
# 650G

## Frame 1, 2 & 3

HA501333U001 Issue 1
Product Manual

aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
sealing & shielding

Parker

ENGINEERING YOUR SUCCESS.

# 650G AC Drive

Frame 1, 2 & 3

## Product Manual

HA501333U001 Issue 1

Compatible with Version 2.x Software onwards



WARRANTY

Parker SSD Drives warrants the goods against defects in design, materials and workmanship for the period of 24 months from the date of manufacture, or 12 months from the date of delivery (whichever is the longer period), on the terms detailed in Parker SSD Drives Standard Conditions of Sale IA500504.

Parker SSD Drives reserves the right to change the content and product specification without notice.

## FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from Parker-Hannifin Corporation, its subsidiaries and authorized distributors provide product or system options for further investigation by users having technical expertise.

The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current product catalog and in any other materials provided from Parker or its subsidiaries or authorized distributors.

To the extent that Parker or its subsidiaries or authorized distributors provide component or system options based upon data or specifications provided by the user, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the components or systems.

Cont.2

# 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 | |
|---|---|
| **Model Number** ***(see product label)*** | |
| **Where installed** ***(for your own information)*** | |
| **Unit used as a:** ***(refer to Certification for the Inverter)*** | O Component O Relevant Apparatus |
| **Unit fitted:** | O Wall-mounted O Enclosure |

### Application Area

The equipment described is intended for industrial motor speed control utilising DC motors, 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

| | | |
|---|---|---|
|  **Caution** Risk of electric shock |  **Caution** Refer to documentation |  **Earth/Ground** Protective Conductor Terminal |

# 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

Cont.4

# Contents



Cont.5

# Contents

# Contents

# Contents

# Chapter 1 GETTING STARTED

## Introduction

The 650G Series AC Drive provides simple, compact, and low-cost speed control for 3-phase induction motors

This manual describes the low-power end of the 650G product range for the following motor power ratings:

| | Nominal Input Voltage | Phase | Drive Power | |
|---|---|---|---|---|
| Frame 1 | 230V | 1 | 0.25 – 0.75kW | 0.3 - 1.0 Hp |
| Frame 2 | 230V | 1 | 1.1 – 1.5kW | 1.5 - 2.0 Hp |
| Frame 2 | 400V | 3 | 0.37 – 2.2kW | 0.5 - 3.0 Hp |
| Frame 3 | 230V | 1 | 2.2kW | 3.0 Hp |
| Frame 3 | 230V | 3 | 2.2 - 4.0 kW | 3.0 - 5.0 Hp |
| Frame 3 | 400V | 3 | 3.0 – 7.5kW | 4.0 - 10.0 Hp |

The drive features:

- Local or Remote mode operation
- SELV control terminals (Safe Extra Low Volts)
- Intelligent monitoring strategy to avoid nuisance tripping
- In-built protection of the unit against overloads, excessive voltages, phase-to-phase and phase-to-earth short circuits
- An internal RFI filter is fitted as standard
- An internal dynamic brake switch for connection to an external resistor (Frame 3: 230V, and 400V units only)
- Quiet operation
- Controlling the unit locally using the 6511 Keypad 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.

***Note:*** *Do not attempt to control motors whose rated current is less than 50% 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 drive is suitable for your requirements by reading the Product Code on the rating label. Refer to Chapter 9: “Technical Specifications” - Understanding the Product Code.

If the unit is damaged, refer to Chapter 8: “Routine Maintenance and Repair” for information on returning damaged goods.

## Storage and Packaging

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

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.

# About this Manual

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

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

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

## Software Product Manual

An accompanying Software Product Manual is available for download from the Parker SSD Drives website: www.SSDdrives.com.

# Chapter 2 AN OVERVIEW OF THE DRIVE

## Component Identification

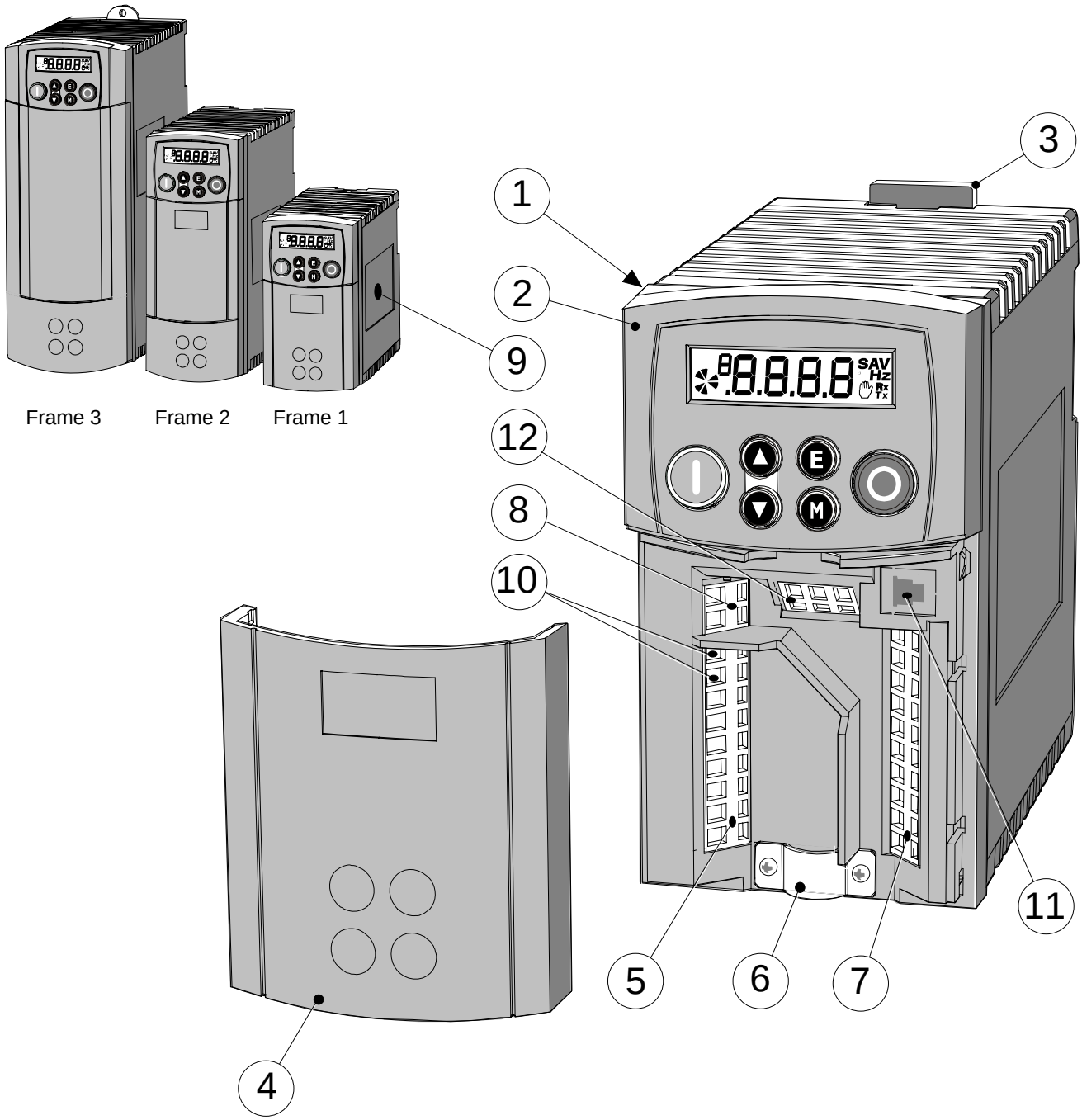


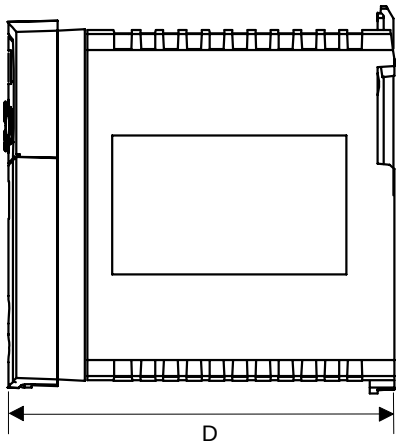

**Figure 2-1 View of Component Parts (Frame 1 illustrated)**

| | | | |
|---|---|---|---|
| **1** | Main drive assembly | **7** | Control terminals |
| **2** | Keypad | **8** | Volt-free relay contacts |
| **3** | DIN clip/fixing bracket | **9** | Product rating label |
| **4** | Terminal cover | **10** | Motor thermistor terminals |
| **5** | Power terminals | **11** | RS232 programming port - P3 |
| **6** | Motor cable screen clamp | **12** | Encoder/digital inputs |

# Chapter 3 INSTALLING THE DRIVE

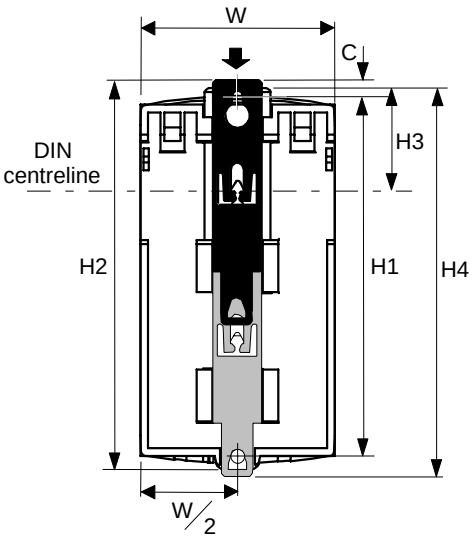
**IMPORTANT:** Read Chapter 10: "Certification for the Drive" before installing this unit.

## Mechanical Installation

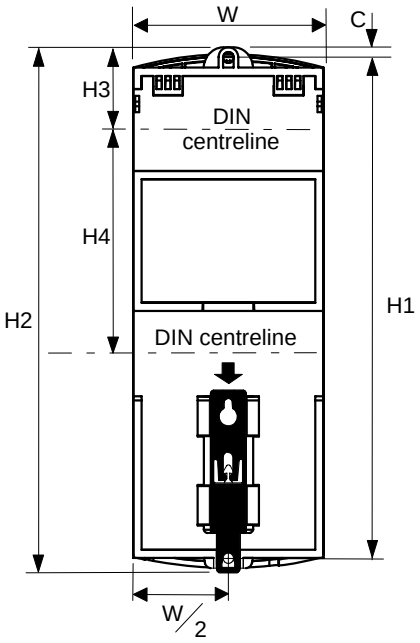



**SIDE VIEW - Frame 1 illustrated**

The DIN clip is repositioned on Frames 1 and 2 to provide the upper fixing hole when wall-mounting




**REAR VIEW - Frame 1 illustrated (Frame 2 similar)**




**REAR VIEW - Frame 3**

| | Fixing | Torque | Weight | H1 Fixing Centres | H2 | H3 | H4 | C | W | D |
|---|---|---|---|---|---|---|---|---|---|---|
| Frame 1 | M4 | 1.5Nm | 0.85kg | 132 | 143 | 35 | 139 | 6 | 73 | 142 |
| | | | (2 lbs) | (5.2″) | (5.6″) | (1.4″) | (5.5″) | (0.2″) | (2.9″) | (5.6″) |
| Frame 2 | M5 | 3.0Nm | 1.4kg | 188 | 201 | 35 | 194 | 6.5 | 73 | 173 |
| | | | (3 lbs) | (7.4″) | (7.9″) | (1.4″) | (7.7″) | (0.24″) | (2.9″) | (6.8″) |
| Frame 3 | M5 | 3.0Nm | 2.7kg | 242 | 260 | 38 | 112 | 5 | 96 | 200 |
| | | | (6 lbs) | (9.5″) | (10.2″) | (1.5″) | (4.4″) | (0.2″) | (3.8″) | (7.9″) |

Dimensions are in millimetres ( inches )

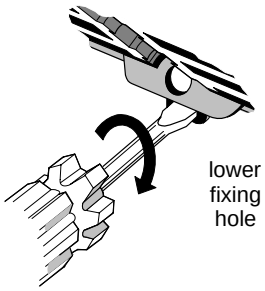
### Mounting the Drive

To maintain compliance with European Electrical Safety Standard VDE0160(1994)/EN50178 (1998) the unit must be mounted inside a control cubicle that requires a tool for opening. The cubicle should provide 15dB attenuation to radiated emissions between 30-100MHz.

M**ount the drive vertically** on a solid, flat, non-flammable, vertical surface. It can be panel-mounted, or rail-mounted on a rail complying with EN50022 (35mm DIN).

#### DIN Mounting

To DIN mount the unit, hang the unit on the top DIN rail and push the unit onto the bottom DIN rail until it snaps in to position. Secure with a lower screw fixing. To release the unit, use a flat bladed screwdriver as shown.




### Ventilation

Maintain a minimum air clearance for ventilation of 100mm (4 inches) above and below the unit. When mounting two or more 650G units together, these clearances are additive. Ensure that the mounting surface is normally cool. Be aware that adjacent equipment may generate heat and also have clearance requirements. Provided the minimum clearance for ventilation is maintained, 650G drives may be mounted side-by-side.

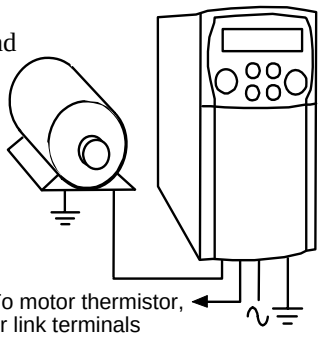
# Electrical Installation

**IMPORTANT:** Read the Safety Information on page Cont. 2 before proceeding.

## Wiring Instructions

### Local Control Wiring

*Minimum Connections*




This is the simplest installation. Every new drive will operate in Local Control when first powered-up. The keypad is used to start and stop the drive.

Refer to the Connection Diagram and install the:

- Thermistor cable, or link/jumper terminals TH1A and TH1B (we recommend you do use a thermistor)
- Motor cable
- Supply cable
- Follow the earthing/grounding and screening advice

Refer to Chapter 4: "Operating the Drive"- Local Control Operation.

### Remote Control Wiring

If operating in Remote Control you will use your control panel to start and stop the drive, via a speed potentiometer and switches or push-buttons.

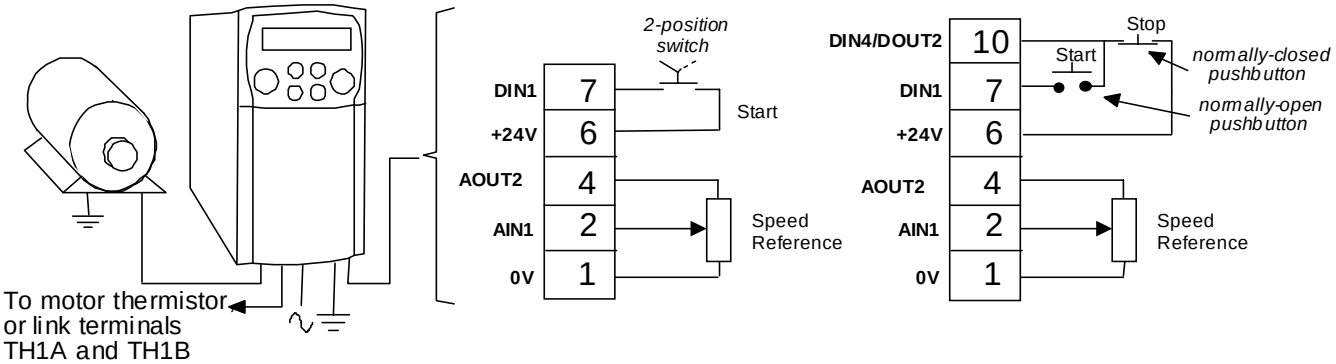
Your wiring of the control terminals will be governed by the Application you use: refer to Chapter 12 for an explanation of the various Applications you can select and the appropriate control wiring. Application 1 is the default Application.

The diagram below shows the **minimum** connections to operate the drive for single-wire (switch) starting, and push-button starting. Other control connections for your Application are shown in Chapter 12 and can be made to suit your system.

Referring to the Connection Diagram:

- Follow the instructions for Local Control Wiring, as detailed above
- Install using minimum connections (suitable for Application 1 only), or refer to Chapter 12 and install the appropriate control wiring for your system

**Minimum Connections for Application 1:** **Single Wire Starting** **Push-Button Starting**




***Note:*** *You can still operate the drive in Local mode, if necessary, with any Application selected.*

Refer to Chapter 4: "Operating the Drive" and follow the relevant instructions for Single Wire Starting or Push-Button Starting.

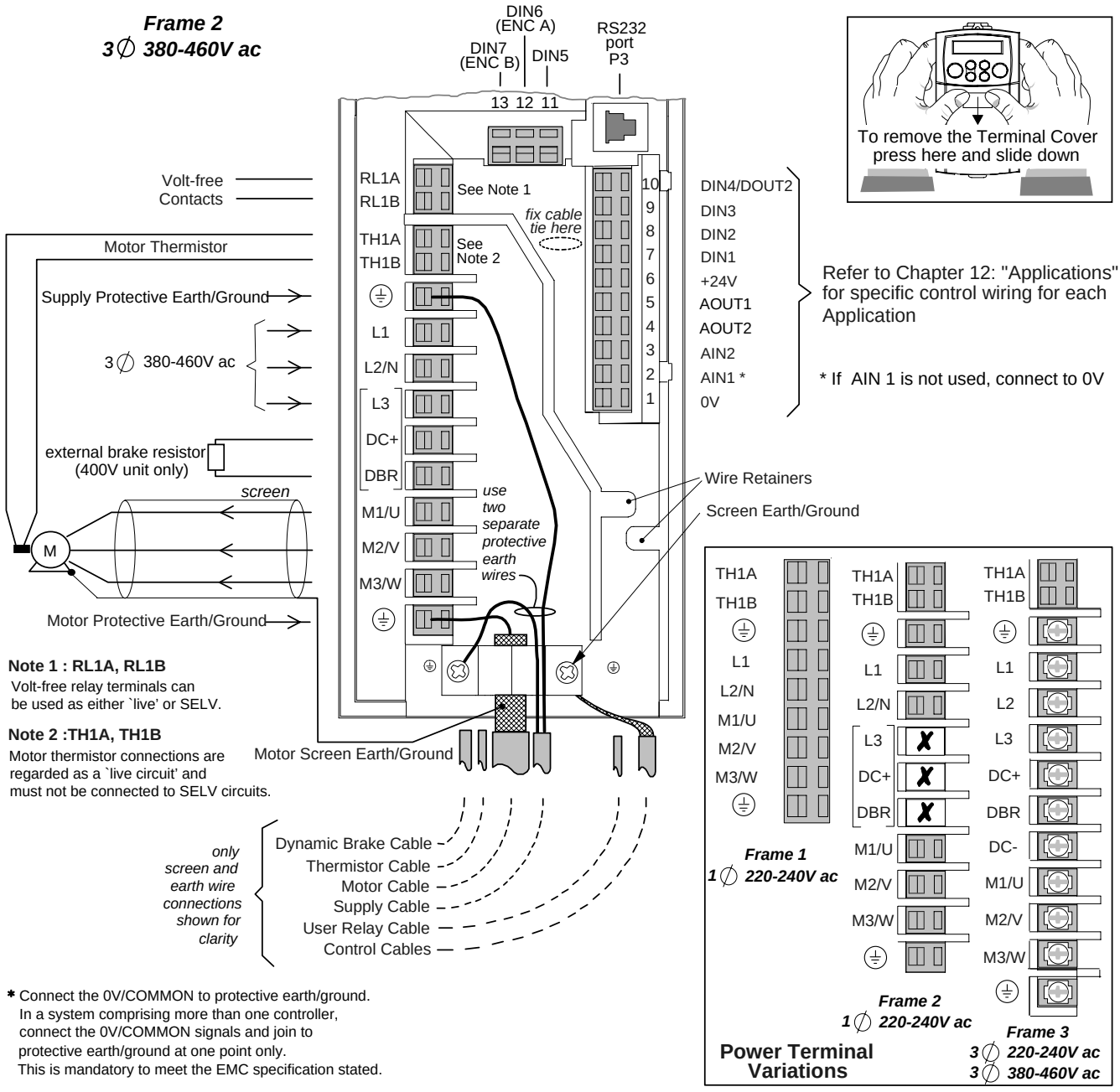
**WARNING!**

This product is designated as "professional equipment" as defined in EN61000-3-2. Where enforced, permission of the supply authority shall be obtained before connection to the low voltage domestic supply.

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

The drive is suitable for use with both earth referenced supplies (TN) and non-earth referenced supplies (IT) when fitted with an internal ac supply EMC filter.

# Connection Diagram



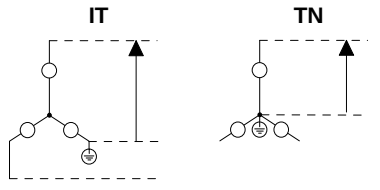

**Note 1 : RL1A, RL1B**
Volt-free relay terminals can be used as either `live' or SELV.

**Note 2 :TH1A, TH1B**
Motor thermistor connections are regarded as a `live circuit' and must not be connected to SELV circuits.

***** Connect the 0V/COMMON to protective earth/ground. In a system comprising more than one controller, connect the 0V/COMMON signals and join to protective earth/ground at one point only. This is mandatory to meet the EMC specification stated.

### Wiring Instructions

1 Remove the terminal cover from the drive.
2 Loosen the motor cable screen clamp.
3 Connect the power supply cable, motor cable and control cables (if required).
4 Fasten the motor cable in place with the motor cable screen clamp. Secure any control cable screen connections under the right hand screw. *Frames 2 & 3 only : Secure control cables under the wire retainers.*
5 Connect the thermistor and user-relay if required. *Frames 2 & 3 only: connect the dynamic brake if required (400V units only).*
6 Use a cable tie and secure all the control cables and user-relay cables (if fitted) as close to the control terminals as possible.
7 Connect the ancillary equipment as shown, for example, an external brake resistor.
8 Re-fit the terminal cover.




Non-earth referenced supply

Earth referenced supply

The drive is suitable for use with earth referenced supplies (TN) and non-earth referenced supplies (IT) when fitted with an internal ac supply EMC filter.

**IMPORTANT:**
Note that the 650G unit must be **permanently earthed** using two independent protective earth/ground incoming supply conductors.

## Control Wiring Connections

| Terminal (SELV) | Name | Application 1 Default Function (for other Applications refer to Chapter 12: "Applications") | Range |
|---|---|---|---|
| P3 | P3 | RS232 port for use with remote-mounted RS232 keypad or programming PC | - |
| RL1A | User Relay | Volt-free contact | 0-250Vac/24Vdc 4A |
| RL1B | User Relay | Volt-free contact | 0-250Vac/24Vdc 4A |
| 13 | DIN7 (ENC B) | Configurable digital input | 0-24V |
| 12 | DIN6 (ENC A) | Configurable digital input | 0-24V |
| 11 | DIN5 | **Not Coast Stop** - configurable digital input:<br>0V = Stop, 24V = Coast Stop | 0-24V |
| 10 | DIN4/<br>DOUT2 | Configurable digital input/output<br>**Not Stop** (input):<br>0V = No latching of Run (DIN1), 24V = Run latched | 0-24V source open collector * |
| 9 | DIN3 | **Jog** – configurable digital input:<br>0V = Stop, 24V = Jog | 0-24V |
| 8 | DIN2 | **Direction** – configurable digital input:<br>0V = Forward, 24V = Reverse | 0-24V |
| 7 | DIN1 | **Run Forward** – configurable digital input: 0V=Stop, 24V=Run | 0-24V |
| 6 | +24V | 24V supply for digital I/O | * |
| 5 | AOUT1 | **Ramp Output** – configurable analog output (10mA loading) | 0-10V |
| 4 | AOUT2 | Defaults to provide a 10V reference (10mA loading) | 0-10V |
| 3 | AIN2 | **Speed Trim** – analog input 2 | 0-10V, 4-20mA |
| 2 | AIN1 | **Speed Setpoint** – analog input 1.<br>If AIN 1 is not used, connect to 0V. | 0-10V |
| 1 | 0V | 0V reference for analog/digital I/O | 0V |

***** *The total current available is 50mA, either individually or as the sum of outputs from terminasl 6, 10 and 11.*

## Power Wiring Connections

| Terminal | Description | Function | Range | |
|---|---|---|---|---|
| | | | 200V 1-Phase | 200V/400V 3-Phase |
| TH1A | Thermistor | Connection to motor thermistor | It is good practice to protect motors by fitting temperature sensitive resistors. A typical resistance (up to a reference temperature of 125°C) is 200Ω, rising rapidly to 2000Ω above this temperature. Connect devices in series between TH1A and TH1B. Link the terminals if temperature sensors are not used. | |
| TH1B | Thermistor | Connection to motor thermistor | | |
| ⏚ | Reference Terminal | Supply protective earth (PE). This terminal must be connected to a protective (earth) ground for **permanent earthing.** | | |
| L1 * | Power Input | Single and three phase live connection | 220/240V ac ±10% rms with respect to L2/N. 50-60Hz (IT/TN) | 220/240V or 380/460V ac ±10% rms with respect to L2, L3 phase-to-phase. 50-60Hz (IT/TN) |
| L2/N *<br>L2 | Power Input | Single phase neutral (or L2 three phase live connection) | 220/240V ac ±10% with respect to L1. 50-60Hz (IT/TN) | 220/240V or 380/460V ac ±10% with respect to L1, L3. 50-60Hz (IT/TN) |
| L3 | Power Input | Three phase live connection | Not applicable | 220/240V or 380/460V ac ±10% with respect to L1, L2. 50-60Hz (IT/TN) |
| DC- | *No user connection* | | | |
| DC+ | Dynamic Brake | Connection to external brake resistor | Not applicable | Frame 2 (high volt only) & 3.<br>See "Internal Dynamic Brake Switch" table |
| DBR | Dynamic Brake | Connection to external brake resistor | Not applicable | Frame 2 (high volt only) & 3.<br>See "Internal Dynamic Brake Switch" table |
| M1/U<br>M2/V<br>M3/W | Motor Outputs | Connection for motor | Motor rated at:<br>0 to 220/240V ac<br>0 to 240Hz | Motor rated at:<br>0 to 220/240V or 0 to 380/460V ac<br>0 to 240Hz |
| ⏚ | Reference Terminal | Supply protective earth (PE). This terminal must be connected to a protective (earth) ground for **permanent earthing.** | | |

## Terminal Block Acceptance Sizes

Wire sizes should be chosen with respect to the operating conditions and your local National Electrical Safety Installation Requirements. Local wiring regulations always take precedence.

| Frame Size | Power Terminals (maximum wire size) | Brake Terminals (maximum wire size) | Thermistor/Control Terminals (maximum wire size) |
|---|---|---|---|
| Frame 1 *230V* | 2.5mm$^2$/12 AWG | Not Applicable | 2.5mm$^2$/12 AWG |
| Frame 2 *230V* | 2.5mm$^2$/12 AWG | Not Applicable | 2.5mm$^2$/12 AWG |
| Frame 2 *400V* | 2.5mm$^2$/12 AWG | 2.5mm$^2$/12 AWG | 2.5mm$^2$/12 AWG |
| Frame 3 *230V* | 6.0mm$^2$/10 AWG | 6.0mm$^2$/10 AWG | 2.5mm$^2$/12 AWG |
| Frame 3 *400V* | 6.0mm$^2$/10 AWG | 6.0mm$^2$/10 AWG | 2.5mm$^2$/12 AWG |

### Power Wiring

***Note:*** *For specified EMC emission and immunity performance, install to EMC Installation Instructions. Refer to Chapter 10: "Certification for the Drive" - for more information*

Terminal tightening torque for Frame 3 power connections is 20 lb.in (2.26Nm).

Protect the incoming mains supply using the specified fuse, or RCD circuit breaker Type B.

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

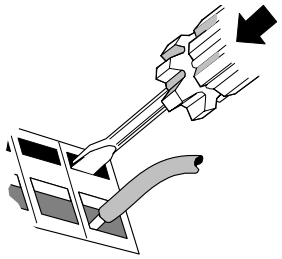
- Operate correctly with dc and ac protective earth currents (i.e. type B RCDs as in Amendment 2 of IEC755).
- Have adjustable trip amplitude and time characteristics to prevent nuisance tripping on switch-on.

### Control Wiring

Control wiring of between 0.08mm$^2$ (28AWG) and 2.5mm$^2$ (12AWG) can be used. Ensure all wiring is rated for the highest system voltage. All control terminals are SELV, i.e. double-insulated from power circuits.

### Using Cage Clamp Terminals

Strip wire insulation to 5-6mm (0.20-0.24 inches), or alternatively use wire-crimps. Use a flat-bladed screwdriver, maximum blade size 3.5mm. The cage provides the correct force for a secure connection.



**IMPORTANT:** DO NOT lever or turn the screwdriver.

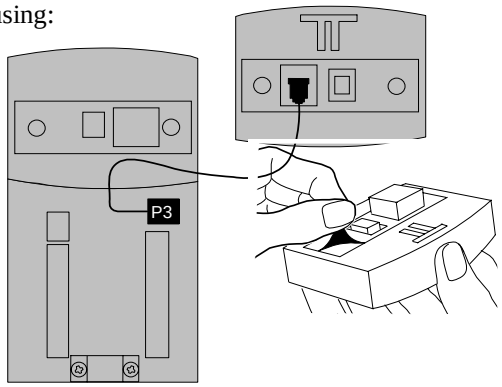
# Optional Equipment

## Fitting the Remote 6511 Keypad

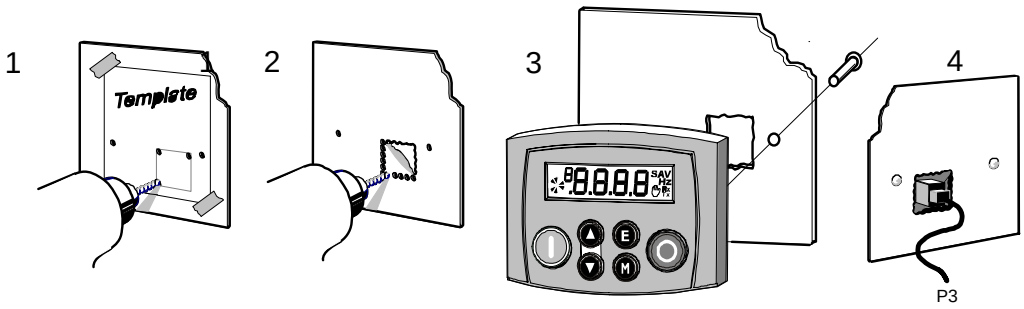
You can remote-mount the drive-mounted Keypad using:

- the RS232 (P3) port located under the terminal cover
- A standard P3 lead, Parker SSD Part Number CM057375U300, which is used to connect the Keypad to the drive.

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

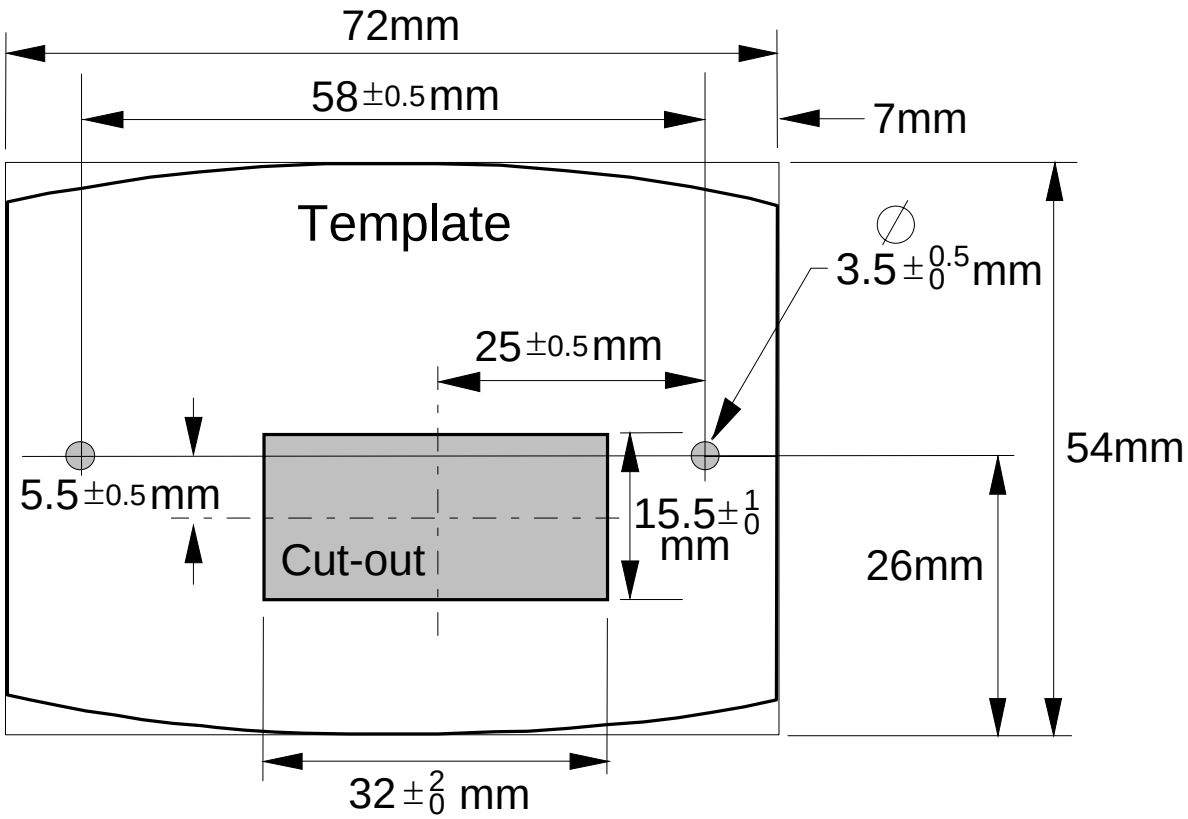



### Assembly Procedure




### Cut-out Dimensions

The drawing below can be photocopied actual size (100%) and used as a template.



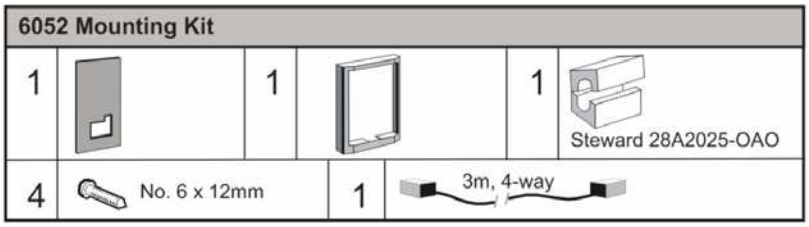
# Fitting the Remote 6521/6901/6911 Keypad

The 6052 Mounting Kit is required to remote-mount a 6521 Keypad. An enclosure rating of IP54 is achieved for the remote Keypad when correctly mounted using the 6052 Mounting Kit.

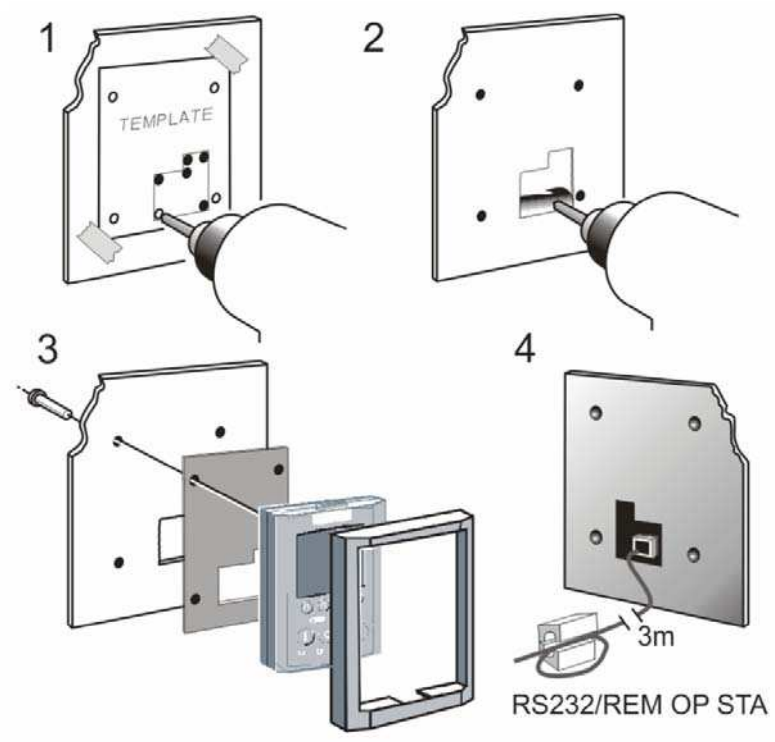
### 6052 Mounting Kit Parts for the Remote Keypad

### Tools Required

No. 2 Posidrive screwdriver.



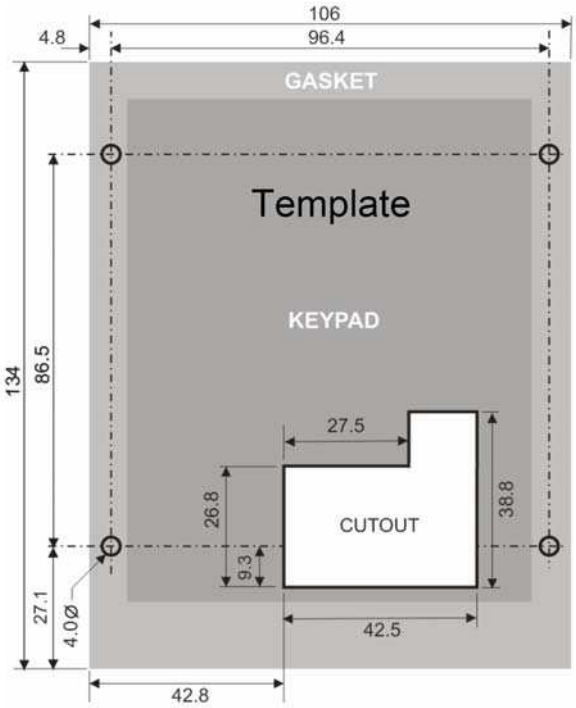

## Assembly Procedure




## Cutout Dimensions

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

**Figure 3-1 Mounting Dimensions for the Remote-Mounted Keypad 6521/6901/6911**




6901

The 6901/6911 keypad, supplied with 690+ products, may be remote mounted and connected to the 650G drive in the same way.

## RS485/RS232 Communication Module

You can create a network of drives by linking a Master (PC/PLC) to one or more 650G drives fitted with this module.

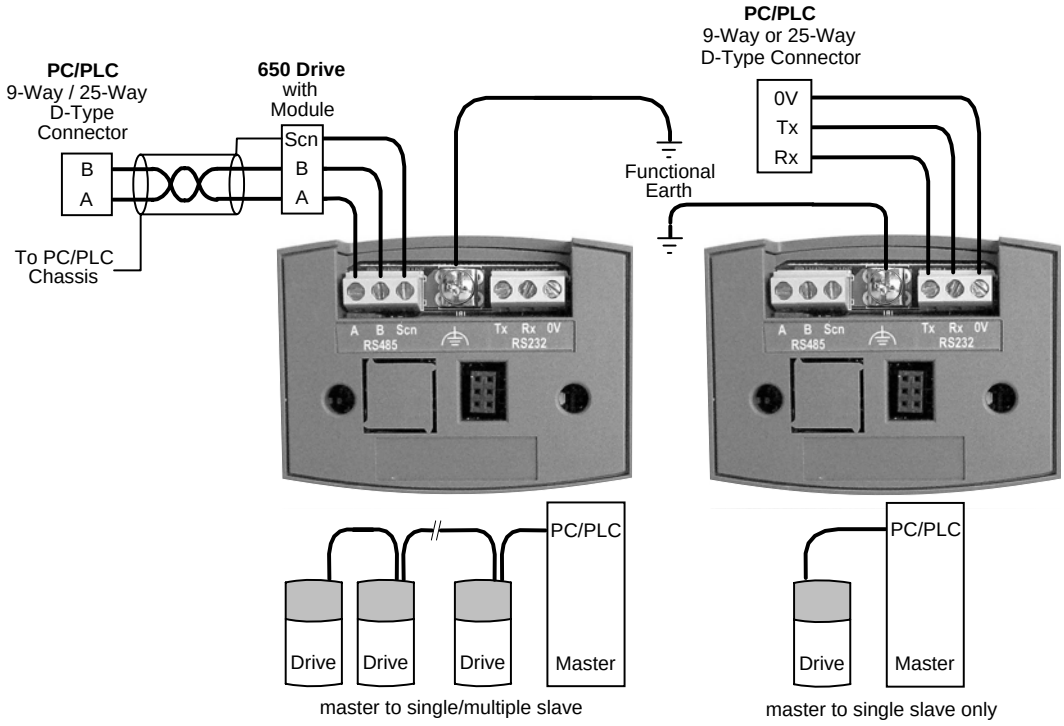
Plug this Communication Module on to the front of the 650G drive, replacing the keypad.

It converts signals from the host 650G drive into RS485 or RS232, and vice versa, so that information can be shared between the Master and 650G drive(s).

Wiring is very simple - all connections are SELV (Safe Extra Low Voltage). Select to use RS485 or RS232 by wiring to the appropriate terminal on the module.

***Note:*** *RS485 and RS232 terminals cannot be used simultaneously.*

We recommend you ground the module to the system earth using the Functional Earth terminal.




| Wiring Specifications | | |
|---|---|---|
| | **RS485 Connections** | **RS232 Connections** |
| **Network Type** | 2-Wire Shielded Twisted-Pair | 3-Wire Un-Shielded Cable |
| **Connections** | A=RxA/TxA, B=RxB/TxB, Shield | Rx, Tx, Ground (0V) |
| **Signal Levels** | To RS485 Standard | To RS232 Standard |
| **Receiver Input Impedance** | ¼ Unit Load | 3 kΩ minimum<br>7kΩ maximum |
| **Maximum Cable Length** | 1200m (4000ft) | 3 metres |
| **Maximum Baud Rate** | 57.6kbaud | 57.6kbaud |
| **Maximum Number of Units** | 32 including slaves and masters | 2: 1 master and 1 slave only |

## LED Indications

The module has three LEDs providing diagnostic information about the 650G host drive's 'Health', 'Receive' and 'Transmit' activity.

HEALTH = Green, Rx = Red, Tx =Red


| LED Name | LED Duty | Drive State |
|---|---|---|
| HEALTH | SHORT FLASH | Re-configuration, or corrupted non-volatile memory at power-up |
| | EQUAL FLASH | Tripped |
| | ON | Healthy |
| | LONG FLASH | Braking |
| | OFF | No drive power, or serious hardware fault |
| Rx | INTERMITTENT | Indicates activity on the 'receive' line carrying data from the Master |
| Tx | INTERMITTENT | Indicates activity on the 'transmit' line carrying data to the Master |

## Configure the Drive

Before the module can be used you must configure the drive to your system. Set-up the parameters in the SERIAL menu as appropriate. Refer to Chapter 6: "Programming Your Application" - SET::SERL Menu, parameters $^{S}$SE01 to $^{S}$SE08.

For Tag number information refer to the 650G Software Product Manual, available on the Parker SSD Drives website: www.SSDdrives.com.

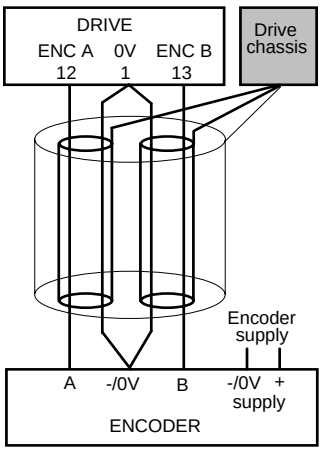
***Note:*** *This Option can only be used on drives using software version 4.1 or higher.*

# Encoder Connections

The drive is **only** suitable for use with single-ended encoders. Take special care wiring the encoder to the drive due to the low level of the signals.

All wiring to the drive 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 drive chassis.

*Recommended cable (pairs individually screened):*
Belden equivalent 8777
Parker SSD Drives Part Number CM052666

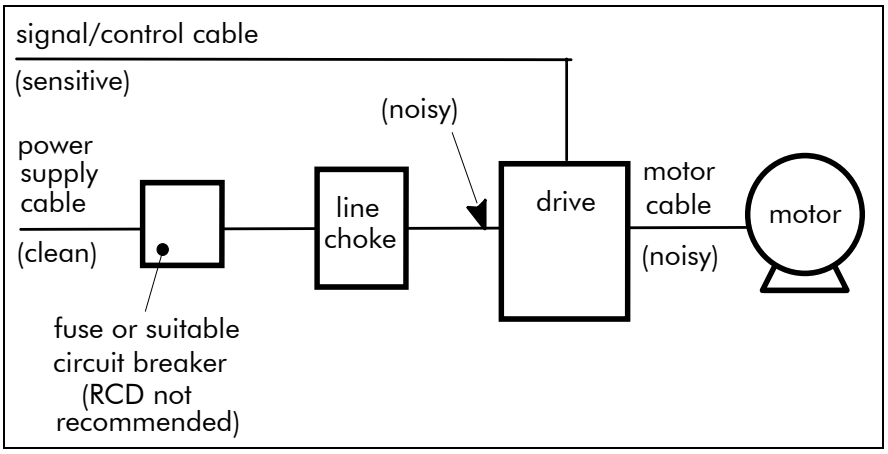



The drive will operate with 5-24V encoders. Provide the correct supply for the encoder. Do not use the 10V or 24V supply from the drive.

The maximum input frequency of terminals 12 and 13 (ENCA and ENCB) is 100kHz.

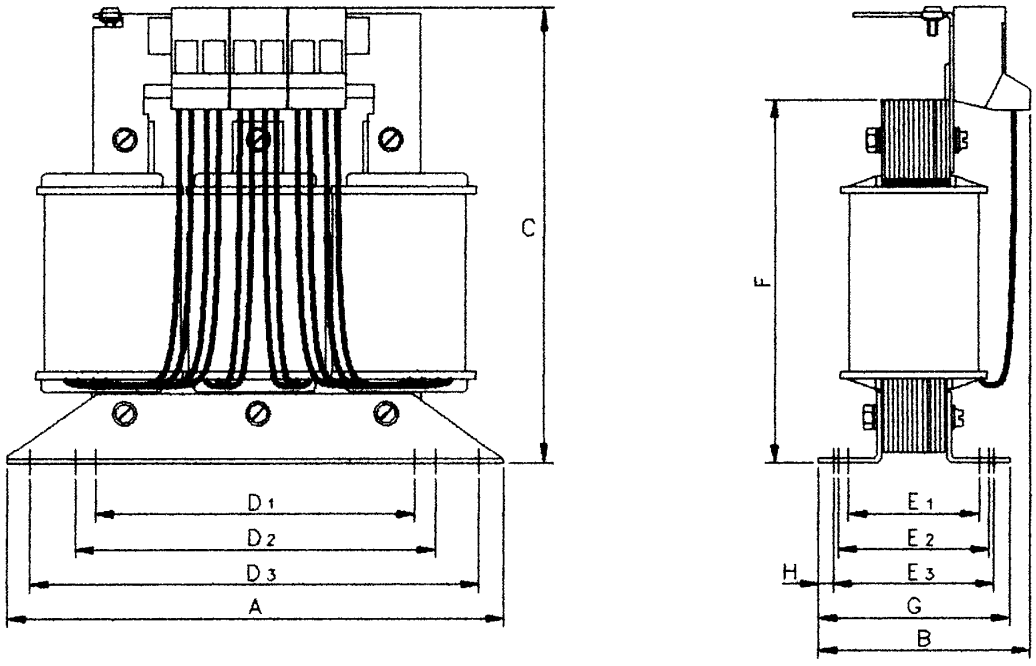
## Line Choke

Cables are considered to be electrically sensitive, clean or noisy. A line choke is used to reduce harmonic emission to meet the limits of EN61000-3-2.




The choke is for use on the following drive:

| Phase | Drive Nominal Input Voltage (V) | Drive Power (kW/hp) | Rated Current (Aeff) | Rated Inductivity (mH) | Choke Part Number |
|---|---|---|---|---|---|
| 3 | 400 | 0.37/0.5 | 6 | 4.88 | CO467763U003 (Europe) |




| Rated Current (Aeff) | Rated Inductivity (mH) | A (mm) | B | C | D1 | D2 | D3 | E1 | E2 | E3 | F* | G | Fixing Screws | Weight (kg/lbs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **650G Frame 2, 3-phase, 400V, 0.37kW/0.5Hp** | | | | | | | | | | | | | | |
| 6 | 4.88 | 148 | 76 | 151 | 90 | 100 | 136 | 39 | 45 | 49 | 110 | 69 | M4 | 2.1/4.63 |

** dimension is dependent of the air gap*

# Chapter 4 OPERATING THE DRIVE

## 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:

- Check for damage to equipment.
- 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 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 drives control terminals are not being used, check whether these unused terminals need to be tied high or low.
- If the motor thermistor terminals are not connected to a motor thermistor, connect these terminals together.
- Check external run contacts are open. Check external speed setpoints are all zero.

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

## Initial Start-up Routines

**Note:** *Refer to Chapter 5: "Using the Keypad" to familiarise yourself with the keypad's indications, and how to use the keys and menu structure.*

**IMPORTANT**
When power is applied to the drive in Remote Control, it will immediately start running if the RUN signal is active.

**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 machinery connected to the motor will not be damaged by unpredictable motion.
Ensure that the emergency stop circuits function correctly before running the motor for the first time.

The drive can be started in either Remote Control or Local Control. **By default, the drive will start in Local Control.**

These routines assume that the drive's control terminals are wired as shown in the Control Wiring Connections in Chapter 3.

Connected in this way, a positive setpoint will rotate the motor in a clockwise direction when viewed down the shaft, looking toward the motor.

**Note:** *If during the start-up routine the display shows either an alarm (indicated by the letter "A") or a flashing Warning message, refer to Chapter 7: "Trips and Fault Finding".*

A typical alarm

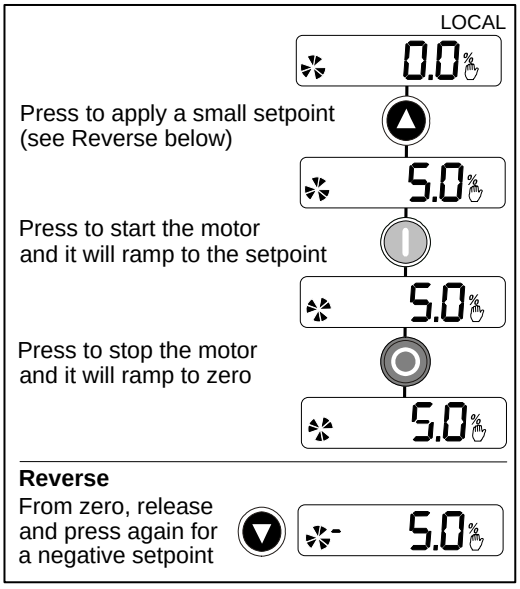
# Local Control Operation


This is the simplest method of operating the drive. Connect the keypad to the drive and power-up the unit. The drive will display the Local screen. If not, refer to Chapter 5 and select Local Control.

Follow the instructions opposite to start and stop the motor.

**Reverse:** Instead of setting a negative setpoint, you can reverse the motor direction by pressing STOP + ▼, or START + ▼. To change the direction to forwards, (the normal direction), press STOP + ▲ or START + ▲.

Note that the Setpoint parameter will not change sign to indicate this change, however the rotating indicator on the MMI will show the direction.




We recommend that you use the STOP key commands if the motor is stopped, and the START key commands if the motor is running. The keys should be pressed and released together.

# Remote Control Operation

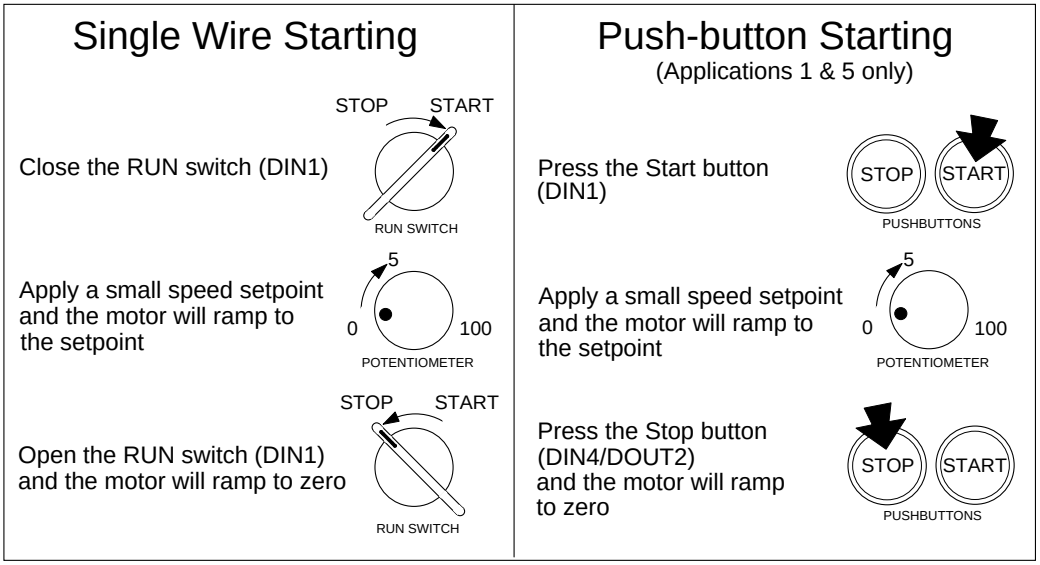

Connect the keypad to the drive and power-up the unit.

The drive will display the Local screen. Refer to Chapter 5 and select Remote Control.

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

Follow the instructions below to start and stop the motor using your control panel.

Reverse the motor's direction of rotation using the DIN2 connection (0V = forward, +24V = reverse). Alternatively, swap two of the motor phases **(WARNING: Disconnect the mains supply first)**.




***The installation of your drive is now complete:***

The drive will operate as an open-loop drive. It is programmed to control an induction motor of equivalent power, current, and voltage rating to the drive. Using the keypad (or other suitable programming tool) the drive must now be set-up:

- as a simple Open-loop drive (V/F Mode)
  *provides less torque control at low speeds, but is ideal for controlling fans and pumps*
- in Sensorless Vector Mode
  *used for maximum torque control at low speeds, for example, in operating a lift*

## Set-up as an Open-loop drive (V/F Mode)

The drive will run the motor without any further adjustment. However, the parameters below are pre-loaded with "typical" values that are dependent upon the Product Code for the drive. To improve performance you can enter "actual" values to suit your system; particularly P6 and P7 whose values should be found on the motor nameplate. Now refer to "Tuning the Drive to Your System", page 4-5.

***Note:*** *For Product Code dependent defaults, refer to Chapter 6: "Programming Your Application".*

| Display | Parameter | Default | Brief Description |
|---|---|---|---|
| SCL01 | CONTROL MODE | VOLTS / HZ (0) | This parameter contains the main method of motor control used by the drive, and by default is set to VOLTS/HZ |
| P 6 | MOTOR CURRENT | Default is Product Code dependent | Enter the motor nameplate full-load line current |
| P 7 | BASE FREQUENCY | Default is Product Code dependent | Enter the output frequency from the motor nameplate |
| P 13 | FIXED BOOST | Default is Product Code dependent | Enter a boost for starting torque to help with high friction loads |

## Set-up using the Sensorless Vector Mode

By default, the drive is operating in V/F Mode. Use the keypad to change to Sensorless Vector Mode:

| Display | Parameter | Default | Brief Description |
|---|---|---|---|
| SCL01 | CONTROL MODE | Set to SENSORLESS VEC (1) | This parameter contains the main method of motor control used by the drive, and by default is set to VOLTS/HZ |

To operate in Sensorless Vector Mode, the drive needs to know more about your system. You **MUST** carry out an Autotune (described over the page) but first, enter "actual" values from your motor nameplate for the parameters listed below.

***Note:*** *For Product Code dependent defaults, refer to Chapter 6: "Programming Your Application".*

| Display | Parameter | Default | Brief Description |
|---|---|---|---|
| P 2 | MAX SPEED | Default is Product Code dependent | Set the speed in Hz at which the 650G will run when the maximum setpoint is applied |
| P 6 | MOTOR CURRENT | Default is Product Code dependent | Enter the motor nameplate full-load line current |
| P 7 | BASE FREQUENCY | Default is Product Code dependent | Enter the output frequency from the motor nameplate |
| SCL02 | NAMEPLATE RPM | 1445.0 | Enter the motor nameplate full-load rated speed. This is the motor speed in rpm at base frequency minus full load slip |
| SCL 11 | MOTOR POLES | 4-pole | Enter the number of motor poles shown on the motor nameplate |
| SCL 12 | MOTOR VOLTAGE | Default is Product Code dependent | Enter the motor nameplate voltage at base frequency |
| SCL 14 | MAG CURRENT | Default is Product Code dependent | Enter the motor model no-load line current only if performing a Stationary Autotune (see over the page) |

# Autotuning the Drive

**IMPORTANT:** You MUST carry out an Autotune if you intend to use the drive in Sensorless Vector Mode. If you are using it in Volts/Hz control an Autotune is not necessary.

The Autotune procedure identifies some of the more obscure characteristics about your motor, and automatically loads them into the drive.

Follow the procedure below to complete the Autotune. When the Autotune is finished, refer to "Tuning the Drive to Your System", page 4-5.

## 1 Stationary or Rotating Autotune?

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

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

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

## 2 Performing the Autotune

| | | | |
|---|---|---|---|
| SCL20 | AUTOTUNE MODE | 0 | Select the Autotune operating mode |
| SCL21 | AUTOTUNE ENABLE | 0 | Enables the Autotune feature. Refer to "The Autotune Feature" below. |

### 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. Set MAX SPEED ($^{P}$ 2) to the maximum speed at which you will operate the drive in normal operation. The Autotune will characterise the motor up to 30% above this speed. If you later wish to run faster than this, you will need to carry out another Autotune.
2. Set the AUTOTUNE MODE ($^{S}$ CL20) parameter to ROTATING (1).
3. Set AUTOTUNE ENABLE ($^{S}$ CL21) to 1 (TRUE), and start the drive. The drive will carry out a Rotating Autotune, indicated by the Run and Stop led's flashing on the blank cover when fitted, or by flashing AtN on the keypad. 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 0 (FALSE).

### Performing a Stationary Autotune

Before starting the stationary Autotune, you **MUST** enter the value of magnetising current for the motor ($^{S}$ CL14). This may be available on the motor nameplate. If not, you may need to contact the motor supplier.

1. Set the AUTOTUNE MODE ($^{S}$ CL20) parameter to STATIONARY (0).
2. Set AUTOTUNE ENABLE ($^{S}$ CL21) to 1 (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 on the blank cover when fitted, or AtN will flash on the keypad. When complete, the drive is returned to the stopped condition and the AUTOTUNE ENABLE parameter is reset to 0 (FALSE).

# Tuning the Drive to Your System

Finally, adjust the parameters below as necessary to tune the drive to your system. Refer to Chapter 6: "Programming Your Application" for details.

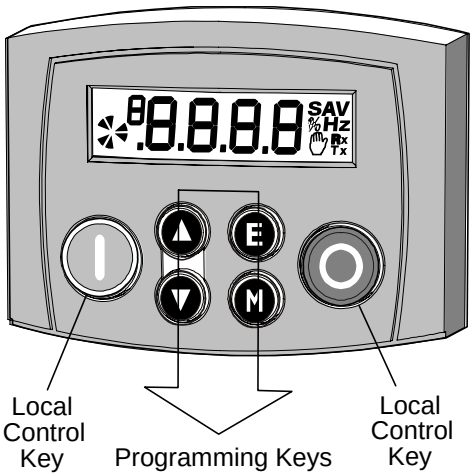
| Display | Parameter | Default | Brief Description |
|---|---|---|---|
| P 2 | MAX SPEED | Default is Product Code dependent | Set the speed in Hz at which the 650G will run when the maximum setpoint is applied.<br>Sensorless Vector Mode: If you change this parameter when in this mode, you must carry out another Autotune. |
| P 3 | MIN SPEED | 0.0% | Set the minimum frequency at which the 650G will run, as a % of MAX SPEED |
| P 4 | ACCEL TIME | 10.0 s | Set the time taken for the 650G to ramp up from zero to MAX SPEED |
| P 5 | DECEL TIME | 10.0 s | Set the time taken for the 650G to ramp down from MAX SPEED to zero |
| P 8 | JOG SETPOINT | 10.0 % | Set the jogging speed setpoint, as a % of MAX SPEED |
| P 9 | RUN STOP MODE | 0 | Select the method by which the motor speed is reduced to zero |
| P 11 | V/F SHAPE | LINEAR | Select LINEAR or FAN flux characteristics (constant or quadratic respectively) when operating in V/F Mode |
| P 12 | HEAVY/NORMAL DUTY | 0 | Refer to Chapter 6 : P12 for explanation, and consequence of changing P11 |
| P 13 | FIXED BOOST | Default is Product Code dependent | Set a boost for starting torque to help with high friction loads |

# Chapter 5 THE KEYPAD

The 6511 Keypad (Man-Machine Interface, MMI) provides for local control of the drive, monitoring, and complete access for application programming.

The 650G can be fitted with either a Standard or Remote Keypad. Both Keypads fit on the front of the drive, but the Remote Keypad (with its extra connector) can also be remote-mounted up to 3 metres away using a connecting lead: refer to Chapter 3: "Installing the Drive" – Fitting the Remote Keypad.

To remove a Keypad, simply pull it away from the drive. To refit it, push it back into place.




The product rating label identifies the Drive/Keypad type: refer to Chapter 9: "Technical Specifications" – Understanding the Product Code.

### The Power-Up Condition

On initial power-up, direct from the factory, the drive is in Local Control and the MMI will display the Local Setpoint, 0.0 Hz.

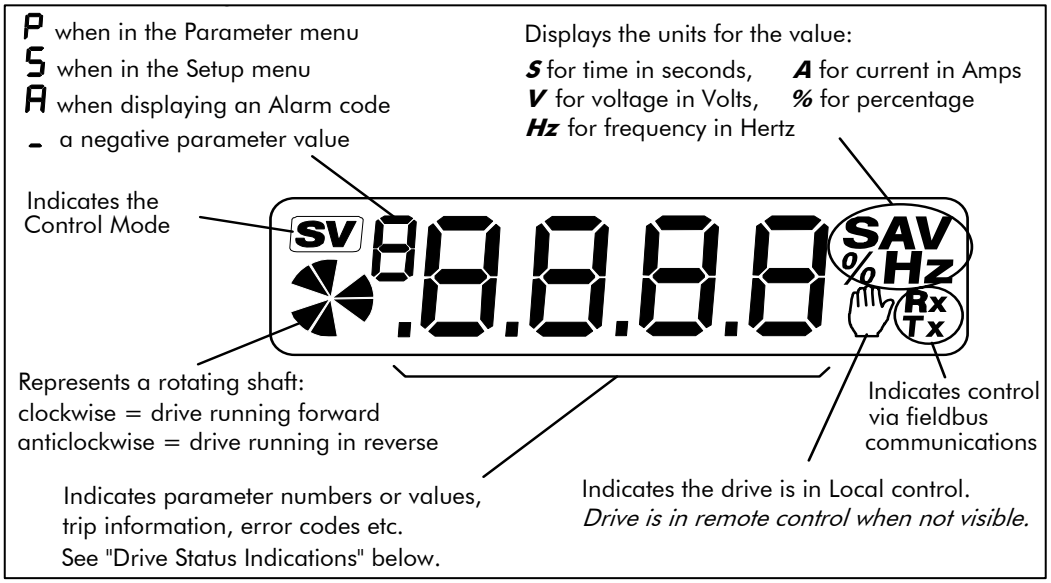
All parameters will be at factory default settings. Any changes to these conditions are automatically saved. The drive will initialise on subsequent power-ups with the previously saved settings and control mode, Local or Remote Control.

## Controlling the Drive using the Keypad

### Control Key Definitions

| Key | Operation | Description |
|---|---|---|
| E | Escape | *Navigation* – Displays the previous level's menu<br>*Parameter* – Returns to the parameter list<br>*Trip Display*– Removes Trip or Error message from display allowing investigation of parameters |
| M | Menu | *Navigation* – Displays the next menu level, or the first parameter of the current Menu<br>*Parameter* – Moves cursor to the left when the parameter is adjustable |
| ▲ | Increment | *Navigation* – Move upwards through the menu system<br>*Parameter* – Increase value of the displayed parameter<br>*Local Mode* – Increase value of the local setpoint |
| ▼ | Decrement | *Navigation* – Move down through the menu system<br>*Parameter* – Decrease value of the displayed parameter<br>*Local Mode* – Decrease value of the local setpoint |
| I | Run | *Local Mode* – Run the drive<br>*Trip Reset* – Resets trip condition allowing drive to resume operation |
| O | Stop | *Local Mode* – Stops the drive. Trip Reset in all modes<br>*Navigation* – Press and hold to toggle between Local and Remote Control modes (refer to page 5-5)<br>*Trip Reset* – Resets trip condition allowing drive to resume operation |

## Display Indications




## Drive Status Indications

The keypad can display the following status information:

| Display | Status Indication and Meaning | Possible Cause |
|---|---|---|
| rdy | READY/HEALTHY No alarms present. Remote mode selected | |
| PASS | PASSWORD Current password must be entered before this parameter may be altered. | Enter password to change the parameter. Refer to page 5-7 |
| LOC | LOCAL Local Control selected, healthy, no alarms present | Added or removed from the display letter-by-letter to indicate entering or leaving Local Control |
| StOP | STOP Coast Stop or Prog Stop active | Jog (6901 op station only) or Run pressed while Coast Stop or Prog Stop lines are active, (low), on the sequencing block. Local control only. |
| run | RUN Not possible to change between Local/Remote mode | The drive is running in Local mode or the Remote run signal is active |
| JOG | JOG Not possible to change between Local/Remote mode | The Remote jog signal is active |
| EnbL | ENABLE Pressed RUN or JOG key in Local mode while Enable signal is low | The drive Enable signal is inactive, (low) |

## Quick Application Selection

You can navigate immediately to the APPLICATION parameter, P1, from power-up, as shown opposite.

*Hold down the key opposite: Power-up the drive, continue to hold for at least 1 second*


Then, press the M key to display the current Application. Press again to allow the parameter to be changed.

Use the ▲ ▼ keys to select the appropriate Application by number.

Press the E key to load the Application.

Refer to Chapter 12: "Applications" for further information.

## Selecting the Menu Detail

For ease of operation the drive can display full or reduced menus. Refer to Chapter 6 to see how the setting changes the displayed menu. Additional parameters are indicated with F in the table.

Navigate to the St 99 parameter (SET::SETP::ST99) and press the M key. This toggles full or partial menu detail. The default setting of 0 provides partial menu detail. Set the parameter to 1 to enable full menu view.

# The DIAGNOSTICS Menu

| Display | Name | Description |
|---|---|---|
| 0.0 Hz | FREQUENCY | The current output frequency in Hertz |
| 0.0 % | SPEED SETPOINT | The set point as a percentage of MAX SPEED |
| 0.0 V | DC LINK VOLTS | Vac (rms) x √2 = dc link Volts (when motor stopped) |
| 0.0 A | MOTOR CURRENT | The current load value in Amps |

To see the following requires detailed menus view to be enabled, see above "Selecting the Menu Detail"

| Display | Name | | Description |
|---|---|---|---|
| | | | *INPUTS MENU:* |
| In | dIn | F | DIGIN WORD |
| | IPA1 | F | ANIN 1 VALUE |
| | IPA2 | F | ANIN 2 VALUE |
| | | | *OUTPUTS MENU:* |
| OUt | doUt | F | DIGOUT WORD |
| | OPA1 | F | ANOUT1 VALUE |
| | OPA2 | F | ANOUT 2 VALUE |
| | | | *TRIP HISTORY MENU:* |
| trIP | tH1 | F | TRIP 1 (NEWEST) |
| | tH2 | F | TRIP 2 |
| | tH3 | F | TRIP 3 |
| | tH4 | F | TRIP 4 |
| | tH5 | F | TRIP 5 |
| | tH6 | F | TRIP 6 |
| | tH7 | F | TRIP 7 |
| | tH8 | F | TRIP 8 |
| | tH9 | F | TRIP 9 |
| | tH 10 | F | TRIP 10 (OLDEST) |

# The Menu System

Use the arrow down key to go left and arrow up key to go right

NOTE:
To move up and down the lists arrow up to go down and arrow down to go up.

## dIAG

*Press M to show following:*

| | |
|---|---|
| Hz | Drive frequency |
| % | Speed setpoint |
| v | DC link volts |
| A | Motor current |

To see the following menu requires detailed menus view to be enabled:

To enable arrow to SEt press M arrow to St99 and press M key.

**In**

| | |
|---|---|
| diN | Digin word |
| IPA1 | Anin 1 value |
| IPA2 | Anin 2 value |

**OUt**

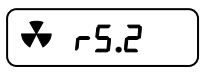
| | |
|---|---|
| dOUt | Digout word |
| OPA1 | Anout 1 value |
| OPA2 | Anout 2 value |

**trIP**

| | |
|---|---|
| tH1 | Trip 1, (newest) |
| tH2 | Trip 2 |
| tH3 | Trip 3 |
| tH4 | Trip 4 |
| tH5 | Trip 5 |
| tH6 | Trip 6 |
| tH7 | Trip 7 |
| tH8 | Trip 8 |
| tH9 | Trip 9 |
| tH10 | Trip 10, (oldest) |

Software Version Number

This is displayed on power-up, for up to 8 seconds. For example, version 5.2:




It can also be displayed by pressing the E key for 2 seconds when at the top of the MMI tree, Menu Level 1.

## PAr

*Press M to show following:*

| | |
|---|---|
| P1 | Application |
| P2 | Max speed |
| P3 | Min speed |
| P4 | Accel time |
| P5 | Decel time |
| P6 | Motor current |
| P7 | Base frequency |
| P8 | Jog setpoint |
| P9 | Run/stop mode |
| P11 | V/F shape |
| P12 | Normal duty |
| P13 | Fixed boost |
| P14 | Auto boost |
| P99 | Password |

## SEt

*See chapter 6 for instructions to view full menu*

*Press M to show following:*

**CtrL**

| | |
|---|---|
| CL01 | Control mode |
| CL02 | Nameplate RPM |
| CL03 | Fly-catch enable |
| CL04 | Slip comp enable |
| CL05 | Stabilisation enable |
| CL06 | Voltage control mode |
| CL07 | Boost mode |
| CL08 | Auto boost |
| CL09 | Energy saving |
| CL 10 | Motor current |
| CL 11 | Motor poles |
| CL 12 | Motor voltage |
| CL 14 | Mag current |
| CL 15 | Power |
| CL 16 | Motor connection |
| CL 17 | Stator resistance |
| CL 18 | Leakage inductance |
| CL 19 | Mutual inductance |
| CL 1A | Rotor time constant |
| CL20 | Autotune mode |
| CL21 | Autotune enable |
| CL81 | Current limit |
| CL82 | Positive torque limit |
| CL83 | Negative torque limit |
| CL84 | Stall trip type |
| CL91 | Speed prop gain |
| CL92 | Speed integral time |
| CL93 | Speed positive limit |
| CL94 | Speed negative limit |

**In**

| | |
|---|---|
| IP01 | Digin 1 invert |
| IP02 | Digin 2 invert |
| IP03 | Digin 3 invert |
| IP04 | Digin 4 invert |
| IP05 | Digin 5 invert |
| IP06 | Digin 6 invert |
| IP07 | Digin 7 invert |
| IP11 | Anin 1 scale |
| IP12 | Anin 1 offset |
| IP13 | Anin 1 type |
| IP21 | Anin 2 scale |
| IP22 | Anin 2 offset |
| IP23 | Anin 2 type |
| IPd1 | Digin 1 value |
| IPd2 | Digin 2 value |
| IPd3 | Digin 3 value |
| IPd4 | Digin 4 value |
| IPd5 | Digin 5 value |
| IPd6 | Digin 6 value |
| IPd7 | Digin 7 value |
| IPA1 | Anin1 value |
| IPA2 | Anin2 value |

**OUt**

| | |
|---|---|
| OPd1 | Digout 1 invert |
| OPd2 | Digout 2 invert |
| OPd3 | Relay invert |
| AO11 | Anout 1 scale |
| AO12 | Anout 1 offset |
| AO13 | Anout 1 abs |
| AO14 | Anout 1 value |
| AO21 | Anout 2 scale |
| AO22 | Anout 2 offset |
| AO23 | Anout 2 abs |
| AO24 | Anout 2 value |

**conF**

| | |
|---|---|
| din1 | Digin 1 destination |
| din2 | Digin 2 destination |
| din3 | Digin 3 destination |
| din4 | Digin 4 destination |
| din5 | Digin 5 destination |
| din6 | Digin 6 destination |
| din7 | Digin 7 destination |
| dOP1 | Digout 1 source |
| dOP2 | Digout 2 source |
| dOP3 | Relay source |
| AOP1 | Anout 1 source |
| AOP2 | Anout 2 source |

**trIP**

| | |
|---|---|
| LOOP | 4 to 20mA loop |
| t 3 | Anin 2 overload |
| StLL | Motor stalled |
| Ot | Moter overtemp |
| It | Inverse time |
| dbr | Dynamic brake resistor |
| db 5 | Dynamic brake switch |
| SPd | Speed feedback |
| OSPd | Over speed |
| diSP | Display / keypad |
| dCrP | DC link ripple |

**SErL**

| | |
|---|---|
| SE01 | Remote comms sel |
| SE02 | Comms timeout |
| SE03 | Comms address |
| SE04 | Comms baud rate |
| SE05 | Comms parity |
| SE06 | Reply delay ms |
| SE07 | Protocol, (OP) |
| SE08 | Protocol, (P3) |

**SEtP**

| | |
|---|---|
| St01 | Jog accel time |
| St02 | Jog decel time |
| St03 | Ramp time |
| St04 | S ramp jerk |
| St05 | S ramp cont |
| St06 | min speed mode |
| St 11 | Skep freq 1 |
| St 12 | Skip freq 1 band |
| St 13 | Skip freq 2 |
| St 14 | Skip freq 2 band |
| St21 | AR attempts |
| St22 | AR delay |
| St23 | AR triggers |
| St24 | AR triggers+ |
| St31 | DB Enable |
| St32 | DB Resistance |
| St33 | DB Power |
| St34 | DB Over-rating |
| St41 | Torque feedback |
| St42 | Torque level |
| St43 | Use abs torque |
| St51 | Local min speed |
| St52 | Enabled keys |
| St98 | Application lock |
| St99 | Detailed menus |

**EnC**

| | |
|---|---|
| En01 | Encoder mode |
| En02 | Encoder reset |
| En03 | Encoder invert |
| En04 | Encoder lines |
| En05 | Encoder speed scale |
| En06 | Encoder speed |

## APP

**This menu is configured by the App Menu blocks in DSE Lite. Also applications 3, 4, 5 & 6 populate this menu as shown.**

*Press M to show following:*

| | |
|---|---|
| AP1 | APP menu 1 |
| AP2 | APP menu 2 |
| AP3 | APP menu 3 |
| AP4 | APP menu 4 |
| AP5 | APP menu 5 |
| AP6 | APP menu 6 |
| AP7 | APP menu 7 |
| AP8 | APP menu 8 |
| AP9 | APP menu 9 |
| AP 10 | APP menu 10 |
| AP 11 | APP menu 11 |
| AP 12 | APP menu 12 |
| AP 13 | APP menu 13 |
| AP 14 | APP menu 14 |
| AP 15 | APP menu 15 |
| AP 16 | APP menu 16 |

**Default settings**

**Macro 3:**

| | |
|---|---|
| AP1 | Preset 0 |
| AP2 | Preset 1 |
| AP3 | Preset 2 |
| AP4 | Preset 3 |
| AP5 | Preset 4 |
| AP6 | Preset 5 |
| AP7 | Preset 6 |
| AP8 | Preset 7 |

**Macro 4:**

| | |
|---|---|
| AP1 | RL ramp rate |
| AP2 | RL max value |
| AP3 | RL min value |
| AP4 | RL reset value |

**Macro 5:**

| | |
|---|---|
| AP1 | PI P gain |
| AP2 | PI I gain |
| AP3 | PID D gain |
| AP4 | PID D filter TC |
| AP5 | PID fbk gain |
| AP6 | PID limit |
| AP7 | PID low limit |
| AP8 | PID symmetric limit |
| AP9 | PID scale |
| AP 10 | PID error |
| AP 11 | PID output |

**Macro 6:**

| | |
|---|---|
| AP1 | Command |
| AP2 | Setpoint |
| AP3 | Status |

# Special Menu Features

## How To Change a Parameter Value

You can change the values of parameters stored in the PAr and SEt menus. Refer to Chapter 6: "Programming Your Application" – Configurable Parameters for further information.

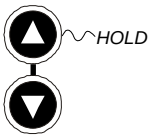
- View the parameter to be edited and press M to display the parameter's value.
- Select the digit to be changed (pressing the M key moves the cursor from right to left).
- Use the ▲ ▼ keys to adjust the value. Hold the key momentarily to adjust the value marginally, or hold the key to make rapid changes;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

## Resetting to Factory Defaults (2-button reset)

Power-up the drive whilst holding the keys as shown to return to factory default settings.

This loads Application 1. Then press the E key.

*Hold down the keys opposite:*
*Power-up the drive, continue to hold for at least 1 second*

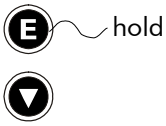



## Changing the Default Operating Frequency

Power-up the drive whilst holding the keys as shown to display the Engineers Menu.

**IMPORTANT:** This menu contains sensitive parameters that can dramatically alter the running of the drive.

*Hold down the keys opposite:*
*Power-up the drive, continue to hold for at least 1 second*




This displays parameter $^{E}$0.01. Press the ▲ key to navigate to $^{E}$0.02. Press the M key to edit the parameter: 0 = 50Hz (default), 1 = 60Hz. Select the required frequency then press the E key.

Power-down the drive. No change has been made to the active configuration at this point. To save the change to parameter $^{E}$0.02, you must now perform a 2-button reset (as above). Please note that this will return the drive to its factory default settings for the selected default frequency.

## Selecting Local or Remote Control

The drive can operate in one of two ways:

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

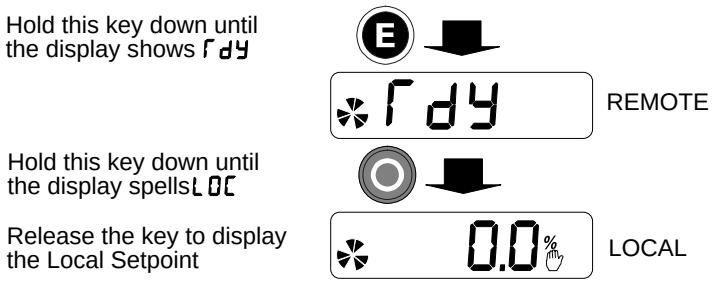
**Local Control:** Providing local control and monitoring of the drive using the Keypad

Local control keys are inactive when Remote Control is selected.

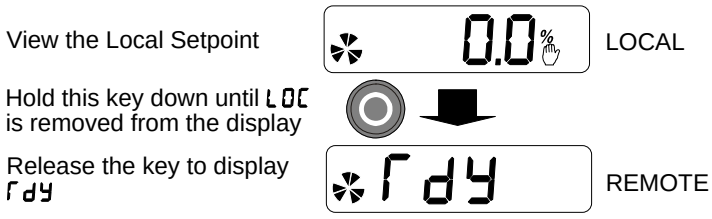
In Remote Control, the drive uses a remote setpoint. In Local Control, it uses the Local Setpoint parameter whose value is adjusted on the MMI.

***Note:*** *You can only change between Local and Remote Control when the drive is "stopped", and either* rdy *or the Local Setpoint is displayed.*

**Remote to Local Control:**




**Local to Remote Control:**




***Note:*** *For safety reasons, the drive will not return to Remote Control if this will cause the drive to start. Check RUN and JOG inputs are low.*

## Changing Direction in Local Control

When the drive is running in Local Control the direction of rotation of the motor shaft can be changed by pressing the following key combinations:

To change the direction to Forward, press UP and START or UP and STOP.

To change the direction to Reverse, press DOWN and START or DOWN and STOP.

It is recommended that if the motor is already turning, choose the key combination that includes the START key. If the motor is stopped then choose the key combination that includes the STOP key.

## Password Protection

When activated, an odd-numbered password prevents unauthorised parameter modification by making all parameters read-only. The local setpoint is not made read-only if an even-numbered password is used. Password protection is set-up using the P 99 parameter

| Steps | ACTIVATE | | TEMPORARY DE-ACTIVATION | | REMOVE PASSWORD | |
|---|---|---|---|---|---|---|
| | Actions | Display | Actions | Display | Actions | Display |
| 1 | Go to P 99<br>Press M | 0000 | Try to edit any parameter with password activated | PASS →<br>0000 | Go to P 99<br>Press M | PASS →<br>0000 |
| 2 | Enter new password using ▲ ▼ | 0001<br>for example | Enter current password using ▲ ▼ | 0001<br>for example | Enter current password using ▲ ▼ | 0001<br>for example |
| 3 | Press E repeatedly until top of menu is reached | rdy, Remote Setpoint or Local Setpoint | Press E | Original parameter displayed, password de-activated | Press E<br>Reset to 0000 using ▲ ▼ | 0000 |
| 4 | Press E to activate password | rdy, Remote Setpoint or Local Setpoint | *A drive will power-up with the last password status. Temporary de-activation is lost on power-down.* | | Press E to remove password | P 99 |
| | *Default = 0000, de-activated<br>Any other value is a password* | | | | | |

# Chapter 6 PROGRAMMING YOUR APPLICATION

You can program the drive to your specific application. This programming simply involves changing parameter values. For instance, parameter P1 selects various Applications which can be used as starting points for application-specific programming.

Each Application internally re-wires the drive for a different use when it is loaded. The default for the parameter is "1". Changing this parameter's setting to "2" will load Application 2. Refer to Chapter 12: “Applications” for further information.

If necessary, there are three parameters for tuning your drive. Refer to PID - Tuning Your Drive, page 6-14.

### Saving Your Modifications

When parameter values are modified or an Application is loaded, the new settings are saved automatically. The drive will retain the new settings during power-down.

## MMI Parameters

This table provides information about each parameter accessible using the keypad, or MMI (Man Machine Interface). For more information about these and additional parameters accessible using DSE Lite (or other suitable programming tool), refer to the 650G Software Product Manual on our website: www.SSDdrives.com.

### Key to MMI Parameters Table

| | |
|---|---|
| F | Parameters indicated with F are visible with full menus only. Refer to the DETAILED MENUS parameter ( ST99). |
| M | Parameters indicated with M are Motor Parameters. They are not reset by changing Application using parameter P1; all other parameters are reset to default values. |
| VF | Parameters indicated with VF are only visible when the drive is in VF (Volts/Hz) motor control mode, as selected by parameter SCL01. |
| SV | Parameters indicated with SV are only visible when the drive is in SV (Sensorless Vector) motor control mode, as selected by parameter SCL01. |

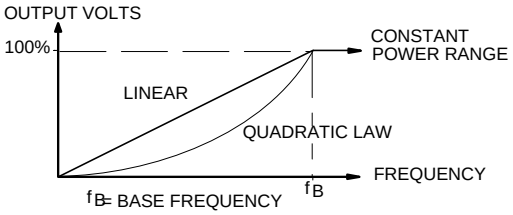
***Note:*** *The “Range” for a parameter value is given in the Configurable Parameters Table. Ranges for outputs are given as “—.xx %”, for example, indicating an indeterminate integer for the value, to two decimal places.*

### MMI Parameters Table

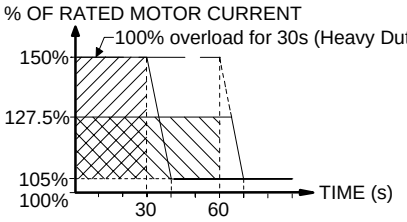
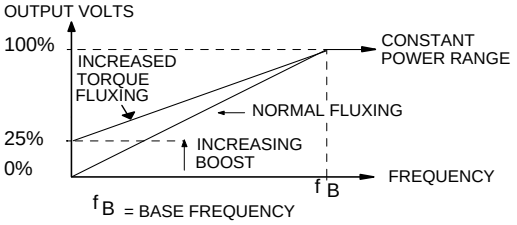
**MMI Parameters Table**

| Display | Parameter | Description | Range | Default |
|---|---|---|---|---|
| | | SET::PAR Menu | | |
| P 1 | APPLICATION | This parameter selects and loads the Application to be used. APP 0 will not control a motor. APP 6, 7 & 8 are for future use. You can edit an Application in DSE Lite and, then set this parameter to CUSTOM to produce your own custom Application. Refer to the 650G Software Product Manual, Chapter 5: "Applications" which gives detailed information about each Application. ***Note:*** *Parameter values are changed to factory settings by loading a new Application, except Motor Parameters (indicated M)* | 0= NULL<br>1= STANDARD<br>2= LOCAL/REM (AUTO/MANUAL)<br>3= PRESETS<br>4= RAISE/LOWER<br>5= PID<br>6= AUXILLARY COMMS<br>7= APP 7<br>8= APP 8<br>9= CUSTOM | 1 |
| P 2 | MAX SPEED M | The frequency at which the 650G will run when maximum setpoint is applied. The default is Product Code dependent | 7.5 to 300Hz | 50 or 60Hz |

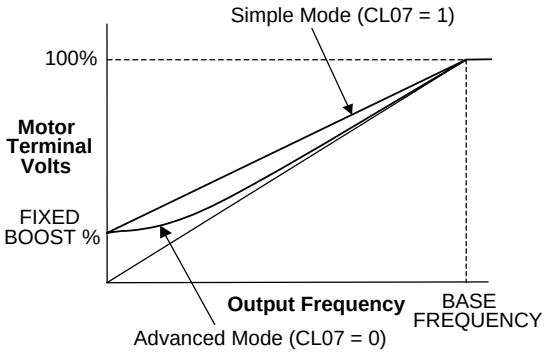
**MMI Parameters Table**

| Display | Parameter | Description | Range | Default |
|---|---|---|---|---|
| P 3 | MIN SPEED | The minimum frequency at which the 650G will run, as a percentage of the MAX SPEED parameter | -100.0 to 100.0% | 0.0% |
| P 4 | ACCEL TIME | The time taken for the 650G output frequency to ramp up from zero to MAX SPEED | 0.0 to 3000.0s | 10.0s |
| P 5 | DECEL TIME | The time taken for the 650G output frequency to ramp down from MAX SPEED to zero | 0.0 to 3000.0s | 10.0s |
| P 6 | MOTOR CURRENT **M** | This parameter contains the motor nameplate full-load line current | 0.01 to 999.99A | product code dependent |
| P 7 | BASE FREQUENCY **M** | The output frequency at which maximum voltage is reached. The default is Product Code dependent | 7.5 to 240Hz | 50 or 60Hz |
| P 8 | JOG SETPOINT | Speed the 650G will run at if the Jog input is high, as a percentage of the MAX SPEED parameter | -100.0 to 100.0% | 10.0% |
| P 9 | RUN STOP MODE | RAMPED : The motor speed is reduced to zero at a rate set by DECEL TIME (P5). A 2 second DC pulse is applied at end of ramp<br>COAST : The motor is allowed to freewheel to a standstill<br>DC INJECTION : On a stop command, the motor volts are rapidly reduced at constant frequency to deflux the motor. A low frequency braking current is then applied until the motor speed is almost zero. This is followed by a timed DC pulse to hold the motor shaft. | 0=RAMPED<br>1=COAST<br>2=DC INJECTION | 0 |
| P 11 | V/F SHAPE | LINEAR LAW: This gives a constant flux characteristic up to the BASE FREQUENCY<br>FAN LAW: This gives a quadratic flux characteristic up to the BASE FREQUENCY. This matches the load requirement for fan and most pump applications<br>Refer to P12<br>  <br> | 0=LINEAR LAW<br>1=FAN LAW | 0 |

## MMI Parameters Table

| Display | Parameter | Description | Range | Default |
|---|---|---|---|---|
| P 12 | NORMAL DUTY |  <br>FALSE - HEAVY DUTY: Inverse time allows 150% overload for 30s, then ramps back the current limit to 105% over a 10s period. At a lower load, the overload area remains the same, e.g. at 127.5% load for 60s - after 60s has expired, the output of the inverse time function is ramped back over a 10s period from 150% as before.<br>TRUE - NORMAL DUTY: current limit is set to 110% motor current, inverse time delay is set to 30s<br>When P11 is changed from FAN LAW to LINEAR LAW, P12 is set to 0 (HEAVY DUTY)<br>When P11 is changed from LINEAR LAW to FAN LAW, P12 is set to 1 (NORMAL DUTY)<br>P12 can be changed independently<br>*NORMAL DUTY was previously referred to as Quadratic Torque in past Drives' manuals.* | 0=FALSE<br>1=TRUE | 0 |
| P 13 | FIXED BOOST<br>**M** **VF** | Used to correctly flux the motor at low speeds. This allows the drive to produce greater starting torque for high friction loads. It increases the motor volts above the selected V/F characteristic at the lower end of the speed range<br>  | 0.00 to 25.00% | product code dependent |
| P 14 | AUTO BOOST<br>**M** **VF** | This parameter allows for load dependent, stator resistance voltage-drop compensation. This correctly fluxes the motor (under load conditions) at low output frequencies, thereby increasing available motor torque. AUTO BOOST is only used when BOOST MODE is set to 0.<br>The value of the AUTO BOOST parameter determines the level of additional volts supplied to the motor for 100% load.<br>Setting the value of AUTO BOOST too high can cause the drive to enter current limit. If this occurs, the time taken for the drive to reach operating speed will be extended. Reducing the value of AUTO BOOST will eliminate this problem. | 0.00 to 25.00% | 0.00 % |
| P 99 | PASSWORD | A password may be set to prohibit unauthorised adjustment of parameters. When P99 is set to non-zero you will be required to match this value before parameters can be adjusted | 0000 – FFFF | 0000 |

**MMI Parameters Table**

| Display | Parameter | Description | Range | Default |
|---|---|---|---|---|
| | | **SET::CTRL Menu** | | |
| SCL01 | CONTROL MODE | This parameter contains the main method of motor control used by the drive. | 0=VOLTS/HZ<br>1=SENSORLESS VEC | 0 |
| SCL02 | NAMEPLATE RPM<br>**M** | This parameter contains the motor nameplate full-load rated speed. This is the motor speed in rpm at base frequency minus full load slip. | 0.1 to 30000.0 RPM | product code dependent |
| SCL03 | FLY-CATCH ENABLE<br>**VF** | Enables flycatching in Volts/Hz control mode when TRUE. Allows the drive to catch a spinning load. | 0=FALSE<br>1=TRUE | 0 |
| SCL03 | FLY-CATCH ENABLE<br>**SV** | Enables flycatching in Sensorless Vector control mode when TRUE. Allows the drive to catch a spinning load. | 0=FALSE<br>1=TRUE | 0 |
| SCL04 | SLIP COMP ENABLE<br>**VF** | Slip compensation is operational when TRUE. Eliminates motor speed variations under load conditions in V/F Fluxing Mode when the correct value for MAG CURRENT is entered into SCL14 | 0=FALSE<br>1=TRUE | 0 |
| SCL05 | STABILISATION ENABLE<br>**VF** | Enables the stabilisation function when TRUE. Eliminates light load speed variations in V/F Fluxing Mode | 0=FALSE<br>1=TRUE | 1 |
| SCL06 | VOLTAGE CONTROL MODE<br>**VF** | NONE : no attempt is made to control the PWM modulation depth for variations in dc link voltage<br>FIXED : the drive's output volts are maintained, regardless of variations in the dc link voltage. The drive's product code sets the default value for demanded maximum output voltage (see MOTOR VOLTAGE below)<br>AUTOMATIC : the drive performs controlled over-fluxing during motor deceleration | 0=NONE<br>1=FIXED<br>2=AUTOMATIC | 0 |
| SCL07 | BOOST MODE<br>**F VF** | Determines the relationship between fixed boost and terminal volts. There are two settings:<br>FALSE produces the terminal volts profile shown below (with Auto Boost set to 0.0 %). In this mode AUTO BOOST (CL08) should also be set to provide optimum low speed performance.<br>TRUE emulates the terminal volts profile provided by the Parker SSD Drives' 601 product. This allows drop in replacement of the 601 by the 650G. AUTO BOOST (CL08) has no effect in this mode.<br>  <br> | 0=FALSE<br>1=TRUE | 1 |

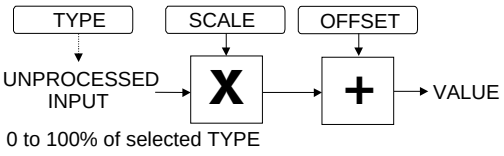
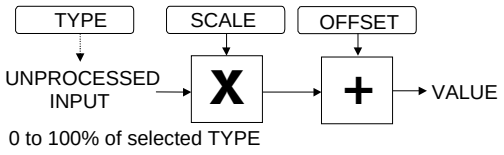
## MMI Parameters Table

| Display | Parameter | Description | Range | Default |
|---|---|---|---|---|
| SCL08 | AUTO BOOST<br>F M VF | This parameter allows for load dependent, stator resistance voltage-drop compensation. This correctly fluxes the motor (under load conditions) at low output frequencies, thereby increasing available motor torque. AUTO BOOST is only used when BOOST MODE is set to 0.<br>The value of the AUTO BOOST parameter determines the level of additional volts supplied to the motor for 100% load.<br>Setting the value of AUTO BOOST too high can cause the drive to enter current limit. If this occurs, the time taken for the drive to reach operating speed will be extended. Reducing the value of AUTO BOOST will eliminate this problem. | 0.00 to 25.00 % | 0.00 % |
| SCL09 | ENERGY SAVING<br>F VF | When set TRUE, the demanded volts are reduced to minimise energy consumption if the drive is operating in a steady state at light load. | 0=FALSE<br>1=TRUE | 0 |
| SCL 10 | MOTOR CURRENT<br>M SV | This parameter contains the motor nameplate full-load line current. | 0.01 to 999.99A | product code dependent |
| SCL 11 | MOTOR POLES<br>M SV | This parameter contains the number of motor poles, as supplied on the motor nameplate. | 2=2 pole<br>4=4 pole<br>6=6 pole<br>8=8 pole<br>10=10 pole<br>12=12 pole | 4 |
| SCL 12 | MOTOR VOLTAGE<br>M | This parameter contains the motor nameplate voltage at base frequency. | 0.0 to 575.0V | product code dependent |
| SCL 14 | MAG CURRENT<br>M | This parameter contains the motor model no-load line current as determined by the Autotune, or taken from the motor nameplate. | 0.01 to 999.99 A | product code dependent |
| SCL 15 | POWER<br>M SV | This parameter contains the motor nameplate power. | 0.00 to 355.00kW | product code dependent |
| SCL 16 | MOTOR CONNECTION<br>M SV | This parameter contains the motor nameplate connection. | 0= DELTA<br>1= STAR | 1 |
| SCL 17 | STATOR RES<br>F M SV | This parameter contains the motor model per-phase stator resistance as determined by Autotune. | 0.0000 to 250.0000Ω | product code dependent |
| SCL 18 | LEAKAGE INDUC<br>F M SV | This parameter contains the motor model per-phase leakage inductance as determined by Autotune. | 0.00 to 300.00mH | product code dependent |
| SCL 19 | MUTUAL INDUC<br>F M SV | This parameter contains the motor model per-phase mutual inductance as determined by Autotune. | 0.00 to 3000.00mH | product code dependent |
| SCL 1A | ROTOR TIME CONST<br>F M SV | This parameter contains the motor model rotor time constant as determined by Autotune. | 10.00 to 3000.00ms | product code dependent |
| SCL20 | AUTOTUNE MODE<br>SV | Selects the Autotune operating mode. | 0= STATIONARY<br>1= ROTATING | 0 |
| SCL21 | AUTOTUNE ENABLE<br>SV | Determines whether the Autotune sequence is operational or not. The Autotune sequence is operational when set to TRUE and the drive is run. | 0=FALSE<br>1=TRUE | 0 |
| SCL81 | CURRENT LIMIT<br>F | This parameter sets the level of motor current, as a % of MOTOR CURRENT ($^{S}$CL10) at which the drive begins to take current limit action. | 0.00 to 300.00% | 300.00% |
| SCL82 | POS TORQUE LIMIT<br>F | This parameter sets the maximum allowed level of positive motor torque. | -500.0 to 500.0% | 200.0% |

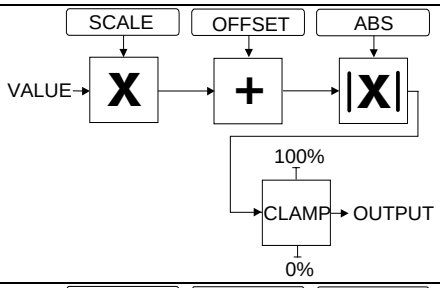
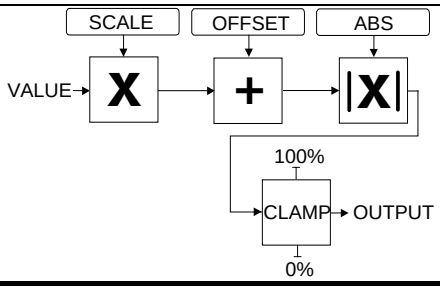
**MMI Parameters Table**

| Display | Parameter | Description | Range | Default |
|---|---|---|---|---|
| SCL83 | NEG TORQUE LIMIT **F** | This parameter sets the maximum allowed level of negative motor torque. | -500.0 to 500.0% | -200.0% |
| SCL84 | STALL TRIP TYPE **F** | This parameter determines whether the stall trip operates on motor torque or motor current. FALSE = TORQUE, TRUE = CURRENT | 0= FALSE<br>1= TRUE | 1 |
| SCL91 | SPEED PROP GAIN **F M SV** | Sets the proportional gain of the loop. Speed error (revolutions per second) x proportional gain = torque percent. | 0.00 to 300.00 | product code dependent |
| SCL92 | SPEED INT TIME **F M SV** | This is the integral time constant of the speed loop. A speed error which causes the proportional term to produce a torque demand T, will cause the integral term to also ramp up to a torque demand T after a time equal to “speed int time”. | 1 to 15000ms | product code dependent |
| SCL93 | SPEED POS LIMIT **F SV** | This sets the upper limit of the speed demand. | -110.00 to 110.00% | 110.00% |
| SCL94 | SPEED NEG LIMIT **F SV** | This sets the lower limit of the speed demand. | -110.00 to 110.00% | -110.00% |

## MMI Parameters Table

| Display | Parameter | Description | Range | Default |
|---|---|---|---|---|
| | | **SET::IN Menu** | | |
| S IP01 | DIN 1 INVERT | Inverts the value of the signal, TRUE or FALSE. | 0= FALSE<br>1= TRUE | 0 |
| S IP02 | DIN 2 INVERT | As SIP01 | As SIP01 | 0 |
| S IP03 | DIN 3 INVERT | As SIP01 | As SIP01 | 0 |
| S IP04 | DIN 4 INVERT | As SIP01 | As SIP01 | 0 |
| S IP05 | DIN 5 INVERT | As SIP01 | As SIP01 | 1 |
| S IP06 | DIN 6 INVERT | As SIP01 | As SIP01 | 0 |
| S IP07 | DIN 7 INVERT | As SIP01 | As SIP01 | 0 |
| S IP11 | AIN 1 SCALE |  | -300.0 to 300.0% | 100.0% |
| S IP12 | AIN 1 OFFSET | | -300.0 to 300.0% | 0.0% |
| S IP13 | AIN 1 TYPE | | 0= 0-10V<br>1= 0-5V | 0 |
| S IP21 | AIN 2 SCALE |  | -300.0 to 300.0% | 100.0% |
| S IP22 | AIN 2 OFFSET | | -300.0 to 300.0% | 0.0% |
| S IP23 | AIN 2 TYPE | | 0= 0-10V<br>1= 0-5V<br>2= 0-20mA<br>3= 4-20mA | 3 |
| S IPd1 F | DIN 1 VALUE | The TRUE or FALSE input (after any inversion) | 0=FALSE<br>1=TRUE | 0 |
| S IPd2 F | DIN 2 VALUE | The TRUE or FALSE input (after any inversion) | 0=FALSE<br>1=TRUE | 0 |
| S IPd3 F | DIN 3 VALUE | The TRUE or FALSE input (after any inversion) | 0=FALSE<br>1=TRUE | 0 |
| S IPd4 F | DIN 4 VALUE | The TRUE or FALSE input (after any inversion) | 0=FALSE<br>1=TRUE | 0 |
| S IPd5 F | DIN 5 VALUE | The TRUE or FALSE input (after any inversion) | 0=FALSE<br>1=TRUE | 0 |
| S IPd6 F | DIN 6 VALUE | The TRUE or FALSE input (after any inversion) | 0=FALSE<br>1=TRUE | 0 |
| S IPd7 F | DIN 7 VALUE | The TRUE or FALSE input (after any inversion) | 0=FALSE<br>1=TRUE | 0 |
| S IPA1 F | AIN 1 VALUE | The input reading with scaling and offset applied | —.x% | —.x% |
| S IPA2 F | AIN 2 VALUE | The input reading with scaling and offset applied | —.x% | —.x% |

## MMI Parameters Table

| Display | Parameter | Description | Range | Default |
|---|---|---|---|---|
| **SET::OUT Menu** | | | | |
| SOPd1 | DIGOUT1 INVERT | (OUTPUT) As SIP01. | As SIP01 | 0 |
| SOPd2 | DIGOUT2 INVERT | (OUTPUT) As SIP01. | As SIP01 | 0 |
| SOPd3 | RELAY INVERT | (OUTPUT) As SIP01. | As SIP01 | 0 |
| SAO11 | ANOUT1 SCALE |  | -300.00 to 300.00% | 100.00% |
| SAO12 | ANOUT1 OFFSET | | -300.00 to 300.00% | 0.00% |
| SAO13 | ANOUT1 ABS | | 0= FALSE (not absolute)<br>1= TRUE (absolute) | 1 |
| SAO14 | ANOUT1 VALUE | | -300.00 to 300.00% | 0% |
| SAO21 | ANOUT2 SCALE |  | -300.00 to 300.00% | 100.00% |
| SAO22 | ANOUT2 OFFSET | | -300.00 to 300.00% | 0.00% |
| SAO23 | ANOUT2 ABS | | 0=FALSE<br>1=TRUE | 0 |
| SAO24 | ANOUT2 VALUE | | -300.0 to 300.0% | 0.0% |

## SET::CONF Menu

*Defaults for this sub-menu are determined by the selected application*

| | | | |
|---|---|---|---|
| SdIn1 | DIGIN 1 DEST | 0:NONE<br>1:RUN FORWARD<br>2:RUN REVERSE<br>3:NOT STOP<br>4:JOG<br>5:CONTACTOR CLOSED<br>6:DRIVE ENABLE<br>7:NOT FAST STOP<br>8:NOT COAST STOP<br>9:REMOTE REVERSE<br>10:REM TRIP RESET<br>11:RAISE INPUT<br>12:LOWER INPUT<br>13:RL RESET<br>14:PID ENABLE<br>15:VALUE 1 INPUT A<br>16:VALUE 1 INPUT B<br>17:VALUE 1 INPUT C<br>18:VALUE 2 INPUT A<br>19:VALUE 2 INPUT B<br>20:VALUE 2 INPUT C<br>21:VALUE 3 INPUT C<br>22:VALUE 4 INPUT C<br>23:LOGIC 1 INPUT A<br>24:LOGIC 1 INPUT B<br>25:LOGIC 1 INPUT C<br>26:LOGIC 3 INPUT A<br>27:LOGIC 3 INPUT B<br>28:LOGIC 3 INPUT C | Range : 0 to 28 |
| SdIn2 | DIGIN 2 DEST | | |
| SdIn3 | DIGIN 3 DEST | | |
| SdIn4 | DIGIN 4 DEST | | |
| SdIn5 | DIGIN 5 DEST | | |
| SdIn6 | DIGIN 6 DEST | | |
| SdIn7 | DIGIN 7 DEST | | |
| SdOP1 | DIGOUT 1 SOURCE | 0 NONE<br>1 HEALTH<br>2 TRIPPED<br>3 RUNNING<br>4 AT ZERO<br>5 AT SPEED<br>6 AT LOAD<br>7 READY<br>INVERT (output) S IP04 | 0= NONE<br>1= HEALTH<br>2= TRIPPED<br>3= RUNNING<br>4= AT ZERO<br>5= AT SPEED<br>6= AT LOAD<br>7 = READY |
| SdOP2 | DIGOUT 2 SOURCE | | |
| SdOP3 | RELAY SOURCE | | |
| SAOP1 | ANOUT 1 SOURCE | **ANALOG OUTPUT**<br>0 NONE<br>1 DEMAND %<br>2 CURRENT %<br>3 PI ERROR %<br>4 RAISE/LOWER % OUTPUT<br>SCALE S OP02<br>OFFSET S OP03<br>ABSOLUTE S OP04<br>0-10V | 0= NONE<br>1= DEMAND<br>2= CURRENT<br>3= PID ERROR<br>4= RAISE/LOWER OUTPUT |
| SAOP2 | ANOUT 2 SOURCE | | |

## MMI Parameters Table

| Display | Parameter | Description | Range | Default |
|---|---|---|---|---|
| **SET::TRIP Menu** | | | | |
| SLOOP | DISABLE LOOP | Disables LOST I LOOP trip (4-20mA) | 0= TRIP ENABLED<br>1= TRIP DISABLED | 1 |
| S t 3 | AIN2 OVERLOAD | Disables the overload trip (Terminal 3) | As SLOOP | 0 |
| SStLL | DISABLE STALL | Disables STALL trip | As SLOOP | 0 |
| SOt | DISABLE MOTOR OVERTEMP | Disables the motor thermistor trip | As SLOOP | 0 |
| SI t | INVERSE TIME | Disables the inverse time trip | As SLOOP | 1 |
| Sdb r | DYNAMIC BRAKE RESISTOR | Disables the dynamic brake resistor trip | As SLOOP | 1 |
| Sdb S | DYNAMIC BRAKE SWITCH | Disables the dynamic brake switch trip | As SLOOP | 1 |
| SSPd | SPEED FEEDBACK | Disables the speed feedback trip | As SLOOP | 0 |
| SOSPd | OVERSPEED | Disables the overspeed trip | As SLOOP | 0 |
| SdI SP | DISPLAY (KEYPAD) | Disables the display (keypad) trip | As SLOOP | 0 |
| SdCrP | DC LINK RIPPLE<br>F | Disables the DC link ripple trip | As SLOOP | 0 |
| **SET::SERL Menu** | | | | |
| SSE01 | REMOTE COMMS SEL<br>F | Selects the type of remote communications mode:<br>0 : FALSE, and in REMOTE mode then control is from the terminals.<br>1 : TRUE, and in REMOTE mode then control is from the communications. | 0=FALSE<br>1=TRUE | 0 |
| SSE02 | COMMS TIMEOUT<br>F | Sets the maximum time allowed between refreshing the COMMS COMMAND parameter. The drive will trip if this time is exceeded. Set the time to 0.00 seconds to disable this feature. | 0.0 to 600.0s | 0.0s |
| SSE03 | COMMS ADDRESS<br>F | The drives identity address.<br>Note: if set to 0, it will only respond to broadcast messages. | 0 to 255 | 0 |
| SSE04 | BAUD RATE<br>F | Selects the Baud Rate for the MODBUS protocol. | 0 : 1200<br>1 : 2400<br>2 : 4800<br>3 : 7200<br>4 : 9600<br>5 : 14400<br>6 : 19200<br>7 : 38400<br>8 : 57600 | 4 |
| SSE05 | PARITY<br>F | Selects the Parity for the MODBUS protocol. | 0= NONE<br>1= ODD<br>2= EVEN | 0 |
| SSE06 | REPLY DELAY ms | The time in milliseconds between the drive receiving the complete request from the communications master (PLC/PC) and replying to this request. | 0 to 200 | 5 |
| SSE07 | OP PORT PROTOCOL<br>F | Selects the protocol to be used by the keypad port on the front of the drive. When EIBISYNC ASCII is selected, BAUD RATE is 19200 and PARITY is EVEN. FIELDBUS is reserved for future use. | 0= AUTOMATIC<br>1= KEYPAD<br>2=EIBISYNC ASCII<br>3= MODBUS<br>4= FIELDBUS | 0 |
| SSE08 | P3 PORT PROTOCOL<br>F | Selects the protocol to be used by the RS232 programming port on the drive's control board. When EIBISYNC ASCII is selected, BAUD RATE is 19200 and PARITY is EVEN. FIELDBUS is reserved for future use. | As SSE07 | 0 |

**MMI Parameters Table**

| Display | Parameter | Description | Range | Default |
|---|---|---|---|---|
| | | **SET::SETP Menu** | | |
| SSt01 | JOG ACCEL TIME | As P4, for Jog | 0.0 to 3000.0s | 1.0 |
| SSt02 | JOG DECEL TIME | As P5, for Jog | 0.0 to 3000.0s | 1.0 |
| SSt03 | RAMP TYPE | Selects the ramp type | 0=LINEAR<br>1=S | 0 |
| SSt04 | S RAMP JERK | Rate of change of acceleration of the curve in units per second$^3$ | 0.01 to 100.00 s3 | 10.00 |
| SSt05 | S RAMP CONTINUOUS | When TRUE and the S ramp is selected, forces a smooth transition if the speed setpoint is changed when ramping. The curve is controlled by the S RAMP JERK parameter. When FALSE, there is an immediate transition from the old curve to the new curve | 0=FALSE<br>1=TRUE | 1 |
| SSt06 | MIN SPEED MODE | Selects a mode to determine how the drive will follow a reference: Proportional : minimum limit, Linear : between minimum and maximum. | 0=PROP.W/MIN.<br>1=LINEAR (used by the 601 product) | 0 |
| SSt 11 | SKIP FREQUENCY 1 | This parameter contains the centre frequency of skip band 1 in Hz | 0.0 to 240.0 Hz | 0.0 |
| SSt 12 | SKIP FREQUENCY BAND 1 | The width of skip band 1 in Hz | 0.0 to 60.0 Hz | 0.0 |
| SSt 13 | SKIP FREQUENCY 2 | This parameter contains the centre frequency of skip band 2 in Hz | 0.0 to 240.0 Hz | 0.0 |
| SSt 14 | SKIP FREQUENCY BAND 2 | The width of skip band 2 in Hz | 0.0 to 60.0 Hz | 0.0 |
| SSt21 | AUTO RESTART ATTEMPTS | Determines the number of restarts that will be permitted before requiring an external fault reset | 0 to 10 | 0 |
| SSt22 | AUTO RESTART DELAY | Determines the delay between restart attempts for a trip included in AUTO RESTART TRIGGERS and AUTO RESTART TRIGGERS+. The delay is measured from all error conditions clearing | 0.0 to 600.0 s | 10.0 |
| SSt23 | AUTO RESTART TRIGGERS | Allows Auto Restart to be enabled for a selection of trip conditions.<br>Refer to Chapter 6: "Trips and Fault Finding" - Hexadecimal Representation of Trips | 0x0000 to 0xFFFF | 0x0000 |
| SSt24 | AUTO RESTART TRIGGERS+ | Allows Auto Restart to be enabled for a selection of trip conditions.<br>Refer to Chapter 6: "Trips and Fault Finding" - Hexadecimal Representation of Trips | 0x0000 to 0xFFFF | 0x0000 |
| SSt31 | DB ENABLE | Enables operation of the dynamic braking. | 0=FALSE<br>1=TRUE | 1 |
| SSt32 | DB RESISTANCE | The value of the load resistance. | 1 to 1000 | product code dependent |
| SSt33 | DB POWER | The power that the load resistance may continually dissipate. | 0.1 to 510.0 kW | product code dependent |
| SSt34 | DB OVER-RATING | Multiplier that may be applied to DB POWER for power overloads lasting no more than 1 second. | 1 to 40 | 25 |
| SSt41 | TORQUE FEEDBACK | Shows the estimated motor torque, as a percentage of rated motor torque. | —.xx % | —.xx % |
| SSt42 | TORQUE LEVEL | This parameter sets the value of load at which AT LOAD becomes TRUE. AT LOAD is selectable by the digital inputs. Refer to SOP21 and SOP31.<br>100% = rated torque for the motor. | -300.0 to 300.0 % | 100.0 % |

## MMI Parameters Table

| Display | Parameter | Description | Range | Default |
|---|---|---|---|---|
| SEt43 | USE ABS TORQUE F | When TRUE, the direction of rotation is ignored. In this case, the comparison level should always be positive.<br>When FALSE, the direction of rotation is not ignored. Driving a load in the reverse direction gives a negative value for torque. In this case, the comparison level may be positive or negative. | 0=FALSE<br>1=TRUE | 0 |
| SEt51 | LOCAL MIN SPEED F | The magnitude of the minimum setpoint that will be used when running in Local Mode. | 0.0 to 100.0 % | 0.0 % |
| SEt52 | ENABLED KEYS F | The following keys on the 6901 keypad can be enabled or disabled separately. The combination produces the parameter setting as in the table below. The default of FFFF enables all keys. | 0000 to FFFF | FFFF |

| Parameter Setting | RUN | L/R | JOG | DIR |
|---|---|---|---|---|
| 0000 | - | - | - | - |
| 0010 | - | - | - | ENABLED |
| 0020 | - | - | ENABLED | - |
| 0030 | - | - | ENABLED | ENABLED |
| 0040 | - | ENABLED | - | - |
| 0050 | - | ENABLED | - | ENABLED |
| 0060 | - | ENABLED | ENABLED | - |
| 0070 | - | ENABLED | ENABLED | ENABLED |
| 0080 | ENABLED | - | - | - |
| 0090 | ENABLED | - | - | ENABLED |
| 00A0 | ENABLED | - | ENABLED | - |
| 00B0 | ENABLED | - | ENABLED | ENABLED |
| 00C0 | ENABLED | ENABLED | - | - |
| 00D0 | ENABLED | ENABLED | - | ENABLED |
| 00E0 | ENABLED | ENABLED | ENABLED | - |
| 00F0 | ENABLED | ENABLED | ENABLED | ENABLED |


6901


6911


6511


6521

When using the standard 6511 and 6521 keypad, disabling the **DIR** key prevents the local setpoint going negative (for reverse). Similarly, disabling the **L/R** key prevents the drive being changed from Local to Remote, or Remote to Local modes.

| | | | | |
|---|---|---|---|---|
| SEt98 | APPLICATION LOCK F | Setting this parameter to TRUE prevents editing of parameter P1.<br>Set this parameter to FALSE to edit parameter P1. | 0=FALSE<br>1=TRUE | 0 |
| SEt99 | DETAILED MENUS | Selects Full menu detail when TRUE. The additional parameters in the Full menus are indicated in this table by F | 0=FALSE<br>1=TRUE | 0 |

**MMI Parameters Table**

| Display | Parameter | Description | Range | Default |
|---|---|---|---|---|
| | | **SET::ENC Menu** | | |
| SEN01 | ENC MODE F | Set this parameter to the requirements for your encoder:<br>0 : QUADRATURE (using digital inputs 6 & 7, ENCA and ENCB respectively)<br>1 : CLOCK/DIR (using digital inputs 6 & 7, ENCA and ENCB respectively)<br>2 : CLOCK (using digital input 6, ENCA) | 0= QUADRATURE<br>1= CLOCK/DIR<br>2= CLOCK | 0 |
| SEN02 | ENC RESET F | When TRUE the POSITION and SPEED outputs are set (and held) at zero. | 0=FALSE<br>1=TRUE | 0 |
| SEN03 | ENC INVERT F | When TRUE, changes the sign of the measured speed and the direction of the position count. | 0=FALSE<br>1=TRUE | 0 |
| SEN04 | ENC LINES F | The number of lines must be set to match the type of encoder being used. Incorrect setting of this parameter will result in an erroneous speed measurement. | 100 to 10000 | 100 |
| SEN05 | ENC SPEED SCALE F | This parameter allows the output "speed" to be scaled to any value the user requires. With a default value of 1.00, the output "speed" is measured in revs per second. Changing the ENC SPEED SCALE value to 60.00 will provide an output in revs per minute.<br>To provide an output in percent of the motor maximum speed, where maximum speed is the maximum speed your motor will run in rpm, the ENC SPEED SCALE parameter should be set to the result of:<br>$\frac{6000}{\text{maximum speed (rpm)}}$ | 0.00 to 300.00 | 1.00 |
| SEN06 | ENC SPEED F | Speed feedback, in units defined by the ENC SPEED SCALE parameter. | —.x | —.x |

# Configuring Terminals 9 & 10 (Digital Input/Output)

Terminal 10 can be operated as digital input DIN 4 or digital output DOUT2. It is configured via the keypad or DSE Lite (or other suitable programming tool). The default for terminal 10 is to operate as a digital input, and the input logic is non-inverted.

Terminal 9 can be operated as digital input DIN3 or digital output DOUT1, however, it can only be configured via DSE Lite (or other suitable programming tool). The default for terminal 9 is to operate as a digital input, and the input logic is non-inverted.

## Configure for use as a Digital Input (default)

For example, to use terminal 10 as an input, the output circuitry must be disabled by setting $^{S}$DOP2 and $^{S}$OPD2 to zero. You can invert this logic using parameter $^{S}$IP04.

| Parameter | | Setting |
|---|---|---|
| S dOP2 | DOUT2 SOURCE | 0 |
| S OPd2 | DOUT2 INVERT | 0 |
| S I P04 | DIN4 INVERT | Default is 0, setting to 1 inverts the input logic |

## Configure for use as a Digital Output

For example, to use terminal 10 as an output, select $^{S}$DOP2 to be 1, 2, 3, 4 , 5 or 6. For instance, you could set parameter $^{S}$DOP2 to 3 to have the output go high (24V) whenever the motor is running, operating an external relay or lamp. You can invert this logic using parameter $^{S}$OPD2.

| Parameter | | Setting | |
|---|---|---|---|
| S dOP2 | DOUT2 SOURCE | | *The output is high when:* |
| | | 1 = HEALTH | The Run signal is not present, or no trip is active |
| | | 2 = TRIPPED | A trip is present |
| | | 3 = RUNNING | The motor is running |
| | | 4 = AT ZERO | The output frequency is below 1% of MAX SPEED ($^{P}$2) |
| | | 5 = AT SPEED | The output frequency is at or near Setpoint and within ±1% of MAX SPEED, set by (P2). For example: if MAX SPEED = 50Hz and Setpoint = 30Hz, then 1% of MAX SPEED = 0.5Hz. So AT LOAD is True between 30 ±0.5Hz. |
| | | 6 = AT LOAD | The magnitude of the output torque is greater than or equal to the torque level set in $^{S}$ST42 |
| | | 7 = READY | The drive is ready to start. |
| | | Always set $^{S}$IP04 to 0 if using Applications 1 and 5 – refer to Chapter 12. | |
| S OPd2 | DOUT2 INVERT | Default is 0, setting to 1 inverts the output logic | |

## PID - Tuning Your Drive

This section relates to the use of Application 5.

Parameters AP01 to AP11: PID is used to control the response of any closed loop system. It is used specifically in system applications involving the control of drives to provide zero steady state error between Setpoint and Feedback, together with good transient performance.

### **P**roportional Gain (AP01)

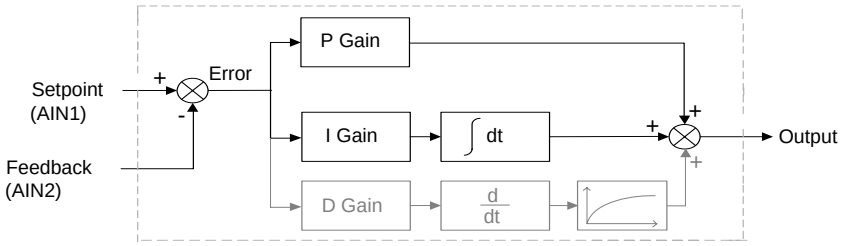
This is used to adjust the basic response of the closed loop control system. The PI error is multiplied by the Proportional Gain to produce an output.

### **I**ntegral (AP02)

The Integral term is used to reduce steady state error between the setpoint and feedback values of the PI. If the integral is set to zero, then in most systems there will always be a steady state error.

### **D**erivative (AP03)

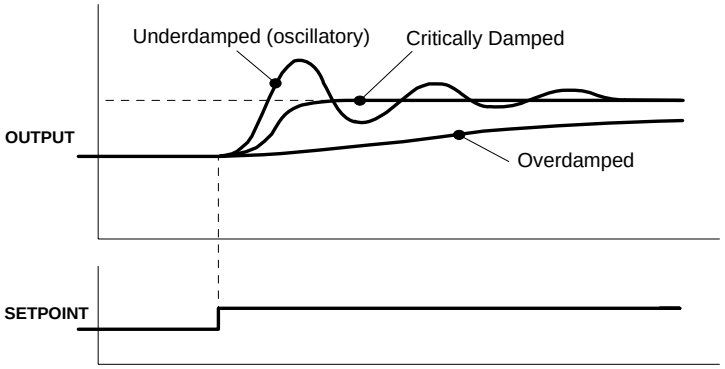
This is used to correct for certain types of control loop instability, and therefore improve response. It is sometimes used when heavy or large inertia rolls are being controlled. The derivative term has an associated filter to suppress high frequency signals.




- Functions as P, PI, PID controller
- Single symmetric limit on output

### *A Method for Setting-up the PI Gains*

The gains should be set-up so that a critically damped response is achieved for a step change in setpoint. An underdamped or oscillatory system can be thought of as having too much gain, and an overdamped system has too little.




To set up the P gain, set the I gain to zero. Apply a step change in setpoint that is typical for the System, and observe the response. Increase the gain and repeat the test until the system becomes oscillatory. At this point, reduce the P gain until the oscillations disappear. This is the maximum value of P gain achievable.

If a steady state error is present, i.e. the feedback never reaches the setpoint value, the I gain needs to be increased. As before, increase the I gain and apply the step change. Monitor the output. If the output becomes oscillatory, reduce the P gain slightly. This should reduce the steady state error. Increasing the I gain further may reduce the time to achieve zero steady state error.

These values of P and I can now be adjusted to provide the exact response required for this step change.

## Auto Restart

Parameters $^{S}$ST21 to $^{S}$ST24 provide the facility to automatically reset a choice of trip events and restart the drive with a programmed number of attempts. If the drive is not successfully started, a manual or remote trip reset is required.

The number of attempted restarts are recorded. This count is cleared after a trip-free period of operation (5 minutes or 4 x AUTO RESTART DELAY, whichever is the longer); or after a successful manual or remote trip reset; or by removing the Run signal (Terminal 7, DIN1).

Refer to Chapter 7: "Trips and Fault Finding" - Hexadecimal Representation of Trips.

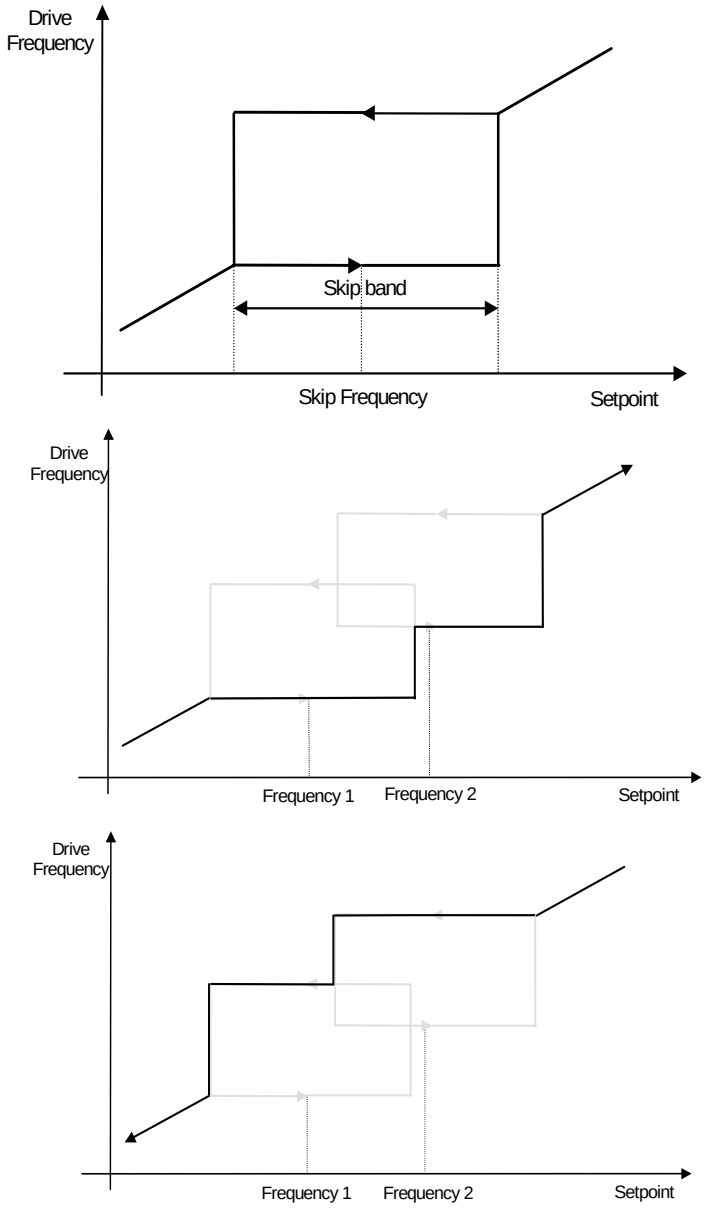
## Skip Frequencies

Parameters $^{S}$ST11 to $^{S}$ST14 control two programmable skip frequencies that can prevent the drive from operating at frequencies that cause mechanical resonance in the load.

- Enter the value of the frequency that causes the resonance into the SKIP FREQUENCY parameter.
- Enter a width for the skip band into the SKIP FREQUENCY BAND parameter.

The drive will then avoid sustained operation within the forbidden band as shown in the diagram. The skip frequencies are symmetrical and thus work in forward and reverse.

Setting SKIP FREQUENCY or SKIP FREQUENCY BAND to 0 disables the corresponding band.

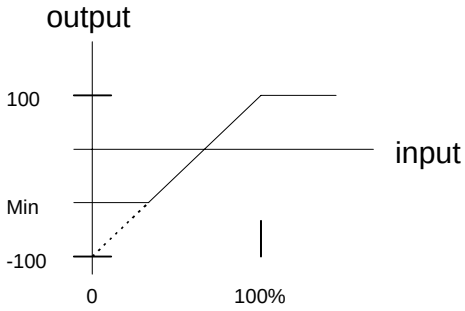


## Minimum Speed Mode

There are two operating modes for the minimum speed feature.

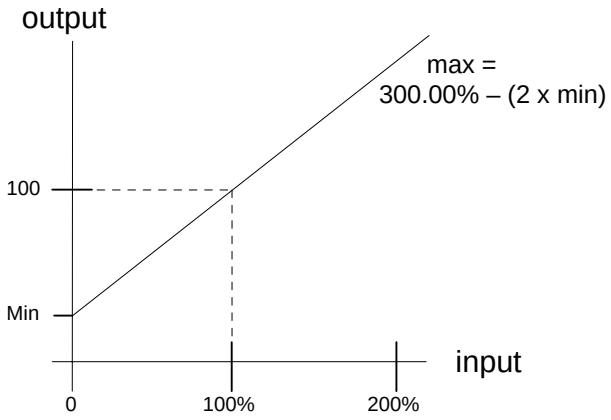
### Proportional with Minimum

In this mode the speed setpoint is clamped to be between the minimum speed value (P3) and 100%. This is the default for the minimum speed feature.




### Linear

In this mode the speed setpoint is first clamped to be in the range 0 to 100%. It is then rescaled so that the output goes linearly between the minimum speed value (P3) and 100% for an input setpoint that goes between 0% and 100%. If the minimum speed value (P3) is negative the speed setpoint will be internally set to 0%.




## Product-Related Default Values

All examples given in this book are based on a UK, 230V, 50Hz, 0.25kW drive. This manual provides information about each parameter accessible using the keypad, or MMI (Man Machine Interface). For more information about these and additional parameters accessible using DSE Lite (or other suitable programming tool), refer to the 650G Software Product Manual on our web site: www.SSDdrives.com.

## * Frequency Dependent Parameters

These parameter values (marked with "*" in the Application diagrams) are dependent upon the drive's "default frequency".

Changing the "default frequency" parameter from 50Hz to 60Hz, and vice versa, causes the values of the parameters in the table below to be changed.

To change the "default frequency", power-down the drive. Power-up the drive holding down the 'E' and DOWN keys on the keypad. Release the keys to display the $^{e}$ 0.01 parameter.

**Caution**

You are now in a menu containing some sensitive and important parameters.

Press the UP key to display the $^{e}$ 0.02 parameter. Press the M key. The values for this parameter are: 0 = 50Hz default, 1 = 60Hz default. Select the setting using the UP/DOWN keys and then press the E key. Power-down the drive and power-up again holding down the UP and DOWN keys. This resets **ALL** parameters to their correct default values, including Motor Parameters.

| Frequency Dependent Defaults | | | | | |
|---|---|---|---|---|---|
| Display | Parameter | Function Block | Tag | 50Hz Operation | 60Hz Operation |
| P 7 | BASE FREQUENCY | MOTOR DATA | 1159 | 50Hz | 60Hz |
| SCL02 | NAMEPLATE RPM | MOTOR DATA | 83 | # | 1750 RPM |
| SCL 12 | MOTOR VOLTAGE | MOTOR DATA | 1160 | * | * |
| P 2 | MAX SPEED | REFERENCE | 57 | 50Hz | 60Hz |
| SCL 16 | MOTOR CONNECTION | MOTOR DATA | 124 | STAR | STAR |

# The correct value is selected for the size of drive - refer to the Power Dependent Parameters table below
* The correct value is selected for the drive, however, when 60Hz is selected the 400V unit = 460V

## ** Power Dependent Parameters

These parameters (marked with "**" in the Application diagrams) are set to a value depending on the drive's overall "power-build" indicated by the Product Code. We recommend that you do not change the Product Code.

| 230V Build Power Dependent Defaults | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Frame 1 | | | | Frame 2 | |
| Parameter | Function Block | Tag | 0.25kW | 0.37kW | 0.55kW | 0.75kW | 1.1kW | 1.5kW |
| POWER | MOTOR DATA | 1158 | 0.25 kw | 0.37 kw | 0.55 kw | 0.75 kw | 1.10 kw | 1.50 kw |
| MOTOR CURRENT | MOTOR DATA | 64 | 1.50 A | 2.20 A | 3.00 A | 4.00 A | 5.50 A | 7.00 A |
| MAG CURRENT | MOTOR DATA | 65 | 0.80 A | 0.80 A | 1.04 A | 1.36 A | 2.50 A | 3.41 A |
| NAMEPLATE RPM | MOTOR DATA | 83 | 1380.0 RPM | 1380.0 RPM | 1400.0 RPM | 1400.0 RPM | 1420.0 RPM | 1420.0 RPM |
| MOTOR VOLTAGE | MOTOR DATA | 1160 | 230.0 V | 230.0 V | 230.0 V | 230.0 V | 230.0 V | 230.0 V |
| POWER FACTOR | MOTOR DATA | 242 | 0.70 | 0.70 | 0.70 | 0.70 | 0.71 | 0.78 |
| STATOR RES | MOTOR DATA | 119 | 5.2060 ohms | 5.2060 ohms | 3.8177 ohms | 2.9367 ohms | 1.5907 ohms | 1.1687 ohms |
| LEAKAGE INDUC | MOTOR DATA | 120 | 110.47 mH | 110.47 mH | 81.01 mH | 62.32 mH | 33.76 mH | 24.80 mH |
| MUTUAL INDUC | MOTOR DATA | 121 | 441.90 mH | 441.90 mH | 324.06 mH | 249.28 mH | 135.02 mH | 99.20 mH |
| ROTOR TIME CONST | MOTOR DATA | 1163 | 91.17 ms | 91.17 ms | 109.40 ms | 109.40 ms | 136.75 ms | 136.75 ms |
| BRAKE POWER | DYNAMIC BRAKING | 78 | 0.1 kW | 0.1 kW | 0.1 kW | 0.1 kW | 0.1 kW | 0.1 kW |
| FREQUENCY | INJ BRAKING | 577 | 9.0 Hz | 9.0 Hz | 9.0 Hz | 9.0 Hz | 9.0 Hz | 9.0 Hz |
| DEFLUX TIME | INJ BRAKING | 710 | 0.1 s | 0.1 s | 0.1 s | 0.1 s | 0.1 s | 0.1 s |
| BASE VOLTS | INJ BRAKING | 739 | 100.00 % | 100.00 % | 100.00 % | 100.00 % | 100.00 % | 100.00 % |
| DC LEVEL | INJ BRAKING | 581 | 10.0 % | 10.0 % | 10.0 % | 10.0 % | 3.0 % | 3.0 % |
| DC PULSE | INJ BRAKING | 579 | 2.0 s | 2.0 s | 2.0 s | 2.0 s | 2.0 s | 2.0 s |
| FINAL DC PULSE | INJ BRAKING | 580 | 1.0 s | 1.0 s | 1.0 s | 1.0 s | 1.0 s | 1.0 s |
| FIXED BOOST | FLUXING | 107 | 5.00% | 5.00% | 5.00% | 5.00% | 5.00% | 5.00% |
| ACCEL TIME | REFERENCE RAMP | 258 | 10.0 s | 10.0 s | 10.0 s | 10.0 s | 10.0 s | 10.0 s |
| DECEL TIME | REFERENCE RAMP | 259 | 10.0 s | 10.0 s | 10.0 s | 10.0 s | 10.0 s | 10.0 s |
| DEFLUX DELAY | PATTERN GEN | 100 | 0.5 s | 0.5 s | 0.5 s | 0.5 s | 1.0 s | 1.0 s |
| SEARCH VOLTS | FLYCATCHING | 573 | 9.00 % | 9.00 % | 9.00 % | 9.00 % | 9.00 % | 9.00 % |
| SEARCH BOOST | FLYCATCHING | 32 | 40.00 % | 40.00 % | 40.00 % | 40.00 % | 40.00 % | 40.00 % |
| SEARCH TIME | FLYCATCHING | 574 | 5.0 s | 5.0 s | 5.0 s | 5.0 s | 5.0 s | 5.0 s |
| REFLUX TIME | FLYCATCHING | 709 | 3.0 s | 3.0 s | 3.0 s | 3.0 s | 3.0 s | 3.0 s |
| OVERLOAD | MOTOR DATA | 1164 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| SPEED PROP GAIN | SPEED LOOP | 1187 | 20 | 20 | 20 | 20 | 20 | 20 |
| SPEED INT TIME | SPEED LOOP | 1188 | 500. ms | 500. ms | 500. ms | 500. ms | 500. ms | 500. ms |
| MOTOR CONNECTION | MOTOR DATA | 124 | 1 : STAR | 1 : STAR | 1 : STAR | 1 : STAR | 1 : STAR | 1 : STAR |
| BRAKE RESISTANCE | DYNAMIC BRAKING | 77 | 500 | 500 | 500 | 500 | 500 | 500 |
| BOOST MODE | FLUXING | 1058 | 1 | 1 | 1 | 1 | 1 | 1 |

## 400V Build Power Dependent Defaults

| | | | Frame 2 | | | | | |
|---|---|---|---|---|---|---|---|---|
| Parameter | Function Block | Tag | 0.37kW | 0.55kW | 0.75kW | 1.1kW | 1.5kW | 2.2kW |
| POWER | MOTOR DATA | 1158 | 0.37 kw | 0.55 kw | 0.75 kw | 1.10 kw | 1.50 kw | 2.20 kw |
| MOTOR CURRENT | MOTOR DATA | 64 | 1.50 A | 2.00 A | 2.50 A | 3.50 A | 4.50 A | 5.50 A |
| MAG CURRENT | MOTOR DATA | 65 | 0.44 A | 0.60 A | 0.78 A | 1.00 A | 1.44 A | 1.96 A |
| NAMEPLATE RPM | MOTOR DATA | 83 | 1380.0 RPM | 1400.0 RPM | 1400.0 RPM | 1420.0 RPM | 1420.0 RPM | 1420.0 RPM |
| MOTOR VOLTAGE | MOTOR DATA | 1160 | 400.0 V | 400.0 V | 400.0 V | 400.0 V | 400.0 V | 400.0 V |
| POWER FACTOR | MOTOR DATA | 242 | 0.70 | 0.70 | 0.70 | 0.71 | 0.71 | 0.78 |
| STATOR RES | MOTOR DATA | 119 | 15.7459 ohms | 11.5470 ohms | 8.8823 ohms | 1.5907 ohms | 4.8113 ohms | 3.5348 ohms |
| LEAKAGE INDUC | MOTOR DATA | 120 | 334.14 mH | 245.04 mH | 188.49 mH | 33.76 mH | 102.10 mH | 75.01 mH |
| MUTUAL INDUC | MOTOR DATA | 121 | 1336.55 mH | 980.14 mH | 753.95 mH | 135.02 mH | 408.39 mH | 300.04 mH |
| ROTOR TIME CONST | MOTOR DATA | 1163 | 91.17 ms | 109.40 ms | 109.40 ms | 136.75 ms | 136.75 ms | 136.75 ms |
| BRAKE POWER | DYNAMIC BRAKING | 78 | 0.1 kW | 0.1 kW | 0.1 kW | 0.1 kW | 0.1 kW | 0.1 kW |
| FREQUENCY | INJ BRAKING | 577 | 9.0 Hz | 9.0 Hz | 9.0 Hz | 9.0 Hz | 9.0 Hz | 9.0 Hz |
| DEFLUX TIME | INJ BRAKING | 710 | 0.1 s | 0.1 s | 0.1 s | 0.1 s | 0.1 s | 0.1 s |
| BASE VOLTS | INJ BRAKING | 739 | 100.00 % | 100.00 % | 100.00 % | 100.00 % | 100.00 % | 100.00 % |
| DC LEVEL | INJ BRAKING | 581 | 3.0 % | 3.0 % | 3.0 % | 3.0 % | 3.0 % | 3.0 % |
| DC PULSE | INJ BRAKING | 579 | 2.0 s | 2.0 s | 2.0 s | 2.0 s | 2.0 s | 2.0 s |
| FINAL DC PULSE | INJ BRAKING | 580 | 1.0 s | 1.0 s | 1.0 s | 1.0 s | 1.0 s | 1.0 s |
| FIXED BOOST | FLUXING | 107 | 5.00% | 5.00% | 5.00% | 5.00% | 5.00% | 5.00% |
| ACCEL TIME | REFERENCE RAMP | 258 | 10.0 s | 10.0 s | 10.0 s | 10.0 s | 10.0 s | 10.0 s |
| DECEL TIME | REFERENCE RAMP | 259 | 10.0 s | 10.0 s | 10.0 s | 10.0 s | 10.0 s | 10.0 s |
| DEFLUX DELAY | PATTERN GEN | 100 | 1.0 s | 1.0 s | 1.0 s | 1.0 s | 1.0 s | 1.0 s |
| SEARCH VOLTS | FLYCATCHING | 573 | 9.00 % | 9.00 % | 9.00 % | 9.00 % | 9.00 % | 9.00 % |
| SEARCH BOOST | FLYCATCHING | 32 | 40.00 % | 40.00 % | 40.00 % | 40.00 % | 40.00 % | 40.00 % |
| SEARCH TIME | FLYCATCHING | 574 | 5.0 s | 5.0 s | 5.0 s | 5.0 s | 5.0 s | 5.0 s |
| REFLUX TIME | FLYCATCHING | 709 | 3.0 s | 3.0 s | 3.0 s | 3.0 s | 3.0 s | 3.0 s |
| OVERLOAD | MOTOR DATA | 1164 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |
| SPEED PROP GAIN | SPEED LOOP | 1187 | 20 | 20 | 20 | 20 | 20 | 20 |
| SPEED INT TIME | SPEED LOOP | 1188 | 500. ms | 500. ms | 500. ms | 500. ms | 500. ms | 500. ms |
| MOTOR CONNECTION | MOTOR DATA | 124 | 1 : STAR | 1 : STAR | 1 : STAR | 1 : STAR | 1 : STAR | 1 : STAR |
| BRAKE RESISTANCE | DYNAMIC BRAKING | 77 | 500 | 500 | 500 | 200 | 200 | 200 |
| BOOST MODE | FLUXING | 1058 | 1 | 1 | 1 | 1 | 1 | 1 |

## 400V Build Power Dependent Defaults

| | | | Frame 3 | | | |
|---|---|---|---|---|---|---|
| Parameter | Function Block | Tag | | | | |
| POWER | MOTOR DATA | 1158 | 3.00 kw | 4.00 kw | 5.50 kw | 7.50 kw |
| MOTOR CURRENT | MOTOR DATA | 64 | 6.80 A | 9.00 A | 12.00 A | 16.00 A |
| MAG CURRENT | MOTOR DATA | 65 | 2.36 A | 3.36 A | 3.39 A | 4.38 A |
| NAMEPLATE RPM | MOTOR DATA | 83 | 1420.0 RPM | 1420.0 RPM | 1445.0 RPM | 1450.0 RPM |
| MOTOR VOLTAGE | MOTOR DATA | 1160 | 400.0 V | 400.0 V | 400.0 V | 400.0 V |
| POWER FACTOR | MOTOR DATA | 242 | 0.8 | 0.8 | 0.8 | 0.8 |
| STATOR RES | MOTOR DATA | 119 | 2.0620 ohms | 2.0620 ohms | 1.3625 ohms | 1.0545 ohms |
| LEAKAGE INDUC | MOTOR DATA | 120 | 43.76 mH | 43.76 mH | 43.37 mH | 33.57 mH |
| MUTUAL INDUC | MOTOR DATA | 121 | 175.03 mH | 175.03 mH | 173.48 mH | 134.27 mH |
| ROTOR TIME CONST | MOTOR DATA | 1163 | 136.75 ms | 136.75 ms | 276.04 ms | 303.65 ms |
| BRAKE POWER | DYNAMIC BRAKING | 78 | 0.2 kW | 0.2 kW | 0.5 kW | 0.5 kW |
| FREQUENCY | INJ BRAKING | 577 | 9.0 Hz | 9.0 Hz | 9.0 Hz | 9.0 Hz |
| DEFLUX TIME | INJ BRAKING | 710 | 0.5 s | 0.5 s | 0.5 s | 0.5 s |
| BASE VOLTS | INJ BRAKING | 739 | 100.00 % | 100.00 % | 100.00 % | 100.00 % |
| DC LEVEL | INJ BRAKING | 581 | 3.0 % | 3.0 % | 3.0 % | 3.0 % |
| DC PULSE | INJ BRAKING | 579 | 2.0 s | 2.0 s | 2.0 s | 2.0 s |
| FINAL DC PULSE | INJ BRAKING | 580 | 1.0 s | 1.0 s | 1.0 s | 1.0 s |
| FIXED BOOST | FLUXING | 107 | 5.00% | 5.00% | 5.00% | 5.00% |
| ACCEL TIME | REFERENCE RAMP | 258 | 10.0 s | 10.0 s | 10.0 s | 10.0 s |
| DECEL TIME | REFERENCE RAMP | 259 | 10.0 s | 10.0 s | 10.0 s | 10.0 s |
| DEFLUX DELAY | PATTERN GEN | 100 | 2.0 s | 2.0 s | 2.0 s | 2.0 s |
| SEARCH VOLTS | FLYCATCHING | 573 | 9.00 % | 9.00 % | 9.00 % | 9.00 % |
| SEARCH BOOST | FLYCATCHING | 32 | 40.00 % | 40.00 % | 40.00 % | 40.00 % |
| SEARCH TIME | FLYCATCHING | 574 | 5.0 s | 5.0 s | 5.0 s | 5.0 s |
| REFLUX TIME | FLYCATCHING | 709 | 3.0 s | 3.0 s | 3.0 s | 3.0 s |
| OVERLOAD | MOTOR DATA | 1164 | 2.0 | 2.0 | 2.0 | 2.0 |
| SPEED PROP GAIN | SPEED LOOP | 1187 | 20 | 20 | 20 | 20 |
| SPEED INT TIME | SPEED LOOP | 1188 | 500. ms | 500. ms | 500. ms | 500. ms |
| MOTOR CONNECTION | MOTOR DATA | 124 | 1 : STAR | 1 : STAR | 1 : STAR | 1 : STAR |
| BRAKE RESISTANCE | DYNAMIC BRAKING | 77 | 100 | 100 | 56 | 56 |
| BOOST MODE | FLUXING | 1058 | 1 | 1 | 1 | 1 |

# Chapter 7 TRIPS AND FAULT FINDING

## Trips

### Trip Warning Message

The trip display message is flashed repeatedly on the screen to warn of an imminent trip. Some trip conditions need time to take effect. The warning can allow you time to rectify the situation.

The message will clear when you use the keypad, but after a short time will reappear until the problem is resolved, or the drive trips.

### What Happens when a Trip Occurs

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

#### Keypad Indications

If a trip condition is detected the activated alarm is displayed on the MMI display.

### Resetting a Trip Condition

All trips must be reset before the drive can be re-enabled. A trip can only be reset once the trip condition is no longer active, i.e. a trip due to a heatsink over-temperature will not reset until the temperature is below the trip level.

You can reset the trip as follows:

1. Press the  (STOP) key to reset the trip and clear the alarm from the display.
2. Remove and then re-apply the RUN command and the drive will run normally.

In remote mode, success is indicated by displaying rdy.

### Using the Keypad to Manage Trips

#### Trip Messages

If the drive trips, then the display immediately shows a message indicating the reason for the trip. The possible trip messages are given in the table below.

| ID | Trip Name | Possible Reason for Trip |
|---|---|---|
| 1 | OVERVOLTAGE<br>AdCH1 | *The drive internal dc link voltage is too high:*<br>• The supply voltage is too high<br>• Trying to decelerate a large inertia load too quickly; DECEL TIME time too short<br>The brake resistor is open circuit |
| 2 | UNDERVOLTAGE<br>AdCL0 | *DC link low trip:*<br>Supply is too low/power down |

| ID | Trip Name | Possible Reason for Trip |
|---|---|---|
| 3 | OVERCURRENT<br>A OC | *The motor current being drawn from the drive is too high:*<br>• Trying to accelerate a large inertia load too quickly; ACCEL TIME time too short<br>• Trying to decelerate a large inertia load too quickly; DECEL TIME time too short<br>• Application of shock load to motor<br>• Short circuit between motor phases<br>• Short circuit between motor phase and earth<br>• Motor output cables too long or too many parallel motors connected to the drive<br>• FIXED BOOST level set too high |
| 4 | HEATSINK<br>AHOt | *Drive heatsink temperature > 100°C:*<br>• The ambient air temperature is too high<br>Poor ventilation or spacing between drives |
| 5 | EXTERNAL TRIP<br>AEt | *The external trip input is high:*<br>• Check configuration to identify the source of the signal (non-standard configuration) |
| 6 | INVERSE TIME<br>A It | *A prolonged overload condition, exceeding the Inverse Time allowance, has caused the trip:*<br>• Remove the overload condition - refer to Chapter 5: P12 |
| 7 | CURRENT LOOP<br>ALOOP | *A current of less than 1mA is present when 4-20mA setpoint is selected:*<br>• Look for a wire break |
| 8 | MOTOR STALLED<br>AStLL | *The motor has stalled (not rotating) Drive in current limit >200 seconds:*<br>• Motor loading too great<br>• FIXED BOOST level set too high |
| 9 | ANIN FAULT<br>At 3 | *AIN2 overload on terminal 3:*<br>• Overcurrent applied in Current mode to terminal 3 |
| 10 | BRAKE RESISTOR<br>Adb r | *External dynamic brake resistor has been overloaded:*<br>• Trying to decelerate a large inertia too quickly or too often |
| 11 | BRAKE SWITCH<br>Adb S | *Internal dynamic braking switch has been overloaded:*<br>• Trying to decelerate a large inertia too quickly or too often |
| 12 | DISPLAY/KEYPAD<br>Ad ISP | *Keypad has been disconnected from drive whilst drive is running in Local Control:*<br>• Keypad accidentally disconnected from drive (indicated over Comms, or by second keypad) |
| 13 | LOST COMMS<br>ASCI | *Lost communications:*<br>• COMMS TIMEOUT parameter set too short<br>• Master device failed<br>• Wiring broken<br>• Incorrect Comms setup |

| ID | Trip Name | Possible Reason for Trip |
|---|---|---|
| 14 | CONTACTOR FBK<br>A CntC | *Contactor feedback signal lost:*<br>• Check connection to the terminal wired to "contactor closed" parameter in Sequencing Logic (non-standard configuration) |
| 15 | SPEED FEEDBACK<br>A SPd | *Speed feedback:*<br>• SPEED ERROR > 50.00% for 10 seconds |
| 17 | MOTOR OVERTEMP<br>A Ot | *The motor temperature is too high:*<br>• Excessive load<br>• Motor voltage rating incorrect<br>• FIXED BOOST level set too high<br>• Prolonged operation of the motor at low speed without forced cooling<br>• Break in motor thermistor connection |
| 18 | CURRENT LIMIT<br>A I HI | *Software overcurrent trip:*<br>• If the current exceeds 180% of stack rated current for a period of 1 second, the drive will trip. This is caused by shock loads. Remove the shock load.<br>• ACCEL TIME and/or FIXED BOOSTset too high<br>• DECEL TIME set too low |
| 21 | LOW SPEED OVER I<br>A LSPd | *The motor is drawing too much current (>100%) at zero output frequency:*<br>• FIXED BOOST level set too high |
| 22 | 10V FAULT<br>A t 4 | *10V fault:*<br>• +10V REF overload warning (terminal 4) - 10mA maximum |
| 25 | DC LINK RIPPLE<br>A dCrP | *The dc link ripple voltage is too high:*<br>• Check for a missing input phase |
| 27 | OVERSPEED<br>A OSPd | *Overspeed:*<br>• >150% base speed when in Sensorless Vector mode |
| 28 | ANOUT FAULT<br>A t 5 | *AOUT overload on terminal 5:*<br>• 10mA maximum |
| 29 | DIGIO 1 (T9) FAULT<br>A t 9 | *DIN3 overload on terminal 9:*<br>• 20mA maximum |
| 30 | DIGIO 2 (T10) FAULT<br>A t 10 | *DOUT2 overload on terminal 10:*<br>• 50mA maximum |
| 31 | UNKNOWN<br>A trIP | Unknown trip |
| 32 | OTHER<br>A trP32 | "OTHER" trip is active (Trip ID 34 to 44 inclusive) |
| 34 | MAX SPEED LOW<br>A AtnI | During Autotune the motor is required to run at the nameplate speed of the motor. If MAX SPEED RPM limits the speed to less than this value, an error will be reported. Increase the value of MAX SPEED RPM up to the nameplate rpm of the motor (as a minimum). It may be reduced, if required, after the Autotune is complete. |

| ID | Trip Name | Possible Reason for Trip |
|---|---|---|
| 35 | MAIN VOLTS LOW<br>AtN2 | The mains input voltage is not sufficient to carry out the Autotune. Re-try when the mains has recovered. |
| 36 | NOT AT SPEED<br>AtN3 | The motor was unable to reach the required speed to carry out the Autotune. Possible reasons include:<br>• motor shaft not free to turn<br>• the motor data is incorrect |
| 37 | MAG CURRENT FAIL<br>AtN4 | It was not possible to find a suitable value of magnetising current to achieve the required operating condition for the motor. Check the motor data is correct, especially nameplate rpm and motor volts. Also check that the motor is correctly rated for the drive. |
| 38 | NEGATIVE SLIP F<br>AtN5 | Autotune has calculated a negative slip frequency, which is not valid. Nameplate rpm may have been set to a value higher than the base speed of the motor. Check nameplate rpm, base frequency, and pole pairs are correct. |
| 39 | TR TOO LARGE<br>AtN6 | The calculated value of rotor time constant is too large. Check the value of nameplate rpm. |
| 40 | TR TOO SMALL<br>AtN7 | The calculated value of rotor time constant is too small. Check the value of nameplate rpm. |
| 41 | MAX RPM DATA ERR<br>AtN8 | This error is reported when the MAX SPEED RPM is set to a value outside the range for which Autotune has gathered data. Autotune gathers data on the motor characteristics up to 30% beyond "max speed rpm". If MAX SPEED RPM is later increased beyond this range, the drive had no data for this new operating area, and so will report an error. To run the motor beyond this point it is necessary to re-autotune with MAX SPEED RPM set to a higher value. |
| 42 | LEAKGE L TIMEOUT<br>AtN9 | The motor must be stationary when starting the Autotune |
| 43 | MOTOR TURNING ERR<br>AtNA | The motor must be able to rotate during Autotune |
| 44 | MOTOR STALL ERR<br>AtNb | The leakage inductance measurement requires a test current to be inserted into the motor. It has not been possible to achieve the required level of current. Check that the motor is wired correctly. |
| - | Product Code Error<br>CodE | Switch unit off/on. If persistent, return unit to factory |
| - | Calibration Data Error<br>CAL | Switch unit off/on. If persistent, return unit to factory |
| - | Configuration Data Error<br>dAtA | Press the E key to accept the default configuration. If persistent, return unit to factory |

# Hexadecimal Representation of Trips

The tables below show the possible parameter values for the AUTO RESTART TRIGGERS and AUTO RESTART TRIGGERS+ parameters, $^{S}$ST23 and $^{S}$ST24 respectively. Refer to the 650G Software Product Manual, "Trips Status" (on our website: www.SSDdrives.com) for additional trip information that is available over the Comms.

Each trip has a unique, four-digit hexadecimal number number as shown in the tables below.

| $^{S}$ST23 : AUTO RESTART TRIGGERS | | | | |
|---|---|---|---|---|
| ID | Trip Name (MMI 6901) | Trip Name (MMI 6511 & 6521) | Mask | User Disable |
| 1 | OVERVOLTAGE | DCHI | 0x0001 | |
| 2 | UNDERVOLTAGE | DCLO | 0x0002 | |
| 3 | OVERCURRENT | OC | 0x0004 | |
| 4 | HEATSINK | HOT | 0x0008 | |
| 5 | EXTERNAL TRIP | ET | 0x0010 | ✓ |
| 6 | INVERSE TIME | $^{S}$I t | 0x0020 | ✓ |
| 7 | CURRENT LOOP | $^{S}$LOOP | 0x0040 | ✓ |
| 8 | MOTOR STALLED | $^{S}$StLL | 0x0080 | ✓ |
| 9 | ANIN FAULT | $^{S}$ t 3 | 0x0100 | ✓ |
| 10 | BRAKE RESISTOR | $^{S}$db r | 0x0200 | ✓ |
| 11 | BRAKE SWITCH | $^{S}$db S | 0x0400 | ✓ |
| 12 | DISPLAY/KEYPAD | $^{S}$dI SP | 0x0800 | ✓ |
| 13 | LOST COMMS | SCI | 0x1000 | ✓ |
| 14 | CONTACTOR FBK | CNTC | 0x2000 | ✓ |
| 15 | SPEED FEEDBACK | $^{S}$SPd | 0x4000 | ✓ |

| $^{S}$ST24 : AUTO RESTART TRIGGERS+ | | | | |
|---|---|---|---|---|
| ID | Trip Name (MMI 6901) | Trip Name (MMI 6511 & 6521) | Mask + | User Disable |
| 17 | MOTOR OVERTEMP | $^{S}$Ot | 0x0001 | ✓ |
| 18 | CURRENT LIMIT | I HI | 0x0002 | |
| 21 | LOW SPEED OVER I | LSPD | 0x0010 | |
| 22 | 10V FAULT | T 4 | 0x0020 | ✓ |
| 25 | DC LINK RIPPLE | DCRP | 0x0100 | ✓ |
| 27 | OVERSPEED | $^{S}$OSPd | 0x0400 | ✓ |
| 28 | ANOUT FAULT | T 5 | 0x0800 | ✓ |
| 29 | DIGIO 1 (T9) FAULT | T 9 | 0x1000 | ✓ |
| 30 | DIGIO 2 (T10) FAULT | T 10 | 0x2000 | ✓ |
| 31 | UNKNOWN | TRIP | 0x4000 | |
| 32 | OTHER | TR32 | 0x8000 | |
| 34 | MAX SPEED LOW | ATN1 | 0x8000 | N/A |
| 35 | MAIN VOLTS LOW | ATN2 | 0x8000 | N/A |
| 36 | NOT AT SPEED | ATN3 | 0x8000 | N/A |
| 37 | MAG CURRENT FAIL | ATN4 | 0x8000 | N/A |
| 38 | NEGATIVE SLIP F | ATN5 | 0x8000 | N/A |
| 39 | TR TOO LARGE | ATN6 | 0x8000 | N/A |
| 40 | TR TOO SMALL | ATN7 | 0x8000 | N/A |
| 41 | MAX RPM DATA ERR | ATN8 | 0x8000 | N/A |
| 42 | LEAKGE L TIMEOUT | ATN9 | 0x8000 | N/A |

| ⁵ST24 : AUTO RESTART TRIGGERS+ | | | | |
|---|---|---|---|---|
| ID | Trip Name (MMI 6901) | Trip Name (MMI 6511 & 6521) | Mask + | User Disable |
| 43 | MOTOR TURNING ERR | ATNA | 0x8000 | N/A |
| 44 | MOTOR STALL ERR | ATNB | 0x8000 | N/A |

**Keypads (MMIs):**

Trips shown as MMI displays in the tables above, i.e. ⁵LOOP, can be disabled using the keypads in the TRIPS menu. Other trips, as indicated, can be disabled over the Comms.


6901


6511


6521


6911

## Hexadecimal Representation of Trips

When more than one trip is to be represented at the same time then the trip codes are simply added together to form the value displayed. Within each digit, values between 10 and 15 are displayed as letters A to F

| Decimal number | Display |
|---|---|
| 10 | A |
| 11 | B |
| 12 | C |
| 13 | D |
| 14 | E |
| 15 | F |

For example referring to the tables above, if the AUTO RESTART TRIGGERS parameter is set to **04A0,** then this represents:

a "**4**" in digit 3

an "8" and a "2" in digit 2
(8+2 = 10, displayed as **A**)

an "**0**" in digit 1

This in turn represents the trips BRAKE SWITCH, ANIN FAULT, MOTOR STALLED and INVERSE TIME.

In the same way, the AUTO RESTART TRIGGERS+ parameter set to **04A0** would represent OVERSPEED, ANIN FAULT, DESAT OVER I and 10V FAULT.

# Fault Finding

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

# Chapter 8 ROUTINE MAINTENANCE & REPAIR

## Routine Maintenance

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

## Repair

There are no user-serviceable components.

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

### Saving Your Application Data

In the event of a repair, application data will be saved whenever possible. However, we advise you to copy your application settings before returning the unit.

## Returning the Unit to Parker SSD Drives

Please have the following information available:

- The model and serial number - see the unit's rating label
- Details of the fault

Contact your nearest Parker SSD Drives Service Centre to arrange return of the item.

You will be given a *Returned Material Authorisation.* Use this as a reference on all paperwork you return with the faulty item. Pack and despatch the item in the original packing materials; or at least an anti-static enclosure. Do not allow packaging chips to enter the unit.

## Disposal

This product contains materials which are consignable waste under the Special Waste Regulations 1996 which complies with the EC Hazardous Waste Directive - Directive 91/689/EEC.

We recommend you dispose of the appropriate materials in accordance with the valid environmental control laws. The following table shows which materials can be recycled and which have to be disposed of in a special way.

| Material | Recycle | Disposal |
|---|---|---|
| metal | yes | no |
| plastics material | yes | no |
| printed circuit board | no | yes |

The printed circuit board should be disposed of in one of two ways:

1. High temperature incineration (minimum temperature 1200°C) by an incinerator authorised under parts A or B of the Environmental Protection Act
2. Disposal in an engineered land fill site that is licensed to take aluminium electrolytic capacitors. Do not dispose of in a land fill site set aside for domestic waste.

### Packaging

During transport our products are protected by suitable packaging. This is entirely environmentally compatible and should be taken for central disposal as secondary raw material.

# Chapter 9 TECHNICAL SPECIFICATIONS

## Understanding the Product Code

### Model Number (Europe)

The unit is fully identified using a four block alphanumeric code which records how the drive was calibrated, and its various settings when despatched from the factory.

The Product Code appears as the “Model No.” on the product rating label. Each block of the Product Code is identified as shown below.

The example below shows this is a Frame 2 650G, 230v single phase, 1.5kW, no auxiliary supply, no brake switch, no filter, RS232 port fitted, panel mounted, no special options, English 50Hz, 6511 keypad option fitted.

| | | Block 1 | Block 2 | | | Block 3 | | | | | Block4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 650G | - | | | - | | | | | - | |
| | Example: | 650G | - | 21 | 1700 | 2 | 0 | - | 0 | 0 1 P | 00 | - A 1 |
| Family | 650G Sensorless vector range | 650G | | | | | | | | | | |
| | Supply Voltage / Heavy Duty kW/A / Heavy Duty HP/A / Standard Duty kW/A / Standard Duty HP/A / Frame Size | | | | | | | | | | | |
| Rating Data | 230v 1phase | | | 21 | | | | | | | | |
| | 0.25/1.5 / 0.3/1.5 | | | | 1150 | 1 | | | | | | |
| | 0.37/2.2 / 0.5/2.2 | | | | 1220 | 1 | | | | | | |
| | 0.55/3.0 / 0.75/3.0 | | | | 1300 | 1 | | | | | | |
| | 0.75/4.0 / 1.0/4.0 | | | | 1400 | 1 | | | | | | |
| | 1.1/5.5 / 1.5/5.5 | | | | 1550 | 2 | | | | | | |
| | 1.5/7.0 / 2/7.0 | | | | 1700 | 2 | | | | | | |
| | 230v 1/3phase | | | 22 | | | | | | | | |
| | 2.2/9.6 / 3.0/9.6 | | | | 1960 | 3 | | | | | | |
| | 230v 3phase | | | 23 | | | | | | | | |
| | 3/12.3 / 4/12.3 | | | | 2123 | 3 | | | | | | |
| | 4/16.4 / 5/16.4 | | | | 2164 | 3 | | | | | | |
| | 400/460v 3phase | | | 43 | | | | | | | | |
| | 0.37/1.5 / 0.5/1.5 | | | | 1150 | 2 | | | | | | |
| | 0.55/2.0 / 0.75/2.0 | | | | 1200 | 2 | | | | | | |
| | 0.75/2.5 / 1/2.5 | | | | 1250 | 2 | | | | | | |
| | 1.1/3.5 / 1.5/3.5 | | | | 1350 | 2 | | | | | | |
| | 1.5/4.5 / 2/4.5 | | | | 1450 | 2 | | | | | | |
| | 2.2/5.5 / 3/5.5 | | | | 1550 | 2 | | | | | | |
| | 3/6.8 / 4/6.8 | | | | 1680 | 3 | | | | | | |
| | 4/9 / 5/9 | | | | 1900 | 3 | | | | | | |
| | 5.5/12 / 7.5/12 | | | | 2120 | 3 | | | | | | |
| | 7.5/16 / 10/16 | | | | 2160 | 3 | | | | | | |
| Auxiliary supply | Not required (frames 1-3 & frames C-E) | | | | | 0 | | | | | | |
| | 115v 1ph (Frame F only) | | | | | 1 | | | | | | |
| | 230v 1ph (Frame F only) | | | | | 2 | | | | | | |
| Brake Switch | Not Fitted (mandatory on F 1 & F 2 230v , optional on Frames D-F) | | | | | | 0 | | | | | |
| | Fitted (mandatory on F 2 400v & all F 3 & C, optional on Frames D-F) | | | | | | B | | | | | |
| Filter | Not fitted (Optional on frames 1-3, mandatory on frames C-F) | | | | | | | 0 | | | | |
| | Filter fitted (Optional on frames 1-3 only) | | | | | | | F | | | | |
| Comms | RS232 port fitted | | | | | | | | 1 | | | |
| | RS232 + RS485 ports fitted (Frames C-F only) | | | | | | | | 2 | | | |
| Mechanical style | Panel Mount | | | | | | | | | P | | |
| | Wall Mount (option on Frames C-E only) | | | | | | | | | W | | |
| | Through Panel Mount (Option on Frames C-E only) | | | | | | | | | T | | |
| Special Option | None | | | | | | | | | | 00 | |
| | Documented special options (01-99) | | | | | | | | | | | |
| Destination | English (50Hz) | | | | | | | | | | | A |
| | English (60Hz) | | | | | | | | | | | B |
| | German | | | | | | | | | | | D |
| | Spanish | | | | | | | | | | | E |
| | French | | | | | | | | | | | F |
| | Italian | | | | | | | | | | | I |
| | Swedish | | | | | | | | | | | S |
| Keypad | None | | | | | | | | | | | 0 |
| | 6511 TTL fitted (option on frames 1-3 only) | | | | | | | | | | | 1 |
| | 6511 RS232 fitted (option on frames 1-3 only) | | | | | | | | | | | 2 |
| | 6521 fitted (option on Frames C-F only) | | | | | | | | | | | 3 |

## US Catalog Number & Legacy Product Code

The unit is identified using a 4 block alphanumeric code which records how the drive was calibrated, and its various settings when dispatched from the factory. All drives are in Standard Parker SSD Drives Livery and operate on 50/60Hz.

The Product Code appears as the "Cat No.". Each block of the Product Code is identified as below:

650G/00F3/230/SNF
*Block 1 2 3 4*
***example product***

| Frame 1, 2, 3 – Catalog Number (North America) | | |
|---|---|---|
| Block No. | Variable | Description |
| 1 | 650G | Generic product |
| 2 | XXXX | Four characters specifying the power output in Hp:<br>00F3 = 0.3Hp 01F5 = 1.5Hp 0005 = 5Hp<br>00F5 = 0.5Hp 0002 = 2Hp 0007 = 7Hp<br>00F7 = 0.75Hp 0003 = 3Hp 0010 = 10Hp<br>0001 = 1Hp |
| 3 | XXX | Three numbers specifying the nominal input voltage rating:<br>230 230 (±10%) 50/60Hz<br>460 380 to 460V (±10%) 50/60Hz |
| 4 | X | One character speciifying the use of the Keypad:<br>S = Standard Keypad fitted<br>R = Remote Keypad fitted |
| | X | Indicates if the drive is fitted with the Brake Switch<br>N = Brake switch not fitted (230V Frames 1 & 2)<br>B = Brake switch fitted (460V Frames 2 & 3) |
| | X | One character specifying the use of the Internal RFI Filter:<br>N = Not fitted<br>F = Internal Supply Filter fitted |

| Environmental Details | |
|---|---|
| Operating Temperature | 0°C to 40°C |
| Storage Temperature | -25°C to +55°C |
| Shipping Temperature | -25°C to +70°C |
| Product Enclosure Rating | IP20 (UL Open Type) suitable for cubicle mount only |
| Cubicle Rating | Cubicle to provide 15dB attenuation to radiated emissions between 30-100MHz. It must also require a security tool for opening |
| Altitude | If >1000 metres (3300 feet) above sea level, derate Motor Power Rating by 1% per 100 metres (330 feet) to a maximum of 2000 metres (6561 feet) |
| Humidity | Maximum 85% relative humidity at 40°C non-condensing |
| Atmosphere | Non flammable, non corrosive and dust free |
| Climatic Conditions | Class 3k3, as defined by EN50178 (1998) |
| Vibration | Test Fc of EN60068-2-6<br>10Hz<=f<=57Hz sinusoidal 0.075mm amplitude<br>57Hz<=f<=150Hz sinusoidal 1g<br>10 sweep cycles per axis on each of three mutually perpendicular axis |
| Safety | |
| Pollution Degree | Pollution Degree II (non-conductive pollution, except for temporary condensation) |
| Overvoltage Category | Overvoltage Category III (numeral defining an impulse withstand level) |

| Power Details | |
|---|---|
| 1-Phase Supply | 220-240V ac ±10%,50/60Hz ±10%, ground referenced (TN) or non-ground referenced (IT) |
| 3-Phase Supply | 220-240V ac or 380-460V ac ±10%,50/60Hz ±10%, ground referenced (TN) or non-ground referenced (IT) |
| Supply Power Factor (lag) | 0.9 (@ 50/60Hz) |
| Output Frequency | 0 – 240Hz |
| Overload | 150% for 30 seconds |
| Supply Short Circuit Rating | 220-240V 1ϕ product -5000A, 220-240V ac 3ϕ product - 7500A<br>380-460V 3ϕ product -10000A |

## Electrical Ratings

Motor power, output current and input current must not be exceeded under steady state operating conditions.

Maximum Motor dv/dt = 10,000V/µs. This can be reduced by adding a motor choke in series with the motor. Contact Parker SSD Drives for recommended choke details.

Local wiring regulations always take precedence. Select cable rated for the drive.

The supply must be protected with a fuse (or Type B RCD) rated to the supply cable.

**FRAME 1 : 1-Phase (IT/TN), 230V**

| Drive Power (kW/hp) | Input Current @ 5kA | | Output Current @ 40°C (A) ac | Maximum Power Loss (W) |
|---|---|---|---|---|
| | Surge Current peak/rms for 10ms (A) | (A) | | |
| 0.25/0.3 | 19/12 | 4.2 | 1.5 | 26 |
| 0.37/0.5 | 19/12 | 6.2 | 2.2 | 32 |
| 0.55/0.75 | 20/14 | 7.9 | 3.0 | 41 |
| 0.75/1.0 | 22/15 | 10.5 | 4.0 | 52 |

**FRAME 2 : 1-Phase (IT/TN), 230V**

| Drive Power (kW/hp) | Input Current @ 5kA | | Output Current @ 40°C (A) ac | Maximum Power Loss (W) |
|---|---|---|---|---|
| | Surge Current peak/rms for 10ms (A) | (A) | | |
| 1.1/1.5 | 24/17 | 13.8 | 5.5 | 65 |
| 1.5/2.0 | 25/18 | 16.0 | 7.0 | 82 |

**FRAME 2 : 3-Phase (IT/TN), 400V**

| Drive Power (kW/hp) | Input Current @ 10kA (A) | Output Current @ 40°C (A) ac | Maximum Power Loss (W) |
|---|---|---|---|
| 0.37/0.5 | 2.5 | 1.5 | 26 |
| 0.55/0.75 | 3.3 | 2.0 | 32 |
| 0.75/1.0 | 4.1 | 2.5 | 40 |
| 1.1/1.5 | 5.9 | 3.5 | 55 |
| 1.5/2.0 | 7.5 | 4.5 | 61 |
| 2.2/3.0 | 9.4 | 5.5 | 70 |

**FRAME 3 : 1-Phase (IT/TN), 230V**

| Drive Power (kW/hp) | Input Current @ 7.5kA (A) | Output Current @ 40°C (A) ac | Maximum Power Loss (W) |
|---|---|---|---|
| 2.2/3.0 | 22.0 | 9.6 | 112 |

**FRAME 3 : 3-Phase (IT/TN), 230V**

| Drive Power (kW/hp) | Input Current @ 7.5kA (A) | Output Current @ 40°C (A) ac | Maximum Power Loss (W) |
|---|---|---|---|
| 2.2/3.0 | 14.3 | 9.6 | 103 |
| 3.0/4.0 | 18.1 | 12.3 | 133 |
| 4.0/5.0 | 23.1 | 16.4 | 180 |

**FRAME 3 : 3-Phase (IT/TN), 400V**

| Drive Power (kW/hp) | Input Current @ 10kA (A) | Output Current @ 40°C (A) ac | Maximum Power Loss (W) |
|---|---|---|---|
| 3.0/4.0 | 11.1 | 6.8 | 80 |
| 4.0/5.0 | 13.9 | 9.0 | 100 |
| 5.5/7.5 | 18.0 | 12.0 | 136 |
| 7.5/10.0 | 23.6 | 16.0 | 180 |

## Supply Short Circuit Rating

Products may be used on 50kA supplies provided an additional supply inductor is fitted, see tables below for further information:

**230V**

| Frame Size | Motor Power | Parker SSD Drives Part Number | MTE Part Number | Inductance mH | Rated amps |
|---|---|---|---|---|---|
| 1 | 0.75kW 1Hp | CO470653 | RL-00401 | 3.00 | 4 |
| 2 | 1.5kW 2Hp | CO353011 | RL-00801 | 1.50 | 8 |
| 3 | 2.2kW 3Hp | CO470638 | RL-01201 | 1.25 | 12 |
| 3 | 4kW 5HP | CO353012 | RL-01801 | 0.80 | 18 |

**460V**

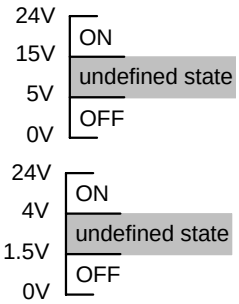
| Frame Size | Motor Power | Parker SSD Drives Part Number | MTE Part Number | Inductance mH | Rated amps |
|---|---|---|---|---|---|
| 2 | 0.75kW 1Hp | CO470650 | RL-00201 | 12.00 | 2 |
| 2 | 1.5kW 2Hp | CO470651 | RL-00402 | 6.50 | 4 |
| 2 | 2.2kW 3Hp | CO352782 | RL-00803 | 5.00 | 8 |
| 3 | 4kW 5Hp | CO470652 | RL-00802 | 3.00 | 8 |
| 3 | 5.5kW 7.5Hp | CO352783 | RL-01202 | 2.50 | 12 |
| 3 | 6.0kW 10Hp | CO352785 | RL-01802 | 1.50 | 18 |
| 3 | 7.5kW 10Hp | CO352785 | RL-01802 | 1.50 | 18 |

| **User Relay** | RL1A, RL1B. |
|---|---|
| Maximum Voltage | 250Vac |
| Maximum Current | 4A |
| Sample Interval | 10ms |

| **Analog Inputs/Outputs** | AIN1 and AIN2 |
|---|---|
| Range | 0-10V and 0-5V (no sign) set via parameter $^{S}$IP13 (AIN1)<br>0-10V, 0-5V, 0-20mA or 4-20mA (no sign) set via parameter $^{S}$IP23 (AIN2)<br>Absolute maximum input current 25mA in current mode<br>Absolute maximum input voltage 24V dc in voltage mode |
| Nominal Input Impedance | 40k impedance in voltage mode, <6V @ 20mA in current mode |
| Resolution | 10 bits, (1 in 1024) |
| Dynamic Response | Sampled every 5ms |

| **Analog Outputs** | AOUT1 and AOUT2 |
|---|---|
| Range | 0-10V (no sign)<br>Maximum rated output current 10mA, with short circuit protection |
| Resolution | 10 bits, (1 in 1024) |
| Dynamic Response | Updated every 5ms<br>Bandwidth 15Hz |

| Digital Inputs | |
|---|---|
| Operating Range | DIN1, DIN2, DIN3, DIN4, DIN5:<br>0-5V dc = OFF, 15-24V dc = ON<br>(absolute maximum input voltage ±30V dc)<br>IEC1131<br><br>DIN6, DIN7:<br>0-1.5V dc = OFF, 4-24V dc = ON<br>(absolute maximum input voltage ±30V dc)<br>IEC1131 |
| Input Current | 7.5mA @ 24V |
| Sample Interval | 10ms |




| Digital Outputs | DOUT1 and DOUT2 |
|---|---|
| Nominal Open Circuit Output Voltage | 23V (minimum 19V) |
| Nominal Output Impedance | 47Ω |
| Rated Output Current | 50mA *(either individually or as the sum of outputs from terminals 6, 10 and 11).* |

| Cabling Requirements for EMC Compliance | | | | |
|---|---|---|---|---|
| | Power Supply Cable | Motor Cable | Brake Resistor Cable | Signal/Control Cable |
| Cable Type (for EMC Compliance) | Unscreened | Screened/armoured | Screened/armoured | Screened |
| Segregation | From all other wiring (clean) | From all other wiring (noisy) | | From all other wiring (sensitive) |
| Length Limitations With Internal AC Supply EMC Filter | Unlimited | *25 metres | 25 metres | 25 metres |
| Length Limitations Without Internal AC Supply EMC Filter | Unlimited | 25 metres | 25 metres | 25 metres |
| Screen to Earth Connection | | Both ends | Both ends | Drive end only |
| Output Choke | | 300 metres maximum | | |
| * Maximum motor cable length under any circumstances | | | | |

# Internal Dynamic Braking Circuit

The dynamic braking circuit is intended for with short term stopping or braking.

| Motor Power (kW/Hp) | Brake Switch Peak Current (A) | Brake Switch Continuous Current (A) | Peak Brake Dissipation (kW/Hp) | Minimum Brake Resistor Value (Ω) |
|---|---|---|---|---|
| **Frame 2 : 3 Phase (IT/TN), 400V, 100% duty** DC link brake voltage : 750V | | | | |
| 0.37/0.5 | 1.5 | 1.5 | 1.1/1.5 | 500 |
| 0.55/0.75 | 1.5 | 1.5 | 1.1/1.5 | 500 |
| 0.75/1.0 | 1.5 | 1.5 | 1.1/1.5 | 500 |
| 1.1/1.5 | 1.5 | 1.5 | 1.1/1.5 | 500 |
| 1.5/2.0 | 3.75 | 3.75 | 2.8/3.75 | 200 |
| 2.2/3.0 | 3.75 | 3.75 | 2.8/3.75 | 200 |
| **Frame 3 : 1 Phase (IT/TN), 230V, 100% duty** | | | | |
| 2.2/3.0 | 7.0 | 7.0 | 2.72 | 56 |
| **Frame 3 : 3 Phase (IT/TN), 230V, 100% duty** DC link brake voltage : 390V | | | | |
| 2.2/3.0 | 7.0 | 7.0 | 2.72 | 56 |
| 3.0/4 | 10.8 | 10.8 | 4.23 | 36 |
| 4.0/5 | 14.0 | 14.0 | 5.44 | 28 |
| **Frame 3 : 3 Phase (IT/TN), 400V, 30% duty** DC link brake voltage : 750V | | | | |
| 3.0/4 | 7.5 | 2.3 | 5.6/7.5 | 100 |
| 4.0/5 | 7.5 | 2.3 | 5.6/7.5 | 100 |
| 5.5/7.5 | 13.5 | 4.0 | 10/13.4 | 56 |
| 7.5/10 | 13.5 | 4.0 | 10/13.4 | 56 |

# External Brake Resistor

All 650G units are supplied without braking resistors. The dynamic brake switch terminals (where fitted) allow easy connection to an external resistor. These resistors should be mounted on a heatsink (back panel) and covered to prevent injury from burning.

## Recommended Brake Resistors

The following brake resistors are available from Parker SSD Drives:

Brake Resistor Value : Frame 2 : 200Ω, 100W - CZ467714; 500Ω, 60W - CZ467715

Frame 3 : 28Ω, 500W (2 x 56Ω in parallel) - CZ467716; 36Ω, 500W - CZ388396; 56Ω, 500W - CZ467716; 100Ω, 200W - CZ467717

## Alternative Brake Resistor Selection

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

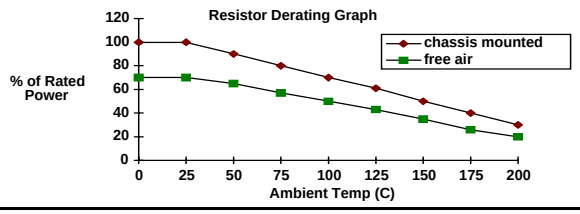
Peak braking power $P_{pk} = \frac{0.0055 \times J \times (n_1^2 - n_2^2)}{t_b}$ (W)

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

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

Obtain information on the peak power rating and the average power rating of the resistors from the resistor manufacturer. If this information is not available, a large safety margin must be incorporated to ensure that the resistors are not overloaded. By connecting these resistors in series and in parallel the braking capacity can be selected for the application.

**IMPORTANT:** The minimum resistance of the combination and maximum dc link voltage must be as specified.



## Supply Harmonic Analysis (230V filtered)

Assumptions: (Short circuit fault to Neutral)

5kA short circuit supply capability at 230V 1ϕ, equivalent to 146µH supply impedance
7.5kA short circuit supply capability at 230V 3ϕ, equivalent to 56µH supply impedance
10kA short circuit supply capability at 400V 3ϕ, equivalent to 73µH supply impedance

$$THD(V) \times 100 = \frac{\sqrt{\sum_{h=40}^{h=2} Q_{h^2}}}{Q_{1n}} \%$$

where $Q_{1n}$ is the rated rms value of the fundamental voltage of the supply transformer.
The results conform to stage 1 and stage 2 of the Engineering Recommendation G.5/4 February 2001, Classification 'C': Limits for Harmonics in the UK Electricity Industry.

| Drive Type | 650G | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Motor Power (kW) | 0.25 | 0.37 | 0.55 | 0.75 | 1.1 | 1.5 | 2.2 | 3.0 | 4.0 |
| Fundamental Voltage (V) | 230 | 230 | 230 | 230 | 230 | 230 | 230 | 230 | 230 |
| Typical Motor Efficiency % | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 |
| Harmonic No. | RMS Current (A) | | | | | | | | |
| 1 | 7.4 | 7.5 | 7.8 | 8.2 | 9.0 | 10.3 | TBA | TBA | TBA |
| 3 | 1.4 | 0.2 | 1.9 | 2.2 | 2.9 | 3.9 | | | |
| 5 | 2.9 | 0.4 | 4.4 | 4.6 | 4.8 | 5.2 | | | |
| 7 | 1.1 | 0.5 | 1.9 | 2.0 | 2.3 | 2.5 | | | |
| 9 | 0.2 | 0.2 | 0.2 | 0.3 | 0.4 | 0.4 | | | |
| 11 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.3 | | | |
| 13 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | | | |
| 15 | 0.1 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | | | |
| 17 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 | | | |
| 19 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | | | |
| 21 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | | | |
| 23 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | |
| 25 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | |
| 27 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | |
| 29 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | |
| 31 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | |
| 33 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | |
| 35 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | |
| 37 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | |
| 39 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | |
| 40 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | |
| Total RMS Current (A) | 8.2 | 7.5 | 9.3 | 9.9 | 10.9 | 12.5 | | | |
| THD (V) % | 0.3559 | 0.0972 | 0.5426 | 0.5733 | 0.6277 | 0.7055 | | | |

## Supply Harmonic Analysis (400V filtered)

Assumptions: (Short circuit fault to Neutral)

5kA short circuit supply capability at 230V 1ϕ, equivalent to 146µH supply impedance
7.5kA short circuit supply capability at 230V 3ϕ, equivalent to 56µH supply impedance
10kA short circuit supply capability at 400V 3ϕ, equivalent to 73µH supply impedance

$$THD(V) \times 100 = \frac{\sqrt{\sum_{h=40}^{h=2} Q_{h^2}}}{Q_{1n}} \%$$

where $Q_{1n}$ is the rated rms value of the fundamental voltage of the supply transformer.
The results conform to stage 1 and stage 2 of the Engineering Recommendation G.5/4 February 2001, Classification 'C': Limits for Harmonics in the UK Electricity Industry.

| Drive Type | 650G | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Motor Power (kW) | 0.37 | 0.55 | 0.75 | 1.1 | 1.5 | 2.2 | 3.0 | 4.0 | 5.5 | 7.5 |
| Fundamental Voltage (V) | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 |
| Typical Motor Efficiency % | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 |
| Harmonic No. | RMS Current (A) | | | | | | | | | |
| 1 | 0.6 | 1.0 | 1.3 | 1.9 | 2.6 | 3.8 | 5.2 | 6.9 | 9.5 | 12.9 |
| 3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | 0.6 | 0.9 | 1.2 | 1.8 | 2.4 | 3.5 | 4.7 | 6.2 | 8.3 | 11.1 |
| 7 | 0.6 | 0.9 | 1.2 | 1.7 | 2.3 | 3.3 | 4.3 | 5.5 | 7.3 | 9.5 |
| 9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 11 | 0.5 | 0.8 | 1.0 | 1.5 | 1.9 | 2.6 | 3.3 | 3.9 | 4.8 | 5.7 |
| 13 | 0.0 | 0.7 | 0.9 | 1.3 | 1.6 | 2.2 | 2.7 | 3.0 | 3.5 | 3.9 |
| 15 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 17 | 0.4 | 0.6 | 0.7 | 1.0 | 1.1 | 1.4 | 1.6 | 1.5 | 1.4 | 1.2 |
| 19 | 0.0 | 0.5 | 0.6 | 0.9 | 0.9 | 1.1 | 1.1 | 0.9 | 0.8 | 0.7 |
| 21 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 23 | 0.2 | 0.3 | 0.4 | 0.6 | 0.5 | 0.5 | 0.4 | 0.3 | 0.5 | 0.7 |
| 25 | 0.0 | 0.3 | 0.3 | 0.4 | 0.3 | 0.3 | 0.2 | 0.4 | 0.5 | 0.7 |
| 27 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 29 | 0.1 | 0.2 | 0.2 | 0.2 | 0.1 | 0.2 | 0.3 | 0.4 | 0.4 | 0.4 |
| 31 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 |
| 33 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 35 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 |
| 37 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 | 0.2 | 0.3 |
| 39 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 40 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total RMS Current (A) | 1.4 | 2.1 | 2.8 | 4.0 | 5.1 | 7.2 | 9.5 | 12.0 | 15.8 | 20.8 |
| THD (V) % | 0.1561 | 0.2158 | 0.2776 | 0.3859 | 0.4393 | 0.5745 | 0.6994 | 0.8111 | 0.9899 | 1.2110 |

## Supply Harmonic Analysis (230V unfiltered)

Assumptions: (Short circuit fault to Neutral)

5kA short circuit supply capability at 230V 1ϕ, equivalent to 146µH supply impedance
7.5kA short circuit supply capability at 230V 3ϕ, equivalent to 56µH supply impedance
10kA short circuit supply capability at 400V 3ϕ, equivalent to 73µH supply impedance

$$THD(V) \times 100 = \frac{\sqrt{\sum_{h=40}^{h=2} Q_{h^2}}}{Q_{1n}} \%$$

where $Q_{1n}$ is the rated rms value of the fundamental voltage of the supply transformer.
The results conform to stage 1, stage 2 and stage 3 of the Engineering Recommendation G.5/3 September 1976, Classification 'C': Limits for Harmonics in the UK Electricity Industry.

| Drive Type | 650G | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Motor Power (kW) | 0.25 | 0.37 | 0.55 | 0.75 | 1.1 | 1.5 | 2.2 | 3.0 | 4.0 |
| Fundamental Voltage (V) | 230 | 230 | 230 | 230 | 230 | 230 | 230 | 230 | 230 |
| Typical Motor Efficiency % | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 |
| Harmonic No. | RMS Current (A) | | | | | | | | |
| 1 | 1.3 | 2.0 | 2.9 | 3.9 | 5.7 | 7.8 | TBA | TBA | TBA |
| 3 | 1.3 | 1.9 | 2.9 | 3.8 | 5.5 | 7.4 | | | |
| 5 | 1.2 | 1.9 | 2.7 | 3.5 | 5.0 | 6.7 | | | |
| 7 | 1.1 | 1.7 | 2.5 | 3.1 | 4.4 | 5.4 | | | |
| 9 | 1.1 | 1.6 | 2.2 | 2.7 | 3.7 | 4.6 | | | |
| 11 | 1.0 | 1.4 | 1.9 | 2.2 | 2.9 | 3.4 | | | |
| 13 | 0.8 | 1.2 | 1.6 | 1.6 | 2.1 | 2.3 | | | |
| 15 | 0.7 | 1.0 | 1.3 | 1.2 | 1.4 | 1.4 | | | |
| 17 | 0.6 | 0.8 | 1.0 | 0.8 | 0.8 | 0.7 | | | |
| 19 | 0.5 | 0.7 | 0.7 | 0.4 | 0.4 | 0.3 | | | |
| 21 | 0.4 | 0.5 | 0.5 | 0.2 | 0.2 | 0.4 | | | |
| 23 | 0.3 | 0.3 | 0.3 | 0.2 | 0.3 | 0.4 | | | |
| 25 | 0.2 | 0.2 | 0.1 | 0.2 | 0.3 | 0.4 | | | |
| 27 | 0.1 | 0.1 | 0.1 | 0.2 | 0.3 | 0.3 | | | |
| 29 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | | | |
| 31 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | | | |
| 33 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | | | |
| 35 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | | | |
| 37 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | | | |
| 39 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | | | |
| 40 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | |
| Total RMS Current (A) | 3.2 | 4.8 | 6.7 | 8.3 | 11.7 | 15.3 | | | |
| THD (V) % | 0.5633 | 0.8016 | 1.0340 | 1.0944 | 1.4611 | 1.7778 | | | |

## Supply Harmonic Analysis (400V unfiltered)

Assumptions: (Short circuit fault to Neutral)

5kA short circuit supply capability at 230V 1ϕ, equivalent to 146µH supply impedance
7.5kA short circuit supply capability at 230V 3ϕ, equivalent to 56µH supply impedance
10kA short circuit supply capability at 400V 3ϕ, equivalent to 73µH supply impedance

$$THD(V) \times 100 = \frac{\sqrt{\sum_{h=40}^{h=2} Q_{h^2}}}{Q_{1n}} \%$$

where $Q_{1n}$ is the rated rms value of the fundamental voltage of the supply transformer.
The results conform to stage 1, stage 2 and stage 3 of the Engineering Recommendation G.5/3 September 1976, Classification 'C': Limits for Harmonics in the UK Electricity Industry.

| Drive Type | 650G | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Motor Power (kW) | 0.37 | 0.55 | 0.75 | 1.1 | 1.5 | 2.2 | 3.0 | 4.0 | 5.5 | 7.5 |
| Fundamental Voltage (V) | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 |
| Typical Motor Efficiency % | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 |
| Harmonic No. | RMS Current (A) | | | | | | | | | |
| 1 | 0.6 | 0.9 | 1.3 | 1.9 | 2.6 | 3.8 | 5.2 | 6.9 | 9.5 | 12.7 |
| 3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | 0.6 | 0.9 | 1.2 | 1.8 | 2.4 | 3.6 | 4.7 | 6.3 | 8.4 | 11.0 |
| 7 | 0.6 | 0.9 | 1.2 | 1.7 | 2.3 | 3.3 | 4.3 | 5.7 | 7.4 | 9.5 |
| 9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 11 | 0.5 | 0.8 | 1.0 | 1.5 | 1.9 | 2.6 | 3.3 | 4.2 | 4.9 | 5.8 |
| 13 | 0.5 | 0.7 | 0.9 | 1.3 | 1.6 | 2.2 | 2.7 | 3.4 | 3.7 | 4.0 |
| 15 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 17 | 0.4 | 0.6 | 0.7 | 0.9 | 1.2 | 1.5 | 1.6 | 1.9 | 1.5 | 1.3 |
| 19 | 0.4 | 0.5 | 0.6 | 0.8 | 0.9 | 1.1 | 1.1 | 1.3 | 0.8 | 0.7 |
| 21 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 23 | 0.3 | 0.4 | 0.4 | 0.5 | 0.5 | 0.5 | 0.4 | 0.4 | 0.5 | 0.7 |
| 25 | 0.2 | 0.3 | 0.3 | 0.3 | 0.4 | 0.3 | 0.2 | 0.3 | 0.5 | 0.7 |
| 27 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 29 | 0.1 | 0.2 | 0.2 | 0.2 | 0.1 | 0.2 | 0.2 | 0.3 | 0.4 | 0.4 |
| 31 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 |
| 33 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 35 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 |
| 37 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.1 | 0.2 | 0.2 |
| 39 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 40 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total RMS Current (A) | 1.5 | 2.1 | 2.8 | 4.0 | 5.1 | 7.4 | 9.5 | 12.4 | 16.0 | 20.6 |
| THD (V) % | 0.1634 | 0.2209 | 0.2817 | 0.3569 | 0.4444 | 0.5886 | 0.7107 | 0.8896 | 1.0127 | 1.2138 |

# Chapter 10 CERTIFICATION FOR THE DRIVE

## Requirements for EMC Compliance

### Earthing Requirements

**IMPORTANT:** Protective earthing always takes precedence over EMC earthing.

#### Protective Earth (PE) Connections

***Note:*** *In accordance with installations to EN60204, only one protective earth conductor is permitted at each protective earth terminal contacting point.*

Local wiring regulations may require the protective earth connection of the motor to be connected locally, i.e. not as specified in these instructions. This will not cause shielding problems because of the relatively high RF impedance of the local earth connection.

#### EMC Earth Connections

For compliance with EMC requirements, the "0V/signal ground" is to be separately earthed. When a number of units are used in a system, these terminals should be connected together at a single, local earthing point.

Control and signal cables connections should be made with screeened cables, with the screen connected only at the VSD end. However, if high frequency noise is still a problem, earth screen at the non VSD end via a 0.1µF capacitor.

***Note:*** *Connect the screen (at the VSD end) to the VSD protective earth point, and not to the control board terminals.*

## Requirements for UL Compliance

#### Solid-State Motor Overload Protection

These devices provide Class 10 motor overload protection. The maximum internal overload protection level (current limit) is 150% for 30 seconds.

An external motor overload protective device must be provided by the installer where the motor has a full-load ampere rating of less than 50% of the drive output rating; or when the DISABLE STALL trip ($^{S}$STLL) is set to True (1); or when the STALL TIME parameter is increased above 480 seconds (refer to the 650G Software Manual, Chapter 1 : STALL TRIP.

#### Short Circuit Rating

The following drives are suitable for use on a circuit capable of delivering not more than:

220-240V product, 1ϕ - 5000 RMS Symmetrical Amperes
220-240V product, 3ϕ - 7500 RMS Symmetrical Amperes
380-460V product, 3ϕ -10000 RMS Symmetrical Amperes

#### Solid-State Short-Circuit Protection

These devices are provided with Solid-State Short-Circuit (output) Protection. Branch circuit protection requirements must be in accordance with the latest edition of the National Electrical Code NEC/NFPA-70.

#### Recommended Branch Circuit Protection

It is recommended that UL Listed (JDDZ) non-renewable cartridge fuses, Class K5 or H; or UL Listed (JDRX) renewable cartridge fuses, Class H, are installed upstream of the drive.

#### Motor Base Frequency

The motor base frequency rating is 240Hz maximum.

#### Field Wiring Temperature Rating

Use 75°C Copper conductors only.

## Field Wiring Terminal Markings

For correct field wiring connections that are to be made to each terminal refer to Chapter 3: "Installing the Drive" - Wiring Guidelines.

## Terminal Tightening Torque

Refer to Chapter 3: "Installing the Drive" – Terminal Tightening Torque.

## Terminal/Wire Sizes

North American wire sizes (AWG) are based on NEC/NFPA-70 for ampacities of thermoplastic-insulated (75ºC) copper conductors.

Power input and output wire sizes should allow for an ampacity of 125% of the rated input and output amperes for motor branch-circuit conductors as specified in NEC/NFPA-70. Refer to Chapter 3: "Installing the Drive" – Terminal Block Acceptance Sizes.

## Input Fuse Ratings

If fitted, fuses should be in accordance with NEC/NFPA-70.

| **FRAME 1 : 1-Phase (IT/TN), 230V** | | |
|---|---|---|
| Drive Power (kW/hp) | Input Current @ 5kA (A) | Supply Fuse Rating (A) 10 x 38mm |
| 0.25/0.3 | 4.2 | 10 |
| 0.37/0.5 | 6.2 | 10 |
| 0.55/0.75 | 7.9 | 10 |
| 0.75/1.0 | 10.5 | 15 |
| **FRAME 2 : 1-Phase (IT/TN), 230V** | | |
| Drive Power (kW/hp) | Input Current @ 5kA (A) | Supply Fuse Rating (A) 10 x 38mm |
| 1.1/1.5 | 13.8 | 20 |
| 1.5/2.0 | 16.0 | 20 |
| **FRAME 2 : 3-Phase (IT/TN), 400V** | | |
| Drive Power (kW/hp) | Input Current @ 10kA (A) | Supply Fuse Rating (A) 10 x 38mm |
| 0.37/0.5 | 2.5 | 10 |
| 0.55/0.75 | 3.3 | 10 |
| 0.75/1.0 | 4.1 | 10 |
| 1.1/1.5 | 5.9 | 10 |
| 1.5/2.0 | 7.5 | 10 |
| 2.2/3.0 | 9.4 | 15 |
| **FRAME 3 : 1-Phase (IT/TN), 230V** | | |
| Drive Power (kW/hp) | Input Current @ 7.5kA (A) | Supply Fuse Rating (A) 10 x 38mm |
| 2.2/3.0 | 22.0 | 30 |
| **FRAME 3 : 3-Phase (IT/TN), 230V** | | |
| Drive Power (kW/hp) | Input Current @ 7.5kA (A) | Supply Fuse Rating (A) 10 x 38mm |
| 2.2/3.0 | 14.3 | 20 |
| 3.0/4.0 | 18.1 | 25 |
| 4.0/5.0 | 23.1 | 30 |
| **FRAME 3 : 3-Phase (IT/TN), 400V** | | |
| Drive Power (kW/hp) | Input Current @ 10kA (A) | Supply Fuse Rating (A) 10 x 38mm |
| 3.0/4 | 11.1 | 15 |
| 4.0/5 | 13.9 | 20 |
| 5.5/7.5 | 18.0 | 25 |
| 7.5/10 | 23.6 | 30 |

### Field Grounding Terminals

The field grounding terminals are identified with the International Grounding Symbol (IEC Publication 417, Symbol 5019).

### Operating Ambient Temperature

Devices are considered acceptable for use in a maximum ambient temperature of 40°C (can be derated up to 50°C).

# European Directives and the CE Mark

## CE Marking for Low Voltage Directive

When installed in accordance with this manual, the 650G AC Drive is CE marked by Parker SSD Drives in accordance with the low voltage directive (S.I. No. 3260 implements this LVD directive into UK law). An EC Declaration of Conformity (low voltage directive) is included at the end of this chapter.

## CE Marking for EMC - Who is Responsible?

***Note:*** *The specified EMC emission and immunity performance of this unit can only be achieved when the unit is installed to the EMC Installation Instructions given in this manual.*

According to S.I. No. 2373 which implements the EMC directive into UK law, the requirement for CE marking this unit falls into two categories:

1. Where the supplied unit has an intrinsic/direct function to the end user, then the unit is classed as ***relevant apparatus***. In this situation the responsibility for certification rests with Parker SSD Drives. The Declaration of Conformity is included at the end of this Chapter.
2. Where the supplied unit is incorporated into a higher system/apparatus or machine which includes (at least) the motor, cable and a driven load but is unable to function without this unit, then the unit is classed as a ***component***. In this circumstance, the reponsibility rests with the manufacturer/supplier/installer of the system/apparatus/machine.

# EMC Compliance

| | |
|---|---|
| | **All Models**<br>All models are compliant with BS EN61800-3. |
| Radiated Emissions | EN50081-1(1992) and EN61800-3 unrestricted distribution when mounted inside the specified cubicle, see above. Control and motor cables must be screened and correctly fitted with glands where they exit the cubicle. Control 0V must be connected to protective earth/ground. |
| Immunity | EN50082-1 (1997), EN61800-3 (1997), EN61000-6-2 (1999) |
| | **FRAME 1 & 2: 1-Phase (TN only),** |
| Conducted Emissions | EN50081-1(1992), EN61800-3 unrestricted distribution,<br>maximum motor cable length: 25m |
| | **FRAME 2 & 3 : 3-Phase, FRAME 3 : 1-Phase (TN only)** |
| Conducted Emissions | EN50081-2(1993), EN61800-3 restricted distribution<br>maximum motor cable length: 25m |

## Certificates

**650G 0.25 - 4.0kW 230V**

### EC Declarations of Conformity

Date CE marked first applied: 26/07/2001

Issued for compliance with the EMC Directive when the unit is used as *relevant apparatus*.

**EMC Directive**

In accordance with the EEC Directive 2004/108/EC

We Parker SSD Drives, address as below, declare under our sole responsibility that the above Electronic Products when installed and operated with reference to the instructions in the Product Manual (provided with each piece of equipment) is in accordance with the relevant clauses from the following standard:-

BSEN61800-3 (2004)

**Low Voltage Directive**

In accordance with the EEC Directive 2006/95/EC

We Parker SSD Drives, address as below, declare under our sole responsibility that the above Electronic Products when installed and operated with reference to the instructions in the Product Manual (provided with each piece of equipment), is in accordance with the following standard :-

EN61800-5 (2007)

The drive is CE marked in accordance with the low voltage directive for electrical equipment and appliances in the voltage range when installed correctly.

### Manufacturers Declarations

This is provided to aid your justification for EMC compliance when the unit is used as a component.

**EMC Declaration**

We Parker SSD Drives, address as below, declare under our sole responsibility that the above Electronic Products when installed and operated with reference to the instructions in the Product Manual (provided with each piece of equipment) is in accordance with the relevant clauses from the following standard:-

BSEN61800-3 (2004)

**Machinery Directive**

The above Electronic Products are components to be incorporated into machinery and may not be operated alone.
The complete machinery or installation using this equipment may only be put into service when the safety considerations of the Directive 89/392/EEC are fully adhered to.
Particular reference should be made to EN60204-1 (Safety of Machinery - Electrical Equipment of Machines).
All instructions, warnings and safety information of the Product Manual must be adhered to.

Since the potential hazards are mainly electrical rather than mechanical, the drive does not fall under the machinery directive. However, we do supply a manufacturer's declaration for when the drive is used(as a component) in machinery.

Dr Martin Payn (Conformance Officer)

**Parker Hannifin Ltd., Automation Group, SSD Drives Europe**
NEW COURTWICK LANE, LITTLEHAMPTON, WEST SUSSEX BN17 7RZ
TELEPHONE: +44(0)1903 737000 FAX: +44(0)1903 737100
Registered Number: 4806503 England. Registered Office: 55 Maylands Avenue, Hemel Hempstead, Herts HP2 4SJ

**650G 0.37 -7.5kW 400V**

CE

## EC Declarations of Conformity

Date CE marked first applied: 26/07/2001

Issued for compliance with the EMC Directive when the unit is used as *relevant apparatus*.

### EMC Directive

In accordance with the EEC Directive 2004/108/EC

We Parker SSD Drives, address as below, declare under our sole responsibility that the above Electronic Products when installed and operated with reference to the instructions in the Product Manual (provided with each piece of equipment) is in accordance with the relevant clauses from the following standard:-

BSEN61800-3 (2004)

### Low Voltage Directive

In accordance with the EEC Directive 2006/95/EC

We Parker SSD Drives, address as below, declare under our sole responsibility that the above Electronic Products when installed and operated with reference to the instructions in the Product Manual (provided with each piece of equipment), is in accordance with the following standard :-

EN50178 (1998)

The drive is CE marked in accordance with the low voltage directive for electrical equipment and appliances in the voltage range when installed correctly.

## Manufacturers Declarations

This is provided to aid your justification for EMC compliance when the unit is used as a component.

### EMC Declaration

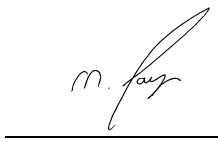
We Parker SSD Drives, address as below, declare under our sole responsibility that the above Electronic Products when installed and operated with reference to the instructions in the Product Manual (provided with each piece of equipment) is in accordance with the relevant clauses from the following standard:-

BSEN61800-3 (2004)

### Machinery Directive

The above Electronic Products are components to be incorporated into machinery and may not be operated alone.
The complete machinery or installation using this equipment may only be put into service when the safety considerations of the Directive 89/392/EEC are fully adhered to.
Particular reference should be made to EN60204-1 (Safety of Machinery - Electrical Equipment of Machines).
All instructions, warnings and safety information of the Product Manual must be adhered to.

Since the potential hazards are mainly electrical rather than mechanical, the drive does not fall under the machinery directive. However, we do supply a manufacturer's declaration for when the drive is used(as a component) in machinery.



Dr Martin Payn (Conformance Officer)

**Parker Hannifin Ltd., Automation Group, SSD Drives Europe**
NEW COURTWICK LANE, LITTLEHAMPTON, WEST SUSSEX BN17 7RZ
TELEPHONE: +44(0)1903 737000 FAX: +44(0)1903 737100
Registered Number: 4806503 England. Registered Office: 55 Maylands Avenue, Hemel Hempstead, Herts HP2 4SJ

# Chapter 11 SERIAL COMMUNICATIONS

## Connection to the P3 Port

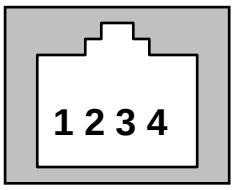
**IMPORTANT:** **The drive MUST be earthed**. Failure to do so could damage your communications ports.

The port is an un-isolated RS232, 19200 Baud, supporting the standard EI bisynch ASCII communications protocol. Contact Parker SSD Drives for further information.

The P3 port is located under the terminal cover and can be used for pc configuration or to remote mount a RS232 Keypad.

### P3 Port

A standard P3 lead is used to connect to the drive.




| P3 Port Pin | Lead | Signal |
|---|---|---|
| 1 | Black | 0V |
| 2 | Red | 5V |
| 3 | Green | TX |
| 4 | Yellow | RX |

***Note:*** *There is 5V present on pin 2 of the P3 port - do not connect this to your PC.*

# Chapter 12 APPLICATIONS

## The Default Application

The drive is supplied with 6 Applications, Application 0 to Application 5. Each Application recalls a pre-programmed structure of internal links when it is loaded.

DEFAULT

- Application 0 will not control a motor. Loading Application 0 removes all internal links.
- Application 1 is the factory default application, providing for basic speed control
- Application 2 supplies speed control using a manual or auto setpoint
- Application 3 supplies speed control using preset speeds
- Application 4 is a set-up providing speed control with Raise/Lower Trim
- Application 5 supplies speed control with Run Forward/Run Reverse
- Application 6 provides for basic speed control with convenient sequencing over comms.

**IMPORTANT:** Refer to Chapter 5: The Keypad – Special Menu Features to reset the drive to factory default values which are suitable for most applications.

## How to Load an Application

In the PAr menu, go to P 1 and press the M key twice.

The Applications are stored in this menu.

Use the ▲ ▼ keys to select the appropriate Application by number.

Press the E key to load the Application.

## Application Description

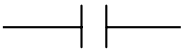
### Control Wiring for Applications

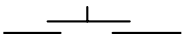
The large Application Diagrams on the following pages show the full wiring for push-button starting. The diagrams on the reverse show the full wiring for single wire starting.

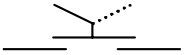
For the minimum connections to make the drive run refer to Chapter 3: "Installing the Drive" - Electrical Installation; the remaining connections can be made to suit your system.

When you load an Application, the input and output parameters shown in these diagrams default to the settings shown. For alternative user-settings refer to the Software Product Manual, Chapter 1 "Programming Your Application".

*Key to Application Diagrams*


normally open contact (relay)

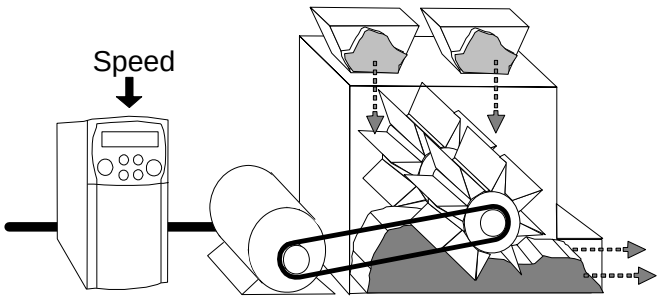

normally open push-button


2-position switch


normally closed push-button

# Application 1: Basic Speed Control

IDEAL FOR GENERAL PURPOSE ALLICATIONS, NORMAL DUTY AND HEAVY DUTY




P I = 1

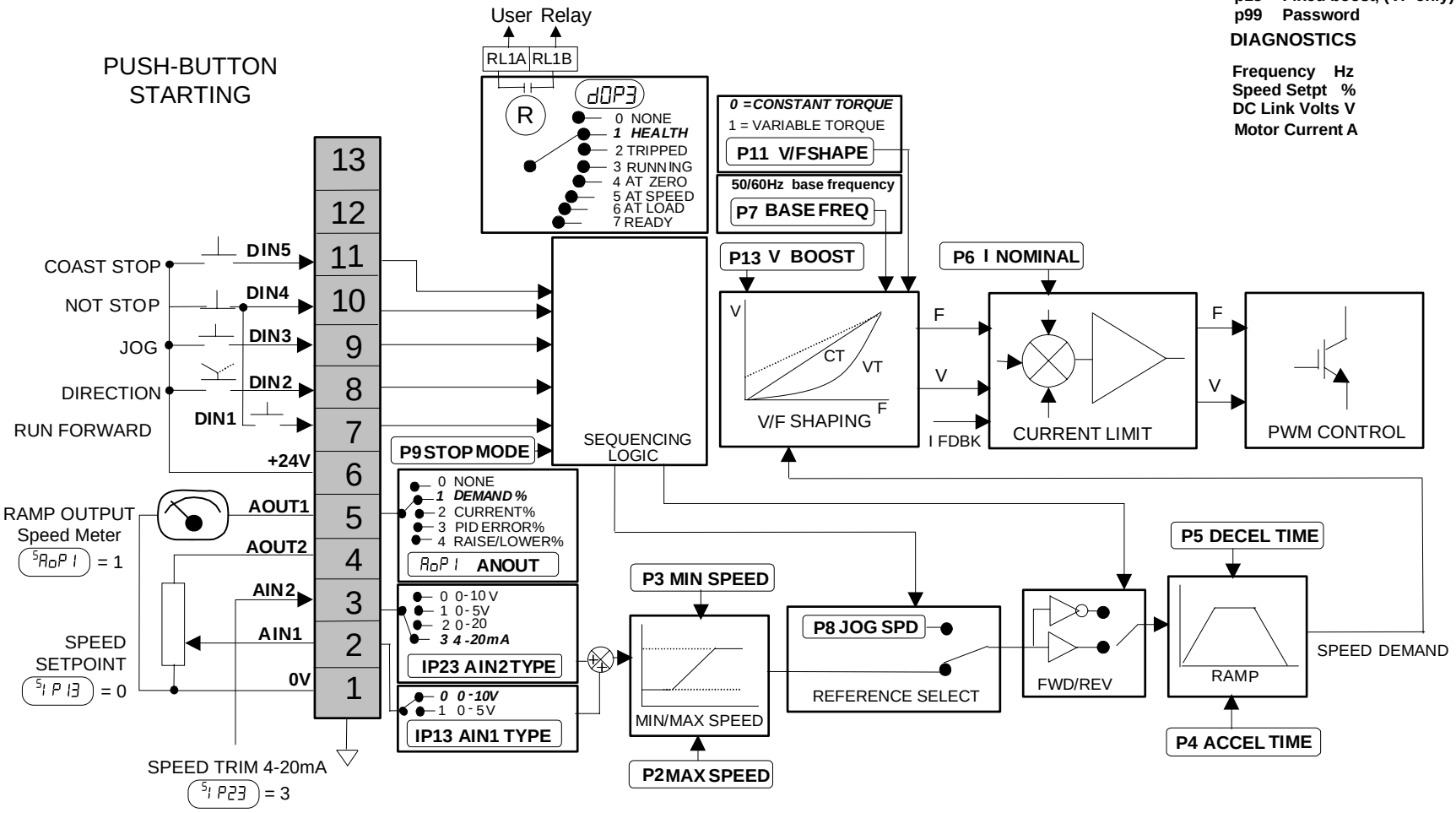
**Italic text indicates Default**

**STANDARD PARAMETERS**

| | |
|---|---|
| p1 | Application |
| p2 | Max speed |
| p3 | Min speed |
| p4 | Accel time |
| p5 | Decel time |
| p6 | Motor rated current |
| p7 | Base frequency |
| p8 | Jog setpoint |
| p9 | Stop mode |
| p11 | V/F shape |
| p12 | Normal duty |
| p13 | Fixed boost, (VF only) |
| p99 | Password |

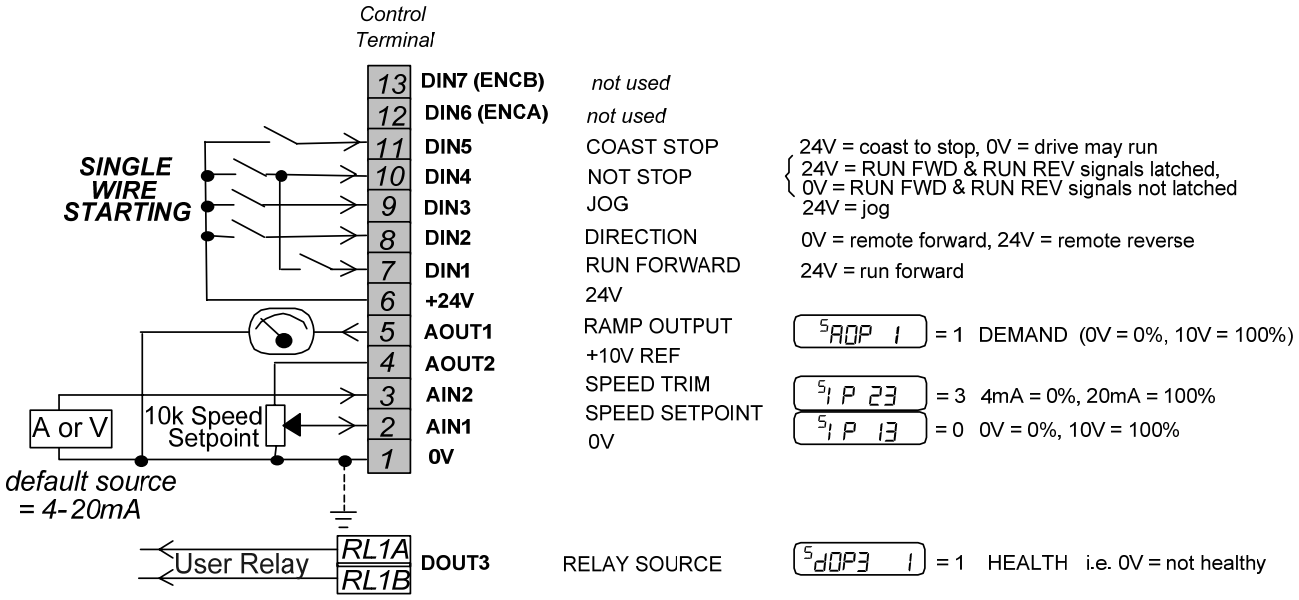
**DIAGNOSTICS**

Frequency Hz
Speed Setpt %
DC Link Volts V
Motor Current A

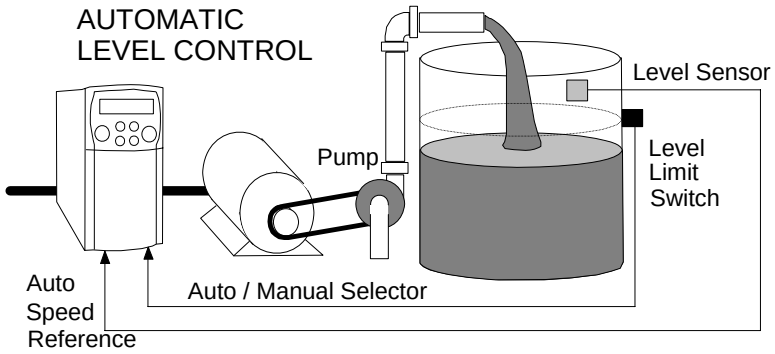


## Application 1: Basic Speed Control (default)

This Application is ideal for general purpose applications. It provides push-button or switched start/stop control. The setpoint is the sum of the two analogue inputs AIN1 and AIN2, providing Speed Setpoint + Speed Trim capability.



# Application 2: Auto/Manual Control




**IDEAL FOR AUTOMATIC CONTROL APPLICATIONS WITH LIMIT SWITCHES OR PROXIMITY TRANSDUCERS**

**P1 = 2**

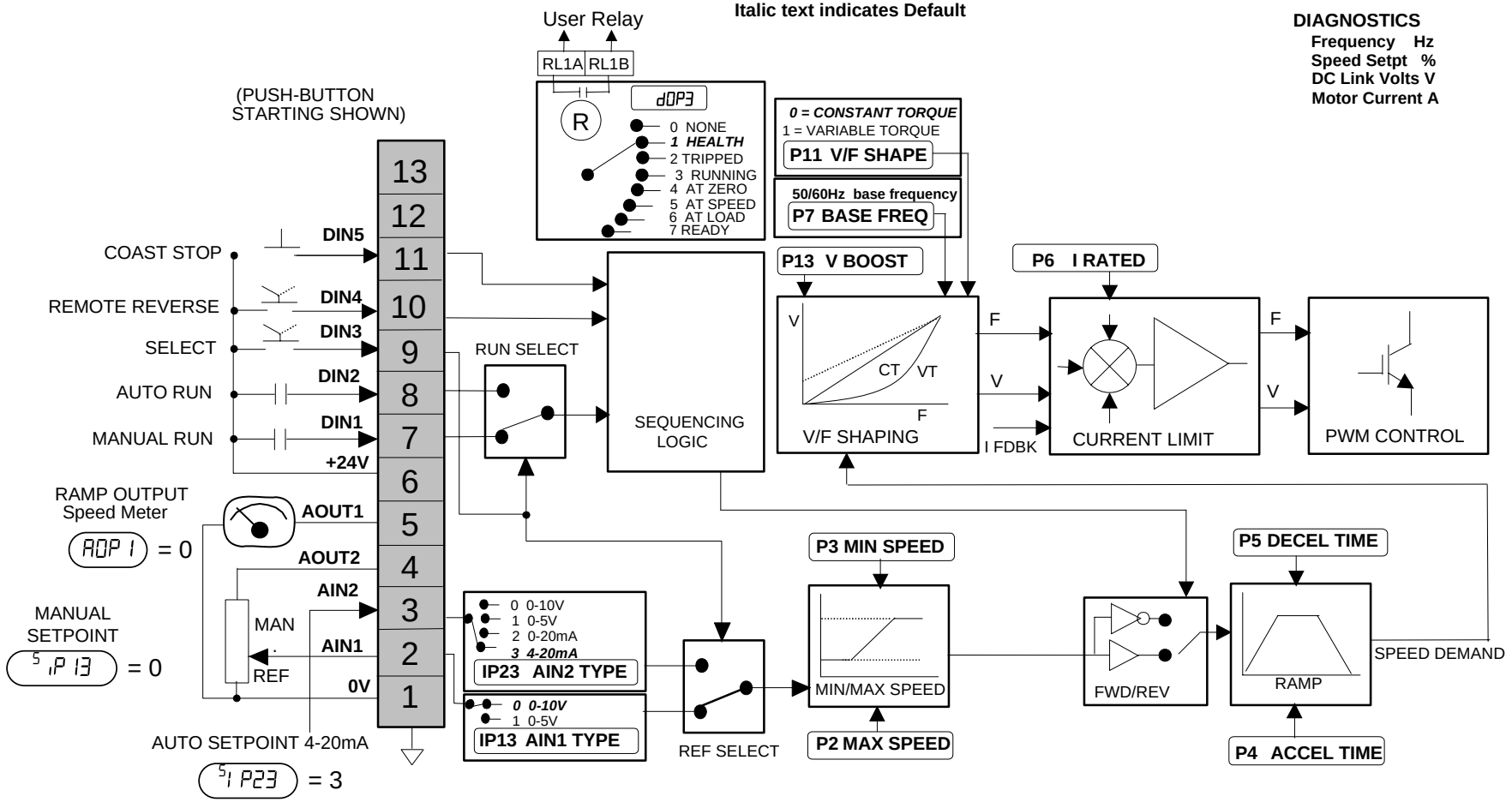
**Italic text indicates Default**

**STANDARD PARAMETERS**

| | |
|---|---|
| p1 | Application |
| p2 | Max speed |
| p3 | Min speed |
| p4 | Accel time |
| p5 | Decel time |
| p6 | Motor current |
| p7 | Base frequency |
| p8 | Jog setpoint |
| p9 | Run stop mode |
| p11 | V/F shape |
| p12 | Normal duty |
| p13 | Fixed boost, (VF only) |
| p99 | Password |

**DIAGNOSTICS**

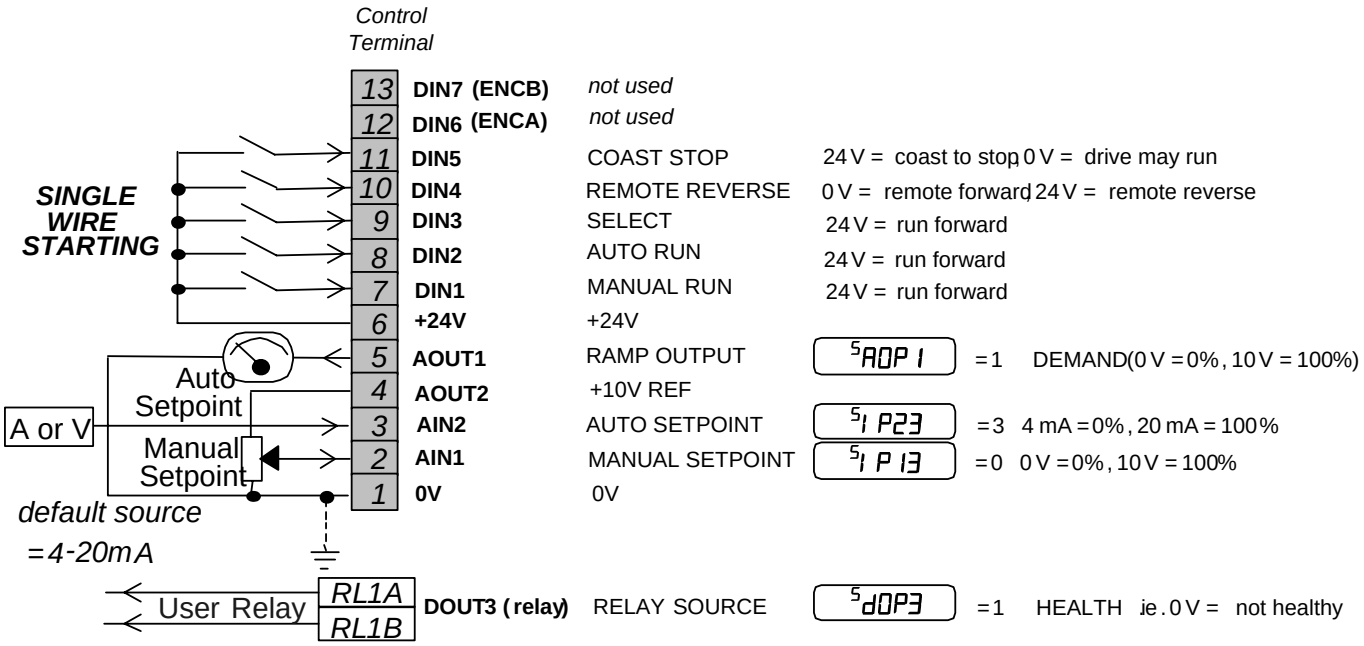
Frequency Hz
Speed Setpt %
DC Link Volts V
Motor Current A



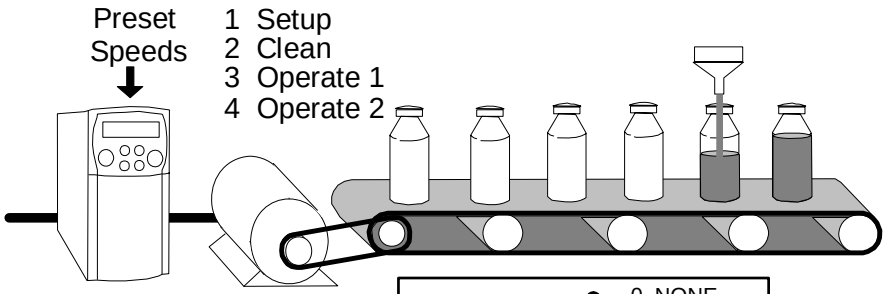
## Application 2: Auto/Manual Control

Two Run inputs and two Setpoint inputs are provided. The Auto/Manual switch selects which pair of inputs is active.

The Application is sometimes referred to as Local/Remote.



# Application 3: Preset Speeds




**IDEAL FOR APPLICATIONS REQUIRING MULTIPLE DISCRETE SPEED LEVELS**

P 1 = 3

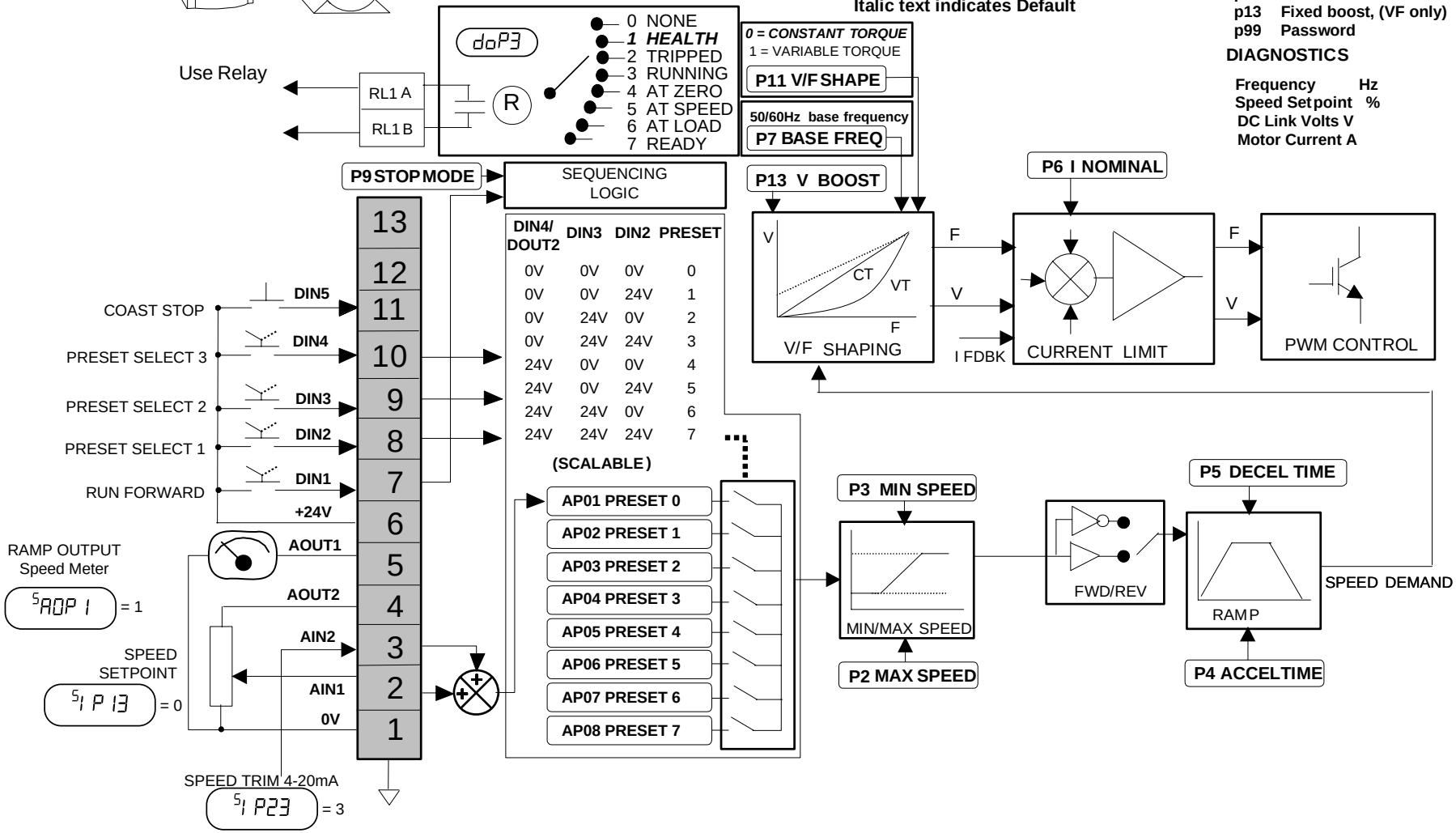
**Italic text indicates Default**

**STANDARD PARAMETERS**

| | |
|---|---|
| p1 | Application |
| p2 | Max speed |
| p3 | Min speed |
| p4 | Accel time |
| p5 | Decel time |
| p6 | Motor current |
| p7 | Base frequency |
| p8 | Jog setpoint |
| p9 | Run Stop mode |
| p11 | V/F shape |
| p12 | Normal duty |
| p13 | Fixed boost, (VF only) |
| p99 | Password |

**DIAGNOSTICS**

| | |
|---|---|
| Frequency | Hz |
| Speed Setpoint | % |
| DC Link Volts | V |
| Motor Current | A |

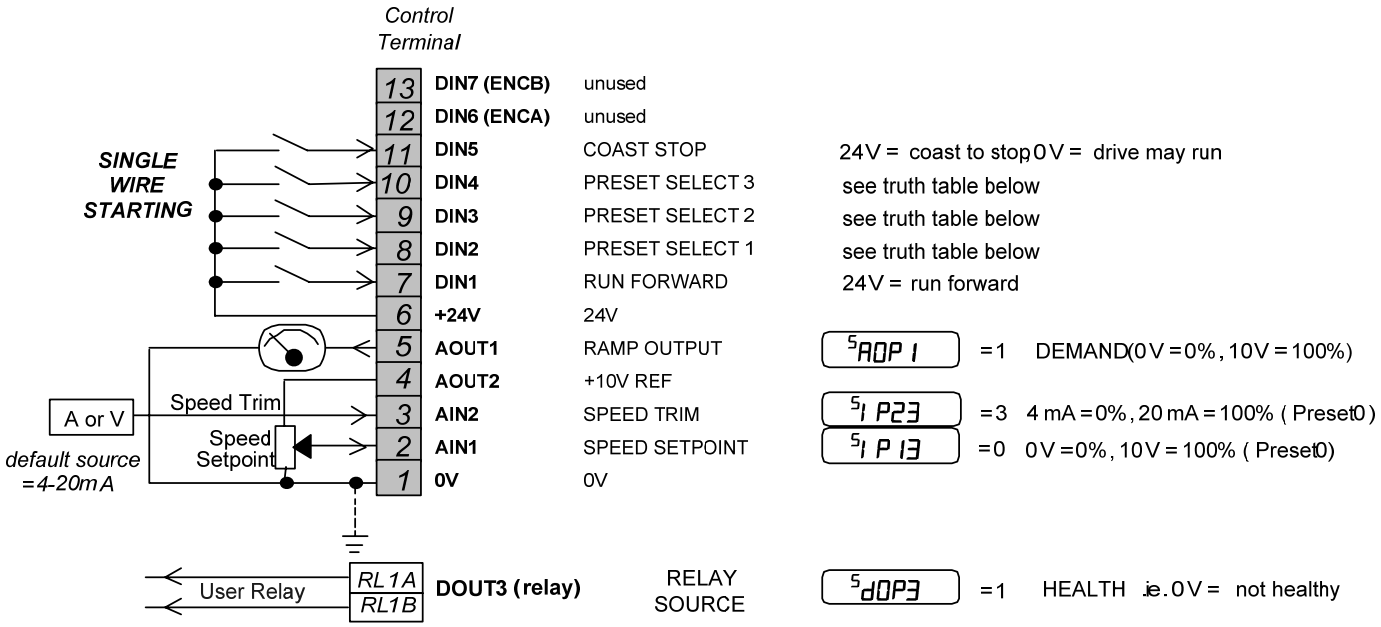


## Application 3: Preset Speeds

This is ideal for applications requiring multiple discrete speed levels.

The setpoint is selected from either the sum of the analogue inputs, (as in Application 1 and known here as PRESET 0), or as one of up to seven other pre-defined speed levels. These are selected using DIN2, DIN3 and DIN4, refer to the Truth Table below.

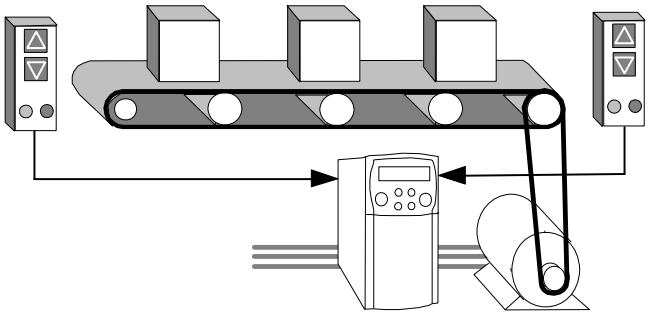
Edit parameters AP2 to AP8 on the keypad to re-define the speed levels of PRESET 1 to PRESET 7. Reverse direction is achieved by entering a negative speed setpoint.




### Preset Speed Truth Table

| DIN4 | DIN3 | DIN2 | Preset |
|---|---|---|---|
| 0V | 0V | 0V | 0 |
| 0V | 0V | 24V | 1 |
| 0V | 24V | 0V | 2 |
| 0V | 24V | 24V | 3 |
| 24V | 0V | 0V | 4 |
| 24V | 0V | 24V | 5 |
| 24V | 24V | 0V | 6 |
| 24V | 24V | 24V | 7 |

# Application 4: Raise/Lower Trim



**IDEAL FOR APPLICATIONS REQUIRING**

**SPEED CONTROL FROM MULTIPLE LOCATIONS**

P I = 4

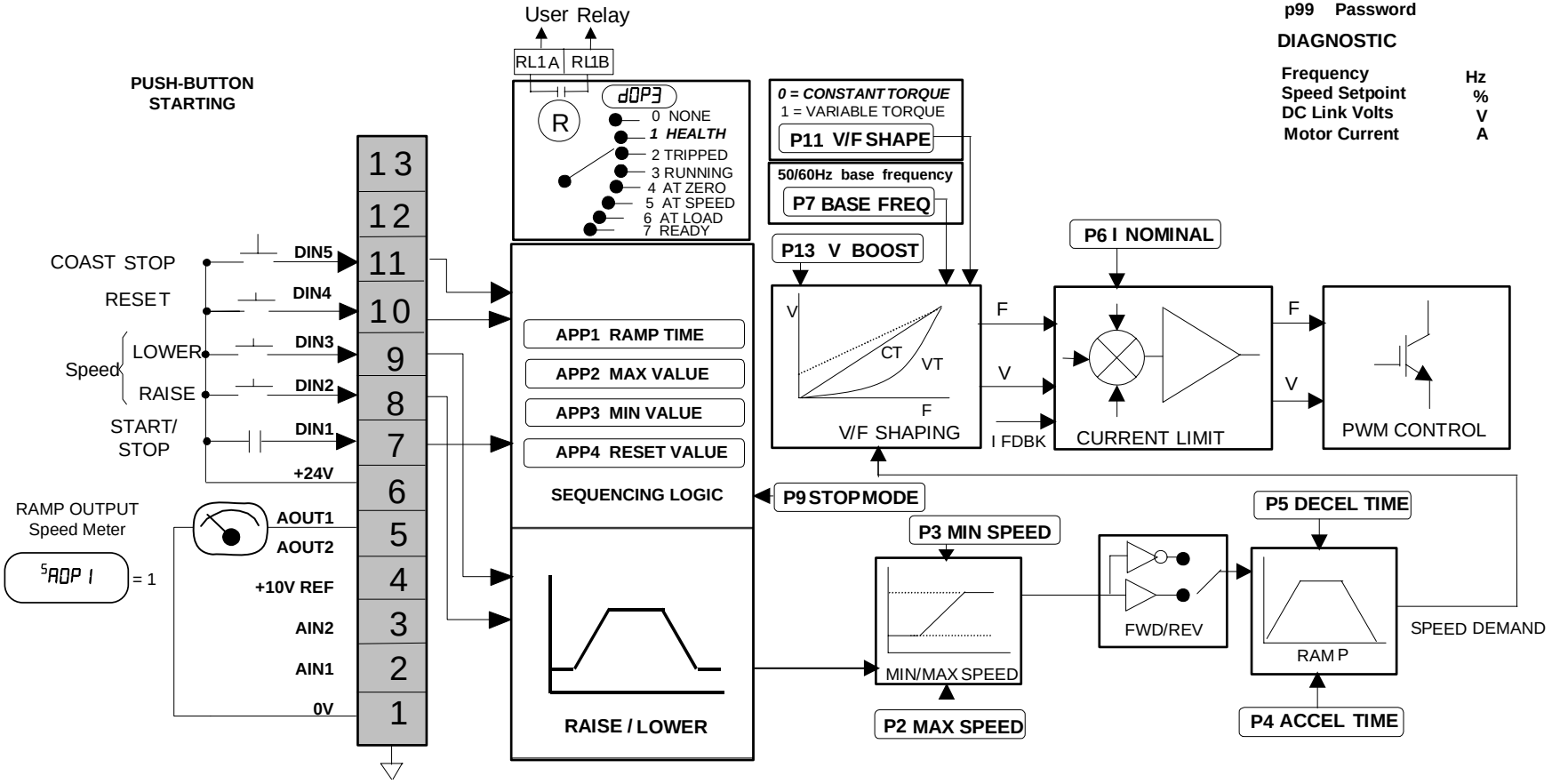
**Italic text indicates Default**

**STANDARD PARAMETERS**

| | |
|---|---|
| p1 | Application |
| p2 | Max speed |
| p3 | Min speed |
| p4 | Accel time |
| p5 | Decel time |
| p6 | Motor current |
| p7 | Base frequency |
| p8 | Jog setpoint |
| p9 | Run stop mode |
| p11 | V/F shape |
| p12 | Normal duty |
| p13 | Fixingboost, (VF only) |
| p99 | Password |

**DIAGNOSTIC**

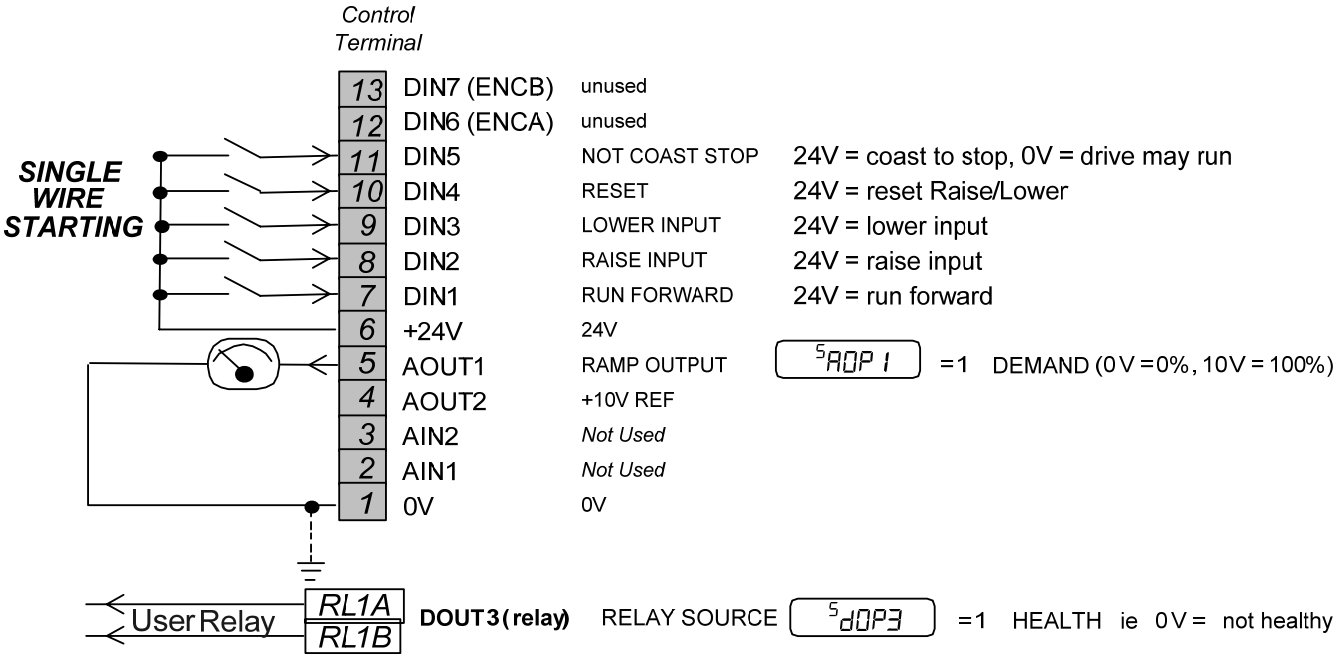
| | |
|---|---|
| Frequency | Hz |
| Speed Setpoint | % |
| DC Link Volts | V |
| Motor Current | A |



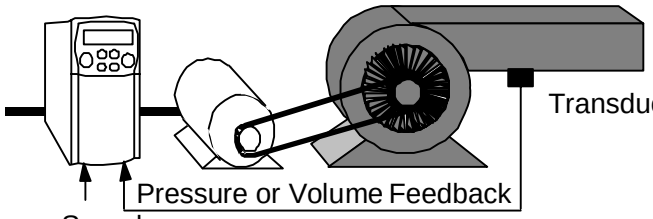
## Application 4: Raise/Lower Trim

This Application mimics the operation of a motorised potentiometer. Digital inputs allow the setpoint to be increased and decreased between limits. The limits and ramp rate can be set using the keypad.

The Application is sometimes referred to as Motorised Potentiometer.



# Application 5: PI Control




**EASY TUNING FOR SETPOINT/FEEDBACK CONTROL APPLICATIONS REGULATING VOLUME OR PRESSURE, SUCH AS AIR HANDLING OR PUMPING**

**STANDARD PARAMETERS**

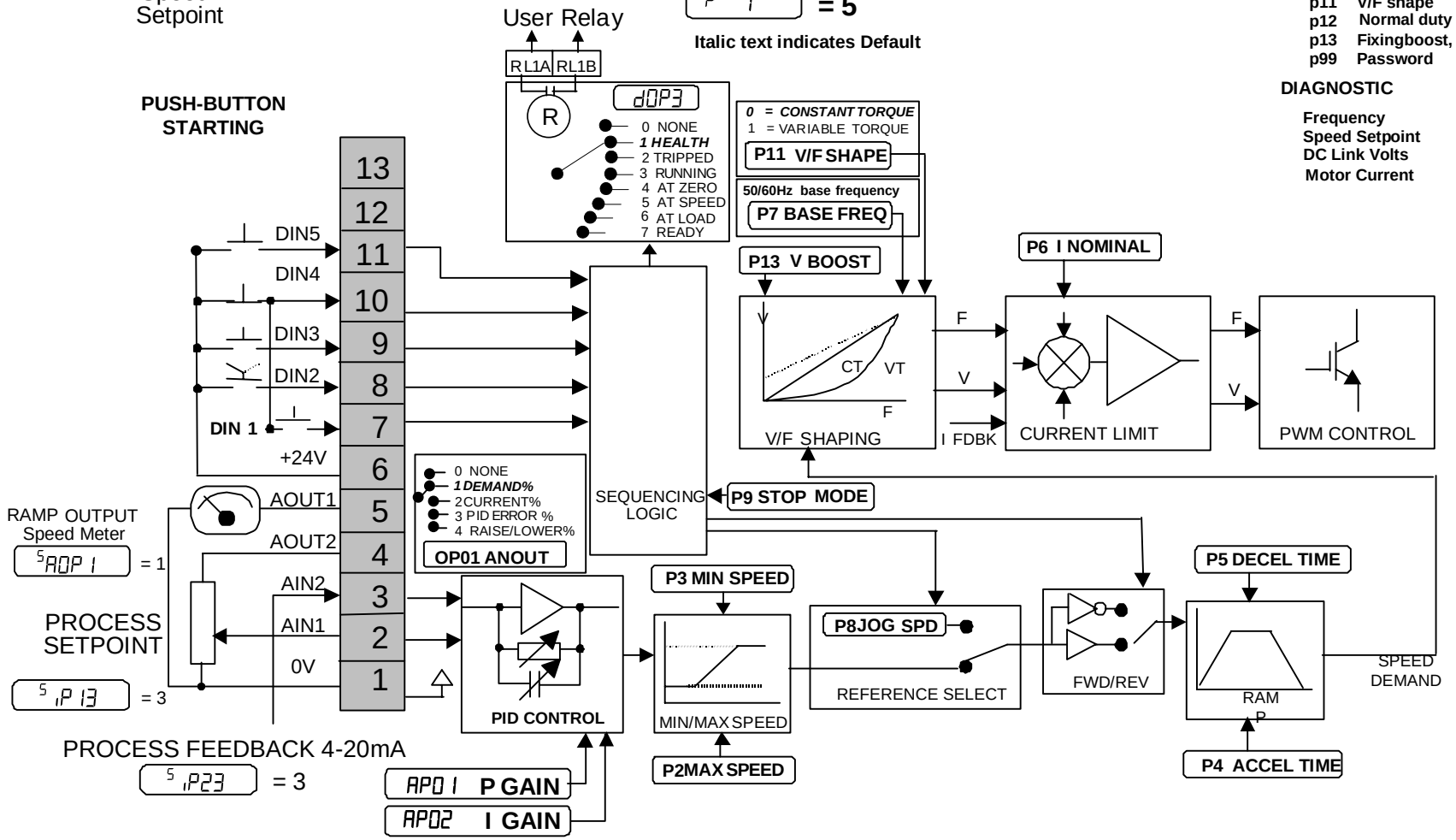
| | |
|---|---|
| p1 | Application |
| p2 | Max speed |
| p3 | Min speed |
| p4 | Accel time |
| p5 | Decel time |
| p6 | Motor current |
| p7 | Base frequency |
| p8 | Jog setpoint |
| p9 | Run stop mode |
| p11 | V/F shape |
| p12 | Normal duty |
| p13 | Fixingboost, (VF only) |
| p99 | Password |

**DIAGNOSTIC**

| | |
|---|---|
| Frequency | Hz |
| Speed Setpoint | % |
| DC Link Volts | V |
| Motor Current | A |

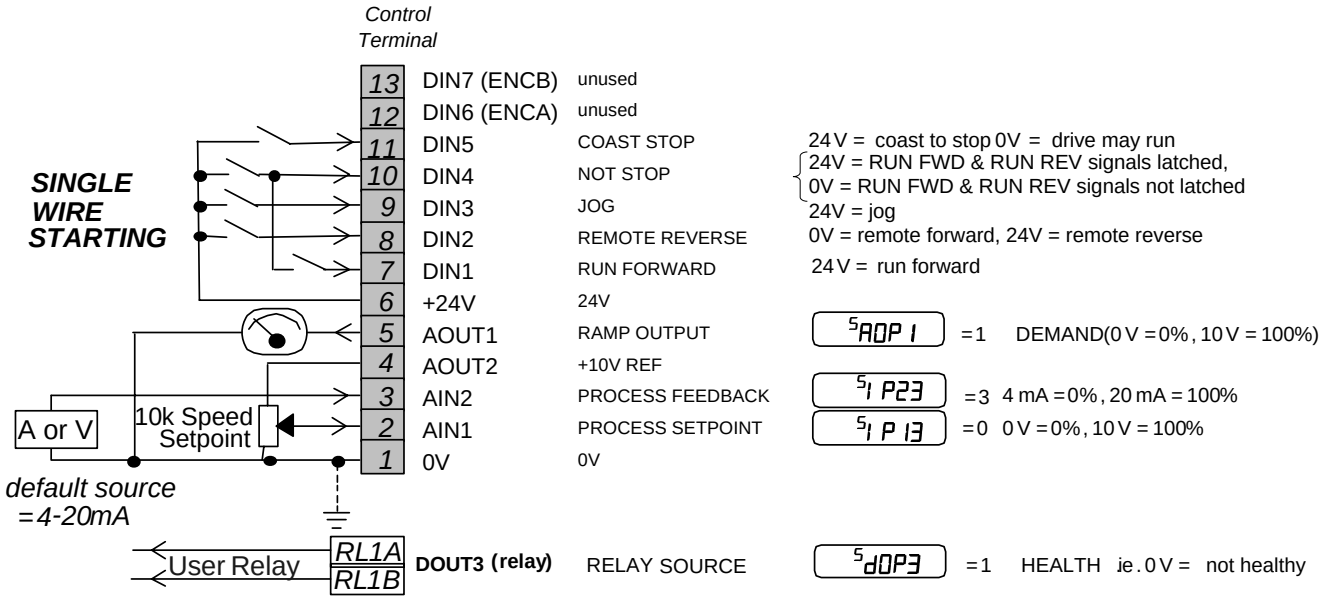
P 1 = 5

**Italic text indicates Default**

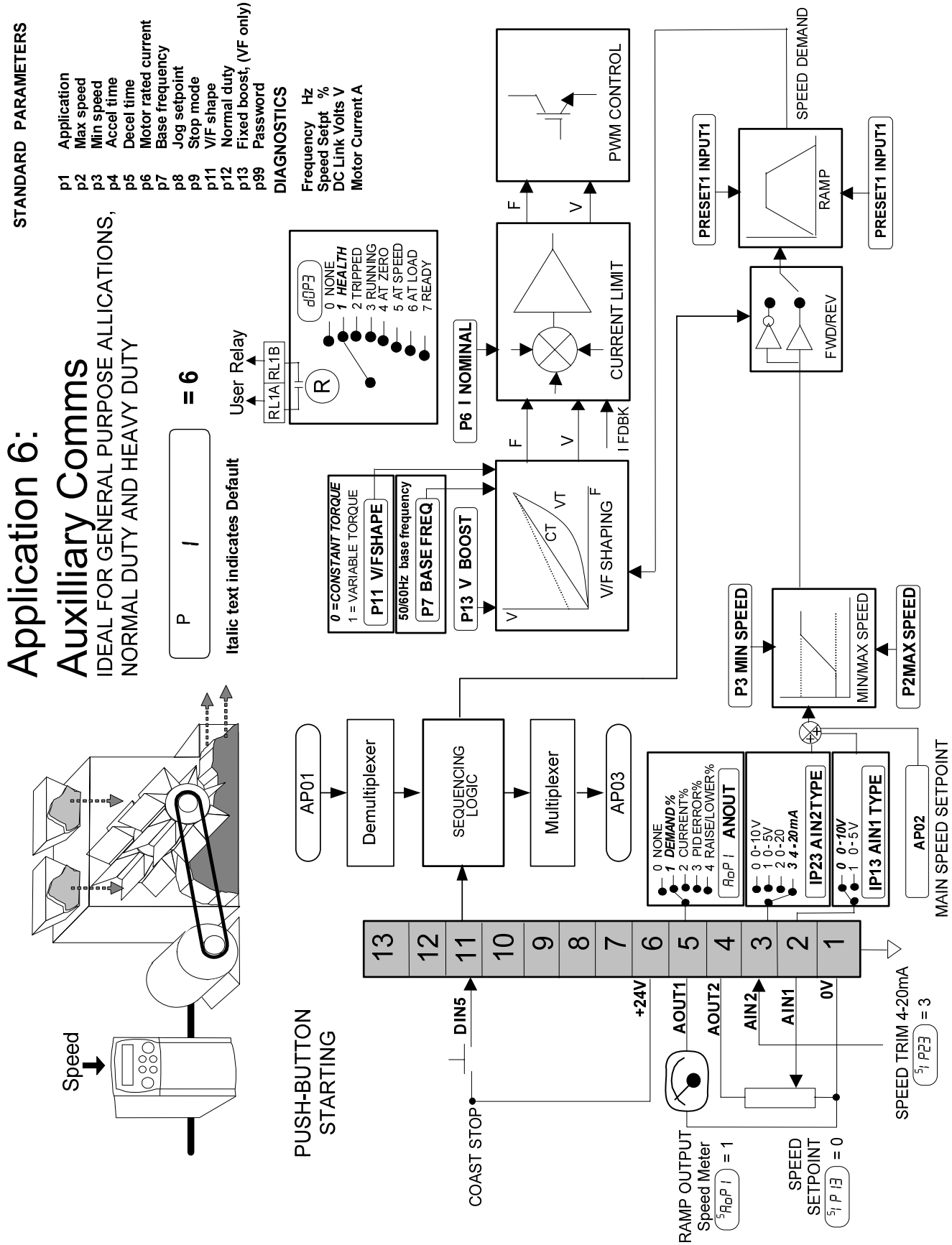


## Application 5: PID

A simple application using a Proportional-Integral-Derivative 3-term controller. The setpoint is taken from AIN1, with feedback signal from the process on AIN2. The scale and offset features of the analogue input blocks may be used to correctly scale these signals. The difference between these two signals is taken as the PID error. The output of the PID block is then used as the drive setpoint.

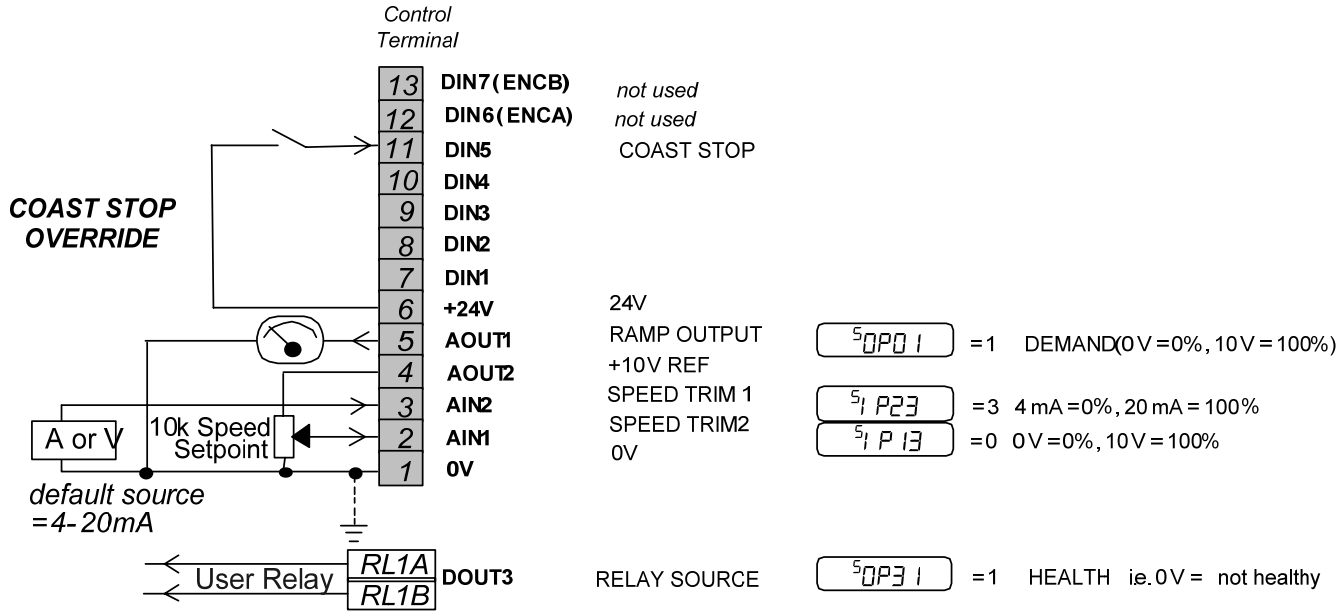


## Application 6 : Auxilliary Comms



## Application 6: AUXILLIARY COMMS

General purpose implementation of basic speed control, with sequencing and speed reference conveniently controlled and monitored (via just 3 parameters) over comms.




**AP01 (Tag 599)**

| Mask | Function |
|---|---|
| Bit 4 | Jog |
| Bit 3 | Trip reset |
| Bit 2 | Reverse |
| Bit 1 | Enable |
| Bit 0 | Run forward |

**AP03 (Tag 598)**

| Mask | Diagnostic |
|---|---|
| Bit 13 | At speed |
| Bit 12 | Zero speed |
| Bit 11 | Ramping |
| Bit 10 | Fan running |
| Bit 9 | Healthy |
| Bit 8 | Reversed |
| Bit 7 | System reset |
| Bit 6 | Ready |
| Bit 5 | Switched on |
| Bit 4 | Switch on enabled |
| Bit 3 | Stopping |
| Bit 2 | Jogging |
| Bit 1 | Running |
| Bit 0 | Tripped |

**Parker Hannifin Ltd., Automation Group, SSD Drives Europe**
New Courtwick Lane, Littlehampton, West Sussex BN17 7RT
Tel: +1(0)903 737000  Fax: +1(0)903 737100

**CANADA**
Parker Hannifin Canada
Motion & Control Division
160 Chisholm Drive
Milton, Ontario L9T 3G9
Tel:  +1(905) 693-3000
Fax:  +1(905) 876-1958

**GERMANY**
Parker Hannifin GmbH
Von-Humboldt-Strasse 10
64646 Heppenheim
Tel: +49 (6252) 798200
Fax: +49(6252) 798205

**CHINA**
Parker Hannifin Motion &
Control (Shanghai) Co. Ltd.,
280 Yunqiao Road
Jinqiao Export Processing Zone,
Pudong District,
Shanghai 201206
Tel: +86(21)5031 2525
Fax: +86(21)5854 7599

**ITALY**
Parker Hannifin SPA
Via C. Gounod,
Cinisello Balsamo
1-20092, Milano
Tel: +39(0236) 1081
Fax: +39(0236) 108400

**FRANCE**
Parker SSD Parvex
8 Avenue du Lac
B.P. 249
21007 Dijon Cedex
Tel: +33(0)80 42 41 40
Fax: +33(0)80 42 41 23

**USA**
Parker Hannifin Corporation
SSD Drives
9225 Forzyth Park Drive
Charlotte
North Carolina 28273
Tel: +1(704)588 3246
Fax: +1(704)588 3249

Also availability and service support also in:

**Argentina • Australia • Austria • Bangladesh • Belgium • Brazil • Chile • Columbia • Costa Rica • Cyprus • Czech Republic • Denmark • Ecuador • Egypt • Finland • Greece • Hong Kong • Hungary • India • Indonesia • Iran • Ireland • Israel • Japan • Jordan • Kenya • Korea • Kuwait • Lithuania • Malaysia • Netherlands • New Zealand • Nigeria • Norway • Peru • Philippines • Poland • Portugal • Quatar • Romania • Russia • Saudi Arabia • Singapore • Slovenia • Slovakia • South Africa • Spain • Sri Lanka • Sweden • Switzerland • Taiwan • Turkey • United Arab Emirates * Vietnam • Zimbabwe**

**www.ssddrives.com**

*HA501333U001 01*