Compact SCR Power Controller

EPack Lite Three Phase

HA033173 Issue 1

02/2018

Eurotherm®

by Schneider Electric

Legal Information

The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Schneider Electric, Eurotherm Limited or any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein.

If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Eurotherm Limited software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

Table of Contents

Safety Information

Important Information

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this manual or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

Safety Notes

⚠ DANGER

BRANCH-CIRCUIT PROTECTION & SAFETY OVERLOAD PROTECTION

1. This product does not contain any branch-circuit protection or internal safety overload protection. The installer must add branch-circuit protection upstream of the unit, and provide external or remote safety overload protection to the end installation. Such branch-circuit and safety overload protection must comply with applicable local regulations.
   UL: The above mentioned branch-circuit protection is necessary for compliance with National Electric Code (NEC) requirements.
2. The cables used to connect the EPack Lite's auxiliary supply and voltage reference must be correctly protected by branch-circuit protection. It is the responsibility of the installer to add branch-circuit protection. Such branch-circuit protection must comply with applicable local regulations.

HAZARD OF ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH

3. Eurotherm shall not be held responsible for any damage, injury, losses or expenses caused by inappropriate use of the product (EPack Lite), or failure to comply with these instructions.
4. If the product is used in a manner not specified by the manufacturer, the protection provided by the product might be impaired.
5. Disassembling the product is strictly forbidden.
6. The product must be installed and maintained by suitably qualified personnel, authorized to work in an industrial low voltage environment.
7. The product is not suitable for isolation applications, within the meaning of EN60947-1.
8. EPack Lite alarms protect thyristors and loads against abnormal operation, and provide the user with valuable information regarding the type of fault. Under no circumstances must these alarms be regarded as a replacement for proper personnel protection. It is strongly recommended that the installing authority include independent, system-safety mechanisms to protect both personnel and equipment against injury or damage, and that such safety mechanisms be regularly inspected and maintained. Consult the EPack Lite supplier for advice.
9. The product is designed to be installed in a cabinet connected to the protective earth ground according to IEC60364-1 and IEC60364-5-54 or applicable national standards.
10. Electrically conductive pollution must be excluded from the cabinet in which the product is mounted. To ensure a suitable atmosphere in conditions of conductive pollution, fit adequate air conditioning/filtering/cooling equipment to the air intake of the cabinet, e.g. fitting fan-cooled cabinets with a fan failure detection device or a thermal safety cut-out.
11. Before carrying out any wiring to the product, it must be ensured that all relevant power and control cables, leads or harnesses are isolated from voltage sources.
12. Before any other connection is made, the protective earth ground terminal shall be connected to a protective conductor. The cables used must be rated 90 stranded copper only.
    CE: Wire conductor cross sections must comply with table 9 of IEC60947-1 taking account of table 54.2 of IEC 60364-5-54.
    U.L.: Wire conductor cross sections must comply with NEC Article 310 Table 310-16 and the earth connection must be made using a UL-listed ring type crimp.
13. The protective earth ground connections and power terminals must be tightened according to the torque values defined in Table 1, "Connection Details," on page 28. Appropriate regular inspections must be performed.

Failure to follow these instructions will result in death or serious injury.

⚠ DANGER

HAZARD OF ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH

14. Any interruption of the protective earth ground conductor inside or outside the product, or disconnection of the protective earth ground terminal is likely to make the product dangerous under some conditions. Intentional interruption is prohibited. Whenever it is likely that protection has been impaired, the unit shall be made inoperative, and secured against accidental operation. The manufacturers nearest service centre must be contacted for advice.
15. Power connections: wire conductor cross sections must comply with table 9 of IEC60947-1 or NEC Article 310 Table 310-16. The cables used must be rated 90°C stranded copper only.
16. If fitted, the 85Vac to 550Vac auxiliary supply shall be protected by a supplemental fuse or by branch circuit fuses as listed in Table 2, “Auxiliary supply fuse protection,” on page 30.
17. According to the CE and UL certifications, supplemental (high speed) fuses are mandatory for compliant installation and protection of the EPack Lite against short circuit, for further details see Fusing (page 73).
18. The EPack Lite’s rated short-circuit conditional current is 100kA for co-ordination type 2. If opening of either the branch circuit protective or the supplemental (high speed) fuses occurs, the product shall be examined by suitably qualified personnel and replaced if damaged.
19. The maximum voltage between any pole of the power supply and terminals1/L1, 3/L2, 5/L3 and Vref shall be lower than 550Vac. The maximum voltage between any pole of the power supply and protective earth ground shall be lower than 550Vac (rated insulation voltage 500V).
20. Connection of two conductors in the same terminal is not permitted.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

1. Signal and power voltage wiring must be kept separate from one another. Where this is impractical, shielded signal wiring has to be used, rated the same as the power voltage wiring.
2. Do not use the Vref terminal to replicate voltage signals (in a ‘daisy chain’), as the PCB track between the two poles is not designed to withstand short-circuit.
3. The product shall have one of the following as a disconnecting device, fitted within easy reach of the operator, and labelled as the disconnecting device:
   - A switch or circuit breaker which complies with the requirements of IEC60947-1 and IEC60947-3.
   - A separable coupler which can be disconnected without the use of a tool.
4. The product is designed to be mounted vertically. There must be no obstructions (above or below) which could reduce or hamper airflow. If more than one instance of the product is located in the same cabinet, they must be mounted in such a way that air from one unit is not drawn into another.
5. To reach the thermal performance the gap between two EPack Lites must be at minimum 10mm.
6. Under some circumstances, the EPack Lite heatsink temperature may rise by more than 50°C and it can take up to 15 minutes to cool after the product is shut down. Give consideration to additional warnings and barriers to prevent injury.
7. This product has been designed for environment A (Industrial). Use of this product in environment B (domestic, commercial and light industrial) may cause unwanted electromagnetic disturbances in which cases the installer may be required to take adequate mitigation measures.
8. The 24V auxiliary supply must be derived from a SELV or PELV circuit, see SELV (page 12) for definition.
9. To ensure that EPack Lite complies with Electromagnetic Compatibility requirements, ensure that the panel or DIN rail to which it is attached is correctly grounded. The ground connection, designed to ensure ground continuity, is not in any way a substitute for the protective earth ground connection.
10. **IP20**: In order to maintain IP20 protection, the stripped length of the power cables from the supply and to the load must be adapted according to the insulation thickness. See "Cable connection specification" on page 32.
11. If the upper and/or lower access door is open and if voltage reference connector is removed, IP20 is compromised and the product is IP10.
12. Breakaway features have been designed into the product especially to improve the IP20 rating. These features should be removed only for cable with a 9mm diameter or larger.
13. To maintain maximum cooling efficiency, the Power Module heat-sink must be cleaned regularly. Periodicity depends on the local environment, but should not exceed six months.

Failure to follow these instructions can result in death, serious injury or equipment damage.

SELV

SELV is defined (in IEC60947-1) as an electrical circuit in which the voltage cannot exceed 'ELV' under normal conditions or under single fault conditions, including earth ground faults in other circuits. The definition of ELV is complex as it depends on environment, signal frequency, etc. See IEC 61140 for further details.

The I/O connector (5-way) & auxiliary supply (24V ac/dc, 2-way) are compliant to the SELV requirements.

The alarm relay output is compliant to the SELV requirements; it can be connected to SELV or to voltage up to 230V (Rated insulation voltage U_i: 230V)

Symbols Used in the Instrument Labelling

One or more of the symbols below may appear as a part of the instrument labelling.

	Protective conductor terminal		Risk of electric shock
	AC supply only		Precautions against static electrical discharge must be taken when handling this unit.
	Underwriters laboratories listed mark, for Canada and the U.S.		Refer to the manual for instructions
	Do not touch heatsink Hot Surface		CE Mark. Indicates compliance with the appropriate European Directives and Standards
	EAC (EurAsian Conformity) customs union mark of conformity		Regulatory Compliance Mark (RCM) to Australian Communication and Media Authority

Introduction

This document describes the installation, operation and configuration of a 3 phase EPack Lite Power Controller. The unit includes the following analogue and digital inputs and outputs, fitted as standard:

- Two digital inputs (contact closure or voltage level), of which one of the digital inputs can be configured as 10v user output
- One analogue input
- One change-over relay under software control, configurable by the user.

Chapter Installation provides details on connector locations and pinouts.

The operator interface consists of a 1.44 inch square TFT display and four push buttons for navigation and data selection.

The 3 phase EPack Lite comes in four versions with maximum load currents of: 32A, 63A, 100A and 125A.

The supply voltage for the units can be specified as either low voltage (24V ac/dc) or line voltage (85 to 550V ac). The choice is made at time of order and cannot be changed in the field.

Unpacking the Units

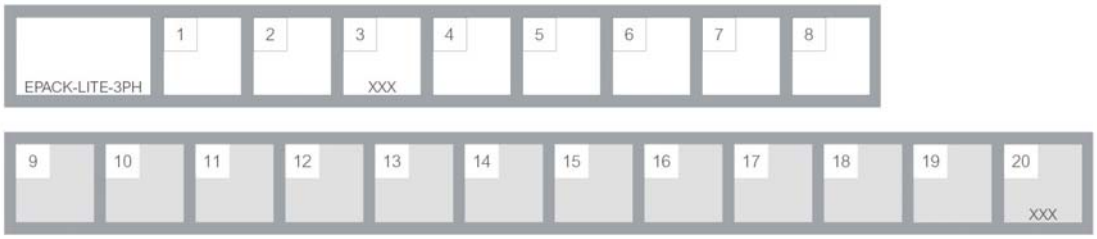
The units are despatched in a special pack, designed to give adequate protection during transit. If any of the outer boxes show signs of damage, they should be opened immediately, and the instrument examined. If there is evidence of damage, the instrument should not be operated and the local representative contacted for instructions.

After the instrument has been removed from its packing, the packing should be examined to ensure that all accessories and documentation have been removed. The packing should then be stored against future transport requirements.

Order Code

EPack Lite power controller is ordered using a short code for hardware and chargeable software options code.

Basic Product Coding



Model	
EPACK-LITE-3PH	Power Controller

1	Maximum current
16A	16 amps
25A	25 amps
32A	32 amps
40A	40 amps
50A	50 amps
63A	63 amps
80A	80 amps
100A	100 amps
125A	125 amps

2	Auxillary Power Supply
500V	500V max
24V	24V ac/dc

3	Reserved
XXX	Reserved

4	Control Option
V2	V^2 control (standard)
I2	I^2 control
OL	Open loop

5	Warranty
XXX	Standard Warranty
WL005	5 Year Warranty
USWL3	US Extended Warranty

6	Custom Labelling
XXX	Standard (Eurotherm)
FXXXX	Special Label

7	Fuse
XXX	Without
HSP	High Speed fuse without microswitch
HSM	High Speed fuse with microswitch

8	Configuration
XXXXX	Default
LC	Long code

Optional configuration

9	Nominal load current
nnnA	1 - Value field 1

10	Nominal line voltage
100V	100 volts
110V	110 volts
115V	115 volts
120V	120 volts
127V	127 volts
200V	200 volts
208V	208 volts
220V	220 volts
230V	230 volts
240V	240 volts
277V	277 volts
380V	380 volts
400V	400 volts
415V	415 volts
440V	440 volts
460V	460 volts
480V	480 volts
500V	500 volts

11	Load configuration
3S	Star without neutral
3D	Closed delta
4S	Star with neutral
6D	Open delta

12	Load type
XX	Resistive
TR	Transformer primary

13	Heater type
XX	Resistive

14	Firing mode
PA	Phase Angle
IHC	Intelligent Half Cycle
BF	Variable Modulation Burst Firing
FX	Fix modulation period (default 2 seconds)
LGC	Logic mode

15	Burst min ON time
XXX	None
FC1	Single cycle 1 period min ON time
C16	Burst with 16 periods min ON time
C64	Burst with 64 periods min ON time

16	Analog Input Function
XX	None
SP	Setpoint

17	Analog input type
0V	0-10 volts
1V	1-5 volts
2V	2-10 volts
5V	0-5 volts
0A	0-20 mA
4A	4-20mA

18	Digital Input 1 Function
XX	None
FI	Firing
LG	Setpoint for logic mode
AK	Alarm acknowledgement
FB	Fuse Blown

19	Digital Input 2 Function
XX	None
FI	Firing
LG	Setpoint for logic mode
AK	Alarm acknowledgement
FB	Fuse Blown
SU	10V supply

20	Reserved
XXX	Reserved

Software Upgrade Options

1	Serial number instrument
nnnn	Serial number

2	Current ratings upgrade
XXX	No change
16A-25A	16A to 25A
16A-32A	16A to 32A
25A-32A	25A to 32A
40A-50A	40A to 50A
40A-63A	40A to 63A
50A-63A	50A to 63A
80A-100A	80A to 100A

Installation

Mechanical Installation

Mounting details

The product is designed to operate at an operating temperature not exceeding 45°C at an altitude not exceeding 1000 metres and not exceeding 40°C at an altitude not exceeding 2000 metres.

⚠ DANGER

The product is designed to be installed in a cabinet connected to the protective earth ground according to IEC60364-1 and IEC60364-5-54 or applicable national standards.

Electrically conductive pollution must be excluded from the cabinet in which the product is mounted. To ensure a suitable atmosphere in conditions of conductive pollution, fit adequate air conditioning/filtering/cooling equipment to the air intake of the cabinet, e.g. fitting fan-cooled cabinets with a fan failure detection device or a thermal safety cut-out.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

The product is designed to be mounted vertically. There must be no obstructions (above or below) which could reduce or hamper airflow. If more than one instance of the product is located in the same cabinet, they must be mounted in such a way that air from one unit is not drawn into another.

To reach the thermal performance the gap between two EPack Lites must be at minimum 10mm.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Figures 4 to 7 show dimensions for the various units.

The units are designed for DIN Rail or bulkhead mounting using the mounting fixings supplied.

Mounted clearance dimensions

Phase:	**3 phase**			
Amps: EPack Lite clearance dimensions mm (inches):	**16 - 32A**	**40 - 63A**	**80 - 100A**	**125A**
between cable tray and EPack Lite	70 (2.76)	100 (3.94)	150 (5.91)	150 (5.91)
between two cable trays	306 (12.05)	366 (14.41)	530 (20.87)	530 (20.87)
between or side by side another EPack Lite	10 (.39)	10 (.39)	10 (.39)	10 (.39)

Bulkhead Mounting

32A and 63A Units

For Bulkhead mounting, fit the upper bracket ‘A’ to the rear of the unit by removing screw ‘B’ x2 and associated shake proof washers, offering the bracket up to the unit, and then securing it by installing x2 screw ‘B’ ensuring that the bracket is correctly oriented (as shown) and that the shakeproof washers are fitted between the screw head and the bracket.

The relevant screwdriver should have a 3mm AF hexagonal bit. The recommended tightening torque is 1.5 Nm (1.1 lb-ft). To mount, secure using x2 M5 screws and shakeproof washers using the top and bottom mount points.

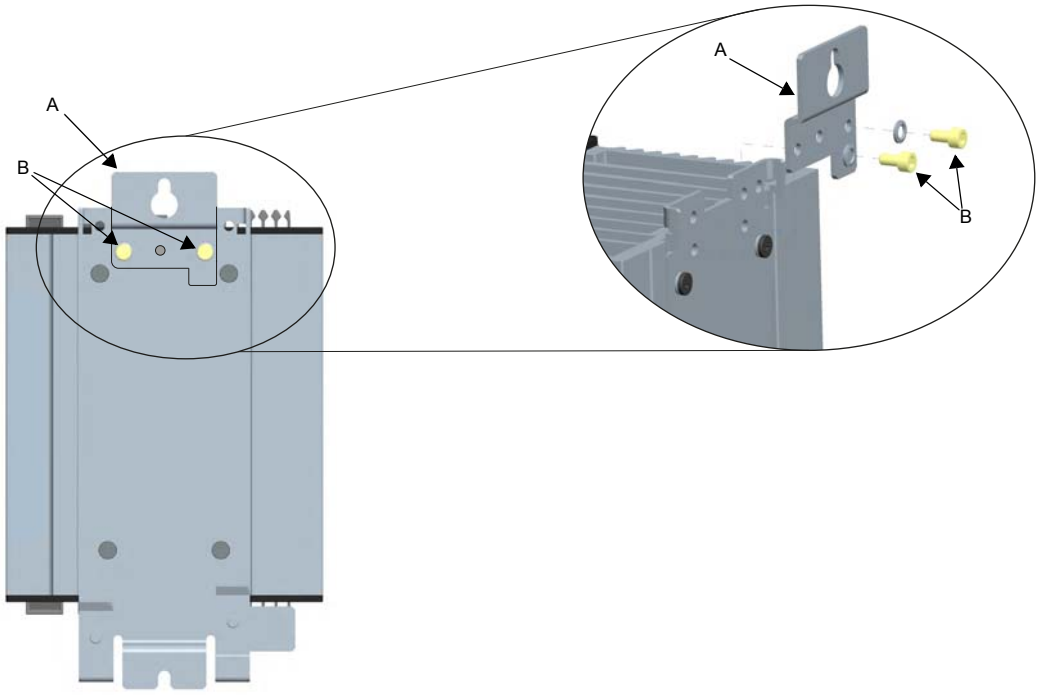


Figure 1: Fitting upper bulkhead mounting bracket (32A unit shown; 63A units similar)

80A, 100A and 125A Units

For bulkhead mounting, brackets ‘A’ and ‘B’ on the rear of the unit are used to mount the product. Secure using x3 M6 screws and shakeproof washers using the top and bottom mount points.

Figure 2: Bulkhead mounting 80A/100A unit shown (125A similar)

DIN Rail Mounting

32A and 63A Units

The 32A and 63A units can be mounted using two horizontal, parallel, 7.5 mm or 15 mm DIN rails. Locate the upper mounting hooks ‘A’ (×2) on the upper DIN rail ‘B’. To secure the unit against the lower DIN rail ‘C’, slide the lower mounting catches ‘D’ (×2) upwards and tighten the mounting screws ‘E’ (x2) to the recommended tightening torque of 3 Nm (2.2 lb ft).

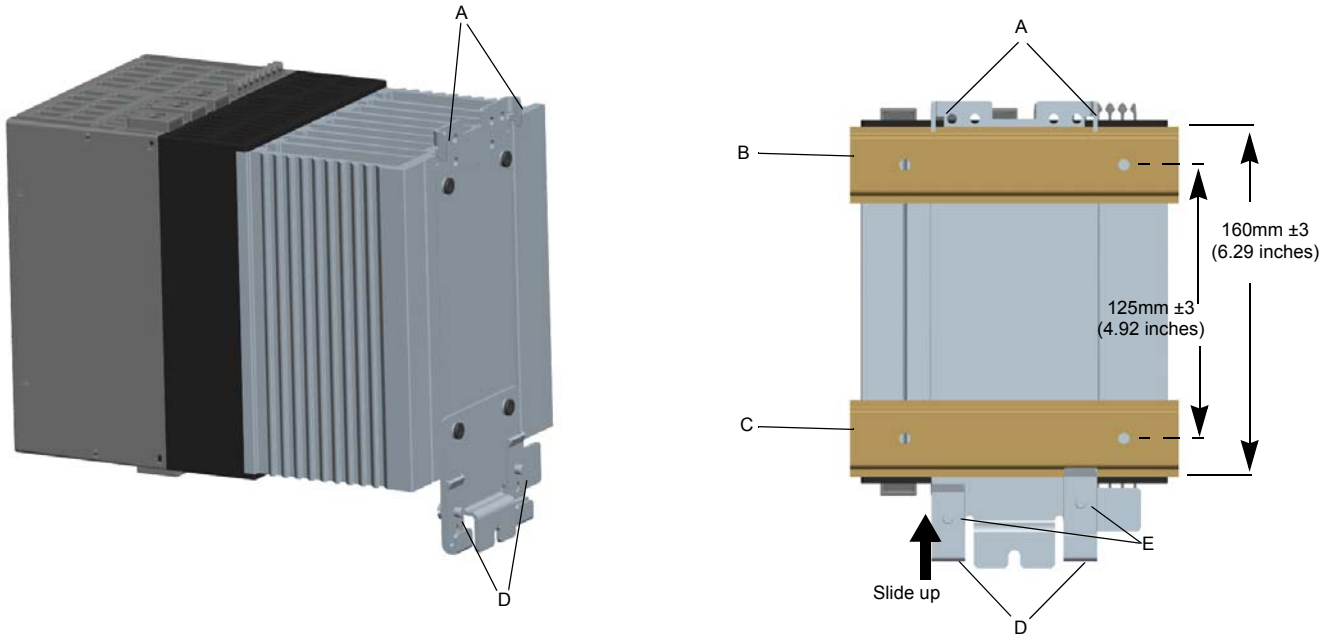


Figure 3: DIN rail mounting (32A unit shown; 63A units similar)

80A, 100A and 125A Units

The higher power units cannot be mounted using any type of DIN rail configuration due to the size and relative mass.

See "Bulkhead Mounting" on page 19 for further details.

Dimensions

16A to 32A unit dimensions

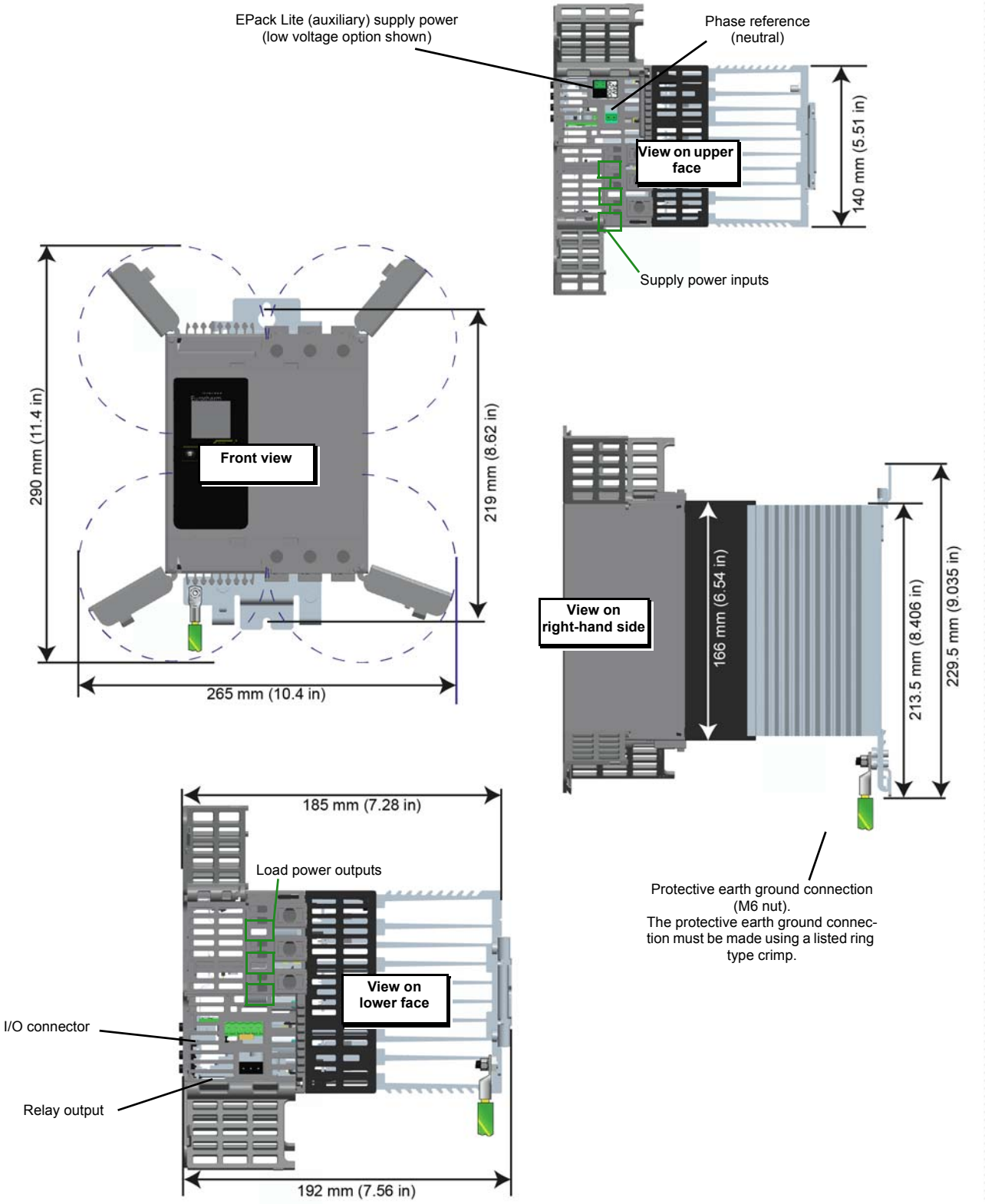


Figure 4: Mechanical installation details (16A to 32A units).

40A to 63A unit dimensions

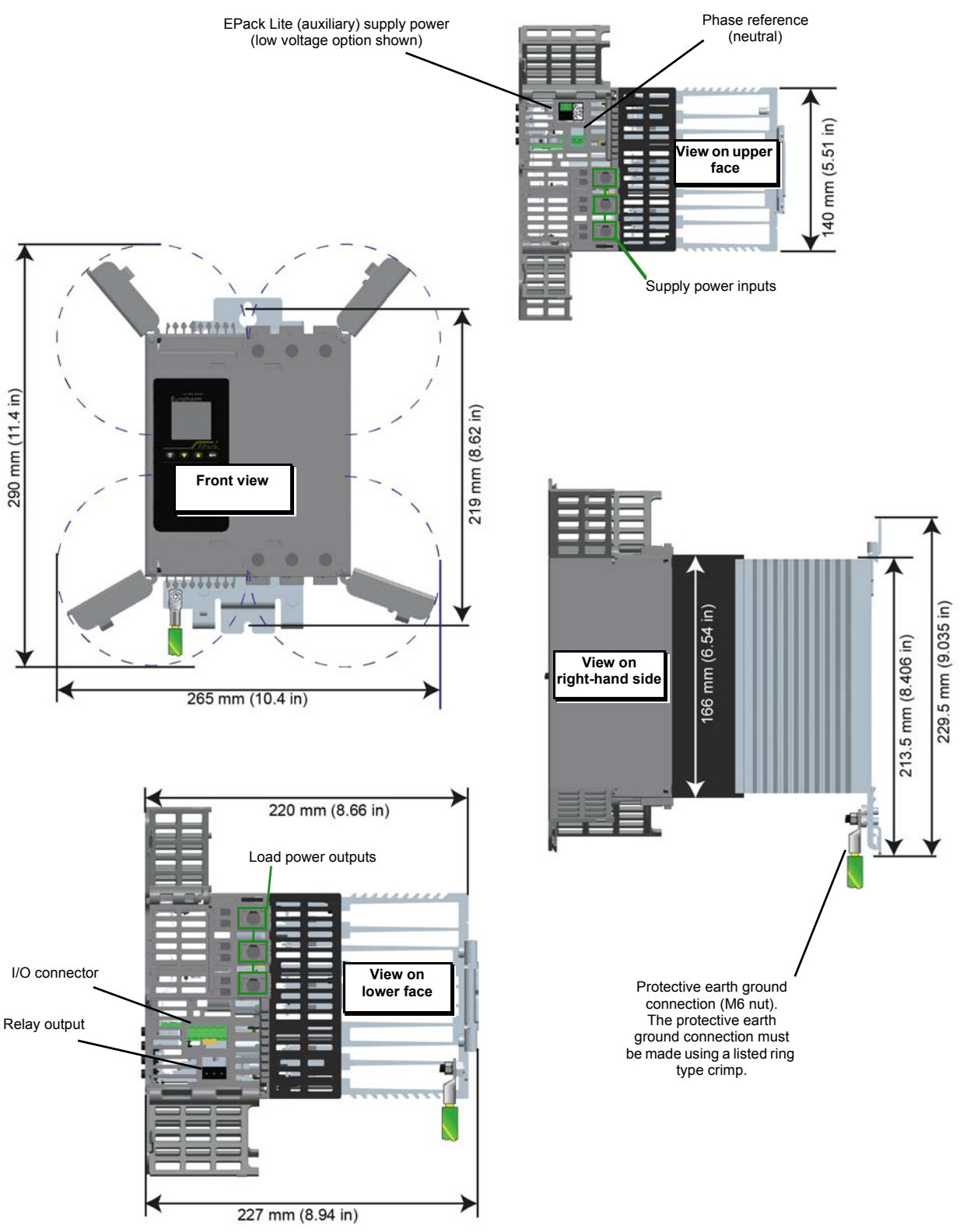
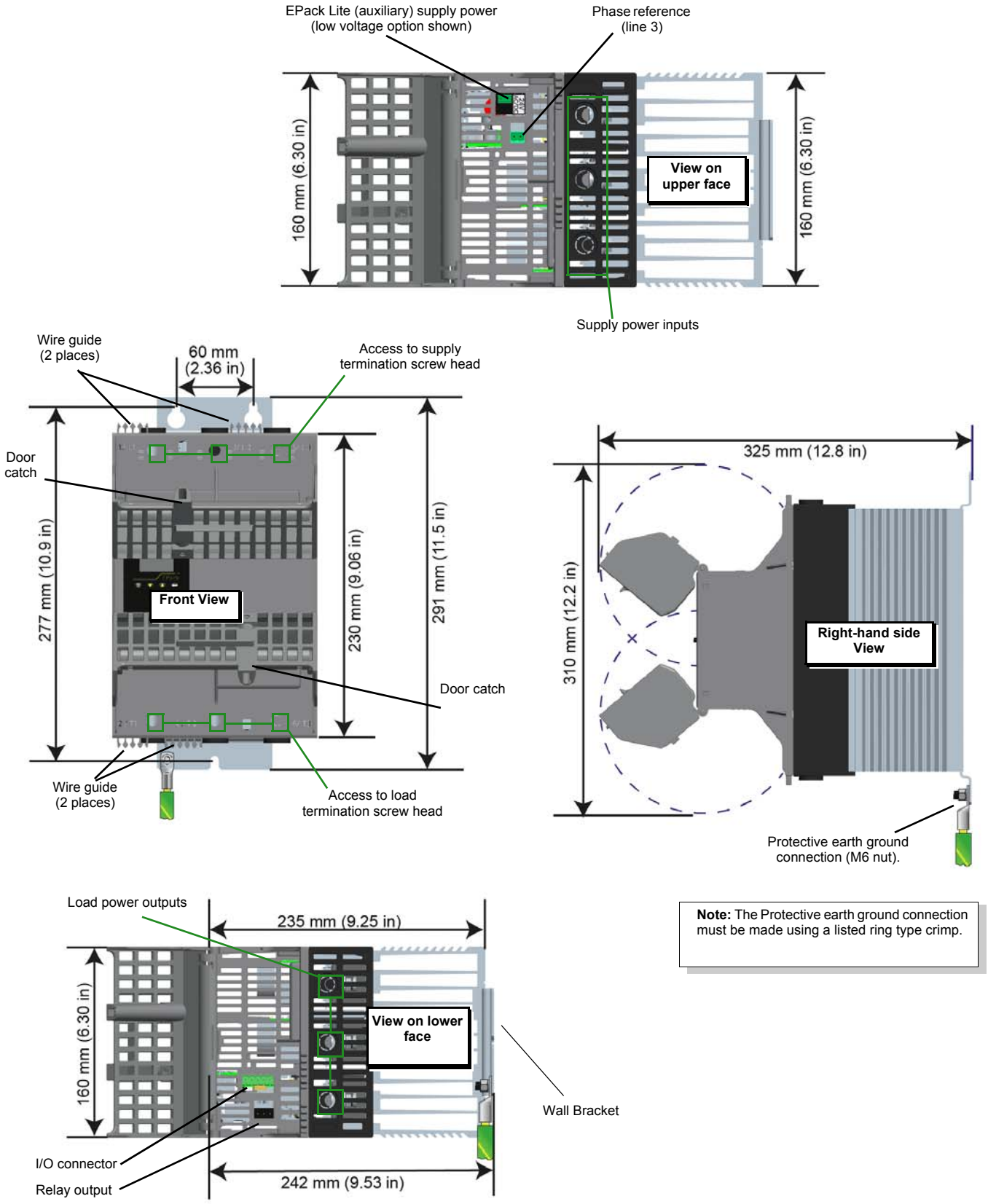


Figure 5: Mechanical installation details (40A to 63A units).

80A to 100A unit dimensions



Note: The Protective earth ground connection must be made using a listed ring type crimp.

Figure 6: Mechanical installation details (80A to 100A units) (doors open).

125A unit dimensions

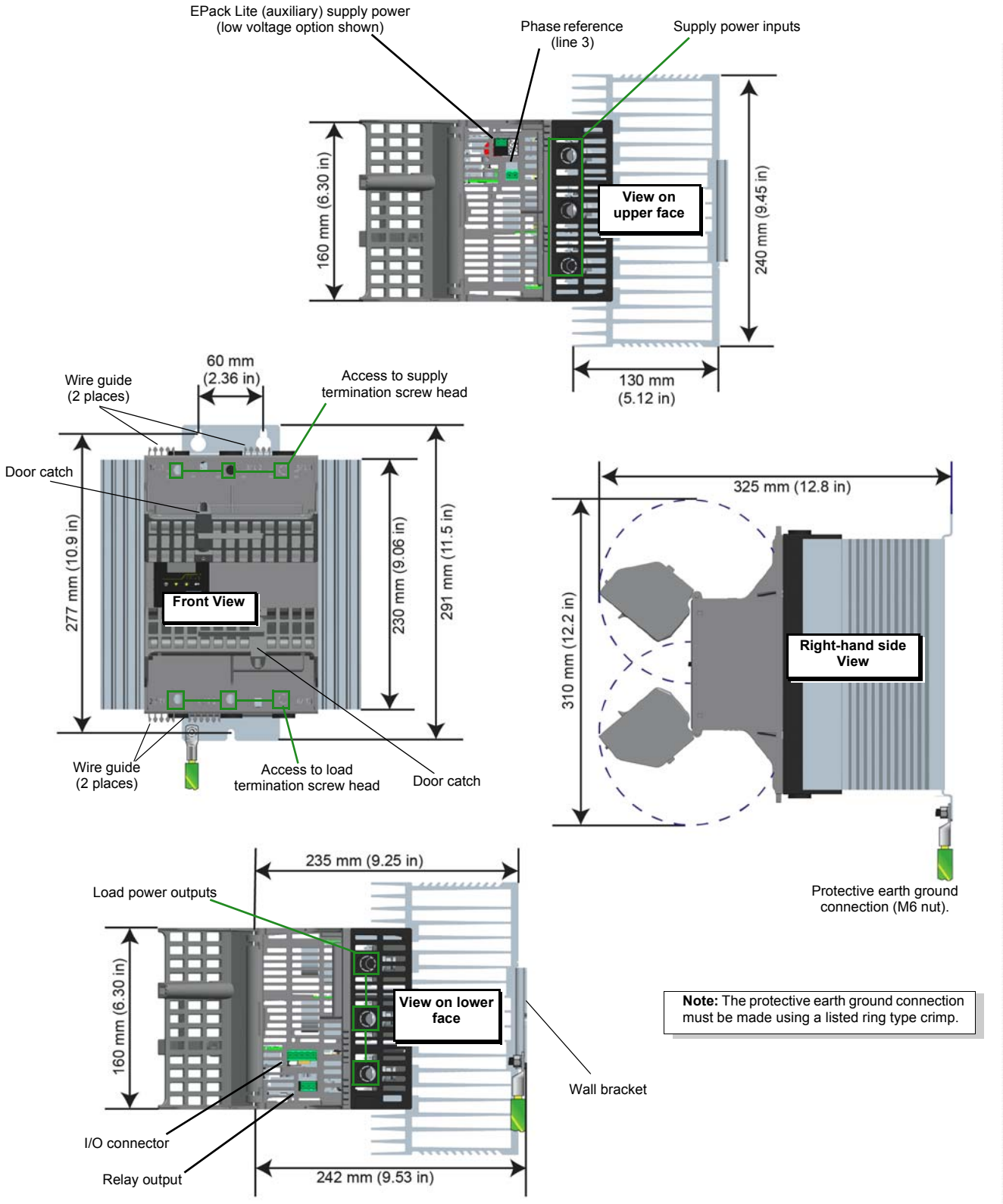


Figure 7: Mechanical installation details (125A units) (Doors open).

Summary - all units (16A - 125A)

Phase	**3 phase**			
Amps: **Dimensions** mm(inches)	**16 - 32A**	**40 - 63A**	**80 - 100A**	**125A**
Height	166 (6.535)	166 (6.535)	230 (9.055)	230 (9.055)
with Double DIN Rail	213.5 (8.405)	213.5 (8.405)	N/A[1]	N/A[1]
with Wall back plate	229.5 (9.035)	229.5 (9.035)	291 (11.456)	291 (11.456)
Doors open	290 (11.417)	290 (11.417)	310 (12.204)	310 (12.204)
Depth	185 (7.283)	220 (8.661)	235 (9.251)	235 (9.251)
with Wall back plate	192 (7.559)	227 (8.937)	242 (9.527)	242 (9.527)
with doors open	N/A[2]	N/A[2]	325 (12.795)	325 (12.795)
Width			160 (6.299)	240 (9.448)
with doors open	242 (9.527)	242 (9.527)	N/A[3]	N/A[3]
Wall mount fixings Distance apart:				
Medium mount	219 (8.622)	219 (8.622)	-	-
Large mount	-	-	277 (10.905)	277 (10.905)
Double DIN Rails	125 ±3 (4.921 ±0.12)	125 ±3 (4.921 ±0.12)	-	-
Distance between top, two mounting fixings:				
Large mount	-	-	60 (2.362)	60 (2.362)
HeatSink Depth	55 (2.165)	90 (3.543)	97 (3.818)	130 (5.118)

1. Not applicable, double DIN rail option not available.
2. Not applicable, doors open sideways increasing only the width.
3. Not applicable, doors open vertically (up or down) towards the centre of the product increasing only the depth.

Electrical Installation

⚠ CAUTION

Ensure effective strain relief mechanism (i.e. trunking) is in place for all EPack Lite cables.

If effective strain relief mechanism (i.e. trunking) is not installed it may result in the unintentional disconnection of one or more connectors resulting in unexpected and possible lack of control.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Connection Details

Supply voltage and load supply wire conductor cables (that terminate at 1/L1, 3/L2, 5/L3 and 2/T1, 4/T2, 6/T3 terminals), must have conductor cross sections that comply with table 9 of IEC60947-1 (or NEC, Article 310 Table 310-16).

Where a range of wire sizes is given it is up to the user to select the correct cross sectional area required for the application.

CE: The protective earth ground cable should be selected according to table 54.2 of IEC 60364-5-54 and cross sectional area of Supply voltage and Load supply wire conductor cross sections. The protective earth ground connection must be made to the unit with a ring type crimp terminal, using the nut and shakeproof washer supplied (M6 for 32A to 125A units).

U.L.: The protective earth ground cable cross sectional area should be selected according to NEC. The protective earth ground connection must be made to the unit with a U.L. listed ring type crimp terminal, using the nut and shakeproof washer supplied (M6 for 32A to 125A units).

Table 1, “Connection Details” gives details of tightening torques for the various supply power and signal wiring connections.

⚠ DANGER

Before any other connection is made, the protective earth ground terminal shall be connected to a protective conductor. The cables used must be rated 90°C stranded copper only.

CE: Wire conductor cross sections must comply with table 9 of IEC60947-1 taking account of table 54.2 of IEC 60364-5-54.

U.L.: Wire conductor cross sections must comply with NEC Article 310 Table 310-16 and the earth connection must be made using a UL-listed ring type crimp.

Failure to follow these instructions will result in death, serious injury or equipment damage.

⚠ DANGER

The protective earth ground connections and power terminals must be tightened according to the torque values defined in Table 1: “Connection Details”, on page 28. Appropriate regular inspections must be performed.

Failure to follow these instructions will result in death, serious injury or equipment damage.

Terminals	Product Rating	Terminal Capacity		Wire Type	Torque	Comments
		mm^2	AWG			
Supply voltage (1/L1, 3/L2, 5/L3) and Load supply (2/T1, 4/T2, 6/T3)	16A to 63A	1.5 mm^2 to 25 mm^2	AWG 16 to AWG 4[1]	Stranded copper Rated 90°C	2 N.m (18 Lb.inch.)	Flat-bladed screwdriver 1 x 5.5 mm or 1.2 x 6.5 mm
	80A to 125A	10 mm^2 to 50 mm^2	AWG 8 to AWG 2/0		5.6 N.m (50 Lb.inch.)	Flat-bladed screwdriver 1 x 5.5 mm or 1.2 x 6.5 mm
Protective earth ground	16A to 63A	M6 ring-type crimp terminal			2.5 N.m (22 Lb.inch.)	U.L.: Listed ring-type crimp terminal must be used
	80A to 125A	M6 ring-type crimp terminal			5.6 N.m (50 Lb.inch.)	U.L.: Listed ring-type crimp terminal must be used
Voltage Reference (Vref) (2-way) Supply (24V ac/dc) (2-way) Supply (85V-550Vac)(3-way) I/O connector (5-way) Relay connector (3-way)	All	0.25 mm^2 to 2.5 mm^2	AWG 24 to AWG 12	Stranded copper Rated 75°C	0.56 N.m (5 Lb.inch.)	Flat-bladed screwdriver 0.6 x 3.5 mm

1.Use crimp terminals BURNDY(E9498), to connect 4 AWG wire to terminal.

Table 1: Connection Details

⚠ DANGER

Connection of 2 conductors in the same terminal is not allowed.
Failure to follow these instructions will result in death, serious injury or equipment damage.

Auxiliary supply

The auxiliary supply connections (to operate the EPack Lite unit) are terminated using a 2-way (24V ac/dc version) or 3-way (85 to 550Vac version) connector, located on the upper side of the unit, as shown in Figure 8 and Figure 9.

24V ac/dc auxiliary supply

⚠ DANGER

The cable used to connect auxiliary supply should be correctly protected by a branch-circuit protection. It is the responsibility of the user to add branch-circuit protection. Such branch-circuit must comply with applicable local regulations.

Auxiliary supply 24V ac/dc:

To comply with safety requirements, the 24V auxiliary supply must be derived from a SELV or PELV circuit.

Failure to follow these instructions will result in death, serious injury or equipment damage.

85 to 550Vac auxiliary supply

⚠ DANGER

The maximum voltage between any pole of the power supply and terminals shall be lower than 550Vac. The maximum voltage between any pole of the power supply and protective earth ground shall be lower than 550Vac (rated insulation voltage 500V).

The 85Vac to 550Vac auxiliary supply shall be protected by a supplemental fuse or by branch circuit fuse as listed in Table 2: “Auxiliary supply fuse protection”, on page 30.

Failure to follow these instructions will result in death, serious injury or equipment damage.

⚠ DANGER

If the supplemental fuse is chosen to protect the 85Vac to 550Vac auxiliary supply, the cable used to connect auxiliary supply should be correctly protected by a branch-circuit protection.

It is the responsibility of the installer to add branch-circuit protection. Such branch-circuit protection must comply with applicable local regulations.

Failure to follow these instructions will result in death, serious injury or equipment damage.

Auxiliary supply fuse protection

UL Fuse Category	CE Fuse Category	Fuse (Make and Type)
Supplemental	Supplemental	ATM2-type fuse rated 2A, 600Vac/dc: Mersen/Ferraz Shawmut (UL file: E33925)
Branch Circuit	Supplemental	J-type fuse rated 3A/600Vac: HSJ3 by Mersen/Ferraz Shawmut (UL file: E2137; CSA class: 1422-02 LR12636) or DFJ-3 by Eaton/Cooper Bussman (UL file: E4273; CSA class: 1422-02 LR53787)
Supplemental	Branch Circuit	gR-type fuses rated 3A /700V: FR10GR69V3 (V1014571) by Mersen/Ferraz Shawmut (UL file: E76491) J-type fuse rated 3A/600Vac: HSJ3 by Mersen/Ferraz Shawmut (UL file: E2137; CSA class: 1422-02 LR12636) or DFJ-3 by Eaton/Cooper Bussman (UL file: E4273; CSA class: 1422-02 LR53787)

Table 2: Auxiliary supply fuse protection

Connections (Supply Power and Load)

16A to 32A and 40A to 63A Units

The supply voltage is connected to terminals on the top of the unit (1/L1, 3/L2 and 5/L3). The load terminals are located on the lower side of the unit (2/T1, 4/T2 and 6/T3). shows the 32 Amp unit (63 Amp unit similar) and Figure 9 gives similar information for the 80/100 Amp unit (125Amp units similar).

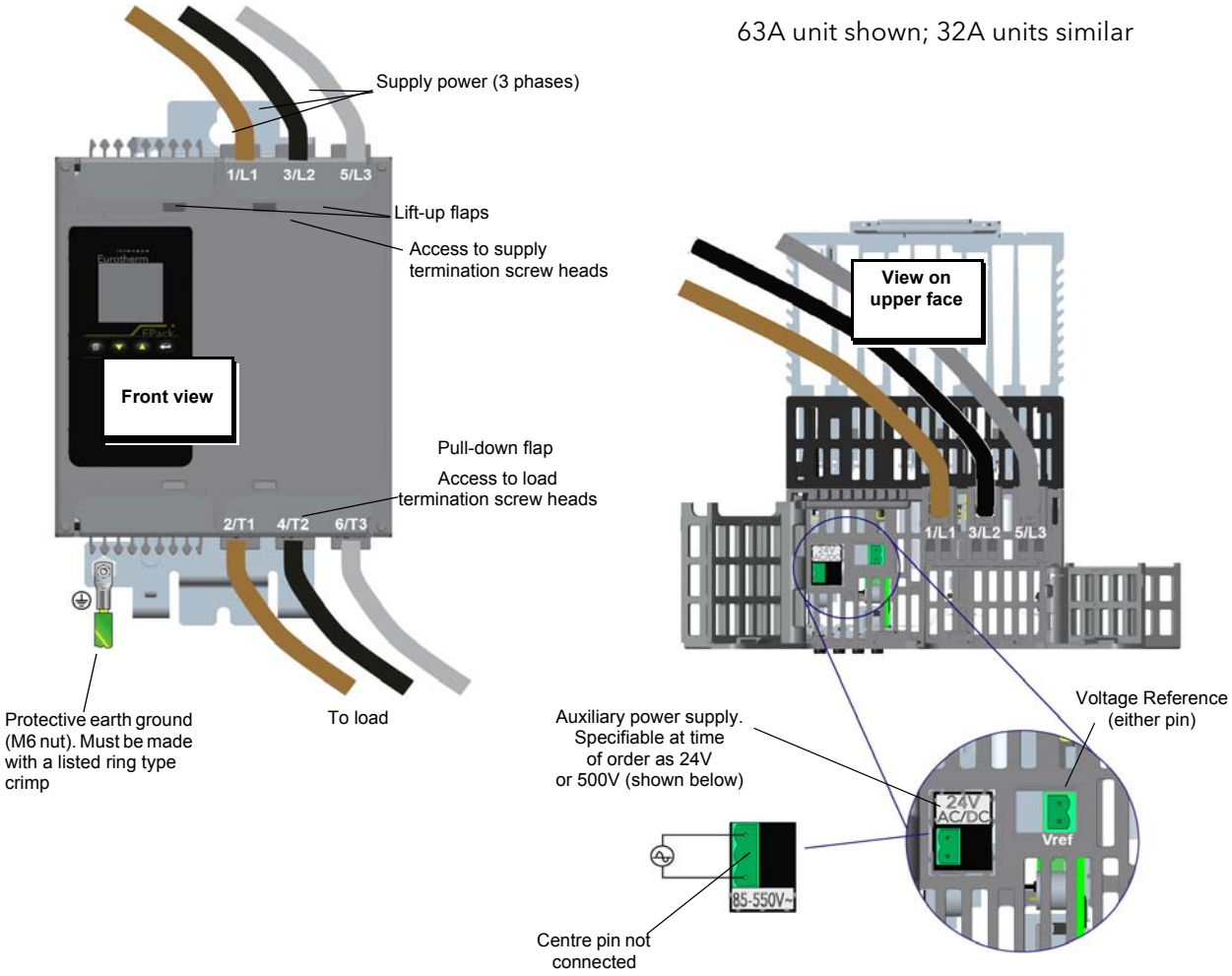


Figure 8: Supply power connection details (32A and 63A units)

80A, 100A and 125A units

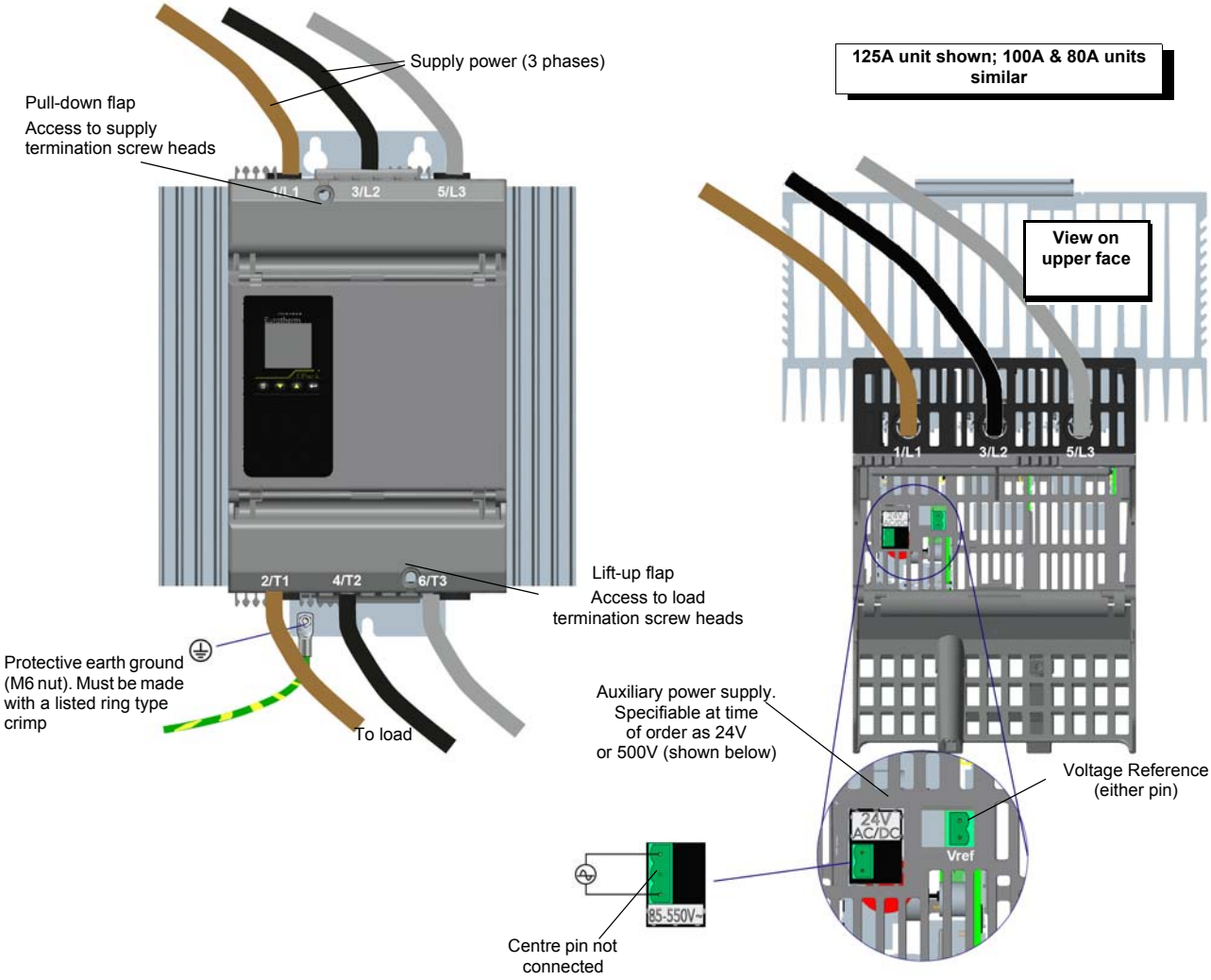


Figure 9: Supply power and Load connection details.

See figure 8 for basic wiring details.

⚠ WARNING

IP20 Protection

1. In order to maintain IP20 protection, the stripped length of the power cables (1/L1, 3/L2, 5/L3 and 2/T1, 4/T26/T3) must be adapted according to the insulation thickness.
2. If the upper and/or lower access door is open, the product protection is IP10.
3. If the Vref connector is removed, IP20 rating is not guaranteed.
4. 16A to 125A units have a breakaway feature as part of the terminal housing to improve the IP20 rating. These features should only be removed, to provide access for cables with a 9mm or larger diameter.
5. If the exposed conductor is less than 20 mm there is a potential risk of a loose connection.
6. If the exposed conductor is greater than 23 mm, IP20 is not guaranteed and the product is instead IP10.

Failure to follow these instructions can result in death, serious injury or equipment damage.

EPack Lite rating (Amps)	**Exposed conductor length** mm (inch)	**Remove terminal housing breakaway part?** mm (inch) cable diameter	**Cable diameter maximum** mm (inch)
16A to 63A	20 - 23 (0.79 - 0.91)	Yes, remove for cables greater than 9 (0.35)	10.5 (0.41)
80A to 125A	20 - 23 (0.79 - 0.91)	Yes, for cables greater than 9 (0.35)	17.5 (0.69)

Table 3: Cable connection specification

Load Configurations

Delta

Closed Delta

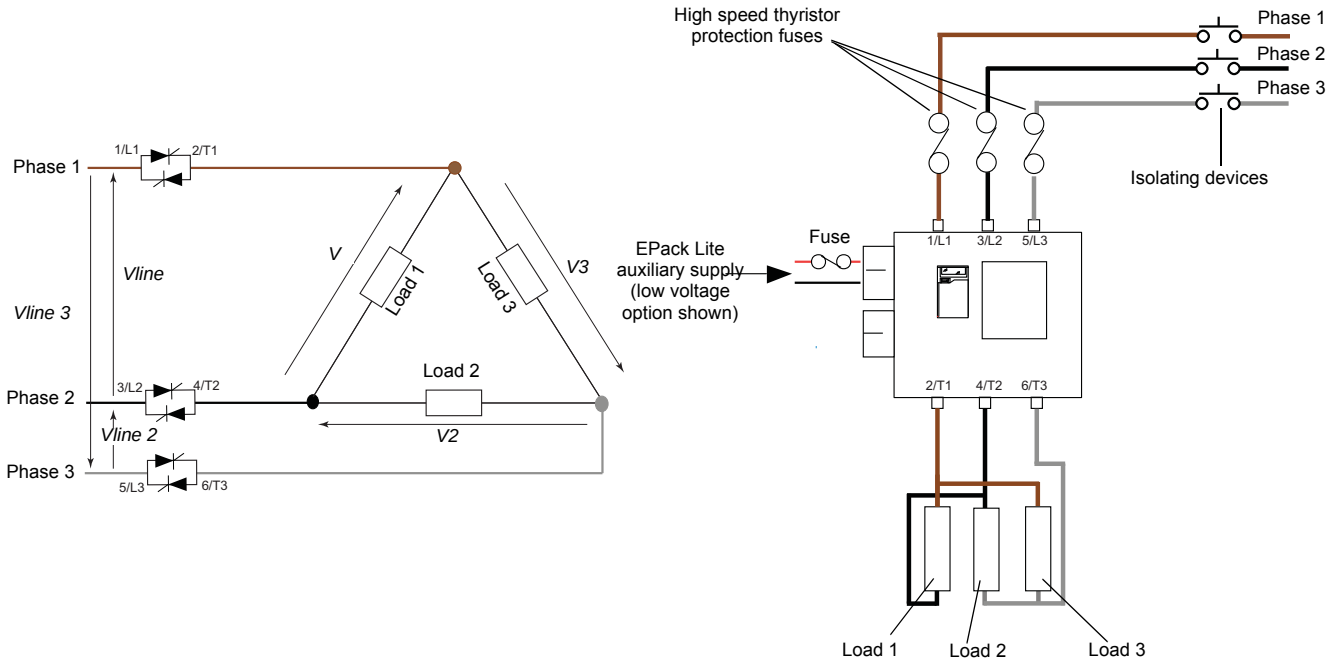


Figure 10: 3 phase Closed Delta wiring scheme/load configuration

Open Delta

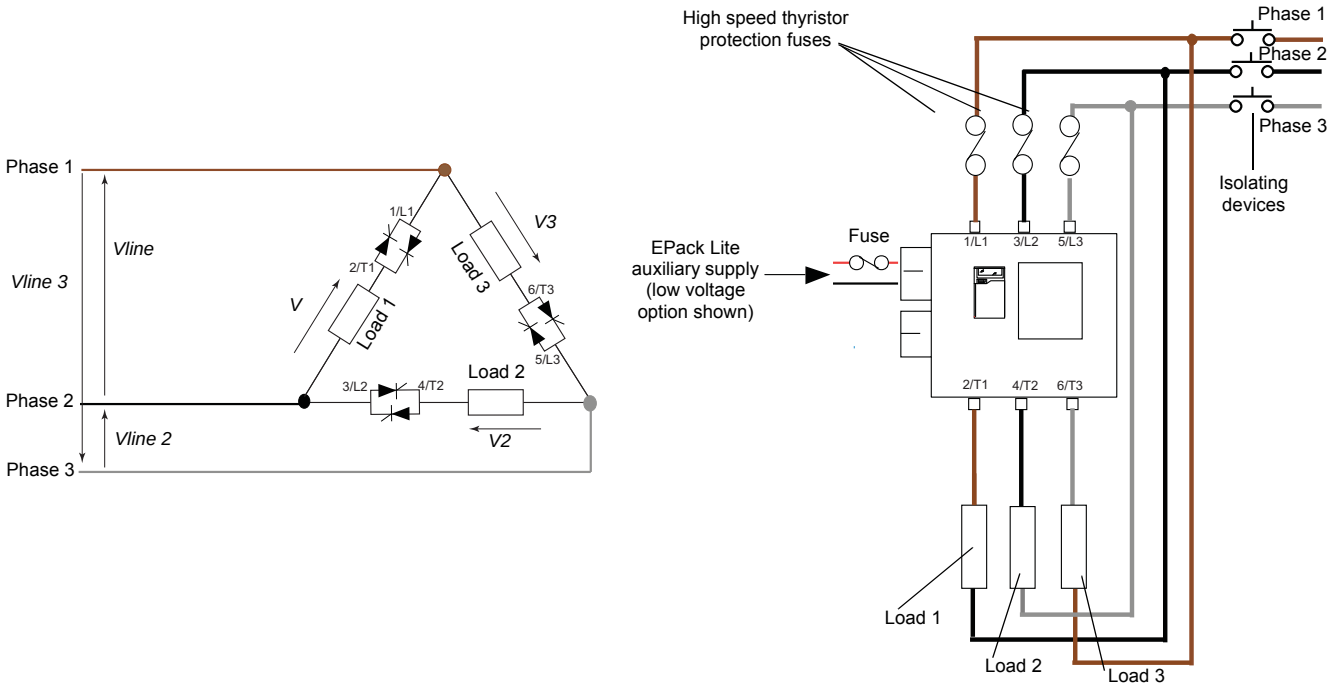


Figure 11: 3 phase Open Delta wiring scheme/load configuration

Star

Star with Neutral

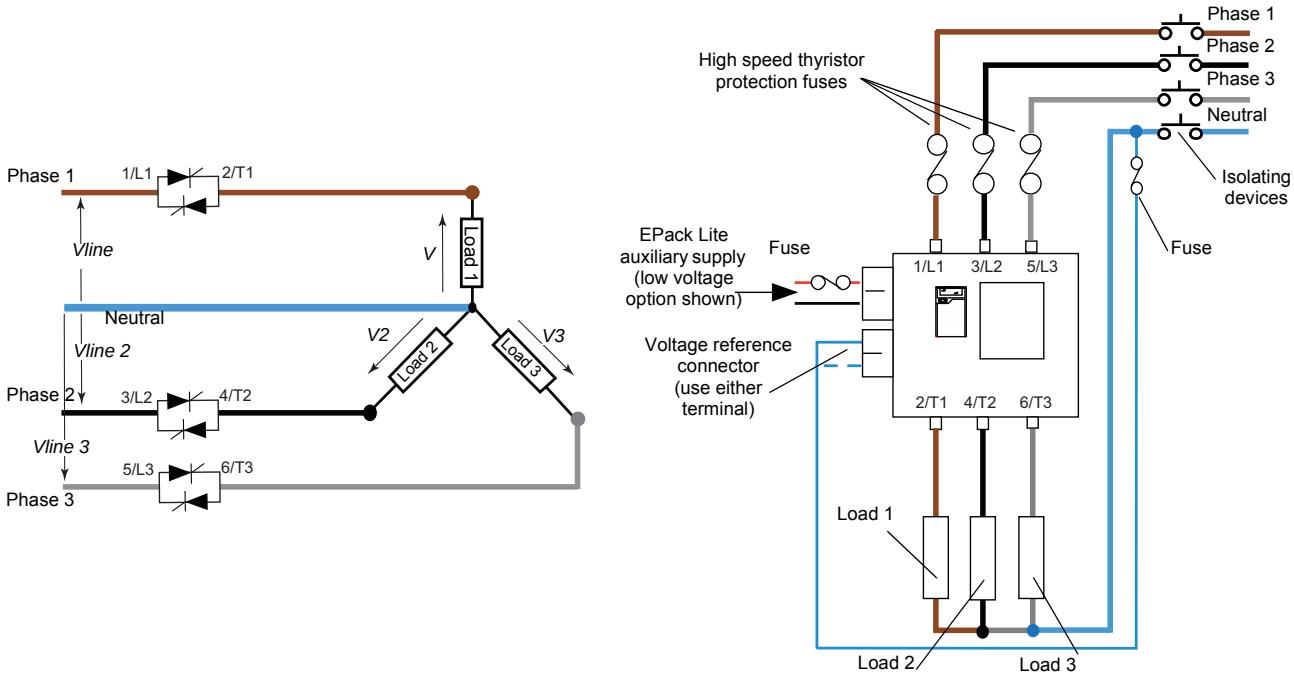


Figure 12: 3 phase Star with Neutral wiring scheme/load configuration

Star without Neutral

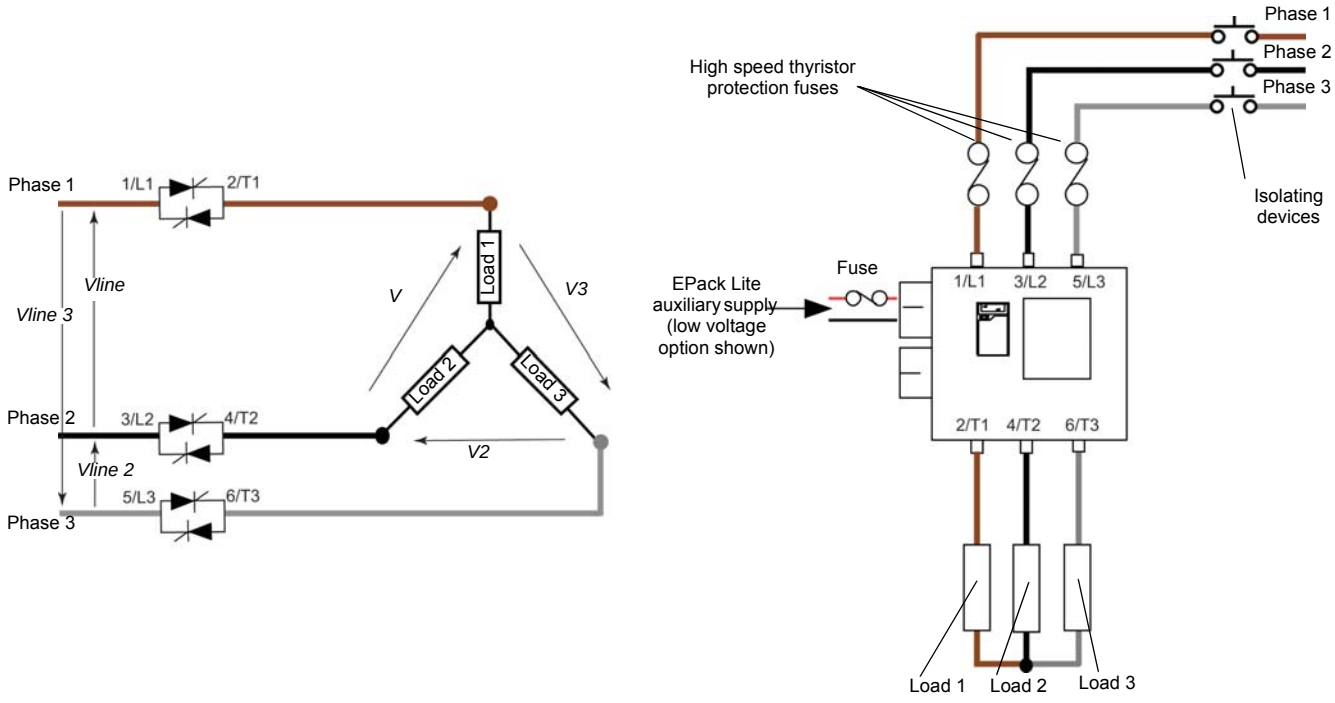


Figure 13: 3 phase Star without neutral wiring scheme/load configuration

Signal wiring

Figure 14 shows the connector location, on the underside of the unit, for the digital and analogue inputs, and for the internal relay output.

Firing Enable

In order for the power module thyristors to operate, the Firing Enable must be valid, in the default configuration, this is achieved by shorting pins 0V and DI1 of the I/O connector located on the underside of the unit (Digital input 1). This can be done also using DI2. If none of them are used, firing will be automatically enabled.

If required, DI1 can be configured as a voltage input, and in this case it requires a high signal to be applied to D1 with the relevant zero voltage connected to 0V.

Alarm Acknowledge

In the default configuration, shorting pins 0V and DI2 of the I/O connector located on the underside of the unit (Digital input 2) acknowledges alarms. This can be done also using DI1.

DI can be configured as a voltage input (if required), and in this case it requires a high signal to be applied to DI with the relevant zero voltage connected to 0V.

Main Setpoint

In the default configuration, the analogue input sets the main setpoint.

Relay Output

The relay is normally energised (Common and Normally Open pins shorted), and is de-energised (Common and Normally Closed pins shorted) when active. In the default configuration, the relay output is operated by the Fault detect ‘Custom Alarm’ becoming active.

By default, the Custom alarm is set up to be equivalent to ‘AnySystemAlarm’ which becomes active if any ‘stop firing’ conditions, such as those listed below, is detected.

In configuration mode, it is also possible to configure the relay using the Alarm Relay menu in the Operator Interface ().

1. Missing mains. Supply voltage line is missing.
2. Thyristor short circuit[1]
3. Network dips. A reduction in supply voltage exceeding a configurable value (VdipsThreshold), causes firing to be inhibited until the supply voltage returns to a suitable value. VdipsThreshold represents a percentage change in supply voltage between successive half cycles.
4. Freq out of range. The supply frequency is checked every half cycle, and if the percentage change between successive 1/2 cycles exceeds a threshold value (max. 5%), a Mains Frequency System Alarm is generated.
5. Supply failure detected to EPack Lite unit.
6. Chop Off (page 49)
7. Analogue input over current. For mA inputs this alarm is active if there is too high a current flowing through the shunt.
8. Line under voltage (of nominal voltage).
9. Line over voltage (of nominal voltage).
10. Over current (of nominal current).

The relay is de-energised temporarily then re-energised at start-up.

1. It is not possible to detect a thyristor short circuit when the unit is delivering 100% output power.

I/O Input & Output Details

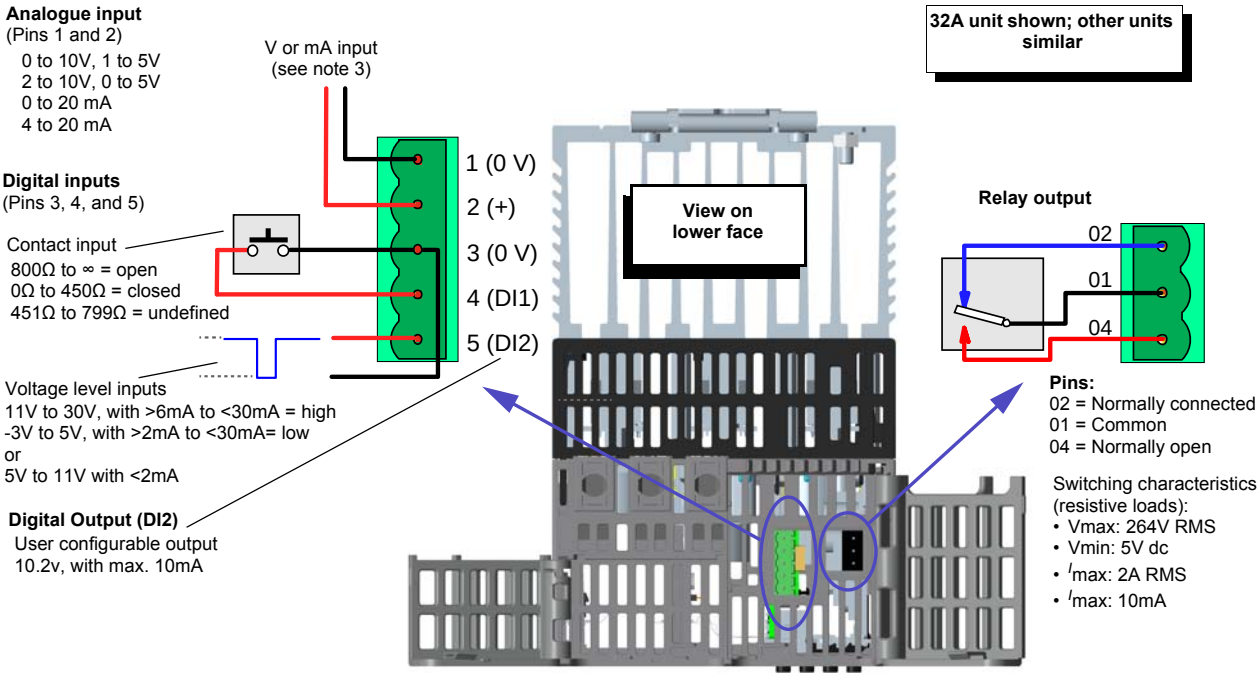


Figure 14: I/O details

NOTES:

1. DI1 shown; DI2 similar
2. DI1 and DI2 can both be contact inputs or both be voltage inputs or be one of each.
3. Analogue input type (Volts or mA) is selected in I/O Analogue IP configuration. When a mA range is selected, a suitable shunt resistor is automatically connected into circuit. It is thus unnecessary for the user to fit external components.
4. Diagram shows DI1 as a contact input and DI2 as a voltage level input, however DI2 can also be configured as a 10.2V, with max. 10mA output, providing it is not being used as a digital input.

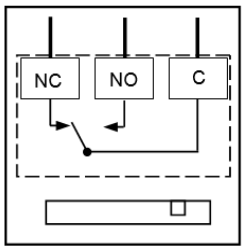
Fuse Holders Contact Data

High speed fuses fitted with a microswitch are mounted in a fuse holder which provides indication of a blown or no fuse. This is shown locally on the fuseholder by a red handle which also activates microcontacts. These contacts may be wired to a digital input on the EPack Lite as shown in the following diagrams.

Fuses Holders Contacts Kit are delivered with NO, NC contact.

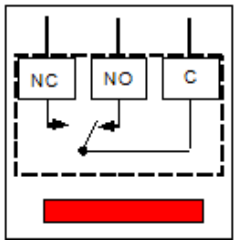
Fuse good

The handle and contacts are in the closed state



No fuse or fuse blown

The handle is open and shown red. The contacts are closed



- Connection: Faston lugs 2.8 X 0.5 mm
- Rated insulation voltage: 250VAC
- Rated operational current following IEC 60947-5 & -1
- Utilization category AC15: 4A/24V, 4A/48V, 3A/127V, 2.5A/240V
- Utilization category DC13: 3A/24V, 1A/48V, 0.2A/127V, 0.1A/240V

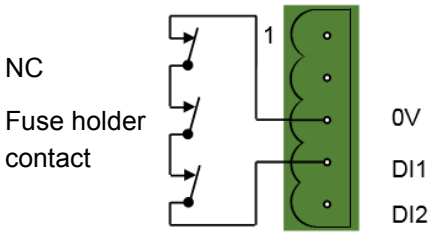
Three Phase

For fuses CP177220 and CP177221 up to 63A (fuses 14x51 and 22x58)

Minimum operational current and voltage: 1mA/4V AC or DC

- This contact is compatible with Digital inputs configured in contact closure mode

Recommended wiring:

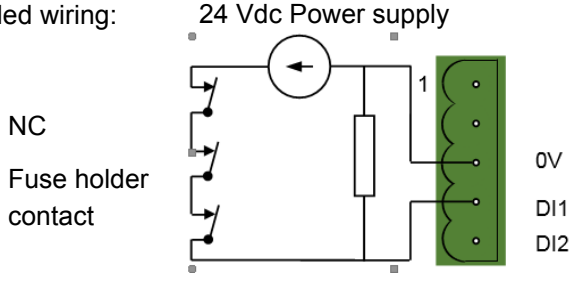


For fuses CP177222 from 80A to 125A (fuses 27x60)

Minimum operational current and voltage: 100mA/20V AC or DC

- This contact is not compatible with Digital inputs configured in contact closure mode
- This contact is compatible with Digital inputs configured in Voltage inputs with external dc power supply and load 100 mA dc minimum.

Recommended wiring:



Operator Interface

Located at the front of the Driver Module, the operator interface consists of a square display, and, four push-button switches.

Display

The display is divided vertically into three areas, which for the purposes of this manual are called the status area at the top, the data display, in the centre, and the soft keys at the bottom. This display, together with the four pushbuttons allows full operation and configuration of the unit.

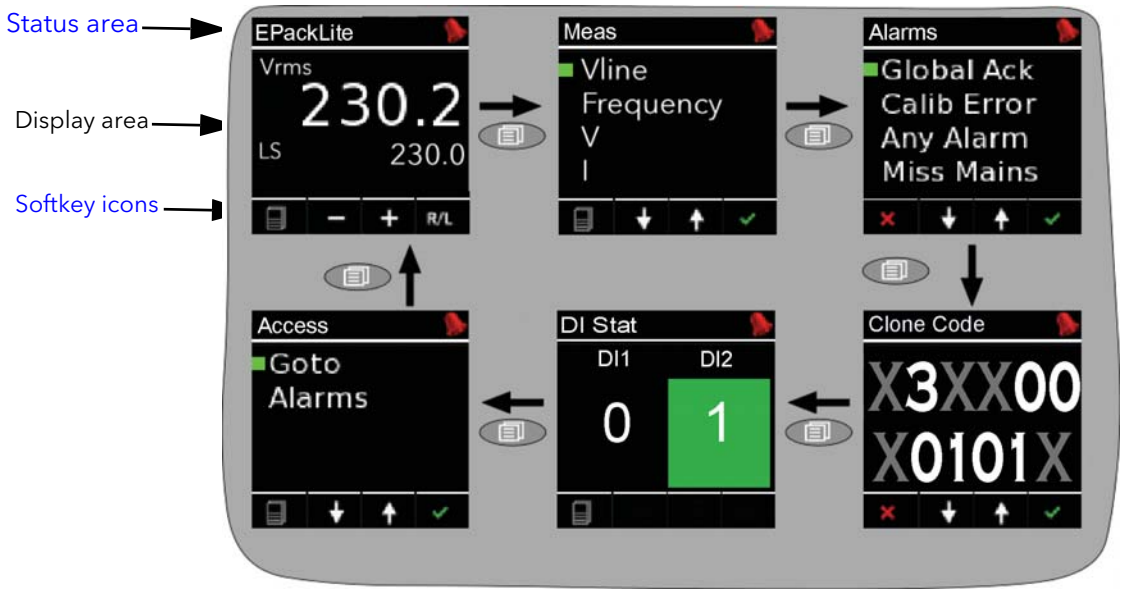


Figure 15 Operator interface

The figure above shows a typical operator mode screen set, scrolled through using the return (page) pushbutton. The configuration of the unit defines which parameters actually appear.

NOTES:

1. The Alarms display appears only if there are any active alarms. The up/down arrow pushbuttons can be used to scroll through the alarm list, if there are more alarms active than can be displayed on one screen height.
2. The 'Goto' item allows the user to enter Engineer or Configuration mode, providing the password(s) are known. Access menu (page 66) describes the procedure (although the screen displays are different because in that section, the unit is shown in configuration mode).

Status area

This area at the top of the screen contains text descriptive of the current operation, and a number of icons as follows

 Configuration key. Displayed when the unit is in configuration mode.

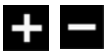
 Alarm symbol. Indicates that one of more alarms is active.

Softkey icons

A number of icons can appear at the bottom of the display, and each icon represents the action of the pushbutton immediately below it.

Menu. This appears in the bottom left corner, and operation of the Return pushbutton causes the top level menu to appear.

Return. This red cross icon appears in the bottom left corner, and operation of the Return pushbutton causes any configuration changes on the current page to be ‘undone’ or, if none, causes the display to ‘go up’ one level.



Plus and minus icons. Operation of the associated scroll up/down pushbutton causes the displayed value to increment or decrement

Up/down arrows. Operation of the associated scroll up/down pushbutton causes the various menu items on display to be scrolled through.

Right/Left arrow. The right-pointing arrow appears in the bottom right-hand corner, and operation of the Enter pushbutton causes the cursor to shift right. Once this has been done, a left-pointing arrow appears in the bottom left-hand corner, allowing the user to shift the cursor to the left using the Return pushbutton.

Enter. This green tick appears in the bottom right corner, and operation of the Enter pushbutton causes any configuration change(s) on the display page to be confirmed.

Remote/Local. This appears in the bottom right corner, and operation of the Enter pushbutton toggles the setpoint selection between local and remote.

Pushbuttons

The functions of the four pushbuttons below the display depend on what is displayed in the softkey area. The leftmost pushbutton (Return) is associated with the leftmost soft key, the down arrow pushbutton is associated with the next soft key and so on. In the example above, the ‘Return’ key is used both to enter the Menu, and to return from it to the initial display.

Pushbutton functions

Return	Returns to previous menu (while menus are displayed), cancels editing (during parameter editing), and performs screen cycling (during operator mode).
Scroll down/up	Allows the user to scroll through the available menu items or values.
Enter	Goes to next menu item. In parameter edit mode, this button confirms the changes.

Menu item value selection

Menu items are scrolled through using the up/down pushbuttons. Once the required item is displayed, the Enter pushbutton is used to select it for editing. Editing of the item’s value is carried out by scrolling through the available choices, using the up and down scroll keys. Once the desired value is displayed, the Enter pushbutton is used to confirm the choice.

Where multiple changes have to be made (as in editing an IP address for example), the Enter pushbutton acts as a right cursor key, moving from the field just edited to the next field. (The Return key moves the cursor left). Once all fields have been edited, the enter key is used a final time to confirm the choice.

Front Panel Event Indication

A number of instrument alarms and events can occur, and these are indicated by icons appearing on the display screen. The events and alarms are listed below. See for a more details.

Instrument events

Conf Entry	The instrument has been placed in configuration mode (cog-wheel symbol).
Conf Exit	The instrument has been taken out of configuration mode (no icon).
GlobalAck	A global acknowledgement of all latched alarms has been performed.
Quick Code Entry	The Quick Code menu is active (cogwheel icon + ‘QCode’ in display area).

The following alarms all cause a red bell icon to appear in the top right hand corner of the screen.

Indication alarms

LoadOverI	An over current alarm has become active in one or more Network blocks.

System alarms

ChopOff	The ‘Chop-off’ alarm has been detected.
FuseBlown	There is no internal fuse, but it is possible to use DI2as a ‘fuse-blown’ input wired to the alarm block in iTools.
MainsFreq	Mains Frequency is outside the acceptable range.
Missmains	Supply power is missing.
NetwDip	The ‘network dip’ alarm has been detected.
Thyr SC	Thyristor short circuit. It is not possible to detect a thyristor short circuit when the unit is delivering 100% output power.

Process alarms

ClosedLp	The Control block ‘Closed Loop’ alarm has been detected.
Ana_In Over C	Over current in shunt. If this alarm is detected, firing is stopped by default and Analogue Input type is automatically switched to 0-10V mode to avoid damage.
Under Volt	Line under voltage
Over Volt	Line over voltage (configurable between 2 and 10% of nominal voltage)
PLF	The ‘Partial Load Failure’ alarm has been detected.
TLF	The ‘Total Load failure’ alarm has been detected.

Quickcode

At first switch-on, the EPack Lite unit enters the ‘QuickCode’ menu which allows the user to configure the major parameters without having to enter the full configuration menu structure of the unit Figure 16 shows an overview of a typical QuickCode menu. The actual displayed menu items will vary according to the number of software features purchased. When ‘Finish’ is selected to ‘Yes’, the instrument cold starts after confirmation (Enter key); when set to ‘Cancel’ the instrument discards any changes and restarts with the previous configuration.

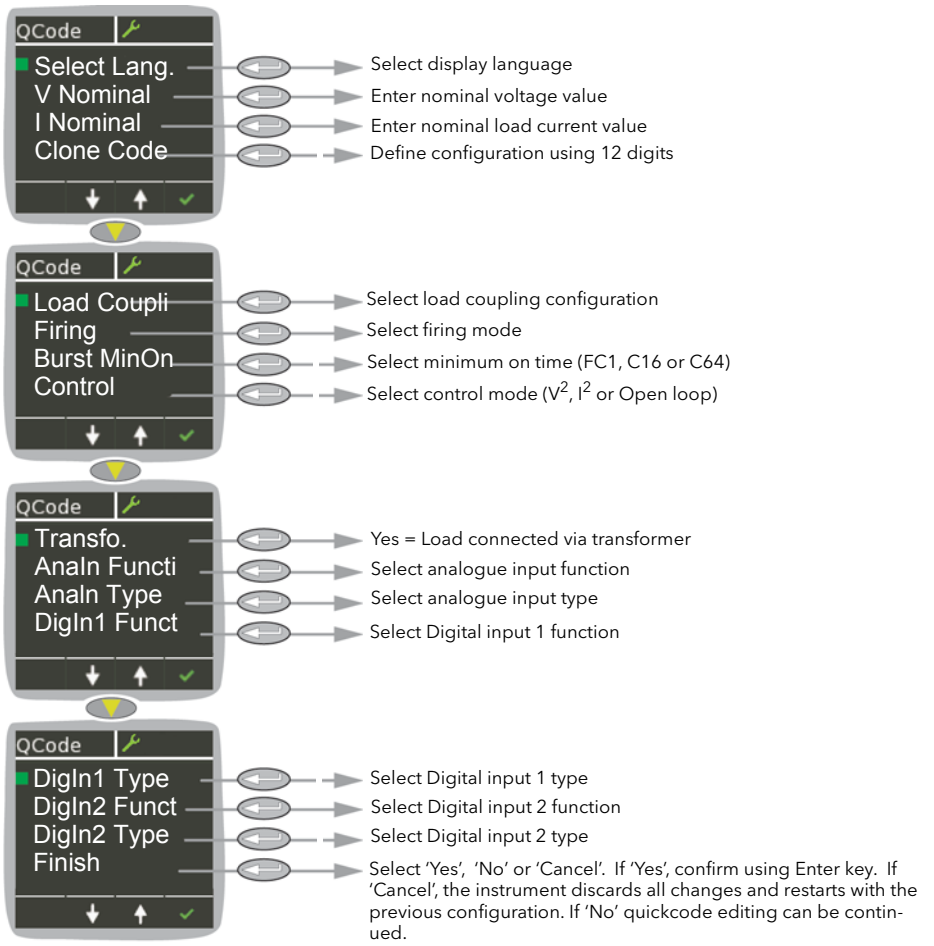


Figure 16 Typical QuickCode menu

NOTES:

1. If the unit has been fully configured at the factory, the Quickcode menu will be skipped, and the unit will go into operation mode at first switch on.
2. Once quit, the Quickcode menu can be returned to at any time from the Access menu via the front panel. Returning to the Quickcode menu cold-starts the unit

Quickcode Menu Parameters Description

Language	Select English, French, German, Italian or Spanish. Once confirmed all further displays appear in the selected language.
V Nominal	The nominal value of the supply voltage (valid entries are 20V to 500V). Default value appears. Use the up/down arrow buttons to edit.
I Nominal	The current flowing through the load according to the nominal load power. This current must not exceed the maximum current the unit has been designed for. Lower values are not recommended as in such cases, the resulting accuracy and linearity are not guaranteed to be within specification. Default value appears. Use up/down arrow buttons to edit.
Load Coupling	Select one of the following; 3D (closed Delta), 3S (star without neutral), 4S (star with neutral) and 6D (open Delta). See Load Configurations (page 33) for more details.
Clone Code	Define the configuration of the unit simply by using 12 digits. By setting these 12 digits (copied from another unit, for example), the product will be fully configured. It is a quick way to clone a configuration from another unit.
Firing Mode	Select from IHC (Intelligent Half Cycle), Burst Var (Burst Variable), Burst Fix (Burst Fixed), Logic or Phase Angle. Note that in Burst fixed firing mode, the modulation period is set to 2 seconds.
Burst MinOn	Select the minimum on-time for the burst variable between 1, 16 and 64 mains cycles.
Control	Select VSq (V^2), Isq (I^2), or Open Loop
XFRMR (Transfo.)	No = Resistive load type; Yes = Transformer primary.
AnaIn Functi	Select SP (setpoint) or None (no function) as Analogue Input function **NOTE:** Setpoint is only available for AnaIn Functi if DI1 or DI2 Fct are not set to 'Setpoint' while Firing Mode is set to 'Logic'.
AnaIn Type	Select 0 to 10V, 1 to 5V, 2 to 10V, 0 to 5V, 0 to 20mA or 4 to 20 mA as analogue input type.
DI1 Fct	Select ‘Firing Enable’, Alarm ack(nowledge), RemSP sel (select remote setpoint), Fuse Blown, Setpoint (in logic mode) or none. **NOTE:** The function is available if not set in DI2. **NOTE:** Setpoint is only available for DigIn1 Function if AnaIn or DI2 Fct is not set to ’Setpoint’ whilst Firing Mode is set to ’Logic’
DigIn1 Type	Select from IpContact (Input contact) and IpVolts (Input volts)
DI2 Fct	Select Firing Enable, Alarm ack(nowledge), RemSP sel (select remote setpoint), Fuse Blown, Setpoint, 10V user output, Firing Enable or none. **NOTE:** Setpoint is only available for DI1 Fct or DI2 Fct if AnaIn Functi is not set to 'Setpoint' while Firing Mode is set to 'Logic'. **NOTE:** DI1 Fct and DI2 Fct are mutually exclusive.
DigIn2 Type	Select from IpContact (Input contact) and IpVolts (Input volts)
Finish	If ‘Yes’ is selected (and confirmed using the enter key), quick code exits and the instrument restarts with the new configuration. If ‘No’ is selected then no action is taken and the user can continue to edit the quick code parameters. If ‘cancel’ is selected then all changes are discarded, quick code exits and the instrument restarts with the previous (i.e. unedited) configuration.

Firing modes definitions

Logic

Power switches on, two or three zero crossings of the supply voltage after the logic input switches on. Power switches off two or three zero crossings of current after the logic input switches off. For resistive loads, voltage and current cross zero simultaneously. With inductive loads, a phase difference exists between the voltage and current, meaning that they cross zero at different times. The size of the phase difference increases with increasing inductance.

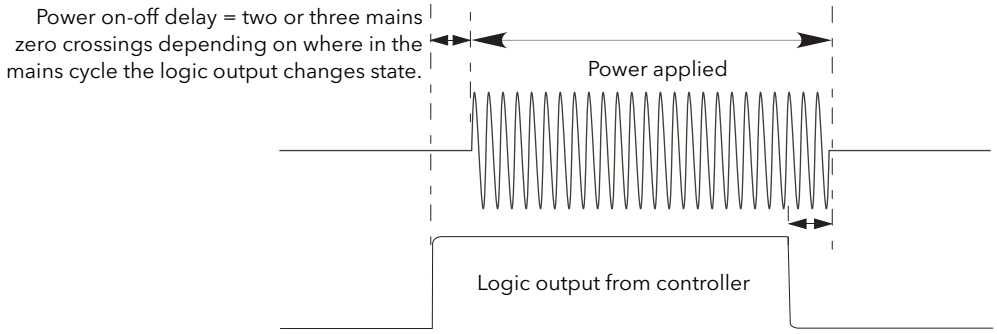


Figure 17 Logic firing mode

Burst Fixed Firing

This means that there is a fixed ‘cycle time’ equal to an integer number of supply voltage cycles as set up in the Modulator menu. Power is controlled by varying the ratio between the on period and the off period within this cycle time (figure 18).

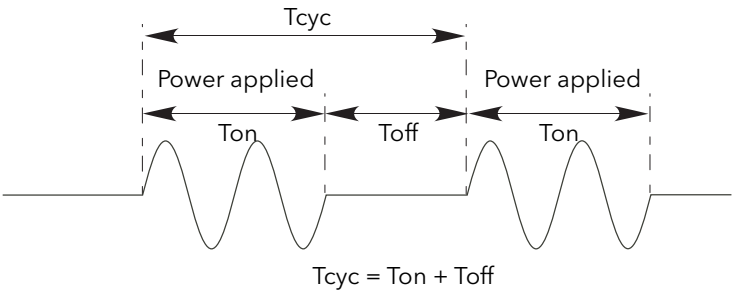


Figure 18 Burst Fixed mode

Burst Variable Firing

Burst Firing Variable is the preferred mode for temperature control. Between 0 and 50% of setpoint, the on time is the ‘Min on’ time set in the modulator menu and the off time is varied to achieve control. Between 50% and 100%, the off time is the value set for ‘Min on’ and power is controlled by varying the number of on cycles.

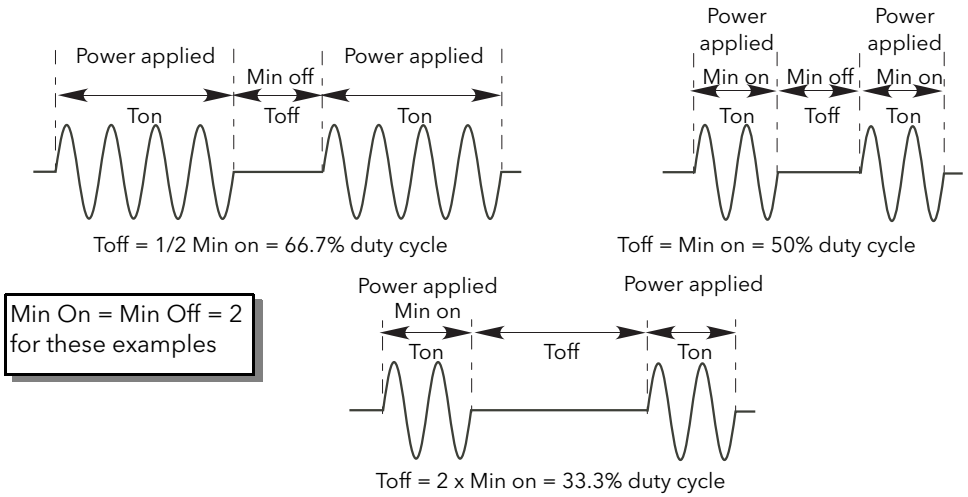


Figure 19 Burst variable firing

Phase Angle Control

This mode of firing controls power by varying the amount of each cycle which is applied to the load, by switching the controlling thyristor on part-way through the cycle. Figure 20 shows an example for 50% power.

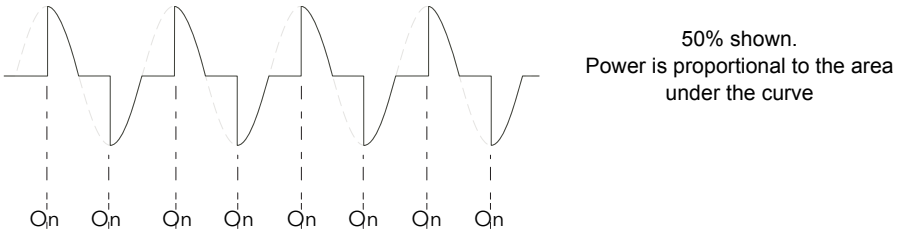


Figure 20 Phase angle mode

Intelligent Half-Cycle (IHC) Mode[1]

Burst mode firing with a single firing (or non-firing) cycle is known as ‘Single cycle’ mode. In order to reduce power fluctuations during firing time, Intelligent half-cycle mode uses half cycles as firing/non-firing periods. Positive and negative going cycles are evened out, to ensure that no dc component arises. The following examples describe half-cycle mode for 50%, 33% and 66% duty cycles.

1. Only available with 3 phase Star with neutral (4S) and Open delta (6D) load configurations.

50% Duty Cycle

The firing and non-firing time corresponds to a single supply cycle (figure 21).

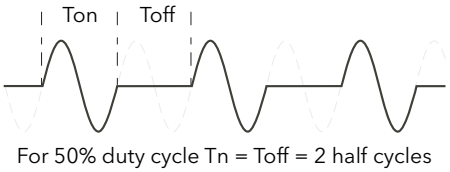


Figure 21 Intelligent half cycle mode: 50% duty cycle

33% Duty Cycle

For duty cycles less than 50%, the firing time is one half-cycle. For a 33% duty cycle, firing time is one half cycle; the non-firing time is two half-cycles (figure 22).

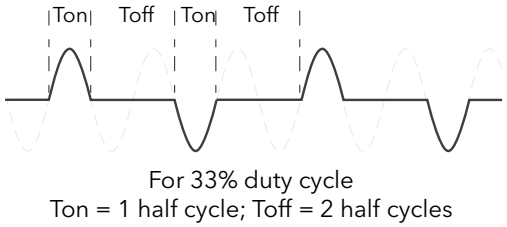


Figure 22 Intelligent half cycle mode: 33% duty cycle

66% Duty Cycle

For duty cycles of greater than 50%, the non-firing time is one half-cycle. For 66% duty cycle, the firing time is two half cycles; the non-firing time is one half cycle (figure 23).

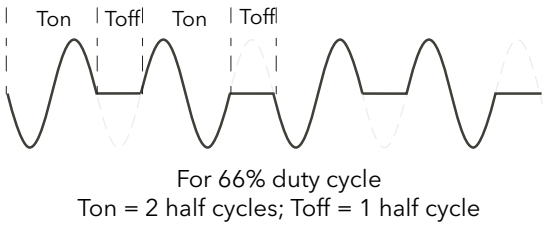


Figure 23 Intelligent half cycle mode: 66% duty cycle

Feedback type

All feedback types (except ‘Open Loop’) are based on real-time measurement of electrical parameters that are normalised to their equivalent Nominal values.

V^2	Feedback is directly proportional to the square of the RMS voltage measured across the load.
I^2	Feedback is directly proportional to the square of the RMS current through the load. For two- or three-phase systems, feedback is proportional to the average of the squares of the individual RMS load currents.
Open loop	No measurement feedback. The thyristor firing angle in Phase angle mode, or the duty cycle in burst-firing mode, are proportional to the setpoint.

Chop Off Definition

This is a technique which detects an over-current alarm state and stops further thyristor firing for the duration of that alarm state.

The conditions that trigger a Chop Off alarm are:

1. When the ChopOff Threshold exceeds the number of times specified in NumberChop Off parameter. (NumberChop Off is set to 10. The ChopOff Threshold is set to 120%.

When the alarm is triggered the unit stops firing and raises a chop off alarm. Firing is not resumed until the operator acknowledges the Chop Off alarm, to restart.

Configuration from the Front Panel

At power up or after quitting the Quickcode menu, the unit initializes and then enters the summary page (figure 24) showing the real-time values of the two parameters configured, see Instrument Display configuration for details.

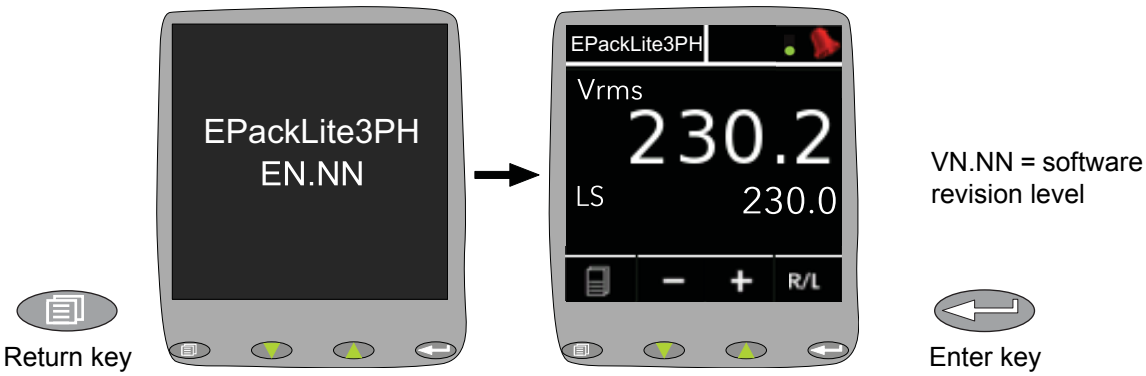


Figure 24 Initialization screens

NOTE: If any issues are detected during the initialization (e.g. supply voltage missing), then a message appears on the display screen.

Menu Pages

Operating the return key opens the first page of the menu, the content of which depends on the current access level and on the number of options enabled.

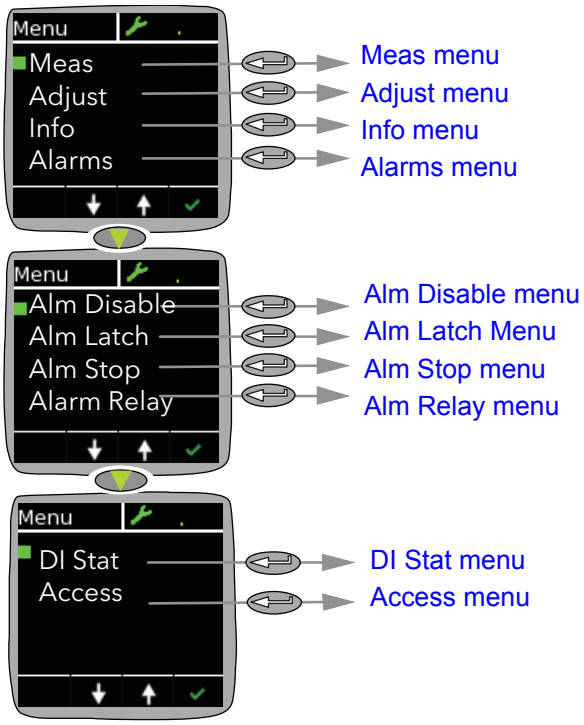


Figure 25 Menu options

Meas menu

This menu allows the user to view a number of measured values in real time.

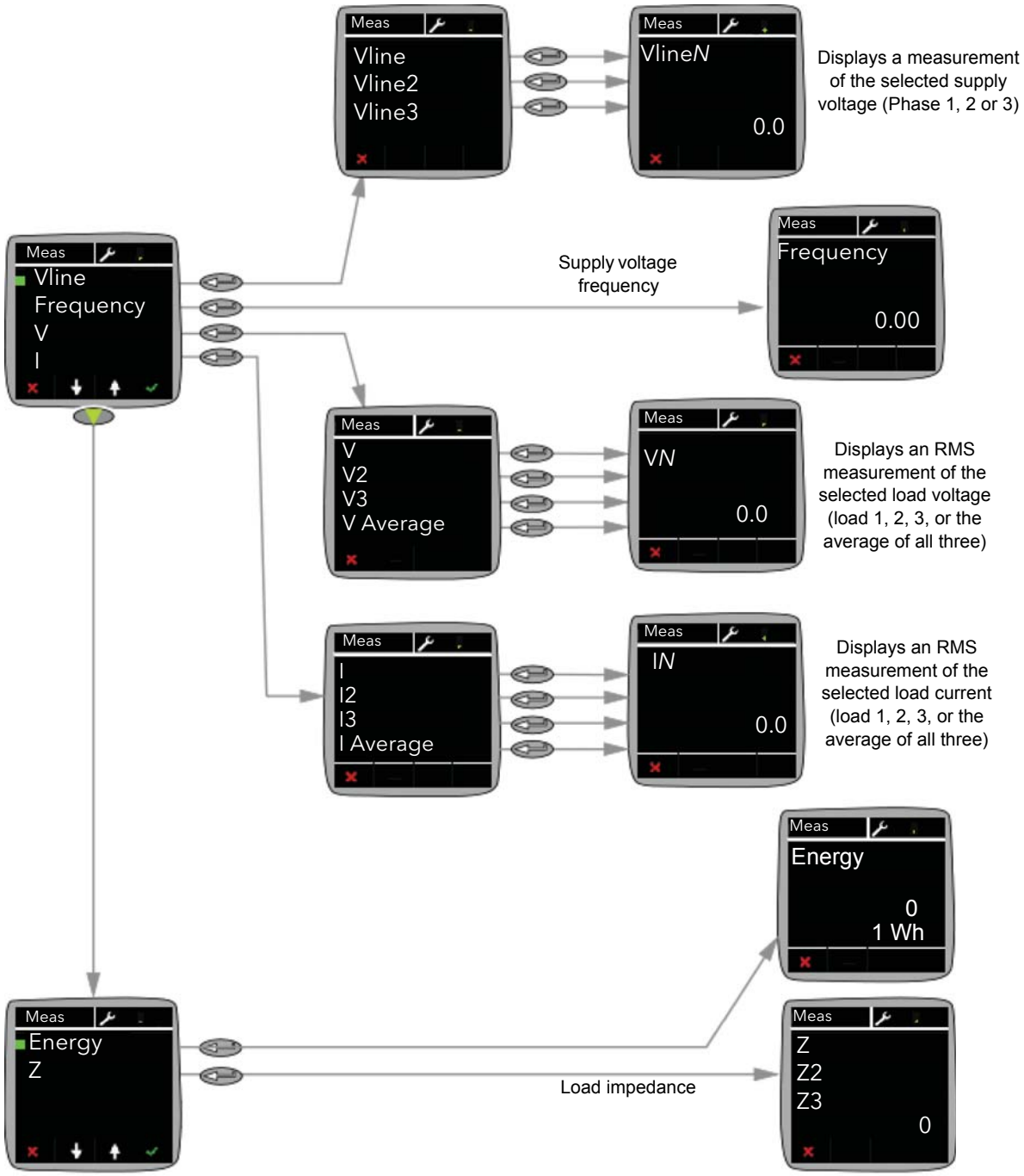


Figure 26 Meas menu

Strat menu

The Strat menu is only available in Engineer mode. It allows the user to view a number of control strategy parameters in real time.

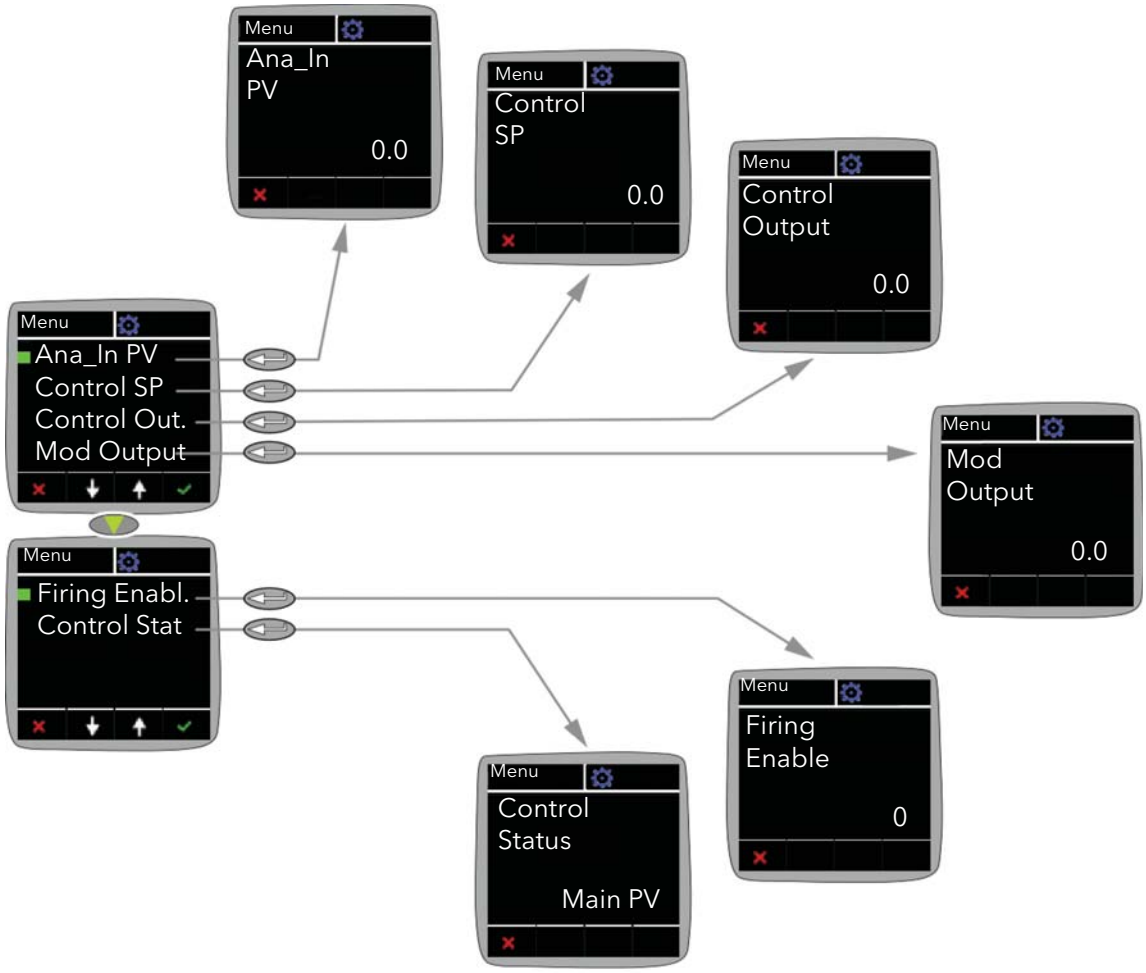


Figure 27 Strat menu

Ana_In PV	The scaled value in process units of the analogue input. Clipped to the Range High or Range Low value if the signal goes over range or under range respectively, (see page 138).
Control SP	The Setpoint to control at, as a percentage of Nominal PV, (see page 122).
Control Out.	The instantaneous control output demand in percent, (see page 124).
Mod Output	The output logic signal controlling the power module on and off times, normally wired to the input of the firing block. For Mode = Phase angle, this is a phase angle demand, (see page 157).
Firing Enabl.	Enables/disables firing. Must be wired to a non-zero value to enable firing, (see page 134).
Control Stat (see page 124)	Indicates the current operating state of the controller: Main PV — The control strategy is using Main PV as the control input

Adjust menu

This menu allows a number of network and firing output parameters to be set up, as well as Analogue input type.

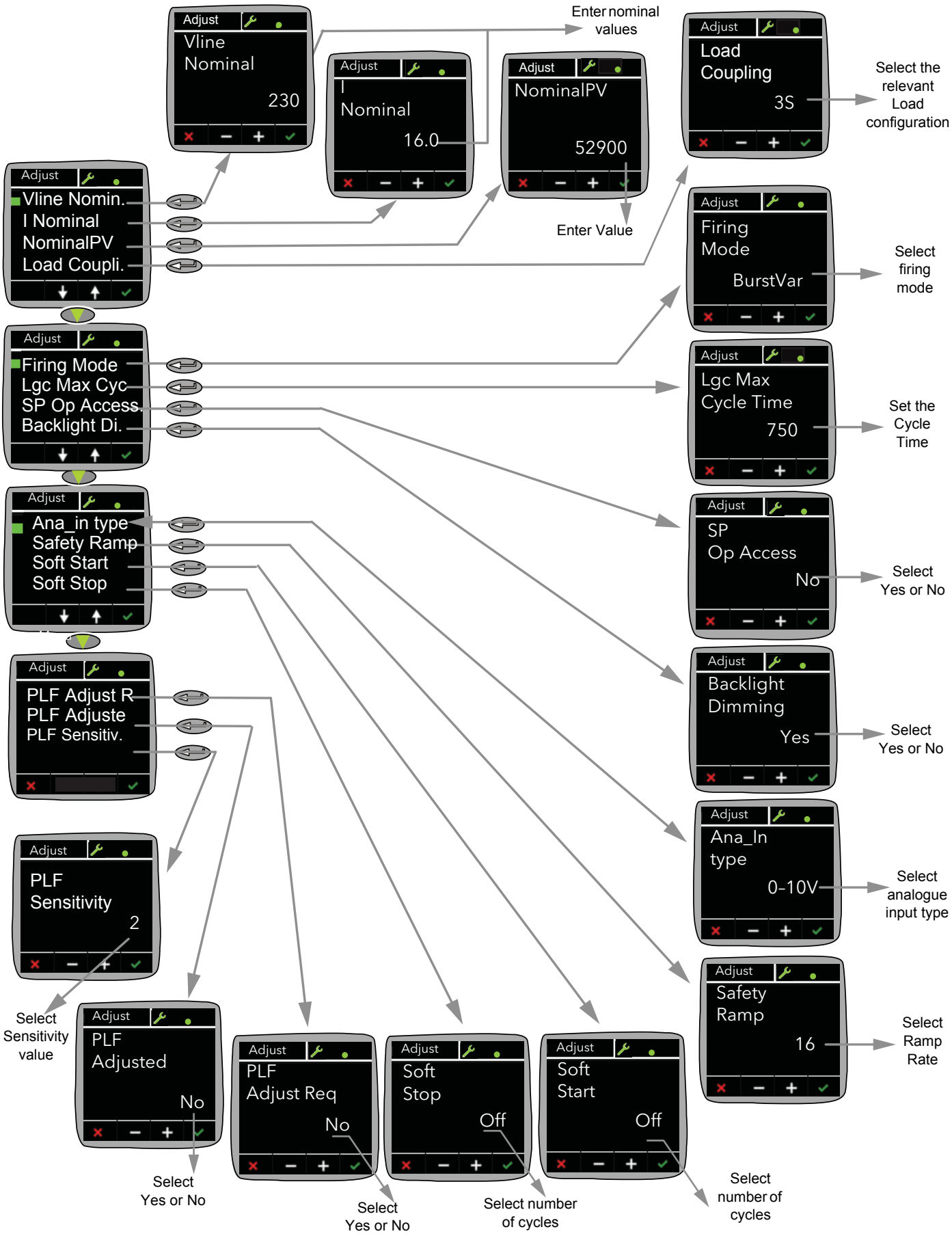


Figure 28 Adjust menu

Vline Nominal	Line voltage nominal value (Line to line for all listed configurations, except Star with Neutral (4S) which is Line to neutral), see Load Configurations (page 33).
I Nominal	Nominal current supplied to the load.
NominalPV	Nominal Process Variable. Defines the nominal value for each control type. For example, for Vsq control, you must set NominalPV to the nominal value you expect for Vsq—typically this could be VloadNominal * VloadNominal.
Load Coupling	Allows you to specify how the load is configured on your installation. Select one of the following; 3D (closed Delta), 3S (star without neutral), 4S (star with neutral) and 6D (open Delta). See Load Configurations (page 33) for more details.
Lgc Max Cyc	Max cycle time for Logic mode. This is set in mains periods.This is the equivalent to the modulation period and it is used to compute Network electrical quantities when there is no modulation shift. It is only available in Logic Mode.
Firing Mode	Firing Mode allows the firing mode to be selected as Burst Var, Burst Fix, or Logic, Phase Angle (PA) or Intelligent half cycle (IHC).
SP Op Access	Setpoint Operator Access: Allows the user setpoint access via the front panel, in operator configuration when enabled. To enable set to Yes. (The default setting is Yes).
Backlight Di.	Backlight Dimming: By default, the backlight on the EPack Lite's display dims automatically to save power. Set this parameter to No if you want the backlight to always remain on. If set to Yes, the backlight dims 30 seconds after you last operate the buttons on the front panel.
Ana_in type	Select the Analogue Input type as 0 to 10V, 1 to 5 V, 2 to 10V, 0 to 5V, 0 to 20mA,4 to 20mA.
'Safety Ramp'	Displays the startup ramp duration, in supply voltage cycles (0 to 255), to be applied at startup. The ramp is either a phase angle ramp from zero to the requested target phase angle or, for Burst Firing, from 0 to 100%. See Figures 91. 'Safety Ramp' is not applicable to Half cycle Mode.
Soft Start	For Burst Firing only, this is the soft start duration, in supply voltage cycles, applying a phase angle ramp at the beginning of each on period.
Soft Stop	In Burst Firing, the soft stop duration, in supply voltage cycles, applying a phase angle ramp at the end of each on period.
Delay Triggering	Appears only if Mode is Burst, Soft Start is Off, and Load Type is TxFormer. Delayed Trigger specifies the triggering delay, in phase angle, when delivering power into a transformer load. Used to minimise inrush current, the value is configurable between 0 and 90 degrees, inclusive.
PLF Adjust R	Partial Load Failure Adjustment Request: When the process has achieved a steady state condition the operator must set the PLFAdjustReq. This makes a load impedance measurement to be used as a reference for detecting a partial load failure. If the load impedance measurement is successful 'PLFAdjusted' is set. The measurement cannot be made if the load voltage (V) is below 30% of VNominal or if the current (I) is below 30% of INominal. The input is edge sensitive, so if the request is made from external wiring, and the input remains permanently at a high level, only the first 0 to 1edge is taken into account.
PLF Adjusted	Partial Load Failure Adjusted: A successful load impedance measurement has been made (see PLF Adjust R above).
PLF Sensitivity	Partial load failure sensitivity. This defines how sensitive the partial load failure detection is to be as the ratio between the load impedance for a PLFadjusted

load and the current impedance measurement. For example for a load of N parallel, identical elements, if the PLF Sensitivity (s) is set to 2, then a PLF alarm will occur if N/2, or more elements are broken (i.e. open circuit). If PLF Sensitivity is set to 3, then a PLF alarm occurs if N/3 or more elements are broken. If (N/s) is non-integer, then the sensitivity is rounded up. E.G. if the N = 6 and s= 4, then the alarm is triggered if 2 or more elements are broken.

Examples

Safety Ramps, Soft Start and Delayed Trigger, firing types

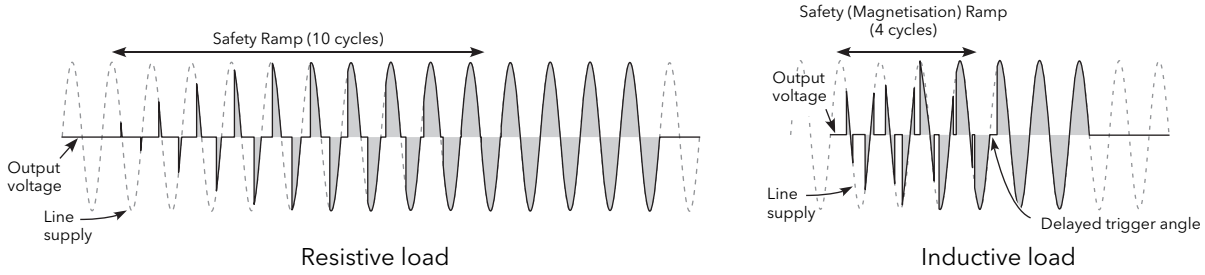


Figure 29 Safety ramp (burst firing) examples

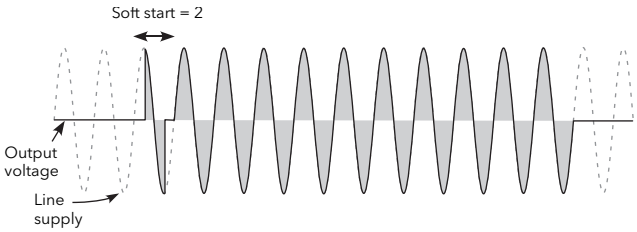


Figure 30 Soft start example

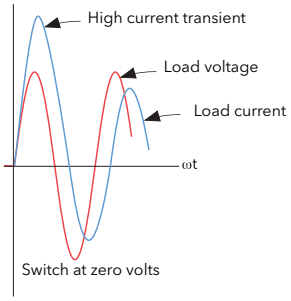


Figure 31 Delayed trigger definition

NOTE: Waveforms have been idealised for clarity.

PLF menu

The PLF (Partial Load Failure) menu is only available in Engineer mode.

NOTE: The default Engineer access level code is 2.

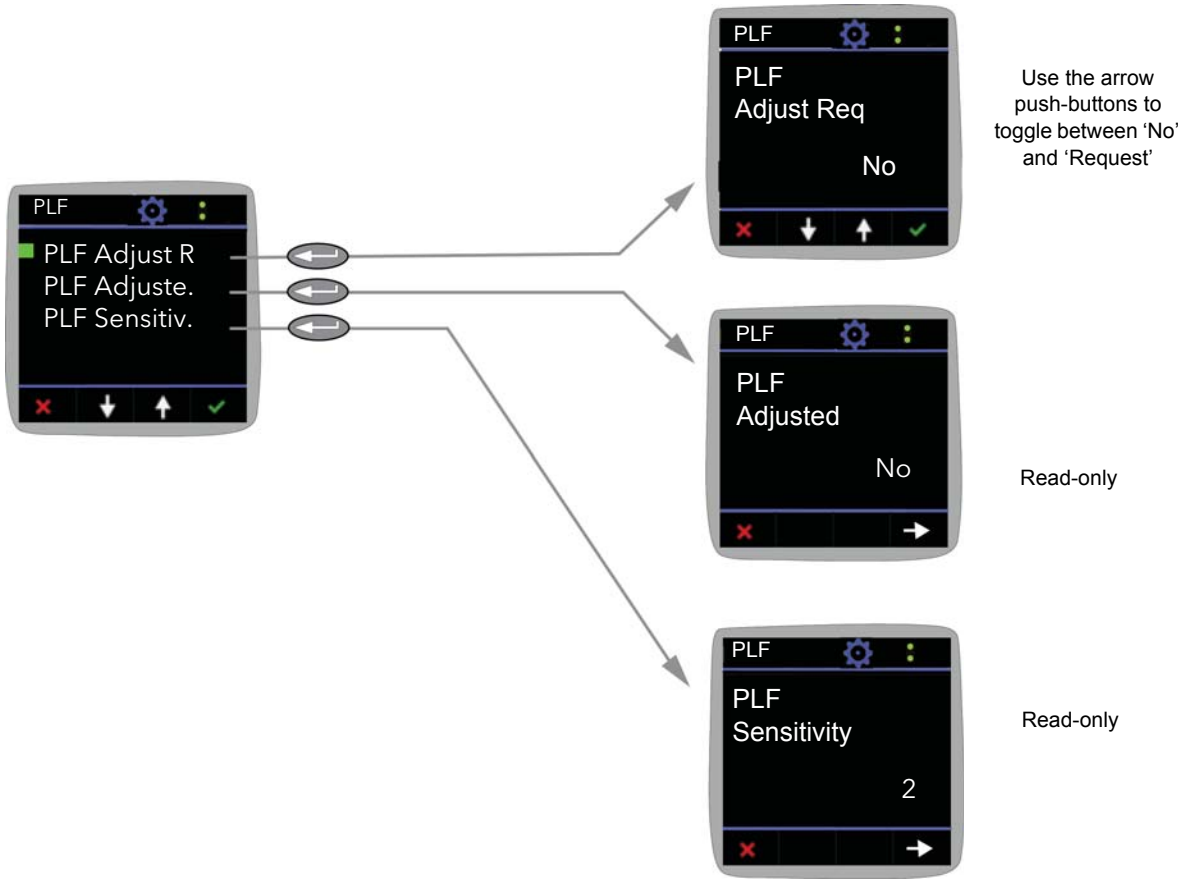


Figure 32 PLF menu

PLF Adjust R	Partial Load Failure Adjustment Request: When the process has achieved a steady state condition the operator must set the PLF-AdjustReq. This makes a load impedance measurement to be used as a reference for detecting a partial load failure. If the load impedance measurement is successful 'PLFAdjusted' is set. The measurement cannot be made if the load voltage (V) is below 30% of VNominal or if the current (I) is below 30% of INominal. The input is edge sensitive, so if the request is made from external wiring, and the input remains permanently at a high level, only the first 0 to 1edge is taken into account.
PLF Adjusted	Partial Load Failure Adjusted: Reports whether a successful load impedance measurement has been made (see PLF Adjust R above).
PLF Sensitivity	Partial load failure sensitivity. This defines how sensitive the partial load failure detection is to be as the ratio between the load impedance for a PLFadjusted load and the current impedance measurement. For example for a load of N parallel, identical elements, if the PLF Sensitivity (s) is set to 2, then a PLF alarm will occur if N/2, or more elements are broken (i.e. open circuit). If PLF Sensitivity is set to 3, then a PLF alarm occurs if N/3 or more elements are broken. If (N/s) is non-integer, then the sensitivity is rounded up. E.G. if the N = 6 and s= 4, then the alarm is triggered if 2 or more elements are broken.

Info menu

This display gives read only information about the unit.

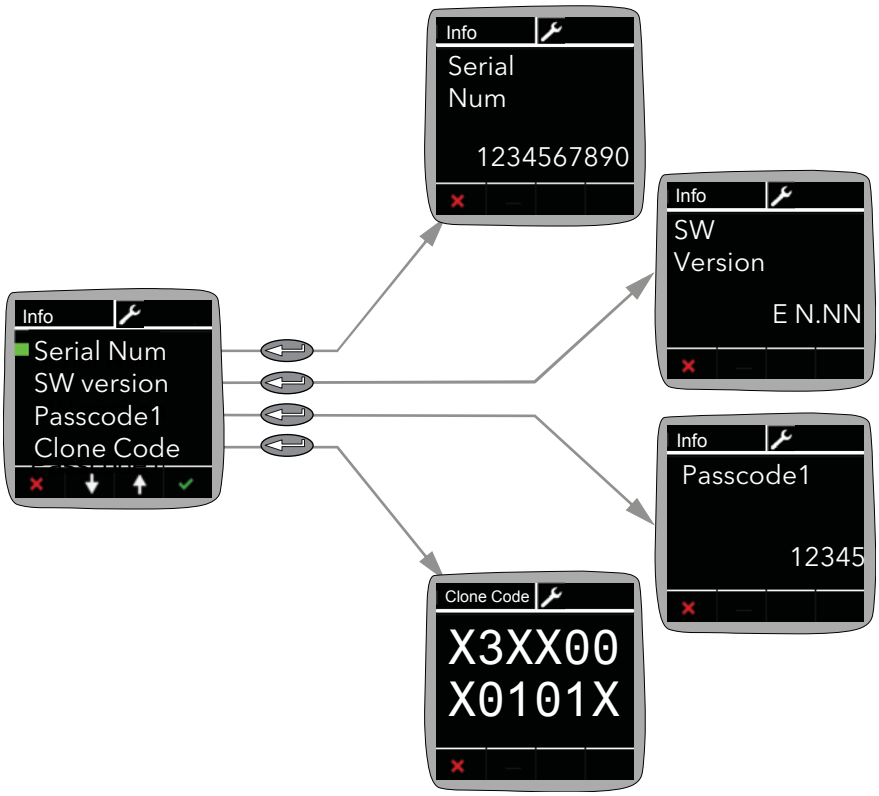


Figure 33 Info menu

Alarms menu

Allows the user to view Global acknowledgement enable status, and issues with calibration (if any). Any active alarms appear, and details can be found by selecting the relevant alarm and using the Enter push button.

Active alarms can be acknowledged, if applicable, by a further operation of the Enter button.

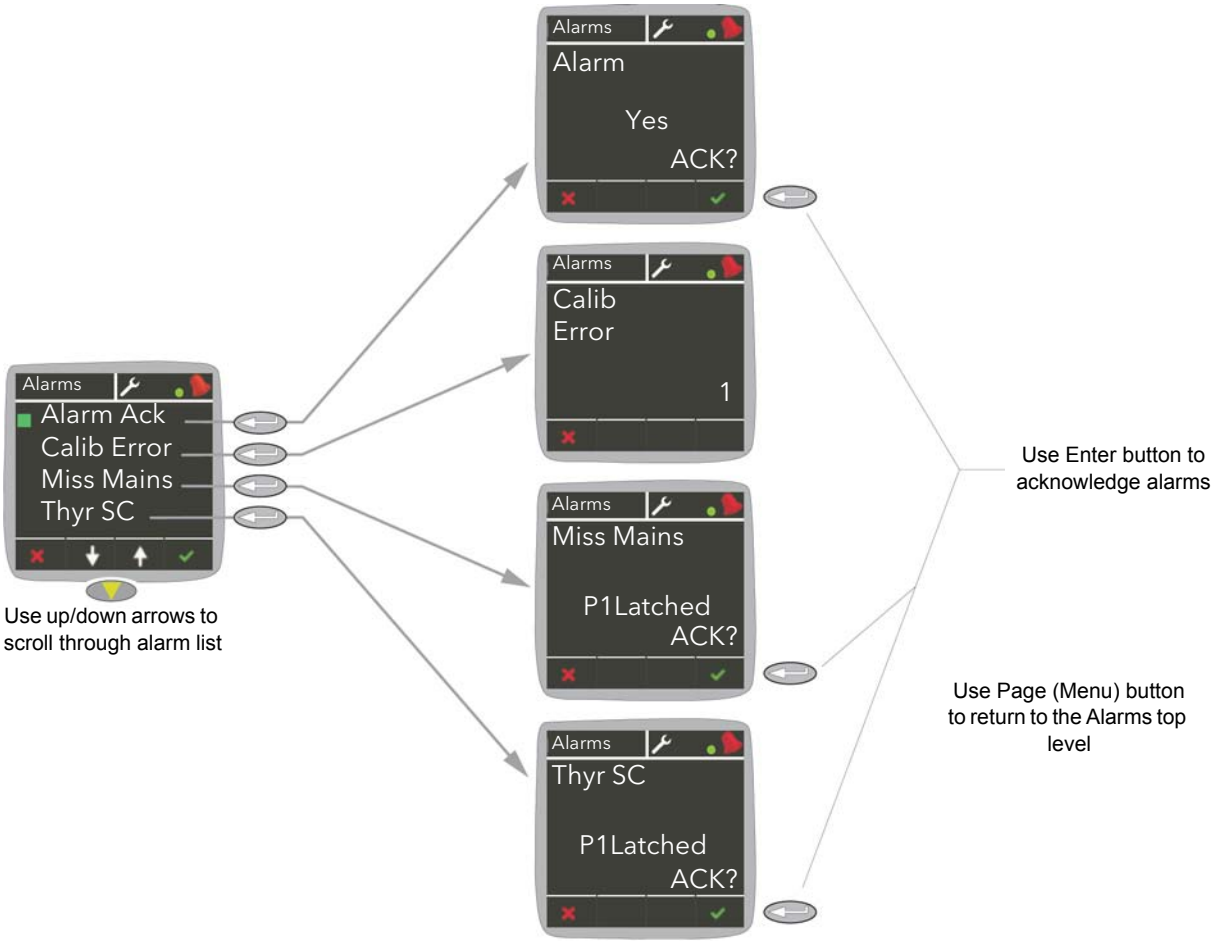


Figure 34 Alarms menu

Alm Disable menu

This menu allows the user to disable particular alarm types, so that they are no longer detected or acted upon.

By default all of the alarms are enabled.

To disable or re-enable an alarm, simply scroll through the list and select the alarm you want, then use the arrow keys to toggle its status between Disable and Enable as required.

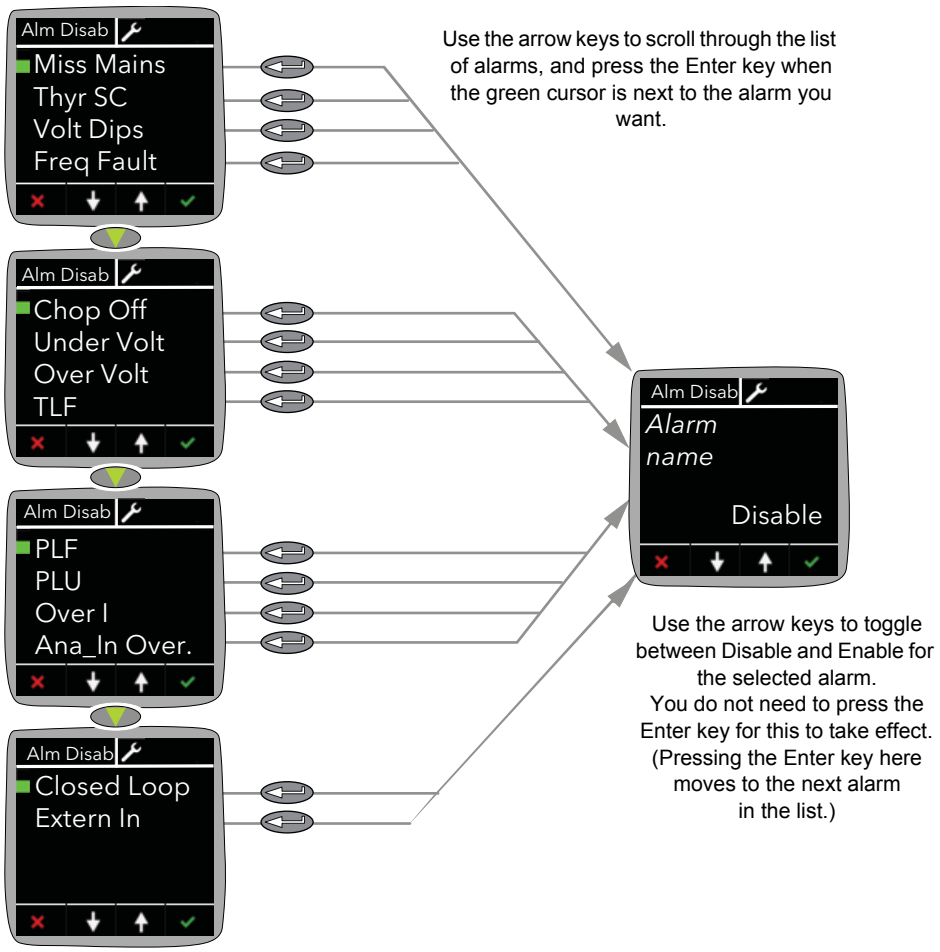


Figure 35 Alarm Disable menu

Alm Latch Menu

This menu allows the user to set latching or no latching to particular alarm types.

To select the latching type, simply scroll through the list and select the alarm you want, then use the arrow keys to toggle its status between Latch and NoLatch as required.

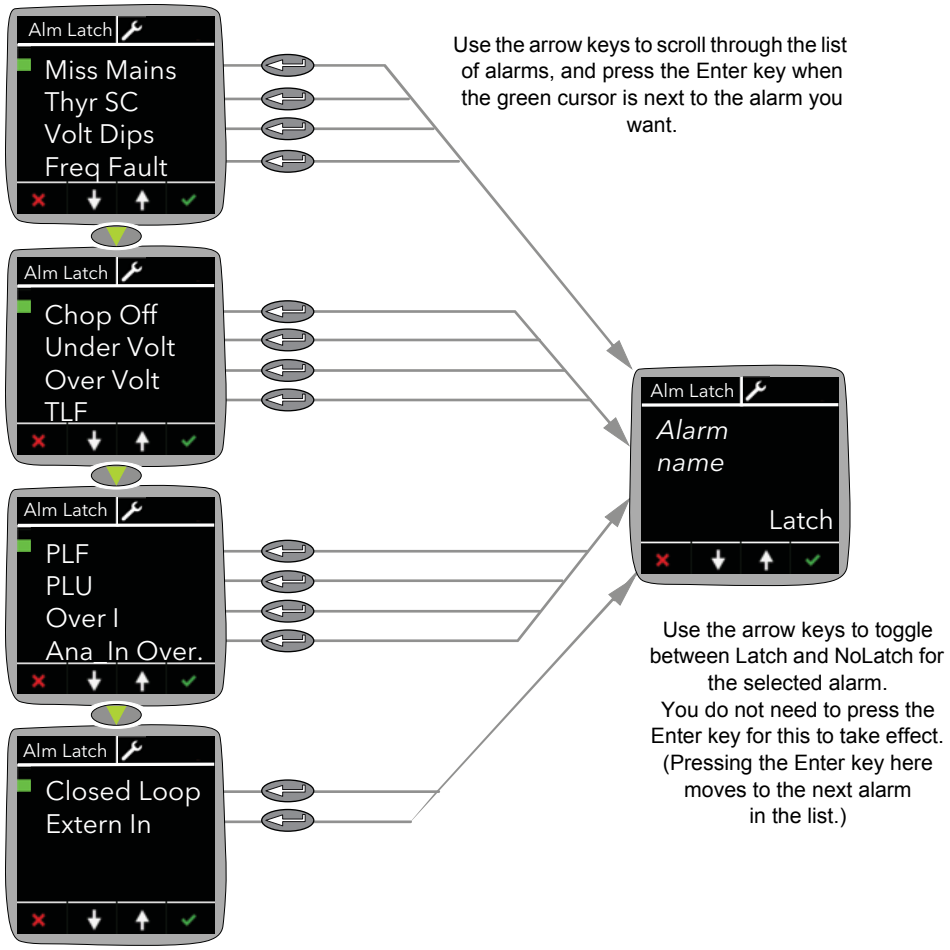


Figure 36 Alarm Latch Menu

Alm Stop menu

This menu allows the user to set which alarms will cause the EPack Lite to stop firing.

By default, non of the alarms are set to stop firing.

To change whether an alarm causes the EPack Lite to stop firing, simply scroll through the list and select the alarm you want, then use the arrow keys to toggle its status between Stop and NoStop as required.

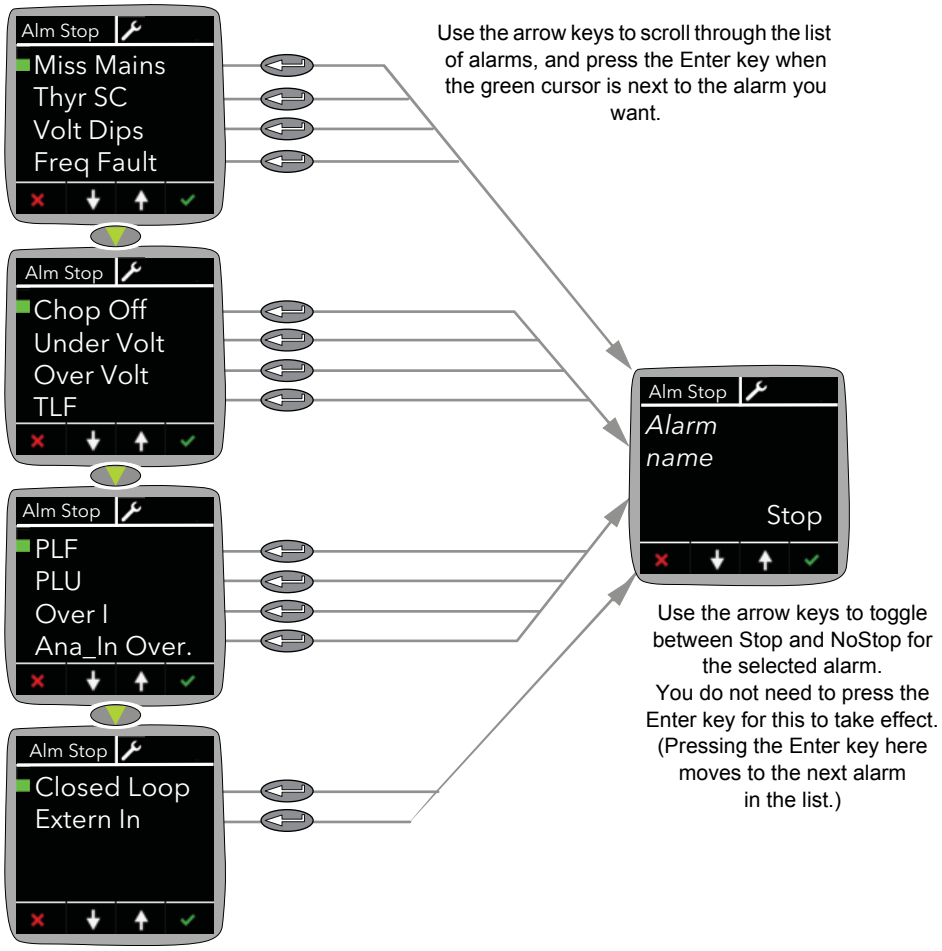


Figure 37 Alarm Stop menu

Alm Relay menu

This menu allows the user to select which alarms are to operate (de-energise) the EPack Lite's 'watchdog' relay. For each selected alarm, select 'Yes' or 'No'.

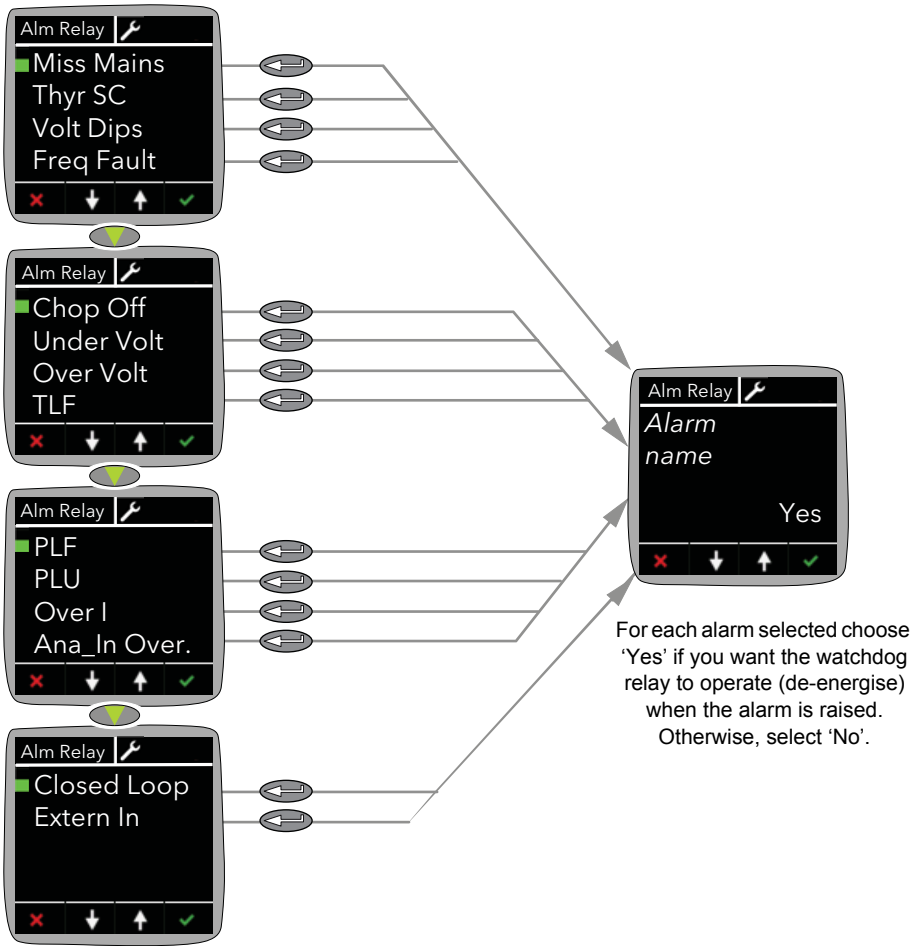


Figure 38 Alarm Relay menu

DI Stat menu

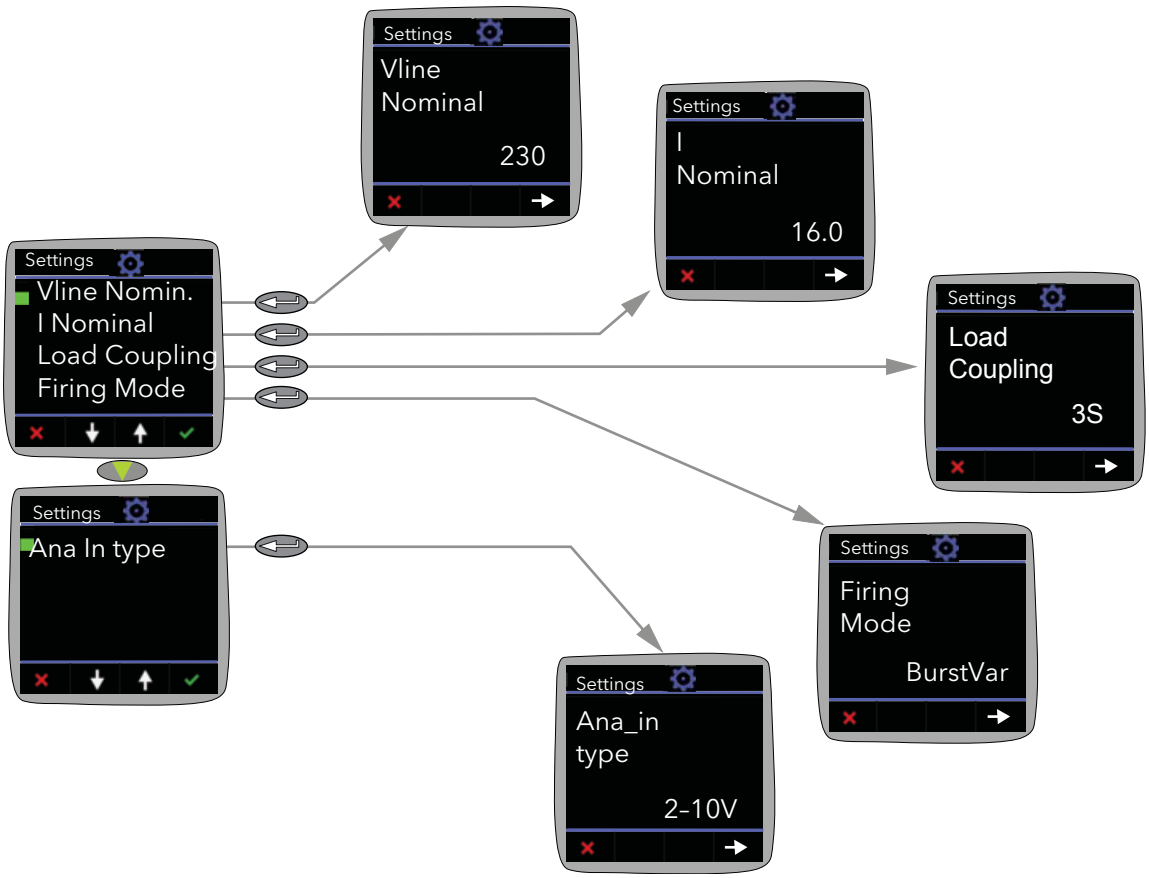
The DI Stat menu displays the status of the EPack's two digital inputs, DI1 and DI2.

'0' means a low level logic signal is being received at the input, '1' means a high level logic signal is being received at the input.

Figure 39 DI Stat menu

Settings menu

The Settings menu is only available in Engineer mode. This menu is read-only, and lets you view the values of the parameters described below.



Vline Nominal	Line voltage nominal value (Line to line for all listed configurations, except Star with Neutral (4S) which is Line to neutral), see Load Configurations (page 33).
I Nominal	Nominal current supplied to the load.
Load Coupling	Displays the current load configuration type. For diagrams of these configurations, see Load Configurations (page 33).
Firing Mode	Reports the firing mode: Burst Var, Burst Fix, Logic, Phase Angle (PA) or Intelligent half cycle (IHC).
Ana_in type	Reports the Analogue Input type: 0 to 10V, 1 to 5 V, 2 to 10V, 0 to 5V, 0 to 20mA, or 4 to 20mA.

Access menu

Allows access to the Operator, Engineer, Configuration, and Quick Code and allows passwords to be set up.

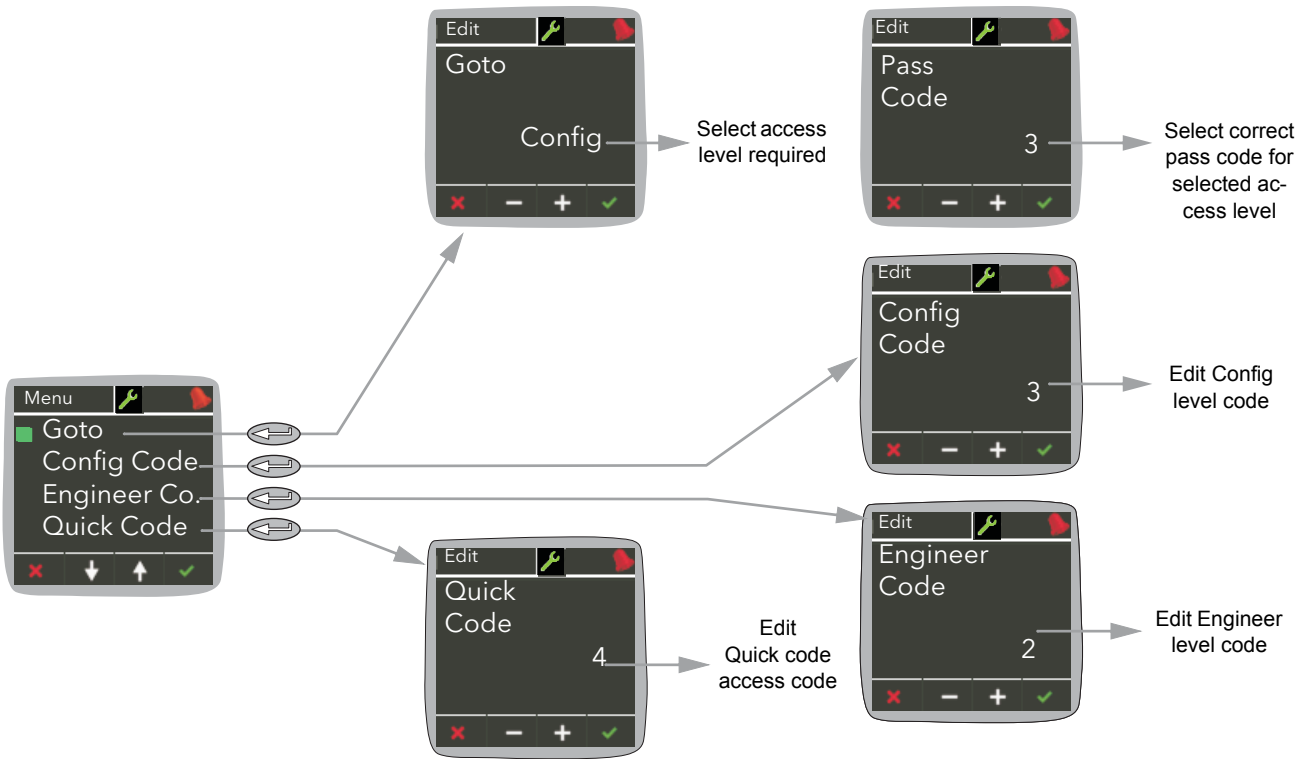


Figure 40 Access menu

Goto	Allows access level to be selected.
Pass Code	Allows the user to enter the code for the access level required.
Config Code	Allows the user to edit the Configuration access level code
Engineer Code	Allows the user to edit the Engineer access level code
Quick Code	Allows the user to edit the Quick code access code

NOTE: The default access codes are Operator = 0, Engineer = 2, Config = 3, Quickcode = 4.

Access to Menus

1. Open the Access menu item.
2. Open the Goto menu item and select the access level required.
3. Enter the access code for the level required. If this access code is correct the relevant menu appears.

NOTE: The above applies only when the user attempts to access a higher level than that current. If accessing a lower level, the user needs only to open the Goto item and select the required level. After doing this, the instrument will probably restart.

Alarms

System Alarms

System alarms are considered to be ‘Major Events’ which help prevent proper operation of the system, and the unit is placed in standby mode.

The following subsections describe each of the possible system alarms.

Missing mains

Supply power is missing.

Thyristor short circuit

A thyristor short circuit leads to current flow even when not firing.

Over temperature

Reserved for future development.

Network dips

This detects a reduction in supply voltage, and if this reduction exceeds a configurable measured value (VdipsThreshold), firing will be inhibited until the supply voltage returns to a suitable value. VdipsThreshold represents a percentage change in supply voltage between successive half cycles and is set to 20% of Vline Nominal.

Mains frequency fault detected

Triggered if the supply voltage frequency strays out of the range 47 to 63 Hz, or if the mains frequency changes, for one cycle to the next, by more than the threshold defined in theNetwork

The threshold value is set to 5%.

Chop Off alarm

Chop-off alarm will be active when a current threshold is exceeded for more than a pre-defined number of mains periods. This current threshold is set to 120%.

Process Alarms

Process Alarms are related to the application and can be configured either to stop the unit firing (Standby Mode) or to allow operation to continue. Process alarms can also be configured to be latched and if so, they have to be acknowledged before the alarm is considered to be non-active. Alarms cannot be acknowledged until the trigger source has returned to a non-active state.

Total Load Failure (TLF)

No load is connected.

Closed Loop alarm

Closed loop break alarm is currently active.

Alarm input

The alarm input associated with the alarm block is active.

Over current detection

The analogue input over current detection alarm is active.

Over Voltage Alarm

A threshold to monitor an over-voltage is set to 10% of Vline Nominal. If exeeded, the OverVoltage alarm is set.

NOTE: This Alarm is returned FALSE if the MissingMains Alarm is set.

Under Voltage Alarm

The threshold to monitor the under-voltage is set to 25% of Vline Nominal. If the VLine voltage falls below this threshold the UnderVoltage alarm is set.

NOTE: This Alarm is returned FALSE if the MissingMains Alarm is set.

Partial Load Failure (PLF)

This alarm detects a static increase in load impedance by comparing the reference load impedance (as configured by the user) with the actual measured load impedance over a mains cycle (for phase angle firing) and over the burst period (for burst and logic firing).

Non-inductive loads, for example resistance furnaces, resistive loads with low temperature coefficient or short wave infrared loads can be monitored using this function. For other load types, for example AC51 slightly inductive loads or AC56a primary of transformer, please consult Eurotherm.

The sensitivity of the partial load failure measurement can be set to any value between 2 to 6 inclusive, where an entry of 2, for example, means that one half of the elements (or more) must be open circuit in order to trigger the alarm; an entry of 3 means that one third of the elements (or more) must be open circuit in order to trigger the alarm, and so on down to one sixth. All elements must have identical characteristics and identical impedance values and must be connected in parallel).

The relevant parameters (PLFAdjustReq, and PLFSensitivity) are both to be found in the PLF Menu as described in the section "Configuration from the Front Panel" on page 51.

Indication Alarms

Indication Alarms signal events for operator action if required. Indication alarms cannot be configured to stop power module firing, but they may be latched if required, and if latched, they must be acknowledged for the Signalling Status to return to the normal (non-alarm) state.

Load Over-Current

Indicates when a configurable RMS load current threshold (OverIthreshold) is reached or exceeded. This threshold is set to 120% of he nominal current.

Maintenance

Precautions

Branch-circuit Protection and Safety Overload Protection

⚠ DANGER

BRANCH-CIRCUIT PROTECTION & SAFETY OVERLOAD PROTECTION

This product does not contain any branch-circuit protection or internal safety overload protection. It is the responsibility of the user to add branch-circuit protection upstream of the unit. It is also the responsibility of the user to provide external or remote safety overload protection to the end installation. Such branch-circuit and safety overload protection must comply with applicable local regulations.
UL: The above mentioned branch-circuit protection is necessary for compliance with National Electric Code (NEC) requirements.

Failure to follow these instructions will result in death, serious injury or equipment damage

⚠ DANGER

HAZARD OF ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH

1. Eurotherm shall not be held responsible for any damage, injury, losses or expenses caused by inappropriate use of the product (EPack), or failure to comply with these instructions.
2. If the product is used in a manner not specified by the manufacturer, the protection provided by the product might be impaired.
3. Disassembling the product is strictly forbidden.
4. The product must be installed and maintained by suitably qualified personnel, authorized to work in an industrial low voltage environment.
5. Before carrying out any work on the product, it must be ensured that all relevant power and control cables, leads or harnesses are isolated from voltage sources.

Failure to follow these instructions will result in death, serious injury or equipment damage

.

⚠ WARNING

BURN RISK, HOT HEATSINK - DO NOT TOUCH

Under some circumstances, the EPack Lite heatsink temperature may rise by more than 50°C and it can take up to 15 minutes to cool after the product is shut down.
Failure to follow these instructions can result in death, serious injury or equipment damage.

Preventive Maintenance

Please read the warnings above, before attempting to carry out any work on the unit(s).

⚠ DANGER

The protective earth ground connections and power terminals must be tightened according to the torque values defined in Table 1, “Connection Details,” on page 28. Appropriate regular inspections must be performed.

Failure to follow these instructions will result in death, serious injury or equipment damage.

⚠ WARNING

To maintain maximum cooling efficiency, the Power Module heat-sink must be cleaned regularly. Periodicity depends on the local environment, but should not exceed six months.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Fusing

⚠ DANGER

According to the CE and UL certifications, high speed fuses (supplemental fuses) are mandatory for compliant installation and protection of the EPack Lite power controller against short circuit.

Failure to follow these instructions will result in death, serious injury or equipment damage.

The power circuit shall be protected by a supplementary fuse, which should be used in conjunction with suitable fuse holders (and contact kits, if required) as shown in table 4.

With a supplementary fuse (high speed fuse), EPack Lite is suitable for use on a circuit capable of delivering not more than 100kA RMS symmetrical amperes, 500 Volts Maximum (coordination Type 2)

NOTE: Coordination Type 1 and Type 2 explanations.

Type 1: Type 1 coordination requires that, under short-circuit conditions, the device shall cause no danger to persons or to the installation but may not be suitable for further service without repair and replacement of parts.

Type 2: Type 2 coordination requires that, under short-circuit conditions, the device shall cause no danger to persons or to the installation and shall be suitable for further use.

⚠ DANGER

The EPack Lite unit's rated short-circuit conditional current is 100kA for co-ordination type 2.

Nevertheless, if opening of either the protective branch circuit or the supplemental (high speed) fuses occurs, the product shall be examined by suitably qualified personnel and replaced if damaged.

Failure to follow these instructions will result in death, serious injury or equipment damage.

EPack Lite nominal current	Required fuse rating	Blown fuse indicator?	Fuse body size (mm)	Eurotherm part numbers		
				Fuse (one per phase)	Fuse holder (three phase)	Contact kit (one per phase)
(≤ 25A	32A	no	10 × 38	CS031505U002	HUA39296	n/a
		yes	14 × 51	CS031506U002	HUA43299	CP177220
32A	40A	no	14 × 51	CS031507U002	HUA43299	n/a
		yes	14 × 51	CS031508U002	HUA43299	CP177220
40A	50A	no	14 × 51	CS031509U002	HUA43299	n/a
		yes	14 × 51	CS031510U002	HUA43299	CP177220
50A	63A	no	22 × 58	CS031511U002	HUA43302	n/a
		yes	22 × 58	CS031512U002	HUA43302	CP177221
63A	80A	no	22 × 58	HUA42588	HUA43302	n/a
		yes	22 × 58	HUA42589	HUA43302	CP177221
80A	200A	no	27 × 60	n/a	n/a	n/a
		yes	27 × 60	CS032166U002	HUA43304	CP177222
100A	200A	no	27 × 60	n/a	n/a	n/a
		yes	27 × 60	CS032166U002	HUA43304	CP177222
125A	200A	no	27 × 60	n/a	n/a	n/a
		yes	27 × 60	CS032166U002	HUA43304	CP177222

Table 4: Details of fuses, fuse holders and contact kits required for EPack Lite

Fuses Holders Contacts Kit:

For technical specification and recommended wiring, see "Fuse Holders Contact Data" on page 38.

Fuse holder dimensions

Figures 41 to 42 show dimensional details for the various fuse holders listed in table 4 (not all shown to the same scale).

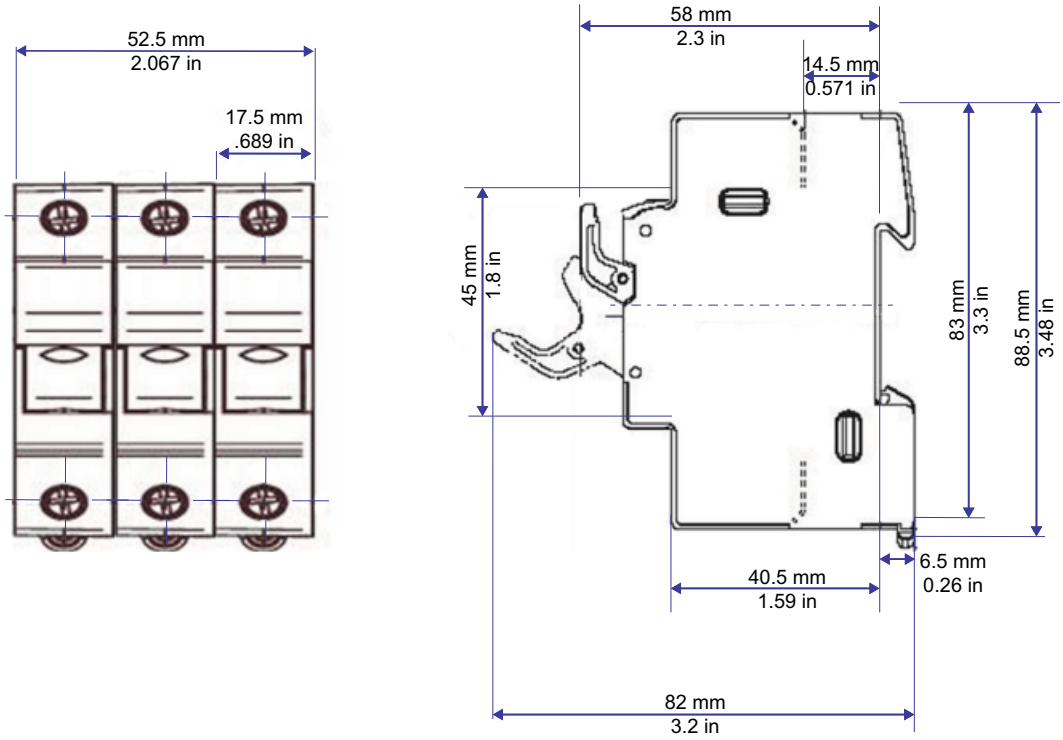


Figure 41 Fuse holder dimensions: HUA39296

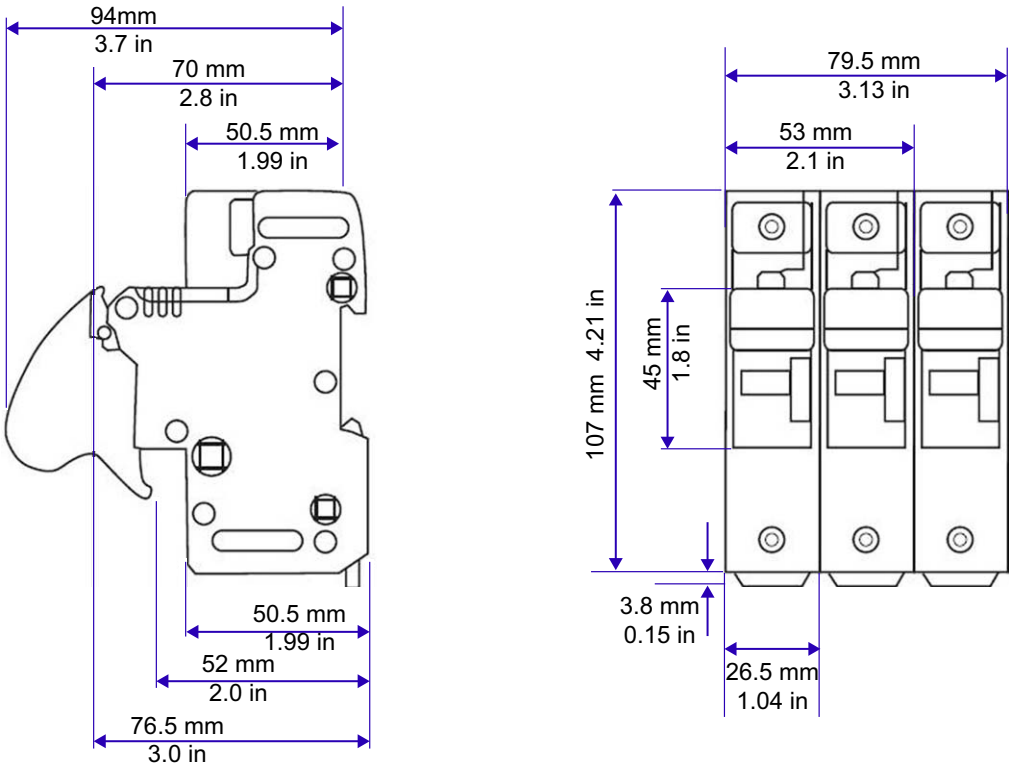


Figure 42 Fuse holder dimensions: HUA43299

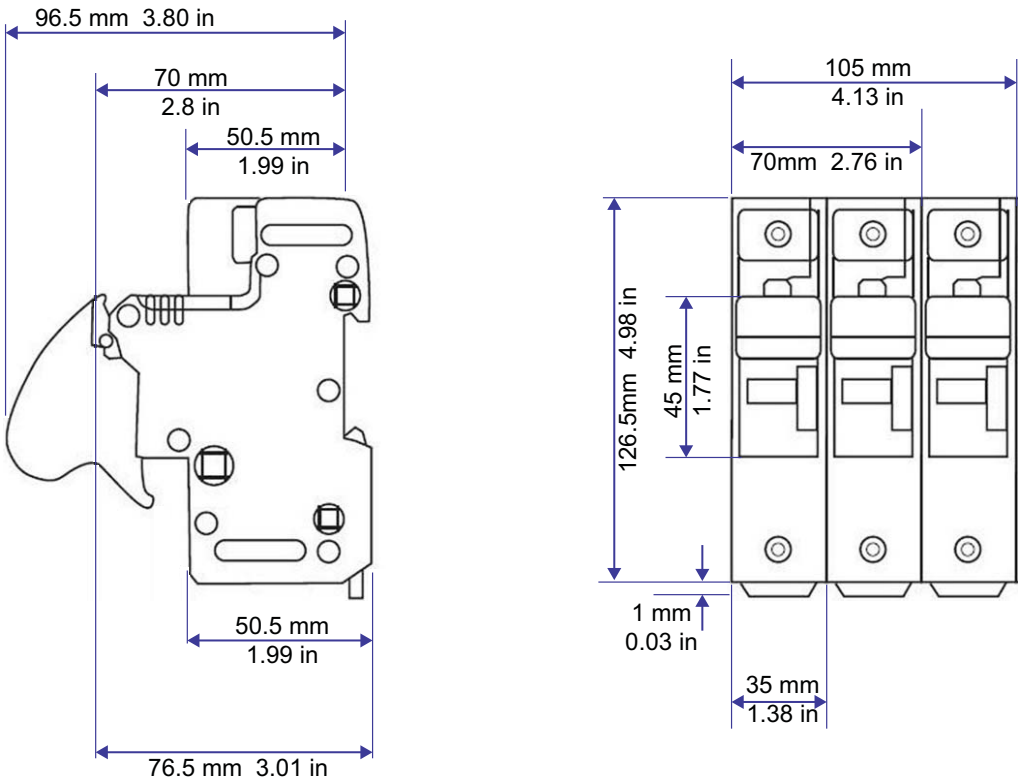


Figure 43 Fuse holder dimensions: HUA43302

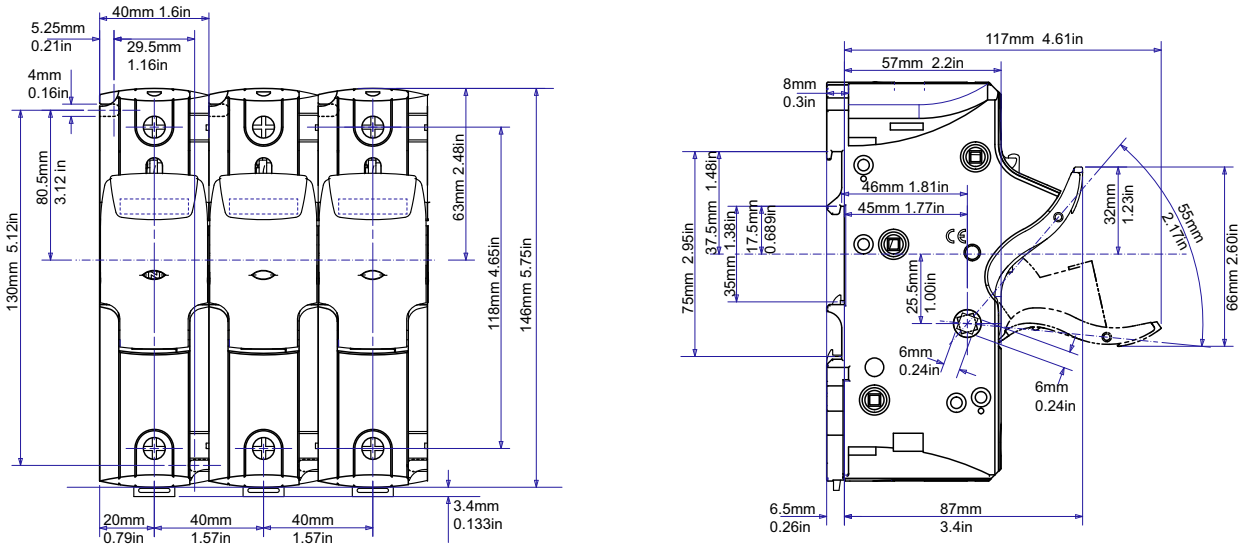


Figure 44 Fuse holder dimensions: HUA43304

Instrument upgrade

Contact your local representative.

Software upgrade

Software upgrade can be carried out by following the section below.

Obtaining a Passcode via Telephone

1. Telephone the local Eurotherm Sales/Service agent with the serial number of the instrument to be updated, and the current software version. This information can be found in the Info sub-menu whilst in Configuration mode from the front panel. Refer to "Info menu" on page 58.
2. Place an order for the required new functionality.
3. A new passcode will be provided which is to be entered in the Info menu available from the front panel whilst in Configuration mode.

EPack Lite Licence Notice

FreeRTOS
EPack Lite is powered by an original FreeRTOS from version v7.1.0.
FreeRTOS is available at http://www.freertos.org

Technical Specification

Standards

The product is designed and produced to comply with:

Countries	Standard symbol	Standard details
European community	CE	EN60947-4-3:2014. Low-voltage switchgear and controlgear - Part 4-3:Contactors and motor-starters - AC semiconductor controllers and contactors for non-motor loads (identical to IEC60947-4-3:2014). Declaration of conformity available on request.
USA & Canada	c UL us	UL60947-4-1 CAN/CSA C22.2 NO.60947-4-1-14 Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-Starters - Electromechanical Contactors and Motor-Starters U.L. File N° E86160
Australia		Regulatory Compliance Mark (RCM) to Australian Communication and Media Authority. Based on compliance to EN60947-4-3:2014.
China	/	Product not listed in catalogue of products subject to China Compulsory Certification (CCC)

Installation Categories

General installation category details are summarized in the table below.

	Installation Category	Rated impulse withstand voltage (Uimp)	Rated insulation voltage
Communications	II	0.5 kV	50 V
Standard IO	II	0.5 kV	50 V
Relays	III	4 kV	230 V
Unit Power	III	6 kV	500 V

Table 5: Installation categories

Specification

Power (At 45°c)

Voltage range	Load:	100 to 500V (+10% -15%)
	Auxiliary:	24V ac/dc (+20% -20%)
		or
		100 to 500V (+10% -15%)

⚠ WARNING

For 24V supplies, in order to comply with safety requirements, the supply voltage must be derived from a SELV or PELV circuit.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Frequency range		47 to 63 Hz for line and ac auxiliary supplies
Power requirement	24V dc	12W
	24V ac	18VA
	500V ac	20VA
Installation category		See Table 5 above.
Nominal load current		16 to 125 Amps
Power Dissipation		1.3 Watts per amp, per phase
Pollution degree		Pollution degree 2
Utilization categories		AC51: Non-inductive or slightly inductive loads, resistance furnaces
		AC56a: Transformer Primary
Duty cycle		Uninterrupted duty / continuous operation
Device form designation		Form 4 (Semiconductor controller)
Short circuit protection		By external supplemental fuses (high speed fuse) - see Fusing.
Rated conditional short-circuit current		100kA (Coordination Type 2)
Load Types		Three phase control of resistive loads and transformer primaries.
Overload conditions		AC51: 1xIe continuous

Physical

Dimensions and mounting centres		See figure 4, figure 5, figure 6 and figure 7 for details
Weight	16 to 32A units	3060g + user connectors
	40 to 63A units	3510g + user connectors
	80A and 100A units	5830g + user connectors
	125 A units	7940g + user connectors

Environment

Temperature limits	Operating:	0°C to 45°C at 1000m 0°C to 40°C at 2000m
	Storage:	-25°C to +70°C
Altitude		1000 m maximum at 45°C 2000 m maximum at 40°C
Humidity limits		5% to 95% RH (non-condensing)
Degree of Protection (CE)[1]		
	All units:	IP20 (EN60529)
Enclosure type ratings (UL)		
	All units:	Open type
Atmosphere		Non-explosive, non-corrosive, non-conductive
External wiring	General:	Must comply with IEC60364-1 and IEC60364-5-54 and all applicable local regulations. Cross sections must comply with Table 9 of IEC60947-1.
	UL:	Wiring must comply with NEC and all applicable local regulations. Cross sections must comply with NEC, Article 310 Table 310-16.(see Table 1 of this manual for temperature ratings)
Shock		According to EN60068-2-27 and IEC60947-1 (Annex Q, Category E)
Vibration		According to EN60068-2-6 and IEC60947-1 (Annex Q, Category E)
EMC Standard:		EN60947-4-3:2014. See Table 6 and Table 7 for EMC emission and immunity levels attained.

1. To maintain the units IP rating, the wiring and installation requirements defined in Connections (Supply Power and Load) (page 31) must be adhered.

EMC immunity tests (According to EN60947-4-3:2014)				
	Level		Criteria	
	Requested	Achieved	Requested	Achieved
Electrostatic discharge (test method of IEC 61000-4-2)	Air discharge mode 8kV Contact discharge mode 4kV	Air discharge mode 8kV Contact discharge mode 4kV	2	2
Radiated radio-frequency electromagnetic field test (test method of EN 61000-4-3)	10V/m from 80MHz to 1GHz and from 1,4GHz to 2GHz	15V/m from 80MHz to 3GHz	1	1
Fast transient/burst test (5/50 ns) (test method of EN 61000-4-4)	Power ports 2kV / 5kHz Signal ports 1kV / 5kHz	Power ports 4kV / 5 kHz Signal ports 4kV / 5 kHz	2	2
Surge Voltage test (1,2/50 µs – 8/20 µs) (test method of EN 61000-4-5)	2kV line to earth 1kV line to line	2kV line to earth 1kV line to line	2	2
Conducted radio-frequency test (test method of EN 61000-4-6)	10V (140dBµV) from 0,15MHz to 80 MHz	15V (143.5dBµV) from 0,15MHz to 80 MHz	1	1
Voltage dips test (test method of EN 61000-4-11)	0% during 0.5 cycle & 1 cycle	0% during 0.5 cycle & 1 cycle	2	2
	40% during 10/12 cycles	40% during 10/12 cycles	3	2
	70% during 25/30 cycles	70% during 25/30 cycles	3	2
	80% during 250/300 cycles	80% during 250/300 cycles	3	2
Short interruptions test (test method of EN 61000-4-11)	0% during 250/300 cycles	0% during 250/300 cycles	3	2

Table 6: EMC immunity tests

EMC emission tests (According to EN60947-4-3:2014)				
Test	Frequency (MHz)	Limit level for class A industrial		Comments
		Quasi peak dB (µV)	Average dB (µV)	
Radiated radio frequency emission test According to EN60947-4-3:2014 (test method of CISPR11)	30 to 230	40 at 10m	N/A	Pass
	230 to 1000	47 at 10m	N/A	
Conducted radio frequency emission test According to EN 60947-4-3:2014 for rated power <20kVA (test method of CISPR11)	0.15 to 0.5	79	66	The conducted emissions can meet the requirement of IEC60947-4-3:2014 with an external filter added on the line connections. This is in line with the rest of the industry[2]
	5 to 30	73	60	
Conducted radio frequency emission test According to EN 60947-4-3:2014 for rated power >20kVA (test method of CISPR11)	0.15 to 0.5	100	90	
	0.5 to 5	86	76	
	5 to 30	90 to 73[1]	80 to 60[1]	
NOTE: This product has been designed for environment A (Industrial). Use of this product in environment B (domestic, commercial and light industrial) may cause unwanted electromagnetic disturbances in which cases the user may be required to take adequate mitigation measures.				

1. Decrease with log of frequency emissions.
2. Technical note TN1618 (available upon customer request) describes the recommended filter structures which reduce conducted radio-frequency emissions.

Table 7: EMC emission tests

Operator Interface

Display	1.44” square TFT colour display allowing viewing of selected parameter values in real time, plus configuration of instrument parameters for users with adequate access permission.
Push buttons	Four push buttons provide page and item entry and scroll facilities.

Inputs/Outputs

All figures are with respect to 0V, unless otherwise stated.

Number of inputs/outputs	1 Analogue input; 2 Digital inputs (DI1 and DI2); 1 Relay output See I/O Input & Output Details (page 37)
Update rate	Twice the mains frequency. Defaults to 55 Hz (18 ms) if the supply frequency lies outside the range 47 to 63Hz.)
Termination	Removable 5-way connector. Located as shown in figure 14.

Analogue Input

Performance	See Table 8 and Table 9
Input type	Configurable as one of: 0 to 10V, 1 to 5V,2 to 10V, 0 to 5V, 0 to 20mA, 4 to 20mA
Absolute input maxima	±16V or ±40mA

Analogue input: Voltage input performance		
Parameter	Typical	Max/Min
Total voltage working input span		0V to +10V
Resolution (electrical noise free) (note 1)	11 bits	
Calibration accuracy (notes 2, 3)	<0.1%	<0.1%
Linearity accuracy (note 2)		±0.1%
Ambient temperature deviation (note 3)		<0.01%/°C
Input resistance (terminal to 0V)	142kΩ	±0.2%
Note 1: w.r.t. total working span Note 2: % of effective range (0 to 5V, 0 to 10V)	Note 3: After warm up. Ambient = 25 °C	

Table 8: Analogue input specification (voltage inputs)

Analogue input: Current input performance		
Parameter	Typical	Max/Min
Total current working input span		0 to +25mA
Resolution (electrical noise free) (note 1)	11 bits	
Calibration accuracy (notes 2, 3)		<0.2%
Linearity accuracy (note 2)		±0.1%
Ambient temperature deviation (note 2)		±0.01%/°C
Input resistance (terminal to 0v)	<102Ω	±1%
Note 1: w.r.t. total working span Note 2: % of effective range (0 to 20mA)	Note 3: After warm up. Ambient = 25 °C	

Table 9: Analogue input specification (current inputs)

Digital Inputs

Voltage inputs

Active level (high):	11V<Vin<30V with 6mA<input current<30mA
Non-active level (low):	-3V<Vin<5V with 2mA<input current<30mA Or 5V<Vin<11V with input current <2mA

Contact closure inputs

Source current:	10mA min - 15mA max
Open contact (non active) resistance:	>800Ω
Closed contact (active) resistance:	<450Ω
Absolute Maxima:	±30V or ±25mA

NOTE: Absolute maximum ratings refer to externally applied signals

Digital Output

User configured output (DI2):	±2% 10.2V, 10mA For example; To suppply a potentiometer between 2kΩ - 10kΩ (±20%) used to drive the Analogue Input when set to Voltage mode - see Inputs/Outputs (page 84).

Relay Specification

The relay has gold plated contacts suitable for ‘dry circuit’ (low current) use. See "I/O Input & Output Details" on page 37.

Contact life

Resistive loads:	100,000 operations
Inductive loads:	Derate as per accompanying graph (figure 45)

High power use

Current:	2A (resistive loads)
Voltage:	<264V RMS (UL: voltage 250Vac.)

Low power use

Current:	>10 mA
Voltage:	>5V

Contact configuration:	Single pole change-over (one set of Common, Normally Open and Normally Closed contacts)
Termination	Removable 3-way connector. Located as shown in figure 14.
Installation Category	Installation category III, assuming that nominal phase to earth ground voltage is ≤ 300V RMS.
Absolute max. switching capability	<2A at 240V RMS (resistive loads)

NOTE: ‘Normally Closed’ and ‘Normally Open’ refer to the relay when the coil is not energised.

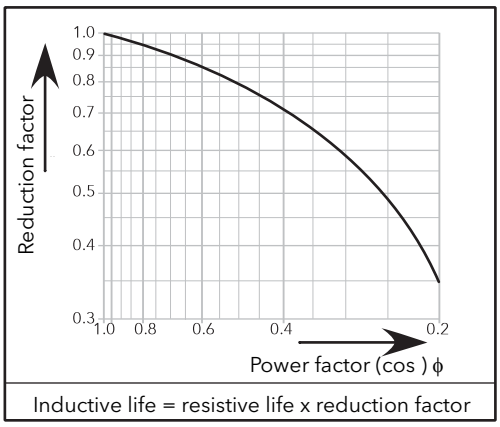


Figure 45 Relay derating curves

Fuse Holders Contacts Kit Specification

Fuse Holders Contacts Kit are delivered with NO, NC contact

Connection:	Faston lugs 2.8 X 0.5 mm
Rated insulation voltage:	250VAC

Rated operational current following IEC 60947-5 & -1

Utilization category AC15: 4A/24V, 4A/48V, 3A/127V, 2.5A/240V
Utilization category DC13: 3A/24V, 1A/48V, 0.2A/127V, 0.1A/240V

Minimum operational current and voltage:

Fuses CP177220 & CP177221: up to 63A (14x51 and 22x58):
1mA/4V AC or DC
Fuses CP177222 from 80A up to 125A(27x60):
100mA/20V AC or DC

Mains Network Measurements

All network measurements are calculated over a full mains cycle, but internally updated every half-cycle. For this reason, power control and alarms all run at the mains half-cycle rate. The calculations are based on waveform samples taken at a rate of 20kHz. The phase voltage referred to is the line voltage referenced to input potential.

The parameters below are directly derived from measurements for each phase.

Accuracy (20 to 25°C)	
Line frequency (F):	±0.02Hz
Line RMS voltage (Vline):	±2% of Nominal Vline.
Load RMS voltage (V):	±2% of Nominal V for voltage readings >1% of Nominal V. Unspecified for readings lower than 1%Vnom.
Load current (I_{RMS}):	±2% of Nominal I_{RMS} for current readings >3.3% of Nominal I_{RMS}. Unspecified for readings ≤ 3.3% of Nominal. I_{RMS}.
Load RMS voltage squared (Vsq):	±2% of (Nominal V)^2
Thyristor RMS current squared (Isq):	±2% of (Nominal I)^2
Frequency resolution	0.1 Hz
Measurement resolution	11 bits of Nominal value
Measurement drift with ambient temp.	<0.02% of reading / °C

Further parameters (Z, IsqBurst, and Vsq Burst) are derived from the above, for the network (if relevant).

Scan for local contents

Eurotherm Ltd
Faraday Close
Durrington
Worthing
West Sussex
BN13 3PL
Phone: +44 (0)1903 268500
www.eurotherm.co.uk

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this publication.

HA033173 Issue 1
CN36273