# Chapter 1

# PRODUCT OVERVIEW

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# Chapter 1 PRODUCT OVERVIEW

## INTRODUCTION

This manual provides the necessary information to plan, install and commission the 620 Vector series drives.

### Division of Information

This manual comprises eight chapters, plus appendices.

- Chapter 1 summarises the 620 Vector drive's electrical and mechanical specifications.
- Chapter 2 covers the planning required prior to installing a 620 Vector drive.
- Chapter 3 describes the mechanical and electrical procedures for installing a 620 Vector drive.
- Chapter 4 shows how to commission an installation and how to adapt the 620 Vector drive to the motor/application.
- Chapter 5 describes the function blocks.
- Chapter 6 lists the diagnostic facilities built into the drive.
- Chapter 7 EMC and the 'CE' mark, explains how Eurotherm are assisting their customers in achieving European conformance.
- Chapter 8 contains routine maintenance and repair information.
- Chapter 9 Appendices.

This manual contains the information required to set up a motor drive system which automatically tunes itself to the motor and provides control of speed, ramp up and down times and similar functions. The 620 Vector series provides a further host of sophisticated programming options as standard.

## GENERAL DESCRIPTION

The 620 Vector drive allows high performance speed control of AC asynchronous induction motors fitted with an encoder. It is available with a range of power ratings in two variants:

620STD STANDARD for use in systems incorporating analogue setpoints and logic control systems.

620L As above with the addition of a Link co-processor, LINK fibre optic ports for use in Eurotherm Drives LINK fibre-optic based networks and a reference encoder input for phase control applications. This drive is programmed using ConfigEd Release 4.0+ available and documented separately.

This manual only covers the 620Std and the hardware / software differences for the 620L for more information on the 620L refer to Link documentation.

## PRODUCT RANGE

The 620 is available in four chassis types as follows:

| CHASSIS | POWER (208 to 240 volts) | POWER (380 to 460 volts) |
|---|---|---|
| TYPE 4 | 0.75 - 4.0kW; | 0.75 - 7.5kW |
| TYPE 5 | 5.5 - 7.5kW; | 11.0 - 15.0kW |
| TYPE 6 | 11 - 18kW; | 18.0 - 37.0kW |
| TYPE 7 | 22 - 37kW; | 45.0 - 75.0kW |

Table 1.1 620 Vector Drive variants

The 620 models are housed in chassis of similar appearance with a 32 character Man-Machine Interface (MMI) - an alphanumeric display utilising multi-level menus to present all parameters, diagnostics and alarms (refer to Figure 1.1). The chassis size increases with power rating. The models are further identified by the product code, refer to "**PRODUCT CODE**" in this chapter.

### Equipment Supplied

The standard 620 Vector series is supplied with this manual and an external brake resistor. The standard options which are available are listed overleaf.

## Optional Equipment

The following equipment options are available for the 620 Vector Drives:

1. Dynamic Braking Module (fitted internally). This is a factory fitted option and usually fitted as standard
2. NEMA 1 Top Cover.
3. Glandbox.

## COMPONENT IDENTIFICATION

This manual refers to various connector terminals within the equipment which are accessible to the user for installation purposes. An exploded view of a 620 Vector Drive is shown in Figure 1.1.

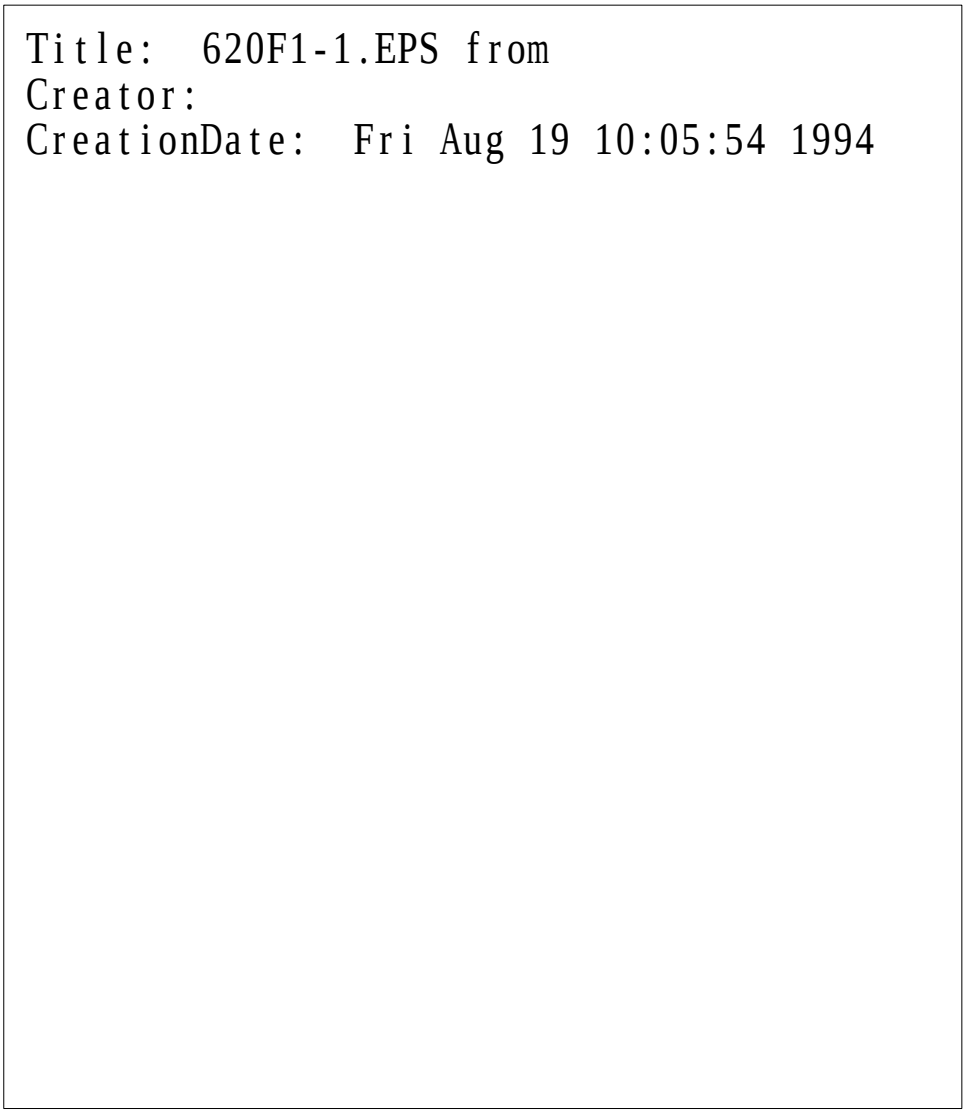


Figure 1.1 - 620 Vector Drive Exploded View

| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Chassis or Stack | 5 | LCD |
| 2 | Control Board Terminals | 6 | Fixing Points |
| 3 | Terminal Cover | 7 | MMI (LCD + Buttons) |
| 4 | Power Terminals | 8 | Status LEDs |

## TECHNICAL SPECIFICATION

The following paragraphs provide technical information regarding the features and performance characteristics of the 620 Vector Drives.

### General

The MMI display menus provides full access to all the drive's parameters.

| | |
|---|---|
| Output Frequency | 0-400Hz |
| Switching Frequency | 5 or 3kHz depending on type |
| Preset Speeds | 8 |
| Overload rating | 150% for 60s |
| Speed control range | 0-8 x base speed, 1000:1 of max. speed |
| Speed control precision | ± 0.01% steady state of max. setpoint (digital setpoint)<br>± 0.1% steady state of max. setpoint (analogue setpoint). |
| Speed ref. resolution | ± 0.01% digital<br>± 0.025% analogue (12 bit) |
| Stopping Modes | Ramp<br>Fast stop<br>Coast |

#### Protection

The 620 Vector series drives will trip under the following conditions:

- Short circuit line - line
- Short circuit line - earth
- Earth fault
- Overcurrent >220%
- Overvoltage
- Undervoltage
- Stall
- Overspeed
- 5703 repeater error
- External trip
- Heatsink overtemperature
- Motor thermistor overtemperature

#### Diagnostics and monitoring

Full diagnostics/monitoring is provided by the MMI display and status LEDs.

#### Inputs and Outputs

The following range of inputs and outputs are provided:

5 Analogue Inputs (4 programmable)

2 Analogue Outputs (both programmable)

Digital Inputs (24V DC) for Run, Fast Stop, Coast Stop, Jog, Enable, Ramp Hold, Preset 1, 2, and 3 (the last 4 inputs are programmable.

Three programmable digital outputs are provided (24V DC).

A 24V DC supply is available for interfacing external digital inputs.

A +10V and -10V DC supply is available for interfacing external analogue inputs.

## Electrical Ratings - Power Circuit

| Input Voltage 380V to 460V ±10%, 50/60Hz | TYPE 4 | | | | | | | TYPE 5 | | TYPE 6 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Power (kW) | 0.75 | 1.1 | 1.5 | 2.2 | 4.0 | 5.5 | 7.5 | 11 | 15 | 18 | 22 | 30 | 37 |
| Input Current (A) | 3.0 | 4.5 | 6.0 | 8.0 | 11 | 15 | 18.0 | 25 | 31 | 40 | 46 | 61 | 72 |
| Output Current (A) | 2.3 | 3.3 | 4.5 | 6.3 | 9.4 | 13 | 16 | 24 | 30 | 39 | 46 | 61 | 72 |
| Input power factor. | 0.95 | | | | | 0.86 | | | | | | | |
| Input Fuse (A) | 10 ① | | | | 15 ① | | 20 ① | 32 ② | 40 ② | 50 ② | 63 ② | 100 ② | 125 ② |
| Approx. loss (W) | 60 | 70 | 85 | 110 | 150 | 200 | 250 | 350 | 400 | 550 | 630 | 820 | 1050 |
| Switching Frequency | 5kHz | | | | | | | | | | | | |

| Input Voltage 208V to 240V ±10%, 50/60Hz | TYPE 4 | | | | | TYPE 5 | | TYPE 6 | | | TYPE 7 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Power (kW) | 0.75 | 1.1 | 1.5 | 2.2 | 4.0 | 5.5 | 7.5 | 11 | 15 | 18 | 22 | 30 | 37 |
| Input Current (A) | 5.5 | 7.5 | 9.5 | 12 | 19 | 25 | 31 | 46 | 61 | 72 | 86 | 120 | 145 |
| Output Current (A) | 4.3 | 6 | 8 | 10.5 | 17 | 24 | 30 | 46 | 61 | 72 | 86 | 120 | 145 |
| Input p.f. | 0.95 | | | 0.86 | | | | | | | | | |
| Input Fuse (A) | 10 ① | | 15 ① | | 20 ① | 32 ② | 40 ② | 63 ② | 100 ② | | 125 ② | 160 ② | 200 ② |
| Approx. loss (W) | 70 | 90 | 100 | 130 | 210 | 270 | 360 | 510 | 680 | 830 | 980 | 1300 | 1600 |
| Switching Frequency | 5kHz | | | | | | | | | | 3kHz | | |

| Common data | | TYPE 4 | TYPE 5 | TYPE 6 | TYPE 7 |
|---|---|---|---|---|---|
| Output Voltage (max) | | Input Voltage | | | |
| Output Overload | | 150% for 60s | | | |
| Output Frequency | | 0 to 240Hz | | | |
| Ambient Operating Temperature Range | | 0 to 50°C<br>0 to 40°C for 2.2kW (380 - 460V) | | | |
| | Nema 1 | 0 to 40°C | | | |

Table 1-2 - 620 Electrical Specifications

Notes :-

① Class "T" Fuses.

② For installations requiring UL compliance, short circuit protection Semiconductor Fuses should be installed in the 3-phase supply to the 620 products. These fuses are suitable for branch circuit short-circuit protection of the solid-state motor controllers only. For installations NOT requiring UL compliance, use class"T" fuses.

## Electrical Ratings - Control Circuit

The following ratings relate to all 620 variants.

### Supplies

| | |
|---|---|
| Reference Supplies (for all analogue inputs) | +10V ± 0.1V, 10mA max<br>- 10V ± 0.1V, 10mA max |
| Supply (for all digital inputs) | +24V ± 10%, 200mA max. This is in addition to the digital outputs. |

Table 1-3 Reference Inputs

### Analogue I/O

| | INPUT | OUTPUT |
|---|---|---|
| Impedance | 100kΩ | Min load 3kΩ to 0v |
| Range | ± 10V | ± 10V |
| Resolution | 12 bit (1 in 4096) + sign<br>Approx. 2.5mV resolution | 12 bit (1 in 4096) + sign |
| Sample Rate | Synchronous with block diagram<br>Terminal C4 (Direct I/P) 1.1mS | Synchronous with block diagram |
| Current (max.) | 1mA | 3mA |

Table 1-4 Analogue Interface Specification

### Digital Inputs

| | |
|---|---|
| Input voltage | Nominal 24V DC, Max. +30V DC |
| Input impedance | 4k7Ω |
| Sample Rate | Synchronous with block diagram |
| Threshold | $V_{in}$ low < +6V DC<br>Typical +12V DC<br>$V_{in}$ high > +18V DC |

Table 1-5 Digital Inputs

### Digital Outputs

Digital outputs are open circuit when Off. The On specification is shown in Table 1-7.

| | |
|---|---|
| On Voltage | +24V ±10% |
| Maximum On Current | 50mA (Source). |

Table 1-6 Digital Outputs

## Pilot Output

Pilot output is an open collector output that is off while the drive is healthy. The specification is shown in Table 1-7.

| | |
|---|---|
| Open Collector 0V to 24V | 50mA (Current Sink). |

Table 1-7 Pilot Output

## Encoder Inputs

| | |
|---|---|
| Input Voltage | -30V to +30V differential |
| Input Threshold Voltage | 4V ± 1V DIL 7-12 switch on<br>9V ± 1V DIL 7-12 switch off |
| Input Current | 10mA ± 3mA |
| Maximum Input Frequency | 250kHz on each of A and B<br>$MaxFreq = \frac{MaxSpeedRPM}{60} * NoOfLines$ |

Table 1-8 Control Terminal Specifications

## Encoder Supply Output

| | |
|---|---|
| Output Voltage | 15 - 21V (0 to 200mA load)<br>16V ± 1V (Recommended load) |
| Recommended Load Current | 50 - 200mA |
| Short Circuit Duration | Indefinite |

Table 1-9 Encoder Supply Output Specifications

## Mechanical Details

The mechanical details of all the 620 vector series controllers are shown in Tables 1-10 to 1-13. The general layout of the cases is shown in Chapter 3.

### 620 TYPE 4

| | |
|---|---|
| DIMENSIONS | Refer to figure 3.1 |
| ENCLOSURE | Chassis mounted IP20, with NEMA 1 option |
| MOUNTING ORIENTATION | Vertical |
| WEIGHT | 8kg max. |
| AIR FLOW CLEARANCE | Refer to figure 3.1 |
| POWER TERMINATIONS | M5 tapped bushes with slotted screws.<br>Tightening torque 2.5Nm (1.8lb-ft).<br>Earth terminal is M4 stud with nut.<br>Tightening torque 1.3Nm (0.9lb-ft). |
| CONTROL TERMINATIONS | Removable screw connectors for 0.75mm$^2$ wire (18 AWG).<br>Terminals will accept up to 1.5mm$^2$ wire (16 AWG).<br>Tightening torque 0.6Nm (0.4lb-ft) |
| | Spring terminal connectors for 1.5mm$^2$ wire (16 AWG).<br>Terminals will accept up to 1.5mm$^2$ wire (16 AWG). |

Table 1-10 620 type 4 mechanical details

### 620 TYPE 5

| | |
|---|---|
| DIMENSIONS | Refer to figure 3.1 |
| ENCLOSURE | Chassis mounted IP20. |
| MOUNTING ORIENTATION | Vertical |
| WEIGHT | 12kg |
| AIR FLOW CLEARANCE | Refer to figure 3.1 |
| POWER TERMINATIONS | M5 tapped bushes with slotted screws.<br>Tightening torque 2.5Nm (1.8lb-ft). |
| CONTROL TERMINATIONS | Removable screw connectors for 0.75mm$^2$ wire (18 AWG).<br>Terminals will accept up to 1.5mm$^2$ wire (16 AWG).<br>Tightening torque 0.6Nm (0.4lb-ft) |
| | Spring terminal connectors for 1.5mm$^2$ wire (16 AWG).<br>Terminals will accept 0.5 - 1.5mm$^2$ wire (16 AWG). |

Table 1-11 620 type 5 mechanical details

### 620 TYPE 6

| | |
|---|---|
| DIMENSIONS | Refer to figure 3.1 |
| ENCLOSURE | Chassis mounted IP20. |
| MOUNTING ORIENTATION | Vertical |
| WEIGHT | 31kg |
| AIR FLOW CLEARANCE | Refer to figure 3.1 |
| POWER TERMINATIONS | Compact high current terminal blocks.<br>Terminals accommodate 0 - 35mm$^2$ wire<br>(0 - 1/0) cables<br>Tightening torque 4Nm (5.4lb-ft).<br>Clamping screw: cheese head, slotted M8 |
| CONTROL TERMINATIONS | Removable screw connectors for 0.75mm$^2$ wire (18 AWG).<br>Terminals will accept up to 1.5mm$^2$ wire (16 AWG).<br>Tightening torque 0.6Nm (0.4lb-ft) |
| | Spring terminal connectors for 1.5mm$^2$ wire (16 AWG).<br>Terminals will accept 0.5 - 1.5mm$^2$ wire (16 AWG). |

Table 1-12 620 type 6 mechanical details

### 620 TYPE 7

| | |
|---|---|
| DIMENSIONS | Refer to figure 3.1 |
| ENCLOSURE | Chassis mounted IP20. |
| MOUNTING ORIENTATION | Vertical |
| WEIGHT | 83kg |
| AIR FLOW CLEARANCE | Refer to figure 3.1 |
| POWER TERMINATIONS | (a) Supply (L1-3), Motor (M1-3), Brake (DB1,2) and Earth:<br>Compact high current terminal blocks.<br>Terminals accommodate 25 - 95mm$^2$<br>(2 - 4/0) cables<br>Tightening torque 20Nm (14.7lb-ft).<br>Clamping screw: socket head, M8,<br>6.0 mm across flats.<br>(b) D.C. interconnection terminals (DC+, DC-):<br>Compact high current terminal blocks.<br>Terminals accommodate 35-150mm$^2$<br>(2-6/0) cables<br>Tightening torque 30 Nm (22lb-ft).<br>Clamping screw: socket head, M10,<br>8.0mm across flats. |
| CONTROL TERMINATIONS | Removable screw connectors for 0.75mm$^2$ wire<br>(18 AWG).<br>Terminals will accept up to 1.5mm$^2$ wire (16 AWG).<br>Tightening torque 0.6Nm (0.4lb-ft) |
| | Spring terminal connectors for 1.5mm$^2$ wire (16 AWG).<br>Terminals will accept 0.5 - 1.5mm$^2$ wire (16 AWG). |

Table 1-13 620 type 7 mechanical details

## EMC Specification

Refer to Chapter 7.

## Special Considerations

*For installations requiring compliance with UL standards:*

Motor Overload Protection

An external motor overload protective device must be provided by the installer.

OR

Motor overload protection is provided in the controller by means of the thermal device in the motor winding. This protection cannot be evaluated by UL hence it is the responsibility of the installer and/or the local inspector to determine whether the overload protection is in compliance with the National Electrical Code or Local Code requirements.

Overcurrent Protection Requirements

Fuses must be installed upstream of the drive. For fuse rating and type see Chapter 1 "**Electrical Ratings - Power Circuit**".

Short Circuit Rating

Suitable for use on a circuit capable of delivering not more than 5000 RMS Symmetrical Amperes, 240/460V maximum.

Field Wiring Temperature Rating

Use (60°C) copper conductors only.

External Surge Suppressor

A UL Recognised surge suppressor with a clamping voltage less than 6000V shall be installed upstream of this equipment.

Motor Base Frequency

The motor base frequency rating is 240Hz maximum.

Operating Ambient Temperature

For operating ambient temperature range, see Chapter 1 "**Electrical Ratings - Power Circuit**".

## Environmental Requirements

The environmental limits for the 620 Vector series controllers are shown in Table 1-14.

| | |
|---|---|
| Humidity (max.) | 85% relative humidity (non-condensing) at 40°C |
| Altitude | Above 1000m derate power by 1% per 100m up to a maximum 5000m |
| Atmosphere | Non flammable, non corrosive and dust free (Pollution Degree 2) . |
| Operating temperature range | 0°C to 50°C<br>(NEMA 1 option: 0°C to 40°C) |
| Storage temperature range | -20°C to +80°C short term (< 100 hours)<br>0°C to +60°C long term |
| Enclosure | IP20 (direct conduit connection and NEMA 1 options) |

Table 1-14 620 Series environmental requirements

## Product Code

All 620 units are fully identified using an eleven block alphanumeric code, as shown in figure 1-2. This code details the drive calibration and settings on despatch from the factory. The product code appears as the "Model No." on the rating label at the side of the unit.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Example code | 620STD / | 0750 / | 400 / | 0010 / | UK / | ENW / | 0000 / | 000 / | B1 / | 000 / | 000 |
| Block number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |

Figure 1-2 Product code blocks

Details of each block of the product code are given in Table 1-15.

| Block No. | Variable | Description |
|---|---|---|
| 1 | 620STD<br>620L | 620 Vector Standard<br>620 Vector Link |
| 2 | <br>0007<br>0011<br>0015<br>0022<br>0040<br>0055<br>0075<br>0110<br>0150<br>0180<br>0220<br>0300<br>0370<br>0450<br>0550<br>0750 | Four numbers specifying the power rating in kW<br>0.75 kW<br>1.1 kW<br>1.5 kW<br>2.2 kW<br>4.0 kW<br>5.5 kW<br>7.5 kW<br>11 kW<br>15 kW<br>18 kW<br>22 kW<br>30 kW<br>37 kW<br>45 kW (380-460V only)<br>55 kW (380-460V only)<br>75 kW (380-460V only) |
| 3 | <br>230<br>400 | Three numbers specifying the nominal input voltage rating<br>208 to 240V (±10%) 50/60Hz<br>380 to 460V (±10%) 50/60Hz |
| 4 | <br><br><br>00xx<br>01xx-99xx<br><br>xx1x<br>xx2x<br><br>xx3x<br>xx5x<br>xx6x<br><br><br><br>xxx0 | Four digits specifying the mechanical package including livery and mechanical package style<br>First two digits: Livery<br>Standard Eurotherm Drives livery<br>Defined customer liveries<br>Third digit: Mechanical packaging style<br>Standard (IP20), protected panel mounting<br>IP20 and falling dirt protection (NEMA1) with glandplate cable entry<br>Enclosed (IP20), through panel mounting<br>IP20 with falling dirt protection (NEMA1) only<br>IP20 with glandcable entry only<br>Note: options 3 and 4 apply to certain power ratings only.<br><br>Fourth digit: Operator Station<br>Standard product (always 0) - Built in MMI |

| Block No. | Variable | Description |
|---|---|---|
| 5 | UK | Two characters specifying the user interface language<br>These characters are the same as used for computer keyboard specifications:<br>English |
| 6 | ENW | Three characters specifying any feedback option installed over and above the standard features of the product, e.g.<br>Encoder (Wire-ended) |
| 7 | 0000<br>N/A | Four characters specifying the communications protocol and its hardware implementation method<br>No communications options fitted<br>Indicates the particular communications option |
| 8 | 000<br>N/A | Three characters specifying any optional loaded software<br>No software options loaded<br>Indicates the particular software option |
| 9 | 00<br>B0<br>B1 | Two characters specifying the braking option<br>Brake power switch not fitted<br>Brake power switch fitted - no braking resistors supplied<br>Brake power switch fitted and default value braking resistors supplied **(standard)**<br>Note: Extra braking resistors can be specified and ordered separately |
| 10 | 000<br>TBA | Three characters specifying the mains filtering standard fitted<br>No mains filtering option fitted<br>Code for the filtering option installed |
| 11 | 000<br>nnn | 3 digits specifying engineering special options:<br>No special options<br>Code for the special engineering option installed |

Table 1-15 - Product Code Block Descriptions

### Example Code:

620STD/0750/400/0010/UK/ENW/0000/000/B1/000/000

This code indicates a drive which is:

- a 620 Standard product
- 75kW power rating
- 380-460v input supply
- Eurotherm Drives livery
- enclosed mechanical package (IP20)
- no additional optional operator station
- UK language
- wire-ended 15V encoder option
- no optional communications
- no optional loaded software
- brake switch fitted with default value resistors supplied
- no mains filtering option fitted
- no special options.