

# **690+ Series**

# **AC Drive**

Frame K

## Product Manual

HA465746U001 Issue 2

Compatible with Version 5.5 Software onwards

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# Safety Information



## Requirements

**IMPORTANT:** Please read this information BEFORE installing the equipment.

### Intended Users

This manual is to be made available to all persons who are required to install, configure or service equipment described herein, or any other associated operation.

The information given is intended to highlight safety issues, EMC considerations, and to enable the user to obtain maximum benefit from the equipment.

Complete the following table for future reference detailing how the unit is to be installed and used.

INSTALLATION DETAILS	
Serial Number <i>(see product label)</i>	
Where installed <i>(for your own information)</i>	
Unit used as a: <i>(refer to Certification for the Inverter)</i>	<input type="checkbox"/> Component <input type="checkbox"/> Relevant Apparatus
Unit fitted:	<input type="checkbox"/> Wall-mounted <input type="checkbox"/> Enclosure

### Application Area

The equipment described is intended for industrial motor speed control utilising AC induction or AC synchronous machines.

### Personnel

Installation, operation and maintenance of the equipment should be carried out by qualified personnel. A qualified person is someone who is technically competent and familiar with all safety information and established safety practices; with the installation process, operation and maintenance of this equipment; and with all the hazards involved.

### Product Warnings

	<b>Caution</b> Risk of electric shock		<b>Caution</b> Refer to documentation		<b>Earth/Ground</b> Protective Conductor Terminal
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# Safety Information



## Hazards

### **DANGER! - Ignoring the following may result in injury**

1. This equipment can endanger life by exposure to rotating machinery and high voltages.
2. The equipment must be permanently earthed due to the high earth leakage current, and the drive motor must be connected to an appropriate safety earth.
3. Ensure all incoming supplies are isolated before working on the equipment. Be aware that there may be more than one supply connection to the drive.
4. There may still be dangerous voltages present at power terminals (motor output, supply input phases, DC bus and the brake, where fitted) when the motor is at standstill or is stopped.
5. For measurements use only a meter to IEC 61010 (CAT III or higher). Always begin using the highest range. CAT I and CAT II meters must not be used on this product.
6. Allow at least 5 minutes for the drive's capacitors to discharge to safe voltage levels (<50V). Use the specified meter capable of measuring up to 1000V dc & ac rms to confirm that less than 50V is present between all power terminals and earth.
7. Unless otherwise stated, this product must NOT be dismantled. In the event of a fault the drive must be returned. Refer to "Routine Maintenance and Repair".

### **WARNING! - Ignoring the following may result in injury or damage to equipment**

#### **SAFETY**

Where there is conflict between EMC and Safety requirements, personnel safety shall always take precedence.

- Never perform high voltage resistance checks on the wiring without first disconnecting the drive from the circuit being tested.
- Whilst ensuring ventilation is sufficient, provide guarding and /or additional safety systems to prevent injury or damage to equipment.
- When replacing a drive in an application and before returning to use, it is essential that all user defined parameters for the product's operation are correctly installed.
- All control and signal terminals are SELV, i.e. protected by double insulation. Ensure all external wiring is rated for the highest system voltage.
- Thermal sensors contained within the motor must have at least basic insulation.
- All exposed metalwork in the Inverter is protected by basic insulation and bonded to a safety earth.
- RCDs are not recommended for use with this product but, where their use is mandatory, only Type B RCDs should be used.

#### **EMC**

- In a domestic environment this product may cause radio interference in which case supplementary mitigation measures may be required.
- This equipment contains electrostatic discharge (ESD) sensitive parts. Observe static control precautions when handling, installing and servicing this product.
- This is a product of the restricted sales distribution class according to IEC 61800-3. It is designated as "professional equipment" as defined in EN61000-3-2. Permission of the supply authority shall be obtained before connection to the low voltage supply.

### **CAUTION!**

#### **APPLICATION RISK**

- The specifications, processes and circuitry described herein are for guidance only and may need to be adapted to the user's specific application. We can not guarantee the suitability of the equipment described in this Manual for individual applications.

#### **RISK ASSESSMENT**

Under fault conditions, power loss or unintended operating conditions, the drive may not operate as intended. In particular:

- Stored energy might not discharge to safe levels as quickly as suggested, and can still be present even though the drive appears to be switched off
- The motor's direction of rotation might not be controlled
- The motor speed might not be controlled
- The motor might be energised

A drive is a component within a drive system that may influence its operation or effects under a fault condition. Consideration must be given to:

- Stored energy
- Supply disconnects
- Sequencing logic
- Unintended operation

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# GETTING STARTED

## Introduction



The 690+ Frame K unit comprises a Master drive and either one or two Slave drives connected in parallel. The Master and Slave drives are specially adapted 690+ Frame G, H or J drives which form a power-sharing combination that we call the 690+ Frame K.

The 690+ Series AC Drive is designed for speed control of standard 3-phase induction motors. These larger models are available in a range of ratings for constant torque and quadratic torque applications. This dual mode feature provides a cost effective solution to general industrial applications, as well as the control of pumps and fans.

- The unit can be controlled remotely using configurable analogue and digital inputs and outputs, requiring no optional equipment.
- Controlling the master unit locally using the 6901 Keypad, or remotely using ConfigEd Lite (or other suitable PC programming tool) gives access to parameters, diagnostic messages, trip settings and full application programming. Other features also become available, such as the advanced sensorless vector control scheme which gives high torque, low speed operation; selectable switching frequencies; and a unique Quiet Pattern control system that minimises audible noise from the motor.
- Technology Options can be fitted to the master drive to provide serial communications and closed loop speed control.
- A System Board can be factory-fitted to the master drive. This enables the drive for high end web processing or mini PLC replacement applications.

**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 or Autotune problems may occur if you do.

## 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.

Refer to Chapter 2: “An Overview of the Drive” to check the rating label/product code. Refer to Chapter 7: “Routine Maintenance and Repair” for information on returning damaged goods.

## Packaging and Lifting Details

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### Caution

The packaging is combustible and, if disposed of in this manner incorrectly, may lead to the generation of lethal toxic fumes.

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Save the packaging in case of return. Improper packaging can result in transit damage.

Use a safe and suitable lifting procedure when moving the drive. Never lift the drive by its terminal connections.

Refer to Chapter 2: “An Overview of the Drive” – Component Identification for the lifting eyes locations. Refer to Chapter 3: “Installing the Drive” - Mounting the Drive for unit weights.

Refer to Chapter 3: “Installing the Drive” – Handling the Drive for further information.

## About this Manual

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This manual is intended for use by the installer, user and programmer of the 690+ 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.

Enter the “Model Number” from the rating label into the table at the front of this manual. There is also a column for you to record your application’s parameter settings in the Parameter Specification Table in the Software Product Manual. It is important that you pass these manuals on to any new user of this unit.

## Initial Steps

Use the manuals 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 (Keypad or suitable PC programming tool only)

Know your application:

- install the most appropriate macro
- plan your “block diagram programming”
- enter a password to guard against illicit or accidental changes
- customise the keypad to the application

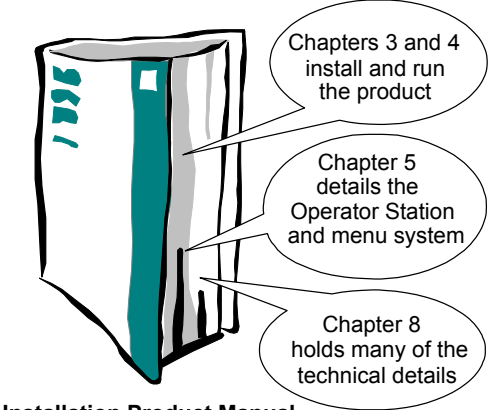
## How the Manual is Organised

The information is arranged in to separate “Installation” and “Software” Product Manuals. The Installation Product Manual is considered to be Volume 1, the Software Product Manual is Volume 2. Each manual is divided into chapters and paragraphs. Page numbering restarts with every chapter, i.e. 5-3 is Chapter 5, page 3.

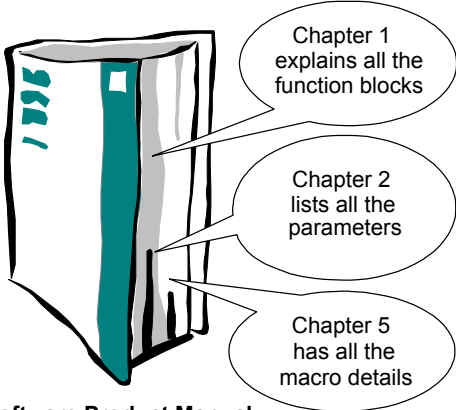
### Application Block Diagrams

You will find the appropriate diagrams at the rear of each manual. The pages unfold to show a complete block diagram, these will become your programming tool as you become more familiar with the 690+ unit’s software.

**Quick-Start Guide**



**Installation Product Manual**



**Software Product Manual**

**Information for Users without a Keypad**

DEFAULT

This symbol identifies important text for users operating the drive using the default (factory) set-up. If the text is italic, *such as this*, then the information is especially for users without the keypad or suitable PC programming tool.

# 1-4 Getting Started



# AN OVERVIEW OF THE DRIVE

## Introduction

The 690+ Frame K unit extends the power output of the 690+ series of drives by connecting 690+ Frame G, H or J drives in parallel. These specially adapted drives form a power-sharing, master-slave relationship. A Master plus one or two slaves can be supported, depending upon the required power output.

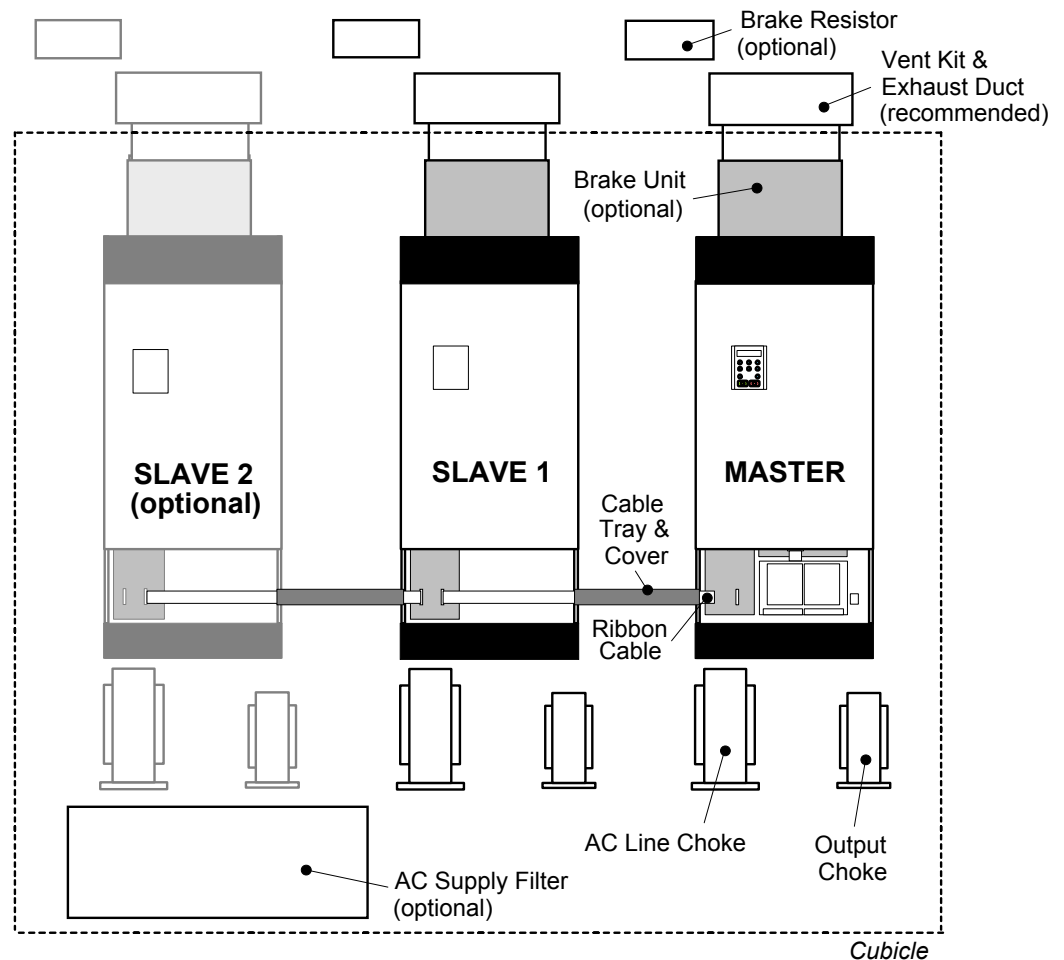


Figure 2-1 Typical Frame K Drive Layout

### Important Points

- Individual drives are connected in parallel to form a Frame K.
- The Master drive must always be the right-hand drive in the cubicle.
- All drives must have the same electrical rating.
- All drives must use an AC Line Choke with the same electrical rating.
- All drives must use an Output Choke with the same electrical rating.
- The ribbon cable must be used to connect between drives.
- The Cable Tray and Cover for the ribbon cable must be fitted.
- If fitted, all drives must use a Brake Resistor with the same electrical rating.



## 2-2 An Overview of the Drive

### **For those familiar with the 690+ Frame G, H & J drives:**

The Master and Slave drives are standard units with the following modifications:

- Master Drive Unit:** Power Control PCB replaced by Master Power Board plus Slave Power Board. Keypad and Technology Box options.
- Slave Drive Unit:** Power Control PCB replaced by Slave Power Board. Power Control PCB removed. Keypad removed and blanking plate fitted. No Technology Box option.

#### **Master Power Board**

The Master Power Board provides the interface between the Control Board and the drive power stacks. It includes the following functions:

- slave detection** *detects the number of connected slave units and scales the current feedback accordingly*
- dead-time compensation:** *adjusts the PWM control signals to minimise the effects of IGBT dead-time on the output current waveforms and maintain stable operation*
- current balance compensation:** *adjusts the slave IGBT turn-on delay to promote current sharing between the individual drive units*
- fault handling:** *combines the fault signals from the individual drive units (over-current, stack fault, over-temperature, heatsink-hot) for processing by the control board*
- overall current protection:** *rapid overall over-current detection and overall output current imbalance (ie. earth fault) detection.*

#### **Slave Power Board**

The Slave Power Board provides the interface between the Master Power Board and the individual drive power stack. It includes the following functions:

- local fault handling:** *rapid local over-current trip for short-circuit protection  
local output current imbalance trip to detect sharing imbalance in one phase  
local over-voltage detection (results in a “STACK TRIP” trip)  
local line phase-loss detection*
- local fault diagnosis:** *fault LEDs to aid in fault diagnosis*
- local DB unit control:** *detects the presence of a DB unit and enables control and trip functions*
- slave-slave interface:** *the slave power PCB provides a ribbon cable header for connection of the control signals to the next slave power unit – the ribbon cable must be correctly installed since the interface contains high speed unprotected control signals*

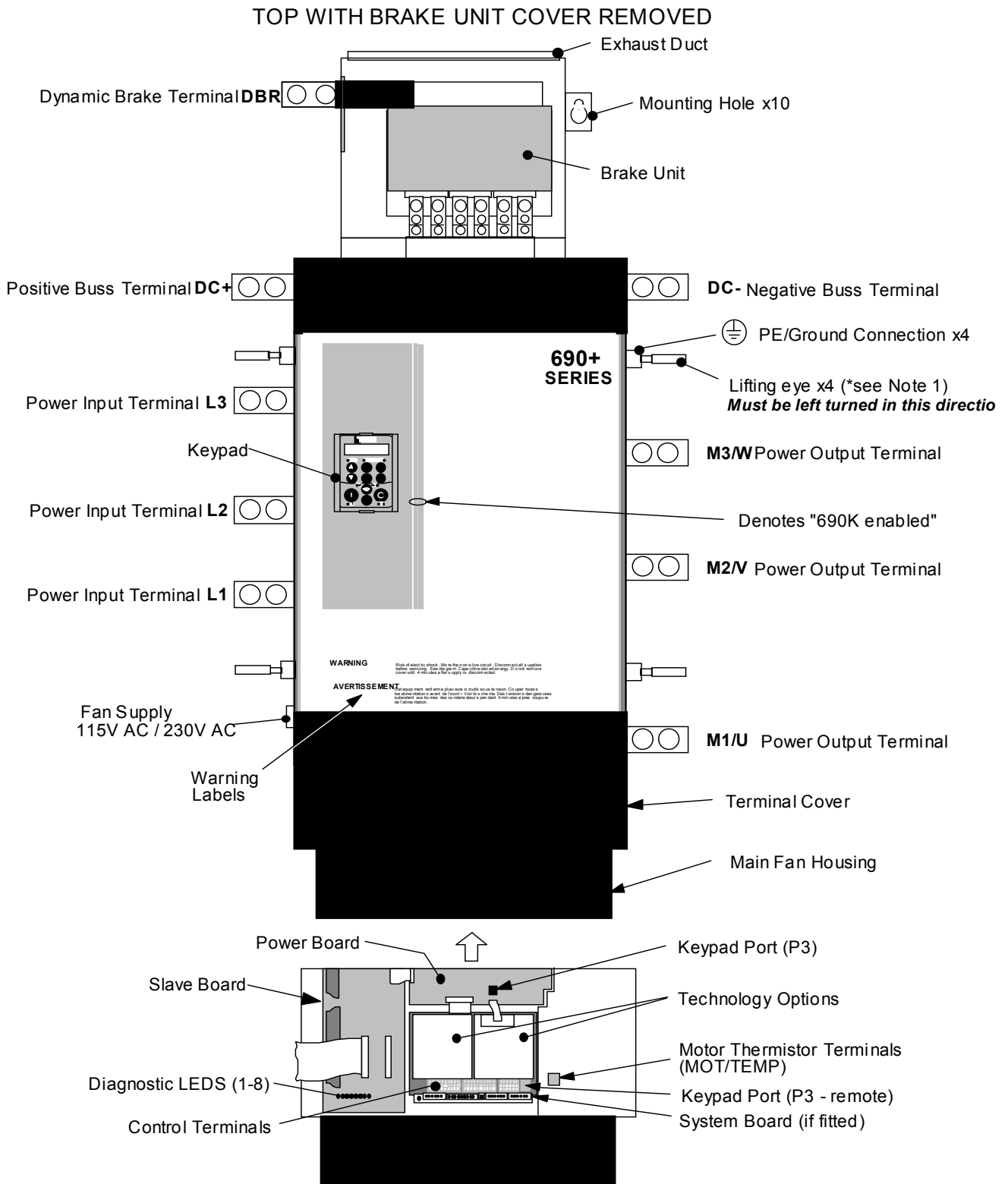
#### **Software**

The software is updated to include stack identification and a new PHASE FAIL trip to protect individual drive input bridges in the event of a blown line fuse.

#### **Hardware**

The drives are mechanically identical to the standard 690+ Frame G, H and J drives.

# Component Identification



**\* Note 1:**  
**PE / Grounding Connections**  
 Lifting eyes must be replaced with supply and motor earth (ground) connections using M10 bolts and washers supplied. Under no circumstances should lifting eyes be used to make the PE / grounding connection.



**Figure 2-2 690+ Frequency Drive – Frame G - Master illustrated**

## 2-4 An Overview of the Drive

### Product Range

Frame Size	Number of Drives	Product Code (Europe)	Product Code (USA)
Frame G	1 Master with 1 or 2 Slaves	690PG-X/1800...	690+G-X/0300...
Frame H	1 Master with 1 or 2 Slaves	690PH-X/2200...	690+H-X/0350...
Frame H	1 Master with 1 or 2 Slaves	690PH-X/2800...	690+H-X/0450...
Frame J	1 Master with 1 or 2 Slaves	690PJ-X/3150...	690+J-X/0500...

**Note:** "-X" in the Product Code is replaced by "-M" for Master, or "-S" for Slave

### A typical UK order for a "1 Master/2 Slave" Frame K drive:

1x	Master Drive	* 690PG-M/1800...
2x	Slave Drive	* 690PG-S/1800...
2x	Ribbon Cable, Tray & Cover	LA468328U001
3x	AC Line Choke	CO389936U402
3x	Output Choke	(Parker SSD Drives can supply)
	Filter(s)	(Parker SSD Drives can supply)
	Brake Resistors	(Parker SSD Drives can supply)

\* The drive Product Code indicates the requirement for Technology Boxes, Comms Board, Brake Option etc.

### Equipment Supplied

The following equipment is supplied as standard with each Frame G, H or J drive:

- 1) Installation and Software Product manuals
- 2) Lifting eyes (4 off) per drive
- 3) Exhaust duct and top vent assembly per drive
- 4) Main cooling fan (Frame J only, per drive)

## Control Features

The drive is fully-featured when controlled using the optional keypad (or a suitable PC programming tool).

DEFAULT

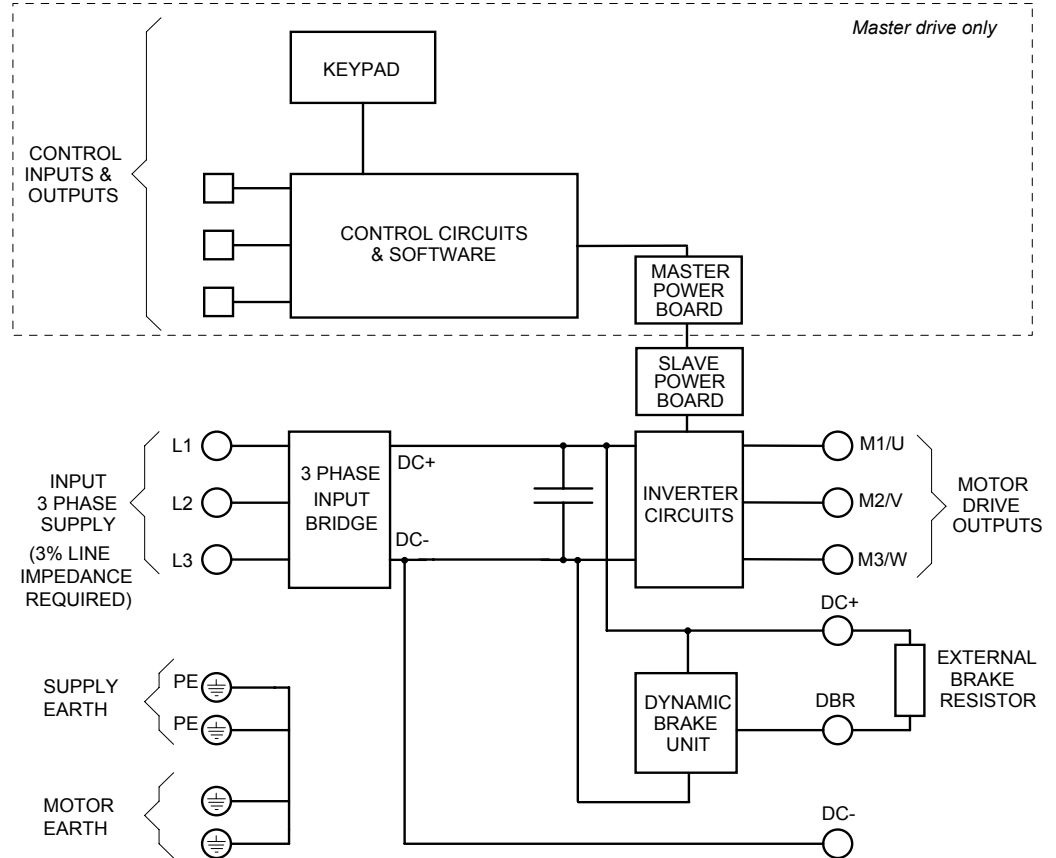
*The 'General' control features below are not user-selectable when the unit is controlled using the analog and digital inputs and outputs.*

<b>General</b>	Output Frequency	Selectable 0-120Hz
	Switching Frequency	Constant Torque : 2kHz Quadratic Torque : 2kHz
	Voltage Boost	0-5% (Fixed or Auto Boost)
	Flux Control	1. V/F control with linear or fan law profile 2. Sensorless vector 3. Closed loop vector (with speed feedback Technology Box)
	Skip Frequencies	4 skip frequencies with adjustable skip band width
	Preset Speeds	8 presets with programmable ramp rates
	Stopping Modes	Ramp, ramp with hold, coast, dc injection, fast stop
	Ramps	Symmetric or asymmetric ramp up and down rates
	Raise/Lower	Programmable MOP function
	Jog	Programmable jog speed
	Logic Functions	10 programmable 3 input logic function blocks performing NOT, AND, NAND, OR, NOR and XOR functions
	Value Functions	10 programmable 3 input value function blocks performing IF, ABS, SWITCH, RATIO, ADD, SUB, RATIO, TRACK/HOLD, and BINARY DECODE functions
	Diagnostics	Full diagnostic and monitoring facilities
<b>Protection</b>	Trip Conditions	Output short line to line, and line to earth Overcurrent > 220% I* <sub>t</sub> overload 50-105% (adjustable) Heatsink overtemperature Motor Thermistor overtemperature Overvoltage and undervoltage
	Current Limit	Adjustable 50%-150% 180% shock load limit
	Voltage/ Frequency Profile	Linear law, Fan Law, User Defined (v5.1 onwards)
	<b>Inputs/ Outputs</b>	Analog Inputs
Analog Outputs		3 configurable outputs - voltage or current
Digital Inputs		7 configurable 24V dc inputs, 1 fixed 24V dc input
Relay/Digital Outputs		3 relay contacts (voltage-free)

**Table 2-1 Control Features**

## Functional Overview

690+ AC Drives are microprocessor based 3-phase drives used to control the speed of standard 3-phase induction motors. An extensive range of configuration options are available to the user. A menu structure controlled using the Keypad allows access to various options and adjustable parameters.



**Figure 2-3 Functional Block Diagram**

The diagram above shows the basic internal arrangement of the drive with the circuitry split between the control circuits, and the power circuits.

### Power Circuits

**IMPORTANT:** An external AC Line Choke is required for each drive, between the supply and L1, L2, L3. Refer to Chapter 8: "Technical Specifications" - AC Line Choke.

The 3-phase supply is connected to terminals L1, L2 and L3, and is rectified to produce the DC link.

### Dynamic Braking

The in-line choke and DC link capacitors, smooth the DC link voltage. During motor deceleration or at other times when the motor acts as a generator, energy flows from the motor into the DC link capacitors and causes the DC link voltage to rise. The drive trips if the DC link voltage rises above the over voltage trip level. If the dynamic braking option is used, each drive must be fitted with an identical drive brake unit. An external brake resistor is switched to be in parallel with the DC link capacitors and absorbs the energy when the DC link voltage rises to the braking level. Voltage detection is performed by the control circuits and the switching is performed by the optional dynamic brake circuit. Refer to Chapter 3: Drive Brake Unit for details of the dynamic braking option.

## Motor Drive Output

**IMPORTANT:** An Output Choke is required for each drive. Refer to Chapter 3: "Installing the Drive" - Output Sharing Choke.

The drive circuits convert the DC link to the 3 phase output used to drive the motor. The GATE DRIVE signals generated by the control circuits control the drive circuits to reproduce the 3-phase MOTOR DRIVE OUTPUTS. The frequency and amplitude are determined by the control inputs and by the parameters set up via the Keypad.

## Control Circuits and Software

Inputs to the master drives' control circuit are provided by physical connections to the control board terminals (identified on the left and right hand edges of the Block Diagram) and by parameters set via the Keypad.

## Processor

The processor provides for a range of analog and digital inputs and outputs, together with their reference supplies. For further details refer to Chapter 8: "Technical Specifications" - Control Terminals.

## Technology Options

These can be fitted to the Master drive only:

### Comms Technology Box

This is a multi-way connector and processor bus interface with control signals allowing various Technology Box protocol options to be fitted to the drive.

### Speed Feedback Technology Box

Provides speed feedback for HTTL encoders.

## Keypad Interface

This is a non-isolated RS232 serial link for communication with the keypad. Alternatively, a PC running Parker SSD Drives' "ConfigEd Lite" Windows-based configuration software (or some other suitable PC programming tool) can be used to graphically program and configure the drive.

### Parameters

Parameters are values or options that are programmed via the Setup Parameters and System menus within the MMI (man-machine interface) structure. These are usually set up during installation and commissioning and are not changed during normal operation.

Number parameters assign a value to a variable, eg. PRESET 1 which determines the motor speed if PRESET 1 is selected.

Logic parameters are used to control switching functions, eg. ADVANCE which controls a software switch that adds counts to the position error calculator.

Refer to Chapter 5 for further information about the Keypad (MMI). The separate Software Product Manual gives details about parameters.

### Diagnostics

Number and logic diagnostics are values and settings that can be displayed via the Diagnostic menu within the MMI. These values are read-only and are provided for the user to determine operating or fault conditions. Refer to Chapter 5: "The Keypad" for further information and descriptions of the diagnostics.

## System Board Interface

The System Board interface hosts the factory-fitted System Board which enhances the 690+ product in to a fully featured systems drive. If supplied, this is fitted to the Master drive.

## 2-8 An Overview of the Drive

# INSTALLING THE DRIVE

**IMPORTANT:** Read Chapter 9: "Certification for the Drive" before installing this unit.

## Mechanical Installation

The Master drive is ALWAYS the right-hand drive in the cubicle.

### Handling the Drive

Prepare a clear, flat surface to receive the drive before attempting to move it. Do not damage any terminal connections when putting the drive down.

**IMPORTANT:** Under no circumstances must the drive be lifted using the power terminals.

The drives are supplied with 4 lifting eye bolts fitted to the 4 PE/grounding locations on the sides of the drive for handling using a hoist.

Frames G and H may be set on end for installation by forklift. Frame J may be placed on forklift blades with care to avoid the fan mounting studs and fan power terminals on the bottom (with the fan removed - the fan is shipped separately from the drive).

### Ventilation

The drive gives off heat in normal operation and must therefore be mounted to allow the free flow of air through the ventilation slots and heatsink. Maintain minimum clearances for ventilation, and ensure that heat generated by other adjacent equipment is not transmitted to the drive. Refer to fold-out drawings HG465731U001, 2 and 3 at the end of this chapter for information to ensure adequate cooling of the drive. Be aware that other equipment may have its own clearance requirements. When mounting two or more 690+ units together, these clearances are additive. Ensure that the mounting surface is normally cool.

### Air Flow

The drives use very large airflows and have been designed with specific airflow patterns within a cabinet. It is generally intended that the bulk of the air comes into the cabinet at the top, flows down (some going through the drive to maintain internal temperatures), into the main cooling fan, through the drive, the brake/exhaust duct (supplied), and finally out the top of the cabinet through vent assembly (supplied).

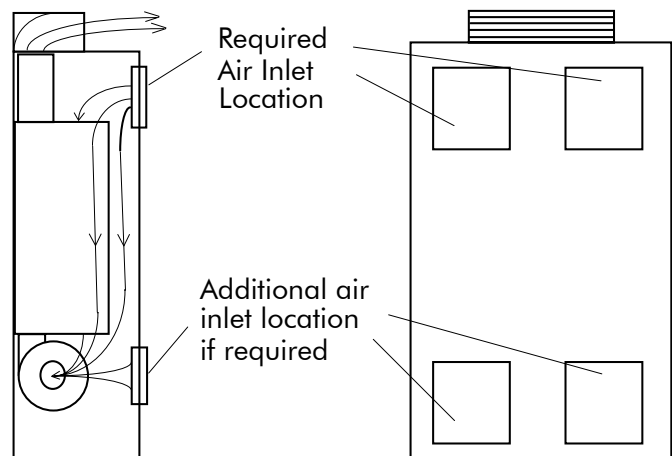
This flow pattern ensures that the top of the cabinet is effectively evacuated and the inside of the drive is cooled by fresh air.

The brake/exhaust duct allows for field installation of a braking module and it gives clearance for inlet air to come from the front of the cabinet into the top of the drive and down; we strongly recommend that this is fitted with the drive whether a brake is fitted or not. It is also important that the top vent is properly fitted to assure that the exhaust air is not recirculated. Refer to the fold-out drawings at the end of this chapter for typical cubicle layout information.

We recommend that these drives are separated from other equipment in a large multifunction cabinet so that the airflow is better controlled. i.e. air heated by other items should not affect the inlet temperature to the drive's main fan.

Take care in placing the cabinet so that there is sufficient space in front of the cabinet to keep the exhaust air and inlet air separated. If there is not sufficient space, redirection of the exhaust air is required.

These drives dissipate substantial heat (refer to Chapter 8: "Technical Specifications" – Electrical Ratings, for Total





## 3-2 Installing the Drive

Power Loss) and therefore sufficient volume for exhaust venting is required to keep the drive from raising the operating temperature beyond that specified in the Environmental Specification.

The volumetric airflow rate for each drive is:

$$\begin{aligned}G &= 583\text{m}^3/\text{hr} \text{ (343CFM)} \\H &= 1505\text{m}^3/\text{hr} \text{ (884CFM)} \\J &= 1753\text{m}^3/\text{hr} \text{ (1032CFM)}.\end{aligned}$$

### Mounting the Drive

**Note:** The 690+ Frame K consists of two or three, identical specification Frame G, H or J drives. It comprises a Master drive with either one or two Slave drives.

**The Master drive is ALWAYS the right-hand drive in the cubicle.**

- The Master Drive can be recognised by “-M” in the Product Code, for example: 690PG-M/... is the Model Number for a Frame G Master drive in Europe.
- A Slave Drive is indicated by “-S”. Refer to the Product Label on the side of the drive.

The drives must be installed inside a cubicle. The cubicle must provide the required security, mounting surfaces and minimum clearances for ventilation.

Mount the drives vertically on a flat surface inside the cubicle with the correct spacing between the drives. Refer to Figure 3-2 Wiring Scheme for 690+ Frame K, page 3-7 for the spacing. The correct spacing is required to fit the Cable Tray(s).

**IMPORTANT:** Bolt the drive securely using all 10 off M8 mounting hole positions as detailed on HG465731U00. Refer to the drawings at the end of this chapter.

For product enclosure ratings, refer to Chapter 8: “Technical Specifications” - Environmental Details.

#### Frame G

<b>Weight</b>	100kg/202lb (108kg/238lb including Dynamic Brake unit)
<b>Dimensions</b>	Refer to drawing HG465731U003

#### Frame H

<b>Weight</b>	125kg/276lb (138kg/304lb including Dynamic Brake unit)
<b>Dimensions</b>	Refer to drawing HG465731U002

#### Frame J

<b>Weight</b>	160kg/353lb (176kg/388lb including Dynamic Brake unit)
<b>Dimensions</b>	Refer to drawing HG465731U001

With the drives securely in position, mount the ancillary equipment for each drive:

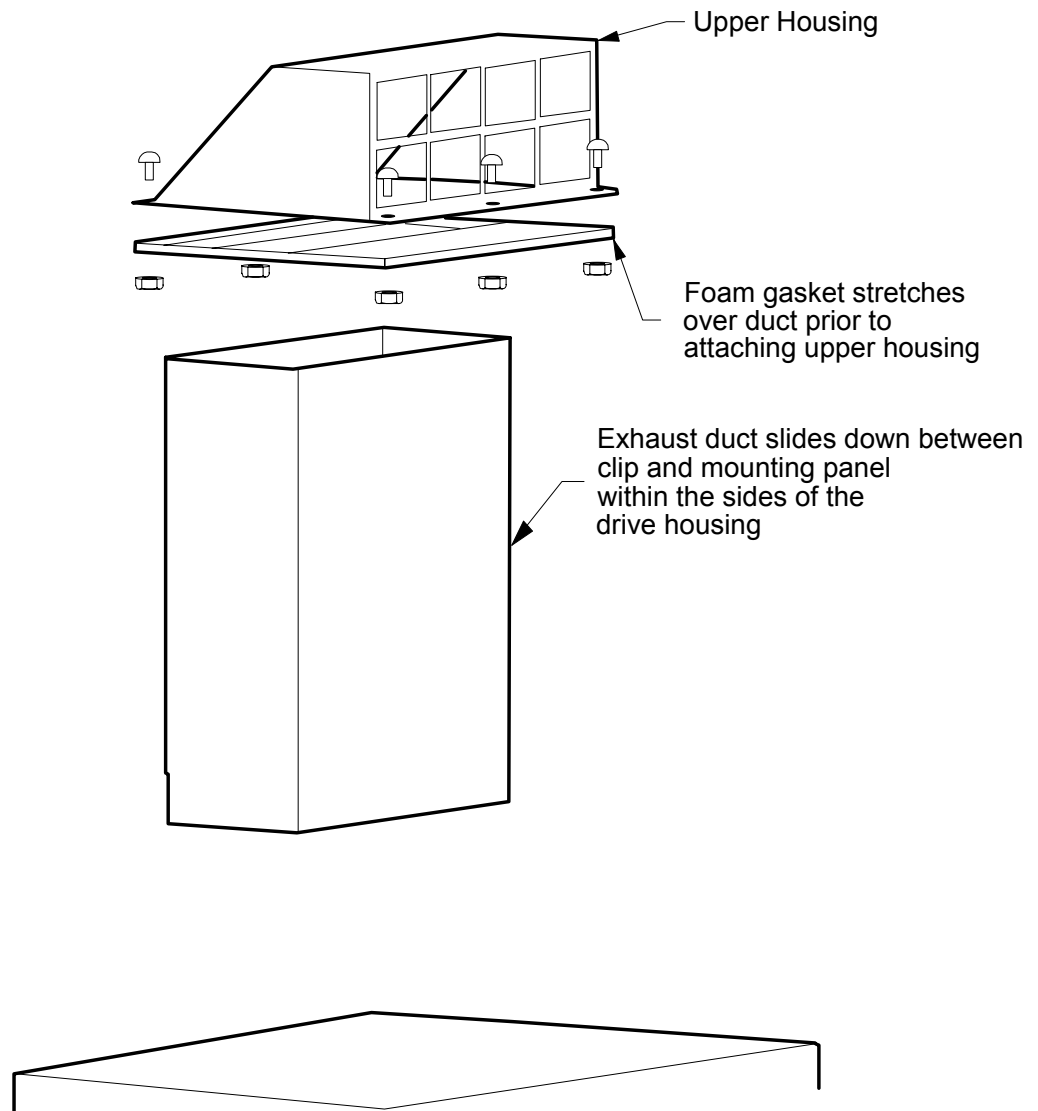
- Dynamic Braking Option, plus a bank of brake resistors (optional). Refer to page 3-22.
- External Vent Kit (recommended even if the Dynamic Braking Option is not fitted). Refer to page 3-3 or page 3-4.
- AC Line Choke and Output Sharing Reactor (mandatory). These must be identical for each drive. Refer to pages 3-5 and 3-14.
- Cable Tray and Cover (mandatory). Refer to page 3-6.
- External AC Supply Filter (optional). Refer to page 3-24.
- Frame J drives: fit the Main Cooling Fan which is supplied separately. Refer to page 3-5.
- For a typical layout refer to Figure 3-2 Wiring Scheme for 690+ Frame K, page 3-7.

## Fitting the External Vent Kit (Frame G)

**Note:** We recommend that the External Vent Kit is fitted to each drive.

Parker SSD Drives Part Numbers: Frame G : LA465720U001

Refer to Drawing HG465731U003 Sheet 2 at the end of this Chapter for top panel and mounting plate hole positions.



## 3-4 Installing the Drive

### Fitting the External Vent Kit (Frames H & J)

**Note:** We recommend that the External Vent Kit is fitted to each drive.

#### WARNING!

This unit must be operated with either a brake unit or blanking plate fitted to the supplied outlet duct. The top vent is then mounted on to the outlet duct. It is very important that the gasket for the vent is correctly fitted to the brake/exhaust outlet duct. Otherwise, hot exhaust air will flow back into the cabinet and overheat the drive. The brake/exhaust outlet duct should protrude from the top of the cabinet by 5-10mm to ensure engagement with the gasket. Refer to fold-out drawings HG465731U001 & HG465731U002 at the end of this chapter.

This assembly provides IP-22 protection for the drive when fitted properly. The main function is to seal the path of return air to the enclosure as well as protect against falling contaminants. The same assembly is used for frame sizes H & J. The different sizes are accommodated by removal of the gasket inserts.

#### Supplied parts:

Qty.	Description
1	Vent top
1	Top Vent Baffle
1	Mounting Flange
1	Gasket
4	M6 support studs
2	M6 x 195 hex studs
1	Grille
8	M6x25 panhead slotted screws
8	M6 flat washers
20	M6 hex captive nuts

#### Tools Required:

M10 wrench, quantity 2  
#3 Phillips or posidrive screwdriver  
10mm (3/8") flat blade screwdriver

#### Assembly Procedure

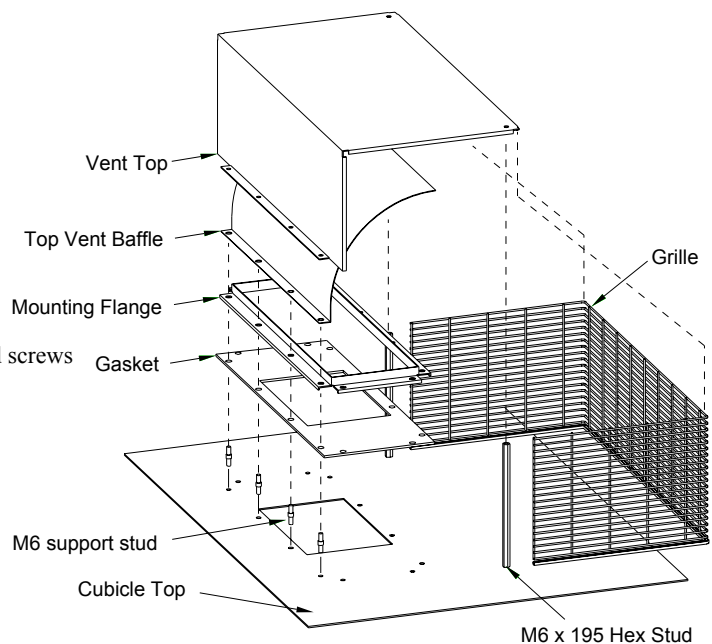
On cabinets with removable panels the following procedure should be performed off the cabinet. For non-removable cabinets this procedure should be performed prior to mounting the drive.

**Note:** If the drive is not removed, then it must be protected from any cutting chips.

1. Cut top of cabinet as per drawing HG465731U001 & HG465731U002 at the end of this chapter.
2. Install (4) M/M support studs in rearmost row of holes in pattern
3. Install (2) F/F M6 x 195 support studs in forward most holes with (2) M6 x 10 posidrive screws

*Complete the following with the drive and exhaust duct fitted to ensure a good fit of the gasket to the duct.*

4. Fit the gasket over the 4 support studs and exhaust duct.
5. Fit the mounting flange over the gasket and attach via (8) M6 x 25 screws, (16) M6 washers, and (8) M6 nuts.
6. Fit the top vent baffle over the support studs.
7. Fit grommet strip to bottom edge of grill and position.
8. Fit vent top over the 4 support studs and grill.
9. Fix vent top via (2) M6 x 10 screws (using a 10 mm wrench on the support studs through the grill is helpful in aligning the stud to the hole in the top) and (4) M6 nuts and washers.



## Fitting the Main Cooling Fan (Frame J)

The Frame G and H drives have an integral main cooling fan. However, the Frame J drive has a separate main cooling fan which must be fitted to the bottom panel of the enclosure as shown in drawing HG465731U001 at the end of this chapter, with the 4 off M6 nuts provided. Refer to drawing HG463151D002 for fan wiring details (Frame J only) in Chapter 7: “Routine Maintenance and Repair” – Fan Replacement.

The drive requires an external single phase supply and fuse protection (motor start type) for the main cooling fan.

	Frame G	Frame H	Frame J
<b>Supply Voltage</b>	110 to 130 VAC, 50/60 Hz		
<b>Fuse Rating</b>	4 A	6 A	10 A
<b>Supply Voltage</b>	220 to 240VAC, 50/60Hz		
<b>Fuse Rating</b>	2A	4A	6A
<b>Airflow Requirement</b>	750m <sup>3</sup> /h (425CFM)	1200m <sup>3</sup> /h (700CFM)	1700m <sup>3</sup> /h (1000CFM)

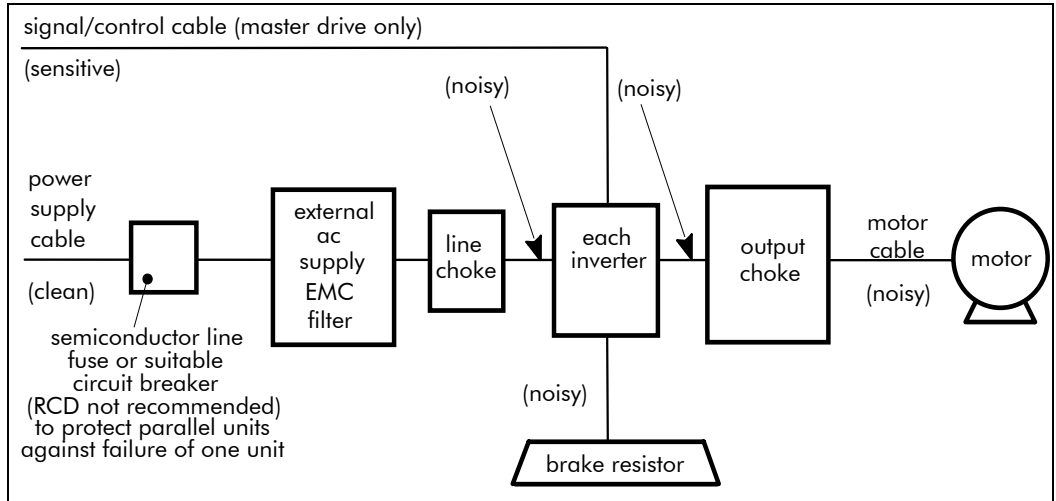
# 3-6 Installing the Drive

## Electrical Installation

**IMPORTANT:** Please read the Safety Information on page Cont. 3 & 4 before proceeding.

**WARNING!**  
Ensure that all wiring is electrically isolated and cannot be made "live" unintentionally by other personnel.

**Note:** Refer to Chapter 8: "Technical Specifications" for additional Cabling Requirements and Terminal Block Wire Sizes.



**Figure 3-1 Cabling Requirements**

Cables are considered to be electrically *sensitive*, *clean* or *noisy*. You should already have planned your cable routes with respect to segregating these cables for EMC compliance. If not, refer to Chapter 9: "Certification for the Drive".

### Removing the Terminal Cover

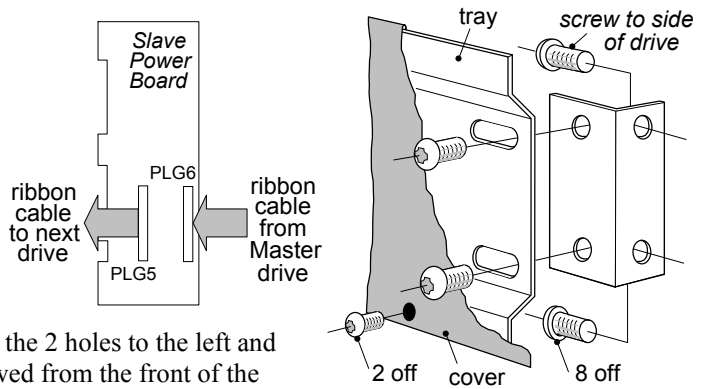
Remove the terminal cover by releasing the 2 captive, quarter-turn fixings at the base of the drive. To replace, engage the tabs at the top of the cover into the drive and secure with the fixings.

### Cable Tray and Cover

The drive control signals are passed to the slave(s) by connecting the 50-way ribbon cable as shown. The ribbon cable sits inside the metal cable tray which provides mechanical protection and electrical screening.

Always fit the cable tray with the 2 holes to the left and the 2 slots to the right, as viewed from the front of the drive.

Remove the break-outs for the cable tray on the sides of the Terminal Cover as required.



Frame	Cable/Tray Assembly
G	LA468328U001
H	LA468328U002
J	LA468328U003

### Wiring Scheme

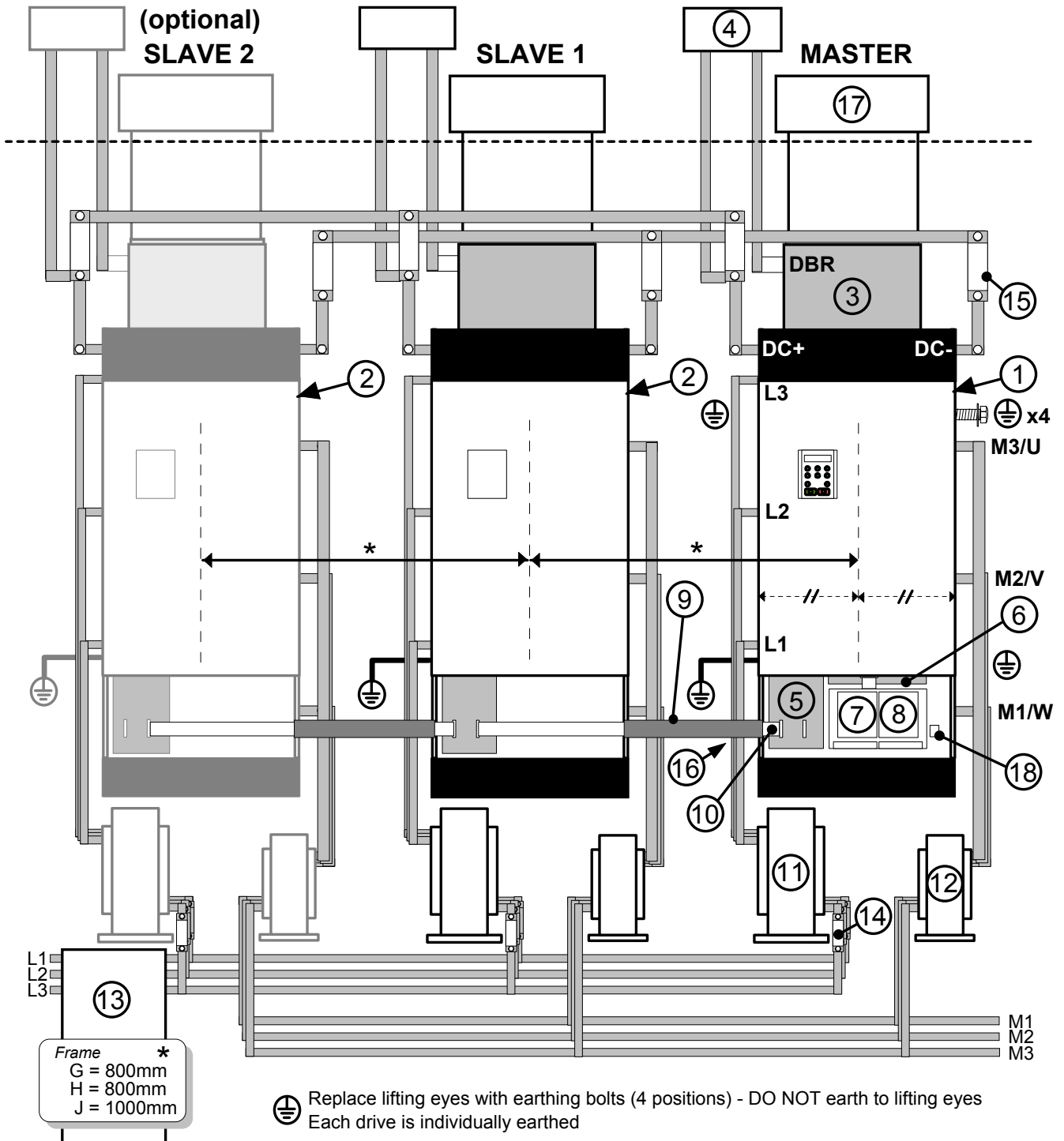



Figure 3-2 Wiring Scheme for 690+ Frame K

1	Master Drive (ALWAYS the right-hand drive)	10	Ribbon Cable
2	Slave Drive (Slave 2 is optional)	11	AC Line Choke (mandatory)
3	Brake Unit (optional - roof/internal mount)	12	Output Choke (mandatory)
4	Brake Resistor (optional)	13	AC Supply Filter (optional)
5	Slave Power Board	14	AC Line Fuse - semiconductor type
6	Master Power Board	15	DC Fuse - semiconductor type
7	Speed Feedback Technology Box (optional)	16	Product Label
8	Comms Technology Box (optional)	17	Vent Kit and Exhaust Duct (recommended)
9	Cable Tray and Cover (mandatory)	18	Motor Thermistor Terminal

## 3-8 Installing the Drive

<b>Connections</b>	
<b>Power Terminations</b>	
L1, L2, L3 M1/W M2/V M3/U	3-phase supply and output terminals Bus-bars with 2 off M12 holes, 25mm separation. 2 off M12 bolt, nut and washer supplied. Tightening torque 97Nm (71.5lb-ft)
	Protective earth terminals - 4 positions 4 off M10 bolts with conical washers - supplied loose. These replace the lifting eyes. Do NOT earth to the lifting eyes. Tightening torque 55Nm (40.5lb-ft)
DC+, DC-	DC link terminals Bus-bars with 2 off M12 holes, 35mm separation. Designed to accept semiconductor fuses directly mounted on terminals (eg. Gould Sawmut A100P). 2 off M12 bolt, nut and washer supplied. Tightening torque 97Nm (71.5lb-ft)
DBR	Dynamic brake terminal Bus-bars with 2 off M12 holes, 44mm separation. 2 off M12 bolt, nut and washer supplied. Tightening torque 97Nm (71.5lb-ft)
<b>Motor Thermistor Terminations (Master drive only)</b>	
MOT/TEMP	Motor Thermistor terminal Tightening torque 0.6/0.8 Nm (0.4/0.5lb-ft)
<b>Control Terminations (Master drive only)</b>	
TB1 TB2 TB3	Removable screw connectors for 0.75mm <sup>2</sup> wire (18 AWG). Terminals will accept up to 1.5mm <sup>2</sup> wire (16 AWG). Tightening torque 0.6Nm (0.4lb-ft)

### Power Terminals

**IMPORTANT:** The drive is only suitable for earth referenced supplies (TN) when fitted with an external ac supply filter.

Each drive must be **permanently earthed**. Protect the incoming mains supply using a suitable fuse or circuit breaker (circuit breaker types RCD, ELCB, GFCI are not recommended). Refer to “External AC Supply Filter”, page 3-24.

The unit must be **permanently earthed** according to EN 50178:

- ◆ A cross-section conductor of at least 10mm<sup>2</sup> is required. This can be achieved either by using a single conductor (PE) or by laying a second conductor through separate terminals (PE2 where provided) and electrically in parallel.

Refer to Chapter 9: “Certification for the Drive” - EMC Installation Options.

Each individual drive connected to the common DC Bus must be protected by DC Link fuses in both the DC+ and DC- lines. Refer to Chapter 8: “Technical Specifications” - DC Link Fuses.

### Motor Thermistor Terminals

(Master drive only).

Used 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

#### MMI Menu Map

1	SETUP
2	TRIPS
3	I/O TRIPS
	INVERT THERMIST

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.

### **DC Link Terminals**

Connect the dc link terminals of the Master and Slave modules. This allows balancing currents to flow between the dc link capacitors. Protect each drive by fitting dc link fuses in both the DC+ and DC- lines. Semiconductor fuses are preferred in order to limit any device failure to one drive. The fuse should be capable of breaking an 800V dc supply.

### **690K Stand-alone Drive**

In a stand-alone 690K drive, the balancing currents are small. The fuse currents given in Chapter 8: “Technical Specifications” - DC Link Fuses allow the use of a smaller wire gauge and have adequate headroom to accommodate transient events.

### **Regen Supply Unit/ Common DC Link Connection**

When a 690K drive is used as a regen supply unit, or is a drive used in a common dc link scheme (i.e, supplied by the dc link terminals) the fuses must be rated for the full dc link current. The rms value of dc link current in this case can be calculated as:

$$I_{DC} = 1.23 \times I_{LINE} \text{ (A rms)}$$

where  $I_{LINE}$  is the rms input current specified in the electrical ratings table in Chapter 8.



# 3-10 Installing the Drive

## Control Terminals

(Master drive only).

**Note:** Use screened control cables to comply with EMC requirements. All screens terminated using a gland at the gland plate.

1. Feed the control cables into the drive through the metal gland plate and connect to the control terminals. The diagram below shows the typical control connections required for operation as a simple speed controller.  
Each bank of cables (1-10, 11-20 and 21-26) **must** be secured together with a cable tie as close to the terminals as possible.
2. Refit and secure the terminal cover using the retaining screws.

**IMPORTANT:** The control board 0V must be connected to protective earth outside of the product to meet EMC and safety requirements.

**Note:** Refer to Chapter 8: "Technical Specifications" for Control Terminal information

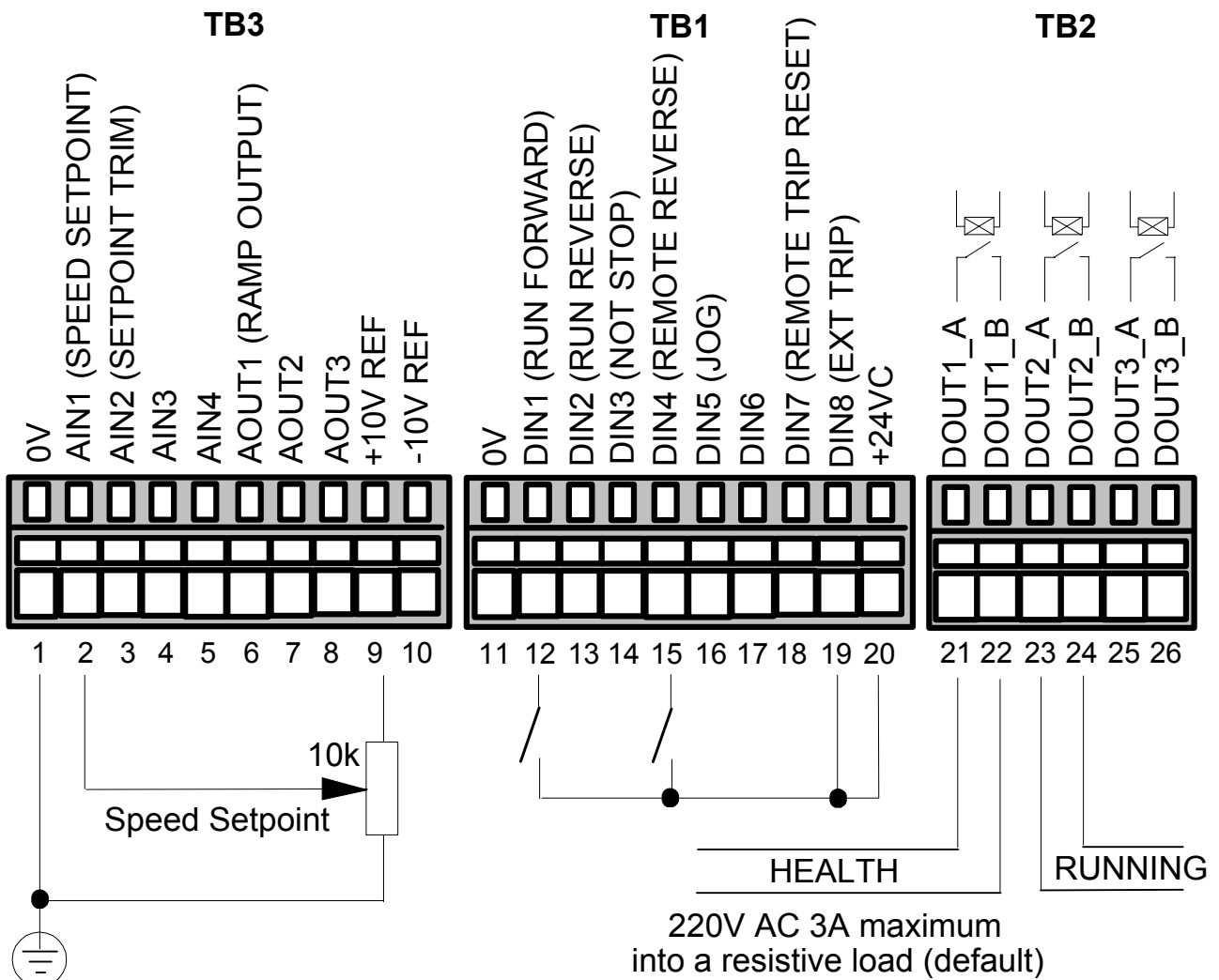


Figure 3-3 Typical Connection to the Control Terminals

## Mandatory Equipment

### AC Line Choke (input)

**IMPORTANT:** Each drive must be used with an AC Line Choke.

**Note:** Refer to Chapter 8: "Technical Specifications" for further information.

#### Caution

Failure to provide the correct line impedance will severely reduce the drives lifetime and could result in catastrophic failure of the drive.

### Rating Guidelines for AC Line Chokes

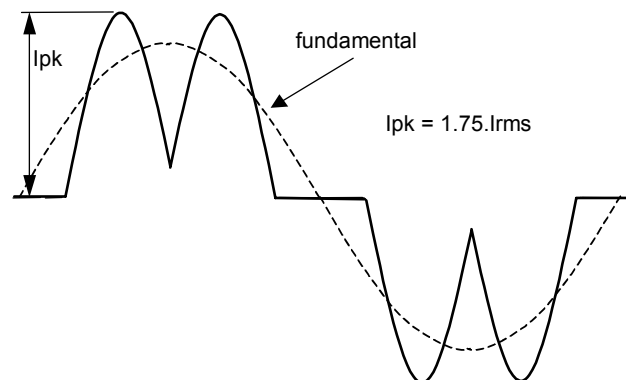
Parker SSD Drives can supply the line chokes listed in Chapter 8: "Technical Specifications" - Line Chokes.

If you wish to source your own line choke refer to the individual Electrical Rating tables in Chapter 8 for the relevant rms line currents. For constant torque applications refer to the AC Line Choke table for the peak instantaneous line current under overload conditions.

Note that the choke thermal design must accommodate the harmonic currents present in the supply waveform. These will vary according to supply impedance, but as a general guideline, the values used in the diagram below can be used.

1. Number of supply phases: 3
2. Frequency of operation: 50 - 60 Hz
3. Choke inductance during overload should be a minimum of 90% of nominal inductance.

#### Typical AC Line Current Waveform

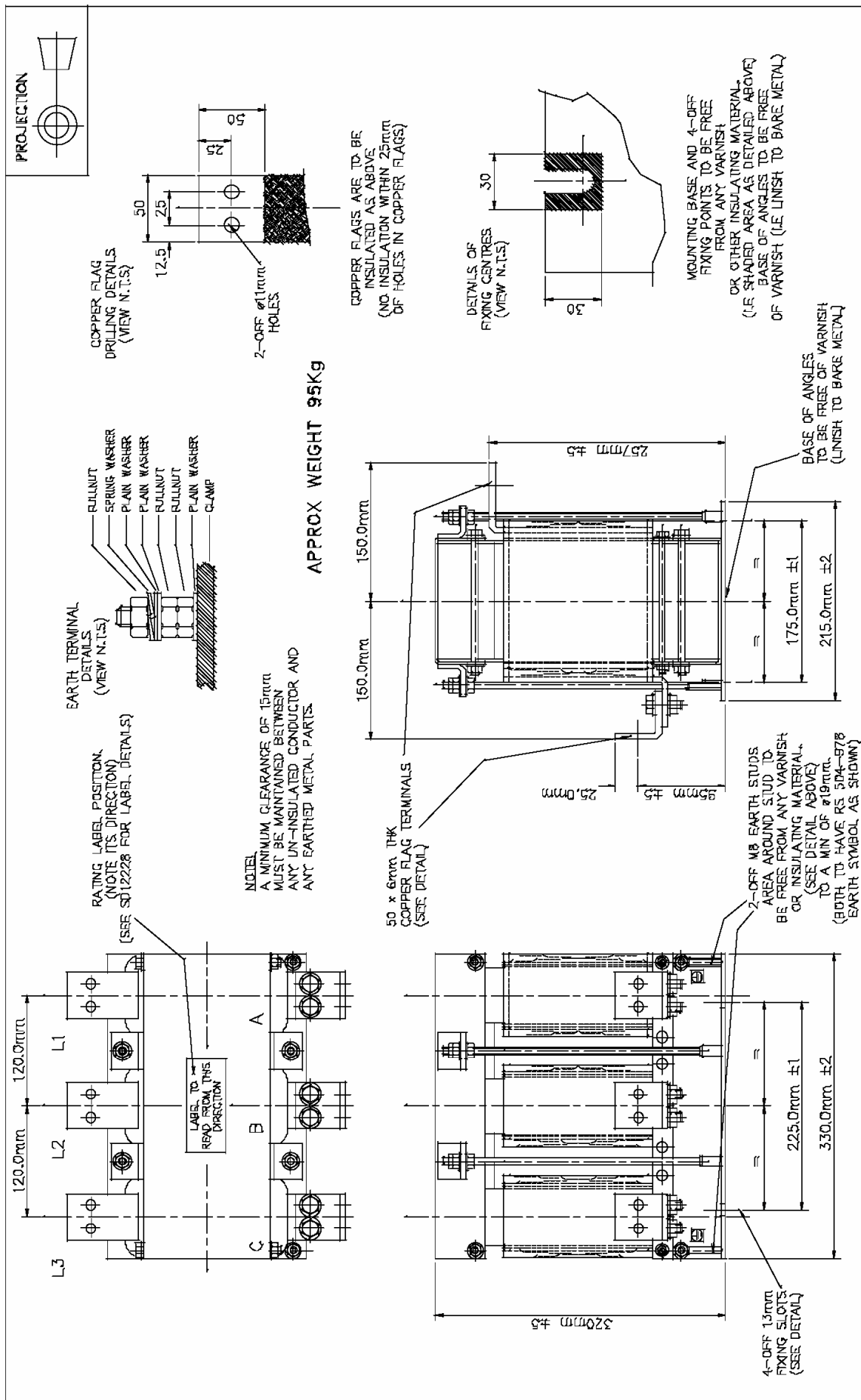


#### Typical AC Line Harmonic Current Content

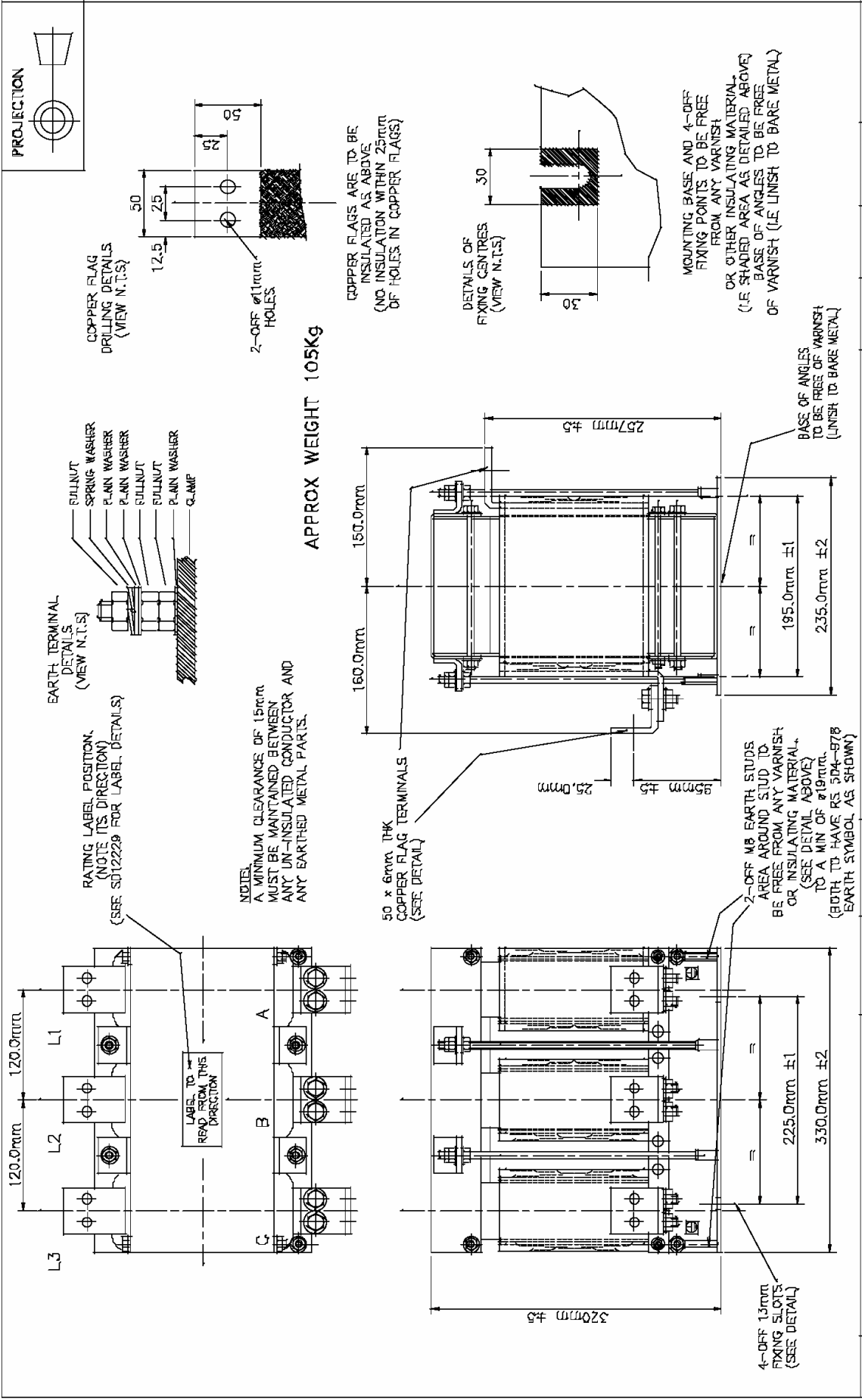
(Refer to Parker SSD Drives for exact information)

fundamental	90%
5th harmonic	40%
7th harmonic	15%
11th harmonic	7%
13th harmonic	3%

# 3-12 Installing the Drive



**480A, 50µH Input Choke Outline Drawing for Frames G & H-220kW - Drawing No. SD12225**  
 (refer to Chapter 8 : "Technical Specifications" - AC Line Choke)



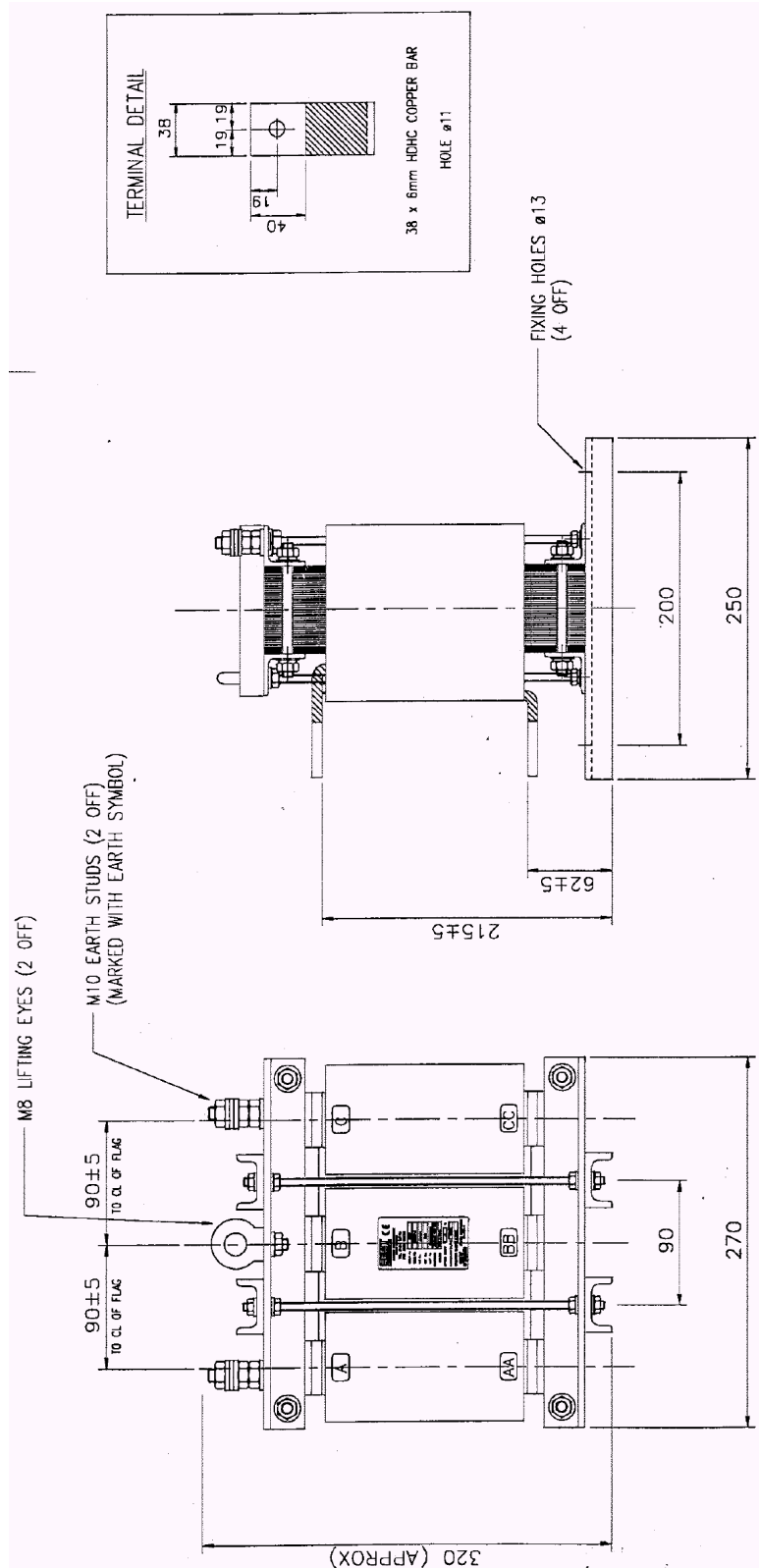
680A, 35µH Input Choke Outline Drawing for Frames H-280kW & J - Drawing No. SD12226 (refer to Chapter 8 : "Technical Specifications" - AC Line Choke)

# 3-14 Installing the Drive

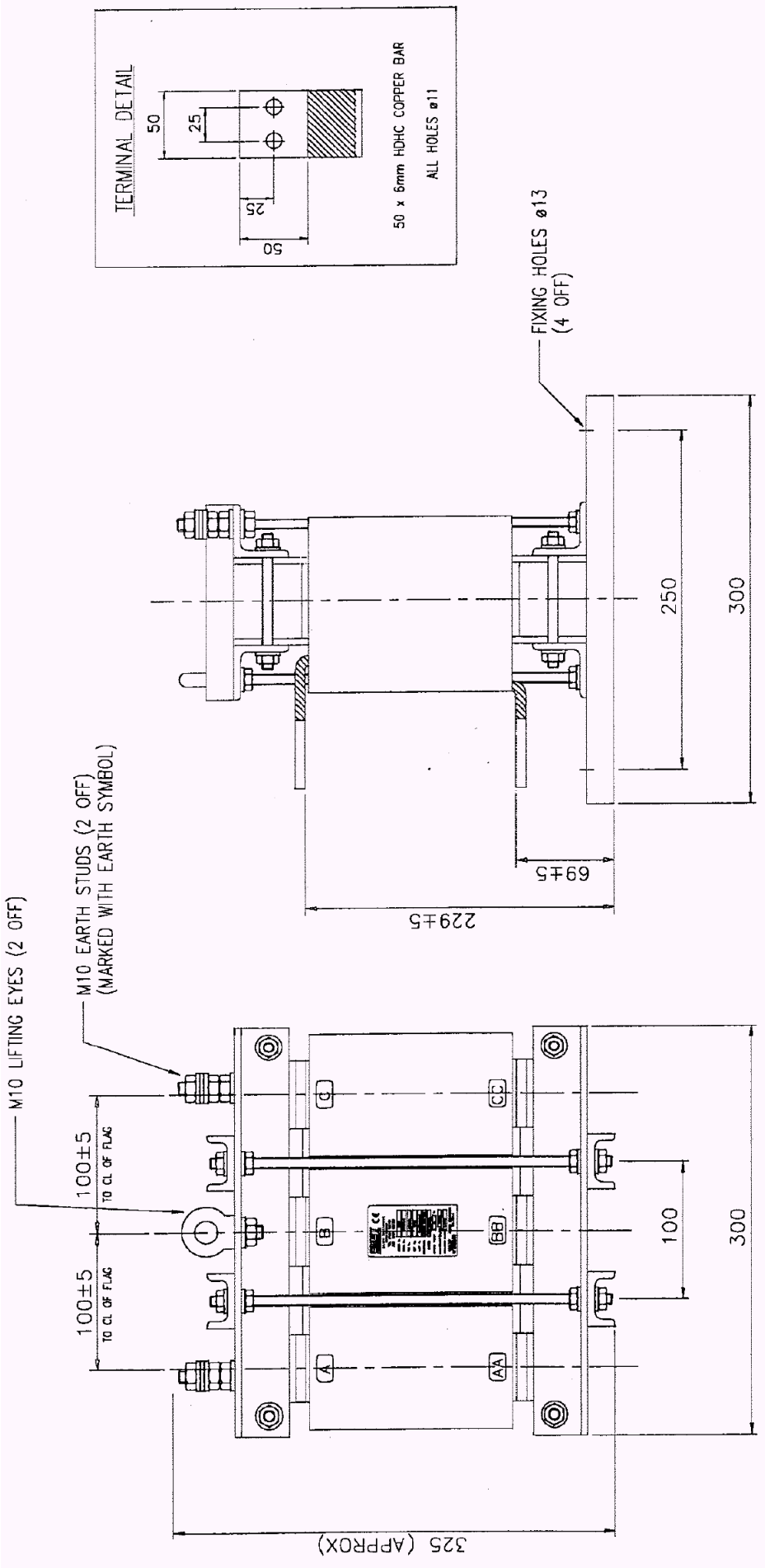
## Output Sharing Choke

The 690K requires an output choke to be fitted to each Master and Slave drive. The following chokes are available from Parker SSD Drives:

Parker SSD Part Number	Frame Size
CO468314U420	G
CO468314U650	H, J



Output Sharing Choke for Frame G - CO468314U420




Output Sharing Choke for Frame H & J - CO468314U650

# 3-16 Installing the Drive

## Rating Guidelines for Output Sharing Chokes

### Requirements

1. Supplier to advise Parker SSD Drives if they are unable to meet any part of this specification.
  2. Supplier is responsible for performing and reporting all testing on these components, (see 4).
  3. All Components purchased will be Installed outside of the AC drive according to EN60204 - "Safety of Machinery. Electrical equipment of Machines"
  4. Design and test evidence should be maintained for a 5 year period from date of last shipment.
  5. Input and Output Terminal Identification :  
Inputs A B C , Outputs AA BB CC..
  6. Earth Stud Terminal Identification : International Grounding Symbol (IEC417 Symbol 5019)  

  7. Manufacturers Rating Label to display the following information :
    - Voltage Rating : (460V)
    - Frequency : (0Hz to 120Hz)
    - Current Rating : a) 420A RMS b) 650A RMS
    - Inductance a) 7.5μH b) 5μH
    - Date Code : \_\_\_\_\_
    - Parker SSD Part number – CO468314U420 (420A 7.5μH) , CO468314U650 (650A 5μH).
  8. Insulation resistance between winding and core @ >500V DC : *Should be >100MΩ*
  9. Heat Output (to be advised to ED Ltd by Manufacturer) if >10Watts : \_\_\_\_\_ Watts
  10. To be suitable for horizontal mounting.
  11. Packaging: Suitable for delivery to Parker SSD Drives Goods In Department without any damage and observing Parker SSD Drives Static Handling Precautions.
  12. Winding to winding and winding to earth must withstand 3kV AC test voltage for 1 minute, to be applied to each choke/transformer.
  13. RMS AC Supply Voltage (Vrms) : - 460 (±10%).
  14. Current Rating
    - Choke a) Continuous current = 420A rms, overload 542A rms for 1 minute no saturation. Peak instantaneous current = 1175A under trip conditions at which point the inductance should be >85% of its' initial inductance.
  
    - Choke b) Continuous current = 650A rms, overload 885A rms for 1 minute no saturation. Peak instantaneous current = 1920A under trip conditions at which point the inductance should be >85% of its' initial inductance.
- Harmonic content : 10% at 2KHz.**
15. Supply Voltage Reference : Suitable for Earth Referenced (TN) and Non-Earth Referenced (IT) Supply Configurations.
  16. Number of Supply Phases : 3
  17. Environment of Pollution Degree : 2 (see IEC 664).
  18. Overvoltage/Installation Category : III (see IEC 664).
  19. Overload Capability: 150% of Irms for 60 seconds 1min in every 10min.
  20. Maximum Ambient Operating Temperature (°C) : 50°C
  21. Maximum Terminal Temperature "Copper conductor" (°C) : 90°C
  22. Inductance +/-5% nominal.

## Conformance Requirements

Component must meet the requirements of the following standards:-

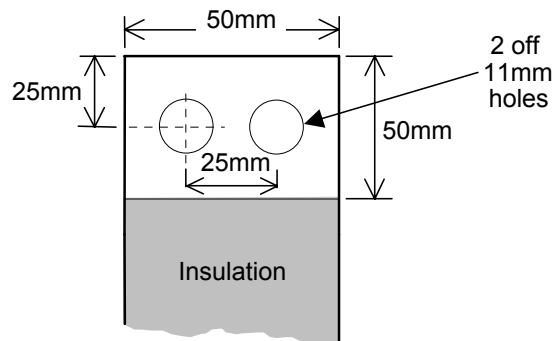
1. UL 506
  2. BS EN 60289
  3. IEC 664
- Design must be CE marked to conform to the Low Voltage Directive by using the appropriate standards listed above. The supplier should maintain design evidence for a period of 5 years from the last shipment.
  - Design to be UL recognised and marked UL recognised.
  - UL506 : Eleventh Edition July 28, 1994 (including Revisions up to October 17, 1997) “Speciality Transformers” - used for all Wound components so they conform to North American Safety Requirements.
  - IEC664-1 : 1992 “Basic Safety Publication” Insulation co-ordination for equipment within low-voltage systems, Principles, requirements and tests should be used to determine Spacings for ALL wound components.
  - BS 171:Part 1:1978 Power transformers , General Specifications for power transformers.
  - A minimum clearance of 15mm must be maintained between any un-insulated conductor and any earthed metal parts.
  - Two off earth studs required on opposite side to input/output leads. The area around the earth stud must be free from any varnish or insulating material to a minimum diameter of 19mm.
  - Plastics / Flammable Materials UL Rating : Must be Flame Retardant - UL94V-O min
  - IP Rating IP00.

## Mechanical

Copper flags – no insulation within 25mm of holes in copper.

Fixing/mounting points – Four off 13mm slots to be free from any varnish or insulating material 30mm x 30mm.

Input output leads – 2 x 11mm holes per lead.



**Preferred Lead-Out**

Any alternative lead out must be approved by Parker SSD Drives.

The following are to be advised to Parker SSD Drives by the Component Manufacturer :

Weight (In Kg) : \_\_\_\_\_.

Dimensions (in mm) : Length (L) : \_\_\_\_\_ Width (W) : \_\_\_\_\_ Height (H) : \_\_\_\_\_.

Mounting Requirement : Horizontal : \_\_\_\_\_ Vertical : \_\_\_\_\_ Foot Mounting : \_\_\_\_\_.

Other : \_\_\_\_\_.



# 3-18 Installing the Drive

## Optional Equipment

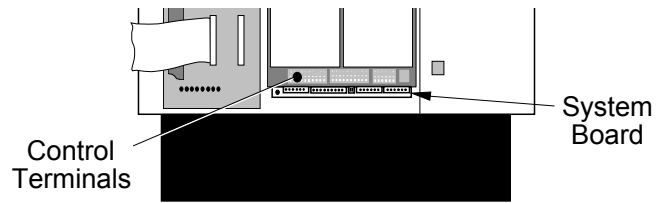
### System Board

(Master drive only).

With this factory-fitted expansion board, the 690+ drive is suitable for high-end web processing and mini PLC replacement applications.

The following features are provided:

- Converts AIN1-4 in to high resolution (12-bit plus sign) non-isolated analog inputs
- 5 configurable fully-isolated digital inputs/outputs (for PLC applications), individually selectable to input or output
- Supplies variable voltage, isolated encoder power supply
- Decoding logic to interface the encoder to the microprocessor
- Master Encoder Input (isolated HTTL), A, B and Z
- Slave Encoder Input (isolated HTTL), A, B and Z
- Encoder Re-Transmit (isolated HTTL), A, B and Z



BOTTOM WITH TERMINAL COVER REMOVED

### External Power Supply

An external 0V and 24V dc ( $\pm 10\%$ ) 1A power supply is required for the board to operate and supply the digital I/O and encoder power supply at maximum loading.

### Encoder Input Specification

Maximum Pulse Rate	250kHz
Receiver Current	$\leq 10\text{mA}$ per channel
Input Format	Two differential channels in quadrature
Differential Input Threshold	$3\text{V} \pm 1$
Encoder Supply	Maximum load = 200mA. Voltage adjustable 12-24V by switches SW1 & SW2

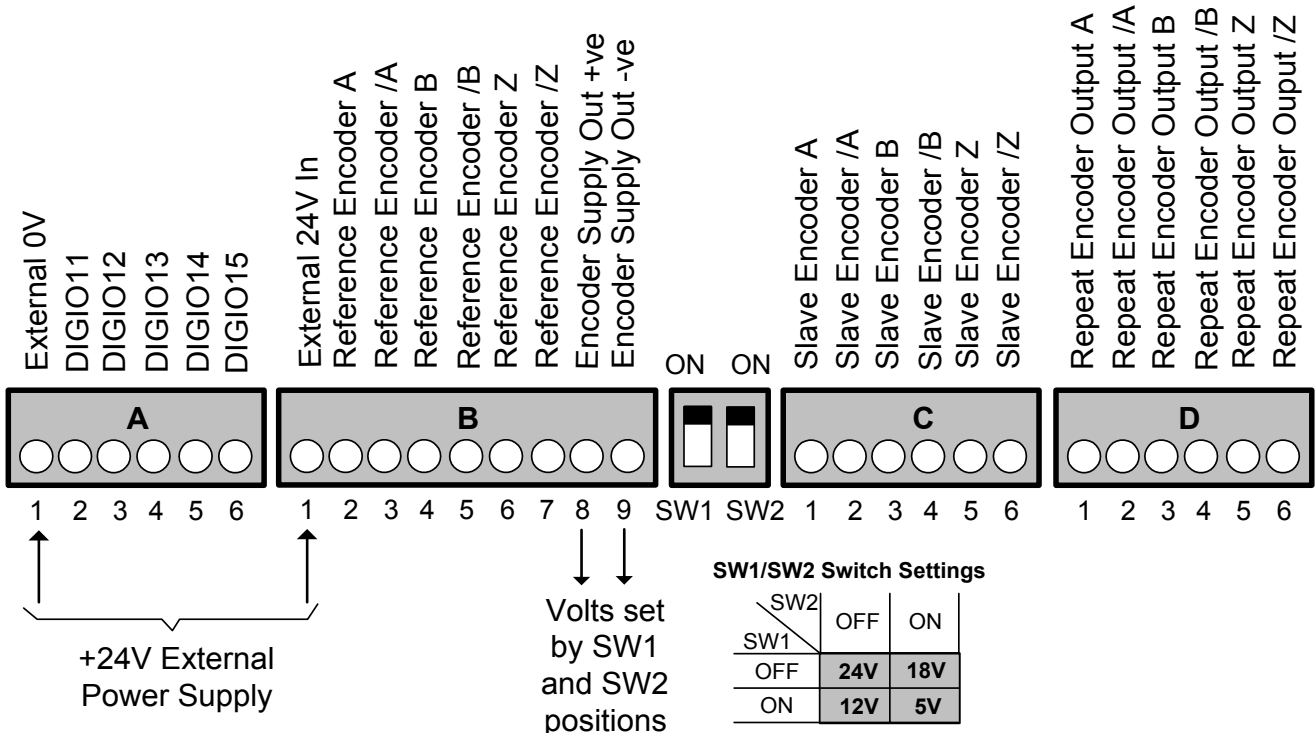


Figure 3-4 System Board Terminals

## Encoder Connections

(Master drive only).

Take special care wiring the encoders to the system board due to the low level of the signals.

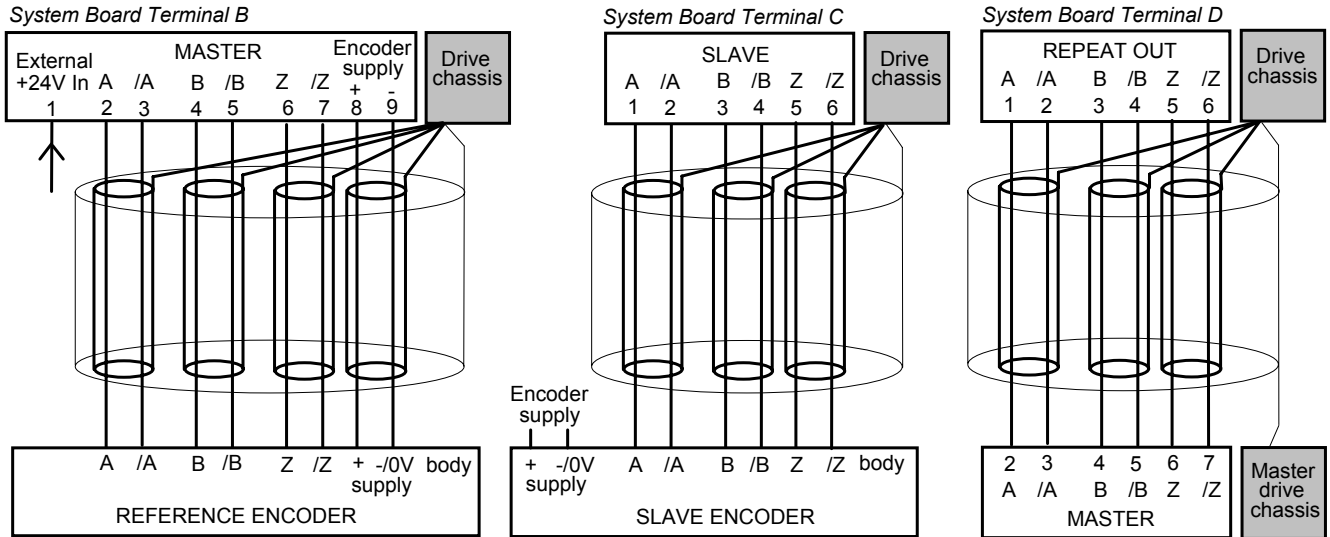
All wiring to the system board should be made in screened cable. Use cable with an overall screen and a screen over each individual pair. To ensure compliance with the EMC Directive the overall cable screen should be connected to the encoder body and to the drive chassis.

*Recommended cable (pairs individually screened):*

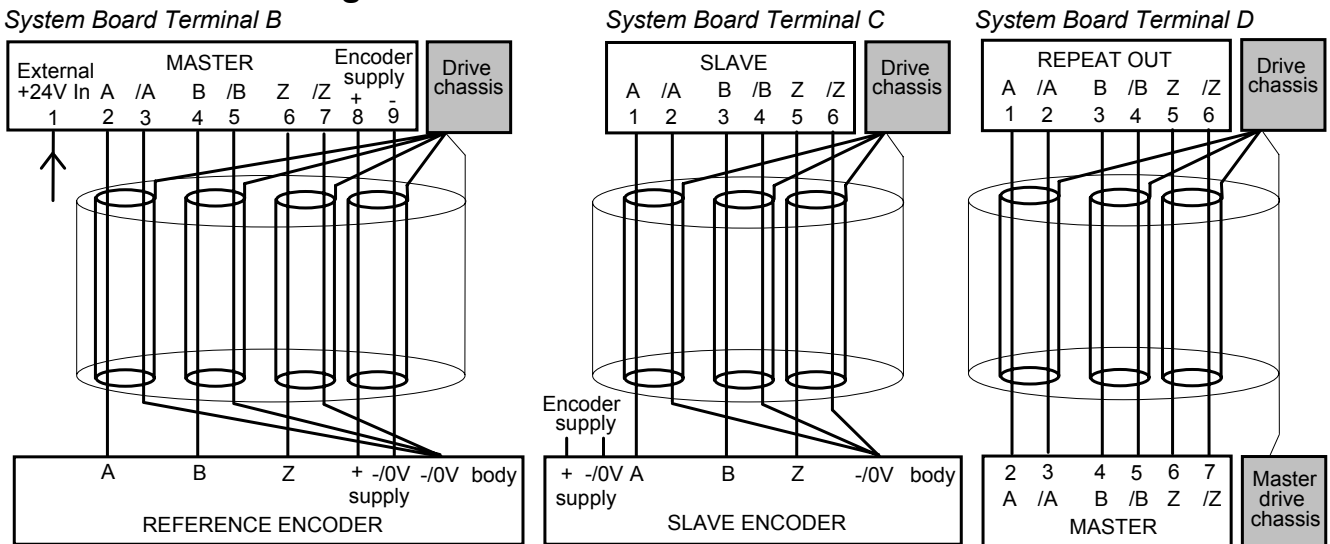
Belden equivalent 8777

Parker SSD Drives Part Number CM052666

### Differential Encoders



### Single-Ended Encoders



### Parker SSD Drives Approved Encoders

(Master drive only).

Operation with 5V encoders is not recommended. We recommend using 10-24V differential encoders, as shown below.

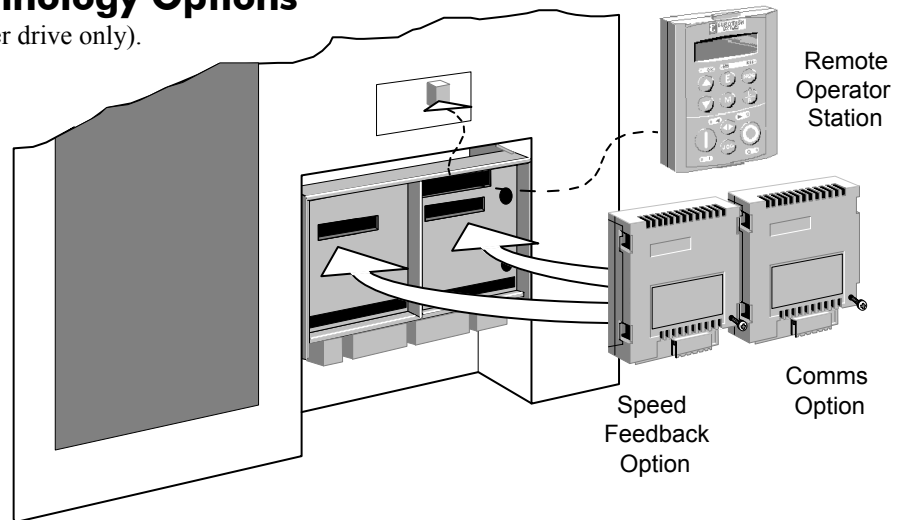
Recommended Encoder (12mm bore)	Hengstler: ParkerSSD Drives Part Number:	RI 58TD//2048ED.37IF DD464475U012
Alternative Encoders (20mm bore)	Hengstler: Parker SSD Drives Part Number:	RI 76TD/2048ED-4N20IF DD464475U020

Encoders are available from Hengstler in other accuracies such as 500 lines/rev or 2000 lines/rev to suit the application.

# 3-20 Installing the Drive

## Technology Options

(Master drive only).



### WARNING!

Isolate the drive before fitting or removing the option.

There are two Technology Options:

1. Speed Feedback
2. Communications

These are plugged into the two positions, as illustrated above.

All Technology Options are designed as plug-in technology boxes. You can operate the drive with the Speed Feedback and/or Communications Technology Options, but you **cannot** use two options of the same kind.

**Note:** Refer to the appropriate Technology Option Technical Manual for further information.

## Technology Box

Remove a technology box option by carefully pushing a long screwdriver (for instance) under the option and gently prising it out. The pins are protected by the option moulding.



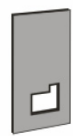

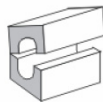

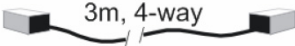
Item	Part No: Frames G, H, J
<b>TB1 Comms Technology Option</b> <i>Plug-in field bus communications interface options.</i> Profibus Profibus Technology Option manual RS485/RS422/Modbus/EI Bisynch RS485 Technology Option manual Link Link Technology Option manual Device Net Device Net Technology Option Manual CANopen CANopen Technology Option Manual Modbus Plus Modbus Plus Technology Option Manual ControlNet ControlNet Technology Option Manual LonWorks LonWorks Technology Option Manual	6055/PROF HA463561U001 6055/EI00 HA463560U001 6055/LINK HA470237 6055/DNET HA463575U001 6055/CAN HA467800U001 6055/MBP HA468032U001 6055/CNET HA468029U001 6055/LON HA468031U001
<b>TB2 Speed Feedback Technology Option</b> <i>Plug-in speed feedback HTTL Encoder option.</i> Technology Box (Frames C, D, E, F, G, H, J)	6054/HTTL

**Fitting the Remote 6901/6911 Keypad**

(Master drive only). The 6052 Mounting Kit is required to remote-mount a 6901 keypad.

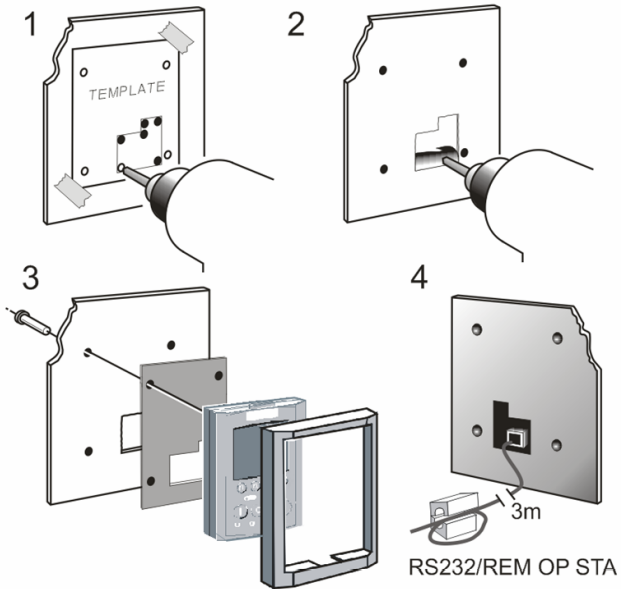
You can also replace the keypad for a PC running ConfigEd Lite (or other suitable PC programming tool) in all of the options above. Refer to the Software Product Manual, Chapter 3: “Serial Communications”.

**6052 Mounting Kit Parts for the Remote Keypad**

6052 Mounting Kit			
1		1	
		1	 Steward 28A2025-OAO
4	 No. 6 x 12mm	1	 3m, 4-way

**Assembly Procedure**

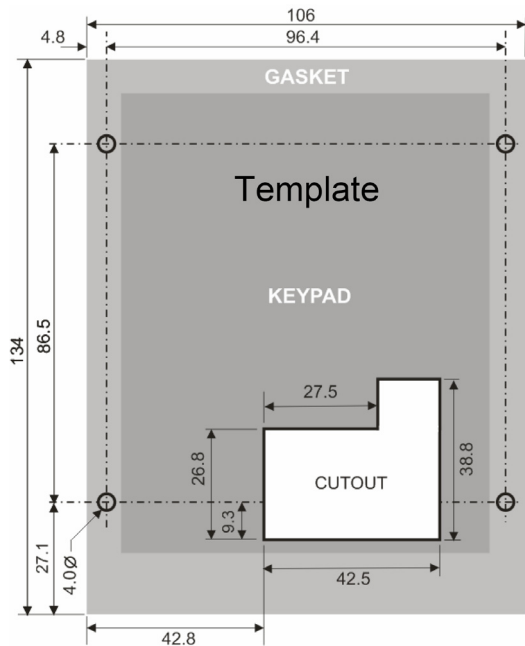
Remove the factory-fitted P3 lead from the P3 port under the terminal cover which connects the fitted keypad. Fit the ferrite to one end of the 3m connector lead, passing the cable through the ferrite twice as shown below. Plug the 3m connector lead from the remote-mounted keypad into the P3 port (see the diagram on the previous page) ensuring that the ferrite is at the drive end of the lead and is as close to the drive as possible.



**Cutout Dimensions**

An actual size template is provided with Keypad/6052 Mounting Kit.

**Figure 3-5 Mounting Dimensions for the Remote-Mounted Keypad 6901/6911**



## 3-22 Installing the Drive

### Dynamic Braking Option

**IMPORTANT:** To fit the Brake Option to the Frame K, each drive (Frame G, H or J) must be fitted with a brake unit and brake resistors. The braking load is shared between the individual brake units.

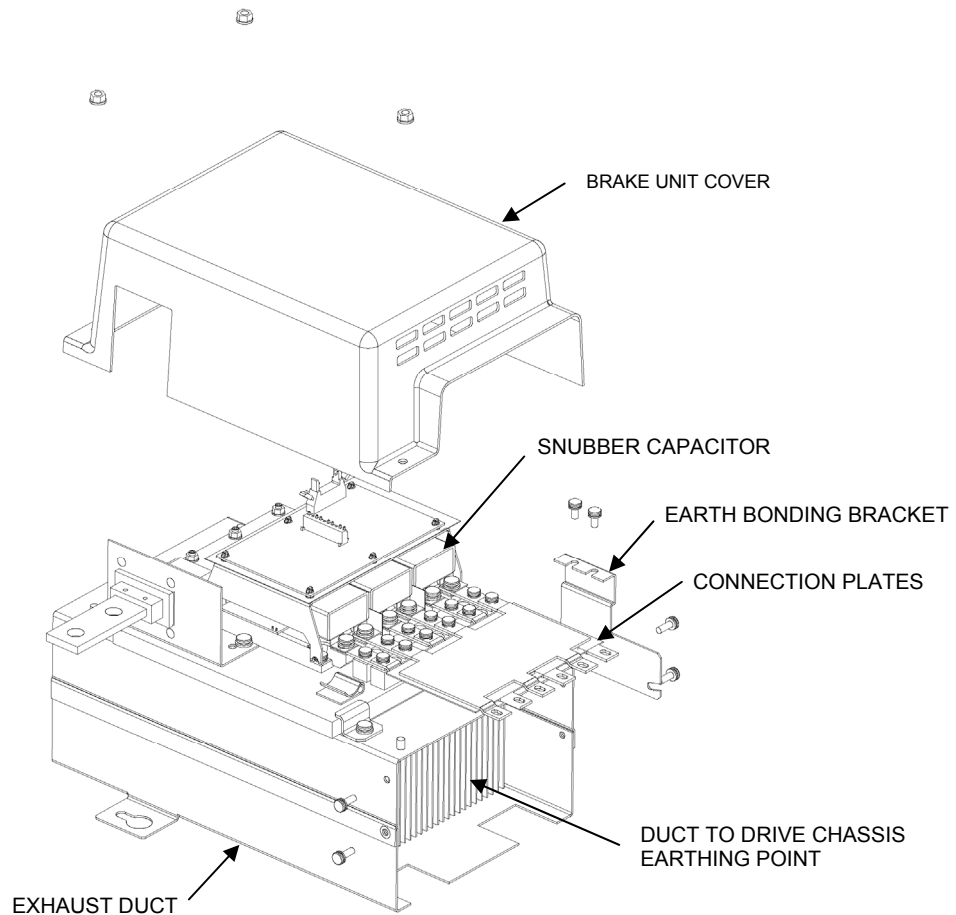
**Note:** Refer to Chapter 8: "Technical Specifications" - Internal Dynamic Brake Switch for further details.

The brake unit is optional. However, it is possible to retro-fit a brake unit should the need arise. There are three brake units, one for each drive frame size.

The brake units have the following specification -

Operating voltage:	750 - 820V dc
Maximum duty cycle:	30%
Maximum on time:	20 seconds
Continuous duty:	30% of Constant Torque drive rating

**Note:** For more detail refer to Chapter 8: "Technical Specifications".



The original exhaust duct supplied with the drive or the exhaust duct supplied with the brake unit may be used in the final installation.

The brake unit consists of the following parts:

- Exhaust Duct.
- Heatsink & IGBT assembly.
- Control cable.
- Brake connection plates - 1 set for Frames G, H & J.
- Heatsink fixings.
- Brake unit cover and retaining nuts.
- Earth bonding bracket.

The brake unit is shipped in a pre-assembled state (except for the connection plate(s)). It is recommended that this assembly is carefully studied prior to installation within the cubicle. We also recommend that the brake unit heatsink/IGBT assembly is removed from the exhaust duct before installing the unit within the cubicle.

**Required tools**

- M10 spanner
- #3 posidrive or phillips torque screwdriver
- #2 posidrive or phillips torque screwdriver

**Installation Procedure****WARNING!**

Follow the procedure carefully.

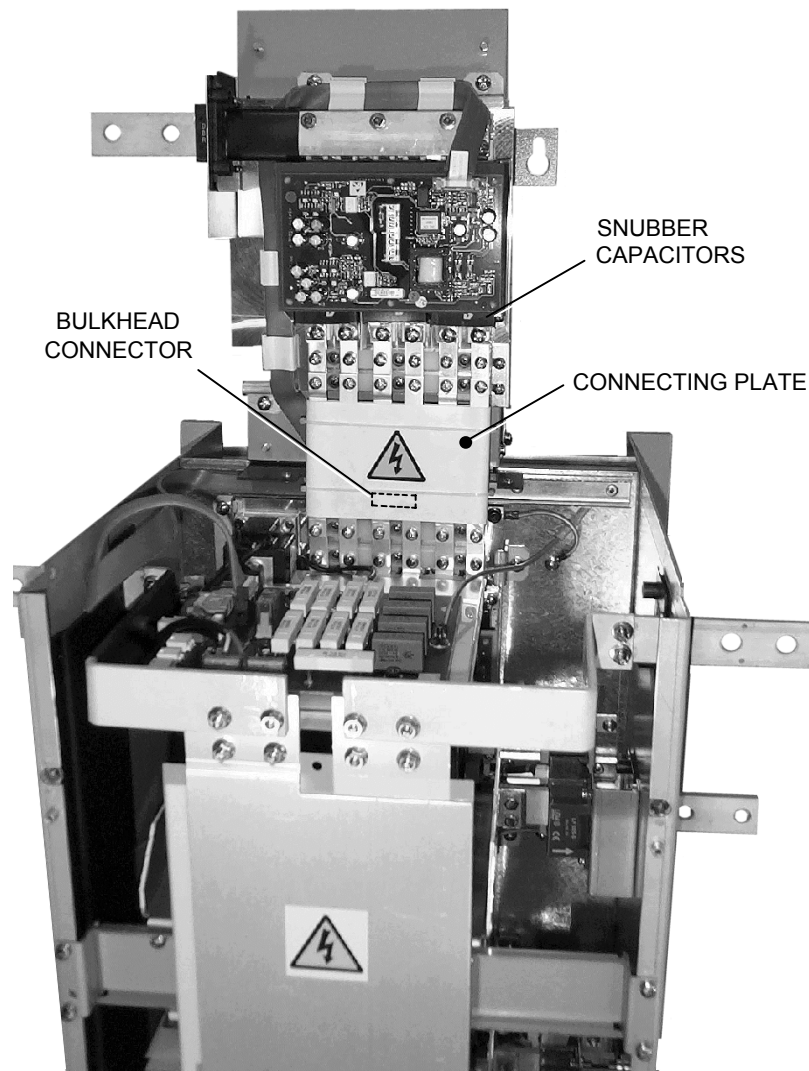
Disconnect all electrical supplies before working on the drive - allow 15 minutes for the drive dc link capacitors to fully discharge.

Do not drop any screws, nuts or extraneous parts into the drive.

Refer to Figure 3-6, page 3-24, for typical brake unit installation.

1. Remove the brake unit cover.
2. Remove the earth bonding bracket from the heatsink.
3. Loosen heatsink clamps.
4. Remove the heatsink/IGBT assembly and carefully place it on a clear flat surface - take care not to damage the heatsink fins.
5. If retro-fitting the brake unit to an existing exhaust duct then: Remove the exhaust duct aperture cover and screws. Transfer heatsink clamps and screws from shipping brake duct to existing drive duct.
6. Remove the drive's top front cover (plastic) via 2 off ¼ turn fasteners at top of drive.
7. Remove drive top cover which is attached via 4 off M5 screws on the side and 2 off M5 screws on the top. Care should be taken to prevent the cover from falling into the drive and damaging the internal components. If fitting a new exhaust duct assembly, fit the duct assembly in to the top panel and secure to drive with 4 off M5 screws. Secure to the mounting panel with M8 fixings.
8. Install brake unit IGBT/heatsink assembly within exhaust duct and tighten clamps. Take care not to damage components on the open PCB with handtools.
9. Connect brake unit control cable to the 14 way bulkhead connector at the top of the drive.
10. Secure the brake connecting plate(s) to the phase joining tabs of the drive top phase (M3/U) and the phase joining tabs on the brake unit with M5 screws provided. Tighten to 4Nm (3ft/lbs).
11. Fit earth bonding bracket to heatsink and duct connection/earthing screws (M5) to exhaust duct. Tighten to 4 Nm (3 ft-lb). **NOTE - This connection must not be omitted as it is required for safety reasons.**
12. Replace drive top cover, **exercise care to not damage brake connection plates with the top cover as this will compromise the electrical insulation.** Tighten 4 off M5 screws on side of drive and 2 off M5 screws on top of cover to 2.5 Nm (1.84 ft-lb).
13. Replace drive front top cover with 2 off ¼ turn fasteners.
14. Fit brake unit cover with M6 captive washer nuts.

## 3-24 Installing the Drive



**Figure 3-6** Front View of Exhaust Duct/Brake Unit/Drive Assembly showing the Brake Connecting Plate and Snubber Capacitors fitted

### External AC Supply Filter

#### **WARNING!**

The specified external filters are only suitable for use with TN supplies. Please check for suitability in Chapter 8: "Technical Specifications" - External AC Supply (RFI) Filters.

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(s) and line chokes as close as possible to the drive module. Refer to Figure 3-2 Wiring Scheme for 690+ Frame K, page 3-7. Take care not to obstruct the filter or drive ventilation ducts. Allow 40mm spacing between filters.

Connections between the drive, choke and filter must always be as short as possible, and be segregated from all other cables.

The routing of the connections between the filter, choke and drive module should be chosen to ensure their close proximity. **Ensure that the filter output leads are separated from the filter input leads. Failure to achieve this will result in increased conducted emissions.**

### Caution

The filter flying leads may reach 100°C under normal operating conditions. These should be separated by at least one cable diameter and adequately ventilated.

The connection between the drive module and the motor must be installed away from all other cables or wires. Ideally the filter(s) and choke will be mounted onto the same metallic back panel as the drive. The RF connection between the drive, filter, choke and panel should be enhanced as follows:-

- Remove any paint/insulation between the mounting points of the EMC filter(s), choke, drive module and panel.
- Liberally apply petroleum jelly over the mounting points and securing threads to prevent corrosion. Alternately conducting paint could be used on mounting panels.
- If the proceeding is not possible, then the RF earth bond between the filter and drive module is usefully improved by making an additional RF earth connection using wire braid of at least 10mm<sup>2</sup> cross sectional area (due to skin effect).

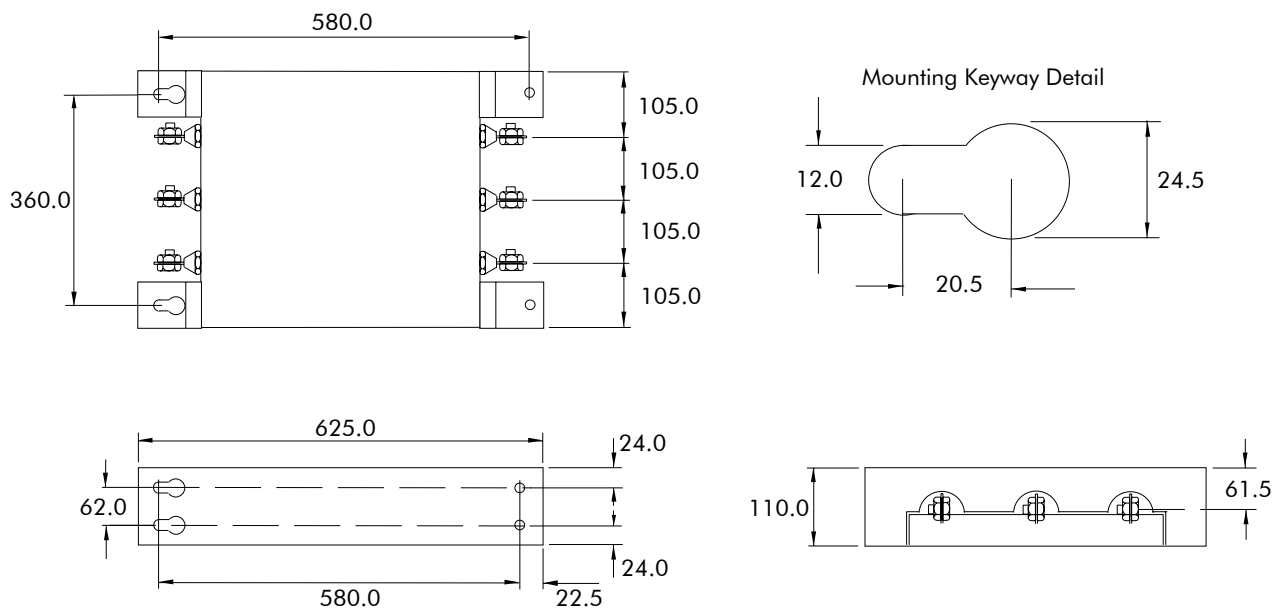
**Note:** Metal surfaces such as eloxized or yellow chromed (e.g., cable mounting or 35mm DIN rails, screws and bolts) have a high RF impedance which can be very detrimental to EMC performance.

A low RF impedance path must be provided between the motor frame and back panel on which the drive, choke and EMC filters are mounted. This low impedance RF path should follow the path of the motor cables in order to minimise the loop area. **Failure to do so will result in increased conducted emissions.**

This will normally be achieved by:-

1. Bonding the armour of the motor supply cables at one end to the motor frame and at the other to the cubicle back panel. Ideally 360° bonding is required, which can be achieved with cable glands.
2. Ensuring that conduit containing the motor supply cables is bonded together using braid. The conduit shall also be bonded to the motor frame and the cubicle back panel.

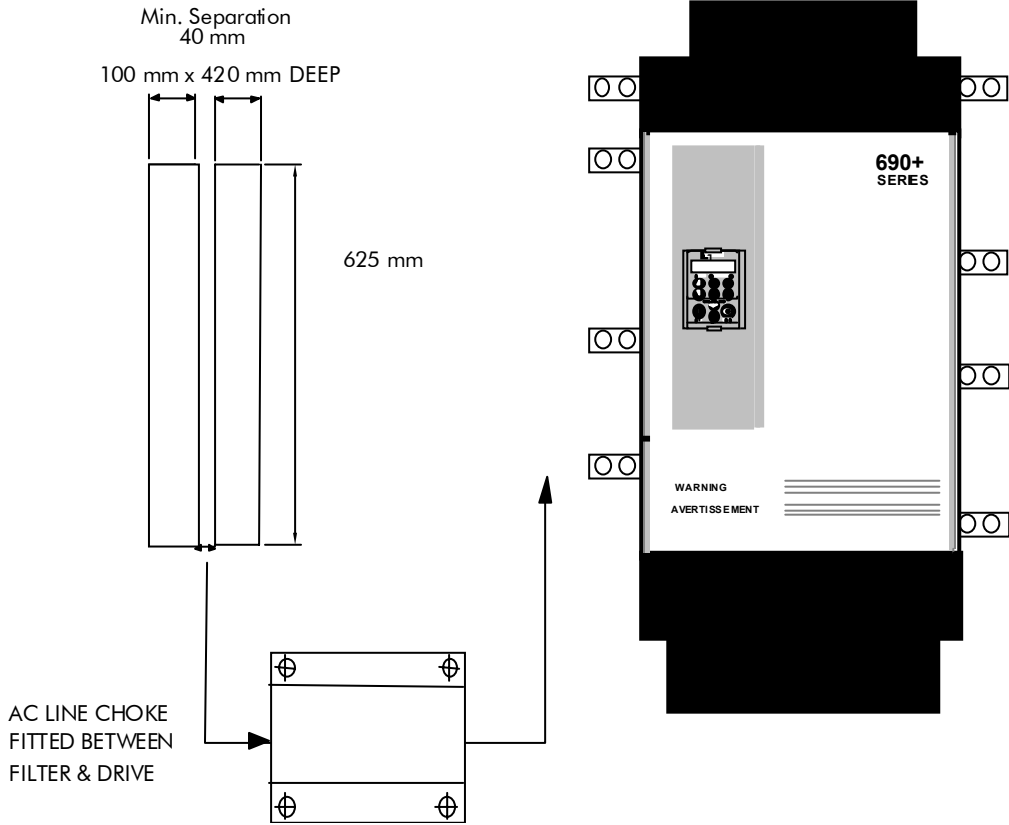
### AC Supply Filter CO467843U340



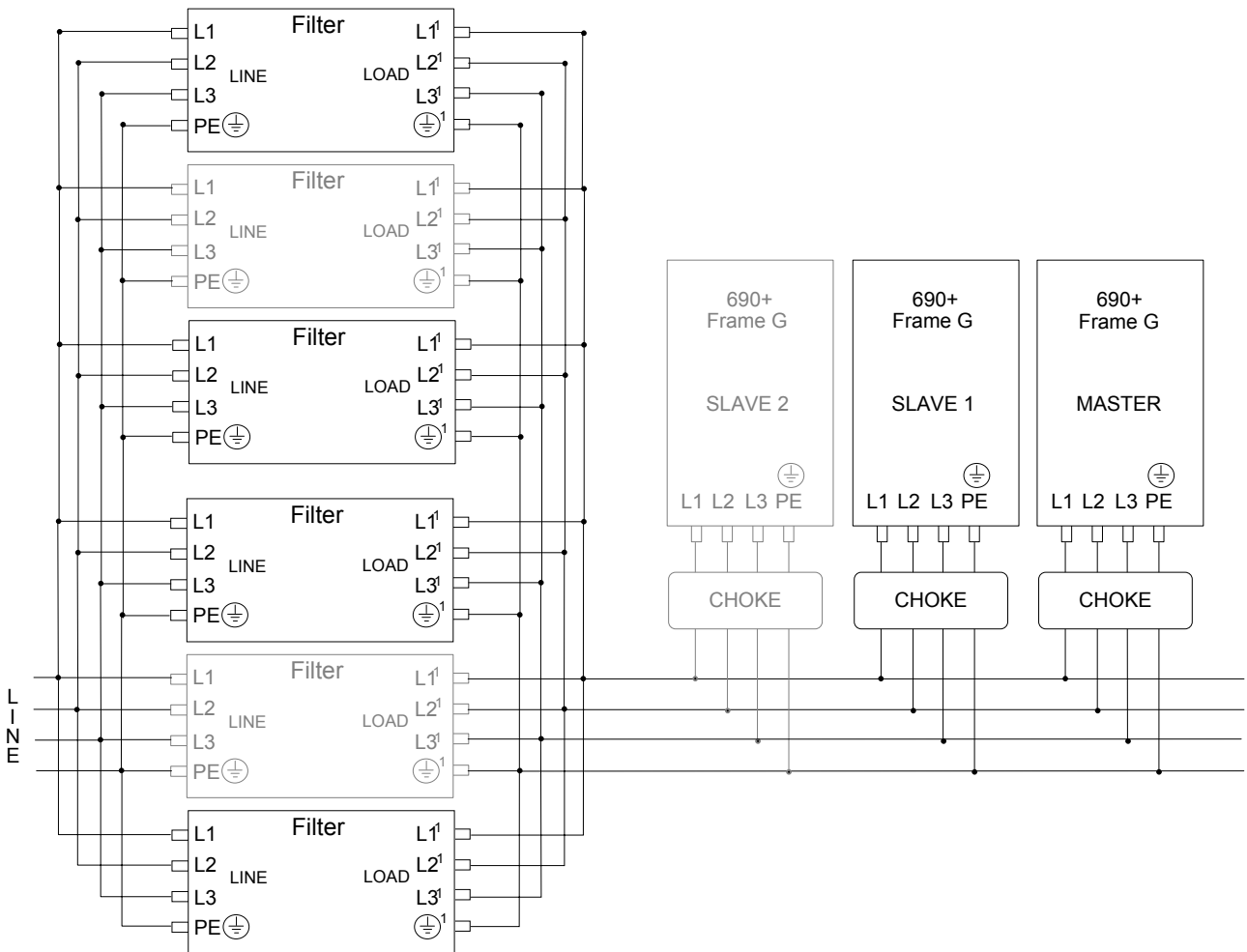
Dimensions are in millimetres



# 3-26 Installing the Drive



**Figure 3-7 Filter Mounting Details Using 2 off Part No. CO467843U340 for Type G, H & J**



**Figure 3-8 Typical Wiring Details (schematic) Using 2 off Part No. CO467843U340 per Frame G, H & J**

## Output Contactors

Output contactors can be used, although we recommend that this type of operation is limited to emergency use only, or in a system where the drive can be inhibited before closing or opening this contactor.

## Earth Fault Monitoring Systems

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 (1998) / EN60204-1 (1994)

## 5703/1 Speed Repeater Support

(Master drive only).

The 5703/1 unit provides the facility to run a line of drives in speed-lock. For accurate speed holding, encoder feedback is required. Ratioed speed-locking is supported.

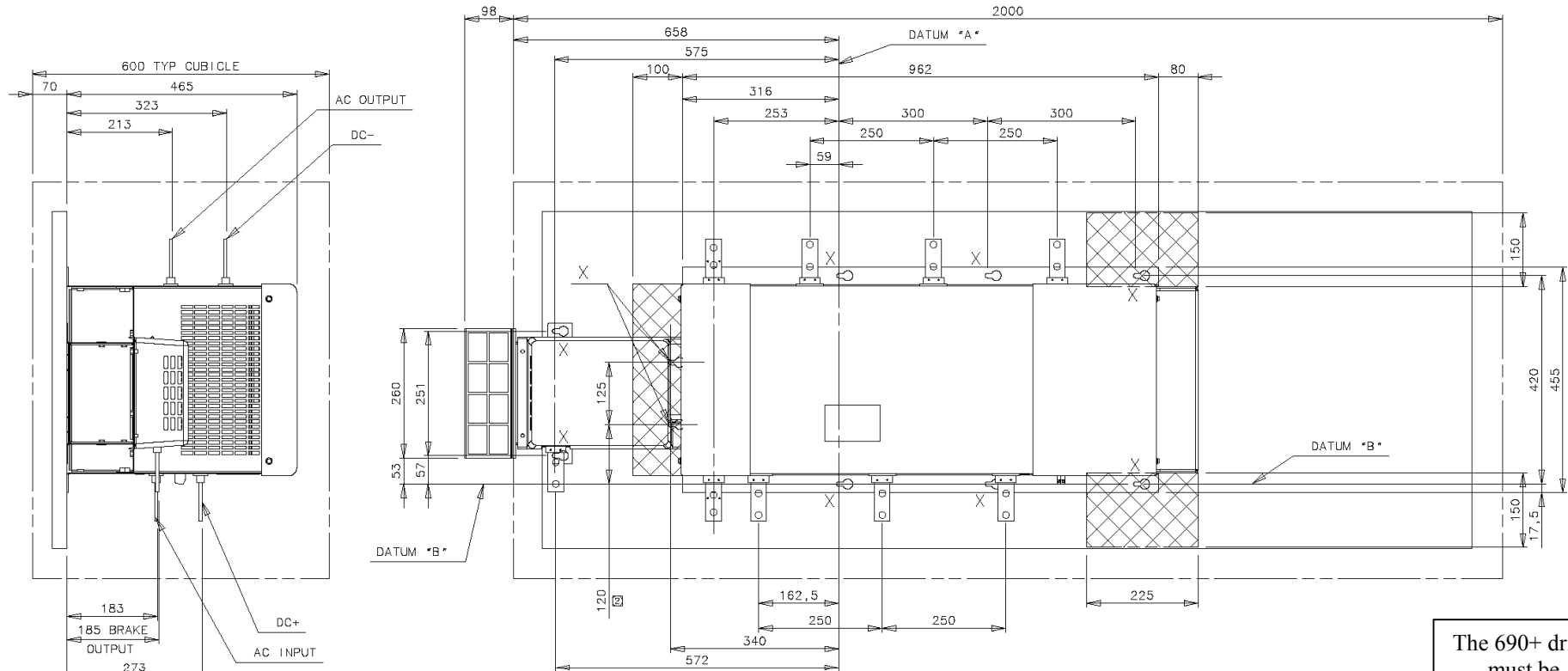
A 16-bit signal is passed between the drives using a fibre optic link connected to the P3 port on each drive. The P3 port operates RS232 compatible signal levels. The 5703/1 unit converts these signals into a fibre optic signal for transmission, and from the converted optical signal to RS232 for reception.

Refer to the manual supplied with the 5703/1 Speed Repeater.

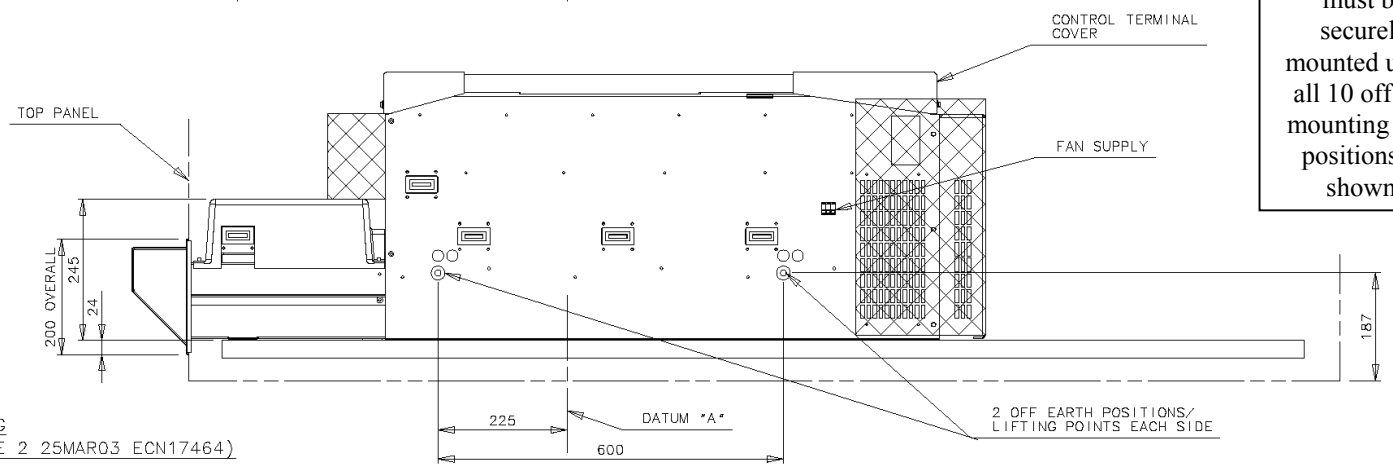
**Note:** The P3 port is configured for 5703/1 support using the MMI. Refer to the Software Product Manual, Chapter 1: "Programming Your Application"

## 3-28 Installing the Drive

# Installation Drawings



VIEW OF TOP OF 690 SIZE G WITH TOP VENT ASSEMBLY REMOVED



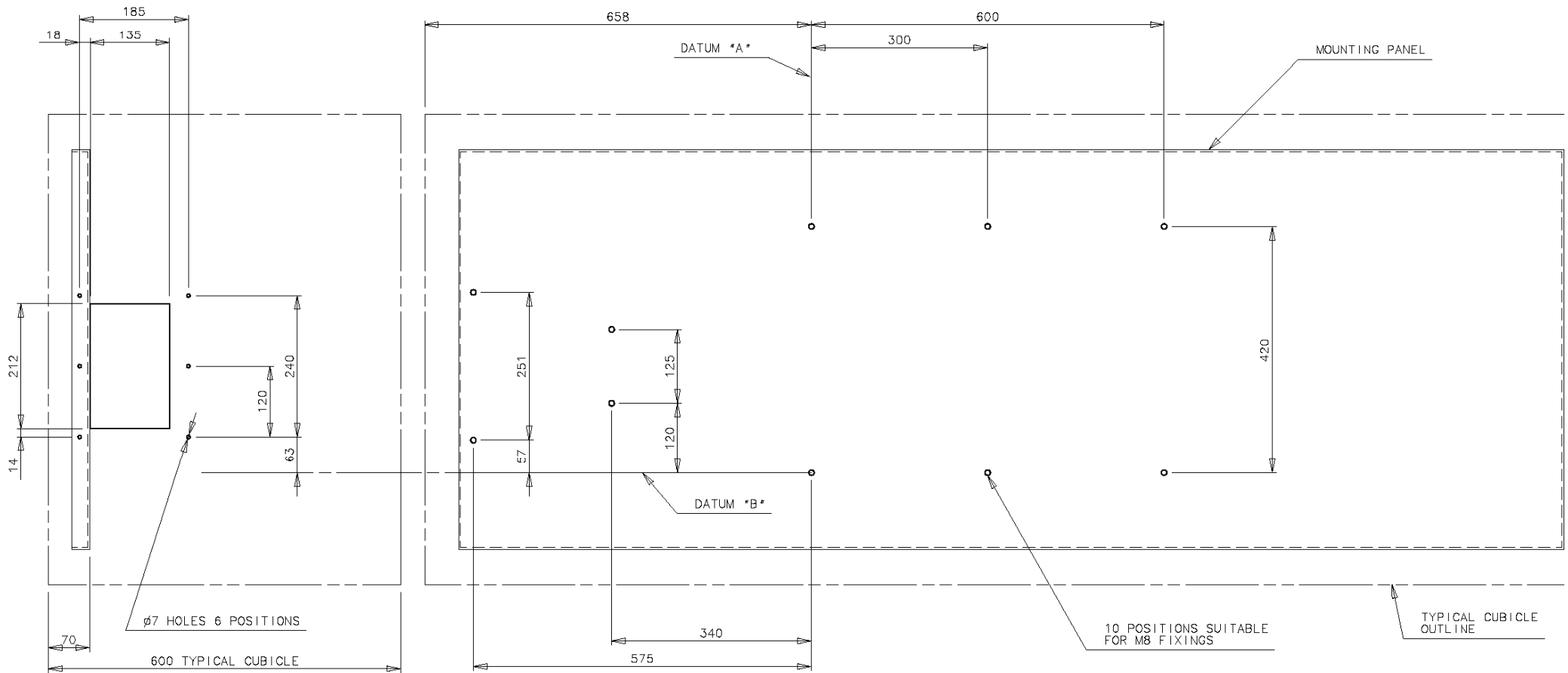
The 690+ drive must be securely mounted using all 10 off M8 mounting hole positions as shown.

NOTE 1 AREAS INDICATED TO BE FREE FROM ANY OBSTRUCTION TO ALLOW AIR FLOW THROUGH PRODUCT.  
 2 10 OFF M8 FIXING POSITION INDICATED \*X\* MUST BE USED.

MOUNTING DIMENSIONS FOR 690 SIZE G (DRAWING NUMBER HG465731U003 ISSUE 2 25MAR03 ECN17464)

SHEET 1 OF 2

Frame G Typical Cubicle Installation Outline Drawing (HG465731U003 Sheet 1)

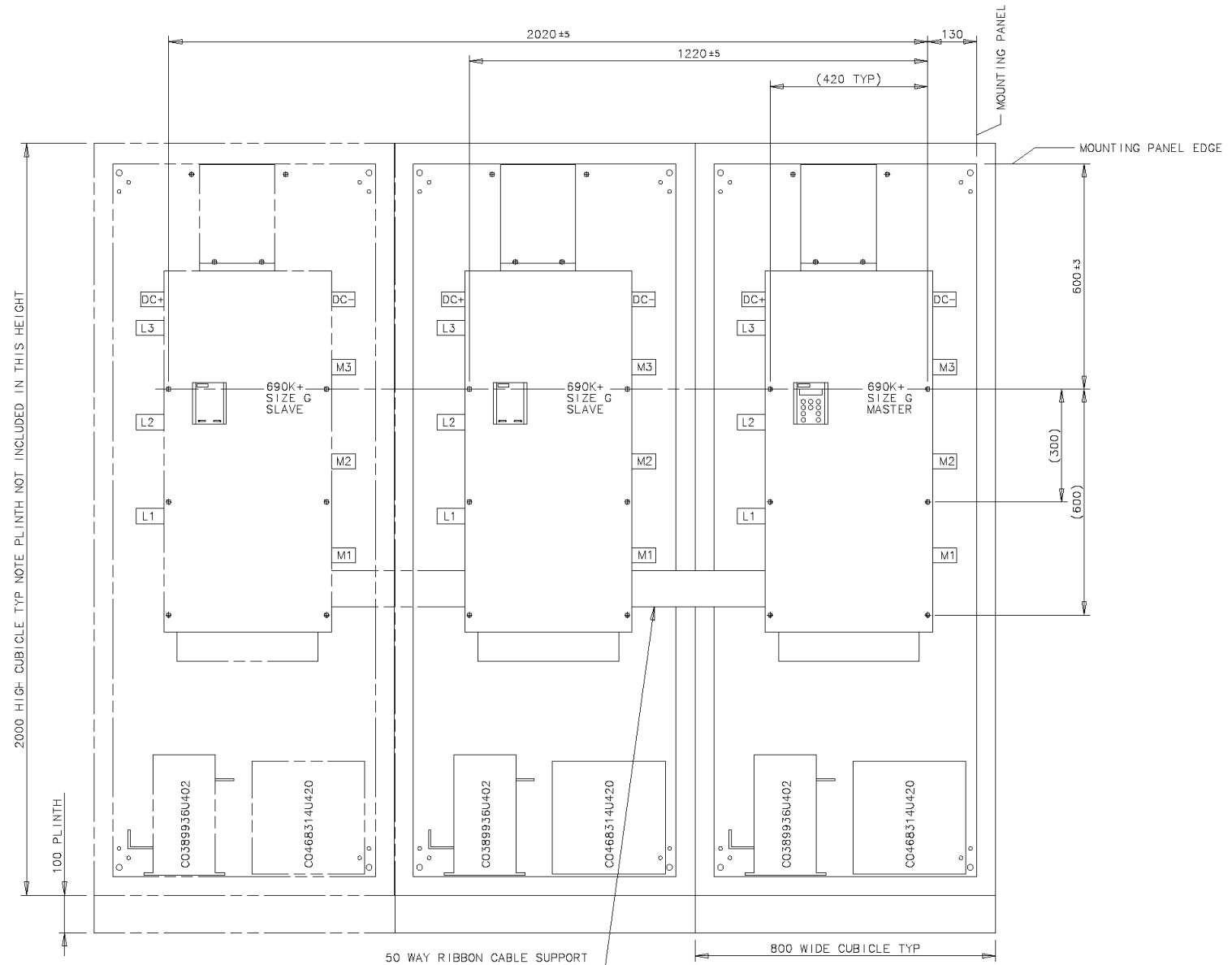


TYPICAL CUBICLE DETAIL SHOWING TOP PANEL AND MOUNTING PLATE HOLE POSITIONS FOR 690 SIZE G

MOUNTING DIMENSIONS FOR 690 SIZE G  
(DRAWING NUMBER HG465731U003 ISSUE 2 25MAR03 ECN17464)

SHEET 2 OF 2

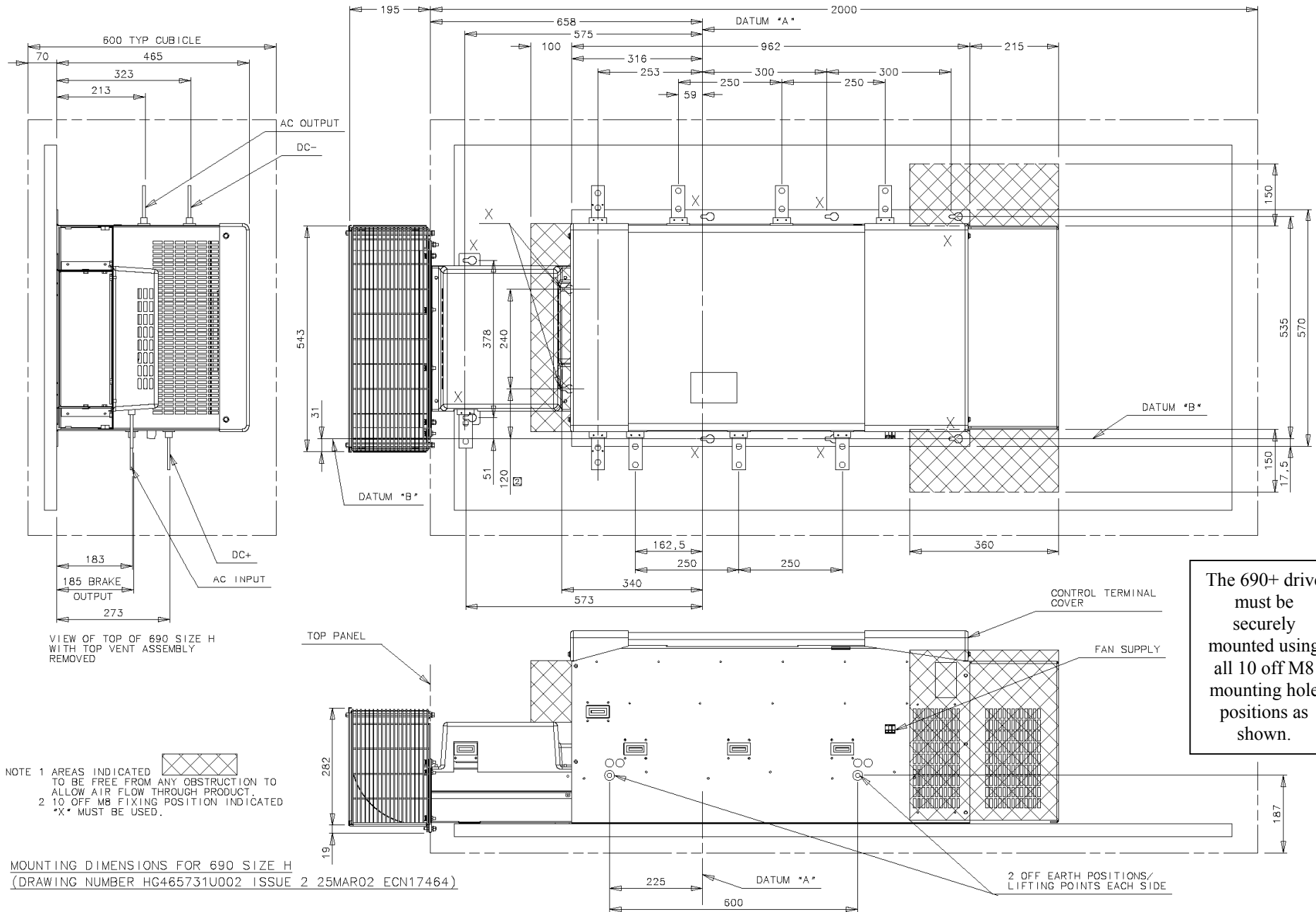
**Frame G Typical Cubicle Machining (HG465731U003 Sheet 2)**



SCHEMATIC CUBICLE MOUNTING DETAILS FOR 690K SIZE G  
(DRAWING NUMBER HG468318U003 ISSUE B 24OCT03)

- NOTE 1. SCHEMATIC LAYOUT OF 690K SIZE G SHOWING RELATIVE POSITIONS OF MASTER AND SLAVE DRIVES MOUNTED IN A 800mm WIDE CUBICLES.
- NOTE 1 OFF 690K SIZE G MASTER SHOWN WITH 1 OFF 690K SIZE G SLAVE IN PARALLEL. A SECOND 690K SIZE G SLAVE IS SHOWN IN PHANTOM LINE WHICH IS ALSO CONNECTED IN PARALLEL.
3. FOR ALL OTHER DETAILS FOR MOUNTING HOLES POSITIONS AND POSITIONING OF TOP VENT ASSY REFER TO HG465731U003

**Frame G Schematic Cubicle Mounting Details (HG468318U003)**



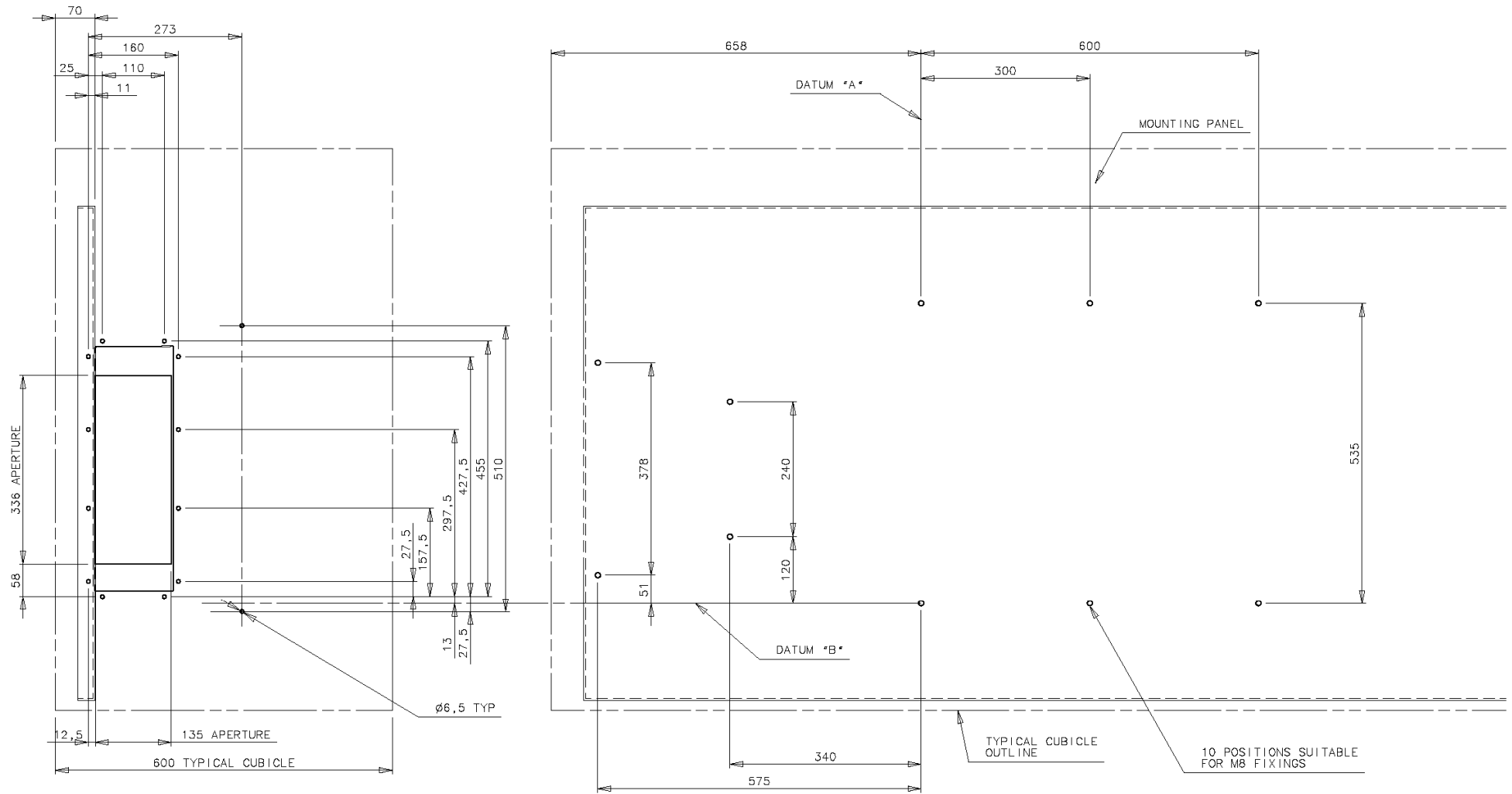
The 690+ drive must be securely mounted using all 10 off M8 mounting hole positions as shown.

VIEW OF TOP OF 690 SIZE H WITH TOP VENT ASSEMBLY REMOVED

NOTE 1 AREAS INDICATED TO BE FREE FROM ANY OBSTRUCTION TO ALLOW AIR FLOW THROUGH PRODUCT.  
2 10 OFF M8 FIXING POSITION INDICATED "X" MUST BE USED.

MOUNTING DIMENSIONS FOR 690 SIZE H  
(DRAWING NUMBER HG465731U002 ISSUE 2 25MAR02 ECN17464)

Frame H Typical Cubicle Installation Outline Drawing (HG465731U002 Sheet 1)



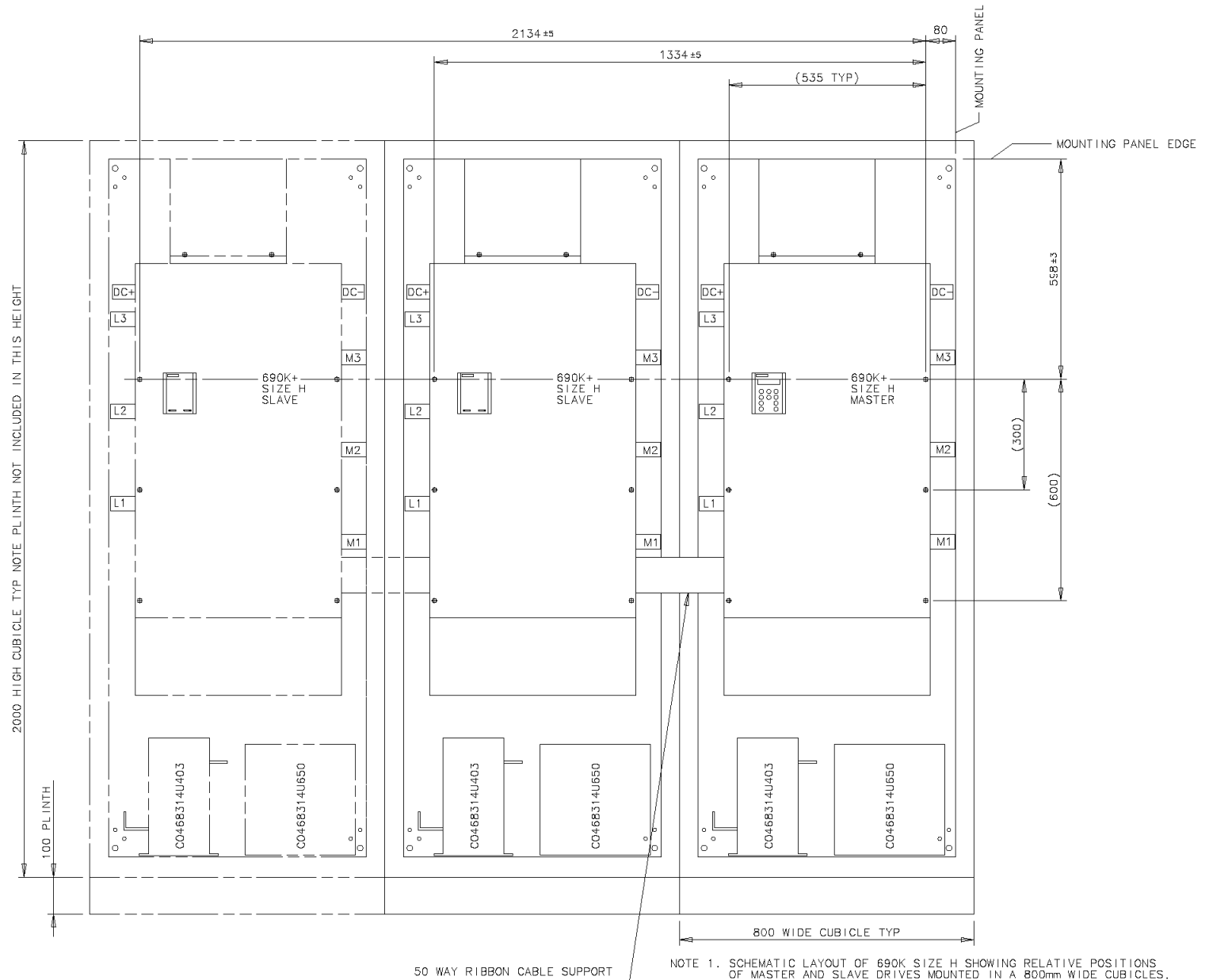
TYPICAL CUBICLE DETAIL SHOWING TOP PANEL AND MOUNTING PLATE HOLE POSITIONS FOR 690 SIZE H

MOUNTING DIMENSIONS FOR 690 SIZE H  
(DRAWING NUMBER HG465731U002 ISSUE 2 25MAR02 ECN17464)

SHEET 2 OF 2

**Frame H Typical Cubicle Machining (HG465731U002 Sheet 2)**

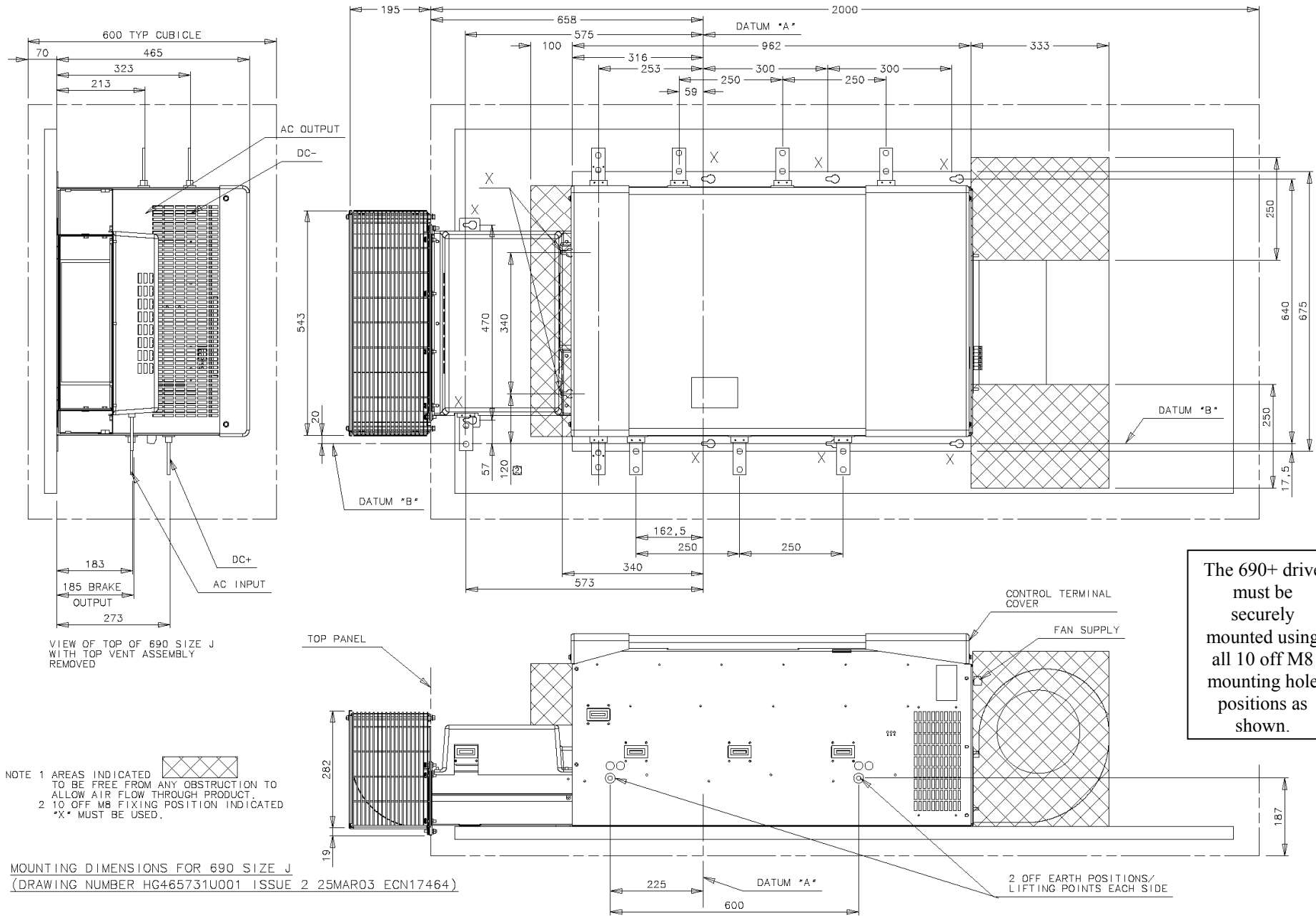




SCHMATIC CUBICLE MOUNTING DETAILS FOR 690K SIZE H  
 (DRAWING NUMBER HG468318U002 ISSUE B 24OCT03)

- NOTE 1. SCHEMATIC LAYOUT OF 690K SIZE H SHOWING RELATIVE POSITIONS OF MASTER AND SLAVE DRIVES MOUNTED IN A 800mm WIDE CUBICLES.  
 2. NOTE 1 OFF 690K SIZE H MASTER SHOWN WITH 1 OFF 690K SIZE H SLAVE IN PARALLEL. A SECOND 690K SIZE H SLAVE IS SHOWN IN PHANTOM LINE WHICH IS ALSO CONNECTED IN PARALLEL.  
 3. FOR ALL OTHER DETAILS FOR MOUNTING HOLES POSITIONS AND POSITIONING OF TOP VENT ASSY REFER TO HG465731U002

**Frame H Schematic Cubicle Mounting Details (HG468318U002)**



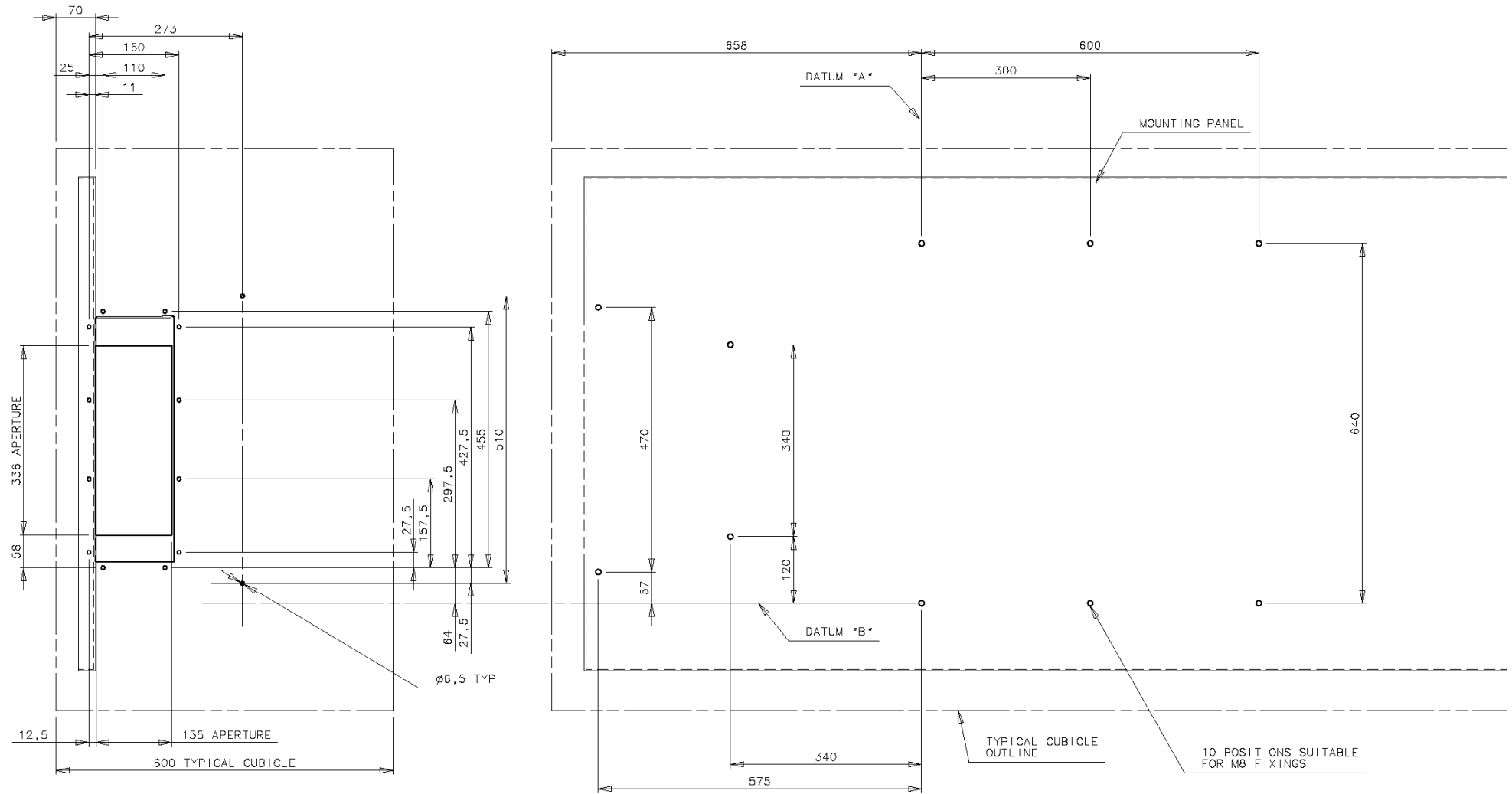
The 690+ drive must be securely mounted using all 10 off M8 mounting hole positions as shown.

NOTE 1 AREAS INDICATED TO BE FREE FROM ANY OBSTRUCTION TO ALLOW AIR FLOW THROUGH PRODUCT.  
 2 10 OFF M8 FIXING POSITION INDICATED "X" MUST BE USED.

MOUNTING DIMENSIONS FOR 690 SIZE J  
 (DRAWING NUMBER HG465731U001 ISSUE 2 25MAR03 ECN17464)

SHEET 1 OF 2

Frame J Typical Cubicle Installation Outline Drawing (HG465731U001 Sheet 1)

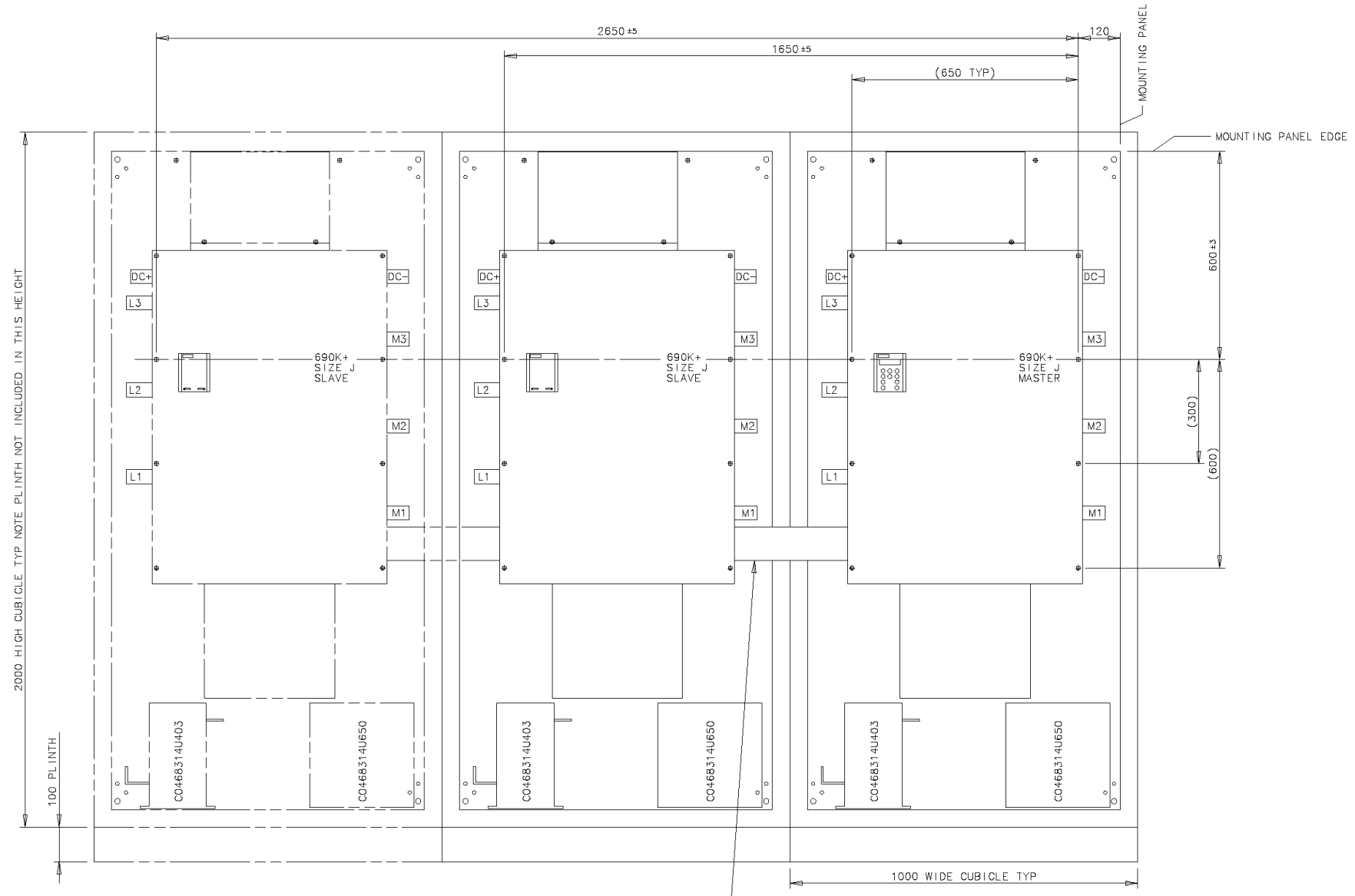


TYPICAL CUBICLE DETAIL SHOWING TOP PANEL AND MOUNTING PLATE HOLE POSITIONS FOR 690 SIZE J

MOUNTING DIMENSIONS FOR 690 SIZE J  
(DRAWING NUMBER HG465731U001 ISSUE 2 25MAR03 ECN17464)

SHEET 2 OF 2

**Frame J Typical Cubicle Machining (HG465731U001 Sheet 2)**



SCHMATIC CUBICLE MOUNTING DETAILS FOR 690K SIZE J  
(DRAWING NUMBER HG468318U001 ISSUE B 24OCT03)

- NOTE 1. SCHEMATIC LAYOUT OF 690K SIZE J SHOWING RELATIVE POSITIONS OF MASTER AND SLAVE DRIVES MOUNTED IN A 1000mm WIDE CUBICLES.
2. NOTE 1 OFF 690K SIZE J MASTER SHOWN WITH 1 OFF 690K SIZE J SLAVE IN PARALLEL. A SECOND 690K SIZE J SLAVE IS SHOWN IN PHANTOM LINE WHICH IS ALSO CONNECTED IN PARALLEL.
3. FOR ALL OTHER DETAILS FOR MOUNTING HOLES, POSITIONS AND POSITIONING OF TOP VENT ASSY REFER TO HG465731U001

**Frame J Schematic Cubicle Mounting Details (HG468318U001)**



# OPERATING THE DRIVE

**Note:** The instructions in this Chapter refer to the set-up and operation of the Master drive. The Slave drive(s) require no set-up, and operation is via the master drive.

DEFAULT

By default, the drive will operate in Remote Start/Stop and Remote Speed Control. Analog and digital inputs and outputs are selected to control the unit.

The drive will operate as an open-loop drive. No set-up or tuning is required. It is programmed to control an induction motor of equivalent power, current and voltage rating to the drive.

In this chapter, refer to Control Philosophy, Initial Start-up Routine, (Routine 1: Remote Control using Control Terminals) and The Start/Stop Mode Explained.

## Pre-Operation Checks

### WARNING!

Wait for 5 minutes after disconnecting power before working on any part of the system or removing the terminal cover from the drive.

#### Initial checks before applying power:

- Mains power supply voltage is correct.
- Motor is of correct voltage rating and is connected in either star or delta, as appropriate.
- Check all external wiring circuits - power, control, motor and earth connections.

**Note:** Completely disconnect the drive before point to point checking with a buzzer, or when checking insulation with a Meggar.

- Check for damage to equipment.
- Check for loose ends, clippings, drilling swarf etc. lodged in the drive and system.
- If possible check that the motor can be turned freely, and that any cooling fans are intact and free from obstruction.

#### Ensure the safety of the complete system before the drive is energised:

- Ensure that rotation of the motor in either direction will not cause damage.
- Ensure that nobody else 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.

#### Prepare to energise the drive and system as follows:

- Remove the supply fuses, or isolate using the supply circuit breaker.
- Disconnect the load from the motor shaft, if possible.
- If any of the drive's control terminals are not being used, check whether these unused terminals need to be tied high or low. Refer to Chapter 8: "Technical Specifications" - Control Terminals.
- Check external run contacts are open.
- Check external speed setpoints are all zero.

#### Re-apply power to the drive and system

The drive has Macro 1 installed as the factory default. If you are controlling the drive in Remote control, refer to the Software Product Manual : "Application Macros" for details of other macros.

## 4-2 Operating the Drive

### Control Philosophy

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

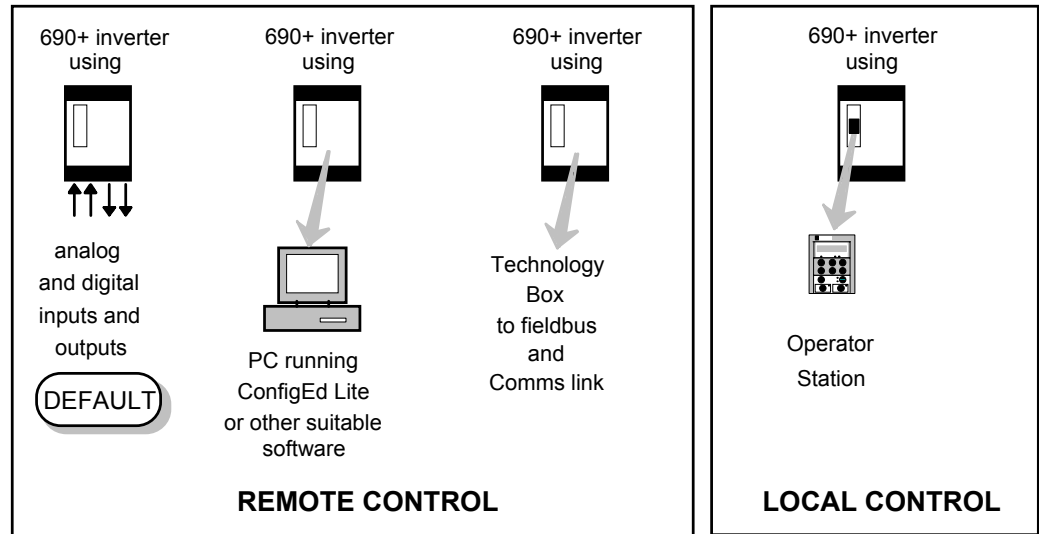


Figure 4-1 Remote and Local Control Modes

### 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 the 6053 Technology Box

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

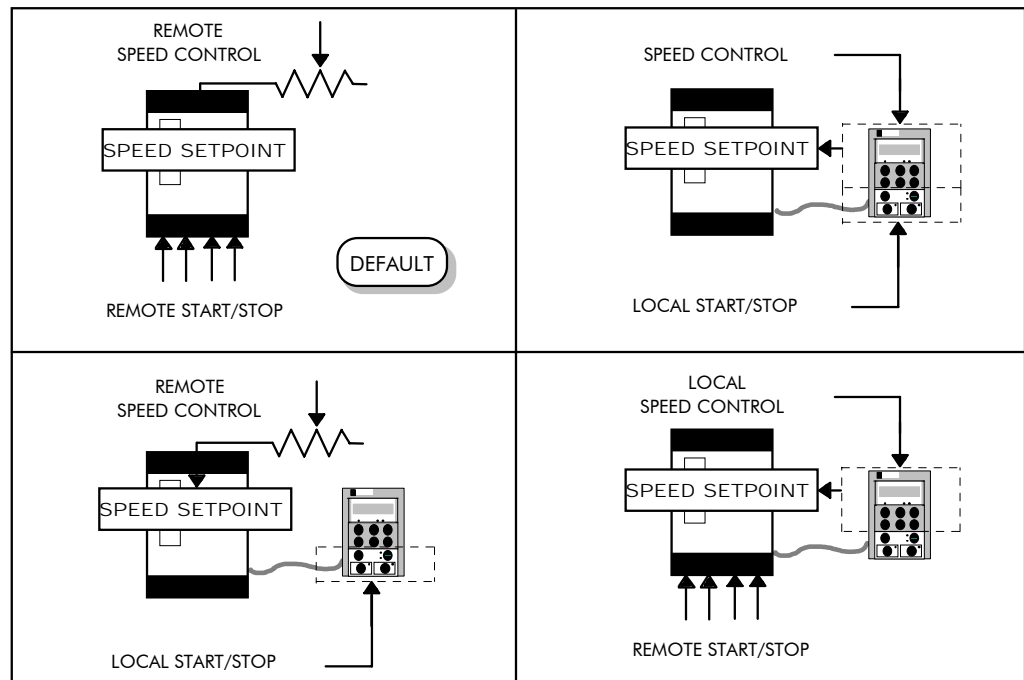


Figure 4-2 The Four Combinations of Local and Remote Control

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

### Selecting Local or Remote Control

If the default combination of remote Start/Stop and Speed Control is not suitable for your application, follow the instructions below using the keypad or a suitable PC programming tool to select suitable combinations of local or remote control.

**Note:** You can only change between Local and Remote control when the drive is "stopped".

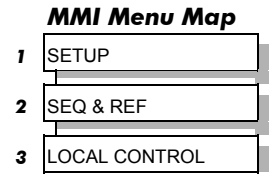
To change a combination the keypad must have FULL VIEW selected; allowing you to view enough of the menu structure to make the change. Refer to Chapter 5: "The Keypad" - Menu Viewing Levels.

The L/R key on the keypad toggles between Local and Remote control, changing both Start/Stop and Speed Control modes at the same time.

However, you can "fix" either or both modes in software to be either Local or Remote control. This makes the L/R key inoperative for that mode. In this way, you can select a combination where both Local and Remote modes are present.

To do this, go to the LOCAL CONTROL menu at level 4 and select either:

- LOCAL ONLY                Sets Local control
- REMOTE ONLY             Sets Remote control
- LOCAL/REMOTE          Gives selection powers back to the L/R key.



Fixing only one of the modes will mean that the L/R key will still toggle the other mode between Local and Remote control.

### LED Indications

The mode of control is indicated by the "LOCAL" LEDs on the keypad:

- SEQ = Start/Stop
- REF = Speed Control

If the LED is illuminated (●), then LOCAL mode is in force.

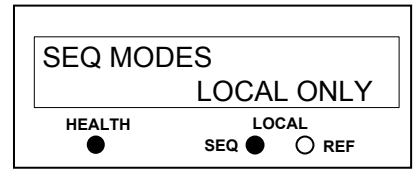


Figure 4-3 Control Mode LED Indications

**Note:** The default is for the L/R key to be operative for both Sequencing and Reference Generation, and to be set for Remote control, i.e. both LEDs will be off.



## 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 routine below will run the drive in the default V/F fluxing control mode (VOLTS / HZ) to begin with using either the Control Terminals, or the keypad (if supplied).

### Routine 1: Remote Control using Control Terminals

DEFAULT

*This is the simplest method of operating the drive. No Set-up or tuning is required. The drive can only operate in V/F Fluxing control mode (VOLTS / HZ).*

This routine assumes that the drive's control terminals are wired as shown in Figure 3-2 "Typical Connection to the Control Terminals" and the Master and Slave drives are connected as shown in Figure 3-3 "Wiring Scheme for 690+ Frame K".

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

1. Power-up the unit. The HEALTH LED will light (the RUN LED remains off).  
*If the HEALTH LED flashes, the drive has tripped. Refer to Chapter 6: "Trips and Fault Finding" to investigate and remove the cause of the trip. Reset the unit by momentarily closing either the RESET switch or the RUN switch. The HEALTH LED will now light.*
2. Close the RUN switch. The RUN LED will flash if the setpoint is at zero. Turn the speed potentiometer up a little to apply a small speed setpoint. The RUN LED will light and the motor will rotate slowly.

Reverse the motor's direction of rotation either by pressing the DIR key, or by swapping two of the motor phases (**WARNING: Disconnect the mains supply first**).

### Reading the Status LEDs

The HEALTH and RUN LEDs indicate status. The LEDs are considered to operate in five different ways:

- OFF
- SHORT FLASH
- EQUAL FLASH
- LONG FLASH
- ON

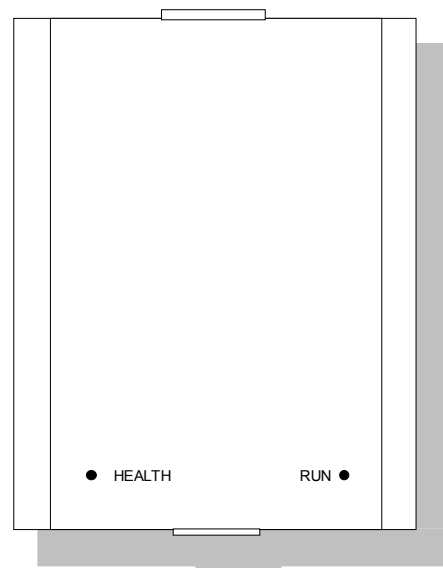


Figure 4-4 Blank Cover showing LED Operation























HEALTH	RUN	Drive State
		Re-configuration, or corrupted non-volatile memory at power-up
		Tripped
		Auto Restarting, waiting for trip cause to clear
		Auto Restarting, timing
		Stopped
		Running with zero reference, enable false or contactor feedback false
		Running
		Stopping
		Braking and running with zero speed demand
		Braking and running
		Braking and stopping

Table 4-1 Status indications given by the Blank Cover Health and Run LEDs

## Routine 2: Local Control using the Keypad

**Note:** Refer to Chapter 5: “The Keypad” to familiarise yourself with the keypad’s LED indications, and how to use the keys and menu structure.

This routine assumes that the drive’s control terminals are wired as shown in Figure 3-2 “Typical Connection to the Control Terminals” and the Master and Slave drives are connected as shown in Figure 3-3 “Wiring Scheme for 690+ Frame K”.

1. Power-up the unit. The display will show the power-up screen, “AC MOTOR DRIVE”. After a few seconds, SETPOINT(REMOTE) will appear on the display. The HEALTH, STOP, and FWD LEDs will light.

*If the HEALTH LED flashes, the drive has tripped. The display will indicate the reason for the trip. Refer to Chapter 6: “Trips and Fault Finding” to investigate and remove the cause of the trip. Reset the trip condition by pressing the **Stop/Reset** key on the keypad. The HEALTH LED will now light.*

2. Press the **L/R** (Local/Remote) key to enable Local control. Both the LOCAL SEQ and LOCAL REF LEDs will light when Local control in enabled.
3. Press the **RUN** key. The RUN LED will light and the motor will rotate slowly. (The RUN LED would flash if the setpoint was at zero.)
4. Reverse the motor’s direction of rotation by pressing either the **DIR** key, or by swapping two of the motor phases (**WARNING: Disconnect the mains supply first**).

## Drive Set-up

Using the keypad (or other suitable programming tool) the drive must now be set-up:

- as a simple Open-loop Drive (V/F fluxing)
- in Sensorless Vector Fluxing mode
- in Closed-Loop Vector mode

## 4-6 Operating the Drive

### Set-up as an Open-loop Drive (V/F Fluxing)

The parameters from the QUICK SETUP menu most likely to require attention in this control mode (VOLTS / HZ) are shown below.

**MMI Menu Map**

1 QUICK SETUP

Tag	QUICK SET-UP Parameters	Default	Brief Description
1105	CONTROL MODE	<b>VOLTS / HZ</b>	Selects the control mode for the drive
106	BASE FREQUENCY	* 50.0 Hz	Frequency at which maximum output volts is generated
931	MAX SPEED	* 1500 RPM	Max speed clamp and scale factor for other speed parameters
337	MIN SPEED	-100.00 %	Min speed clamp
258	RAMP ACCEL TIME	10.0 s	Acceleration time from 0Hz to max speed
259	RAMP DECEL TIME	10.0 s	Deceleration time from max speed to 0Hz
104	V/F SHAPE	LINEAR LAW	Constant torque V to F characteristic
50	QUADRATIC TORQUE	FALSE	Selects between Constant or Quadratic mode of operation
64	MOTOR CURRENT	** 11.3 A	Calibrates drive to motor full load current
365	CURRENT LIMIT	100.00%	Level of motor current as % of FULL LOAD CALIB
107	FIXED BOOST	** 0.00 %	Boosts starting torque by adding volts at low speed
279	RUN STOP MODE	RAMPED	Ramp to standstill when RUN signal removed
246	JOG SETPOINT	10.0 %	Drive speed setpoint whilst jogging
13	ANALOG INPUT 1	0..+10 V	Input range and type
22	ANALOG INPUT 2	0..+10 V	Input range and type
712	ANALOG INPUT 3	0..+10 V	Input range and type
719	ANALOG INPUT 4	0..+10 V	Input range and type
231	DISABLED TRIPS	0000 >>	Sub-menu to set disabled trips
742	DISABLED TRIPS +	0040 >>	Sub-menu to set disabled trips
1083	MOTOR BASE FREQ	** 50.0 Hz	Frequency at which drive gives maximum output volts
1084	MOTOR VOLTAGE	** 400.0 V	Maximum motor output voltage
65	MAG CURRENT	** 3.39 A	Calibrates drive to motor no load current
83	NAMEPLATE RPM	** 1445 RPM	Motor nameplate speed
84	MOTOR POLES	** 4	Number of motor poles

### Set-up using the Sensorless Vector Fluxing Mode

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.

**MMI Menu Map**

1 QUICK SETUP

**IMPORTANT:** You **MUST** use the Autotune feature.

Enter values for the following parameters in the QUICK SETUP menu.

Tag	QUICK SET-UP Parameters	Default	Brief Description
1105	CONTROL MODE	<b>SENSORLESS VEC</b>	Selects the control mode for the drive
931	MAX SPEED	* 1500 RPM	Max speed clamp and scale factor for other speed parameters
64	MOTOR CURRENT	** 11.3 A	Calibrates drive to motor full load current
365	CURRENT LIMIT	100.00%	Level of motor current as % of FULL LOAD CALIB
1083	MOTOR BASE FREQ	** 50.0 Hz	Frequency at which drive gives maximum output volts
1084	MOTOR VOLTAGE	** 400.0 V	Maximum motor output voltage
83	NAMEPLATE RPM	** 1445 RPM	Motor nameplate speed (motor synchronous speed (rpm) minus full load slip)
84	MOTOR POLES	** 4	Number of motor poles
603	AUTOTUNE ENABLE	FALSE	Enables the Autotune feature

For more information refer to Chapter 5: "The Keypad" - The QUICK SETUP Menu.

## Set-up using the Closed-loop Vector Mode

### WARNING!

When the drive is run for the first time the direction of rotation will be unknown, the drive may run inconsistently, and the speed control may not operate.

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.

If the encoder is to be fitted to the System Board option rather than the Speed Feedback option, set SPD LOOP SPD FBK to SLAVE ENCODER.

#### MMI Menu Map

- 1 SETUP
- 2 ENCODER FUNCS
- 3 PHASE CONFIGURE
  - SPD LOOP SPD FBK

**IMPORTANT:** You **MUST** use the Autotune feature.

Enter values for the following parameters in the QUICK SETUP menu.

#### MMI Menu Map

- 1 QUICK SETUP

Tag	QUICK SET-UP Parameters	Default	Brief Description
1105	CONTROL MODE	<b>CLOSED-LOOP VEC</b>	Selects the control mode for the drive
931	MAX SPEED	* 1500 RPM	Max speed clamp and scale factor for other speed parameters
64	MOTOR CURRENT	** 11.3 A	Calibrates drive to motor full load current
365	CURRENT LIMIT	100.00%	Level of motor current as % of FULL LOAD CALIB
566	ENCODER LINES	** 2048	Set to the number of lines used by the encoder
1083	MOTOR BASE FREQ	** 50.0 Hz	Frequency at which drive gives maximum output volts
1084	MOTOR VOLTAGE	** 400.0 V	Maximum motor output voltage
83	NAMEPLATE RPM	** 1445 RPM	Motor nameplate speed (motor synchronous speed (rpm) minus full load slip)
84	MOTOR POLES	** 4	Number of motor poles
124	MOTOR CONNECTION	** STAR	Type of motor connection
567	ENCODER INVERT	FALSE	Encoder direction
603	AUTOTUNE ENABLE	FALSE	Enables the Autotune feature
For more information refer to Chapter 5: "The Keypad" - The QUICK SETUP Menu.			

## The Autotune Feature

**IMPORTANT:** You **MUST** carry out an Autotune if you intend to use the drive in either of the two vector control modes. If you are using it in Volts/Hz control an Autotune is not necessary.

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.

Parameter	Description	Note
ENCODER INVERT	Encoder direction	Parameter is only set up if drive is configured to run as Closed-loop Vector
MAG CURRENT	Magnetising current	Not measured by Stationary Autotune
STATOR RES	Per phase stator resistance	
LEAKAGE INDUC	Per phase stator leakage inductance	

## 4-8 Operating the Drive

Parameter	Description	Note
MUTUAL INDUC	Per phase mutual inductance	
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 the Software Product Manual, Chapter 1: “Programming your Application”.

### Stationary or Rotating Autotune?

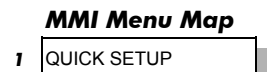
Will the motor spin freely, i.e. not connected to a load, during the Autotune?

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

	Action	Requirements
<b>Rotating Autotune</b> <i>Preferred method</i>	Spins the motor up to the maximum speed set by the user to identify all necessary motor characteristics	Motor must spin freely during Autotune
<b>Stationary Autotune</b> <i>Only used when the motor cannot spin freely during the Autotune feature</i>	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

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 ok, 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 to the maximum speed at which you will operate the drive in normal operation.



**IMPORTANT:** 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 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.

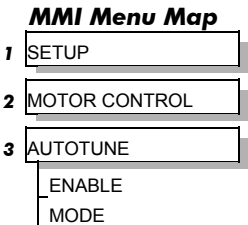
**IMPORTANT:** Now perform a SAVE CONFIG to save your new settings. Refer to Chapter 5: “The

Keypad" - Quick Save Feature.

### Performing a Stationary Autotune

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 AUTOTUNE menu, set the MODE parameter to STATIONARY.
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.

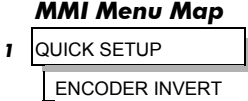


**IMPORTANT:** Now perform a SAVE CONFIG to save your new settings. Refer to Chapter 5: "The Keypad" - Quick Save Feature.

- 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

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.

## 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.

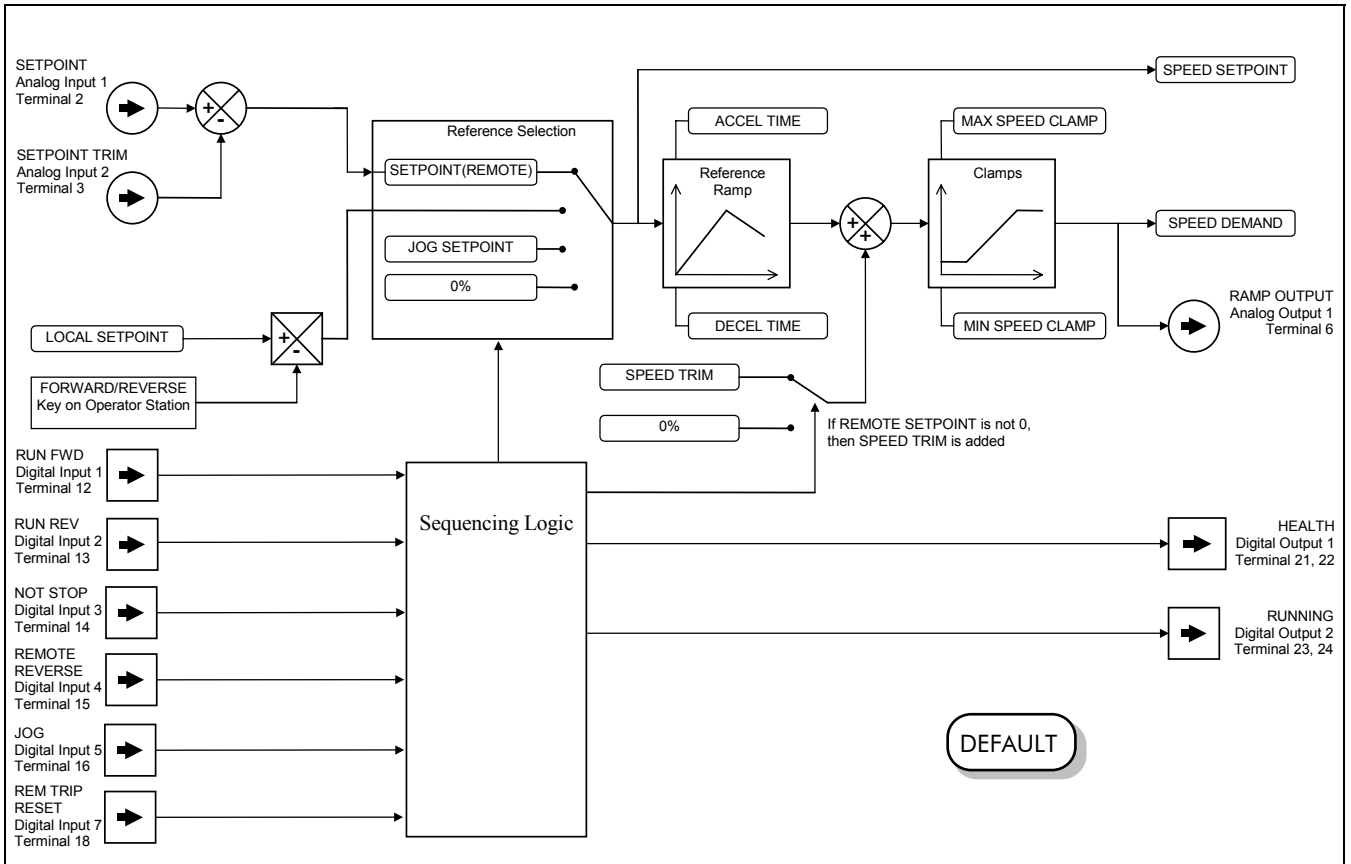


Figure 4-5 Portion of the Default Configuration

### Start/Stop Controlled Remotely

DEFAULT

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.

### 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 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

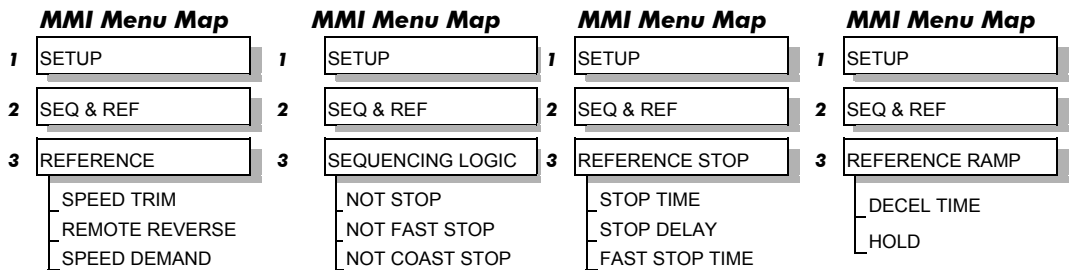
In the configuration shown, Start/Stop mode provides two DIGITAL OUTPUT signals (RUNNING and HEALTH).

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 the Software Product Manual, Chapter 4: “Sequencing Logic States” 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 the Software Product Manual, Chapter 4: “Programming Your Application” and “Sequencing Logic States”.

## Starting and Stopping Methods



**Note:** Refer to the Software Product Manual, Chapter 1: “Programming Your Application” - REFERENCE, SEQUENCING LOGIC, REFERENCE STOP and REFERENCE RAMP, for explanations of parameters.

### Normal Stopping Methods

DEFAULT

Macro 1 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 FWD input, terminal 12

With the keypad, or suitable programming 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).



# 4-12 Operating the Drive

## Ramp to Stop

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.

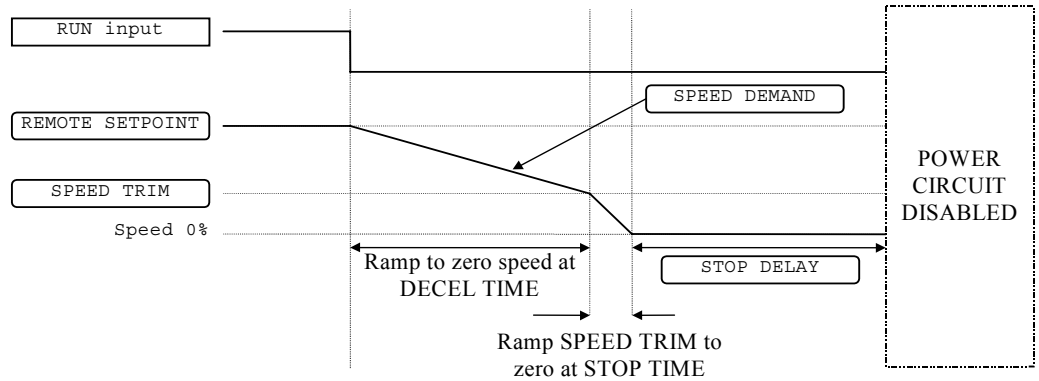


Figure 4-6 Ramp to Stop with a Remote Reference

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.

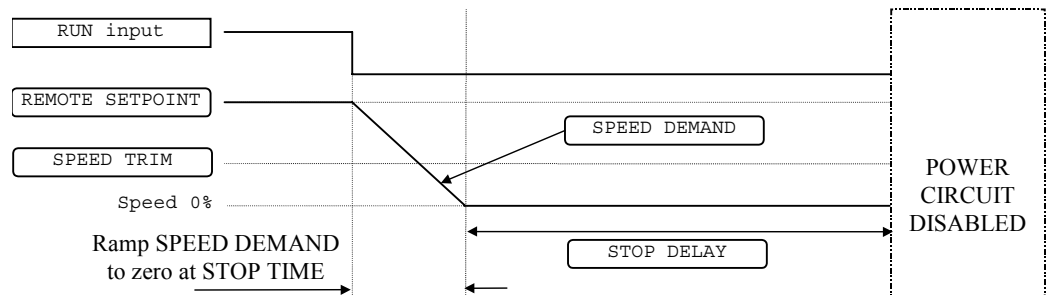


Figure 4-7 Remote to Stop with a Remote Reference: no DECEL TIME

## Coast to Stop

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.

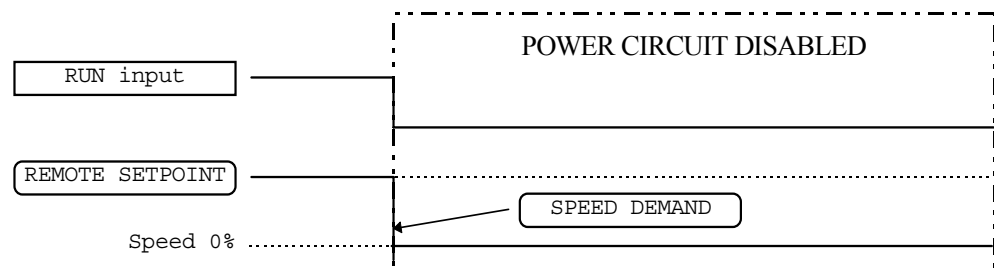


Figure 4-8 Coast to Stop with a Remote Reference

## 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 FWD, RUN REV and JOG inputs in Remote mode, and the RUN and JOG keypad keys in Local mode. It is selected by setting NOT FAST STOP to TRUE.

The Fast Stop mode can be set 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.

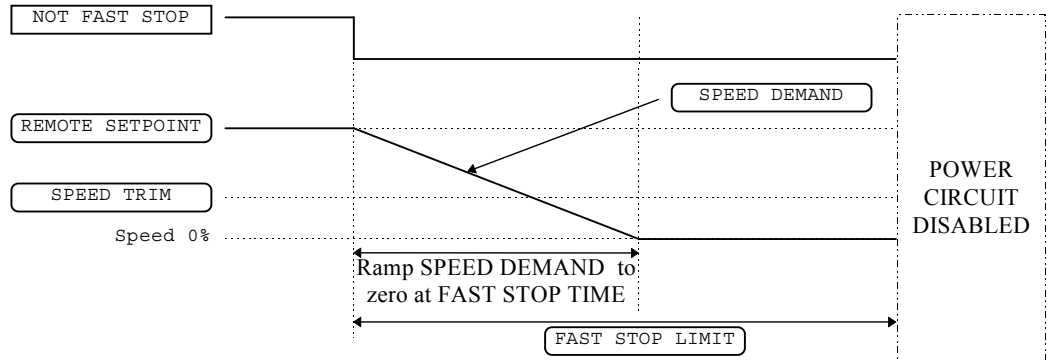


Figure 4-9 Forced Fast Stop RAMP Mode example

### 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.

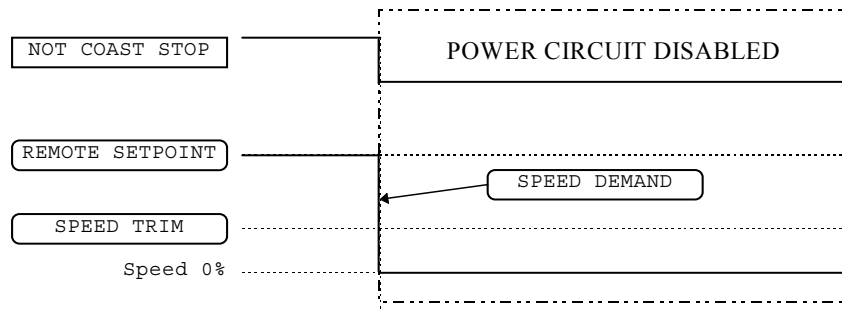


Figure 4-10 Forced Coast Stop example

### 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 6: “Trips and Fault Finding” for further details.

# 4-14 Operating the Drive

## 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.

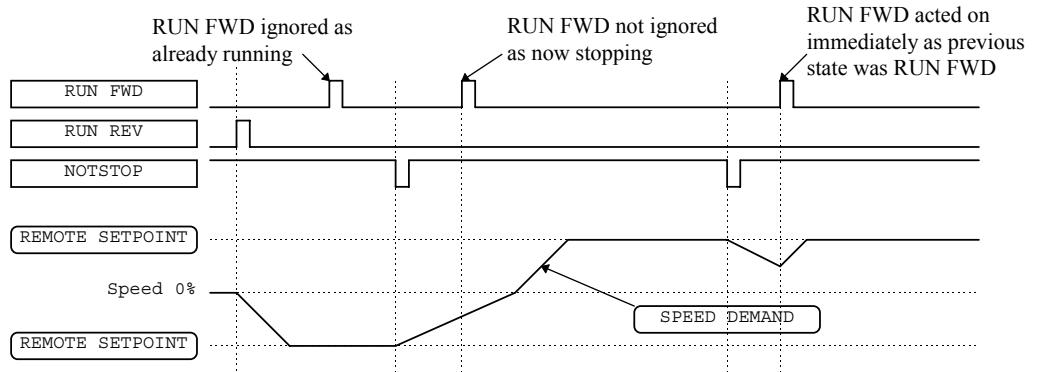


Figure 4-11 Interaction between RUN FWD, RUN REV and NOT STOP Parameters

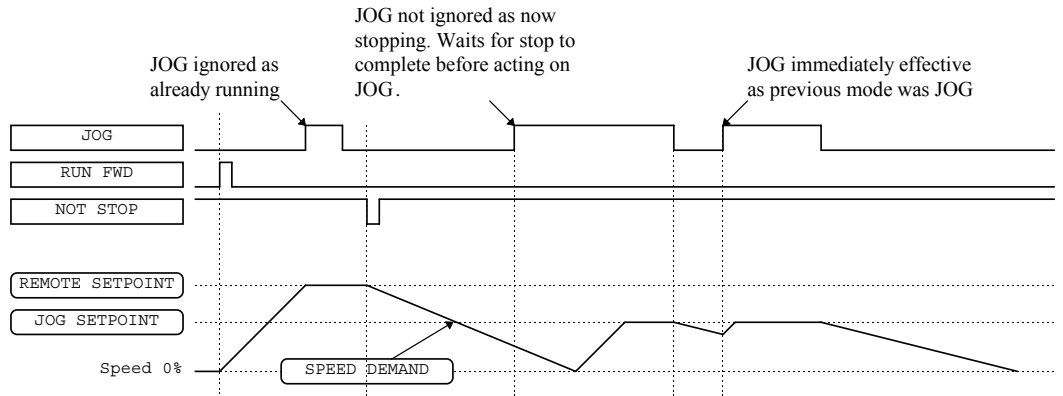


Figure 4-12 Example of the Interaction between RUN and JOG Parameters

## Starting Methods

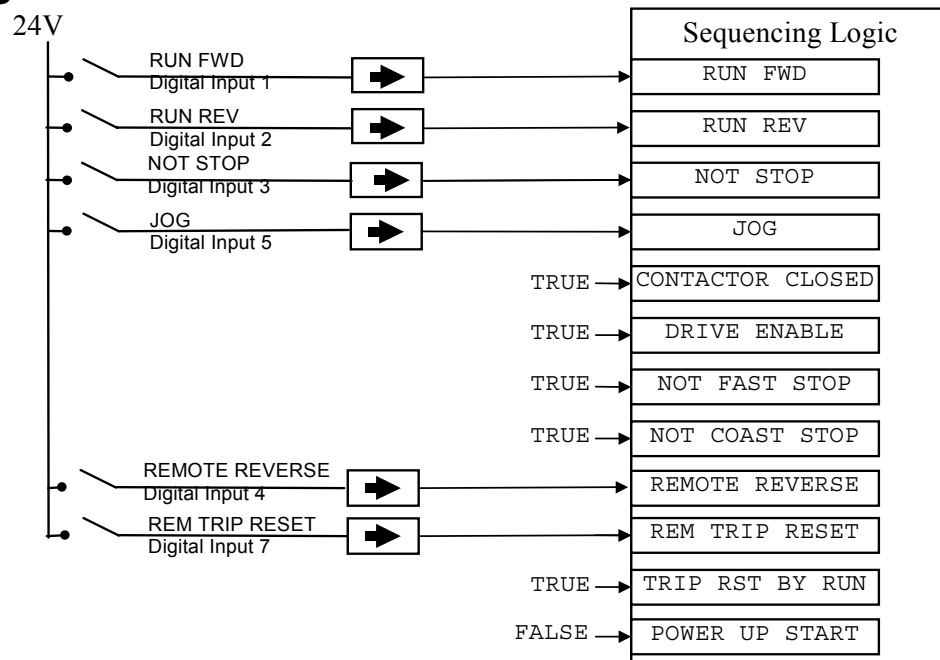


Figure 4-13 Default Sequencing Wiring (Macro 1)

The methods below can be used when the drive has Macro 1, 2, 3 or 4 installed.

DEFAULT

The default configuration view above caters for Single, Two, and Three Wire Logic Starting without rewiring. Note that the NOT STOP parameter is active (FALSE - not wired to), meaning that the drive will only run while the relevant RUN parameters are held TRUE.

## Starting Several Drives Simultaneously

**Note:** This text refers to starting other drives in a system simultaneously with this Frame K.

**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.

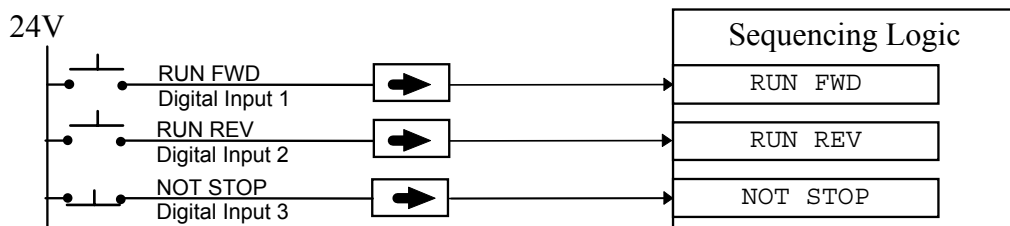
## Single Wire Logic Starting

Use just DIGITAL INPUT 1 when the motor direction will always be the same. All other digital inputs are FALSE (0V). The motor will run while the RUN FWD switch is closed, and will stop when it is open.

## Two Wire Logic Starting

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

## Three Wire Logic Starting



**Figure 4-14 Wiring for Three Wire Logic Starting**

This example uses three inputs; RUN FWD, RUN REV and NOT STOP.

- Fit normally-open push button switches to RUN FWD and RUN REV.
- 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 FWD and RUN REV signals. When FALSE, these signals are not latched.

For example, operating the RUN FWD switch starts the drive running forward. Operating the RUN REV 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.

## 4-16 Operating the Drive

# THE KEYPAD

## Connecting the Keypad

The Keypad is a plug-in MMI (Man-Machine Interface) option that allows full use of the drive's features.

It provides for local control of the drive, monitoring, and complete access for application programming.

Insert the Keypad into the front of the drive (replacing the blank cover and plugging into the RS232 programming port); or mount it up to 3 metres away using the optional panel mounting kit with connecting lead: refer to Chapter 3: "Installing the Drive" - Fitting the Remote 6901 Keypad.

Two Keypads (or one and a PC running suitable programming software) can be used simultaneously. In this case each Keypad runs independently.

The drive can operate in one of two modes:

**Remote Control Mode:** Allowing access for application programming using digital and analog inputs and outputs

**Local Control Mode:** Providing local control and monitoring of the drive using the Keypad, or PC running suitable programming software

Local control keys are inactive when Remote control mode is selected and vice versa, with one exception; the L/R key toggles Local or Remote control modes and so is always operative.

**HINT:** Customise the action of the Keypad to create an effective working tool.

### The Power-Up Condition

On power-up, a default Welcome screen is displayed for several seconds showing the product description; power rating, voltage and software version of the drive. After a few seconds the display changes to the SETPOINT (REMOTE) parameter.

**Note:** By default the drive always initialises in Remote control mode, with the Local control keys inactive, making it unlikely that the motor could be started accidentally.

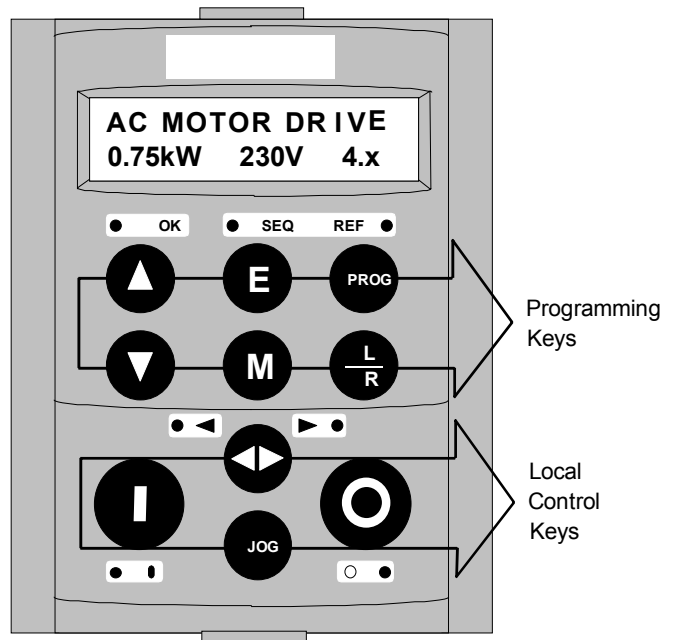
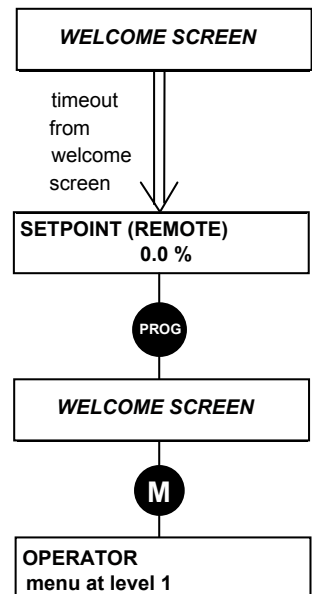


Figure 5-1 Keypad displaying Welcome screen



Remote Mode (default)







## Controlling the Drive using the Keypad

### Control Key Definitions





**Note:** Refer to Chapter 4: "Operating the Drive" for more detail about Remote and Local modes.

### Keys for Programming the Drive

**Note:** See "Navigating the Menu System", page 5-4 for a quick-start to using the menu.




<p>UP</p> 	<p>Navigation - Moves upwards through the list of parameters.</p> <p>Parameter - Increments the value of the displayed parameter.</p> <p>Command Acknowledge - Confirms action when in a command menu.</p>
<p>DOWN</p> 	<p>Navigation - Moves downwards through the list of parameters.</p> <p>Parameter - Decrements the value of the displayed parameter.</p>
<p>ESCAPE</p> 	<p>Navigation - Displays the previous level's Menu.</p> <p>Parameter - Returns to the parameter list.</p> <p>Trip Acknowledge - Acknowledges displayed Trip or Error message.</p>
<p>MENU</p> 	<p>Navigation - Displays the next Menu level, or the first parameter of the current Menu.</p> <p>Parameter - Allows a writable parameter to be modified (this is indicated by → appearing on the left of the bottom line).</p>
<p>PROG</p> 	<p>Navigation - Toggles between current locations within the Operator menu and any other menu.</p>
<p>LOCAL/ REMOTE</p> 	<p>Control - Toggles between Remote and Local Control 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.</p>

### Keys for Operating the Drive Locally




























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









## 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), FWD, REV, RUN, and STOP. 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
			Autotuning
			Auto Restarting, waiting for trip cause to clear
			Auto Restarting, timing

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



# 5-4 The Keypad

## The Menu System

The menu system is divided into a 'tree' structure with 5 menu levels. Menu Level 1 is at the top of the tree.

The Keypad has selectable "viewing levels" which can restrict the view of the menu system.

Below is a simple description of the menus at Menu Level 1:

- OPERATOR: a customised view of selected parameters contained in the SETUP menu. You can create a working list of parameters for operating your drive.
- DIAGNOSTICS: a view of important diagnostic parameters contained in the SETUP menu.
- QUICK SETUP: contains all the parameters necessary for the drive to turn the motor.
- SETUP: contains all the function block parameters for programming your application.
- SYSTEM: Macro selection.

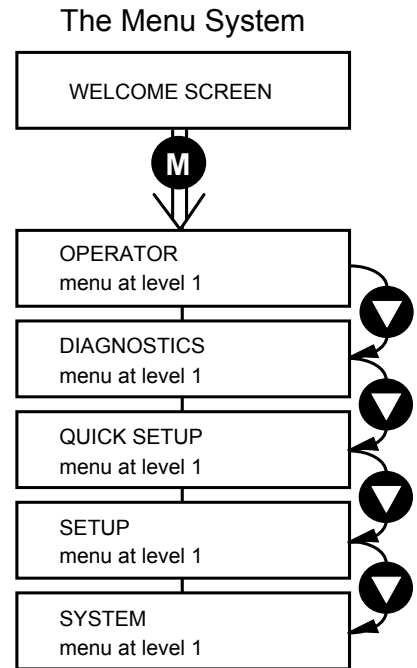


Figure 4-2 The Menu System showing Menus at Level 1

### Navigating the Menu System

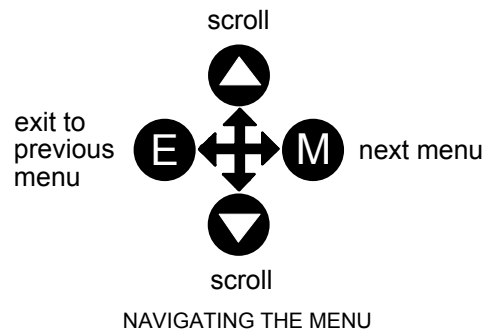
On power-up, the Keypad defaults into the OPERATOR menu, timing out from the Welcome screen. You can skip the timeout by pressing the **M** key immediately after power-up which will take you directly to the OPERATOR menu.

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

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.



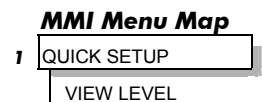
### Menu Viewing Levels

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.

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 5-6 to see how VIEW LEVEL changes the menu.



## Changing a Parameter Value

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

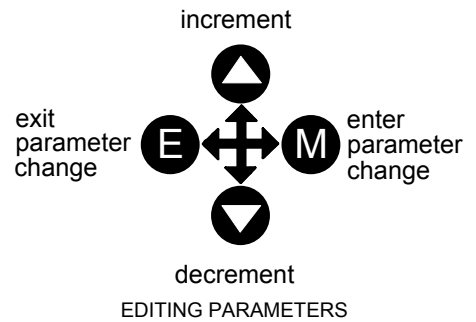
Each menu contains parameters.

*With the Parameter you want on view, press M to begin editing.*

*The up (▲) and down (▼) keys will now change the parameter/function value.*

*Press E to finish editing.*

The four keys will once again navigate around the Menus. Refer back to “Navigating the Menu System”, page 5-4.



**Note:** When viewing a “number” value, i.e. 100.00%, pressing the M key moves the cursor along the number for editing of that character by the up (▲) and down (▼) keys. “Alphanumeric” values, i.e. PUMP 2, are produced and edited in a similar way.

## What do the Symbols mean next to some Parameters?

### Parameter Status Information → ← =

→	Pressing M in a parameter displays → on the left of the bottom line to indicate that the up and down keys will now change parameter values. Pressing E removes the symbol and reverts the up and down keys to scrolling through the parameters.
←	A writable parameter may be non-writable if it is the destination of a link. In this case it will be indicated by ← appearing on the left of the bottom line.
←	A Feedback Link is indicated by ← appearing on the right of the bottom line. Refer to the Software Product Manual, Chapter 1: “Programming Your Application”.
=	Non-writable parameters are identified by = appearing on the left of the bottom line. Note that some parameters become non-writable when the drive is running.

### Expanded Menu Information >>

The parameters listed below are followed by >> to the right of the bottom display line indicating that there is more information. Press the M key to display a further list of parameters.

*AUTO RESTART menu at level 4:* AR TRIGGERS 1, AR TRIGGERS+ 1, AR TRIGGERS 2  
AR TRIGGERS+ 2

*TRIPS STATUS menu at level 4:* DISABLED TRIPS, DISABLED TRIPS+,  
ACTIVE TRIPS, ACTIVE TRIPS+,  
TRIP WARNINGS, TRIP WARNINGS+

*OP STATION menu at level 4:* ENABLED KEYS

## 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.*
- 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.*

**\* KEY INACTIVE \***  
**REMOTE SEQ**

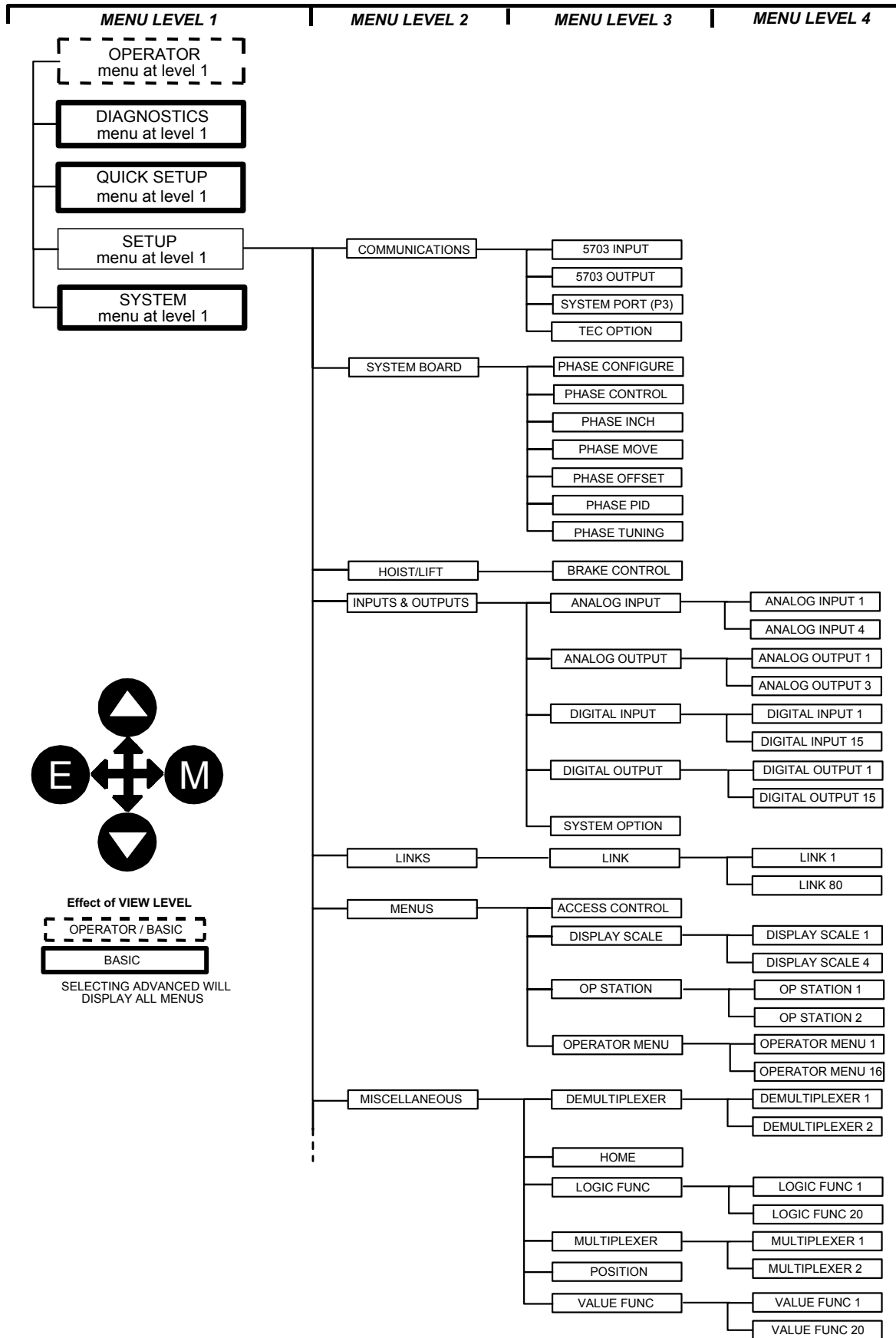
**\*\*\* TRIPPED \*\*\***  
**HEATSINK TEMP**

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.

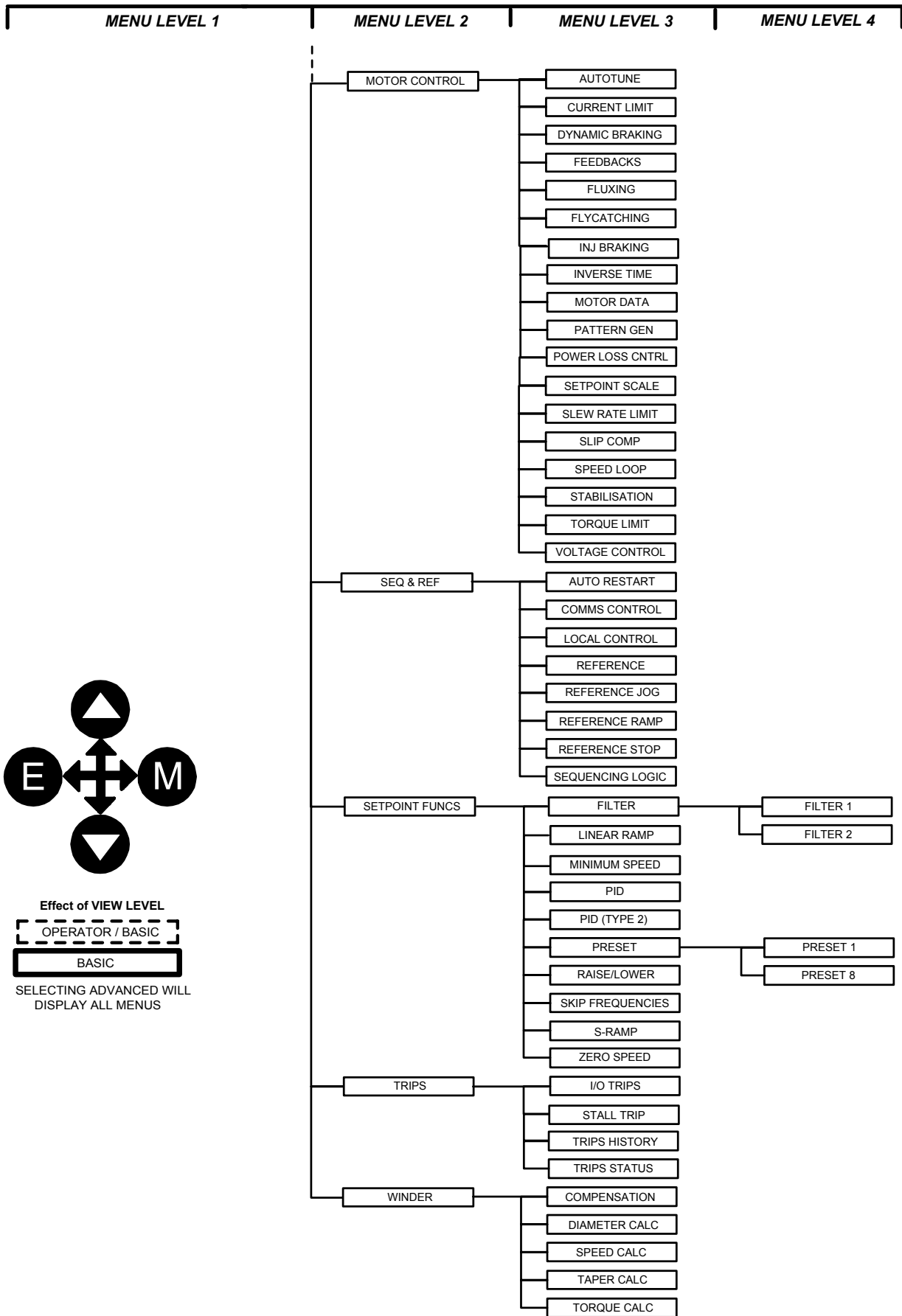
Experience will show how to avoid most messages. They are displayed in clear, concise language for easy interpretation. Refer to Chapter 6: “Trips and Fault Finding” for trip messages and reasons.

# 5-6 The Keypad

## The Menu System Map



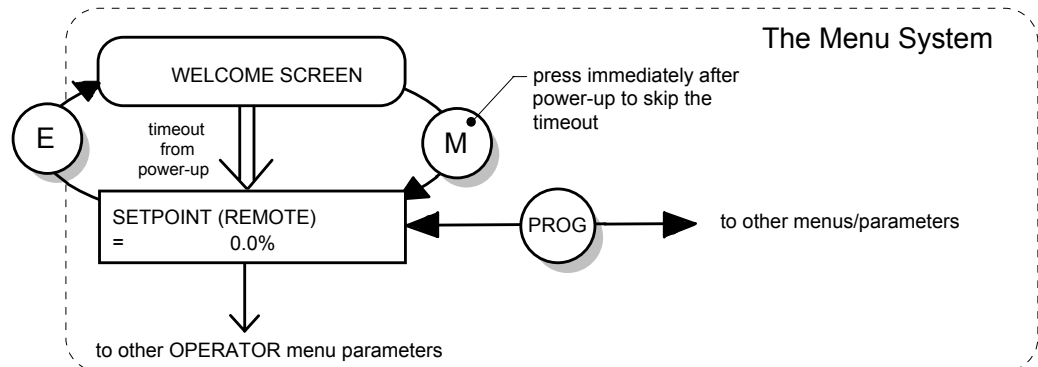
**Note:** When VIEW LEVEL is set to OPERATOR, the PROG key also toggles to the VIEW LEVEL parameter in the QUICK SETUP menu. This can be password protected.



## 5-8 The Keypad

### 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.



**Figure 5-3 The Menu System showing Operation of the E, M and PROG Keys**

Holding the PROG key for approximately three seconds takes you to the SAVE CONFIG menu. Refer to "Quick Save Feature", page 5-18.

### The L/R Key

The **L/R** key (LOCAL/REMOTE) toggles between Remote and Local Control. 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.

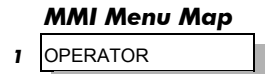
**Note:** A different naming convention is applied in the OPERATOR menu for these parameters when displayed as the first parameter entry:

- *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 OPERATOR Menu

You can create 16 “custom screens” for display in the OPERATOR menu at level 1.



Each screen contains:

- a top line of sixteen characters
- user-definable units
- user-selectable scaling factor
- user selectable limits
- user selectable coefficients

This feature may be used to re-display the setpoint, for example, in more convenient units.

To add an item to the Operator Menu select a parameter (as shown below) in an OPERATOR MENU function block. You can also give the parameter a new name, and set the scaling and units to be displayed.

**Note:** If *PARAMETER* is set to *NULL*, the Operator Menu item is not included in the Operator Menu.

## Parameter Selection

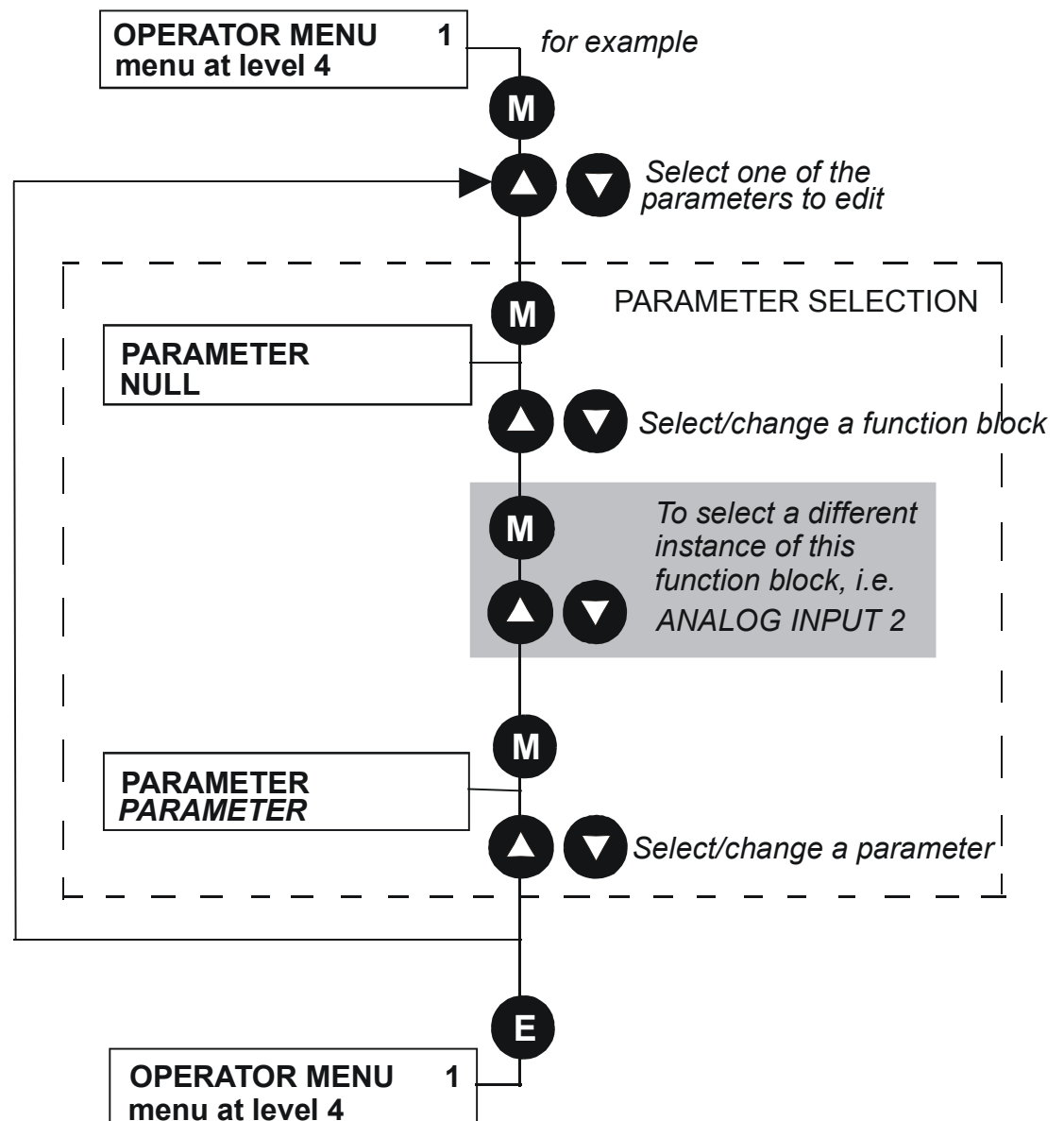


Figure 4-4 Parameter Selection

## String Entry

### Customising the Parameter Name

To enter a string:

- Press the **M** key to begin entering a character.
- Use the (▲) and down (▼) keys to scroll through the character set for each of the character spaces. If a key is not pressed within 2 seconds, the cursor will progressively move to the left of the screen.
- Press the **M** key to move to the next character within 2 seconds.
- Press the **E** key to exit parameter editing.

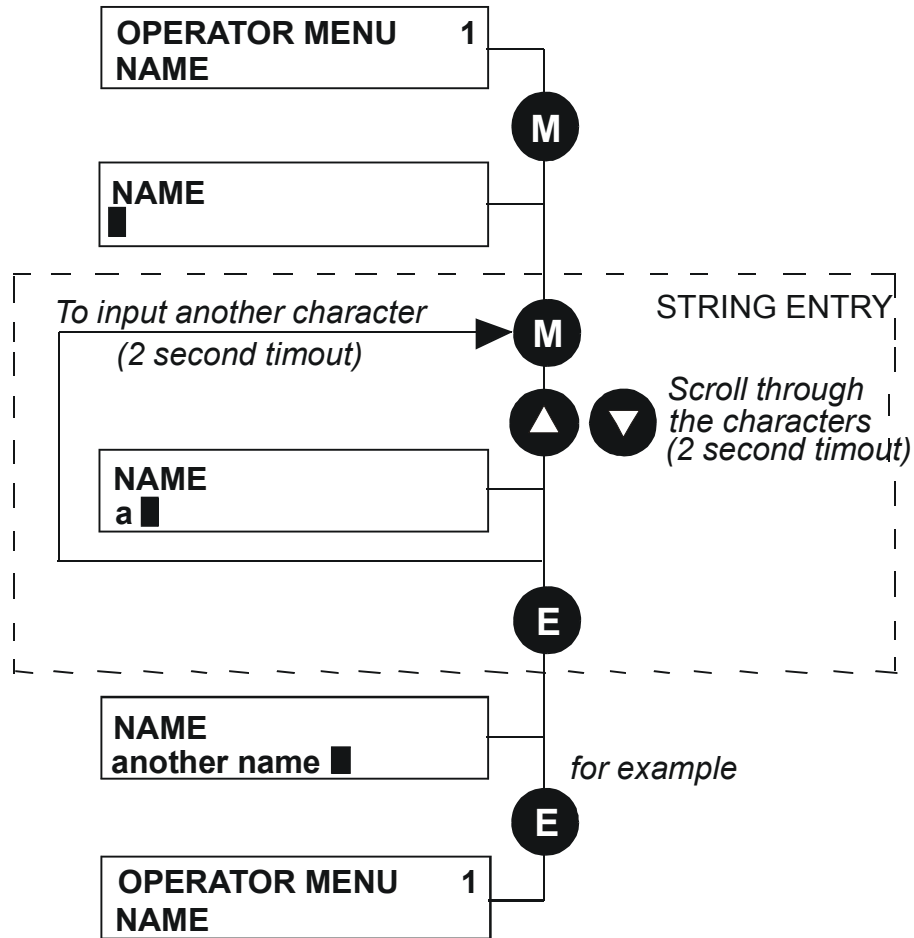


Figure 4-5 String Entry

**Note:** For details about user-definable units, scaling factors, limits and coefficients refer to the Software Product Manual, Chapter 1: Programming Your Application - OPERATOR MENU and DISPLAY SCALE function blocks.

## The DIAGNOSTICS Menu

Diagnostics are used to monitor the status of the drive, internal variables, and its inputs and outputs.

### MMI Menu Map

1 **DIAGNOSTICS**

The table below describes the parameters contained in the DIAGNOSTICS menu at level 1.

Ranges are given as “—.xx %”, for example, indicating an indeterminate integer for the value.

(Note the reference in brackets to the function block where each parameter is stored. Refer to the Software Product Manual).

### The DIAGNOSTICS Menu

<b>SPEED DEMAND</b>	<b>Tag No. 255</b>	<b>Range:</b> —.xx %
Indicates actual speed demand. This is the input to the frequency controller. (Refer to the REFERENCE function block)		
<b>REMOTE SETPOINT</b>	<b>Tag No. 245</b>	<b>Range:</b> —.xx %
This is the target reference that the drive will ramp to in remote reference mode (not including trim), direction is taken from REMOTE REVERSE and the sign of REMOTE SETPOINT. (Refer to the REFERENCE function block)		
<b>COMMS SETPOINT</b>	<b>Tag No. 770</b>	<b>Range:</b> —.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)		
<b>LOCAL SETPOINT</b>	<b>Tag No. 247</b>	<b>Range:</b> —.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)		
<b>JOG SETPOINT</b>	<b>Tag No. 246</b>	<b>Range:</b> —.xx %
The setpoint is the target reference that the drive will ramp to. (Refer to the REFERENCE function block)		
<b>TOTAL SPD DMD RPM</b>	<b>Tag No. 1203</b>	<b>Range:</b> —.xx rpm
The final value of speed demand obtained after summing all sources. (Refer to the SPEED LOOP function block)		
<b>TOTAL SPD DMD %</b>	<b>Tag No. 1206</b>	<b>Range:</b> —.xx %
The final value of speed demand obtained after summing all sources. (Refer to the SPEED LOOP function block)		
<b>SPEED FBK RPM</b>	<b>Tag No. 569</b>	<b>Range:</b> —.xx rpm
The mechanical speed of the motor shaft in revolutions per minute. (Refer to the FEEDBACKS function block)		
<b>SPEED FBK %</b>	<b>Tag No. 749</b>	<b>Range:</b> —.xx %
Shows the mechanical speed of the motor shaft as a percentage of the maximum speed setting. (Refer to the FEEDBACKS function block)		
<b>SPEED ERROR</b>	<b>Tag No. 1207</b>	<b>Range:</b> —.xx %
The difference between the demanded speed and the actual speed. (Refer to the SPEED LOOP function block)		
<b>DRIVE FREQUENCY</b>	<b>Tag No. 591</b>	<b>Range:</b> —.xx Hz
Shows the drive output frequency in Hz. (Refer to the PATTERN GEN function block)		



## 5-12 The Keypad

### The DIAGNOSTICS Menu

<b>DIRECT INPUT</b>	<b>Tag No. 1205</b>	<b>Range:</b> —.xx %
The value of the direct input, after scaling and clamping. (Refer to the SPEED LOOP function block)		
<b>TORQ DMD ISOLATE</b>	<b>Tag No. 1202</b>	<b>Range:</b> FALSE / TRUE
Speed Control mode and Torque Control mode selection. Torque Control mode = TRUE. (Refer to the SPEED LOOP function block)		
<b>ACTUAL POS LIM</b>	<b>Tag No. 1212</b>	<b>Range:</b> —.xx %
The final actual positive torque limit. (Refer to the TORQUE LIMIT function block)		
<b>ACTUAL NEG LIM</b>	<b>Tag No. 1213</b>	<b>Range:</b> —.xx %
The final actual negative torque limit. (Refer to the TORQUE LIMIT function block)		
<b>AUX TORQUE DMD</b>	<b>Tag No. 1193</b>	<b>Range:</b> —.xx %
The auxiliary motor torque as a percentage of rated motor torque. (Refer to the SPEED LOOP function block)		
<b>TORQUE DEMAND</b>	<b>Tag No. 1204</b>	<b>Range:</b> —.xx %
The demanded motor torque as a percentage of rated motor torque. (Refer to the SPEED LOOP function block)		
<b>TORQUE FEEDBACK</b>	<b>Tag No. 70</b>	<b>Range:</b> —.xx %
The estimated motor torque, as a percentage of rated motor torque. (Refer to the FEEDBACKS function block)		
<b>FIELD FEEDBACK</b>	<b>Tag No. 73</b>	<b>Range:</b> —.xx %
A value of 100% indicates the motor is operating at rated magnetic flux (field). (Refer to the FEEDBACKS function block)		
<b>MOTOR CURRENT %</b>	<b>Tag No. 66</b>	<b>Range:</b> —.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 DATA function block. (Refer to the FEEDBACKS function block)		
<b>MOTOR CURRENT A</b>	<b>Tag No. 67</b>	<b>Range:</b> —.x A
This diagnostic contains the level of rms line current being drawn from the drive. (Refer to the FEEDBACKS function block)		
<b>DC LINK VOLTS</b>	<b>Tag No. 75</b>	<b>Range:</b> —. V
The internal dc voltage tested by the FEEDBACKS block. (Refer to the FEEDBACKS function block)		
<b>TERMINAL VOLTS</b>	<b>Tag No. 1020</b>	<b>Range:</b> —. V
This shows the rms voltage, between phases, applied by the drive to the motor terminals. (Refer to the FEEDBACKS function block)		
<b>BRAKING</b>	<b>Tag No. 81</b>	<b>Range:</b> FALSE / TRUE
A read-only parameter indicating the state of the brake switch. (Refer to the DYNAMIC BRAKING function block)		
<b>DRIVE FREQUENCY</b>	<b>Tag No. 591</b>	<b>Range:</b> —.x Hz
The drive output frequency. (Refer to the PATTERN GEN function block)		

**The DIAGNOSTICS Menu**

<b>ACTIVE TRIPS</b>	<b>Tag No. 4</b>	<b>Range:</b> 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)		
<b>ACTIVE TRIPS +</b>	<b>Tag No. 740</b>	<b>Range:</b> 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)		
<b>FIRST TRIP</b>	<b>Tag No. 6</b>	<b>Range:</b> 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)		
<b>ANALOG INPUT 1</b>	<b>Tag No. 16</b>	<b>Range:</b> —.xx %
(VALUE) The input reading with scaling and offset applied. (Refer to the ANALOG INPUT function block)		
<b>ANALOG INPUT 2</b>	<b>Tag No. 25</b>	<b>Range:</b> —.xx %
(VALUE) The input reading with scaling and offset applied. (Refer to the ANALOG INPUT function block)		
<b>ANALOG INPUT 3</b>	<b>Tag No. 715</b>	<b>Range:</b> —.xx %
(VALUE) The input reading with scaling and offset applied. (Refer to the ANALOG INPUT function block)		
<b>ANALOG INPUT 4</b>	<b>Tag No. 722</b>	<b>Range:</b> —.xx %
(VALUE) The input reading with scaling and offset applied. (Refer to the ANALOG INPUT function block)		
<b>DIGITAL INPUT 1</b>	<b>Tag No. 31</b>	<b>Range:</b> FALSE / TRUE
(VALUE) The TRUE or FALSE input, (after any inversion). (Refer to the DIGITAL INPUT function block)		
<b>DIGITAL INPUT 2</b>	<b>Tag No. 34</b>	<b>Range:</b> FALSE / TRUE
(VALUE) The TRUE or FALSE input, (after any inversion). (Refer to the DIGITAL INPUT function block)		
<b>DIGITAL INPUT 3</b>	<b>Tag No. 37</b>	<b>Range:</b> FALSE / TRUE
(VALUE) The TRUE or FALSE input, (after any inversion). (Refer to the DIGITAL INPUT function block)		
<b>DIGITAL INPUT 4</b>	<b>Tag No. 40</b>	<b>Range:</b> FALSE / TRUE
(VALUE) The TRUE or FALSE input, (after any inversion). (Refer to the DIGITAL INPUT function block)		
<b>DIGITAL INPUT 5</b>	<b>Tag No. 43</b>	<b>Range:</b> FALSE / TRUE
(VALUE) The TRUE or FALSE input, (after any inversion). (Refer to the DIGITAL INPUT function block)		
<b>DIGITAL INPUT 6</b>	<b>Tag No. 726</b>	<b>Range:</b> FALSE / TRUE
(VALUE) The TRUE or FALSE input, (after any inversion). (Refer to the DIGITAL INPUT function block)		

## 5-14 The Keypad

### The DIAGNOSTICS Menu

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<b>DIGITAL INPUT 7</b>	<b>Tag No. 728</b>	<b>Range: FALSE / TRUE</b>
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(VALUE) The TRUE or FALSE input, (after any inversion).

(Refer to the DIGITAL INPUT function block)

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<b>EXTERNAL TRIP</b>	<b>Tag No. 234</b>	<b>Range: FALSE / TRUE</b>
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(EXTERNAL) A general purpose signal designed to be internally wired to a digital input block. When this signal goes TRUE this causes an EXTERNAL TRIP to occur, (unless this trip is disabled within the TRIPS area). This parameter is not saved in the drive's non-volatile memory and thus is reset to the default setting at power-up.

(Refer to the I/O TRIPS function block)

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<b>ANALOG OUTPUT 1</b>	<b>Tag No. 45</b>	<b>Range: —.xx %</b>
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(VALUE) The demanded value to output.

(Refer to the ANALOG OUTPUT function block)

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<b>ANALOG OUTPUT 2</b>	<b>Tag No. 731</b>	<b>Range: —.xx %</b>
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(VALUE) The demanded value to output.

(Refer to the ANALOG OUTPUT function block)

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<b>ANALOG OUTPUT 3</b>	<b>Tag No. 800</b>	<b>Range: —.xx %</b>
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(VALUE) The demanded value to output.

(Refer to the ANALOG OUTPUT function block)

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<b>DIGITAL OUTPUT 1</b>	<b>Tag No. 52</b>	<b>Range: FALSE / TRUE</b>
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(VALUE) The TRUE or FALSE output demand.

(Refer to the DIGITAL OUTPUT function block)

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<b>DIGITAL OUTPUT 2</b>	<b>Tag No. 55</b>	<b>Range: FALSE / TRUE</b>
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(VALUE) The TRUE or FALSE output demand.

(Refer to the DIGITAL OUTPUT function block)

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<b>DIGITAL OUTPUT 3</b>	<b>Tag No. 737</b>	<b>Range: FALSE / TRUE</b>
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(VALUE) The TRUE or FALSE output demand.

(Refer to the DIGITAL OUTPUT function block)

## The QUICK SETUP Menu

By loading a different macro, you are installing the default settings for that macro's application. Once a macro has been loaded (or the default Macro 1 is used), the parameters most likely to require attention are contained in the QUICK SETUP menu at level 1.

### MMI Menu Map

1 QUICK SETUP

The Default values in the table below are correct for when the UK country code is selected and a 400V 5.5kW Frame C power board is fitted. Some parameters in the table are marked:

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

\*\* Value dependent upon the overall "power-build", e.g. 400V, 5.5kW

The values may be different for your drive/application.

Tag	QUICK SET-UP Parameters	Default	Brief Description
1105	CONTROL MODE	VOLTS / HZ	Selects the control mode for the drive
1032	MAX SPEED	* 1500 RPM	Max speed clamp and scale factor for other speed parameters
337	MIN SPEED	-100.00 %	Min speed clamp
258	RAMP ACCEL TIME	10.0 s	Acceleration time from 0Hz to max speed
259	RAMP DECEL TIME	10.0 s	Deceleration time from max speed to 0Hz
279	RUN STOP MODE	RAMPED	Ramp to standstill when RUN signal removed
246	JOG SETPOINT	10.0 %	Drive speed setpoint whilst jogging
106	VHZ BASE FREQ	** 50.0 Hz	Determines the frequency at which maximum output volts is generated
104	V/F SHAPE	LINEAR LAW	Constant torque V to F characteristic
50	QUADRATIC TORQUE	FALSE	Selects between Constant or Quadratic mode of operation
64	MOTOR CURRENT	** 11.3 A	Calibrates drive to motor full load current
107	FIXED BOOST	** 6.00 %	Boosts starting torque by adding volts at low speed
365	CURRENT LIMIT	100.00%	Level of motor current as % of FULL LOAD CALIB
1159	MOTOR BASE FREQ	** 50.0 Hz	Frequency at which drive gives maximum output volts
1160	MOTOR VOLTAGE	** 400.0 V	Maximum motor output voltage
83	NAMEPLATE RPM	** 1445 RPM	Motor nameplate speed
84	MOTOR POLES	** 4	Number of motor poles
124	MOTOR CONNECTION	** STAR	Type of motor connection
761	ENCODER SUPPLY	10.0V	Set to supply voltage required by the encoder
566	ENCODER LINES	** 2048	Set to the number of lines used by the encoder
567	ENCODER INVERT	FALSE	Encoder direction
603	AUTOTUNE ENABLE	FALSE	Enables the Autotune feature
65	MAG CURRENT	** 3.39 A	Calibrates drive to motor no load current
119	STATOR RES	** 1.3625 $\Omega$	Motor per-phase stator resistance
120	LEAKAGE INDUC	** 43.37 mH	Motor per-phase stator leakage inductance
121	MUTUAL INDUC	** 173.48 mH	Motor per-phase stator mutual (magnetising) inductance
1163	ROTOR TIME CONST	** 276.04 ms	The motor model rotor time constant as determined by Autotune
1187	SPEED PROP GAIN	20.00	Sets the proportional gain of the loop
1188	SPEED INT TIME	100 ms	The integral time constant of the speed loop
13	AIN 1 TYPE	0..+10 V	Input range and type
22	AIN 2 TYPE	0..+10 V	Input range and type
712	AIN 3 TYPE	0..+10 V	Input range and type
719	AIN 4 TYPE	0..+10 V	Input range and type
231	DISABLE TRIPS	0000 >>	Sub-menu to set disabled trips
742	DISABLE TRIPS +	0040 >>	Sub-menu to set disabled trips
876	VIEW LEVEL	TRUE	Selects full menu for MMI display

Table 4-1 Parameters for setting-up the drive

## The SYSTEM Menu

### Saving/Restoring/Deleting Your Application

**Caution**

On power-up, the drive will always run APPLICATION.

**HINT:** The default APPLICATION supplied with the drive is a copy of Macro 1. Saving your current configuration to APPLICATION will ensure that it is always ready to run on power-up.

**SAVE CONFIG**

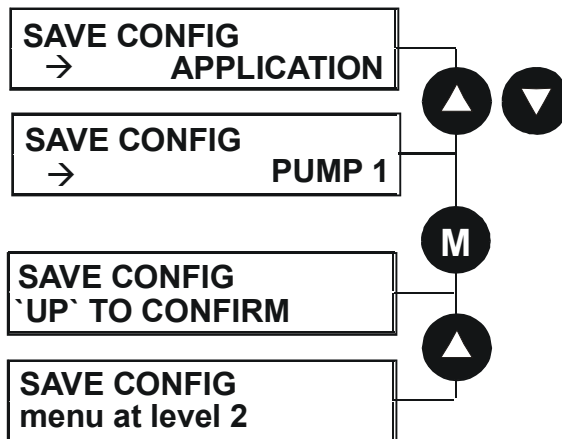
The SAVE CONFIG menu saves your current settings to the displayed config name.

You can save to any config name listed. Saving to an existing config name, rather than a newly created config name, will overwrite the previous information.

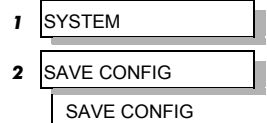
By default, the only name in this list will be APPLICATION. As you create new config names, they will be added to this list. If you also save the new config into APPLICATION, it will always be restored on power-up.

**Note:** Because factory macros are read-only, they do not appear in the SAVE CONFIG menu.

To save an application see below.



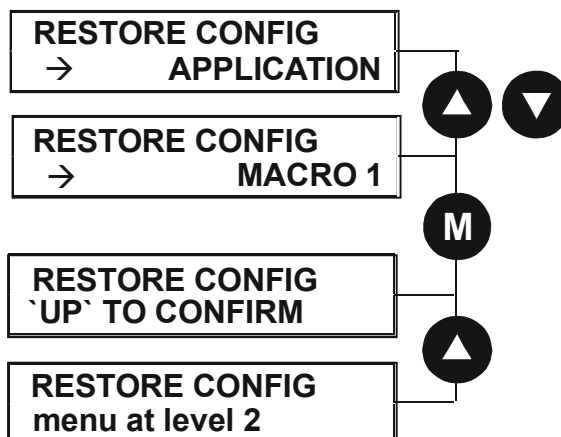
**MMI Menu Map**



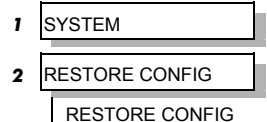
**RESTORE CONFIG**

This menu restores the displayed application/macro to the drive.

To restore an application/macro see below.



**MMI Menu Map**

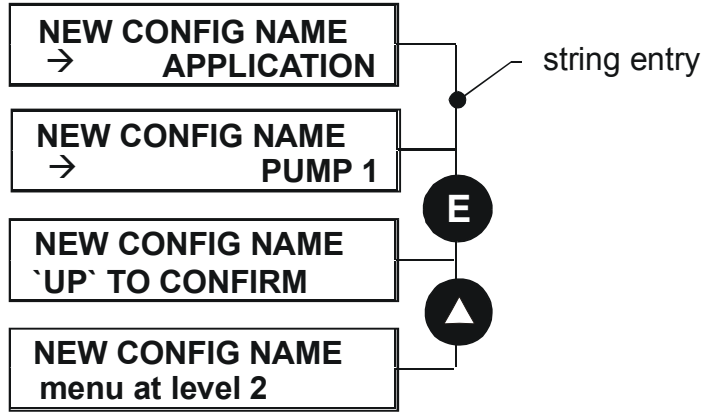
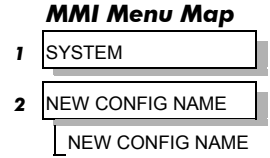


## NEW CONFIG NAME

Use the NEW CONFIG NAME parameter to create a new config name.

The Keypad provides a default name, APPLICATION, for you to save your application in. You can save more than one application using different names, e.g. PUMP 1, PUMP 2.

To enter a config name see below. Refer to “Figure 4-5 String Entry”, page 5-10 for details of how to enter a string.



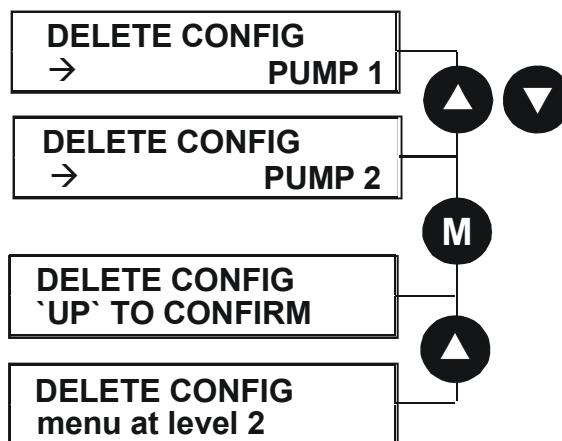
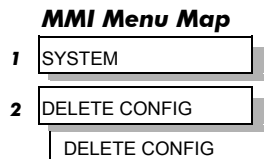
## DELETE CONFIG

You can delete your own applications in this menu.

**Note:** If you delete APPLICATION, don't worry. Software always provides a new APPLICATION on power-up which will be the same as MACRO 1.

You cannot delete the factory macros.

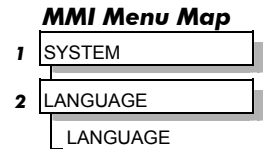
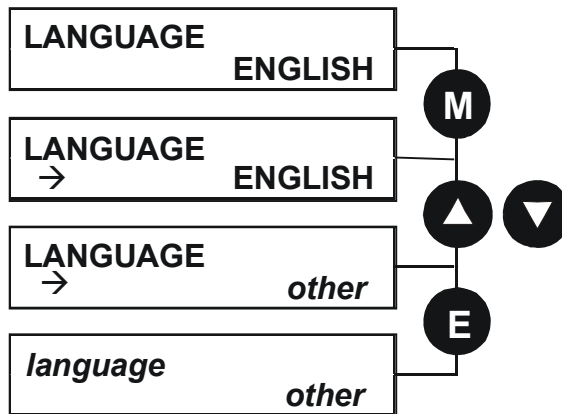
To delete an application see below.



# 5-18 The Keypad

## Selecting the Language

This option selects a different display language.

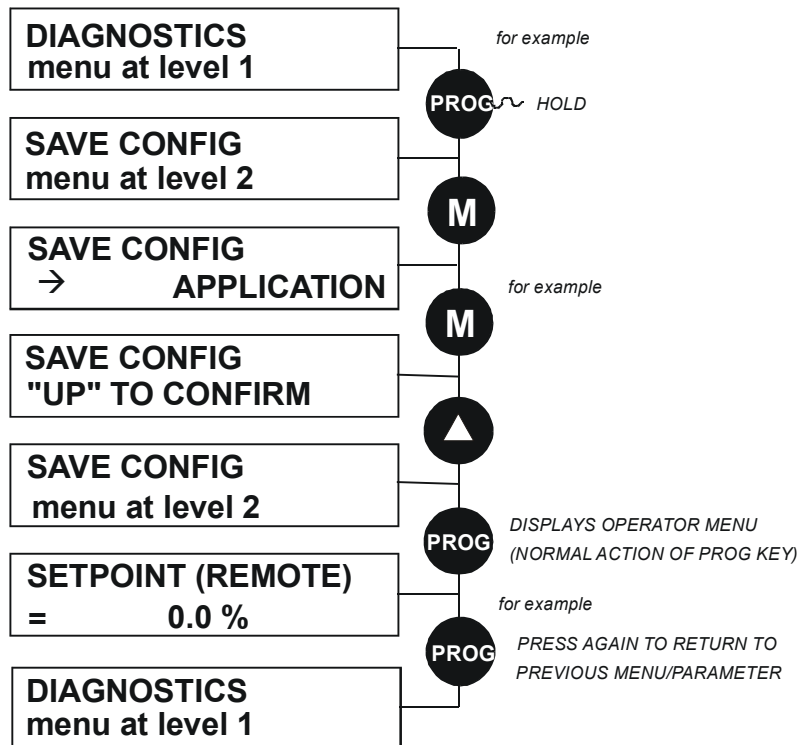


The available languages are: ENGLISH, GERMAN, FRENCH, SPANISH, ITALIAN, SWEDISH, POLISH, PORTUGUESE.

## Special Menu Features

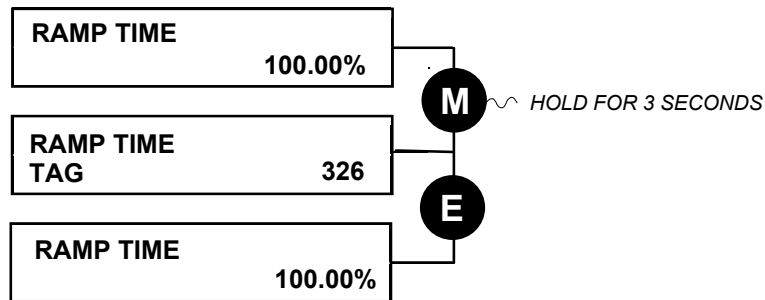
### Quick Save Feature

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.



## 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).

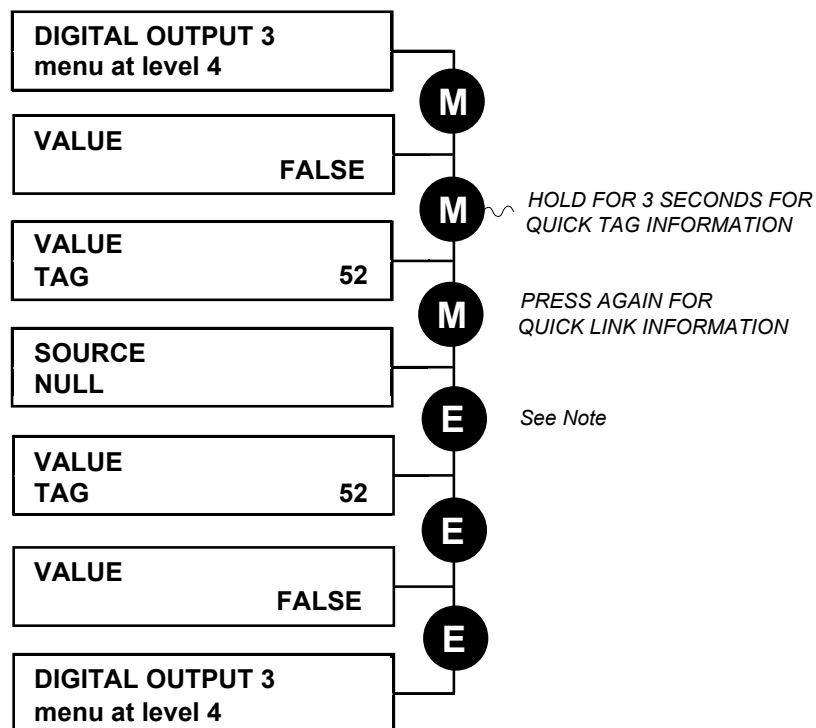


## Quick Link Information

When in Advanced view level and with the Quick Tag Information on display, press the **M** key in any *configurable* parameter to display link information about that parameter.

The drive is in Parameterisation Mode and links cannot be edited.

**Note:** Quick Link Information is not available for parameters that are non-configurable.



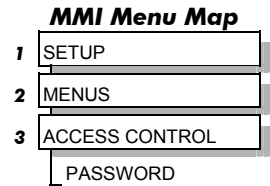
**Note:** The drive must be in Configuration mode before links can be edited. Pressing the **M** key at this point will display the **ENABLE CONFIG** page. Refer to the Software Product Manual, Chapter 1: "Programming Your Application" - Making and Breaking Links in Configuration Mode.



## Password Protection

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.

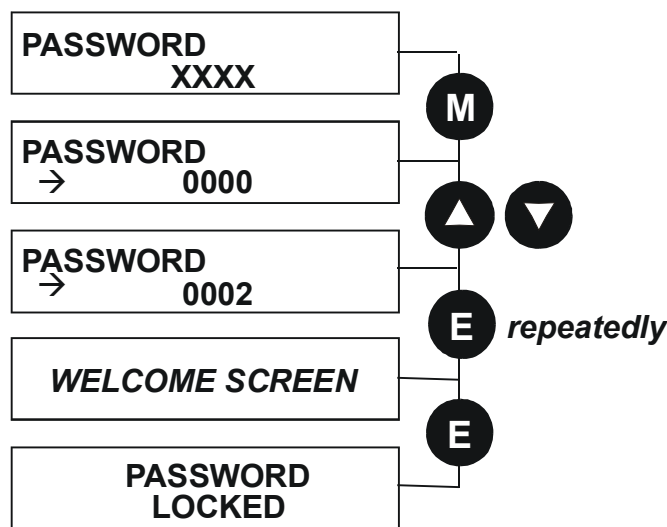
The password protection is activated/deactivated using the PASSWORD parameter.



### 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.

**Note:** You can choose to have the password protect individual parameters in the OPERATOR menu. Under default conditions these are not protected. Refer to the Software Product Manual, Chapter 1: “Programming Your Application” - OPERATOR MENU::IGNORE PASSWORD and ACCESS CONTROL::NO SETPOINT PWRD.

### 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.





































































































































































