IMPORTANT NOTES

SAFETY WARNINGS:
– It is the installer’s responsibility to ensure the configuration and installation of the Elite Series meets the requirements of any site specific, local and national electrical regulations.
– The Elite Series operates from HIGH VOLTAGE, HIGH ENERGY ELECTRICAL SUPPLIES. Stored charge is present after switch off.
– Due to the high leakage currents inherent to AC drives, earth connection of both the motor and the Elite Series is essential before connection to the supply. The Elite Series must be permanently connected to the supply.
– For safety reasons, normal operation of the Elite Series requires front covers/doors to be in place and secured closed.
– Do not attempt to isolate the motor while the Elite Series is running.
– Some parameter settings may cause the Elite Series to start automatically after power failure.
– Motor overspeed operation may be limited by mechanical constraints.

RELIABILITY WARNINGS:
– Always screen control wiring.
– Ensure that the Elite Series is not mounted in an adverse environment.

SERVICING WARNINGS:
– Service only by qualified personnel.
– Always isolate and allow to discharge before servicing.
– Never replace ceramic fuses with glass types.
– Always wear safety glasses when operating with the cover removed.
– The Elite Series contains static sensitive printed circuit boards. Use static safe procedures when handling these boards.
– Never work on live equipment alone.
– Observe all recommended practices.

NOTES:
– This manual and the screen list contained within this document relate to Elite Series software version 3.7. Refer to Screen Z2 for the software version of your Elite Series.
– It is the responsibility of the end user/purchaser to ensure that operators understand how to use this equipment safely. Please read this manual thoroughly.
– The latest revision of this manual is available from our web-site www.pdl.co.nz.
DEDICATION TO QUALITY

AC Motor Control Products can dramatically improve your process control, productivity and energy efficiency, but only if they are working correctly.

Which is why we at PDL Electronics go to great lengths in our design and manufacturing, to ensure that our products operate correctly first time, every time.

An extensive research and development investment ensures that this product is one of the most technically advanced in the world, with built-in strength and robustness to suit your application and environment.

Our AS/NZS ISO 9001 certification gives you the confidence of our international, independently certified Quality Assurance program. All staff are actively involved in continuous improvement programs with a customer focus.

The components that go into our products are selected from the best in the world - and must pass our rigorous and demanding test program.

Finally, every new drive design is run through a rigorous test program, including full load operation at above rated temperature, under the most demanding load conditions.

Our dedication to quality makes the PDL Electronics product, regardless of price, less expensive than other controllers in the long run.

COMPREHENSIVE SUPPORT PROGRAM

The PDL Electronics customer support program demonstrates our confidence in our Quality Assurance system. We have total faith in our products and their reliability, and so provide a comprehensive warranty.

Fully trained engineers and technicians, with a wealth of experience and easy access to information, can assist in solving any of your drive application projects.

Our service staff are available for commissioning, after sales service, and repairs, 24 hours a day, seven days a week.

We select capable and highly qualified representatives to act as our distributors and service agents. Only after passing PDL Electronics' intensive training program are they accredited for repair or on-selling of our products.

To further support our products and customers, we run a series of comprehensive training programs focusing on self maintenance and application advice. These are available on-site and at our Head Office.

REVISION HISTORY

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<td>Process Control and Fibre Optic Mode added.</td>
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<td>Nov. 1997</td>
<td>E</td>
<td>Elite Software Version 2.0</td>
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<tr>
<td>May 1998</td>
<td>F</td>
<td>Ultradrive specifications added</td>
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<tr>
<td>March 1999</td>
<td>G</td>
<td>Add large Ultradrive specifications</td>
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<tr>
<td>Dec. 2000</td>
<td>H</td>
<td>Update to software revision 3.5. UL listings added.</td>
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<td>500V ratings &amp; Open Loop Vector added.</td>
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<td>Oct. 2001</td>
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<td>New 500V ratings and parallel drive fault codes added</td>
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**SYMBOLS USED**

- 🚨 **Caution, risk of electric shock**  
  ISO 3864, No. B.3.6

- ⚠️ **Caution (refer to accompanying documents)**  
  ISO 3864, No. B.3.1

- 🌘 **Three-phase alternating current**  
  IEC 617-2, No. 02-02-06

- ⚡ **Direct Current**  
  IEC 417, No. 5031

- ⚔️ **Protective Earth (PE) Terminal**  
  IEC 417 No. 5019

- ⚡️ **Earth (ground) Terminal**  
  IEC 417 No. 5017

- 🐻 **Induction motor, three phase, squirrel cage**  
  IEC 617-2, No. 06-08-01
1 INTRODUCTION TO THE ELITE SERIES AC MOTOR CONTROLLER

1.1 THE CONCEPT

The AC induction motor is the preferred choice of motive power for many industrial applications. With the development of electronic variable voltage variable frequency (VVVF) controllers, it became possible to control the speed of the induction motor. PDL Electronics has been at the forefront of development of VVVF controllers for the past 25 years.

However standard VVVF controllers have certain performance limitations, specifically in applications where high torque is required at standstill and very low speeds, and in applications where extremely fast dynamic response is required. To address these limitations, PDL Electronics has developed the Elite Series of controllers. Advanced flux vector control techniques enables extended performance to be obtained from the AC induction motor, including full torque at standstill, and a speed response rivalling that of servomotors.

The Elite Series further evolves the hardware and software technology of previous ranges. The same Elite Series induction motor controller can be used without motor feedback for general industry applications, or with a shaft encoder (pulse tacho) driven by the motor to give the full performance associated with flux vector orientation control.

1.2 THE ELITE SERIES RANGE

The Elite Series has been developed from PDL's previous AC motor controller series, the Microdrive and Microvector. It inherits the Microdrive's simplicity and well proven electrical design. The Elite Series improves on the already highly flexible digital controls which have become the hallmark of the Microdrive and Microvector series.

The Elite Series range currently consists of 37 models spanning the range from 0.75 kW to 355kW (1hp to 500hp), with extensions to the range presently under development. All models are constructed to meet IP54, for protection against the ingress of dust and splashing water. Alternatively, IP20 rated models are also available for the Microdrive Elite Series.

Elite Series models up to frame 4 have attained UL listing in the categories of Power Conversion Equipment and Power Conversion Equipment Certified for Canada.

1.3 THE BASIC PRINCIPLE OF FLUX VECTOR CONTROL

Field orientated flux vector control (or simply vector control) is a technique for controlling the torque developed by an AC induction motor. By independently controlling the magnitude of the air gap flux and the rotor current, and maintaining their orthogonality, it becomes possible to directly control the torque output of the motor. This is achieved by controlling the torque-producing and flux-producing components of the motor stator current. This is similar to controlling the armature and field currents in a separately excited DC motor. To achieve this level of control, the shaft speed and position must be sensed using a shaft encoder on the motor.

The Elite Series employs this technique in its Closed Loop Vector control mode. However if a shaft encoder is not used on the motor, Open Loop Mode control operation is available. This uses sophisticated monitoring and modelling techniques to estimate the rotor position. Speed and torque accuracy are sacrificed, and very low speed operation may not be possible.

1.4 CONFIGURATION OF CONTROLLER TYPE

When the Elite Series is set up for Closed Loop Vector control, it is set up as a torque controller. If further configured to "torque control" mode, it provides accurate output torque from the motor, in response to an external torque reference signal. This torque is available down to zero speed. This mode is most suited for use in torque control applications, e.g., power winder and rewinder systems. It can also be used in position control applications, with an external speed-position controller. A quadrature shaft encoder will be required on the motor, to provide rotor position feedback.

Closed Loop Vector control "speed control" mode is recommended for servomotor type applications, or anywhere that a speed controller with fast dynamic response or accurate speed holding is required. This mode is suitable for elevators or crane hoists, and other applications where full torque capability at zero speed are required. In this mode, the Elite Series can also be used in conjunction with an external position controller to do position control applications. A quadrature shaft encoder will be required on the motor, to provide rotor position and speed feedback.

Open Loop Mode control operating mode is for general purpose speed control applications, e.g., pumps, fans, conveyors, mixers etc. This mode gives equivalent or better performance to that of drives using previous VVVF technologies. In this mode, a quadrature shaft encoder on the motor is not necessary.

The V/Hz control operating mode is also suitable for general purpose speed control applications e.g., pumps, fans, conveyors, mixers etc. This mode gives equivalent or better performance to that of drives using previous VVVF technologies. When multiple motors are to be driven from the output of the Elite Series, the V/Hz control operating mode must be utilised.

The Elite Series will also function as an accurate sensor of torque, power and speed. The accuracy of this sensing is improved by using in Closed Loop Vector control operating mode. The outputs are available in analogue or digital format, or can be applied to internal comparators and limits.

1.5 CONTROL CONFIGURATION OPTIONS

The functions and formats of the six digital and two analogue inputs, and three digital and two analogue outputs, can be configured in a number of different ways.

Full details of the available screens and control functions are given in Section 9 of this manual.
2 ELITE SERIES SPECIFICATIONS

2.1 ELITE SERIES SPECIFICATIONS

INPUT

- Input frequency range: 48 to 62Hz
- Input current: > output current
- Input displacement factor: > 0.99
- Input current THD: > 2 seconds at nominal voltage
- Power loss ride through (model dependant) refer Figures 2.1 and 2.2 for details.

OUTPUT

- Output voltage to motor
  - Microdrive Elite Series: 0 to V_{in} -3V @ 100% load
  - Ultradrive Elite Series: 0 to V_{in} -15V @ 100% load
- Current overload capability: 150% for 30 secs (when hot) at 50°C at nominal rating, 150% for 60 secs (when hot) at 40°C at nominal rating
- Frequency range
  - Closed Loop Mode: 0 to ±100Hz
  - Open Loop Mode
    - V/Hz Mode: 0 to ± 100Hz
    - Efficiency (full load, 50Hz): >97%
- Suit motor rated kW: typically 50 to 150% of Elite Series nominal rating
- Suit motor rated voltages: 5 to 500Vac
- Suit motor rated frequencies: 10 to 400Hz
- Modulation method: Space vector modulation
- Modulation frequency: Up to 16kHz Whisper Wave or Narrow Band (model dependant)
- Cable Length: Maximum cable length is typically 150m, but it is dependant on cable type and switching frequency. For more information please refer to PDL Document 4216-035, (The effect of long cable runs on inverter outputs).

ENVIRONMENTAL

- Protection standard: Refer to Figures 2.1 and 2.2.
  - IP54/NEMA 12
  - IP20/NEMA 1
- Operating temperature: 0°C to 50°C
- Temperature re-rating of output current @ 40°C
- For quadratic torque applications, the Elite Series may be up-rated when operated with a maximum ambient temperature of 40°C. Refer to Figures 2.1 and 2.2.
- Storage temperature: -25°C to +80°C
- Relative humidity: <90%, noncondensing

Specifications are subject to change without notice
**Elite Series 400V Ratings**

**Rated Voltage ($V_{in}$):** 380Vac to 440Vac (-10% to +10%)

**Supply type:** 3 phase earthed neutral

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<th>ENCLOSURE RATING</th>
<th>FRAME</th>
<th>MODEL</th>
<th>380V-440V (Note 1)</th>
<th>RECOMMENDED CABLE SIZING PER PHASE</th>
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<td>I[A] @ 50°C (Note 2)</td>
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**Note 1:** Frames sizes 1-4 are also available to suit a 230Vac (-20+10%) supply.

**Note 2:** Current rating is constant across the voltage range.

**Note 3:** Power rating applies to typical 4-pole machines only. Check your motor specification before selecting.

**Note 4:** Decrease linearly to nominal at 0Hz.

**Note 5:** Fuse must be selected to protect circuits with a maximum 200kA symmetrical short circuit supply.

*Figure 2.1: Elite Series 400V Nominal and Re-rated Specifications*
### Elite Series Technical Manual

#### Elite Series 500V Ratings

**Rated Voltage (VIN)**

- 440Vac to 500Vac (-10% to +10%)

**Supply type**

- 3 phase earthed neutral

---

### Table: 440-500V (Note 1)

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**Note 1:** Frames 1-4 are UL/cUL approved to 480Vac.
Frames 5-7 & Parallel drives (inside delta) are UL/cUL approved to 500V.
Frames 1-4 are also available to suit a 230Vac (-20% +10%) supply.
Current rating is constant across the voltage range.
Power rating applies to typical 4-pole machines only.
Check your motor specification before selecting.
Decrease linearly to nominal at 0Hz.
To comply with UL/cUL, use copper conductors only.

**Note 2:** Frames 1-4 are UL/cUL approved to 480Vac.
Frames 5-7 & Parallel drives (inside delta) are UL/cUL approved to 500V.
Frames 1-4 are also available to suit a 230Vac (-20% +10%) supply.
Current rating is constant across the voltage range.
Power rating applies to typical 4-pole machines only.
Check your motor specification before selecting.
Decrease linearly to nominal at 0Hz.
To comply with UL/cUL, use copper conductors only.

**Note 3:** Frames 1-4 are UL/cUL approved to 480Vac.
Frames 5-7 & Parallel drives (inside delta) are UL/cUL approved to 500V.
Frames 1-4 are also available to suit a 230Vac (-20% +10%) supply.
Current rating is constant across the voltage range.
Power rating applies to typical 4-pole machines only.
Check your motor specification before selecting.
Decrease linearly to nominal at 0Hz.
To comply with UL/cUL, use copper conductors only.

**Note 4:** Frames 1-4 are UL/cUL approved to 480Vac.
Frames 5-7 & Parallel drives (inside delta) are UL/cUL approved to 500V.
Frames 1-4 are also available to suit a 230Vac (-20% +10%) supply.
Current rating is constant across the voltage range.
Power rating applies to typical 4-pole machines only.
Check your motor specification before selecting.
Decrease linearly to nominal at 0Hz.
To comply with UL/cUL, use copper conductors only.

**Note 5:** Frames 1-4 are UL/cUL approved to 480Vac.
Frames 5-7 & Parallel drives (inside delta) are UL/cUL approved to 500V.
Frames 1-4 are also available to suit a 230Vac (-20% +10%) supply.
Current rating is constant across the voltage range.
Power rating applies to typical 4-pole machines only.
Check your motor specification before selecting.
Decrease linearly to nominal at 0Hz.
To comply with UL/cUL, use copper conductors only.

**Note 6:** Frames 1-4 are UL/cUL approved to 480Vac.
Frames 5-7 & Parallel drives (inside delta) are UL/cUL approved to 500V.
Frames 1-4 are also available to suit a 230Vac (-20% +10%) supply.
Current rating is constant across the voltage range.
Power rating applies to typical 4-pole machines only.
Check your motor specification before selecting.
Decrease linearly to nominal at 0Hz.
To comply with UL/cUL, use copper conductors only.

**Note 7:** Frames 1-4 are UL/cUL approved to 480Vac.
Frames 5-7 & Parallel drives (inside delta) are UL/cUL approved to 500V.
Frames 1-4 are also available to suit a 230Vac (-20% +10%) supply.
Current rating is constant across the voltage range.
Power rating applies to typical 4-pole machines only.
Check your motor specification before selecting.
Decrease linearly to nominal at 0Hz.
To comply with UL/cUL, use copper conductors only.

**Note 8:** Frames 1-4 are UL/cUL approved to 480Vac.
Frames 5-7 & Parallel drives (inside delta) are UL/cUL approved to 500V.
Frames 1-4 are also available to suit a 230Vac (-20% +10%) supply.
Current rating is constant across the voltage range.
Power rating applies to typical 4-pole machines only.
Check your motor specification before selecting.
Decrease linearly to nominal at 0Hz.
To comply with UL/cUL, use copper conductors only.

**Note 9:** Frames 1-4 are UL/cUL approved to 480Vac.
Frames 5-7 & Parallel drives (inside delta) are UL/cUL approved to 500V.
Frames 1-4 are also available to suit a 230Vac (-20% +10%) supply.
Current rating is constant across the voltage range.
Power rating applies to typical 4-pole machines only.
Check your motor specification before selecting.
Decrease linearly to nominal at 0Hz.
To comply with UL/cUL, use copper conductors only.

**Note 10:** Frames 1-4 are UL/cUL approved to 480Vac.
Frames 5-7 & Parallel drives (inside delta) are UL/cUL approved to 500V.
Frames 1-4 are also available to suit a 230Vac (-20% +10%) supply.
Current rating is constant across the voltage range.
Power rating applies to typical 4-pole machines only.
Check your motor specification before selecting.
Decrease linearly to nominal at 0Hz.
To comply with UL/cUL, use copper conductors only.
3 DESCRIPTIONS

3.1 DESCRIPTION OF THE ELITE SERIES HARDWARE

3.1.1 Overview

The Elite Series range is a family of advanced AC induction motor controllers, presented in seven frame styles. All models are available with IP54 ingress protection rating, suitable for installation in an environment where dust and splashing water may be present. Alternatively, IP20 rated models are also available for the Microdrive Elite Series.

Ensure the correct model was specified for the intended environment. For detailed dimensional drawings, refer to Figures 3.1 to Figure 3.3.

An electrical overview is shown in Figure 3.4.

Full details of mounting are provided in the Elite Series Getting Started Manual, Part No. 4201-179.

![Diagram of Elite Series Hardware Dimensions](https://example.com/diagram.png)

### Table of Dimensions

<table>
<thead>
<tr>
<th>MODEL</th>
<th>H (mm/ins)</th>
<th>W (mm/ins)</th>
<th>D (mm/ins)</th>
<th>Weight (kg/lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRAME 1 &amp; 2</td>
<td>430 (17)</td>
<td>199 (5.5)</td>
<td>262 (10.3)</td>
<td>10-14 (22-31)</td>
</tr>
<tr>
<td>FRAME 3</td>
<td>430 (17)</td>
<td>279 (11)</td>
<td>262 (10.3)</td>
<td>27 (60)</td>
</tr>
</tbody>
</table>

*Figure 3.1: Microdrive Elite Series Dimensions*
<table>
<thead>
<tr>
<th>MODELS</th>
<th>Net Weight kg (lbs)</th>
<th>Packaged Weight kg (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UE-60, UE-75</td>
<td>73.5 (162.04)</td>
<td>90 (198.42)</td>
</tr>
<tr>
<td>UE-90</td>
<td>77.5 (170.86)</td>
<td>94 (207.24)</td>
</tr>
<tr>
<td>UE-115, UE-140</td>
<td>80.5 (177.47)</td>
<td>97 (213.85)</td>
</tr>
</tbody>
</table>

Figure 3.2: Ultradrive Elite Frame 4 Dimensions
3.1.2 Power Conversion

Key electrical circuit elements of the Elite Series range are shown in Figure 3.5.

AC power is fed to the Elite Series input via external input fuses. Here it is rectified to DC, filtered by chokes and capacitors and reconverted ("inverted") to AC current at the appropriate frequency, phase and voltage to supply the motor.

DC bus terminals are provided for connection of dynamic braking modules or direct supply from a DC source (external soft charge needed for DC supply).

<table>
<thead>
<tr>
<th>500V MODELS</th>
<th>400V MODELS</th>
<th>W (mm)</th>
<th>Net Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UE-170D</td>
<td>UE-170</td>
<td>545</td>
<td>160 (353)</td>
</tr>
<tr>
<td>UE-205D</td>
<td>UE-210</td>
<td>545</td>
<td>160 (353)</td>
</tr>
<tr>
<td>UE-250D</td>
<td>UE-250</td>
<td>545</td>
<td>175 (386)</td>
</tr>
<tr>
<td>UE-305D</td>
<td>UE-305</td>
<td>965</td>
<td>320 (668)</td>
</tr>
<tr>
<td>UE-340D</td>
<td>UE-340</td>
<td>965</td>
<td>320 (668)</td>
</tr>
<tr>
<td>UE-420D</td>
<td>UE-420</td>
<td>965</td>
<td>350 (734)</td>
</tr>
<tr>
<td>UE-480D</td>
<td>UE-480</td>
<td>965</td>
<td>350 (734)</td>
</tr>
<tr>
<td>UE-575D</td>
<td>UE-575</td>
<td>1385</td>
<td>525 (1005)</td>
</tr>
<tr>
<td>UE-660D</td>
<td>UE-660</td>
<td>1385</td>
<td>525 (1005)</td>
</tr>
</tbody>
</table>

All dimensions in millimetres and (inches)

3.1.3 Control Board

The control processor (control board) is supplied from the DC bus via a DC to DC converter. In this way the control system uses the DC bus to provide brief energy storage to achieve significant immunity to small mains supply interruptions or variations. Provision is made for energising of the control board from an external power supply.

A Display Unit (3 LEDs, 16 x 2 character alphanumeric display, 3 keys, and START and STOP-RESET push-buttons) provides the primary user interface to the Elite Series. Detail follows in Section 3.1.4. The Elite Series can be configured from this Display Unit. Alternatively custom configuration can be achieved by use of the external PDL Vysta® for Windows software package, on a PC running Microsoft Windows.

The push-buttons can be configured to be inactive, or to provide stand-alone START/STOP-RESET control.

Analogue and digital inputs and outputs are provided as detailed in Section 3.1.5. More details can be found in the Elite Series Getting Started Manual, Part No. 4201-179.
Figure 3.4: Elite Series Electrical Overview
Figure 3.5a: Power Electronics - Microdrive Elite Frames 1 & 2

Figure 3.5b: Power Electronics - Microdrive Elite Frame 3

Figure 3.5c: Power Electronics - Ultradrive Elite Frame 4

Figure 3.5d: Power Electronics - Ultradrive Elite Frames 5 to 7
3.1.4 The Display Unit and Controls

The Display Unit of the Elite Series may be removed from the front of the unit, and refitted in any orientation, or mounted remotely from the unit (up to three metres away). The display is in an IP54 enclosure, thus is protected against ingress of dust and moisture.

The following descriptions refer to Figure 3.6.

THE LED INDICATORS

- **ON** Indicates mains power is supplied to the Elite Series Display.
- **RUN** Indicates the Elite Series is running (driving a motor).
- **OK Steady:** Indicates that the Elite Series is operating normally.
- **OK Flashing:** Indicates that the Elite Series has tripped on fault protection.

THE LCD DISPLAY

The Elite Series has a sixteen character by two line (16x2) LCD display.

The lines each have different functions:

- The **STATUS LINE** is always present and shows the Elite Series status, the output current or torque and the motor speed.
- The **CONTROL LINE** of the display is used to view and/or adjust the many parameters of the Elite Series.

THE CONTROL KEYS

The “+” and “−” keys are used to scroll between screen groups. The “+” key can be used to unfold a screen group, then the “−” or “+” keys used to adjust the parameter or mode on display on the control line. Refer to Section 7 of this manual for full details of screen organisation and control.

THE START AND STOP-RESET PUSH-BUTTONS

These push-buttons may be configured to enable starting and stopping of the motor from the display unit if required, and also to reset the Elite Series in the event of a fault trip.

Alternatively, the START push-button can be configured to be in parallel with an external START switch, and the STOP-RESET push-button in series with an external STOP-RESET switch.

Details on configuring these push-buttons are given in Section 9 of this manual.

SCREEN ORGANISATION

Screens can be arranged in folded format. Each screen group has a main screen with the group identifying letter and description. Folded under this main Screen can be a number of subscreens, each of which has a single parameter or mode for viewing or adjustment. These subscreens cannot be viewed until unfolded using the “+” key. The entire set of screens is known as a Screen List.

Once unfolded, some subscreens in a Screen List have a numerical parameter which may be adjusted. Others may have a list of options, with each option separately viewable and selectable.

Each screen or subscreen has a viewing attribute. This attribute defines if the screen is “read only”, “read–write” or “hidden”.

Note that the main screen or subscreen will be visible only if its attribute is configured to be “read” or “read-write”. If a screen is configured as “hidden” it will only be visible when the Elite Series is in “commissioning” mode.

Details on controlling these screens and adjusting parameters and modes are given in Section 7 of this manual.

Full details of the Screen List are given in Section 9 of this manual.

CUSTOMISATION OF CONFIGURATION

The Elite Series Control Board processor has a number of logic and processing blocks integrated into the firmware. These can be configured using PDL VYSTA® for Windows to enhance the existing default configuration, or for configuring a completely new control system. These blocks include logic gates, counters, timers, analogue signal processors, PID controllers, inputs and outputs.

To suit any custom configuration, a custom Screen List can also be designed. This Screen List may be a modified version, or a foreign language version, of the default Screen List provided.

More details on customisation of control are given in Section 8 of this manual.

SECURITY PROTECTION

For reasons of security, the Elite Series must be in commissioning mode (Screen Z) before certain adjustments can be made. Some adjustments also cannot be made unless the Elite Series is in a OFF state (this is for safety reasons).

If commissioning mode is enabled, any user can adjust all settings and configurations. To enable this mode, scroll to Screen Z, and enter the correct password. Further details are given in Section 9 of this manual.

3.1.5 Control Inputs and Outputs

Figure 3.7 provides the complete electrical specification of all Elite Series control inputs and outputs. Each input and output is individually described below. Further information (including specific examples of connection) is presented in the detailed descriptions of the relevant control screens.
For further connection information to these terminals, refer to Elite Series Getting Started Manual, Part No. 4201-179.

**Terminals T1 to T7 - Configurable Relay Outputs**

These are low power relay contacts offering operation at signal or 250Vac levels (referenced to the protective earth - PE). Selection of their function is made through Screen Group O. Avoid settings which cause the relays to switch excessively as this will reduce their life expectancy. The software places a 250ms minimum pulse width to prevent relay chatter.

**Terminals T8, T9 - Dynamic Brake Control**

If a dynamic brake is to be installed in conjunction with the Elite Series, it can be controlled from these terminals. For drives up to and including ME-22.5, these terminals will be internally connected to the inbuilt dynamic brake transistor. Dynamic brake resistor thermal protection can be configured from Screen Group D.

**Terminal T10 to T12 - Display Unit**

The connections to the Display Unit are made via these terminals. The Display Unit may be removed from its position within the drive and be mounted remotely. The maximum allowable length of wiring is 3 metres.

**Terminals T13 to T18 - Multi-function Inputs**

The function of these inputs can be programmed from the keyboard, from Screen Group I. Alternatively they can be customised via the PDL Vysta® for Windows software running on a personal computer.

Their operating format may be set for active high or active low. These inputs are factory preset for active high operation (that is, they are internally connected to bias low). Sampling rate: 4ms.

**Terminal T19 - External trip/Motor PTC**

This is a digital input committed to causing a protective trip should the resistance between this terminal and the selected common exceed 2.1kOhms. This is characterised for a set of standard motor PTC thermistors. The operating mode of the input can be changed between active high and active low. Opening this circuit will always trip the Elite Series, removing power from the motor. Open this circuit in the event of a “loss of control” situation. Sampling rate: 4ms.

**Terminals T20, T21 - Input Switch 0V & +24Vdc Connections**

These terminals provide a return point for the seven digital inputs connected to terminals T13 to T19. If active high is selected, the common points of the switches connect to Terminal T21. If active low is selected, the common points of the switches connect to Terminal T20.

**Terminal T22 - Analogue Output 0V Connection**

This 0V is a suitable return point for the two analogue outputs connected to Terminals T23, T24. This ground is internally linked to the other control grounds with the exception of T40.

**Terminals T23, T24 - Configurable Analogue Outputs**

These two analogue outputs may have their formats and sources configured. Formats can be 0 to 10Vdc, -10 to +10Vdc; 5mA max or 0 to 20mA or 4 to 20mA. Configuration is done from Screen Group O. Accuracy: ± 2%; Resolution: 8 bits.

**Terminal T25 - Analogue Input 0V Connection**

This 0V connection is a suitable return point for the two analogue outputs connected to Terminals T26, T27. This ground is internally linked to the other control grounds with the exception of T40.

**Terminals T26, T27 - Analogue Inputs**

These inputs are configurable as to their function, also their formats and scaling may be set. Formats can be 0 to 10Vdc, -10 to +10Vdc, 0 to 20mA or 4 to 20mA. Configuration is done from Screen Group I. Accuracy: ± 2%; Resolution: 10 bits.

**Terminals T28, T29 - Potentiometer Supply**

A 10mA constant current source provides up to 10Vdc for a 1k Ohm potentiometer.

**Terminals T30 - +5Vdc**

This terminal is provided for the encoder power supply. Maximum load is 100mA.
T13. Terminals T31 to T34 - Incremental Quadrature Encoder Inputs

The Elite Series is designed to accept input from a standard quadrature encoder designed to operate from +5Vdc to 24Vdc and having single ended open collector outputs, push-pull open collector outputs, or differential logic driver outputs. This encoder is only required if operating in Closed Loop Vector control mode. The encoder type and pulses per revolution may be configured from Screen Group N.

Terminal T35 - Encoder 0V

This terminal is provided for the encoder power supply 0V return. This ground is internally linked to the other control grounds with the exception of T40.

Terminals T36, T37 - User 24Vdc In/out, 0V

These are provided for powering of user controls, encoder power supply or for back feeding a backup power supply to energise the control board in the event of mains failure. This output is fuse protected.

Maximum output current capability: 500mA
Minimum input current capacity of backup supply: 1A.
Backup supply voltage: 24Vdc ±10%

Terminals T38 to T42 - RS232 / RS485 Connections

These terminals are provided for serial communications connections, for control, monitoring or configuration from a PC or other remote host. These terminals are optically isolated from the Elite Series potential.

IMPORTANT NOTES REGARDING RELIABILITY OF CONTROL CIRCUITS

Screening

Screening - it is essential that all control inputs and analogue outputs are screened. There are no exceptions if you expect reliability!

Cable Separation

Do not run control signals together with power input or output cables to the motor - space at least 300mm away, and cross at right angles.

Relay Signals

Output relay signals do need to be screened. If power switching, do not include output relay signals in the same screened cable with control signals. Do not overload relays.

Switch Inputs

Switch (multifunction) Input circuits are designed for 24Vdc operation. Do not apply any other voltage.

Earting of Control 0V

To comply with the requirement of a Class 1 earthing system, the Elite Series control 0V must be linked to earth at some point. Connection of multiple earth points may cause earth loops and should be avoided. An earth link is provided, and must be removed if not required. Removal will allow the 0V point to float up to ±50Vdc (30Vac) from chassis earth.

More comprehensive connection information is given in the Elite Series Getting Started Manual (PDL Part No. 4201-179).

3.2 DESCRIPTION OF THE ELITE SERIES CONTROL SYSTEM

3.2.1 Structure of the Inputs and Outputs

The following descriptions refer to Figure 3.8.

ANALOGUE INPUTS

Two analogue inputs are provided. The format and scaling of these inputs are configurable from the front panel.

The format of each is configurable by Screens I6a, I6d, I6f.

ANALOGUE OUTPUTS

Potentiometer Supply - A 11mA constant current source provides 10V to a 1kOhm potentiometer.

Relay Outputs - Each of three relay outputs may be controlled from a large number of sources using Screens O2a, O2c, O2e. Each may be individually inverted. RLY1 is of changeover configuration, RLY2 and RLY3 have normally open contacts.

Analogue Outputs - Each of the two analogue outputs can have its source, format and scaling configured from the
display unit. Each analogue output can have its format configured, with a choice of 0 to 10Vdc (unipolar), –10 to +10Vdc (bipolar), 0 to 20mA or 4 to 20mA using Screens O1a to O1h.

COMPARATOR
Comparator -Two software comparators allow relay outputs to respond to analogue levels. The comparators may be individually selected to any analogue output source. Individual ON and OFF levels may be set. A window function may also be selected. Configuration is by Screens C1 to C6.

SWITCH INPUTS - MULTI-FUNCTION INPUTS
Switch Inputs - Six switch inputs are provided. These inputs set digital levels and are collectively known as Multi-function Inputs (MFI).

The multi-function inputs are factory set from the Display Unit to bias low for active high switching, which is considered to be a “fail-safe” mode. Alternatively the inputs may be set for active low switching using Screen I7b.

The six multi-function inputs perform control functions according to the input mode selected on Screen I7a. When certain modes are selected the function of some (or all) of the inputs may be individually programmed to act as one of a wide range of possible controls, by use of Screens I7c to I7h.

The switch inputs are processed together with keyboard controls (and set point references - multi-references) to provide a number of internal digital controls as well as the control of two analogue reference signals (motorised potentiometer and multi-reference).

3.2.2 Structure of the Motor Control System
Referring to Figure 3.9, unless the Elite Series is operating in V/Hz mode, the structure of the Elite Series control system may be considered as a torque controller, (the flux vector control system), the input of which selects either a speed referencing or torque referencing processor. This torque controller may be operated with a shaft encoder mounted on the motor for the best response and low speed operation. Alternatively it may be used without an encoder (Open Loop Mode control mode) for less critical applications.

THE FLUX VECTOR (TORQUE) CONTROLLER
Unlike conventional AC motor speed controllers, the Elite Series is primarily a torque control system. The flux vector control method requires complete knowledge of motor parameters, together with feedback of the rotor shaft speed. A high resolution encoder fixed to the motor shaft directly feeds back accurate indication of motor speed. This is scaled according to the pulse per revolution rating of the encoder (typically 2000 ppr) and the motor rated speed. The encoder additionally feeds back speed to the speed control loop, and overspeed protection override.

To ensure accurate operation, all the motor and shaft encoder parameters must be entered using the N screen group. Also vector loop tuning parameters (the X screens) must also be entered. The X screens can most easily be set up by using the autotuning facilities available (Screen X2).

Open Loop mode operation is also available, where a motor shaft encoder is not used. A reduction in performance may be expected when running in this mode. Torque control is not available when operating in Open loop Mode.

The source of the torque demand reference is selected according to the desired (speed or torque) operating mode. The torque reference is subject to overspeed limits set on Screens L2 and L3, and minimum and maximum torque limits set on Screens L4 and L5.

Additionally a special torque limit (L8 MAX REGEN) is provided which controls the maximum level of regenerated power.

TORQUE REFERENCE PROCESSING
The torque set point may be selected from eight possible torque references. Additionally a second alternative reference selection may be made. The chosen torque set point may optionally be inverted. Minimum and maximum torque limits are provided. An optional torque filter completes the processing. The torque set point is then routed to the flux vector controller source selector.

SPEED REFERENCE PROCESSING
The speed set point may be selected from eight possible sources. Additionally a second alternative reference selection may be made. The chosen speed reference may optionally be inverted. At this point the speed set point may be overridden by fixed speed demands such as inch references.

Minimum and maximum speed limits are provided followed by Skip speeds (set by Screens L10 to L12) to allow the user to avoid mechanical resonances. The speed set point is then processed by the acceleration, deceleration and speed filter controls according to various rate (R) screen settings.

As the flux vector controller is a torque control system, the speed control signal cannot be applied directly to the vector controller. Instead it must be applied to a speed feedback loop, the output of which is a torque demand. Thus, the speed set point is finally applied to a PID speed controller. The set point is compared to the actual speed, fed back from the shaft speed encoder. The resulting torque command signal is routed to the flux vector controller source selector.

PROCESS CONTROL
The inclusion of a full three term PID regulator allows the Elite Series to perform process control (e.g., constant pressure pumping etc.). External auto/manual selection is also available to assist during start-up conditions. Refer to Figure 3.10.
Figure 3.9: Structure of the Elite Series Motor Control System
Figure 3.10: Process Control
4 APPLICATION RECOMMENDATIONS

4.1 THE MOTOR

4.1.1 Sizing the Motor and Elite Series

The Elite Series is suitable for controlling all standard three phase induction motors. In sizing the Elite Series, the torque requirements of the load must first be assessed. Under flux vector control conventional induction motors are able to provide at least 200% of rated torque (often 250%). Choose a motor capable of supplying the required torque and an Elite Series capable of supplying the motor’s current requirements.

In applications requiring high peak torques, the Elite Series is required to supply current approximately in proportion to the torque. The Elite Series should be chosen according to its short term overload limit of 150% (30 seconds).

Note: Figure 4.1 is presented as a guide only, refer to Figure 2.1 for the 400V ratings and Figure 2.2 for the exact ratings of the 500V models.

4.1.2 Operation Above Motor Rated Speed

The Elite Series can be operated above motor rated speed in V/Hz and closed loop mode only, however the torque that is able to be generated declines (1/f) as there is insufficient voltage to provide correct stator flux. The torque response also reduces significantly in this mode of operation for the same reasons.

Check that the motor is suitable for operation above rated speed. Consult the motor manufacturer.

A popular solution to achieve a wider speed range is to reconfigure the motor for lower voltage operation (e.g., connect a 400Vac star motor as a 230Vac delta, or specially wind the motor). Full performance is achieved at increased speeds (until the supply voltage is reached), at the penalty of increased motor current.

4.1.3 Operation of More Than One Motor

When running the Elite Series in Open or Closed Loop mode, operation of more than one motor from the Elite Series is generally impractical. In certain applications utilising identical motors with identical loads (e.g., load sharing or mechanically locked) connection of more than one motor may be possible.

When running the Elite Series in V/Hz Mode, it is possible to run more than one motor in parallel off one Elite Series. If running parallel motors, the rating of the Elite Series should exceed the sum of the individual motor currents. Each motor will require individual thermal protection. Performance will be reduced.

4.1.4 Thermal Protection of the Motor

The Elite Series maintains a thermal model of the motor as its primary means of detecting overload and providing protection. Nevertheless the use of a temperature protecting PTC embedded in the motor windings provides ultimate protection and is recommended. The thermal model will not
be effective if the Elite Series is running more than one motor.

4.1.5 Large Frame-size Motor Considerations

Large frame-size motors (typically greater than 315 frame) have additional installation requirements when used with AC motor controllers. These motors may exhibit rotor voltage build-up due to parasitic capacitance. Unless protective measures are taken, this voltage may discharge through the anti-friction bearings possibly leading to degradation of the bearing via electrical discharge machining (EDM).

The preferred solution is to fit insulated bearings (or an insulated bearing housing) with a rotor earthing brush. Careful selection of the rotor earthing brush is required, as this brush must provide a low impedance earth for high frequency pulses. Rotor shaft earthing brushes are now commercially available to suit this low voltage, low current application. These brush systems are designed for long life with minimal maintenance. Contact PDL Electronic or its agent for further information on suitable earthing brushes. An alternative solution is available from PDL Electronics in the form of PDL’s EDM Filter. The EDM filters out the common mode voltage applied to the motor. Contact PDL Electronics or its agent for further information on the EDM Filter.

4.2 THE ENCODER

4.2.1 Choice of Encoder

If the Elite Series is to be used in Closed Loop Vector control mode, a shaft encoder will need to be connected to the motor. A specification for a suitable encoder for a 50 or 60Hz motor is:

Encoder type:
Incremental, quadrature (bi-phase), differential or single-ended output. Push-pull output preferred to maximise range.

Recommended ppr:
1000 to 2000 ppr per motor pole pair, for directly driven encoder

Minimum ppr:
500 ppr per motor pole pair (4 pole motor = 1000 ppr)

Supply requirement:
5Vdc, 100mA maximum

The shaft encoder should be fitted directly to the motor (using a flexible coupling) or indirectly via a toothed (zero slip) belt drive or similar. There must be zero slip or backlash, and high shaft loads or loose coupling motions must be avoided.

The encoder MUST be connected using shielded twisted cable. The shield should be earthed at the Elite Series end only, to avoid the possibility of earth loops. The maximum cable length is inversely proportional to the required maximum pulse rate. A push-pull output encoder gives a better range than a single ended open collector type, and is recommended for cable runs exceeding 30 metres. If using an open collector type of encoder, when wired with typical shielded cable with capacitance of 200pF/metre, the product of cable length (metres) x max. frequency (kHz) should not exceed 1500.

A differential output encoder has a high common-mode noise rejection capability, thus is recommended for electrically noisy environments. The encoder inputs to the Elite Series will also accept input pulses from an encoder operating off a supply up to 24Vdc.

4.2.2 Connection of the Encoder

The encoder orientation shown in the drawings in this manual (i.e., the connection of the A and B outputs) assumes the encoder is to be connected directly to the non-drive end (non-shaft end) of the motor and that motor wiring orientation is normal (motor terminals U1, V1 and W1 are connected to Elite Series terminals U, V, W, respectively). In this case, an increasing count (Screen Z9) should correspond to rotation in the positive direction (motor shaft rotates clockwise when the motor is viewed from the drive end), in response to a positive speed reference.

If the encoder direction is inverted (e.g., by mounting at the drive end or using an inverting belt coupling), A and B, or for a differential encoder, A and A signals should be swapped. Refer Figure 5.4.

4.3 SWITCHING

4.3.1 Power Switching

Generally it is better practice to leave electronic equipment (including the Elite Series) permanently connected to the mains supply. Switching the mains on and off to control the Elite Series is bad practice and should be avoided (use the control terminals). Mains switching must not occur more often than once every five minutes to avoid overheating the charging circuits.

4.3.2 Motor Switching

Because the Elite Series acts as a variable frequency (including DC) current source :-

WARNING: Motor isolation MUST NOT BE OPENED while the Elite Series is running.

Although the Elite Series will not be damaged, standard industrial switchgear (AC1 or AC3) is not designed to operate at or near DC conditions, and there is great danger of damage or fire due to arcing under these conditions.

4.4 TORQUE AND SPEED CONTROL MODES

4.4.1 Torque Control Mode

Unlike conventional AC motor speed controllers, the Elite Series is primarily a torque controlling device. When used in Closed Loop Vector torque mode, a reference torque demand signal sets the output torque level which the Elite Series will try to achieve from the motor. This level may be positive or negative and is quite independent of the motor speed (within speed limits). Web control systems which require constant tension applied to the web, regardless of speed, are a typical torque control application.

While in torque mode, speed limits are used to limit overspeed such as may occur from temporary loss of load (e.g., a web break in the above example). The speed reference signal is disregarded while in torque control mode.
To run in torque control mode, it is necessary to employ Closed Loop Vector control mode and use a shaft encoder on the motor.

### 4.4.2 Speed Control Mode

In Open Loop or Closed Loop vector mode PID settings are used to adjust the response of the speed control loop. Apart from this, speed control is implemented and settings made in a similar way to conventional AC drives.

A reference speed control signal sets the output speed which the Elite Series will try to achieve at the motor. The direction may be positive or negative, and is independent of load torque (within torque limits).

While in speed control mode, torque limits are used to limit over-torque such as may occur due to process changes or fault conditions.

For best performance in speed control mode, employ Closed Loop Vector control mode and use a shaft encoder on the motor. This gives improved speed regulation, faster dynamic response, and full torque capability at zero speed.

If such high performance is not required, Open Loop Mode or V/Hz control mode may be employed. In these modes a shaft encoder on the motor is not necessary.

### 4.4.3 Switching Between Torque and Speed Control Modes

When switched, transition from torque control mode to speed control mode and the inverse, is achieved without discontinuity (i.e., smoothly). **Torque Control mode may only be selected** when the Elite Series is used in Closed Loop Vector control mode.

### 4.5 DYNAMIC BRAKING

Regeneration is achieved through the motor being driven by the load (e.g., lowering crane hoists or rapid deceleration of high inertia loads). While being driven, the motor acts as a generator and energy is transferred back into the DC bus capacitors of the Elite Series. In its standard form the Elite Series can only dissipate this energy as losses and so can only provide limited braking of 5-10%.

Where higher levels of braking are needed, an additional dynamic brake module must be fitted. Dynamic brakes are controlled power switches which are used to dump energy from the DC bus into resistive loads. Generally such brakes and resistors must be sized to suit the requirements of the application according to considerations of both peak and continuous power dissipation requirements. Refer to the supplier for more information regarding specific dynamic brake modules, or to the dynamic brake manual if already supplied.

The Elite Series frame 1 to 2 models have a dynamic brake transistor built into the unit. Simply connect the appropriately sized resistor between the positive DC bus terminal “+” and the dynamic brake resistor terminal “B”.

<table>
<thead>
<tr>
<th>ELITE SERIES</th>
<th>DB RESISTOR MINIMUM (Ohms)</th>
<th>DB RESISTOR POWER RATING (MIN-kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME-2.5</td>
<td>500</td>
<td>1.1</td>
</tr>
<tr>
<td>ME-2D</td>
<td>500</td>
<td>1.4</td>
</tr>
<tr>
<td>ME-6.5</td>
<td>180</td>
<td>3</td>
</tr>
<tr>
<td>ME-6D</td>
<td>180</td>
<td>3.8</td>
</tr>
<tr>
<td>ME-10.5</td>
<td>130</td>
<td>4</td>
</tr>
<tr>
<td>ME-9D</td>
<td>130</td>
<td>5.3</td>
</tr>
<tr>
<td>ME-12</td>
<td>100</td>
<td>5.3</td>
</tr>
<tr>
<td>ME-11D</td>
<td>100</td>
<td>6.7</td>
</tr>
<tr>
<td>ME-18</td>
<td>50</td>
<td>10.6</td>
</tr>
<tr>
<td>ME-16D</td>
<td>50</td>
<td>13.5</td>
</tr>
<tr>
<td>ME-22.5</td>
<td>50</td>
<td>10.6</td>
</tr>
<tr>
<td>ME-21D</td>
<td>50</td>
<td>13.5</td>
</tr>
</tbody>
</table>

Figure 4.3: Dynamic Brake Resistor Ratings (Typical)

For application advice on resistor sizing and cabling requirements please request assistance from PDL Electronics or its agent.

### Dynamic Brake Resistor Wiring

Due to the high voltage switching and the currents involved, special wiring practices must be observed when connecting the dynamic brake resistor.

For the dynamic brake resistor connection a multicore cable with screen is recommended. Alternatively, two separate cables securely tied together at 200mm intervals without gaps between the cables may be used. This minimises the cable inductance. Keep the cable length to a minimum to reduce overall cable inductance.

The resistor bank MUST be of non-inductive construction.

Do observe normal wiring practices of separating control and power cables.

The dynamic brake resistor cable must have sufficient dielectric strength to withstand 1000 Vdc (conductor to conductor rating for multicore cables).

On the Elite Series, set Screen D1 (DB Time Constant) to the time it would take to reach 64% of the resistor’s final temperature if continuously energised.

Set Screen D2 (DB Duty) to the average percentage of time that the resistor may be operated for.
5 UNPACKING, INSTALLATION AND CONNECTION

5.1 UNPACKING

Full details on the unpacking procedure are given in the Elite Series Getting Started Manual (Part No. 4201-179). Ensure that all of the listed items are supplied, and that there is no visible damage. The packaging material must be disposed of thoughtfully.

5.2 INSTALLATION

Full details on the installation of the Elite Series are given in the Elite Series Getting Started Manual (Part No. 4201-179).

The Elite Series IP54 models are protected against an environment contaminated to pollution degree 2 (damp or dusty air). The IP20 models should be situated in an environment not exceeding pollution degree 1. The Elite Series can handle an ambient air temperature not exceeding 50°C. However the cleaner and cooler the environment, the longer the lifetime that can be expected from the unit. If used in an ambient temperature not exceeding 40°C, the Elite Series may have its output current re-rated according to Figure 2.1 (125% for Elite frame sizes 1 to 4, 110% for Elite frame sizes 5 to 7) for motor speeds exceeding 25Hz. This is useful for pump and fan applications with quadratic torque requirements.

The Microdrive Elite Series range is designed for wall mounting, either vertical upright, vertical inverted, with back or side to the wall.

The Ultradrive Elite Series frame 4 is designed for wall mounting (vertical upright). Do not Invert.

The Ultradrive Elite Series frames 5 to 7 are designed for floor mounting only (vertical upright). Secure using the wall supports for earthquake protection.

The IP20 Elite Series must be protected against electrically conductive (wet or dry) dust (e.g., carbon, fibre, salt, etc.) and free of spraying water. As with all electronic equipment, the cleaner, cooler and more vibration free environment, the longer and more trouble free will be the life of the Elite Series AC Motor Controller.

If the environment cannot be guaranteed to the pollution degree 1 or less, then the IP20 Elite Series must be mounted inside an IP54 or equivalent enclosure. The enclosure must be such that the interior air temperature does not exceed 50°C while the Elite Series is operating at normal levels.

<table>
<thead>
<tr>
<th>Frame</th>
<th>380-440V Models (note 1)</th>
<th>440-500V Models (note 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ME-2.5 to ME-12</td>
<td>ME-2D to ME-11D</td>
</tr>
<tr>
<td>2</td>
<td>ME-18 to ME-22.5</td>
<td>ME-16D to ME-21D</td>
</tr>
<tr>
<td>3</td>
<td>ME-31 to ME-46</td>
<td>ME-30D to ME-41D</td>
</tr>
<tr>
<td>4</td>
<td>UE-60 to UE-140</td>
<td>UE-60D to UE-140D</td>
</tr>
<tr>
<td>5</td>
<td>UE-170 to UE-250</td>
<td>UE-170D to UE-250D</td>
</tr>
<tr>
<td>6</td>
<td>UE-305 to UE-480</td>
<td>UE-305D to UE-540D</td>
</tr>
<tr>
<td>7</td>
<td>UE-575 to UE-660</td>
<td>UE-620D to UE-700D</td>
</tr>
</tbody>
</table>

Note 1: Frames 1-4 are also available to suit a 230Vac (-20%10%) supply
Note 2: Frames 1-4 are UL/cUL approved to 480Vac

5.3 MANUFACTURER'S RECOMMENDATIONS

Failure to adhere to the manufacturer's recommendations for installation, environmental conditions and electrical specifications may result in damage to the Elite Series (and/or external equipment) and may void the warranty.

5.4 POWER WIRING CONNECTIONS

Full electrical connection details are given in the Elite Series Getting Started Manual (Part No. 4201-179).

Figure 5.2 provides a summary of required power connections. Note the following requirements:

1 The Elite Series is designed for operation from a three phase earthed neutral supply. Input fuses are required. Details of the recommended fuse size are given in Figure 5.3. In all cases, observe all site, local and national wiring and safety regulations.

2 Power factor capacitors are not required on the Elite Series input, and must not be connected to the Elite Series output.

3 An off load isolation switch or contactor may be fitted to the Elite Series output. Never attempt to operate this switch under load. Never open a contactor on the output while the Elite Series is running as the Elite Series operates as a current source. Opening the output while running could cause extensive damage or fire in the switchgear.

4 The Microdrive Elite Series and Ultradrive Elite frame 4 are fitted with electromagnetic interference (EMI) filtering as standard. External supply side EMI filters are required for the Ultradrive Elite frames 5 to 7. To maximise the effectiveness of these filters, screened cable (minimum - neutral screen, steel conduit; preferred - copper tape and/or mesh) must be used on the Elite Series output. Bond the screen solidly to the Elite Series and motor chassis. Failure to use screened output cables may lead to disruption of other electronic equipment. The output cables should be run separately from the input cables, to reduce the chance of EMI cross-coupling between cables. Refer to Figures 5.5 to 5.7 for screen connection details.

5 The Elite Series protects the motor with an electronic overload, so an external overload relay is not necessary. Where multiple motors are attached, separate overload protection must be applied to each motor. The Elite Series or the motor must be isolated before operating on the motor terminals.

6 The Elite Series output switching voltage waveform can give rise to high (capacitive) earth leakage currents. Permanent earth connection of the motor and the Elite Series is essential before connection to the supply. Screened cable must be used between the Elite Series output and the motor to reduce the chances of radio frequency interference problems. A suitable cable is three phase neutral screened (minimum), with the screen wired as the earth return. Steel conduit may also be suitable.

7 For applications where regeneration is likely to occur, a dynamic brake resistor may be required. The resistor must be positioned where the expected heat
generated by it will not ignite or damage its surroundings.

8 The location and order of the power terminals varies from model to model. Refer to the terminals labels before connection. Figure 5.1 provides recommended tightening torques for the power terminals.

9 The 400V Elite series, frame sizes 5 to 7, are fitted with AC cooling fans. These fans are phase sequences sensitive. Please ensure the input phases have the correct phase rotation sequence.

10 The 500V Elite series, frame sizes 5 to 7, are fitted with UL approved DC cooling fans. These fans are powered from a DC power supply. The AC supply to the fan power supply transformer must be matched to the incoming supply voltage. Ensure that the phase to phase voltage of the incoming supply goes into the correct position on the Fan Supply terminal block. These drives are factory wired for 500V operation.

Mismatching the fan power supply and line voltage can lead to inefficient cooling, or fan damage.

To achieve full IP54 and UL Type 12 ingress protection rating, it is important to pass all external wiring through the gland plate supplied. Glands must be correctly fitted to the cables and the gland plate screws tightened to the recommended torque refer to the Elite Series Getting Started Manual (PDL Part No. 4201-179). Also once connections are made, ensure that the terminal cover is fitted correctly and all screws and locks tightened to the recommended torque.

<table>
<thead>
<tr>
<th>Model</th>
<th>Torque N.m (lbs.ins)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME frames 1 to 2</td>
<td>1.7 - 2.3 (15-20)</td>
</tr>
<tr>
<td>ME frame 3</td>
<td>10.2 - 12.4(90-110)</td>
</tr>
<tr>
<td>UE frame 4</td>
<td>M8 22 - 29 (195-257)</td>
</tr>
<tr>
<td></td>
<td>M10 43 - 56(381-496)</td>
</tr>
<tr>
<td>UE frames 5 to 7</td>
<td>43 - 56(381-496)</td>
</tr>
</tbody>
</table>

Figure 5.1: Elite Series Power Terminal tightening Torque

5.5 CONTROL WIRING CONNECTIONS

Control wiring should be done using screened cable. The screen is earthed at one end only (at the Elite Series end). For safety reasons, the Elite Series control 0V should be linked to earth at some point. Avoid connection of multiple 0V points to earth as this will cause earth loops.

Note that the control inputs and output are highly configurable, so the desired configuration should be planned and designed before attempting connections.

Communications connections can be made to the RS232 or RS485 ports.

Control wiring connections and recommendations are detailed in the Elite Series Getting Started Manual (Part No. 4201-179).

5.6 SHAFT ENCODER CONNECTIONS

If using the Elite Series in Closed Loop Mode a shaft encoder is required on the motor. Shaft encoder recommendations are detailed in Section 4.2 of this manual. Figure 5.4 details encoder connections. Refer to the Elite Series Getting Started Manual (PDL Part No. 4201-179) for details on achieving correct orientation of encoder and motor wiring.

5.7 FIBRE OPTIC CONNECTION

The fibre optic cable used can be any low cost plastic fibre with 1mm core diameter. The maximum recommended cable length is 50m at 50°C ambient. Note that if the fibre optic cable is located near power cables, the local ambient temperature may exceed 50°C. Signal attenuation increases with temperature thereby decreasing the maximum cable length for reliable communication.

Connection is made by cutting a suitable length using a knife (recommended) or side cutters, inserting through a rubber control cable grommet into the fibre optic port and screwing tight the connector. There is no need to strip back the sleeving of the fibre optic cable.

5.8 DYNAMIC BRAKE DETAILS

The possible need for dynamic braking is discussed in Section 4.5 of this manual. If a dynamic brake is required, the brake resistor must be mounted in a position where the expected heat generated by it will not ignite or damage its surroundings.

5.9 ANCILLARY EQUIPMENT

The Ultradrive Elite frames 5 to 7 has mounting points for small items of ancillary equipment. Do not drill additional holes in the Elite metalwork as swarf (metal filings etc) may short internal components leading to irreparable damage and danger to personnel.

5.10 COMMISSIONING DETAILS

Full information on the commissioning of the Elite Series are given in the Elite Series Getting Started Manual (Part No. 4201-179).
Figure 5.3: Shaft Encoder Connection Details

(a) DIFFERENTIAL ENCODER

(b) SINGLE-ENDED ENCODER

Figure 5.4: Microdrive Elite Series Cable Configuration
Figure 5.5: Ultradrive Elite Frame 4 Cable Configuration

Figure 5.6: Ultradrive Elite Frame 5 Cable Configuration
Figure 5.7: Ultradrive Elite Frame 6 Cable Configuration

Figure 5.8: Ultradrive Elite Frame 7 Cable Configuration
6 SERVICE AND MAINTENANCE

WARNING: Observe the safety precautions detailed at the beginning of this manual.

6.1 FAULT FINDING

Faults in the Elite Series will fall into one of five major categories:

• Failure of an external control device, e.g., switch or analogue input device.
• Protective fault operation with resulting display message.
• Incorrect settings, set up or adjustment resulting in unsatisfactory performance.
• Encoder failure.
• Electrical failure within the drive.

6.1.1 Electrical Failure

Electrical failure is rare but can occur in the power electronic circuits or in the control circuits. A problem with the power electronics will usually evidence itself as an input fuse failure, and subsequent loss of power to the Elite Series, or as a “Desaturation fault” or “Current Trip fault” which is persistent or can not be reset. Note that the desaturation fault indication also can be caused by wiring faults or load related problems. Often severe electrical faults will cause physical damage which must be checked for and corrected before any attempt is made to restart the Elite Series.

Electrical failure is generally not repairable by the user. Repair is achieved by returning the faulty unit to PDL Electronics or their authorised Service Agent. Before disconnection, try to record commissioning parameters either on paper or by uploading to a PC running PDL Drivecomm for Windows. If, due to the nature of the fault, you cannot power up the unit to do this recording, it may be possible to view the Control Board by back-feeding with 24Vdc. Refer to the Elite Series Getting Started Manual (4201-179) for instructions.

6.1.2 Protective Fault Operation

The Elite Series is designed to trip when a fault or user programmed trip function is detected. The fault message will be displayed on the LCD display. Refer to Section 6.2 for detailed descriptions.

6.1.3 Encoder Failure

The Elite Series cannot continue to operate in Closed Loop mode if the encoder signals are missing or excessively corrupted by noise. Should the signals be lost, the unit will indicate 0% speed. If the Elite Series is operating in speed control and the encoder signal is lost then the output frequency and shaft speed will drop to only a few percent and the unit will typically indicate torque or current limit.

If you cannot run the Elite Series above a certain speed in spite of a high speed reference signal, and torque limit is indicated at this speed, this may indicate that the encoder signals are becoming unreadable by the Control Board. The usual cause of this is excess encoder cable capacitance. This can be overcome by using a screened cable of lower capacitance per metre, using a shorter cable run, or by selecting a complementary output or differential output type shaft encoder. These types of encoder can drive a higher capacitance than a single-ended open collector type.

To check the encoder connection and function use V/Hz control mode (by setting Screen X1) and monitor the encoder Screen Z9.

6.1.4 Incorrect Set-up or Adjustment

Many problems will stem from an inappropriate configuration or mal-tuned control parameters.

Ensure the correct input mode and reference source is chosen and that the programmable input selections are appropriate. Note that some input modes are designed to operate in conjunction with other parameters and may be affected by the reference source selection.

In some instances the Elite Series may be unable to follow the prescribed control signals. This will be indicated by the various limit status indications (as seen on the Status Screen). The torque, speed, and regeneration limits (L screens) are user selectable within bounds and must be set to suit the application.

All the screens apart from those which define the motor ratings and vector control parameters (N and X screens) can be returned to the factory default settings using the Initialise User Parameters function in Screen Y2. The level of initialisation can be chosen. Refer to Section 9 of this manual for details. Use this feature if the set-up is unknown.

6.1.5 Poor Vector Control Tuning

If the parameters in the X and N screens are not correctly adjusted the Elite Series may operate erratically. Excessive current draw, vibration and motor noise, and the failure to accelerate indicate possible maladjustment. Generally if autotuning has been employed, this problem should not occur. Autotuning can be invoked from Screen X2. Full details on tuning options are given in the Elite Series Getting Started Manual (4201-179).

If when running in Closed Loop Vector control mode, the Elite Series output voltage is very sensitive to load torque and/or the torque reading is in error and does not correspond to the expected current (rated current at rated torque) then parameters X3a and X3c may be incorrect. If the Elite Series operates correctly in torque control mode but is unstable in speed control mode then the speed control parameters X4f, X4g, X4h and X5i may be mal-tuned.

All the X and N screens can be returned to the factory default settings using the Initialise Motor Parameters function (Screen Y2). Use this feature if the setup is unknown. Reinitialisation will cause a “ZERO PARAM” fault indication which can be reset only after the N nameplate parameters are reprogrammed.

6.1.6 Failure of External Control Device

A problem with the signal processing circuitry may cause erratic and possibly rough operation or cause the Elite Series to fail to respond to control signals. External wiring faults or incorrect setup can also stop the Elite Series responding to control signals in the desired manner. Therefore special provision has been made to simplify the checking of the incoming signals and input circuitry. Refer to Screens Z3 to Z12 for diagnostic information.

6.1.7 Failure of the Display Unit

Should the Elite Series fail to communicate with the Display Unit, the message NO COMMS will be displayed. This indicates that the 24Vdc supply to the Display Unit is functioning but invalid (or no) communications has been received by the Display Unit. Check the connection to the Display Unit from the Elite Series unit.
### 6.2 THE FAULT SCREEN

*(See also Status Messages, Screen AA)*

#### 6.2.1 Control of the Fault Screen

Fault messages are automatically displayed on the Fault Screen (Screen F).

There is a **fault log** folded as subscreens of the fault screen. This fault log records the previous five faults, with the first screen being the most recent fault. This fault log may be inspected at any time.

When a fault is cleared and the Elite Series is reset, the fault message will be moved to the first of the screens folded behind the fault screen. All existing messages on the fault log will be moved down one screen, with the oldest message being discarded. The fault message on the main fault screen will be replaced by **NO FAULT**.

#### 6.2.2 Fault Messages

Fault conditions, their interpretation and suggested remedies are listed below.

<table>
<thead>
<tr>
<th>Fault</th>
<th>Detail</th>
<th>Possible cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO FAULT</td>
<td>No fault detected</td>
<td>Normal operation</td>
<td>None required</td>
</tr>
<tr>
<td>LOW Vdc</td>
<td>Mains voltage has dropped too low (=LOW V TRIP - Screen S5).</td>
<td>Model dependant, Mains interruption, dip.</td>
<td>Check supply conditions. Disable Low Volts Trip (refer detailed description of Screen S7).</td>
</tr>
<tr>
<td>HIGH Vdc</td>
<td>DC bus voltage has risen to a dangerous level</td>
<td>Very high mains surge. Excessive regeneration from regenerative load or excessive deceleration rate (refer detailed description of Screen R2). Earth fault on motor.</td>
<td>Reduce deceleration rate. Check motor circuit for earth fault. Apply Speed Filter via Screen R7.</td>
</tr>
<tr>
<td>HI Vdc T/O</td>
<td>DC bus voltage has risen to a dangerous level</td>
<td>Mains too high for too long. Earth fault on motor.</td>
<td>Check mains supply voltage. Check motor circuit for earth fault.</td>
</tr>
<tr>
<td>SUPPLY FLT</td>
<td>Input supply phase voltage imbalance</td>
<td>40Vac ripple voltage in Elite Series DC bus. Phase imbalance is most sensitive under heavy load conditions. Under light load conditions, the Elite Series will run satisfactorily with only two phases connected.</td>
<td>Check supply conditions, check wiring to motor, check motor.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fault</th>
<th>Detail</th>
<th>Possible cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>S/W DL FLT</td>
<td>Incorrect software downloaded.</td>
<td>Data transmission error; incompatible software and hardware revisions.</td>
<td>Down load correct software.</td>
</tr>
<tr>
<td>EEPROM FLT</td>
<td>Nonvolatile memory (EEPROM) is faulty</td>
<td>IC failure</td>
<td>Seek service.</td>
</tr>
<tr>
<td>I LIM FLT</td>
<td>Output current has reached a dangerous level.</td>
<td>Short circuit; wiring fault; circuit fault; motor fault.</td>
<td>Check entire output circuit and motor for wiring or winding faults. Check output circuit contactors or isolators for correct operation.</td>
</tr>
<tr>
<td>U+ DESAT</td>
<td>The temperature calculated by the Elite Series inverter thermal model has reached a dangerous level.</td>
<td>220% of rated Elite Series current.</td>
<td>Check entire output circuit and motor for wiring or winding faults. Check output circuit contactors or isolators for correct operation.</td>
</tr>
<tr>
<td>V+ DESAT</td>
<td>The temperature calculated by the thermal model of the motor has reached a dangerous level.</td>
<td>110%</td>
<td>Check load requirements.</td>
</tr>
<tr>
<td>W+ DESAT</td>
<td>The temperature calculated by the Elite Series inverter thermal model has reached a dangerous level.</td>
<td>150% of rated Elite Series current for 30 seconds at 50°C. Maximum continuous operation possible without trip is 105% of Elite Series rating.</td>
<td>Check load and thermal model settings in Screens N1 and N6.</td>
</tr>
<tr>
<td>U– DESAT</td>
<td>The temperature calculated by the Elite Series inverter thermal model has reached a dangerous level.</td>
<td>Continuous overload of Elite Series.</td>
<td>Check load and thermal model settings in Screens N1 and N6.</td>
</tr>
</tbody>
</table>
Fault 17 BRAKE O/L
Detail The temperature calculated by the thermal model of the dynamic brake resistor has reached a dangerous level.
Sense level Set by dynamic brake thermal model in Screens D1 and D2.
Possible cause Excessive regeneration for the resistor specified in Screens D1 and D2. Incorrect values entered.
Action Check values (refer detailed descriptions of Screens D1 and D2). Reduce regeneration via Screen L8. Select a bigger braking resistor. Reduce deceleration rate (Screen R2).
Note: Active whether a dynamic brake is connected or not.

Fault 18 DATA FLT
Detail Nonvolatile memory (EEPROM) reading error. This fault can only be cleared using Screen Y2 to initialise user and motor settings. Be sure motor is isolated before resetting fault and entering correct data.
Sense level Check sum in memory
Possible cause Spurious fault; faulty memory.
Action If fault recurs, replace Elite Series.

Fault 19 ZERO PARAM
Detail Zero parameters (N screens) have been detected.
Possible cause Elite Series has been reinitialised; ex-factory state; error in set up.
Action Enter all N values correctly.

Fault 20 PARAM FLT
Detail Inconsistent set of parameters (N screens, L9 screen) selected.
Possible cause Error in set up; wrong values chosen.
Action Enter consistent set of N values.

Fault 21 GROUND FLT
Detail Excessive current flow to ground.
Sense level Internally set.
Possible cause Motor or cable insulation fault.
Action Check motor and cables (isolate from Elite Series first). Refer to Screen L13.

Fault 22 EXT/PTC
Detail External trip device has operated. External motor winding temperature sensor (PTC, thermostat etc.) circuit (Terminal T19) has operated.
Sense level Circuit resistance exceeds 4kOhms.
Possible cause Operation of external trip device; Motor has become too hot (motor load exceeds cooling capacity at the operating speed); Fault in sensor wiring.
Action Check motor temperature and sensor wiring. Check external trip switch (if fitted).

Fault 23 H/S TEMP
Detail Elite Series heatsink too hot.
Sense level 90°C.
Possible cause Poor ventilation; obstructed ventilation path, Elite Series cooling fan failure; local ambient temperature exceeds 50°C.
Action Check fan is operating; Check ventilation and thermal conditions. Improve cooling. Clean fins with compressed air. Seek service.

Fault 24 INT TEMP
Detail Elite Series internal temperature too hot.
Sense level 80°C.
Possible cause Poor ventilation; obstructed ventilation path, Elite Series cooling fan failure; local ambient temperature exceeds 50°C.
Action Check fan is operating; Check ventilation and thermal conditions. Improve cooling. Clean fins with compressed air. Seek service.

Fault 25 COMMS TRIP
Detail Host computer generated trip.
Sense level Trip generated by the host computer via serial communications.
Possible cause Serial communications wiring faults; host computer fault; incorrect settings on Screens H1 to H4.
Action Check complete serial communications system; Check screen settings, Seek Service.

Fault 26 COMMS T/O
Detail Time since last valid serial communication has exceeded timeout period on Screen H2.
Sense level Set by communications timeout value on Screen H2.
Possible cause Serial communications wiring faults; host computer fault; incorrect settings on Screens H1 to H4.
Action Check complete serial communications system; Check screen settings, Seek Service.

Fault 27 FIBRE T/O
Detail Time since last valid fibre optic input has exceeded timeout period on Screen I8d.
Sense level Set by Fibre T/O value on Screen I8d.
Possible cause Speed or torque reference (Screens I2 to I5) selected from fibre optic port with no fibre optic cable connected; fibre optic cable connected to fibre optic output port instead of input port; fibre optic cable fault.
Action Check fibre optic cable; Check screen settings, Seek Service.

Fault 28 OVERSPEED
Detail Maximum output speed has been exceeded.
Sense level 300% of motor rated frequency; absolute maximum 450Hz.
Possible cause Loss of control of the motor while being driven by load; excessive load.
Action Check actual operating conditions to determine cause. Adjust load or set up to eliminate problem.

Fault 29 TQ LIM T/O
Detail At torque limit for longer than specified.
Sense level Set by Screen L7.
Possible cause Load condition or inappropriate setting of Screen L7; encoder failure. Additional causes for this fault occurring during Open Loop mode starting are: Insufficient start torque (Screen X4c) Too high an acceleration rate (Screen R1, & R3), and Insufficient start delay (Screen S5). Another possible cause is the motor is overloaded while in Open Loop normal mode.
Action Check load condition or alter Screen L7. For Open Loop mode starting fault adjust any of the three screens mentioned above as follows: Increase start torque (Screen X4c). Decrease acceleration rate (Screen R1), Increase the torque limit (Screen L4 & L5). Increase Rs(Screen X3b)

Fault 30 SP LIM T/O
Detail At speed limit for longer than specified.
Sense level Set by Screen L6.
<table>
<thead>
<tr>
<th>Fault</th>
<th>Detail</th>
<th>Possible Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>31 CAL FLT</td>
<td>The system has not stopped within the timeout set by Screen S11</td>
<td>Parameters set incorrectly: Stop Timeout (Screen S11), Decel rates (Screen R2, R4, R6), Speed filter (R7), Mal-tuned speed pid in vector systems.</td>
<td>Check all parameters. Check Dynamic brake.</td>
</tr>
<tr>
<td>32 S/LW T/O</td>
<td>Internal timing requirements exceeded.</td>
<td>PDL Vysta® for Windows configuration too complex.</td>
<td></td>
</tr>
<tr>
<td>33 LVDC FLT</td>
<td>Failure of the low voltage dc power supplies.</td>
<td>Heatsink cooling fan failure, control PCB failure.</td>
<td>Seek service.</td>
</tr>
<tr>
<td>34 VYSTA TRIP</td>
<td>Custom configuration developed using PDL Vysta® for Windows has deliberately tripped the Elite Series.</td>
<td>Refer to custom configuration schematic.</td>
<td></td>
</tr>
<tr>
<td>35 NO DISPLAY</td>
<td>The Elite Series has detected that the display unit is disconnected or faulty. The Elite Series will trip on this fault only if the display unit is enabled via Screen I1 (I1 LOCAL S/STOP= 1,2,3).</td>
<td>Display removed by personnel; display mounted more than 3m distance from the Elite Series unit; faulty display unit.</td>
<td>Connect display unit and disable keyboard mode using Screen I1 (I1 LOCAL S/STOP=0); reduce distance, replace display unit.</td>
</tr>
<tr>
<td>36 EPLD TRIP</td>
<td>An unrecognised fault has been detected by the control board EPLD.</td>
<td>Power supply fault.</td>
<td>Reset fault; if fault persists, seek service or replace the Elite Series.</td>
</tr>
<tr>
<td>37 WATCHDOG</td>
<td>An unknown fault has reset the Control Board microcontroller.</td>
<td>PDL Vysta® for Windows configuration too complex.</td>
<td>Reset fault; if fault persists, seek service or replace the Elite Series; simplify PDL Vysta® for Windows configuration.</td>
</tr>
<tr>
<td>38 NO VYSTA PRG</td>
<td>User Program not set</td>
<td>Reload Program via Drivelink software</td>
<td></td>
</tr>
<tr>
<td>39 FIBRE TRIP</td>
<td>The Elite Series has tripped due to a fault being reported via the Fibre Optic Network</td>
<td>See other Elite Series connected to the network.</td>
<td>Reset fault on the other Elites</td>
</tr>
<tr>
<td>40 ILIMIT T/O</td>
<td>The hardware current limit has been active for longer than 30 seconds.</td>
<td>A partial short circuit in the cabling or motor.</td>
<td>Check cables and motor for possible short circuit.</td>
</tr>
</tbody>
</table>
## 6.3 USE OF LED INDICATORS

The LED indicators on the Display Unit provide visual indication of the unit's status as follows:

### LED ON
- **Functional indication:** Mains power is supplied and stored charge is present.
- **Actual indication:** +24V functioning on the Display Unit.
- **Implication:** Primary and secondary switchmodes functioning.

### LED RUN
- **Functional indication:** Elite Series is running.
- **Actual indication:** Output devices enabled.
- **Implication:** Elite Series is functional.

### LED OK (Steady)
- **Functional indication:** Elite Series is operating normally.
- **Actual indication:** Elite Series ready to operate.
- **Implication:** No fault is present.

### LED OK (Flashing)
- **Functional indication:** Fault trip.
- **Actual indication:** Output disabled.
A fault (Screen F) has tripped the Elite Series.

6.4 FUSE FAILURE

The Elite Series incorporates electronic protection. The few fuses included are for SAFETY back up.

Supply fuses

Fitted by customer at point of supply

Possible reason for failure
Wrong fuses; Supply surge; Age or cyclic stress failure; Fault in supply cable to Elite Series; Elite Series failure.

Action
Check supply cable; check Elite Series unit. Isolate Elite Series and replace fuses. If OK reconnect Elite Series and re-test. If failure persists replace Elite Series or request service.

+24Vdc User supply fuse (F1)

Fitted beneath the expansion board cover beneath the normal Display Unit position.

Possible reason for failure
Overload of the +24Vdc supply or low voltage supplies derived from +24Vdc. Faulty external equipment connected to the User +24Vdc supply. 230Vac accidentally connected to the +24Vdc input supply.

Action
Check external equipment connected to the +24Vdc supply. Replace fuse. If failure persists request service.

Microdrive Elite Series Supply fuses

These fuses must be fitted at the point of input termination to the Elite Series. Refer to Table 5.2 for recommended fuses. These fuses are fitted to limit fault energy let-through to protect cables and upstream switchgear.

Possible reason for failure
Wrong fuses; supply surge; age or cyclic stress failure; fault in supply cable to Elite Series; Elite Series failure.

Action
Check input cables and Elite Series for any signs of a fault. Isolate Elite Series and replace with correct fuses. Test. If OK, reconnect Elite Series and re-test. If failure persists replace Elite Series, or request service.

Ultradrive Elite frames 5 to 7

DC bus fuses

These fuses are fitted to limit fault energy and prevent damage to the Power PCB.

Possible reason for failure
Supply surge; age or cyclic stress failure; wrong fuses; fault in output cable to motor; Ultradrive Elite Series failure.

Action
Isolate Ultradrive Elite Series. Check output cables; check Ultradrive Elite Series; Unless confident fault found and cured, contact service agent. Replace fuses. Reconnect Ultradrive Elite Series and test. If failure persists replace Ultradrive Elite Series, or request service.

Ultradrive Elite frames 5 to 7

F1/F2 2A 440Vac SMPS DC Bus Fuses

Fitted on Ultradrive Elite frames 5 to 7 DC Fuse PCB to protect the Power PCB and DC bus cable loom to the Power PCB.
7 THE ELITE SERIES DISPLAY UNIT

7.1 DISPLAY UNIT CONTROLLABILITY

The Display Unit, as described in Section 3.1.4, is shown in Figure 7.1. The degree of control and monitoring available from this display will be as set up at the time of commissioning.

The status (top) line of the display will display the drive status, overload status, output current or torque and speed magnitude and direction, and operation mode (speed or torque control).

Each screen will have a pre-configured attribute, controlling whether it is hidden, read only, or read-write. The attribute will apply only when the Elite Series is in Operation Mode (refer Section 7.3 following). When in Commissioning Mode, all screens will be read-write. Before control adjustment is available from the Display Unit when in Operation Mode, the respective screen must have its attribute set to read-write.

![Figure 7.1: The Display Unit](image)

The Display Unit is considered to be the LOCAL controller. Therefore for local control, the START and STOP-RESET are usually enabled via Screen I1 (I1 LOCAL S/STP=3) and the speed reference is usually set to come from the Display Unit Screen A3 (I2 REF S=LOCAL).

The digital inputs are usually disabled by setting to local mode (I7a I/P MODE=00 DISABLED). This is the factory default mode.

7.2 MENU STRUCTURES AND SCREENS

7.2.1 Screen Lists

The Elite Series screen list is comprised of multiple screens. Each individual screen, its function and options are discussed in detail in Section 9 of this manual.

A Screen List may also be a foreign language translation of the default screen list as discussed above. When operating in a specific configuration, the required Screen List may be selected (when in Commissioning Mode) from Screen Y1.

7.2.2 Scrolling, Unfolding and Folding

Each screen list is organised in a hierarchical structure, as shown in Figure 7.2.

Scrolling between main screens is by use of “+” or “–” keys. When the main screen of interest is reached, press then release “+” key. This will unfold any subscreens under the main screen, and pressing the “+” key will scroll to the first subscreen. Only subscreens that do not have attributes set to “hidden” will be visible.

Scroll down the subscreens by using “+” key. Scroll up using “–” key. When the top subscreen is reached, press “–” key to fold up the subscreens and return to the main screen.

![Figure 7.2: Screen Unfolding and Folding](image)

7.2.3 Parameter Conventions

**USE OF %**

Where possible, all adjustments are normalized to the motor parameters - i.e., they are given as a percentage of a motor rating.

The motor ratings themselves are entered in engineering units (volts, amps, etc.).

**USE OF “+” AND “–”**

“+” is used to describe speed or torque in the forward direction of the motor.

“–” is used to describe speed or torque in the reverse direction of the motor.

According to IEC34-7, the motor rotates forward (clockwise) when:

- viewed from the drive (shaft) end
- and terminals U1, V1, and W1 or U2, V2 and W2 are connected to Elite Series phases U, V, W respectively
- and the Elite Series is operating with “+” speed.

7.2.4 Adjusting a Screen Value

Before a screen value can be changed, the screen on view must have its attribute set to “read-write”.

To adjust a numeric parameter, press “+” and “+” to make it more positive. Press “–” and “–” to make it more negative. The new value is stored to nonvolatile memory (EEPROM) on release of “+” key.

To adjust a two-state parameter (e.g., HI/LO, Y/N) use “+” and “+” or “–” to toggle the state of the parameter.

To select from a list, use “+” and “+” or “–” keys to scroll through the choices. Release of “+” key will store the displayed choice to EEPROM.
7.2.5 Off to Modify
For maximum flexibility, most screens can be adjusted while the Elite Series is running.
For reasons of safety, however, certain settings may not be adjusted while running. Attempts to do so will cause the display of the message OFF TO MODIFY.

7.3 OPERATING MODES

7.3.1 Summary of Operating Modes

Operation Mode
This is the normal operating mode of the drive. Each screen will have a pre-configured attribute, controlling whether it is hidden, read only, or read-write. Thus operator access to screens can be controlled.

Commissioning Mode
In this mode, each screen is visible and commissioning parameters may be adjusted, irrespective of the screen’s attribute. Some parameters are not adjustable while the drive is started or running.
Access to Commissioning Mode may be controlled by a password.

Menu Set-Up Mode
This mode is accessible when in commissioning mode, and enables the attributes of each screen to be set. The attribute controls access to the screen when in Operation Mode, as follows:
Hidden: The screen cannot be viewed or changed.
Read Only: The screen can be viewed, but not changed.
Read-Write: The screen can be viewed and the parameter changed when in Operation Mode.

7.3.2 Swapping Between OPERATION and COMMISSIONING Modes

Setting to COMMISSIONING mode before a Password has been set:
Scroll to Main Screen Z.
Z COMMISSION= N
Press “+” and “-” or “*” The status line should change to:
Z COMMISSION= Y
All screens will now be visible, and all parameters adjustable.

Selecting COMMISSIONING mode after a Password has been set:
Figure 7.3 illustrates the procedure for swapping between OPERATION and COMMISSIONING modes using a password.
Scroll to Main Screen Z. The display’s control (bottom) line will read:
Z COMMISSION= N
Press “+” and “-” or “*” The screen will automatically display:
PASSWORD= ZZZZZ
Now press “+” and “-” or “*” until the correct password is reached. Then release the keys.
All screens will now be visible, and all parameters adjustable.

Selecting OPERATION Mode:
To change from COMMISSIONING Mode to OPERATION Mode, scroll to Screen Group Z.
The display’s control line will read:
Z COMMISSION= Y
Use “+” and “-” or “*” to toggle to:
Z COMMISSION = N

Setting a Password for the First Time
Refer to Figure 7.4.
Once set to COMMISSIONING mode as described above, a password may be set up. Unfold Screen Group Z and scroll to Screen Z1. The display will read:
Z1 PASSWORD= OFF.
Press “+” and “-” or “*” to set the required password.

What happens if a password is unknown or forgotten?
Once a password has been entered, a special hashing number is displayed on Screen Z when trying to enter COMMISSIONING mode.
The display will read:
Z PASSWORD= ZZZZZ
Take a note of this number and contact a PDL Electronics Applications Engineer, who with suitable authority will be able to pass this code through an algorithm to reconstruct the original password.
7.3.3 MENU SET-UP Mode

Entering MENU SET-UP mode

The drive must be stopped before entering MENU SET-UP Mode.

While in COMMISSIONING mode and displaying the commissioning screen (Screen Z), press "*" for five seconds. The status (top) line of the display will be replaced with the message: MENU SET-UP MODE

Figure 7.5 illustrates the procedure for entering to and exiting MENU SET-UP mode.

Figure 7.5: Entering and Exiting Menu Set-up Mode

Figure 7.6 shows a typical screen display when in MENU SET-UP mode.

<table>
<thead>
<tr>
<th>MENU</th>
<th>SET-UP MODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>N 1</td>
<td>M O D E</td>
</tr>
<tr>
<td>M T R CUR = ?</td>
<td></td>
</tr>
</tbody>
</table>

Where ? = R (read only) or W (read-write) or H (hidden or invisible)

Figure 7.6: Typical Screen Display in Menu Set-up Mode

All screens will be unhidden, but the parameter value on each control line will be replaced by R or W or H (for read only/ read-write/Hidden). The attribute can be altered by "*" and "+" or "-".

Exiting MENU SET-UP Mode

This is achieved by pressing "*" for more than five seconds.

Exit also occurs after more than five minutes of inactivity, or on start-up after power-down.

Initialising user parameters in Screen Y2 will return the menu setup to the default configuration.
8 CUSTOMISATION OF CONTROL

8.1 PDL VYSTA® FOR WINDOWS CONFIGURATION SOFTWARE

Customisation of Control
The Elite Series Control Board processor has a number of logic and processing blocks integrated into the firmware. These can be configured to enhance one of the existing default configuration, or for configuring a completely new control system. These blocks include logic gates, counters, timers, analogue signal processors, PID controllers, inputs and outputs.

PDL Vysta® for Windows Editor
Configuration of these processing blocks is done by PDL Vysta® for Windows. PDL Vysta® for Windows is an editing software package which can be installed on a personal computer running Microsoft Windows. Each processing block is represented by an icon.

The icons can be placed on the screen and interconnected as required. Each icon has an associated dialogue box for naming and defining parameters. Each type of icon can be used as many times as required, within the limits of user memory within the Elite Series. The resultant schematic diagram can have comments and text attached, and a title block attached. The schematic can be printed.

Compilation and Decompilemation of PDL Vysta® for Windows Schematics
A configuration schematic designed using the PDL Vysta® for Windows editor is compiled into a text-based Netlist. This list stores sufficient information to identify the blocks, their associated names, inputs, outputs, variables, interconnection information, and associated screens. When a file is saved inside the PDL Vysta® for Windows editor, it is saved in Netlist format.

When a saved file is opened, the Netlist is decompiled and icons will be regenerated for display on the screen.

The PDL Vysta® for Windows is available for Microsoft Windows 95/98 and Windows NT. PDL Part No. VYSTA 0407.

8.2 CUSTOM SCREEN CONFIGURATION

Screen Editor
The PDL Vysta® for Windows configuration software has a screen editing utility included. This enables a new Screen List to be created and down loaded to the Elite Series.

Creating or Modifying a Screen List
When creating a new Screen List, a dialogue box is presented to name and number the list. Then a Screen Window is presented enabling the hierarchical structure of the Screen List to be designed. Screen groups and subscreens can be inserted, deleted, or edited.

Editing a Screen
When a screen is selected for editing, a dialogue box appears. The screen title, attributes and text may be inserted. When down loaded to the Elite Series, this text will appear in the control line (second line) of the display.

The text can include variables, which can be set up as read only, or modifiable from the front panel of the Elite Series. These variables can be defined as the variable names assigned when configuring processing blocks, or system names.

8.3 PDL DRIVELINK FOR WINDOWS SOFTWARE PACKAGE

The DRIVELINK software package allows Vysta for Windows configuration to be downloaded to the Elite Series drives. It also allows the system code within the Elite to be updated with later revision software as it is developed.

This package is available for Microsoft Windows 95, and Windows NT. PDL Part No. 0407.

8.4 MODBUS COMMUNICATIONS CONNECTIONS BETWEEN PC AND DRIVE

8.4.1 The Elite Series to PC Connection
The Modbus serial communications format is used for data transfer between the Elite Series and a personal computer. The Elite Series is equipped with RS485 and RS232 ports, either of which (but not both) can be used.

For long range communication (more than five metres), or where connection to more than one drive is required, RS485 is the recommended connection. An RS485/RS232 protocol converter will be required, located near to the PC.

For one-to-one communication over a short range and downloading system code, the RS232 connection should be satisfactory. It is more noise sensitive than RS485, and can only be connected to a single drive. However direct connection is possible, without the need for a protocol converter.

8.4.2 Configuring the Connection
Each Elite Series unit connected to the serial communications link will require a Modbus Address. Program this address on Screen H3a. This address must be unique to each drive on the same link.

The baud rate must be set on Screen H3b of the Elite Series. This should be set to the maximum (9600 baud). However if regular communications failures are noted, the baud rate may require reducing.

Configure the PDL Drivelink baud rate to match that of the connected drive(s). Configure the serial port to COM 1 if the 9-pin serial connector is available on the PC. If this port is used (e.g., by the mouse), configure the serial port to COM 2 (usually a 25-pin connector on the PC).

8.4.3 Down-loading from a PC to the Elite Series
Once the serial connection is established and configured, a custom control configuration and custom Screen List can be down loaded from the PC to the Elite Series. On transfer, the Netlist files stored in the Elite are converted to Modbus code and transmitted via the configured RS232 port. The Netlist file can then be stored for future reference.
The Elite Series provides as a default a very flexible set of formats and functions for control inputs and outputs.

The Elite Series can be operated in Open Loop mode as a speed controller, or in Closed Loop mode as a torque or speed controller.

The Screen List available in the default configuration is shown in Figure 9.1.

---

**Figure 9.1a: Screen List A-H**
I INPUTS

I1 LOCAL S/STP=3
I2 REF S=LOCAL
I3 REF T=NULL
I4 AREF S=AIN1
I5 AREF T=NULL
I6 ANALOGUE I/P

INPUTS

[Diagram showing various inputs and their settings]

I7 DIGITAL I/P

I7a I/P MODE=0
I7b POLARITY=Hi
I7c MFI1 SEL=00
I7d MFI2 SEL=00
I7e MFI3 SEL=00
I7f MFI4 SEL=00
I7g MFI5 SEL=00
I7h MFI6 SEL=00

I8 FIBRE I/P

I8a F LO=-100%
I8b F HI=+100%
I8c FIBREMODE=0
I8d FIB T/O = OFF

LIMITS

M7 MREF7=+0.00%
M6 MREF6=+0.00%
M5 MREF5=+0.00%
M4 MREF4=+0.00%
M3 MREF3=+0.00%
M2 MREF2=+0.00%
M1 MREF1=+0.00%

MULTIREFS

-0.00% to 2400%

NAMEPLATE

N1 MTR CUR= 14.6A
N2 MTR VOLT= 400V
N3 MTR FRQ= 50Hz
N4 MTR P= 7.5kW
N5 MTR RPM= 1476
N6 ENC I/P= 0
N7 ENC I/P= 0

Figure 9.1b: Screen List I-N

* MODEL DEPENDENT
### Figure 9.1c: Screen List O-P

**Outputs**

- O1 ANALOGUE OUT
  - O1A AOUT=+6V
  - O1B AOUT=-10V
  - O1C AOUT=+20V
  - O1D AOUT=-10V
  - O1E AOUT=-100%

- O2 DIGITAL OUT
  - O2A RELAY1=02
  - O2B RELAY2=05
  - O2C RELAY3=08

- O3 DIGITAL OUT
  - O3A FIBRE O/P=06

**Digital Outputs**

- O2a RELAY1 INV=N/Y
- O2b RELAY2 INV=N/Y
- O2c RELAY3 INV=N/Y

**Analogue Outputs**

- O1a AO1 OUT=02
- O1b AO1 OUT=+100%
- O1c AO1 OUT=-100%
- O1d AO1 OUT=+/-10V
- O1e AO2 OUT=+/-10V
- O1f AO2 OUT=+/-10V
- O1g AO2 OUT=+/-10V
- O1h AO2 OUT=+/-10V

**Process**

- P1 FIB FULL SCALE
- P2 FIB LOCAL
- P3 FIB PROCESS
- P4 FIB ERROR
- P5 FIB INVERT
- P6 INVERT PID

**Status**

- 0.0 to 20mA
- 4.0 to 20mA
- 0 to 25mA
- TSTMD

---

This document is part of the Elite Series Technical Manual, PDL Part No. 4201-180 Rev J.
### Screen List R-Z

<table>
<thead>
<tr>
<th>Screen</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R2</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R3</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R4</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R5</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R6</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R7</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R8</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R9</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R10</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R11</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R12</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R13</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R14</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R15</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R16</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R17</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R18</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R19</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R20</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R21</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R22</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R23</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R24</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R25</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R26</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R27</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R28</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R29</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R30</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R31</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R32</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R33</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R34</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R35</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R36</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R37</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R38</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R39</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R40</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R41</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R42</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R43</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R44</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R45</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R46</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R47</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R48</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R49</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R50</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R51</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R52</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R53</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R54</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R55</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R56</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R57</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R58</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R59</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R60</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R61</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R62</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R63</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R64</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R65</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R66</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R67</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R68</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R69</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R70</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R71</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R72</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R73</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R74</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R75</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R76</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R77</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R78</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R79</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R80</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R81</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R82</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R83</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R84</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R85</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R86</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R87</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R88</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R89</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R90</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R91</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R92</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R93</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R94</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R95</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R96</td>
<td>Start/Stop Ramp</td>
</tr>
<tr>
<td>R97</td>
<td>Start/Stop Normal</td>
</tr>
<tr>
<td>R98</td>
<td>Start/Stop Spin</td>
</tr>
<tr>
<td>R99</td>
<td>Start/Stop Stop R</td>
</tr>
<tr>
<td>R100</td>
<td>Start/Stop Ramp</td>
</tr>
</tbody>
</table>

**Figure 9.1d**
STATUS LINE

AA STATUS LINE

Screen AA
OFF 0.0% 0.0%
STP +000% S +000%

Description
STATUS, OVERLOAD, TORQUE/CURRENT, SPEED, INDICATION

Units
% OF RATED MOTOR TORQUE/AMPS,
% OF RATED MOTOR SPEED

Notes
ALWAYS DISPLAYED

FUNCTION
This is the top line of the display and is permanently present. The status line shows Elite Series status, overload condition, output torque or current and output speed. Indication of operational mode is also provided.

SCREEN
OFF 0.0% 0.0%
STP () t +000% S +000%
1 2 3 4 5 6

Table Reference
1 2 3 4 5 6

REF. FUNCTION
1 Elite Series Status Indication
Refer to list opposite

2 Overload Status
Indicated by a lower case letter while overload is present
i - current exceeds Elite Series rating. The Elite Series will shut down to protect itself if the overload persists.
m - current exceeds motor capability. The thermal model of the motor indicates the motor will become too hot if this condition persists. The Elite Series will eventually trip if the overload is not eliminated.
o - Elite Series and motor overload exists.

3 Torque Mode Indicator
T- Elite Series is in C/L vector torque mode
t- Elite Series is in C/L vector speed mode
I Elite Series is in VHz speed mode or O/L mode

4 Motor Torque or Current Indication
In C/L vector mode this shows the actual motor torque as a percentage of rated motor torque. In V/Hz or O/L mode the motor current is displayed in amps.

5 Speed Mode Indicator
S - Elite Series is in speed mode
s - Elite Series is in torque mode

6 Motor Speed Indication
Shows actual motor speed as a percentage of rated motor speed

Status Messages

Indication
STP

Message
STOPPED

Notes
Motor stopped.

Indication
SPG

Message
STOPPING

Notes
Motor is stopping.

Indication
RDY

Message
READY

Notes
Elite Series is ready to run. A start command has been received but the bus voltage is too low to run or L14 run at minimum speed is set to NO and setpoint is below minimum speed (L2).

Indication
RUN

Message
RUNNING

Notes
Motor is running.

Indication
INC

Message
INCHING

Notes
Elite Series is responding to an inch command.

Indication
ILT

Message
CURRENT LIMITING

Notes
Elite Series has altered the motor speed to maintain the motor current at or below the current limit setting.

Indication
VLT

Message
VOLTAGE LIMITING

Notes
Elite Series is limiting the deceleration rate to avoid excessive regeneration (Vdc > 720V).

Indication
Fnn

Message
FAULT TRIP

Notes
Elite Series has tripped on a fault. Where “nn” indicates the fault number (refer to Screen F for detail).

Indication
OFF

Message
OUTPUT OFF

Notes
Elite Series has switched off all output power.

Indication
SLT

Message
SPEED LIMITING

Notes
Speed is being limited to value set by Screens L1 or L2.

Indication
TLT

Message
TORQUE LIMITING

Notes
Torque is being limited to value set by Screens L3 or L4 or L8.

Indication
ATU

Message
AUTOTUNING

Notes
Autotune in progress.

Indication
SPN

Message
SPIN STARTING

Notes
Elite Series is searching for the speed of the motor.

Indication
HGT

Message
HEATING

Notes
DC Heat is being applied to the motor.

Indication
LFX

Message
LOW FLUX STATUS

Notes
Open loop vector controller has detected that the motor is close to stalling and has taken compensatory action.
A1 LOCAL CONTROL MODE

Screen LOCAL MODE=SP
Description LOCAL KEYBOARD MODE SELECT
Range SPEED/TORQUE
Default Value SPEED
OFF to Modify NO
Attribute Read-Write
FUNCTION Sets the operating mode of the Elite Series if not otherwise selected (i.e., as a Multi-function input. Refer Screen I7a).
SETTING UP Select the desired operating (speed or torque) mode.
Note: The selected mode is indicated on the Status Screen by means of a uppercase “S” (speed mode) or uppercase “T” (torque mode).

A2 LOCAL TORQUE REFERENCE

Screen LOCAL TQ=+0.0%
Description LOCAL TORQUE REFERENCE
Range -250% to +250%
Units % OF MOTOR RATED TORQUE
Default Value NO
OFF to Modify NO
Attribute Read-Write
FUNCTION Local keyboard control of reference torque.
SETTING UP The reference torque source (Screen I3 or I5) must be set to LOCAL before this screen has an effect. Although it can be adjusted to ±250% of motor rated torque, the reference torque is constrained between the minimum and maximum torque (set by Screens L4 and L5).

A3 LOCAL SPEED REFERENCE

Screen LOCAL SP=+100.0%
Description LOCAL SPEED REFERENCE
Range -250% to +250%
Units % OF MOTOR RATED SYNCHRONOUS SPEED
Default Value 100%
OFF to Modify NO
Attribute Read-Write
FUNCTION Local keyboard control of reference speed.
SETTING UP The reference speed source (Screen I2 or I4) must be set to LOCAL before this screen has an effect. Although it can be adjusted to ±250% of motor rated synchronous speed, the reference speed is constrained between the minimum and maximum speeds (set by Screens L2 and L3).

A4 REFERENCE TORQUE, REFERENCE SPEED

Screen TQ=+100.0% SP=+100%
Description TORQUE REFERENCE, SPEED REFERENCE
Range -250% TO +250%; -250 TO +250%
Units % OF MOTOR RATED TORQUE; % OF MOTOR RATED SYNCHRONOUS SPEED
Attribute Read Only
FUNCTION Shows reference torque and speed. This screen is displayed after power up or external reset.

A5 MOTOR POWER, MOTOR RPM

Screen +7.5kW +1480RPM
Description MOTOR POWER, MOTOR RPM
Range -999kW TO +999kW; -12000RPM TO +12000RPM
Units kW - KILOWATTS; RPM - REVOLUTIONS PER MINUTE
Attribute Read Only
FUNCTION Shows estimated motor power and motor speed in revolutions per minute (RPM). In Open Loop Mode and V/Hz control modes, the speed will be estimated.
SETTING UP The motor rated kW (Screen N4) and rated RPM (Screen N5) must be entered for correct calibration of this screen.
A6  MOTOR CURRENT, STATOR FREQUENCY

Screen  +16A  +50.0Hz
Description  MOTOR CURRENT, FREQUENCY OF AC APPLIED TO STATOR
Units  Amps; HERTZ
Attribute  Read Only

A6a  PHASE OUTPUT CURRENTS

Screen  1.2A 1.2A 1.2A
Description  PHASE OUTPUT CURRENTS
Range  0 to 1999A
Units  Amps
Attribute  Read Only
FUNCTION  This screen displays the individual phase currents of the Elite Series.

A7  MOTOR, INVERTER TEMPERATURES

Screen  Tm=100% Ti=100%
Description  ESTIMATED MOTOR TEMPERATURE; ESTIMATED INVERTER TEMPERATURE
Range  0 TO 150%; 65 TO 150%
Units  % OF RATED MOTOR TEMPERATURE; % RATED INVERTER TEMPERATURE
Attribute  Read Only
FUNCTION  Shows motor temperature as estimated by the motor thermal model, and Elite (inverter) temperature as estimated by the inverter thermal model.

Note:  The inverter thermal model is non-linear, starting at 66%, determined by the 30 second overload rating at 150% of rated inverter current in a 50°C ambient. Refer Section 4.1.1.

A7a  ACTUAL HEATSINK & INTERNAL TEMPS

Screen  Th=23° Ti=26°
Description  HEATSINK TEMPERATURE; INTERNAL TEMPERATURE
Units  °C
Attribute  Read only
FUNCTION  This screen displays the actual measured heatsink and internal temperatures of the Elite.

A8  BUS AND OUTPUT VOLTAGES

Screen  565Vdc 400Vac
Description  DC BUS VOLTAGE ; OUTPUT VOLTAGE
Units  Vdc;Vac
Attribute  Read only
FUNCTION  Shows the internal DC voltage of the Elite Series, and the AC voltage applied to the motor.

Note:  The control system of the Elite Series will attempt to apply whatever voltage is necessary to achieve the calculated current requirement - therefore output voltages displayed with the motor disconnected or isolated may not relate to the voltage applied once the motor is connected.

<table>
<thead>
<tr>
<th>NO.</th>
<th>SOURCE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>NULL</td>
<td>minimum signal output</td>
</tr>
<tr>
<td>01</td>
<td>FULL SCALE</td>
<td>maximum signal output</td>
</tr>
<tr>
<td>02</td>
<td>OUTPUT CURR</td>
<td>% of motor rated current</td>
</tr>
<tr>
<td>03</td>
<td>OUTPUT VOLTS</td>
<td>% of motor rated voltage</td>
</tr>
<tr>
<td>04</td>
<td>BUS VOLTAGE</td>
<td>% of motor rated voltage x 1.414</td>
</tr>
<tr>
<td>05</td>
<td>MOTOR POWER</td>
<td>% of motor rated power</td>
</tr>
<tr>
<td>06</td>
<td>MOTOR SPEED</td>
<td>% of motor rated speed</td>
</tr>
<tr>
<td>07</td>
<td>MOTOR TORQUE</td>
<td>% of motor rated torque</td>
</tr>
<tr>
<td>08</td>
<td>REF SPEED</td>
<td>% of motor rated speed</td>
</tr>
<tr>
<td>09</td>
<td>REF TORQUE</td>
<td>% of motor rated torque</td>
</tr>
<tr>
<td>10</td>
<td>MOTOR TEMP</td>
<td>% of motor rated temperature</td>
</tr>
<tr>
<td>11</td>
<td>INVERTER TEMP</td>
<td>% of inverter rated temperature</td>
</tr>
<tr>
<td>12</td>
<td>ANALOG IN 1</td>
<td>%</td>
</tr>
<tr>
<td>13</td>
<td>ANALOG IN 2</td>
<td>%</td>
</tr>
<tr>
<td>14</td>
<td>ANALOG IN 1+2</td>
<td>%</td>
</tr>
<tr>
<td>15</td>
<td>FIBRE IN</td>
<td>%</td>
</tr>
<tr>
<td>16</td>
<td>PROCESS REF</td>
<td>%</td>
</tr>
<tr>
<td>17</td>
<td>PROCESS FEEDBACK</td>
<td>%</td>
</tr>
<tr>
<td>18</td>
<td>PROCESS CONTROL</td>
<td>%</td>
</tr>
</tbody>
</table>

Figure 9.2: Comparator Source Selection
SCREEN GROUP C: LEVEL COMPARATOR

**Group Attribute Hidden**

**C1**

**C2**

**C3**

**C4**

**C5**

**C6**

**Screen C5**

C1 COMP1 SEL = 02
C4 COMP2 SEL = 02

**Description**

COMPARATOR SOURCE SELECTION

**Range**

00-18, REFER FIGURE 9.2

**Default Value**

02 (OUTPUT CURRENT)

**OFF to Modify**

NO

**Screen C6**

C2 1 ON = +100%
C5 2 ON = +100%

**Description**

COMPARATOR ON SETPOINT

**Units**

% OF FUNCTION SELECTED

**Range**

C3, C6 TO +250%

**Default Value**

100

**OFF to Modify**

NO

**Screen D1**

C3 1 OFF = -90%
C6 2 OFF = -90%

**Description**

COMPARATOR OFF SETPOINT

**Units**

% OF FUNCTION SELECTED

**Range**

-250% TO C2, C5

**Default Value**

90

**OFF to Modify**

NO

**FUNCTION**

Provides two highly programmable relay output comparator functions. Each comparator may select one of a number of analogue levels. Screens C1 & C4, select from the table Figure 9.2. The level at which the relay should turn ON and turn OFF is programmable (Screens C2, C5 and C3, C6 respectively).

**SETTING UP**

If not required, leave set to default values. Where required, select the appropriate function for the Comparator (Screens C1, C4) and set the desired ON and OFF levels (C2, C5 and C3, C6).

The output of Comparator is only available to the relay outputs. The desired relay must be configured to connect to the comparator (see Screens O2).

The output of Comparator 1 and Comparator 2 may be connected to the relay outputs to form a window comparator. Comparator 1 sets the lower switching level and Comparator 2 sets the upper switching level.

**Note:**

If ON/OFF levels are adjusted very closely together any noise in the signal may cause the relays to chatter, significantly reducing their life. Avoid this condition by ensuring a reasonable margin between the ON and OFF levels.

SCREEN GROUP D: DYNAMIC BRAKE CONTROLS

**Group Attribute Hidden**

**Screen D1**

D1 DB TIME= 10s

**Description**

TIME CONSTANT OF DYNAMIC BRAKE RESISTOR

**Range**

0 TO 250 SEC

**Units**

SEC

**Default Value**

10

**OFF to Modify**

NO

**Screen D2**

D2 DB DUTY= OFF

**Description**

% DUTY RATING OF DYNAMIC BRAKE RESISTOR

**Range**

OFF, 0 TO 100%

**Units**

% OF TIME ON

**Default Value**

OFF

**OFF to Modify**

NO

**FUNCTION**

The Elite Series includes thermal model protection for a dynamic brake. To protect the brake resistor the Elite Series will stop (indicating BRAKE O/L) when the calculated use of the resistor exceeds its rating.

The time constant of the brake resistor is the time it would take to reach 64% of its final temperature if continuously energised.

The percentage duty rating represents the average percentage of time the resistor may be operated for (when averaged over periods long in comparison to the time constant).

**SETTING UP**

Leave these screens set at 10s and OFF respectively unless a Elite Series dynamic brake option is fitted (the model is active whether a dynamic brake is fitted or not).

If a dynamic brake option is fitted, these screens MUST BE CORRECTLY SET according to the manufacturer’s resistor specifications. The dynamic brake thermal model can only protect the resistor if it is correctly set - never consider using larger than specified figures.

Refer to Section 4.5 for dynamic brake resistor selection.
SCREEN GROUP H: SERIAL COMMUNICATION CONTROLS

Group Attribute Hidden

Screen H1 PROTOCOL= M
Description SELECT SERIAL PROTOCOL TO USE
Range MODBUS/DEVICENET
Default Value MODBUS
OFF to Modify NO
NOTE DeviceNet operation requires an additional product (EDNI) to be used with the Elite Series.

Screen H2 COMMS T/O=OFF
Description SERIAL COMMUNICATIONS TIMEOUT PERIOD
Range 1/5/25/OFF
Units SEC
Default Value OFF
OFF to Modify NO
FUNCTION The communications timeout period provides the option of tripping the Elite Series (indicating COMMS T/O) if the time since the last valid serial communications data transfer has exceeded the communications timeout period. Serial communications with the Elite Series is available via the RS232 serial communications terminals, RS485 serial communications terminals or serial communication interface. This allows the Elite Series to be controlled by a host computer such as a PLC or computer from a remote location, and enables the down loading of customised application configurations generated by the PDL Vysta® for Windows PC software package. All the controls, parameters and modes available on the Elite Series can be monitored or adjusted by using the serial communications option. For example, the host controller can start and stop the motor, control its speed, monitor the estimated motor temperature, and the status of the drive. In addition, the host controller can monitor a process by accessing unused digital and analogue inputs on the Elite Series.

SETTING UP When there is no host controller connected, the communications address and baudrate parameters have no effect. However, the communications timeout feature remains active, and, as such, should be set to "OFF". If the Elite Series serial communications feature is required, select the required address, baudrate, parity and timeout period.
SUBGROUP H3: MODBUS COMMUNICATION PARAMETERS

Screen H3a COMM ADR=10
Description MODBUS SERIAL COMMUNICATIONS ADDRESS
Range 1–240
Units -
Default Value 10
OFF to Modify NO

Screen H3b BAUD=9600
Description MODBUS SERIAL COMMUNICATIONS BAUDRATE
Range 1200/2400/4800/9600/OFF
Units -
Default Value 9600
OFF to Modify NO
FUNCTION Sets the Modbus serial communication Baudrate.

SUBGROUP H4: DEVICENET COMMUNICATION PARAMETERS

These options will be valid if an Elite DeviceNet Interface (EDNI) module has been installed.

Screen H4a Mac ID=63
Description Mac Identification number
Range 0 to 63
Default Value 63
OFF to Modify NO
FUNCTION Defines the Mac ID for the Elite Series unit.

Screen H4b BAUD=125kbps
Description DeviceNet Communication Baud rate
Range 125/250/500/kbps
Units kbps
Default Value 125kbps
OFF to Modify NO
FUNCTION Changes to MAC ID have no effect until Baud rate EDNI is reset via DeviceNet or the power is cycled.

Screen H4c Ass In=70
Description Assembly Input Instance
Range 50 Basic Overload/Contactor Input (1 byte)
51 Extended Overload/Contactor Input (1 byte)
52 Basic Motor Starter Input (1 byte)
53 Extended Motor Starter 1 Input (1 byte)
54 Extended Motor Starter 2 Input (1 byte)
60 Basic Softstarter Input (1 byte)
61 Extended softstarter Input (1 byte)
70 Basic Speed Control Input (4 bytes)
71 Extended Speed Control Input (4 bytes)
101 PDL Control Input (8 bytes)

Screen H4d Ass Out=20
Description Assembly Output Instance
Range 1 Basic Contactor Output (1 byte)
2 Basic Overload Output (1 byte)
3 Basic Motor Starter Output (1 byte)
4 Extended Contactor Output (1 byte)
5 Extended Motor Starter Output (1 byte)
20 Basic Speed Control Output (4 bytes)
21 Extended Speed Control Output (4 bytes)
100 PDL Control Output (8 bytes)

Screen H4e CTRL SRC=00
Description DEVICENET CONTROL SOURCE
Range 00 DNEN DECIDES
01 DNEN CTRL
02 LOCAL REF
Default Value 00
OFF to Modify NO
FUNCTION Controls where the Run & Reset commands for the Elite Series come from. Local control selects the normal Elite Series controls (keyboard and multifunction inputs). DNEN Ctrl selects the commands to come from the source selected by the “Control from Net” bit in the input instance.

Screen H4f REF SRC=00
Description DEVICENET REFERENCE SOURCE
Range 00 DNEN DECIDES
01 DNEN CTRL
02 LOCAL CONTROL
Default Value 00
OFF to Modify NO
FUNCTION Controls where the speed reference for the Elite Series comes from. Local Control selects the normal Elite Series reference. DNEN CTRL selects the drives reference to come from DeviceNet and DNEN DECIDES allows the Elite Series speed reference to come from the source selected by the “Reference from Net” bit in the input instance.
### Screen Group I: Inputs

#### Screen Description
- **DeviceNet Interface Status**
  - **Range**
    - **Off Line** Interface board not responding or network not powered up.
    - **No Net Power** 24Volts missing on DeviceNet network
    - **Self-Testing** Powering up.
    - **Standby** Network power OK but no communications established.
    - **Operational** Network is OK and communication is established.
    - **R Fault** Recoverable network fault has occurred.
    - **NR Fault** Non-recoverable network fault has occurred.

### Input Screen

#### Local Start/Stop-Reset Control

**Screen**: **11 LOCAL S/STP=3**

**Description**: LOCAL START/STOP AND RESET CONTROL

**Range**: 0-3 See Table below

**Default Value**: 3 START/STOP-RST

**OFF to Modify**: NO

**Attribute**: READ ONLY

**FUNCTION**: Enables the display unit’s START, STOP and RESET functions.

**SETTING UP**

<table>
<thead>
<tr>
<th>Code</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td><strong>NONE</strong> Display START and STOP/RESET inactive. Allows operation without display.</td>
</tr>
<tr>
<td>1</td>
<td><strong>RESET ONLY</strong> Display START and STOP inactive. STOP/RESET key resets faults only.</td>
</tr>
<tr>
<td>2</td>
<td><strong>STOP-RESET</strong> Display START inactive. STOP and RESET functions active.</td>
</tr>
<tr>
<td>3</td>
<td><strong>START/STOP-RST</strong> Display START, STOP and RESET functions active.</td>
</tr>
</tbody>
</table>

**Figure 9.3**: Local Start/Stop-Reset Control
### I2, I4 Speed Reference Sources

<table>
<thead>
<tr>
<th>Screen</th>
<th>Description</th>
<th>Range</th>
<th>Default Value</th>
<th>OFF to Modify</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>I2 REF</td>
<td>SPEED REFERENCE SOURCE</td>
<td>REFER FIGURE 9.4</td>
<td>LOCAL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Function: Defines which input source is used as the speed reference (I2) or alternative speed reference source (I4):

<table>
<thead>
<tr>
<th>CODE</th>
<th>SPEED REFERENCE SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>NULL</td>
<td>NO SOURCE SELECTED</td>
</tr>
<tr>
<td>AN1</td>
<td>ANALOGUE INPUT 1</td>
</tr>
<tr>
<td>AN2</td>
<td>ANALOGUE INPUT 2</td>
</tr>
<tr>
<td>AN1+2</td>
<td>ADDITION OF SCALED ANALOGUE INPUTS 1 + 2</td>
</tr>
<tr>
<td>FIBRE</td>
<td>FIBRE OPTIC INPUT</td>
</tr>
<tr>
<td>LOCAL</td>
<td>LOCAL SPEED CONTROL (SCREEN A3)</td>
</tr>
<tr>
<td>MREF</td>
<td>MULTI-REFERENCE (SCREENS I7a, M1 TO M7)</td>
</tr>
<tr>
<td>MTRPOT</td>
<td>MOTORISED POTentiOMETER (SCREEN I7a)</td>
</tr>
<tr>
<td>PROCESS</td>
<td>PROCESS CONTROL OUTPUT</td>
</tr>
</tbody>
</table>

Figure 9.4: Speed Reference Source Selection

Note: The alternative speed reference is a switchable second source option. This function is enabled by selecting alternative reference as a multi-function input, by appropriate selection of Screens I7a to I7h.

**SETTING UP** Select the desired (and alternative, if required) speed reference source to suit your requirements.

Note: If the alternative speed reference is to be used, the Digital Input controlling this also selects the alternative torque reference source, so Screen I4 must also be set appropriately.

### I3, I5 Torque Reference Sources

<table>
<thead>
<tr>
<th>Screen</th>
<th>Description</th>
<th>Range</th>
<th>Default Value</th>
<th>OFF to Modify</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>I3 REF</td>
<td>TORQUE REFERENCE SOURCE</td>
<td>REFER FIGURE 9.5</td>
<td>NULL (NO SOURCE SELECTED)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Function: Defines which input source is used as the torque reference (I3) or alternative torque reference source (I5):

<table>
<thead>
<tr>
<th>CODE</th>
<th>TORQUE REFERENCE SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>NULL</td>
<td>NO SOURCE SELECTED</td>
</tr>
<tr>
<td>AN1</td>
<td>ANALOGUE INPUT 1</td>
</tr>
<tr>
<td>AN2</td>
<td>ANALOGUE INPUT 2</td>
</tr>
<tr>
<td>AN1+2</td>
<td>ADDITION OF SCALED ANALOGUE INPUTS 1 + 2</td>
</tr>
<tr>
<td>FIBRE</td>
<td>FIBRE OPTIC INPUT</td>
</tr>
<tr>
<td>LOCAL</td>
<td>LOCAL SPEED CONTROL (SCREEN A2)</td>
</tr>
<tr>
<td>MREF</td>
<td>MULTI-REFERENCE (SCREENS I7a, M1 TO M7)</td>
</tr>
<tr>
<td>MTRPOT</td>
<td>MOTORISED POTentiOMETER (SCREEN I7a)</td>
</tr>
<tr>
<td>PROCESS</td>
<td>PROCESS CONTROL OUTPUT</td>
</tr>
</tbody>
</table>

Figure 9.5: Torque Reference Source Selection

Note: The alternative torque reference is a switchable second source option. This function is enabled by selecting alternative reference as a multi-function input, by appropriate selection of Screens I7a to I7h.

**SETTING UP** Select the desired (and alternative, if required) torque reference source to suit your requirements.

Note: If the alternative torque reference is to be used, the Digital Input controlling this also selects the alternative speed reference source, so Screen I4 must also be set appropriately.
SUBGROUP I6: ANALOG INPUTS

I6a - I6f ANALOGUE INPUT FORMATTING AND SCALING CONTROLS

Screen I6a AI1=0-10V
Description ANALOGUE INPUT 1 FORMAT
Range REFER FIGURE 9.6
Default Value 0-10V
OFF to Modify YES

Screen I6b AI1 LO= 0%
Description ANALOGUE INPUT 1 LOW SETPOINT
Range -400% TO +400%
Units %
Default Value 0%
OFF to Modify NO

Screen I6c AI1 HI= +100%
Description ANALOGUE INPUT 1 HIGH SETPOINT
Range -400% TO +400%
Units %
Default Value +100%
OFF to Modify NO

Screen I6d AI2=0-10V
Description ANALOGUE INPUT 2 FORMAT
Range REFER TABLE BELOW
Default Value 0-10V
OFF to Modify YES

Screen I6e AI2 LO=0%
Description ANALOGUE INPUT 2 LOW SETPOINT
Range -400% TO +400%
Units %
Default Value 0%
OFF to Modify NO

Screen I6f AI2 HI=+100%
Description ANALOGUE INPUT 2 HIGH SETPOINT
Range -400% TO +400%
Units %
Default Value +100%
OFF to Modify NO

<table>
<thead>
<tr>
<th>CODE</th>
<th>ANALOGUE INPUT FORMAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10V</td>
<td>0 to 10Vdc input</td>
</tr>
<tr>
<td>+/-10V</td>
<td>-10 to +10Vdc input</td>
</tr>
<tr>
<td>4-20mA</td>
<td>4 to 20 mA input</td>
</tr>
<tr>
<td>0-20mA</td>
<td>0 to 20 mA input</td>
</tr>
</tbody>
</table>

Figure 9.6: Analogue Input Format Selection

SETTING UP
If it has been determined that one or both analogue inputs are needed as torque or speed reference sources, they must first be selected (Screens I2 to I5).

Determine the required format of these analogue inputs, and set up on Screens I6a, I6d.

Determine the range over which analogue control is desired. Adjust the LO setting (Screens I6b, I6e) to the speed/torque desired at minimum analogue input. Adjust the HI setting (Screens I6c, I6f) to the speed/torque desired at maximum analogue input (+10V/20mA).

SCALING
AI1 LO / AI2 LO
Sets the reference level when the minimum analogue level is applied to the respective input.

AI1 HI / AI2 HI
Sets the reference level when the maximum analogue level is applied to the respective input. The Elite Series input is interpolated linearly between the selected LO and HI settings.

LO settings may be greater than HI settings, thus providing inverse control (i.e., increasing the reference input decreases the reference speed, torque or process setpoint).

I6g ANALOGUE ZERO BAND

Screen I6g ZERO BAND=N
Description ZERO BAND OF ±2% FOR ANALOGUE INPUT SOURCES
Range YES/NO
Default Value NO
OFF to Modify NO

FUNCTION
To provide a definite zero region for analogue controls, especially for speed control.

This is important in applications where absolute zero speed (or torque) is required in conjunction with analogue control. It overcomes small errors in the reference voltage about the zero reference point.

SETTING UP
Not required if analogue reference inputs are not used.

If analogue input references are to be used to command exactly zero speed (or torque) or the motor shaft is to be locked (i.e., mechanical brake) at zero speed, the zero band must be set to YES.

If absolute zero speed (or torque) is not critical, the shaft is not mechanically locked at zero speed or the analogue reference
forms part of a feedback loop, set the zero band to NO.

Note: Zero band is provided since the digital tacho feedback employed in the Elite Series in Closed Loop Mode control mode is absolute - i.e., it cannot lose counts. Therefore any error in zero speed reference setting, however small, will be integrated over time causing the shaft to rotate.

The zero band function does not apply to the digital speed references (e.g., Local keyboard, fibre optic, or multi-reference select) since such zero settings are absolute.

---

**SUBGROUP I7: DIGITAL INPUT**

I7a **DIGITAL INPUT CONTROLS**

I7a **MULTI-FUNCTION INPUT MODE SELECTION**

<table>
<thead>
<tr>
<th>Screen</th>
<th>I/P MODE=0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>MULTI-FUNCTION INPUT MODE SELECTION</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>0 TO 5, REFERENCE Figure 9.9</td>
</tr>
<tr>
<td><strong>Default Value</strong></td>
<td>0 - DISABLED</td>
</tr>
<tr>
<td><strong>OFF to Modify</strong></td>
<td>YES</td>
</tr>
</tbody>
</table>

**DESCRIPTIONS OF MULTI-FUNCTION INPUT MODES**

0  **Disabled** - Disables all multifunction digital inputs. If the Display Unit Start/Stop-Reset is enabled from Screen I1, then the motor may be started and stopped using the Display Unit. Useful for commissioning by keyboard control without interference from external inputs. The PTC/Ext Trip input is still active in this mode.

1  **Remote (3 Wire) Control** - Enables Start/Stop-Reset control from external inputs.

   MFI 1 ASTOP-RESET
   MFI 2 START
   MFI 3 STOP-RESET
   MFI 4 INVERT SPEED
   MFI 5 INVERT TORQUE
   MFI 6 SPEED/TORQUE

   If the Display Unit Start/Stop-Reset are enabled from Screen I1, then the motor may also be started and stopped using the Display Unit.

2  **All Programmable** - Each of the six inputs (MFI 1 to MFI 6) can individually be programmed to one of many functions, using Screens I7c to I7h respectively.

3  **Multi-reference, 2 Wire** - Two of the six inputs (MFI 5, MFI 6) may be used to select from the multi-reference settings (Y, Z; refer to Screens M4 to M7), allowing a selection of four preset references.

   The remaining four inputs (MFI 1 to MFI 4) may be individually programmed using Screens I7c to I7f respectively.

4  **Multi-reference, 3 Wire** - Three of the six inputs (MFI 4 to MFI 6) may be used to select from the multi-reference settings (X, Y, Z; refer to Screens M1 to M7), allowing a selection of zero plus seven preset references.

   The remaining three inputs (MFI 1 to MFI 3) may be individually programmed using Screens I7c to I7e respectively.

5  **Motorised Potentiometer** - Offers reference control by UP (increase reference) or DOWN (decrease reference) push buttons.

   UP (increase reference) (MFI 5) is defined as normally open and may be parallel connected to provide distributed control points. DOWN (decrease reference) (MFI 6) is defined as normally closed and may be series connected to provide distributed control points.
MULTI-FUNCTION SETTING UP WARNING

Altering the multi-function input mode of the Elite Series completely reconfigures the logic of operation of the input control terminals. Be very sure that you understand the operating mode that you require, and that any inputs already connected will not cause the unit to automatically start once your mode is selected.

Hints:

Mode 0 is a special “safe” multi-function mode in which all inputs are disabled except for the PTC/Ext Trip Input. In this mode the Elite Series will not respond to external terminal inputs, but it will show the state and operation of the analogue and multifunction inputs on the control status display screens (Screens Z3 to Z12). Before finally selecting your desired operating multifunction mode, use this mode to safely inspect the status and operation of all of your inputs. If the previous setup of the Elite Series is not known - remove the link from the External Trip input (Terminal T19). This will trip the Elite Series and prevent possible instantaneous starting of the motor upon applying power.

The status of the six inputs can be observed on Screen Z7.

Notes:

The multifunction Speed/Torque reference modes can be selected using Screens I2-I5.

<table>
<thead>
<tr>
<th>INPUT MODES</th>
<th>CONTROL INPUT TERMINAL FUNCTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO.</td>
<td>NAME</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>DISABLED</td>
</tr>
<tr>
<td>1</td>
<td>3 WIRE</td>
</tr>
<tr>
<td>2</td>
<td>ALL PROG</td>
</tr>
<tr>
<td>3</td>
<td>MULTIREF  2 WIRE</td>
</tr>
<tr>
<td>4</td>
<td>MULTIREF  3 WIRE</td>
</tr>
<tr>
<td>5</td>
<td>MOTORISED POT</td>
</tr>
</tbody>
</table>

Figure 9.9: Input Mode Selection
**MULTI-FUNCTION INPUT INVERSION**

**Screen**:

**I7b POLARITY=HI**

**Description**:
MULTI-FUNCTION INPUT LOGICAL INVERSION

**Range**:
HI (active high) or LO (active low)

**Default Value**:
HI (active high)

**OFF to Modify**:
YES

**FUNCTION**
The Elite Series has the ability to have its input circuits operated in two modes:

**ACTIVE HIGH** (I7b POLARITY= HI)
Pull input high to activate

**ACTIVE LOW** (I7b POLARITY= LO)
Pull input low to activate

**Note 1**:
Changing the input polarity allows the user to select the voltage level required to close the input circuits — either 24Vdc (when configured as active high) or 0Vdc (when configured in active low).

**Note 2**:
The setting of this screen is not modified when the Elite Series is initialised from Screen Y2. The default (factory set) mode for this screen is:

**ACTIVE HIGH** (I7b POLARITY= HI)
Pull input high to activate.

**Note 3**:
The setting of this screen can not be modified unless Screen I7a is set to DISABLED. This is to prevent possible starting upon changing the digital input polarity.

**WARNING**
It is strongly recommended that the Elite Series on any one site should be configured for either ACTIVE HIGH or ACTIVE LOW to minimise the risk of non-fail-safe operation if the Elite Series are exchanged. The mode would probably be set up to correspond to that used by other models of drive used on site.

**MULTI-FUNCTION INPUT SELECTIONS**

**Screen**:

**I7c MFI 1 SEL=00**

**Description**:
MULTI-FUNCTION 1 INPUT SELECTIONS; TERMINAL T13

**Range**:
00 TO 19, REFER FIGURE 9.11

**Default Value**:
00 (UNUSED)

**OFF to Modify**:
YES

**Screen**:

**I7d MFI 2 SEL=00**

**Description**:
MULTI-FUNCTION 2 INPUT SELECTIONS; TERMINAL T14

**Range**:
00 TO 19, REFER FIGURE 9.11

**Default Value**:
00 (UNUSED)

**OFF to Modify**:
YES

**Screen**:

**I7e MFI 3 SEL=00**

**Description**:
MULTI-FUNCTION 3 INPUT SELECTIONS; TERMINAL T15

**Range**:
00 TO 19, REFER FIGURE 9.11

**Default Value**:
00 (UNUSED)

**OFF to Modify**:
YES

**Screen**:

**I7f MFI 4 SEL=00**

**Description**:
MULTI-FUNCTION 4 INPUT SELECTIONS; TERMINAL T16

**Range**:
00 TO 19, REFER FIGURE 9.11

**Default Value**:
00 (UNUSED)

**OFF to Modify**:
YES

**Screen**:

**I7g MFI 5 SEL=00**

**Description**:
MULTI-FUNCTION 5 INPUT SELECTIONS; TERMINAL T17

**Range**:
00 TO 19, REFER FIGURE 9.11

**Default Value**:
00 (UNUSED)

**OFF to Modify**:
YES

**Screen**:

**I7h MFI 6 SEL=00**

**Description**:
MULTI-FUNCTION 6 INPUT SELECTIONS; TERMINAL T18

**Range**:
00 TO 19, REFER FIGURE 9.11

**Default Value**:
00 (UNUSED)

**OFF to Modify**:
YES

**FUNCTION**
Certain input modes are able to be selected from Screen I7a which offer programmable input functions. There are a maximum of six inputs and each may be programmed individually using Screens I7c to I7h. The selection of functions available is shown in table opposite.

**SETTING UP**
Determine which input mode is required (Screen I7a). Program each input, MFI 1 to 6, Screens I7c to I7h, as required.

Be very careful that you have selected the correct functions.

Always check operation under safe conditions before entering the system into service.
### SUBGROUP I8: FIBRE OPTIC INPUT

#### I8a - I8d  FIBRE OPTIC INPUT SCALING CONTROLS

<table>
<thead>
<tr>
<th>Screen</th>
<th>I8a F LO=−100.0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>FIBRE INPUT LOW SETPOINT</td>
</tr>
<tr>
<td>Range</td>
<td>-400% TO +400%</td>
</tr>
<tr>
<td>Units</td>
<td>% OF MOTOR RATED SYNCHRONOUS SPEED OR TORQUE</td>
</tr>
<tr>
<td>Default Value</td>
<td>−100%</td>
</tr>
<tr>
<td>OFF to Modify</td>
<td>NO</td>
</tr>
<tr>
<td>Attribute</td>
<td>HIDDEN</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Screen</th>
<th>I8b F HI=+100.0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>FIBRE INPUT HIGH SETPOINT</td>
</tr>
<tr>
<td>Range</td>
<td>-400% TO +400%</td>
</tr>
<tr>
<td>Units</td>
<td>% OF MOTOR RATED SYNCHRONOUS SPEED OR TORQUE</td>
</tr>
<tr>
<td>Default Value</td>
<td>+100%</td>
</tr>
<tr>
<td>OFF to Modify</td>
<td>NO</td>
</tr>
<tr>
<td>Attribute</td>
<td>HIDDEN</td>
</tr>
</tbody>
</table>

**FUNCTION**

Defines the scaling of the Fibre Optic input.

<table>
<thead>
<tr>
<th>Screen</th>
<th>I8c FIBRE MODE=0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>FIBRE OPTIC CONTROL MODE SELECTION</td>
</tr>
<tr>
<td>Range</td>
<td>0-5, REFER TABLE BELOW</td>
</tr>
<tr>
<td>Default Value</td>
<td>0 (No Control)</td>
</tr>
<tr>
<td>OFF to Modify</td>
<td>YES</td>
</tr>
<tr>
<td>Attribute</td>
<td>HIDDEN</td>
</tr>
</tbody>
</table>

**FUNCTION**

A master/slave fibre optic network enabling synchronised starting/stopping and fault response of the Elite Series connected via a fibre optic loop. Refer General Application Note 4216-045 for more detail.

**SETTING UP**

Only one Elite Series in the loop should be set to master.

<table>
<thead>
<tr>
<th>NO</th>
<th>FIBRE MODE</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>NO CONTROL</td>
<td>No response to the fibre optic control</td>
</tr>
<tr>
<td>1</td>
<td>MASTER</td>
<td>Overall control of the network</td>
</tr>
<tr>
<td>2</td>
<td>SLAVE</td>
<td>Full slave control</td>
</tr>
<tr>
<td>3</td>
<td>SLAVE TRIP</td>
<td>Slave control with Trip/Reset related control only</td>
</tr>
<tr>
<td>4</td>
<td>SLAVE RUN</td>
<td>Slave control with run control only</td>
</tr>
<tr>
<td>5</td>
<td>SLAVE RUN/STP</td>
<td>Slave control with run control and stop on trip</td>
</tr>
</tbody>
</table>

**NOTE:**

The setting on this screen does not affect the transmission or reception of reference information which is controlled by screens I8a, I8b, and O3a.

**Screen**

<table>
<thead>
<tr>
<th>I8d FIB T/O=OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
</tr>
<tr>
<td>Range</td>
</tr>
<tr>
<td>Units</td>
</tr>
<tr>
<td>Default Value</td>
</tr>
<tr>
<td>OFF to Modify</td>
</tr>
<tr>
<td>FUNCTION</td>
</tr>
</tbody>
</table>

---

Figure 9.11: Multi-function Input Functions (Selectable Functions)
SCREEN GROUP L: LIMITS

Group Attribute READ

Screen L2 MIN S=-110%
Description MINIMUM SPEED
Range -250% TO MAXIMUM SPEED SETTING
Units % OF MOTOR RATED SYNCHRONOUS SPEED
Default Value -110% Frames 1 to 4
0% Frames 5 to 7
Off to Modify NO

FUNCTION Sets the speed limits within which the Elite Series can be commanded to operate the motor. Commands to operate beyond these limits will be limited to these limits.

Note that a negative reference speed implies motor operation in reverse.

SETTING UP Adjust minimum and maximum speed limits according to your application requirements.

Screen L3 MAX S=+110%
Description MAXIMUM SPEED
Range MINIMUM SPEED SETTING TO +250%
Units % OF MOTOR RATED SYNCHRONOUS SPEED
Default Value +110%
Off to Modify NO

FUNCTION Sets the speed limits within which the Elite Series can be commanded to operate the motor. Commands to operate beyond these limits will be limited to these limits.

Note that a negative reference speed implies motor operation in reverse.

SETTING UP Adjust minimum and maximum speed limits according to your application requirements.

Screen L4 MIN T=-150%
Description MINIMUM TORQUE
Range -250% TO MAXIMUM TORQUE SETTING
Units % OF RATED MOTOR TORQUE
Default Value -150%
Off to Modify NO

FUNCTION Sets the torque limits within which the Elite Series can be commanded to operate the motor. Commands to operate beyond these limits (e.g., from torque reference input, or as a result of speed control demands) will be limited to these limits.

SETTING UP Adjust minimum and maximum torque limits according to your application limits.

Screen L5 MAX T=+150%
Description MAXIMUM TORQUE
Range MINIMUM TORQUE SETTING TO +250%
Units % OF RATED MOTOR TORQUE
Default Value +150%
Off to Modify NO

FUNCTION Sets the torque limits within which the Elite Series can be commanded to operate the motor. Commands to operate beyond these limits (e.g., from torque reference input, or as a result of speed control demands) will be limited to these limits.

SETTING UP Adjust minimum and maximum torque limits according to your application limits.

Note: The motor will draw current in approximate proportion to the torque demanded. Therefore be sure that the Elite Series connected is able to supply the current necessary to supply the torque required. Do not select minimum or maximum torque which will require the Elite Series to produce more than 150% of its rated output current.

When running in Closed Loop Mode control mode, torque limiting will be indicated if the shaft encoder signals are lost.

Screen L6 SP T/O =INF
Description SPEED LIMIT TIMEOUT
Range 0 TO 25 SEC AND INFINITE
Units SECONDS
Default Value INFINITE
Off to Modify NO

FUNCTION To provide the option of automatically tripping the Elite Series if the speed or torque limits are encountered for a period of time between 0 and 25 seconds.

SETTING UP The Elite Series will automatically limit speed or torque (Screens L2 - L5) if required. In some processes this is normal and may occur continuously, in which case these screens should be set to never timeout - i.e., Set to infinite.

In other processes, such activity indicates loss of process control which may be tolerated for a brief period of time, or may call for immediate tripping of the process. In such cases these screens may be set to the appropriate time.

Torque limit timeout control also protects against shaft encoder signal loss when running in Closed Loop Mode mode.

Zero settings equate in action to instantaneous speed or torque shear-pin functions.

Note: The Torque limit timeout is also used for Current limit timeout.

Screen L8 REGEN= 150%
Description REGENERATION LIMIT
Range 0 TO 250%
Units % OF MOTOR POWER
Default Value 150
Off to Modify NO

FUNCTION When the sign of the load torque and motor speed are different the motor acts as generator (e.g., when decelerating high inertia loads).

This function automatically limits the torque applied (by controlling motor speed) to control the amount of regenerated power.

The object of this is to keep the regenerated power within the system's capabilities.
(whether relying on natural losses or using a dynamic brake).

In utilising this function the optimum braking performances can be achieved without danger of loss of control due to regeneration beyond the system’s ability to dispose of it.

**SETTING UP**

If the application does not involve regeneration, this screen need not be adjusted. When relying on natural losses to dissipate regenerated power adjust this level to the estimated loss level (typically 5 to 10 percent) and confirm correct (i.e., trip free) operation by experiment.

When utilising a dynamic brake, set this screen to the appropriate (short or long term) power limit level according to the application requirement and brake dissipation capability.

**L9 CURRENT LIMIT CONTROLS**

**Screen**

L9 | LIMIT = 16A

**Description** CURRENT LIMIT

**Range** 0.25/1.50 times Elite Series nominal rating

**Default** 1.2 times Elite Series nominal rating

**OFF to Modify** NO

**FUNCTION**

To maintain load current within controllable bounds (status = ILT). Torque limit timeout (L7) provides a setable maximum time of active current limit, beyond which the Elite Series will automatically trip (Fault status = TQ LIM T/O).

If the torque limit timeout period is set at zero, the current limit function effectively acts as a “SHEARPIN”, providing rapid over-torque protection.

In Open Loop mode, the current limit is restricted to 125% of the drive current rating even if the value entered is higher. This is to preserve the integrity of the current waveshape, which is important for Open Loop mode control.

**SETTING UP**

Current limit: Where not strictly part of the required setup for the particular application leave this set at 1.2 x Elite Series nominal rated current (refer Figure 2.1).

If there is a particular requirement for this function (e.g., for torque limiting or to ensure the motor cannot approach the overload setting and thus will not trip out) set the current limit to the desired value.

**Hints:**

For normal operation, avoid choosing values much below the motor’s rated current as various effects (starting torque settings, rapid acceleration or deceleration) can lead to confusing results.

In a well set up application current limit should never be required. Current limit acts to override incorrect Elite Series setup or load problems. If current limit action is observed during normal operation of the Elite Series or process, check that the setup is correct - particularly check acceleration, deceleration, motor parameters and boost settings.

**L10, L11, L12 SKIP SPEEDS**

**Screen**

L10 SKIP 1 =+0.0%

**Description** SKIP SPEED 1

**Range** -250% to +250%

**Default** 0%

**OFF to Modify** No

Screen

L11 SKIP 2 =+0.0%

**Description** SKIP SPEED 2

**Range** -250% to +250%

**Default** 0%

**OFF to Modify** No

Screen

L12 SKIP BW=0.0%

**Description** SKIP BANDWIDTH

**Range** 0% TO 20%

**Default** 0%

**OFF to Modify** NO

**FUNCTION**

To provide two zones of reference speeds that cannot be set. The object is to provide “keep out” area of operation which may be selected so that natural mechanical system resonances can be avoided. Skip speeds 1 and 2 define the middle of each skip zone. The skip bandwidth defines the width of the zones.

**SETTING UP**

Complete other commissioning first. Determine points, and breadths of any (two) mechanical resonances in your system. Enter skip speeds and desired bandwidth.

To turn off skip speeds set SK BW to 0.0%.

Check operation and readjust as necessary.

**Hints:**

Avoid choosing values much below the motor’s rated current as various effects (starting torque settings, rapid acceleration or deceleration) can lead to confusing results.

In a well set up application current limit should never be required. Current limit acts to override incorrect Elite Series setup or load problems. If current limit action is observed during normal operation of the Elite Series or process, check that the setup is correct - particularly check acceleration, deceleration, motor parameters and boost settings.
L13 GROUND CURRENT LIMIT

Description: GROUND CURRENT LIMIT
Range: OFF/0.1 to 9999A
Units: Amps/Phase
Default: 30% of Inverter rated current per phase

FUNCTION: To set the limit of ground current that is acceptable.

L14 RUN AT MINIMUM SPEED

Description: RUN MINIMUM SPEED
Range: YES/NO
Default: YES

FUNCTION: If set to NO then the Elite Series will change to the READY state if the reference speed is reduced to below the minimum speed while running.

SCREEN GROUP M: MULTI-REFERENCE SETPOINTS

Group Attribute: HIDDEN

M1 MREF1=+0.00%
M2 MREF2=+0.00%
M3 MREF3=+0.00%
M4 MREF4=+0.00%
M5 MREF5=+0.00%
M6 MREF6=+0.00%
M7 MREF7=+0.00%

Description: MULTI-REFERENCE SETPOINTS
Range: -250% to +250%
Units: % OF RATED MOTOR SPEED OR Torque
Default Value: 0.00%
OFF to Modify: NO

FUNCTION: These are reference setpoints into which user values can be loaded.

Note: Figure 9.14 shows special functions that can be assigned as Multi-reference setpoints using either the motorised Pot input mode or all programmable input mode with multi-function input selection in Screens I7c to I7h.

SCREEN M REF SETPOINTS

Figure 9.14: Special Functions using Multi-Reference Setpoints

Note: Figure 9.15 shows special functions assigned to Multi-reference setpoints M4-M7 when using Input Mode O3 (MRef 2W). Multi-reference setpoints M1-M3 are available as in Figure 9.14.
Setting up adjustment is only necessary when a function requiring multi-references is selected. Determine the speed or torque reference level needed for each state and enter this value.

**SCREEN GROUP N: MOTOR NAMEPLATE DATA**

### Attribute: HIDDEN

- **NAMEPLATE**
  - N1 MTR CUR=14.6A
  - N2 MTR VOLT=400V
  - N3 MTR FRQ=50Hz
  - N4 MTR P=7.5kW
  - N5 MTR RPM=1476
  - N6 MTR COOL=40%

### Screen N1 MTR CUR=0.0A
- **Description:** RATED (NAMEPLATE) MOTOR CURRENT
- **Valid Range:** 20% TO 150% OF ELITE SERIES SIZE
- **Units:** AMPs
- **Default Value:** 75% (Dependant on Elite Series model)
- **OFF to Modify:** NO

### Screen N2 MTR VOLT=0V
- **Description:** RATED (NAMEPLATE) MOTOR VOLTAGE
- **Valid Range:** 0 TO 999V
- **Units:** VOLTS
- **Default Value:** 400
- **OFF to Modify:** NO

### Screen N3 MTR FRQ=0Hz
- **Description:** RATED (NAMEPLATE) MOTOR FREQUENCY
- **Valid Range:** 25 TO 400Hz
- **Units:** HERTZ
- **Default Value:** 50
- **OFF to Modify:** NO

### Screen N4 MTR P=0.0kW
- **Description:** RATED (NAMEPLATE) MOTOR POWER
- **Valid Range:** 0 TO 650kW, 50% TO 150% OF ELITE RATED kW
- **Units:** KILOWATTS
- **Default Value:** Dependant on Elite Series model
- **OFF to Modify:** NO

### Screen N5 MTR RPM=0
- **Description:** RATED (NAMEPLATE) MOTOR SPEED
- **Valid Range:** 200 TO 24000 RPM
- **Units:** REVOLUTIONS PER MINUTE
- **Default Value:** Dependant on Elite Series model
- **OFF to Modify:** NO

### Screen N6 MTR COOL=40%
- **Description:** MOTOR COOLING AT ZERO SPEED
- **Range:** 20 to 100%, OFF
- **Units:** PERCENTAGE OF COOLING AT RATED SPEED
- **Default Value:** 40%
- **OFF to Modify:** NO

**FUNCTION** Calibrates the Elite Series for the motor being driven. Provides information for the thermal model motor protection.

The Elite Series must be correctly sized to control the motor being driven. The motor should be between 50% and 150% of the Elite Series rated power (kW) and the motor must have between two and twelve poles.

If the motor nameplate power is listed in horsepower(hp) then convert to kilowatts(kW) by using the following formula:
The thermal model includes correction for the reduced efficiency of standard motor cooling at reduced speed by interpolating between the zero speed cooling term (Screen N6) and rated cooling at rated speed (refer Figure 4.2). The thermal model is reset when power is removed from the Elite Series.

**SETTING UP**

These parameters must be set before operating the Elite Series. Invalid combinations of values will be detected as “Parameter Fault” error, tripping the Elite Series.

Enter motor rated (nameplate) parameters - current, voltage, frequency, power and speed (rpm). Where the nameplate includes multiple options or the configuration (star/delta) of the windings has been altered, be sure to enter the correct data for your configuration.

Estimate the efficiency of cooling of your motor at zero speed and enter this figure. (This is very application dependent - as a guide, 40% is typical. Where open frame, force cooled or water cooled motors are used, higher zero speed cooling efficiency will be achieved.) If extended operation at low speed leads to tripping due to the motor thermal model, check the motor. If it is clearly not very hot, the zero speed cooling figure may be safely increased. The motor thermal model may be disabled by setting the motor cooling parameter to OFF. Independent external thermal protection should then be applied to the motor.

---

**ENCODER SENSOR CALIBRATION**

**Screen**

N8 ENCODER=0

**Description**

PULSES PER REVOLUTION OF TACHO ENCODER

**Range**

0 TO 8191 PPR

**Default Value**

0

**FUNCTION**

To operate the Elite Series in Closed Loop vector mode, feedback of motor shaft position is required. The Elite Series is designed to accept input from an incremental shaft encoder. This parameter calibrates the Elite Series to the number of pulses per motor shaft revolution generated by the encoder.

**SETTING UP**

Enter the encoder’s number of pulses per motor shaft revolution. Any gearing between the motor and encoder must be taken into account.

**Notes:**

See also Section 4.2.

Full details on selection, mounting and checking of the shaft encoder are detailed in the Elite Series Getting Started Manual (PDL Part No. 4201-179).

---

**ENCODER INPUT TYPE SELECTION**

**Screen**

N9 ENC I/P=DIFF

**Description**

SELECTION OF TYPE OF ENCODER

**Range**

SING (single ended) or DIFF (differential)

**Default Value**

DIFF

**FUNCTION**

The input circuit on the Control Board can be configured to accept either style of shaft encoder. Differential type is recommended for its superior noise-rejection capabilities.

Full details on selection, mounting and checking of the shaft encoder are detailed in the Elite Series Getting Started Manual (PDL Part No. 4201-179).
SCREEN GROUP O: OUTPUTS

Group Attribute HIDDEN

SUBGROUP O1: ANALOGUE OUTPUTS

O1a, O1e  ANALOGUE OUTPUTS SOURCE SELECTION

Screens  
- O1a AO1 O/P=06
- O1e AO2 O/P=02

Description  ANALOGUE OUTPUT SOURCE SELECTION

Range  00 TO 19 - REFER TO FIGURE 9.17
Default Value  AO1 O/P= 06 (MOTOR SPEED)
- AO2 O/P= 02 (OUTPUT CURRENT)

OFF to Modify  YES

FUNCTION  Provides the ability to select the driving source for each of the two analogue outputs, from the following list:

<table>
<thead>
<tr>
<th>NO.</th>
<th>SOURCE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>NULL</td>
<td>minimum signal output</td>
</tr>
<tr>
<td>01</td>
<td>FULL SCALE</td>
<td>maximum signal output</td>
</tr>
<tr>
<td>02</td>
<td>OUTPUT CURR</td>
<td>% of motor rated current</td>
</tr>
<tr>
<td>03</td>
<td>OUTPUT VOLTS</td>
<td>% of motor rated voltage</td>
</tr>
<tr>
<td>04</td>
<td>BUS VOLTAGE</td>
<td>% of motor rated voltage x 1.414</td>
</tr>
<tr>
<td>05</td>
<td>MOTOR POWER</td>
<td>% of motor rated power</td>
</tr>
<tr>
<td>06</td>
<td>MOTOR SPEED</td>
<td>% of motor rated speed</td>
</tr>
<tr>
<td>07</td>
<td>MOTOR TORQUE</td>
<td>% of motor rated torque</td>
</tr>
<tr>
<td>08</td>
<td>REF SPEED</td>
<td>% of motor rated speed</td>
</tr>
<tr>
<td>09</td>
<td>REF TORQUE</td>
<td>% of motor rated torque</td>
</tr>
<tr>
<td>10</td>
<td>MOTOR TEMP</td>
<td>% of motor rated temperature</td>
</tr>
<tr>
<td>11</td>
<td>INVERTER TEMP</td>
<td>% of inverter rated temperature</td>
</tr>
<tr>
<td>12</td>
<td>ANALOG IN 1</td>
<td>%</td>
</tr>
<tr>
<td>13</td>
<td>ANALOG IN 2</td>
<td>%</td>
</tr>
<tr>
<td>14</td>
<td>ANALOG IN 1+2</td>
<td>%</td>
</tr>
<tr>
<td>15</td>
<td>FIBRE IN</td>
<td>%</td>
</tr>
<tr>
<td>16</td>
<td>PROCESS REF</td>
<td>%</td>
</tr>
<tr>
<td>17</td>
<td>PROCESS FEEDBACK</td>
<td>%</td>
</tr>
<tr>
<td>18</td>
<td>PROCESS ERROR</td>
<td>%</td>
</tr>
<tr>
<td>19</td>
<td>VISTA CONTROL</td>
<td>%</td>
</tr>
</tbody>
</table>

Figure 9.17: Analogue & Fibre Outputs Source Selection

SETTING UP  Select the desired analogue signal source for each of the two analogue outputs.

Select the format of each output using Screens O1b, O1f. Adjust the scaling using Screens O1c and O1d for Analogue Output 1, and O1g and O1h for Analogue Output 2.
ANALOGUE OUTPUT FORMATTING AND SCALING CONTROLS

FUNCTION

Provides the ability to change each of the two analogue outputs to one of the four formats listed in Figure 9.16.

SCALING

AO1 LO / AO2 LO
Maps the AO1 LO / AO2 LO level to the minimum output signal level for the selected output format.

AO1 HI / AO2 HI
Maps the AO1 HI / AO2 HI level to the maximum output signal level for the selected output format. The Elite Series analogue outputs are interpolated linearly between the selected LO and HI settings.

LO settings may be greater than HI settings, thus providing inverse control (i.e., increasing the analogue output source level decreases the analogue output signal level).

SETTING UP

No action is required if no devices are connected to these terminals.

Determine the required format of these analogue outputs to suit the external devices being driven by their respective output terminals, and set up on Screens O1b, O1f.

Determine the range over which analogue control is desired.

Adjust the LO setting (Screens O1c, O1g) to the desired minimum analogue output signal (-10V/0V/4mA/0mA).

Adjust the HI setting (Screens O1d, O1h) to the desired maximum analogue output signal (+10V/20mA).

ANALOGUE OUTPUT SCALING

<table>
<thead>
<tr>
<th>CODE</th>
<th>ANALOGUE OUTPUT FORMAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10V</td>
<td>0 to 10Vdc, input&gt; 1 kohms</td>
</tr>
<tr>
<td>+/-10V</td>
<td>-10 to +10Vdc, input&gt;1 kohms</td>
</tr>
<tr>
<td>4-20mA</td>
<td>4 to 20 mA, input&lt;500 ohms</td>
</tr>
<tr>
<td>0-20mA</td>
<td>0 to 20 mA, input&lt;500 ohms</td>
</tr>
</tbody>
</table>

Example 1
Analogue Output 1 (AO1) is formatted as a ±10V output and is used to drive an analogue meter to represent motor speed for a 1440 rpm motor across the range –3000 rpm to +3000 rpm;

Set the source via Screen O1a to:
O1a AO1 O/P=06 (actual motor speed)

Set the format via Screen O1b to:
O1b AO1=+/-10V (–10Vdc to +10Vdc)

Set the scaling via Screens O1c and O1d to:
O1c AO1 LO= –200%
O1d AO1 HI=+200%

With this setup, Analogue Output 1 (AO1) would output –4.8Vdc when the motor was rotating in the reverse direction at 1440 rpm.

\[
\text{actual motor speed} = \frac{\text{actual motor speed}}{\text{rated synchronous speed}} \times 10V \times \left(\frac{\text{actual synchronous speed}}{100\%} \right)
\]

\[
\text{rated synchronous speed} = 1500 \text{rpm}
\]

Example 2
Analogue Output 2 (AO2) is formatted as a 4-20mA output and is used to drive into a 4-20mA PLC analogue input to represent motor current for a 20A motor across the range 0A to 50A;

Set the source via Screen O1e to:
O1e AO2 O/P=02 (actual motor current)

Set the format via Screen O1f to:
O1f AO2=4-20mA

Set the scaling via Screens O1c and O1d to:
O1c AO2 LO= –200%
O1d AO2 HI=+200%

EXAMPLE 1 Analogue Output 1 (AO1) is formatted as a ±10V output and is used to drive an analogue meter to represent motor speed for a 1440 rpm motor across the range –3000 rpm to +3000 rpm;

Set the source via Screen O1a to:

O1a AO1 O/P=06 (actual motor speed)

Set the format via Screen O1b to:

O1b AO1=+/-10V (–10Vdc to +10Vdc)

Set the scaling via Screens O1c and O1d to:

O1c AO1 LO= –200%
O1d AO1 HI=+200%

With this setup, Analogue Output 1 (AO1) would output –4.8Vdc when the motor was rotating in the reverse direction at 1440 rpm.

\[
\text{actual motor speed} = \frac{\text{actual motor speed}}{\text{rated synchronous speed}} \times 10V \times \left(\frac{\text{actual synchronous speed}}{100\%} \right)
\]

\[
\text{rated synchronous speed} = 1500 \text{rpm}
\]

EXAMPLE 2 Analogue Output 2 (AO2) is formatted as a 4-20mA output and is used to drive into a 4-20mA PLC analogue input to represent motor current for a 20A motor across the range 0A to 50A;

Set the source via Screen O1e to:

O1e AO2 O/P=02 (actual motor current)

Set the format via Screen O1f to:

O1f AO2=4-20mA
With this setup, Analogue Output 2 (AO2) would source 10.4mA when the motor was drawing 20A.

**SUBGROUP O2: DIGITAL O/P RELAYS**

**O2a, O2c, O2e RELAY SELECTIONS**

**Screens**
- O2a RELAY1=02
- O2c RELAY2=05
- O2e RELAY3=08

**Description**
RELAY CONTROL SOURCE SELECTION

**Range**
00 TO 23, REFER FIGURE 9.20

**Default Value**
- RLY1 = 02 (No faults)
- RLY2 = 05 (Overload fault)
- RLY3 = 08 (Run)

**OFF to Modify**
NO

**FUNCTION**
Provides the ability to link each relay to one of the outputs shown in Figure 9.20.

All relays have a 250ms minimum pulse width.

**SETTING UP**
No action required if relays are not to be used.

Select the desired source for each relay. If necessary, set up associated level setting screens (i.e., comparators C1 to C6).

**O2b, O2d, O2f RELAY INVERSION**

**Screens**
- O2b RELAY1 INV=N
- O2d RELAY2 INV=N
- O2f RELAY3 INV=N

**Description**
INVERT THE LOGIC OF THE OUTPUT RELAY

**Range**
Y/N

**Default Value**
N

**OFF to Modify**
NO

**FUNCTION**
Provides the ability to invert the function of each output relay if desired.

**SETTING UP**
No action required unless relays are used and an inverted output is necessary.

Determine desired logic inversion and select as necessary.

**Note:**
RLY1 has both normally open contacts (T1/T2) and normally closed contacts (T2/T3).
RLY2 has normally open contacts (T4/T5).
RLY3 has normally open contacts (T6/T7).

---

**Table 9.20: Relay Table Selection**

**Brake Release:**
This function can be used to release a mechanical brake on the motor. The output is activated after the current is first applied to the motor and deactivated one second before the end of the off delay period (Refer Screen S6).
**O3a**

**SUBGROUP O3: FIBRE OUTPUT**

**O3a**

**FIBRE OUTPUT SOURCE SELECT**

<table>
<thead>
<tr>
<th>Screen</th>
<th>FIBRE O/P=06</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>FIBRE OUTPUT SOURCE SELECTION</td>
</tr>
<tr>
<td>Range</td>
<td>00 TO 19 - REFER TO FIGURE 9.17.</td>
</tr>
<tr>
<td>Default Value</td>
<td>06 (MOTOR SPEED)</td>
</tr>
<tr>
<td>OFF to Modify</td>
<td>NO</td>
</tr>
<tr>
<td>FUNCTION</td>
<td>Provides the ability to select the driving source for Fibre Optic output.</td>
</tr>
</tbody>
</table>

**SETTING UP**

Select the desired Fibre signal source.

---

**SCREEN GROUP P: PROCESS CONTROL**

**P1**

**PROCESS CONTROL SETPOINT SOURCE**

<table>
<thead>
<tr>
<th>Screen</th>
<th>P1 PR SRC=NULL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>PROCESS CONTROL SETPOINT SOURCE</td>
</tr>
<tr>
<td>Range</td>
<td>REFER FIGURE 9.21</td>
</tr>
<tr>
<td>Default Value</td>
<td>NULL</td>
</tr>
<tr>
<td>OFF to Modify</td>
<td>YES</td>
</tr>
<tr>
<td>FUNCTION</td>
<td>Defines which input source is used as the setpoint source for process control:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CODE</th>
<th>PROCESS CONTROL SETPOINT SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>NULL</td>
<td>NO SOURCE SELECTED</td>
</tr>
<tr>
<td>AN1</td>
<td>ANALOGUE INPUT 1</td>
</tr>
<tr>
<td>AN2</td>
<td>ANALOGUE INPUT 2</td>
</tr>
<tr>
<td>AN 1+2</td>
<td>ADDITION OF SCALED ANALOGUE INPUTS 1 + 2</td>
</tr>
<tr>
<td>FIBRE</td>
<td>FIBRE OPTIC INPUT</td>
</tr>
<tr>
<td>LOCAL</td>
<td>LOCAL SETPOINT CONTROL (SCREEN A3)</td>
</tr>
<tr>
<td>MREF</td>
<td>MULTI-REFERENCE (SCREENS 7A, M1 TO M7)</td>
</tr>
<tr>
<td>MTRPOT</td>
<td>MOTORISED POTentiOMETER (SCREEN 7A, M1 TO M7)</td>
</tr>
</tbody>
</table>

*Figure 9.21: Process Control Setpoint Source*

**SETTING UP**

Select the desired process control setpoint source to suit your requirements. Refer Figure 3.10.
P2 PROCESS CONTROL FEEDBACK SOURCE

Screen P2 FB SRC=NULL
Description PROCESS CONTROL FEEDBACK SOURCE
Range REFER FIGURE 9.22
Default Value NULL
OFF to Modify YES
FUNCTION Defines which input source is used as the feedback source for process control:

<table>
<thead>
<tr>
<th>CODE</th>
<th>PROCESS CONTROL FEEDBACK SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>NULL</td>
<td>NO SOURCE SELECTED</td>
</tr>
<tr>
<td>AN1</td>
<td>ANALOGUE INPUT 1</td>
</tr>
<tr>
<td>AN1+2</td>
<td>ADDITION OF SCALED ANALOGUE INPUTS 1 + 2</td>
</tr>
<tr>
<td>FBRE</td>
<td>FBRE OPTIC INPUT</td>
</tr>
</tbody>
</table>

Figure 9.22: Process Control Feedback Source

SETTING UP Select the desired process control feedback source to suit your requirements. Refer Figure 3.10.

P3, P4, P5 PROCESS CONTROL PID SETTINGS

Screen P3 Kc=0.1
Description CONTROLLER GAIN (Kc)
Range 0.1 TO 10.0
Default Value 0.1
OFF to Modify NO
FUNCTION Defines the controller gain (Kc) of the process controller.

SETTING UP Select the desired controller gain to suit your requirements.

Screen P4 Ti=INF
Description INTEGRATION TIME (Ti)
Range 1s TO 1000s, INF
Default Value INF
OFF to Modify NO
FUNCTION Defines the integration time of the process controller.

SETTING UP Select the desired integration time to suit your requirements.

ANTI-WINDUP PROTECTION LIMITS THE PROCESS CONTROLLER INTEGRATOR.

SETTING UP Select the desired integration time to suit your requirements.

Note: The process controller has a sampling period (Ts) of 100ms.

Screen P5 Td=0.0s
Description DIFFERENTIATION TIME (Td)
Range 0.0s TO 250s
Default Value 0.0s
OFF to Modify NO
FUNCTION Defines the differentiation time of the process controller.

P2 PROCESS CONTROL FEEDBACK SOURCE

Screen P2 FB SRC=NULL
Description PROCESS CONTROL FEEDBACK SOURCE
Range REFER FIGURE 9.22
Default Value NULL
OFF to Modify YES
FUNCTION Defines which input source is used as the feedback source for process control:

<table>
<thead>
<tr>
<th>CODE</th>
<th>PROCESS CONTROL FEEDBACK SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>NULL</td>
<td>NO SOURCE SELECTED</td>
</tr>
<tr>
<td>AN1</td>
<td>ANALOGUE INPUT 1</td>
</tr>
<tr>
<td>AN1+2</td>
<td>ADDITION OF SCALED ANALOGUE INPUTS 1 + 2</td>
</tr>
<tr>
<td>FBRE</td>
<td>FBRE OPTIC INPUT</td>
</tr>
</tbody>
</table>

Figure 9.22: Process Control Feedback Source

SETTING UP Select the desired process control feedback source to suit your requirements. Refer Figure 3.10.

P3, P4, P5 PROCESS CONTROL PID SETTINGS

Screen P3 Kc=0.1
Description CONTROLLER GAIN (Kc)
Range 0.1 TO 10.0
Default Value 0.1
OFF to Modify NO
FUNCTION Defines the controller gain (Kc) of the process controller.

SETTING UP Select the desired controller gain to suit your requirements.

Screen P4 Ti=INF
Description INTEGRATION TIME (Ti)
Range 1s TO 1000s, INF
Default Value INF
OFF to Modify NO
FUNCTION Defines the integration time of the process controller.

SETTING UP Select the desired integration time to suit your requirements.

ANTI-WINDUP PROTECTION LIMITS THE PROCESS CONTROLLER INTEGRATOR.

SETTING UP Select the desired integration time to suit your requirements.

Note: The process controller has a sampling period (Ts) of 100ms.

Screen P5 Td=0.0s
Description DIFFERENTIATION TIME (Td)
Range 0.0s TO 250s
Default Value 0.0s
OFF to Modify NO
FUNCTION Defines the differentiation time of the process controller.
SCREEN GROUP R: ACCEL/DECEL RATES

Group Attribute HIDDEN

R1, R2 ACCELERATION AND DECELERATION RATES

Screen R1 ACC=10.0%/s
Description ACCELERATION RATE
Range 0.02 to 1300%/SEC
Units % OF MOTOR RATED SYNCHRONOUS SPEED PER SECOND
Default Value 10%/s
OFF to Modify NO
FUNCTION Controls the rates of change of speed (acceleration or deceleration) of the Elite Series.

SETTING UP These rates should be set according to suitability to a process. In high performance applications it may be desirable to calculate the maximum rates with respect to torque capability of the drive system and motor/load inertia. In some cases it may be desirable to adjust the rate to a very high level and rely on the automatic torque limit function - this will give the fastest response.

Generally, use the slowest settings acceptable for your application. An acceleration rate which is too fast may cause the drive to overload (status ILT) and automatically override your setting with a slower one. A deceleration rate which is too fast can cause the motor to regenerate (status VLT) into the drive and automatically override your setting with a slower one.

Being realistic with these settings generally leads to a more successful commissioning. Where fast accelerations/decelerations are called for, it is often best to use slower settings initially, until all other operations are proven.

Freewheel to stop (instead of controlled deceleration) can be achieved by setting the Stop mode (Screens S2, S4) to spin or OFF.

Regeneration limit may be used to automatically provide maximum deceleration rate for the given losses of a system as an alternative to fixed deceleration. See Screen L8.

EXAMPLE For a 4 pole 50Hz motor with rated synchronous speed of 1500rpm; setting 5%/s acceleration rate would accelerate the motor from 0% speed (standstill) to 100% speed (1500rpm) in 20s.

Note: Remember when using extended (long) deceleration rates, adjust the Stop Timeout (Screen S11) appropriately.

R3, R4, R5 ALTERNATIVE ACCELERATION RATES

Screen R3 AACC=10%/s
Description ALTERNATIVE ACCELERATION RATE
Range 0.02 to 1300%/SEC
Units % OF MOTOR RATED SYNCHRONOUS SPEED PER SECOND
Default Value 10.0%/s
OFF to Modify NO

Screen R4 ADEC=10%/s
Description ALTERNATIVE DECELERATION RATE
Range 0.02 to 1300%/SEC
Units % OF MOTOR RATED SYNCHRONOUS SPEED PER SECOND
Default Value 10.0%/s
OFF to Modify NO

Screen R5 BRK SP=OFF
Description BREAK SPEED FOR ALTERNATIVE ACCEL/DECEL
Range OFF, 0.1 TO 250%
Units % OF MOTOR RATED SYNCHRONOUS SPEED
Default Value OFF
OFF to Modify NO
FUNCTION These alternative acceleration and deceleration settings are provided to offer the ability to achieve alternative rates. They may be accessed in two ways:

i) Access by break point - Screen R5 is used to select a break speed below which the alternative rates are active.

ii) Access by utilising alternative acceleration rate multi-function control - A multi-function input (Option 14, Screens I7c to I7h) via Screen I7a. The acceleration/ deceleration rates which are not currently in use (as controlled by Screen R5) are chosen when the input is active (closed).

SETTING UP Program the desired control (multi-function input selection or break point) as desired. Set the alternative rates to the desired levels. The break speed for alternative accel/decel (Screen R5) defaults to zero, effectively disabling the alternative rates for normal use.

Figure 9.23: Dual Acceleration/Deceleration Rates
Note: Remember when using extended (long) deceleration rates, adjust the Stop Timeout (Screen S11) appropriately.

### R6 STOP DECELERATION RATE

<table>
<thead>
<tr>
<th>Screen</th>
<th>R6 STOPR=1300%/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>DECELERATION (STOPPING) RATE USED WHEN STOPPING</td>
</tr>
<tr>
<td>Range</td>
<td>0.02 to 1300%/SEC</td>
</tr>
<tr>
<td>Units</td>
<td>% OF RATED MOTOR SYNCHRONOUS SPEED PER SECOND</td>
</tr>
<tr>
<td>Default Value</td>
<td>1300</td>
</tr>
<tr>
<td>OFF to Modify</td>
<td>NO</td>
</tr>
<tr>
<td>Attribute</td>
<td>HIDDEN</td>
</tr>
<tr>
<td>FUNCTION</td>
<td>When the Elite Series receives a “stop-rate” command (see Screens S2, S4) this deceleration rate is used. This provides the ability to separately program running accel/decel rates (e.g., to suit a control system) and a different stop-rate (e.g., to provide a very fast stop for safety reasons). This function overrides normal and alternative deceleration rates.</td>
</tr>
<tr>
<td>SETTING UP</td>
<td>If this function is desired, set to the appropriate deceleration rate. Set desired stop mode screen (Screen S2, S4) to STOPR.</td>
</tr>
</tbody>
</table>

### R7 SPEED FILTER TIME CONSTANT

<table>
<thead>
<tr>
<th>Screen</th>
<th>R7 SP FILT=0.0s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>SPEED S-CURVE FILTER TIME CONSTANT (used to “soften” acceleration and deceleration)</td>
</tr>
<tr>
<td>Range</td>
<td>0 to 60s</td>
</tr>
<tr>
<td>Units</td>
<td>seconds for 100%/s change in acceleration and deceleration</td>
</tr>
<tr>
<td>Default Value</td>
<td>0.0s/100%/s Frames 1 to 3</td>
</tr>
<tr>
<td></td>
<td>1.0s/100%/s Frame 4</td>
</tr>
<tr>
<td></td>
<td>2.0s/100%/s Frames 5 to 7</td>
</tr>
<tr>
<td>OFF to Modify</td>
<td>NO</td>
</tr>
<tr>
<td>Attribute</td>
<td>HIDDEN</td>
</tr>
<tr>
<td>FUNCTION</td>
<td>Provide “S-CURVE” filtering to changes in speed reference, including STOP and START commands. The S Curve filter limits the changes of acceleration and deceleration. It is often used to “soften” acceleration and deceleration, especially in hoists and elevators. Also useful for improving deceleration under high inertia. Active only in speed control mode. Not active during Stop Rate stop.</td>
</tr>
<tr>
<td>SETTING UP</td>
<td>Leave set at the default value if not required. Setting at a value other than 0 will affect the unit’s ability to follow a speed profile. Increase this value to improve deceleration under voltage limits.</td>
</tr>
</tbody>
</table>

### R8 TORQUE FILTER TIME CONSTANT

<table>
<thead>
<tr>
<th>Screen</th>
<th>R8 TQ FLT=0.00s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>TORQUE FILTER TIME CONSTANT</td>
</tr>
<tr>
<td>Range</td>
<td>0 to 10.0 SEC</td>
</tr>
<tr>
<td>Units</td>
<td>SECONDS</td>
</tr>
<tr>
<td>Default Value</td>
<td>0.0 SEC</td>
</tr>
<tr>
<td>OFF to Modify</td>
<td>NO</td>
</tr>
<tr>
<td>Attribute</td>
<td>HIDDEN</td>
</tr>
<tr>
<td>FUNCTION</td>
<td>Provides low-pass filtering to changes in torque reference, including STOP and START commands. This controls the rate of change of output torque. It is often used to “soften” changes in torque. It is especially useful when changing the sign of the torque. If there is any backlash in the mechanical system it can soften the taking up of the backlash. Active only in torque control modes.</td>
</tr>
<tr>
<td>SETTING UP</td>
<td>Adjust if the shock due to sudden changes in commanded torque exhibit undesirable effects in the mechanical system. If the time constant is set to one second, the response to a 100% torque reference step change will be a 63% change in the reference torque after one second.</td>
</tr>
</tbody>
</table>
**SCREEN GROUP S: START AND STOP MODES**

Group Attribute HIDDEN

<table>
<thead>
<tr>
<th>Screen</th>
<th>S1 START=NORMAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>NORMAL/SPIN</td>
</tr>
<tr>
<td>Default</td>
<td>NORMAL</td>
</tr>
<tr>
<td>OFF to Modify</td>
<td>NO</td>
</tr>
</tbody>
</table>

FUNCTION

In V/Hz operation this screen provides the option of a special starting mode for motor loads which may be spinning when started (e.g., freewheeling fans).

Problems can occur if a spinning load is started conventionally (i.e., Elite Series turns on at zero hertz, before accelerating to the set speed) as the load must first be stalled to near zero speed, before being accelerated.

When spin start is selected, the Elite Series starts at the maximum frequency, instead of zero hertz. If the set speed does not match the spinning speed of the load, an over current situation arises, causing the Elite Series to operate in current limit and reduce its output frequency until the frequency matches the speed of the load. Once the frequencies match, the current will be reduced and the load will be accelerated normally toward the set point.

**Note:**

When spin starting from the maximum frequency, the direction is set to the same as the reference speed. When the reference speed is 0.0, the spin start will be in the positive direction.

SETTING UP

- If the Elite Series will not normally be required to start spinning loads or is operating in Closed Loop Vector Mode, set the starting mode to (normal) ramp acceleration.

- If starting into spinning loads is a specific requirement of your application, set the starting mode to SPIN. During a spin start, while the Elite is trying to match the output frequency with the motor speed, the output current will be controlled independently of the motor current limit (Screen L9) and the Torque limit timeout (Screen L7). For most reliable starting, set the torque limit timeout to above 0.0s to prevent "Shearpin" tripping once the Elite matches the motor speed.

  For reliable low speed spin starting, the Start Torque (Screen X4c) must be set correctly. Set the screen using Normal start.

**S2 STOP MODE**

<table>
<thead>
<tr>
<th>Screen</th>
<th>S2 STOP=NORMAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>USUAL STOPPING MODE</td>
</tr>
<tr>
<td>Range</td>
<td>NORMAL/RAMP/SPIN/STOP-RATE/OFF/DC-BRAKE</td>
</tr>
<tr>
<td>Default Value</td>
<td>NORMAL</td>
</tr>
<tr>
<td>OFF to Modify</td>
<td>NO</td>
</tr>
</tbody>
</table>

FUNCTION

Select the stopping mode to use (see figure 9.24).

SETTING UP

Be sure to understand the function which the process needs. Usually the default [Normal] setting will be appropriate. Select other modes to suit the application.

**S4 ALTERNATIVE STOP MODE**

<table>
<thead>
<tr>
<th>Screen</th>
<th>S4 ASTOP=NORMAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>ALTERNATIVE STOPPING MODE</td>
</tr>
<tr>
<td>Range</td>
<td>NORMAL/RAMP/SPIN/STOP-RATE/OFF/DC-BRAKE</td>
</tr>
<tr>
<td>Default Value</td>
<td>NORMAL</td>
</tr>
<tr>
<td>OFF to Modify</td>
<td>NO</td>
</tr>
</tbody>
</table>

FUNCTION

Select the stopping mode to use (see figure 9.22). The alternative stop mode is used if the MFI input function Alternative Stop-Reset is activated.

SETTING UP

Be sure to understand the function which the process needs. Usually the default [Normal] setting will be appropriate. Select other modes to suit the application.

**S5 START DELAY TIME**

<table>
<thead>
<tr>
<th>Screen</th>
<th>S5 STR DLY=0.00s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>START DELAY TIME</td>
</tr>
<tr>
<td>Range</td>
<td>0 to 5 SEC</td>
</tr>
<tr>
<td>Units</td>
<td>SECONDS</td>
</tr>
<tr>
<td>Default Value</td>
<td>0.00s</td>
</tr>
<tr>
<td>OFF to Modify</td>
<td>NO</td>
</tr>
</tbody>
</table>

FUNCTION

Sets a period of time following the receipt of a START command before accelerating the motor.

Operates in speed control only. It is intended to provide time for slow release functions to operate (particularly hoist brakes in cranes) before accelerating the motor.

SETTING UP

Leave set to zero (default) unless the application specifically requires such a delay. If required, set the appropriate delay.

**S6 OFF DELAY TIME**

<table>
<thead>
<tr>
<th>Screen</th>
<th>S6 OFF DLY T=1.0s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>OFF DELAY TIME</td>
</tr>
<tr>
<td>Range</td>
<td>0 to 3600 SEC</td>
</tr>
<tr>
<td>Units</td>
<td>SECONDS</td>
</tr>
<tr>
<td>Default Value</td>
<td>1s</td>
</tr>
<tr>
<td>OFF to Modify</td>
<td>NO</td>
</tr>
</tbody>
</table>

FUNCTION

Sets the period of time that the Elite Series maintains the magnetising flux in the motor after coming to zero speed when stopping. It is desirable to maintain the flux if the motor is expected to restart without a delay (the
reason for this is that when starting from the “OFF” state, flux must first be built up before attempting to accelerate the motor or provide torque. This may take several hundred milliseconds, and such a delay may be undesirable in some situations).
The delay may also be used in applications to maintain control of the motor at zero speed, until the brake is applied, before turning the motor off.

**SETTING UP** Leave set to the default setting unless the application requires a special value. Set to the appropriate time according to your process.

<table>
<thead>
<tr>
<th>MODE</th>
<th>V/Hz and Open Loop</th>
<th>Closed Loop Vector Speed Mode</th>
<th>Closed Loop Vector Torque Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORMAL</td>
<td>Applies a zero speed reference and decelerate to zero speed</td>
<td>Applies a zero torque reference and coasts to zero speed</td>
<td>Transitions to speed control and performs a normal speed controlled stop - i.e., decelerates to zero speed</td>
</tr>
<tr>
<td>RAMP</td>
<td>Same as NORMAL</td>
<td>Transitions to torque control and performs a normal torque controlled stop (i.e., coasts to zero speed)</td>
<td>Same as NORMAL</td>
</tr>
<tr>
<td>SPIN</td>
<td>Turns outputs off for the off delay time then changes to OFF state</td>
<td>Transitions to torque control and performs a normal torque controlled stop (i.e., coasts to zero speed)</td>
<td>Same as NORMAL</td>
</tr>
<tr>
<td>STOP-RATE</td>
<td>Same as NORMAL except the special stop deceleration rate (Screen R6) is used</td>
<td>Transitions to speed control and performs a speed controlled stop using the special stop deceleration rate (Screen R6)</td>
<td></td>
</tr>
<tr>
<td>OFF</td>
<td>Immediately disables the output - i.e, coasts to zero speed</td>
<td>Immediately disables the output - i.e, coasts to zero speed</td>
<td>Applies a DC current as set by Screen S8 until the end of the OFF delay time</td>
</tr>
<tr>
<td>DC BRAKE</td>
<td>Applies a DC current as set by screen S8 until the end of the OFF delay time</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 9.24: Stopping Modes**

**Figure 9.25: Start and Off Delay Times**

**S7 MAINS POWER LOSS RESPONSE**

- **Screen** LOW V TRIP=N
- **Description** MAINS POWER LOSS RESPONSE
- **Options** [Y]ES / [N]O
- **Default Value** [N]O
- **OFF to Modify** NO

**FUNCTION** The high voltage (mains supply) power loss function provides an optional response to a power loss situation.

Upon power loss or brown out conditions, the Elite Series continues to operate normally until the energy supplied to the motor load discharges the inverter high voltage DC bus to its minimum working voltage. At this stage the output power from the inverter is disabled to prevent further energy consumption by the load, but otherwise the Elite Series continues to operate from the remaining energy in the DC bus. The minimum voltage for the Elite Series is 250Vdc, for the frames 5 to 7 the minimum is 385Vdc. Depending on the size of the Elite Series (and hence the energy in its DC bus), the control board can stay active for several seconds during such an event. While in this state (before the DC bus discharges below the switch mode power supply minimum operating voltage) the Elite Series is able to restart and continue normal operation when the mains supply returns to normal.

If the high voltage (mains supply) power loss function is set to not trip (N), the Elite Series will stay active as long as there is sufficient DC supply (perhaps several seconds). If the mains returns to normal while the control board is still active, the Elite Series will restart.
automatically.

If the high voltage (mains supply) power loss function is set to trip (Y), the Elite Series will trip and register a mains low fault after a two second power loss and require resetting. If the mains returns to normal within two seconds, the Elite Series will restart automatically.

**SETTING UP**

The decision of whether to trip or not is usually based upon questions of the safety of automatically restarting equipment after brief power outages, the ability of associated equipment to continue normal operation and the reliability required of a process. If required, the Elite Series control board may be powered with a 24Vdc supply. Connection information is given in the Elite Series Getting Started Manual (PDL Part No. 4201-179).

**S8 DC BRAKE CURRENT LEVEL**

<table>
<thead>
<tr>
<th>Screen</th>
<th>BRAKE I=0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>0 to 150%</td>
</tr>
<tr>
<td>Units</td>
<td>PERCENT OF MOTOR RATED CURRENT</td>
</tr>
<tr>
<td>Default</td>
<td>0.00%</td>
</tr>
<tr>
<td>Off to Modify</td>
<td>NO</td>
</tr>
</tbody>
</table>

**FUNCTION**

Sets the level of current to be applied to the motor while DC Braking. This level of current is applied for the OFF DELAY TIME (Screen S6). In Closed Loop Vector Mode, this current is applied while stopping and during the off delay time.

**SETTING UP**

DC braking is used to stop the motor without regenerating power into the Elite Series. In some circumstances this allows for faster stopping than regenerative braking. It should be noted that during DC braking the energy of the load is dissipated within the motor and the Elite’s motor thermal model does not take this into account.

Adjust the current level until the desired braking is achieved.

**S9 DC HOLDING VOLTAGE IN V/Hz**

<table>
<thead>
<tr>
<th>Screen</th>
<th>HOLD V=0.0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>0 to 25%</td>
</tr>
<tr>
<td>Units</td>
<td>PERCENT OF MOTOR RATED VOLTAGE</td>
</tr>
<tr>
<td>Default</td>
<td>0.00%</td>
</tr>
<tr>
<td>Off to Modify</td>
<td>NO</td>
</tr>
</tbody>
</table>

**FUNCTION**

Sets the amount of DC voltage applied to the motor during the off delay period in V/Hz mode. When applied, the DC current causes the motor to resist movement and is used to brake the motor.

**SETTING UP**

If motor braking after stopping is not required leave set to 0. First set the off delay time to a suitable value (say 2 seconds) and adjust the hold voltage to give the required amount of hold when the motor is stopped (but not off).

**Notes**

DC hold is only used in V/Hz mode and is not used if the DC-BRAKE stopping mode is selected.

**S10 DC HEATING CURRENT**

<table>
<thead>
<tr>
<th>Screen</th>
<th>S10 HEAT I=OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>OFF/1 to 30%</td>
</tr>
<tr>
<td>Units</td>
<td>PERCENT OF MOTOR RATED CURRENT</td>
</tr>
<tr>
<td>Default</td>
<td>OFF</td>
</tr>
<tr>
<td>Off to Modify</td>
<td>NO</td>
</tr>
</tbody>
</table>

**FUNCTION**

Sets the amount of DC current applied to the motor after the off delay period or before a start command is received. This provides standby (anti-condensation) heating to the motor.

**SETTING UP**

If motor heating is not required leave set to OFF. Anti-condensation heating is normally set to between 10% and 25%.

**WARNING:**

High voltage will be present on the motor terminals while DC heating is employed.

**S11 STOP TIMEOUT**

<table>
<thead>
<tr>
<th>Screen</th>
<th>STP T/O=30s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>OFF, 1 TO 3600 SEC</td>
</tr>
<tr>
<td>Units</td>
<td>SECONDS</td>
</tr>
<tr>
<td>Default Value</td>
<td>30s Frames 1 to 3</td>
</tr>
<tr>
<td></td>
<td>60s Frame 4</td>
</tr>
<tr>
<td></td>
<td>120s Frames 5 to 7</td>
</tr>
<tr>
<td>Off to Modify</td>
<td>NO</td>
</tr>
</tbody>
</table>

**FUNCTION**

To provide the safety function of automatically tripping the Elite Series if the motor has not stopped within the selected Stop Timeout period once a stop signal has been received.

**SETTING UP**

This function is typically used to protect against incorrectly set parameters malturning the Elite Series and preventing a controlled stop. The controlled stop time is the time to stop under normal conditions and is determined from the maximum speed (Screen L3), deceleration rates (Screens R2, R4, and R6), speed filter time constant (Screen R7), and Off Delay (Screen S6). The Stop Timeout period should be set to a value greater than the controlled stopping time. Alternatively, the controlled stopping time may be measured experimentally and the Stop Timeout set appropriately.

**Note:**

With a high input supply voltage, the Elite Series has limited headroom in the DC bus to absorb regenerated power from a high inertia motor/load combination. This may prevent the Elite Series from being able to follow the requested speed reference profile. The Stop Timeout may be used to provide protection against loss of control from excessive regeneration.

The Stop Timeout is also useful for protecting against incorrectly set speed PID settings in closed loop vector mode.
### SCREEN GROUP X: TUNING

**Group Attribute HIDDEN**

<table>
<thead>
<tr>
<th>X1</th>
<th>CONTROL TYPE SELECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Screen</strong></td>
<td>X1 CTRL TYP=V/Hz</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>SELECTION OF OPERATING MODE</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>O/L = OPEN LOOP MODE</td>
</tr>
<tr>
<td></td>
<td>C/L = CLOSED LOOP VECTOR MODE</td>
</tr>
<tr>
<td></td>
<td>V/Hz = V/Hz</td>
</tr>
<tr>
<td><strong>Default Value</strong></td>
<td>V/Hz</td>
</tr>
<tr>
<td><strong>OFF to Modify</strong></td>
<td>YES</td>
</tr>
<tr>
<td><strong>FUNCTION</strong></td>
<td>This selection determines the type of operating mode for the Elite Series.</td>
</tr>
<tr>
<td></td>
<td>V/Hz:</td>
</tr>
<tr>
<td></td>
<td>No external feedback is required to operate in the mode. Selection the of control type V/Hz forces the control mode to Speed Control.</td>
</tr>
<tr>
<td></td>
<td>Closed Loop Mode:</td>
</tr>
<tr>
<td></td>
<td>This control type requires an incremental encoder to be mounted on the motor to provide direct feedback on actual rotor speed. Commissioning and auto-tuning must be completed before selecting this control type. Closed Loop Vector Mode is used where there are high requirements for speed accuracy or torque control is required.</td>
</tr>
<tr>
<td></td>
<td>Open Loop Mode:</td>
</tr>
<tr>
<td></td>
<td>The Open Loop mode is a speed control mode suitable for frames 1 to 4. This mode of operation can provide improved starting torque and speed accuracy compared to V/Hz mode. No external feedback is required to operate in this mode, which can offer features of the Closed Loop Vector Mode. Commissioning and autotuning must be completed before selecting this control type.</td>
</tr>
<tr>
<td><strong>SETTING UP</strong></td>
<td>V/Hz mode should be used for initial commissioning to check the operation of any shaft encoder fitted to the motor and to check motor rotation direction.</td>
</tr>
<tr>
<td></td>
<td>Once initial commissioning is complete, select Closed Loop Vector Mode, Open Loop Mode or V/Hz as required.</td>
</tr>
<tr>
<td></td>
<td>V/Hz mode must also be employed when multiple motors are connected to the Elite Series output.</td>
</tr>
</tbody>
</table>

### X2 AUTOTUNE MODE SELECTION

**Note:** Autotune only applies to Elite Series operated in open loop or closed loop vector mode.

| **Screen** | AUTOTUNE=N |
| **Description** | AUTOTUNES MOTOR |
| **Range** | NO/YES |
| **Default Value** | None |
| **OFF to Modify** | YES |
| **FUNCTION** | The motor must be correctly characterised for good dynamic performance. This can be done automatically by the Elite Series. Autotuning will automatically set optimum values for the following parameters (without turning the motor): |
| | X3a Lm Motor Main Inductance |
| | X3b Rs Stator Resistance |
| | X3c Rr Rotor Resistance |
| | The motor must be stopped for Autotuning to function correctly. |
| **WARNING:** | Autotuning applies voltage to the terminals of the motor. Check that all personnel are clear of the motor and attached machinery, and that it is safe to operate the motor. |
| **Note:** | Manual tuning of the Motor/Drive is required for optimum performance in dynamic applications. |
| **SETTING UP** | Ensure that LOCAL control is enabled (Screen I7a = 00 DISABLED) before autotuning the motor. |
| | Screen X2 selects AUTOTUNE options, as follows: |
| | X2 AUTOTUNE = NO |
| | Autotuning not active |
| | X2 AUTOTUNE = YES |
| | This tunes the motor without moving the motor. |
| | Autotuning may take from several seconds to several minutes to complete. |
| | Refer to Section 3 of the Elite Series Getting Started Manual, Part No. 4201-179 for details on preliminary commissioning. |
### SUBGROUP X3: MOTOR TUNING

#### X3a-X3d MOTOR IMPEDANCES

**Note:** Only applies to Elite Series operated in open loop or closed loop vector mode.

**Screen X3a Lm=190%**
- **Description:** MAIN INDUCTANCE
- **Range:** 40 to 800%
- **Units:** PERCENTAGE OF RATED IMPEDANCE
- **Default Value:** 190% (Dependant on Elite Series model)
- **OFF to Modify:** NO

**FUNCTION:** The main inductance of the motor defines the magnetising current. This is a key parameter directly affecting motor fluxing.

**SETTING UP:** This parameter is self-adjusting and should set itself up under autotuning (Screen X2). Typical values range from 75% (for small motors) to 800% for large motors.

The correctness of the setting may be gauged by first ensuring that the Elite Series is operating in full vector control (speed control) mode. Now operate the motor at no load at some defined speed (e.g., 50%) and check that the output voltage matches the percentage speed (i.e., approximately 50% of rated voltage in this case).

If the voltage does not match, adjust the main inductance value up (will decrease voltage) or down (will increase voltage).

**Screen X3b Rs=3.0%**
- **Description:** STATOR RESISTANCE
- **Range:** 0 to 15.0%
- **Units:** PERCENTAGE OF RATED IMPEDANCE
- **Default Value:** 3.0% (Dependant on Elite Series model)
- **OFF to Modify:** NO

**FUNCTION:** The stator resistance represented as a percentage of rated impedance.

**SETTING UP:** This parameter is self-adjusting and should set itself up under autotuning (Screen X2). Usually the stator resistance varies approximately between half to twice the rotor resistance (see Screen X3c Rr).

In Open Loop mode, care should be taken to set this correctly. The value can be set using Autotune. Alternatively, the per cent rated slip value can be used (See X3c below).

**Screen X3c Rr=6.0%**
- **Description:** ROTOR RESISTANCE
- **Range:** 0 to 15.0%
- **Units:** PERCENTAGE OF RATED IMPEDANCE
- **Default Value:** 6.0% (Dependant on Elite Series model)
- **OFF to Modify:** NO

**FUNCTION:** Sets rotor resistance of the motor. This is a key parameter directly affecting output torque.

**SETTING UP:** This parameter is self-adjusting and should set itself up under autotuning (Screen X2). The parameter should set itself to approximately the rated slip of the motor - i.e.,

\[
\text{Slip} = 100 \times \frac{\text{Syncspeed} - \text{Ratedspeed}}{\text{Syncspeed}}
\]

The setting should change dynamically with changing motor temperature. The accuracy of this setting may be checked by observing output voltage variation during a step load change. If the voltage dips upon a small increase in load, Rr is set too high. If the voltage overshoots, Rr is set too low. If set correctly, the voltage should not change significantly. This setting should be checked when the motor is at its normal operating temperature.

For Open Loop mode, set up as per Closed Loop Vector Mode.

This value will also influence the accuracy of slip compensation (X5d).

**Screen X3d SIGMA=6.0%**
- **Description:** TOTAL LEAKAGE
- **Range:** 0 to 20%
- **Units:** PERCENTAGE OF RATED IMPEDANCE
- **Default Value:** 6.0%
- **OFF to Modify:** NO

**FUNCTION:** The total leakage inductance represented as a percentage of main inductance.

**SETTING UP:** This parameter is not usually adjusted by the user.

In Open Loop mode, sigma should be set to 6% for motors below 7.5kW and for motors above this the following calculation can be used (however 6% should suffice for most cases).

\[
\text{Sigma} = ((\text{No load current/Rated current})^2) ^ {0.8}
\]

#### X3e FIELD WEAKENING POINT

**Screen FLD WEAK=100%**
- **Description:** FIELD WEAKENING POINT
- **Range:** 50 to 100%
- **Units:** PERCENT OF AVAILABLE VOLTAGE
- **Default Value:** 100%
- **OFF to Modify:** NO

**FUNCTION:** May be used to force the Elite Series to enter the field weakening region at less than the maximum potential voltage. The advantages of this is that it then leaves some voltage available to maintain full vector control - i.e., response in the field weakening region is improved.

The disadvantage is that since full voltage is not available, rated power cannot be achieved. If left at 100%, full voltage is applied to the motor and in the field weakening region vector control transitions to slip control. Torque response is slower in, and during exit of, this region.

**SETTING UP:** If highly dynamic performance is not required (near maximum output voltage of the Elite Series), leave set to 100%. Otherwise set to approximately 90%. Note that the achievable motor power will be reduced in proportion.

For Open Loop mode, this value is also the point at which the system transitions between Open Loop normal mode and Open Loop overspeed mode.
**SUBGROUP X4: LOAD TUNING**

<table>
<thead>
<tr>
<th>Screen</th>
<th>Description</th>
<th>Range</th>
<th>Default</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>X4a MIN. FLX=100%</td>
<td>DYNAPLUX MINIMUM FLUX LEVEL</td>
<td>40% to 100%</td>
<td>100%</td>
<td>Dynaflux only operates in V/Hz control mode.</td>
</tr>
<tr>
<td>X4b STR TYP=AUTO</td>
<td>STARTING BOOST TYPE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X4c STR TQ=0%</td>
<td>STARTING TORQUE (BOOST) ADJUSTMENT</td>
<td>0 to 250%</td>
<td>0%</td>
<td></td>
</tr>
</tbody>
</table>

**SETTING UP**

If the flux reducing feature is not required, leave set at 100% (factory set value).

Dynaflux is best suited for slowly varying loads (e.g., pump and fan). This is due to the possibility of motor stall, upon a rapid load increase at a time when there is insufficient fluxing.

For fan and pump (or similar) loads, set to the lowest value, consistent with reliable operation. Usually 40% will be suitable.

Using a value which is too low can lead to instability or surging. If this occurs, increase the minimum flux level.

Selecting intermediate levels of minimum fluxing caters for more dynamic loads with reduced amounts of Dynaflux action.

Set the minimum flux level to 100% for highly dynamic loads (e.g., servos and cranes).

**FUNCTION**

Provides compensation to start difficult loads.

Under V/Hz control a compensating boost may be applied to the motor in order to obtain full torque at low frequency. This screen permits configuration for Automatic Voltage Boost [AUTO], Fixed Voltage Boost [FIX], or Current Controlled Boost [CUR]. Open Loop mode can use any setting of this variable.

The Start Boost Type provides three different starting torque profiles – the most suitable of which depends on the application.

- **Automatic Voltage Boost**
  - For normal single motor operation, the automatic voltage boost [AUTO] provides the best performance. In this mode the boost level is automatically adjusted according to the load conditions. Automatic voltage boost does not operate at zero frequency, therefore applications which are required to produce torque at zero frequency (e.g., hoists) must have the Start Boost Type set to [FIX] or [CUR].

- **Fixed Voltage Boost**
  - This starting boost type may be used with simple non-varying loads. However, for multiple motor operation, fixed voltage boost [FIX] must be selected to provide reliable starting.

Current Controlled Boost

Current controlled boost [CUR] should be used for high friction loads that are unable to be started using the voltage boost modes [AUTO], [FIX]. This mode allows the starting profile to be tuned using Screens X4c and X4d, where the boost level and the region it operates over are defined.

**NOTES**

Screen X4c defines the level of boost that will be applied and must be set to a level appropriate to the motor being used.

When using V/Hz with Automatic or Fixed Voltage Boost, adjustment should be made until sufficient starting torque is developed to start the load. If the load is such that the adjustment levels required to start the load causes the Elite Series to enter a current limiting protection state, then Current controlled Boost (rather than Automatic or with fixed voltage Boost) is recommended.

When using V/Hz Current Controlled Boost, adjust the Starting Torque level so that the load starts and smoothly accelerates. High levels of adjustment may require the Torque Limit screens (Screens L4 and L5) and Current Limit screen (Screen L9) to be adjusted. The Starting Torque adjustment should be used in conjunction with the Starting Band adjustment (Screen X4d) to provide the desired starting torque profile. Levels far in excess of that required by the load should be avoided, as this will cause increased heating of the motor.

When using Open Loop Mode, adjust the starting Torque to the desired starting Torque level.

When using Closed Loop Vector Mode the starting torque adjustment has no affect.

**SETTING UP**

This screen has different setting up procedures depending on the control mode (Screen X1) and the starting boost type (Screen X4b) selected.
FUNCTION Provides speed related profiling of the starting torque for the current controlled boost (Screen X4b STR TYPE=CUR).

For Open Loop, this parameter determines the transition from Open Loop start mode to Open Loop normal mode. When stopping, the drive will re-enter the Open Loop start mode from Open Loop normal mode. This will occur when the speed drops to 4.5% below the STR BAND value. In Open Loop mode this cannot be increase above 50% as the overspeed band can be reduced to 50% speed.

SETTING UP Adjust the Starting Band to define the region (from zero speed) where the current controlled starting torque is required. When the output speed exceeds this band the boost level will be automatically adjusted to a reduced level to minimise the heating effects of possible high levels set by Screen X4c.

Loads that are characterised by high stiction but relatively low inertia will usually only require a small starting band. High inertia loads may require prolonged Current Controlled Boost to ensure smooth acceleration of the load.

It is recommended that the minimum band adjustment necessary to start and accelerate the load be used to avoid undue heating of the motor.

NOTES If this band is set to the default 0% then the starting torque level set by Screen X4c will not have its full effect.

---

**X4f, X4g, X4h ROTOR SPEED PID LOOP GAINS**

**Note** Only operates in Open Loop or Closed Loop Vector mode.

<table>
<thead>
<tr>
<th>Screen</th>
<th>Description</th>
<th>Range</th>
<th>Default Value</th>
<th>OFF to Modify</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>X4f</td>
<td>Rotor Speed PID Loop Proportional Gain</td>
<td>0 to 300%</td>
<td>20%</td>
<td>NO</td>
<td>The proportional gain of the rotor speed PID controller. Affects the response, stiffness and damping of the speed loop. In Open Loop mode, set up as per Closed Loop Vector mode.</td>
</tr>
<tr>
<td>X4g</td>
<td>Rotor Speed PID Loop Integral Gain</td>
<td>0 to 999%</td>
<td>30%</td>
<td>NO</td>
<td>The integral gain of the rotor speed PID controller. Affects the long term speed hold accuracy of the speed control loop. In Open Loop mode, set up as per Closed Loop Vector mode.</td>
</tr>
<tr>
<td>X4h</td>
<td>Rotor Speed PID Loop Derivative Gain</td>
<td>0 to 999%</td>
<td>0%</td>
<td>NO</td>
<td>The derivative gain of the rotor PID controller. May improve damping of the PID loop in some cases.</td>
</tr>
</tbody>
</table>

**X4i LS FL BO=0%**

**Description** Flux Boost A

**Range** X4j setting to 99%

**Default Value** 0%

**OFF to Modify** NO

**FUNCTION** Boost flux to cope with large or unstable loads when operating in Open Loop mode. Increased flux means less torque current is needed to generate a given torque.

**SETTING UP** Leave at default unless a large or unstable load is present, a conservative setting of up to 15% is recommended for these loads.

---

**X4j HS FL BO=0%**

**Description** Flux Boost B

**Range** 0% to X4i setting

**Default Value** 0%

**OFF to Modify** NO

**FUNCTION** Used in conjunction with Flux Boost A in order to phase out the adjustment linearly at higher speeds in order to prevent early onset of Open Loop Mode overspeed mode.

**SETTING UP** Leave set to zero if phasing out of Flux Boost A is required. For a constant flux boost set to the X4i setting.
**X4k INERTIA COMPENSATION**

**Screen** X4k INERTIA k=1
**Description** INERTIA COMPENSATION
**Range** 1 to 10
**Units** none
**Default** 1
**FUNCTION** The compensation factor for inertia is required for large inertia loads if slip compensation or open loop mode is used. Used for enhancing stability and not for tuning of the speed controller.

**SUBGROUP X5: CONTROLLER TUNING**

**Note** V/Hz and Open Loop mode only

**Screen** X5a ILT SLIP=2.0%
**Description** CURRENT LIMIT SLIP VALUE
**Range** 0.0% TO 10%, OFF
**Default Value** 2.0%(dependant on Elite Series model)
**FUNCTION** To actively reduce the Elite frequency or acceleration to maintain load current within controllable bounds (status=ILT).

**SETTING UP** Do not adjust this unless current limit action is unstable. Nominally this value should be set to the rated percent slip of the motor. To improve stability of current limit use a lower figure (the penalty against this is that predictive current limit action will occur at an earlier stage, more severely limiting acceleration rates and possibly intruding more into the normal area of operation).

For optimal operation in Open Loop mode set value to motor slip in per cent.

**Screen** X5b VLT SLIP=2.0%
**Note** V/Hz only
**Description** VOLTAGE LIMIT SLIP
**Range** 0.0% TO 20%
**Default Value** 2.0%(dependant on Elite Series model)
**FUNCTION** If a motor is overdriven (e.g., by decelerating its attached load too fast) it will regenerate into the Elite. Too much regeneration will cause the Elite to take evasive action (“voltage limiting”) by reducing the deceleration rate as regeneration occurs. The voltage limit slip setting is an adjustment which is used to enhance the stability of voltage limiting control.

**SETTING UP** Do not adjust this setting unless voltage limiting is unstable. Nominally this value should be set to the rated percent slip of the motor. To improve stability of voltage limit use a lower value. The penalty against this is that voltage limiting will occur at an earlier stage, thus affecting deceleration more.

The speed filter setting (Screen R7) may also be used to improve stability during voltage limiting.

For optimal operation in Open Loop mode, set value to motor slip in per cent.

**Screen** X5c DAMPING=2.0%
**Description** NO LOAD DAMPING
**Range** 0% TO 20%
**Default Value** 2.0%(dependant on Elite Series model)
**FUNCTION** Some motors may become unstable and appear to surge when operated at light load and at certain speeds. The damping term may be introduced to eliminate this tendency.

**SETTING UP** Do not adjust this value unless light load stability problems exist.

Increase setting to improve stability. Increasing the setting too far may induce instability.

No load damping introduces very small output frequency variations (typically <0.1 Hz). If absolute fixed output frequency is a specific requirement of your application, set to 0.0%

**Screen** X5d SLIP COMP=N
**Note** V/Hz only
**Description** ENABLE SLIP COMPENSATION
**Default Value** NO COMPENSATION
**FUNCTION** Changes the output frequency based on the load current to compensate for the slip of the motor.

**SETTING UP** If Speed regulation under varying load is required in V/Hz or open Loop control modes - turn on.

May be enabled when using Open loop mode, this will assist with speed regulation when in operating in the Open Loop mode overspeed region.

**Screen** X5e FREQ = AUTO
**Description** MODULATION FREQUENCY
**Options** AUTO/4000-16000 or 4000-1000 > 22.5
**Units** HERTZ
**Default Value** AUTO
**OFF to Modify** NO
**FUNCTION** Alters the output frequency to the motor. May be used to avoid mechanical noise within the motor. AUTO allows the Elite’s thermal management system to optimise the switching frequency to maintain reliable operation.

**Note:** Maximum frequency on the Elite Series greater than 22.5 Amps is limited to 10000Hz.

**Screen** X5f SWITCH FR=WW
**Description** MODULATION TYPE
**Options** [WW] WHISPER WAVE [NB] NARROW BAND
**Units** HERTZ
**Default Value** WW
**OFF to Modify** NO
**FUNCTION** Alters the type of noise produced by the motor. Narrow band produces a conventional fixed frequency noise spectrum. Whisper...
Wave is a special mode which distributes the noise over a wider frequency range. The noise produced in Whisper Wave mode is usually found to be less annoying and easier to mask.

To allow for direct comparison of the motor acoustic noise level, this mode may be switched while the Elite Series is running. Choose the option that you find most suitable. Whisper Wave or Narrow Band should be selected to minimise the audible noise.

**X5g**

**X5h**

**X5i**

**Y1**

**CURRENT CONTROL LOOP GAIN**

**X5g, X5h**

**CURRENT PI LOOP PROPORTIONAL GAIN**

**Y2**

**CURRENT PI LOOP INTEGRAL GAIN**

**X5i**

**ROTOR SPEED FILTER CONSTANT**

**SCREEN GROUP Y: MENU OPTIONS**

**Y1 LANGUAGE=1**

**DESCRIPTION**

SELECTS LANGUAGE OF SCREEN LIST

**RANGE**

1 = ENGLISH  
2 = DEUTSCH  
3 = SPANISH

**DEFAULT**

ENGLISH

**OFF to Modify**

NO

**FUNCTION**

Determines the language displayed by the Elite Series

**SETTING UP**

Choose the required language. Further languages will be available on an “as required” basis.

**Y2 INITIALISE**

**DESCRIPTION**

SELECTS LEVEL OF INITIALISATION OF PARAMETERS AND MODES

**RANGE**

REFER FIGURE 9.26

**ATTRIBUTE**

HIDDEN

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO</td>
<td>Not initialising</td>
</tr>
<tr>
<td>INIT USER SETTINGS</td>
<td>Initialises all user settings including menu setup mode with the exception of the motor parameters (Screens N1 to N6, X3 to X5)</td>
</tr>
<tr>
<td>INIT MOTOR PARAMS</td>
<td>Initialises all motor parameters (Screens N1 to N6, X3 to X5)</td>
</tr>
<tr>
<td>INIT ALL</td>
<td>Initialises all parameters. Available after F18 fault</td>
</tr>
</tbody>
</table>

**Figure 9.26: Initialisation Levels**

**FUNCTION**

This screen allows for the initialisation of parameters (setting to default values) to the desired level.

If you want to retain settings for re-entry after initialisation, record these settings first, (e.g., on the appropriate Commissioning Configuration Record at the end of this manual).

**SETTING UP**

Select the required level and release the keys. The display will show INITIALISING... while doing so, and returns to NO when completed.
Screen Y3 PROG 1 of 1
Description SELECTS PROGRAM TO USE
Default 1
OFF to Modify YES
Attribute READ ONLY
FUNCTION Determines the Control program that is running. See Section 8.

SCREEN GROUP Z: COMMISSIONING SCREENS

Group Attribute READ ONLY

FUNCTION Determines the Control program that is running. See Section 8.

Z Commissioning Mode

SCREEN Z COMMISSION=NO
Description COMMISSIONING MODE
Range YES or NO
Default Value NO
OFF to Modify NO
Attribute Read only (if password is set)
          Read-Write (if password is not set).
FUNCTION Commissioning mode is a special mode that allows the commissioning engineer to modify commissioning data.
SETTING UP Set to YES to enter commissioning mode.
          The commissioning mode is normally protected with a password set from Screen Z1. This prevents unauthorised modification to commissioning data.
          Once the commissioning data has been entered (and a password set if required), this screen should be set to NO.
Setting to COMMISSIONING mode before a Password has been set:
          Scroll to Main Screen Z.
          Z COMMISSION=N
          Press “*” and “+” or “-”. The control line should change to:
          Z COMMISSION=Y
          All screens will now be visible, and all parameters are adjustable.
Selecting COMMISSIONING mode after a Password has been set:
          Scroll to Main Screen Z. The display’s control (bottom) line will read:
          Z COMMISSION=N
          Press “*” and “+” or “-”. The screen will automatically display:
          PASSWORD=ZZZZZ
          Where the number shown as “ZZZZZ” is a special hashing number and is required for lost passwords. Refer to the description of Screen Z1.
          Now press “*” and “+” or “-” until the correct password is reached. Then release the keys.
The display’s control (bottom) line will now read:
Z COMMISSION=Y
All screens will now be visible, and all parameters adjustable.

Selecting OPERATION Mode:
To change from COMMISSIONING Mode to OPERATION Mode, scroll to Screen Group Z.
The display’s control line will read:
Z COMMISSION=Y
Use ‘*’ and ‘+’ or ‘–’ to toggle to :
Z COMMISSION=N

Z1 Commissioning Mode Password

Screen
Z1 PASSWORD=OFF

Description COMMISSIONING MODE PASSWORD
Range OFF, 1 to 65535
OFF to Modify NO

FUNCTION Allows the commissioning engineer to set a password to protect against unauthorised modification of commissioning parameters.

SETTING UP
Once set to COMMISSIONING mode as described above, a password may be set up. Unfold Screen Group Z and scroll to Screen Z1. The display will read:
Z1 PASSWORD= OFF.
Press ‘*’ and ‘+’ or ‘–’ to set the required password.

What happens if a password is unknown or forgotten?
Once a password has been entered, a special hashing number is displayed on Screen Z when trying to enter COMMISSIONING mode.
The display will read:
Z PASSWORD= ZZZZZ
Take a note of this number and contact a PDL Electronics Applications Engineer, who with suitable authority will be able to pass this code through an algorithm to reconstruct the original password.

Z2 SOFTWARE AND HARDWARE REVISIONS

Screen Z2 S/W1.1 H/W1.1

Description SOFTWARE AND HARDWARE REVISION NUMBERS

FUNCTION Shows the revision number (X.X) of the software and hardware currently fitted to the Elite Series.

Z3 ANALOGUE INPUT 1 STATUS

Screen Z3 AI1=99=+9.9V or
Z3 AI1=99=+20mA

Description STATUS OF ANALOGUE INPUT 1
Range 00 to 99;
–10V to +10V or 0 to 20mA

Screen Z3 AI1=99=+9.9V or
Z3 AI1=99=+20mA

Reference 0 1 2
Reference 0: Screen number Z3
Reference 1: Status of Analogue Input 1 (Terminal T26) 00 to 99% of the input range
For ±10V input, -10V = 00, +10V = 99
For 0-10V input, 0V = 00, +10V = 99
For 4-20mA input, 4mA = 00, 20mA = 99
For 0-20mA input, 0mA = 00, 20mA = 99
Reference 2: Status of Analogue Input 1 (Terminal T26) For Voltage inputs, -10V to +10V For Current inputs, 0mA to 20mA

Z4 ANALOGUE INPUT 2 STATUS

Screen Z4 AI2=99=+9.9V
Z4 AI2=99=+20mA

Description STATUS OF ANALOGUE INPUT 2
Range 00 TO 99;
–10V to +10V or 0 to 20mA

Screen Z4 AI2=99=+9.9V
Z4 AI2=99=+20mA

Reference 0 1 2
Reference 0: Screen number Z4
Reference 1: Status of Analogue Input 2 (Terminal T27) 00 to 99% of the input range
For ±10V input, -10V = 00, +10V = 99
For 0-10V input, 0V = 00, +10V = 99
For 4-20mA input, 4mA = 00, 20mA = 99
For 0-20mA input, 0mA = 00, 20mA = 99
Reference 2: Status of Analogue Input 2 (Terminal T27) For ±10V input, -10V to +10V For 0-10V input, 0V to +10V For 4-20mA input, 4mA to 20mA For 0-20mA input, 0mA to 20mA

Z5 ANALOGUE OUTPUT 1 STATUS

Screen Z5 AO1=99=+9.9V
Z5 AO1=99=+20mA

Description STATUS OF ANALOGUE OUTPUT 1
Range 00 TO 99;
–10V to +10V or 0 to 20mA

Screen Z5 AO1=99=+9.9V
Z5 AO1=99=+20mA

Reference 0 1 2
Reference 0: Screen number Z5
Reference 1: Status of Analogue Output 1 (Terminal T23) 00 to 99% of the input range
For ±10V output, -10V = 00, +10V = 99
For 0-10V output, 0V = 00, +10V = 99
For 4-20mA output, 4mA = 00, 20mA = 99
For 0-20mA output, 0mA = 00, 20mA = 99
Reference 2: Status of Analogue Output 1 (Terminal T23)
For ±10V output, -10V to +10V
For 0-10V output, 0V to +10V
For 4-20mA output, 4mA to 20mA
For 0-20mA output, 0mA to 20mA

Z6 ANALOGUE OUTPUT 2 STATUS
Screen Z6 AO2=99=+9.9V or Z6 AO2=99=+20mA
Description STATUS OF ANALOGUE OUTPUT 2
Range 00 to 99;
-10V to +10V or 0 to 20mA
Attribute Read Only
Screen Z6 AO2=99=+9.9V or Z6 AO2=99=+20mA
Reference 0 1 2
Reference 0: Screen number Z6
Reference 1: Status of Analogue Output 2 (Terminal T24)
For ±10V output, -10V = 00, +10V = 99
For 0-10V output, 0V = 00, +10V = 99
For 4-20mA output, 4mA = 00, 20mA = 99
For 0-20mA output, 0mA = 00; 20mA = 99
Reference 2: Status of Analogue Output 2 (Terminal T24)
For ±10V output, -10V to +10V
For 0-10V output, 0V to +10V
For 4-20mA output, 4mA to 20mA
For 0-20mA output, 0mA to 20mA

Z7 MULTIFUNCTION INPUT STATUS
Screen Z7 MFI:000000 X
Description STATUS OF MULTI-FUNCTION INPUTS
Range O (OPEN) or X (CLOSED)
Attribute Read Only
Screen Z7 MFI:000000 X
Reference 0 123456 7
Reference 0: Screen number Z7
Reference 1: Status of Digital Input 1 (Terminal T13)
O - Open
X - Closed
Reference 2: Status of Digital Input 2 (Terminal T14)
O - Open
X - Closed
Reference 3: Status of Digital Input 3 (Terminal T15)
O - Open
X - Closed
Reference 4: Status of Digital Input 4 (Terminal T16)
O - Open
X - Closed
Reference 5: Status of Digital Input 5 (Terminal T17)
O - Open
X - Closed
Reference 6: Status of Digital Input 6 (Terminal T18)
O - Open
X - Closed
Reference 7: Status of External Trip Input (Terminal T19)
O - Open
X - Closed
Note 1: Multi-function inputs - O or X represent only an Open (circuit not connected to the common) or a Closed (circuit connected to the common) respectively.

Z8 FIBRE OPTIC INPUT STATUS; SERIAL INPUT STATUS
Screen Z8 FI:O SERIAL:O
Description STATUS OF FIBRE OPTIC INPUT; STATUS OF SERIAL INPUT
Range O (INACTIVE) or X (ACTIVE);
O (INACTIVE) or X (ACTIVE);
Attribute Read Only
Screen Z8 FI:O SERIAL:O
Reference 0 1 2
Reference 0: Screen number Z8
Reference 1: Status of Fibre Optic Input
O (Inactive)
X (Active)
Reference 2: Status of Serial Input
O (Inactive)
X (Active)
Note 1 An Active (X) status indicates that a valid fibre optic data packet has been received since the last screen update. An Inactive (O) status indicates that no valid data packet has been received since the last screen update.
Note 2 An Active (X) status indicates that a valid serial communication data packet has been received since the last screen update. An Inactive (O) status indicates that no valid data packet has been received since the last screen update.

Z9 ENCODER COUNT
Screen Z9 ENCODER=0000
Description ENCODER COUNT
Range 0 to 16383
FUNCTION Encoder counter; displays the number of edges counted by the incremental encoder input terminals (Terminals T31 to T34). Increasing count should correspond with forward rotation (see Section 4.2 and Screen N8 for more information).
EXAMPLE For a 2000 ppr encoder, this status screen should increase by 2000 counts for a 360° rotation of the motor shaft, in the forward direction.

Z9a ENCODER SPEED
Screen Z9a TACHO=0.0%
Description ENCODER SPEED
FUNCTION Displays the speed of the encoder as a % of motor synchronous speed.
This screen is useful for checking for faults in the encoder and encoder wiring.
OUTPUT RELAY STATUS;  
DYNAMIC BRAKE OUTPUT STATUS

Screen Z10 RLY:XXX DB:X
Description STATUS OF OUTPUT RELAYS;  
STATUS OF DYNAMIC BRAKE OUTPUT
Range O (OPEN) or X (CLOSED);  
O (OPEN) or X (CLOSED);
Attribute Read Only

Reference 0: Screen number Z10
Reference 1: Status of Output Relay 1 (Terminals T1/T2)  
R (Open)  
X (Closed)  
Reference 2: Status of Output Relay 2 (Terminals T4/T5)  
R (Open)  
X (Closed)  
Reference 3: Status of Output Relay 3 (Terminals T6/T7)  
R (Open)  
X (Closed)  
Reference 4: Status of Dynamic Brake (DB) Output  
R (Open)  
X (Closed)

Note 1  
RLY1 is normally open on Terminals (T1/T2)  
RLY1 is normally closed on Terminals (T2/  
T3)  
RLY2 is normally open on Terminals (T4/T5)  
RLY3 is normally open on Terminals (T6/T7)  
The status of the change-over relay (RLY1)  
on the normally closed terminals (Terminals  
T2/T3) is the inverse of reference 1.

Note 2  
A Closed (X) status indicates that the  
Dynamic Brake (DB) output has been closed  
in the interval since the last screen update.  
An Open (O) status indicates that the  
Dynamic Brake (DB) output has not been  
closed in the interval since the last screen  
update.

FIBRE OPTIC INPUT AND OUTPUT STATUS

Screen Z11 F I/P=+0.0%
Description FIBRE OPTIC INPUT STATUS
Range -250% to +250%
Attribute Read Only
FUNCTION Indicates the level of the data on the fibre  
optic input port.
The status indicates the magnitude and sign  
of the data packet being received by the Elite  
Series fibre optic input port.

Screen Z12 F O/P=+0.0%
Description FIBRE OPTIC OUTPUT STATUS
Range -250% to +250%
Attribute Read Only
FUNCTION Indicates the level of the data on the fibre  
optic output port.
The status indicates the magnitude and sign  
of the data packet being sent by the Elite  
Series fibre optic output port.
Refer to Screen Z8 for an indication of fibre  
optic input errors.
A typical application example is for simple fan speed control using a potentiometer to set 0-10V speed reference, and pushbuttons for start and remote stop-reset control. External speed monitoring is achieved using a simple 0-10V meter representing 0-100% speed. This section shows the configuration, wiring and adjustment of a typical example.

The example given is of a system of the following specification:

Control signal 0-10V (potentiometer)
Motor 5.5kW, 11.4A, 400V 1450rpm
Elite Model ME-12
Stop/start control 3 wire
Direction control None required

The configuration table (not including irrelevant and/or settings that have not been altered from factory set values) and wiring configurations follow:

**SIMPLE FAN SPEED CONTROL EXAMPLE CONFIGURATION TABLE**

<table>
<thead>
<tr>
<th>DRIVE NO:</th>
<th>MODEL:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ME-12</td>
</tr>
</tbody>
</table>

| LOCATION: | FAN SPEED CONTROL |

<table>
<thead>
<tr>
<th>MOTOR:</th>
<th>kW:</th>
<th>A:</th>
<th>V:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5.5</td>
<td>11.4</td>
<td>400</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>POLES:</th>
<th>RPM:</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>1450</td>
</tr>
</tbody>
</table>

**SETUP:**

Using the procedure as set up in Section 2.1:

Set up the motor information of Screen Group N:

N1 MTR CUR=11.4A
N2 MTR VOLT=400V
N3 MTR FR=50Hz
N3 MTR RPM=1450
N6 MTR COOL=40%

Set the limits of operation using Screen Group L:

L2 MIN S=0.0%
L3 MAX S=+100%
L9 I LIMIT=17.1A (this represents 150%)

Set up the control sources via Screen Group I:

I1 LOCAL S/STP=0 (Local control disabled)
I2 REF S=AIN1
I6a A11=0-10V
I6b A11 LO=0%
I6c A11 HI=+100%
I7a I/P MODE=1 (Remote 3 wire control)

External monitoring of speed is achieved via Screen Group O:

O1a AO1 O/P=06 (%of motor speed)
O1b AO1=0-10V
O1c AO1 LO=0%
O1d AO1 HI=+100%

The ramp rates are then set via Screen Group R:

R1 ACC=5.0%/s
R2 DEC=5.0%/s
R6 STOPR=10.0%/s

START is activated by momentarily closing the normally open pushbutton connected at Terminal T14. This starts the Elite Series accelerating the motor to the reference speed defined by the potentiometer connected at Terminal T26.

STOP is activated by momentarily opening the normally closed pushbutton connected at Terminal T15. This stops the Elite Series decelerating the motor to zero speed.

The acceleration and deceleration rates are defined by Screens R1 and R2.

By momentarily opening the normally closed EXT TRIP pushbutton connected at Terminal T19 the Elite series will trip, displaying the fault condition “22 EXT/PTC”.

By opening the normally closed switch connected at Terminal T13, the Elite Series will stop, decelerating the motor using the stop rate defined by Screen R6 (This overrides the deceleration rate defined by Screen R2). If any internal or external fault should occur, then the Elite Series may be reset (once the fault condition has bee removed) upon the opening edge of the ASTOP-RESET switch.
## Commissioning Configuration Record — Screens

<table>
<thead>
<tr>
<th>SCREEN</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A1</strong> LOCAL MODE=SP</td>
<td>______</td>
</tr>
<tr>
<td><strong>A2</strong> LOCAL TQ=+0.0% %</td>
<td>______</td>
</tr>
<tr>
<td><strong>A3</strong> LOCAL SP=+100.0% %</td>
<td>______</td>
</tr>
</tbody>
</table>

### Comparator Controls

<table>
<thead>
<tr>
<th>SCREEN</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C1</strong> COMP1 SEL=02</td>
<td>______</td>
</tr>
<tr>
<td><strong>C2</strong> COMP1 ON =+100% %</td>
<td>______</td>
</tr>
<tr>
<td><strong>C3</strong> COMP1 OFF=+90% %</td>
<td>______</td>
</tr>
<tr>
<td><strong>C4</strong> COMP2 SEL=02</td>
<td>______</td>
</tr>
<tr>
<td><strong>C5</strong> COMP2 ON =+100% %</td>
<td>______</td>
</tr>
<tr>
<td><strong>C6</strong> COMP2 OFF=+90% %</td>
<td>______</td>
</tr>
</tbody>
</table>

### Dynamic Brake Controls

<table>
<thead>
<tr>
<th>SCREEN</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>D1</strong> DB TIME=10s SEC</td>
<td>______</td>
</tr>
<tr>
<td><strong>D2</strong> DB DUTY=OFF %</td>
<td>______</td>
</tr>
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</table>

### Serial Communications Controls

<table>
<thead>
<tr>
<th>SCREEN</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>H1</strong> PROTOCOL=M</td>
<td>______</td>
</tr>
<tr>
<td><strong>H2</strong> COMS T/O=OFF SEC</td>
<td>______</td>
</tr>
<tr>
<td><strong>H3a</strong> COMM SADR=10</td>
<td>______</td>
</tr>
<tr>
<td><strong>H3b</strong> BAUDRATE=9600</td>
<td>______</td>
</tr>
<tr>
<td><strong>H3c</strong> PARITY=EVEN</td>
<td>______</td>
</tr>
<tr>
<td><strong>H4a</strong> MAC ID=63</td>
<td>______</td>
</tr>
<tr>
<td><strong>H4b</strong> BAUDRATE=125kps</td>
<td>______</td>
</tr>
<tr>
<td><strong>H4c</strong> ASM IN=70</td>
<td>______</td>
</tr>
<tr>
<td><strong>H4d</strong> ASM OUT=20</td>
<td>______</td>
</tr>
<tr>
<td><strong>H4e</strong> CTRL SRC=00</td>
<td>______</td>
</tr>
<tr>
<td><strong>H4f</strong> REF SRC=00</td>
<td>______</td>
</tr>
</tbody>
</table>

### Input Controls

<table>
<thead>
<tr>
<th>SCREEN</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I1</strong> LOCAL S/STP= STR/STP RESET</td>
<td>______</td>
</tr>
<tr>
<td><strong>I2</strong> REF S=LOCAL</td>
<td>______</td>
</tr>
<tr>
<td><strong>I3</strong> REF T=NULL</td>
<td>______</td>
</tr>
<tr>
<td><strong>I4</strong> AREF S=AIN1</td>
<td>______</td>
</tr>
<tr>
<td><strong>I5</strong> AREF T=NULL</td>
<td>______</td>
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### Screen Configuration Record

<table>
<thead>
<tr>
<th>SCREEN</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I6a</strong> A11=0-10V</td>
<td>______</td>
</tr>
<tr>
<td><strong>I6b</strong> A11 LO=0%</td>
<td>______</td>
</tr>
<tr>
<td><strong>I6c</strong> A11 HI=+100%</td>
<td>______</td>
</tr>
<tr>
<td><strong>I6d</strong> A12=0-10V</td>
<td>______</td>
</tr>
<tr>
<td><strong>I6e</strong> A12 LO= 0%</td>
<td>______</td>
</tr>
<tr>
<td><strong>I6f</strong> A12 HI=+100%</td>
<td>______</td>
</tr>
<tr>
<td><strong>I6g</strong> ZERO BAND=N</td>
<td>______</td>
</tr>
<tr>
<td><strong>I6h</strong> I/P MODE=0</td>
<td>______</td>
</tr>
<tr>
<td><strong>I6i</strong> POLARITY=Hi</td>
<td>______</td>
</tr>
<tr>
<td><strong>I6j</strong> MF1 SEL=00</td>
<td>______</td>
</tr>
<tr>
<td><strong>I6k</strong> MF12 SEL=00</td>
<td>______</td>
</tr>
<tr>
<td><strong>I6l</strong> MF13 SEL=00</td>
<td>______</td>
</tr>
<tr>
<td><strong>I6m</strong> MF14 SEL=00</td>
<td>______</td>
</tr>
<tr>
<td><strong>I6n</strong> MF15 SEL=00</td>
<td>______</td>
</tr>
<tr>
<td><strong>I6o</strong> MF16 SEL=00</td>
<td>______</td>
</tr>
<tr>
<td><strong>I6p</strong> F LO =+100% %</td>
<td>______</td>
</tr>
<tr>
<td><strong>I6q</strong> F HI = +100%</td>
<td>______</td>
</tr>
<tr>
<td><strong>I6r</strong> FIBRE MODE=0</td>
<td>______</td>
</tr>
<tr>
<td><strong>I6s</strong> FIB T/O=OFF SEC</td>
<td>______</td>
</tr>
</tbody>
</table>

### L Limits

<table>
<thead>
<tr>
<th>SCREEN</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>L1</strong> MIN S=+110%</td>
<td>______</td>
</tr>
<tr>
<td><strong>L2</strong> MAX S=+150%</td>
<td>______</td>
</tr>
<tr>
<td><strong>L3</strong> MIN T=+150%</td>
<td>______</td>
</tr>
<tr>
<td><strong>L4</strong> MAX T=+150%</td>
<td>______</td>
</tr>
<tr>
<td><strong>L5</strong> SP T/O=INF</td>
<td>______</td>
</tr>
<tr>
<td><strong>L6</strong> Q T/O=INF</td>
<td>______</td>
</tr>
<tr>
<td><strong>L7</strong> REGEN=150%</td>
<td>______</td>
</tr>
<tr>
<td><strong>L8</strong> I LIMIT=* AMP</td>
<td>______</td>
</tr>
<tr>
<td><strong>L9</strong> SKIP1=+0.0%</td>
<td>______</td>
</tr>
<tr>
<td><strong>L10</strong> SKIP2=+0.0%</td>
<td>______</td>
</tr>
<tr>
<td><strong>L11</strong> SK BW=0.0%</td>
<td>______</td>
</tr>
<tr>
<td><strong>L12</strong> GND ILT=12A AMP</td>
<td>______</td>
</tr>
<tr>
<td><strong>L13</strong> MIN SP RUN=Y</td>
<td>______</td>
</tr>
</tbody>
</table>

### Multi-Reference

<table>
<thead>
<tr>
<th>SCREEN</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>M1</strong> MREF1=+0.00%</td>
<td>______</td>
</tr>
<tr>
<td><strong>M2</strong> MREF2=+0.00%</td>
<td>______</td>
</tr>
<tr>
<td><strong>M3</strong> MREF3=+0.00%</td>
<td>______</td>
</tr>
<tr>
<td><strong>M4</strong> MREF4=+0.00%</td>
<td>______</td>
</tr>
<tr>
<td><strong>M5</strong> MREF5=+0.00%</td>
<td>______</td>
</tr>
<tr>
<td><strong>M6</strong> MREF6=+0.00%</td>
<td>______</td>
</tr>
</tbody>
</table>
M7  MREF7=+0.00%  %  ________  

MOTOR NAMEPLATE PARAMETERS
N1  MTR CUR*  AMP  ________  
N2  MTR VOLT=400V  VOLT  ________  
N3  MTR FRQ=50Hz  Hz  ________  
N4  MTR PWR*  kW  ________  
N5  MTR RPM*  RPM  ________  
N6  MTR COOL=40%  %  ________  
N8  ENCODER=0  ________  
N9  ENC I/P=DIFF  ________  

OUTPUT SIGNALS
O1a  AO1 O/P=06  ________  
O1b  AO1=+/-10V  ________  
O1c  AO1 LO= -100%  %  ________  
O1d  AO1 HI=+100%  %  ________  
O1e  AO2 O/P=02  ________  
O1f  AO2=+/-10V  ________  
O1g  AO2 LO= -100%  %  ________  
O1h  AO2 HI=+100%  %  ________  
O2a  RELAY1=02  ________  
O2b  RELAY1 INV=N  ________  
O2c  RELAY2=05  ________  
O2d  RELAY2 INV=N  ________  
O2e  RELAY3=08  ________  
O2f  RELAY3 INV=N  ________  
O3a  FIBRE O/P=06  ________  

PROCESS
P1  PR SRC=NULL  ________  
P2  FB SRC=NULL  ________  
P3  Kc = 0.1  ________  
P4  Ti = INF  SEC  ________  
P5  Td = 0.0s  SEC  ________  
P6  ERROR=+0.0%  %  ________  
P7  INVERT PID=N  ________  

ACCELERATION RATES
R1  ACC=10.0%/s  %/SEC  ________  
R2  DEC=10.0%/s  %/SEC  ________  
R3  AAC*=  %/SEC  ________  
R4  ADEC*=  %/SEC  ________  
R5  BRK SP=OFF  %  ________  
R6  STOPR=1300%/s  %/SEC  ________  
R7  SP FILT=*  SEC  ________  
R8  TQ FILT=0.00s  SEC  ________  

START/STOP MODES
S1  START=NORMAL  ________  
S2  STOP=NORMAL  ________  
S4  ASTOP=NORMAL  ________  
S5  STR DLY=0.00s  SEC  ________  
S6  OFF DLY=1s  SEC  ________  
S7  LOW V TRIP=N  ________  
S8  BRAKE I=0%  %  ________  
S9  HOLD V=0%  %  ________  
S10  HEAT=OFF  %  ________  
S11  STP T/O=*  SEC  ________  

IMPEDEANCES AND GAINS
X1  CTRL TYPE=V/Hz  ________  
X3a  Lm=*  %  ________  
X3b  R*=  %  ________  
X3c  Rr=*  %  ________  
X3d  SIGMA=6.0%  %  ________  
X3e  FL WEAK=100%  %  ________  
X4a  MIN FLX=100%  %  ________  
X4b  STR TYPE=AUTO  ________  
X4c  STR TQ=0%  %  ________  
X4d  STR BAND=10%  %  ________  
X4f  Kp w=20%  %  ________  
X4g  Ki w=30%  %  ________  
X4h  Kd w=0%  %  ________  
X4i  LS FL BO=0%  %  ________  
X4j  HS FL BO=0%  %  ________  
X4k  INERTIA k=1  ________  
X5a  ILT SLP*  %  ________  
X5b  VLT SLP*  %  ________  
X5c  DAMPING*  %  ________  
X5d  SLIP COMP=N  ________  
X5e  FREQ=AUTO  ________  
X5f  SWITCH FR=WW  Hz  ________  
X5g  Kp I=25%  %  ________  
X5h  Ki I=13%  %  ________  
X5i  Kf w=50%  %  ________  

MENU OPTIONS
Y1  LANGUAGE=1  ________  
Y3  PROGRAM=1  ________  

COMMISSION = Y/N
Z1  PASSWRD=OFF  ________  
Z2  S/W REVISION  ________  
Z2  H/W REVISION  ________  

*Model dependant default
## COMMISSIONING CONFIGURATION CONTROL — TERMINALS

### Relay 1
- **N.O.**
  - T1: O2a
  - T2: O2b
  - T3: Inverted = Y/N

### Relay 2
- **N.O.**
  - T4: O2c
  - T5: O2a
  - T6: Inverted = Y/N

### Relay 3
- **N.O.**
  - T6: O2a
  - T7: Inverted = Y/N

### Relays:
- Relay Selection = O2a O2b
- Relay Selection = O2c
- Relay Selection = O2d
- N.O.
- N.C.

### External
- T8: D1
- D2: D.B. Time = D.B. Duty

### Display
- DATA: Local
- Display: Start/Stop-Reset

### Multi-function Inputs
- MFI 1: I7a
  - I7c: MFI 1 =

### Multi-function Inputs
- MFI 2: I7d
  - I7e: MFI 2 =

### Multi-function Inputs
- MFI 3: I7f
  - I7g: MFI 3 =

### Multi-function Inputs
- MFI 4: I7h
  - I7i: MFI 4 =

### Multi-function Inputs
- MFI 5: I7j
  - I7k: MFI 5 =

### Multi-function Inputs
- MFI 6: I7l
  - I7m: MFI 6 =

### Ext Trip/PTC
- T9: External Trip/PTC Input

### EncoderSupply
- T10: +24V
- I1: 0V

### Display
- T11: Display
- T12: START/STOP

### Digital Inputs
- I7b: Digital Input
- I8a: Lo
- I8b: Hi
- I8c: Lo
- I8d: Hi

### Analog Inputs
- T23: PS Input 1
- T24: PS Output 2
- T25: PS Output 3
- T26: PS Input 2
- T27: PS Output 4

### EncoderSupply
- T30: Encoder Supply
- T31: Encoder Input
- T32: Encoder PPR
- T33: Encoder Type
- T34: Encoder Supply

### User Supply
- T35: User Supply
- T36: User Supply

### Isolated Supply
- T38: Isolated 0V
- T39: Isolated RS485

### Communications
- T40: Communications Address
- T41: Baud Rate
- T42: RS232

### Fibre Optic
- F1: Mode
- FO: Output
## ELITE SERIES SPARES LIST

### COMMON SPARES

<table>
<thead>
<tr>
<th>Description</th>
<th>PDL Part No.</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elite Control Board</td>
<td>E000-610S</td>
<td>1</td>
</tr>
<tr>
<td>Control board fuse link set</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1A Ceramic, 20x5mm</td>
<td>2401-037</td>
<td>10</td>
</tr>
<tr>
<td>Control Wiring plug set</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

### MICRODRIVE ELITE SPARES (FRAME SIZE 1)

Common to 400Vac and 500Vac models:

<table>
<thead>
<tr>
<th>Description</th>
<th>PDL Part No.</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heatsink cooling fan</td>
<td>2941-012</td>
<td>1</td>
</tr>
<tr>
<td>Terminal Shield</td>
<td>3903-124</td>
<td>1</td>
</tr>
<tr>
<td>Elite Display 3m cable</td>
<td>E000-621S</td>
<td>1</td>
</tr>
<tr>
<td>Microdrive Elite Series display unit</td>
<td>E000-620S</td>
<td>1</td>
</tr>
</tbody>
</table>

ME2.5A to 12A:

<table>
<thead>
<tr>
<th>Description</th>
<th>PDL Part No.</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME-2.5 Gate drive PCB</td>
<td>E002-612S</td>
<td>1</td>
</tr>
<tr>
<td>ME-2.5 Terminal PCB</td>
<td>E002-616S</td>
<td>1</td>
</tr>
<tr>
<td>ME-2.5/6.5 Power Board</td>
<td>E006-611S</td>
<td>1</td>
</tr>
<tr>
<td>ME-6.5 Gate Drive Board</td>
<td>E006-612S</td>
<td>1</td>
</tr>
<tr>
<td>ME-6.5 Terminal Board</td>
<td>E006-616S</td>
<td>1</td>
</tr>
<tr>
<td>ME-10.5/12 Power Board</td>
<td>E010-612S</td>
<td>1</td>
</tr>
<tr>
<td>ME-12 Gatedrive Board</td>
<td>E012-612S</td>
<td>1</td>
</tr>
<tr>
<td>ME-10.5/12 Terminal Board</td>
<td>E012-616S</td>
<td>1</td>
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ME2D to 11D:

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<th>PDL Part No.</th>
<th>Quantity</th>
</tr>
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<tbody>
<tr>
<td>ME-2A 500V Terminal PCB</td>
<td>E003-616S</td>
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</tr>
<tr>
<td>ME-6A 500V Terminal Board</td>
<td>E007-616S</td>
<td>1</td>
</tr>
<tr>
<td>ME-2/12A 500V Gatedrive Board</td>
<td>E013-612S</td>
<td>1</td>
</tr>
<tr>
<td>ME9/11A 500V Terminal Board</td>
<td>E013-616S</td>
<td>1</td>
</tr>
</tbody>
</table>

### MICRODRIVE ELITE SPARES (FRAMES SIZE 2)

Common to 400Vac and 500Vac models:

<table>
<thead>
<tr>
<th>Description</th>
<th>PDL Part No.</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heatsink cooling fan</td>
<td>2941-012</td>
<td>1</td>
</tr>
<tr>
<td>Terminal Shield</td>
<td>3903-124</td>
<td>1</td>
</tr>
<tr>
<td>Elite Display 3m cable</td>
<td>E000-621S</td>
<td>1</td>
</tr>
<tr>
<td>Microdrive Elite Series display unit</td>
<td>E000-620S</td>
<td>1</td>
</tr>
</tbody>
</table>

ME18 to 22A:

<table>
<thead>
<tr>
<th>Description</th>
<th>PDL Part No.</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME-16 Power Board</td>
<td>E016-611S</td>
<td>1</td>
</tr>
<tr>
<td>ME-16 Gatedrive Board</td>
<td>E016-612S</td>
<td>1</td>
</tr>
<tr>
<td>ME-16 Terminal Board</td>
<td>E016-616S</td>
<td>1</td>
</tr>
<tr>
<td>ME-18 Gatedrive Board</td>
<td>E018-612S</td>
<td>1</td>
</tr>
<tr>
<td>ME-18/22.5 Power Board</td>
<td>E022-611S</td>
<td>1</td>
</tr>
<tr>
<td>ME-22.5 Gatedrive Board</td>
<td>E022-612S</td>
<td>1</td>
</tr>
<tr>
<td>ME-18/22.5 Terminal Board</td>
<td>E022-616S</td>
<td>1</td>
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ME16D to 21D:

<table>
<thead>
<tr>
<th>Description</th>
<th>PDL Part No.</th>
<th>Quantity</th>
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</thead>
<tbody>
<tr>
<td>ME-15/22A 500V Power Board</td>
<td>E023-611S</td>
<td>1</td>
</tr>
<tr>
<td>ME-15/22A 500V Gatedrive Board</td>
<td>E023-612S</td>
<td>1</td>
</tr>
<tr>
<td>ME-15/22A 500V Terminal Board</td>
<td>E023-616S</td>
<td>1</td>
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</table>
### MICRODRIVE ELITE SPARES (FRAMES SIZE 3)

<table>
<thead>
<tr>
<th>Common to 400Vac and 500Vac models:</th>
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<tbody>
<tr>
<td>Microdrive Elite Series display unit</td>
<td>E000-620S 1</td>
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<tr>
<td>Heatsink cooling fans</td>
<td>2941-012 2</td>
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<td><strong>ME-31A to 46A:</strong></td>
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<tr>
<td>ME-31 Power Board</td>
<td>E031-611S 1</td>
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<td>ME-31 Gatedrive Board</td>
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<td>ME-31 Capacitor Board</td>
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<td>ME-38/46 Power Board</td>
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<td>ME-38 Gatedrive Board</td>
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<td>ME-38 Capacitor Board</td>
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<td>ME-38/46 Power Board</td>
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<td>ME-46 Gatedrive Board</td>
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<td>ME-31/46 Rectifier Board</td>
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<tr>
<td>ME-46 Capacitor Board</td>
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<tr>
<td>ME-31/46 DCCT Interface Board</td>
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<td><strong>ME-30D to 41D:</strong></td>
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<td>ME-30A 500V Power Board</td>
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<td>ME-30A 500V Capacitor Board</td>
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<tr>
<td>ME-35A 500V Capacitor Board</td>
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<td>ME-35/46A 500V Power Board</td>
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<tr>
<td>ME-30/46A 500V Gatedrive Board</td>
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<tr>
<td>ME-30/41A 500V Rectifier Board</td>
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<tr>
<td>ME-41A 500V Capacitor Board</td>
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<tr>
<td>Ultradrive Elite Series display unit</td>
<td>E000-622S 1</td>
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<tr>
<td>Heatsink cooling fan, Dia. 172mm</td>
<td>2941-015 1</td>
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<tr>
<td>Heatsink cooling fan, 120x120mm</td>
<td>2941-012 1</td>
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<tr>
<td>Internal cooling fan</td>
<td>2941-013 1</td>
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<td><strong>UE-60A to 140A (400V):</strong></td>
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<tr>
<td>UE-60 Power Tray</td>
<td>E060-611S 1</td>
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<tr>
<td>UE-75 Power Tray</td>
<td>E075-611S 1</td>
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<tr>
<td>UE-90 Power Tray</td>
<td>E090-611S 1</td>
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<tr>
<td>UE-115 Power Tray</td>
<td>E115-611S 1</td>
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<tr>
<td>UE-140 Power Tray</td>
<td>E140-611S 1</td>
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<tr>
<td>UE-60/140 RFI PCB Assy</td>
<td>E140-614S 1</td>
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<tr>
<td>UE-55/660 Thermal Sense</td>
<td>E000-619S 1</td>
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<tr>
<td>UE-60/140 PCB Bus Assembly</td>
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<tr>
<td><strong>UE-60D to 140D (500V):</strong></td>
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<td>UE-55/60A 500V Power Tray</td>
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<tr>
<td>UE-80/140A 500V Power Tray</td>
<td>E141-611S 1</td>
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<tr>
<td>UE-68/75A 500V Terminal Board</td>
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<tr>
<td>UE-80/140A 500V PCB Bus</td>
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<td>UE-55/660A Thermal Sense</td>
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<tr>
<td>UE-60/140 PCB Bus Assembly</td>
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<thead>
<tr>
<th>Description</th>
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<th>Quantity</th>
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<tbody>
<tr>
<td>Elite control PCB</td>
<td>E000-610S</td>
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<tr>
<td>Elite Series display unit - 1.2m cable</td>
<td>E480-620S</td>
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<tr>
<td>Elite Series display unit - 1.7m cable</td>
<td>E680-620S</td>
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<tr>
<td>Elite Series display unit - 850mm cable</td>
<td>E250-620S</td>
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<tr>
<td>Fuse link, UE DC fuse board, 2A ceramic 32x6.3mm</td>
<td>2401-004</td>
<td>10</td>
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<tr>
<td>Fuse link, UE SCR board, 10A ceramic 32x6.3mm</td>
<td>2401-025</td>
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<tr>
<td>Fuse: A1-66C350TS</td>
<td>3302-615</td>
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<tr>
<td>Heatsink cooling fan, Dia. 170mm</td>
<td>2941-011</td>
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<tr>
<td>Internal cooling fan</td>
<td>2941-006</td>
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<td>SCR Rectifier: PD160F-120</td>
<td>1421-027</td>
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<tr>
<td>Thermstrate, IGBT</td>
<td>1781-104</td>
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<tr>
<td>Thermstrate, rectifier</td>
<td>1781-103</td>
<td>1</td>
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<tr>
<td>Transistor: SKM 300 GA 123 D, IGBT (E170, E240, E305, E340)</td>
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<tr>
<td>Transistor: SKM 400 GA 124 D, IGBT (E250, E420, E480)</td>
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<td>UE-305/480 Gatedrive board</td>
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<td>UE-575/660 Gatedrive board</td>
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<tr>
<td>UE-170/660 SCR board</td>
<td>E680-615S</td>
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<tr>
<td>UE-170/660 DC fuse assembly</td>
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<td>UE-170 Drive select board</td>
<td>E170-623S</td>
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<td>UE-190 Drive select board</td>
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<td>UE-210 Drive select board</td>
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<td>UE-305 Drive select board</td>
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<td>UE-340 Drive select board</td>
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<td>UE-380 Drive select board</td>
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<td>UE-420 Drive select board</td>
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<td>UE-575 Drive select board</td>
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<tr>
<td>UE-660 Drive select board</td>
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<td>UE-60/660 Thermal sense</td>
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<td>UE-660 power tray (incl. power PCB, requires drive select)</td>
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### ULTRADRIVE ELITE SPARES 500V (FRAMES 5-7)

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<tr>
<th>Description</th>
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<td>SCR Rectifier: PD160F-160</td>
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<td>Transistor: SKM 400 GA 124 D, IGBT (All other models)</td>
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<tr>
<td>Thermstrate, IGBT</td>
<td>1781-104</td>
<td>4 8 12</td>
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<td>Fan: 6424HR 24VDC: Axial 172x150</td>
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<td>UE: Frame 7 Gatedrive Board</td>
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<tr>
<th>OPTION</th>
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<tr>
<td>Elite Series display unit (3m cable)</td>
<td>E000-621S</td>
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<td>DeviceNet interface</td>
<td>EDNI</td>
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<td>Profibus DP Interface</td>
<td>PBUS</td>
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<td>Interbus interface</td>
<td>IBUS</td>
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<td>Serial bus interface</td>
<td>ESBI</td>
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<td>Fibre optic cable, 10m</td>
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<td>Fibre optic cable, 50m</td>
<td>2727-050</td>
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<td>IP54 Remote control (graduated potentiometer and on/off switch)</td>
<td>0302</td>
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<td>Dynamic Brake 15A (includes resistor)</td>
<td>B015</td>
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<tr>
<td>Dynamic Brake 140A (external resistor required)</td>
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<td>UE 170/660 extension Plinth</td>
<td>0397 to 0400</td>
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<td>Shaft Encoder Mounting Bracket</td>
<td>0300-BR</td>
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<td>Shaft Encoder Coupling</td>
<td>0300-CP</td>
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