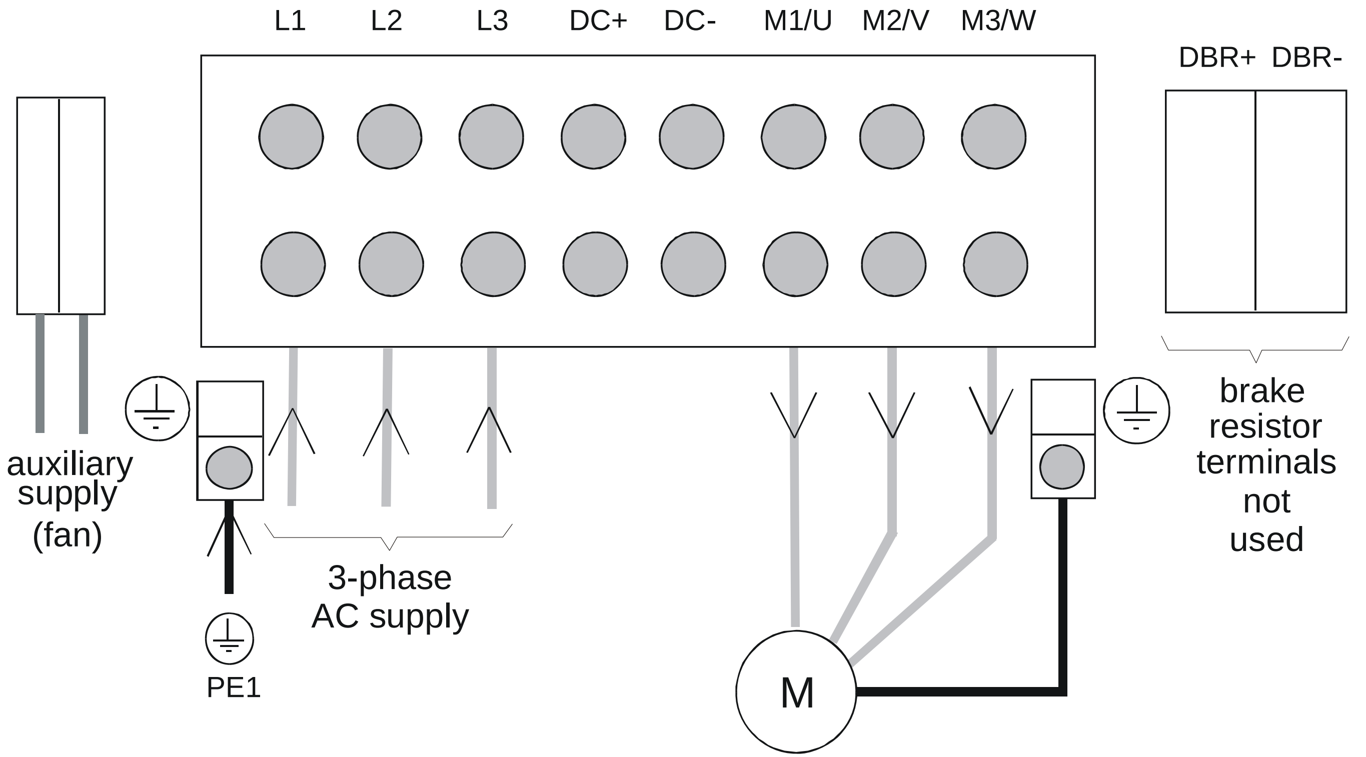


Note ***The standard Frame E terminals are not intended for flat busbar. A Power Terminal adaptor is available to enable wiring with flat busbar, part number BE465483.***

Remove the terminal cover retaining screws and lift off the terminal cover.

Feed the power supply and motor cables into the drive through the metal gland plate using the correct cable entries, and connect to the power terminals. Tighten all terminals to the correct tightening torque, refer to Appendix E: "Technical Specifications" - Wire Sizes tables.

Power Wiring Connections (Frame F)



Terminate all control cable screens using a gland at the gland plate
Bond the motor cable screen to the drive and motor, as close as possible to both terminals

Note ***For cooling fan details, refer to Appendix E: "Technical Specifications" - Cooling Fans.***

Note ***The standard Frame F terminals are not intended for flat busbar. A Power Terminal adaptor is available to enable wiring with flat busbar, part number BE465483.***

Remove the terminal cover retaining screws and lift off the terminal cover. Feed the motor cables into the cubicle using the correct cable entry glands ensuring the screen is connected.

Feed the power supply and motor cables into the drive through the large aperture in the metal gland plate and connect to the power terminals. Tighten all terminals to the correct tightening torque, refer to Appendix E: "Technical Specifications" - 890CD/890SD Wire Sizes.

Motor Thermistor Connections

MMI Menu Map

1 SETUP
2 TRIPS
3 I/O TRIPS
INVERT THERMIST

This input is provided to detect over-temperature in motors fitted with an internal thermistor. There is no polarity to the thermistor connections.

IMPORTANT **This input provides “Basic” insulation only to the SELV control circuits and assumes the motor has “Basic” insulation to the windings/mains circuits.**

The thermistor type supported is PTC `Type A’ as defined in IEC 34-11 Part 2. The drive uses the following resistance thresholds:

Rising temperature trip resistance:	1650 to 4000Ω
Falling temperature trip reset resistance:	750 to 1650Ω

If the motor is not fitted with an internal thermistor, you should disable the thermistor trip function either by setting INVERT THERMIST to be TRUE, or by linking the thermistor terminals.

Step 3: Control Connections

WARNING

During commissioning, remove the fuses (or trip the circuit breaker) on your 3-phase supply.
Make sure the power is OFF, and that it cannot be switched on accidentally whilst you are working.

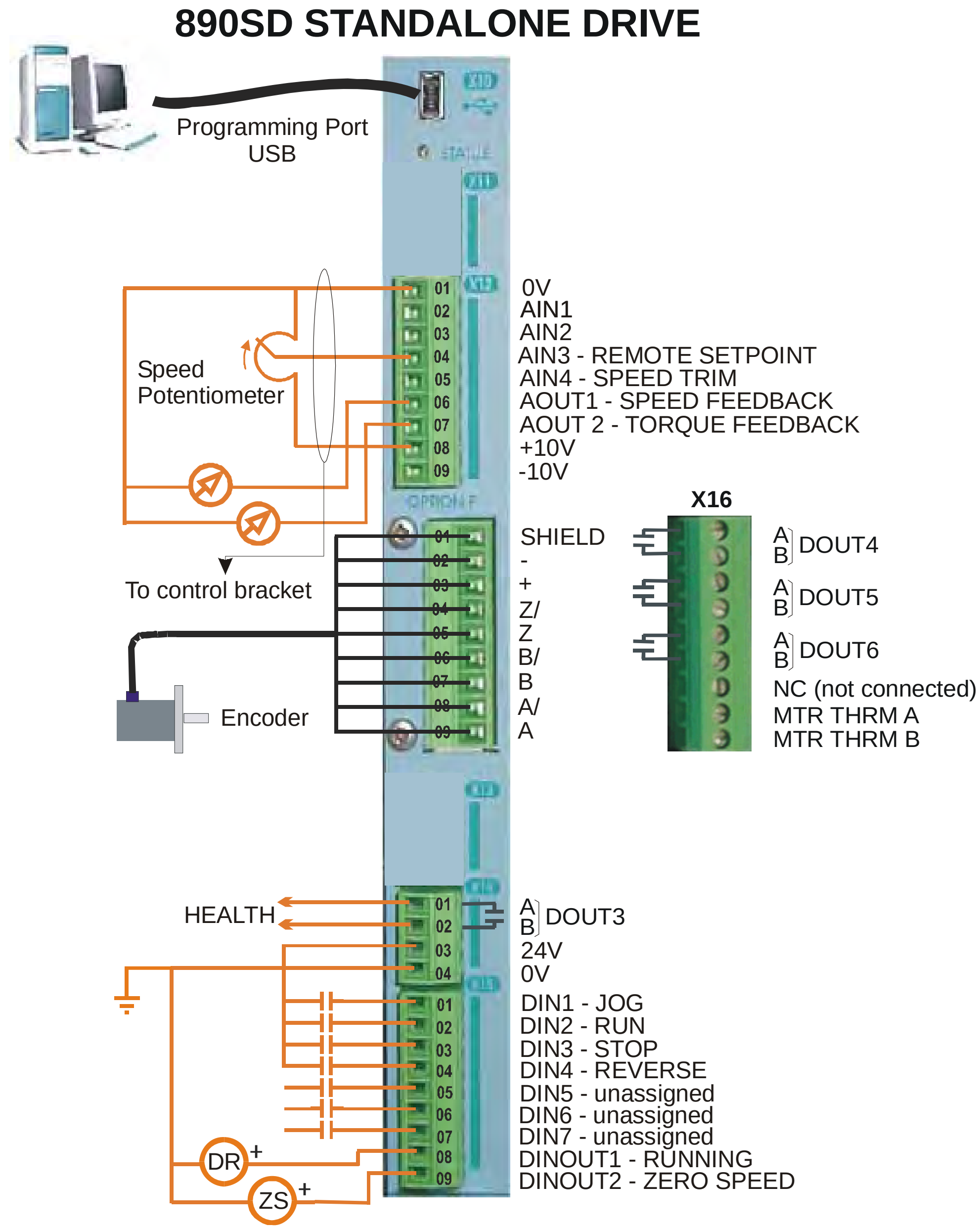
Main Points

- The 890 is a system product and is designed for Remote mode operation using the analog & digital inputs/outputs and/or FireWire™ connection. The use of the keypad (Local mode) is for configuration purposes.

  Connecting 890SD Standalone Drives using the FireWire™ Option Cards is recommended for applications requiring high levels of accuracy. Otherwise, use I/O to transfer data from master to slave units.

- The control terminals will accept a single wire of size 1.5mm^2/16AWG. For two wires per terminal, use smaller gauge wire such as 0.5mm^2/22AWG.
- Use screened control cables to comply with EMC requirements. All screens must be terminated at the base of the product using cable glands.
- The control board 0V at X14/04 must be connected to protective (clean) earth outside of the product to meet EMC and safety requirements.

Control Connection Diagram



890SD Minimum Control Connections

5

Minimum Connections

Speed Reference

- Connect a 10kΩ potentiometer at terminal X12:

  X12/01 : Low (CCW)
  X12/04 : Wiper
  X12/08 : High (CW)

- Connect the shield to earth/ground at the control bracket.

OR

- External 2-wire speed reference between:

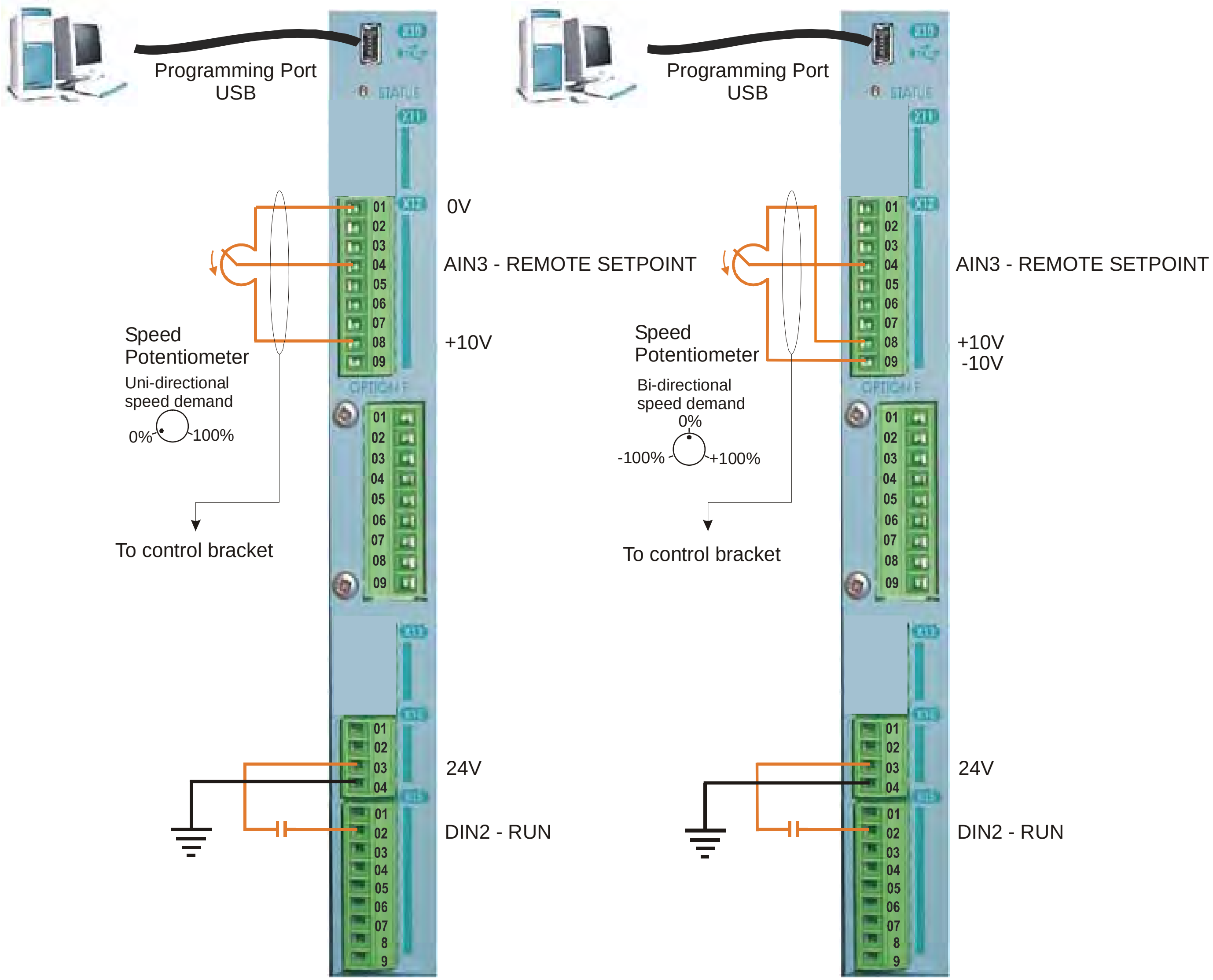
  X12/01 : negative
  X12/04 : positive

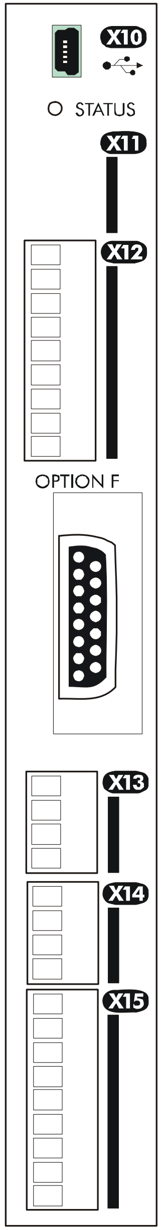
- Connect the shield to earth/ground at the control bracket.

Sequencing

- RUN (maintained contact)

  X14/03 : 24V
  X15/02 : RUN

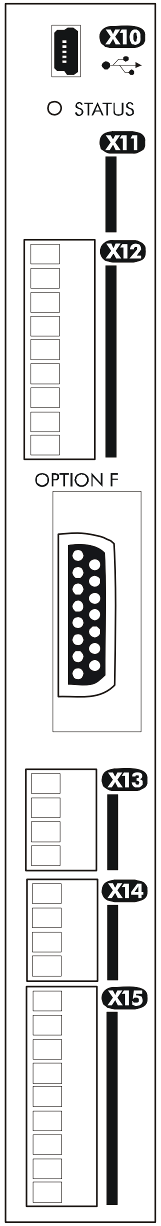




Control Connections - 890SD Standalone Drive

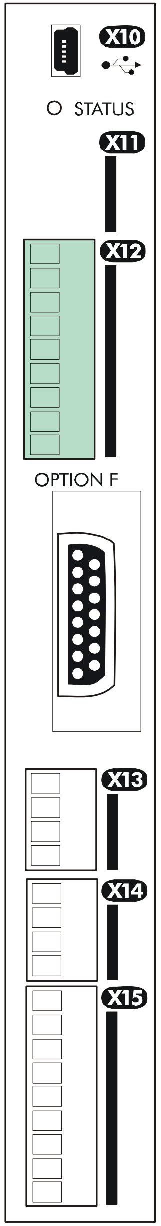
The table below shows the factory defaults.

Mini USB Port			
	Name	**Range**	**Description**
X10	USB		This Mini USB port provides a serial communications link to a host computer running the DSE 890 Configuration Tool. Use an approved USB lead: A to mini-B.



FUTURE USE				
		Name	Range	Description
X11	01			
	02			
	03			
	04			

Note **Terminal X11 is for future use.**

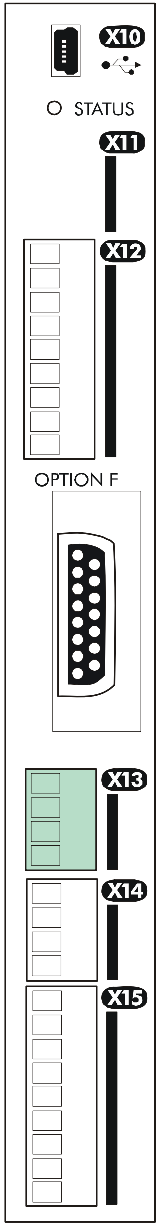


ANALOG I/O

		Name	Range	Description
X12	**01**	0V		0V reference for analog I/O
	02	AIN1	0-10V, ±10V	Analog Input 1 (default = diff I/P +)
	03	AIN2	0-10V, ±10V	Analog Input 2 (default = diff I/P -)
	04	AIN3	±10V, 0-10V, 0-20mA, 4-20mA	Analog Input 3 (default = remote setpoint I/P) -10V = 100.00% reverse, +10V = 100.00% forward (% maximum speed)
	05	AIN4	±10V, 0-10V, 0-20mA, 4-20mA	Analog Input 4 (default = speed trim I/P)
	06	AOUT1	±10V (10V = 100% speed)	Analog Output 1 (default = speed feedback O/P)
	07	AOUT2	±10V (10V = 200% torque)	Analog Output 2 (default = torque feedback O/P)
	08	+10V REF	+10V (output)	10V reference for analog i/o. Load 10mA maximum
	09	–10V REF	-10V (output)	10V reference for analog i/o. Load 10mA maximum

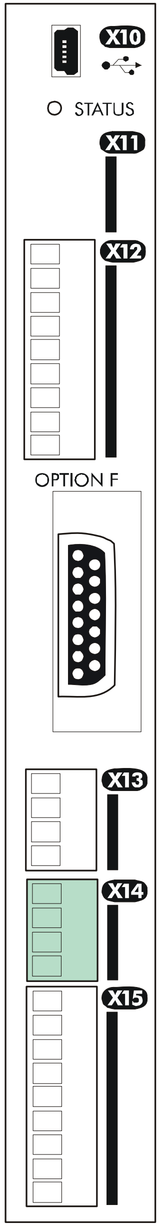
Note ***AIN1 and AIN2 are fitted with a link to ensure no noise pick-up when not in use. These terminals can be used as a differential ±10V input (which we call AIN5), but AIN1 and AIN2 must remain within ±10V relative to 0V. AIN5 has a direct input into the Speed Loop providing a fast speed or torque demand for servos.***

All analog inputs/outputs are configurable using the DSE 890 (Drive System Explorer) Configuration Tool supplied on disk. The table above shows the factory defaults. These analog connections require ±10V DC which is supplied at terminal X12/08 and X12/09 respectively. For further information refer to the DSE 890 Configuration Tool.



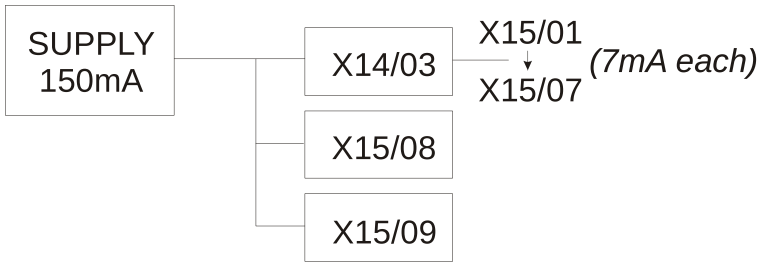
FUTURE USE				
		Name	Range	Description
X13	01			
	02			
	03			
	04			

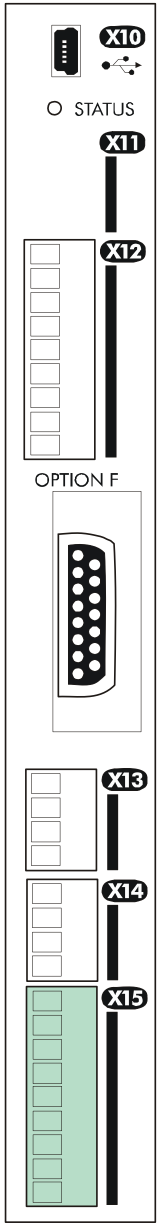
Terminal X13 is for future use.



RELAY CONTACTS				
		Name	**Range**	**Description**
X14	**01**	DOUT3A	0-24V DC	Relay Output: normally-open, volt-free, 24V DC 1A resistive load or use down to 1mA, 12V levels (DOUT3 closed = HEALTH)
	02	DOUT3B	0-24V DC	Relay Output: normally-open, volt-free, 24V DC 1A resistive load or use down to 1mA, 12V levels (DOUT3 closed = HEALTH)
	03	USER 24V	0-24V DC	24V DC Output, 150mA maximum load
	04	0V	0-24V DC	0V reference for USER 24V output

Note ***The maximum permissible sum of currents from X14/03, X15/08, X15/09 is 150mA. An Alert message will be displayed if exceeded.***

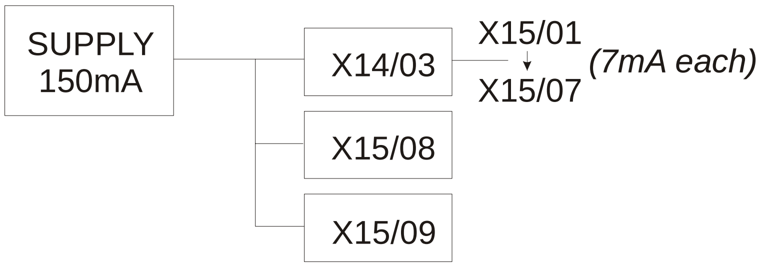


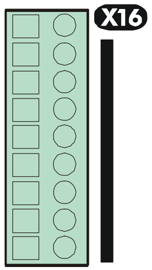


DIGITAL I/O				
		Name	**Range**	**Description**
X15	**01**	DIN1	0-24V DC	Digital Input 1 (default = JOG)
	02	DIN2	0-24V DC	Digital Input 2 - (default = RUN)
	03	DIN3	0-24V DC	Digital Input 3 - (default = STOP)
	04	DIN4	0-24V DC	Digital Input 4 - (default = REVERSE)
	05	DIN5	0-24V DC	Digital Input 5 - (default = unassigned). Refer to I/O TRIPS::EXT TRIP MODE for special function.
	06	DIN6	0-24V DC	Digital Input 6 - (default = unassigned)
	07	DIN7	0-24V DC	Digital Input 7 - (default = unassigned)
	08	DIN8/DOUT1	0-24V DC	Digital Input/output 1 - (default = digital output: RUNNING)
	09	DIN9/DOUT2	0-24V DC	Digital Input/output 2 - (default = digital output: ZERO SPEED)

All digital inputs/outputs are configurable using the DSE 890 (Drive System Explorer) Configuration Tool supplied on disk. The table shows the factory defaults. The digital inputs require 24V DC which is supplied at terminal X14/03. For further information refer to the DSE 890 Configuration Tool.

Note ***The maximum permissible sum of currents from X14/03, X15/08, X15/09 is 150mA. The load on X15/08 & X15/09 connects from these pins to X14/04 (0V). An Alert message will be displayed if exceeded.***





DIGITAL I/O

		Name	Range	Description
X16	**01**	DOUT4A	0-24V DC	Normally-open relay contacts, A & B.
	02	DOUT4B	0-24V DC	Default function DOUT4 closed = healthy
	03	DOUT5A	0-24V DC	Normally-open relay contacts, A & B.
	04	DOUT5B	0-24V DC	Default function DOUT5 closed = running
	05	DOUT6A	0-24V DC	Normally-open relay contacts, A & B.
	06	DOUT6B	0-24V DC	No default function.
	07	NC		Not Connnected - this terminal is unused
	08	MTR THRM A		Motor thermistor connection, or link to MTR THRM B
	09	MTR THRM B		Motor thermistor connection, or link to MTR THRM A

All digital inputs/outputs are configurable using the DSE 890 (Drive System Explorer) Configuration Tool supplied on disk. The table shows the factory defaults. The digital inputs require 24V DC which is supplied at terminal X14/03. For further information refer to the DSE 890 Configuration Tool.

Relay outputs are volt-free, normally open contacts. Rated to 240V 3A resistive load. Alternatively they may be used down to 1mA, 12V levels.

Step 4: Powering-up the Unit

Main Points

1. Complete all Pre-Operation Checks.
2. Ensure all the set-up parameter values for each 890SD Standalone Drive have been entered. Refer to "Set-up Parameters page 5-35.
3. Autotune each drive where necessary.
4. Save your Application.
5. Follow one of the Start-up Routines: Local Mode or Remote Mode.

Pre-Operation Checks

Before Applying Power:

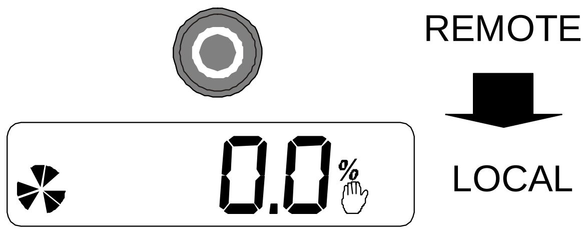
- ♦ Read the Safety section at the front of the Manual.
- ♦ Ensure that all local electric codes are met.
- ♦ Check for damage to equipment.
- ♦ Check for loose ends, clippings, drilling swarf etc. lodged in the drive and system.
- ♦ Check all external wiring circuits of the system - power, control, motor and earth connections.
- ♦ Ensure that unexpected rotation of the motor in either direction will not result in damage, bodily harm or injury. Disconnect the load from the motor shaft, if possible.
- ♦ Check the state of the Motor Thermistor and Brake Resistor connectors. Check external run contacts are open. Check external speed setpoints are all at zero.
- ♦ Ensure that nobody is working on another part of the system which will be affected by powering up.
- ♦ Ensure that other equipment will not be adversely affected by powering up.
- ♦ Check motor stator connections are correctly wired for Star or Delta as necessary for drive output voltage.

4.1: Apply the 3-Phase Supply

1. **Apply the 3-phase supply to the 890SD Standalone Drive.**
2. Select LOCAL mode operation:

Hold the Stop key down until the display spells LOC

Release the key to display the previous menu for example,Local Setpoint



♦ The Keypad will display the Remote Setpoint parameter (%).

3. **You MUST carry out an Autotune** if you intend to use the drive in Sensorless Vector Fluxing Mode or Closed-Loop Vector Mode - go to page 4-45. If you are using the drive in Volts/Hz Mode (Open-Loop Drive) an Autotune is not necessary - go to page 4-50.

4.2: Configure the 890SD Standalone Drive

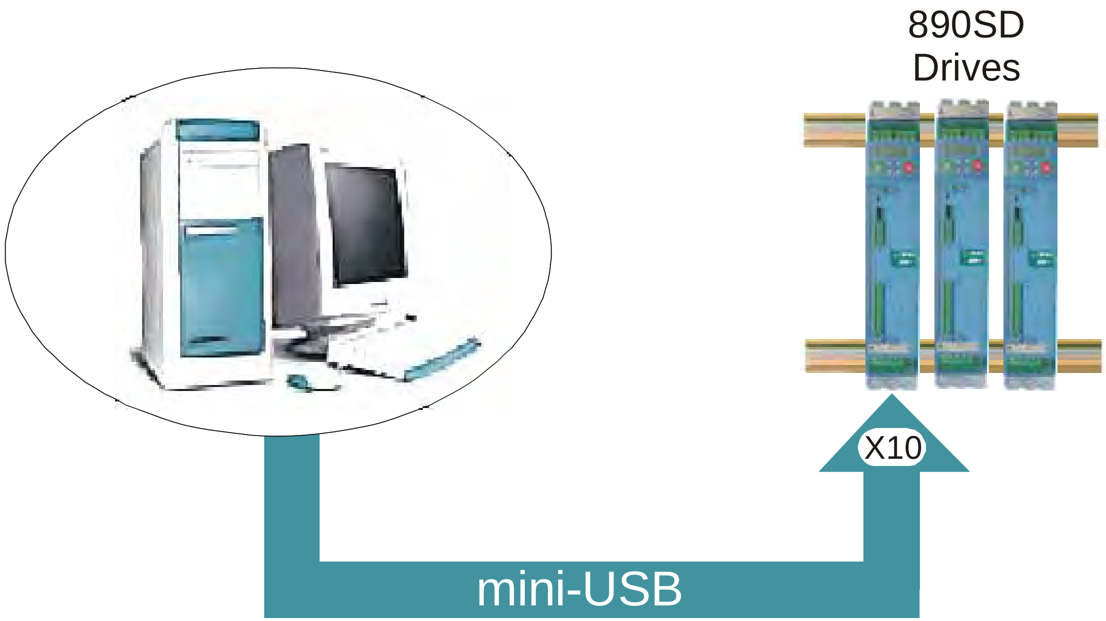
You must now configure each 890SD Standalone Drive to your application. This is done using the DSE 890 Configuration Tool supplied on the CD, or the keypad.

Using the DSE 890 Configuration Tool

The DSE 890 (Drive System Explorer) Configuration Tool has a full Help system. Insert the DSE 890 disk into your PC and follow the on-screen instructions. Use the tool to set-up the I/O connectivity so that it meets the requirements for each 890SD Standalone Drive. When connected, enter the set-up parameters as discussed on page 5-35.

Connecting to a PC

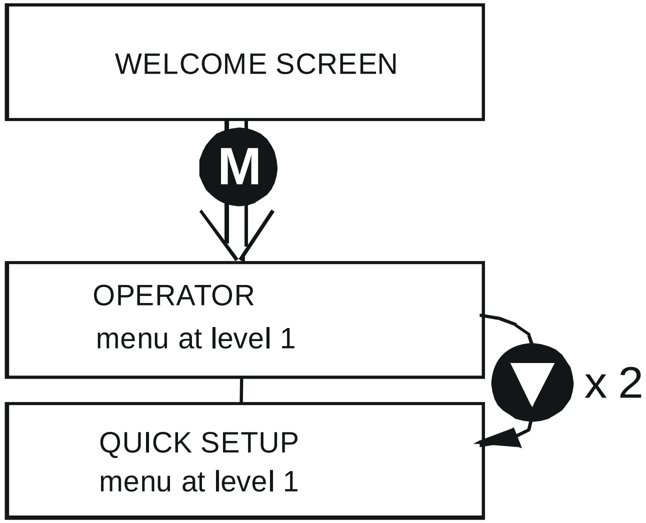
Connect the 890SD Standalone Drive to your PC using an approved mini-USB lead. You can order this lead from Parker SSD Drives: part number CM471050 (3m long) or CM465778 (1m long).



Using the Keypad

Fit the keypad to the front of the unit, or connect remotely. The set-up parameters are stored in QUICK SETUP menu on the 6901 keypad.

6901 Keypad



How to Edit a Parameter

Press  to enter the QUICK SETUP menu.

Scroll through the parameters using the  and  keys.

Press  to select a parameter for editing.

Increment/decrement the parameter value using the  and  keys.

Press  to exit the parameter.

Set-up Parameters

The drive has several control modes:

Control Modes		
V/Hz	VOLTS / HZ	Set-up as an Open-Loop Drive (V/F Fluxing) - *low performance applications (fan, pump). Simplest method involving no speed feedback and no compensation for load changes.* ***Autotune is not required***.
SV	SENSORLESS VEC	Set-up using the Sensorless Vector Fluxing Mode - *medium performance applications where the drive uses an electrical model of the motor to automatically compensate for load changes.* The drive must be tuned to the motor in use by matching the motor parameters in the drive to those of the motor being controlled. **You MUST use the Autotune feature after entering your parameter values.**
CLV	CLOSED-LOOP VEC	Set-up using the Closed-Loop Vector Mode - *high performance applications where the drive uses external sensors (encoders) to automatically compensate for load changes.* In this mode, speed feedback signals from the motor shaft encoder are processed to determine the rotational speed of the shaft. A PI algorithm within the software uses this information to produce varying gate drive signals to the drive circuits. These signals cause the drive to output the required voltage and frequency for a particular motor speed. **You MUST use the Autotune feature after entering your parameter values.**

5

Control Modes		
4-Q	4-Q REGEN	Set-up using 4Q Regen active front end (AFG) control mode. Refer to Chapter 7 to correctly set-up the drive for an 890CD/SD 4-Q Regen AFE Application. Autotune is not required.
PMAC	PMAC	Set-up using PMAC (Permanent Magnet AC) servo or torque motor control mode - *a high performance application where the drive uses Resolver or Sin/Cos Encoder motor feedback.* In this mode, speed feedback signals from the motor shaft encoder are processed to determine the rotational speed of the shaft. A PI algorithm within the software uses this information to produce varying gate drive signals to the drive circuits. These signals cause the drive to output the required voltage and frequency for a particular motor speed. Autotune is not required. The Motor Selection Wizard in the 890 DSE Configuration Tool **MUST** be used to correctly set-up the motor and feedback device parameters. Failure to do so may result in damage to the servo motor.

The following is a list of the Set-up parameters you may need to check before starting the drive. Set only the ones marked with "x" for the intended mode of operation.

Note ***Parameters whose values are "product code dependent" will have a typical value for the size of unit. Where possible (or required), enter an application-specific value for improved performance, otherwise use the typical value.***

Note ***"PREF" is a parameter reference number used by the DSE 890 Configuration Tool.***

SET-UP PARAMETERS								
PREF	6511/6901 Display	Default	Brief Description	V/Hz	SV	CLV	4-Q	PMAC
136.02	S 1 CONTROL MODE	0 : VOLTS / HZ 1 : SENSORLESS VEC 2 : CLOSED-LOOP VEC 3 : 4-Q REGEN 4 : PMAC*	Select the operating mode for the drive. * If PMAC control is required, the motor wizard feature in the 890 DSE Configuration Tool **MUST** be used to correctly set-up the motor and feedback device parameters. Failure to do so may result in damage to the servo motor.	x (0)	x (1)	x (2)	x (3)	x (4)

SET-UP PARAMETERS								
PREF	6511/6901 Display	Default	Brief Description	V/Hz	SV	CLV	4-Q	PMAC
101.08	5 2 MAX SPEED	product code dependent	The maximum speed clamp and scale factor for other speed parameters (at full process speed)	x	x	x		x
100.02	5 3 RAMP ACCEL TIME	10.0 s	Acceleration time from 0 rpm to MAX SPEED	x	x	x	x	x
100.03	5 4 RAMP DECEL TIME	10.0 s	Deceleration time from MAX SPEED to 0 rpm	x	x	x	x	x
102.01	5 5 RUN STOP MODE	0 : RUN RAMP 1 : COAST 2 : DC INJECTION 3 : STOP RAMP	Selects the stopping mode used by the drive	x	x	x	x	x
103.01	5 6 JOG SETPOINT	10.0 %	Drive speed setpoint whilst jogging (percentage of MAX SPEED)	x	x	x	x	x

SET-UP PARAMETERS								
PREF	6511/6901 Display	Default	Brief Description	V/Hz	SV	CLV	4-Q	PMAC
21.01	S 7 V/F SHAPE	0 : LINEAR LAW 1 : FAN LAW 2 : USER DEFINED	Sets the type of volts to frequency template that is used to flux the motor	x				
70.01	S 8 QUADRATIC TORQUE	0 : FALSE 1 : TRUE	0 : FALSE = Constant Selects between Constant or Quadratic mode of operation	x	x	x		x
27.05	S 9 MOTOR CURRENT	product code dependent	Enter the motor full load current from the motor nameplate	x	x	x	x	
21.03	S 10 FIXED BOOST	product code dependent	Boosts starting torque by adding volts at low speed	x				
82.01	S 11 CURRENT LIMIT	150.00%	Level of motor current as % of FULL LOAD CALIB	x	x	x	x	
27.03	S 12 MOTOR BASE FREQUENCY	product code dependent	Enter the motor nameplate base frequency	x	x	x		

5

SET-UP PARAMETERS								
PREF	6511/6901 Display	Default	Brief Description	V/Hz	SV	CLV	4-Q	PMAC
27.04	S 13 MOTOR VOLTAGE	product code dependent	Enter the motor nameplate voltage at base frequency	x	x	x		
27.07	S 14 NAMEPLATE RPM	product code dependent	Enter the motor nameplate full-load rated speed. This is the motor speed in rpm at base frequency minus full load slip.	x	x	x		
27.09	S 15 MOTOR POLES	product code dependent 0 : 2 pole 1 : 4 pole 2 : 6 pole 3 : 8 pole 4 : 10 pole 5 : 12 pole	Enter the number of motor poles from the motor nameplate	x	x	x		
27.08	S 16 MOTOR CONNECTION	product code dependent 0 : DELTA 1 : STAR	Enter the type of motor connection		x	x		

SET-UP PARAMETERS								
PREF	6511/6901 Display	Default	Brief Description	V/Hz	SV	CLV	4-Q	PMAC
71.01	S 17 PULSE ENC VOLTS	product code dependent	Set between 10-20V to match the encoder supply voltage			x		
71.02	S 18 ENCODER LINES	product code dependent	Set to the number of lines used by the encoder			x		
71.03	S 19 ENCODER INVERT	0 : FALSE 1 : TRUE Rotating Autotune sets actual value	Encoder direction :- when TRUE, changes the sign of the measured speed and the direction of the position count.			x		
80.01	S 20 AUTOTUNE ENABLE	0 : FALSE 1 : TRUE	Set TRUE to enable Autotune. Resets to FALSE when complete.	x				
80.02	S 21 AUTOTUNE MODE	0 : ROTATING 1 : STATIONARY 2 : SPD LOOP ROTATING 3 : SPD LOOP STATIONARY	Set the type of Autotune.		x	x		

5

SET-UP PARAMETERS								
PREF	6511/6901 Display	Default	Brief Description	V/Hz	SV	CLV	4-Q	PMAC
27.06	S 22 MAG CURRENT	product code dependent Rotating Autotune sets actual value	Enter the No-Load Amps from the motor nameplate	x	x	x		
27.14	S 23 STATOR RES	product code dependent Autotune sets actual value	Motor per-phase stator resistance		x	x		
27.15	S 24 LEAKAGE INDUC	product code dependent Autotune sets actual value	Motor per-phase stator leakage inductance		x	x		
27.16	S 25 MUTUAL INDUC	product code dependent Autotune sets actual value	Motor per-phase stator mutual (magnetising) inductance		x	x		
27.17	S 26 ROTOR TIME CONST	product code dependent Autotune sets actual value	The motor model rotor time constant as determined by Autotune		x	x		

SET-UP PARAMETERS

PREF	6511/6901 Display	Default	Brief Description	V/Hz	SV	CLV	4-Q	PMAC
78.01	S 27 SPEED PROP GAIN	20.0	Sets the proportional gain of the loop		x	x		x
78.02	S 28 SPEED INT TIME	100 ms	The integral time constant of the speed loop		x	x		x
1.03	S 29 A1N1 TYPE	0 : -10..+10 V 1 : 0..+10 V	Select the input range and type	x	x	x	x	x
2.03	S 30 AIN2 TYPE	0 : -10..+10 V 1 : 0..+10 V	Select the input range and type	x	x	x	x	x
3.03	S 31 AIN3 TYPE	0 : -10..+10 V 1 : 0..+10 V 2 : 0..20 mA 3 : 4..20 mA	Select the input range and type	x	x	x	x	x
4.03	S 32 AIN4 TYPE	0 : -10..+10 V 1 : 0..+10 V 2 : 0..20 mA 3 : 4..20 mA	Select the input range and type	x	x	x	x	x
97.01	S 33 DISABLED WORD 1	0700 >>	Indicates which trips have been disabled - refer to Chapter 10	x	x	x	x	x

SET-UP PARAMETERS								
PREF	6511/6901 Display	Default	Brief Description	V/Hz	SV	CLV	4-Q	PMAC
97.02	S 34 DISABLED WORD 2	0840 > >	Indicates which trips have been disabled - refer to Chapter 10	x	x	x	x	x
31.01	S 35 VIEW LEVEL	0 : BASIC 1 : OPERATOR 2 : ADVANCED	Selects full menu for MMI display	x	x	x	x	x

Step 5: Run the Motor

WARNING
Remove the fuses (or trip the circuit breaker) on your 3-phase supply.
Make sure the power is OFF, and that it cannot be switched on accidentally whilst you are working.

The Autotune Feature

Note ***The drive will not perform an Autotune when in Volts/Hz Mode (Open-Loop Drive.) An Autotune is not necessary in this control mode.***

The Autotune feature identifies motor characteristics to allow the drive to control the motor.
It loads the values into the parameters below, which are in the QUICK SETUP menu.

PREF	Parameter	Description	Note
71.03	ENCODER INVERT	Encoder direction	Parameter is only set up if drive is configured to run as Closed-loop Vector Not measured by Stationary Autotune
27.06	MAG CURRENT	Magnetising current	Not measured by Stationary Autotune
27.14	STATOR RES	Per phase stator resistance	
27.15	LEAKAGE INDUC	Per phase stator leakage inductance	
27.16	MUTUAL INDUC	Per phase mutual inductance	
27.17	ROTOR TIME CONST	Rotor time constant	This is identified from magnetising current and motor nameplate rpm

For further information on the functions of all parameters, refer to Appendix D: "Programming".

Stationary or Rotating Autotune?

Will the motor spin freely, i.e. not connected to a load, during the Autotune?

- If it can spin freely, use a Rotating Autotune (preferred)
- If it cannot spin freely, use a Stationary Autotune

	Action	**Requirements**
Rotating Autotune ***Preferred method***	Spins the motor up to the maximum speed set by the user to identify all necessary motor characteristics	Motor must spin freely during Autotune
Stationary Autotune *Only used when the motor cannot spin freely during the Autotune feature*	Motor does not spin during Autotune. A limited set of motor characteristics are identified	You must enter the correct value of magnetising current Do not subsequently operate the drive above base speed In Closed-loop Vector Mode set up the encoder direction parameter

Necessary Data

You **MUST** enter values for the following parameters, found in the QUICK SETUP menu, before an Autotune can be carried out:

MOTOR CURRENT	
MOTOR BASE FREQ	
MOTOR VOLTAGE	(maximum motor output voltage)
NAMEPLATE RPM	(motor nameplate speed)
MOTOR POLES	(the number of motor poles)
ENCODER LINES	(if an encoder is fitted, enter the number of lines used by the encoder)

Performing a Rotating Autotune

Note ***The drive will not perform an Autotune when in Volts/Hz Mode (Open-Loop Drive.) An Autotune is not necessary in this control mode.***

Check that the motor can rotate freely in the forward direction. Ensure also that the motor is unloaded. Ideally, the motor shaft should be disconnected. If the motor is connected to a gearbox this is okay, provided that there is nothing on the output of the gearbox which could load the motor.

1. In the QUICK SETUP menu, set MAX SPEED (S2) to the maximum speed at which you will operate the drive in normal operation. The Autotune will characterise the motor up to 30% above this speed. If you later wish to run faster than this, you will need to carry out another Autotune.

2. Set AUTOTUNE ENABLE (S20) to TRUE, and start the drive . The drive will carry out a Rotating Autotune (indicated by the Run and Stop led's flashing. This may take several minutes, during which the motor will be accelerated to maximum speed and then brought to a stop. When complete, the drive is returned to the stopped condition and the AUTOTUNE ENABLE parameter is reset to FALSE. In Closed-loop Vector mode (with an encoder) the encoder sign has been adjusted by the Autotune feature.

IMPORTANT **Now perform a SAVE CONFIG to save your new settings. Refer to Chapter 8: "The Keypad" - SAVE CONFIG.**

Performing a Stationary Autotune

Note ***The drive will not perform an Autotune when in Volts/Hz Mode (Open-Loop Drive.) An Autotune is not necessary in this control mode.***

Before starting the stationary Autotune, you **MUST** enter the value of magnetising current for the motor. This may be available on the motor nameplate. If not, you may need to contact the motor supplier.

1. In the QUICK SETUP menu, set the AUTOTUNE MODE parameter to STATIONARY (0).
2. Set ENABLE to TRUE, and start the drive . The drive will carry out a stationary Autotune, injecting current into the motor but not turning the shaft. The Run and Stop led's will flash. When complete, the drive is returned to the stopped condition and the AUTOTUNE ENABLE parameter is reset to FALSE.

IMPORTANT **Now perform a SAVE CONFIG to save your new settings. Refer to Chapter 8: "The Keypad" - SAVE CONFIG.**

- If the drive is configured to run in Sensorless Vector mode, set-up is complete.
- If the drive is configured to run in Closed-loop Vector mode, i.e. using an encoder, then the encoder direction must be set up. Refer to "Setting the Encoder Sign" below.

Setting the Encoder Sign (Closed-Loop Vector Mode)

If you have performed a Stationary Autotune in Closed-loop Vector mode, you should check the encoder direction as follows:

Look and listen to the motion of the motor when the drive is running at a speed demand of between 5 - 10%.

As a test, use the **Up** (▲) control key to increase the speed to about double the original figure. Change the direction of rotation using the **FWD/REV** control key.

If ENCODER INVERT is correct, the motor will rotate smoothly and will respond to the changes in speed demand and direction.

If ENCODER INVERT is incorrect, the motor will rotate in a jerky and/or noisy manner. Alternatively, it may rotate smoothly at a very low speed but not respond to changes in speed demand or direction.

- Change the setting of ENCODER INVERT to change the encoder sign.
- Change the direction of rotation back to the original direction. Re-set the speed demand.

The encoder sign is now correct for the original motor direction.

If however the direction of the motor is incorrect at this point, then power down the entire drive, wait for 3 minutes (for the dc link capacitors to discharge) and then swap the motor drive cables M1/U and M2/V. Change the setting of ENCODER INVERT.

The encoder sign is now correct for the new motor direction.

IMPORTANT **Now perform a SAVE CONFIG to save your new settings. Refer to Chapter 8: “The Keypad” - SAVE CONFIG.**

Initial Start-Up Routines

WARNING

Unpredictable motion, especially if motor parameters are incorrect.

Ensure no personnel are in the vicinity of the motor or any connected machinery.

Ensure that no machinery connected to the motor will be damaged by unpredictable motion.

Ensure that the emergency stop circuits function correctly before running the motor for the first time.

The Routines 1 & 2 below will run the drive in the default V/F fluxing control mode (VOLTS / HZ) to begin with using either the Keypad or the Control Terminals.

Routine 1: Local Mode

Note ***Refer to Chapter 8: "The Keypad" to familiarise yourself with the keypad and menu structure.***

Local control has a use for commissioning a drive. It is not the expected way to operate a system drive.

On the 890SD Standalone Drive's keypad:

1. Select Local Mode (refer to Chapter 8: "The Keypad" for details).
2. The drive should be "healthy" now it is powered-up: no flashing trip messages displayed, and the 6901 keypad's HEALTH LED is lit (the RUN LED remains off). The keypad will display the Remote Setpoint parameter.
   If the drive has tripped, the keypad will be flashing a trip message, and the 6901 keypad's HEALTH LED will flash. Refer to Chapter 10: "Trips and Fault Finding" to investigate and remove the cause of the trip.

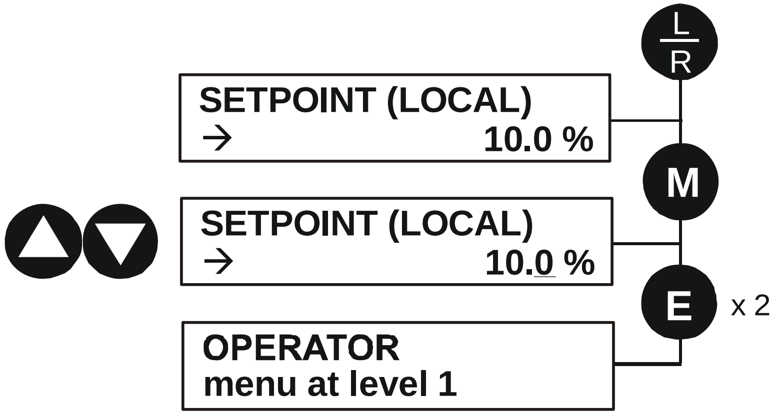
3. Press the Start key . The 6901 keypad's RUN LED will light and the motor will rotate slowly (the RUN LED will flash if the setpoint is at zero).

   *Reverse the motor's direction of rotation either by pressing the FORWARD/REVERSE key on the 6901 keypad, or by swapping two of the motor phases (**WARNING: Disconnect the mains supply first**).*

4. Control the value of the Local Setpoint parameter using the keys.

5. Press the Stop key .

6901 Keypad



Routine 2: Remote Mode

This routine assumes that the drive's control terminals are wired as shown in "Control Connection Diagram" on page 5-21.

IMPORTANT **Ensure that the speed potentiometer is set to zero.**

On the 890SD Standalone Drive:

1. The drive should be "healthy" now it is powered-up: no flashing trip messages displayed, and the 6901 keypad's HEALTH LED is lit (the RUN LED remains off).
   If the drive has tripped, the keypad will be flashing a trip message, and the 6901 keypad's HEALTH LED will flash. Refer to Chapter 10: "Trips and Fault Finding" to investigate and remove the cause of the trip.
2. Select Remote Mode - refer to Chapter 8: "The Keypad" for details, or power-down and power up the unit to re-initialise in Remote mode.
3. To Start in Remote Mode, close the "Run" switch on your control panel (applying 24V to DIN2, terminal X15/02 - RUN).
4. Turn the speed potentiometer up a little to apply a small speed setpoint (applying a variable voltage to AIN3, terminal X12/04 - REMOTE SETPOINT). The 6901 keypad's RUN LED will light and the motor will rotate slowly (the RUN LED will flash if the setpoint is at zero).
   *Reverse the motor's direction of rotation either by pressing the FORWARD/REVERSE key on the 6901 keypad, or by swapping two of the motor phases (**WARNING: Disconnect the mains supply first**).*
5. To Stop in Remote Mode, open the "Run" switch on your control panel (removing 24V from DIN2, terminal X15/02 - RUN).

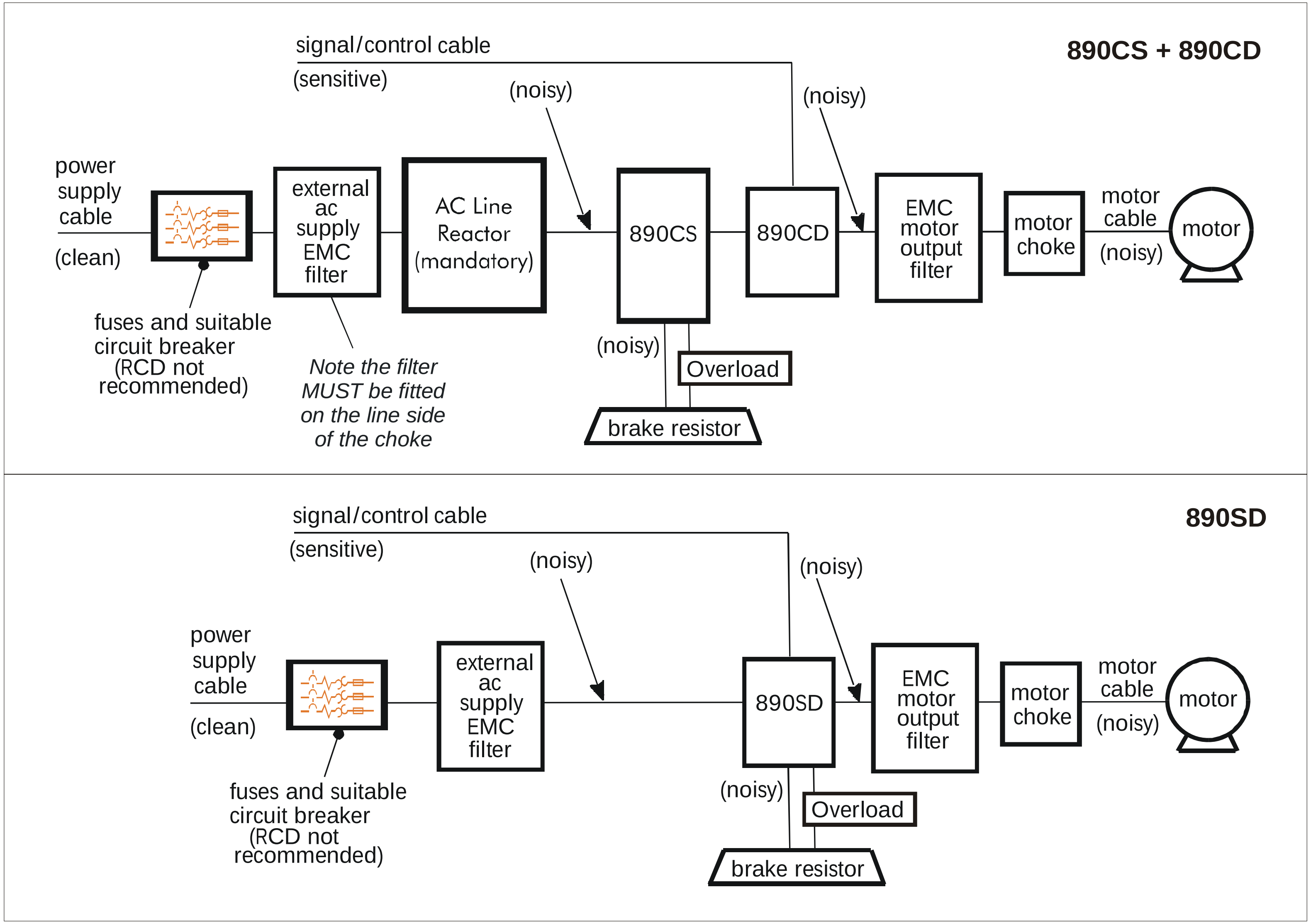
Chapter 6

Associated Equipment

Details for all the ancilliary parts of a system that can be used with the 890.

Main Points

Connect the associated equipment in the following order:



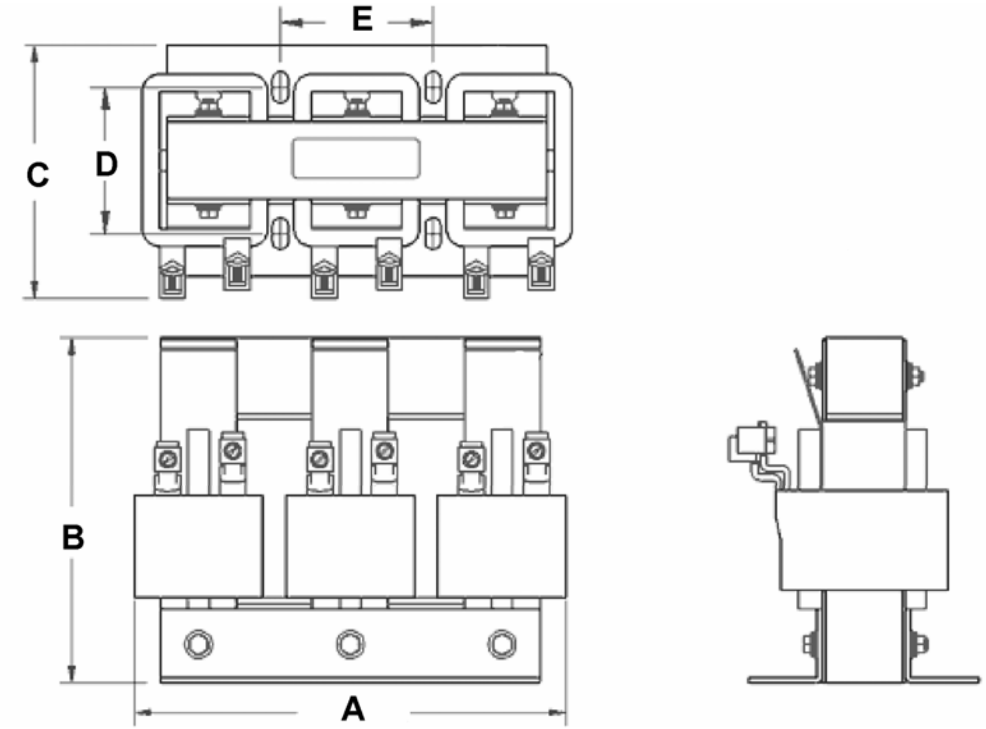
890CS : AC Line Reactors

IMPORTANT **An AC Line Reactor MUST be used with the 890CS Common Bus Supply unit to achieve the design output rating, and to reduce the harmonic content of the supply current.**

The recommended external line reactor for each unit is listed below:

SSD Part Number	890CS Input Current	Supply Voltage	Reactor Value	Reactor Current
CO352903	54A	380-500V	500µH	55A
CO352905	108A	380-500V	300µH	100A
CO470057	162A	380-500V	150µH	160A

Associated Equipment



Typical View

SSD Part Number	Length A	Height B	Width C	Fixing Centres D	E	MTE	Weight kg/lbs
CO353014	183/7.2	147/5.8	102/4.0	66/2.60	76/3.00	RL03501	6.4/14
CO352901	183/7.2	147/5.8	102/4.0	70/2.75	76/3.00	RL03502	7.3/16
CO353016	229/9.0	185/7.3	135/5.3	80/3.16	76/3.00	RL05501	11/24
CO352903	229/9.0	178/7.0	135/5.3	80/3.16	76/3.00	RL05502	12/27
CO470654	279/11.0	216/8.5	178/7.0	88/3.46	92/3.62	RL10001	21/47
CO352905	279/11.0	216/8.5	170/6.7	93/3.66	92/3.62	RL10002	23/51
CO470058	274/10.8	216/8.5	172/6.8	80/3.16	92/3.62	RL16001	19/42
CO470057	279/11.0	216/8.5	178/7.0	88/3.47	92/3.62	RL16002	23/51
Dimensions are in mm/inches							

External Braking Resistors

We can supply suitable braking resistors, found on the following pages. Alternatively, you can use the calculation on page 6-**Error! Bookmark not defined.** to help you select alternative resistors.

IMPORTANT **We recommend using a thermal overload switch to protect the braking circuit. Refer to page 6-6.**

Main Points

- **The 890SD unit must be fitted with external braking resistors if braking is required.** Use the DSE 890 Configuration Tool to set the following parameters in the 890SD unit:

  Set the INT DB RESISTOR parameter (PREF 31.75 in the DYNAMIC BRAKING function block) to FALSE. Also enter information about the external resistor being used in to this function block.

  Enable the "Brake Resistor" and "Brake Switch" trips in the TRIPS STATUS function block (DISABLED WORD 1 parameter).

890CS Dynamic Braking Resistor Kits - USA/Canada

These kits (complete with cover) are designed for stopping a motor at full load current from base speed with two times motor inertia, three times in rapid succession in accordance with NEMA ICS 3-302.62 Dynamic Braking Stop option.

Frame Size	Drive Amps (A)	Drive Rating (Hp)	Brake Level (V)	Peak Amps (A)	Minimum Ohms (Ω)	SSD Part Number	Dimensions L x W x H (inches)	Resistance (Ω)	Rated Amps (A)
460 Vac									
B	32	25	770	20	38.5	CZ353181	10 x 7 x 5	54	3.6
B	54	45	770	40	19.3	CZ353184	12 x 10 x 5	22.5	7.2
D	108	90	770	75	10.3	CZ353186	19 x 10 x 5	12	13
D	162	135	770	100	7.7	CZ353188	27 x 10 x 5	9	18

890SD Resistor Selection

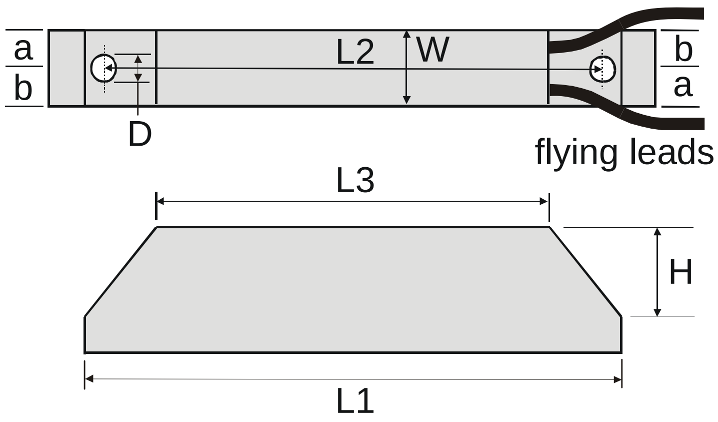
These small, metal-clad resistors should be mounted on a heatsink (back panel) and covered to prevent injury from burning.

There are four resistor values available.

Each one can support "10 x Power Rating" for 5 seconds.

Refer to the following "Calculation".

IMPORTANT **The continuous rating quoted is not to be exceeded under repetitive loading.**



	Flying Lead Length	L1	L2	L3	a	b	D	W	H
500W	500	335	316	295	13	17	5.3	60	30
200W	500	165	146	125	13	17	5.3	60	30

Dimensions are in millimetres

SSD Part Number	Power Rating (W)	Resistance (Ω)	Current Rating (A)
CZ467717	200	100	1.4
CZ463068	200	56	1.9
CZ467716	500	56	3.0
CZ388396	500	36	3.7

Calculation

Brake resistor assemblies must be rated to absorb both peak braking power during deceleration and the average power over the complete cycle.

$$\text{Peak braking power } P_{pk} = \frac{0.0055 \times J \times (n_1^2 - n_2^2)}{t_b} \quad \text{(W)}$$

$$\text{Average braking power } P_{av} = \frac{P_{pk}}{t_c} \times t_b$$

- J - total inertia (kgm^2)
- n_1 - initial speed (rpm)
- n_2 - final speed (rpm)
- t_b - braking time (s)
- t_c - cycle time (s)

Obtain information on the peak power rating and the average power rating of the resistors from the resistor manufacturer. If this information is not available, a large safety margin must be incorporated to ensure that the resistors are not overloaded.

By connecting these resistors in series and in parallel the braking capacity can be selected for the application.

IMPORTANT **The minimum resistance of the combination and maximum dc link voltage must be as specified in Appendix E: "Technical Specifications" - Internal Dynamic Brake Switch.**

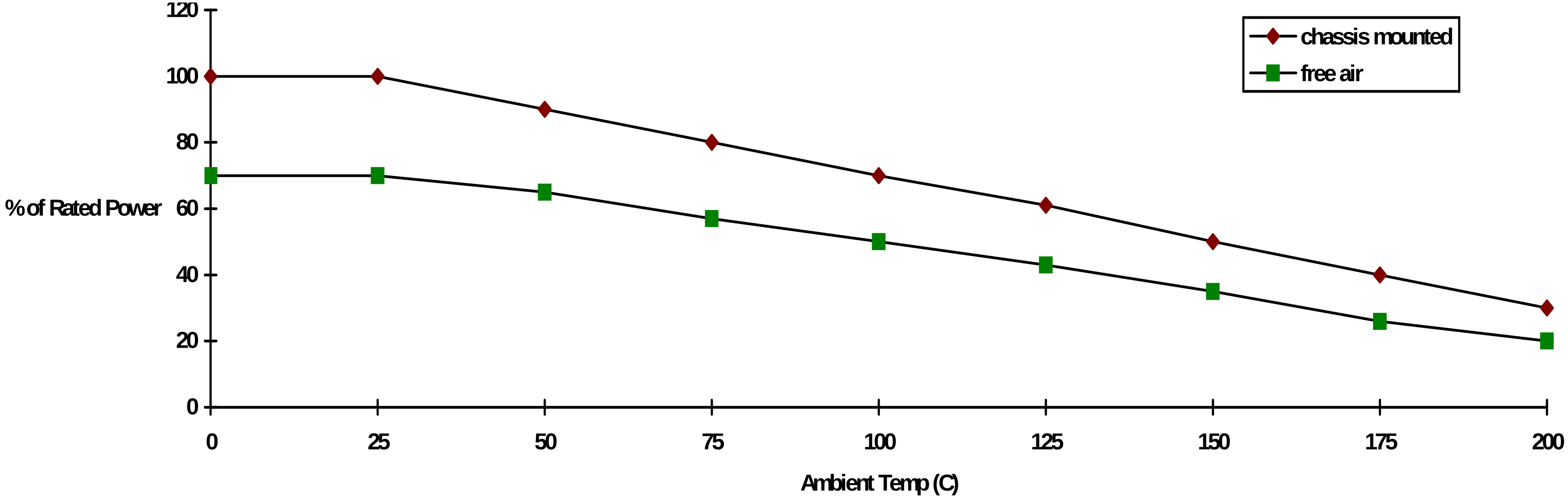


Figure 3.1 Braking Resistor Derating Graph (Metal Clad Resistors)

Dynamic Brake Resistor Overload Protection

We recommend that the braking resistor and wire are protected by a motor circuit protector rated at 110% of the continuous current rating of the resistor(s).

Route the braking wire through all three poles of the motor overload. An auxiliary contact can be used to annunciate an alarm if a trip should occur.

US Resistors

Resistor			Overload		
Part Number	**Value**	**Rating**	**Rating**	**Telemechanique / SquareD**	**SSD Part Number**
460-480Vac					
CZ353181	54R	3.6A	2.5 to 4 A	GV2-ME08	DB388419
CZ353184	22.5R	7.2A	6.0 to 10.0 A	GV2-ME14	DB388421
CZ353186	12R	13A	13.0 to 18.0A	GV2-ME20	DB388423
CZ353188	9R	18A	17.0 to 23.0A	GV2-ME21	DB388424
Auxiliary Contact Block (fitted to left hand side)				GV2-AN11	DB388426

European Resistors

Resistor			Overload		
Part Number	**Value**	**Rating**	**Rating**	**Telemechanique / SquareD**	**Part Number**
400-500Vac					
HP1-45R	45R	6A	4 to 6.3A	GV2-ME10	DB388420
HP1-24R	24R	8A	6 to 10A	GV2-ME14	DB388421
HP2-12R	12R	16A	13 to 18A	GV2-ME20	DB388423
HP3-9R	9R	22A	17 to 23A	GV2-ME21	DB388424
Auxiliary Contact Block (fitted to left hand side)				GV2-AN11	DB388426

Note ***Intermediate overload circuit breakers are available if required:***

DB388422 - 6V2ME16 - 9 to 14A
DB388425 - 6V2ME22 - 20 to 25A

890CS Semiconductor Protection Fuses

890CS Input Current Rating	Model Number	Bolted Fuses for USA			DIN Mounted Fuses for Europe		
		Fuse Rating	Reference Number	SSD Part Number	Fuse Rating	Reference Number	SSD Part Number
32A	890CS/…/032B	50A	A50QS50-4R	CS470408U050	40A	170M1563	CH570044
54A	890CS/…/054B	80A	A50QS80-4R	CS470408U080	80A	170M1566	CH570084
108A	890CS/…/108D	125A	A50QS125-4R	CS470408U125	125A	170M1568	CH571253
162A	890CS/…/162D	200A	A50QS200-4R	CS470408U200	200A	170M3815	CH580025

Note ***These fuses are semi-conductor fuses. They are not suitable for branch protection. Refer to Appendix E for branch circuit fuse information.***

890CD Semiconductor Protection Fuses

Model Number	Input Fuse Rating (A)		Model Number	Input Fuse Rating (A)	
	Constant Torque	Quadratic Torque		Constant Torque	Quadratic Torque
400VAC BUILD VARIANT					
Frame E			Frame F		
890CD/4/0073E/..	100	125	890CD/4/0105F..	150	200
890CD/4/0087E/..	110	150	890CD/4/0145F/..	200	225
			890CD/4/0156F/..	225	250
			890CD/4/0180F/..	225	250
500VAC BUILD VARIANT					
Frame E			Frame F		
890CD/5/0073E	80	90	890CD/5/0105F	110	175
890CD/5/0087E	90	110	890CD/5/0145F	175	200
			890CD/5/0156F	200	-

Note ***These fuses are semi-conductor fuses. They are not suitable for branch protection. Refer to Appendix E for branch circuit fuse information.***

6

Circuit Breakers

We do not recommend the use of circuit breakers (e.g. RCD, ELCB, GFCI), but where their use is mandatory, they should:

- Operate correctly with dc and ac protective earth currents (i.e. type B RCDs as in Amendment 2 of IEC755).
- Have adjustable trip amplitude and time characteristics to prevent nuisance tripping on switch-on.

When the ac supply is switched on, a pulse of current flows to earth to charge the internal/external ac supply EMC filter's internal capacitors which are connected between phase and earth. This has been minimised in Parker SSD Drives' filters, but may still trip out any circuit breaker in the earth system. In addition, high frequency and dc components of earth leakage currents will flow under normal operating conditions. Under certain fault conditions larger dc protective earth currents may flow. The protective function of some circuit breakers cannot be guaranteed under such operating conditions.

WARNING

Circuit breakers used with VSDs and other similar equipment are not suitable for personnel protection. Use another means to provide personal safety. Refer to EN50178 (1997) / VDE0160 (1994) / EN60204-1 (1994)

Filters

WARNING!

Do not use an internal ac supply EMC filter with supplies that are not balanced with respect to earth (IT). They must only be used with earth referenced supplies (TN).

External filters are available for use with TN and IT supplies.
Please check for suitability in Appendix E: "Technical Specifications".

Do not touch filter terminals or cabling for at least 3 minutes after removing the ac supply.
Only use the ac supply filter with a permanent earth connection.

Mount the filter as close as possible to the drive.

Note ***Follow the cabling requirements given in Appendix E: "Technical Specifications".***

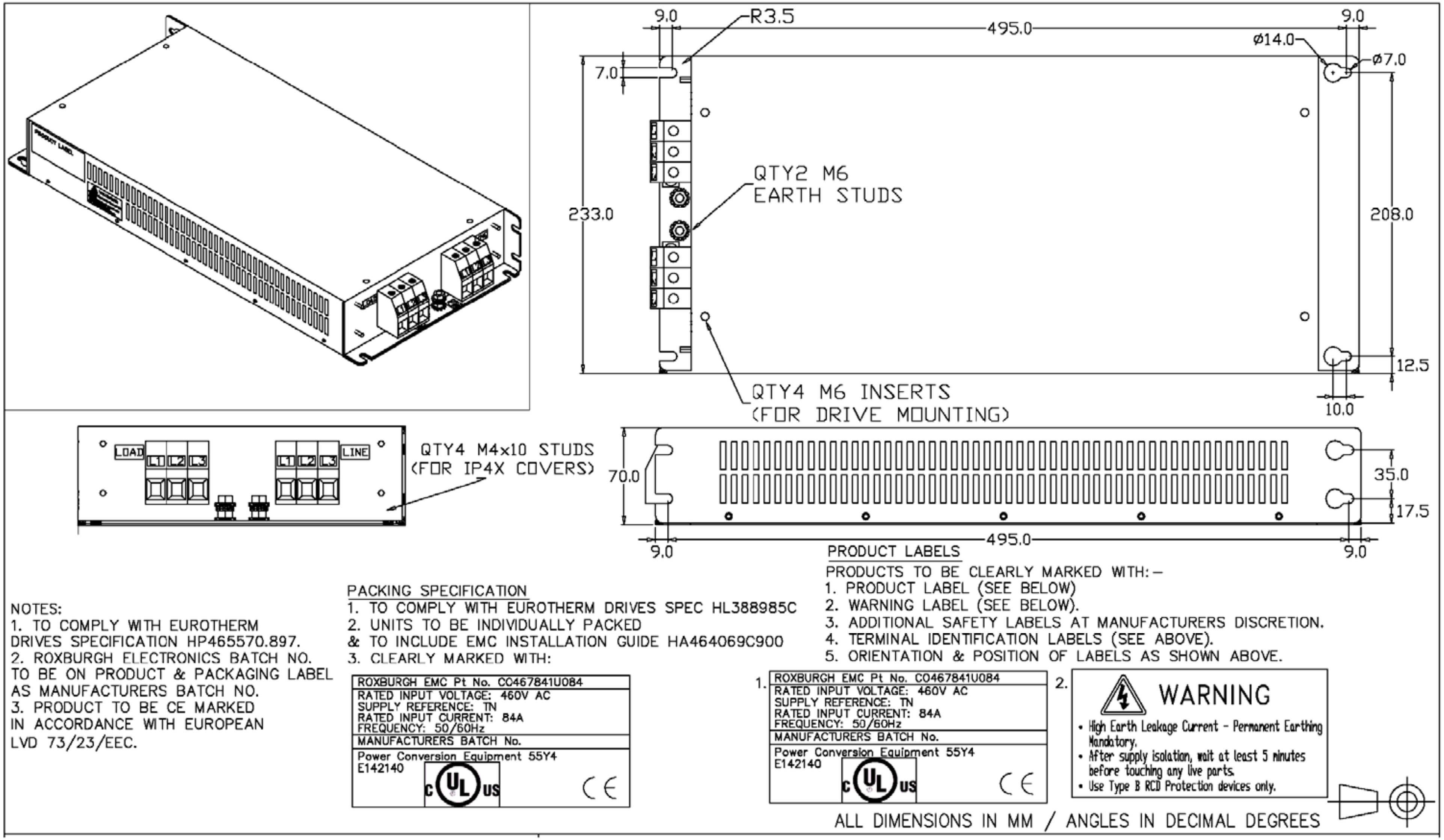
Footprint/Bookcase Mounting Filters

These filters can be both footprint and bookcase mounted. They are suitable for wall or cubicle mount, but the filter must be fitted with the appropriate gland box when wall mounted.

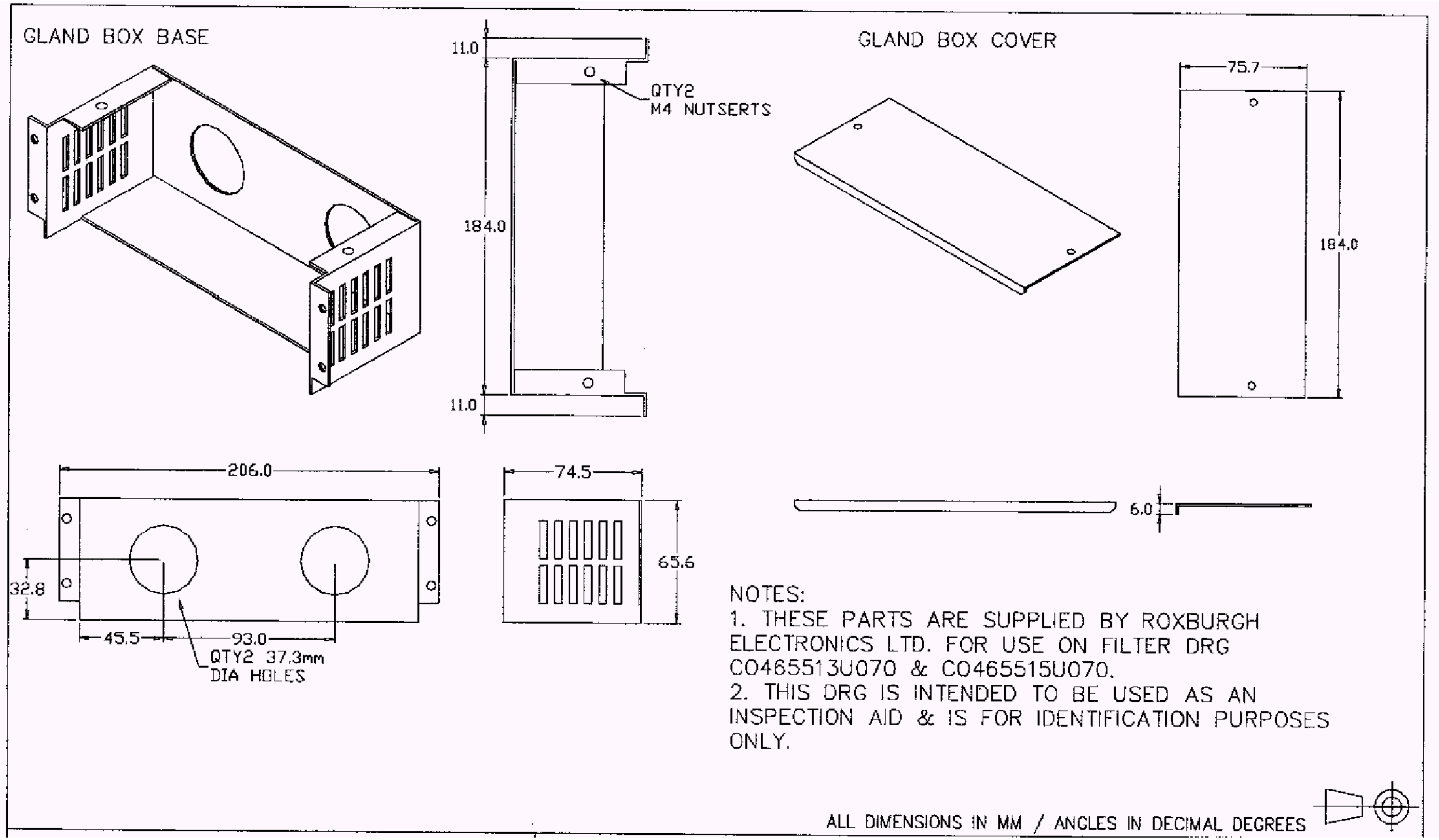
The typical filter drawing is given in the following pages for the Frame E unit. Size variations for the frames are given in the table below.

The Frame F drawing and sizes are also supplied.

Filter Description	Filter Part Number	Terminal Block	Earth Terminal	Gland Mounting	Dimensions	Fixing Centres	Weight
Frame E							
460V TN	CO467841U105	$50mm^2$	8mm	4 x 4mm	698 x 250 x 80mm	680 x 216mm	6.2kg
500V IT/TN	CO467842U105	$50mm^2$	8mm	4 x 4mm	698 x 250 x 80mm	680 x 216mm	6.2kg
Gland Plate : BA467840U105							
Frame F							
460V TN	CO467841U215	$95mm^2$	8mm	not applicable	825 x 250 x 15mm	795 x 216mm	
500V IT/TN	CO467842U215	$95mm^2$	8mm	not applicable	825 x 250 x 15mm	795 x 216mm	
Gland Plate : Not applicable							



Footprint/Bookcase Mounting Filters (generic drawing)



Gland Box for Footprint/Bookcase Mounting Filters (generic drawing)

Chapter 7

Operating the Drive

Having turned the motor for the first time, now learn about the various ways you can start and stop the drive. This chapter also offers some application advice.

Control Philosophy

There are four ways to control the drive using Remote and Local control:

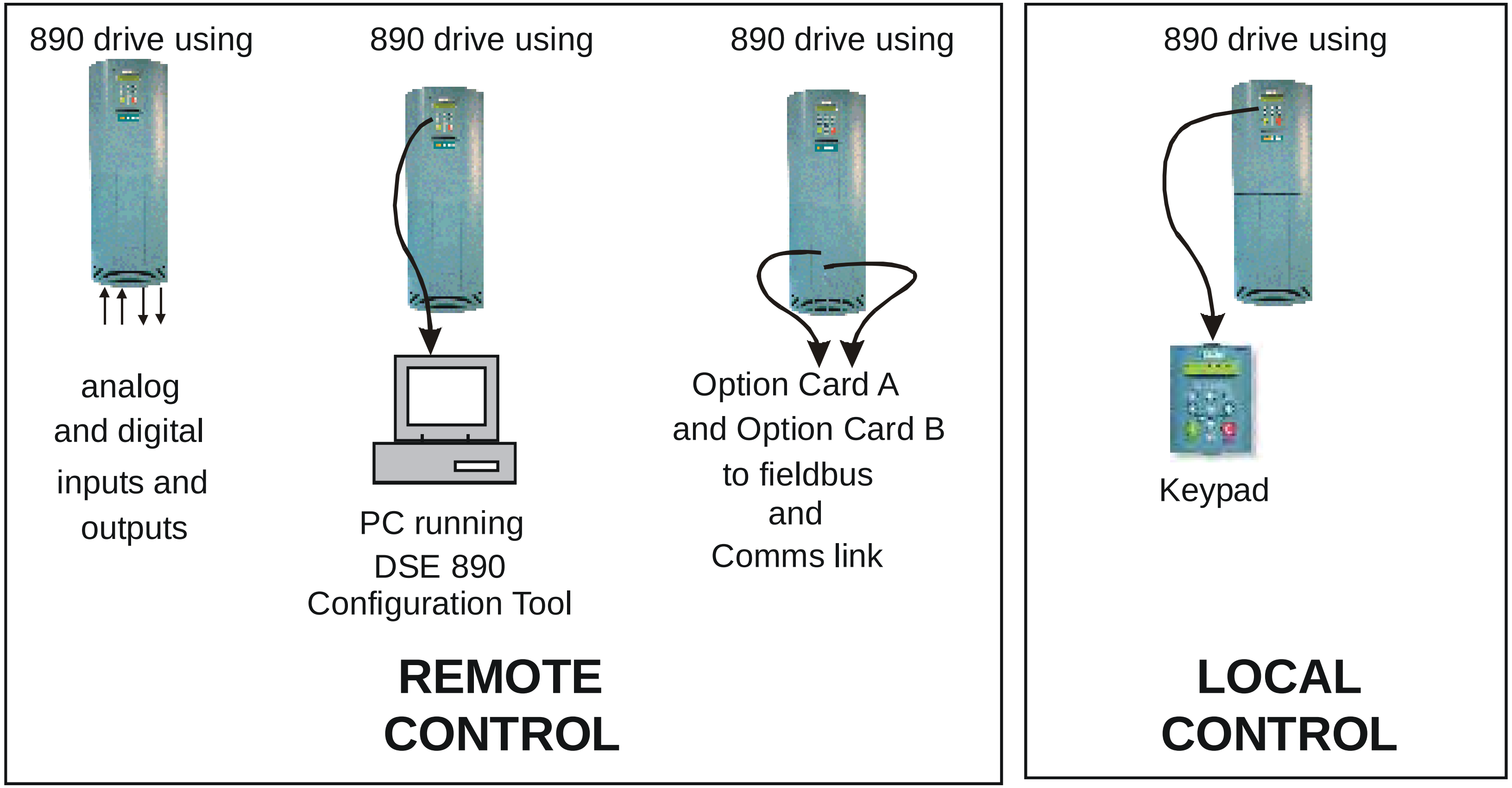


Figure 7.1 Remote and Local Control Modes

Start/Stop and Speed Control

There are two forms of control in operation at any time: *Start/Stop* and *Speed Control*. Each can be individually selected to be under either Local or Remote Control.

- **Local or Remote Start/Stop** decides how you will start and stop the drive.
- **Local or Remote Speed Control** determines how you will control the motor speed.

In each case, Local and Remote control are offered by using the following:

Local: The Keypad
Remote: Analog and digital inputs and outputs, RS232 Port or Technology Options

Note ***Refer to Appendex D: "Programming" - LOCAL CONTROL.***

Operating the Drive

Thus the drive can operate in one of four combinations of local and remote modes:

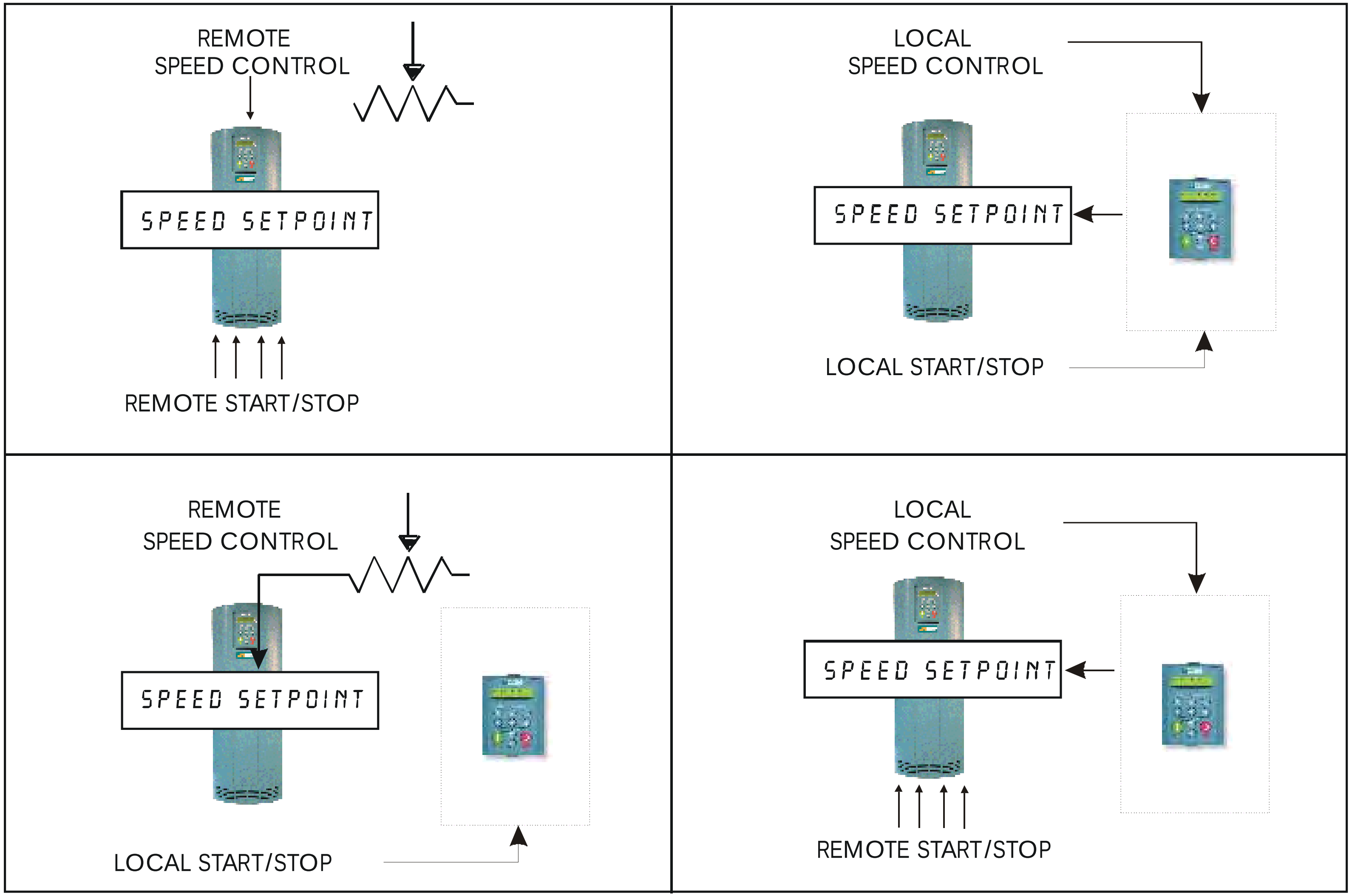


Figure 7.2 The Four Combinations of Local and Remote Control

Note ***Start/Stop is also known as "Sequencing".***
Speed Control is also known as "Reference Generation".

7

The Start/Stop Mode Explained

The default configuration below shows the drive in Remote control, (using the analog and digital inputs and outputs). This example will be referred to in the following explanations.

Start/Stop Controlled Remotely

In the configuration shown, the reference value is obtained by summing ANALOG INPUT 1 and ANALOG INPUT 2. The direction of rotation is controlled by DIGITAL INPUT 4. When the RUN input (DIGITAL INPUT 1) is TRUE, the SPEED DEMAND ramps up to the reference value at a rate controlled by ACCEL TIME. The drive will continue to run at the reference value while the RUN input remains TRUE.

Similarly when the JOG input (DIGITAL INPUT 5) is TRUE, the SPEED DEMAND ramps up to the JOG SETPOINT at a ramp rate set by JOG ACCEL TIME (not shown in the diagram).
The drive will continue to run at the JOG SETPOINT while the JOG input remains TRUE.

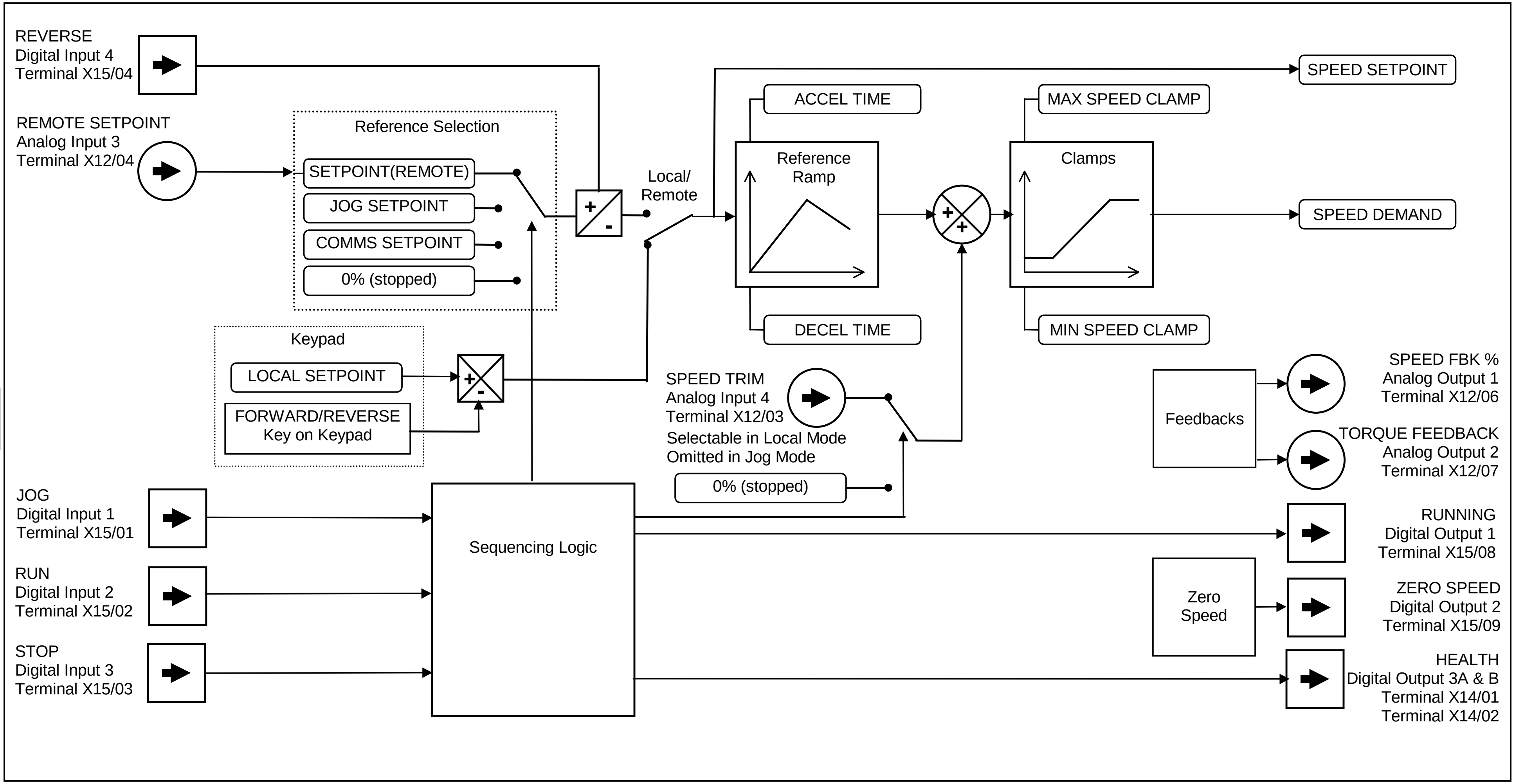


Figure 7.3 Portion of the Shipping Configuration

Start/Stop Controlled Locally

The reference value is set by the SETPOINT (LOCAL) parameter. (The direction of rotation is controlled by the DIR key (forward/reverse) on the 6901 Keypad). When the RUN key is pressed the SPEED DEMAND ramps up to the reference value at a rate controlled by ACCEL TIME. The drive will continue to run at the reference value even when the RUN key is released. Press the STOP key to “stop” the drive.

When the JOG key is pressed and held, the SPEED DEMAND ramps up to the JOG SETPOINT at a ramp rate set by JOG ACCEL TIME (not shown in the diagram). Release the JOG key to “stop” the drive.

Interaction between RUN and JOG

Only one of these signals can be in effect at any one time; the other signal is ignored. The drive must be “stopped” to change from running to jogging, or vice versa.

Start/Stop Mode Diagnostics

In the configuration shown, Start/Stop mode provides two DIGITAL OUTPUT signals (RUNNING and HEALTH).

The RUNNING signal is TRUE from the time a start command is processed until a stop sequence is completed. This normally means the time between the drive starting until the power stack is quenched. Refer to Appendix B : “Sequencing Logic” for a more detailed description.

The HEALTH output is TRUE when the drive is not tripped.

Additional diagnostic parameters are available when using the Keypad. These are described in Chapter 9: "Keypad Menus".

Starting and Stopping Methods

Note ***Refer to Appendix D: "Programming" - REFERENCE, SEQUENCING LOGIC, REFERENCE STOP and REFERENCE RAMP, for explanations of parameters.***

Normal Stopping Methods

The Shipping Configuration is set to "Ramp to Stop" (at STOP TIME, set to 10.0s).

- To "stop" the locally controlled drive press the STOP key on the Keypad
- To "stop" the remotely controlled drive remove the 24V from the RUN input (terminal X15/02), and from the STOP input (terminal X15/03)

Using the Keypad or DSE Configuration Tool, the drive can be selected to "Ramp to Stop", or to "Coast to Stop" at one of two rates (STOP TIME or FAST STOP TIME). To do this, change the RUN STOP MODE parameter (PREF102.01) to the required selection.

Ramp to Stop

Set the SETUP::SEQ & REF::REFERENCE STOP::RUN STOP MODE parameter to RUN RAMP.

When a stop command is received, the drive decelerates from its actual speed towards zero for the programmed DECEL TIME time. When this time has elapsed, SPEED TRIM is ramped to 0% in the programmed STOP TIME time.

Note ***If SPEED TRIM does not operate, SPEED DEMAND is reduced to 0% in DECEL TIME.***

The power stack remains energised until the STOP DELAY period has elapsed.

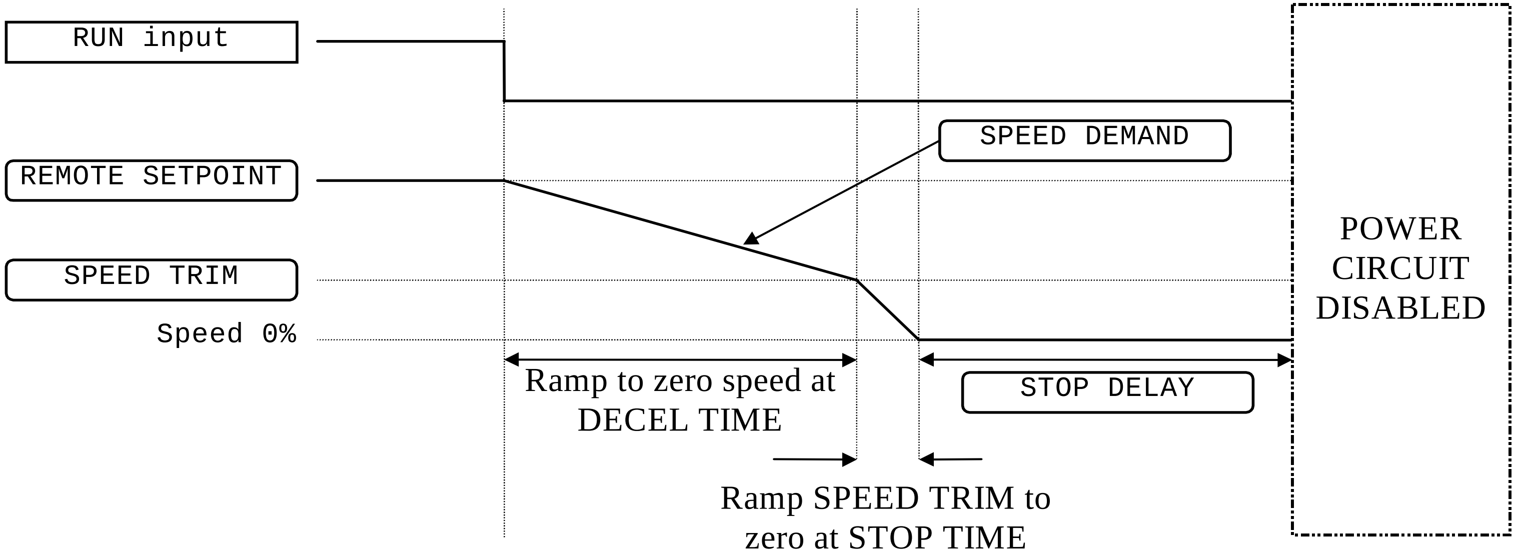


Figure 7.4 Ramp to Stop with a Remote Reference

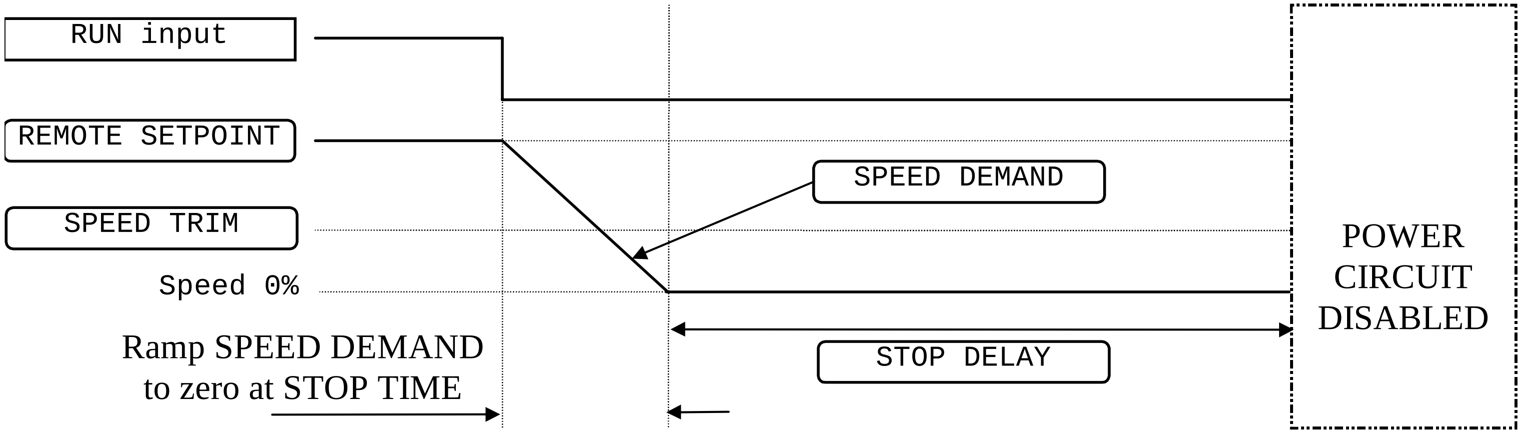


Figure 7.5 Remote to Stop with a Remote Reference: DECEL TIME = 0.0s

A special case exists when the DECEL TIME is set to 0.0 seconds, or when the HOLD parameter is TRUE. In both these situations the SPEED DEMAND will ramp down to zero at the STOP TIME.

Coast to Stop

Set the SETUP::SEQ & REF::REFERENCE STOP::RUN STOP MODE parameter to COAST.

In this mode the DECEL TIME ramp and the STOP TIME ramp are both ignored. Thus the SPEED DEMAND changes immediately to 0% as soon as the Stop command is given. The power stack is also immediately disabled at this time, causing the load to coast.

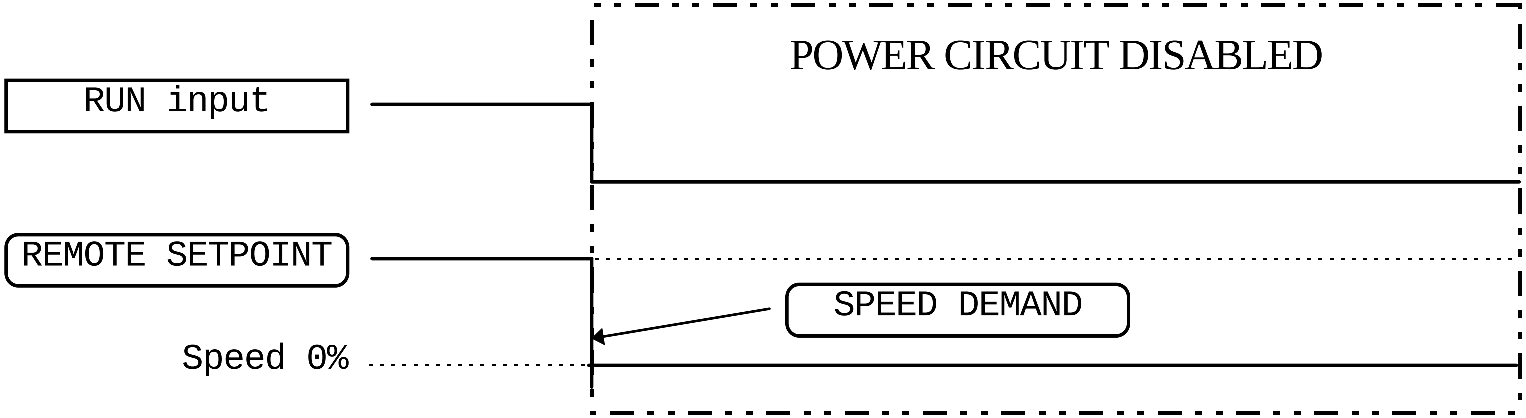


Figure 7.6 Coast to Stop with a Remote Reference

Advanced Stopping Methods

The drive can be selected to NOT FAST STOP or to NOT COAST STOP. The stopping procedure is unaffected by Local or Remote Sequencing options.

Forced Fast Stop

The Not Fast Stop mode overrides the RUN FORWARD, RUN REVERSE and JOG inputs in Remote mode, and the RUN and JOG Keypad keys in Local mode.

Select the SETUP::SEQ & REF::REFERENCE STOP::FAST STOP MODE parameter to either RAMP or COAST. The stopping sequence starts when the NOT FAST STOP input goes FALSE, regardless of the state of the RUN input.

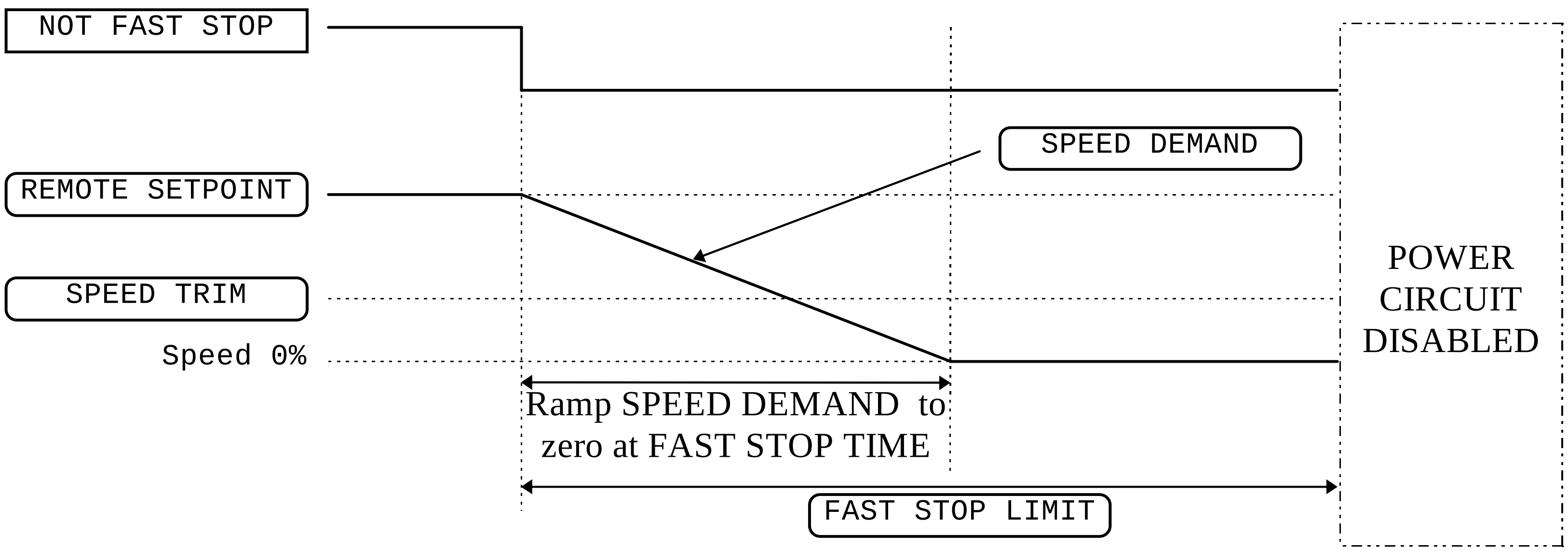


Figure 7.7 Forced Fast Stop RAMP Mode example

Forced Coast Stop

Using the Not Coast Stop mode immediately disables the power stack, causing the load to coast to a stop.

The drive gives priority to the NOT COAST STOP signal. The NOT FAST STOP signal is therefore ignored while NOT COAST STOP is active.

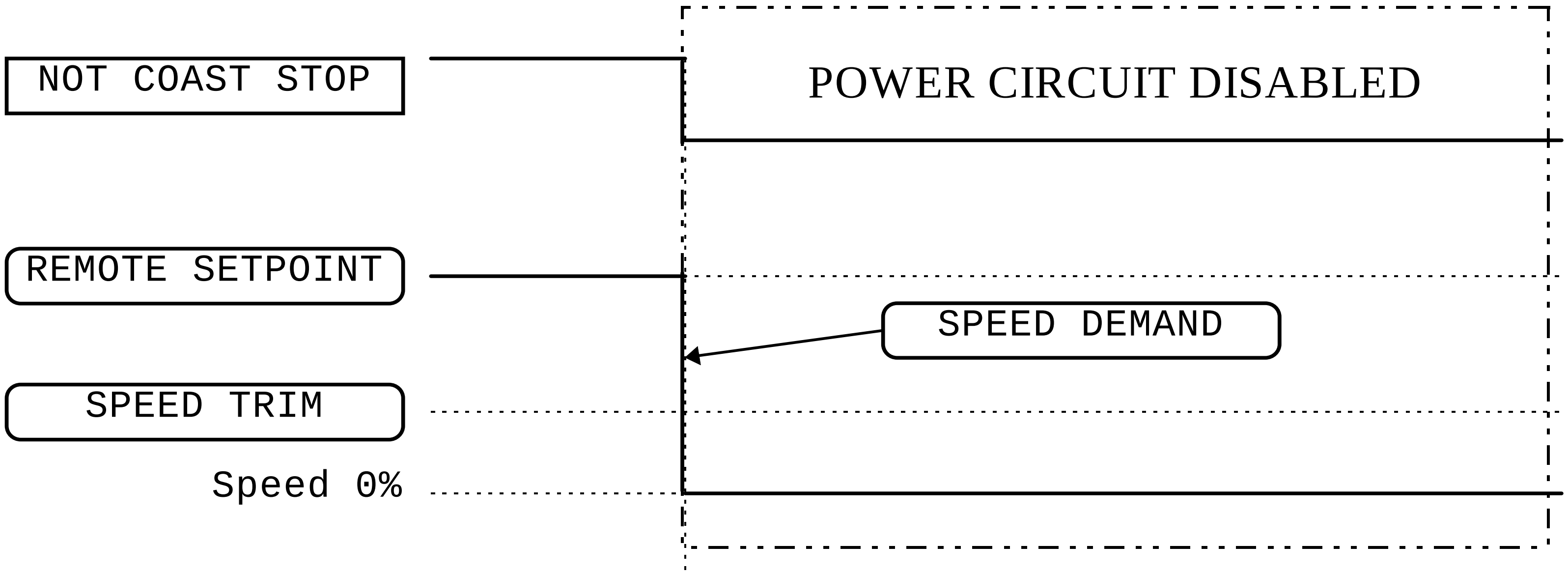


Figure 7.8 Forced Coast Stop example

The Trip Condition

When a trip condition is detected, a similar stopping method to NOT COAST STOP is used. The power stack cannot be re-enabled until the trip condition has been cleared and successfully reset.
Refer to Chapter 10: “Trips and Fault Finding” for further details.

Logic Stopping

The drive can be stopped by setting the NOT STOP to FALSE for a short time, (>100 ms). The stop sequence continues even if the NOT STOP signal goes inactive before the drive is stopped. Various combinations of stop logic are shown below.

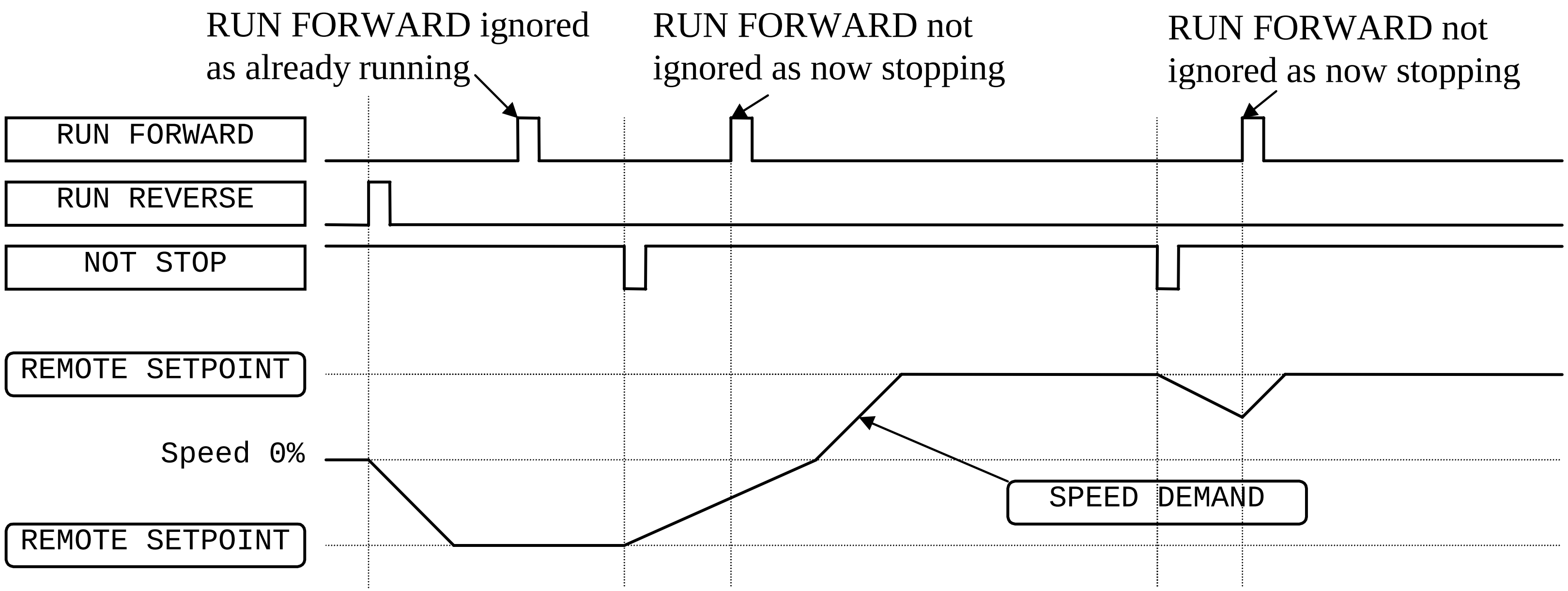


Figure 7.9 Interaction between RUN FORWARD, RUN REVERSE and NOT STOP Parameters

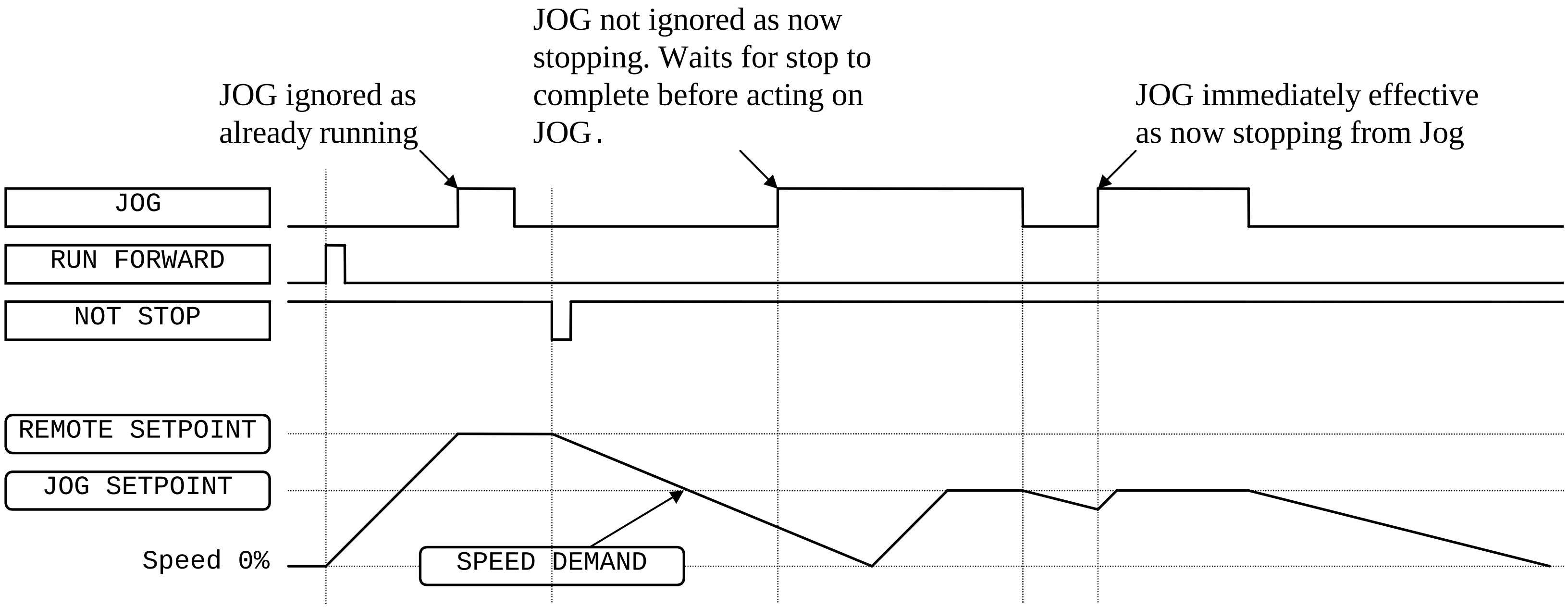


Figure 7.10 Example of the Interaction between RUN FORWARD and JOG Parameters

Starting Methods

The methods below can be used when the drive has the following default configurations from DSE 890 installed: Closed Loop Vector, Sensorless Vector, Shaftless Printing, Shipping, Volts/Hertz.

IMPORTANT **DRIVE ENABLE must be True in all cases.**

Single Wire Logic Starting

Use just DIGITAL INPUT 2 when the motor direction will always be the same. The motor will run while the RUN switch is closed, and will stop when it is open.

Note that the SETUP::SEQ & REF::SEQUENCING LOGIC::NOT STOP parameter is active (FALSE - not wired to), meaning that the drive will only run while the RUN parameter is held TRUE.

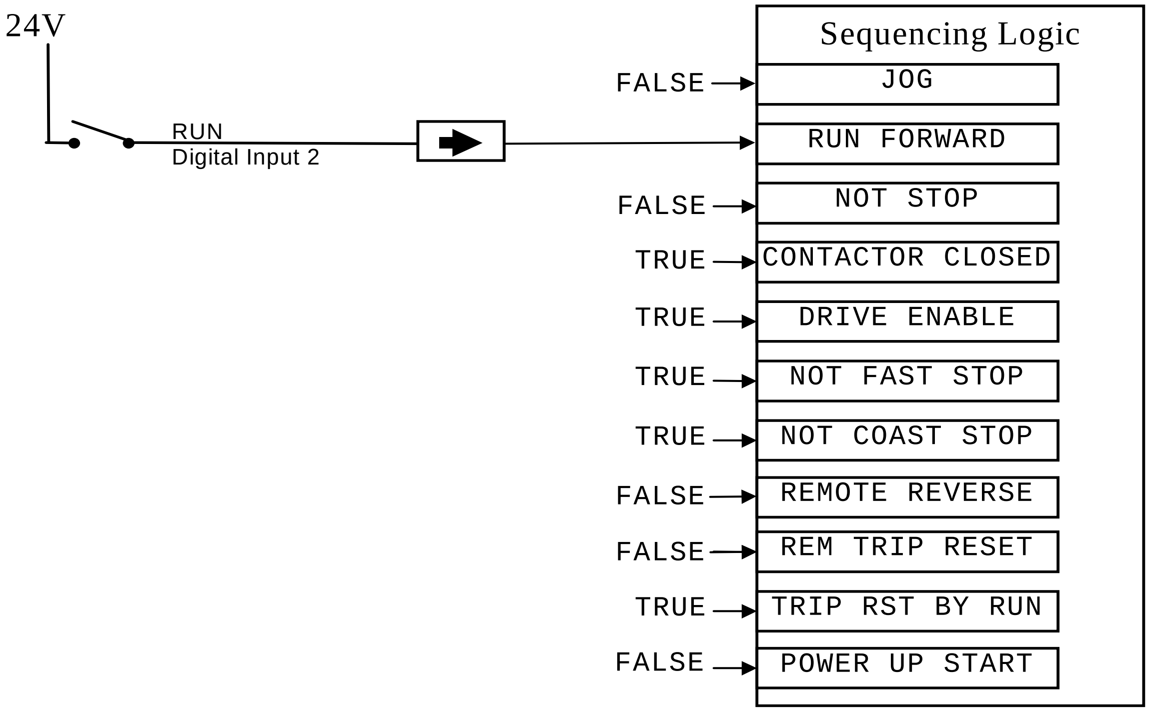


Figure 7.11 Wiring for Single Wire Starting (Default Configurations)

Two Wire Logic Starting

Re-configure the DSE 890 default configuration(s) by connecting SETUP::SEQ & REF::SEQUENCING LOGIC::REMOTE REV OUT to SETUP::SEQ & REF::REFERENCE::REMOTE REVERSE.

This uses two inputs; RUN and REVERSE. The drive can operate in forward and reverse depending upon which switch is closed. If both RUN and REVERSE are TRUE (24V) at the same time, both are ignored and the drive will stop.

Note that the SETUP::SEQ & REF::SEQUENCING LOGIC::NOT STOP parameter is active (FALSE - not wired to), meaning that the drive will only run while the RUN parameter is held TRUE.

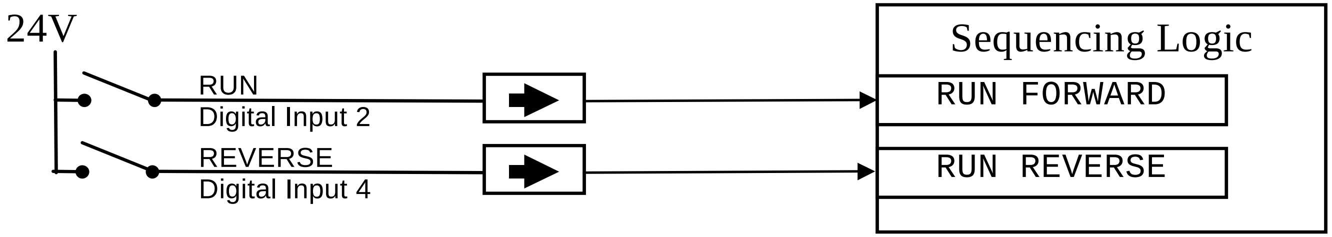


Figure 7.12 Wiring for Two Wire Logic Starting (Re-configured Default Configurations)

Three Wire Logic Starting

Re-configure the DSE 890 default configuration(s) by connecting SETUP::SEQ & REF::SEQUENCING LOGIC::REMOTE REV OUT to SETUP::SEQ & REF::REFERENCE::REMOTE REVERSE.

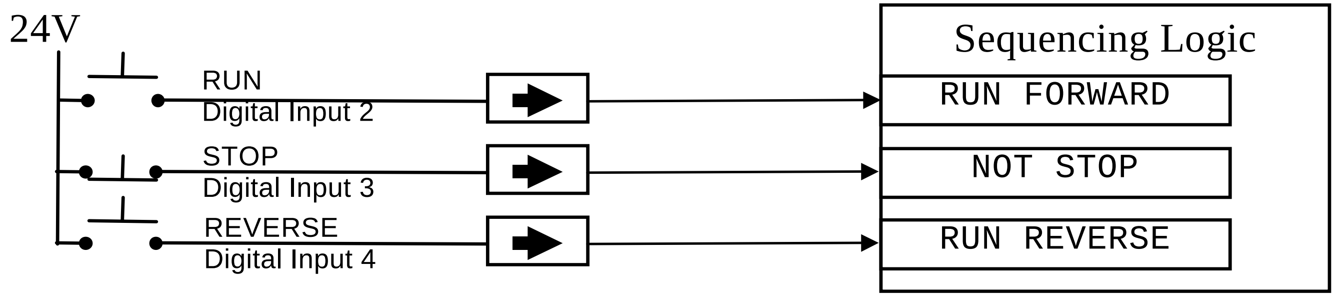


Figure 7.13 Wiring for Three Wire Logic Starting (Re-configured Default Configurations)

- Fit normally-open push button switches to RUN FORWARD and RUN REVERSE.
- Fit a normally-closed push button switch to NOT STOP, thus NOT STOP is held TRUE (24V). When TRUE, the action of NOT STOP is to latch the RUN FORWARD and RUN REVERSE signals. When FALSE, these signals are not latched.

For example, operating the RUN FORWARD switch starts the drive running forward. Operating the RUN REVERSE switch causes the drive to run in reverse. Operating the NOT STOP switch (making “NOT STOP” FALSE) at any time causes the drive to stop running.

Note ***The JOG parameter is never latched in this way. The drive only jogs while the JOG parameter is TRUE.***

Starting Several Drives Simultaneously

IMPORTANT **We do not recommend that the DRIVE ENABLE signal is used to start a drive in “normal” use.**

Use the DRIVE ENABLE parameter to control the output power stack. When this parameter is FALSE, the power stack is disabled regardless of the state of any other parameters. In conjunction with the HEALTH output parameter, DRIVE ENABLE can synchronise several drives on power-up.

Application Advice

Application advice is available through our Technical Support Department, who can also arrange for on-site assistance if required. Refer to the back cover of this manual for the address of your local Parker SSD Drives company.

- ♦ Always use gold flash relays, or others designed for low current operation (5mA), on all control wiring.
- ♦ Remove all power factor correction equipment from the motor side of the drive before use.
- ♦ Avoid using motors with low efficiency and small cos ø (power factor) as they require a larger kVA rated drive to produce the correct shaft kW.

Brake Motors

Brake motors are used in applications requiring a mechanical brake for safety or other operational reasons. The motor can be a standard induction motor fitted with an electro-mechanical brake, or it could be a special conical rotor machine. In the case of a conical rotor machine the spring-loaded brake is controlled by the motor terminal voltage as follows:

- ♦ At rest the motor is braked.
- ♦ When the motor is energised an axial component of the magnetic field due to the conical air-gap overcomes the force of the brake spring and draws the rotor into the stator. This axial displacement releases the brake and allows the motor to accelerate like a normal induction motor.
- ♦ When the motor is de-energised the magnetic field collapses and the brake spring displaces the rotor, pushing the brake disc against the braking surface.

Drives can be used to control the speed of conical rotor brake motors since the linear V/F characteristic maintains the motor magnetic field constant over the speed range. It will be necessary to set the FIXED BOOST parameter to overcome motor losses at low speed (see the FLUXING menu on the Keypad).

Using Line Reactors

IMPORTANT **A line reactor MUST be used with the 890CS Common Bus Supply unit to reduce the harmonic content of the supply current.**

Line reactors are not required to limit input current to 890SD drives. However, line reactors may be used to reduce the harmonic content of the supply current where this a particular requirement of the application or where greater protection from mains borne transients is required.

Using Output Contactors

The use of output contactors is permitted. It is recommended that this type of operation be limited to emergency use only or in a system where the drive can be inhibited before closing or opening this contactor.

Using Motor Chokes

Installations with motor cable runs in excess of 50m may suffer from nuisance overcurrent trips. This is due to the capacitance of the cable causing current spikes to be drawn from the drive output. A choke may be fitted in the drive output which limits the capacitive current. Screened cable has a higher capacitance and may cause problems in shorter runs. The recommended choke values are shown in Table 7.1.

Motor Power		Choke Inductance	RMS Current Rating	SSD Part Number
kW	HP			
0.75	1	2mH	7.5A	CO055931
1.1	1.5			
1.5	2			
2.2	3			
4.0	5	0.9mH	22A	CO057283
5.5	7.5			
7.5	10			
11	15	0.45mH	33A	CO057284
15	20			
18	35	0.3mH	44A	CO057285
22	30	50μH	70A	CO055193
30	40			
37	50	50μH	99A	CO055253
45	60	50μH	99A	CO055253
55	75	50μH	243A	CO057960
75	100	50μH	360A	CO387886
90	120	50μH	360A	CO387886
110	150	50μH	360A	CO387886

Table 7.1 Recommended Choke Values for Cables up to 300 Metres

Using Multiple Induction Motors on a Single Drive

A single large drive can be used to supply several smaller induction motors provided that each individual motor has overload protection.

Note ***Conventional V/F control strategy must be enabled for use with parallel motors. (Sensorless vector control strategy cannot be used). See the VECTOR ENABLE parameter under VECTOR SET-UP menu at level 2.***

The drive must be rated to supply the **total motor current**. It is not sufficient to simply sum the power ratings of the motors, since the drive has also to supply the magnetising current for each motor.

Note that the overload device will not prevent the motor overheating due to inadequate cooling at low speed. Force vented motors may be required; consult your motor supplier.

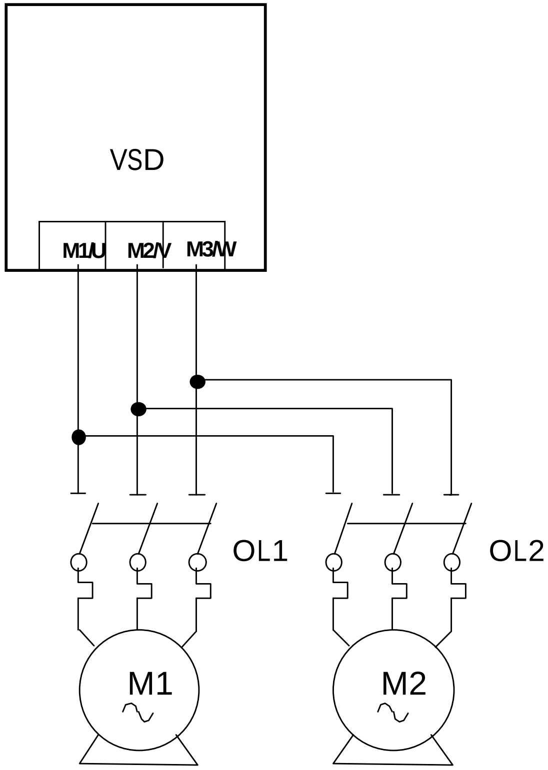


Figure 7.14 Single Drives supplying Multiple Motors

WARNING
All motors should be connected to the drive output before the START command is given.

Caution

Restrict the total cable length on multiple motor installations as follows:
50 metres with no output choke fitted,
300 metres with choke.

High Starting Torque

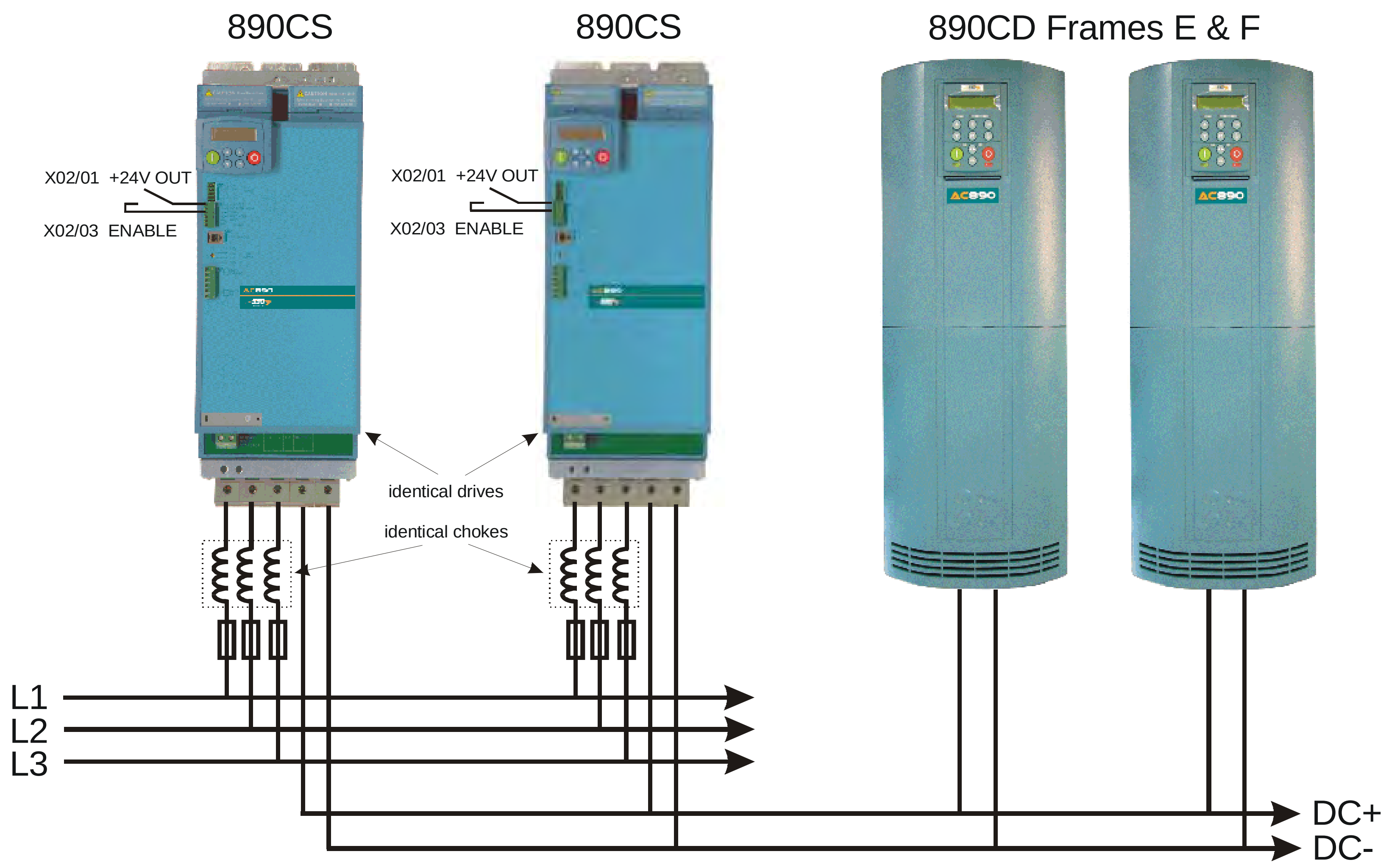
Applications requiring high motor starting torque (greater than 100% of rated torque) need careful setup of the drive voltage boost feature. For most motors, a FIXED BOOST parameter (FLUXING function block) setting of 6.0% is usually adequate. Setting the FIXED BOOST parameter level too high can cause the drive current limit feature to operate. If this occurs, the drive will be unable to ramp up in frequency. The IT LIMITING diagnostic (INVERSE TIME function block) will indicate TRUE when the inverse time current limit feature is operating. Simply reducing the level of the FIXED BOOST parameter will remove this problem. It is important to use the minimum level of FIXED BOOST necessary to accelerate the load. Using a level of FIXED BOOST higher than necessary will lead to increased motor heating and increased risk of drive overload.

Note ***Motor torques greater than 100% require high currents to be drawn from the drive. Thus, the CURRENT LIMIT parameter (CURRENT LIMIT function block) will have to be set accordingly such that the drive current limit feature will not activate when accelerating the load.***

The best motor starting performance can be achieved by setting up the SLIP COMP function block, refer to the Appendix D: “Programming” - SLIP COMP. Also setting the BASE VOLTS parameter (VOLTAGE CONTROL function block) to 115.4% and the FREQ SELECT parameter (PATTERN GEN function block) to 3kHz, can help to start difficult loads in the most extreme cases.

Paralleling 890CS Common Bus Supplies

In high power applications involving 890CS Common Bus Supplies and 890CD Common Bus Drives it is acceptable to parallel the DC output from two or more 890CS units.



Follow the advice given in Appendix E: "Technical Specifications" - Electrical Ratings: : 890CS - Calculation.

IMPORTANT **When paralleling 890CS units, derate the combination 890CS unit by 5%. For example, the 890CS Frame D has a rated current of 162A AC and should be derated to 154A AC, i.e. two paralleled units will have a combined rating of 308A AC.**

- All 890CS units require the customer 24VDC auxiliary supply at terminals X01/01 and X01/04 (not shown in the diagram).
- All 890CS units require an Enable signal at terminal X02/03.
- All 890CS units on the system must be identical (have the same first three blocks of the Model Number - for example: 890CS/4/0162D /…). See the Rating Label on the 890CS.
- All 890CS units on the system must be fitted with the (identical) recommended line choke.

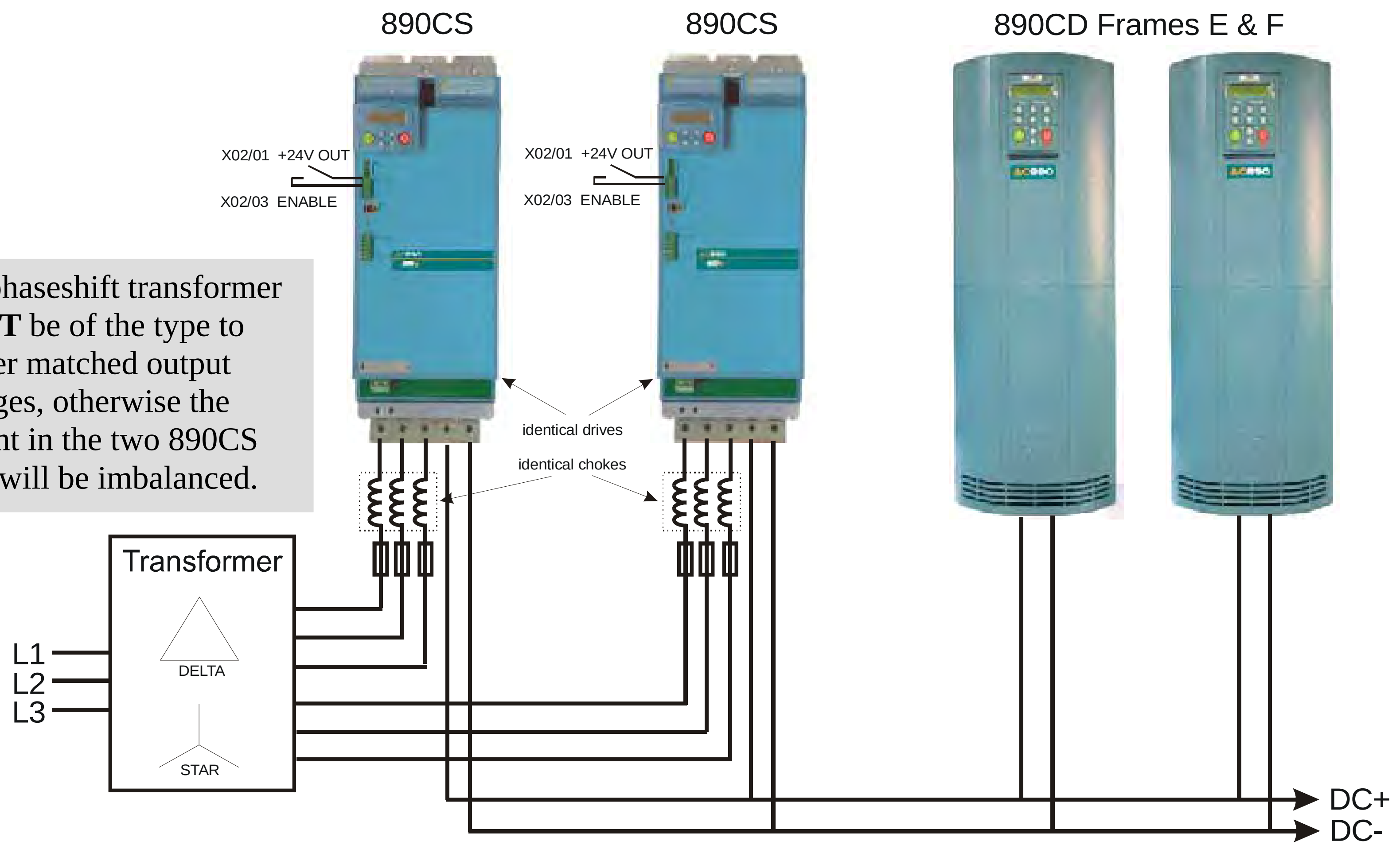
12-Pulse Systems

12-pulse drives are used:

- ♦ for very large horsepower applications
- ♦ to reduce harmonic distortion

A 30 degree phase shifting transformer is used. A characteristic of the phase shifting is to cause the 5th, 7th, 17th, 19th, etc. harmonics to cancel and this results in reduced line harmonics.

The phaseshift transformer **MUST** be of the type to deliver matched output voltages, otherwise the current in the two 890CS units will be imbalanced.



890CD/SD 4-Q Regen AFE Applications

Introduction

A **4-Q REGEN** (4 Quadrant Regenerative) control mode is available on all 890CD Common Bus Drives and 890 Standalone Drives, provided that :

- the drive uses Software Version 1.x (1.8 or greater), or Software Version 3.x (Software Version 2.x does not support 4Q mode)

  AND

- **for Frame B-D**: the SETUP::MISCELLANEOUS::EMC CAPACITORS parameter is set to (1) NOT CONNECTED
- **for Frame E-K**: the drive displays "/007" in Block 12 of the (Europe) Product Code indicating that Special Option 7 is applied ("Y" cap disconnection)

IMPORTANT All drives **in a common DC link scheme using a 4-Q Regen front-end** MUST **have their internal EMC filter "Y" caps to earth (PE) removed.**

The **4-Q REGEN** control mode allows a single 890 to act as a 4-Q power supply unit that is capable of drawing (motoring) and supplying (regenerating) sinusoidal, near-unity power factor current from the supply.

The output from the 4-Q Regen drive acts as a DC supply which is used to power other drives on a common DC Bus system.

Advantages

Using the 890 as a 4-Q power supply in common DC Bus schemes provides the following advantages:

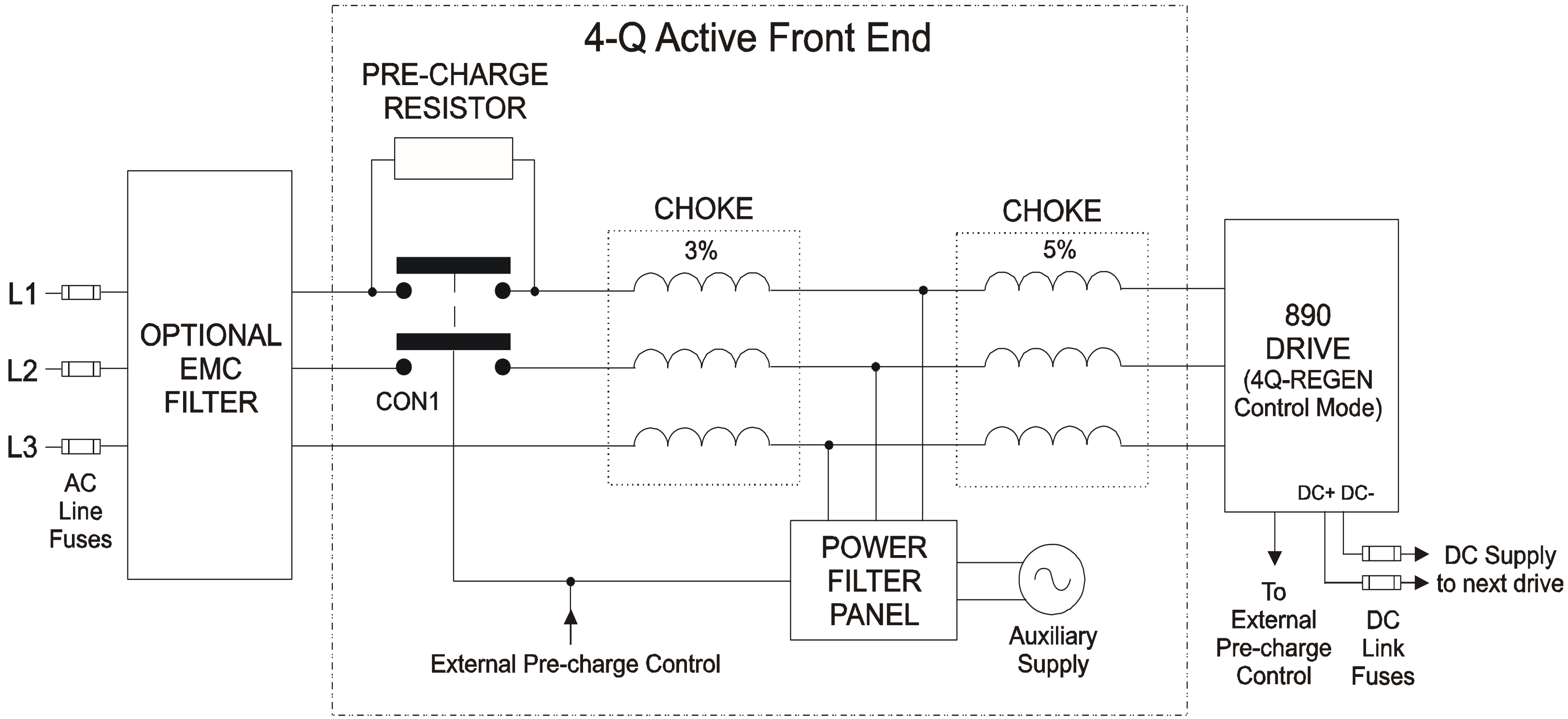
- Simplified approach to Common DC Link systems
- Allows standard 890 drive to act as 4-Q DC Link power supply unit
- Near-sinusoidal supply currents (Motoring and Regenerating)
- Near-unity power factor operation (0.99 or better)
- Low supply harmonics currents (helps to meet G5/4 and IEEE519)

WARNING!

890 drives operating in **4-Q REGEN** control mode are **NOT** suitable for use on systems where the mains supply (L1, L2, L3) is provided by a generator (where the supply cannot absorb the regenerated current).

4-Q Active Front End

The 4-Q Regen drive requires the following 4-Q Active Front End:



Notes:

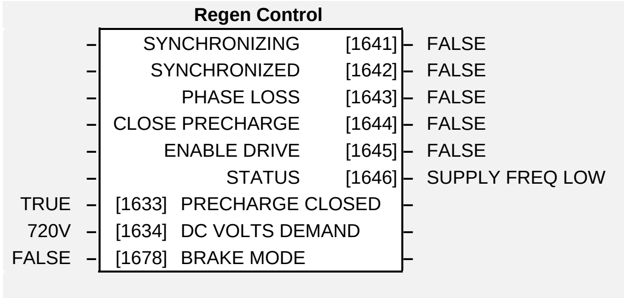
Contactor CON1 is rated to match the 4-Q power supply drive current (AC1 rating)

The 3% and 5% line chokes are custom designed for this application. Refer to page 7-47.

Power Filter Panel				
Frame	**kW**	**Volts**	**Part Number 110V fans + control**	**Part Number 230V fans + control**
B	4	230	LA482467U004	LA482470U004
C	7.5	230	LA482467U011	LA482470U011
D	18.5	230	LA482467U018	LA482470U018
E	22	230	LA482467U030	LA482470U030
F	45	230	LA482467U055	LA482470U055
B	6	400	LA482468U006	LA482471U006
C	15	400	LA482468U018	LA482471U018
D	30	400	LA482468U037	LA482471U037
E	45	400	LA482468U055	LA482471U055
F	90	400	LA482468U110	LA482471U110
G	180	400	LA482468U220	LA482471U220
H	280	400	LA482468U315	LA482471U315
J	315	400	LA482468U355	LA482471U355
B	6	500	LA482469U006	LA482472U006
C	15	500	LA482469U018	LA482472U018
D	30	500	LA482469U037	LA482472U037
E	45	500	LA482469U055	LA482472U055
F	90	500	LA482469U110	LA482472U110
G	180	500	LA482469U220	LA482472U220
H	280	500	LA482469U315	LA482472U315
J	315	500	LA482469U355	LA482472U355

EMC Filtering

We recommend all 890 Regen systems meet the EMC product specific standard EN61800-3:1997. To achieve this, an EMC filter is required. Refer to Chapter 6: "associated Equipment" for details of suitable filters.



Contactor and Fusing

- Use AC Line Fuses to protect the 4-Q Regen drive. These fast, semiconductor protection fuses must be capable of withstanding the system AC supply voltage. Refer to Appendix E.

- The AC contactor, CON1, used in the external pre-charge circuit must have an AC1 or thermal rating of the constant torque current rating of the 4-Q Regen drive. Refer to page 7-44.

- Use DC Link fuses in both the DC+ and DC- lines to protect each drive connected to the common DC bus. The fuses must be of suitable current rating and capable of withstanding 1000Vdc . Although HRC fuses would be adequate, the high DC voltage requirement (1000Vdc) may limit the choice to semiconductor fuses. Refer to page 7-42.

- The DC contactor used in the Brake Mode system (refer to page 7-40) must have an adequate thermal rating for the regen current required. Typically the regen rating of the system, and hence the rating of the DC contactor and fuses, will be less than motoring requirement as the contactor should not open under load.

Drive Set-up

The 890 Common Bus drive must be set-up correctly to work in a 4-Q Regen Control/Common DC Bus Application.

Typically the system will contain an 890 4-Q Regen drive providing the 4-Q power supply, and one or more 890 drives on the common DC bus.

Settings

All 890CD and 890SD Drives

ALL 890 drives in the system **MUST** have their internal EMC "Y" caps to earth disconnected.

Set the demanded boosted DC link voltage (DC VOLTS DEMAND) appropriately for the drive voltage rating. This is given in the separate table below.

Refer to Appendix D for a full description of the REGEN CONTROL function block parameters.

MMI Menu Map

1 SETUP
2 MOTOR CONTROL
3 REGEN CNTROL
   DC VOLTS DEMAND

890 4-Q Regen Drive:

Create an application using the DSE 890 Configuration Tool.
Refer to page 7-34 for wiring details.

sv 1.x
MMI Menu Map

1 SETUP
2 MOTOR CONTROL
3 MOTOR DATA
   CONTROL MODE
   LEAKAGE INDUC

sv 3.x
MMI Menu Map

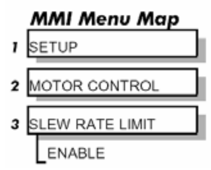
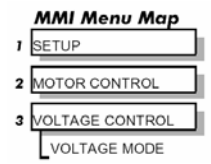
1 SETUP
2 MOTOR CONTROL
3 MOTOR DATA
   LEAKAGE INDUC

sv 3.x
MMI Menu Map

1 SETUP
2 DRIVE SETUP
3 DRIVE CONFIG
   CONTROL MODE

Set the CONTROL MODE parameter to "4-Q REGEN".

Set the LEAKAGE INDUC parameter to the value of the total line choke inductance. Refer to page 7-48.

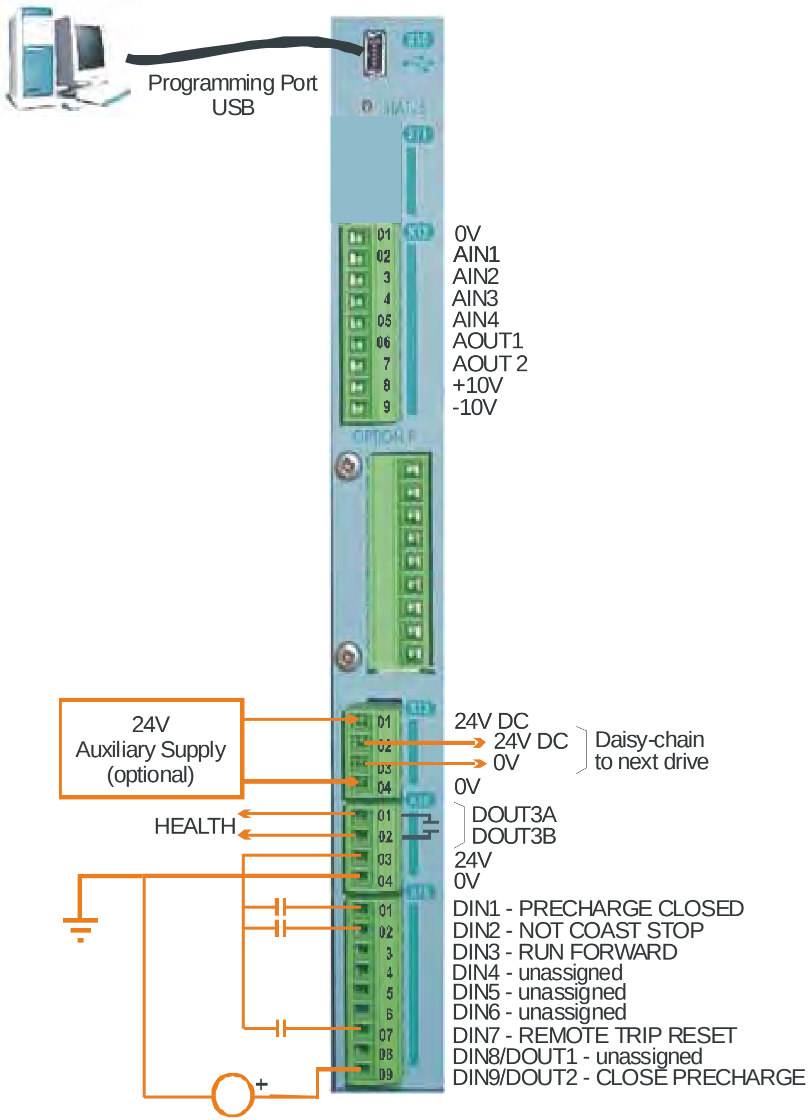
<table>
<tr><th colspan="2">Other 890 Drives on the Bus</th></tr>
<tr><td>Set the ENABLE parameter in the SLEW RATE LIMIT function block to FALSE. This disables ramp-hold during deceleration on high link volts feature.</td><td></td></tr>
<tr><td>If in Volts/Hz motor control mode, the VOLTAGE MODE parameter in the VOLTAGE CONTROL function block MUST be set to FIXED. This will ensure the motor is not overfluxed by the boosted 720V DC Bus. Failure to do this may lead to motor overheating and possible burn out.</td><td></td></tr>
</table>

Setting for DC VOLTS DEMAND Parameter

Drive Voltage Rating (V)	Under Volts Trip Level (V)	Over Volts Trip Level (V)	Recommended DC VOLTS DEMAND
380V – 460V	410V	820V	720V
220V – 240V	205V	410V	370V

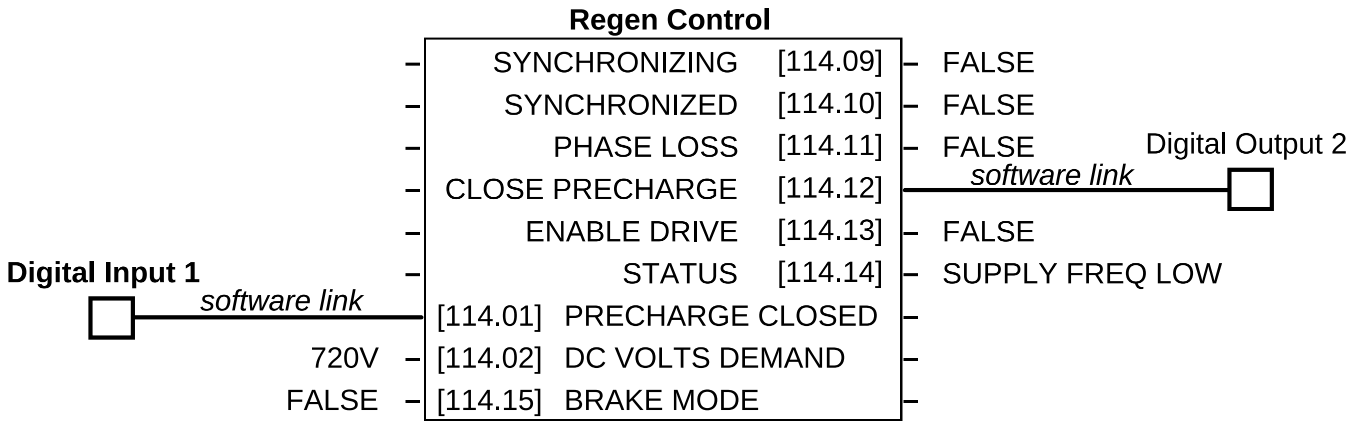
Create DSE 890 Application

Use the DSE 890 Configuration Tool to configure the drive for the 4Q Regen application. A suggested wiring diagram for the 890 control board is shown below.

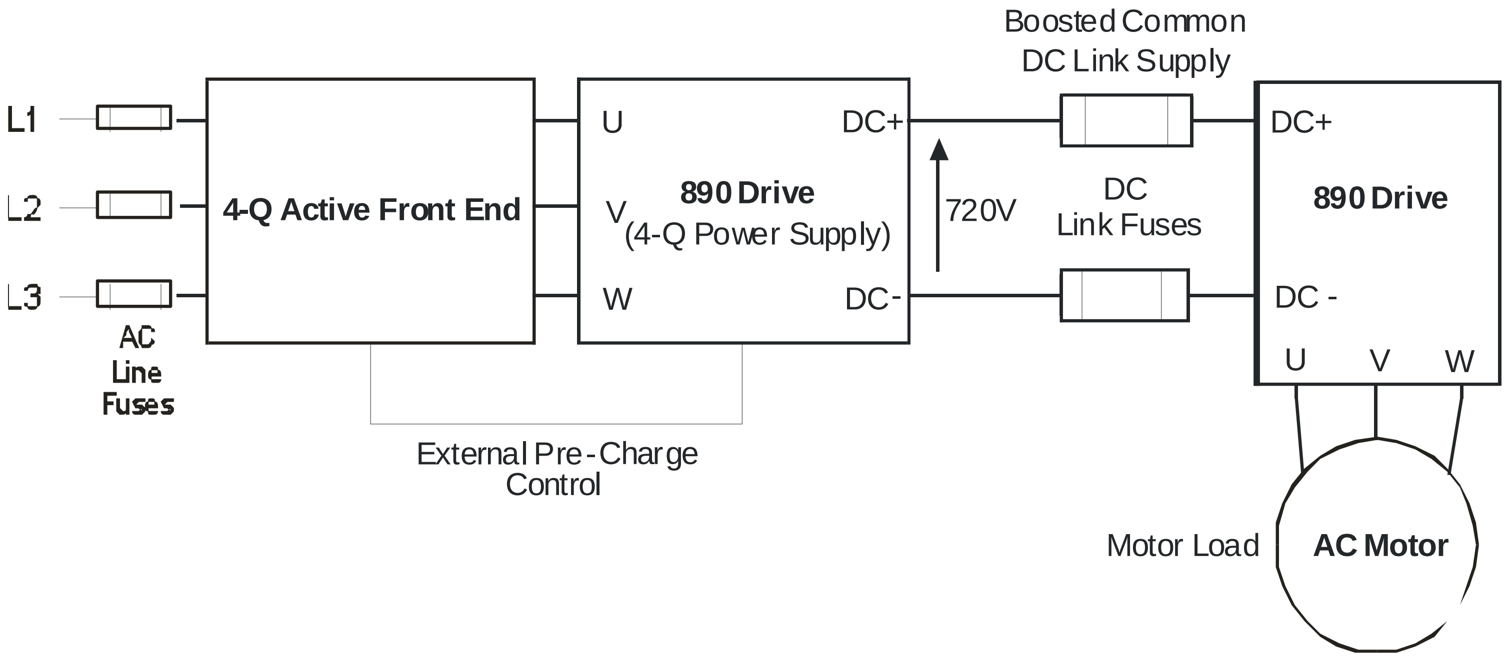


Connection Table		PREF
DIN1	to SETUP::MOTOR CONTROL::REGEN CNTRL::PRECHARGE CLOSED	114.01
DIN2	to SETUP::SEQ & REF::SEQUENCING LOGIC::NOT COAST STOP	92.08
DIN3	to SETUP::SEQ & REF::SEQUENCING LOGIC::RUN FORWARD	92.01
DIN7	to SETUP::SEQ & REF::SEQUENCING LOGIC::REM TRIP RESET	92.10
DOUT2	to SETUP::MOTOR CONTROL::REGEN CNTRL::CLOSE PRECHARGE	114.12

REGEN CONTROL Function Block, for example:



A Single Motor System



The simplest configuration for 4-Q Regen control is a single 890 Regen drive acting as the unity power factor supply, connected via the DC link to another 890 driving the application.

Applications of single motor 4-Q Regen systems include :

- Hoist and Elevators
- Dynamometer test rigs
- Unwind Stands
- Installations that would otherwise require a Harmonic Power Filter

In this system, the two 890 drives are matched in power. The 4-Q Regen drive supplies the full motoring and regenerating requirement of the load.

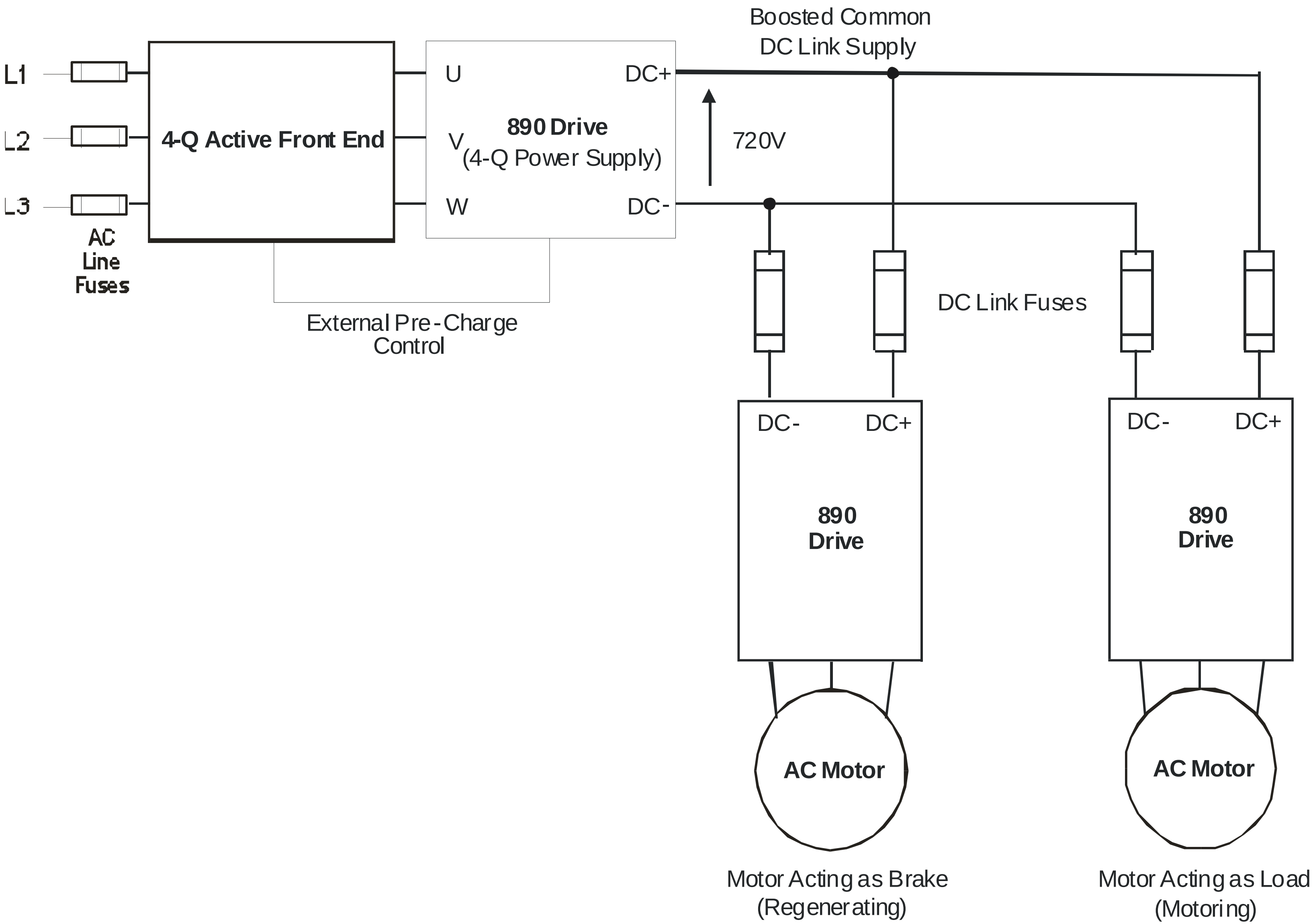
Additional external equipment required by the 4-Q Regen drive includes :

- EMC Filter
- AC Line Fuses
- DC Link Fuses

No extra hardware is required to detect the rotation, frequency and phase of the mains supply. Also, no dynamic braking resistor is required.

When mains power is applied to the 4-Q Regen drive, the DC link slowly charges through the external pre-charge circuit and the drive's internal power supply will start in the normal way. If the 4-Q Regen drive is healthy and the Run signal is applied, it will synchronise to the mains supply (phase, rotation and frequency). This process takes approximately 100ms. After synchronisation, the DC link on the common bus is boosted to approximately 720V (on a 400V product). This high value of DC link volts is required for successful regen operation.

A Multi-Motor System



In many applications, the total power consumed by the system is less than the installed power of the drives. This is because some drives are motoring (eg. winders) and some are regenerating (eg. unwinders). In these situations it is convenient to connect the drives on a common DC link.

In this system, the 4-Q Regen drive supplies the motoring and regenerating requirement of the load.

Additional external equipment required by the 4-Q Regen drive includes :

- EMC Filter
- AC Line Fuses
- DC Link Fuses

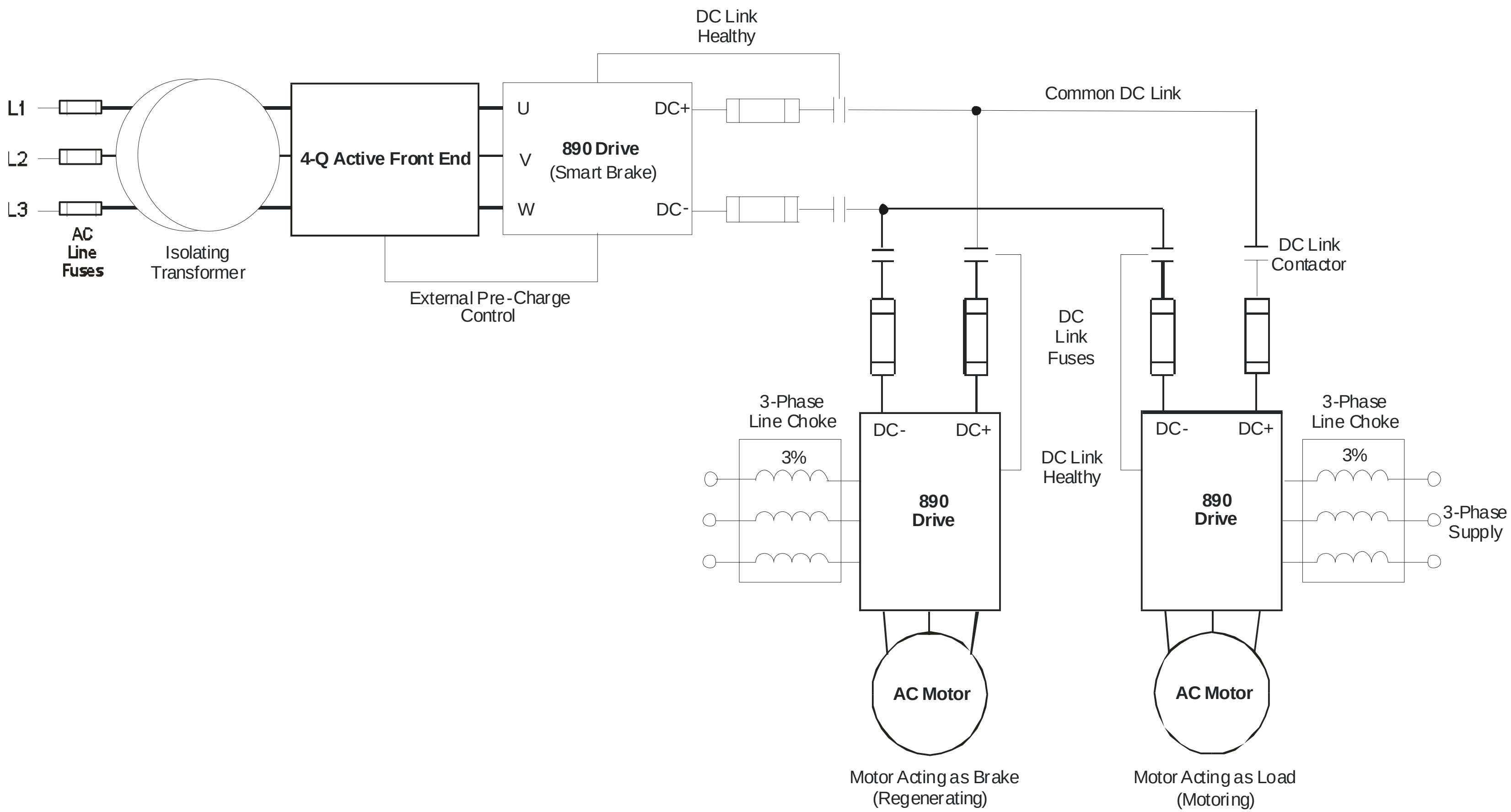
No extra hardware is required to detect the rotation, frequency and phase of the mains supply. Also, no dynamic braking resistor is required.

The 4-Q Regen drive draws sinusoidal, unity power factor current from the supply and only has to be rated for either the power consumed or supplied by the system, or by the system braking requirements, whichever is the larger.

Dynamic Braking (eg. for Emergency Stopping purposes) can still be used in this control mode if required.

7

A Smart Brake System



IMPORTANT **It is essential to use an isolation transformer on the supply to the Smart Brake drive, as shown above.**

The 4-Q Regen drive can act as a Smart Brake:

4-Q Regen Drive:

MMI Menu Map

1 SETUP
2 MOTOR CONTROL
3 REGEN CNTROL
BRAKE MODE

- ♦ In addition to the settings given in "Drive Set-up", page 7-31, set the BRAKE MODE parameter in the REGEN CONTROL function block to TRUE.

In this system, the 4-Q Regen drive supplies the regenerating requirement of the load.

Additional external equipment required by the 4-Q Regen drive includes:

- EMC Filter
- AC Line Fuses
- DC Link Fuses

During motoring operation, the drives on the common link are supplied via their own internal 3-phase diode bridge. The 4-Q Regen drive tracks the mains supply but does not supply motoring power to the common DC Link.

During regeneration, the DC link voltage will rise and trigger the 4-Q Regen drive to return the excess power to the mains (sinusoidal current, unity power factor).

Thus, the 4-Q Regen drive acts as a smart, no loss, Dynamic Brake.

The BRAKE MODE allows the level of regeneration (braking) capacity in the system to be rated differently from the required motoring capacity.

When using the Brake Mode, each drive is responsible for pre-charging its own DC Link. When an individual drive is pre-charged and healthy, it connects itself on to the common DC Bus via a DC contactor.

The drives disconnect from the common bus if a trip occurs.

DC Link Fuses

Below is a list of parts for the DC Link Fuses. Refer to the Electrical Ratings tables for Quadratic Duty motor powers. Select the correct part for the drive's Motor Power.

Motor Power (Constant Duty @ 400V) (kW/Hp)	Frame Size	DC Fuse Rating (A)	DC Fuse Type	Fuse	Fuse Switch	Fuse Holder
0.75/1	B	15	CO89495J	CS481079	CS481099	CS481039
1.5/2	B	15	CO89495J	CS481079	CS481099	CS481039
2.2/3	B	15	CO89495J	CS481079	CS481099	CS481039
4/5	B	15	CO89495J	CS481079	CS481099	CS481039
5.5/7.5	C	40	SO86795J	CS481080	CS481099	CS481039
7.5/10	C	40	SO86795J	CS481080	CS481099	CS481039
11/15	C	40	SO86795J	CS481080	CS481099	CS481039
15/20	D	80	FWP 80BI	CS481081	CS481088	
18.5/25	D	80	FWP 80BI	CS481081	CS481088	
22/30	D	80	FWP 80BI	CS481081	CS481088	
30/40	E	150	IXL70F150	CS481082	CS481088	
37/50	E	150	IXL70F150	CS481082	CS481088	
45/60	E	150	IXL70F150	CS481082	CS481088	
55/75	F	300	IXL70F300	CS481083	CS481088	

Motor Power (Constant Duty @ 400V) (kW/Hp)	Frame Size	DC Fuse Rating (A)	DC Fuse Type	Fuse	Fuse Switch	Fuse Holder
75/100	F	300	IXL70F300	CS481083	CS481088	
90/125	F	300	IXL70F300	CS481083	CS481088	
90/150	F	300	IXL70F300	CS481083	CS481088	
110/150	G	350	IXL70F350	CS481084	CS481088	
132/200	G	600	IXL70F600	CS481085	CS481088	
160/250	G	600	IXL70F600	CS481085	CS481088	
200/300	H	600	IXL70F600	CS481085	CS481088	
220/350	H	800	FWP 800AI	CS481086	CS481088	
250/400	H	800	FWP 800AI	CS481086	CS481088	
280/450	H	800	FWP 800AI	CS481086	CS481088	
315/500	J	900	FWP 900AI	CS481087	CS481088	

Pre-Charge Sizing

The external pre-charge contactor is required to carry the full load current rating (including overload) of the 4-Q Regen drive. Thus, it must have an AC1 rating of the Constant Duty current rating of the drive. Refer to the Electrical Ratings tables for Constant Duty motor powers.

We recommend that standard SSD Dynamic Braking resistors are used for the external pre-charge circuit. The continuous and peak power capabilities of these resistors are given below:

SSD Part Nº	Resistance (Ω)	Continuous Power Rating (W)	Peak Power Rating (kW)
CZ389853	100	100	2.5
CZ463068	56	200	5
CZ388396	36	500	12.5

The recommended pre-charge resistor networks are shown in the table below. The table indicates the amount of total DC Link capacitance the network can charge for a given supply voltage.

External Pre-Charge Network	Continuous Power Rating (W)	Impulse Joule Rating (J)	Pre-Charge Capability (μF) @ $240V_{rms}$ +10%	Pre-Charge Capability (μF) @ $460V_{rms}$ +10%
100 Ohm 100W	100	2,500	35,000	9,700
56 Ohm 200W	200	5,000	71,000	19,500
36 Ohm 500W	500	12,500	179,000	48,800

The internal DC Link Capacitance for each drive in the 890 range is given in the table below:

Drive Power (kW/Hp)	230V Units Nominal		400V Units Nominal		500V Units Nominal	
	Size	μF	Size	μF	Size	μF
0.55/0.75	B	470			B	235
1.1/1.5	B	470			B	235
1.5/2	B	940			B	235
2.2/3	B	940			B	235
4/5	B	1410			B	470
5.5/7.5	C	4200			B	705
7.5/10	C	4200			B	705
11/15					C	1400
15/20					C	2100
18.5/25					D	2100
22/30					D	2100
30/40					D	2800
37/50			E	3000	E	3000
45/60			E	3500	E	3500
55/75			F	5600	F	5600
75/100			F	5600	F	5600

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Drive Power (kW/Hp)	230V Units Nominal		400V Units Nominal		500V Units Nominal	
	Size	µF	Size	µF	Size	µF
90/125			F	5600	F	5600
-/150			*US/Canada only*		F	5600
110/150			G	6600		
132/200			G	9900		
160/250			G	13500		
180/300			G	13500		
200/300			H	14850		
220/350			H	14850		
250/400			H	20250		
280/450			H	20250		
315/500			J	19800		

Simply sum the DC Link capacitance for all the drives on the common DC Link and select the appropriate pre-charge network.

For example: a system comprising 5 x 37kW, 400V Frame E drives would have a total DC Link capacitance of:

$$C_{Total} = 5 \times 3000\mu F = 18{,}000\mu F$$

This is less than 19,500µF and thus a 56Ω, 200W (CZ463068) resistor will be adequate.

3-Phase Choke Sizing

One of the benefits of the 890 4-Q Regen drive is the reduction in the levels of harmonic currents drawn from the supply. The total harmonic distortion (THD) of the mains current is related to the PWM switching frequency, the supply voltage, the supply frequency and the inductance of the 3-phase line choke. The maximum allowed PWM carrier frequency in non-overload conditions, for each frame size is given below:

890 Frame Size	PWM Carrier Frequency
B to F	3kHz
G and H	2.5kHz
J	2kHz

The IEEE 519 standard (IEEE Standard Practices and Requirements for Harmonic Control in Electrical Power Systems) requires a THD of current of 5%. The tables below show the recommended 3-phase line chokes (5% and 3% in series) and expected THD of current for 400V and 230V drives.

The PWM switching produces high levels of harmonic current in the 3% chokes. It is essential to have these properly rated to avoid significant overheating. Suitable chokes have been developed for Parker SSD Drives and their Part Numbers are provided below.

5% Choke

Drive Frame Size	Motor Power (kW/Hp)	Input Voltage (V)	Choke	Inductance (µH)	Currents			
					50Hz	1kHz	2.5kHz	Sum
B	4/5	230	CO468342U004	1424	14.85	0.30	2.72	16
C	7.5/10	230	CO468342U011	839	25.20	0.50	4.61	26
D	18.5/25	230	CO468342U018	346	61.20	1.22	11.20	63
E	22/30	230	CO468342U030	294	72.00	1.44	13.18	74
F	45/60	230	CO468342U055	153	138.60	2.77	25.36	141
B	6/10	400	CO468326U006	2918	12.60	0.25	2.31	13
C	15/20	400	CO468326U018	1362	27.00	0.54	4.94	28
D	30/40	400	CO468326U037	693	53.10	1.06	9.72	54
E	45/60	400	CO468326U055	470	78.30	1.57	14.33	80
F	90/150	400	CO468326U110	227	162.00	3.24	29.65	165
G	180/300	400	CO468326U220	114	324.90	6.50	59.46	331
H	280/450	400	CO468326U315	79	468.00	9.36	85.64	476
J	315/500	400	CO468326U355	70	531.00	10.62	97.17	540

3% Choke

Drive Frame Size	Motor Power (kW/Hp)	Input Voltage (V)	Choke	Inductance (µH)	Currents			
					50Hz	1kHz	2.5kHz	Sum
B	4/5	230	CO468341U004	854	14.95	0.39	0.00	15
C	7.5/10	230	CO468341U011	503	25.38	0.66	0.00	26
D	18.5/25	230	CO468341U018	208	61.63	1.59	0.00	62
E	22/30	230	CO468341U030	177	72.50	1.87	0.00	73
F	45/60	230	CO468341U055	92	139.57	3.60	0.00	140
B	6/10	400	CO468325U006	1750	12.69	0.33	0.00	13
C	15/20	400	CO468325U018	817	27.19	0.70	0.00	28
D	30/40	400	CO468325U037	416	53.47	1.38	0.00	54
E	45/60	400	CO468325U055	282	78.85	2.04	0.00	79
F	90/150	400	CO468325U110	137	163.13	4.21	0.00	164
G	180/300	400	CO468325U220	68	327.17	8.45	0.00	328
H	280/450	400	CO468325U315	48	471.28	12.17	0.00	472
J	315/500	400	CO468325U355	42	534.72	13.81	0.00	535

Lower values for THD of current can be achieved by adding extra line impedance.

Chapter 8
The Keypad

In this chapter, learn about the control keys and keypad indications. The main menu maps are shown here, but for details of sub-menus refer to Chapter 9.

Introduction

The 890CS units are factory fitted with the 6511 Keypad. It can be plugged into the front of the unit. To remove it, simply pull it away from the drive. To refit it, push it back into place.

You can also use a remote mounted 6901 Keypad.

The 890CD and 890SD units are fitted with the 6901 Keypad.

Both the 6511 and 6901 Keypad can be mounted up to 3 metres away from the 890 using the optional panel mounting kit with connecting lead: refer to "Remote Mounting the Keypad", page 8-40.

6901

6511

The keypads display the following information:

890CS +		DIAG menu (5 important diagnostics)
890CS +		DIAGNOSTICS menu (5 important diagnostics)
890CD & 890SD +		OPERATOR, DIAGNOSTICS, QUICK SETUP, SETUP & SYSTEM menus *(SETUP menu lists all parameters available in the DSE 890 Configuration Tool)*

6511 Keypad

890CS Common Bus Supply

The 6511 Keypad (Man-Machine Interface, MMI) provides for local control (power-up/power-down), and also monitoring of the five diagnostics provided on the display.

To display the Software Version:

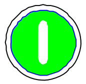
Press and hold  to display software version.

To display the Line Voltage Rating:

Press and hold  to display software version.

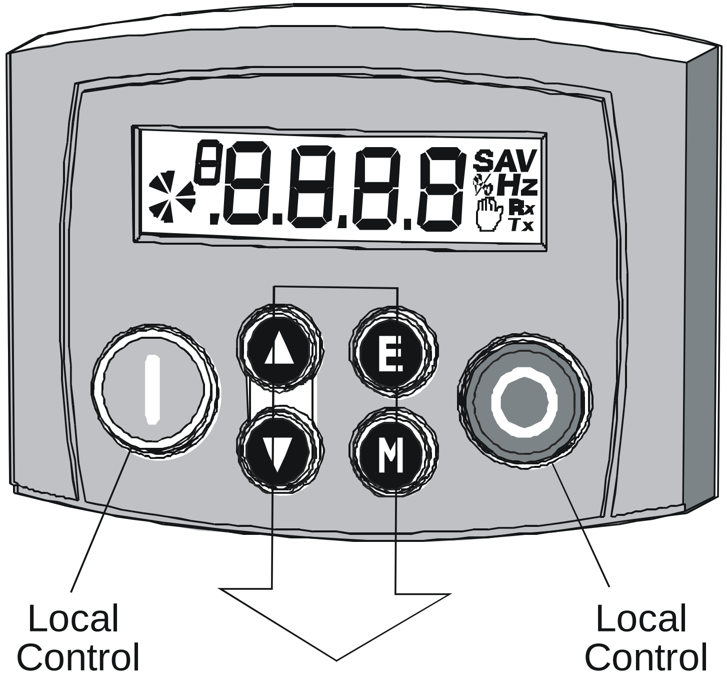
Press  or  to view.

To Start in Local Mode:

Press 

To Stop in Local Mode:

Press 



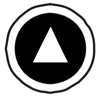
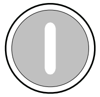
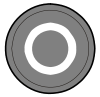
8

Initial Power-Up Conditions

The unit will always power-up in Remote mode.

The Keypad will display the DC Link Power  on the 890CS Common Bus Supply.

Control Key Definitions

Key	Operation	Description
	Escape	*Navigation* – Hold to display the Welcome screen *Trip Message* – Clear Trip or Error message from display
	Menu	Bypasses the time-out from the Welcome screen to display the Diagnostics menu.
	Increment	Move up through the Diagnostics menu
	Decrement	Move down through the Diagnostics menu
	Run	*Local Mode* – Run the unit (power-up the DC link)
	Stop	*Local Mode* – Stops the unit (power-down the DC link) *Navigation* – Press and hold to toggle between Local and Remote Mode (refer to page 8-8) *Trip Reset* – Resets trip condition allowing unit to resume operation

Example: To view the INPUT CURRENT diagnostic

1. The display will default to show the OUTPUT POWER (%) diagnostic  .
2. Press the  key repeatedly to scroll to the INPUT CURRENT (A) diagnostic  .
   Alternatively, press the  key just once to cycle round the list.

Display Indications

A when displaying an Alarm code

- a negative parameter value

Displays the units for the value:

V for voltage in Volts,
Hz for frequency in Hertz
A for current in Amps
% for percentage

Rrotating = DC link charged

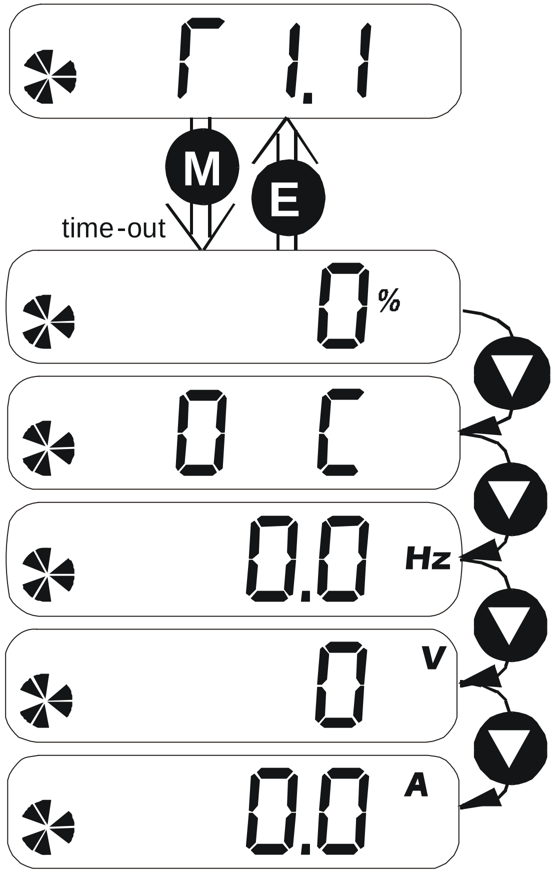
Indicates the drive is in Local control.
Drive is in remote control when not visible.

**Indicates numbers or values,
trip information, error codes etc.
See "Status Indications" below.**

The Menu System

The unit will initialise in Remote Mode from factory conditions.

The Keypad will display the Output Power (%). This is the first of five diagnostics.



Welcome Screen Displays the software version of the unit

From the Welcome Screen, the display times-out (alternatively you can press the M key) to show the first of 5 diagnostics:

Output Power	As a percentage of nominal full power for the selected input voltage
Heatsink Temp	The heatsink temperature in Centrigrade
Supply Frequency	The real time frequency of the input supply in Hz
DC Link Volts	Vac (rms) x $\sqrt{2}$ = dc link Volts (when motor stopped)
Input Current	The real time input current in Amps

8

Drive Status Indications

The keypad can display the following status information:

Display	Status Indication and Meaning	Possible Cause
rdy	READY/HEALTHY No alarms present. Remote mode selected	
LOC	LOCAL Local Mode selected, healthy, no alarms present	Added or removed from the display letter-by-letter to indicate entering or leaving Local Mode
run	RUN Not possible to change between Local/Remote mode	The drive is running in Local mode or the Remote run signal is active

Alert Message Displays

A message will be displayed on the Keypad when either:

- A requested operation is not allowed
- The drive has tripped

Most messages are displayed for only a short period, or for as long as an illegal operation is tried, however, trip messages must be acknowledged by pressing the **E** key.

Experience will show how to avoid most messages. Refer to Chapter 10: "Trips and Fault Finding" for trip messages and reasons.

Selecting Local or Remote Mode

The unit can operate in one of two ways:

Remote Mode: Remote control using digital inputs

Local Mode: Local control using the Keypad

Local control keys are inactive when Remote mode is selected.

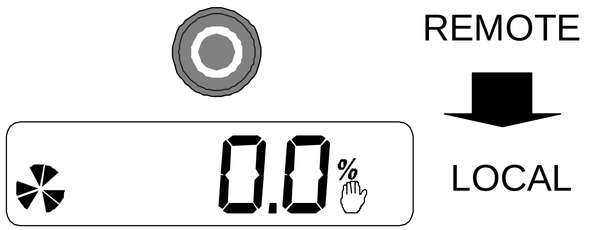
You can change between local and remote mode from any point on the MMI.

Note ***You can only change between Local and Remote Mode when the unit is "stopped" (when the DC link is powered-down).***

Remote to Local Mode:

Hold the Stop key down until the display spells LOC

Release the key to display the previous menu for example,Local Setpoint



Local to Remote Mode:

Hold the Stop key down until LOC and are removed from the display

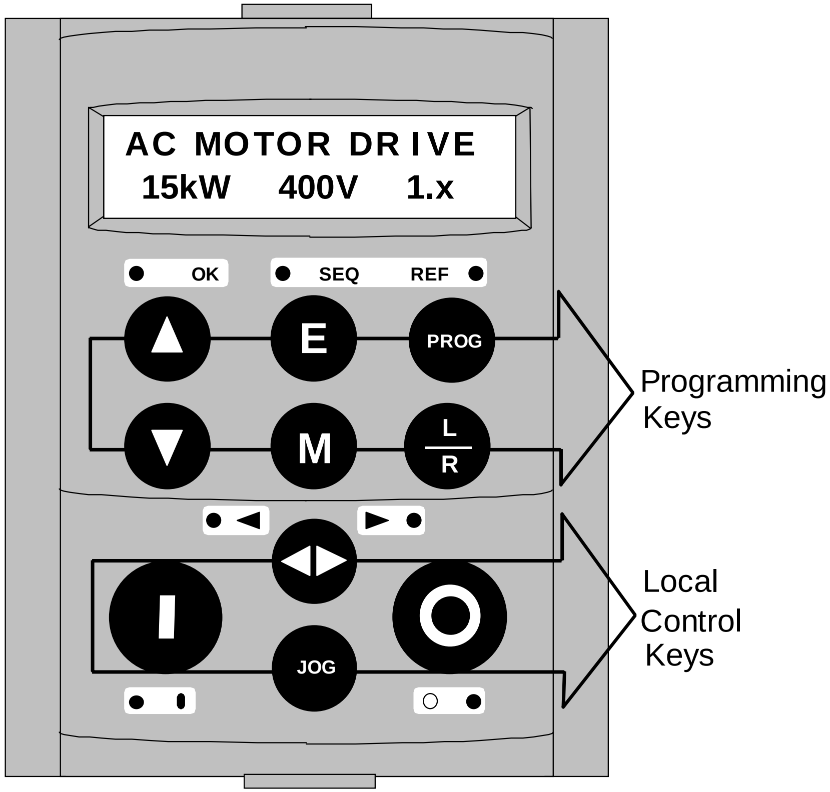
Release the key to display the previous menu

The ENABLE input (DIGIN2) must be inactive to effect this change.

6901 Keypad

890CS Common Bus Supply

The 6901 Keypad (Man-Machine Interface, MMI) provides for local control (power-up/power-down), and also monitoring of the five diagnostics provided on the display.



To display the Software Version & Voltage Rating:

Press and hold E to display software version.

Time-out or press M.

To Start in Local Mode:

Press I

To Stop in Local Mode:

Press O

Initial Power-Up Conditions

The unit will always power-up in Remote mode.

The Keypad will display the DC Link Power 0.0% on the 890CS Common Bus Supply.

8

Control Key Definitions

Key	Operation	Description
E	Escape	*Navigation* – Hold to display the Welcome screen *Trip Message* – Clear Trip or Error message from display
M	Menu	Bypasses the time-out from the Welcome screen to display the Diagnostics menu
▲	Increment	Move up through the Diagnostics menu
▼	Decrement	Move down through the Diagnostics menu
I	Run	*Local Mode* – Run the unit (power-up the DC link)
O	Stop	*Local Mode* – Stops the unit (power-down the DC link) *Trip Reset* – Resets trip condition allowing unit to resume operation
L/R	Local/Remote	Toggles between Remote and Local Mode
PROG	Prog	*KEY INACTIVE*
◁▷	Forward/ Reverse	*KEY INACTIVE*
JOG	Jog	*KEY INACTIVE*

Example: To view the INPUT CURRENT diagnostic

1. The display will default to show the OUTPUT POWER (%) diagnostic.

```
OUTPUT POWER
                0 %
```

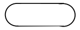
2. Press the  key repeatedly to scroll to the INPUT CURRENT (A) diagnostic.

```
INPUT CURRENT
              0.0 A
```

Alternatively, press the  key just once to cycle through the list.

LED Indications

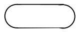
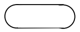
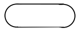
There are seven LEDs that indicate the status of the drive. Each LED is considered to operate in three different ways:

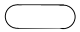
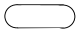
 OFF

 FLASH

 ON

The LEDs are labelled HEALTH, LOCAL (as SEQ and REF), RUN, STOP, FWD and REV. (FWD and REV are unused). Combinations of these LEDs have the following meanings:

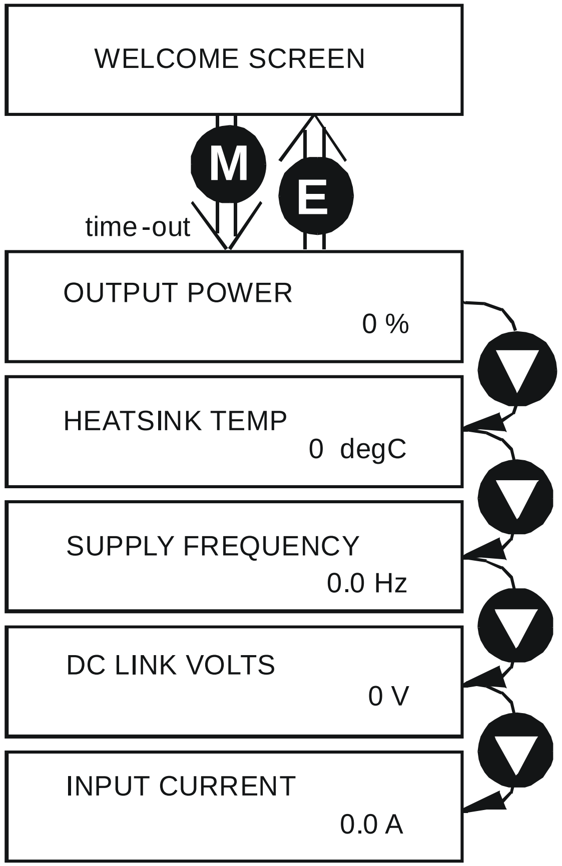
HEALTH	RUN	STOP	Drive State
			Tripped
			Stopped
			Running

LOCAL SEQ	LOCAL REF	Local / Remote Mode
		Start/Stop controlled from the terminals
		Start/Stop is controlled from the Keypad

The Menu System

The unit will initialise in Remote Mode from factory conditions.

The Keypad will display the Output Power (%). This is the first of five diagnostics.



Welcome Screen Displays the software version of the unit

From the Welcome Screen, the display times-out to show the first of 5 diagnostics:

Output Power As a percentage of nominal full power for the selected input voltage

Heatsink Temp The heatsink temperature in Centrigrade

Supply Frequency The real time frequency of the input supply in Hz

DC Link Volts Vac (rms) x $\sqrt{2}$ = dc link Volts (when motor stopped)

Input Current The real time input current in Amps

8

Alert Message Displays

A message will be displayed on the Keypad when either:

- A requested operation is not allowed:
  details the illegal operation, while the
  gives the reason or cause. See example

```
* KEY INACTIVE *
  REMOTE SEQ
```

The top line
bottom line
opposite.

- The unit has tripped:
  indicates a trip has occurred while the
  gives the reason for the trip. See
  opposite.

```
*** TRIPPED ***
 HEATSINK TEMP
```

The top line
bottom line
example

Most messages are displayed for only a short period, or for as long as an illegal operation is tried, however, trip messages must be acknowledged by pressing the **E** key.

Experience will show how to avoid most messages. When using the 6901 keypad, they are displayed in clear, concise language for easy interpretation. Refer to Chapter 10: “Trips and Fault Finding” for trip messages and reasons.

Selecting Local or Remote Mode

The unit can operate in one of two ways:

Remote Mode: Remote control using digital and analog inputs and outputs

Local Mode: Providing local control and monitoring of the drive using the Keypad

Local control keys are inactive when Remote Mode is selected.

You can change between local and remote mode from any point on the MMI.

Note ***You can only change between Local and Remote Mode when the unit is "stopped".***

To toggle between Modes:

Press L/R

Remote to Local Mode:

To toggle between Modes:

Press L/R

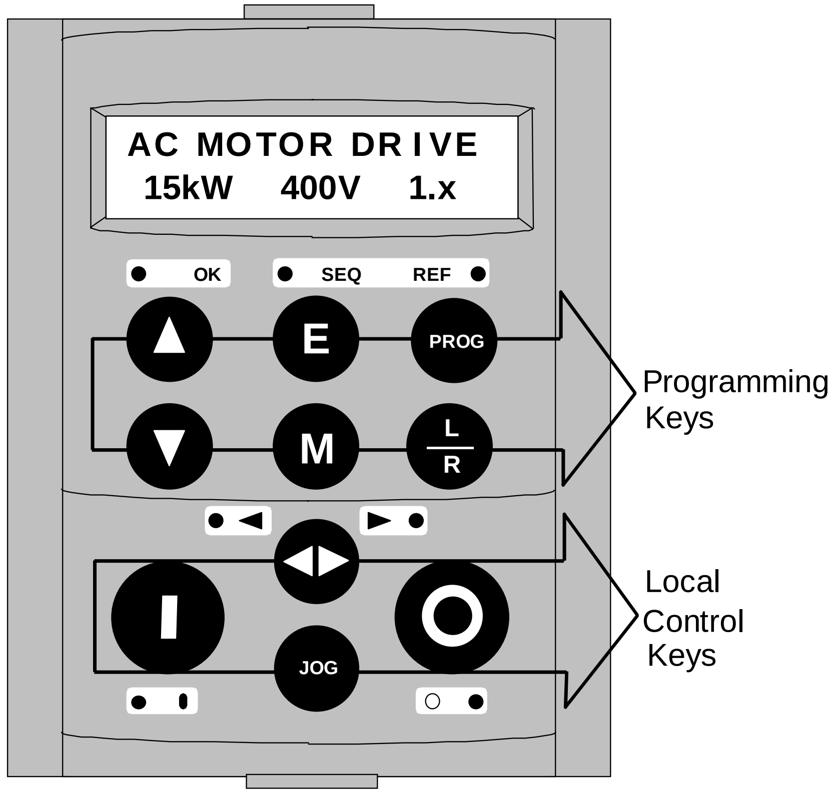
Local to Remote Mode:

Refer to "The L/R Key", page 8-19.

6901 Keypad

890CD Common Bus Drive/890SD Standalone Drive

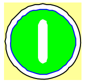
The 6901 Keypad (Man-Machine Interface, MMI) provides for local control of the drive, monitoring, and complete access for application programming.



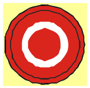
To display the Software Version:

Press and hold E to display software version.
Time-out or press M.

To Start in Local Mode:

Press 

To Stop in Local Mode:

Press 

Initial Power-Up Conditions

The Keypad will display the Operator menu on the 890CD Common Bus Drive and 890SD Standalone Drive.

Control Key Definitions

Keys for Programming the Drive

UP ▲	*Navigation* - Moves upwards through the list of parameters or menus *Parameter* - Increments the value of the displayed parameter. *Command Acknowledge* - Confirms action when in a command menu.
DOWN ▼	*Navigation* - Moves downwards through the list of parameters or menus *Parameter* - Decrements the value of the displayed parameter.
ESCAPE E	*Navigation* - Displays the previous level's Menu. *Parameter* - Returns to the parameter list. *Trip Message* - Clear the Trip or Error message from the display.
MENU M	*Navigation* - Displays the next Menu level, or the first parameter of the current Menu. *Parameter* - Allows a writable parameter to be modified (this is indicated by → appearing on the left of the bottom line). Hold to display the PREF.
PROG PROG	*Navigation* - Toggles between current locations within the Operator menu and any other menu.
LOCAL/ REMOTE L/R	*Control* - Toggles between Remote and Local Mode for both Start/Stop (Seq) and Speed Control (Ref). When toggling, the display automatically goes to the relevant SETPOINT screen, and the SETPOINT (LOCAL) screen will have the ▲ and ▼ keys enabled to alter the setpoint.

8

Keys for Operating the Drive Locally

FORWARD/ REVERSE	*Control* - Changes the direction of motor rotation. Only operates when the drive is in Local Speed Control mode.
JOG	*Control* - Runs the motor at a speed determined by the JOG SETPOINT parameter. When the key is released, the drive returns to "stopped". Only operates when the drive is "stopped" and in Local Start/Stop mode.
RUN	*Control* - Runs the motor at a speed determined by the LOCAL SETPOINT or REMOTE SETPOINT parameter. *Trip Reset* - Resets any trips and then runs the motor as above. Only operates when the drive is in Local Start/Stop (Seq) mode.
STOP/RESET	*Control* - Stops the motor. Only operates when the drive is in Local Sequence mode. *Trip Reset* - Resets any trips and clears displayed message if trip is no longer active.

The L/R Key

The **L/R** key (LOCAL/REMOTE) toggles between Remote and Local Mode. In doing so, the view of the SETPOINT parameter in the OPERATOR menu toggles between SETPOINT (LOCAL) and SETPOINT (REMOTE). The default is for the SETPOINT (REMOTE) parameter to be displayed.

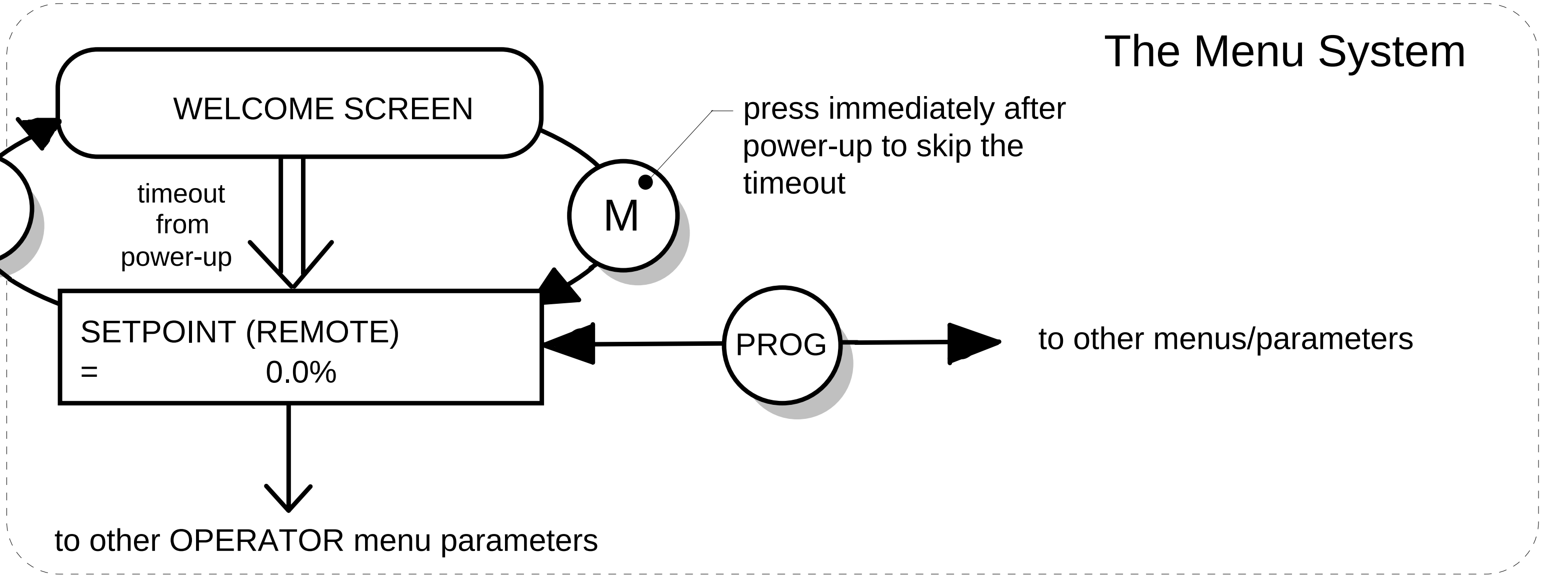
Note ***A different naming convention is applied in the OPERATOR menu for these parameters when displayed as the first parameter entry:***

- *REMOTE SETPOINT is displayed as SETPOINT (REMOTE)*
- *LOCAL SETPOINT is displayed as SETPOINT (LOCAL)*
- *COMMS SETPOINT is displayed as SETPOINT (COMMS)*
- *JOG SETPOINT is displayed as SETPOINT (JOG)*

Pressing the L/R key when in Remote mode takes you directly to the SETPOINT (LOCAL) parameter with the Edit mode enabled. Press the PROG key to return to the previous display.

The PROG Key

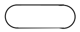
The **PROG** key toggles between the OPERATOR menu and any other menu, remembering and returning to previous positions in each menu. As you press the **PROG** key, the title of the menu you are about to enter is displayed, i.e. OPERATOR or for example DIAGNOSTICS. Releasing the key clears the display and releases you into that menu.



Holding the PROG key for approximately three seconds takes you to the SAVE CONFIG menu. Refer to "How to Save the Application", page 8-30.

LED Indications

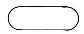
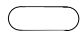
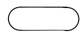
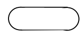
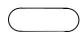
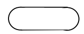
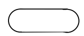
There are seven LEDs that indicate the status of the drive. Each LED is considered to operate in three different ways:

 OFF

 FLASH

 ON

The LEDs are labelled HEALTH, LOCAL (as SEQ and REF), RUN, STOP, FWD and REV. Combinations of these LEDs have the following meanings:

HEALTH	RUN	STOP	Drive State
			Re-Configuration
			Tripped
			Stopped
			Stopping
			Running with zero speed demand or enable false or contactor feedback false
			Running
			Running
			Autotuning
			Auto Restarting, waiting for trip cause to clear
			Auto Restarting, timing

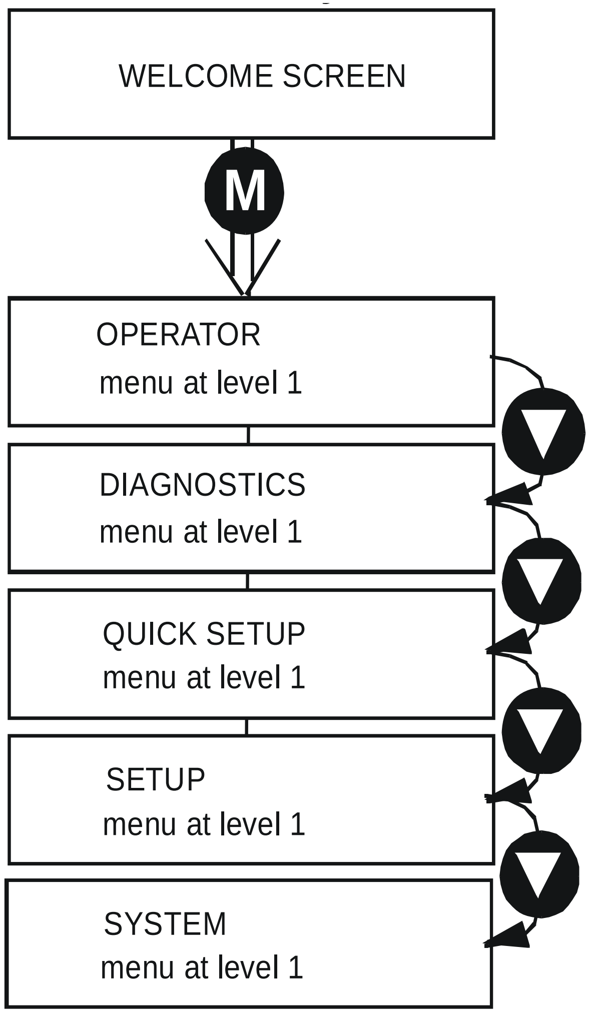
The Keypad

FWD	REV	Forward / Reverse State
⬬	⬭	Requested direction and actual direction are forward
⬭	⬬	Requested direction and actual direction are reverse
◯⬤	⬭	Requested direction is forward but actual direction is reverse
⬭	◯⬤	Requested direction is reverse but actual direction is forward

LOCAL SEQ	LOCAL REF	Local / Remote Mode
⬭	⬭	Start/Stop (Seq) and Speed Control (Ref) are controlled from the terminals
⬬	⬭	Start/Stop (Seq) is controlled using the RUN, STOP, JOG and FWD/REV keys. Speed Control (Ref) is controlled from the terminals
⬭	⬬	Start/Stop (Seq) is controlled from the terminals Speed Control (Ref) is controlled using the up (▲) and down (▼) keys
⬬	⬬	Start/Stop (Seq) and Speed Control (Ref) are controlled using the Keypad keys

The Menu System

The unit will initialise in Remote Mode from factory conditions. The Keypad will display the Operator Menu. Each menu contains parameters.



Welcome Screen Displays the software version of the unit

From the Welcome Screen, the display times-out (alternatively you can press the M key) to show the first of 4 menus:

Operator A customised view of selected parameters contained in the SETUP menu. Refer to Chapter 9.

Diagnostics A view of important diagnostic parameters contained in the SETUP menu. Refer to Chapter 9.

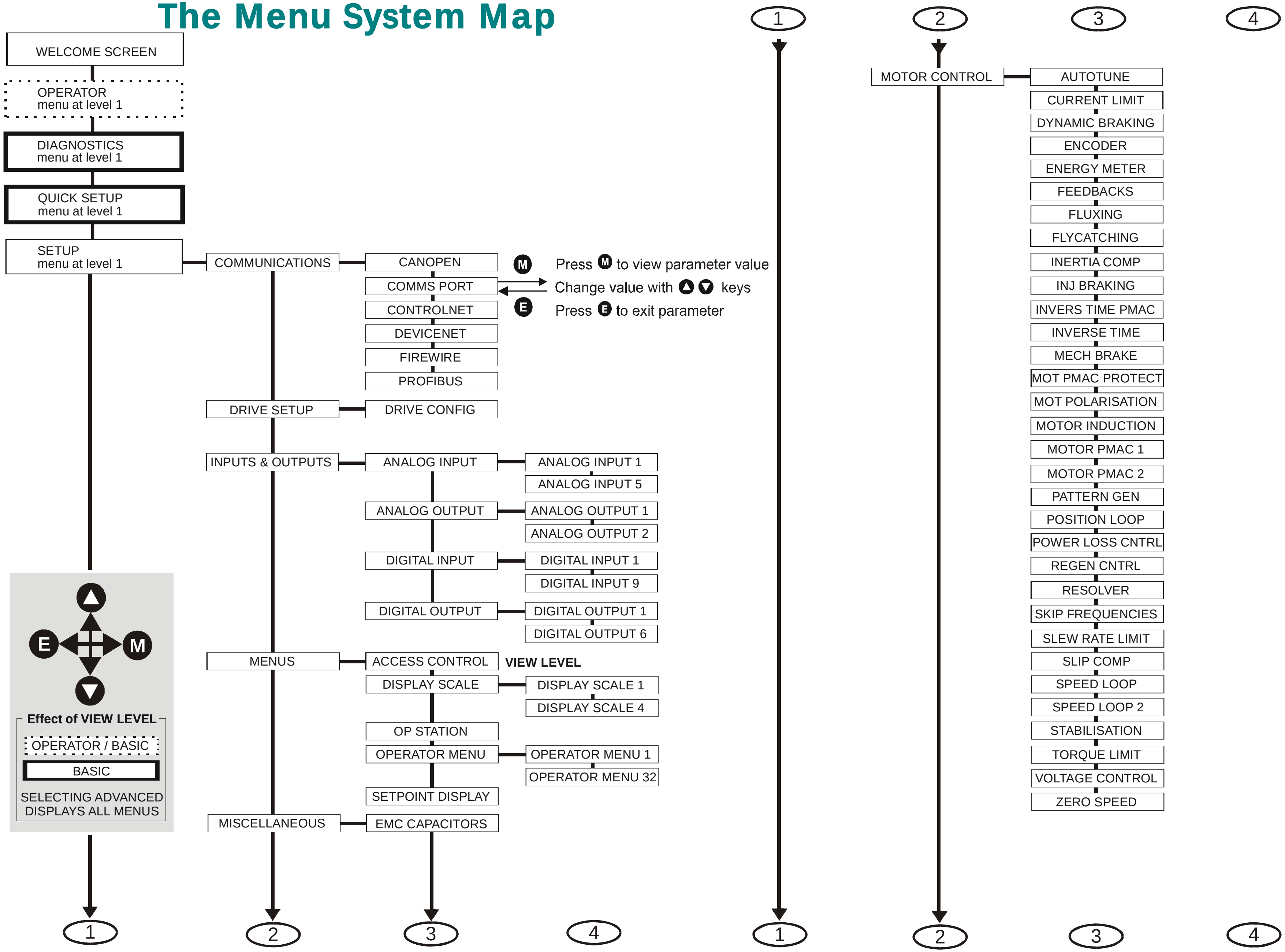
Quick Setup A quick-setup list of the most commonly used configuration parameters. Refer to Chapter 9.

Setup Contains all the function blocks parameters for programming your application. Refer to Appendix D.

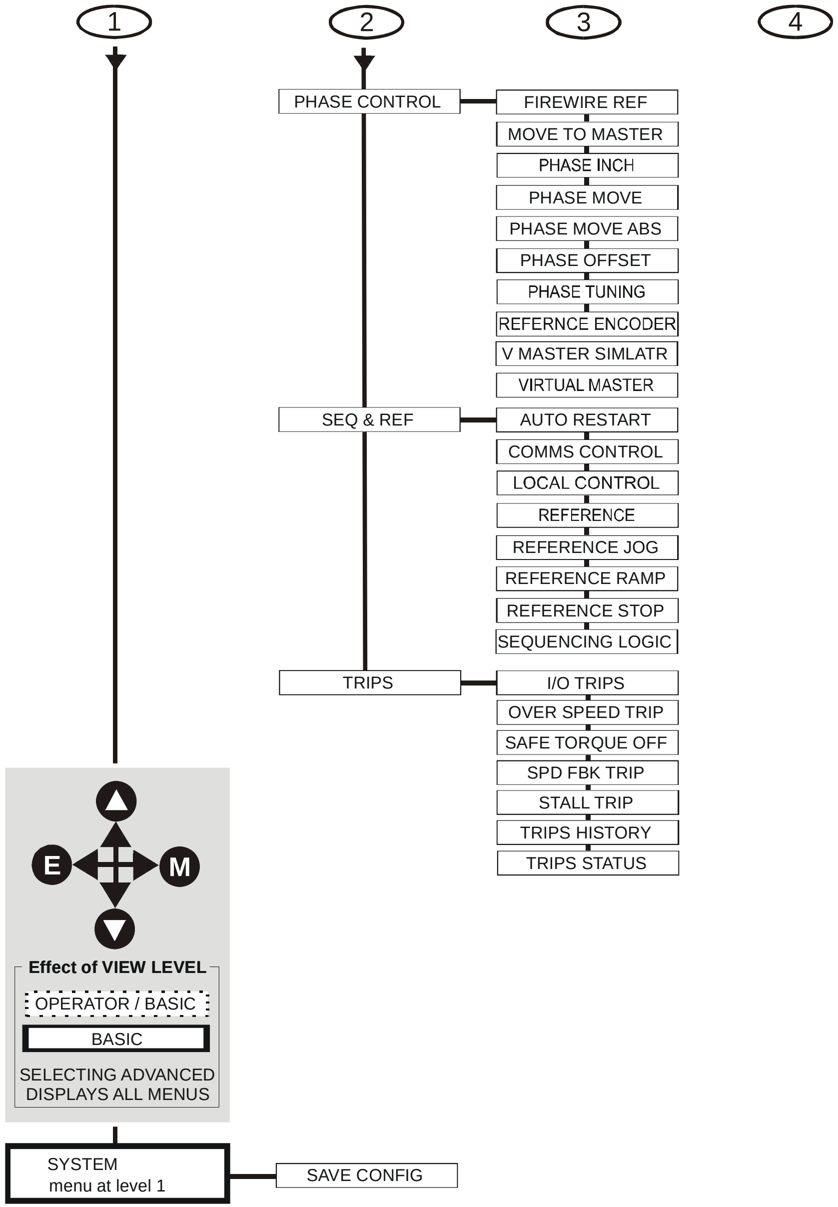
System Application "save" and macro selection.

8

The Menu System Map



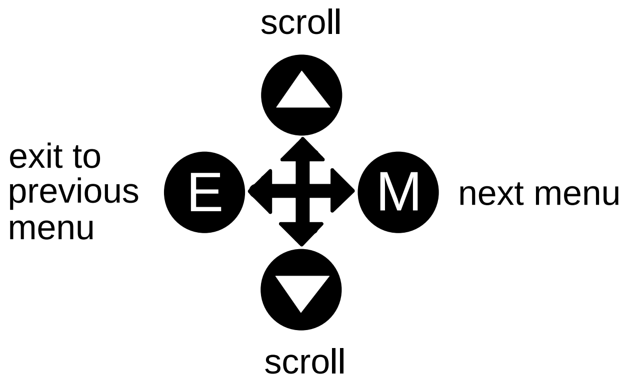
The Menu System Map continued



Navigating the Menu System

On power-up, the Keypad defaults into the OPERATOR menu, timing out from the Welcome screen. You can skip the timeout by pressing the **M** key immediately after power-up which will take you directly to the OPERATOR menu.

The menu system can be thought of as map which is navigated using the four keys shown opposite.



NAVIGATING THE MENU

Keys **E** *and* **M** *navigate through the menu levels.*
The up (▲*) and down (*▼*) keys scroll through the Menu and Parameter lists.*

Refer to "The Menu System Map" to see how the full menu is mapped.

HINT: Remember that because the Menu and Parameter lists are looped, the ▲ key can quickly move you to the last Menu or Parameter in the loop.

Alert Message Displays

A message will be displayed on the Keypad when either:

- A requested operation is not allowed:
  The top line details the illegal operation, while the bottom line gives the reason or cause. See example opposite.

* KEY INACTIVE *
REMOTE SEQ

- The drive has tripped:
  The top line indicates a trip has occurred while the bottom line gives the reason for the trip. See example opposite.

* * * TRIPPED * * *
HEATSINK TEMP

Most messages are displayed for only a short period, or for as long as an illegal operation is tried, however, trip messages must be acknowledged by pressing the **E** key.

Experience will show how to avoid most messages. They are displayed in clear, concise language for easy interpretation. Refer to Chapter 10: “Trips and Fault Finding” for trip messages and reasons.

Selecting Local or Remote Mode

The unit can operate in one of two ways:

Remote Mode: Remote control using digital and analog inputs and outputs

Local Mode: Providing local control and monitoring of the drive using the Keypad

Local control keys are inactive when Remote Mode is selected.

Note ***You can only change between Local and Remote Mode when the unit is "stopped".***

Remote to Local Mode:

To toggle between Modes:

Press 

Local to Remote Mode:

To toggle between Modes:

Press 

Refer to "The L/R Key", page 8-19.

How To Change a Parameter Value

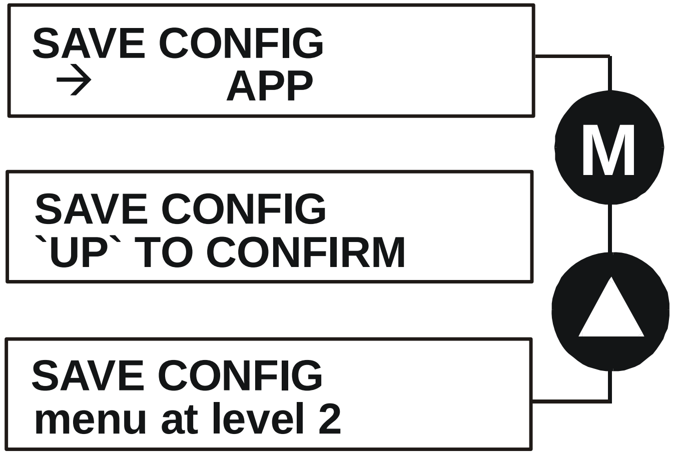
You can change the values of parameters stored in the OPERATOR, QUICK SETUP and SETUP menus. Refer to Chapter 9 for further information.

- View the parameter to be edited and press M to display the parameter's value.
- Select the digit to be changed (pressing the M key moves the cursor from right to left).
- Use the ▲ ▼ keys to adjust the value. Hold the key momentarily to adjust the value marginally, or hold the key to make rapid changes; the rate of change varies with the time held.
- Press E to return to the parameter display.

How to Save the Application

The SAVE menu, available in all menu levels, is used to save any changes you make to the Keypad settings.

Press the UP key as instructed to save all parameters. Values are stored during power-down.



Special Menu Features

Selecting the Menu Level

For ease of operation there are three `viewing levels' for the Keypad. The setting for the VIEW LEVEL parameter decides how much of the menu system will be displayed. The choice of menu for each has been designed around a type of user, hence we have the Operator, Basic and Advanced viewing levels.

MMI Menu Map

1 QUICK SETUP

VIEW LEVEL

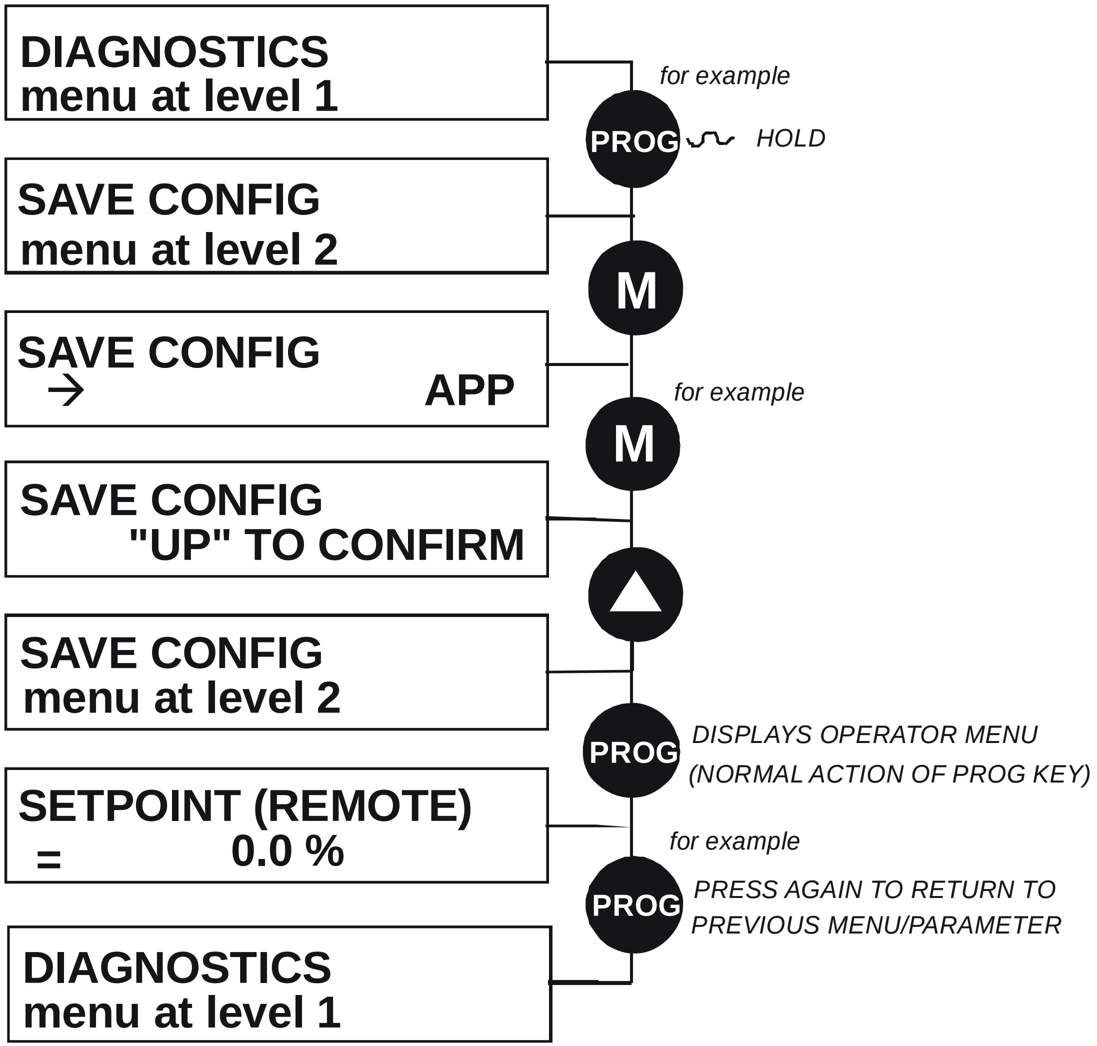
In the QUICK SETUP menu, press the ▲ key to quickly move to VIEW LEVEL, the last parameter in the menu.

Note ***The contents of the OPERATOR menu remains unchanged for all view levels.***

Refer to “The Menu System Map”, page 8-24 to see how VIEW LEVEL changes the menu.

Quick Save Feature

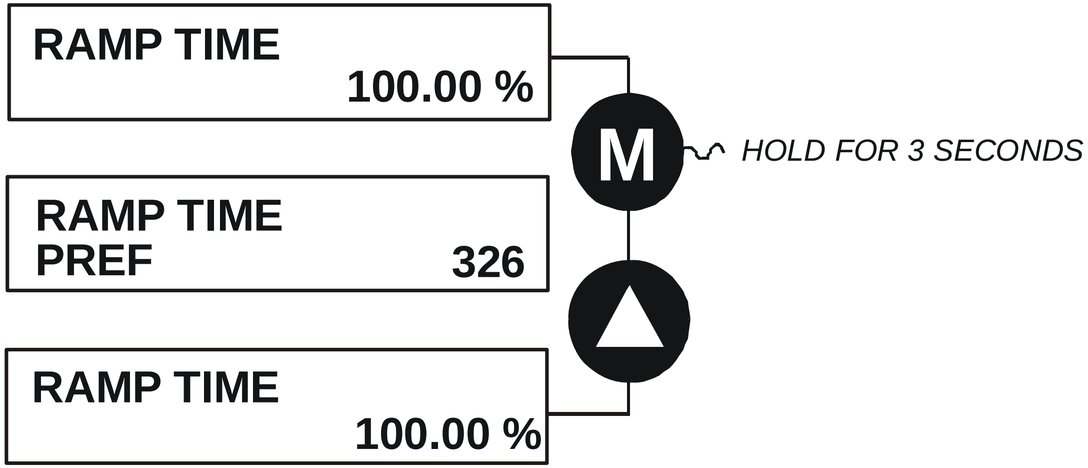
From anywhere in the menu system, hold down the **PROG** key for approximately 3 seconds to move quickly to the SAVE CONFIG menu. You can save your application and return conveniently to your original display.



8

Quick Tag Information

With a parameter displayed, hold down the **M** key for approximately 3 seconds to display the parameter's tag number (a message may be displayed during this time).



Password Protection (6901 keypad)

When activated, the password prevents unauthorised parameter modification by making all parameters “read-only”. If you attempt to modify a password protected parameter, you will be prompted for the password.

The password protection is activated/deactivated using the PASSWORD parameter.

MMI Menu Map

1 SETUP

2 MENUS

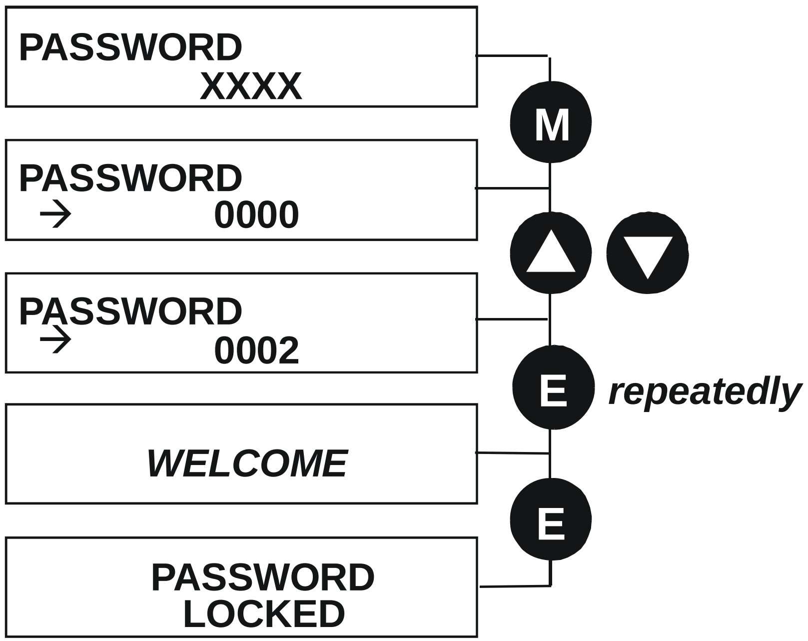
3 ACCESS CONTROL

PASSWORD

To Activate Password Protection

By default the password feature is deactivated, i.e. 0000.

1. Enter a new password in the PASSWORD parameter (anything other than the default value of 0000), for example 0002.
2. Press the **E** key repeatedly until the Welcome screen is displayed. Pressing the **E** key again activates password protection.



Note ***Perform a SAVE CONFIG if you need the password to be saved on power-down.***

To De-activate Password Protection

If you try to change the value of a parameter with password protection activated, the PASSWORD screen is displayed for you to enter the current password. If you enter the password correctly password protection is temporarily de-activated.

To Re-activate Password Protection

Re-activate an existing password by pressing the **E** key repeatedly until the PASSWORD LOCKED screen is displayed.

To Remove Password Protection (default status)

Navigate to the PASSWORD parameter and enter the current password. Press the **E** key. Reset the password to 0000. Password protection is now removed.

You can check that password protection has been removed by repeatedly pressing the **E** key until the Welcome screen is displayed. Pressing the **E** key again will NOT display the PASSWORD LOCKED screen.

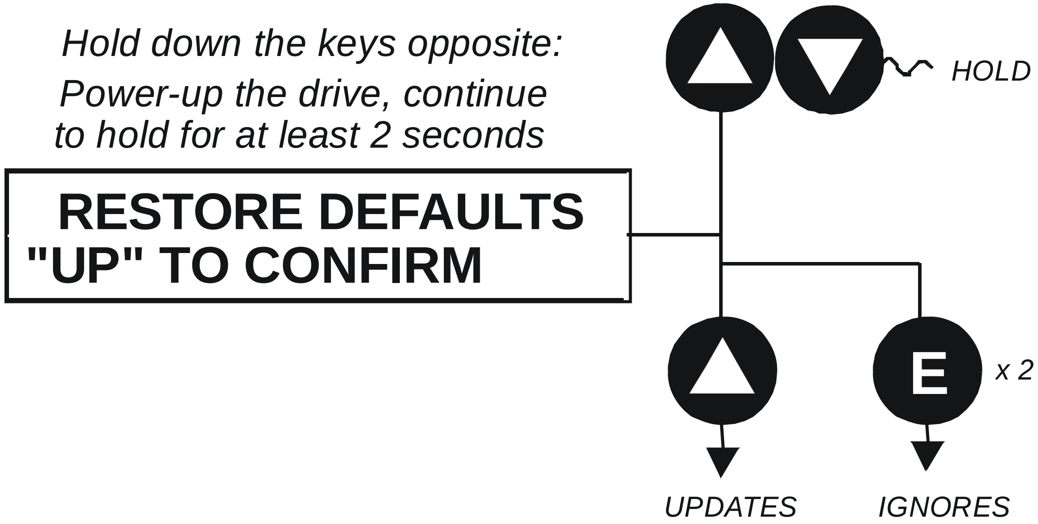
Note ***Perform a SAVE CONFIG if you need "no password" to be saved on power-down.***

Power-up Key Combinations

Resetting to Factory Defaults (2-button reset)

A special key combination restores to the drive the current product code default parameter values. This feature is only available at power-up as a security measure.

6901 Keypad Combination



On pressing "UP", the factory defaults will be restored. The keypad will display the RESTORE DEFAULTS menu. Press "E" to exit this menu.

If you decide not to update to factory defaults, press the "E" key twice to return to the menus at level 1.

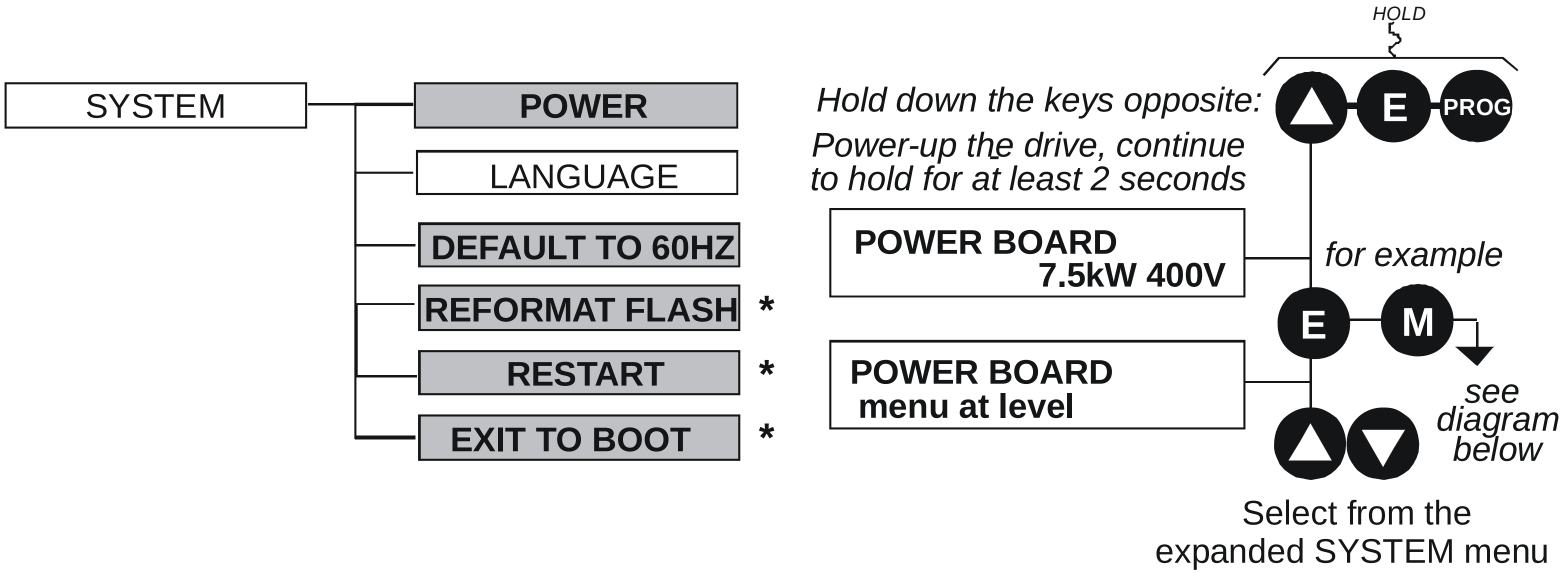
Changing the Product Code (3-button reset)

On rare occasions it may be necessary to change the default settings by changing the Product Code. The Product Code is detailed in Appendix E.

A special key combination is required to change the product code. This feature is only available at power-up as a security measure.

The 3-button reset will take you to the POWER BOARD menu in the expanded SYSTEM menu (highlighted in the diagrams below).

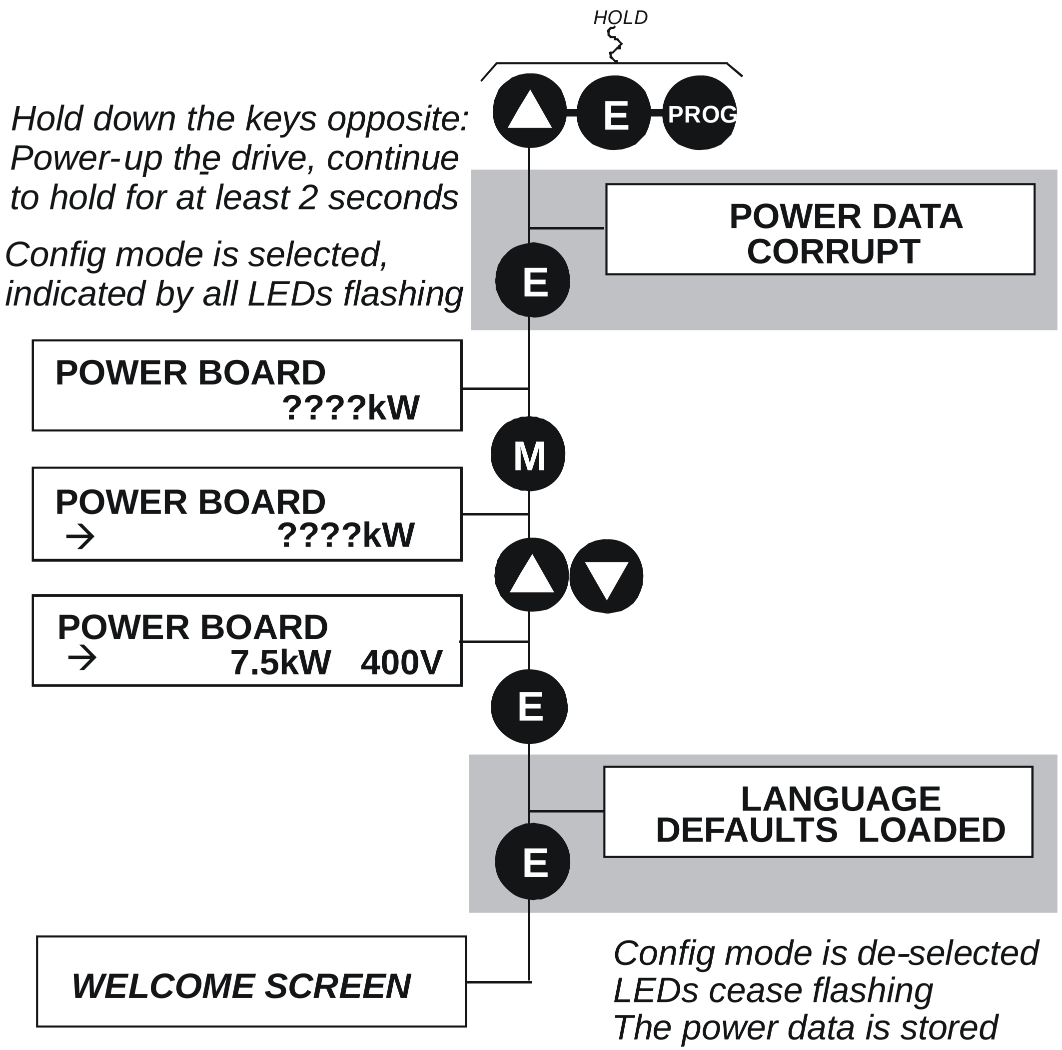
6901 Keypad Combination



IMPORTANT **We recommend the menus marked * above are only used by Parker SSD Drives or suitably qualified personnel.**

Note ***The LANGUAGE menu currently contains selection for ENGLISH only.***

POWER BOARD (6901 keypad)



The diagram above shows a 3-button reset when there is no power data stored in the drive. If the drive has power data stored, then the "Power Data Corrupt" and "Language Defaults Loaded" alert messages will not be displayed, also the display will show the current power board selection, instead of "????kW ???V".

DEFAULT TO 60HZ

The setting of this parameter selects the drive operating frequency. It affects those parameters whose values are dependent upon the default base frequency of the drive. Settings will only be updated following a "restore macro" operation.

The default is 50Hz (6511 keypad = 0 , 6901 keypad = FALSE).

Refer to Appendix D: "Programming" - Frequency Dependent Defaults.

RESTORE DEFAULTS

Refer to "Resetting to Factory Defaults (2-button reset)", page 8-36.

Remote Mounting the Keypad

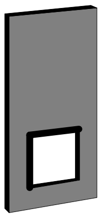
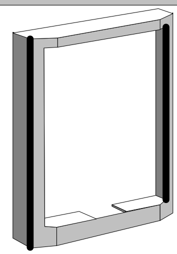
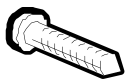
Fitting the Remote 6901 Keypad

The 6052 Mounting Kit is required to remote-mount a 6901 Keypad. An enclosure rating of IP54 is achieved for the remote Keypad when correctly mounted using the 6052 Mounting Kit.

6052 Mounting Kit Parts for the Remote Keypad

Tools Required

No. 2 Posidrive screwdriver.

6052 Mounting Kit			
1		1	
4	 No. 6 x 12mm	1	 3m, 4-way

Assembly Procedure

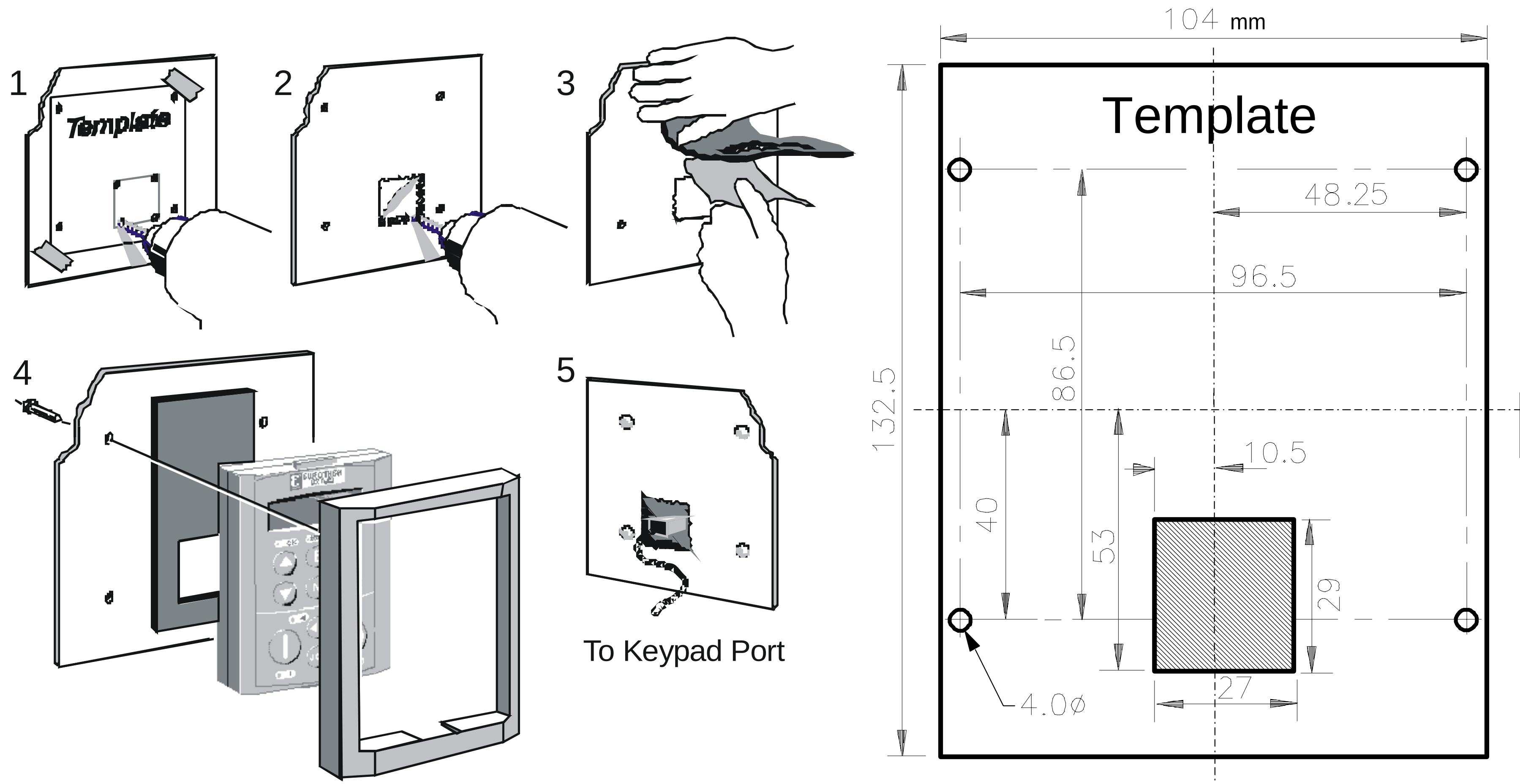
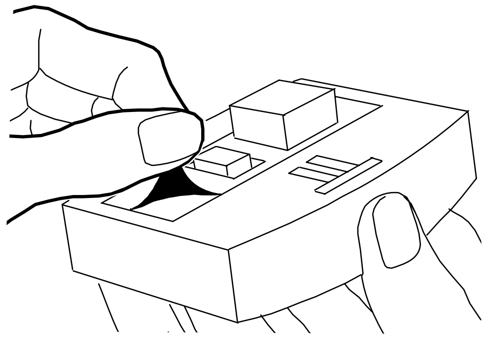


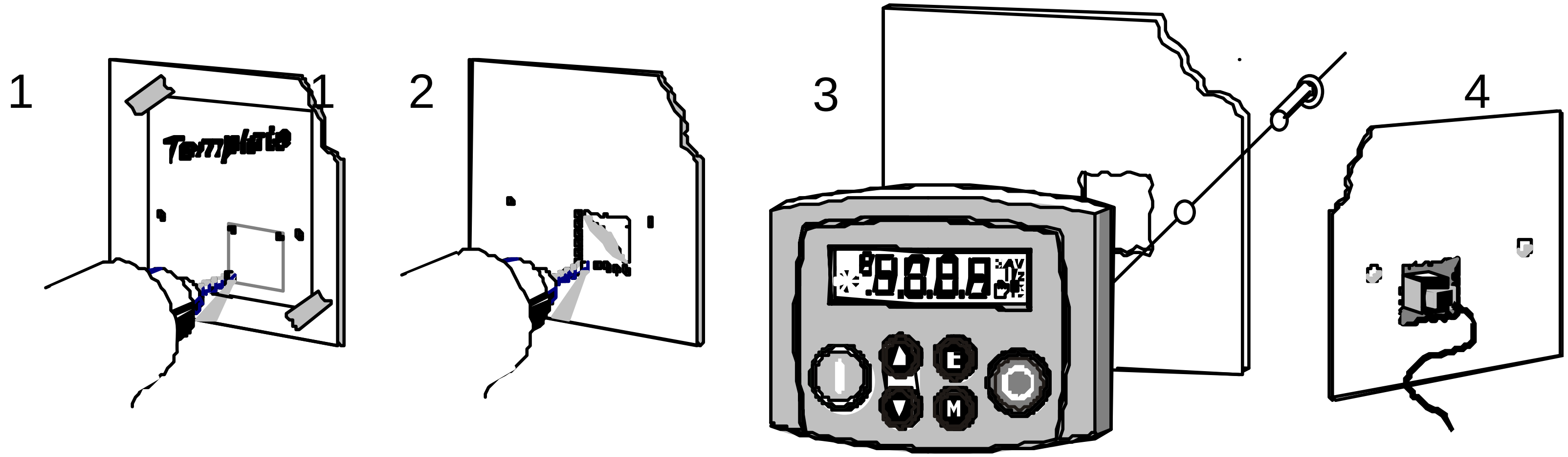
Figure 7.1 Mounting Dimensions for the Remote-Mounted 6901 Keypad

Fitting the Remote 6511 Keypad

You can remote-mount the keypad using a standard P3 lead, SSD Part Number CM057375U300, to connect the keypad to the drive.



Two self-tapping screws are provided with the keypad. Remove the protective film from the gasket. An enclosure rating of IP54 is achieved for the remote keypad when correctly mounted.



Assembly Procedure

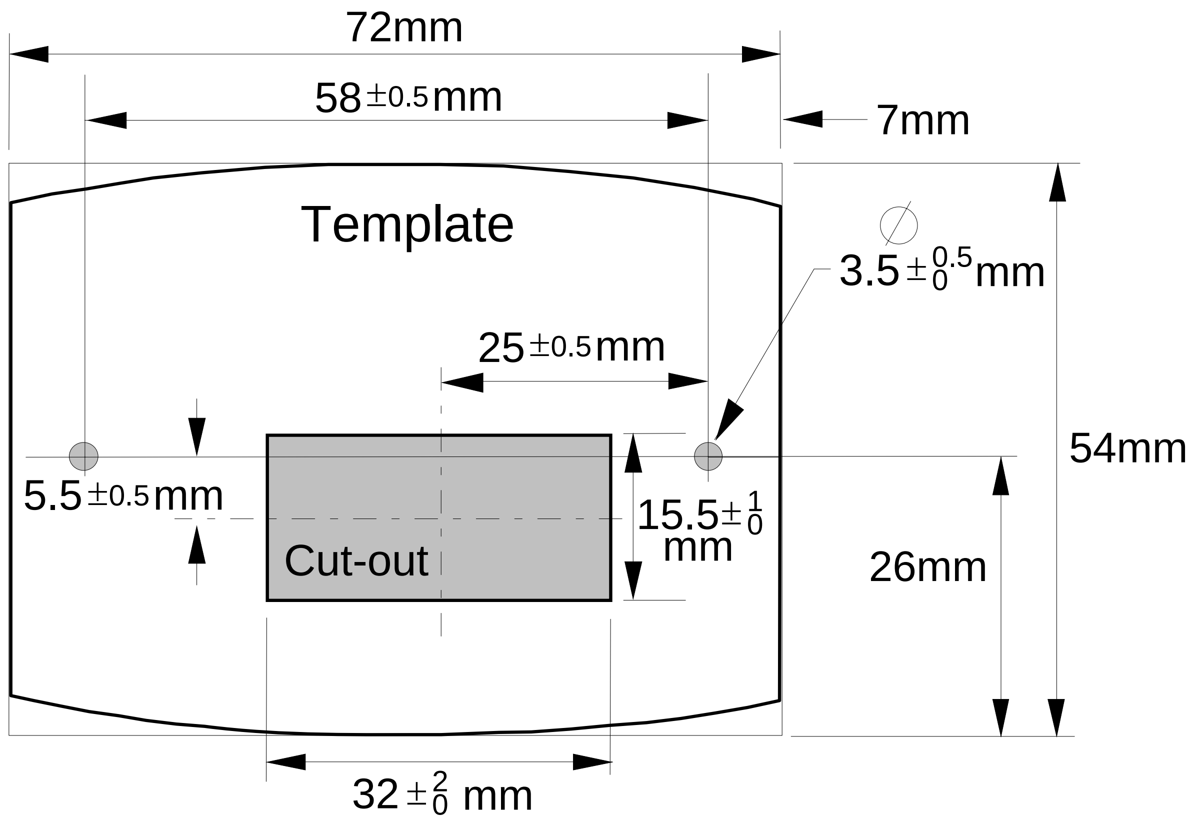


Figure 7.2 Mounting Dimensions for the Remote-Mounted 6511 Keypad

Chapter 9

Keypad Menus

This chapter details the Keypad menus available on the 6511 and 6901 Keypads when used on the 890CS Common Bus Supply, and the 6901 Keypad when used on the 890CD Common Bus Drive & 890SD Standalone Drive.

The 6511 keypad displays a numbered menu, whilst the 6901 keypad displays information using concise text and allows access to more parameters.

890CS Common Bus Supply

The table below shows the parameters available using the 6511 Keypad. The full names as displayed by the 6901 Keypad and the DSE Configuration Tool are also provided. The list is shown in MMI order.

The DIAGNOSTIC Menu

DIAGNOSTIC MENU 890CS Common Bus Supply		
6511 Display	6901 Display	
0.0 %	OUTPUT POWER	As a percentage of nominal full power for the selected input voltage
0 C	HEATSINK TEMP	The heatsink temperature in Centrigrade
0.0 Hz	SUPPLY FREQUENCY	The real-time output frequency in Hertz
0 V	DC LINK VOLTS	Vac (rms) x √2 = dc link Volts (when motor stopped)
0.0 A	INPUT CURRENT	The input current in Amps

890 Common Bus/890 Standalone Drive

The table below shows the parameter's full name, as displayed by the 6901 Keypad and the DSE Configuration Tool. The list is shown in MMI order.

Note ***Additional parameters are available using the 6901 Keypad and the DSE Configuration Tool. Refer to Appendix D for a full listing of all parameters.***

Keypad Menus

651 **6901 Keypad/DSE**

```
|__OPERATOR
|        |__SETPOINT
|        |__SPEED DEMAND
|        |__DRIVE FREQUENCY
|        |__MOTOR CURRENT A
|        |__TORQUE FEEDBACK
|        |__DC LINK VOLTS
|__DIAGNOSTICS
|        |__SPEED DEMAND
|        |__REMOTE SETPOINT
|        |__COMMS SETPOINT
|        |__LOCAL SETPOINT
|        |__JOG SETPOINT
|        |__TOTL SPD DMD RPM
|        |__TOTAL SPD DMD %
|        |__SPEED FBK RPM
|        |__SPEED FBK %
|        |__SPEED ERROR
|        |__DRIVE FREQUENCY
|        |__DIRECT INPUT
```

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Keypad Menus

6511 Keypad **6901 Keypad/DSE**

```
|        |__TORQ DMD ISOLATE
|        |__ACTUAL POS LIM
|        |__ACTUAL NEG LIM
|        |__AUX TORQUE DMD
|        |__TORQUE DEMAND
|        |__TORQUE FEEDBACK
|        |__FIELD FEEDBACK
|        |__MOTOR CURRENT %
|        |__MOTOR CURRENT A
|        |__DC LINK VOLTS
|        |__TERMINAL VOLTS
|        |__BRAKING
|        |__DRIVE FREQUENCY
|        |__ACTIVE WORD 1
|        |__ACTIVE WORD 2
|        |__FIRST TRIP
|        |__TRIP 1 (NEWEST)
|        |__TRIP 2
|        |__TRIP 3
|        |__TRIP 4
|        |__TRIP 5
|        |__TRIP 6
|        |__TRIP 7
|        |__TRIP 8
|        |__TRIP 9
|        |__TRIP 10 (OLDEST)
|        |__ANALOG INPUT 1
|        |__ANALOG INPUT 2
```

Keypad Menus

6511 Keypad **6901 Keypad/DSE**

```
|         |__ANALOG INPUT 3
|         |__ANALOG INPUT 4
|         |__ANALOG INPUT 5
|         |__DIGITAL INPUT 1
|         |__DIGITAL INPUT 2
|         |__DIGITAL INPUT 3
|         |__DIGITAL INPUT 4
|         |__DIGITAL INPUT 5
|         |__DIGITAL INPUT 6
|         |__DIGITAL INPUT 7
|         |__DIGITAL INPUT 8
|         |__DIGITAL INPUT 9
|         |__ANALOG OUTPUT 1
|         |__ANALOG OUTPUT 2
|         |__DIGITAL OUTPUT 1
|         |__DIGITAL OUTPUT 2
|         |__DIGITAL OUTPUT 3
|__QUICK SETUP
|         |__CONTROL MODE
|         |__MAX SPEED
|         |__RAMP ACCEL TIME
|         |__RAMP DECEL TIME
|         |__RUN STOP MODE
|         |__JOG SETPOINT
|         |__V/F SHAPE
|         |__QUADRATIC TORQUE
|         |__MOTOR CURRENT
|         |__FIXED BOOST
```

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Keypad Menus

```
6511 Keypad         6901 Keypad/DSE
                    |          |__CURRENT LIMIT
                    |          |__MOTOR BASE FREQ
                    |          |__MOTOR VOLTAGE
                    |          |__NAMEPLATE RPM
                    |          |__MOTOR POLES
                    |          |__MOTOR CONNECTION
                    |          |__PULSE ENC VOLTS
                    |          |__ENCODER LINES
                    |          |__ENCODER INVERT
                    |          |__AUTOTUNE ENABLE
                    |          |__AUTOTUNE MODE
                    |          |__MAG CURRENT
                    |          |__STATOR RES
                    |          |__LEAKAGE INDUC
                    |          |__MUTUAL INDUC
                    |          |__ROTOR TIME CONST
                    |          |__SPEED PROP GAIN
                    |          |__SPEED INT TIME
                    |          |__AIN 1 TYPE
                    |          |__AIN 2 TYPE
                    |          |__AIN 3 TYPE
                    |          |__AIN 4 TYPE
                    |          |__DISABLED WORD 1
                    |          |__DISABLED WORD 2
                    |          |__VIEW LEVEL
                    |__SYSTEM
                    |          |__SAVE CONFIG
```

The OPERATOR Menu

OPERATOR MENU 890CD Common Bus Drive & 890SD Standalone Drive	
6901 Display	
SETPOINT (xxxxxx)	***Range:*** *—.xx %*
(Fixed as PREF 101.10) Indicates target speed. This will be equal to either: LOCAL SETPOINT, REMOTE SETPOINT, JOG SETPOINT, COMMS SETPOINT or FIREWIRE SETPOINT.	*(Refer to the REFERENCE or REFERENCE JOG function blocks)*
SPEED DEMAND	***Range:*** *—.xx %*
(Default: PREF 101.16) Indicates actual speed demand. This is the input to the Drive.	*(Refer to the REFERENCE function block)*
DRIVE FREQUENCY	***Range:*** *—.xx Hz*
(Default: PREF 73.04) The Drive output frequency.	*(Refer to the REFERENCE function block)*
MOTOR CURRENT A	***Range:*** *—.xx A*
(Default: PREF 70.13) This diagnostic contains the level of rms line current being drawn from the Drive.	*(Refer to the REFERENCE function block)*
TORQUE FEEDBACK	***Range:*** *—.xx %*
(Default: PREF 70.10) Shows the estimated motor torque, as a percentage of rated motor torque.	*(Refer to the REFERENCE function block)*
DC LINK VOLTS	***Range:*** *—. V*
(Default: PREF 70.02) This shows the voltage on the dc link capacitors.	*(Refer to the REFERENCE function block)*

The DIAGNOSTIC Menu

DIAGNOSTIC MENU 890CD Common Bus Drive & 890SD Standalone Drive		
PREF	6901 Display	
101.09	SPEED DEMAND	**Range:** —.xx %
	Indicates actual speed demand. This is the input to the frequency controller. *(Refer to the REFERENCE function block)*	
101.01	REMOTE SETPOINT	**Range:** —.xx %
	This is the target reference that the drive will ramp to in remote reference mode (not including trim), direction is taken from REFERENCE::REMOTE REVERSE and the sign of REMOTE SETPOINT. *(Refer to the REFERENCE function block)*	
101.14	COMMS SETPOINT	**Range:** —.xx %
	This setpoint is the target reference that the drive will ramp to in Remote Reference Comms mode (not including trim). The direction is always positive, i.e. forward. *(Refer to the REFERENCE function block)*	
101.12	LOCAL SETPOINT	**Range:** —.xx %
	Indicates the Keypad setpoint. It is always a positive quantity; saved on power down. Direction is taken from LOCAL REVERSE. *(Refer to the REFERENCE function block)*	
103.01	(JOG) SETPOINT	**Range:** —.xx %
	The setpoint is the target reference that the drive will ramp to in Jog Reference mode. *(Refer to the REFERENCE JOG function block)*	

DIAGNOSTIC MENU
890CD Common Bus Drive & 890SD Standalone Drive

PREF	6901 Display	
78.17	TOTL SPD DMD RPM	***Range:*** *—.xx rpm*
	The final value of speed demand obtained after summing all sources in rpm. *(Refer to the SPEED LOOP function block)*	
78.18	TOTAL SPD DMD %	***Range:*** *—.xx %*
	The final value of speed demand obtained after summing all sources as a percentage of MAX SPEED CLAMP (REFERENCE function block). *(Refer to the SPEED LOOP function block)*	
70.04	SPEED FBK RPM	***Range:*** *—.xx rpm*
	The mechanical speed of the motor shaft in revolutions per minute. *(Refer to the FEEDBACKS function block)*	
70.06	SPEED FBK %	***Range:*** *—.xx %*
	Shows the mechanical speed of the motor shaft as a percentage of MAX SPEED CLAMP (REFERENCE function block). *(Refer to the FEEDBACKS function block)*	
78.19	SPEED ERROR	***Range:*** *—.xx %*
	The difference between the demanded speed and the actual speed. *(Refer to the SPEED LOOP function block)*	
73.04	DRIVE FREQUENCY	***Range:*** *—.xx Hz*
	Shows the drive output frequency in Hz. *(Refer to the PATTERN GEN function block)*	

DIAGNOSTIC MENU 890CD Common Bus Drive & 890SD Standalone Drive		
PREF	6901 Display	
78.21	DIRECT INPUT	**Range:** —.xx %
	The value of the direct input, after scaling and clamping. *(Refer to the SPEED LOOP function block)*	
78.16	TORQ DMD ISOLATE	**Range**: FALSE / TRUE
	Speed Control mode and Torque Control mode selection. Torque Control mode = TRUE. *(Refer to the SPEED LOOP function block)*	
83.05	ACTUAL POS LIM	**Range:** —.xx %
	The final actual positive torque limit as a percentage of rated motor torque. *(Refer to the TORQUE LIMIT function block)*	
83.06	ACTUAL NEG LIM	**Range:** —.xx %
	The final actual negative torque limit as a percentage of rated motor torque. *(Refer to the TORQUE LIMIT function block)*	
78.07	AUX TORQUE DMD	**Range:** —.xx %
	The auxiliary motor torque as a percentage of rated motor torque as a percentage of rated motor torque. *(Refer to the SPEED LOOP function block)*	
78.20	TORQUE DEMAND	**Range:** —.xx %
	The demanded motor torque as a percentage of rated motor torque. *(Refer to the SPEED LOOP function block)*	

DIAGNOSTIC MENU 890CD Common Bus Drive & 890SD Standalone Drive		
PREF	6901 Display	
70.10	TORQUE FEEDBACK	***Range:*** *—.xx %*
	The estimated motor torque, as a percentage of rated motor torque. *(Refer to the FEEDBACKS function block)*	
70.11	FIELD FEEDBACK	***Range:*** *—.xx %*
	A value of 100% indicates the motor is operating at rated magnetic flux (field). *(Refer to the FEEDBACKS function block)*	
70.12	MOTOR CURRENT %	***Range:*** *—.xx %*
	This diagnostic contains the level of rms line current being drawn from the drive and is seen as a % of the MOTOR CURRENT parameter setting in the MOTOR INDUCTION function block. *(Refer to the FEEDBACKS function block)*	
70.13	MOTOR CURRENT A	***Range:*** *—.x A*
	This diagnostic contains the level of rms line current being drawn from the drive. *(Refer to the FEEDBACKS function block)*	
70.02	DC LINK VOLTS	***Range:*** *—. V*
	The internal dc voltage tested across the DC link capacitors. *(Refer to the FEEDBACKS function block)*	
70.03	TERMINAL VOLTS	***Range:*** *—. V*
	This shows the rms voltage, between phases, applied by the drive to the motor terminals. *(Refer to the FEEDBACKS function block)*	

DIAGNOSTIC MENU 890CD Common Bus Drive & 890SD Standalone Drive		
PREF	6901 Display	
99.06	BRAKING	***Range:*** *FALSE / TRUE*
	A read-only parameter indicating the state of the dynamic brake switch. *(Refer to the DYNAMIC BRAKING function block)*	
73.04	DRIVE FREQUENCY	***Range:*** *—.x Hz*
	The drive output frequency in Hertz. *(Refer to the PATTERN GEN function block)*	
97.05	ACTIVE WORD 1	***Range:*** *0000 to FFFF*
	Indicates which trips are currently active. These parameters are a coded representation of the trip status. *(Refer to the TRIPS STATUS function block)*	
97.06	ACTIVE WORD 2	***Range:*** *0000 to FFFF*
	Indicates which trips are currently active. These parameters are a coded representation of the trip status. *(Refer to the TRIPS STATUS function block)*	
97.09	FIRST TRIP	***Range:*** *Enumerated - refer to block*
	From when a trip occurs until that trip is reset, this parameter indicates the trip source. When several trips have occurred, this parameter indicates the first one that was detected. *(Refer to the TRIPS STATUS function block)*	

DIAGNOSTIC MENU 890CD Common Bus Drive & 890SD Standalone Drive		
PREF	6901 Display	
96.01	TRIP 1 (NEWEST) Records the most recent trip that caused the drive to stop. *(Refer to the TRIPS STATUS function block)*	***Range:*** *Enumerated - refer to block*
96.02	TRIP 2 Records the second most recent trip that caused the drive to stop. *(Refer to the TRIPS STATUS function block)*	***Range:*** *Enumerated - refer to block*
96.03	TRIP 3 Records the third most recent trip that caused the drive to stop. *(Refer to the TRIPS STATUS function block)*	***Range:*** *Enumerated - refer to block*
96.04	TRIP 4 Records the fourth most recent trip that caused the drive to stop. *(Refer to the TRIPS STATUS function block)*	***Range:*** *Enumerated - refer to block*
96.05	TRIP 5 Records the fifth most recent trip that caused the drive to stop. *(Refer to the TRIPS STATUS function block)*	***Range:*** *Enumerated - refer to block*

DIAGNOSTIC MENU 890CD Common Bus Drive & 890SD Standalone Drive		
PREF	6901 Display	
96.06	TRIP 6	***Range:*** *Enumerated - refer to block*
	Records the sixth most recent trip that caused the drive to stop. *(Refer to the TRIPS STATUS function block)*	
96.07	TRIP 7	***Range:*** *Enumerated - refer to block*
	Records the seventh most recent trip that caused the drive to stop. *(Refer to the TRIPS STATUS function block)*	
96.08	TRIP 8	***Range:*** *Enumerated - refer to block*
	Records the eighth most recent trip that caused the drive to stop. *(Refer to the TRIPS STATUS function block)*	
96.09	TRIP 9	***Range:*** *Enumerated - refer to block*
	Records the ninth most recent trip that caused the drive to stop. *(Refer to the TRIPS STATUS function block)*	
96.10	TRIP 10 (OLDEST)	***Range:*** *Enumerated - refer to block*
	Records the tenth most recent trip that caused the drive to stop. *(Refer to the TRIPS STATUS function block)*	

DIAGNOSTIC MENU 890CD Common Bus Drive & 890SD Standalone Drive		
PREF	6901 Display	
1.06	ANALOG INPUT 1	***Range:*** *—.xx %*
	(VALUE) The input reading. *(Refer to the ANALOG INPUT function block)*	
2.06	ANALOG INPUT 2	***Range:*** *—.xx %*
	(VALUE) The input reading. *(Refer to the ANALOG INPUT function block)*	
3.06	ANALOG INPUT 3	***Range:*** *—.xx %*
	(VALUE) The input reading. *(Refer to the ANALOG INPUT function block)*	
4.06	ANALOG INPUT 4	***Range:*** *—.xx %*
	(VALUE) The input reading. *(Refer to the ANALOG INPUT function block)*	
5.06	ANALOG INPUT 5	***Range:*** *—.xx %*
	(VALUE) The input reading (ANIN1 - ANIN2). *(Refer to the ANALOG INPUT function block)*	
8.02	DIGITAL INPUT 1	***Range:*** *FALSE / TRUE*
	(VALUE) The TRUE or FALSE input. *(Refer to the DIGITAL INPUT function block)*	

DIAGNOSTIC MENU 890CD Common Bus Drive & 890SD Standalone Drive			
PREF		6901 Display	
9.02		DIGITAL INPUT 2	***Range:*** *FALSE / TRUE*
	(VALUE) The TRUE or FALSE input.		
			(Refer to the DIGITAL INPUT function block)
10.02		DIGITAL INPUT 3	***Range:*** *FALSE / TRUE*
	(VALUE) The TRUE or FALSE input.		
			(Refer to the DIGITAL INPUT function block)
11.02		DIGITAL INPUT 4	***Range:*** *FALSE / TRUE*
	(VALUE) The TRUE or FALSE input.		
			(Refer to the DIGITAL INPUT function block)
12.02		DIGITAL INPUT 5	***Range:*** *FALSE / TRUE*
	(VALUE) The TRUE or FALSE input.		
			(Refer to the DIGITAL INPUT function block)
13.02		DIGITAL INPUT 6	***Range:*** *FALSE / TRUE*
	(VALUE) The TRUE or FALSE input.		
			(Refer to the DIGITAL INPUT function block)
14.02		DIGITAL INPUT 7	***Range:*** *FALSE / TRUE*
	(VALUE) The TRUE or FALSE input.		
			(Refer to the DIGITAL INPUT function block)

DIAGNOSTIC MENU 890CD Common Bus Drive & 890SD Standalone Drive		
PREF	6901 Display	
15.02	DIGITAL INPUT 8	***Range:*** *FALSE / TRUE*
	(VALUE) The TRUE or FALSE input.	
		(Refer to the DIGITAL INPUT function block)
16.02	DIGITAL INPUT 9	***Range:*** *FALSE / TRUE*
	(VALUE) The TRUE or FALSE input.	
		(Refer to the DIGITAL INPUT function block)
6.01	ANALOG OUTPUT 1	***Range:*** *—.xx %*
	(VALUE) The demanded value to output.	
		(Refer to the ANALOG OUTPUT function block)
7.01	ANALOG OUTPUT 2	***Range:*** *—.xx %*
	(VALUE) The demanded value to output.	
		(Refer to the ANALOG OUTPUT function block)
17.01	DIGITAL OUTPUT 1	***Range:*** *FALSE / TRUE*
	(VALUE) The TRUE or FALSE output demand.	
		(Refer to the DIGITAL OUTPUT function block)
18.01	DIGITAL OUTPUT 2	***Range:*** *FALSE / TRUE*
	(VALUE) The TRUE or FALSE output demand.	
		(Refer to the DIGITAL OUTPUT function block)

DIAGNOSTIC MENU 890CD Common Bus Drive & 890SD Standalone Drive		
PREF	6901 Display	
19.01	DIGITAL OUTPUT 3	***Range:*** *FALSE / TRUE*
	(VALUE) The TRUE or FALSE output demand.	
		(Refer to the DIGITAL OUTPUT function block)

The QUICK SETUP Menu

Note ***For more information about these and additional parameters accessible using the DSE Configuration Tool. Refer to Appendix D or the DSE Configuration Tool on the CD supplied with your drive.***

The 890 menu system has been designed for use with the DSE Configuration Tool. Hence, the tool is the preferred method of programming, however it is possible to edit some parameters using the keypad.

The parameters most likely to require attention are contained in the QUICK SETUP menu at level 1.

Saving Your Modifications

When parameter values are modified the new settings must be saved. The drive will not retain new settings during power-down unless they have been saved. Refer to "Saving Your Application" if using the keypad.

Note ***The "Range" for a parameter value is given in the Configurable Parameters Table. Ranges for outputs are given as "—.xx %", for example, indicating an indeterminate integer for the value, to two decimal places.***

The Default values in the pages below are correct for when the UK country code is selected and a 400V 30kW Frame E power board is fitted. Some parameters in the table are marked:

* Value dependent upon the Language field of the Product Code, e.g. UK

The values for these parameters may be different for your drive/application. Refer to Appendix D: "Programming" - Product Related Default Values.

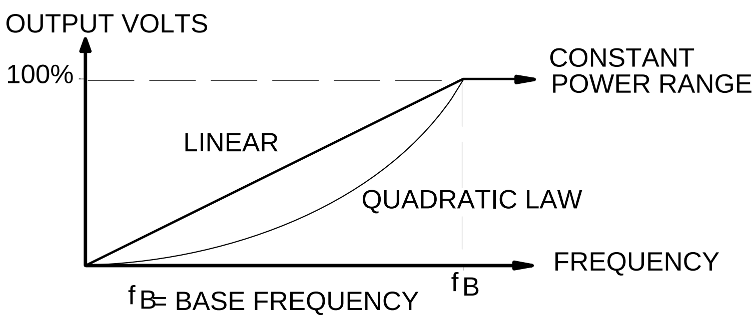
QUICK SETUP MENU 890CD Common Bus Drive & 890SD Standalone Drive				
PREF	6901 Display	Description	Range	Default
136.02	CONTROL MODE	This parameter contains the main method of motor control used by the drive	0 : VOLTS / Hz 1 : SENSORLESS VEC 2 : CLOSED-LOOP VEC 3 : 4-Q REGEN 4 : PMAC	0
101.08	* MAX SPEED	The speed at which the 890 will run when maximum setpoint is applied. The default is Product Code dependent	0 to 32000 RPM	1500 RPM
100.02	RAMP ACCEL TIME	The time taken for the 890 output frequency to ramp up from zero to MAX SPEED	0.0 to 3000.0s	10.0s
100.03	RAMP DECEL TIME	The time taken for the 890 output frequency to ramp down from MAX SPEED to zero	0.0 to 3000.0s	10.0s

QUICK SETUP MENU
890CD Common Bus Drive & 890SD Standalone Drive

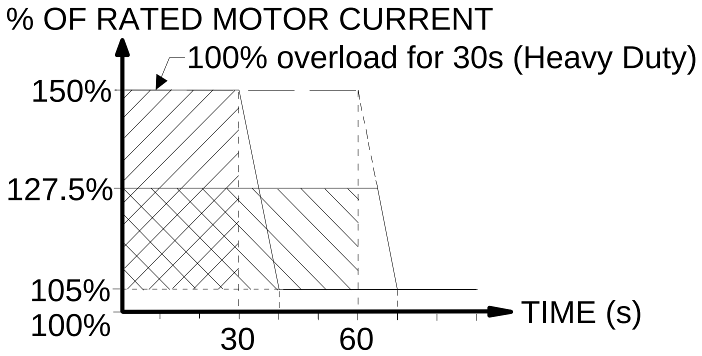
PREF	6901 Display	Description	Range	Default
102.01	RUN STOP MODE	RUN RAMP : The motor speed is reduced to zero at a rate set by RAMP DECEL TIME (S4). A 2 second DC pulse is applied at end of ramp COAST : The motor is allowed to freewheel to a standstill DC INJECTION : On a stop command, the motor volts are rapidly reduced at constant frequency to deflux the motor. A low frequency braking current is then applied until the motor speed is almost zero. This is followed by a timed DC pulse to hold the motor shaft. STOP RAMP : The motor will decelerate at a rate set by STOP TIME (REFERENCE STOP function block).	0 : RUN RAMP 1 : COAST 2 : DC INJECTION 3 : STOP RAMP	0
103.01	JOG SETPOINT	Speed the 890 will run at if the Jog input is high, as a percentage of the MAX SPEED parameter	-100.00 to 100.00%	10.00%

QUICK SETUP MENU
890CD Common Bus Drive & 890SD Standalone Drive

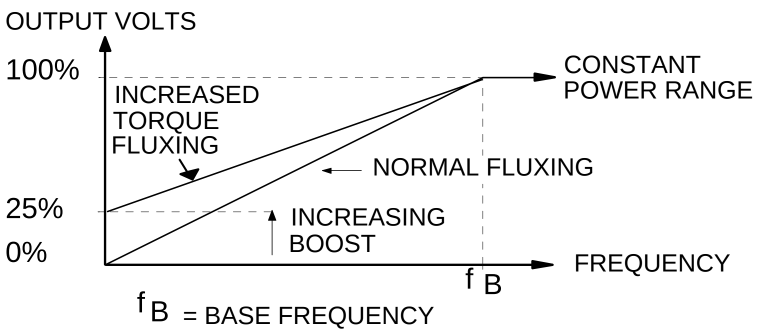
PREF	6901 Display	Description	Range	Default
21.01	V/F SHAPE	LINEAR LAW: This gives a constant flux characteristic up to the BASE FREQUENCY FAN LAW: This gives a quadratic flux characteristic up to the BASE FREQUENCY. This matches the load requirement for fan and most pump applications USER DEFINED: This gives a user defined flux characteristic up to the BASE FREQUENCY	0 : LINEAR LAW 1 : FAN LAW 2 : USER DEFINED	0



QUICK SETUP MENU
890CD Common Bus Drive & 890SD Standalone Drive

PREF	6901 Display	Description	Range	Default
70.01	QUADRATIC TORQUE	 FALSE - CONSTANT: Inverse time allows 150% overload for 60s, then ramps back the current limit to 105% over a 10s period. At a lower load, the overload area remains the same, e.g. at 127.5% load for 120s - after 120s has expired, the output of the inverse time function is ramped back over a 10s period from 150% as before. TRUE - QUADRATIC: current limit is set to 110% motor current, inverse time delay is set to 30s	0=FALSE 1=TRUE **Note that 890 Frames B, C & D have no quadratic torque current rating.**	0
70.13	MOTOR CURRENT	This parameter contains the motor nameplate full-load line current	0.01 to 999.99A	product code dependent

QUICK SETUP MENU
890CD Common Bus Drive & 890SD Standalone Drive

PREF	6901 Display	Description	Range	Default
21.03	FIXED BOOST	Used to correctly flux the motor at low speeds. This allows the drive to produce greater starting torque for high friction loads. It increases the motor volts above the selected V/F characteristic at the lower end of the speed range  	0.00 to 25.00%	product code dependent
82.01	CURRENT LIMIT	This parameter sets the level of motor current, as a % of MOTOR CURRENT (S9) at which the drive begins to take current limit action.	0.00 to 300.00%	150.00%
27.03 (induction motor only)	MOTOR BASE FREQ	The output frequency at which maximum voltage is reached.	7.5 to 1000.0 Hz	50.0 Hz

QUICK SETUP MENU 890CD Common Bus Drive & 890SD Standalone Drive				
PREF	6901 Display	Description	Range	Default
27.04 (induction motor only)	* MOTOR VOLTAGE	This parameter contains the motor nameplate voltage at base frequency	0.0 to 575.0V	product code dependent
27.07 (induction motor only)	* NAMEPLATE RPM	This parameter contains the motor nameplate full-load rated speed. This is the motor speed in rpm at base frequency minus full load slip	0.0 to 30000.0 RPM	product code dependent
27.09 (induction motor only)	MOTOR POLES	This parameter contains the number of motor poles, as supplied on the motor nameplate	0=2 pole 1=4 pole 2=6 pole 3=8 pole 4=10 pole 5=12 pole	1
27.08 (induction motor only)	*MOTOR CONNECTION	This parameter contains the motor nameplate connection.	0= DELTA 1= STAR	1

QUICK SETUP MENU 890CD Common Bus Drive & 890SD Standalone Drive				
PREF	6901 Display	Description	Range	Default
71.01	PULSE ENC VOLTS	The voltage output from the encoder feedback card.	10 to 20V	5.0
71.02	ENCODER LINES	The number of lines must be set to match the type of encoder being used. Incorrect setting of this parameter will result in an erroneous speed measurement.	250 to 32767	2048
71.03	ENCODER INVERT	When TRUE, changes the sign of the measured speed and the direction of the position count.	0=FALSE 1=TRUE	0
80.01	AUTOTUNE ENABLE	Determines whether the Autotune sequence is operational or not. The Autotune sequence is operational when set to TRUE and the drive is run	0=FALSE 1=TRUE	0
80.02	AUTOTUNE MODE	Selects the Autotune operating mode.	0 : STATIONARY 1 : ROTATING 2 : SPD LOOP ROTATING 3 : SPD LOOP STATIONARY	
27.06 (induction motor only)	MAG CURRENT	This parameter contains the motor model no-load line current as determined by the Autotune, or taken from the motor nameplate	0.00 to 3276.70 A	product code dependent

QUICK SETUP MENU 890CD Common Bus Drive & 890SD Standalone Drive				
PREF	6901 Display	Description	Range	Default
27.14 (induction motor only)	STATOR RES	This parameter contains the motor model per-phase stator resistance as determined by Autotune.	0.0000 to 250.0000Ω	product code dependent
27.15 (induction motor only)	LEAKAGE INDUC	This parameter contains the motor model per-phase leakage inductance as determined by Autotune.	0.00 to 300.00mH	product code dependent
27.16 (induction motor only)	MUTUAL INDUC	This parameter contains the motor model per-phase mutual inductance as determined by Autotune.	0.00 to 3000.00mH	product code dependent
27.17 (induction motor only)	ROTOR TIME CONST	This parameter contains the motor model rotor time constant as determined by Autotune.	10.00 to 3000.00ms	product code dependent
78.01	SPEED PROP GAIN	Sets the proportional gain of the loop. Speed error (mechanical rev/s) x proportional gain = torque percent.	0.0 to 3000.0	20.0

QUICK SETUP MENU 890CD Common Bus Drive & 890SD Standalone Drive				
PREF	6901 Display	Description	Range	Default
78.02	SPEED INT TIME	This is the integral time constant of the speed loop. A speed error which causes the proportional term to produce a torque demand T, will cause the integral term to also ramp up to a torque demand T after a time equal to “speed int time”.	1 to 15000ms	100
1.03	AIN 1 TYPE	Selects input range for Analog Input 1.	0 = -10..+10 V 1 = 0..+10 V	0
2.03	AIN 2 TYPE	Selects input range for Analog Input 2.	0 = -10..+10 V 1 = 0..+10 V	0
3.03	AIN 3 TYPE	Selects input range for Analog Input 3.	0 = -10..+10 V 1 = 0..+10 V 2 = 0..20 mA 3 = 4..20 mA	0
4.03	AIN 4 TYPE	Selects input range for Analog Input 4.	0 = -10..+10 V 1 = 0..+10 V 2 = 0..20 mA 3 = 4..20 mA	0
97.01	DISABLE TRIPS	Indicates which trips have been disabled. Not all trips may be disabled, the DISABLED TRIPS mask is ignored for trips that cannot be disabled. Refer to Chapter 10.	0000 to FFFF	0700

QUICK SETUP MENU
890CD Common Bus Drive & 890SD Standalone Drive

PREF	6901 Display	Description	Range	Default
97.02	DISABLE TRIPS+	Indicates which trips have been disabled. Not all trips may be disabled, the DISABLED TRIPS mask is ignored for trips that cannot be disabled. Refer to Chapter 10.	0000 to FFFF	0840
31.01	VIEW LEVEL	Selects the menu to be displayed by the keypad.	0 : OPERATOR 1 : BASIC 2 : ADVANCED	1

For more information refer to Chapter 4/5: “Keypad Menus” - The QUICK SETUP Menu.

The SETUP Menu

This menu contains all the parameters available to you when using the DSE 890 Configuration Tool.

ADVANCED view level must be selected to view this menu. using the 6901 keypad on the 890CD Common Bus Drive and 890SD Standalone Drive.

Note ***We recommend that you program the 890 using the DSE Configuration Tool.***

For details of the parameters in this menu, refer to Appendix D.

The SYSTEM Menu

SAVE CONFIG

The SAVE CONFIG menu saves your current settings.

To save an application press the **M** key when displaying the SAVE CONFIG menu. Press the ▲ key to confirm, as instructed.

Saving again will overwrite the previous information.

Saved information is stored during power-down and is restored at power-up.

This does not save the link configuration. It saves information for MMI parameters.

Chapter 10

Trips and Fault Finding

The drive may trip in order to protect itself. To restart the drive, you will need to clear the trip(s).
This chapter provides a list of trips, as displayed by the 6511 keypad and 6901 keypad.

Trips

What Happens when a Trip Occurs

When a trip occurs, the drive's power stage is immediately disabled causing the motor and load to coast to a stop. The trip is latched until action is taken to reset it. This ensures that trips due to transient conditions are captured and the drive is disabled, even when the original cause of the trip is no longer present

Drive Indications

If a trip condition is detected the unit displays and performs the following actions.

1. The programming block SEQ & REF::SEQUENCING LOGIC::TRIPPED signal is set to TRUE.
2. The FIRST TRIP parameter in the TRIPS STATUS function block displays the trip ID. Refer to Chapter 9: "Keypad Menus" - DISABLED WORD 1, DISABLED WORD 2 for a table of enumerated values..

Keypad Indications (when connected)

If a trip condition is detected the MMI displays and performs the following actions.

1. The trip source is displayed on the keypad.
2. 6901 keypad only: the HEALTH LED on the Keypad flashes indicating a trip condition has occurred and a trip message is displayed stating the cause of the trip.
3. The trip message(s) must be acknowledged by pressing the **STOP** key. The trip message may be cleared by pressing the **E** key. Refer to Chapter 8: "The Keypad" - Alert Message Displays.

Resetting a Trip Condition

Before a trip can be reset, the trip condition must be removed.

Note ***A Heatsink Over-temperature trip may not reset immediately. The unit needs to cool sufficiently.***

Local Mode

To reset a trip in Local Mode:		
Remove the trip condition		Press the Stop key to clear the trip. You can now press Run to restart the system..

Remote Mode

To reset a trip in Remote Mode:		
Remove the trip condition		Press the Stop key to clear the trip. You can now press Run to restart the system..
Remove the trip condition	-	Alternatively, remove and re-apply the 24V supply at X01, or toggle the ENABLE to 0V and then 24V to restart the system.

Trips Table

The following trips may occur to protect the drive.

6511 Keypad Display	6901 Keypad Display	Description	Possible Reason for Trip
DCHI	OVERVOLTAGE	The drive internal dc link voltage is too high	♦ The supply voltage is too high ♦ Trying to decelerate a large inertia load too quickly ♦ The brake resistor is open circuit
DCLO	UNDERVOLTAGE	The drive internal dc link voltage is too low	♦ The supply voltage is too low ♦ The supply has been lost ♦ A supply phase is missing

6511 Keypad Display	6901 Keypad Display	Description	Possible Reason for Trip
OC	OVERCURRENT	The motor current being drawn from the drive is too high	♦ Trying to accelerate a large inertia load too quickly ♦ Trying to decelerate a large inertia load too quickly ♦ Application of shock load to motor ♦ Short circuit between motor phases ♦ Short circuit between motor phase and earth ♦ Motor output cables too long or too many parallel motors connected to the drive ♦ Fixed or auto boost levels are set too high
HOT	HEATSINK	The drive heatsink temperature is too high	♦ The ambient air temperature is too high ♦ Poor ventilation or spacing between drives
ET	EXTERNAL TRIP	User trip caused via control terminals	♦ +24V not present on external trip (terminal X15/05) ♦ Check setting of EXT TRIP MODE parameter
IN 1	INPUT 1 BREAK	I/O TRIPS:: INPUT 1 BREAK has gone True	♦ Check configuration to determine source of signal
IN 2	INPUT 2 BREAK	I/O TRIPS:: INPUT 2 BREAK has gone True	♦ Check configuration to determine source of signal

Trips and Fault Finding

6511 Keypad Display	6901 Keypad Display	Description	Possible Reason for Trip
STLL	MOTOR STALLED	The motor has stalled (not rotating)	♦ Motor loading too great ♦ Current limit level is set too low ♦ Stall trip duration is set too low ♦ Fixed or auto boost levels are set too high
IT	INVERSE TIME		♦ The inverse time current limit is active: motor loading is too great; fixed or autoboost levels are too high (Full Load Current = 150% for 60 seconds)
DB R	BRAKE RESISTOR	External dynamic braking resistor has been overloaded	♦ Trying to decelerate a large inertia load too quickly or too often
DB S	BRAKE SWITCH	Internal dynamic braking switch has been overloaded	♦ Trying to decelerate a large inertia load too quickly or too often
DISP	OP STATION	Keypad has been disconnected from drive whilst drive is running in local control	♦ Keypad accidentally disconnected from drive
SCI	COMMS BREAK	Can't refresh the COMMS COMMAND parameter	♦ COMMS TIMEOUT parameter set too short (refer to COMMS CONTROL menu at level 3)

6511 Keypad Display	6901 Keypad Display	Description	Possible Reason for Trip
CNTC	CONTACTOR FBK		♦ The CONTACTOR CLOSED input in the SEQUENCING LOGIC function block remained FALSE after a run command was issued
SPD	SPEED FEEDBACK		♦ SPEED ERROR > 50.00% for 10 seconds
AOT	AMBIENT TEMP		♦ The ambient temperature in the drive is too high
OT	MOTOR OVERTEMP	The motor temperature is too high	♦ Excessive load ♦ Motor voltage rating incorrect ♦ FIXED BOOST and/or AUTO BOOST set too high ♦ Prolonged operation of the motor at low speed without forced cooling ♦ Check setting of INVERT THERMIST parameter in I/O TRIPS menu at level 3. ♦ Break in motor thermistor connection

6511 Keypad Display	6901 Keypad Display	Description	Possible Reason for Trip
I HI	CURRENT LIMIT	V/Hz mode only: If the current exceeds 180% of induction stack rated current for a period of 1 second, the drive will trip. This is caused by shock loads	♦ Remove the cause of the shock load
A24SC	24V FAILURE	The 24V customer output has fallen below 17V	♦ 24V customer output is short circuited ♦ Excessive loading
LSPD	LOW SPEED OVER I	The motor is drawing too much current (>100%) at zero output frequency	♦ FIXED BOOST and/or AUTO BOOST set too high (refer to FLUXING menu at level 3)
PHAS	PHASE FAIL		♦ One or more input phases not present
ENC 1	FBK ENCODER FAIL		♦ Encoder fault
SHRT	DESAT (OVER I)		♦ Instantaneous overcurrent. Refer to OVERCURRENT in this table


6511 Keypad Display	6901 Keypad Display	Description	Possible Reason for Trip
DCRP	VDC RIPPLE		♦ The dc link ripple voltage is too high. Check for a missing input phase.
DBSC	BRAKE SHORT CCT	Brake resistor overcurrent	♦ Check brake resistance is not less than minimum value allowed ♦ check wiring and brake resistor for earth faults
OSPD	OVERSPEED		♦ Speed feedback > 150% for 0.1 seconds
ANIN	ANALOG INPUT ERR		♦ 4-20mA analog input current > 22mA could damage the input circuit
DBCT	INT DB RESISTOR		♦ Braking mode set to INTERNAL (future use only). Set to EXTERNAL and connect an External Braking Resisitor if braking is required.
TRIP	UNKNOWN		♦ An unknown trip - refer to Parker SSD Drives
TR32	OTHER		♦ Refer to OTHER in Appendix D : TRIPS STATUS. One or more trips have occurred with a Value greater than 32. See the list.

Trips and Fault Finding

6511 Keypad Display	6901 Keypad Display	Description	Possible Reason for Trip
ATN1	MAX SPEED LOW		♦ During Autotune the motor is required to run at the nameplate speed o f the motor. If MAX SPEED RPM limits the speed to less than this value, an error will be reported. Increase the value of MAX SPEED RPM up to the nameplate rpm of the motor (as a minimum). It may be reduced, if required, after the Autotune is complete.
ATN2	MAINS VOLTS LOW		♦ The mains input voltage is not sufficient to carry out the Autotune. Re-try when the mains has recovered.
ATN 3	NOT AT SPEED		♦ The motor was unable to reach the required speed to carry out the Autotune. Possible reasons include: motor shaft not free to turn; the motor data is incorrect
ATN4	MAG CURRENT FAIL		♦ It was not possible to find a suitable value of magnetising current to achieve the required operating condition for the motor. Check the motor data is correct, especially nameplate rpm and motor volts. Also check that the motor is correctly rated for the drive.

6511 Keypad Display	6901 Keypad Display	Description	Possible Reason for Trip
ATN5	NEGATIVE SLIP F		♦ Autotune has calculated a negative slip frequency, which is not valid. Nameplate rpm may have been set to a value higher than the base speed of the motor. Check nameplate rpm, base frequency, and pole pairs are correct.
ATN6	TR TOO LARGE		♦ The calculated value of rotor time constant is too large. Check the value of nameplate rpm.
ATN7	TR TOO SMALL		♦ The calculated value of rotor time constant is too small. Check the value of nameplate rpm.
ATN8	MAX RPM DATA ERR		♦ This error is reported when the MAX SPEED RPM is set to a value outside the range for which Autotune has gathered data. Autotune gathers data on the motor characteristics up to 30% beyond “max speed rpm”. If MAX SPEED RPM is later increased beyond this range, the drive had no data for this new operating area, and so will report an error. To run the motor beyond this point it is necessary to re-autotune with MAX SPEED RPM set to a higher value.
STAC	STACK TRIP		♦ The drive was unable to distinguish between an overcurrent/desat or overvoltage trip

6511 Keypad Display	6901 Keypad Display	Description	Possible Reason for Trip
ATNA	LEAKGE L TIMEOUT		♦ The leakage inductance measurement requires a test current to be inserted into the motor. It has not been possible to achieve the required level of current. Check that the motor is wired correctly.
PLOS	POWER LOSS STOP		♦ Power Loss Stop sequence has ramped Speed Setpoint to zero or timed out
ATNC	MOTR TURNING ERR		♦ The motor must be stationary when starting the Autotune
ATND	MOTR STALLED ERR		♦ The motor must be able to rotate during Autotune
ATNE	AT TORQ LIM ERR		♦ The motor is in torque limit during Autotune
ECAL	FBK ENCODR CAL	The drive has failed to set absolute position	♦ Check the encoder supports absolute position, and that the encoder is wired correctly.
GEAR	OUTPUT GBX ERROR		♦ A non-unity output gearbox is not supported if the encoder direction is reversed.
APP	APP HALTED		♦ The application has been halted by the DSE Configuration Tool
AERR	APP ERROR		♦ The application has ceased execution due to an error

6511 Keypad Display	6901 Keypad Display	Description	Possible Reason for Trip
FERR	FIRMWARE ERROR		♦ The firmware in the drive has stopped executing
RSLV	RESOLVER ERROR	See function block description	♦ Motor current is too high
MI2T	I2T MOTOR TRIP	See function block description	♦ Motor is undersized
STO	SAFE TORQUE OFF	-	♦ *Function not implemented*
REFC	REF ENCODER CAL	The drive has failed to set absolute position	♦ Check the encoder supports absolute position, and that the encoder is wired correctly.
REFF	REF ENCODER FAIL	-	♦ *Function not implemented*
DCFG	DRIVE CONFIG ERR	Drive configuration error	♦ The configuration defined in DRIVE CONFIG doesn't match the actual drive configuration.
CT1	CUST TRIP 1	See function block description	
CT2	CUST TRIP 2	See function block description	

6511 Keypad Display	6901 Keypad Display	Description	Possible Reason for Trip
CT3	CUST TRIP 3	See function block description	
CT4	CUST TRIP 4	See function block description	
CT5	CUST TRIP 5	See function block description	
CT6	CUST TRIP 6	See function block description	
CT7	CUST TRIP 7	See function block description	

Trip Groups

The DISABLE WORD, ACTIVE WORD, WARNINGS WORD and TRIGGERS WORD parameters use a four digit hexadecimal number to identify individual trips. Each trip has a unique corresponding number.

- Refer to Appendix D : TRIPS STATUS for a complete trip listing for DISABLE WORD, ACTIVE WORD, WARNINGS WORD.
- Refer to Appendix D : AUTO RESTART for information about TRIGGERS WORD.

Automatic Trip Reset (6901 keypad)

Using the Keypad, the drive can be configured to automatically attempt to reset a trip when an attempt is made to start driving the motor, or after a preset time once the trip condition has occurred. The following function blocks (MMI menus) are used to enable automatic trip resets.

Seq & Ref::Auto Restart (Auto-Reset)
Seq & Ref::Sequencing Logic

Setting Trip Conditions (6901 keypad)

The following function blocks (MMI menus) are used to set trip conditions:

Trips::I/O Trips
Trips::Trips Status

Viewing Trip Conditions (6901 keypad)

The following function blocks (MMI menus) can be viewed to investigate trip conditions:

Seq & Ref::Sequencing Logic
Trips::Trips History
Trips::Trips Status
Trips Status::Active Trips
Trips Status::Active Trips+
Trips Status::First Trip
Trips History::Trip 1 (NEWEST) to Trip 10 (OLDEST)

Viewing Trip Conditions (6511 keypad)

The following function blocks (MMI menus) can be viewed to investigate trip conditions:

Trips Status::Active Trips
Trips Status::Active Trips+
Trips Status::First Trip
Trips History::Trip 1 (NEWEST) to Trip 10 (OLDEST)

Alert Messages

A message will be displayed on the Keypad when either:

♦ A requested operation is not allowed

♦ The drive has tripped

The table below lists the messages and the reason for each message.

Alert Message IDs			
ID	**Message**		**Reason**
	6901 Keypad	**6511 Keypad**	
0			No Alert
1	RUNTIME ALERT XXXX YYYYYYYY	XXXX	Runtime alert
2	SAVING	SAVE	Saving to flash
3	LOADING	LOAD	Loading from flash.
4	LIMIT REACHED	HI	High or low limit reached while editing.
5	KEY INACTIVE RUN FORWARD TRUE	RUN	Can't switch to remote mode.
6	KEY INACTIVE RUN REV TRUE	RUN	Can't switch to remote mode.
7	KEY INACTIVE JOG TRUE	JOG	Can't switch to remote mode.

Alert Message IDs			
ID	Message		Reason
	6901 Keypad	6511 Keypad	
8	KEY INACTIVE REMOTE SEQ	SEQ	Run, Jog and direction keys inactive.
9	KEY INACTIVE REMOTE REF	REF	Direction key inactive.
10	KEY INACTIVE DRIVE RUNNING	RUN	Local/Remote and Jog keys inactive.
11	KEY INACTIVE COAST STOP FALSE	STOP	Run and Jog keys over ridden.
12	KEY INACTIVE FAST STOP FALSE	STOP	Run and Jog keys over ridden.
13	KEY INACTIVE ENABLE FALSE	ENBL	Run and Jog keys over ridden.
14	CONFIG MODE FAILED	ERR1	Unable to enter configuration mode.
15	KEY INACTIVE READ ONLY	READ	Can’t edit read-only parameters
16	KEY INACTIVE PARAMETER LINKED	READ	Obsolete message

Alert Message IDs			
ID	Message		Reason
	6901 Keypad	6511 Keypad	
17	PASSWORD LOCKED	PASS	Incorrect password entered Password activated, (by pressing E key at the top of the MMI tree)
18	CHECKSUM FAIL DEFAULTS LOADED	ERR2	Error reading data on power-up.
19	SUCCESS	GOOD	
20	FAILED	FAIL	
21	NEW PCODE FAILED	FAIL	Failed to save new product code or country data.
22	DEFAULTS LOADED	DATA	Loaded default fixed parameters.
23	KEY INACTIVE NO FREE LINKS	ERR3	Obsolete message
24	KEY INACTIVE LOCKED	ERR4	Obsolete message
25	QUADRATIC TORQUE UP TO CONFIRM	ND	Validate change to quadratic torque mode.
26	CONSTANT TORQUE UP TO CONFIRM	HD	Validate change to constant torque mode.

Alert Message IDs			
ID	**Message**		**Reason**
	6901 Keypad	**6511 Keypad**	
27	USING BACKUP APPLICATION	ERR5	Failed to load most recently save application, using previous copy. This applies to: Fixed parameter file, (APP.CFG) Fixed motor data file, (MOTOR1.MOT) Fixed persistent data file, (APP.PST) Default frequency and language file, (COUNTRY.SYS) Drive ID file, (DRIVE_ID.SYS), now obsolete.
28	NEW PCODE SUCCESS	CODE	Saved new product code.
29	CONFIG MODE LOCKED	CONF	Exiting configuration mode.
30	FILE SYSTEM CORRUPT	FILE	The file store is corrupted. All saved files are lost.
31	USING BACKUP POWER DATA	CODE	At least one copy of the stack eeprom data has been corrupted.
32	POWER DATA CORRUPT	CODE	All copies of the stack eeprom data have been corrupted.

Alert Message IDs			
ID	**Message**		**Reason**
	6901 Keypad	**6511 Keypad**	
33	NEW POWER DATA DEFAULTS LOADED	CODE	Power board data on the control board does not match that on the stack eeprom.
34	LANGUAGE DEFAULTS LOADED	LANG	Default language and frequency settings lost.
35	USING BACKUP LANGUAGE	LANG	Obsolete message
36	APPLICATION NOT FOUND	DATA	Attempt to save fixed parameter set before it is valid.
37	AUTOTUNE IN PROGRESS	ATN	
38	OPERATOR	OPER	Alert displayed while changing to the operator menu on pressing the PROG key.
39	DIAGNOSTIC	DIAG	Alert displayed while changing to the diagnostic menu on pressing the PROG key.
40	QUICK SETUP	SET	Alert displayed while changing to the quick setup menu on pressing the PROG key.
41	SETUP	PAR	Alert displayed while changing to the setup menu on pressing the PROG key.
42	SYSTEM	SYS	Alert displayed while changing to the system menu on pressing the PROG key.

Alert Message IDs			
ID	**Message**		**Reason**
	6901 Keypad	**6511 Keypad**	
43	SUPER USER TRUE	SUPR	Reserved for Parker SSD Drives.
44	INCOMPATIBLE POWER BOARD	ERR6	Power board 500v and/or underlap signals incompatible with selected product code.
45	CALIBRATION CHECKSUM FAIL	CAL	The control board calibration data is invalid.
46	INCOMPATIBLE PCB	PCB	Software is not compatible with this version of control card PCB.
47	INCOMPATIBLE POWER BOARD TYPE	TYPE	Stack has been marked as a 650 or Baldor stack
48	INCOMPATIBLE EEPROM FLAGS	FLGS	Reserved flags in stack eeprom are not zero. See comms command ri.
49	INCOMPATIBLE POWER BOARD CODE	CODE	Product code not compatible with this version of software.

Fault Finding

Problem	Possible Cause	Remedy
Drive will not power-up	Fuse blown	Check supply details, replace with correct fuse.
		Check Product Code against Model No.
	Faulty cabling	Check all connections are correct and secure.
		Check cable continuity
Drive fuse keeps blowing	Faulty cabling or connections wrong	Check for problem and rectify before replacing with correct fuse
	Faulty drive	Contact Parker SSD Drives
Cannot obtain HEALTH state	Incorrect or no supply available	Check supply details
Motor will not run at switch-on	Motor jammed	Stop the drive and clear the jam
Motor runs and stops	Motor becomes jammed	Stop the drive and clear the jam
Motor won’t rotate or runs in reverse	Encoder fault	Check encoder connections
	Open circuit speed reference potentiometer	Check terminal

Table 10-1 Fault Finding

Control Board STATUS LED Indications

Colour	LED Indication	Description
OFF/GREEN	FLASH Off 95 : Green 5	Initialization, checking for network
GREEN/OFF	FLASH Green 50 : Off 50	OK – application running, no network
GREEN/OFF	FLASH Green 95 : Off 5	OK – application running, network OK
RED/GREEN	ALTERNATING Red 95 : Green 5	Node halted
RED/GREEN	ALTERNATING Red 5 : Green 95	Duplicate address in network
RED/OFF	FLASH Red 50 : Off 50	No configuration
RED/GREEN	ALTERNATNG Red 50 : Green 50	Application error

Chapter 11

Routine Maintenance and Repair

Routine Maintenance

Periodically inspect the drive for build-up of dust or obstructions that may affect ventilation of the unit. Remove this using dry air.

Repair

There are no user-serviceable components.

IMPORTANT **MAKE NO ATTEMPT TO REPAIR THE UNIT - RETURN IT TO PARKER SSD DRIVES.**

Saving Your Application Data

In the event of a repair, application data will be saved whenever possible. However, we advise you to copy your application settings before returning the unit.

Returning the Unit to Parker SSD Drives

Please have the following information available:

- The model and serial number - see the unit's rating label
- Details of the fault

Contact your nearest Parker SSD Drives Service Centre to arrange return of the item.

You will be given a *Returned Material Authorisation.* Use this as a reference on all paperwork you return with the faulty item. Pack and despatch the item in the original packing materials; or at least an anti-static enclosure. Do not allow packaging chips to enter the unit.

Disposal

This product contains materials which are consignable waste under the Special Waste Regulations 1996 which complies with the EC Hazardous Waste Directive - Directive 91/689/EEC.

We recommend you dispose of the appropriate materials in accordance with the valid environmental control laws. The following table shows which materials can be recycled and which have to be disposed of in a special way.**{**xe "Disposal" \f **}**

Material	Recycle	Disposal
metal	yes	no
plastics material	yes	no
printed circuit board	no	yes

The printed circuit board should be disposed of in one of two ways:

1. High temperature incineration (minimum temperature 1200°C) by an incinerator authorised under parts A or B of the Environmental Protection Act
2. Disposal in an engineered land fill site that is licensed to take aluminium electrolytic capacitors. Do not dispose of in a land fill site set aside for domestic waste.

Packaging

During transport our products are protected by suitable packaging. This is entirely environmentally compatible and should be taken for central disposal as secondary raw material.

Appendix A
Options

This Chapter contains information about various options that can be fitted to the 890 range.

Option Cards

There are a range of Option Cards that may come factory-fitted to the 890CD and 890SD drives, or are available for customer fitting.

The options provide for fieldbus communications and speed feedback and are mounted on to the Control Board.

Refer to the Technical Manual suppled with each Option Card for detailed instructions.

Option Card A slot

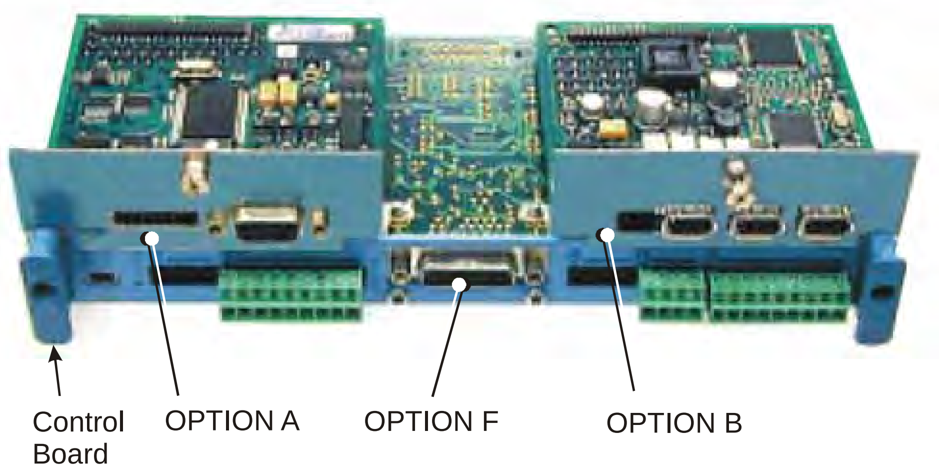
Fieldbus communications option cards for all major protocols

Option Card B slot

Fieldbus communications option cards for all major protocols (FireWire is currently fitted to this slot only)

Option Card F slot

Speed feedback option cards



Removing the Control Board

WARNING!
Disconnect all sources of power before attempting installation. Injury or death could result from unintended actuation of controlled equipment.

Caution
This option contains ESD (Electrostatic Discharge) sensitive parts. Observe static control precautions when handling, installing and servicing this option.

1. Remove the lower front cover from the drive.
2. Undo the two screws securing OPTION A and OPTION B.
3. Undo the screws (A) located in handles of the control board. Gently pull on the handles to withdraw the board from the drive, supporting any attached option boards. Note that the boards are sliding in slots.
4. Refer to the Option Card Technical Manual for fitting/wiring details.
5. Replace the control board (with attached options) into the drive.
6. If fitted, tighten the OPTION A and OPTION B screws.

Figure 2 Control board with an Option Card correctly mounted

Options

A

Appendix B
Sequencing Logic

The 890CD Common Bus Drive and 890SD Standalone Drive's reaction to commands is defined by a state machine. This determines which commands provide the demanded action, and in which sequence.

Principle State Machine

Main Sequencing States

The main sequencing state of the unit is indicated by an enumerated value given by the parameter SEQUENCER STATE under SEQUENCING LOGIC menu.

Enumerated Value	Main Seq State	Standard Name	Description
0	START DISABLED	Switch On Disabled	The Drive will not accept a switch on command
1	START ENABLED	Ready To Switch On	The Drive will accept a switch on command
2	SWITCHED ON	Switched On	The Drive's stack is enabled
3	READY	Ready	Waiting for Contactor to be closed
4	ENABLED	Enabled	The Drive is enabled and operational
5	F-STOP ACTIVE	Fast-Stop Active	Fast stop is active
6	TRIP ACTIVE	Trip Active	The Drive is processing a trip event
7	TRIPPED	Tripped	The Drive is tripped awaiting trip reset

Table B-1 Enumerated Values for the SEQUENCING LOGIC Function Block

State Outputs of the SEQUENCING LOGIC Function Block

The following table shows the states of individual parameters for the SEQUENCING LOGIC function block required to produce the condition of the MAIN SEQ STATE parameter.

	START DISABLED	START ENABLED	SWITCHED ON	READY	ENABLED	F-STOP ACTIVE	TRIP ACTIVE	TRIPPED
Tripped	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	TRUE
Running	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE
Jogging	FALSE	FALSE	FALSE	FALSE	Note 1	FALSE	FALSE	FALSE
Stopping	FALSE	FALSE	FALSE	FALSE	Note 2	TRUE	FALSE	FALSE
Output Contactor	Depends on previous state	Depends on previous state	TRUE	TRUE	TRUE	TRUE	TRUE	FALSE
Switch On Enable	FALSE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	FALSE
Switched On	FALSE	FALSE	TRUE	TRUE	TRUE	TRUE	TRUE	FALSE
Ready	FALSE	FALSE	FALSE	TRUE	TRUE	TRUE	TRUE	FALSE
Healthy	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	FALSE	FALSE Note 3

Table B-2 Parameter States for the MAIN SEQ STATE Parameter

B

Sequencing Logic

Note ***1. JOGGING is set TRUE once the jog cycle has started, and remains TRUE until the jog cycle has finished which is when either the stop delay has finished or another mode is demanded.***

2. STOPPING is set TRUE during the stopping cycles commanded by either RUNNING going low, JOGGING going low or if Fast Stop is active, i.e. SEQUENCING LOGIC is F-STOP ACTIVE.

3. Once Run and Jog are both FALSE, HEALTHY O/P will be set TRUE.

Transition of States

The transition matrix describes what causes the transition from one state to another, for example see number 4 below: the transition from "Ready To Switch On" to "Trip Active" is triggered by "TRIP" going TRUE. Note – where a state has more than one exit transition, the transition with the lowest number has priority.

Refer to the following table and state diagram.

	Current State	Next State	Cause (FALSE to TRUE)
1	Power Up	Switch On Disabled	Power-Up, Restore Configuration or exit from Configuration mode.
2	Switch On Disabled	Trip Active	Trip
3	Switch On Disabled	Ready To Switch On	RUN = FALSE, JOG = FALSE, NOT FAST STOP = TRUE and NOT COAST STOP = TRUE
4	Ready To Switch On	Trip Active	Trip
5	Ready To Switch On	Switch On Disabled	NOT COAST STOP = FALSE or NOT FAST STOP = FALSE
6	Ready To Switch On	Switched On	RUN = TRUE or JOG = TRUE

B

	Current State	Next State	Cause (FALSE to TRUE)
7	Switched On	Trip Active	Trip (includes CONTACTOR CLOSED = FALSE after 10 seconds)
8	Switched On	Switch On Disabled	NOT COAST STOP = FALSE or NOT FAST STOP = FALSE
9	Switched On	Ready To Switch On	RUN = FALSE and JOG = FALSE
10	Switched On	Ready	CONTACTOR CLOSED = TRUE and defluxed
11	Ready	Trip Active	Trip (includes CONTACTOR CLOSED = FALSE)
12	Ready	Switch On Disabled	NOT COAST STOP = FALSE or NOT FAST STOP = FALSE
13	Ready	Ready To Switch On	RUN = FALSE and JOG = FALSE
14	Ready	Enabled	ENABLE = TRUE
15	Enabled	Trip Active	Trip (includes CONTACTOR CLOSED = FALSE)
16	Enabled	Switch On Disabled	NOT COAST STOP = FALSE
17	Enabled	Fast Stop Active	NOT FAST STOP = FALSE
18	Enabled	Ready To Switch On	RUN = FALSE, JOG = FALSE and stopping complete
19	Enabled	Ready	ENABLE = FALSE

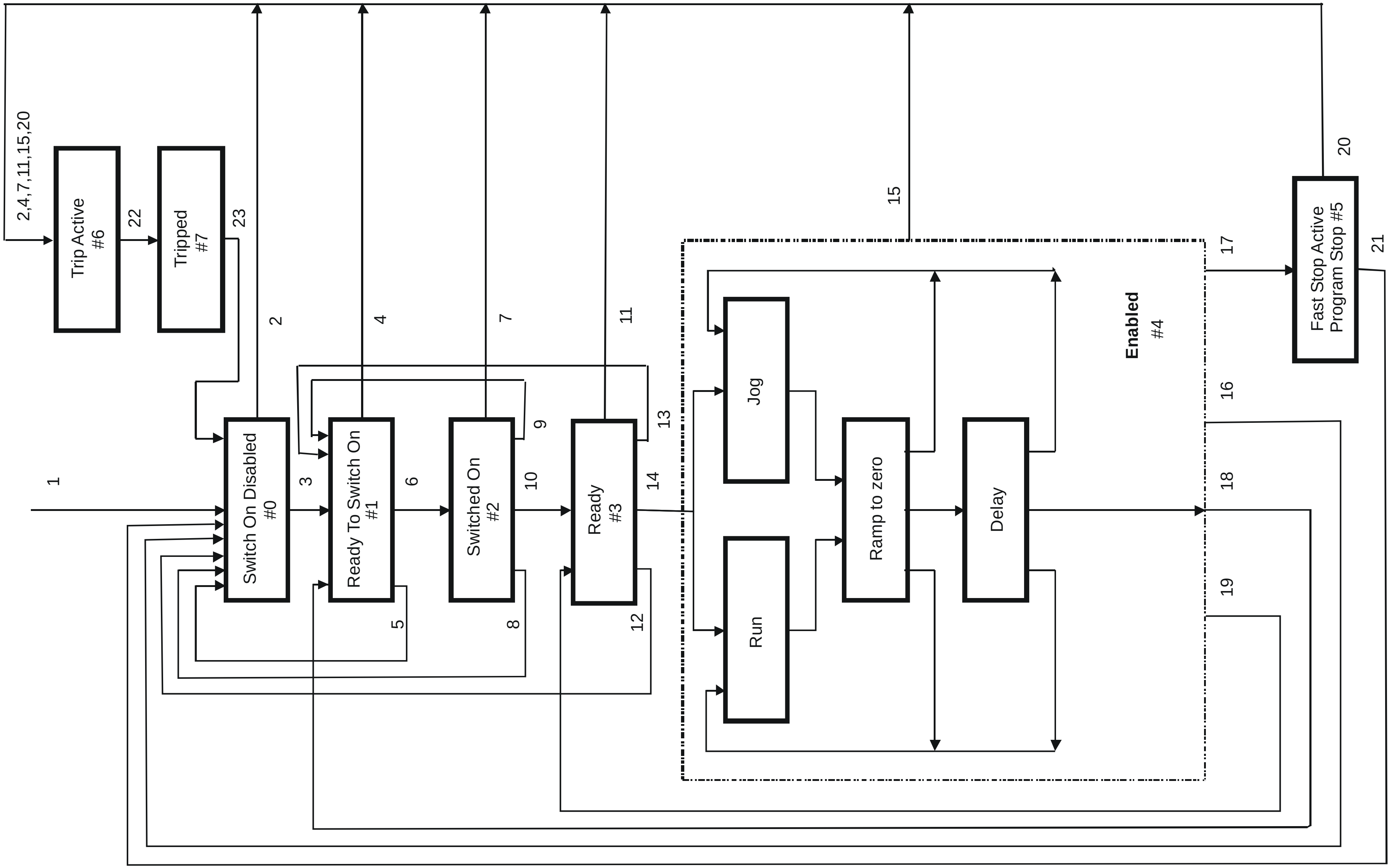
Sequencing Logic

	Current State	Next State	Cause (FALSE to TRUE)
20	Fast Stop Active	Trip Active	Trip (includes CONTACTOR CLOSED = FALSE)
21	Fast Stop Active	Switch On Disabled	Fast Stop timer expired or FAST STOP MODE = Coast Stop OR Drive at zero setpoint
22	Trip Active	Tripped	Stack quenched
23	Tripped	Switch On Disabled	Trip = FALSE and TRIP RESET 0->1 transition

Table B-3 Transition Matrix

B

State Diagram



External Control of the Drive

Communications Command

When sequencing is in the Remote Comms mode, the sequencing of the Drive is controlled by writing to the COMMS COMMAND (PREF 95.05).

The COMMS COMMAND parameter is a 16-bit word based on standard fieldbus drive profiles. Some bits are not implemented in this release (see "Supported" column of the table below).

Bit	Name	Description	Supported	Required Value
0	Switch On	OFF1 Operational	√	
1	(Not) Disable Voltage	OFF2 Coast Stop	√	
2	(Not) Quick Stop	OFF3 Fast Stop	√	
3	Enable Operation		√	
4	Enable Ramp Output	=0 to set ramp output to zero		1
5	Enable Ramp	=0 to hold ramp		1
6	Enable Ramp Input	=0 to set ramp input to zero		1
7	Reset Fault	Reset on 0 to 1 transition	√	
8				0
9				0
10	Remote	=1 to control remotely		1
11				0
12				0
13				0
14				0
15				0

Switch On

Replaces the RUN FWD, RUN REV and NOT STOP parameters of the SEQUENCING LOGIC function block. When Set (=1) is the same as :

RUN FWD	=	TRUE
RUN REV	=	FALSE
NOT STOP	=	FALSE

When Cleared (= 0) is the same as :

RUN FWD	=	FALSE
RUN REV	=	FALSE
NOT STOP	=	FALSE

(Not) Disable Voltage

ANDed with the NOT COAST STOP parameter of the SEQUENCING LOGIC function block.
When both Set (=1) is the same as:

NOT COAST STOP	=	TRUE

When either or both Cleared (= 0) is the same as :

NOT COAST STOP	=	FALSE

(Not) Quick Stop

ANDed with the NOT FAST STOP parameter on the SEQUENCING LOGIC function block.
When both Set (=1) is the same as:

NOT FAST STOP	=	TRUE

When either or both Cleared (= 0) is the same as :

NOT FAST STOP	=	FALSE

Enable Operation

ANDed with the DRIVE ENABLE parameter on the SEQUENCING LOGIC function block.
When both Set (=1) is the same as:

DRIVE ENABLE	=	TRUE

When either or both Cleared (= 0) is the same as :

DRIVE ENABLE	=	FALSE

Enable Ramp Output, Enable Ramp, Enable Ramp Input

Not implemented. The state of these bits must be set (=1) to allow this feature to be added in the future.

Reset Fault

Replaces the REM TRIP RESET parameter on the SEQUENCING LOCIC function block. When Set (=1) is the same as:

REM TRIP RESET	=	TRUE

When Cleared (= 0) is the same as :

REM TRIP RESET	=	FALSE

Remote

Not implemented. It is intended to allow the PLC to toggle between local and remote. The state of this must be set (=1) to allow this feature to be added in the future.

Example Commands

047F hexadecimal to RUN

047E hexadecimal to STOP

B

Communications Status

The COMMS STATUS parameter (PREF 95.08) in the COMMS CONTROL function block monitors the sequencing of the Drive. It is a 16-bit word based on standard fieldbus drive profiles. Some bits are not implemented in the initial release and are set to 0 (see “Supported” column of the table below).

Bit	Name	Description	Supported
0	Ready To Switch On		√
1	Switched On	Ready for operation (refer control bit 0)	√
2	Operation Enabled	(refer control bit 3)	√
3	Fault	Tripped	√
4	(Not) Voltage Disabled	OFF 2 Command pending	√
5	(Not) Quick Stop	OFF 3 Command pending	√
6	Switch On Disable	Switch On Inhibited	√
7	Warning		
8	SP / PV in Range		
9	Remote	= 1 if Drive will accept Command Word	√
10	Setpoint Reached	= 1 if not ramping	√
11	Internal Limit Active	= 1 if current limit active or speed loop is in torque limit	√
12			
13			
14			
15			

Ready To Switch On

Same as the SWITCH ON ENABLE output parameter of the SEQUENCING LOGIC function block.

Switched On

Same as the SWITCHED ON output parameter of the SEQUENCING LOGIC function block.

Operation Enabled

Same as the RUNNING output parameter of the SEQUENCING LOGIC function block.

Fault

Same as the TRIPPED output parameter of the SEQUENCING LOGIC function block.

(Not) Voltage Disabled

If in Remote Comms mode, this is the same as Bit 1 of the COMMS COMMAND parameter. Otherwise it is the same as the NOT COAST STOP input parameter of the SEQUENCING LOGIC function block.

(Not) Quick Stop

If in Remote Comms mode, this is the same as Bit 2 of the COMMS COMMAND parameter. Otherwise it is the same as the NOT FAST STOP input parameter of the SEQUENCING LOGIC function block.

Switch On Disable

Set (=1) only when in START DISABLED state, refer to Table B-1.

Remote

This bit is set (= 1) if the Drive is in Remote mode **AND** the parameter REMOTE COMMS SEL of the COMMS CONTROL function block is Set (= 1).

Sequencing Logic

Setpoint Reached

This bit is set (=1) if the Reference Ramp is not ramping.

Internal Limit Active

This bit is set (=1) if, while in vector control mode, the speed limit has reached the torque limit; or, while in Volts/Hz mode, the open loop current limit is active.

Appendix E

Technical Specifications

Understanding the Product Code

Each unit is identified using an alphanumeric code which records how the unit was configured when dispatched from the factory. Each block of the Model Number is identified as below using a 7 block short code (shaded) and a 9 or 12 block long code. The short code defines the "base build" product and the long code defines the configuration including options.

Example Model Number:

LONG CODE →

890SD/4/0073E/B/00/A/UK/00/00/EQ/PB/FA

SHORT CODE →

Not applicable to 890CS units

Block 1	**890SD**	This is a standard 890SD Standalone Drive
Block 2	**4**	Nominal input voltage rating is 400V
Block 3	**0073E**	Current rating (continuous output RMS Amps) : 73 Amps Physical frame size E
Block 4	**B**	Supplied with braking control - external resistors required
Block 5	**00**	Build Option : not applicable
Block 6	**A**	Advanced performance level
Block 7	**UK**	Destination is the United Kingdom (English documentation and 50Hz settings)
Block 8	**00**	SSD standard livery
Block 9	**00**	Special options : none fitted
Block 10	**EQ**	Feedback Option : Encoder Quadrature incremental
Block 11	**PB**	Communications Option - Slot A: ProfiBus
Block 12	**FA**	Communications Option - Slot B: FireWire IEEE 1394A

Model Number		
Block	Variable	Description
1	89xXX	Generic product: 890 = Standard Product 891 = Conformal Coated PCB's 89xCS = Common Bus Supply 89xCD = Common Bus Drive 89xSD = Standalone Drive
2	X	One number specifying the nominal input voltage rating: 4 = 400 Vac 5 = 500 Vac
3	XXXXX	Four numbers specifying the nominal current in Amps and one character indicating size frame **Current Rating (Continuous Output RMS Amps in Induction Motor Mode)** **Common Bus and Standalone Drives (CD/SD)** *CD/SD 400/500 Vac Units:* 0073E = 50 HP@460Vac/37kW@400Vac: Frame E 0087E = 60 HP@460Vac/45kW@400Vac: Frame E 0105F = 75 HP@460Vac/55kW@400Vac: Frame F 0145F = 100 HP@460Vac/75kW@400Vac: Frame F 0156F = 125 HP@460Vac/90kW@400Vac: Frame F 0180F = 150 HP@460Vac: Frame F *(US/Canada only)*

Technical Specifications

Model Number		
Block	**Variable**	**Description**
3 cont.	XXXX	**Current Rating (Continuous Input RMS Amps)** **Common Bus Supplies (CS):** *230 thru 500 Vac Units:* 0108D = 75 HP@460Vac/60kW@400Vac: Frame D 0162D = 135 HP@460Vac/90kW@400Vac: Frame D
4	X	One character specifying the Dynamic Braking Option: N = No Braking Control
5	XX	Two characters specifiying the Internal Fan Option: 00 = Not applicable 1F = 110Vac fan(s) fitted 2F = 230Vac fan(s) fitted
6	X	One character specifying the Perfomance Level: S = Standard - Velocity/Torque Applications *Basic LINK macro blocks: (Math Functions, PID, Boolean, Simple Winder). Induction and PM Servo Motors Supported* A = Advanced - Standard Level plus: *Advanced LINK macro blocks such as SPW/CPW winder control and Electronic Gearing. Industry standard motion commands supported such as Move Incremental, Move Absolute etc... PLCOpen(like) programming environment.* H = High Performance - Advanced Level plus: *Application specific LINK macro blocks to include, Camming, Cut-to-Length and Shaftless Printing.* N = Not Applicable for CS Units

Model Number		
Block	**Variable**	**Description**
7	XX	Two characters specifiying the destination: EN = English, 50/60Hz (890CS units only) FR = France 50Hz (50/60Hz if 890CS) GR = Germany 50Hz (50/60Hz 890CS) IT = Italy 50Hz (50/60Hz 890CS) SW = Sweden 50Hz (50/60Hz 890CS) UK = United Kingdom, 50Hz (890CD and 890SD units only) US = United States, 60Hz (890CD and 890SD units only)
8	XX	Two characters specifiying the livery (Brand Label Partners - 01 thru 99): 00 = SSD Standard
9	XX	Two characters specifiying special options: 00 = None fitted
10	XX	Two characters specifiying the Feedback Option (8902 product) for OPTION F slot: EQ = Encoder Quadrature Incremental E1 = EnDat Encoder (Sin/Cos Type, V2.1) E2 = EnDat Encoder (Sin/Cos Type, V2.2) HF = HiperFace Encoder (Sin/Cos Type) RE = REsolver (Standard for Servo) 00 = Not Fitted : blanking panel fitted

Technical Specifications

Model Number		
Block	**Variable**	**Description**
11	XX	Two characters specifiying the Communications Option (8903 product) for OPTION A slot: DN = DeviceNet Fieldbus Communications PB = ProfiBus Fieldbus Communications CN = ControlNet Fieldbus Communications CB = CanOpen FieldBus Communications 00 = Not Fitted: blanking panel fitted
12	XX	Two characters specifiying the Communications Option (8903 product) for OPTION B slot: FA = FireWire IEEE1394A, 890 LAN Communications 00 = Not Fitted: blanking panel fitted

Electrical Ratings: 890CS Frame B, 500V

Output current must not be exceeded under steady state operating conditions.

FRAME B : 32A AC rms Input Current (nominal power 15kW)					
Model Number		890CS/5/0032B			
Operating Voltage		208V to 500V ±10%			
Nominal Operating Voltage	V	208/230	380/415	460	500
Input Current	A	32			
Continuous RMS Output Current	A	40			
Output Power		7.5kW/10HP	15kW	25HP	18kW
Power Loss	W	105	105	105	105
Output Overload		150% overload for 60 seconds			
Dynamic Brake Current Rating	A	20	20	20	20
Input Bridge I^2t	A^2s	1000			
Prospective Short Circuit Current	kA	65			
FRAME B : 54A AC rms Input Current (nominal power 30kW)					
Model Number		890CS/5/0054B			
Operating Voltage		208V to 500V ±10%			
Nominal Operating Voltage	V	208/230	380/415	460	500
Input Current	A	54			
Continuous RMS Output Current	A	65			
Output Power		15kW/20HP	30kW	45HP	37kW
Power Loss	W	195	195	195	195
Output Overload		150% overload for 60 seconds			
Dynamic Brake Current Rating	A	40	40	40	40
Input Bridge I^2t	A^2s	1500			
Prospective Short Circuit Current	kA	65			

Electrical Ratings: 890CS Frame D, 500V

Output current must not be exceeded under steady state operating conditions.

FRAME D : 108A AC rms Input Current (nominal power 60kW)					
Model Number		890CS/5/0108D			
Operating Voltage		208V to 500V ±10%			
Nominal Operating Voltage	V	208/230	380/415	460	500
Input Current	A	108			
Continuous RMS Output Current	A	135			
Output Power		30kW/40HP	60kW	90HP	75kW
Power Loss	W	300	300	300	300
Output Overload		150% overload for 60 seconds			
Dynamic Brake Current Rating	A	75	75	75	75
Input Bridge I^2t	A^2s	108,000			
Prospective Short Circuit Current	kA	100			
FRAME D : 162A AC rms Input Current (nominal power 90kW)					
Model Number		890CS/5/0162D			
Operating Voltage		208V to 500V ±10%			
Nominal Operating Voltage	V	208/230	380/415	460	500
Input Current	A	162			
Continuous RMS Output Current	A	200			
Output Power		45kW/60HP	90kW	135HP	110kW
Power Loss	W	500	500	500	500
Output Overload		150% overload for 60 seconds			
Dynamic Brake Current Rating	A	100	100	100	100
Input Bridge I^2t	A^2s	128,000			
Prospective Short Circuit Current	kA	100			

Electrical Ratings: : 890CS - Calculation

The required rating for the 890CS input stage can be calculated by adding up the sum of the motor currents attached to the associated output stages.

For example:

if a 45kw 4 pole, 400VAC motor has a FLC of 82A,

and a 90kW 4 pole, 400VAC motor has a FLC of 157A.

Then a system with 1 x 45kW motor and 1 x 90kW motor has a total load current of 239A, which is greater than the single 162A 890CS input stage rating. This example would need to use 2 x 162A 890CS input stages in parallel.

But, if it is known that the 45kW motor is overhauled during normal operation, then that motor current can be subtracted from, and not added to, the total load current.

In this case, total load current would be reduced to 75A. This is within the rating of a single 108A 890CS input stage.

Electrical Ratings: 890CD Frame E, 400V

Power Supply = 380-460V ±10%, 50/60Hz ±5%

Motor power, output current and input current must not be exceeded under steady state operating conditions. Input currents listed at 560V DC (from 400Vac 50Hz) for kW ratings and 650V DC (from 460Vac 60Hz) for Hp ratings, assuming a 3% line choke is fitted to the 890CS unit.

Model Number (Europe)	Catalog Number (North America)	Motor Power	Output Current (A) *(note 1)*	DC Input Current rms (A)	Heatsink Power Loss (W)	Total Power Loss (W)	Maximum Switching Frequency (kHz)
FRAME E :	Prospective short circuit current 65kA.						
Constant Torque (Output Overload Motoring 150% for 60s, 180% for 0.5s short term rating)							
890CD/4/0073E/..		37kW	73	82	546	665	3, 6
	890CD/4/0073E/..	50Hp	73	72	546	665	3, 6
890CD/4/0087E/..		45kW	87	100	645	645	3, 6
	890CD/4/0087E/..	60Hp	87	87	645	645	3, 6
Quadratic Torque (Output Overload Motoring 110% for 60s)							
890CD/4/0073E/..		45kW	87	102	667	795	3
	890CD/4/0073E/..	60Hp	87	88	667	795	3
890CD/4/0087E/..		55kW	105	123	791	939	3
	890CD/4/0087E/..	75Hp	105	107	791	939	3

Note 1: Up to the highest supply voltage that maintains shaft power less than the product power rating, for a typical induction motor. Derated for operation above this supply voltage.

Electrical Ratings: 890CD Frame F, 400V

Power Supply = 380-460V ±10%, 50/60Hz ±5%

Motor power, output current and input current must not be exceeded under steady state operating conditions. Input currents listed at 560V DC (from 400Vac 50Hz) for kW ratings and 650V DC (from 460Vac 60Hz) for Hp ratings, assuming a 3% line choke is fitted to the 890CS unit.

Model Number (Europe)	Catalog Number (North America)	Motor Power	Output Current (A) *(note 1)*	DC Input Current rms (A)	Heatsink Power Loss (W)	Total Power Loss (W)	Maximum Switching Frequency (kHz)
FRAME F :	Prospective short circuit current 65kA.						
Constant Torque (Output Overload Motoring 150% for 60s, 180% for 0.5s short term rating)							
890CD/4/0105F/..		55kW	105	123	665	965	3
	890CD/4/0105F/..	75Hp	100	107	645	875	3
890CD/4/0145F/..		75kW	145	166	992	1342	3
	890CD/4/0145F/..	100Hp	130	144	872	1172	3
890CD/4/0156F/..		90kW	180	203	1190	1650	3
	890CD/4/0156F/..	125Hp	156	176	1040	1480	3
890CD/4/0180F/..		90kW	180	203	1190	1650	3
	890CD/4/0180F/..	150Hp	180	213	1370	1880	3

Electrical Ratings: 890CD Frame F, 400V

Power Supply = 380-460V ±10%, 50/60Hz ±5%

Motor power, output current and input current must not be exceeded under steady state operating conditions. Input currents listed at 560V DC (from 400Vac 50Hz) for kW ratings and 650V DC (from 460Vac 60Hz) for Hp ratings, assuming a 3% line choke is fitted to the 890CS unit.

Model Number (Europe)	Catalog Number (North America)	Motor Power	Output Current (A) *(note 1)*	DC Input Current rms (A)	Heatsink Power Loss (W)	Total Power Loss (W)	Maximum Switching Frequency (kHz)
FRAME F :	Prospective short circuit current 65kA.						
Quadratic Torque							
890CD/4/0105F/..		75kW	145	166	1024	1294	3
	890CD/4/0105F/..	100Hp	125	144	824	1124	3
890CD/4/0145F/..		90kW	165	203	1172	1542	3
	890CD/4/0145F/..	125Hp	156	176	932	1372	3
890CD/4/0156F/..		110kW	205	245	1407	1557	3
	890CD/4/0156F/..	150Hp	180	213	1277	1787	3

Note 1: *Up to the highest supply voltage that maintains shaft power less than the product power rating, for a typical induction motor. Derated for operation above this supply voltage.*

Electrical Ratings: 890CD Frame E, 500V

Power Supply = 380-500V ±10%, 50/60Hz ±5%

Motor power, output current and input current must not be exceeded under steady state operating conditions. Input currents listed at 705V DC (from 500Vac 50Hz) for kW ratings, assuming a 3% line choke is fitted to the 890CS unit.

500V unit full power ratings are only available at 500V. The unit can be operated between 380-500V supply voltage with reduced output power below 500V.

Model Number (Europe)	Catalog Number (North America)	Motor Power	Output Current (A) *(note 1)*	DC Input Current rms (A)	Heatsink Power Loss (W)	Total Power Loss (W)	Maximum Switching Frequency (kHz)
FRAME E :	Prospective short circuit current 65kA.						
Constant Torque (Output Overload Motoring 150% for 60s, 180% for 0.5s short term rating)							
890CD/5/0073E/..	-	37kW	67	66	615	727	3, 6
890CD/5/0087E/..	-	45kW	79	80	722	848	3, 6
Quadratic Torque (Output Overload Motoring 110% for 60s)							
890CD/5/0073E/..	-	45kW	79	82	532	660	3
890CD/5/0087E/..	-	55kW	98	98	627	775	3

Note 1: Up to the highest supply voltage that maintains shaft power less than the product power rating, for a typical induction motor. Derated for operation above this supply voltage.

Electrical Ratings: 890CD Frame F, 500V

Power Supply = 380-500V ±10%, 50/60Hz ±5%

Motor power, output current and input current must not be exceeded under steady state operating conditions. Input currents listed at 705V DC (from 500Vac 50Hz) for kW ratings, assuming a 3% line choke is fitted to the 890CS unit.

500V unit full power ratings are only available at 500V. The unit can be operated between 380-500V supply voltage with reduced output power below 500V.

Model Number (Europe)	Catalog Number (North America)	Motor Power	Output Current (A) *(note 1)*	DC Input Current rms (A)	Heatsink Power Loss (W)	Total Power Loss (W)	Maximum Switching Frequency (kHz)
FRAME F :	Prospective short circuit current 65kA.						
Constant Torque (Output Overload Motoring 150% for 60s, 180% for 0.5s short term rating)							
890CD/5/0105F/..	-	55kW	100	98	645	875	3
890CD/5/0145F/..	-	75kW	125	133	872	1172	3
890CD/5/0156F/..	-	90kW	156	162	1040	1480	3

E

Electrical Ratings: 890CD Frame F, 500V

Power Supply = 380-500V ±10%, 50/60Hz ±5%

Motor power, output current and input current must not be exceeded under steady state operating conditions. Input currents listed at 705V DC (from 500Vac 50Hz) for kW ratings, assuming a 3% line choke is fitted to the 890CS unit.

500V unit full power ratings are only available at 500V. The unit can be operated between 380-500V supply voltage with reduced output power below 500V.

Model Number (Europe)	Catalog Number (North America)	Motor Power	Output Current (A) *(note 1)*	DC Input Current rms (A)	Heatsink Power Loss (W)	Total Power Loss (W)	Maximum Switching Frequency (kHz)
FRAME F :	Prospective short circuit current 65kA.						
Quadratic Torque (Output Overload Motoring 110% for 60s)							
890CD/5/0105F/..		75kW	125	133	824	1124	3
	890CD/5/0105F/..	100Hp	125	133	824	1124	3
890CD/5/0145F/..		90kW	156	162	932	1372	3
	890CD/5/0145F/..	125Hp	156	162	932	1372	3

Note 1: *Up to the highest supply voltage that maintains shaft power less than the product power rating, for a typical induction motor. Derated for operation above this supply voltage.*

E

Electrical Ratings: 890SD Frame E, 400V

Power Supply = 380-460V ±10%, 50/60Hz ±5%

Motor power, output current and input current must not be exceeded under steady state operating conditions.
Input currents listed at 400Vac 50Hz for kW ratings and 460Vac 60Hz for Hp ratings.

Model Number (Europe)	Catalog Number (North America)	Motor Power	Output Current (A) *(note 1)*	AC Input Current (A)	Heatsink Power Loss (W)	Total Power Loss (W)	Maximum Switching Frequency (kHz)	Input Bridge I^2t (A^2s)
FRAME E :	Prospective short circuit current 18kA.							
Constant Torque (Output Overload Motoring 150% for 60s, 180% for 0.5s short term rating)								
890SD/4/0073E/..		37kW	73	81	730	850	3, 6	18000
	890SD/4/0073E/..	50Hp	73	68	730	850	3, 6	18000
890SD/4/0087E/..		45kW	87	95	880	880	3, 6	18000
	890SD/4/0087E/..	60Hp	87	80	880	880	3, 6	18000
Quadratic Torque (Output Overload Motoring 110% for 60s)								
890SD/4/0073E/..		45kW	87	95	901	1029	3	18000
	890SD/4/0073E/..	60Hp	87	80	901	1029	3	18000
890SD/4/0087E/..		55kW	105	110	1094	1242	3	18000
	890SD/4/0087E/..	75Hp	105	95	1094	1242	3	18000

Note 1: Up to the highest supply voltage that maintains shaft power less than the product power rating, for a typical induction motor. Derated for operation above this supply voltage.

Electrical Ratings: 890SD Frame F, 400V

Power Supply = 380-460V ±10%, 50/60Hz ±5%

Motor power, output current and input current must not be exceeded under steady state operating conditions. Input currents listed at 400Vac 50Hz for kW ratings and 460Vac 60Hz for Hp ratings.

Model Number (Europe)	Catalog Number (North America)	Motor Power	Output Current (A) *(note 1)*	AC Input Current (A)	Heatsink Power Loss (W)	Total Power Loss (W)	Maximum Switching Frequency (kHz)	Input Bridge I^2t (A^2s)
FRAME F :	Prospective short circuit current 18kA.							
Constant Torque (Output Overload Motoring 150% for 60s, 180% for 0.5s short term rating)								
890SD/4/0105F/..		55kW	105	114	920	1220	3	100,000
	890SD/4/0105F/..	75Hp	100	99	900	1130	3	100,000
890SD/4/0145F/..		75kW	145	143	1320	1670	3	100,000
	890SD/4/0145F/..	100Hp	130	124	1200	1500	3	100,000
890SD/4/0156F/..		90kW	180	164	1490	1950	3	100,000
	890SD/4/0156F/..	125Hp	156	148	1340	1780	3	100,000
890SD/4/0180F/..		110kW	180	164	1490	1950	3	100,000
	890SD/4/0180F/..	150Hp	180	169	1670	2180	3	100,000

Electrical Ratings: 890SD Frame F, 400V

Power Supply = 380-460V ±10%, 50/60Hz ±5%

Motor power, output current and input current must not be exceeded under steady state operating conditions. Input currents listed at 400Vac 50Hz for kW ratings and 460Vac 60Hz for Hp ratings.

Model Number (Europe)	Catalog Number (North America)	Motor Power	Output Current (A) *(note 1)*	AC Input Current (A)	Heatsink Power Loss (W)	Total Power Loss (W)	Maximum Switching Frequency (kHz)	Input Bridge I^2t (A^2s)
FRAME F :	Prospective short circuit current 18kA.							
Quadratic Torque (Output Overload Motoring 110% for 60s)								
890SD/4/0105F/..		75kW	145	143	1400	1670	3	100,000
	890SD/4/0105F/..	100Hp	125	124	1200	1500	3	100,000
890SD/4/0145F/..		90kW	165	164	1580	1950	3	100,000
	890SD/4/0145F/..	125Hp	156	148	1340	1780	3	100,000
890SD/4/0156F/..		110kW	205	195	1800	1950	3	100,000
	890SD/4/0156F/..	150Hp	180	169	1670	2180	3	100,000
890SD/4/0180F/..		90kW	205	195	1800	1950	3	100,000
	890SD/4/0180F/..	150Hp	180	169	1670	2180	3	100,000

Note 1: Up to the highest supply voltage that maintains shaft power less than the product power rating, for a typical induction motor. Derated for operation above this supply voltage.

Electrical Ratings: 890SD Frame E, 500V

Power Supply = 380-500V ±10%, 50/60Hz ±5%

Motor power, output current and input current must not be exceeded under steady state operating conditions. Input currents listed at 500Vac 50Hz for kW ratings.

500V unit full power ratings are only available at 500V. The unit can be operated between 380-500V supply voltage with reduced output power below 500V.

Model Number (Europe)	Catalog Number (North America)	Motor Power	Output Current (A) *(note 1)*	AC Input Current (A)	Heatsink Power Loss (W)	Total Power Loss (W)	Maximum Switching Frequency (kHz)	Input Bridge I^2t (A^2s)
FRAME E :	Prospective short circuit current 18kA.							
Constant Torque (Output Overload Motoring 150% for 60s, 180% for 0.5s short term rating)								
890SD/5/0073E/..		37kW	67	69	799	911	3, 6	18000
	-							
890SD/5/0087E/..		45kW	79	82	957	1083	3, 6	18000
	-	60Hp	79	82	957	1083	3, 6	18000
Quadratic Torque (Output Overload Motoring 110% for 60s)								
890SD/5/0073E/..		45kW	79	82	766	894	3	18000
	-	60Hp	79	82	766	894	3	18000
890SD/5/0087E/..		55kW	98	98	930	1078	3	18000
	-	75Hp	98	98	930	1078	3	18000

Note 1: Up to the highest supply voltage that maintains shaft power less than the product power rating, for a typical induction motor. Derated for operation above this supply voltage.

Electrical Ratings: 890SD Frame F, 500V

Power Supply = 380-500V ±10%, 50/60Hz ±5%

Motor power, output current and input current must not be exceeded under steady state operating conditions. Input currents listed at 500Vac 50Hz for kW ratings.

500V unit full power ratings are only available at 500V. The unit can be operated between 380-500V supply voltage with reduced output power below 500V.

Model Number (Europe)	Catalog Number (North America)	Motor Power	Output Current (A) *(note 1)*	AC Input Current (A)	Heatsink Power Loss (W)	Total Power Loss (W)	Maximum Switching Frequency (kHz)	Input Bridge I^2t (A^2s)
FRAME F :	Prospective short circuit current 18kA.							
Constant Torque (Output Overload Motoring 150% for 60s, 180% for 0.5s short term rating)								
890SD/5/0105F/..	-	55kW	100	93	900	1130	3	100,000
890SD/5/0145F/..	-	75kW	125	118	1200	1500	3	100,000
890SD/5/0156F/..	-	90kW	156	140	1340	1780	3	100,000

Electrical Ratings: 890SD Frame F, 500V

Power Supply = 380-500V ±10%, 50/60Hz ±5%

Motor power, output current and input current must not be exceeded under steady state operating conditions. Input currents listed at 500Vac 50Hz for kW ratings.

500V unit full power ratings are only available at 500V. The unit can be operated between 380-500V supply voltage with reduced output power below 500V.

Model Number (Europe)	Catalog Number (North America)	Motor Power	Output Current (A) *(note 1)*	AC Input Current (A)	Heatsink Power Loss (W)	Total Power Loss (W)	Maximum Switching Frequency (kHz)	Input Bridge I^2t (A^2s)
FRAME F :	Prospective short circuit current 18kA.							
Quadratic Torque (Output Overload Motoring 110% for 60s)								
890SD/5/0105F/..	-	75kW	125	118	1200	1500	3	100,000
890SD/5/0145F/..	-	90kW	156	140	1340	1780	3	100,000
890SD/5/0156F/..	-	110kW	180	166	1670	2180	3	100,000

Note 1: Up to the highest supply voltage that maintains shaft power less than the product power rating, for a typical induction motor. Derated for operation above this supply voltage.

E

Earthing/Safety Details	
Earthing	Permanent earthing is mandatory on all units. Use a copper protective earth conductor 10mm² minimum cross-section, or install a second conductor in parallel with the protective conductor to a separate protective earth terminal The conductor itself must meet local requirements for a protective earth conductor
Input Supply Details **(TN) and (IT)**	Drives with or without external filters are suitable for use on earth (TN) or non-earth referenced (IT) supplies
Earth Leakage Current	>10mA (all models)

Cabling Requirements for EMC Compliance

	Power Supply Cable	Motor Cable	External AC Supply EMC Filter to Drive Cable	Brake Resistor Cable	Signal/Control Cable
Cable Type (for EMC Compliance)	Unscreened	Screened/ armoured	Screened/ armoured	Screened/ armoured	Screened
Segregation	From all other wiring (clean)	From all other wiring (noisy)			From all other wiring (sensitive)
890xx/x/… Unfiltered Length Limitations	Unlimited	25 meters To achieve EN61800-3 Table 11 I<100 A		25 metres	25 metres
890xx/x/… Length Limitations With External AC Supply EMC Filter	Unlimited	50 metres To achieve EN61800-3 Table 9 restricted distribution	0.3 metres	25 metres	25 metres
Screen to Earth Connection		Both ends	Both ends	Both ends	Drive end only
Output Choke		300 metres maximum			

* Maximum motor cable length under any circumstances

Cooling Fans

The forced-vent cooling for the 890CS, 890CD and 890SD is achieved by 1, or in some cases 2 fans.
All except the Frame F fans are internally-supplied 24V fans.

The Air Flow gives the volume of air venting from the drive.

890CD / 890SD FRAME F:
One single phase fan is provided, supplied from an auxiliary input. There are two voltage variants, either 115V ac or 220Vac. The fan is powered from a single phase supply which uses a capacitor to generate the quadrature phase. Protect the fan using a 3A fuse.

110/120V : 130W, 10µF, Stator - 16Ω

220/240V : 140W, 2.5µF, Stator - 62Ω

890 Product	Frame Size	Drive Voltage Rating (V)	Drive Current Rating (A)	Air Flow (m^3/hr / cfm)
CS	B	208 - 500	32	46 / 27
CS	B	208 - 500	54	46 / 27
CS	D	208 - 500	108	46 / 27
CS	D	208 - 500	108	204 / 120
CS	D	208 - 500	162	46 / 27
CS	D	208 - 500	162	204 / 120
CD/SD	E	All models	All models	272 / 160
CD/SD	F	All models	All models	459 / 270

Analog Output : 890CS

AOUT.

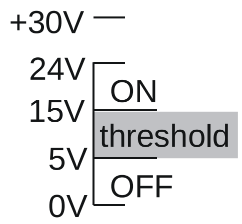
Range	0-10V (no sign)
Resolution	10 bit (1 in 1024)
Dynamic Response	Bandwidth 15Hz
Overload/Short Circuit Protection	10mA maximum

Digital Inputs : 890CS

DIGIN1, ENABLE, AOUT MODE.

Conforming to IEC1131-2.

Nominal Rated Voltage	24V DC
Absolute Maximum Input Voltage	0V to +30V
Input Threshold	9.0V ±2.5V
Sample Rate	10ms
Input Current	7.5mA ±10% @ 24V



Digital Outputs : 890CS

The digital outputs on the 890CS are dedicated outputs.

24V OUT		
Output High Voltage	≥18V, ≤26V On state, output current = 0 to maximum output current	
Maximum Output Current	≥160mA	
Overload/Short Circuit Protection	≥160mA	
PRE-TRIP WARNING (X04-01 & 02)		
Rated Voltage	24V DC SELV	240V AC
Rated Current	4A resistive load at rated voltage	
Update Rate	5ms	
HEALTH (X04-05 & 06)		
Rated Voltage	24V DC SELV	240V AC
Rated Current	4A resistive load at rated voltage	
Update Rate	5ms	

Analog Inputs/Outputs : 890CD & 890SD

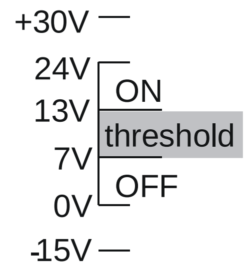
AIN1 - AIN4, AOUT1 - AOUT2

	Inputs	Outputs
Range	0-10V, ±10V, 0-20mA or 4-20mA (range set in software). Absolute maximum input voltage -15V to +30V	0-10V, ±10V (10mA maximum), (range set in software)
Impedance	Voltage range = 47kΩ Current range = 150Ω + series diode	Voltage range = 100Ω
Resolution	12 bit plus sign	12 bit plus sign
Sample Rate	5ms (one selected input can be 1ms)	5ms

Digital Inputs : 890CD & 890SD

DIN1 - DIN9. Conforming to IEC1131-2.

Nominal Rated Voltage	24V DC	
Absolute Maximum Input Voltage	-15V to +30V	
Input Threshold	9.0V ±2.5V	
Input Hysteresis	No	
Sample Rate	1ms	
Input Current	7.3mA ±10% @ 24V	



E

Digital Outputs : 890CD & 890SD There are six digital outputs. Two are current sourcing outputs, DINOUT1 and DINOUT2. The third is a pair of volt-free relay contacts, DOUT3A and DOUT 3B.	
DINOUT1, DINOUT2	
Output High Voltage	≥18V, ≤26V On state, output current = 0 to maximum output current
Maximum Output Current	≥160mA Note: The maximum output is the sum of all 24V sourced outputs, i.e. $i_{DINOUT1} + i_{DINOUT2} + i_{24V\ USER} \leq 160mA$
Overload/Short Circuit Protection	Indefinite
DOUT3A, DOUT3B	
Rated Voltage	24V DC SELV
Rated Current	1A resistive load at rated voltage
Resistance	≤0.05Ω - on state
Isolation Resistance	$>10^{10}\Omega$ - off state
Arc Protection	No
Update Rate	1 ms

Relay Outputs : 890CD & 890SD

There are three pairs of volt-free relay outputs available on Terminal X16. Rated to 230V 3A resistive load.
Alternatively they may be used down to 1mA, 12V levels.

DOUT4, DOUT5, DOUT6	
DOUT4_A DOUT4_B	Normally-open relay contacts. Default function DOUT4 closed = healthy
DOUT5_A DOUT5_B	Normally-open relay contacts. Default function DOUT5 closed = running
DOUT6_A DOUT6_B	Normally-open relay contacts. No default function.

Reference Outputs

There are two reference outputs that provide +10V and -10V. They can be used, for example, to generate -10V to +10V signals via potentiometers for the analog inputs.

Accuracy	±1% Output current = 0 to maximum. Ambient temperature = 0°C to 70°C.
Maximum Output Current	≥10mA
Overload/Short Circuit Protection	Indefinite

User 24V Supply

A supply is provided for powering external equipment or for providing power to the digital inputs.

Terminal X14/03	
Output Voltage	≥18V, ≤28V
Maximum Output Current	≥160mA Note: The maximum output is the sum of all 24V sourced outputs, i.e. $i_{DINOUT1} + i_{DINOUT2} + i_{24V\ USER} \leq 160mA$
Overload/Short Circuit Protection	Indefinite

Auxiliary Power Supply Load Requirements

This tables lists the auxiliary power supply requirements for the 890 units and ancillary equipment, assuming normal operating conditions with maximum SMPS and fan loads.

890CS		
890CS	**Load Requirements**	**Fan Load ***
Frame B	20W	3W
Frame D	24W	10.2W
** The 890CS fan load is additionally supplied from the customer auxiliary SMPS +24V power supply.*		

Auxiliary Power Supply Load Requirements

This tables lists the auxiliary power supply requirements for the 890 units and ancillary equipment, assuming normal operating conditions with maximum SMPS and fan loads.

Item	Load Requirements	Item	Load Requirements
Tech Cards - Speed Feedback			
8902/EQ : HTTL Encoder	8W	8902/E1 : Sin/Cos Encoder	3.3W
8902/RE : Resolver	3.2W		
Tech Cards - Communications			
8903/DN : DeviceNet	1.3W	8903/RS : RS485 (Modbus)	1.3W
8903/FA : Firewire	0.7W	8903/PB : Profibus	2.3W
8903/CN : ControlNet	1.3W	8903/CB : CANOpen	1.3W
Keypads			
6511 Keypad	0.9W	6901 Keypad	1W

Worked Example

To calculate the total requirement for an 890CS Frame D fitted with a 6511 keypad:

Power = 24 + 10.2 (fan load) + 0.9 = 35.1W, Input Current @ +24V = 35.1 / 24 = 1.463A

IMPORTANT

The 890CS unit's internal +24V SMPS has a 3A current limit which is used during start-up.
In a system containing two 890CS units for example, the initial loading will be 2 x 3A for approximately 50ms during start-up, i.e. 6A. Consequently, the customer auxiliary SMPS +24V power supply must be able to over-load for a brief time to accommodate the start-up condition.

E

890CS Wire Sizes

Model Number	Description	Power Input	Power Output		Brake
			Bus Bar Connections	**Wire Connections**	
890CS/5/xxxxx					
890CS/5/xxxxB	**Terminal Capacity** *AWG / mm²*	20 to 4 / 0.5 to 16	10mm by 3mm	20 to 4 / 0.5 to 16	20 to 6 / 0.5 to 10
	Tightening Torque *Nm* Sleeved Lug	 2.0 to 2.3 2.5 to 3.0	 2.0 2.0	 2.0 to 2.3 2.5 to 3.0	 1.2 1.2
890CS/5/0027B	**Wire size** *AWG / mm²*	8 / 10	10mm by 3mm	8 /10	10 / 6.0
890CS/5/0054B	**Wire size** *AWG / mm²*	4 / 25	10mm by 3mm	4 / 25	10 / 6.0
890CS/5/xxxxD	**Terminal Capacity** *AWG / mm²*	4 to 4-0 25/ 95	10mm by 3mm	4 to 4-0 25/ 95	20 to 6 / 0.5 to 10
	Tightening Torque *Nm*	15 to 20	2.0	15 to 20	1.2
890CS/5/0108D	**Wire size** *AWG / mm²*	1-0 / 50	10mm by 3mm	2-0 / 70	3 / 25
890CS/5/0162D	**Wire size** *AWG / mm²*	4-0 / 95	10mm by 3mm	4-0 / 95	1 / 50

890CD/890SD Wire Sizes (Europe)

Wire sizes for Europe should be chosen with respect to the operating conditions and your local National Electrical Safety Installation Requirements. Local wiring regulations always take precedence.

Frame Size	Power Terminals (minimum/maximum acceptance for aperture)		Control Terminals including Thermistor Terminals
	Solid	**Stranded**	
Frame E	16 / 50mm^2	25 / 50mm^2 (* 70mm^2)	2.5 mm^2
Frame F	25/120mm^2	35 / 95mm^2 (*120mm^2)	2.5 mm^2

***Note**: The standard Frame E and Frame F terminals are not intended for flat busbar. A Power Terminal adaptor is available to enable wiring with flat busbar, part number BE465483.*

** The larger wire sizes can be used provided a crimp is fitted to the wire*

Terminal Tightening Torques

Frame Size	Thermistor & fan supply	Power Terminals	Brake Terminals	Ground Terminals
Frame E	0.7Nm (6.1 lb-in)	6-8Nm (53-70 lb-in)	6-8Nm (53-70 lb-in)	6-8Nm (53-70 lb-in)
Frame F	0.7Nm (6.1 lb-in)	15-20Nm (132-177 lb-in)	0.7Nm (6.1 lb-in)	42Nm (375 lb-in)

890CD/890SD Wire Sizes (North America)

North American wire sizes (AWG) are based on NEC/NFPA-70 for ampacities of thermoplastic-insulated (75ºC) copper conductors assuming not more than three current-carrying conductors in raceway or cable, based on ambient temperature of 30ºC. The wire sizes allow for an ampacity of 125% of the rated input and output amperes for motor branch-circuit conductors as specified in NEC/NFPA-70.

Model Number	Power Input AWG	Power Output AWG	Brake Output AWG
FRAME E: Terminal acceptance range: 6-1/0 AWG			
Constant Torque			
890xD/4/0073E/..	4	3	8
890xD/4/0087E/..	3	2	8
Quadratic Torque			
890xD/4/0073E/..	3	2	8
890xD/4/0087E/..	1	1	8
FRAME F: Terminal acceptance range: 2AWG-250kcmil			
Constant Torque			
890xD/4/0105F/..	1	1	8
890xD/4/0145F/..	2/0	2/0	8
890xD/4/0156F/..	3/0	3/0	8
890xD/4/0180F/..	4/0	4/0	8
Quadratic Torque			
890xD/4/0105F/..	2/0	2/0	8
890xD/4/0145F/..	3/0	3/0	8
890xD/4/0156F/..	4/0	4/0	8
890xD/4/0180F/..	4/0	4/0	8

890CS Branch Protection Fuses (North America)

It is recommended that UL Listed (JDDZ) non-renewable cartridge fuses, Class K5 or H;
or UL Listed (JDRX) renewable cartridge fuse, Class H, are installed upstream of the drive.

Model Number	Input Fuse Rating (A)		Model Number	Input Fuse Rating (A)	
	Constant	Quadratic		Constant	Quadratic
208VAC TO 500VAC ±10%					
Frame B			Frame D		
890CS/5/0032B	40	-	890CS/5/0108D	125	-
890CS/5/0054B	60	-	890CS/5/0162D	175	-

890SD Branch Protection Fuses (North America)

c UL US LISTED

It is recommended that UL Listed (JDDZ) non-renewable cartridge fuses, Class K5 or H; or UL Listed (JDRX) renewable cartridge fuse, Class H, are installed upstream of the drive.

Model Number	Input Fuse Rating (A)		Model Number	Input Fuse Rating (A)	
	Constant Torque	Quadratic Torque		Constant Torque	Quadratic Torque
400VAC BUILD VARIANT					
Frame E			Frame F		
890SD/4/0073E	100	110	890SD/4/0105F	125	175
890SD/4/0087E	110	125	890SD/4/0145F	175	200
			890SD/4/0156F	200	225
			890SD/4/0180F	200	225
500VAC BUILD VARIANT					
Frame E			Frame F		
890SD/5/0073E	80	90	890SD/5/0105F	110	150
890SD/5/0087E	90	110	890SD/5/0145F	150	175
			890SD/5/0156F	175	200