Eurotherm®

by Schneider Electric

# EPower™ Controller
# User Guide

EPower™ Power management and control units
Versions 3.06 and later

HA179769 Issue 15
March 2020

Eurotherm
by Schneider Electric

| 部件名称 Part Name | 有害物质 - Hazardous Substances | | | | | |
|---|---|---|---|---|---|---|
| | 铅 (Pb) | 汞 (Hg) | 镉 (Cd) | 六价铬 (Cr (VI)) | 多溴联苯 (PBB) | 多溴二苯醚 (PBDE) |
| 金属部件 Metal parts | X | O | O | O | O | O |
| 塑料部件 Plastic parts | O | O | O | O | O | O |
| 电子件 Electronic | X | O | O | O | O | O |
| 触点 Contacts | O | O | O | O | O | O |
| 线缆和线缆附件 Cables & cabling accessories | O | O | O | O | O | O |

**本表格依据SJ/T11364的**规定编制。
**O: 表示**该有害物质在该部件所有均质材料中的含量均在**GB/T 26572**规定的限量要求以下。
**X: 表示**该有害物质至少在该部件的某一均质材料中的含量超出**GB/T 26572**规定的限量要求。

**This table is made according to SJ/T 11364.**
**O: indicates that the concentration of hazardous substance in all of the homogeneous materials for this part is below the limit as stipulated in GB/T 26572.**
**X: indicates that concentration of hazardous substance in at least one of the homogeneous materials used for this part is above the limit as stipulated in GB/T 26572**

Signed (Kevin Shaw, R&D Director): KShaw Date: 24th June 2016

# INSTALLATION AND OPERATION MANUAL

## LIST OF SECTIONS



## Associated Documents

HA179770 Communications Manual
HA028838 iTools help manual

## Software Effectivity

This manual relates to units with software version 3.05

Patents
This product is covered by one or the more of the following patents:
France: FR 06/02582 (Published 2899038)
Europe: 07104780.7 (Pending)
US: 11/726,906 (Pending)
China: 200710089399.5 (Pending)

# TABLE OF CONTENTS

# TABLE OF CONTENTS (CONT.)

# TABLE OF CONTENTS (CONT.)

# TABLE OF CONTENTS (CONT.)

# TABLE OF CONTENTS (CONT.)

# TABLE OF CONTENTS (CONT.)

# TABLE OF CONTENTS (CONT.)

# TABLE OF CONTENTS (CONT.)

Section Page

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## SAFETY NOTES

**⚠ DANGER**

**HAZARD OF ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH**

1. If the product (EPower) is used in a manner not specified by the manufacturer, the protection provided by the product might be impaired.
2. Any adjustment, maintenance and repair of the opened apparatus under voltage, is forbidden for safety reasons.
3. The product must be installed and maintained by suitably qualified personnel, authorized to work in an industrial low voltage environment.
4. The product is not suitable for isolation applications, within the meaning of EN60947-1.
5. Do not exceed the device's ratings.
6. The product is designed to be installed in a cabinet connected to the protective earth ground
   CE: protective earth ground minimum size must be selected according to IEC 60364-5-54 table 54.2 or IEC61439-1 table 5 or applicable national standards
   U.L.: protective earth ground minimum size must be selected according to NEC table 250.122 or NFPA79 table 8.2.2.3 or applicable national standards
7. The product has been designed for pollution degree 2 according to IEC60947-1 definition: Normally, only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation may be expected.
   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.
8. 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.
9. Before any other connection is made, the protective earth ground terminal shall be connected to a protective conductor. The earth connection must be made by using a lug terminal of size as given in table 2.2.1..
   The cables must be rated 90°C stranded copper only
   CE: protective earth ground minimum size must be selected according to IEC 60364-5-54 table 54.2 or IEC61439-1 table 5 or applicable national standards
   U.L.: protective earth ground minimum size must be selected according to NEC table 250.122 or NFPA79 table 8.2.2.3 or applicable national standards. The earth connection must be made using a UL-listed lug terminal.
10. The protective earth ground connections must be tightened according to the torque values defined in table 2.2.1. Appropriate regular inspections must be performed. Periodicity depends on the local environment, but should not exceed 1 year.
11. 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.
12. According to the CE and UL certifications, high speed fuses (supplemental fuses) are mandatory for compliant installation and protection of the EPower controller against short circuit. See paragraph 12.3 for details.
13. The EPower's rated short-circuit conditional current is defined for co-ordination type 1. 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.

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

**⚠ DANGER**

**HAZARD OF ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH**

14. To achieve IP10 rating according to IEC60529, power connections must be made by using lug terminals of size as given in Table 2.2.2.. U.L.: Power connections connection must be made using UL-listed lug terminals.
15. The mains supply fuse within the Driver Module is not replaceable. If it is suspected that the fuse is faulty, the manufacturer's local service centre should be contacted for advice.
16. The I/O Input & Output, the Communications ports are SELV circuit. They must be connected to SELV or PELV circuit.
17. The relays outputs are compliant to the SELV requirements; they can be connected to SELV, PELV circuit or to voltage up to 230V (maximum value of rated operational voltage to earth:300V)

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

## ⚠ DANGER

**HAZARD OF FIRE**

18. 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. Branch circuit shall be rated according to maximum current in each phase.
    CE: branch-circuit protection must be selected according to IEC 60364-4-43 or applicable local regulations.
    UL: branch-circuit protection must be selected according to NEC article 210.20, it is necessary for compliance with National Electric Code(NEC) requirements.
19. Power connections: The cables must be rated 90°C stranded copper only, the cross section must be selected according to the branch circuit protection rating.
    CE: Wire conductor cross sections must comply with IEC 60364-5-52 or applicable national standards
    U.L.: Wire conductor cross sections must comply with NEC Table 310.15(B)(16) (formerly Table 310.16) taking account of table 310.15(B)(2) for the ampacity correction factors or NFPA79 Table 12.5.1 taking account of Table 12.5.5(a) for the ampacity correction factors or applicable national standards.
20. Power terminals must be tightened according to the torque values defined in Table 2.2.2.. Appropriate regular inspections must be performed. Periodicity depends on the local environment, but should not exceed 1 year.
21. The tightening torques for supplemental (high speed) fuses should be checked according to value defined in table 12.3. Ceramic fuse bodies should be checked for visible cracks. Appropriate regular inspections must be performed. Periodicity depends on the local environment, but should not exceed 1 year.
22. Neutral cross-sectional area when neutral is connected to the star point of the load (4S load type):
    Without current limit activated, maximum neutral current is not upper than maximum current in each phase. The cross-sectional area of the neutral conductor, shall be sized to carry the maximum phase current.
    With current limit activated, maximum neutral current may reach √3 x current limit setting. The cross-sectional area of the neutral conductor shall be sized to carry up to √3 x current limit setting.
    CE: Wire conductor cross sections must comply with IEC 60364-5-52 or applicable national standards
    U.L.: Wire conductor cross sections must comply with NEC Table 310.15(B)(16) (formerly Table 310.16) taking account of table 310.15(B)(2) for the ampacity correction factors or NFPA79 Table 12.5.1 taking account of Table 12.5.5(a) for the ampacity correction factors or applicable national standards.
23. The cables used to connect the remote voltage sensing inputs (if fitted) and the cable used to connect the reference input in 4S, 6D and two-leg configurations must be correctly protected by branch-circuit protection. It is the responsibility of the user to add branch-circuit protection. Such branch-circuit must comply with applicable local regulations.
    UL: The above-mentioned branch-circuit protection is necessary for compliance with National Electric Code (NEC) requirements.
24. The cables used to connect the EPower auxiliary/fans supply must be correctly protected by 3A branch-circuit protection. (3A rating selected to protect AWG18 fan supply wiring). It is the responsibility of the installer to add branch-circuit protection. Such branch-circuit protection must comply with applicable local regulations.
    UL: The Auxiliary (Fan) supply is Installation category II. Supply to Auxiliary (Fan) supply shall be provided by isolated transformer secondary grounded protected by a Listed 3A branch circuit fuse. The above-mentioned branch-circuit protection is necessary for compliance with National Electric Code (NEC) requirements.
25. EPower 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 EPower supplier for advice.

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

## Reasonable use and responsibility

The information contained in this manual is subject to change without notice. While every effort has been made to ensure the accuracy of the information, your supplier shall not be held liable for errors contained herein.

EPower is an "AC semiconductor controllers for non-motor loads" designed according to IEC60947-4-3 & UL60947-4-1, it meets the requirements of the Low voltage and EMC European Directives which covers safety and EMC aspects

Use in other applications, or failure to observe the installation instructions of this manual may impair safety or EMC.

The safety and EMC of any system incorporating this product is the responsibility of the assembler/installer of the system.

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

Eurotherm shall not be held responsible for any damage, injury, losses or expenses caused by inappropriate use of the product (EPower), or failure to comply with these instructions.

## ⚠ WARNING

**HAZARD OF FIRE**

1. EPower has been designed for a maximum temperature of 40°C at 1000m altitude at nominal current (35°C at 2000m altitude at nominal current), refer to derating curve for upper temperature. At commissioning ensure that the ambient temperature inside the cabinet does not exceed the limit under maximum load condition.
2. 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.
3. To reach the thermal performance the gap between two EPower must be at minimum 10mm.
4. The Driver Module power supply can work from any supply voltage between 85V ac and 265V ac. The fans (if fitted) on the power modules are specified for use at 115V ac or 230V ac, as defined at time of order. It must therefore be ensured that the fan voltage matches the supply voltage, or the fan will either fail within a short period, or it will be ineffective at cooling.
5. To maintain maximum cooling efficiency, the heat-sink and fans must be cleaned regularly and fan operation need to be checked. Periodicity depends on the local environment, but should not exceed 1 year.
6. Product current rating must be upper or equal to the maximum current of the load. The maximum current of the load shall be calculated taking account of load resistive tolerance (tolerance and variation due to temperature) and voltage tolerance. Failure to follow these instructions may result in Branch circuit protection fuses, high-speed fuses (supplemental fuses) and product overload.
7. Current limit function by phase angle reduction may be selected to limit the inrush current of the load and reduce the current rating of the product.
   With Current limit function by phase angle reduction the product rating must be greater than or equal to the nominal current of the load and to Current limit function by phase angle reduction setting.
8. With External current feedback, Current limit function by phase angle reduction will limit the inrush current in the load which may not be the current in the product (ie resistive load at the secondary side of a transformer). Ensure that the current in the product does not exceed the product current rating with the setting of Current limit function by phase angle reduction.
9. The current limit function by phase angle reduction is not available with Intelligent Half Cycle (IHC), The product rating shall be selected to cope with inrush current according to warning 6. Failure to follow these instructions may results in Branch circuit protection fuses, high-speed fuses (supplemental fuses) and product overload.
10. Duty cycle current limiting features (in burst mode), does not limit the peak current value. The product rating shall be selected to cope with the peak current value according to warning 6. Failure to follow these instructions may results in Branch circuit protection fuses, high-speed fuses (supplemental fuses) and product overload.

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

## ⚠ WARNING

**HAZARD OF ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH**

11. 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.
12. In 4S, 6D and two-leg configurations do not use the reference terminal to replicate voltage signals (in a 'daisy chain'), as the PCB track between the two poles is not designed to withstand short-circuit.

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

## ⚠ WARNING

**UNINTENDED EQUIPMENT OPERATION**

13. External feedback connections must be correctly phased (figure 2.2.2b) or the unit might switch to full conduction at start-up.
14. With external feedback: The current transformer should be chosen such that its full-scale output is 5 amps
15. Signal and power voltage wiring must be kept separate from one another. Where this is impractical, all wires must be rated to the power voltage & shielded cables are recommended for signal wiring.
16. 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.
17. To ensure that EPower complies with Electromagnetic Compatibility requirements, ensure that the panel 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.

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

## ⚠ CAUTION

**HAZARD OF BURNS**

1. Under some circumstances, the EPack 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.
   Ensure that any contact with hot surfaces is avoided.
   Do not allow flammable or heat-sensitive parts in the immediate vicinity of hot surfaces
   Give consideration to additional warnings and barriers to prevent injury.

**Failure to follow these instructions can result in injury or equipment damage.**

## ⚠ CAUTION

**UNINTENDED EQUIPMENT OPERATION**

2. In burst mode and primary of transformer load, the star-star configuration is not recommended as it may become unstable, high speed fuse may blow.
3. Fans have limited lifetime which depends on environment. As preventive maintenance their periodic replacement need to be considered.

**Failure to follow these instructions can result in injury or equipment damage.**

## *NOTICE*

**EQUIPMENT PROTECTION**

1. For software versions prior to version 3 only. The EEPROM, used to retain configuration parameters whilst power is off, has a lifetime of at least 100,000 writes. If the Fieldbus Gateway is configured to include such configuration parameters (see list below), then the lifetime of the EEPROM may be reduced. In this case an 'EE Checksum Fail Error' message appears at power up, and the Driver Module will fail to start, and will have to be replaced.
2. In order to maintain protection against damage due to electrostatic discharge, any ribbon cable which is chafed, scratched or otherwise damaged must be replaced. Periodicity depends on the local environment, but should not exceed 1 year.

**Failure to follow these instructions can result in equipment damage.**

### SELV

Safety Extra Low Voltage. This is defined (in EN60947-1) as an electrical circuit in which the voltage cannot exceed 'ELV' under normal conditions or under single fault conditions, including earth faults in other circuits. The definition of ELV is complex as it depends on environment, signal frequency etc. See IEC 61140 for further details.

## SYMBOLS USED ON 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 |

Complies with the 40 year Environment Friendly Usage Period

### Hazardous Substances

This product conforms to European Restriction of Hazardous Substances (RoHS) (using exemptions) and Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) Legislation.

RoHS Exemptions used in this product involve the use of lead. China RoHS legislation does not include exemptions and so lead is declared as present in the China RoHS Declaration.

Californian law requires the following notice:

⚠WARNING: This product can expose you to chemicals including lead and lead compounds which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to: http://www.P65Warnings.ca.gov.

# USER GUIDE

## 1 INTRODUCTION

This document describes the installation, operation and configuration of an EPower 'station' (Driver Module plus one or more Power Modules). The Driver Module comes in one version, but the Power Modules are available in a number of different power ratings, which are identical in operation and configuration, but which differ in physical size according to the number of phases being controlled and the maximum current being supplied. All but the 50 Amp and 100 Amp unit come with cooling fans attached.

The Driver Module includes the following analogue and digital inputs and outputs, fitted as standard:
10V supply
Two analogue inputs
One analogue output
Two digital Inputs/Outputs.
One change-over relay under software control, configurable by the user.
Also fitted are a Watchdog relay, a configuration port and an isolated EIA485 port for attaching an optional Remote Display.

Three further (optional) I/O modules may be fitted, similar to the standard module but with the addition of an output change-over relay. Other options provide for external voltage and current feedback and for predictive load management.

Section two of this manual gives connector locations and pinouts.

The operator interface consists of a display comprising four lines of 10-characters (where each character is formed using a 5 x 7 LCD dot matrix) and four push buttons for navigation and data selection.

### 1.1 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, open them immediately and examine the instrument. If there is evidence of damage, do not operate the instrument and contact your local representative for instructions.

After the instrument has been removed from its packing, examine the packing to ensure that all accessories and documentation have been removed.

Store the packing for future transport requirements. Or please dispose of your packaging in a responsible and environmentally conscious manner. Where possible, reuse or recycle materials. Please ensure all disposal and recycling is undertaken in compliance with your local law and regulations.

# 2 INSTALLATION

**DANGER**

The product is designed to be installed in a cabinet connected to the protective earth ground

CE: protective earth ground minimum size must be selected according to IEC 60364-5-54 table 54.2 or IEC61439-1 table 5 or applicable national standards

U.L.: protective earth ground minimum size must be selected according to NEC table 250.122 or NFPA79 table 8.2.2.3 or applicable national standards.

**DANGER**

The product is not suitable for isolation applications, within the meaning of EN60947-1.

**WARNINGS**

1. EPower has been designed for a maximum temperature of 40°C at 1000m altitude at nominal current (35°C at 2000m altitude at nominal current), refer to derating curve for upper temperature. At commissioning ensure that the ambient temperature inside the cabinet does not exceed the limit under maximum load condition.
2. 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.
3. To reach the thermal performance the gap between two EPower units must be at minimum 10mm.

## 2.1 MECHANICAL INSTALLATION

### 2.1.1 Fixing details

Units are designed to operate at an operating temperature not exceeding 40°C (unless the modules are de-rated - see specification). Units must be installed in a fan-cooled cabinet (with fan failure detection or thermal safety cutout). Condensation and conductive pollution should be excluded to IEC 60664-1 pollution degree 2. The cabinet must be closed and connected to the protective earth according to IEC 60634 or applicable national standard.

Units must be mounted with the heat sink vertical with no obstructions above or below which impede the airflow. Where more than one set of modules is enclosed in the same cabinet, they must be mounted such that air from one unit is not drawn in by another mounted above it. An air gap of at least 5 cm should be maintained between adjacent sets of modules.

The units are designed for fitting to the front face of a mounting panel using the fixings supplied. The thyristor power modules are heavy, so a Health and Safety risk assessment should be carried out before personnel attempt to lift the units. It should also be ensured, prior to fitting, that the mechanical strength of the panel is sufficient for the mechanical load being applied. Table 2.1.1 gives the weights of the various units.

**GENERAL**

Figure 2.1.1a, below, shows details of a generalised mechanical assembly for the top of the units. Assembly details for the bottom brackets is similar, except that there is no protective earth ground fixing. The power module shown is a 400 Amp unit for which the module is fixed to the support brackets using holes A and B. Lower current power modules use only one screw (C) to secure the module to the support bracket.

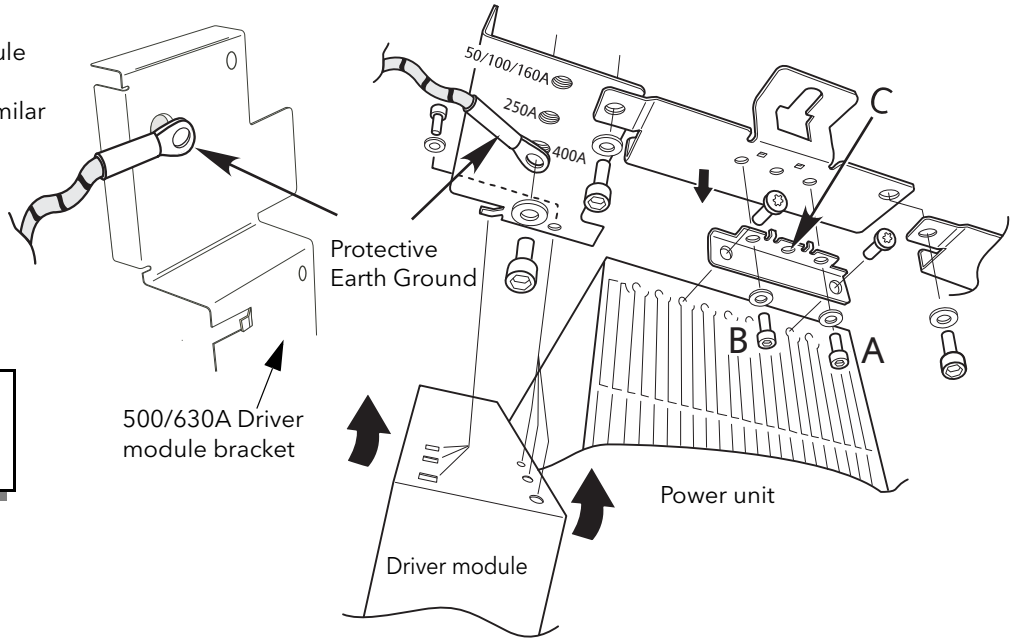
| Current | Weight (including 2 kg (4.4 lb) for driver module) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 phase | | 2 phases | | 3 phases | | 4 phases | |
| | kg | lb | kg | lb | kg | lb | kg | lb |
| 50/100 A | 6.5 | 14.3 | 11.0 | 24.3 | 15.5 | 34.2 | 20.0 | 44.1 |
| 160 A | 6.9 | 15.2 | 11.8 | 26.0 | 16.7 | 36.8 | 21.6 | 47.6 |
| 250 A | 7.8 | 17.2 | 13.6 | 30.0 | 19.4 | 42.8 | 25.2 | 55.6 |
| 400 A | 11.8 | 26.0 | 21.6 | 47.6 | 31.4 | 69.2 | 41.2 | 90.8 |
| 500 A | 14.0 | 30.9 | 26.0 | 57.3 | 38.0 | 83.8 | 50.0 | 110.2 |
| 630 A | 14.5 | 32.0 | 27.0 | 59.5 | 39.5 | 87.1 | 52.0 | 114.6 |

Weights ± 50gm (2 oz)

| lb | oz |
|---|---|
| 0.1 | 1.6 |
| 0.2 | 3.2 |
| 0.3 | 4.8 |
| 0.4 | 6.4 |
| 0.5 | 8.0 |
| 0.6 | 9.6 |
| 0.7 | 11.2 |
| 0.8 | 12.8 |
| 0.9 | 14.4 |

Table 2.1.1 Unit Weights

Single-phase power module mounting shown.
Multi-phase mountings similar

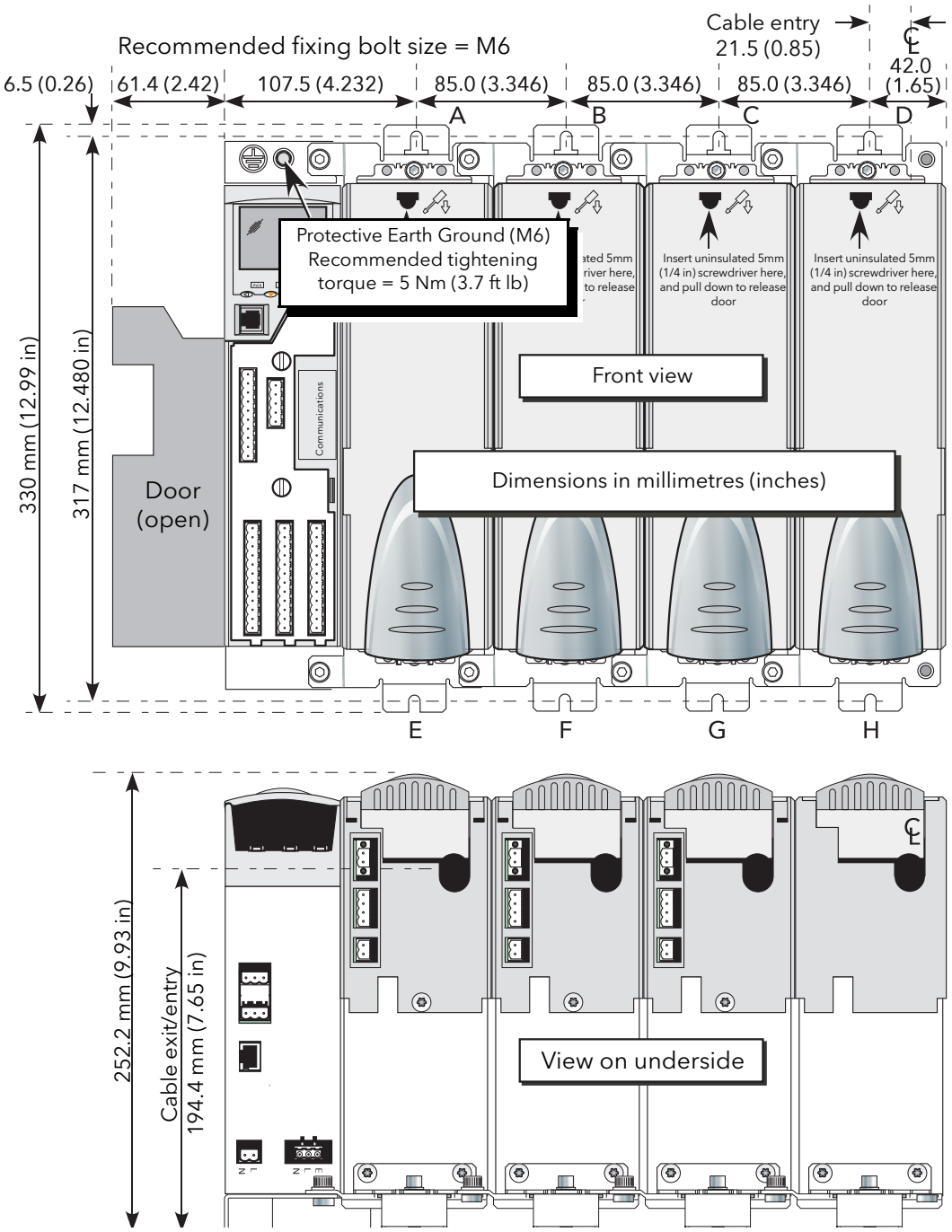



See table 2.2.1 for Protective Earth Ground details

Figure 2.1.1a Bracket fixing details

## 2.1.1 FIXING DETAILS (Cont.)

Figures 2.1.1a to 2.1.1f show fixing centres and other mechanical details for the various modules.




| Overall Widths (mm) | | | | |
|---|---|---|---|---|
| No of phases | 1 | 2 | 3 | 4 |
| Door closed | 149.5 | 234.5 | 319.5 | 404.5 |
| Door open | 211.0 | 296.0 | 381.0 | 466.0 |

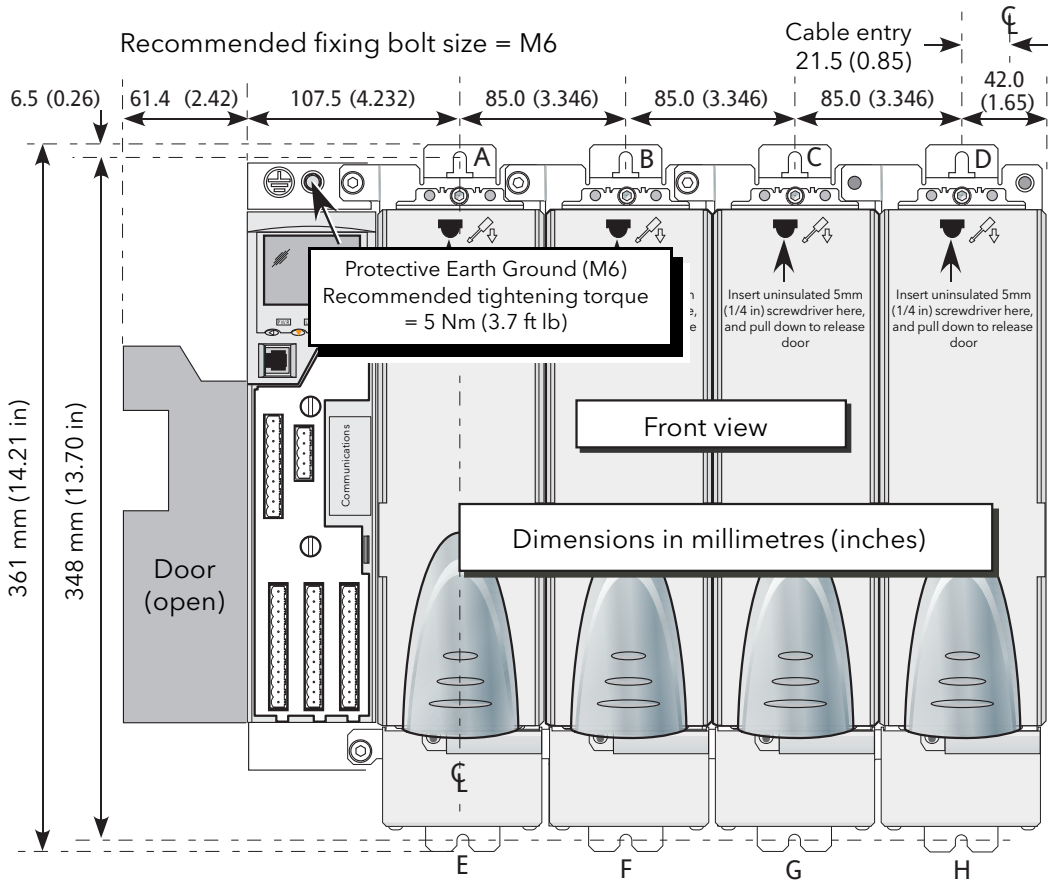
Note: Units are shown with individual mounting brackets. Multi-phase units come supplied with two, three or four phase brackets as appropriate. See table below for details.

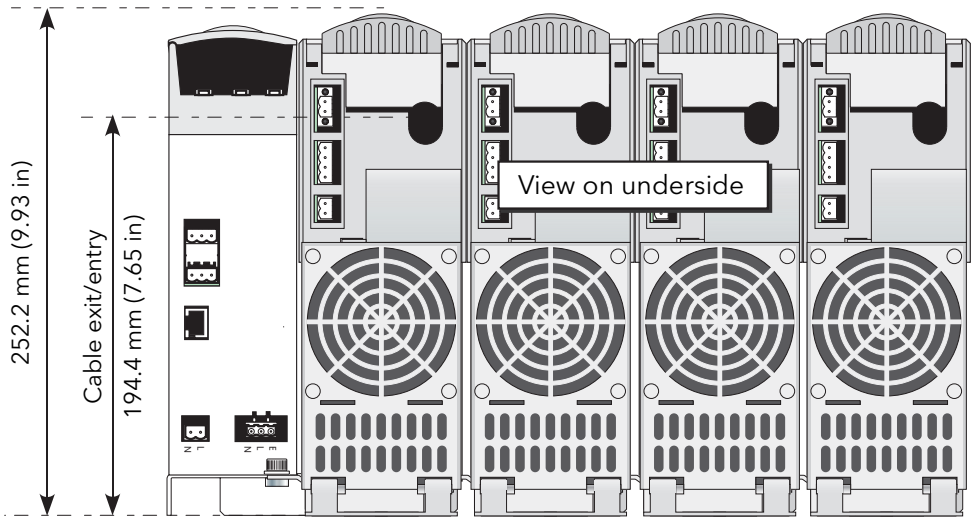
| Overall Widths (inches) | | | | |
|---|---|---|---|---|
| No of phases | 1 | 2 | 3 | 4 |
| Door closed | 5.89 | 9.23 | 12.58 | 15.93 |
| Door open | 8.31 | 11.65 | 15.00 | 18.35 |

| | Upper bracket | Lower bracket |
|---|---|---|
| 2-phase | Use A and B | Use E and F |
| 3-phase | Use A, B and C | Use E and G |
| 4-phase | Use A, B, C and D | Use E, F, G and H |

Figure 2.1.1b Fixing details (50 Amp and 100 Amp units)

## 2.1.1 FIXING DETAILS (Cont.)




| Overall Widths (mm) | | | | |
|---|---|---|---|---|
| No of phases | 1 | 2 | 3 | 4 |
| Door closed | 149.5 | 234.5 | 319.5 | 404.5 |
| Door open | 211.0 | 296.0 | 381.0 | 466.0 |

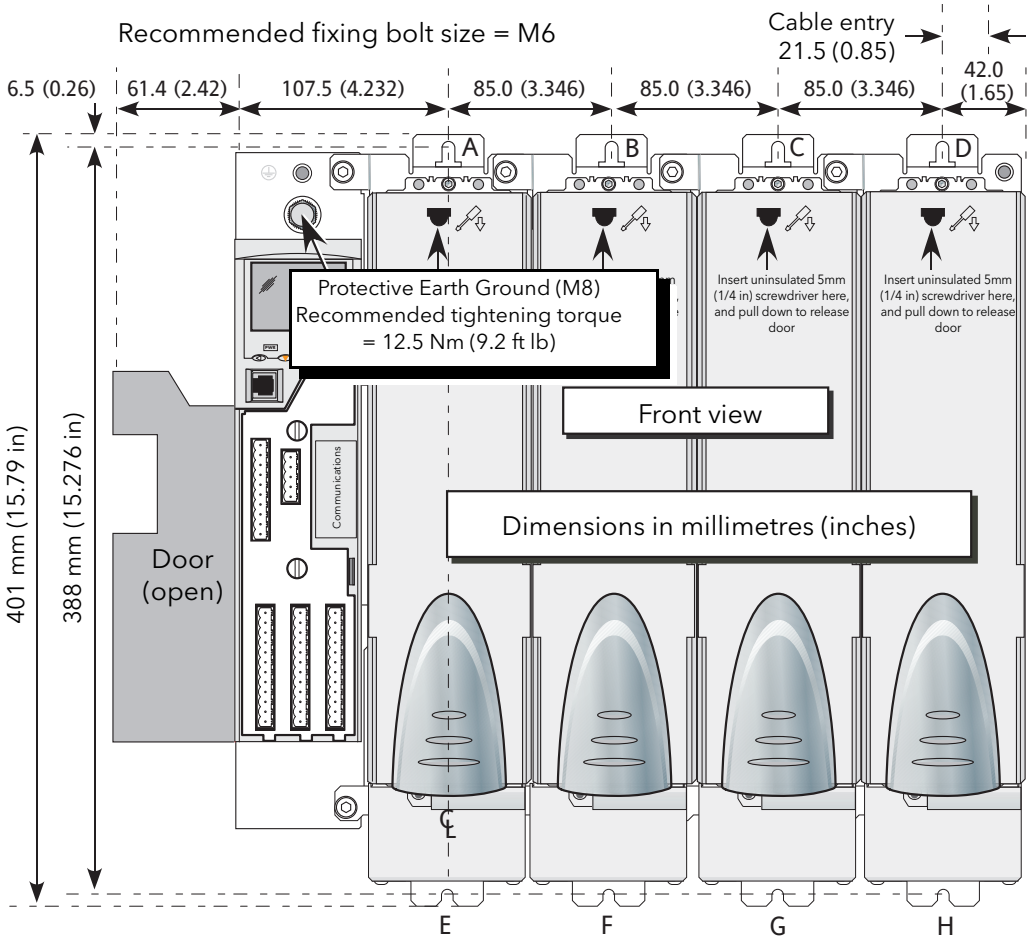
Note: Units are shown with individual mounting brackets. Multi-phase units come supplied with two, three or four phase brackets as appropriate. See table below for details.

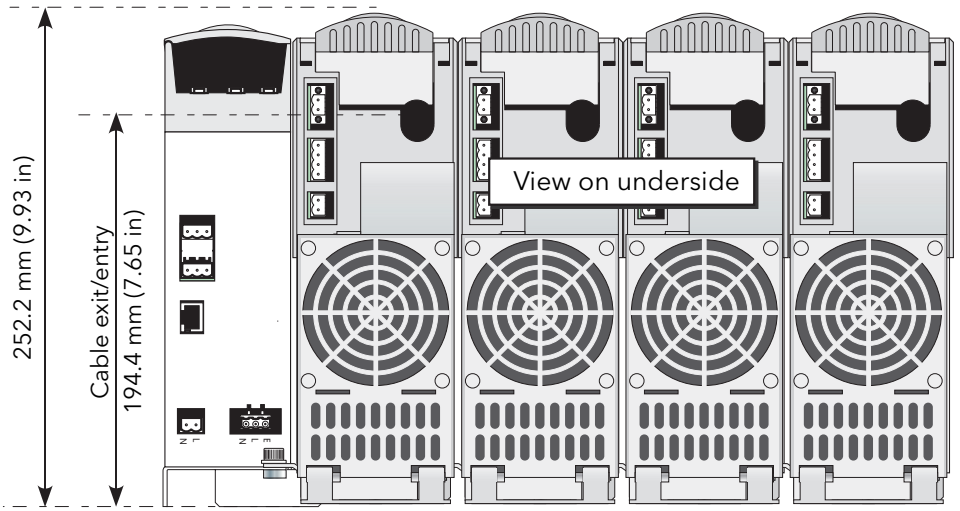
| Overall Widths (inches) | | | | |
|---|---|---|---|---|
| No of phases | 1 | 2 | 3 | 4 |
| Door closed | 5.89 | 9.23 | 12.58 | 15.93 |
| Door open | 8.31 | 11.65 | 15.00 | 18.35 |

| | Upper bracket | Lower bracket |
|---|---|---|
| 2-phase | Use A and B | Use E and F |
| 3-phase | Use A, B and C | Use E, F and G |
| 4-phase | Use A, B, C and D | Use E, F, G and H |

Figure 2.1.1c Fixing details (160 Amp unit)

## 2.1.1 FIXING DETAILS (Cont.)




| Overall Widths (mm) | | | | |
|---|---|---|---|---|
| No of phases | 1 | 2 | 3 | 4 |
| Door closed | 149.5 | 234.5 | 319.5 | 404.5 |
| Door open | 211.0 | 296.0 | 381.0 | 466.0 |

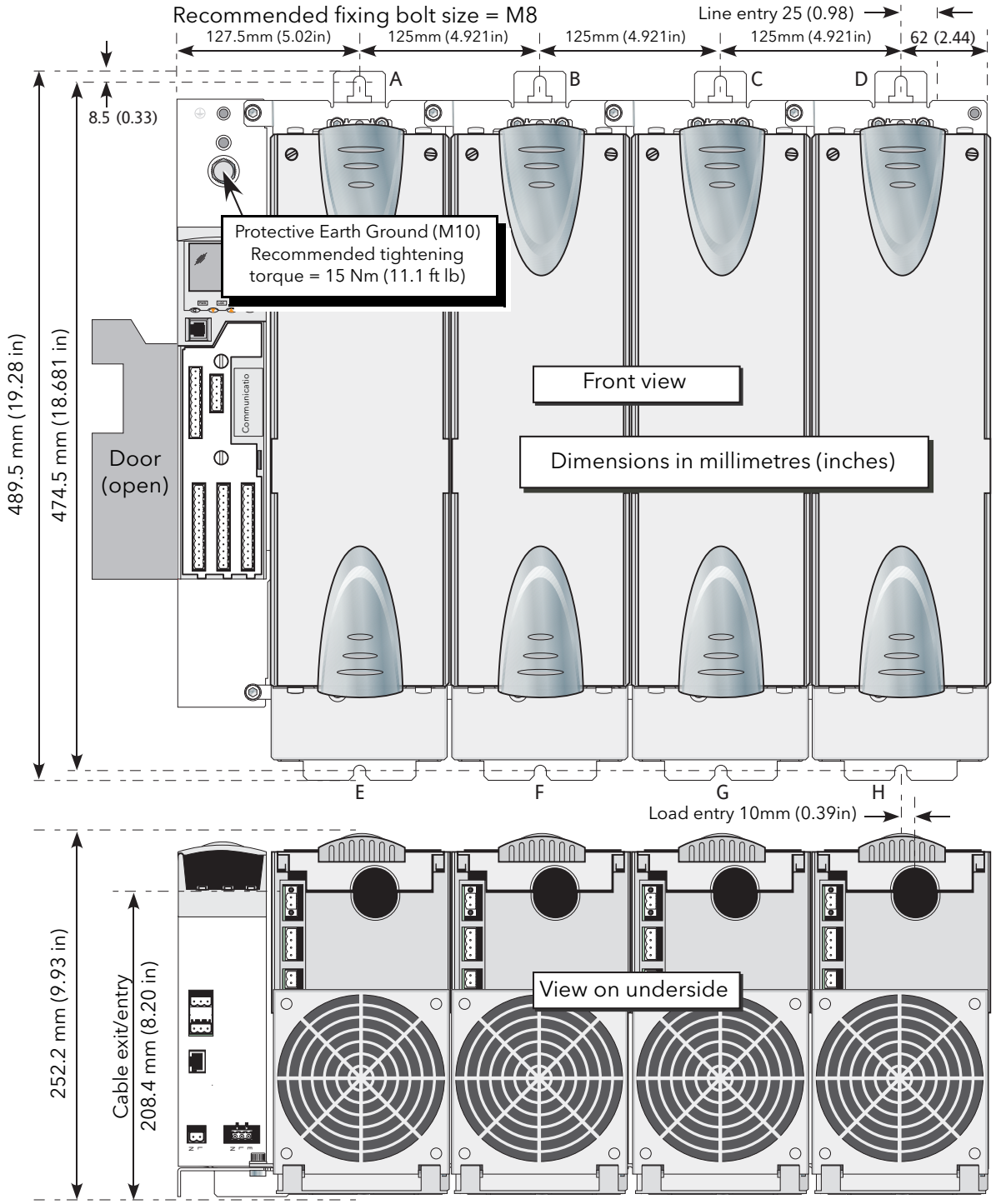
Note: Units are shown with individual mounting brackets. Multi-phase units come supplied with two, three or four phase brackets as appropriate. See table below for details.

| Overall Widths (inches) | | | | |
|---|---|---|---|---|
| No of phases | 1 | 2 | 3 | 4 |
| Door closed | 5.89 | 9.23 | 12.58 | 15.93 |
| Door open | 8.31 | 11.65 | 15.00 | 18.35 |

| | Upper bracket | Lower bracket |
|---|---|---|
| 2-phase | Use A and B | Use E and F |
| 3-phase | Use A, B and C | Use E, F and G |
| 4-phase | Use A, B, C and D | Use E, F, G and H |

Figure 2.1.1d Fixing details (250 Amp unit)

## 2.1.1 DIMENSIONAL DETAILS (Cont.)




| Overall Widths (mm) | | | | |
|---|---|---|---|---|
| No of phases | 1 | 2 | 3 | 4 |
| Door closed | 189.5 | 314.5 | 439.5 | 564.5 |
| Door open | 251.0 | 376.0 | 501.0 | 626.0 |

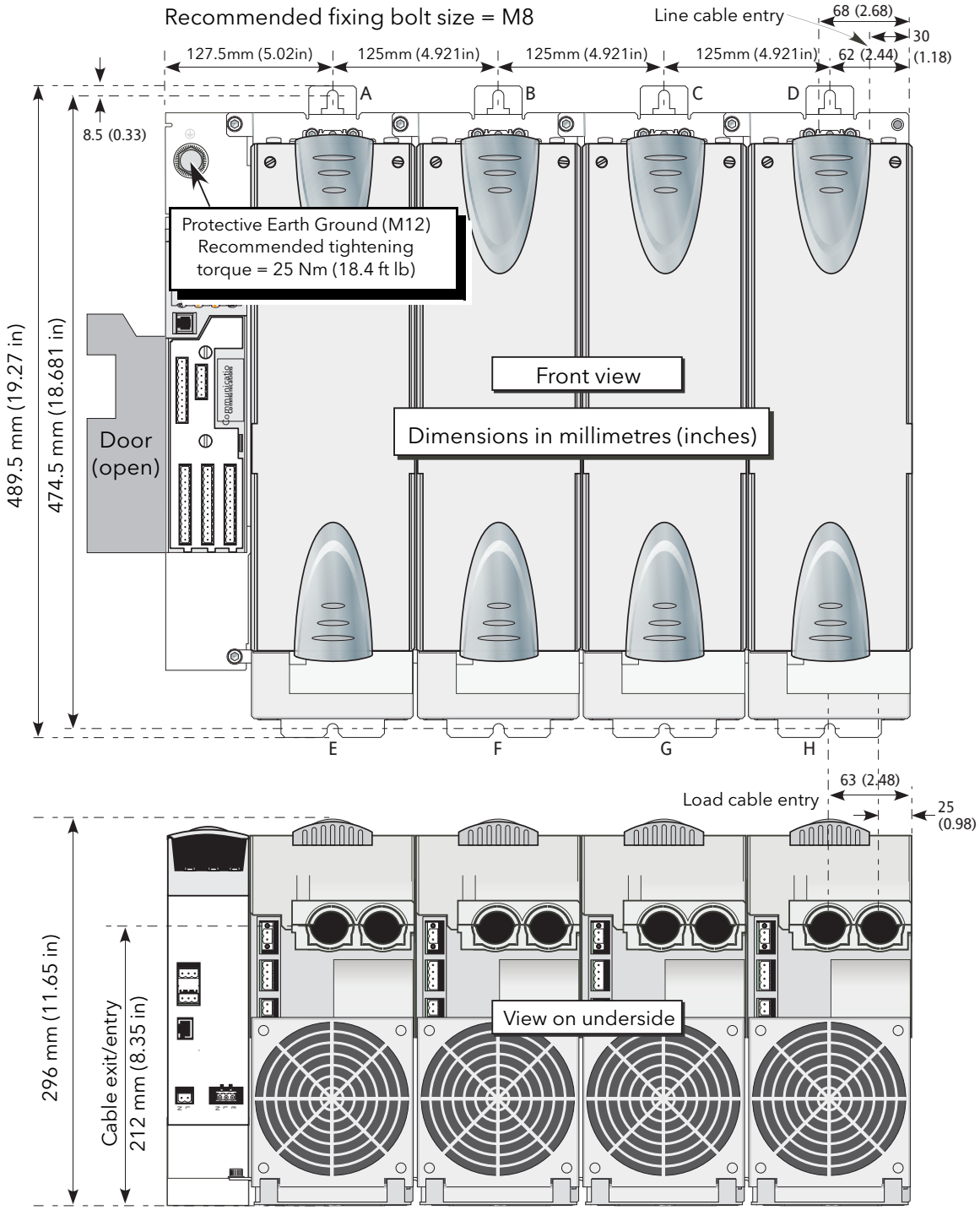
Note: Units are shown with individual mounting brackets. Multi-phase units come supplied with two, three or four phase brackets as appropriate. See table below for details.

| Overall Widths (inches) | | | | |
|---|---|---|---|---|
| No of phases | 1 | 2 | 3 | 4 |
| Door closed | 7.46 | 12.38 | 17.30 | 22.22 |
| Door open | 9.88 | 14.80 | 19.72 | 24.65 |

| | Upper bracket | Lower bracket |
|---|---|---|
| 2-phase | Use A and B | Use E and F |
| 3-phase | Use A, B and C | Use E, F and G |
| 4-phase | Use A, B, C and D | Use E, F, G and H |

Figure 2.1.1e Fixing details (400 Amp unit)

## 2.1.1 DIMENSIONAL DETAILS (Cont.)




| Overall Widths (mm) | | | | |
|---|---|---|---|---|
| No of phases | 1 | 2 | 3 | 4 |
| Door closed | 189.5 | 314.5 | 439.5 | 564.5 |
| Door open | 251.0 | 376.0 | 501.0 | 626.0 |

Note: Units are shown with individual mounting brackets. Multi-phase units come supplied with two, three or four phase brackets as appropriate. See table below for details.

| Overall Widths (inches) | | | | |
|---|---|---|---|---|
| No of phases | 1 | 2 | 3 | 4 |
| Door closed | 7.46 | 12.38 | 17.30 | 22.22 |
| Door open | 9.88 | 14.80 | 19.72 | 24.65 |

| | Upper bracket | Lower bracket |
|---|---|---|
| 2-phase | Use A and B | Use E and F |
| 3-phase | Use A, B and C | Use E, F and G |
| 4-phase | Use A, B, C and D | Use E, F, G and H |

Figure 2.1.1f Fixing details (500 Amp/630A units)

## 2.2 ELECTRICAL INSTALLATION

**DANGER**

1. If the product (EPower) is used in a manner not specified by the manufacturer, the protection provided by the product might be impaired.
2. Any adjustment, maintenance and repair of the opened apparatus under voltage, is forbidden for safety reasons.
3. The product must be installed and maintained by suitably qualified personnel, authorized to work in an industrial low voltage environment.
4. The product is designed to be installed in a cabinet connected to the protective earth ground
   CE: protective earth ground minimum size must be selected according to IEC 60364-5-54 table 54.2 or IEC61439-1 table 5 or applicable national standards
   U.L.: protective earth ground minimum size must be selected according to NEC table 250.122 or NFPA79 table 8.2.2.3 or applicable national standards
5. The product has been designed for pollution degree 2 according to IEC60947-1 definition: Normally, only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation may be expected.
   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.
6. 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.

**WARNING**

1. 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.

**WARNING**

1. Signal and power voltage wiring must be kept separate from one another. Where this is impractical, all wires must be rated to the power voltage & shielded cables are recommended for signal wiring.
2. 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.
3. To ensure that EPower complies with Electromagnetic Compatibility requirements, ensure that the panel 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.

### 2.2.1 Driver Module

**DANGER**

The mains supply fuse within the Driver Module is not replaceable. If it is suspected that the fuse is faulty, the manufacturer's local service centre should be contacted for advice.

## SUPPLY VOLTAGE

The Line and neutral supply voltage connections are terminated using a 2-way connector (SK8), located on the underside of the unit, as shown in figure 2.2.1a, below. It is recommended that a 3 Amp slow-blow fuse be incorporated in order to protect the supply voltage wiring.

The Auxiliary (Fan) supply is Installation category II. U.L.: supply to Auxiliary (Fan) supply shall be provided by isolated transformer secondary grounded protected by a Listed 20A branch circuit fuse.

## FAN SUPPLIES

**DANGER**

The cables used to connect the EPower auxiliary/fans supply must be correctly protected by 3A branch-circuit protection. (3A rating selected to protect AWG18 fan supply wiring). It is the responsibility of the installer to add branch-circuit protection. Such branch-circuit protection must comply with applicable local regulations.
UL: The Auxiliary (Fan) supply is Installation category II. Supply to Auxiliary (Fan) supply shall be provided by isolated transformer secondary grounded protected by a Listed 3A branch circuit fuse. The above-mentioned branch-circuit protection is necessary for compliance with National Electric Code (NEC) requirements.

**WARNING**

The Driver Module power supply can work from any supply voltage between 85V ac and 265V ac. The fans (if fitted) on the power modules are specified for use at 115V ac or 230V ac, as defined at time of order. It must therefore be ensured that the fan voltage matches the supply voltage, or the fan will either fail within a short period, or it will be ineffective at cooling.

The three way connector (SK9) provides supply voltage for cooling fans which are fitted to all power modules except 50A and 100A modules. Suitable looms (harnesses) for the fans are supplied with the units. SK9 is not used for 50/100A modules, because there are no cooling fans.

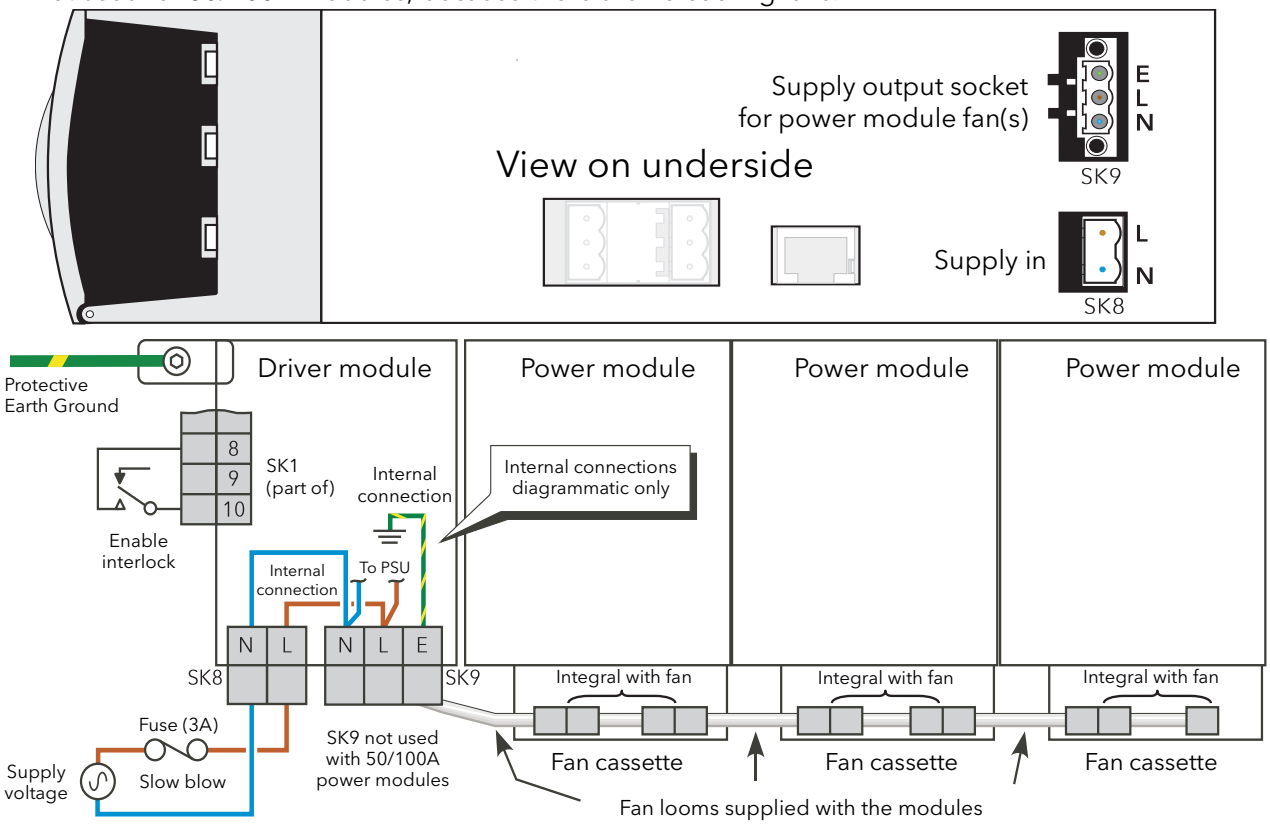



Figure 2.2.1a Driver module wiring

## 2.2.1 Driver Module (Cont.)

### ENABLE INPUT

In order for the power module thyristors to operate, the Enable input to the driver module must be valid, In the default configuration, this is achieved by shorting pins 8 and 10 of SK1 (Digital input 1 - figure 2.2.1b), or by using a User Value block to apply a logic high to the enable input to the relevant firing block in iTools.
If required, DI1 can be reconfigured as a voltage input, and in this case it requires a high signal (figure 2.2.1a) to be applied to SK1 pin8 with the relevant zero voltage connected to pin 10.

### PROTECTIVE EARTH GROUND

**DANGER**

1. Before any other connection is made, the protective earth ground terminal shall be connected to a protective conductor. The protective earth ground connection must be made by using a lug terminal of size as given in table 2.2.1. The cables must be rated 90°C stranded copper only
   CE: protective earth ground minimum size must be selected according to IEC 60364-5-54 table 54.2 or IEC61439-1 table 5 or applicable national standards
   U.L.: protective earth ground minimum size must be selected according to NEC table 250.122 or NFPA79 table 8.2.2.3 or applicable national standards. The protective earth ground connection must be made using a UL-listed lug terminal.
2. The protective earth ground connections must be tightened according to the torque values defined in table Protective Earth Ground Details. Appropriate regular inspections must be performed. Periodicity depends on the local environment, but should not exceed 1 year.
3. 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.

The protective earth ground connection for the driver/power module set is made to the mounting bracket above the unit as shown in figures 2.1.1a to 2.1.1f.
The connection must be made using the correct size of terminal and correct gauge of cable, as given in table 2.2.1 below.
The protective earth ground connection should be tightened at the torque defined in table 2.2.1. It is recommended to perform regular inspection of the tightening

| EPower rating (Amps) | Protective Earth Ground Terminal | |
|---|---|---|
| | Size | Tightening torque |
| 50A | M6 | 5 Nm (3.7 ft lb.) |
| 100A | M6 | 5 Nm (3.7 ft lb.) |
| 160A | M6 | 5 Nm (3.7 ft lb) |
| 250A | M8 | 12.5 Nm (9.2 ft lb) |
| 400A | M10 | 15 Nm (11.1ft lb) |
| 500A | M12 | 25 Nm (18.4 ft lb) |
| 630A | M12 | 25 Nm (18.4 ft lb) |

Table 2.2.1 Protective Earth Ground details

## SIGNAL WIRING

Figure 2.2.1b shows the location of the various connectors; pinouts and typical wiring for SK1 (fitted as standard) are shown in figure 2.2.1a. Wiring for optional I/O units (SK 3 to SK5) is similar, except that they contain a relay in addition to the analog and digital circuits, and the digital circuits are inputs only.

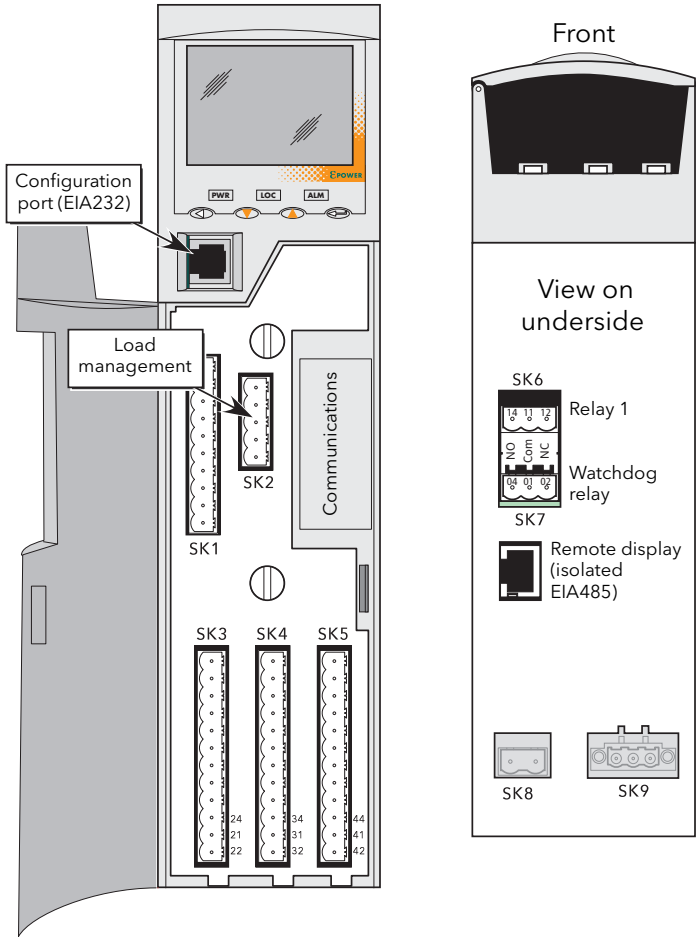


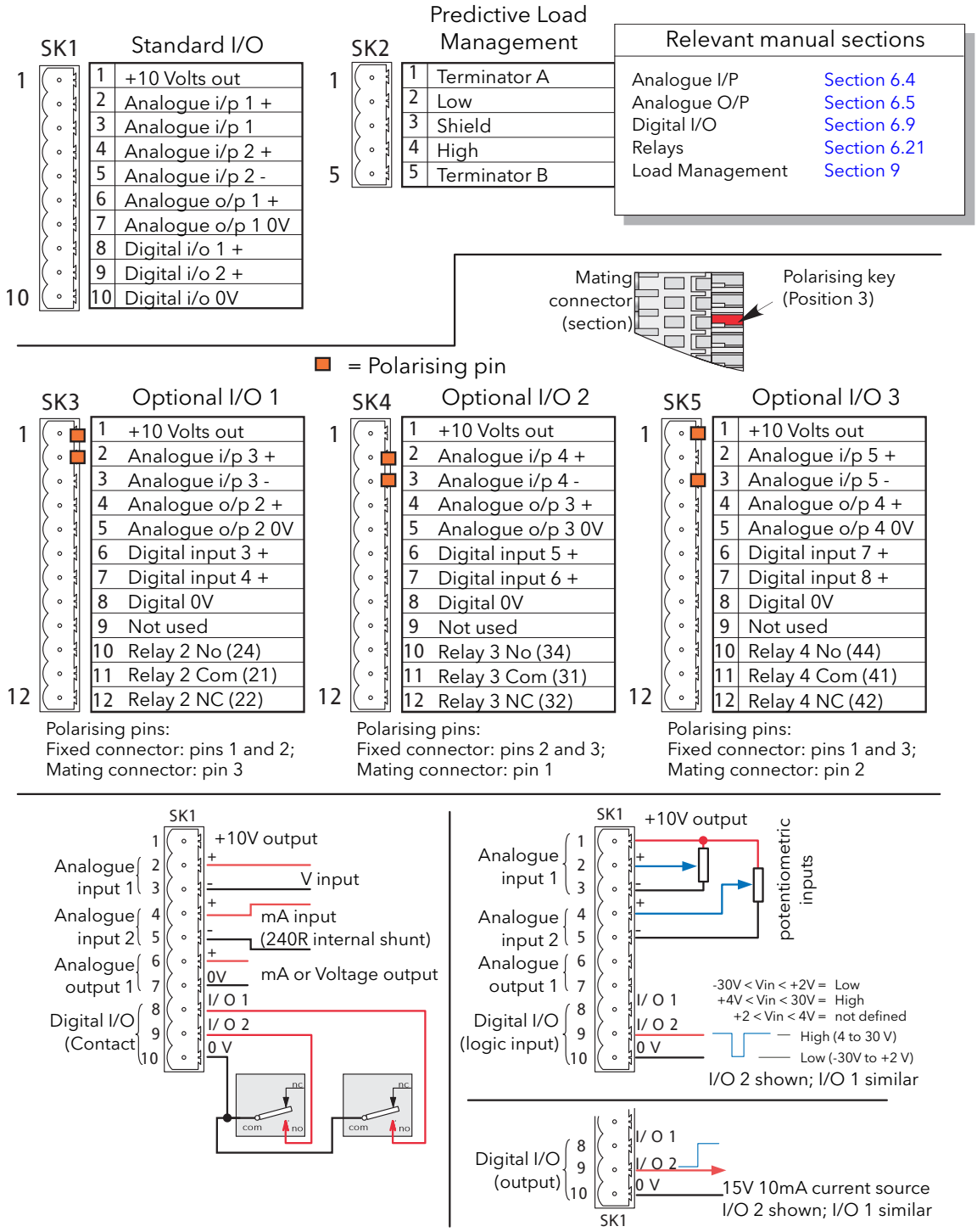

Figure 2.2.1b Connector locations

Note: It is physically possible to insert an RJ11 plug into an RJ45 socket. Care must therefore be taken to ensure that the Configuration port cable is not mistakenly plugged into an RJ45 communications connector (if fitted) or the Remote display connector.

| Connector | Terminal Capacity | Torque |
|---|---|---|
| SK1 to SK5 | 0.5 mm² to 1.5mm²<br>22 AWG to 14 AWG | 0.4 Nm<br>3.5 lb.in |
| SK6 to SK8 | 0.25 mm² to 2.5mm²<br>24 AWG to 12 AWG | 0.55 Nm<br>5 lb.in |

Table 2.2.1 I/O terminals connections details

## 2.2.1 Driver Module (Cont.)




Notes:

1. Analogue input type selected during configuration as one of: 0 to 5V, 0 to 10V, 1 to 5V, 2 to 10V, 0 to 20mA, 4 to 20 mA
2. Analogue output type selected during configuration as one of : 0 to 5V, 0 to 10V, 0 to 20mA, 4 to 20mA. Resolution 12 bits; accuracy ±1% scale.
3. Each analogue input -ve terminal is individually connected to 0V via a 150 Ohm resistor.

Figure 2.2.1a Driver unit connector pinouts

## 2.2.1 Driver Module (Cont.)

### WATCHDOG RELAY

The 'watchdog' relay is wired to a connector on the underside of the Driver Module (figure 2.2.1b).

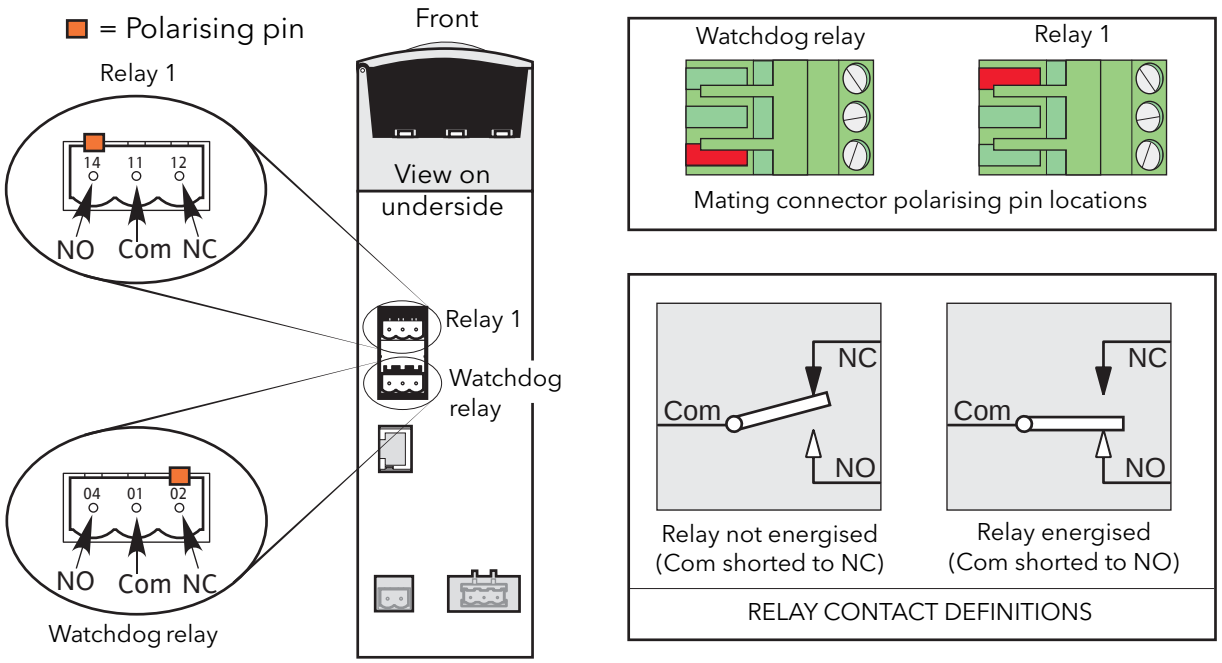



Figure 2.2.1b Relay connector location and pinout.

Under normal operating conditions, the watchdog relay is energised (that is the common and normally open contacts are shorted). Should a system error (listed below) become active (or power to the Driver Module fail), the relay is de-energised (common and normally closed contacts shorted).

1. Missing mains. One or more Power Module supply voltage lines is missing.
2. Thyristor short circuit*
3. Thyristor open circuit*
4. Fuse Blown. Thyristor-protection fuse ruptured in one or more Power Modules.
5. Unit over temperature
6. 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, and can be defined by the user in the Network.Setup menu, as described in section 6.20.2.
7. Supply frequency fault. 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. The threshold value (FreqDriftThold) is defined in the Network.Setup menu described in section 6.20.2.
8. Power Module 24V Failure.

* Note: It is not possible to detect a thyristor short circuit when the unit is delivering 100% output power. Similarly, it is not possible to detect thyristor open circuit when the unit is delivering 0% output.

### RELAY 1

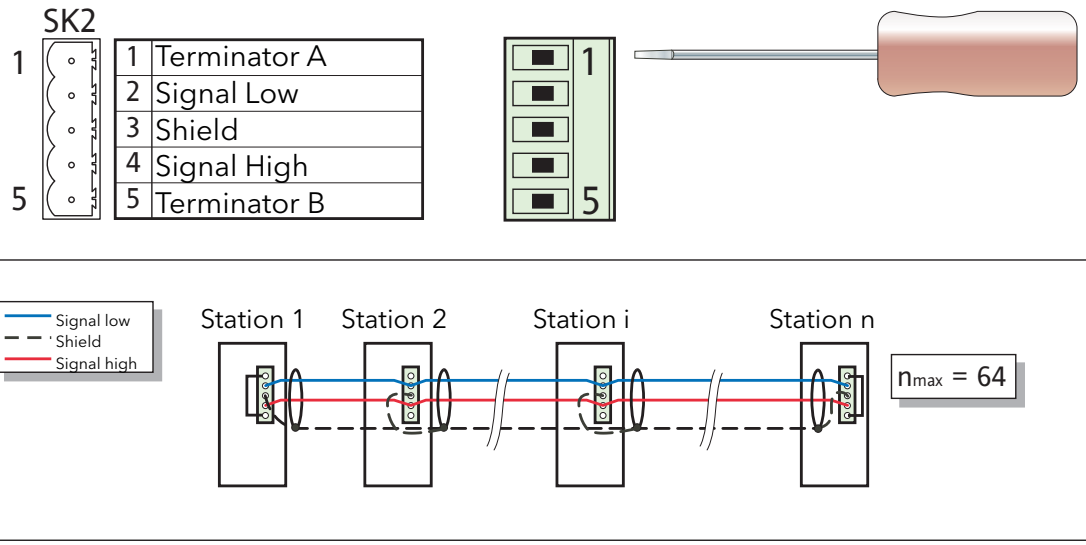
This relay, supplied as standard, is located adjacent to the watchdog relay (figure 2.2.1b). The energisation/de-energisation of the relay coil is under software control and is fully configurable by the user. The terms Normally open (NO) and Normally closed (NC) refer to the relay in its de-energised state. Up to three further relays are available if optional I/O Modules are fitted (see figure 2.2.1a).

## 2.2.1 Driver Module (Cont.)

### PREDICTIVE LOAD MANAGEMENT OPTION CONNECTOR

This option allows a number of systems to communicate with one another to allow load management techniques such as Load Sharing and Load Shedding to be implemented. The connector is located as shown in figure 2.2.1b.

Note: Connecting pins 1 and 5 together has the effect of introducing a terminating (120 Ohm) resistor across pins 2 and 4. It is recommended that this be done at each end of the transmission line.




| |
|---|
| Maximum Trunk line length = 100 metres (328 ft) |
| Maximum individual drop length = 5 metres (16 ft) |
| Maximum cumulative drop length = 30 metres (98 ft) |
| Conductor pair size = 24 gauge (0.25 $mm^2$) |
| Characteristic impedance at 500kHz = 120 Ohms ±10% |
| Nominal capacitance @ 800Hz = ≤40pF |
| Unbalance capacitance = ≤4 ± 10%pF/m |
| Capacitance between conductors = 100pF/metre) |
| Attenuation at 500kHz = 1.64dB/100 metres) |

Note: The figures above are for a network of up to 100 metres with up to 64 units connected. The actual network impedance is a function of cable type, cable length and the number of units connected. For futher details contact the manufacturer or local agent.

Figure 2.2.1c Predictive Load Management wiring

**Load Sharing**

In a system with several heating zones, this allows a strategy to be implemented which distributes power over time in such a way that the overall power consumption remains as steady as possible, thus reducing the peak power demand of the system.

**Load Shedding**

In a system with several heating zones, this allows a strategy to be implemented which limits the available load power at each heating zone and/or switches zones off according to a defined priority level, thus allowing the maximum running power consumption to be controlled. The total running power is the maximum power supplied to the loads, integrated over a 50 minute period.

See the Predictive Load Management option description (section 9), for more details.

## 2.2.1 Driver Module (Cont.)

### CONFIGURATION PORT

This RJ11 connector located on the front of the Driver Module (figure 2.2.1b) is used for direct connection to a PC using EIA232C standard.

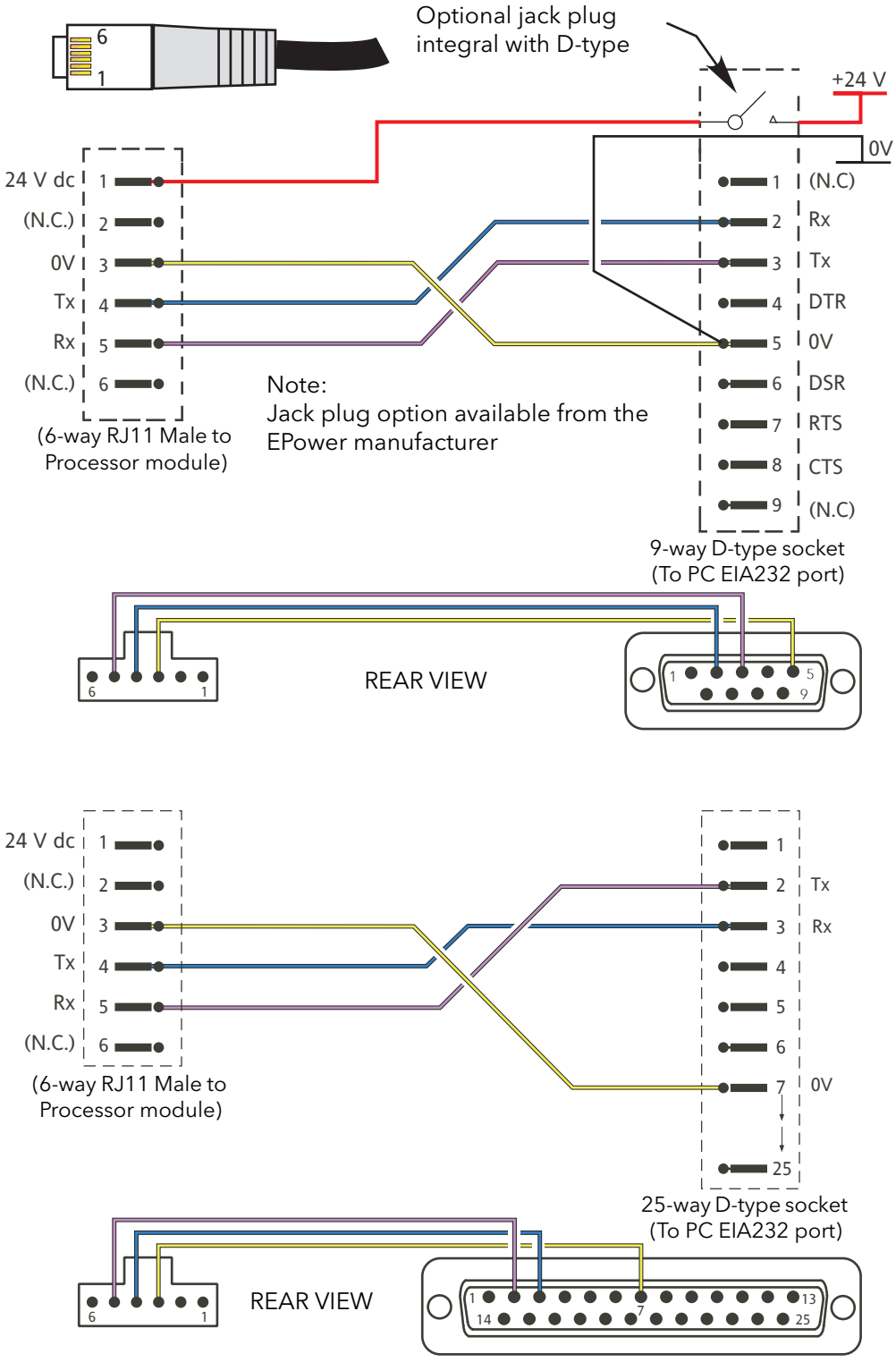
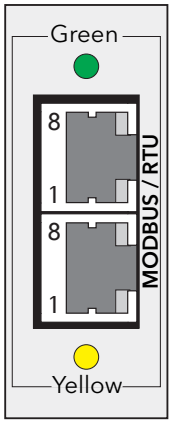



Figure 2.2.1d Configuration port wiring details

## 2.2.1 Driver Module (Cont.)

### COMMUNICATIONS PINOUTS

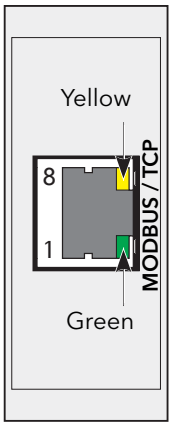
Serial communications is discussed in the Communications Manual HA179770. Pinouts for the relevant protocols are given here for convenience.




Connectors in parallel

| Pin | Signal (EIA485) |
|---|---|
| 8 | Reserved |
| 7 | Reserved |
| 6 | N/C |
| 5 | N/C |
| 4 | N/C |
| 3 | Isolated 0V |
| 2 | A |
| 1 | B |
| Internal connections: Pin 1 to 5V via 100kΩ Pin 2 to 0V via 100kΩ | |
| LEDs: Green = Tx activity Yellow = Rx activity | |

Figure 2.2.1e Modbus RTU pinout




| Pin | Function |
|---|---|
| 8 | N/C |
| 7 | N/C |
| 6 | Rx- |
| 5 | N/C |
| 4 | N/C |
| 3 | Rx+ |
| 2 | Tx- |
| 1 | Tx+ |
| LEDs: Green = Tx activity Yellow = Network activity | |

Figure 2.2.1h Modbus TCP (Ethernet 10baseT) pinout


| NS (Network status) LED (1) | |
|---|---|
| LED state | Interpretation |
| Off | No power or no IP address |
| Steady green | Module is in Process Active or Idle state |
| Flashing green | On-line, waiting for connection |
| Steady red | Duplicate IP address, or FATAL event |
| Flashing red | Process Active Timeout |

| MS (Module status) LED (2) | |
|---|---|
| LED state | Interpretation |
| Off | No power |
| Steady green | Normal operation |
| Steady red | Major fault (Exception state, fatal error etc.) |
| Flashing red | Minor fault in diagnostic object, IP conflict |

| LINK LED (3, 4) | |
|---|---|
| LED state | Interpretation |
| Off | No link; no activity |
| Steady green | Link established |
| Flickering green | Activity |

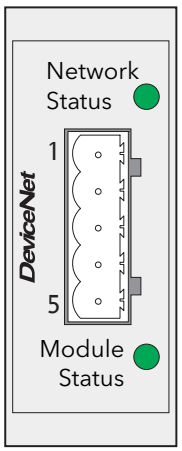
Figure 2.2.1i Modbus TCP connector pinout, double port version

### 2.2.1 Driver Module (Cont.)

## COMMUNICATIONS PINOUTS (Cont.)

| Network status LED Indication | |
|---|---|
| LED state | Interpretation |
| Off | Off-line or no power |
| Steady green | On-line to 1 or more units |
| Flashing green | On-line - no connections |
| Steady red | Critical link failure |
| Flashing red | 1 or more connections timed out |

| Module status LED Indication | |
|---|---|
| LED state | Interpretation |
| Off | No power |
| Steady green | Operating normally |
| Flashing green | Missing or incomplete configuration |
| Steady red | Unrecoverable fault(s) |
| Flashing red | Recoverable fault(s) |



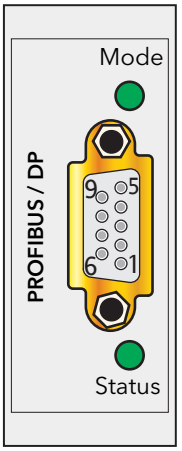

| Pin | Function |
|---|---|
| 1 | V- (negative bus supply voltage) |
| 2 | CAN_L |
| 3 | Cable shield |
| 4 | CAN_H |
| 5 | V+ (positive bus supply voltage). |

Notes:
1. See DeviceNet specification for power supply specification
2. During startup, an LED test is performed, satisfying the DeviceNet standard.

Figure 2.2.1j DeviceNet® connector pinout

| OPERATION MODE LED INDICATION | |
|---|---|
| LED state | Interpretation |
| Off | Off line or no power |
| Steady green | On-line, data exchange |
| Flashing green | On-line, clear |
| Red single flash | Parametrisation error |
| Red double flash | PROFIBUS configuration error |

| STATUS LED INDICATION | |
|---|---|
| LED state | Interpretation |
| Off | No power or not initialised |
| Steady green | Initialised |
| Flashing green | Diagnostic event present |
| Steady red | Exception error |



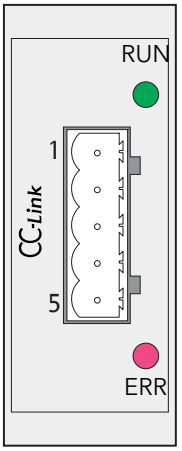

| Pin | Function | Pin | Function |
|---|---|---|---|
| 9 | N/C | 5 | Isolated ground |
| 8 | A (RxD -/TxD -) | 4 | RTS |
| 7 | N/C | 3 | B (RxD+ / TxD+) |
| 6 | +5 V (See note 1) | 2 | N/C |
| | | 1 | N/C |

Notes:
1. Isolated 5 Volts for termination purposes. Any current drawn from this terminal affects the total power consumtion.
2. The cable screen should be terminated to the connector housing.

Figure 2.2.1k Profibus connector pinout

| 'RUN' LED Indication | |
|---|---|
| LED state | Interpretation |
| Off | Off-line or no power |
| Green | Normal operation |
| Red | Major fault (fatal error) |

| 'ERR' LED Indication | |
|---|---|
| LED state | Interpretation |
| Off | No error or no power |
| Steady red | Exception or fatal event |
| Flickering red | CRC Error |
| Flashing red | Station number or Baud rate has changed since startup. |



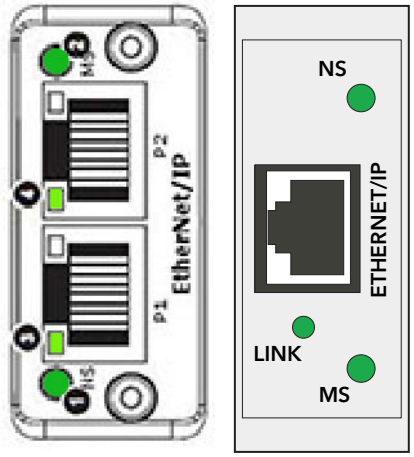

| Pin | Function |
|---|---|
| 1 | DA (Rx+/Tx+) |
| 2 | DB (Rx-/Tx-) |
| 3 | DG (Signal ground) |
| 4 | SLD (Cable shield) |
| 5 | FG (Functional ground) |

110R, 1/2W, 5% across pins 1 and 2 of first and last connectors

SLD and FG connected internally

Notes:
1. A 110 Ohm (±5% 1/2 watt) terminating resistor should be connected across pins 1 and 2 of the connectors at each end of the transmision line.
2. The cable shield should be connected to pin 4 of each CC-Link connector.
3. The shield and Functional ground terminals (pins 4 and 5) are internally connected.

Figure 2.2.1l CC-Link connector pinout

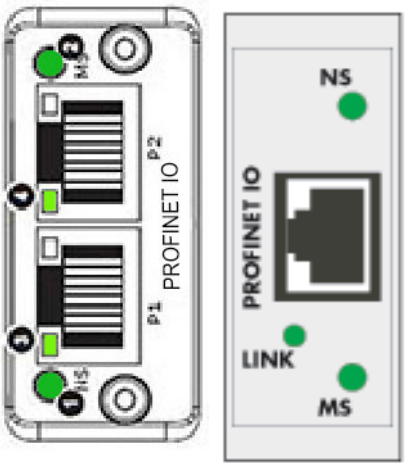



| NS (Network status) LED (1) | |
|---|---|
| LED state | Interpretation |
| Off | No power or no IP address |
| Steady green | On-line; one or more connections established (CIP class 1 or 3) |
| Flashing green | On-line, no connections enabled |
| Steady red | Duplicate IP address ('fatal' error) |
| Flashing red | One or more connections timed out (CIP class 1 or 3) |

| MS (Module status) LED (2) | |
|---|---|
| LED state | Interpretation |
| Off | No power |
| Steady green | Controlled by a scanner in Run state |
| Flashing green | Not configured or scanner in Idle state |
| Steady red | Major fault (Exception state, fatal error etc.) |
| Flashing red | Recoverable fault |

| LINK LED (3, 4) | |
|---|---|
| LED state | Interpretation |
| Off | No link; no activity |
| Steady green | Link established |
| Flickering green | Activity in progress |

Figure 2.2.1m EtherNet/IP connector pinout, both single and double port versions




| NS (Network status) LED (1) | |
|---|---|
| LED state | Interpretation |
| Off | No power or IP address |
| Steady green | On-line (RUN); connection with I/O controller established. Controller in 'Run' state |
| Flashing green | On-line (STOP); connection with IO controller established. Controller in 'Stop' state. |

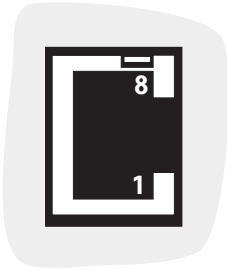
| MS (Module status) LED (2) | | |
|---|---|---|
| LED state | Interpretation | |
| Off | Not initialised | No power, or the module is in 'SETUP' or 'NW_INIT' state. |
| Green steady | Normal operation | The module has shifted from the 'NW_INIT' state. |
| Green 1 flash | Diagnostic event | One or more Diagnostic Event present. |
| Green 2 flash | Blink | Used by engineering tools to identify the node on the network. |
| Red steady | Exception error | The module is in the 'EXCEPTION' state. |
| Red1 flash | Configuration error | The Expected Identification differs from the Real Identification. |
| Red 2 flash | IP address error | The IP address is not set. |
| Red 3 flash | Station Name error | The Station name is not set. |
| Red 4 flash | Internal error | The module has encountered a major internal fault. |

| LINK LED (3, 4) | |
|---|---|
| LED state | Interpretation |
| Off | No link; no activity |
| Steady green | Link established |
| Flickering green | Activity in progress |

Figure 2.2.1n Profinet IO connector pinout, both single and double port versions

**REMOTE PANEL CONNECTOR**

Located on the underside of the driver module (figure 2.2.1b) this RJ45 connector supplies isolated 3-wire EIA485 outputs for an optional remote panel display unit. Figure 2.2.1n gives the pinout. See section 6.6.2 for configuration details. Parity is set to 'None'. See also Appendix A for details of a suitable remote panel unit.




| Pin | Definition |
|---|---|
| 8 | Reserved |
| 7 | Reserved |
| 6 | N/C |
| 5 | N/C |
| 4 | N/C |
| 3 | Isolated 0V |
| 2 | A |
| 1 | B |
| Internal connections:<br>Pin 1 to 5V via 100kΩ<br>Pin 2 to 0V via 100kΩ | |

Figure 2.2.1o Remote panel connector

### 2.2.2 Power modules

**LINE/LOAD CABLES**

Line power is routed through the top of the unit and load power emerges from the bottom of the unit. Protective Earth Ground wiring is discussed in section 2.2.1, above.

**DANGER**

1. 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.
2. To achieve IP10 rating according to IEC60529, power connections must be made by using lug terminals of size as given in Table 2.2.2. U.L.: Power connections connection must be made using UL-listed lug terminals.

**DANGER**

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. Branch circuit shall be rated according to maximum current in each phase.
   CE: branch-circuit protection must be selected according to IEC 60364-4-43 or applicable local regulations.
   UL: branch-circuit protection must be selected according to NEC article 210.20, it is necessary for compliance with National Electric Code(NEC) requirements.
2. Power connections: The cables must be rated 90°C stranded copper only, the cross section must be selected according to the branch circuit protection rating.
   CE: Wire conductor cross sections must comply with IEC 60364-5-52 or applicable national standards
   U.L.: Wire conductor cross sections must comply with NEC Table 310.15(B)(16) (formerly Table 310.16) taking account of table 310.15(B)(2) for the ampacity correction factors or NFPA79 Table 12.5.1 taking account of Table 12.5.5(a) for the ampacity correction factors or applicable national standards.
3. Power terminals must be tightened according to the torque values defined in Table 2.2.2a. Appropriate regular inspections must be performed. Periodicity depends on the local environment, but should not exceed 1 year.

Figures 2.2.2m to 2.2.2p show typical connection details.

| EPower current rating | Internal Lug terminal size | | | Tightening Torque | Cable entry diameter |
|---|---|---|---|---|---|
| | Stud Diameter | Maximum Length (L) | Maximum Capacity | | |
| 50A | M8 (3/8 inch) | 45 mm (1.75 inch) | 70mm$^2$ (AWG 2/0) | 9 Nm (6.6 ft lb) | 17 mm (0.7 inch) |
| 100A | | | | | |
| 160A | | | | | |
| 250A | M10 (1/2 inch) | 60 mm (2.35 inch) | 120mm$^2$ (250 Kcmil) | 15 Nm (11.1 ft lb) | 21.5 mm (0.825 inch) |
| 400A | M12 (1/2 inch) | 80 mm (3.15 inch) | 240mm$^2$ (500 Kcmil) | 28.8 Nm (21.2 ft lb) | 30 mm (1.18 inch) |
| 500A | 2 x M12 (2 x 1/2 inch) | 65 mm (2.55 inch) | 185mm$^2$ (350 Kcmil) | 30 Nm (22.1 ft lb) | 35 mm (1.38 inch) |
| 630A | | | | | |

Table 2.2.2a Line/Load termination details

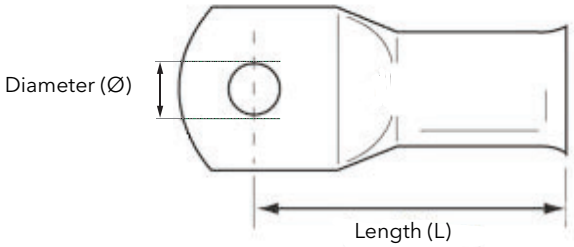



Figure 2.2.2a Lug terminal dimensions

**Power Connection Adapter**

According to standards, ambient temperature, or wiring arrangement, a larger wire section may be requested.

To connect larger wire section, a power connection adapter (optional) can be fitted on the product. It consists of extra copper bars which enable connection of lug terminals outside of the product.

Products equipped with power connection adapter are rated CE: IP00 and remains UL: open type.

.

| EPower current rating | Reference | Maximum Bolt Size | Tightening Torque Inside & outside(1) product |
|---|---|---|---|
| 50A | Power Connection Adapter 100A-160A | M8 (5/16 inch) | 9 Nm (6.6 ft lb) |
| 100A | | | |
| 160A | | | |
| 250A | Power Connection Adapter 250A | M12 (7/12 inch) | 15 Nm (11.1 ft lb) |
| 400A | Power Connection Adapter 400A | M16 (5/8 inch) | 28.8 Nm (21.2 ft lb) |
| 500A | Power Connection Adapter 500A-630A | M16 (5/8/ inch) | 30 Nm (22.1 ft lb) |
| 630A | | | |

Table 2.2.2b Power Connection Adapter termination details

(1) When applying torque to the screw outside product establish balance on the nut.

This optional power connection adapter can also be used to connect flex copper bar.

**DANGER**

Do not connect solid copper bar to the product.

Mechanical stresses linked to thermal expansion may damage product internal fuse and/or thyristor.

The following figures show Power Connection Adapter connection details.

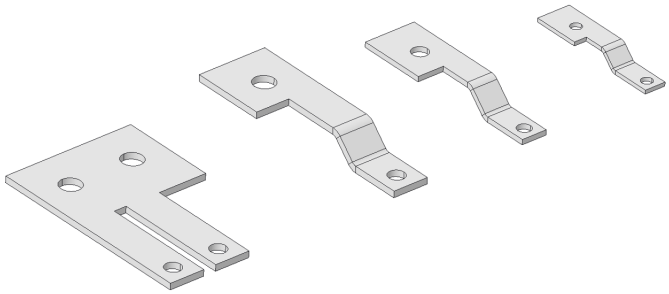


Figure 2.2.2b  Power Connection Adapter

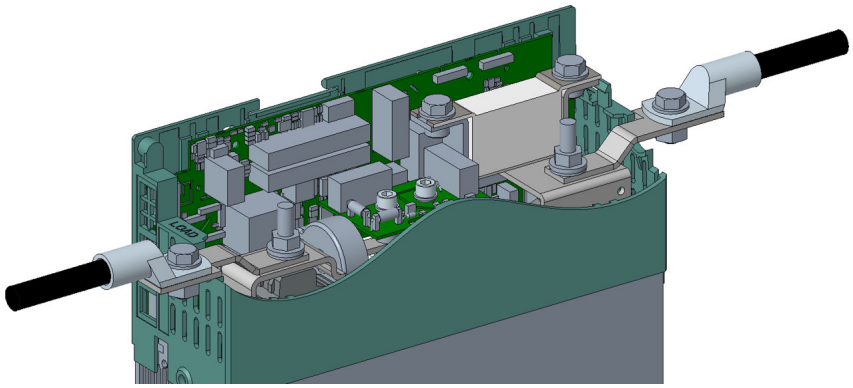


Figure 2.2.2c  Power Connection Adapter 100A-160A fitted (detail)

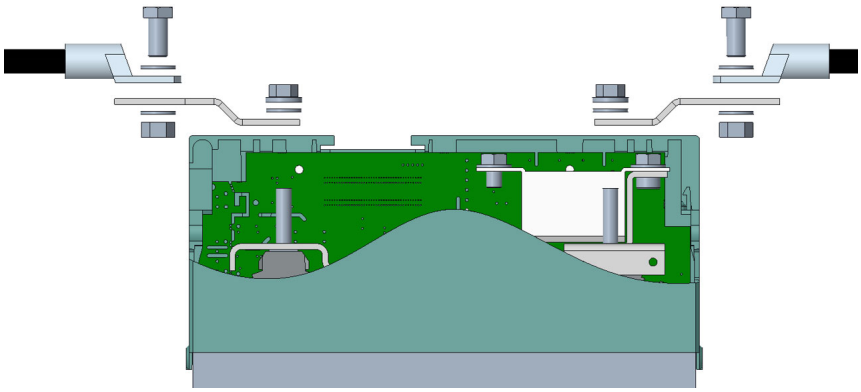


Figure 2.2.2d  Power Connection Adapter 100A-160A fitted (side view)

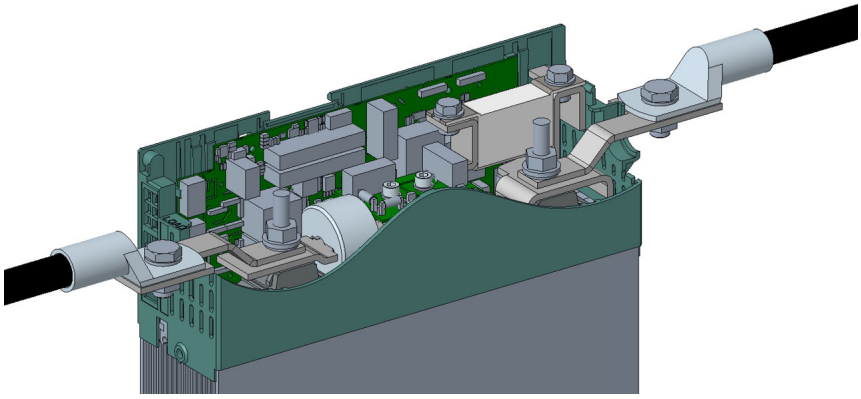


Figure 2.2.2e  Power Connection Adapter 250A fitted (detail)

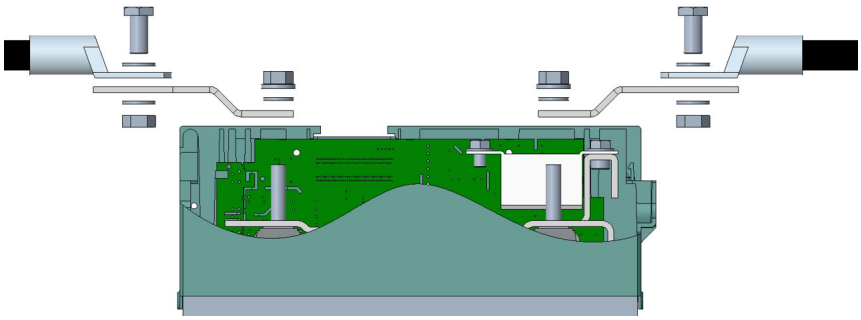


Figure 2.2.2f  Power Connection Adapter 250A fitted (side view)

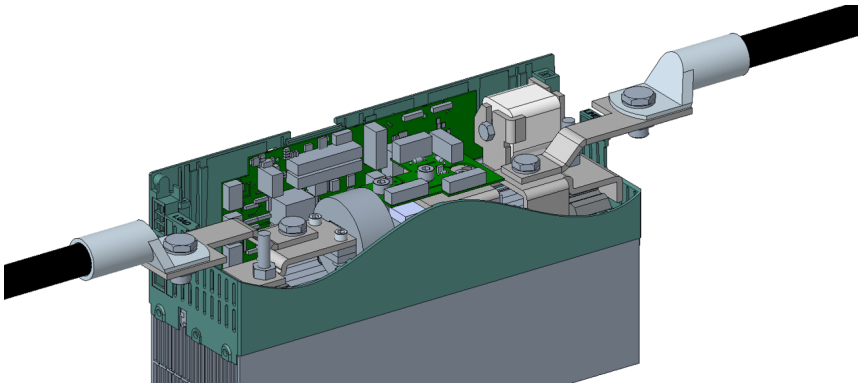


Figure 2.2.2g  Power Connection Adapter 400A fitted (detail)

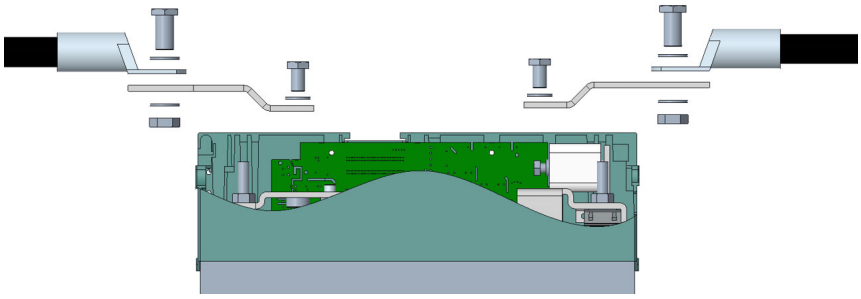


Figure 2.2.2h  Power Connection Adapter 400A fitted (side view)

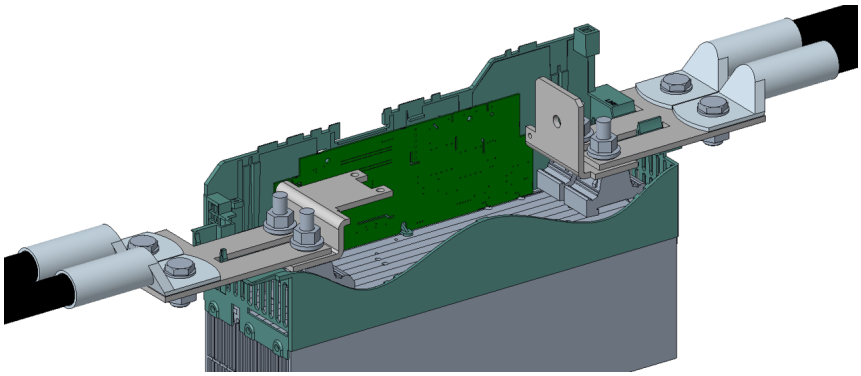


Figure 2.2.2i  Power Connection Adapter 500A/630A fitted (detail)

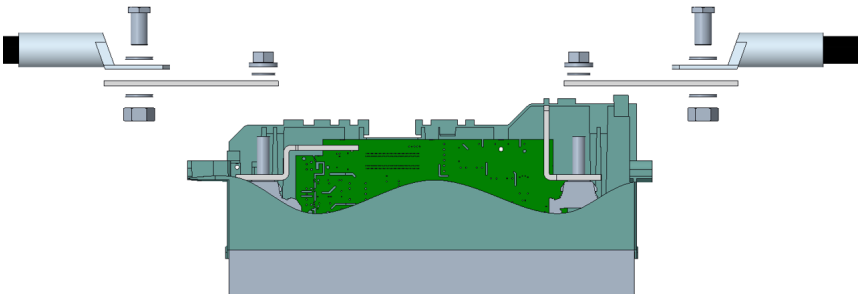


Figure 2.2.2j  Power Connection Adapter 500A/630A fitted (side view)

## RIBBON CABLE

The ribbon cable is daisy-chained from the Driver Module to the power modules.

***NOTICE***

In order to maintain protection against damage due to electrostatic discharge, any ribbon cable which is chafed, scratched or otherwise damaged must be replaced. Periodicity depends on the local environment, but should not exceed 1 year.

## EXTERNAL CURRENT FEEDBACK

If the option is fitted, a two-pin connector on the underside of the unit allows the connection of an external current transformer to measure the load current. The option also includes the Remote Voltage sensing input, described below. Both connectors have polarising devices fitted (description below) to prevent misconnection by the user.

The current transformer ratio must be such that its full scale output is 5 Amps. For example when measuring up to 400 Amps, a 400:5 ratio transformer should be chosen.

**WARNING**

1. External feedback connections must be correctly phased (figure 2.2.2b) or the unit might switch to full conduction at start-up. See also Appendix B for more details about external feedback.
2. With external feedback: The current transformer should be chosen such that its full-scale output is 5 amps.

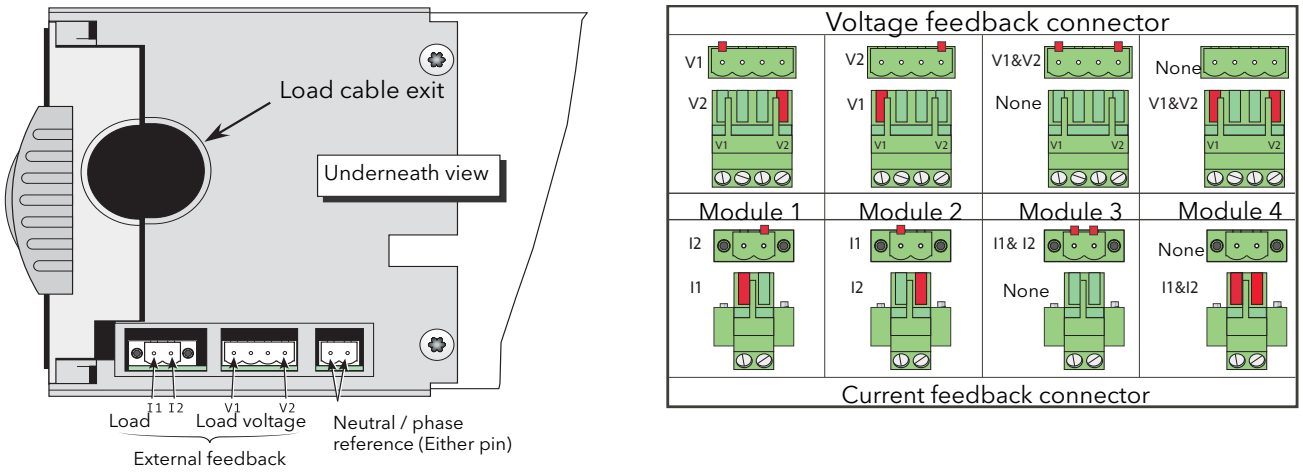



Figure 2.2.2k External feedback, and neutral/phase reference connectors

| Connector | Terminal Capacity | Torque |
|---|---|---|
| Voltage feedback connector<br>& Current feedback connector | 0.25 mm² to 2.5mm²<br>24 AWG to 12 AWG | 0.55 Nm<br>5 lb.in |

Table 2.2.2 Voltage & Current feedback terminals connections details

## REMOTE VOLTAGE INPUT

**DANGER**

The cables used to connect the remote voltage sensing inputs (if fitted) and the cable used to connect the reference input in 4S, 6D and two-leg configurations must be correctly protected by branch-circuit protection. It is the responsibility of the user to add branch-circuit protection. Such branch-circuit must comply with applicable local regulations.

UL: The above-mentioned branch-circuit protection is necessary for compliance with National Electric Code (NEC) requirements.

If the option is fitted, the two end pins of a four-pin connector (figure 2.2.2k) are used for terminating remote voltage sensing cable. It is recommended that each input be fitted with slow-blow fuse (figure 2.2.2a) of a lower current rating than that of the sensing cable harness. If the option is fitted, the Current Transformer input, described above, is also fitted.

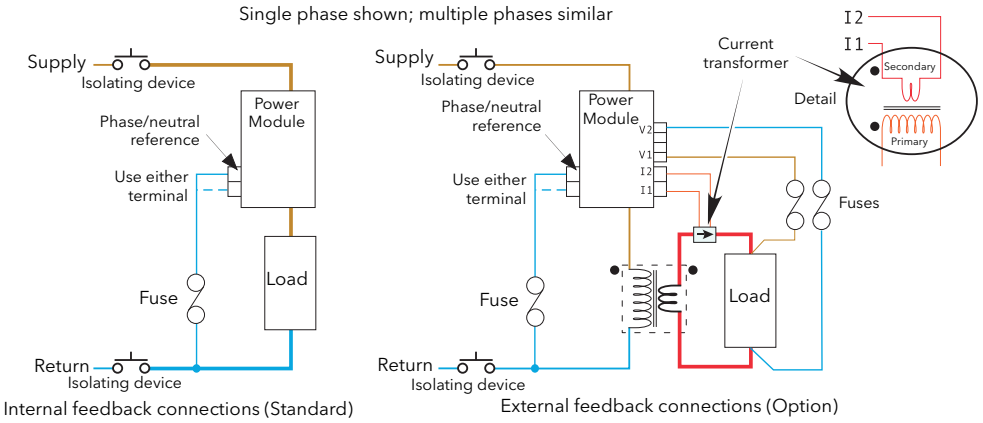



Figure 2.2.2a Fusing for remote voltage sensing input and neutral reference inputs

## NEUTRAL/PHASE REFERENCE INPUT

**DANGER**

The cables used to connect the remote voltage sensing inputs (if fitted) and the cable used to connect the reference input in 4S, 6D and two-leg configurations must be correctly protected by branch-circuit protection. It is the responsibility of the user to add branch-circuit protection. Such branch-circuit must comply with applicable local regulations.

UL: The above-mentioned branch-circuit protection is necessary for compliance with National Electric Code (NEC) requirements.

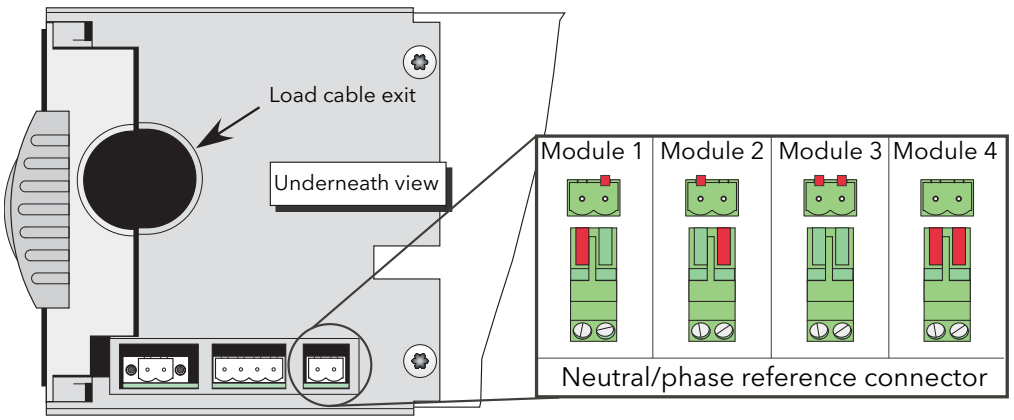
**WARNING**

In 4S, 6D and two-leg configurations do not use the reference terminal to replicate voltage signals (in a 'daisy chain'), as the PCB track between the two poles is not designed to withstand short-circuit.

In order to ensure correct firing for 4S, 6D and two-leg configurations, a connection to neutral or to the relevant phase must be made using the relevant two-pin connector on the underside of the unit (figure 2.2.2k). (Both pins are connected together internally, so either may be used). This is used as a potential reference for voltage measurements within the unit, see figure 2.2.2a and figure 2.2.2e for more detail.

The unit has been designed to detect the loss of any of the reference signals and to suspend firing should any of them 'fail'. Firing may not be correct during the detection period.

Polarising pins are fitted to the connectors as shown in the figure below.




Neutral/phase reference connector polarising pins

| Connector | Terminal Capacity | Torque |
|---|---|---|
| Neutral/phase reference connector | 0.25 mm² to 2.5mm²<br>24 AWG to 12 AWG | 0.55 Nm<br>5 lb.in |

Table 2.2.2 Voltage & Current feedback terminals connections details

## ACCESS TO LINE AND LOAD TERMINATIONS

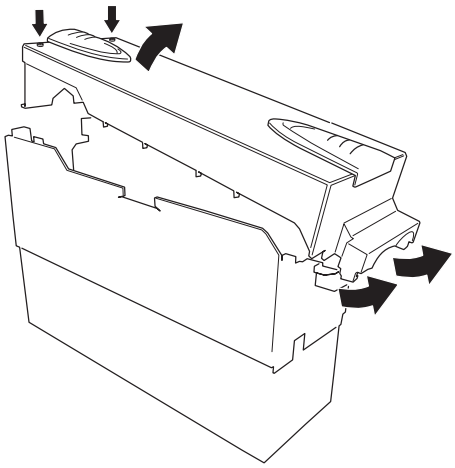
**DANGER**

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.

For 50A, 100A, 160A and 250A units, to remove the doors, insert a non-insulated screwdriver with a 5 mm flat blade into the slot near the top of the door, and gently lever downwards to disengage the catch, and pull the top of the door away from the unit. Once free, the door can be lifted off its pivots which are located at the bottom of the case.

For the 400A unit, the door is released by undoing the two fasteners near the top of the door and then pulling the top of the door away from the unit. Once free, the door can be lifted off its pivots which are located at the bottom of the case.

The 500A/630Amp module door is similar to the 400Amp module, but once released, the bottom of the door is pulled downwards to disengage it from its securing lugs, not lifted off, as described for the 400A module.



Door removal (500/630A units)

## 2.2.2 POWER MODULES (Cont.)

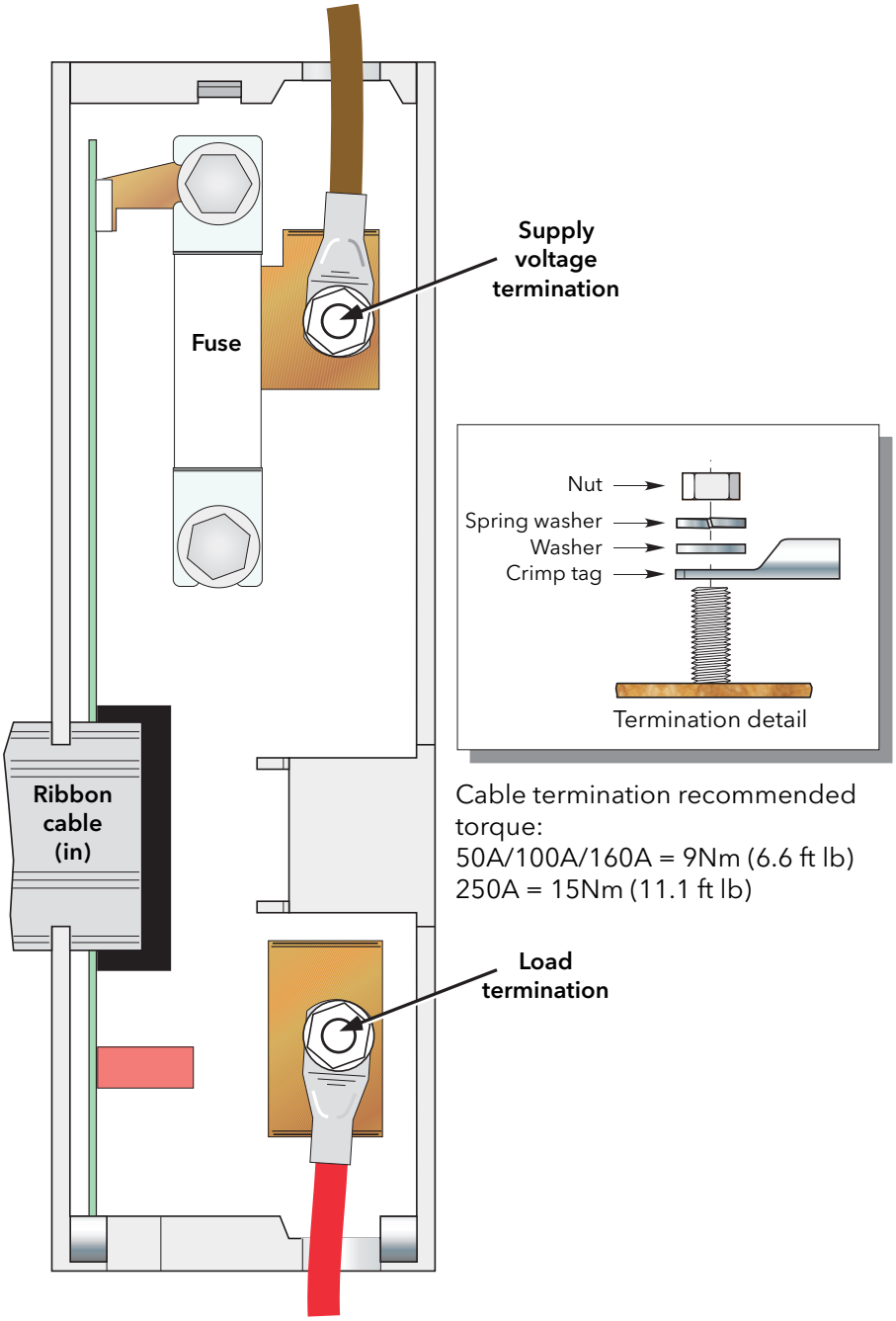



Figure 2.2.2a Line and load termination (50A, 100A and 160A units) (250A units similar)

## 2.2.2 POWER MODULES (Cont.)

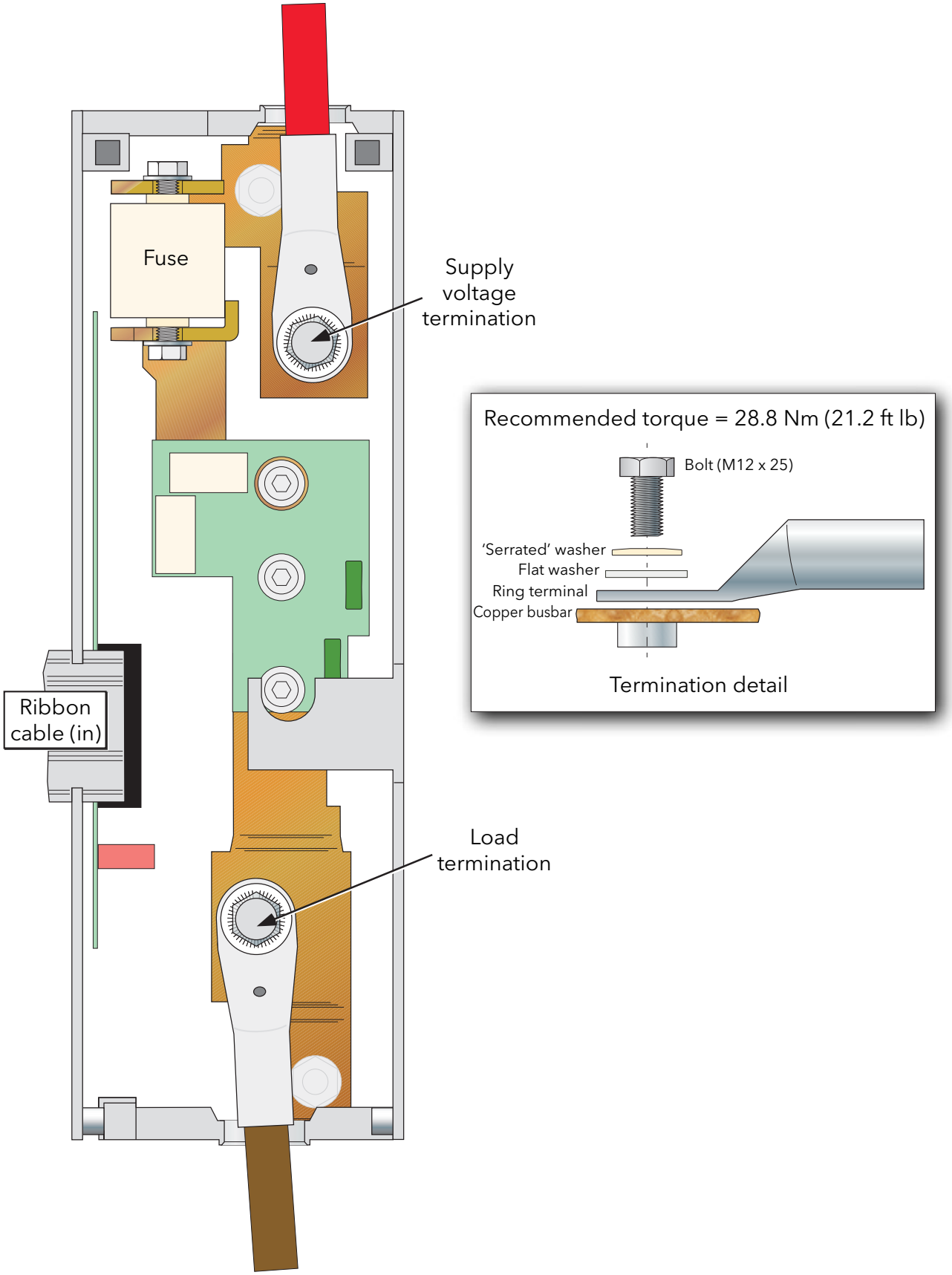



Figure 2.2.2b Line and Load termination (400A units)

## 2.2.2 POWER MODULES (Cont.)

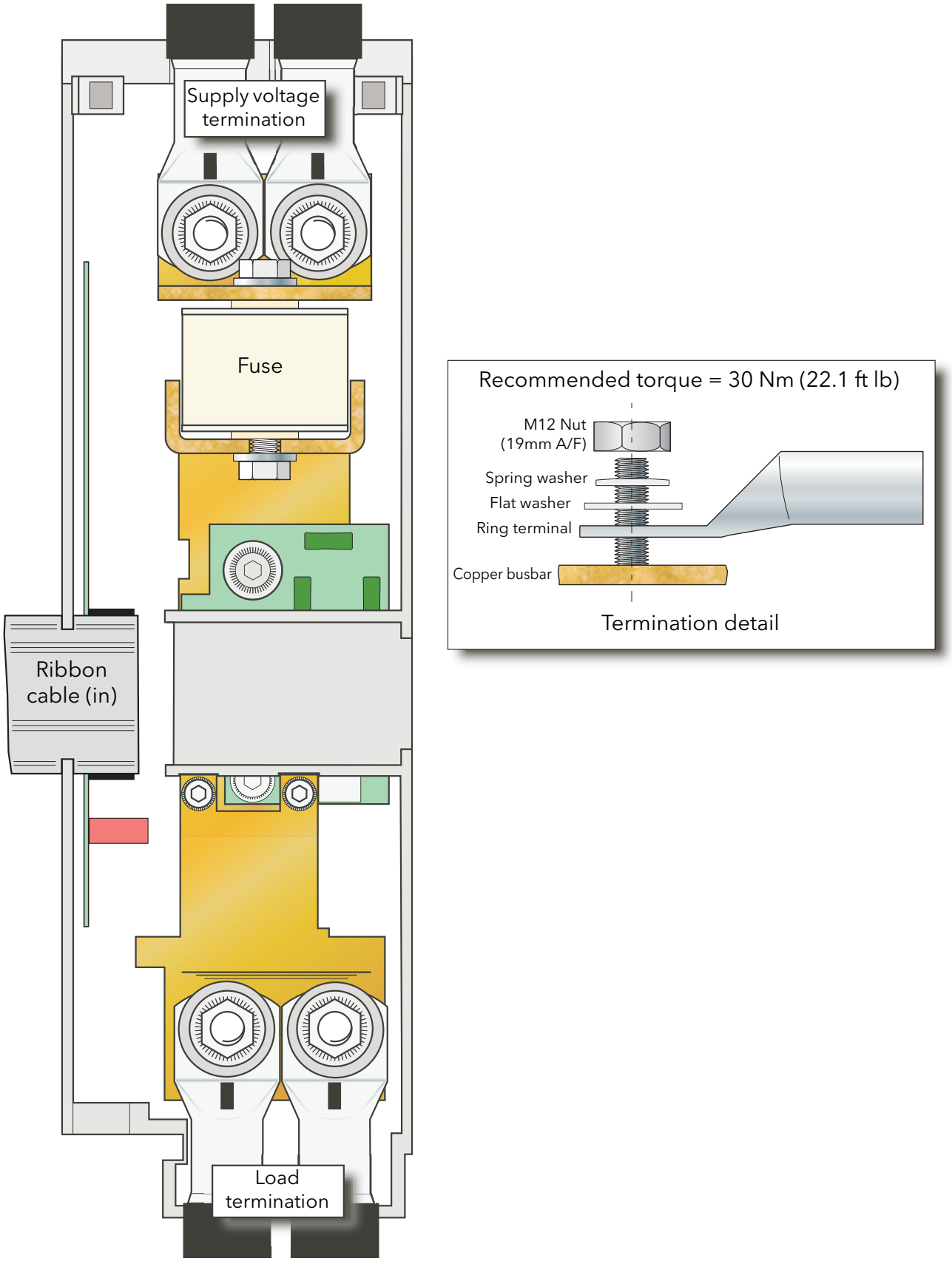



Figure 2.2.2c Line and Load termination (500A units) (630A units similar)

## 2.2.2 POWER MODULES (Cont.)

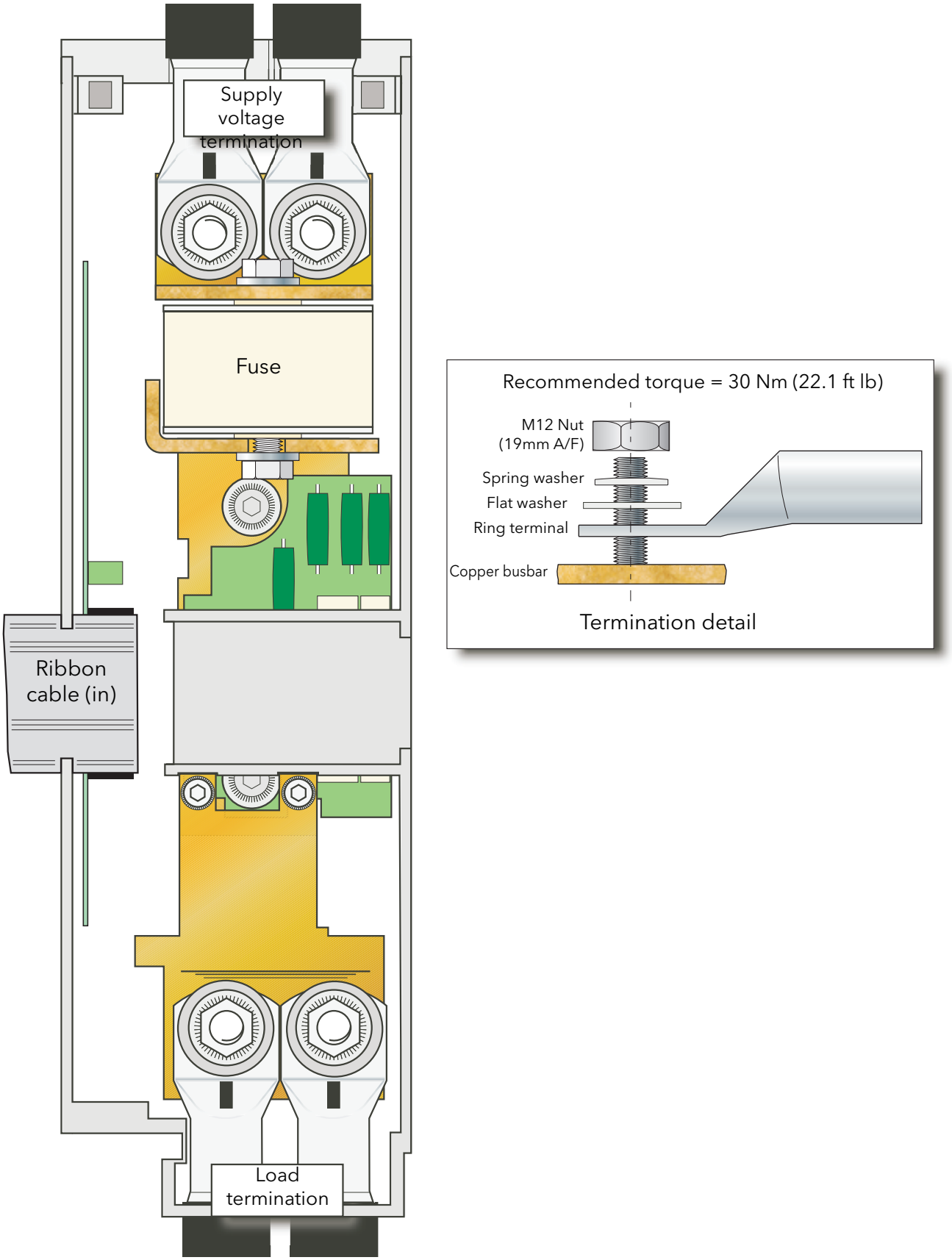



Figure 2.2.2d Line and Load termination (630A units)

## 2.2.2 POWER MODULES (Cont.)

The illustrations which make up figure 2.2.2e, below, show schematic and practical wiring arrangements for a number of common three-phase configurations. Earthing and driver module wiring are omitted for the sake of clarity. Fuses (where fitted) should have values compatible with the current carrying capacity of the associated wiring. Appendix B contains a discussion of external feedback.

**DANGER**

1. Neutral cross-sectional area when neutral is connected to the star point of the load (4S load type): Without current limit activated, maximum neutral current is not upper than maximum current in each phase. The cross-sectional area of the neutral conductor, shall be sized to carry the maximum phase current.
   With current limit activated, maximum neutral current may reach √3 x current limit setting. The cross-sectional area of the neutral conductor shall be sized to carry up to √3 x current limit setting.
   CE: Wire conductor cross sections must comply with IEC 60364-5-52 or applicable national standards
   U.L.: Wire conductor cross sections must comply with NEC Table 310.15(B)(16) (formerly Table 310.16) taking account of table 310.15(B)(2) for the ampacity correction factors or NFPA79 Table 12.5.1 taking account of Table 12.5.5(a) for the ampacity correction factors or applicable national standards.
2. The cables used to connect the remote voltage sensing inputs (if fitted) and the cable used to connect the reference input in 4S, 6D and two-leg configurations must be correctly protected by branch-circuit protection. It is the responsibility of the user to add branch-circuit protection. Such branch-circuit must comply with applicable local regulations.
   UL: The above-mentioned branch-circuit protection is necessary for compliance with National Electric Code (NEC) requirements.

**CAUTION**

In burst mode and primary of transformer load, the star-star configuration is not recommended as it may become unstable, high speed fuse may blow.

## THREE-PHASE STAR CONFIGURATIONS

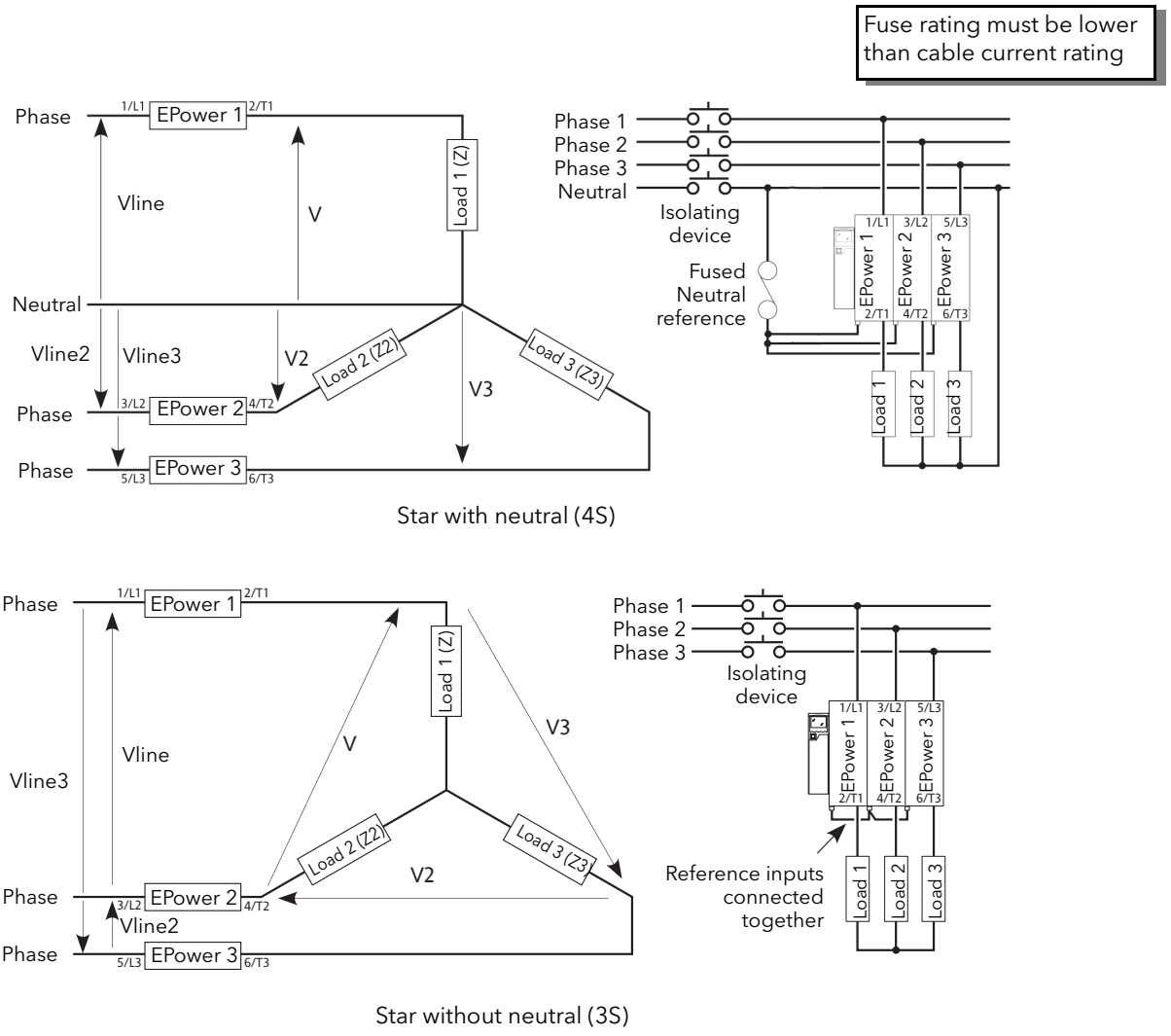
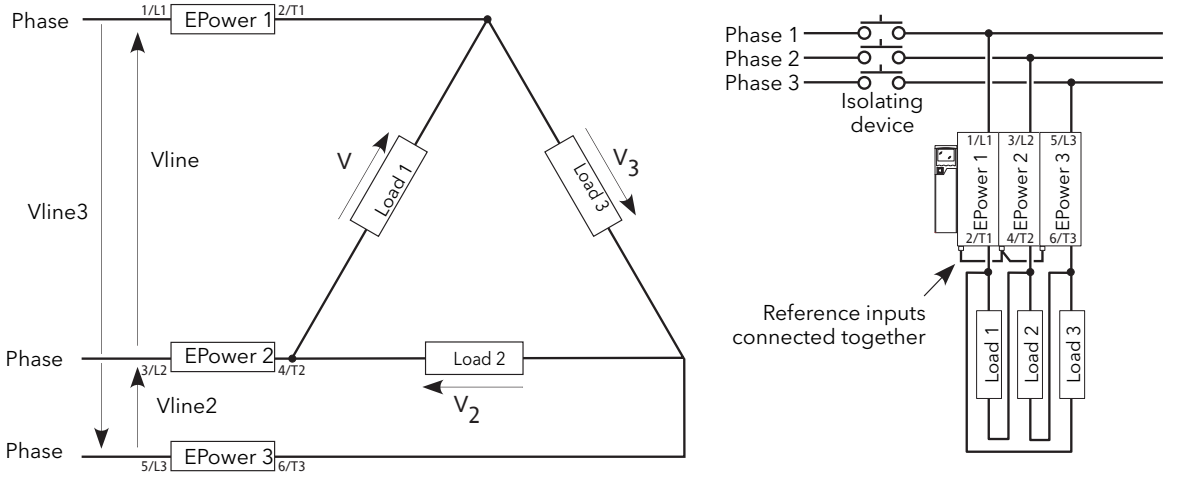


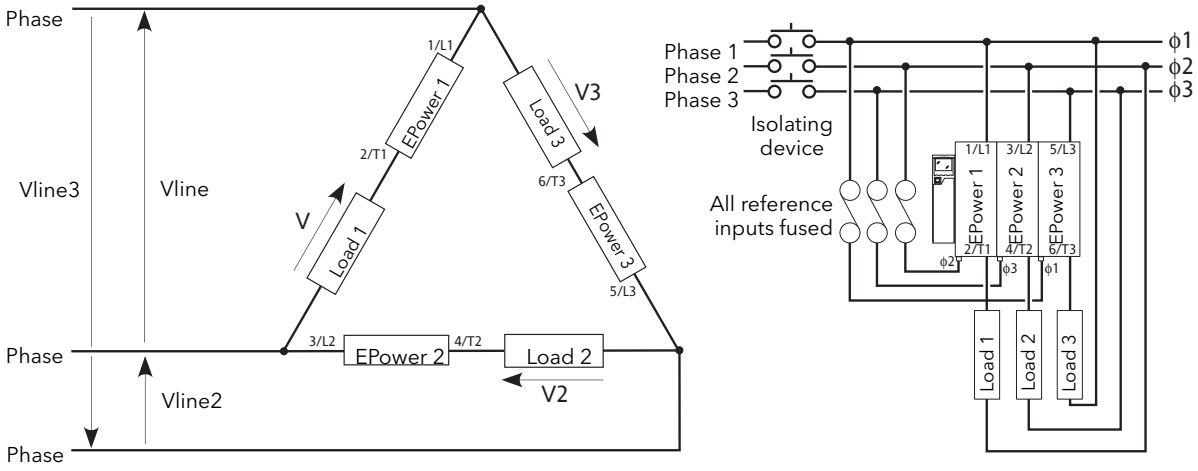

Figure 2.2.2e Typical wiring schemes (Star)

## 2.2.2 POWER MODULES (Cont.)

### THREE-PHASE DELTA CONFIGURATIONS




Closed Delta (3D)

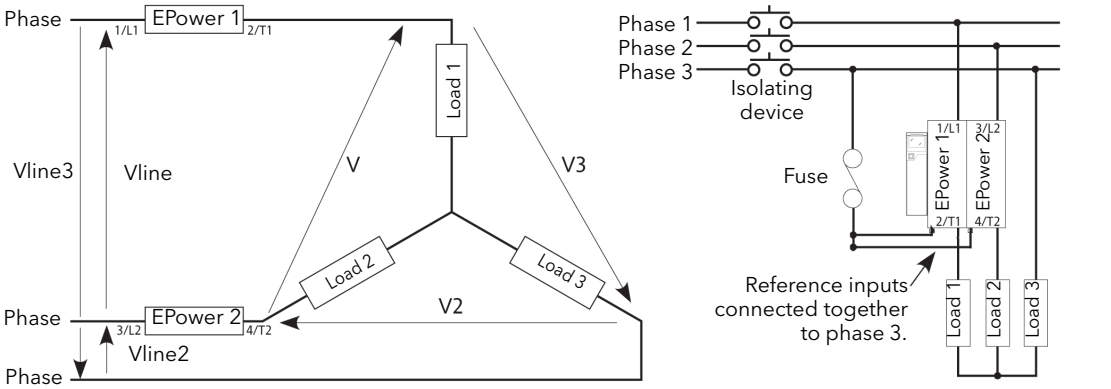



Open Delta (6D)

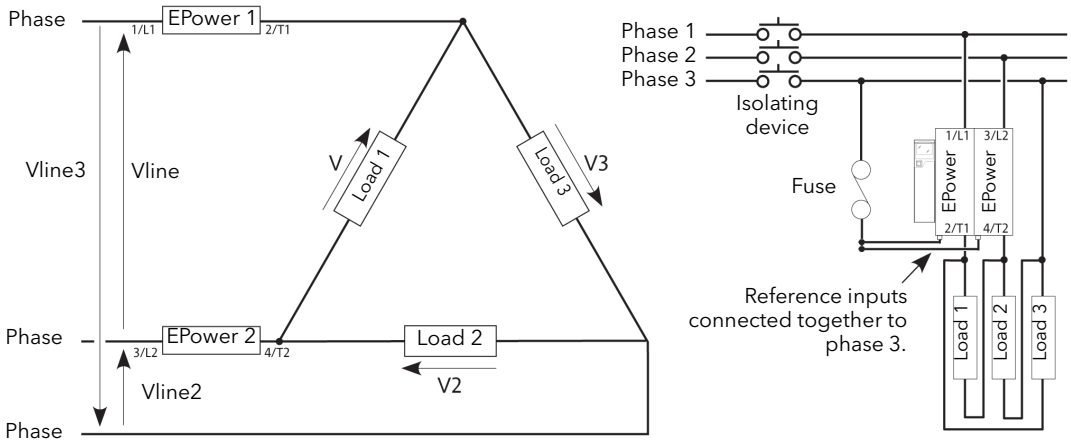
Figure 2.2.2g (Cont.) Typical wiring schemes (Delta)

## 2.2.2 POWER MODULES (Cont.)

### TWO-LEG CONFIGURATIONS




Star (3S)




Delta (3D)

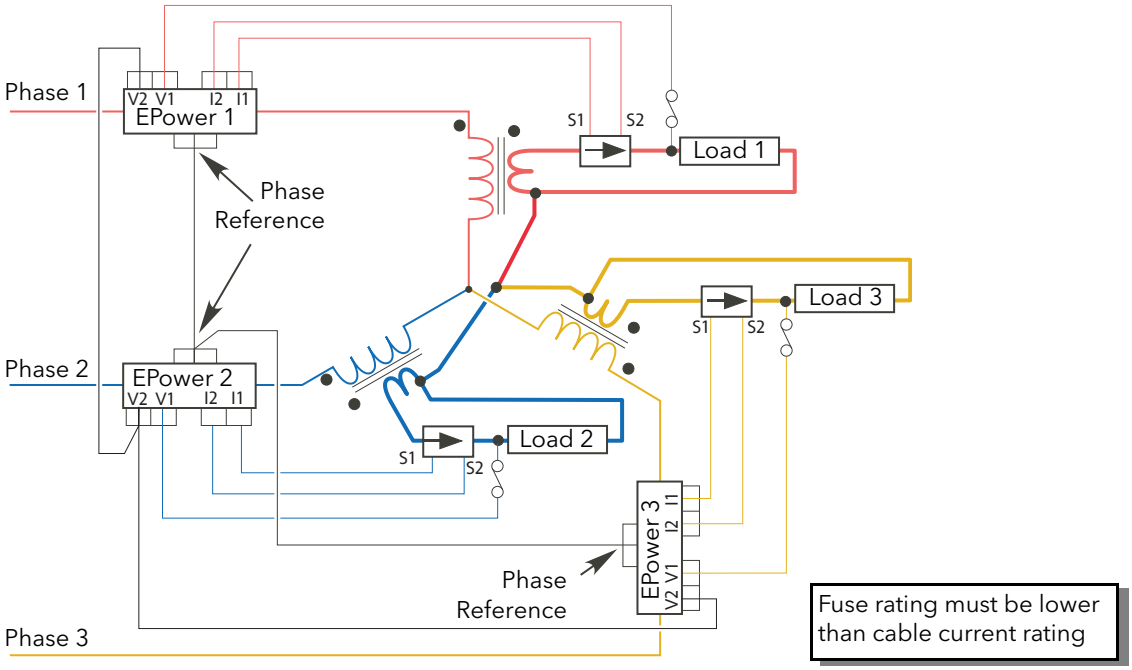
Figure 2.2.2g (Cont.) Typical wiring schemes (2-leg)

## 2.2.2 POWER MODULES (Cont.)

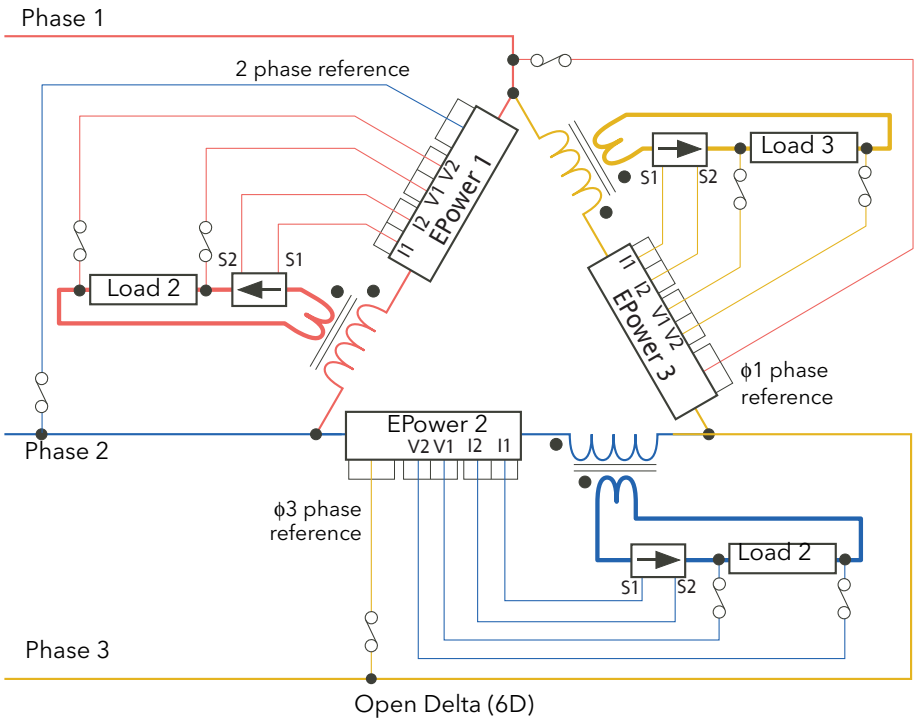
### THREE PHASE CONFIGURATIONS WITH EXTERNAL FEEDBACK

**WARNING**

1. External feedback connections must be correctly phased (figure 2.2.2b) or the unit might switch to full conduction at start-up.
2. With external feedback: The current transformer should be chosen such that its full-scale output is 5 amps.




Star without neutral (3S)

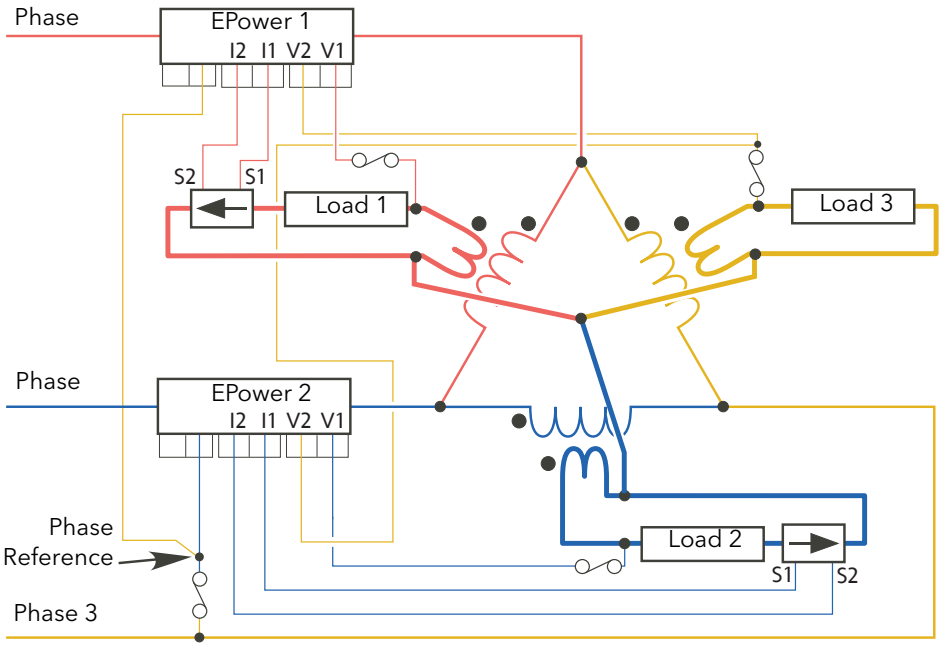



Open Delta (6D)

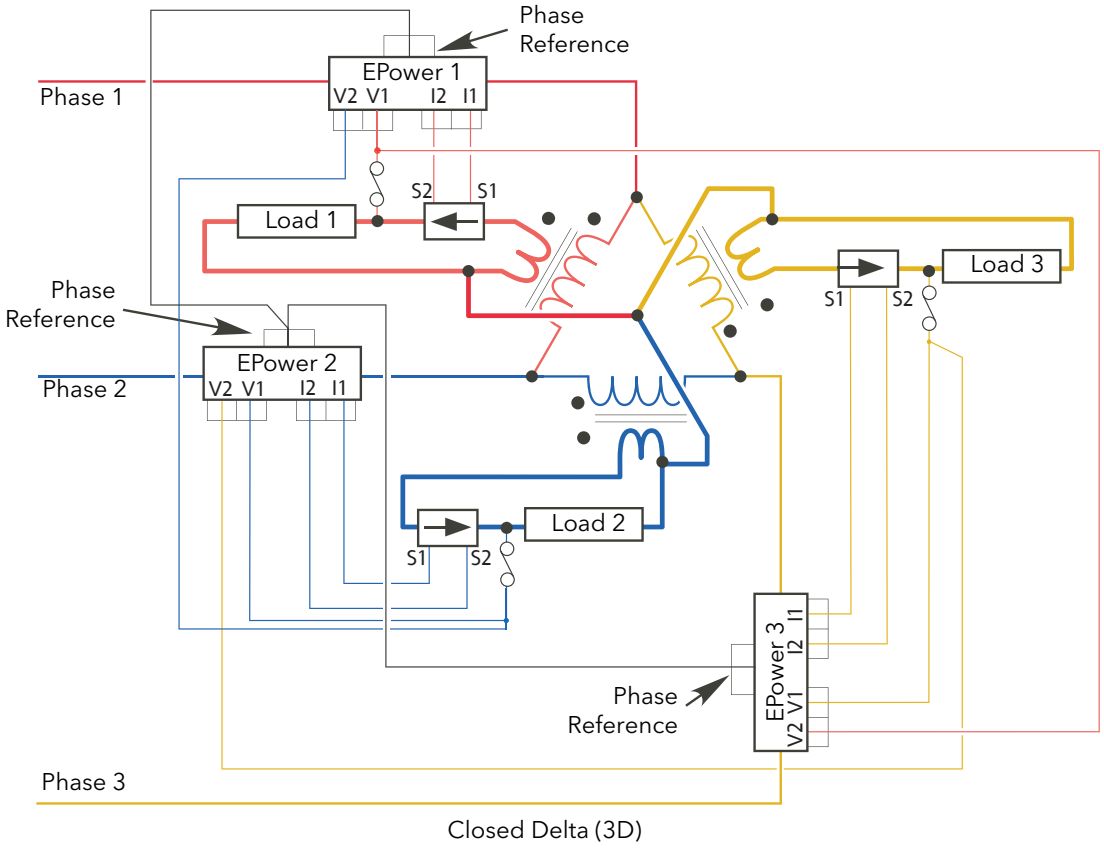
Figure 2.2.2g (cont.) Typical 3-phase external feedback wiring

## 2.2.2 POWER MODULES (Cont.)

### THREE PHASE CONFIGURATIONS WITH EXTERNAL FEEDBACK (Cont.)




2-leg Delta (3D)




Closed Delta (3D)

Figure 2.2.2g (cont.) Typical 3-phase external feedback wiring

# 3 OPERATOR INTERFACE

Located at the front of the Driver Module, the operator interface consists of a display, featuring four lines of up to 10 characters each, four push-button switches and three LED 'beacons'.

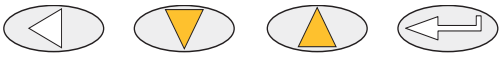

Figure 3 Operator interface

## 3.1 DISPLAY

As mentioned above, the display consists of four lines of characters, these characters being formed using a seven-high, by five-wide dot matrix. This display, together with the four pushbuttons allows full operation and configuration of the unit.

## 3.2 PUSHBUTTONS

The functions of the four pushbuttons below the display depend on whether the unit is in configuration mode or in operating mode:




### 3.2.1 Configuration

| | |
|---|---|
| Return | Generally, this button reverses the last operation of the 'Enter' button |
| Scroll down/up | Allows the user to scroll through the available menu items or values. The up/down arrow symbol appears against menu items that can be edited. |
| Enter | Goes to next menu item. |

### 3.2.2 Operation

In operation, two pushbuttons may be operated simultaneously to carry out the following functions:

| | |
|---|---|
| Scroll up + Scroll down | Acknowledge alarms |
| Scroll up + Enter | Toggle between 'Local' and 'Remote' operation. |
| Scroll down + Enter | PLF adjustment request |

### 3.2.3 Menu item value selection

Menu items are scrolled through using the enter key. 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, it will become the selected value approximately two seconds after the final scroll key operation, this selection being indicated by a single off/on flash of the desired value.

## 3.3 BEACONS

There are three LED illuminated 'beacons' between the display area and the pushbuttons. For clarity, figure 3, above, shows the locations of these beacons in an enhanced way; on the real instrument, they are 'invisible' unless illuminated.


| | |
|---|---|
| PWR | 'Power'. Illuminated green whilst power is applied to the unit. The Beacon flashes if any of the associated power modules is not firing, or if the unit is in Standby (for any reason other than that the unit is in 'config' mode). |
| LOC | 'Local'. Illuminated orange when setpoints are to be read from the operator interface or from PC/iTools. |
| ALM | 'Alarm'. Illuminated red when one or more enabled alarms is active. |

## 3.4 FRONT PANEL MESSAGES

A number of messages can appear at the display panel. These messages and their interpretations are listed below. See section 10 for a more detailed description of some of these alarms.

### 3.4.1 Instrument events

| | |
|---|---|
| Cold Start | The instrument has been cold-started. |
| Conf Entry | The instrument has been placed in configuration mode. |
| Conf Exit | The instrument has been taken out of configuration mode. |
| GlobalAck | A global acknowledgement of all safe latched alarms has been performed. |
| Power down | The instrument has restarted after a power down. |
| QS Entry | The Quick Start menu has been re-entered. |
| QS Exit | The Quick Start menu has been left. |

### 3.4.2 Indication alarms

| | |
|---|---|
| LimitAct | One or more limits are active in the control block |
| LoadOverI | An over current alarm has become active in one or more Network blocks. |
| LMoverSch | (Predictive Load Management over schedule). The actual power (Pr) is greater than the requested shed power value (Ps) (detected in the PLM block). |
| PrcValTfr | Process value transfer is active in one or more control blocks, |

### 3.4.3 System alarms

| | |
|---|---|
| FuseBlown | One or more thyristor protection fuses is ruptured. |
| MainsFreq | Mains Frequency is outside the acceptable range. |
| Missmains | One or more supply phases is missing. |
| NetwDip | One or more 'network dip' alarms has been detected. |
| OverTemp | One or more 'over temperature' alarms has been detected. |
| PMod24V | A power supply problem has been detected on the Driver Unit power board. |

### 3.4.4 Process alarms

| | |
|---|---|
| ChopOff | One or more 'Chop-off' alarm has been detected. |
| ClosedLp | One or more Control block 'Closed Loop' alarm has been detected. |
| InputBrk | An 'Input Break' alarm has been detected in one or more Analogue input blocks. |
| MainVFault | One or more 'Mains Voltage Fault' (over or under) has been detected. |
| OutFault | An 'Output short Circuit' alarm has been detected in one or more Analogue output blocks. |
| PLF | One or more 'Partial Load Failure' alarm has been detected. |
| PLU | One or more 'Partial Load Unbalance' alarm has been detected. |
| TLF | One or more 'Total Load failure' alarm has been detected. |

### 3.4.5 Configuration errors

| | |
|---|---|
| InvPAdata | (Invalid parameter database). The non-volatile parameter database has become corrupt and should not be relied upon. |
| InvWires | (Invalid wiring table). The non-volatile storage of user (soft) wiring has become corrupt and should not be relied upon. |

### 3.4.6 Standby errors

| | |
|---|---|
| PwrModRev | (Power Module revision). One or more power units has an invalid revision number, or its revision level is not compatible with the firmware version of the driver module. |
| HWDiffers | The fitted hardware does not match the instrument configuration. |
| ErrDSP | Error(s) reported by the Digital Signal Processor, during the instrument's start-up self test procedure. |
| Pwr1Ribbon | A fault was detected in the power module 1 ribbon cable during the instrument's start-up self test procedure. |
| Pwr2(3)(4)Ribbon | As above but for power module 2, 3 or 4. |

### 3.4.7 Power module errors

| | |
|---|---|
| Ph1(2)(3)(4)ComErr | The phase 1, 2, 3 or 4 power module has attempted to communicate with the driver module, and either the driver module or the power module (or both) has failed to 'understand' the communication commands/responses. |
| Ph1ComTout | (Comms timeout). The phase 1, 2, 3 or 4 power module indicated that it wished to report a fault to the driver module but the communications transaction was not completed. |
| Ph2(3)(4)ComTout | As for phase 1, above but for phase 2, 3 or 4. |
| Pwr1EEProm | Header information in power module 1 non-volatile memory was found to be invalid at the instrument's start-up self test procedure. |
| Pwr2(3)(4)EEProm | As for power module 1, above but for power module 2, 3 or 4. |
| Ph1(2)(3)(4)Wdog | The phase 1, 2, 3 or 4 power module microprocessor has detected that its watchdog timer has timed out. A reset has been performed and this has caused the power module to report the fault. |

### 3.4.8 General errors

| | |
|---|---|
| Watchdog | The driver module's microprocessor has detected that its watchdog timer has timed out, and has therefore performed a reset, causing the instrument to restart. |
| LogFault | The event log could not be restored at start-up. |
| PWR1(2)(3)(4)cal | The calibration data stored in the non-volatile memory of power module 1, 2, 3 or 4 is invalid, and the default calibration will be used instead. |

### 3.4.9 Reset errors

| | |
|---|---|
| InvRamCsum | (Invalid RAM checksum). Internal fault |
| DSPnoRSP | (DSP no response). Internal fault. |
| DSP Wdog | (DSP task watchdog). Internal fault. |

### 3.4.10 Fatal errors

| | |
|---|---|
| FuseConfig | The driver module's internal fuses are incorrectly configured. |
| ErrRestart | An error has occurred that requires the instrument to be restarted. |

# 4 QUICKSTART

At first switch-on, the Driver Module enters the 'QuickStart' menu which allows the user to configure the major parameters without having to enter the full configuration menu structure of the unit. Figure 4 shows an overview of a typical Quickstart menu. The actual displayed menu items will vary according to the number of options fitted.

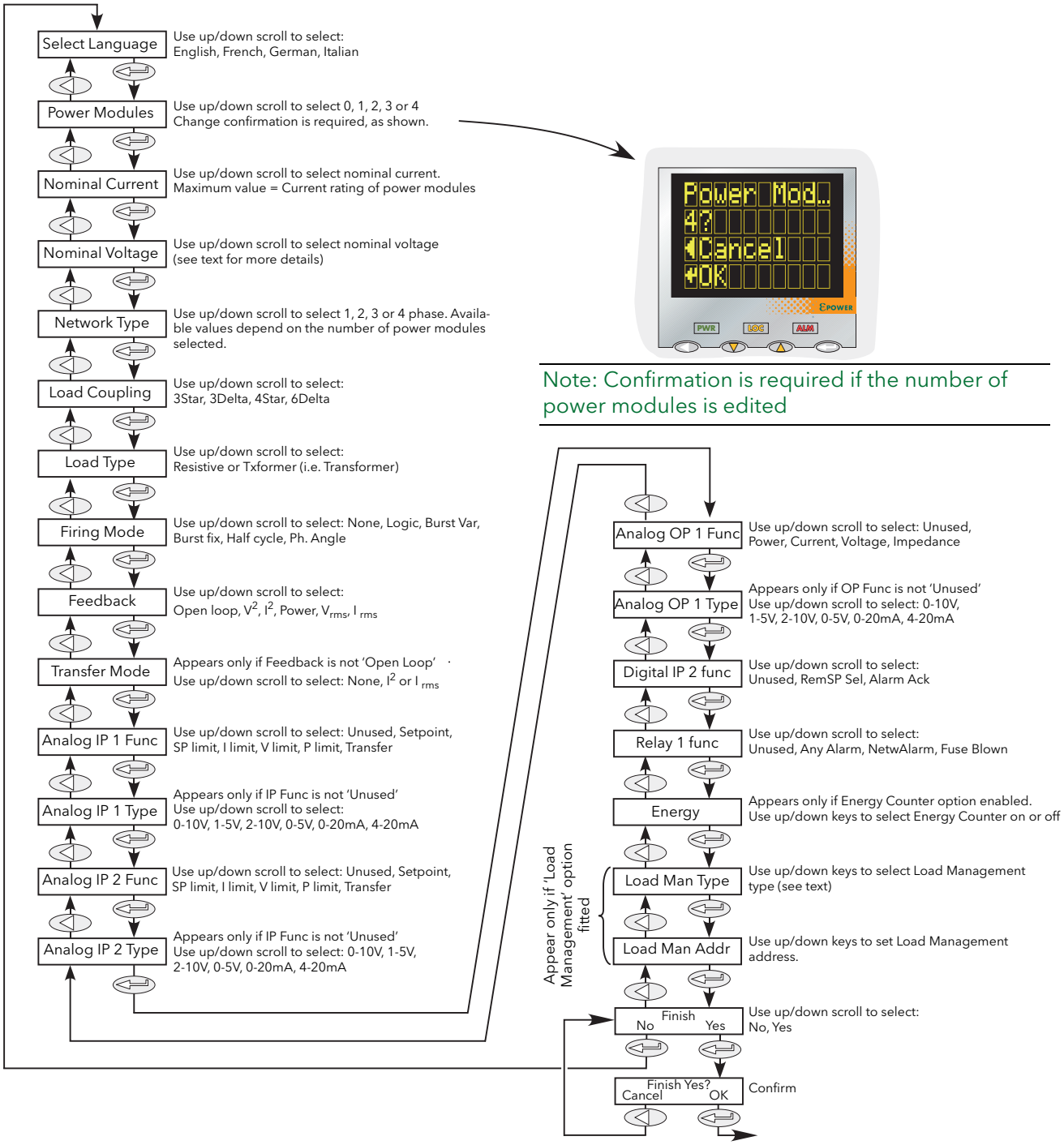



Figure 4 Typical Quickstart menu

## 4 QUICKSTART MENU (Cont.)

Notes:

1. If the unit has been fully configured at the factory, the Quickstart menu will be skipped, and the unit will go into operation mode at first switch on.
2. Once quit, the Quickstart menu can be returned to at any time from the Engineer or Configuration menus (described later in this document) by holding the 'Return' key operated for approximately two seconds. If values have been changed 'outside' the Quickstart menu, these values are displayed as '---' on re-entry to the Quickstart menu.

### 4.1 QUICKSTART MENU PARAMETERS

| | |
|---|---|
| Language | Initially, English, French, German and Italian may be selected. Other languages may be added during the lifetime of this issue of the manual. Once confirmed (single blink after approximately two seconds), then all further displays appear in the selected language. |
| Power Modules | Select the number of power modules between 0 and 4 that the driver module is to control. The number of phases offered (in Network type, below) depends on this value. Editing this value causes a confirmation screen to appear. 'OK' confirms the change. |
| Nominal Current | A value, normally between the maximum current the Power Modules are each able safely to sustain and a quarter of this value. Thus, for a 400 Amp unit, any nominal current value between 100 and 400 may be selected. (Lower values are not recommended as in such cases, the resulting accuracy and linearity are not guaranteed to be within specification.) |
| Nominal Voltage | A value between the maximum permanent supply voltage (+10%) to the modules, and a quarter of this value. Available values are 100, 110, 115, 120, 127, 200, 208, 220, 230, 240, 277, 380, 400, 415, 440, 460, 480, 500, 575 and 600. |
| Network Type | Allows the user to select 1, 2 or 3 phases depending on the selection made in 'Power Modules', above. The table shows the choices. |
| Load Coupling | For Network Type entries other than single phase:<br>2 phase: allows 3 Star or 3 Delta to be selected<br>3 phase: allows 3 Star, 3 Delta, 4 Star or 6 Delta to be selected. |
| Load Type | Allows 'Resistive' or 'Txformer' (transformer) to be selected as the type of load. If Txformer is selected, this modifies the start up procedure to limit the inrush current. |
| Firing Mode | Select from 'Logic', 'BurstVar', 'BurstFix', 'HalfCycle' or 'Ph.Angle'. |
| Feedback | Allows the user to choose open Loop, $V^2$, $I^2$, Power, Vrms or Irms. |
| Transfer Mode | If Feedback is set to any value other than 'Open Loop', 'None', '$I^2$' or 'Irms' can be selected as transfer mode. If Feedback is set to 'Open Loop', the Transfer Mode page does not appear. |
| Analog IP1 Func | Selects the Analogue input 1 function as 'Unused', 'Setpoint', 'SP limit', 'I limit', 'V limit', 'P limit' (power limit) or 'Transfer'. Allows (for example) a potentiometer to be connected to Analogue input 1, so that setpoint can be dynamically varied. |
| Analog IP 1 Type | Allows the user to select the analogue input type as 0 to 10V, 1 to 5V, 2 to 10V, 0 to 5V, 0 to 20mA, 4 to 20mA. This menu item does not appear if 'Unused' is selected in IP1 Func (above). |
| Analog IP 2 Func | As for Analog IP 1 Func, except 'Setpoint' does not appear if it has already been selected as Analog IP 1 type |
| Analog IP 2 Type | As for Analog IP 1 type |
| Analog OP 1 Func | Allows the user to select 'Unused'. 'Power', 'Current', 'Voltage' or 'Impedance' to be selected as output type. |
| Analog OP 1 Type | Allows the user to select the analogue output type as 0 to 10V, 1 to 5V, 2 to 10V, 0 to 5V, 0 to 20mA, 4 to 20mA. This menu item does not appear if 'Unused' is selected in OP1 Func (above). |
| Digital IP2 Func | Select Digital input 2 function as 'Unused', 'RemSP Sel' (Remote setpoint select) or 'Alarm Ack' |
| Relay 1 Func | Allows the function of Relay 1 to be set as 'Unused', 'Any Alarm', 'NetwAlarm', or 'Fuse Blown'. |

| Power Modules | Network Type |
|---|---|
| 0 | 0 |
| 1 | 1 |
| 2 | 1 or 2 |
| 3 | 1 or 3 |
| 4 | 1 or 2 |

## 4.1 QUICKSTART PARAMETERS (Cont.)

| | |
|---|---|
| Relay 1 Func | Allows the function of Relay 1 to be set as 'Unused', 'Any Alarm', 'NetwAlarm', or 'Fuse Blown'. |
| Energy | Appears only if one or more Energy counter blocks (section 6.10) are included in the configuration. Allows energy counters to be enabled and disabled. |
| Load Man Type | Appears only if the Predictive Load Management option is fitted. Allows the user to select one of LMNo (disabled), Sharing, IncrT1, IncrT2, RotIncr, Distrib, DistIncr, RotDisInc.<br>See section 9 for more details. |
| Load Man Address | Appears only if the Predictive Load Management option is fitted. Allows the user to enter a Predictive Load Management address. |
| Finish | Select 'No' to return to the top of the Quickstart menu, or 'Yes' to enter the User menu, after confirmation. (See also note below.) |

Note: The 'Finish' item might not appear if an inconsistent or incomplete configuration is entered. In such a case, the 'Language' selection page at the top of the menu re-appears.

## 4.2 SOME DEFINITIONS

### 4.2.1 Firing modes

**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.

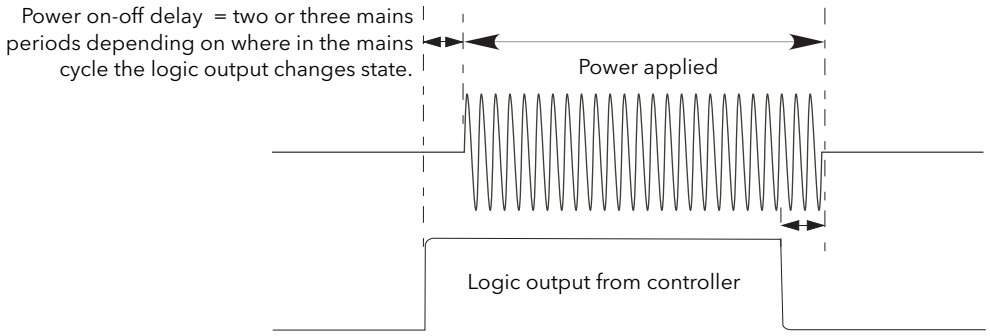



Figure 4.2.1a Logic firing mode

**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 4.2.1b).

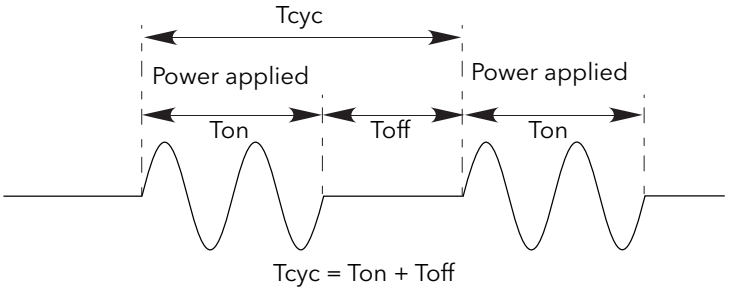



Figure 4.2.1b Burst Fixed mode

## 4.2.1 FIRING MODES (Cont.)

### 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.

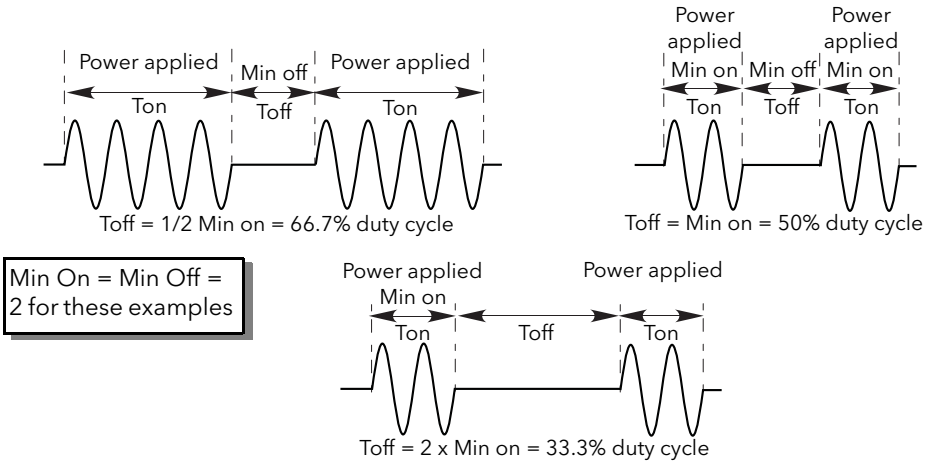
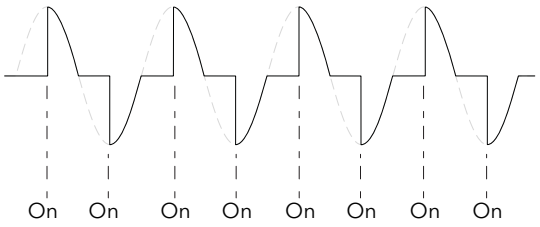



Figure 4.2.1c Burst variable firing

### 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 4.2.1d shows an example for 50% power.




50% shown.
Power is proportional to area under curve

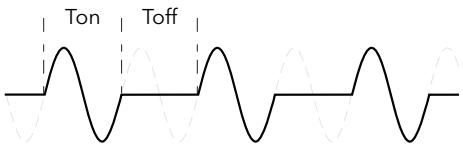
Figure 4.2.1d Phase angle mode

### HALF CYCLE MODE

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.

50% DUTY CYCLE

The firing and non-firing time corresponds to a single supply cycle (figure 4.2.1e).



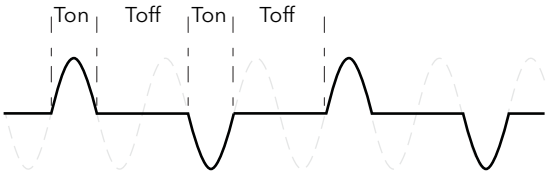

For 50% duty cycle Tn = Toff = 2 half cycles

Figure 4.2.1e Half cycle mode: 50% duty cycle

## 4.2.1 FIRING MODES (Cont.)

### 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 4.2.1f).

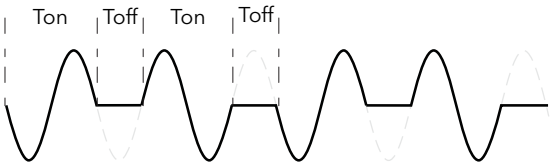



For 33% duty cycle
Ton = 1 half cycle; Toff = 2 half cycles

Figure 4.2.1f 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 4.2.1g).




For 66% duty cycle
Ton = 2 half cycles; Toff = 1 half cycle

Figure 4.2.1g Half cycle mode: 66% duty cycle

## 4.2.2 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. Thus $V_{RMS}$ is normalised to Nominal Voltage; $V^2$ is normalised to the square of Nominal Voltage and 'P' is normalised to the product of Nominal Voltage and Nominal Current.

| | |
|---|---|
| $V^2$ | Feedback is directly proportional to the square of the RMS voltage measured across the load. For two- or three-phase systems, feedback is proportional to the average of the squares of the individual phase-to-phase or phase-to-Neutral RMS voltage across each load. |
| Power | Feedback is directly proportional to the total true power delivered to the load network. |
| $I^2$ | 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. |
| $V_{rms}$ | Feedback is directly proportional to the RMS voltage measured across the load or, for multi-phase systems, to the average of the individual phase-to-phase or phase-to-neutral RMS load voltages. |
| $I_{rms}$ | Feedback is directly proportional to the RMS current through the load or, for multi-phase systems, to the average 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. |

Note: $V_{RMS}$ and $I_{rms}$ require a specific wiring in Burst mode. Contact your local distributor.

### 4.2.3 Transfer Mode

The control system can use automatic transfer of certain feedback parameters. For example with loads with very low cold resistance, $I^2$ feedback should be used to limit inrush current, but once the load has started to warm up, Power feedback should be used; the control program can be configured to change feedback mode automatically.

The Transfer mode can be selected as $I^2$ to P as appropriate to the type of load being controlled.

| | |
|---|---|
| None | No feedback parameter transfer to the control program |
| $I^2$ | Selects transfer mode: $I^2$ to the selected Feedback Mode (above). |

### 4.2.4 Limitation features

This limiting is implemented using phase angle or duty cycle reduction depending on the type of control (e.g. phase angle, burst firing).

To prevent damage on some particular applications the 'chop off' function can be used.

Note: The limiting function 'Chop-Off' is considered an 'Alarm' in EPower.

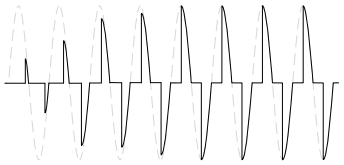
In order, for example, to prevent potentially damaging inrush currents, it is possible to set a value for power or Current squared which is not to be exceeded during the mains period. For this case, limitation has to be configured to run by phase angle reduction.

For loads exhibiting low impedance at low temperatures but a higher impedance at working temperature, the current drawn reduces as the load warms and limiting gradually becomes unnecessary.

Section 6.7.3 describes the configuration parameters which allow the user to enter a Process Variable (PV) and a setpoint (SP) for each phase, where the PV is the value to be limited (e.g. $I^2$) and the SP is the value that the PV must not exceed.

#### FIRING ANGLE LIMITING (IN PHASE ANGLE MODE)

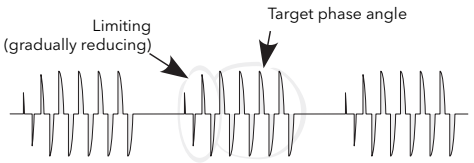
For phase angle control, limiting is achieved by reducing the firing angle on each half mains cycle such that the limit value of the relevant parameter is not exceeded. Limiting is reduced, by the firing angle gradually increasing, until the target setting is achieved.



#### FIRING ANGLE LIMITING (IN BURST MODE)

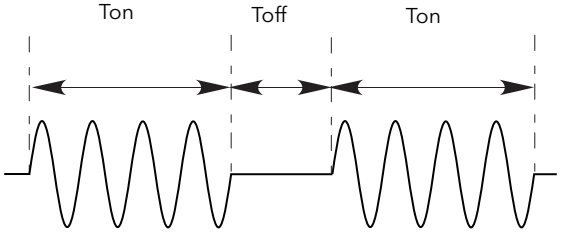
In Burst Mode limiting can also be achieved by reducing firing Angle during the 'ON' time such that the limit value of the relevant parameter is not exceeded.

In this way the PV must not exceed the limit SP during the ON time. We get 'Burst of Phase Angle'. See figure.

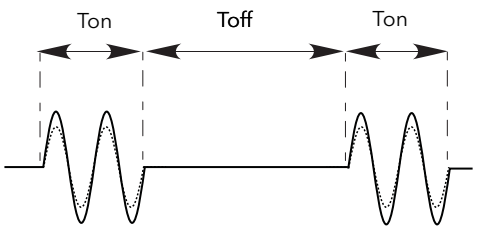



#### DUTY CYCLE LIMITING (IN BURST MODE)

For Burst Firing only, limiting reduces the 'On' state of the burst firing driving the load. Load current, voltage and active power are calculated over the period of each (Ton + Toff) period.




Normal running.




During limitation, amplitude increases when duty cycle decrease

**WARNING**

1. Product current rating must be upper or equal to the maximum current of the load. The maximum current of the load shall be calculated taking account of load resistive tolerance (tolerance and variation due to temperature) and voltage tolerance. Failure to follow these instructions may results in Branch circuit protection fuses, high-speed fuses (supplemental fuses) and product overload
2. For high coefficient temperature resistive load Current limit function by phase angle reduction may be selected to limit the inrush current of the load and downsized the rating of the product. With Current limit function by phase angle reduction the product rating must be upper or equal to the nominal current of the load and to Current limit function by phase angle reduction setting. Failure to follow these instructions may results in Branch circuit protection fuses, high-speed fuses (supplemental fuses) and product overload
3. With External current feedback, Current limit function by phase angle reduction will limit the inrush current in the load which may not be the current in the product (ie resistive load at the secondary side of a transformer). Ensure that the current in the product does not exceed the product current rating with the setting of Current limit function by phase angle reduction.
4. The current limit function by phase angle reduction is not available with Intelligent Half Cycle (IHC), The product rating shall be selected to cope with inrush current according to warning 6. Failure to follow these instructions may results in Branch circuit protection fuses, high-speed fuses (supplemental fuses) and product overload.
5. Duty cycle current limiting features (in burst mode), does not limit the peak current value. The product rating shall be selected to cope with the peak current value according to warning 6. Failure to follow these instructions may results in Branch circuit protection fuses, high-speed fuses (supplemental fuses) and product overload.

**CHOP OFF**

This is a technique which detects an over-current alarm state and stops further thyristor firing for the duration of that alarm state. All the relevant parameters are to be found in the Network Setup menu (see section 6.20.2).

There are two alarms which may trigger Chop Off, as follows:

1. The alarm is active when ChopOff1Threshold is exceeded for more than five seconds. This threshold can be set to any value between 100% and 150% inclusive, of the unit's nominal current (INominal).
2. The alarm is active if ChopOff2Threshold is exceeded more than a specified number of times (NumberChop Off)) within a specified time period (Window Chop Off). ChopOff2Threshold is adjustable between 100% and 350% inclusive, of INominal; NumberChop Off can be selected to any value between 1 and 16 inclusive; Window Chop Off can be set to any value between 1 and 65535 seconds (approximately 18 hours 12 minutes).
   Each time the threshold is exceeded, the unit stops firing, raises a chop off condition alarm, then after 100ms, restarts using an up-going safety ramp. The condition alarm is cleared if the unit successfully restarts. If the alarm is raised more than the specified number of times within the specified window, then the Chop Off alarm is set and the unit stops firing. Firing is not resumed until the operator acknowledges the Chop Off alarm.

# 5 OPERATOR MENU

At power up or after quitting the Quickstart menu, the unit initialises itself (figure 5) and then enters the first summary page of the Operator menu (figure 5.2).

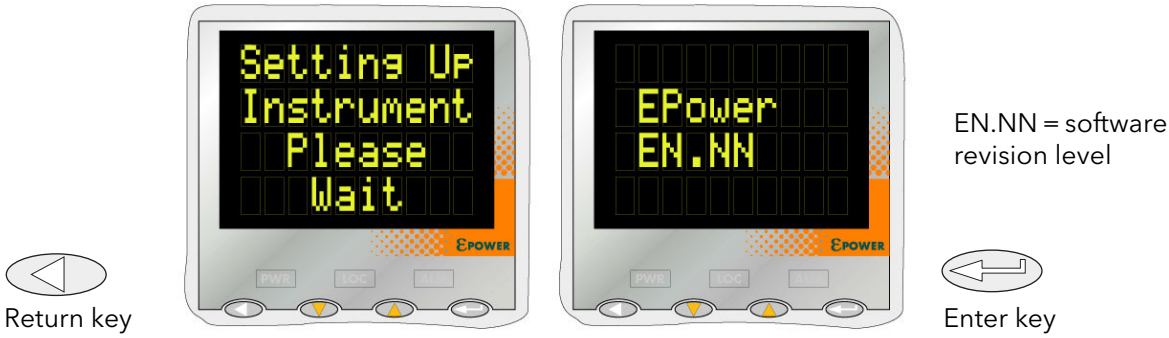



Figure 5 Initialisation screens

Note: If any faults are detected during initialisation (e.g. supply voltage missing), then error messages appear on the display screen. The up and down arrow keys must be operated simultaneously to acknowledge each alarm in turn, before any further operations can take place.

## 5.1 SUMMARY PAGES

Each summary page displays the voltage, current and power status described below calculated over the mains period when in Phase Angle mode or over the Modulation Period when in Burst Mode. The user may also edit the local setpoint from the summary pages. Where more than one, single phase unit is being driven, the parameter names have a numeric suffix (e.g. V2) to indicate which phase is being displayed. The enter key can be used to scroll through the available phases.

The Return key can be operated briefly to access the top level operator menu, which contains all summary pages and Alarm and Event Log entries. (Operation of the Return key for an extended interval calls the Access page - see section 6.3)

Notes:
1. A suffix 'n' below represents the number of the network currently being displayed.
2. 'LSP' is replaced in the display by 'RSP' for remote working.

### 5.1.1 Single phase summary page

| | |
|---|---|
| Vn | The RMS load voltage measurement for network 'n'. |
| In | The RMS load current measurement for network 'n'. |
| Pn | The true power delivered to network 'n'. |
| LSPn | The local setpoint value for network 'n' - see also Note 2 above. |

### 5.1.2 Two or three phase summary page

| | |
|---|---|
| Vavg | The average RMS load voltage over all three loads. |
| Iavg | The average RMS load current over all three loads. |
| P | The true power delivered to the load network. |
| LSP | The local setpoint value - see also Note 2 above. |

### 5.1.3 Two by two phase summary page

This is a mode of operation whereby a single four-power-module unit can control two independent, three-phase networks.

| | |
|---|---|
| Vavn | The RMS load voltage averaged over all three loads for network 'n'. |
| Iavn | The RMS load current averaged over all three loads for network 'n'. |
| Pn | The true power delivered to load network 'n'. |
| LSPn | The local setpoint value for network 'n' - see also Note 2 above. |

## 5.2 TOP LEVEL OPERATOR (USER) MENU

1st Summary page appears:
1. After quitting the Quickstart menu.
2. On power up if the unit was left in Access level 1 (operator) or 2 (Engineer) at power down. (If powered off in Config mode, it restarts in Config mode.)

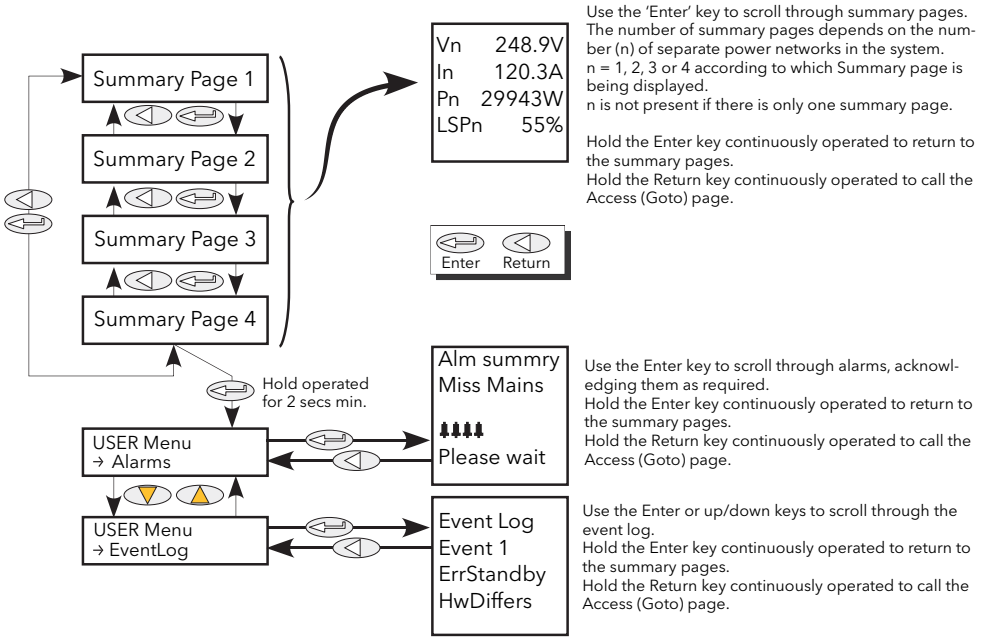



Figure 5.2 User menu overview

Note: The summary page is displayed at switch on only if the unit has been configured, either via the Quickstart menu, or at the factory. Otherwise, at first switch on, the Quickstart menu is entered.

Summary pages are discussed in section 5.1, above.

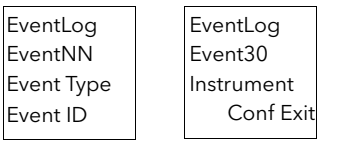
### 5.2.1 Alarm Summary pages

This page contains a list of currently active alarms, together with a group of four flashing bell symbols if the alarm is unacknowledged. The 'Enter' key is used to scroll through the list, and the up/down arrow keys are operated, simultaneously, to acknowledge each alarm, as required.

### 5.2.2 Event Log

This is a list of up to 40 event items where Event 1 is the latest. As shown in the figure below, Event number, Event Type and Actual Event (known as 'Event ID') appear on the screen.

Event Types and Event IDs are given in table 5.2.2.



## 5.2.2 EVENT LOG (Cont.)

| Event Type | Event ID | |
|---|---|---|
| Config error<br>DSP Error<br>Fatal error<br>General error<br>Indication Alarm Network 'n' Active<br>Indication Alarm Network 'n' Inactive<br>Indication Alarm Network 'n' Acknowledged<br>Instrument event<br>Network 'n' error<br>Power Module 'n' error<br>Process Alarm External 'n' Active<br>Process Alarm External 'n' Inactive<br>Process Alarm External 'n' Acknowledged<br>Process Alarm Network 'n' Active<br>Process Alarm Network 'n' Inactive<br>Process Alarm Network 'n' Acknowledged<br>Restart Error<br>Standby Error<br>System Alarm Network 'n' Active<br>System Alarm Network 'n' Inactive<br>System Alarm Network 'n' Acknowledged<br><br>'n' = 1, 2, 3 or 4 | EXTERNAL PROCESS ALARMS<br>Deviation Band<br>Deviation High<br>Deviation Low<br>High<br>Low<br>FATAL ERRORS<br>Internal Fuse configuration<br>Restart Failure<br>CONFIG ERRORS<br>Invalid parameter database<br>Invalid wiring table<br>INDICATION ALARMS<br>Limit active<br>Load over current<br>Load Management over schedule<br>Process Value transfer<br>GENERAL ERRORS<br>Processor watchdog<br>Event Log fault<br>Power Module 'n' Calibration<br>INSTRUMENT EVENTS<br>Cold start<br>Config entry<br>Config exit<br>Global Acknowledge<br>Power down<br>Quickstart entry<br>Quickstart exit<br>NETWORK ERRORS<br>Phase 'n' power module Comms err<br>Phase 'n' power module Timeout<br>Phase 'n' power module watchdog | POWER MODULE POST ERRORS<br>Comms error<br>Comms timeout<br>Fuse blown<br>Power rail fail<br>Watchdog<br>PROCESS ALARMS<br>Chop Off<br>Closed loop<br>Main voltage fault<br>Output short circuit<br>Partial load fault<br>Partial load unbalance<br>Temperature pre-alarm<br>Total Load Failure<br>RESET ERRORS<br>Invalid RAM checksum<br>DSP no response<br>DSP task Watchdog<br>STANDBY ERRORS<br>Invalid Power Module Revision<br>Hardware mismatch<br>Power Module 'n' Ribbon Fault<br>SYSTEM ALARMS<br>Fuse Blown<br>Mains Frequency Fault<br>Missing mains<br>NetworkDip<br>Over Temperature<br>Power Module 24V fault<br>Thyristor Open circuit<br>Thyristor Short circuit |

Table 5.2.2 Event types and IDs

Notes:

1. Event ID 'Fuse blown' may appear in association with either Event Type 'System Alarm Network 'n'' or Event Type 'Power module 'n' Error'.
2. Event ID 'Watchdog' appears in association with Event Type 'General error' and indicates that the microprocessor in the Driver Module has performed a watchdog reset.
3. Event ID 'Watchdog fault' appears with Event Type 'Power Module 'n' Error' and indicates that the relevant Power Module PIC microprocessor has performed a watchdog reset.

## 5.2.3 Strategy Standby mode

For SCADA systems, in order to determine Standby mode, the user should use bit 8 of the Faultdet.Strategy-Status parameter, not the Instrument.Mode parameter.

This is because Instrument Mode reflects user selection, not error states such as Hardware Mismatch.

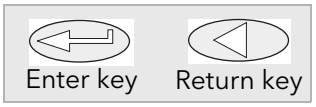
# 6 ENGINEER AND CONFIGURATION LEVEL MENUS

These two menu sets are mostly identical, displaying the unit's parameters in a number of sub-menus. As the Engineer level menu is accessible whilst the Driver Module is on-line to the power module(s), the majority of the displayed items are Read Only (i.e. they can be viewed, but not edited), although some non-critical items can be changed.

Full configuration may be carried out from the Configuration level menus, which (apart from the access menu) contain the same parameters as the equivalent Engineering level menus. It is normally recommended, however, that configuration be carried out from a pc running iTools configuration software. In either case, the unit goes off-line as soon as Configuration mode is entered.

## 6.1 ACCESS TO THE ENGINEER AND CONFIGURATION MENUS

### 6.1.1 Engineer level menu




The Engineer level menu is entered as follows (figure 6.1.1):

1. Operate the return key repeatedly, until no further changes occur, then hold the Return key continuously operated until the 'Access' 'Goto' display appears.
2. Use the up or down arrow key until 'Engineer' appears.
3. Either wait for a few seconds or operate the Enter key.
4. Use the up or down arrow key to change the code to the Engineer level code (factory default = 2, but reconfigurable in the CONFIG level menu)
5. Either wait for a few seconds or operate the Enter key to display the first Summary Page. Press and hold the Enter key until the first page of the top level Engineer menu appears.

Note: when entering from configuration level no password is required. Once Engineer level has been selected, the unit restarts in the Engineer top level menu

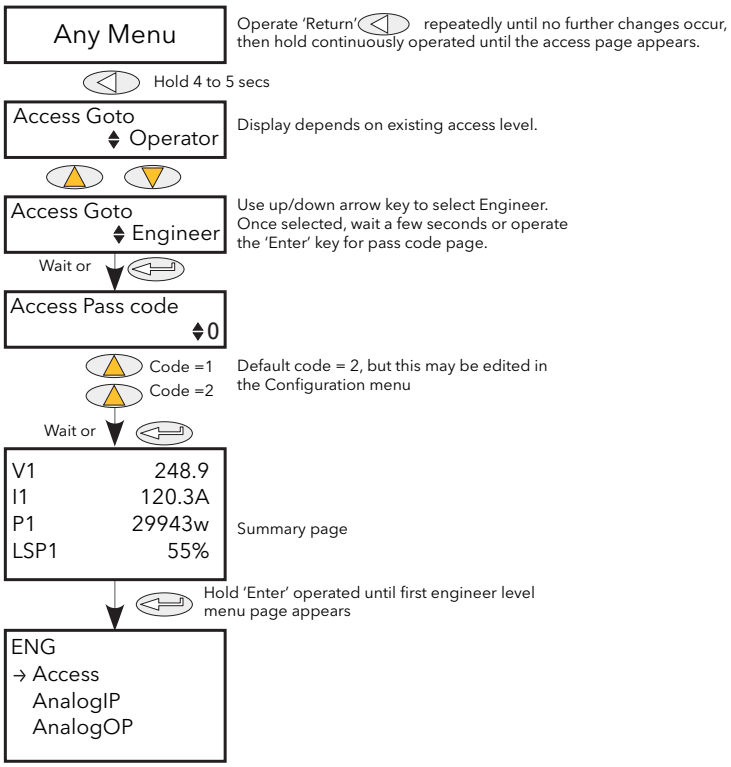



Figure 6.1.1 Access to the Engineer level menu

### 6.1.2 Configuration level menu

The Configuration level menu is entered as follows (figure 6.1.2):

1. Operate the return key repeatedly, until no further changes occur, then hold the Return key continuously operated until the 'Access' 'Goto' display appears.
2. Use the up or down arrow key until 'Configuration' appears.
3. Either wait for a few seconds or operate the Enter key.
4. Use the up or down arrow key to change the code to the Engineer level code (factory default = 3, but reconfigurable in the CONFIG level Access menu)
5. Either wait for a few seconds or operate the Enter key to display the first page of the top level Configuration menu.

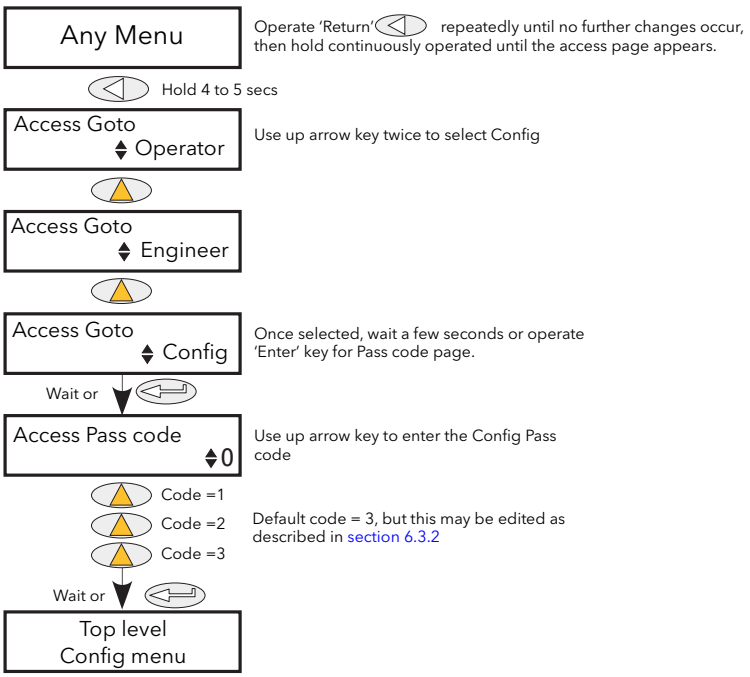



Figure 6.1.2 Access to the Configuration level menu

## 6.2 TOP LEVEL MENU

Figure 6.2 shows the top level menu for Configuration level. Engineer top level menu similar (Default code = 2).

Submenus are discussed in the following sections:

Note: Section 6 contains descriptions of all the menus which can appear. If an option or a feature is not fitted and/or enabled, then it does not appear in the top level menu.



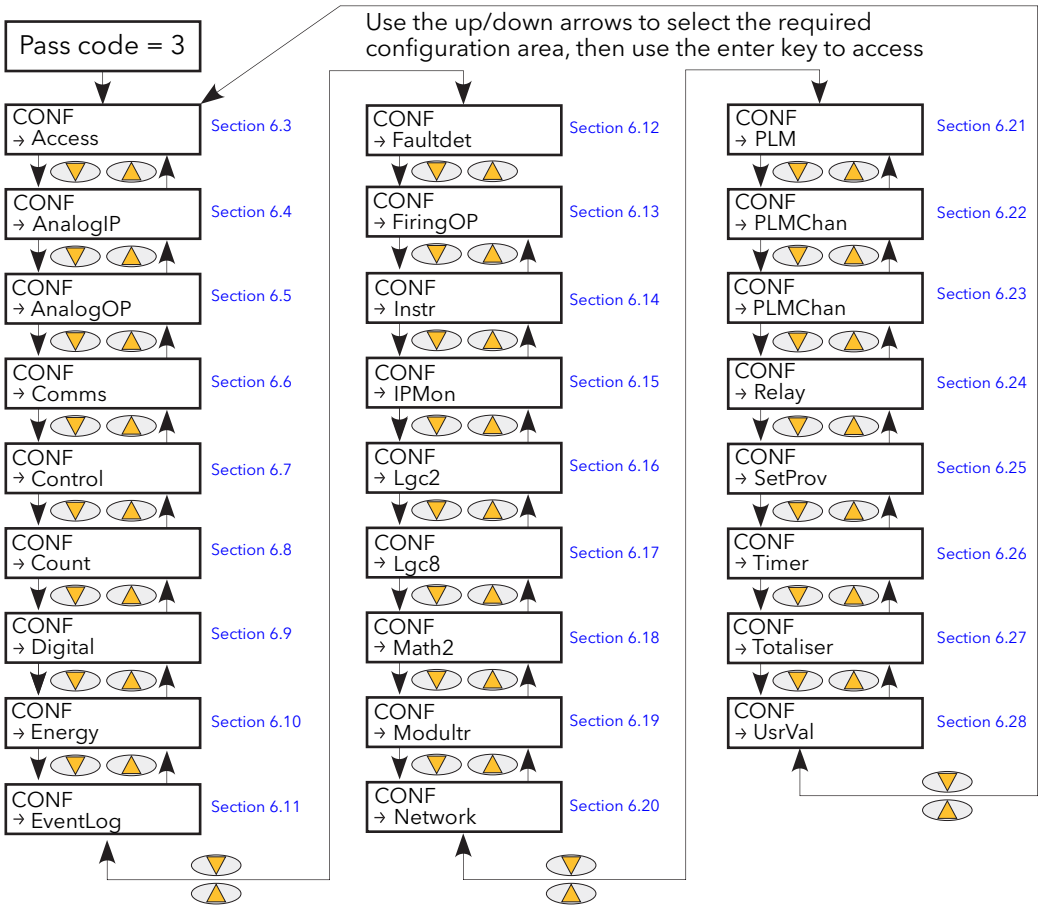



Figure 6.2 Top level menu

## 6.3 ACCESS MENU

### 6.3.1 Engineer level menu

Entered from the Engineer top level menu, this allows the user to go to any other menu for which the access code is known. The default access codes are Operator = 1; Engineer = 2, Config = 3, Quickstart = 4.

Figure 6.3.1 below, shows details.

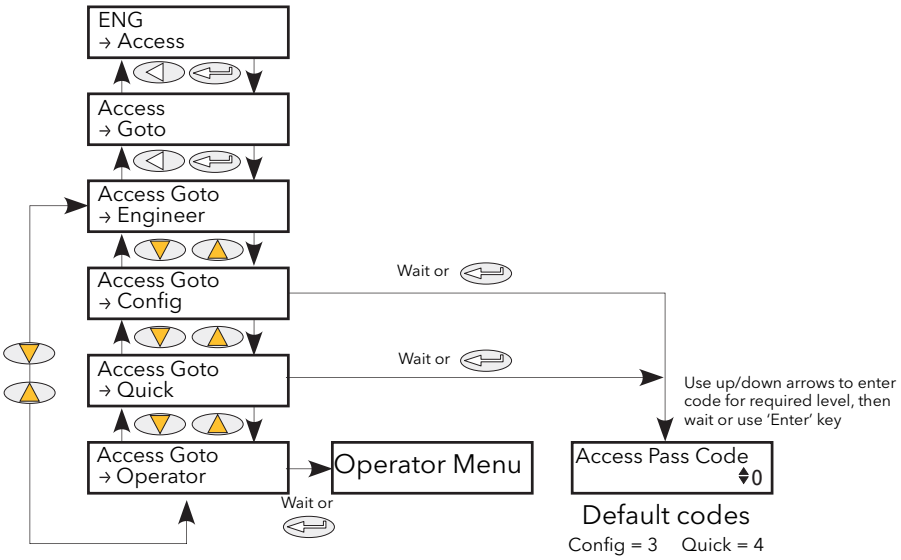



Figure 6.3.1 Engineer level Access menu

### 6.3.2 Configuration level access menu

This menu allows:

1. The user to quit the Configuration level menu and 'Goto' a different access level. Operator and Engineer level menus require no Pass code as they are considered to be at a lower security level than Configuration. (Figure 6.3.2a shows the menu layout.)
2. The user to edit the current Pass codes for Engineer, Configuration and Quickstart menus (figure 6.3.2b),
3. Access to the Operator Interface push-buttons to be restricted in Operator and Engineer Level menus (figure 6.3.2b).

**GOTO MENU**

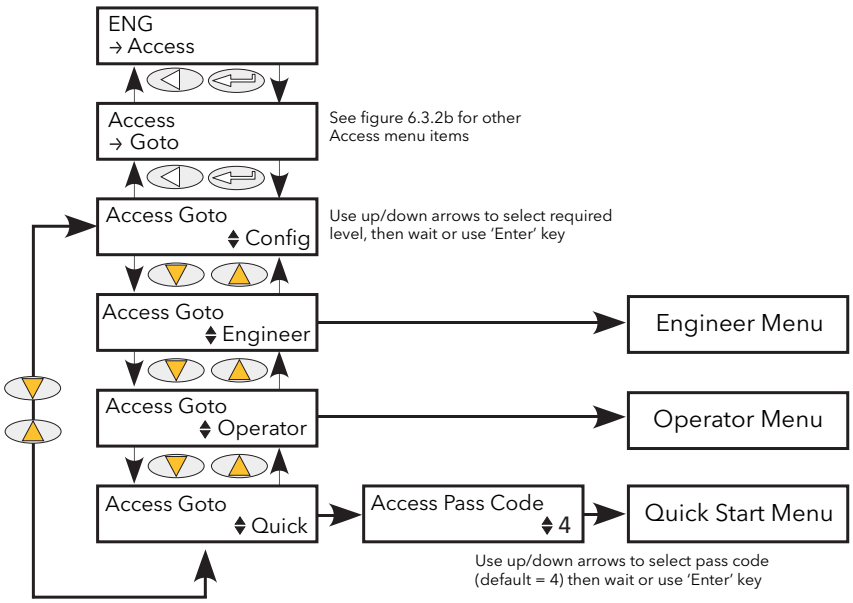



Figure 6.3.2a GoTo menu

To change access level, the 'Enter' key is operated once to select 'Goto', then for a second time to enter the Goto selection page.

The up/down keys are used to select the required access level. After a few seconds, or after a further entry of the 'Enter' key, the unit restarts in the selected level (except for 'Quick Start' which requires the relevant Pass Code (default = 4) to be entered).

## 6.3.3 CONFIGURATION LEVEL ACCESS MENU (Cont.)

### PASS CODE EDITING

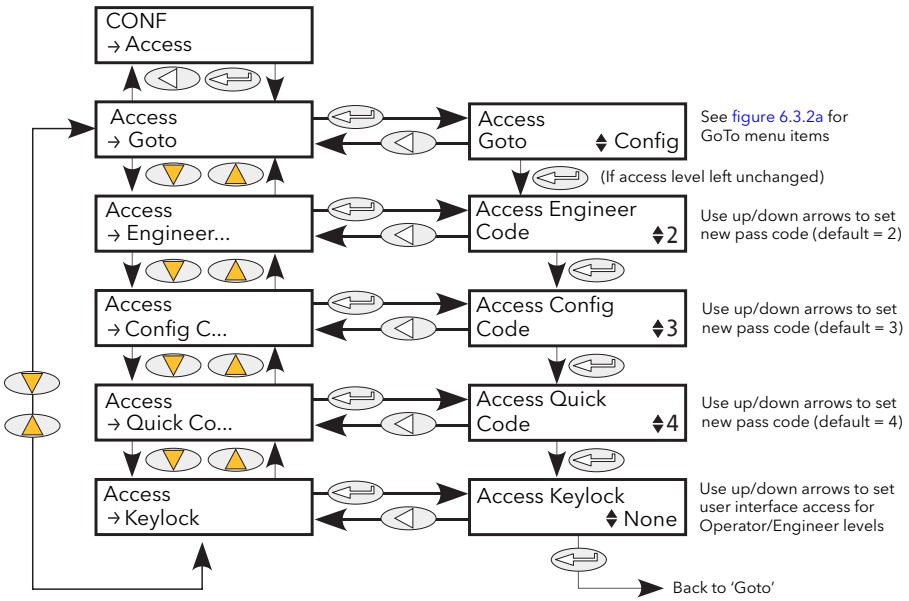



Figure 6.3.2b Access configuration

Code — As depicted above, the 'Enter' key is used to select 'GoTo', then the up/down keys are used to select the required access level's Pass code for editing. Once the required level is selected (e.g. Engineer), the 'Enter' key is used once more, to enter the edit page, where the current Pass Code is displayed (e.g. 2). The up/down keys can now be used to enter a new value of between 0 and 9999. If 0 is selected, then the relevant menu will no longer be pass code protected.
After a few seconds, the new value blinks once to confirm that it has been written into the configuration.

KeyLock
- None: No restriction. All parameters at the current access level may be viewed and edited.
- All: All editing and navigation is prevented. All keys are locked so it is not possible to 'undo' this action from the Operator interface. Once 'All' is selected, the keyboard can be released only via iTools.
- Edit: Parameter editing is possible only in Configuration level; parameters are Read Only in other levels. In the Operator or Engineer level menus, the 'Back' key is still active allowing access to the 'Goto' menu so that the access level may be changed if the relevant Pass code is known.

Note: Keylock is available only from the user interface (i.e. it cannot be accessed from iTools or over a communications link.)

## 6.4 ANALOGIP MENU

This menu item appears only if one or more analogue inputs have been configured as anything but 'Off' in Quickstart, or if one or more analogue inputs has been enabled using iTools.

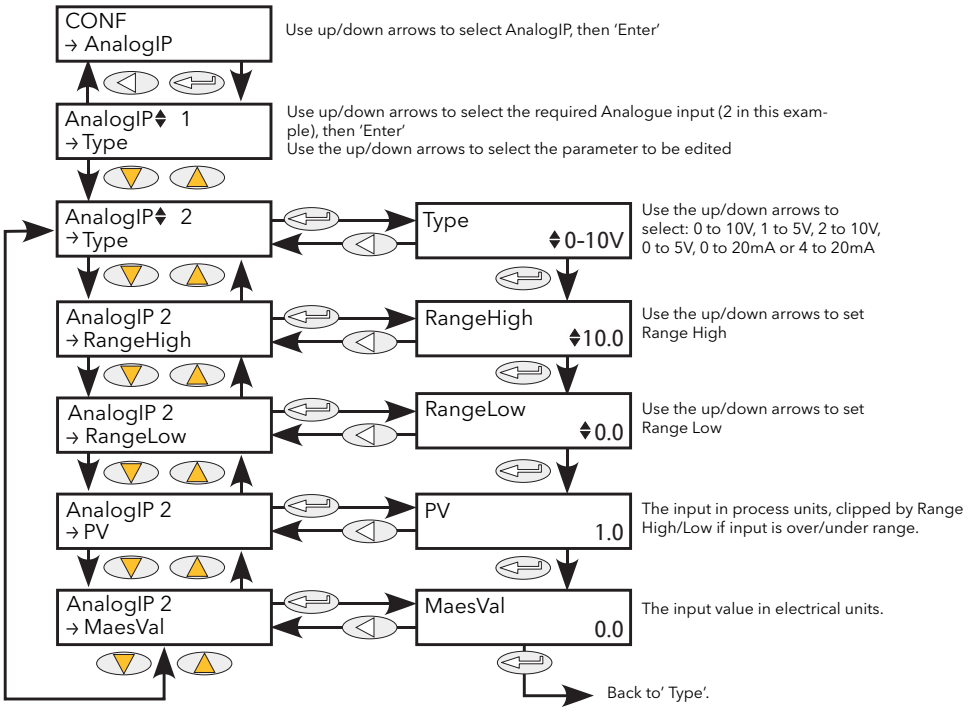



Figure 6.4 Analogue input menu

### 6.4.1 Analogue input parameters

| | |
|---|---|
| Type | Allows the type of input to be set as one of: 0 to 10V, 1 to 5V, 2 to 10V, 0 to 5V, 0 to 20mA, 4 to 20mA. |
| RangeHigh | High range of input for scaling from measurement units to process units. PV is clipped to range high if input goes over range. |
| RangeLow | Low range of input for scaling from measurement units to process units. PV is clipped to range low if input goes under range. |
| PV | The scaled value in process units. Clipped to the Range High or Range Low value if the signal goes over range or under range respectively. |
| MeasVal | The value at the instrument terminals in electrical units. |

## 6.5 ANALOGOP MENU

This menu item appears only if one or more analogue outputs have been configured as anything but 'Off' in Quickstart, or if one or more analogue outputs has been enabled using iTools.

This provides a current or voltage output scaled from a Process Variable (PV) using Range High and Range Low. Figure 6.5.1 shows the 'Main' configuration submenu; figure 6.5.2 shows the alarm parameters.

### 6.5.1 Analogue output 'Main' submenu parameters

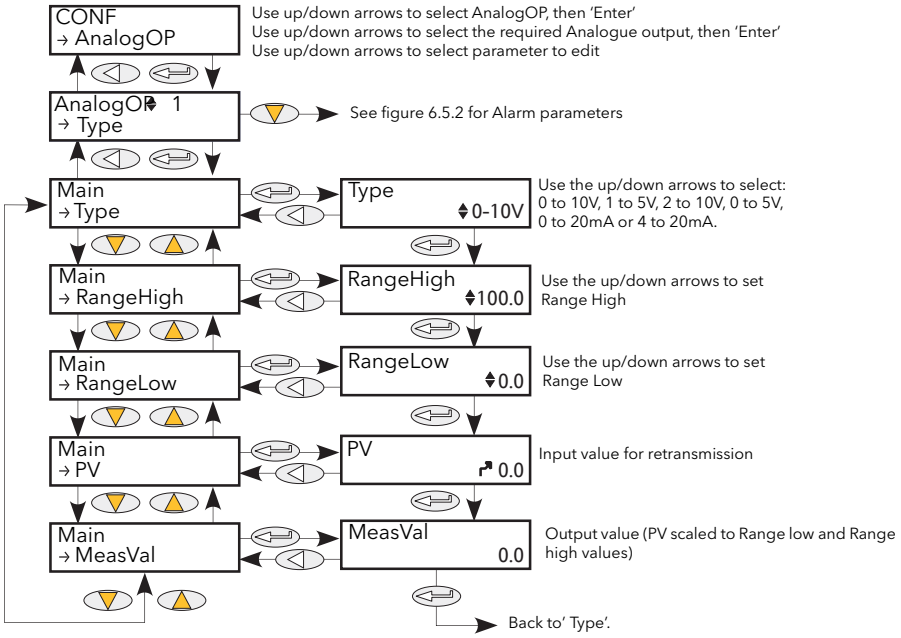



Figure 6.5.1 Analogue output 'Main' menu

| | |
|---|---|
| Type | Allows the output type to be set as one of: 0 to 10V, 1 to 5 V, 2 to 10V, 0 to 5V, 0 to 20mA, 4 to 20mA. |
| RangeHigh | Used to scale the Process Variable (PV) from Process units to electrical units. |
| RangeLow | Used to scale the PV from Process units to electrical units. |
| PV | The value to be output by the analogue output. |
| MeasVal | The electrical output value derived by mapping the input PV via input range to output range. |

## 6.5.2 Analogue output 'Alm' parameters

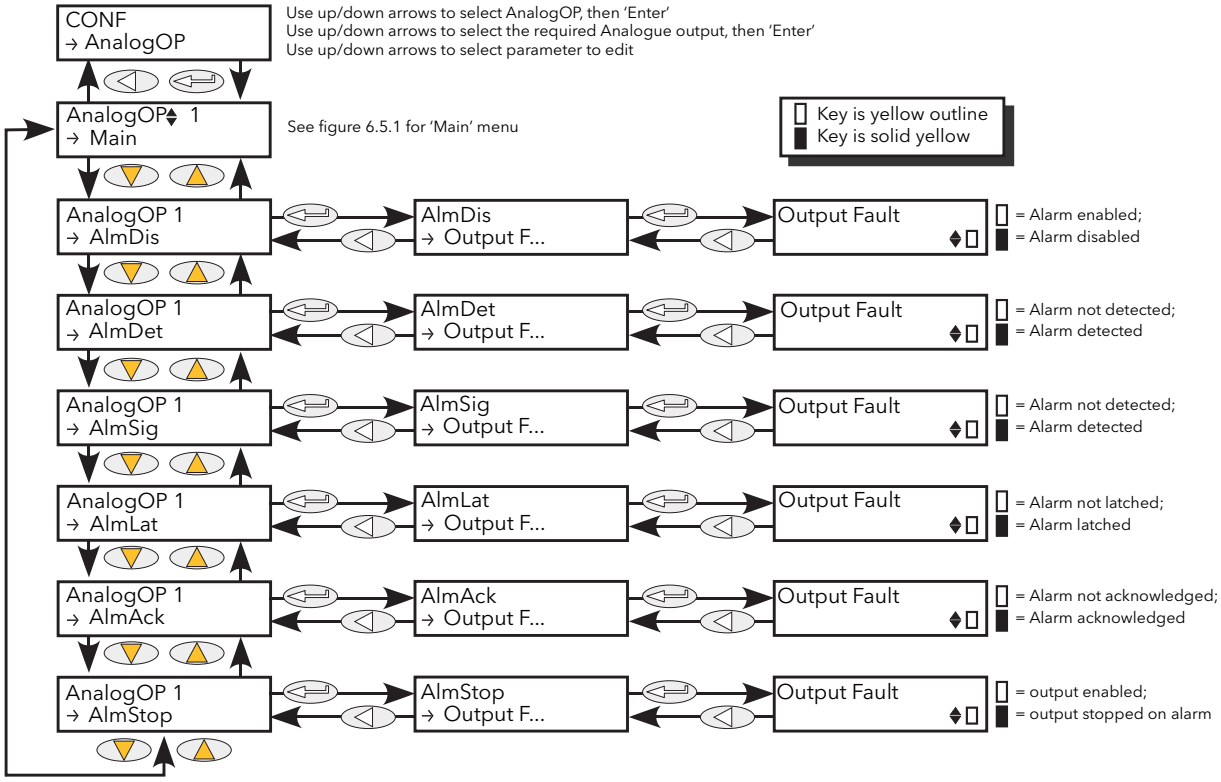



Figure 6.5.2 Analogue output alarm parameter access

| | |
|---|---|
| AlmDis | Allows the user to view the current disable status of the output Fault alarm. |
| AlmDet | Indicates whether the alarm has been detected and is active. |
| AlmSig | Signals that the alarm has occurred and whether it is latched. To assign the alarm to a relay (for example), it is the AlmSig parameter that should be wired. |
| AlmLat | Allows the user to set the alarm as latching or non-latching. |
| AlmAck | Allows the user to view the current acknowledgement status of the output Fault alarm. |
| AlmStop | Allows the user to set up the alarm to disable Power Module firing whilst active. |

Note: Output fault may be triggered by either short circuit or open circuit.

## 6.6 COMMS MENU


Figure 6.6 Communications User menu

## 6.6 COMMS MENU (Cont.)

This menu allows the user to view, and in some cases, to edit communications parameters associated with the communications option. The user may also view the Address and Baud Rate parameters associated with the Remote Panel option.

### 6.6.1 Communications User menu parameters

The following parameter list includes all parameters which can appear. Only those parameters which are relevant to the fitted communications option appear in the menu list.

**ID** Displays the type of communications board fitted: RS-485 (EIA 485), Ethernet, or a Network comms board such as Profibus or DeviceNet. (These options are fully discussed in the Communications manual, HA179770.) ID is not user editable.

**Protocol** Read only. Displays the current transmission protocol: Modbus, Modbus TCP, Network, Profibus, DeviceNet, CANopen, CC-Link, EtherNet/IP.

**Baud** Allows the Baud rate setting for the unit to be set. Available values vary according to the type of communications board fitted.

**Address** Allows the instrument address to be set up. Each instrument in a communications link must have a unique address allocated to it. The available address ranges vary according to link protocol.

**Occupied Stations** Appearing for CC-Link protocol only, this read-only value shows the number of addresses occupied by the unit, according to the number of input and output definitions are set up (in iTools Fieldbus I/O Gateway) , and as shown in the table below. For example, if the address of this unit is 4, and the number of occupied stations is 3, then the next available address is 7.

| Number of occupied stations | Maximum No. of input definitions | Maximum No. of output definitions |
|---|---|---|
| 1 | 3 | 4 |
| 2 | 7 | 8 |
| 3 | 11 | 12 |
| 4 | 15 | 16 |

Input definition:
2-byte word parameter to be read by the master.
Output definition:
2-byte word parameter to be written by master.

**Parity** Allows the parity setting to be selected as None, odd or Even. None is often used because there are other corruption detection methods (e.g. CRC) in use, and selecting 'Odd' or 'Even' increases the number of bits transmitted, thus reducing throughput.

**Delay** Selects Transmission Delay 'On' or 'Off'. 'On' inserts a guaranteed 10 millisecond delay between reception and response. This is needed by some converter boxes in order to switch driver direction.

**Unit ident** Enables/disables the checking of the Modbus TCP Unit Identity field.

- Strict: The Modbus TCP Unit Identity Field (UIF) does not have to match the instrument address. The instrument responds only to Hex value FF in the UIF.
- Loose: The Modbus TCP Unit Identity Field (UIF) does not have to match the instrument address. The instrument responds any value in the UIF.
- Instr: The Modbus TCP Unit Identity Field (UIF) must match the instrument address or no response will be made to messages.
  A value of 0 in the UIF is treated as a 'Broadcast Message'.

**DHCP Enable** Allows the user to choose whether the IP address and subnet mask are fixed or to be supplied by a DHCP Ethernet server.

**IP1 Address** The first byte of the IP address. (If the IP address were to be 111.222.333.444, then the first byte would be 111; the second byte 222, and so on).

**IP2 to IP4 Address** As IP address 1, but for the remaining three Bytes.

**Subnet1 to Subnet4 Mask**
As IP Address 1 to 4, but for the Subnet Mask

**Gateway1 to 4** As IP Address 1 to 4, but for the Default Gateway.

**IP1 Pref Master to IP4 Pref Master**
As for IP Address 1 to 4, but for the Preferred Master.

Local network information (IP address, subnet mask address etc.) is normally supplied by the user's IT department.

## 6.6.1 COMMUNICATIONS USER MENU PARAMETERS (Cont.)

| | |
|---|---|
| Show MAC | Allows the user to choose whether the unit's MAC address may be shown (Yes), or not (No). |
| MAC1 | Appears only if Show MAC (above) is set to 'Yes'. This is the first byte of the non-editable MAC address. (If the MAC address were to be 11.22.33.44.55.66 then the first byte would be 11; the second byte 22, and so on). |
| MAC2 to MAC6 | As for MAC1, but for bytes two to six respectively |
| Network | Read Only. Also known as 'Ethernet Status'. Shows the status of the communictions link, as follows:<br>Running: Link connected and running<br>Init: Communications initialising<br>Ready: Network ready to accept connection<br>Offline: Network offline<br>Bad: Network Status Bad GSD (Profibus only) |
| NetStatus | Read Only. Appears to 'Fieldbus' protocols only. Shows the status of the communications network, as follows:<br>Setup: Anybus module set-up in progress<br>Init: Anybus module is initialising network-specific functionality<br>Ready: Process Data channel ready but inactive<br>Idle: Interface is inactive<br>Active: Process Data channel is active and error free<br>Error: One or more errors have been detected<br>Fault: Host fault detected. |

## 6.6.2 COMMS REMOTE PANEL PARAMETERS

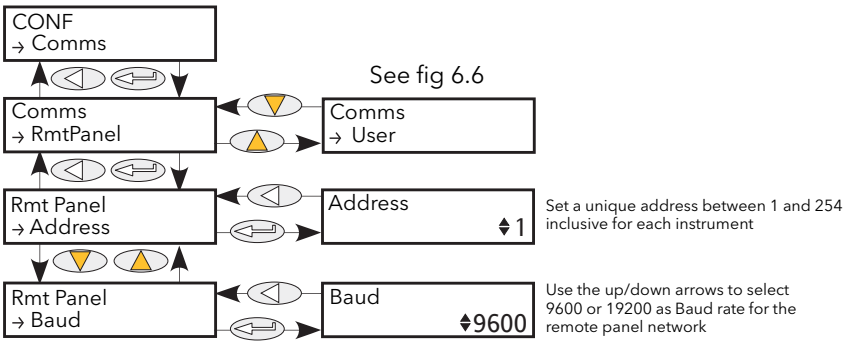



Figure 6.6.2 Communications remote panel menu

| | |
|---|---|
| Address | Each instrument on the link must be given a unique address between 1 and 254 inclusive.<br>This may be the same or different from the address set in the CONF 'User' Menu (section 6.6.1). |
| Baud | Displays the Baud rate for the Remote panel communications. Either 9600 or 19200.<br>This may be the same or different from the Baud rate set in the CONF 'User' Menu (section 6.6.1). |

Note: Remote Panel parity setting should be set to 'No parity' or 'None'.

## 6.7 CONTROL MENU

The control menu provides the control algorithm to perform power control and transfer, threshold limiting and phase angle reduction (in the case of burst firing). Figure 6.7, below, gives an overview of the menu, which is described in the following sections:



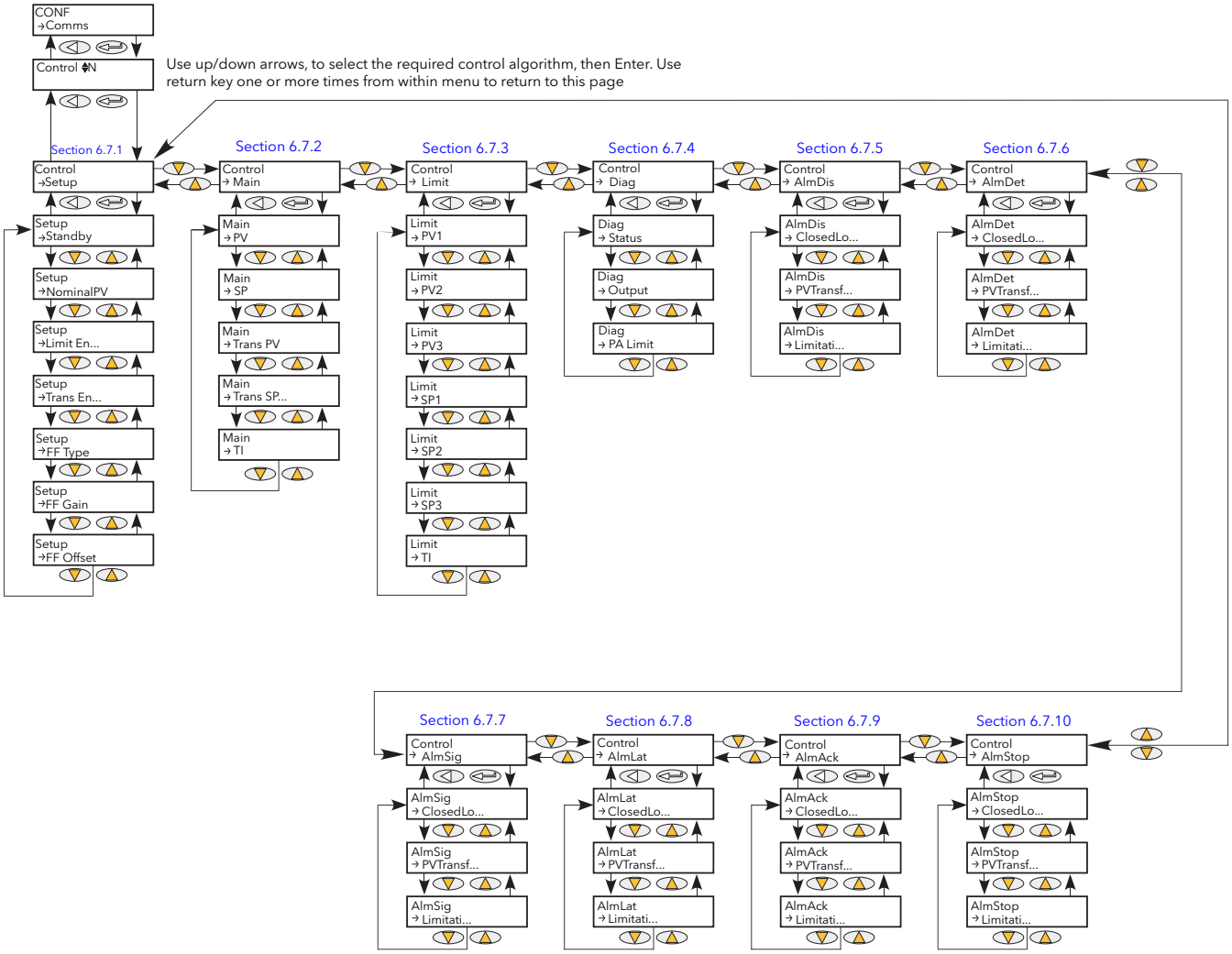



Figure 6.7 Control menu

### 6.7.1 Control Setup Parameters

This contains parameters for setting the type of control to be performed.

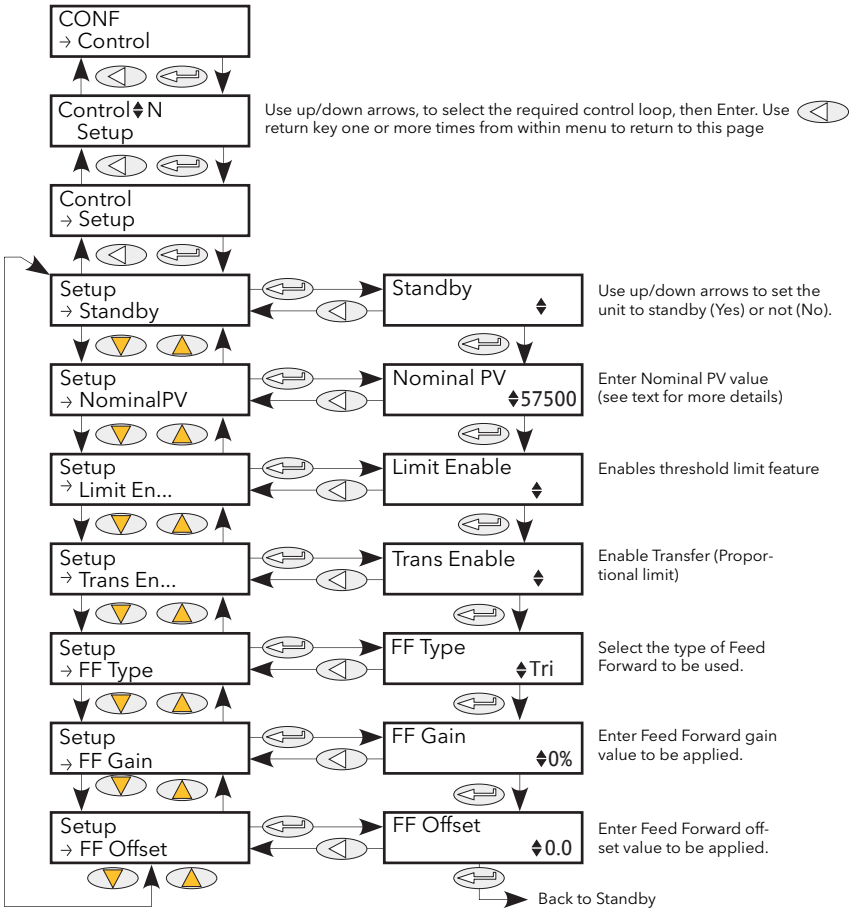



Figure 6.7.1 Control setup menu

| | |
|---|---|
| Standby | If Yes, the controller enters Standby mode and zero % power is demanded. When removed from Standby the unit returns to operating mode in a controlled manner. |
| Nominal PV | Normally the nominal value for each control type. For example, for feedback mode = $V^2$, Vsq should be wired to the Main PV, and Nominal PV set to the nominal value expected for $V^2$ (usually $VLoadNominal^2$). |
| Limit Enable | Used to enable/disable threshold limit. |
| Trans Enable | Select Transfer Enable (Proportional limit) as 'Yes' (enabled) or 'No' (not enabled). |
| FFType | Feedforward Type.<br>Off: Feedforward is disabled<br>Trim: Feedforward value is the dominant element of the output. Trimmed by the control loop based on the Main PV and setpoint.<br>FFonly: The feedforward value is the output from the controller. Open loop control may be configured by this means.<br>Feedforward is for use only with the main control elements, and the limit loop will override feedforward. |
| FFGain | The entered gain value is applied to the Feedforward input. |
| FFOffset | The entered value is applied to the Feedforward input after the Gain value has been applied to it. |

### 6.7.2 Control Main Parameters

This menu contains all the parameters associated with the Main control loop.

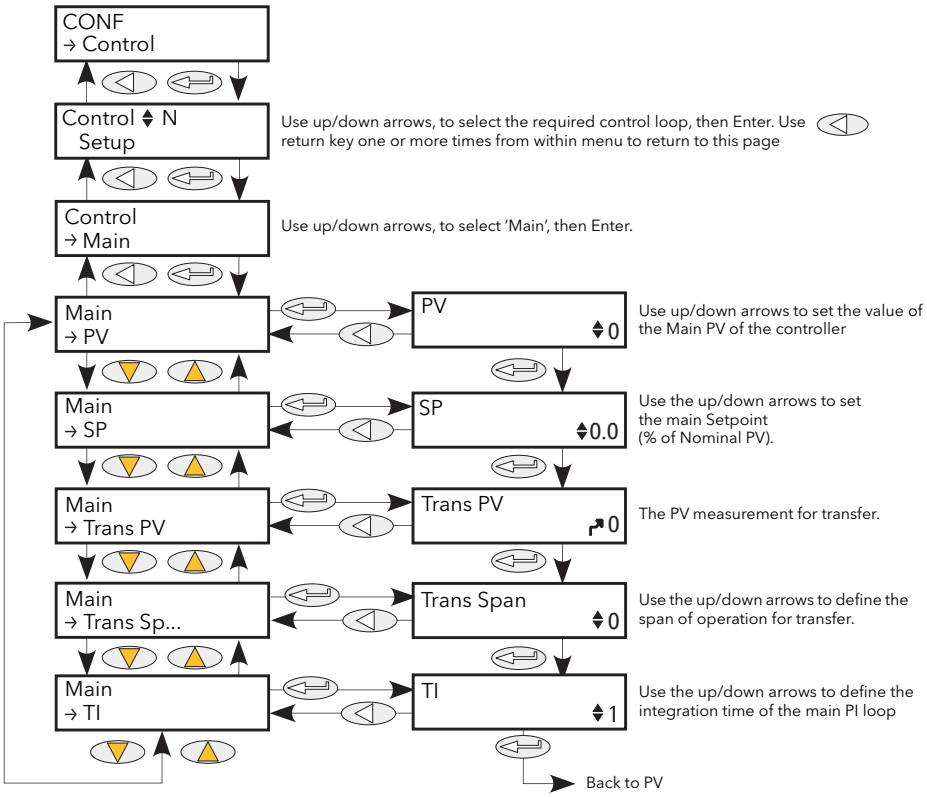



Figure 6.7.2 Control Main parameters

| | |
|---|---|
| PV | Displays the main Controller Process Variable (PV). Wired to the measurement which it is to be controlled. For example, to perform $V^2$ control. Vsq should be wired to this (PV) parameter and Nominal PV configured appropriately (section 6.7.1). |
| SP | The Setpoint to control at, as a percentage of Nominal PV (the upper range of the loop in engineering units). For example, if NominalPV = 500V RMS, and SP is set to 20%, the controller attempts to regulate at 500 x 20/100 = 100V RMS. If Transfer or Limit is enabled, these will override SP. |
| Trans PV | Transfer PV. This is the PV measurement for transfer. For example, if a $V^2$ to $I^2$ transfer is required, the Vsq should be wired to MainPV and Isq to TransferPV. Appears only if Trans Enable (section 6.7.1) is set to 'Yes' (via iTools). |
| Transfer Span | The span of operation for transfer. Appears only if Trans Enable (section 6.7.1) is set to 'Yes' (via iTools). |
| TI | Allows the user to define an integral time for the main PI control loop. |

### 6.7.3 Control Limit parameters

Parameters relating to the limit control loop.

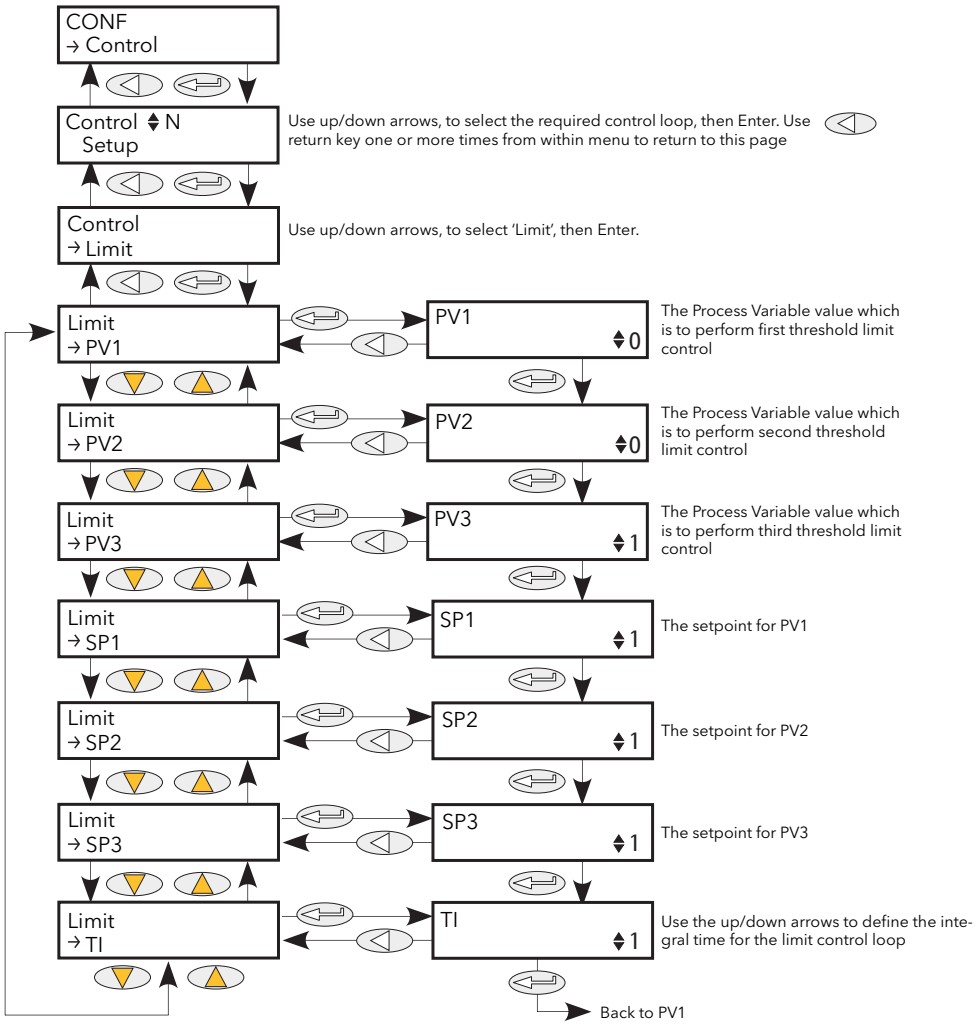



Figure 6.7.3 Control Limit menu

| | |
|---|---|
| PV1 to PV3 | Threshold value for limit loops 1 to 3 respectively. This is the value to perform threshold limit control. 'Limit Enable' must be set to 'Yes' in the Setup menu (section 6.7.1). |
| SP1 to SP3 | The setpoint for limit loops 1 to 3 respectively. |
| TI | The integration time for the limit PI control loop. |

Example:

If $I^2$ threshold limiting is required, Isq is wired to PV1, and the required threshold value is entered at SP1. In phase angle configuration, the phase angle is reduced to achieve the limit setpoint; in burst firing, the unit continues to fire in bursts, but these bursts are of phase angle in order to achieve the limit setpoint. The modulation continues to attempt to reach the main setpoint.

Also known as phase angle reduction burst firing.

### 6.7.4 Control Diag parameters

This menu contains diagnostic parameters related to Control.

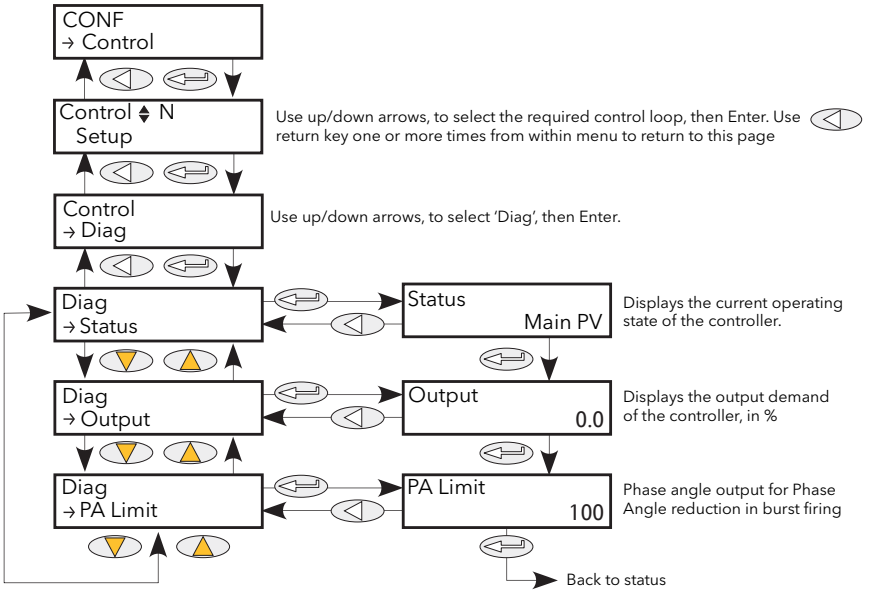



Figure 6.7.4 Control Diag menu

| | | |
|---|---|---|
| Status | Indicates the current operating state of the controller: | |
| | Main PV: | The control strategy is using Main PV as the control input |
| | Transfer function active: | The transfer input us being used as the input to the control strategy. |
| | Limit 1(2)(3) active: | Control limiting is currently active using limit PV1(2)(3) and limit SP 1(2)(3). |
| Output | The current output demand in percent. Normally wired to Modulator.In or FiringOP.In | |
| PA Limit | Applies only to Burst Firing control modes. If this parameter is wired to FiringOP.PALimit, the power module will deliver bursts of phase angle firing depending both on the Main Setpoint and on the Limit Setpoint. | |

### 6.7.5 Control Alarm disable parameters

Allows each alarm of the control block to be disabled, individually. May be wired.

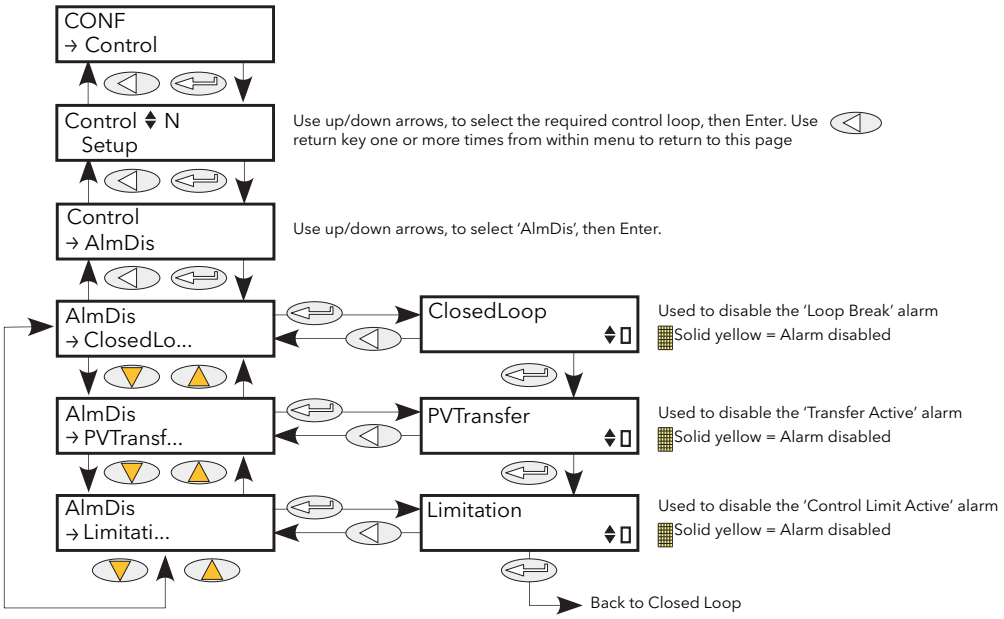



Figure 6.7.5 Control Alarm disable menu

| | |
|---|---|
| Closed Loop | The 'piano key' in the bottom right corner of the display indicates the current enable status of the closed loop alarm. The up and down arrows are used to enable/disable the alarm. An 'empty' key indicates that the alarm is enabled; a solid yellow key means that the alarm is disabled. |
| PV Transfer | As for Closed Loop, but for the 'Transfer Active' alarm. |
| Limitation | As for Closed Loop, but for the 'Control limit active' alarm. |

### 6.7.6 Control Alarm detection parameters

Indicates whether each alarm has been detected and whether or not it is currently active.

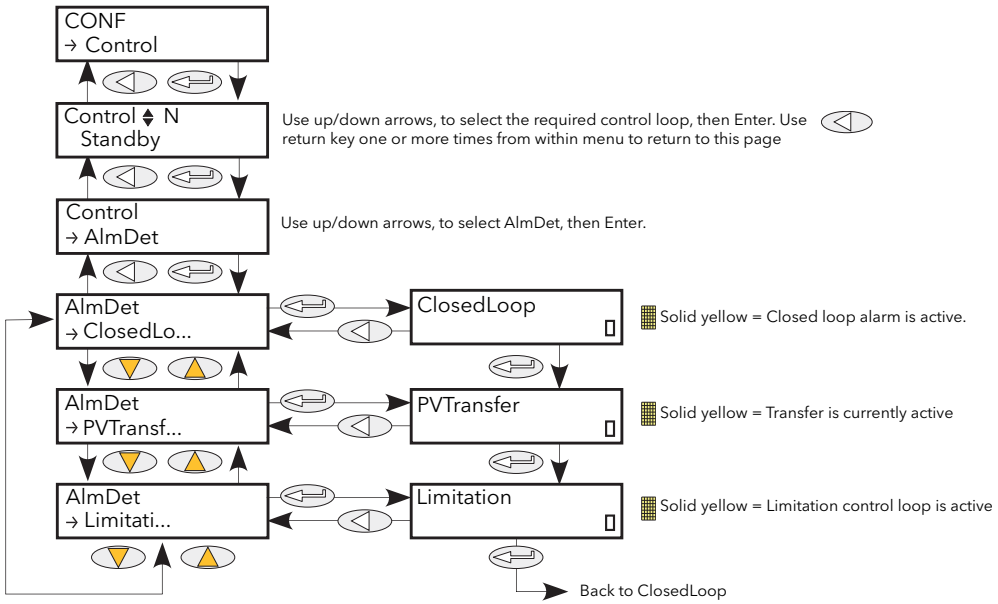



Figure 6.7.6 Control Alarm detection menu

| | |
|---|---|
| Closed Loop | The 'piano key' in the bottom right corner of the display shows whether or not the closed loop alarm is currently active. An 'empty' key indicates that the alarm is inactive; a solid yellow key means that the alarm is active. |
| PV Transfer | As for Closed Loop, but for the 'Transfer Active' alarm. |
| Limitation | As for Closed Loop, but for the 'Control limit active' alarm. |

### 6.7.7 Control Alarm signalling parameters

Signals that an alarm has occurred and has been latched (if so configured in 'Alarm Latch' (section 6.7.8)). If it is required that an alarm is to be assigned to a relay (for example), then the appropriate alarm signalling parameter should be used.

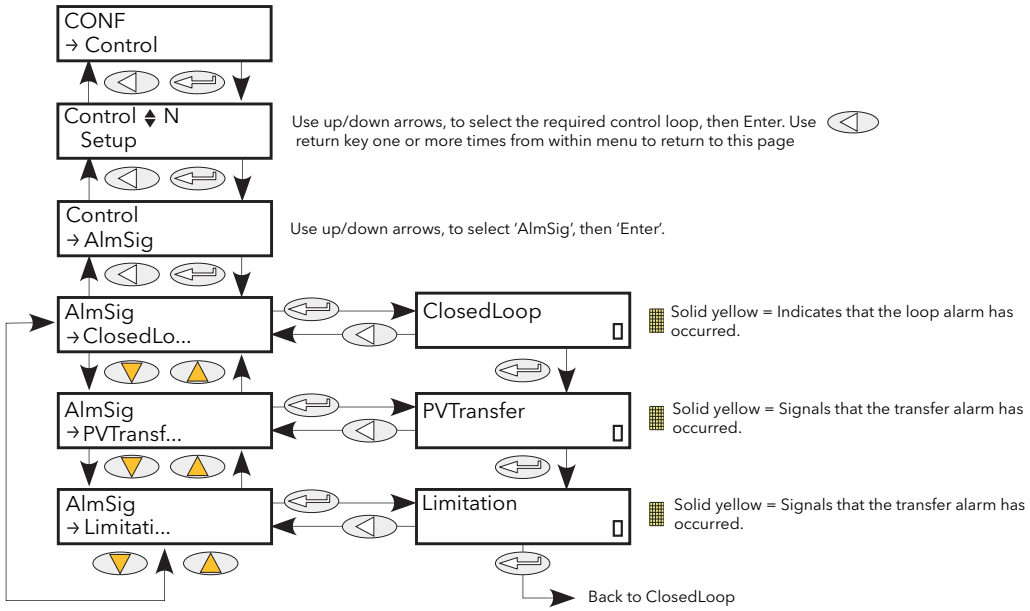



Figure 6.7.7 Control Alarm Signalling menu

| | |
|---|---|
| Closed Loop | The 'piano key' in the bottom right corner of the display indicates whether the closed loop break alarm is currently active. An 'empty' key indicates that the alarm is inactive; a solid yellow key means that the alarm is active. |
| PV Transfer | As for Closed Loop, but for the 'Transfer Active' alarm. |
| Limitation | As for Closed Loop, but for the 'Control limit active' alarm. |

### 6.7.8 Control Alarm Latch parameters

Allows each alarm to be configured as latching or not latching. The latched status is shown in the Network AlmSig submenu (ref section 6.20.3).

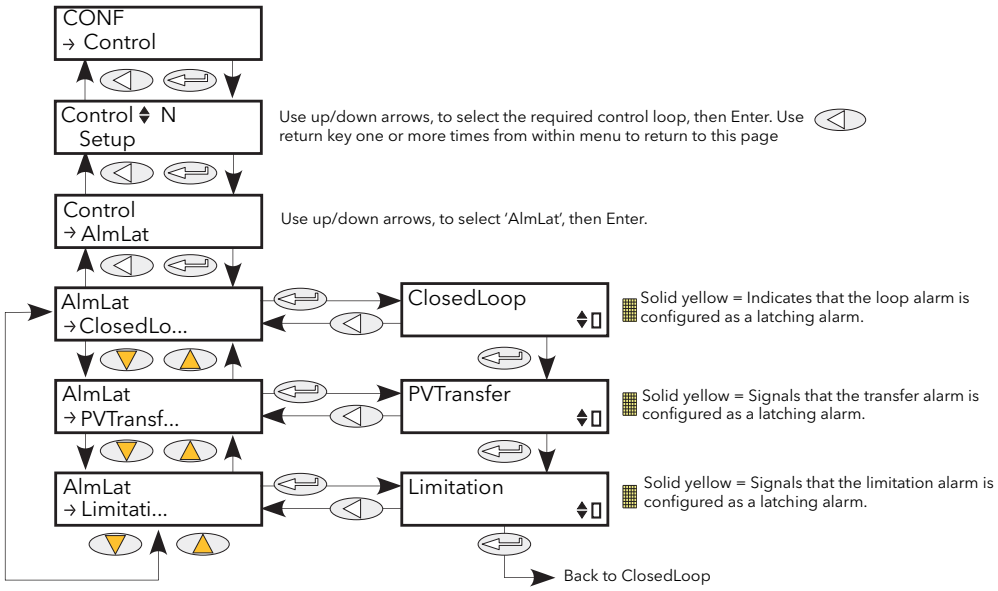



Figure 6.7.8 Control Alarm latching menu

| | |
|---|---|
| Closed Loop | Use the up/down arrows to change the latching status of the alarm. The 'piano key' in the bottom right corner of the display indicates whether the closed loop alarm is latching (solid yellow) or non-latching ('empty'). |
| PV Transfer | As for Closed Loop, but for the 'Transfer Active' alarm. |
| Limitation | As for Closed Loop, but for the 'Control limit active' alarm. |

### 6.7.9 Control Alarm Acknowledgement parameters

This menu allows individual alarms to be acknowledged. On acknowledgement, the related Signalling parameter is cleared. The Acknowledge parameters automatically clear after being written.

If the alarm is still active (as shown by the Alarm Detection display) it may not be acknowledged.

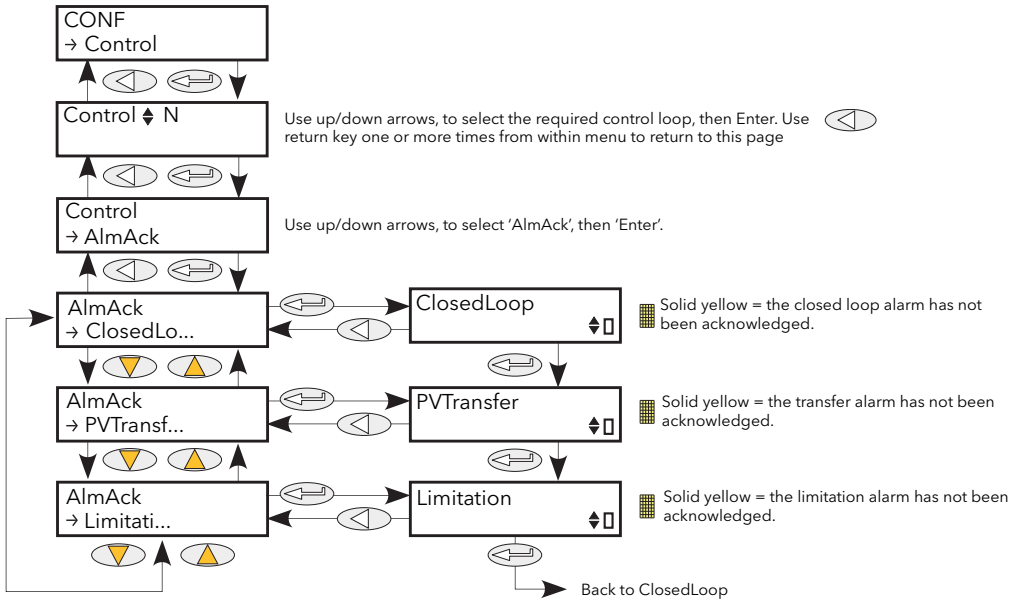



Figure 6.7.9 Control Alarm Acknowledge menu

| | |
|---|---|
| Closed Loop | The 'piano key' in the bottom right corner of the display shows whether the closed loop alarm has been acknowledged or not. An 'empty' key indicates that the alarm is acknowledged; a solid yellow key indicates that the alarm is unacknowledged. The up/down arrow keys are used to acknowledge. |
| PV Transfer | As for Closed Loop, but for the 'Transfer Active' alarm. |
| Limitation | As for Closed Loop, but for the 'Control limit active' alarm. |

### 6.7.10 Control Alarm Stop parameters

Allows individual channels to be configured such that it will stop the associated power channel from firing whilst the alarm is active. This feature is activated by the signalling parameters, so the alarm stop may be latching.

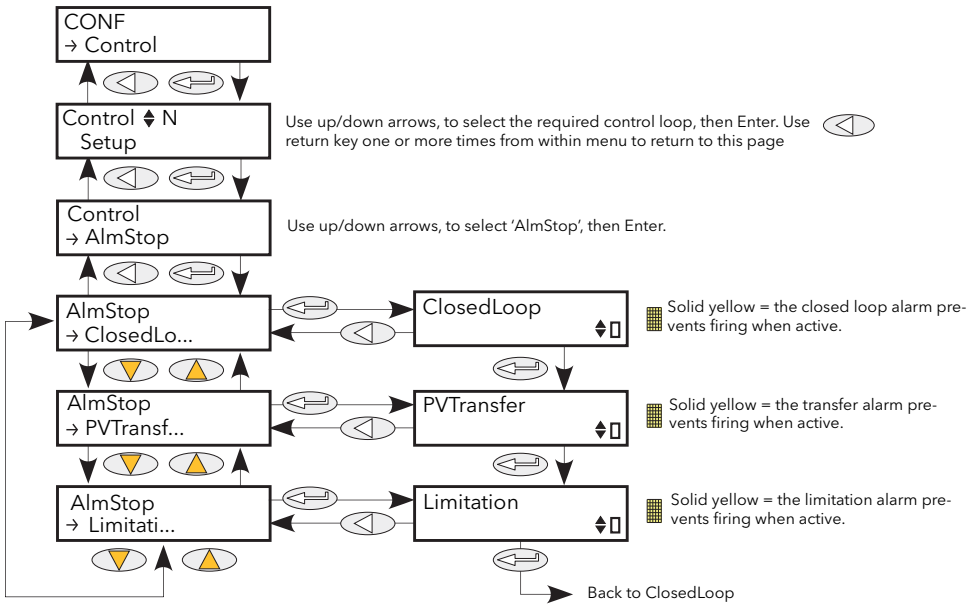



Figure 6.7.10 Control Alarm Stop menu

| | |
|---|---|
| Closed Loop | The 'piano key' in the bottom right corner of the display shows whether the closed loop alarm has been configured to disable firing or not. An 'empty' key indicates that the firing is enabled; a solid yellow key indicates that the firing is disabled. |
| PV Transfer | As for Closed Loop, but for the 'Transfer Active' alarm. |
| Limitation | As for Closed Loop, but for the 'Control limit active' alarm. |

## 6.8 COUNTER MENU

The counter output is a 32-bit integer the value of which is recalculated every sample period. When a clock state change from 0 (false) to 1 (true) is detected the counter value is incremented if the count direction is 'up' or decremented if the direction is 'down'.

At reset, the counter value is set to 0 for count up counters or to the 'Target' value for count down counters.

### 6.8.1 Counter configuration menu

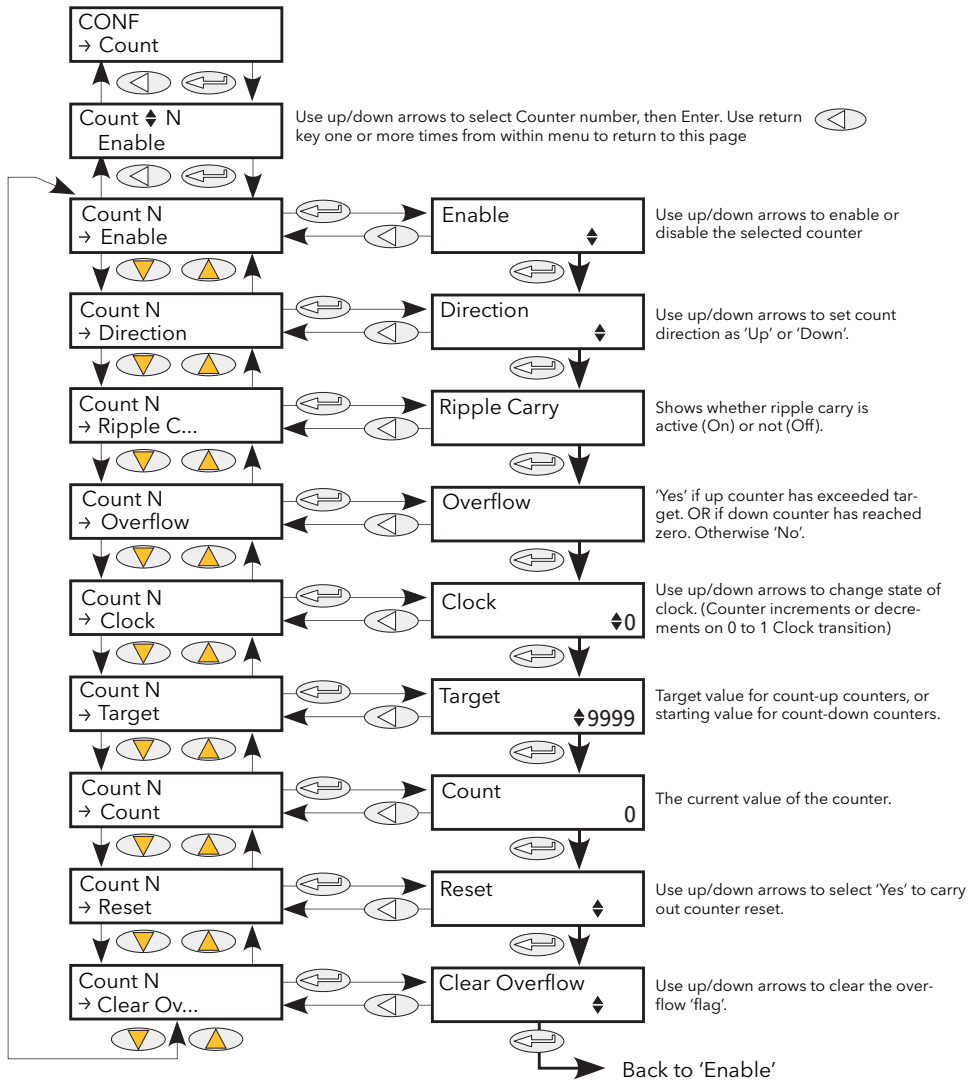



Figure 6.8.1 Counter menu

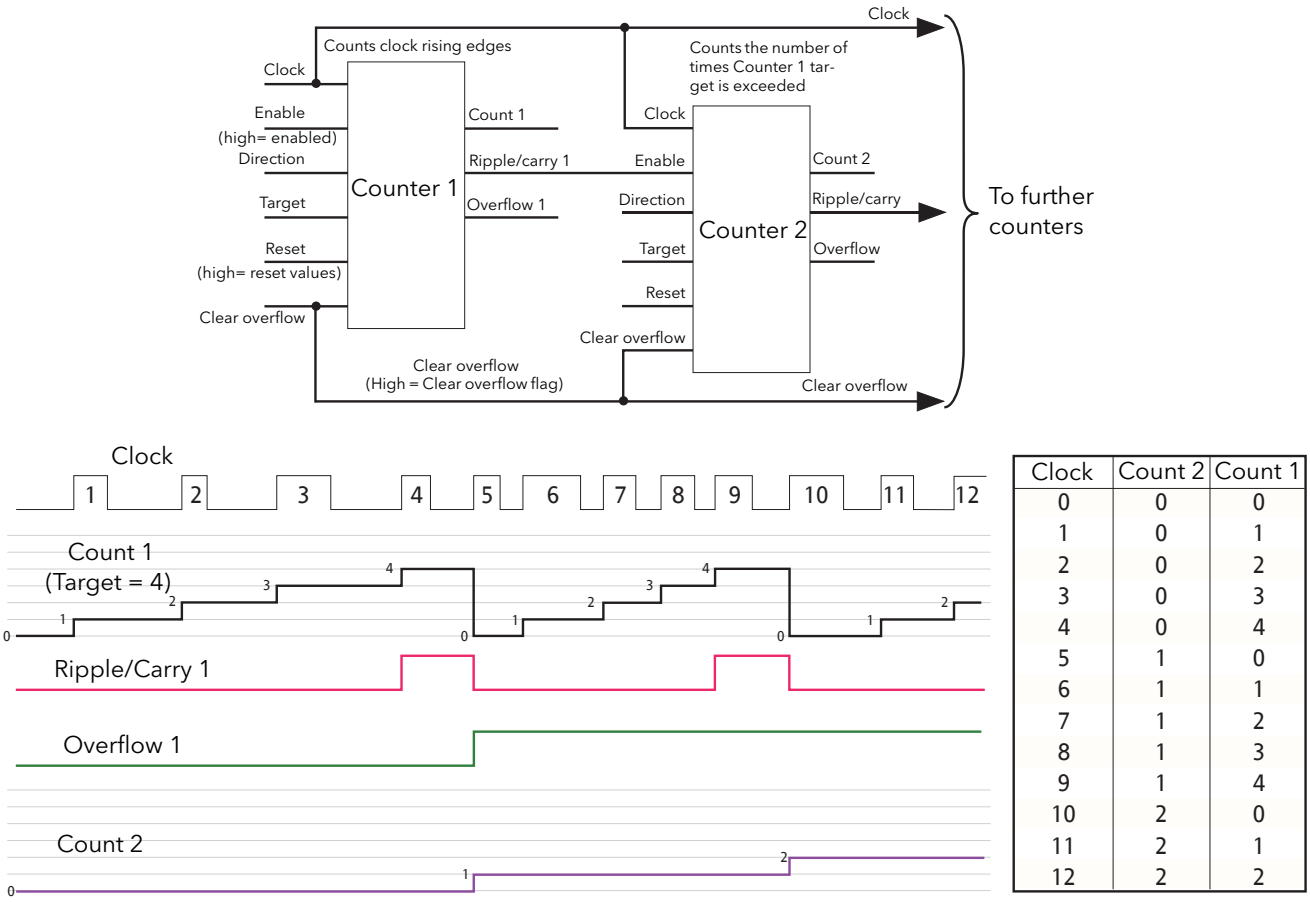
| | |
|---|---|
| Enable | The counter responds to clock transitions when enabled; the count is frozen when disabled. |
| Direction | Select up or down as the direction of count. Up counters start at (and are reset to) zero; down counters start from (and are reset to) the Target value (below) |
| Ripple Carry | The Ripple carry output of one counter can act as the enabling input for the next counter in a cascade. Ripple carry is set 'true' when the counter is enabled and its value is either zero (for count down timers) or equal to the Target value (count up counters). |
| Overflow | Overflow becomes 'true' when the value of the counter is either zero (for count down timers) or equal to the Target value (count up counters). |
| Clock | The counter increments or decrements on a positive going edge (0 to 1; False to true). |

## 6.8 COUNTER MENU (Cont.)

| | |
|---|---|
| Target | Up counters: Start at zero and count towards the Target value. When this value is reached, Overflow and Ripple-carry are set true (value = 1).<br>Down counters: Start at the Target value and count towards zero. When zero is reached, Overflow and Ripple-carry are set true (value = 1). |
| Count | The current value of the counter. This is a 32-bit integer which accumulates clock transitions. Minimum value is zero. |
| Reset | Resets up-counters to zero or down-counters to the Target value. Reset also sets Overflow to False (i.e. Overflow = 0) |
| Clear Overflow | Sets Overflow to False (i.e. Overflow = 0) |

### 6.8.2 Cascading counters

As implied above, it is possible to 'wire' counters in cascade mode. Details for an 'up' counter are shown in figure 6.8.2, below. Down counter configuration is similar.




| Clock | Count 2 | Count 1 |
|---|---|---|
| 0 | 0 | 0 |
| 1 | 0 | 1 |
| 2 | 0 | 2 |
| 3 | 0 | 3 |
| 4 | 0 | 4 |
| 5 | 1 | 0 |
| 6 | 1 | 1 |
| 7 | 1 | 2 |
| 8 | 1 | 3 |
| 9 | 1 | 4 |
| 10 | 2 | 0 |
| 11 | 2 | 1 |
| 12 | 2 | 2 |

Figure 6.8.2 Cascading up counters

Note: Counter 2 above counts the number of times that Counter 1 target is exceeded. By permanently enabling counter 2, and wiring counter 1 'Ripple Carry' output to counter 2 'Clock' input (replacing the connection to the clock pulse stream), counter 2 will indicate the number of times counter 1 target is reached, rather than exceeded.

## 6.9 DIGITAL I/O MENU

Digital I/O configuration.

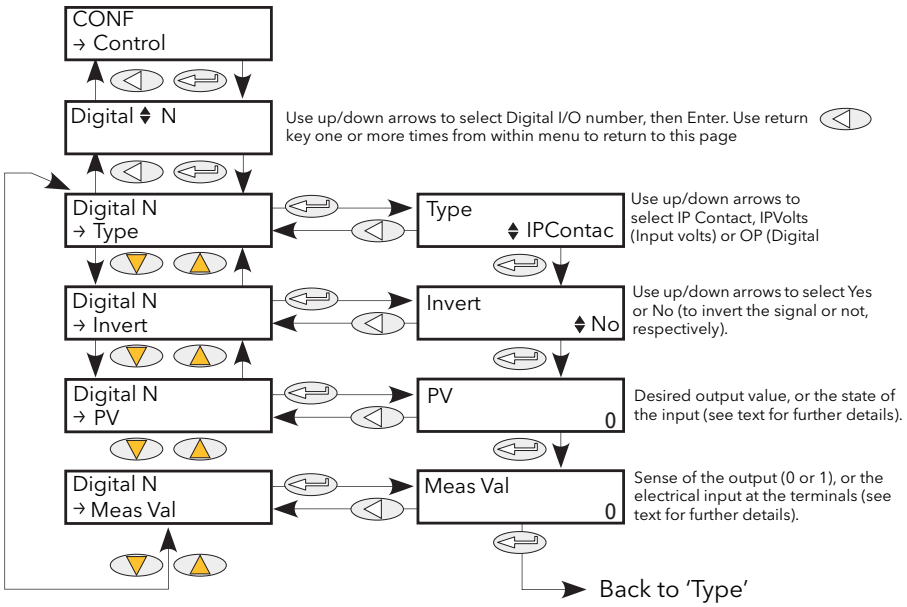



Figure 6.9 Digital I/O menu

| | |
|---|---|
| Type | Selects I/O type: Logic Input, IPContact or digital output. For pinout details, see figure 2.2.1a. |
| Invert | Sets the inversion status to 'No' or 'Yes'.<br>When set to 'No', there is no inversion (e.g. if MeasVal = 0 then PV = 0).<br>When set to 'Yes', an inversion takes place (e.g. if MeasVal = 0 then PV = 1) |
| MeasVal | For inputs, this shows the value measured at the instrument terminals, in electrical units. For outputs, this shows 1 or 0 according as the output is high or low. |
| PV | For inputs, this is the current state of the input, after any inversion has been applied. For outputs, this is the desired output value (before any inversion is applied). |

## 6.10 ENERGY

Provides a number of energy counters to totalise consumed energy. The value(s) can be displayed at the driver module front panel (using iTools User Pages), and at the remote panel, if fitted. The power consumed can be displayed in one of number of units, ranging from W to GW. Figure 6.10 shows the menu.

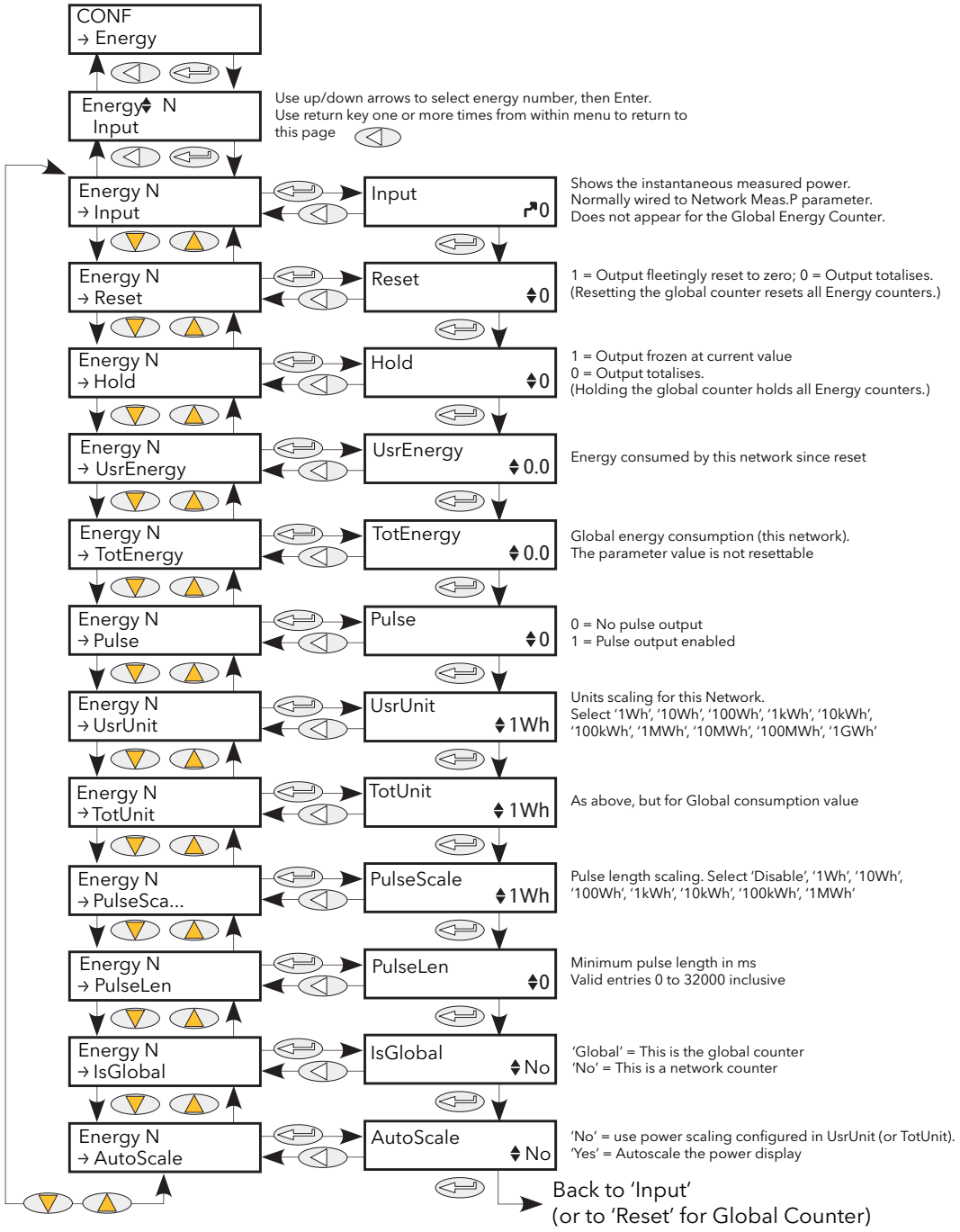



Figure 6.10 Energy counter menu

### 6.10.1 Energy counter parameters

| | |
|---|---|
| Input | Shows the instantaneous power input from the measuring source. Normally wired to the Meas.P output of a Network block. Does not appear for the Global Energy Counter (see 'IsGlobal', below). |
| Reset | 1 = Energy counter output goes to zero and immediately starts accumulating.<br>0 = Energy counter not reset.<br>If the Global Energy counter is reset, it resets all other Energy counters (see 'IsGlobal', below). |
| Hold | 1 = Hold output value. This freezes the output value for the block at the current value. The input continues to be totalised, so when the Hold input returns to 0, the output value is instantaneously updated to the new current value.<br>0 = output value is not held, and represents the current accumulated Energy value.<br>If the Global Energy counter is held, all other Energy counters are held as well (see 'IsGlobal', below). |
| UsrEnergy | Shows the current value for the selected Energy Counter block. If this is the global counter, this value is the sum of the energy values of all those networks being totalised. |
| TotEnergy | Shows the total energy value for the relevant network. Not reset by 'Reset' above. |
| Pulse | This enables a pulse output which causes a pulse to be generated at a specified number of watt-hours (1, 10, 100kW-h or 1MW-h). The length of the pulse and a scaling factor can be entered, as described below. |
| UsrUnit | Allows a scaling units value to be entered for the energy display. Selectable as '1Wh', '10Wh', '100Wh', '1kWh', '10kWh', '100kWh', '1MWh', '10MWh', '100MWh' or '1GWh'. |
| TotUnit | As 'UsrUnit', above, but for the total energy counter. |
| PulseScale | One pulse is generated every 'n' Watt-hours, where 'n' can be selected as 1, 10, 100, 1k, 10k, 100k, 1M Watt-hours. This value, and that of Pulse Len(gth) must be chosen to suit the application, such that the next pulse is not requested before the previous one is finished. (In such a case, the PulseScale factor is automatically increased.) |
| PulseLen* | Select pulse length between 0 and 32000 ms. The actual pulse length is rounded to the next longest multiple of 1/2 the supply frequency. Thus, for a 50Hz system (multiple = 10ms) pulse length entries of 1 to 10 will result in a pulse length of 10ms. For entries of 11 to 20 the pulse length will be 20ms, and so on. This value, and that of Pulse Scale must be chosen to suit the application, such that the next pulse is not requested before the previous one is finished. (In such a case, the PulseScale factor is automatically increased.) |
| IsGlobal | One (only) of the Energy blocks can be defined as being 'Global'. This means that it sums the values of all the other Energy counters. The block 'input' is disabled. The 'IsGlobal' parameter becomes non-editable (set to 'No') for all other Energy counter blocks. If the Global energy Counter is held or reset, all other counters are held and reset as well.<br>'No' = This counter is not the Global counter.<br>'Global' = this counter is the Global counter. |
| Autoscale | No = Use UsrUnit and TotUnit settings.<br>Yes = Autoscale power value display. Table 6.10.1 shows the breakpoints. |

* Note: due to the computing time required, the pulse-length may vary according to circumstance. For example, if a 20ms pulse is selected, the actual pulse length may be a mixture of 20ms and 30 ms pulses.

### 6.10.1 ENERGY COUNTER PARAMETERS (Cont.)

| Power Range (Watt-hours) | | Scaler value |
|---|---|---|
| 0 | to 65,535 | 1 |
| 65,535 | to 65,535,000 | 1k |
| 65,535,000 | to 655,350,000 | 10k |
| 655,350,000 | to 6,553,500,000 | 100k |
| 6,553,500,000 | to 65,535,000,000 | 1M |
| 65,535,000,000 | to 655,350,000,000 | 10M |
| 655,350,000,000 | to 6,553,500,000,000 | 100M |
| 6,553,500,000,000 | upwards | 1G |

Table 6.10.1 Autoscale breakpoints

### 6.10.2 Resolution

The resolution of the stored energy value varies according to the totalised value, as shown in table 6.10.2 below. For example, for stored values between 33,554,432 watt-hours and 67,108,863 watt-hours, the value increases in 4 watt-hour increments.

| Power Range (Watt-hours) | | Resolution (W-h) | Power Range (Watt-hours) | | Resolution (W-h) |
|---|---|---|---|---|---|
| 0 | to 16,777,215 | 1 | 17,179,869,184 | to 34,359,738,367 | 2,048 |
| 16,777,216 | to 33,554,431 | 2 | 34,359,738,368 | to 68,719,476,735 | 4,096 |
| 33,554,432 | to 67,108,863 | 4 | 68,719,476,736 | to 137,438,953,471 | 8,192 |
| 67,108,864 | to 134,217,727 | 8 | 137,438,953,472 | to 274,877,906,943 | 16,384 |
| 134,217,728 | to 268,435,455 | 16 | 274,877,906,944 | to 549,755,813,887 | 32,768 |
| 268,435,456 | to 536,870,911 | 32 | 549,755,813,888 | to 1,099,511,627,775 | 65,536 |
| 536,870,912 | to 1,073,741,824 | 64 | 1,099,511,627,776 | to 2,199,023,255,551 | 131,072 |
| 1,073,741,824 | to 2,147,483,647 | 128 | 2,199,023,255,552 | to 4,398,046,511,103 | 262,144 |
| 2,147,483,648 | to 4,294,967,295 | 256 | 4,398,046,511,104 | to 8,796,093,022,207 | 524.288 |
| 4,294,967,296 | to 8,589,934,591 | 512 | 8,796,093,022,208 | to 17,592,186,044,415 | 1,048,576 |
| 8,589,934,592 | to 17,179,869,183 | 1,024 | | | |

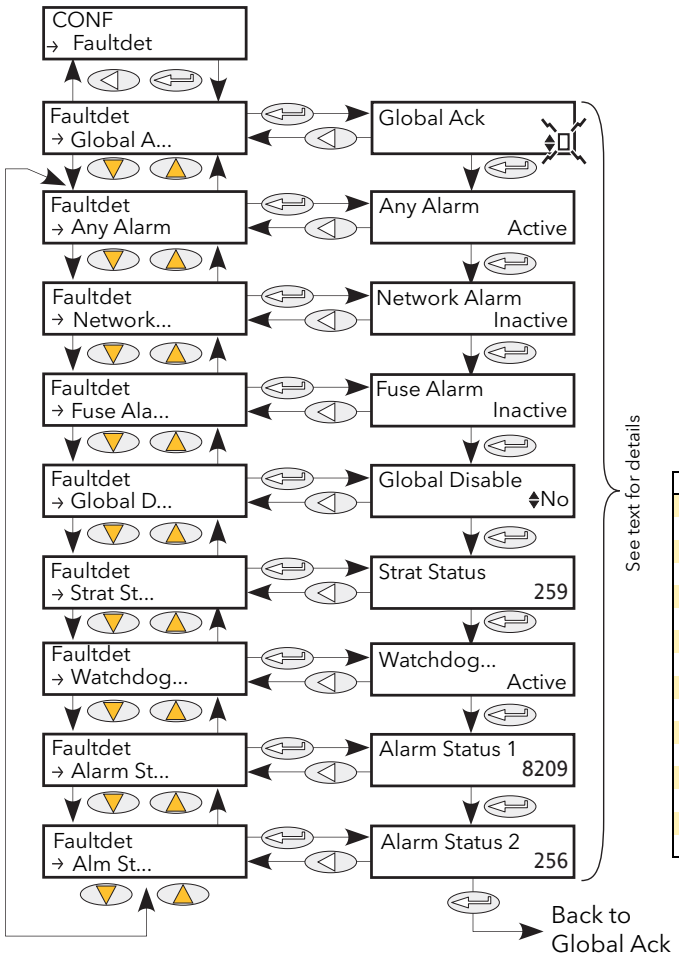
Table 6.10.2 Energy counter resolution

## 6.11 EVENT LOG MENU

This topic is identical with the Event log in the User/Operator menu, and is described in section 5.2.2.

## 6.12 FAULT DETECTION MENU

This manages Alarm logging and provides an interface for the General Alarm Acknowledgement




| Bit | Value | Description |
|---|---|---|
| 0 | 1 | Network 1 not firing |
| 1 | 2 | Network 1 not synchro-nized |
| 2 | 4 | Network 2 not firing |
| 3 | 8 | Network 2 not synchro-nized |
| 4 | 16 | Network 3 not firing |
| 5 | 32 | Network 3 not synchro-nized |
| 6 | 64 | Network 4 not firing |
| 7 | 128 | Network 4 not synchro-nized |
| 8 | 256 | Strategy in standby mode |
| 9 | 512 | Strategy in Telemetry mode |
| 10 | 1024 | Reserved |
| 11 | 2048 | Reserved |
| 12 | 4096 | Reserved |
| 13 | 8192 | Reserved |
| 14 | 16384 | Reserved |

| Bit | Value | Description |
|---|---|---|
| 0 | 1 | Missing Mains |
| 1 | 2 | Thyristor short circuit |
| 2 | 4 | Open Thyristor |
| 3 | 8 | Fuse blown |
| 4 | 16 | Over temp |
| 5 | 32 | Network Dips |
| 6 | 64 | Frequency fault |
| 7 | 128 | PB24V fault |
| 8 | 256 | Total Load Failure |
| 9 | 512 | Chop Off |
| 10 | 1024 | Partial Load Failure |
| 11 | 2048 | Partial Load Unbalance |
| 12 | 4096 | Volt fault |
| 13 | 8192 | Pre Temp |
| 14 | 16384 | Over current |
| 15 | 32768 | Power Module wdog fault |

Table 6.12b
Alarm Status 1 word

| Bit | Value | Description |
|---|---|---|
| 0 | 1 | Power Module Comms error |
| 1 | 2 | Pwr Module Comms time-out |
| 2 | 4 | Closed Loop |
| 3 | 8 | Transfer active |
| 4 | 16 | Limit active |
| 5 | 32 | PLM Pr over Ps fault |
| 6 | 64 | Output fault |
| 7 | 128 | LTC Fuse |
| 8 | 256 | LTC Temp |
| 9 | 512 | Reserved |
| 10 | 1024 | Reserved |
| 11 | 2048 | Reserved |
| 12 | 4096 | Reserved |
| 13 | 8192 | Reserved |
| 14 | 16384 | Reserved |
| 15 | 32768 | Reserved |

Table 6.12c
Alarm Status 2 word

Figure 6.12 Fault detect menu

| | |
|---|---|
| Global Ack | Performs a global acknowledgement of alarms. Latched alarms are cleared if their trigger sources are no longer in an alarm state. |
| Any Alarm | 'Active' indicates that there is one or more System, Process or 'Chop Off' alarm active. If the relevant alarms are enabled, System alarms and Chop Off alarms always cause the power module to stop firing. Process alarms can also be configured to prevent firing in 'Alarm stop'. |
| Network Alarm | Indicates that a process alarm has occurred in one or more Power Modules. |
| Fuse Alarm | Indicates that a fuse has blown in one or more Network blocks. |
| Global Disable | Allows the user to disable/enable all alarms. |
| StratStatus | A coded status word giving strategy information as shown in table 6.12a. |
| Watchdog | Watchdog relay status (Active or Inactive). The watchdog relay is active (non-energised) under fault conditions. |
| Alarm Status 1/2 | Two 16-bit words containing alarm status information as shown in tables 6.12b and 6.12c respectively. |

## 6.13 FIRING OUTPUT MENU

This forms the link between the control strategy and the physical load. Configuration includes Firing mode, Network Type and the type of Load coupling. This block also supplies Phase-Angle Ramp (Soft start) and Safety Ramp.

In Engineer level, these items are mostly Read only (i.e. their values cannot be edited).

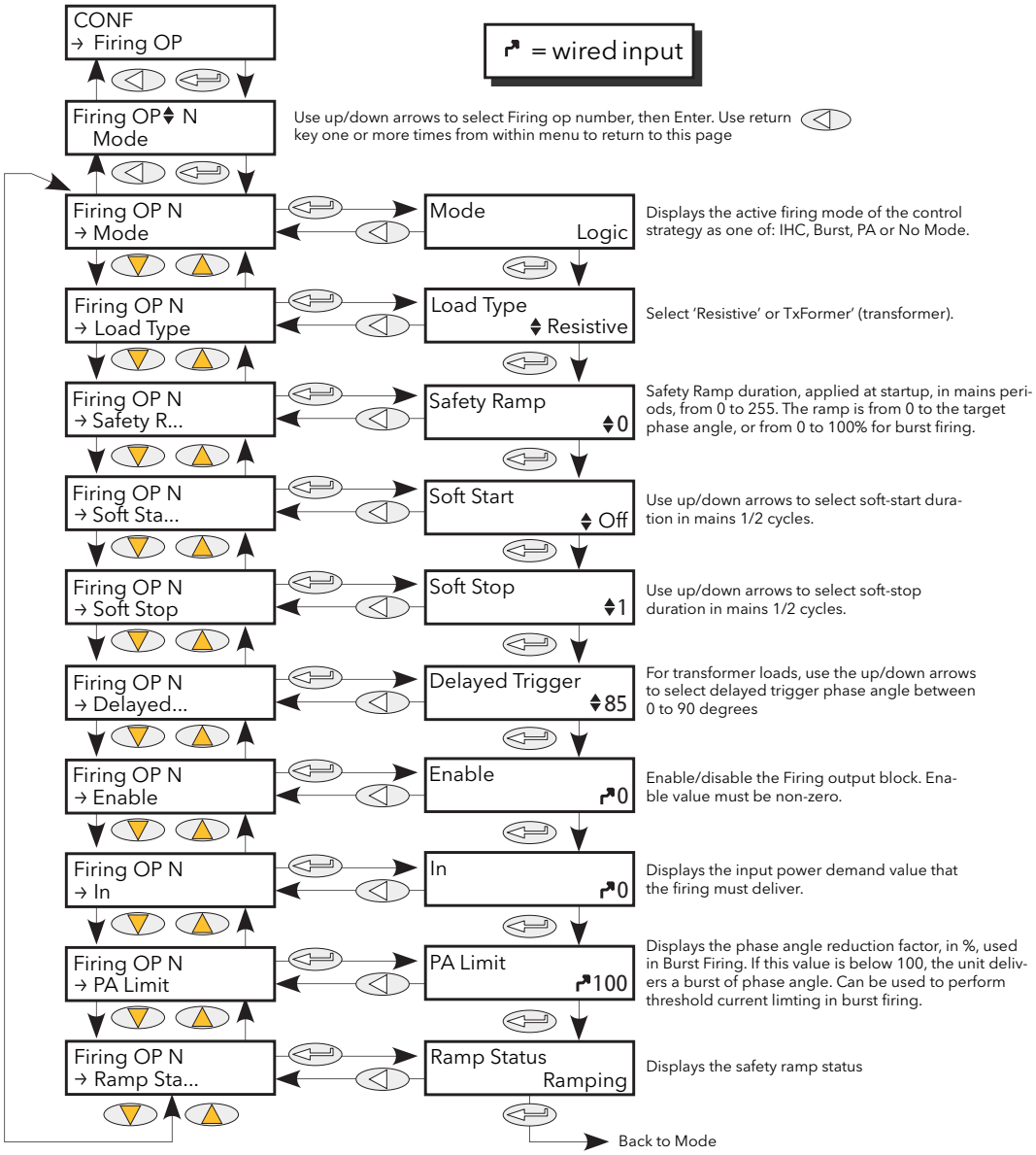



Figure 6.13a Configuration firing Output

| | |
|---|---|
| Mode | Displays the current firing mode as Intelligent half cycle (IHC), Burst firing, Phase angle firing or no mode. Configured in the 'Modultr', menu described below. |
| Load Type | Allows the load type to be selected as 'Resistive' or 'Transformer'. For Load type = Resistive, the load must be connected directly to the power module and only resistive loads may be so connected. For Load Type = Transformer, the load is connected to the power module via a transformer, and may be resistive or reactive. |

## 6.13 FIRING OUTPUT (Cont.)

| | |
|---|---|
| Safety Ramp | Displays the safety 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 figure 6.13b. Safety Ramp is not applicable to Half cycle Mode. |
| Soft Start | For Burst Firing only, this is the soft start duration, in main period, applying a phase angle ramp at the beginning of each on period. (Figure 6.13c). |
| Soft Stop | In Burst Firing, the soft stop duration, in main period, applying a phase angle ramp at the end of each on period. |
| Delayed Trigger | Appears only if Mode = Burst, Soft Start = Off, and Load Type = TxFormer. Delayed Trigger specifies the triggering delay, in phase angle, when delivering power into a transformer load. Used to minimize inrush current on transformer load. See figure 6.13d. |
| Enable | Enables/disables firing. Must be wired to a non-zero value to enable firing (typically a digital input). |
| In | Displays the input power demand value that the power module is to deliver. |
| PA Limit | Phase angle limit. This is a phase angle reduction factor used in Burst Firing. If lower than 100% the power module will deliver a burst of phase angle firing. Used, typically, to perform threshold current limiting in Burst Firing. |
| Ramp Status | Displays the safety ramp status as 'Ramping' or 'Finished'. |

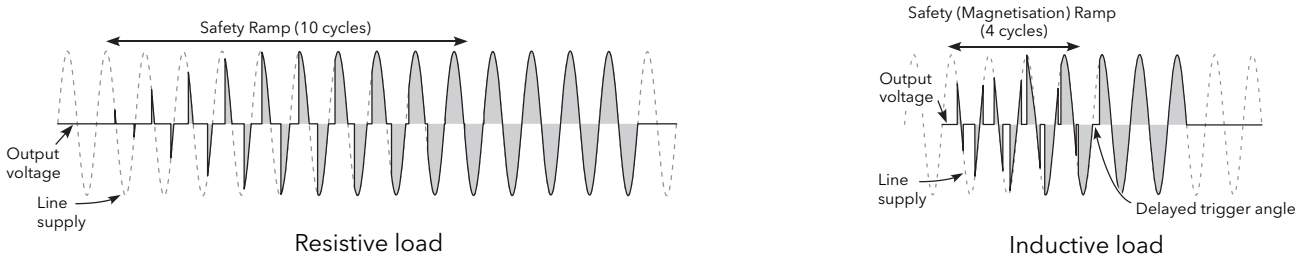



Figure 6.13b Safety ramp (burst firing) examples

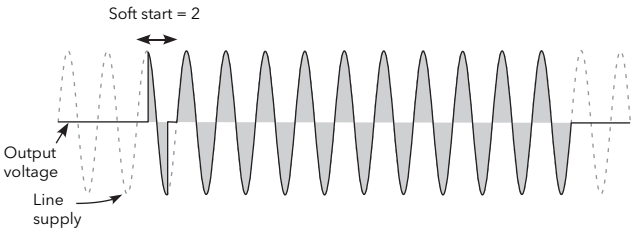



Figure 6.13c Soft start example

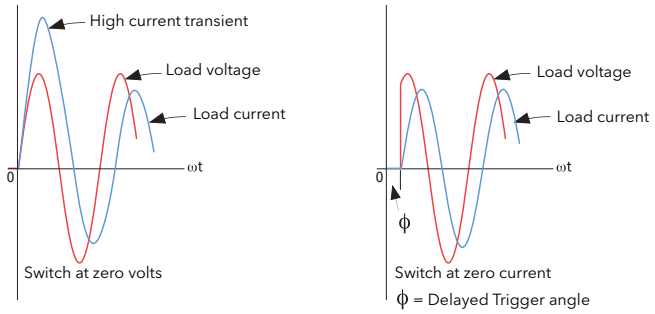



Figure 6.13d Delayed trigger definition

Note: Waveforms have been idealised for clarity

## 6.14 INSTRUMENT MENU

Allows the user to select the display language, and to view the unit's Serial number and the current Network configuration.

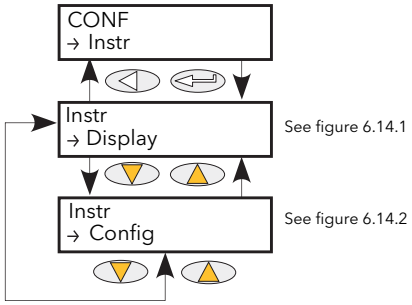



Figure 6.14 Instrument menu

### 6.14.1 Instrument Display parameters

Allows the user to select display language and to view the unit's serial number.

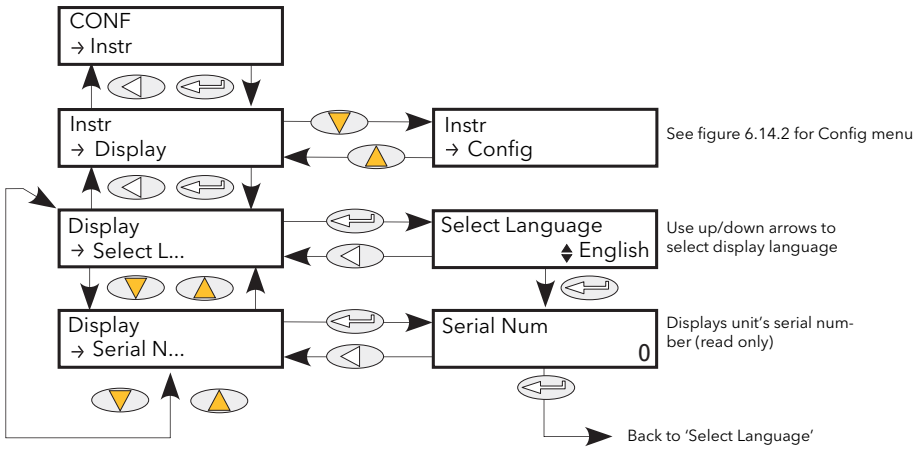



Figure 6.14.1 Instrument Display submenu

| | |
|---|---|
| Serial Num | Read only. Displays the factory-set Serial number of the unit. |
| Select Language | The up and down arrow keys are used to select the required language from English, French, German or Italian. (Correct at time of writing - further languages may be added during the life of this manual.) |

### 6.14.2 Instrument Config parameters

Allows the user access to the current power network configuration.

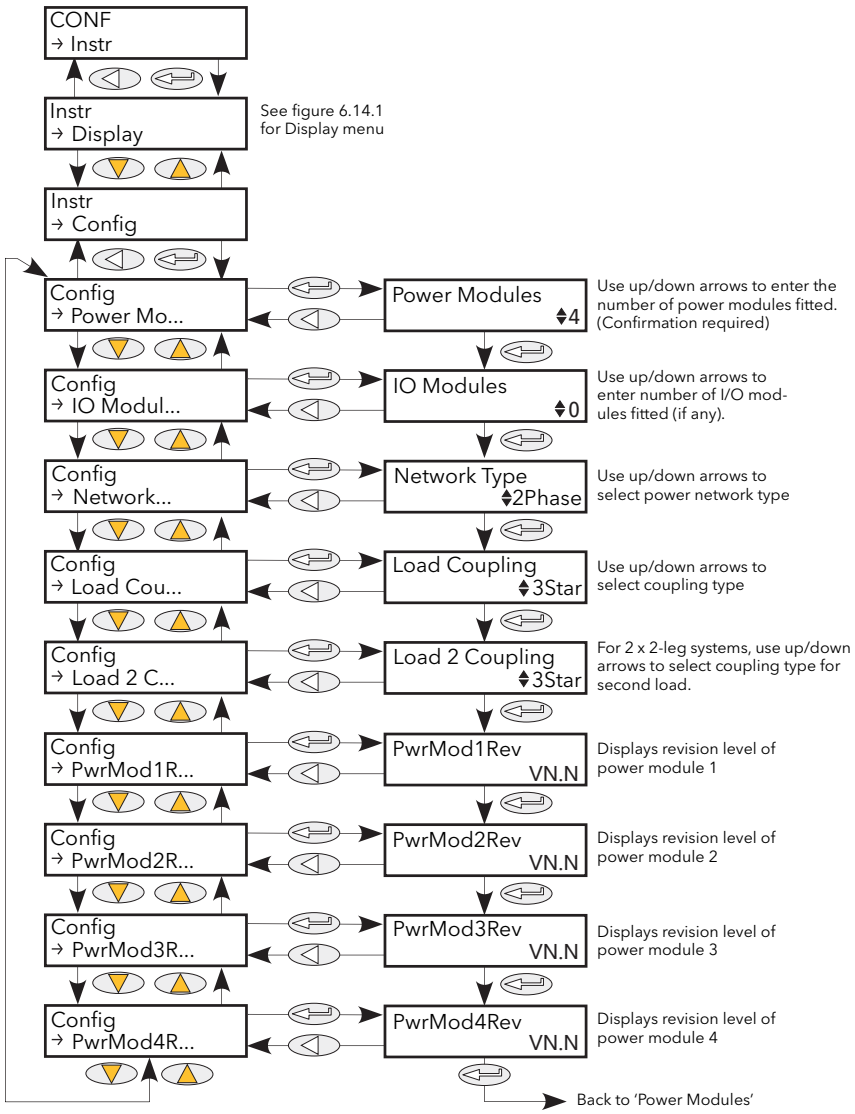



Figure 6.14.2 Instrument Config submenu

| | |
|---|---|
| Power Modules | Configures the number of power modules fitted. If left at zero, the system automatically determines the number of modules fitted and sets the parameter accordingly. |
| IO Modules | Specifies the number of optional I/O modules fitted. If left at zero, the system automatically determines the number of modules fitted and sets the parameter accordingly. |
| Network Type | Selects the type of network to be used, from 3 Phase, Single Phase or 2 Phase. |
| Load Coupling | For a three-phase system this allows the user to select the wiring configuration from 3Star, 3Delta, 4Star or 6Delta. For a two-phase system, only 3Delta or 3Star is selectable. |
| Load 2 Coupling | As Load Coupling, above, but for the second load in 2 x 2-leg systems. |
| PwrMod1Rev | Shows the revision level of power module '1'. |
| PwrMod2Rev | Shows the revision level of power module '2'. |
| PwrMod3Rev | Shows the revision level of power module '3'. |
| PwrMod4Rev | Shows the revision level of power module '4'. |

## 6.15 IP MONITOR MENU

This monitors a wired parameter and records its maximum value, minimum value and the cumulative time that its value spends above a configurable threshold. An alarm can be set up to become active when the time-over-threshold exceeds a further threshold.

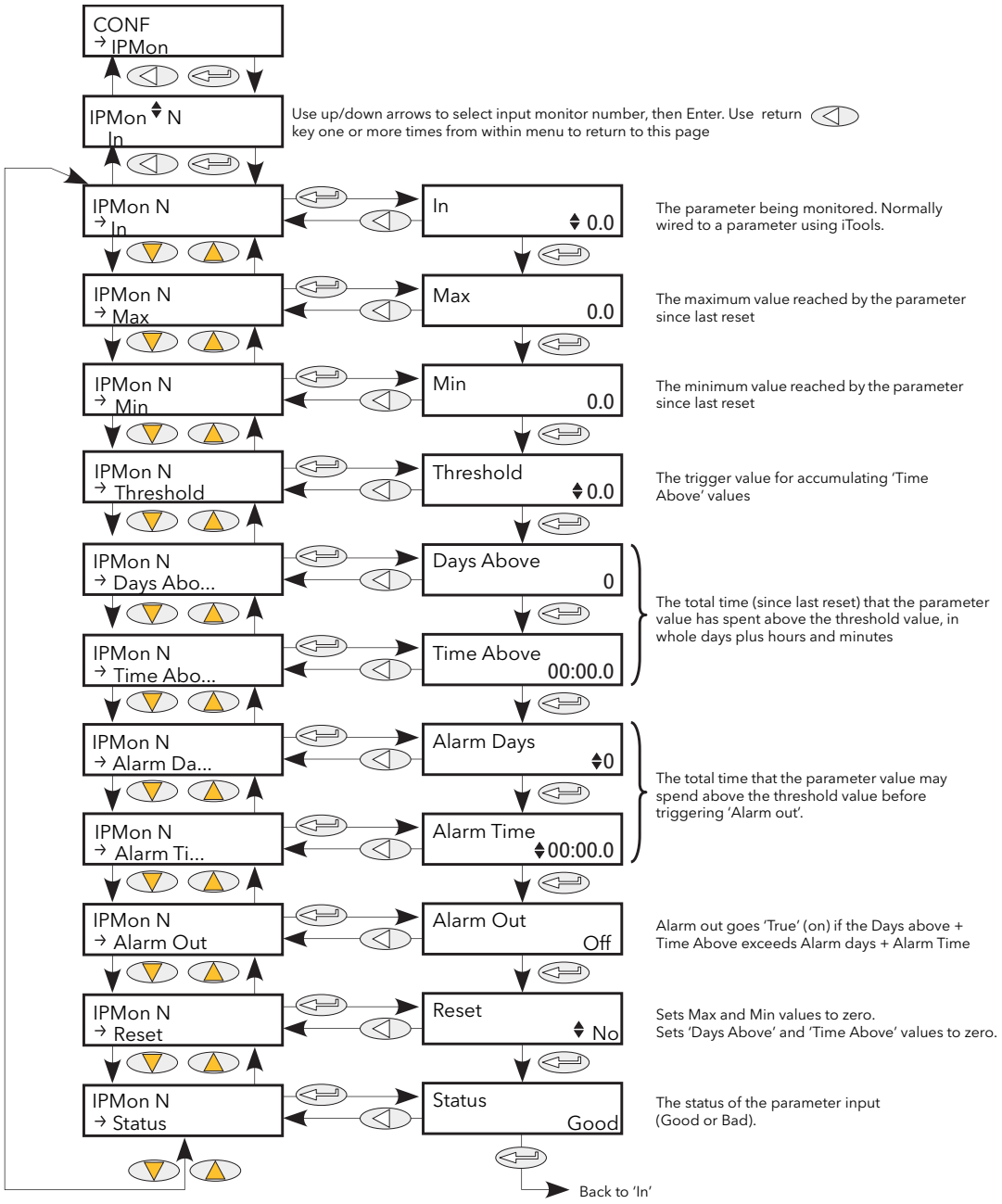



Figure 6.15 IP Monitor menu

## 6.15 IP MONITOR MENU (Cont.)

| | |
|---|---|
| In | The parameter to be monitored. Normally wired (using iTools) to a parameter, but a numeric entry can be made for testing purposes. |
| Max | The maximum value reached by the parameter since last reset. |
| Min | The minimum value reached by the parameter since last reset |
| Threshold | This value acts as a trigger for the 'Time Above' measurement. |
| Days above | Shows how many complete days the parameter value has spent above the Threshold value (continuously or intermittently) since last reset. The 'Time Above' value should be added to 'Days Above' in order to find the total time. |
| Time Above | Shows how many hours, minutes and tenths of minutes that the parameter value has spent above the threshold value (continuously or intermittently) since last reset, or since the last complete day. (once the value exceeds 23:59.9, it increments the 'Days Above' value and resets itself to 00:00.0.) The 'Time Above' value should be added to 'Days Above' in order to find the total time. |
| Alarm Days | Together with 'Alarm Time' this defines a 'total time above threshold' value, which, when exceeded, sets the Alarm out parameter 'On'. |
| Alarm Time | See 'Alarm Days' above. |
| Reset | Resetting causes the Max. and Min. values to be set to the current value, sets the 'Days Above' value to zero, and the 'Time Above' value to 00:00.0. |
| Status | Shows the status of the input parameter as either 'Good' or 'Bad'. |

## 6.16 LGC2 (TWO INPUT LOGIC OPERATOR) MENU

This logic operator block provides a number of two-input logic operations. The output is always a 'Boolean' (logic 0 or 1) no matter whether the inputs are analogue or digital. For analogue inputs, any value below 0.5 is deemed to be logic 0 (off). A value equal to or greater than 0.5 is treated as a logic 1 (on).

Either input can be 'inverted' as a part of the configuration (that is, a high input is treated as a low input and *vice-versa*.)

Figure 6.16 shows the LGC2 menu.

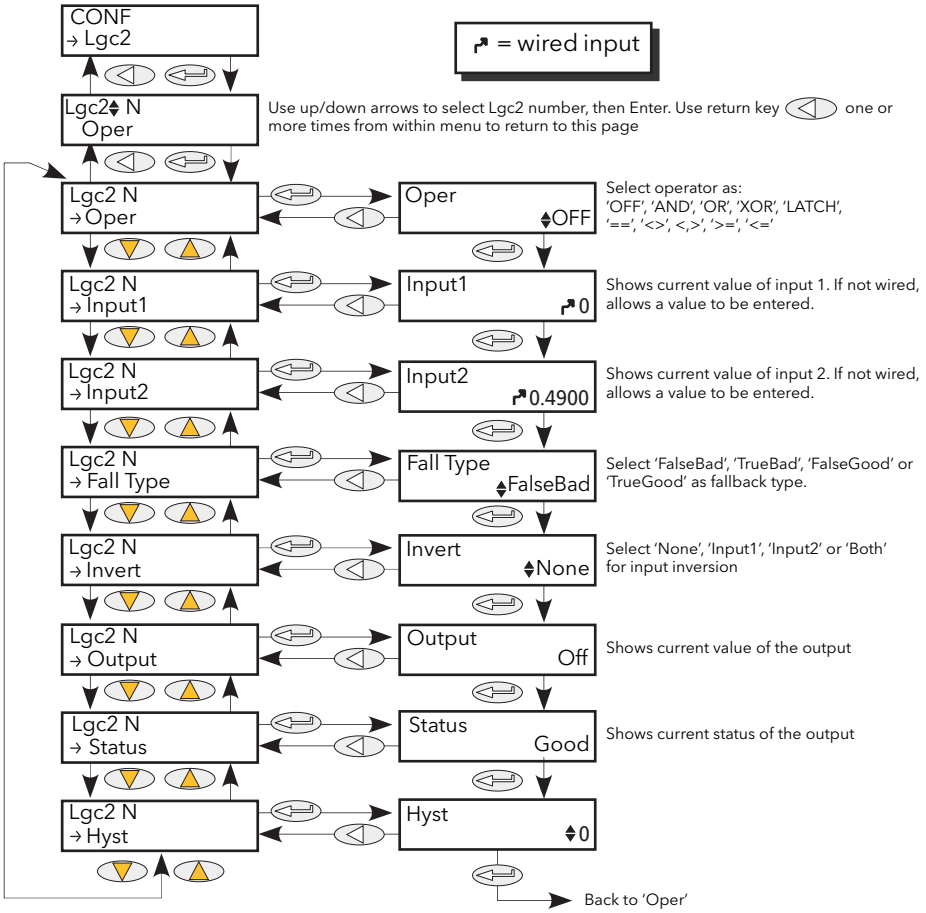


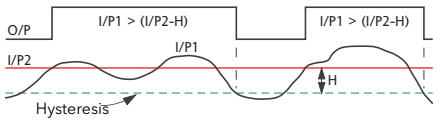

Figure 6.16 LGC2 menu

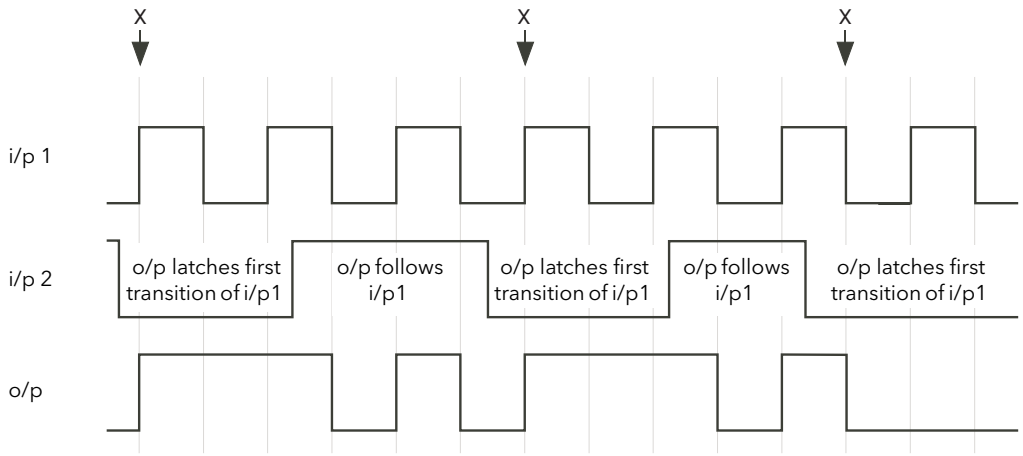
### 6.16.1 Lgc2 Parameters

| | |
|---|---|
| Oper | Allows the user to select a logic operation for the block. The descriptions below assume neither input is inverted. High = 1 or on; Low = 0 or off. |
| Off | No logic operation selected. |
| AND | Output high if both inputs high, otherwise output is low. |
| OR | Output high if either or both inputs high, otherwise output low. |
| XOR | Output high if either (but not both) inputs high. Low if neither or both inputs high. |
| LATCH | If i/p2 low, output latches next transition of i/p1. Value remains latched until i/p2 goes low, when output = i/p1 (see figure 6.16.1). |
| == | Output high if both inputs are equal, otherwise output is low. |
| <> | Output high if inputs are unequal. Output is low if both inputs are equal. |
| > | Output high if i/p1 value greater than i/p2 value, otherwise output is low. |
| < | Output high if i/p1 value less than i/p2 value, otherwise output is low. |
| >= | Output high if i/p1 value is equal to or greater than i/p2 value, otherwise output is low. |
| <= | Output high if i/p1 value is less than or equal to i/p2 value, otherwise output is low. |

### 6.16.1 LGC2 PARAMETERS (Cont.)

| | |
|---|---|
| Input 1 | If wired, shows the value of input 1; if not, allows the user to enter a value. |
| Input 2 | If wired, shows the value of input 1; if not, allows the user to enter a value. |
| Fall type | Allows a fallback type to be selected. This defines the output value and status displays if the status of one or both inputs is 'bad'. |
| FalseGood | Output value displays 'False' ; Status displays 'Good' |
| FalseBad | Output value displays 'False' ; Status displays 'Bad' |
| TrueGood | Output value displays 'True' ; Status displays 'Good' |
| TrueBad | Output value displays 'True' ; Status displays 'Bad' |
| Invert | Allows none, either or both inputs to be inverted. |
| Output | Shows the current output value |
| Status | Shows the status of the output ('Good' or 'Bad'). |
| Hysteresis | For comparison operators only (e.g. >) this allows a hysteresis value to be entered. For example, if the operator is '>' and hysteresis is H, then the output goes high when input 1 exceeds input 2, and remains high until input 1 falls to a value less than (Input 2 - H). Not applicable to the '==' (equals) function. |




When i/p2 goes low, o/p follows the next positive or negative transition of i/p 1 (points 'X') and latches at this value until i/p2 goes high. When i/p2 is high, o/p follows i/p1.

Figure 6.16.1 Latch operation

## 6.17 LGC8 (EIGHT-INPUT LOGIC OPERATOR) MENU

This allows between 2 and 8 inputs to be combined using an AND, OR or Exclusive OR (EXOR) logic function. The inputs may be individually inverted, and the output can also be inverted, thus allowing the full range of logic functions to be implemented.

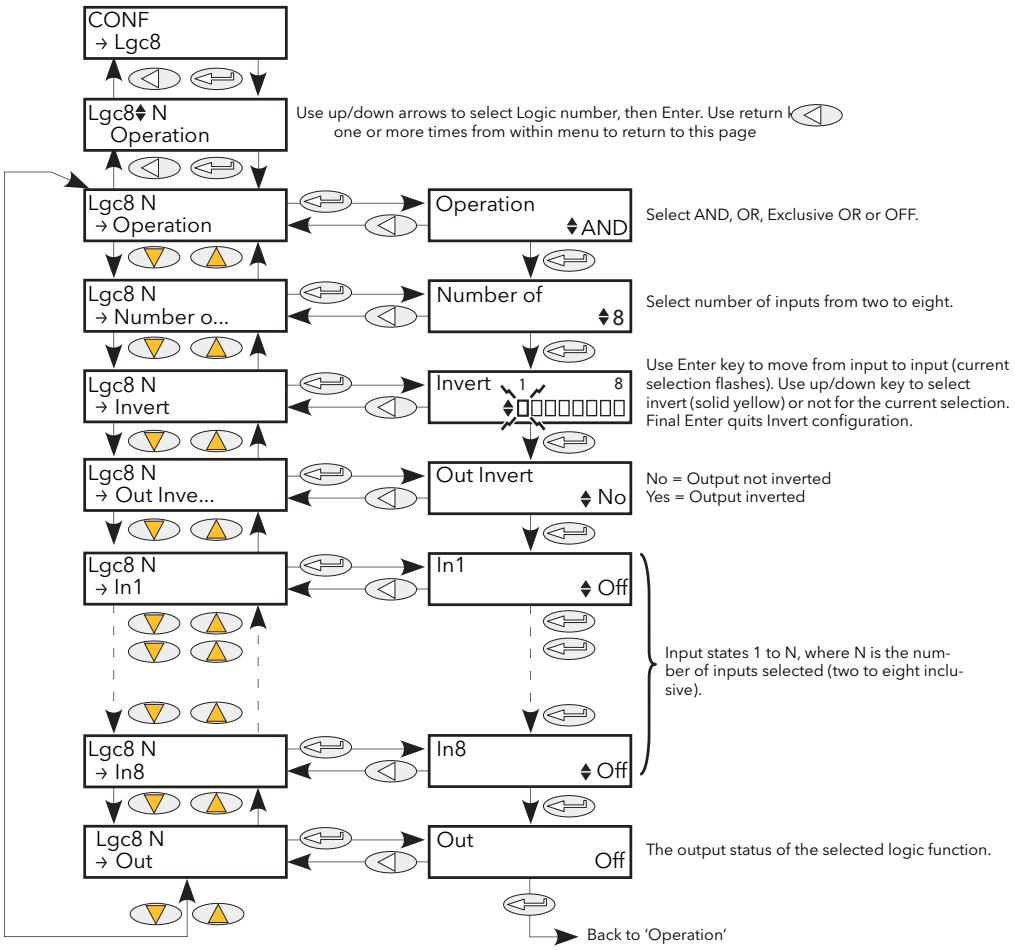



Figure 6.17 Lgc8 Menu

| | |
|---|---|
| Operation | Allows selection of AND, OR or Exclusive OR functions (or OFF).<br>AND = output is high only if all inputs are high<br>OR = output is high if any or all inputs are high<br>XOR = output is high if an odd number of inputs are high, and low if an even number of inputs are high. Logically, a cascaded XOR function: (((((((In1 ⊕ In 2) ⊕ In 3) ⊕ In 4).... ⊕ In 8) |
| Number of inputs | Set the number of inputs to between two and eight inclusive. This number defines how many invert keys appear in 'Invert', and how many Input value pages appear. |
| Invert | Between two and eight piano keys appear (according to the number of inputs selected) at the bottom line of the display, with the left-most one (input 1) flashing. The up or down arrow can be used to select 'invert' for this input (key goes solid yellow), and/or the 'Enter' key can be used to move to the next input. Once all the inputs have been accessed, the final operation of the Enter key quits the Invert configuration, and 'output invert' is entered. |
| Out Invert | No = normal output; 'Yes' means that the output is inverted, allowing NAND and NOR functions to be implemented. |
| In1 | The state (on or off) of the first input |
| In2 onwards | The state of the remaining inputs |
| Out | The Output value of the function (i.e. On or Off) |

## 6.18 MATH2 MENU

This feature allows a range of two-input mathematical functions to be performed. The available functions are listed below.

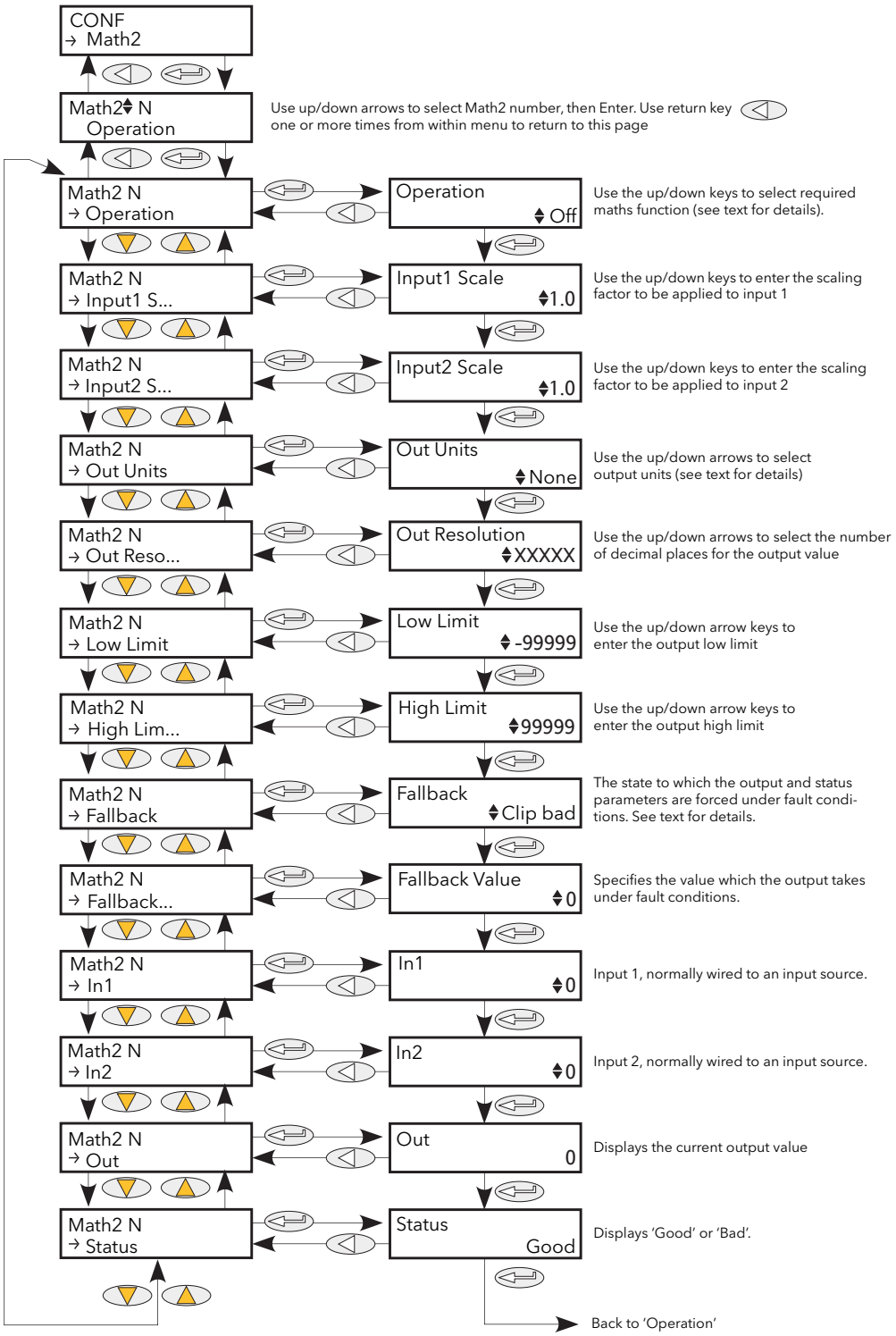



Figure 6.18 Analogue maths functions menu

## 6.18 MATH2 MENU (Cont.)

Note: For the sake of this description, 'High', '1' and 'True' are synonymous, as are 'Low', '0' and 'False'.

| | | |
|---|---|---|
| Operation | Defines the mathematical function to be applied to the inputs: | |
| | None | No operation. |
| | Add | Adds input one to input two. |
| | Sub | Subtracts input two from input one. |
| | Mul | Multiplies inputs one and two together. |
| | Div | Divides input one by input two. |
| | AbsDif | The difference in value between inputs one and two, ignoring sign. |
| | SelMax | Output = the higher of inputs one and two. |
| | SelMin | Output = the lower of inputs one and two. |
| | HotSwp | Input one appears as the output for as long as input one is 'good'. If input one status is bad, input two appears as the output instead. |
| | SmpHld | Sample and Hold. The output follows input one, for as long as input two is high (sample). When input two goes low (hold), the output is held, at the value current when the output went low, until input two goes high again. Input two is normally a digital value (low = 0 or high =1); when it is an analogue value, then any positive non-zero value is interpreted as a high. |
| | Power | Output = Input one raised to the power of input two ($In1^{In2}$). For example if input one has the value 4.2, and the value of input two is 3, then output = $4.2^3 = 74.09$. |
| | Sqrt | The output is the square root of input one. Input two is not used. |
| | Log | Output = $Log_{10}$ (input one). (Log base 10). Input two is not used. |
| | Ln | Output = $Log_n$ (input one). (Log base e). Input two is not used. |
| | Exp | Output = $e^{(input\ one)}$. Input two is not used. |
| | 10 x | Output = $10^{(input\ one)}$. Input two is not used. |
| | Select | If the Select input is high, input two appears at the output; if the Select input is low, input one appears at the output. |
| Input1 Scale | The scaling factor to be applied to input one. | |
| Input2 Scale | The scaling factor to be applied to input two. | |
| Out Units | Allows the user to choose units for the output. | |
| Out Resolution | Use the up and down arrows to position the decimal point as required. | |
| Low Limit | The low limit for all inputs to the function and for the fallback value. | |
| High Limit | The high limit for all inputs to the function and for the fallback value. | |
| Fallback | The fallback strategy comes into play if the status of the input value is 'Bad', or if its value lies outside the range (High limit- Low limit). | |
| | Fall Good: | The output is set to the fallback value (below); output status is set to 'Good'. |
| | Fall Bad: | The output is set to the fallback value (below); output status is set to 'Bad'. |
| | Clip Good: | The output is set to the high or low limit as appropriate; output status is set to 'Good'. |
| | Clip bad: | The output is set to the high or low limit as appropriate; output status is set to 'Bad'. |
| | DownScale: | The output is set to the low limit and Status is set to 'Bad'. |
| | Upscale: | The output is set to the high limit and Status is set to 'Bad'. |
| Fallback value | Allows the user to enter the value to which the output is set for Fallback = Fall Good, or Fall Bad. | |
| Select | Appears only if Operation = Select. Allows input one or input two to be selected for output. | |
| In1 | Input one value (normally wired to an input source). | |
| In2 | Input two value (normally wired to an input source). | |
| Out | The output value resulting from the configured mathematical operation. If either input is 'Bad', or if the result is out of range, the fallback strategy is adopted. | |
| Status | Indicates the status of the operation as 'Good' or 'Bad'. Used to flag error conditions and can be used as an interlock for other operations. | |

## 6.19 MODULATOR MENU

This function implements the modulation type firing modes such as fixed and variable period modulation.

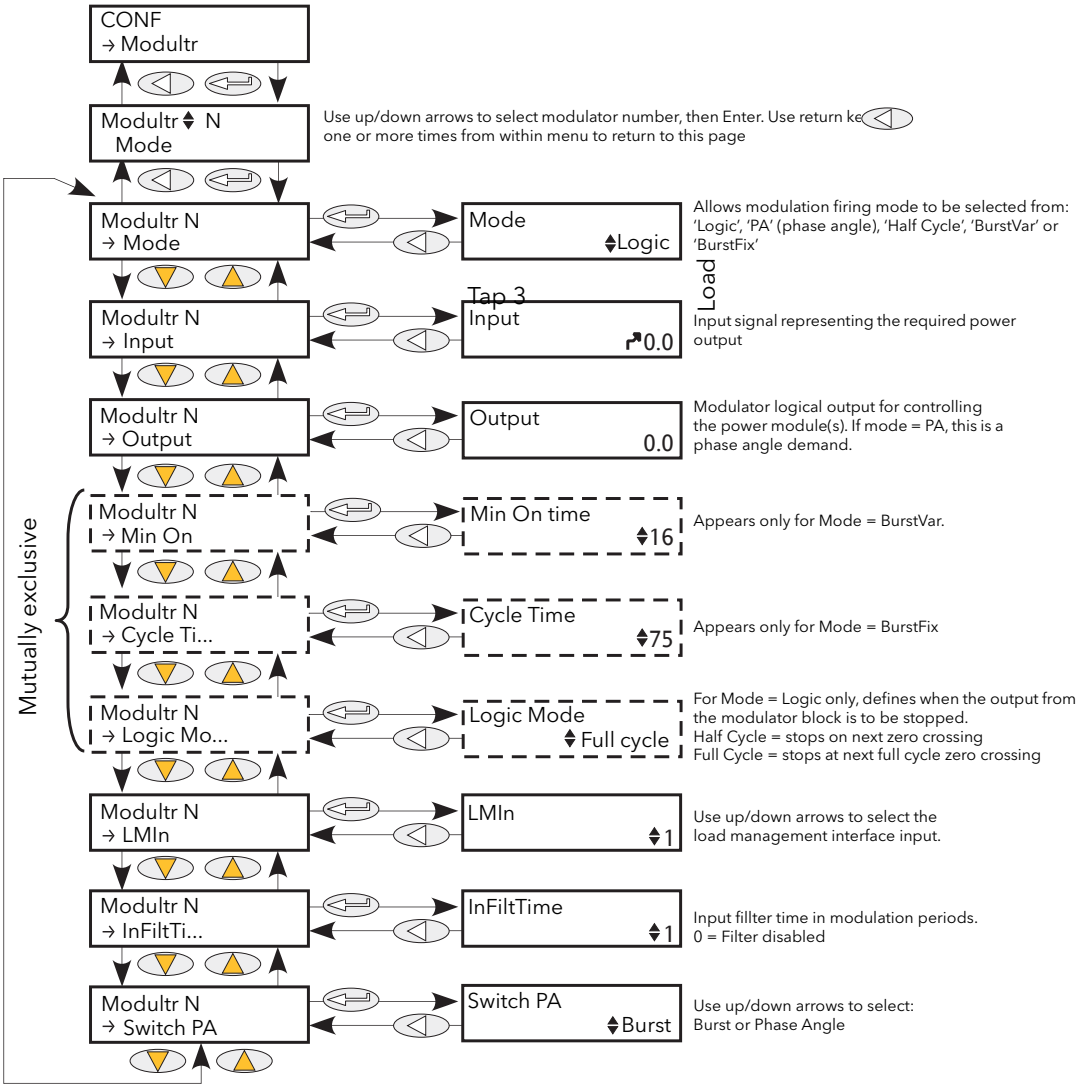



Figure 6.19 Modulator menu

| | |
|---|---|
| Mode | Select the required firing mode from "Logic', 'PA' (Phase angle) 'Half cycle', 'BurstVar' (Burst firing - minimum on time) or 'BurstFix' (Burst firing - cycle time). |
| Input | This is the value that the modulator is required to deliver. |
| 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. |
| Min on Time | For Variable Period Modulation, this sets the minimum on time in supply voltage periods. At 50% demand from the modulator, Ton = Toff = Minimum on time, and Cycle time is 2 x Minimum on time = Modulation period. The minimum off time is equal to 'Min on time'. |
| Cycle Time | For Fixed Period Modulation, this is the cycle time in supply voltage periods. |
| Logic Mode | For Logic Firing Modulation, Half cycle sets firing stop to the next zero crossing; Full cycle sets firing stop at the zero crossing of the next full cycle. |
| LMIn | Load Management Interface input. Defines a connection from the modulator to a load management channel (if fitted). |
| InFiltTime | Modulator input filter time as a number of modulation periods. When set to zero, filter is disabled. |
| Switch PA | Allows the user to impose Phase Angle firing, overriding the configured Burst Mode as displayed in 'Mode', above. |

## 6.20 NETWORK MENU

This identifies the type of electrical network to be controlled, and this, in turn defines how the network's electrical measurements are presented. The configuration is related to a power channel, not necessarily the Power Module number. For a network of four single-phase units, four network blocks are required; for two leg control of a three-phase network, two network blocks are used; for three-phase control of a single network, one Network block is required.

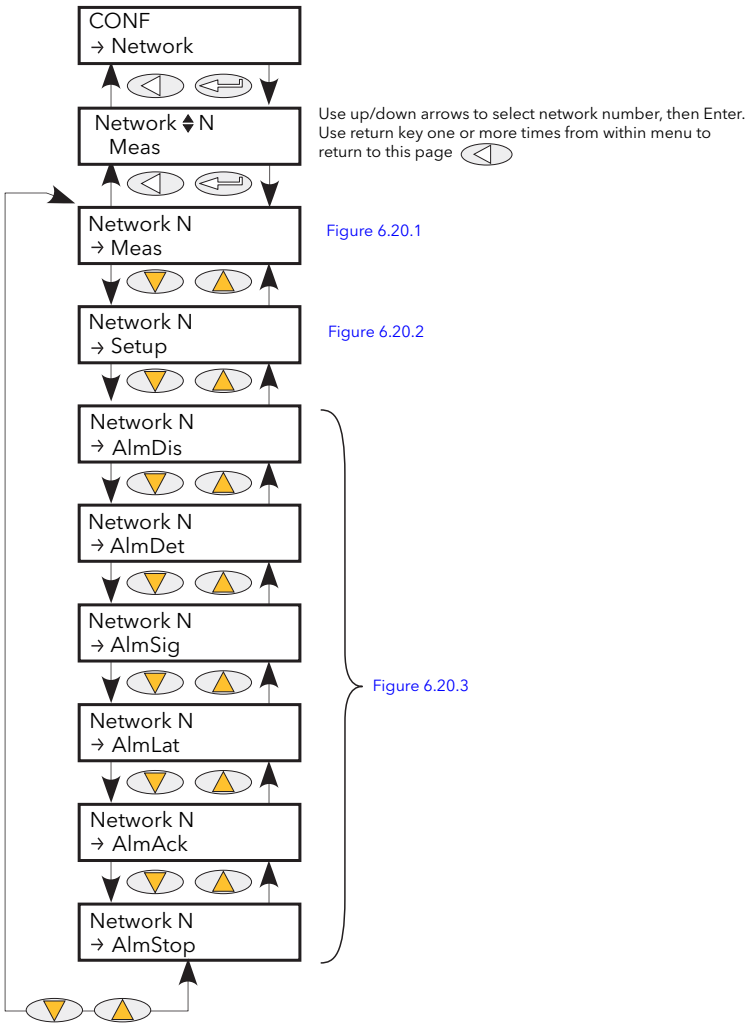



Figure 6.20 Network menu

## 6.20.1 Meas submenu


Figure 6.20.1 Meas submenu layout

### 6.20.1 MEAS SUBMENU (Cont.)

This submenu presents power network measurements, according to the network type. All available measurements are listed below, but which values actually appear depends on the network configuration.

| | |
|---|---|
| Frequency | Displays the calculated frequency of the supply voltage of the power channel associated with this network. |
| Vline | Supply voltage measurement on the primary power module. Displays line to neutral except in three phase or two-leg control when line to line voltage is displayed. |
| Vline2, Vline 3 | As for VLine but for power modules two and three respectively |
| I | Load Irms measurement on primary power module. The time base measurement is the main period in Phase Angle, and the modulation period in Burst Mode. |
| I2, I3 | As for I, above, but for power modules two and three respectively. |
| I Average | This is the average of the current in the three channels of a three-phase system. This is relevant only for 3 phase and 2 leg controlled systems:- $I_{RMS}Avg = (I_{RMS} + I_{RMS}2 + I_{RMS}3)/3$ |
| $I^2$ Burst | Average square value of load current in burst firing. The average Isq in burst firing, the average is taken over the duration of the burst period. This is typically used for monitoring and alarming over the burst period. |
| $I^2$ | Square value of load current in Burst Firing and over the main period in phase angle. Typically used for Isq control. In 3-phase or 2-leg control this is the average of the three network squared currents, calculated as $I^2 = (I^2Phase1 + I^2Phase2 + I^2Phase3)/3$ |
| $I^2$Maxim... | In a three-phase network, this is the maximum of $I^2$, $I2^2$ and $I3^2$. Used in current limiting in three-phase networks, and in alarm strategies. |
| Irms Max... | The RMS value of $I^2$Max measured over the mains period. Typically used for current limiting or current transfer in 3-phase networks, in phase angle mode. |
| V | Load Vrms measurement on primary power module of this channel of power control. Displays load to neutral (or to second line) except in three phases star or delta load coupling displays load1 to load2 voltage The time base measurement is the main period in phase angle, and the modulation period in burst mode. |
| V2, V3 | As for V, but for 2nd and 3rd Power Modules respectively. |
| V Average | The average of the voltage in the three channels of a three-phase system. This is relevant only for three-phase and two-leg power networks $V_{RMS}Avg = (V_{RMS} + V_{RMS}2 + V_{RMS}3)/3$ |
| $V^2$ Burst | Average square value of load voltage in burst firing taken over the duration of the burst period. Typically used for monitoring and alarm strategies over the burst period. |
| $V^2$ | Square value of load voltage in Burst Firing and on main period in Phase Angle Firing. Typically used for Vsq control. In three-phase or Two-leg control this is the average of the three network squared voltages, calculated as Vsq = (VsqPhase1 + VsqPhase2 + VsqPhase3)/3 |
| $V^2$ Maxim... | The maximum squared voltage out of VsqPhase1, VsqPhase2, VsqPhase3. Typically used for voltage limiting in three-phase networks and for alarm strategies. |
| Vrms Max... | The RMS value of $V^2$Max measured over the mains period. Typically used for voltage limiting or transfer in 3-phase networks, in phase angle mode. |
| P Burst | Measurement of true power on the network. This is calculated over the modulation period in Burst Firing mode. Typically used for monitoring, alarm strategy and in Load management (if option fitted). |
| P | True power measurement in Burst Firing and over the modulation period in Phase Angle firing. Typically used for true power control |
| S | Apparent power measurement. For phase angle firing S=Vline x $I_{RMS}$; for burst firing $S=V_{RMS} \times I_{RMS}$ |
| PF | Calculation of power factor. Defined as Power Factor = True Power / Apparent Power. In phase angle this is PF=P/S; in burst firing PF = PBurst/S = Cosϕ(Load) |
| Q | Calculation of the reactive power defined in phase angle as $Q = \sqrt{S^2 - P^2}$, or in burst firing as $Q = \sqrt{S^2 - P_{Burst}^2}$. |
| Z | Load impedance measurement on first power module, defined as:- Z=Vrms/Irms. Measurement uses line current (not leg current) and load voltage, so value may not be accurate for some multi-phase wiring configurations. |
| Z2, Z3 | Load impedance measurement on the 2nd and 3rd phase of the network respectively. |
| HSink1(2)(3) T... | Heat sink temperatures. Used to protect the Power Modules from overheating. |

### 6.20.2 Network Setup Submenu

This displays the setup of the network and associated functions.

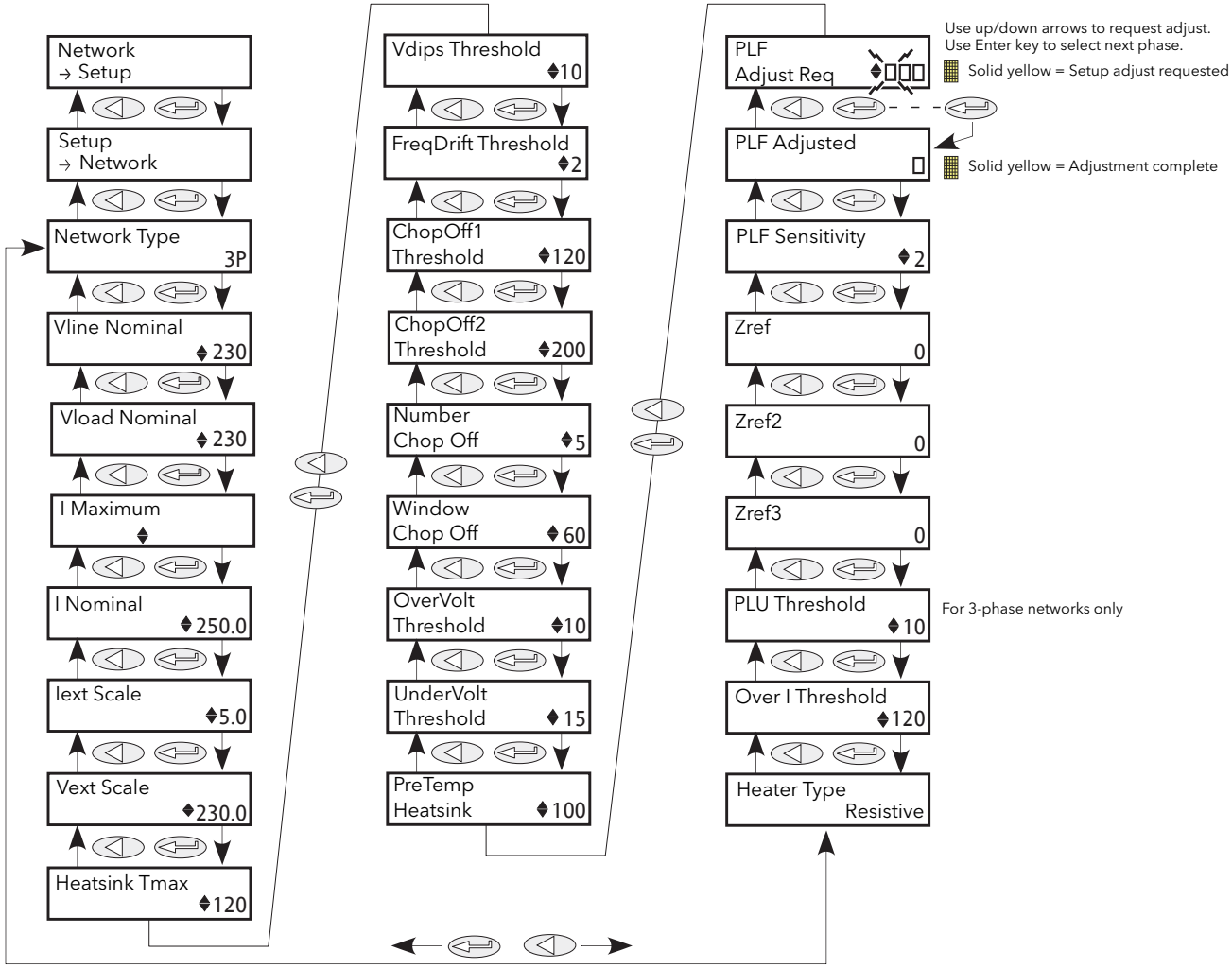



Figure 6.20.2 Network Setup submenu

| | |
|---|---|
| Network Type | Displays the Network type as Three phase, Single phase or Two-leg control. |
| Vline Nominal | Line voltage nominal value required to calibrate the stack. This is the line to line voltage except for Single phase to Neutral and Three-phase Star with Neutral networks, when the measurement is line to neutral. |
| VloadNominal | Nominal Load voltage, required to calibrate the Power Module. This is the same as the Vline Nominal except when external feedback is used e.g. from a transformer secondary. In which case this value must be correctly set to scale the measurement. |
| IMaximum | Indicates the maximum current of the stack (50, 100, 160, 250, 400, 500, 630). For transformer-driven loads, select EXT100 etc. and configure IextScale appropriately. |
| INominal | Nominal current supplied by the Power Module. This value is used for calibrating the current measurement in the stack. This is limited by IMaximum, which imposes the limit of the physical channels unless external feedback is configured, in which case the limit is 4000A. |
| IextScale | External current scale adjustment for use when IMaximum is set to external feedback. If an external current transformer is fitted, IextScale should be set to the normal primary current of the current transformer. If an external current transformer is not being used, IextScale should be set to 5A. |

### 6.20.2 NETWORK SETUP SUBMENU (Cont.)

| | |
|---|---|
| VextScale | External voltage scale adjustment for use when IMaximum is set to external feedback. If an external transformer is fitted, VextScale should be set to the nominal primary voltage of the external transformer. If an external transformer is not fitted, VextScale should be set to Vnominal. |
| HeatsinkTmax | Displays the maximum permissible temperature of the heat sink. This forms an alarm threshold for the 'Heat sink Overtemperature' alarm. |
| VdipsThreshold | Voltage dips threshold. This is a percentage difference (relative to Vline Nominal) between 2 consecutive half cycles. Each half cycle voltage measurement is integrated and at the end of each half cycle the last 2 voltage integrals are compared. |
| FreqDriftThold | The supply frequency is checked every half cycle, and if the percentage change between 1/2 cycles exceeds this threshold value, a Mains Frequency System Alarm is generated. The threshold may be set to a maximum of 5% to cater for the effects of heavily inductive networks. |
| ChopOff1Threshold | The 'Chop-off' alarm becomes active if load current exceeds this threshold for more than five seconds. Threshold values lie between 100% and 150% of INominal. |
| ChopOff2Threshold | The Chop-off' alarm also becomes active if this second current threshold is exceeded more than a predefined number of times (NumberChopOff ) within a predefined time period (WindowChopOff). Current threshold values lie between 100% to 350% of INominal.<br>NumberChopOff can be set to between one and 16 (inclusive) and any value between 1 and 65535 seconds may be configured for WindowChopOff.<br>Each time an over-current is detected, the unit stops firing, raises a 'Chop-off' condition alarm, waits for about 100ms and then restarts firing using an up-going safety ramp. The 'Chop-off' condition alarm is cleared if the unit restarts successfully after an over-current event.<br>If NumberChopOff is reached within the WindowChopOff period, the unit stops firing and remains stopped. A chop-off state alarm is triggered, making it necessary for the user to acknowledge the chop-off state alarm before restarting firing. |
| NumberChopOff | Displays the number of 'Chop Off' events that can occur within the WindowChopOff period before a 'Chop Off' alarm is enabled. Used only with ChopOff2Threshold. |
| WindowChopOff | Displays the 'Chop Off' window in seconds. Used only with ChopOff2Threshold. |
| OverVoltThreshold | The threshold for detecting an over voltage condition as a percentage of VLineNominal. If Vline rises above the threshold a Mains Voltage Alarm is set (DetMainsVoltFault). |
| UnderVoltThreshold | This is the threshold for detecting an under voltage condition as a percentage of VLineNominal. If Vline falls below the threshold a Mains Voltage Alarm occurs (DetMainsVoltFault). |
| PreTempHeatsink | The threshold for the heat sink temperature pre-alarm in degrees C, which, if exceeded, causes a pre-temperature (DetPreTemp) alarm to occur. |
| PLFAdjustReq | Partial load failure adjustment request. To make the Partial Load Failure (PLF) alarm operate correctly, the normal steady-state condition must be known to the instrument. This is done by activating the PLF Adjust Req, for each Network, once the controlled process has achieved a steady state condition. This causes a load impedance measurement to be made which is used as a reference for detecting a partial load failure. If the load impedance measurement is successful PLFAdjusted (below) is set. The measurement fails if the load voltage (V) is below 30% of (VNominal) or the current (I) is below 30% of (INominal). The PLF alarm becomes active as setup in 'PLF Sensitivity', below. |
| PLFAdjusted | Partial load failure adjusted acknowledge. Indicates that the user requested a PLF adjustment and that the adjustment was successful. |
| PLFSensitivity | 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.<br>E.G. if the N = 6 and s= 4, then the alarm is triggered if 2 or more elements are broken. |

## 6.20.2 NETWORK SETUP SUBMENU (Cont.)

| | |
|---|---|
| Zref | Reference load impedance for phase 1, as measured when PLF adjust is requested. |
| Zref2, Zref3 | As for Zref but for phases 2 and 3 respectively. |
| PLUthreshold | Partial load unbalance threshold. Defines the threshold for detecting a partial load unbalance condition. This is only applicable to a three phase system. This occurs when the difference between the maximum and minimum current of the three phase system exceeds the threshold as a percentage of Inominal. The alarm can be detected between 5 and 50%. |
| OverIThreshold | The threshold for detecting an over current condition as a percentage of INominal. If I is above the threshold a Mains Current Alarm occurs (DetoverCurrent). |
| HeaterType | Shows the type of heater used in the load as: 'Resistive', 'SWIR' (Short wave infra-red), 'CSi' (Silicon Carbide), 'MoSi2' (Molybdenum Disilicide). |
| MaxInom | Fix limit to I Nominal |

**PARTIAL LOAD FAILURE CALCULATIONS**

The PLF alarm detects a static increase in load impedance (low temperature coefficient loads and Short wave Infra Red heaters can be controlled by this feature).

The alarm works by comparing the reference load impedance with the actual measured load impedance. The user must set the reference impedance (by requesting PLFAdjust) and the partial load failure sensitivity.

Notes:

1. All elements are assumed to be identical and connected in parallel
2. For three phase loads, the impedance reference can be set only if the load is balanced.

The impedance comparison takes place over a mains cycle (in phase angle firing) or over the burst period (for burst and logic firing). For star with neutral (4S) or open delta (6D) networks, the measured load voltage and current correspond directly to the load parameters. In these configurations the partial load failure sensitivity is limited only by measurement accuracy and element impedance inaccuracies. For star without neutral (3S) and closed delta (3D) configurations, equivalent impedances are calculated using line-to-line voltages and line currents, this resulting in minor inaccuracies.

Special care must be taken for short burst firing modes (e.g. IHC or single cycle firing) if no phase rotation is applied for Burst start (suppression of DC component in current transformers) and for logic firing without DC component suppression feature, for the same reason.

A minimum voltage of 30% of nominal adjusted value (Vload nominal) and a minimum of 30% of INominal must be applied to the load, as below these thresholds, no partial load failure detection or impedance reference setting takes place.

### 6.20.3 Network alarms

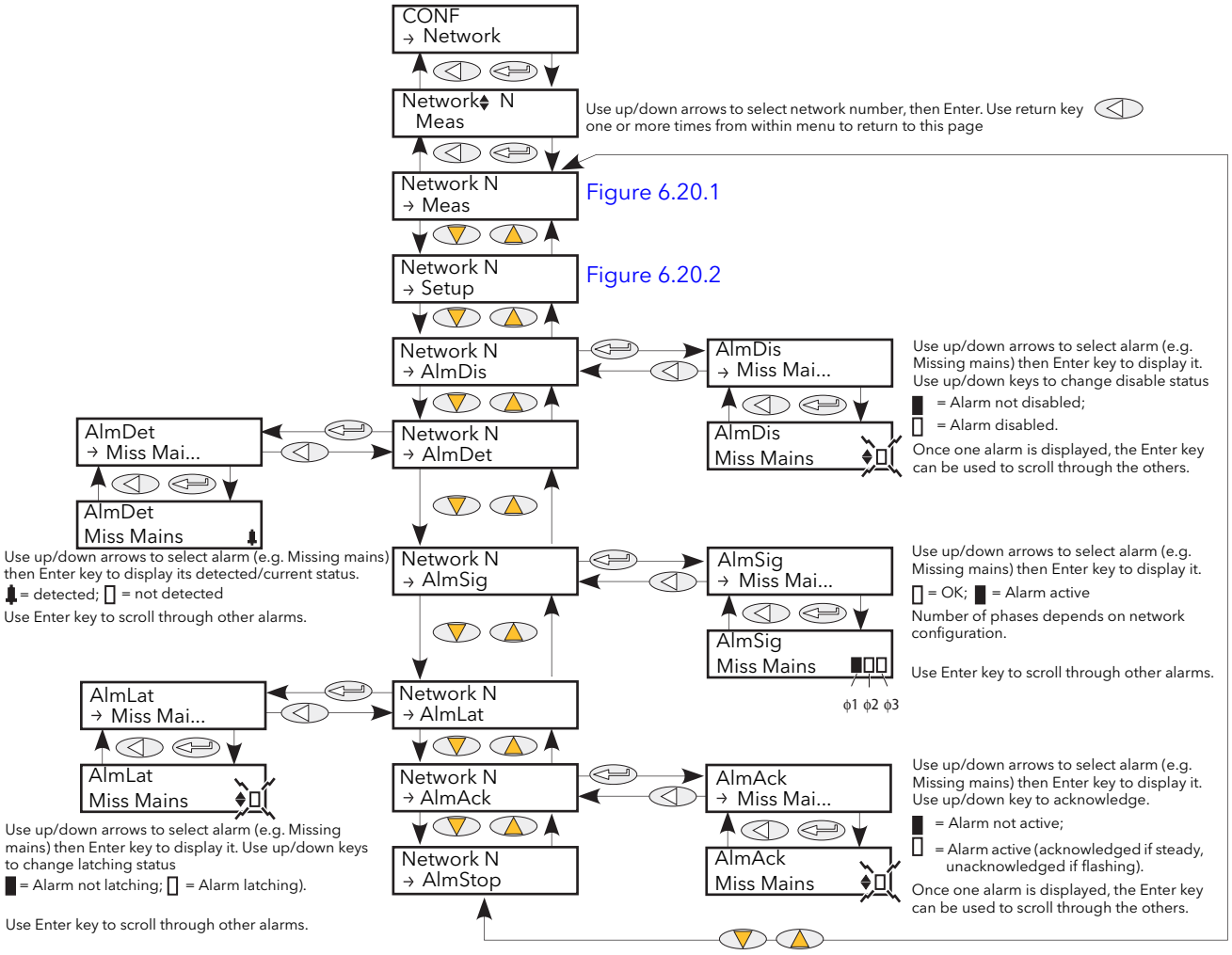



Figure 6.20.3 Network alarm menu

#### NETWORK ALMDIS SUBMENU

This menu allows individual network block alarms (listed below) to be enabled/disabled. Section 10 gives more details of these alarms.

| | |
|---|---|
| MissMains | Missing Mains |
| Thyr SC | Thyristor Short Circuit |
| Open Thyr | Thyristor open Circuit |
| Fuse Blown | Fuse Blown |
| Over Temp | Over Temperature |
| Volt Dips | Mains Voltage Dips |
| Freq Fault | Frequency Fault |
| PB 24V | Power Board 24V Failure |
| TLF | Total Load Failure |
| Chop Off | Chop Off |
| PLF | Partial Load Failure |
| PLU | Partial Load Unbalance |
| VoltFault | Mains Voltage Fault |
| PreTemp | Pre-Temperature |
| Over I | Over Current |

## 6.20.3 NETWORK ALARMS (Cont.)

**NETWORK ALMDET SUBMENU**

As for 'Alarm Disable', above, but this Alarm detect submenu indicates whether any of the network alarms has been detected and is currently active.

**NETWORK ALMSIG SUBMENU**

These displays show whether an alarm has occurred and also contains latching information. The relevant AlarmSig parameter is used when wiring (to a relay for example). The alarm list is as given above.

**NETWORK ALMLAT SUBMENU**

As for 'Alarm Disable', above, but this Alarm Latch submenu allows each individual network block alarm to be defined as latching or non-latching.

**NETWORK ALMACK SUBMENU**

As for 'Alarm Disable', above, but this Alarm Acknowledge submenu allows each individual network block alarm to be acknowledged. Once acknowledged, the associated signalling parameter is cleared. Acknowledge parameters automatically clear after being written.

Note: Alarms may not be acknowledged whilst the trigger source is still active.

**NETWORK ALMSTOP SUBMENU**

Allows each individual alarm type to be configured to stop the related power module from firing. Activated by the related Signalling parameter. The alarm list is as given above.

## 6.21 PLM (STATION AND NETWORK LM PARAMETERS) MENU

This menu appears only if the Predictive Load Management option is fitted and enabled.

LoadMng provides an interface to the parameters of the station and of the load management network. A 'station' is defined as a Driver module and associated power modules. Figure 6.21 gives an overview of the menu.

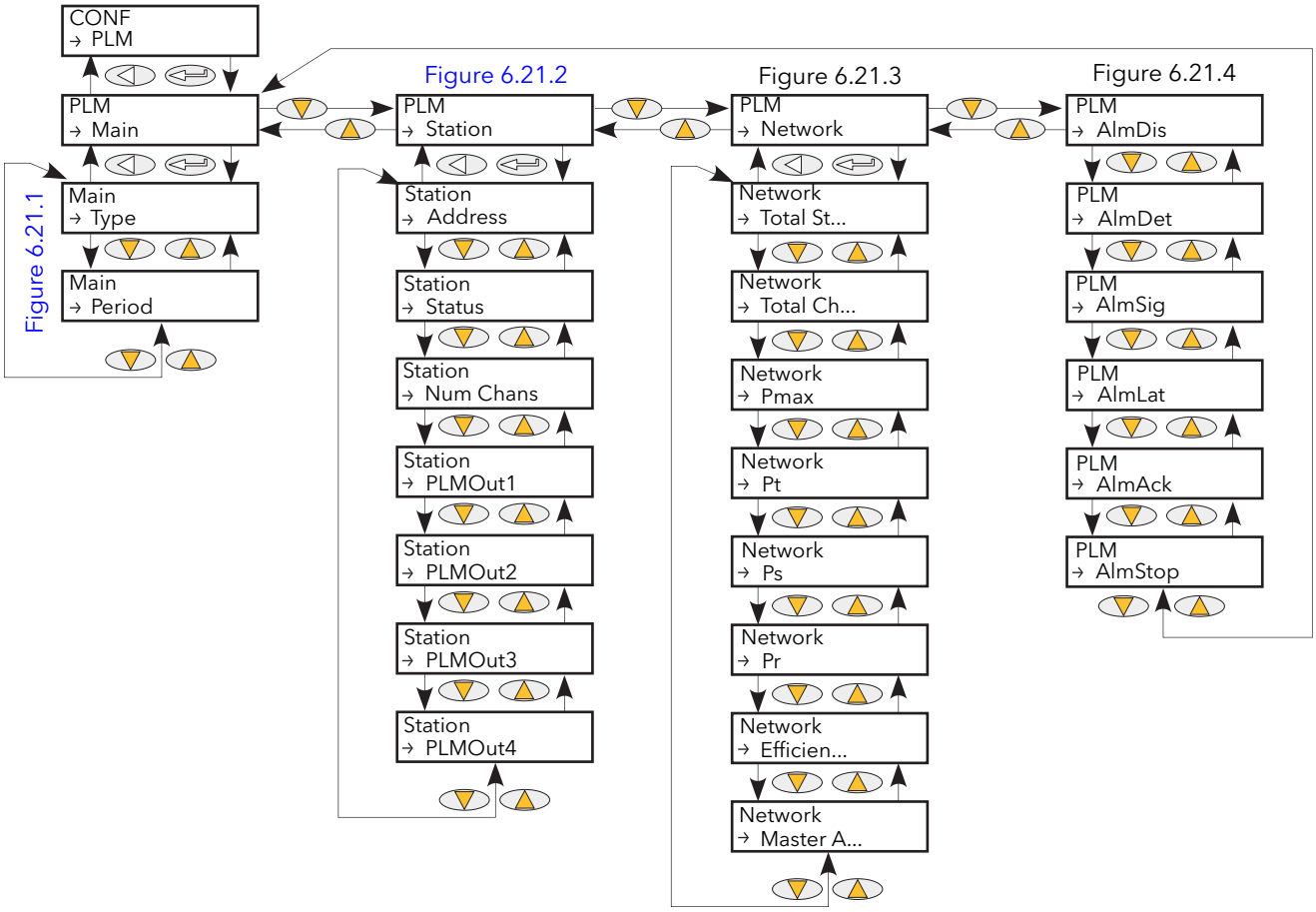



Figure 6.21 Predictive Load Management Menu overview

### 6.21.1 Main

This presents the main Load Management parameters.

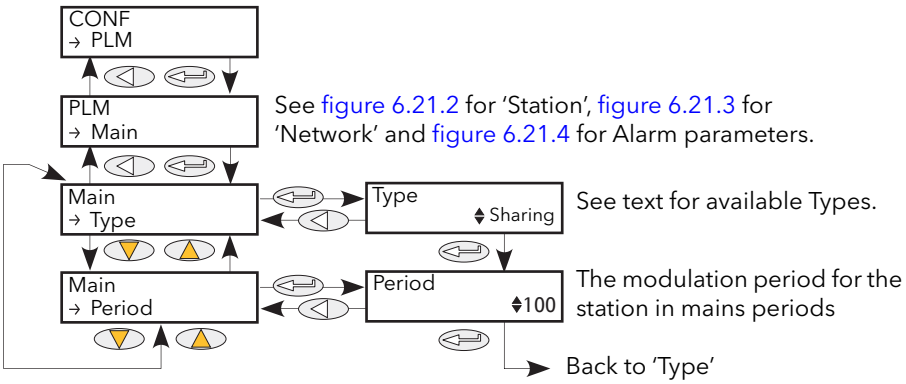



Figure 6.21.1 Load Management 'Main' menu

### 6.21.1 PREDICTIVE LOAD MANAGEMENT 'MAIN' MENU (Cont.)

Type — Configures the type of Predictive Load Management as follows:

- No: No Load Management. Load Management is disabled.
- Sharing: Load Sharing. Used to control the total power demand over time by distributing the conduction periods of the various units.
- IncrT1: Incremental Type 1. Several loads receive a common setpoint. Only one channel is modulated by the duty cycle, the others being at 0% or 100% demand. Total power distributed = setpoint value.
- IncrT2: Incremental Type 2. A number of loads receive a common setpoint. Only the first channel is modulated, by the duty cycle, the others being at 0% or 100% demand. Total power distributed = setpoint value.
- RotIncr: Rotating Incremental. Provides incremental control of between two and 64 channels, operating from a single input. Each channel modulates with an identical mark-space ratio determined by the power demand signal, but each channel is separated from adjacent outputs by the selected time base.
- Distrib: Distributed Control. This mode provides control of between two and 64 channels from an equal number of independent inputs. Each channel modulates with a mark-space ratio proportional to its input signal, but with the switching of adjacent inputs distributed over the selected time cycle.
- DistIncr: Distributed and Incremental control. This provides control of between two and eight groups of loads. A total of 64 channels is available, and these may be freely distributed among the groups, as long as each group has at least one channel. Each group has a single power demand input and operates as in Incremental Type 2 mode, with the first channel modulating to maintain the selected power level. Switching time within groups is distributed over the selected time cycle.
- RotDisInc: Rotating Distributed and Incremental control. This provides control of between two and eight groups of loads. A total of 64 channels is available, and these may be freely distributed among the groups, as long as each group has at least one channel. Each group has a single power demand input and operates in Rotating Incremental mode with all channels modulating at an identical rate. The distributed nature of this mode ensures that the instant of switch on in each group is distributed over the cycle time.

Period — This configures the modulation period for the station, in mains periods between 50 and 1000. The accuracy of control is related to the modulation period - to increase accuracy the period must be increased.
The master unit imposes its modulation period on all slaves. It is recommended that all slave units are configured to use the same period as the master, so that should the master lose control, then the slave that replaces it as master will use the same value and thus achieve the same accuracy of control. (The new master imposes its own value at the next power cycle.)

### 6.21.2 Predictive Load management 'Station' menu

This menu contains all parameters related to Load Management Station configuration, where a 'station' consists of a Driver Module together wit hits associated Power modules.

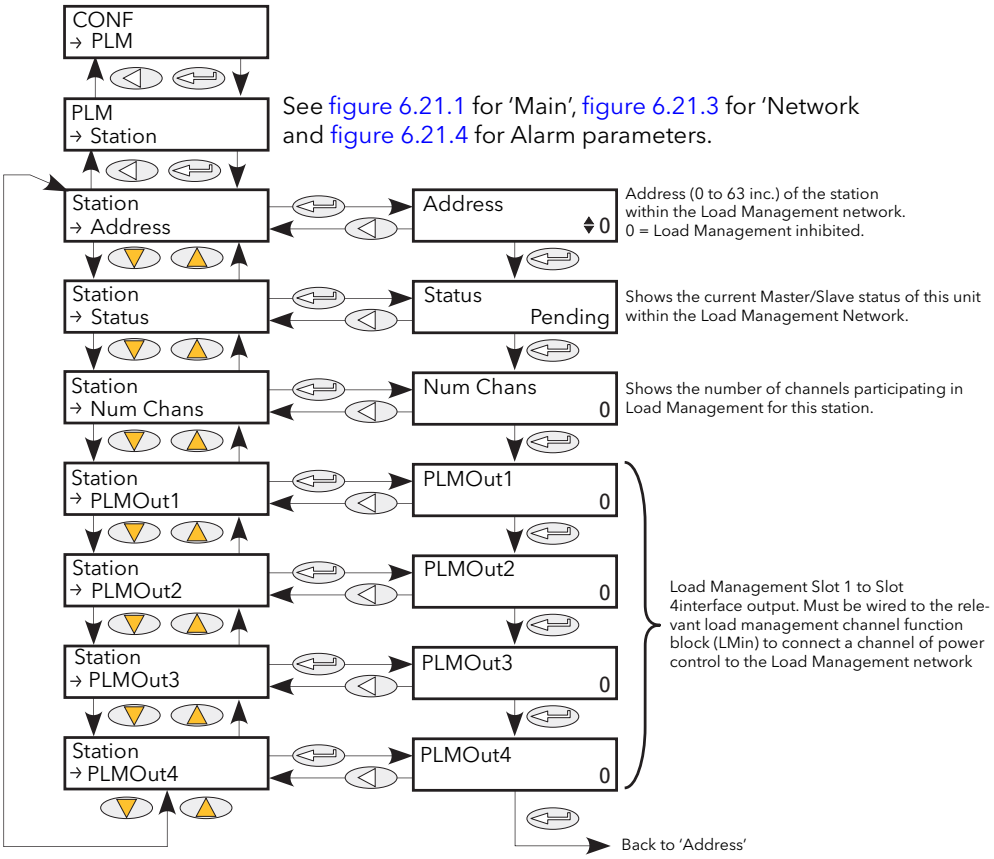



Figure 6.21.2 Load Management 'Station' menu.

| | |
|---|---|
| Address | This is the address of the unit on the Load Management (PLM) network, between 0 and 63 inclusive. An address of 0 disables Load Management. The lowest address on the network normally becomes the master. |
| Status | Indicates the current master/slave status for thisunit, as follows:<br>Pending: The election of the master is not yet complete<br>IsMAster: The unit is athe PLM network master<br>IsSlave: This unit is a slave<br>Duplicate address: Two or more units have the same address. Units with identical addresses are excluded from the load management process. |
| Num Chans | This shows the number of channels participating in load management for this unit. Automatically configured from the load management 'wiring' for this unit.<br>Maximum number of channels = 64<br>Maximum number of channels per station = 4<br>Maximum number of stations = 64<br>Maximum number of groups = 8.<br>Example1: There can be a maximum of 16, four-channel units (i.e 64 channels).<br>Example 2: There can be a maximum of 63 three-phase units, (i.e. 63 channels). |
| PLMOut 1 to 4 | These outputs must be wired to the load management channel function block PLMChan1 (to 4).PLMIn in order to connect a power control channel to the load management network. |

### 6.21.3 Predictive Load Management 'Network' menu

This includes load management network parameters.

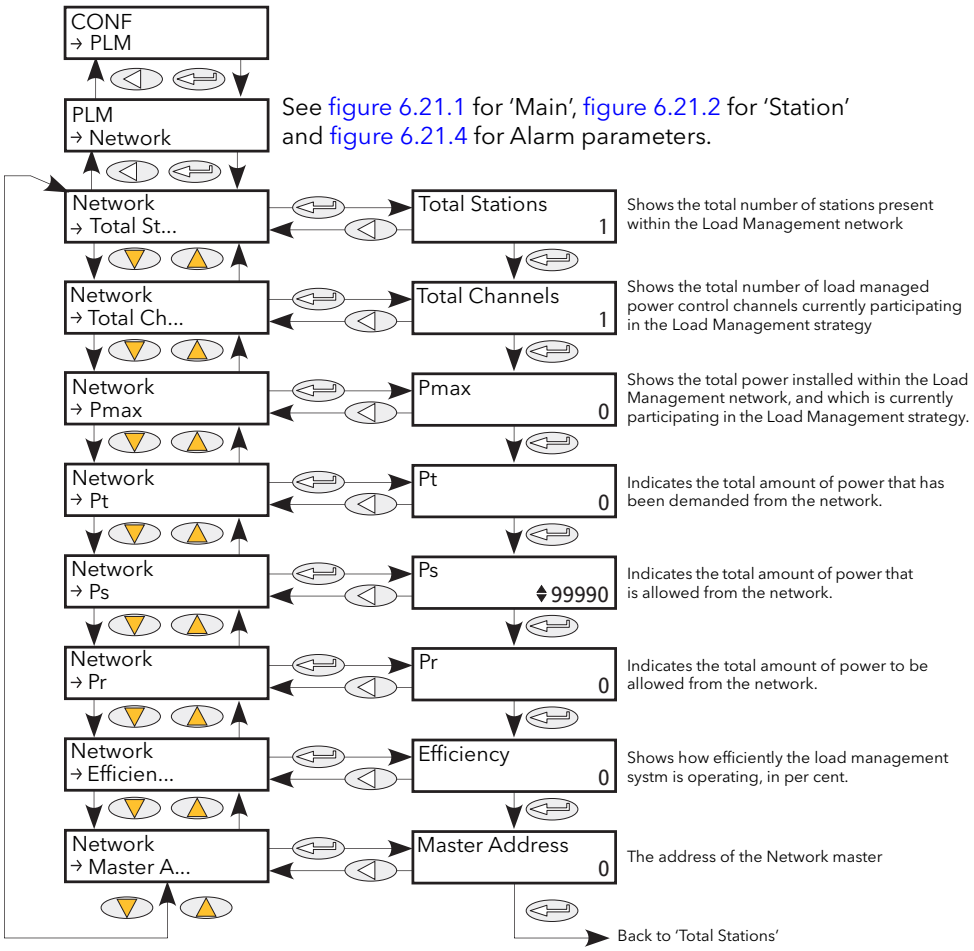



Figure 6.21.3 Load management 'Network' menu

| | |
|---|---|
| Total Stations | Shows the number of units within the Load Management (PLM) network. |
| Total Channels | Shows the number of load management power channels currently participating in the Load Management strategy. |
| Pmax | This indicates the total amount of power installed and participating in the Load Management strategy, within the PLM network |
| Pt | The sum of the power demanded by all channels taking part in the Load Management strategy. |
| Ps | Configured by the user to restrict the power demanded from the network, according to the Load Shedding strategy (setting Ps> Pmax disables Load Shedding).<br>Example: If the total installed power is 2.5MW but the user wishes to restrict the delivered power to be within a tariff band of 2MW, then Ps should be set to 2MW. Load shedding will shed power across the network to keep the total demand to less than 2MW. |
| Pr | This shows the total amount of power that has been delivered through the network. The value can be greater than Ps depending on the shedability factors of all channels. |
| Efficiency | Shows, in percent, how efficient the load management strategy is.<br>Calculated from: Efficiency % = {Pmax - (Ptmax - Ptmin)}/Pmax, where Ptmax and Ptmin are the peak maximum and minimum values for total power during the modulation period, respectively. |
| Master Address | Displays the address of the elected master on the Load Management network. For the master unit, this address is the same as the address set up in 'Station' described above. For a slave unit, the two addresses are different. |

### 6.21.4 Predictive Load Management 'Alarm' menus

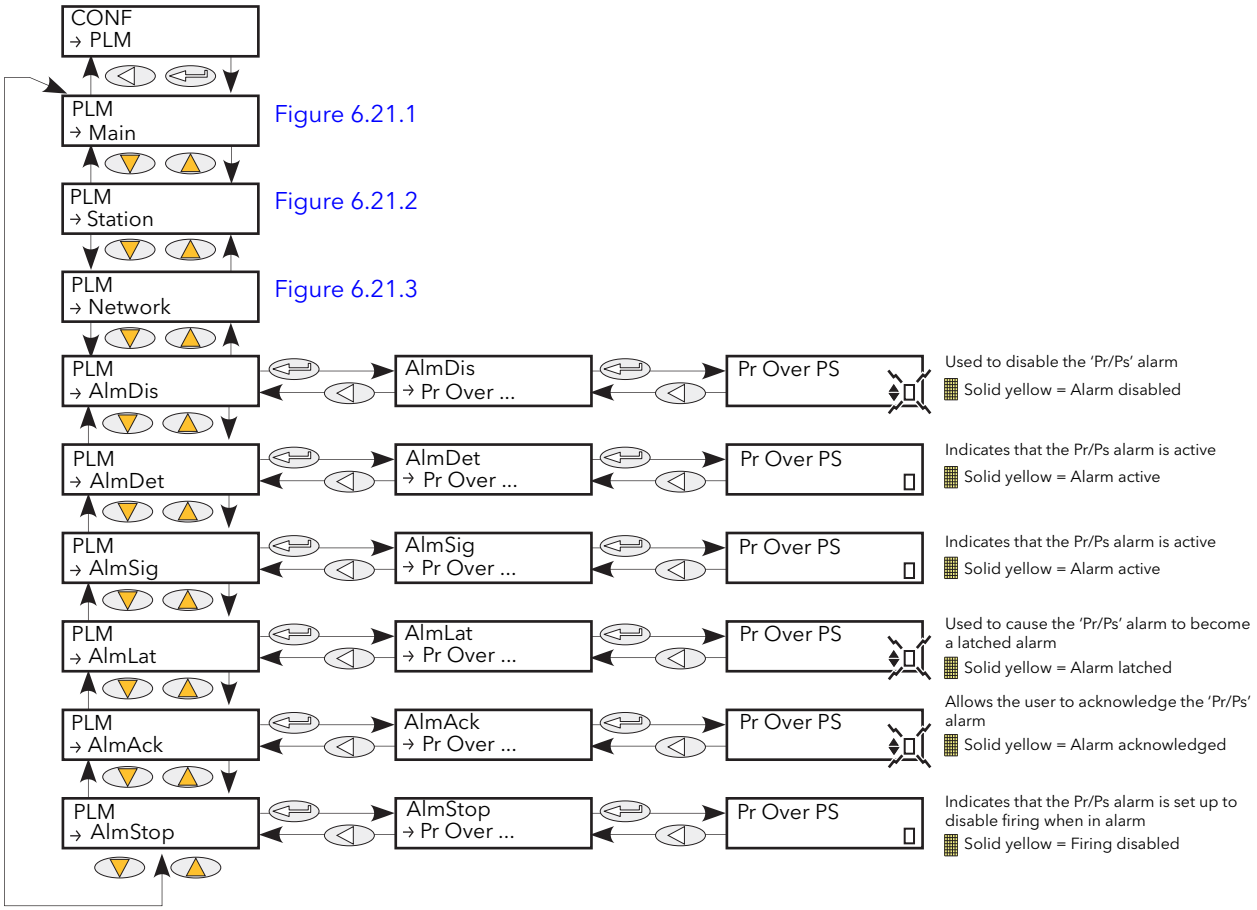



Figure 6.21.4 Load Management 'Alarm' menus

| | |
|---|---|
| AlmDis | Allows the user to disable the Pr/Ps alarm. |
| AlmDet | Indicates to the user that Actual power is greater than the requested maximum. Caused by an incorrect calibration of one or more channels, or possibly as a result of load shedding. |
| AlmSig | Indicates whether or not Pr/Ps alarm has been detected. If action is to be taken as a result of this alarm's going active, then it is AlmSig that should be wired. |
| AlmLat | Allows the user to set Pr/Ps alarm to be a latching type. |
| AlmAck | Allows the user to acknowledge the Pr/Ps alarm. |
| AlmStop | Allows the Pr/Ps alarm to be configured to disable firing whilst active. |

## 6.22 PLMCHAN (LOAD MANAGEMENT OPTION INTERFACE) MENU

This menu appears only if the Predictive Load Management option is fitted and enabled.

PLMChan provides an interface to the channel parameters needed for Load Management. See also section 6.21 and section 9.

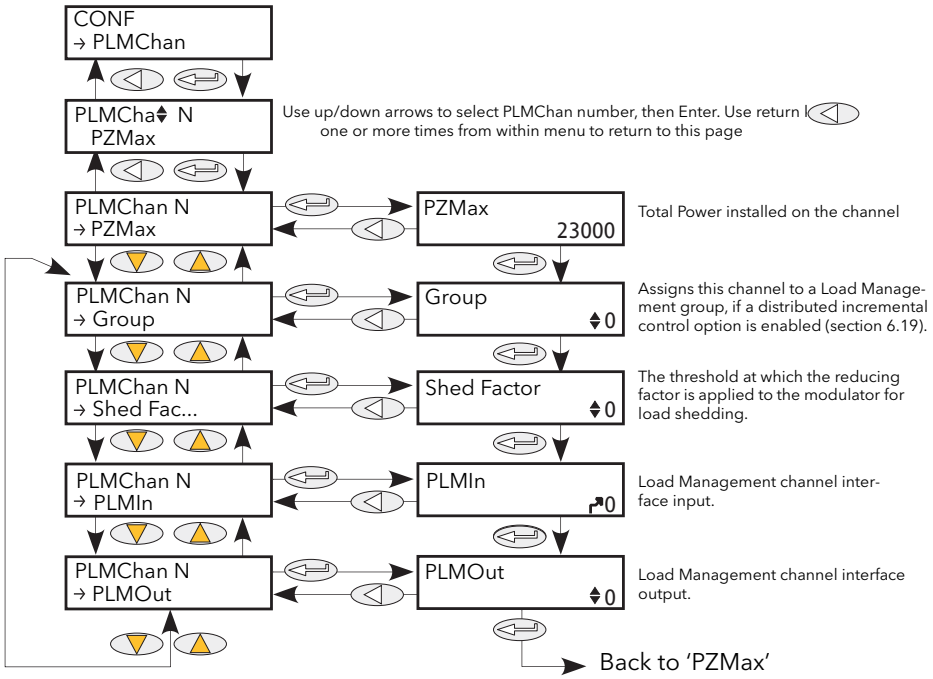



Figure 6.22 Predictive Load Management option interface menu

| | |
|---|---|
| PZMax | Total power installed on the channel. Calculated using the rating of the unit. |
| Group | The group (max. = 8) in which the channel operates. This item appears only if one of the distributed incremental load management options has been selected (section 6.21). |
| ShedFactor | The threshold at which the reducing factor is applied to the modulator for load shedding. This item appears only if Load sharing is enabled (section 6.21) |
| LMIn | The Load Management channel interface input. Must be wired to one of the LMOut connections on the LoadMng function block in order to connect this channel to the network. |
| LMOut | The Load Management channel interface output. Typically wired to the LMin parameter on the modulator block. |

## 6.23 LOAD TAP CHANGER (LTC) OPTION

This option offers automatic load tap selection for primary or secondary windings, as configured. Instruments with this option must also be fitted with the remote current/voltage feedback option.

Figure 6.23 shows the overall menu structure. Figure 6.23.2 shows the Alarm menu, and figures 6.23.3a to 6.23.3f show some typical application wiring.

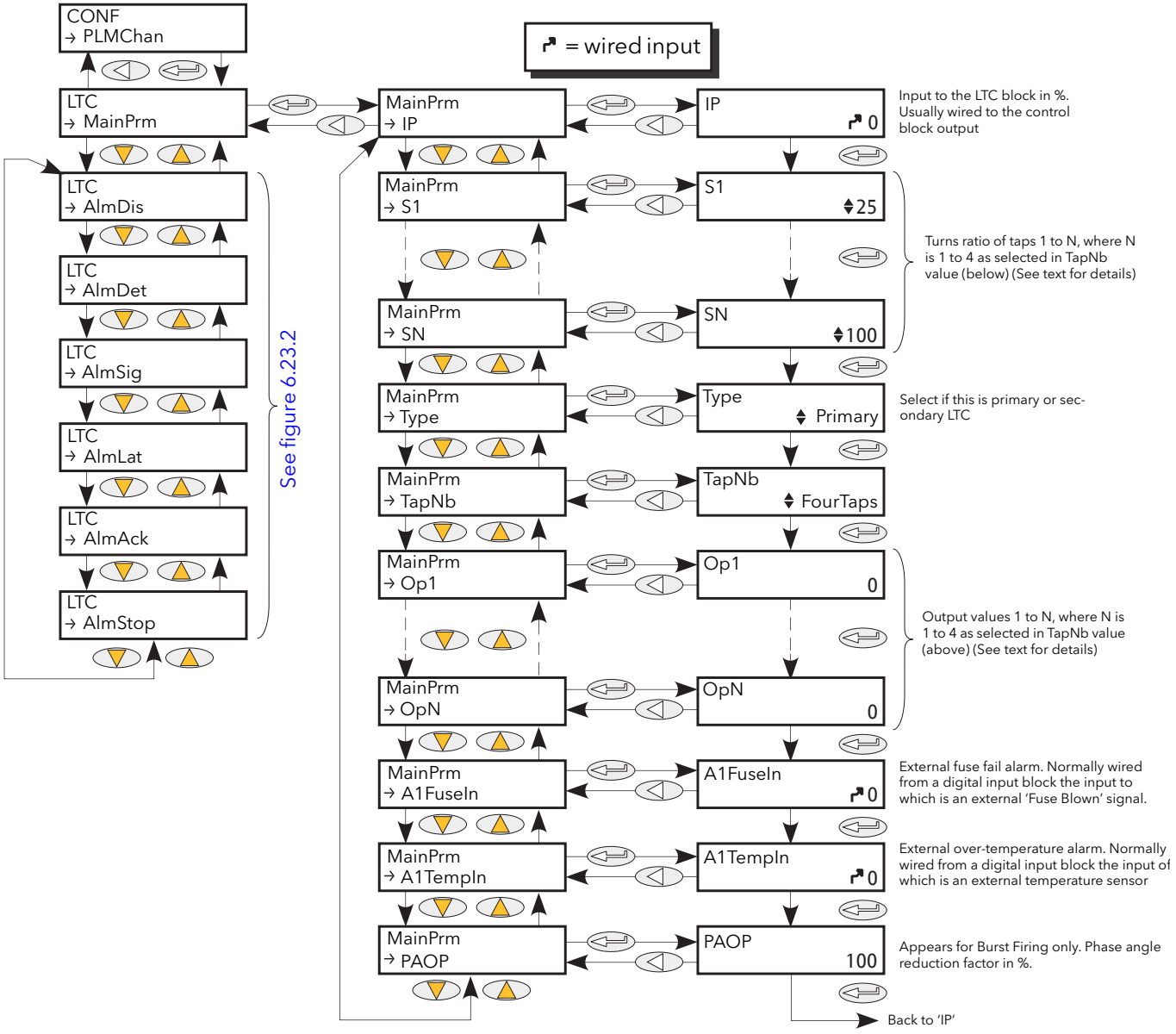



Figure 6.23 Load Tap Changer (LTC) menu overview

### 6.23.1 MainPrm parameters

| | |
|---|---|
| IP | The % demand normally wired from a control block output |
| S1 | Turns ratio of transformer tap 1 in percent. If Type = Primary, $S1=\frac{N_{T1T2}}{N_{Tot}} \times 100$ where $N_{T1T2}$ is the number of turns between Tap1 and Tap 2, and $N_{Tot}$ is the total number of turns. For the primary, T1 is the highest tap. If Type = Secondary, $S1=\frac{N_{T1}}{N_{Tot}} \times 100$ where $N_{T1}$ is the number of turns in Tap 1 (lowest tap) and $N_{Tot}$ is the total number of turns. |
| S2 | Turns ratio of transformer tap 2 in percent. If Type = Primary, $S1=\frac{N_{T1T3}}{N_{Tot}} \times 100$ where $N_{T1T3}$ is the number of turns between Tap1 and Tap 3, and $N_{Tot}$ is the total number of turns. For the primary, T1 is the highest tap. If Type = Secondary, $S1=\frac{N_{T2}}{N_{Tot}} \times 100$ where $N_{T2}$ is the number of turns in Tap 2 and $N_{Tot}$ is the total number of turns. If the number of taps is 2, S2 =100% |
| S3 | Turns ratio of transformer tap 3 in percent. If Type = Primary, $S1=\frac{N_{T1T4}}{N_{Tot}} \times 100$ where $N_{T1T4}$ is the number of turns between Tap1 and Tap 4, and $N_{Tot}$ is the total number of turns. For the primary, T1 is the highest tap. If Type = Secondary, $S1=\frac{N_{T3}}{N_{Tot}} \times 100$ where $N_{T3}$ is the number of turns in Tap 3 and $N_{Tot}$ is the total number of turns. If the number of taps is 3, S3 =100% |
| S4 | Turns ratio of transformer tap 4 in percent. Value always 100% |
| Type | Select Load tap Changer type as 'Primary' or 'Secondary'. |
| TapNb | The number of transformer taps from two to four. |
| OpN | The value of outputs 1 to N of the block, where N is the number of transformer taps as selected in 'TapNb' above. This output is normally wired to the input of a Firing output block (for phase-angle firing) or to a Modulator block (Modulation mode firing). |
| A1FuseIn | External Fuse Fail Alarm input. Wired to the output of a digital input, the input of which is wired to an external Fuse Blown transducer. |
| A1TempIn | External over Temperature Alarm input. Wired to the output of a digital input, the input of which is wired to an external Over Temperature transducer. |
| PAOP | Phase Angle Reduction (This display appears only for Burst Firing applications.). If the value of this parameter is less than 100% a burst of phase angle is delivered. Used, for example, to perform threshold current limiting, |

### 6.23.2 LTC Alarm

Displays the alarm configuration for the Load Tap Changer external Fuse Blown and over Temperature alarms. Figure 6.23.2 shows the menu.

The parameters listed below apply to both alarms individually.

**PARAMETERS**

| | |
|---|---|
| AlmDis | Allows the user to disable the alarm. |
| AlmDet | Indicates to the user whether or not the alarm is active. |
| AlmSig | Indicates to the user whether or not the alarm is active. If action is to be taken as a result of this alarm's going active, then it is AlmSig that should be wired. |
| AlmLat | Allows the user to set the alarm to be a latching type. |
| AlmAck | Allows the user to acknowledge the alarm. |
| AlmStop | Not configurable (see note). |

Note: These two alarms are considered to be system alarms and automatically inhibit thyristor operation (firing) whilst active. 'AlmStop' cannot be set to 'No'.

## 6.23.2 LTC ALARM (Cont.)

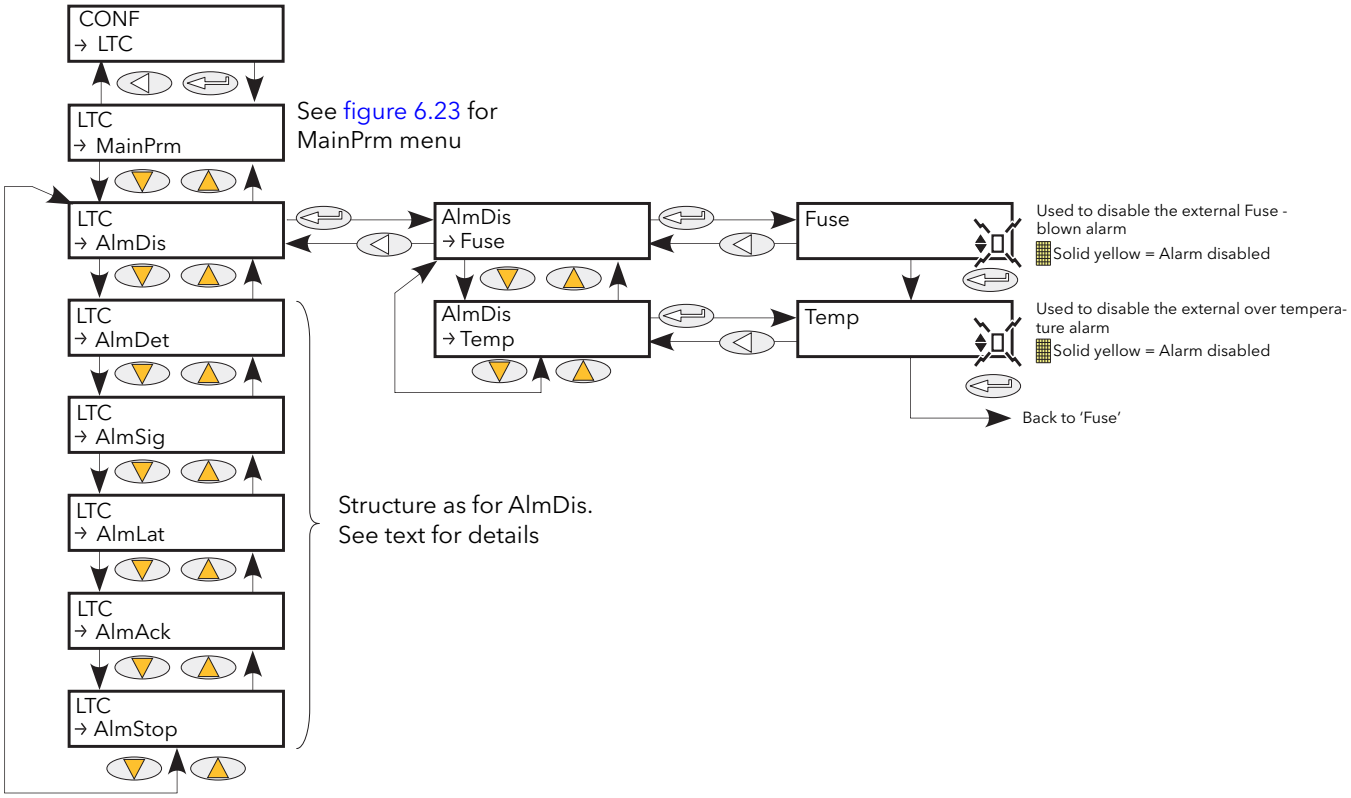



Figure 6.23.2 Load tap changer alarm menu

## 6.23.3 LTC Application wiring

The following illustrations, give typical wiring information for a number of different Load Tap Change applications. The diagrams are meant for guidance only and are not definitive.

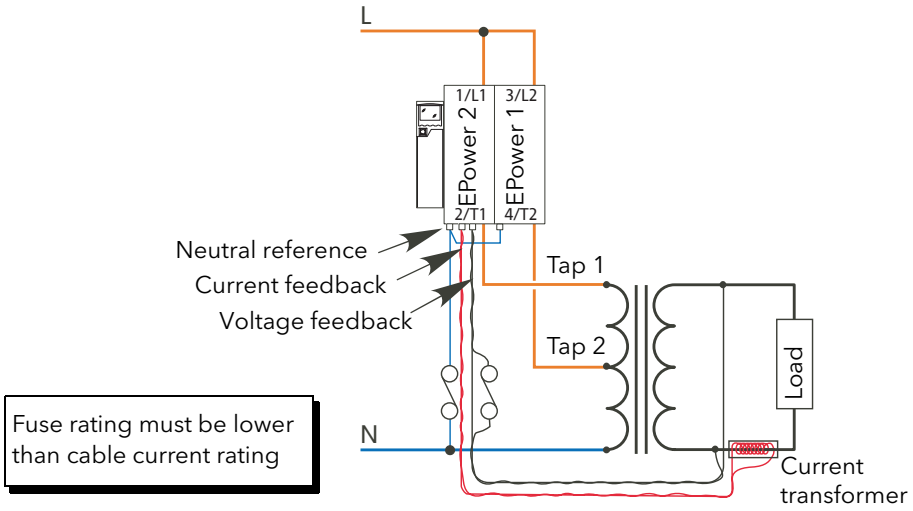



Figure 6.23.3a Two-tap primary

## 6.23.3 LTC APPLICATION WIRING (Cont.)

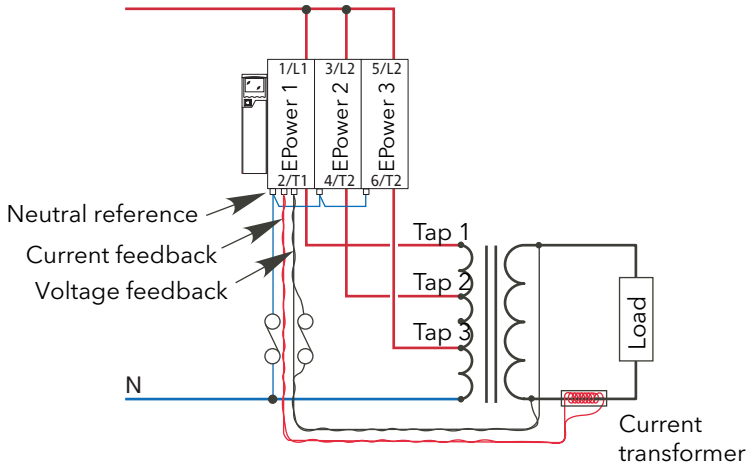



Figure 6.23.3b Three-tap primary

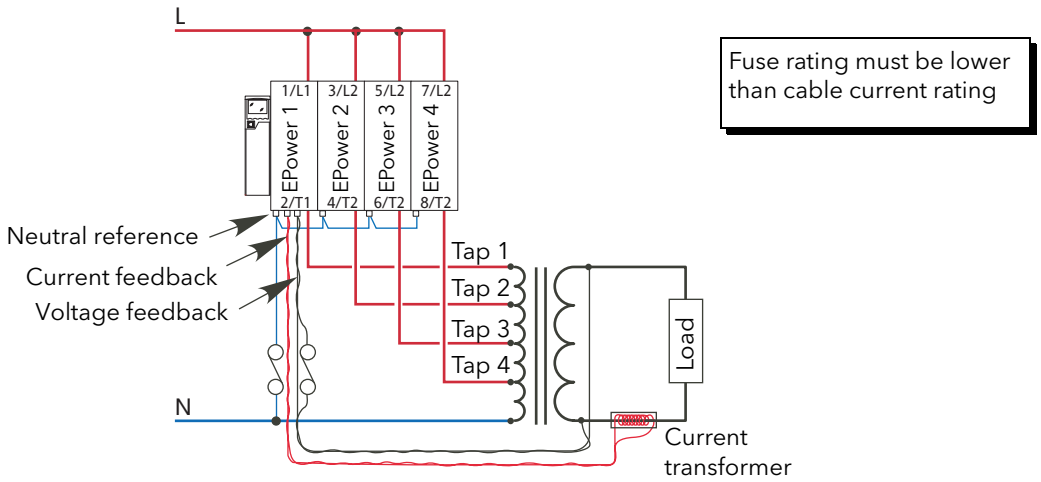
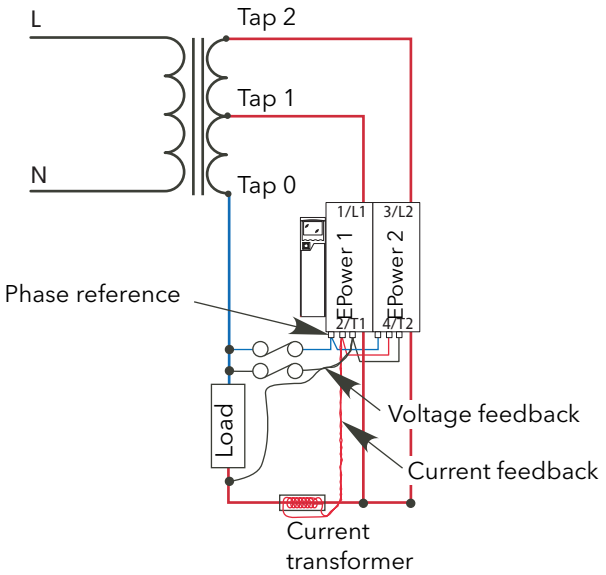



Figure 6.23.3c Four-tap primary



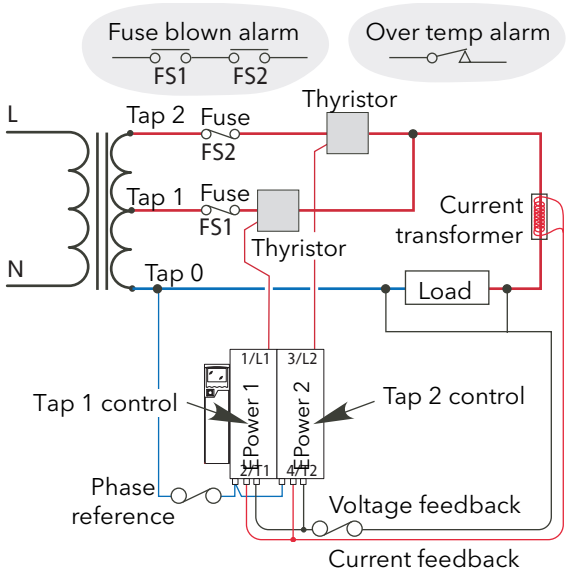
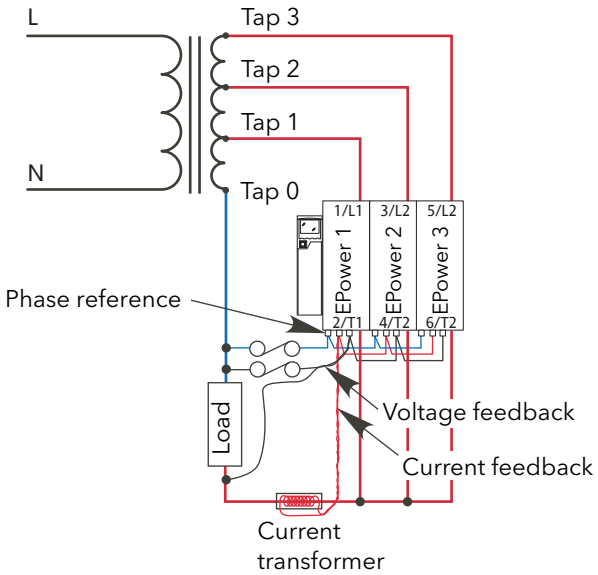



Figure 6.23.3d Two-tap secondary (alternative layouts)

## 6.23.3 LTC APPLICATION WIRING (Cont.)




Fuse rating must be lower than cable current rating

Figure 6.23.3e Three-tap secondary

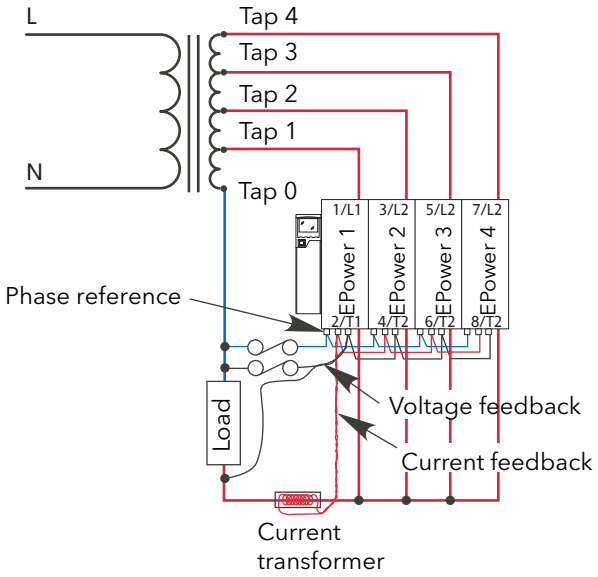



Figure 6.23.3f Four-tap secondary

## 6.24 RELAY MENU

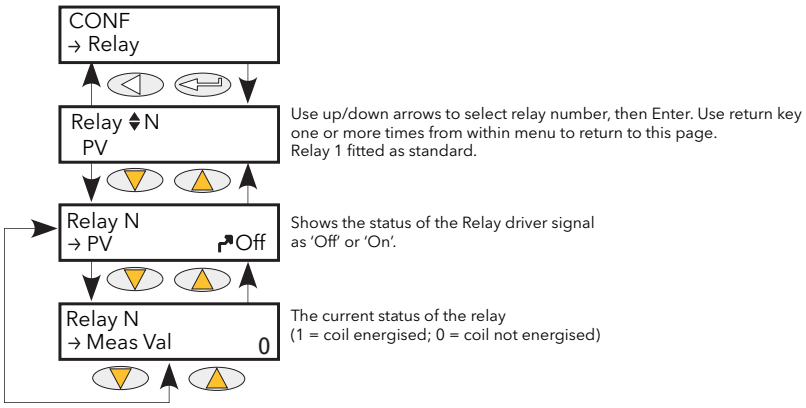



Figure 6.24 Relay menu

### 6.24.1 Relay parameters

| | |
|---|---|
| PV | This shows the status of the input to the relay as either 'On' (True) or 'Off' (False). |
| Meas Val | Shows the current state of the relay coil. 1 = energised; 0 = de-energised, where 'energised' is 'off' and 'de-energised' is 'on'. |

See figures 2.2.1a and 2.2.1b for relay pinout details.

## 6.25 SETPROV MENU

This feature supplies 1 local and two remote setpoints.

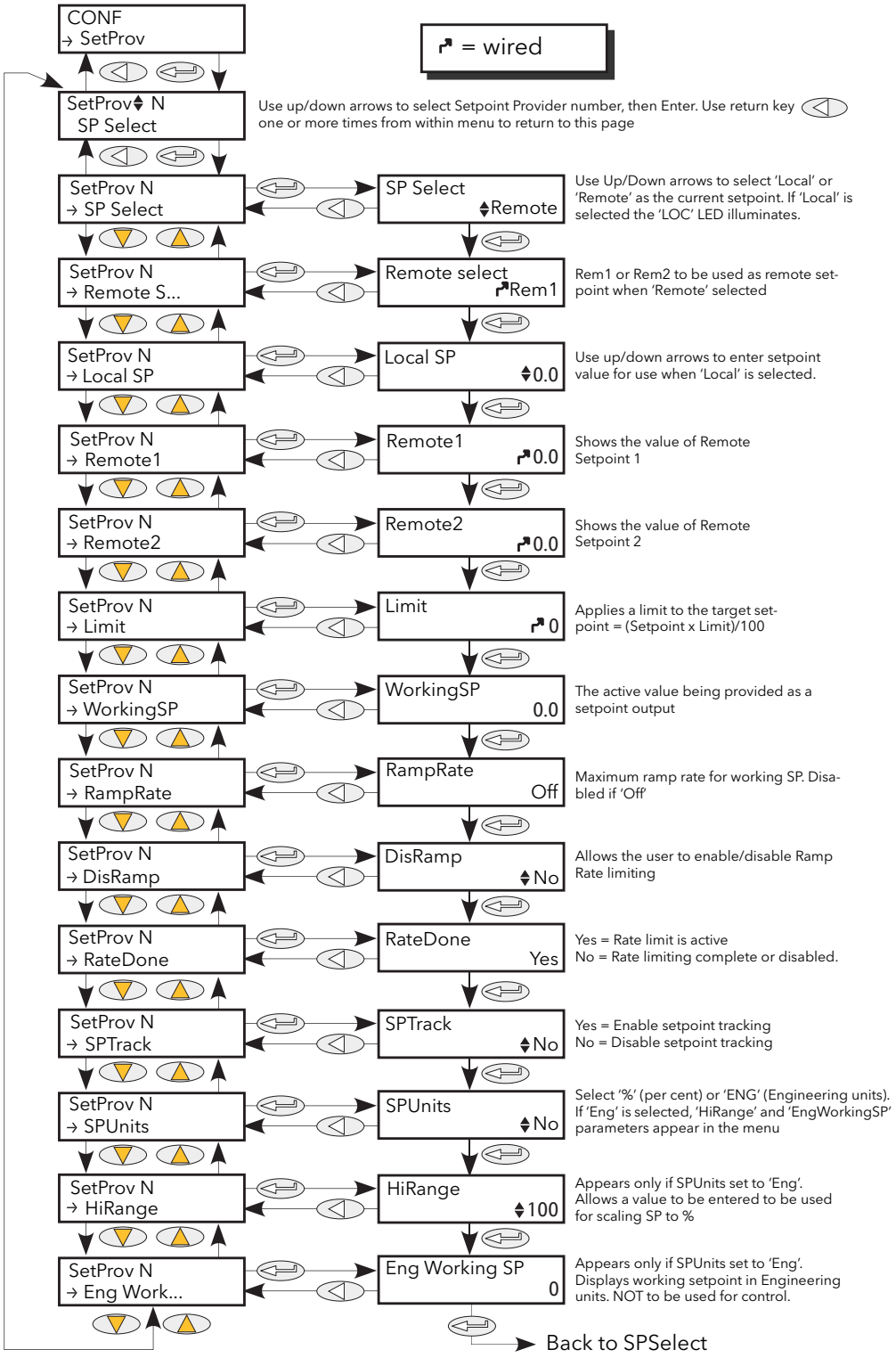



Figure 6.25 SetProv menu

### 6.25.1 Setpoint provider parameters

| | |
|---|---|
| SPSelect | Allows the user to select between Remote or Local as the setpoint source. If 'Local' is selected, the 'LOC' LED illuminates. |
| Remote Select | Allows the user to select which of two Remote setpoints to use when SPSelect (above) is set to 'Remote'. |
| LocalSP | Allows entry of a setpoint value to be used when SPSelect (above) is set to 'Local'. |
| Remote1 (2) | The alternative Remote setpoints which may be chosen in 'Remote Select' (above). |
| Limit | Allows the target setpoint to be scaled such that 'scaled target SP' = (target SP x limit)/100. Thus, when limit = 100, the setpoint is unscaled. |
| WorkingSP | The active value being provided as a setpoint output. This might be the current target setpoint or the rate-limited target setpoint. |
| RampRate | This applies a rate limit to the working setpoint, until the target setpoint has been achieved. The 'RateDone' parameter (below) is set to 'No' for the duration of the rate limiting, then set to 'yes' when rate limiting is complete. |
| DisRamp | This is an external control used to enable/disable ramp rate limiting and to write the target setpoint directly to the working setpoint. The 'RateDone' parameter (below) is set to 'Yes' when DisRamp is 'Yes'. |
| RateDone | Set to 'No' if ramp rate limiting (above) is in operation. Otherwise set to 'Yes'. |
| SPTrack | If enabled ('Yes') the local setpoint tracks the remote setpoints, so that if the setpoint is subsequently set to 'Local', the local setpoint will be the same as the last known value of the remote setpoint, thus ensuring a bumpless transfer. |
| SPUnits | Allows the user to select % or 'Eng' (Engineering units) as Setpoint units. If 'Eng' is selected, 'HiRange' and 'Eng workingSP' appear at the user interface. |
| HiRange | Appears only if SP units set to 'Eng'. This value is the high range of the setpoint used to scale the setpoint into % of High Range. |
| EngWorkingSP | Appears only if SP units set to 'Eng'. This value is an indication of the working setpoint in Engineering units. The parameter must not be used for control because control loops accept setpoints only as % values. |

## 6.26 TIMER MENU

### 6.26.1 Timer configuration

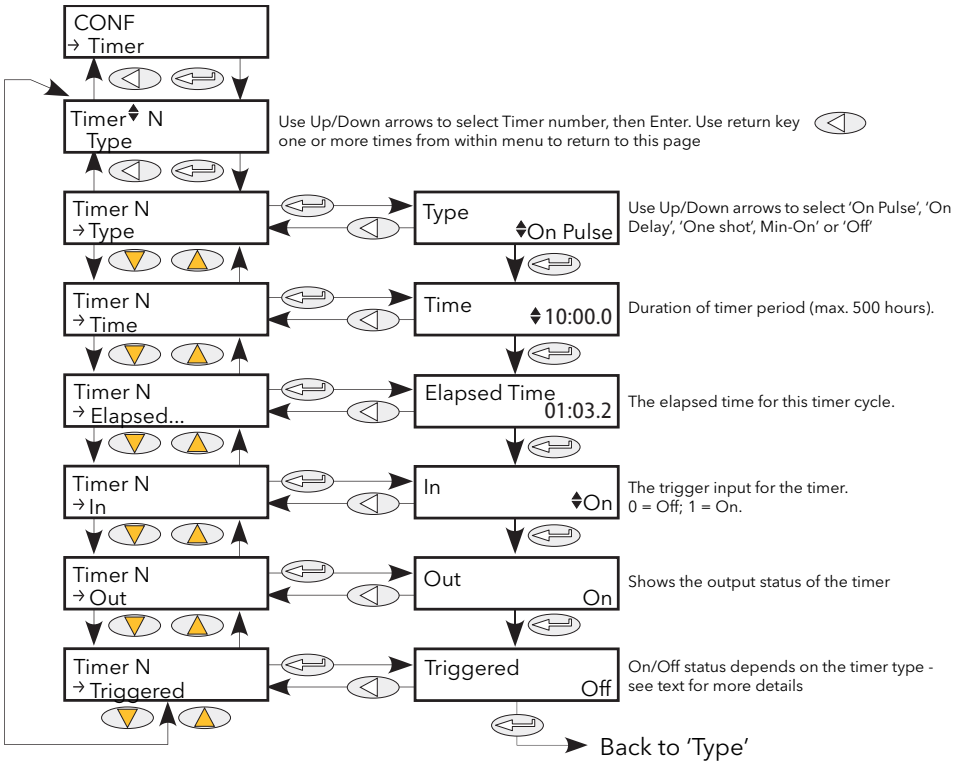



Figure 6.26.1 Timer Menu

Type — Allows the user to select the required timer type as follows:

- **Off** — Timer is off
- **On Pulse** — The timer output switches on when 'In' changes from Off to On, and it remains on until the time period ('Time' - see below) has elapsed. If the input is re-triggered before 'Time' has elapsed, the timer re-starts. 'Triggered' (below) follows the state of the output.
- **On delay** — After the input changes from Off to On, the timer output remains off until the time period defined in 'Time' (below) has elapsed. Once this period has elapsed, if the input is still on, the output switches on and remains on until the input goes Off.
  Elapsed time is set to zero when the input goes off.
  'Triggered' follows the state of the input.

### 6.26.1 TIMER CONFIGURATION (Cont.)

Type (Cont.)

| | |
|---|---|
| One Shot | If the input is On, then as soon as a value is entered into the 'Time' parameter (below) the output goes on, and remains on until the Time period has elapsed, or the input goes off.<br>If the input is off, the output is set off and the time count-down is inhibited until input goes on again.<br>'Triggered' goes On as soon as the time value is edited, and remains on until the output goes Off.<br>The Time value may be edited whilst active.<br>Once the time period has elapsed, the Time value must be re-edited in order to re-start the timer. |
| Min On | The output remains 'On' as long as the Input is on, plus the 'Time' period (below). If the input returns to the on state before the time period has elapsed, the elapsed time is reset to zero, so that the full time period is added to the On period when the input switches off again. 'Triggered' is On whilst the elapsed time is greater than zero. |

| | |
|---|---|
| Time | Allows the user to set a time period for use as described in 'Type' above. Initially, the display is in the form Minutes:seconds.10ths of seconds, but as the input value increases the format changes first to Hours:Mins:Secs, then to Hrs:Mins. (Holding the up arrow key continuously operated causes the speed at which the value increments to increase. Minimum entry is 0.1 seconds; maximum is 500 hours. |
| Elapsed Time | Shows how much of the time period has passed so far. |
| In | The timer trigger input. The function of this input varies according to timer type, as described above. |
| Out | Shows the timer on/off status. |
| Trigger | Function depends on timer type, as described above. |

### 6.26.2 Timer examples

Figure 6.26.2 shows some timing examples for the different types of timer available.

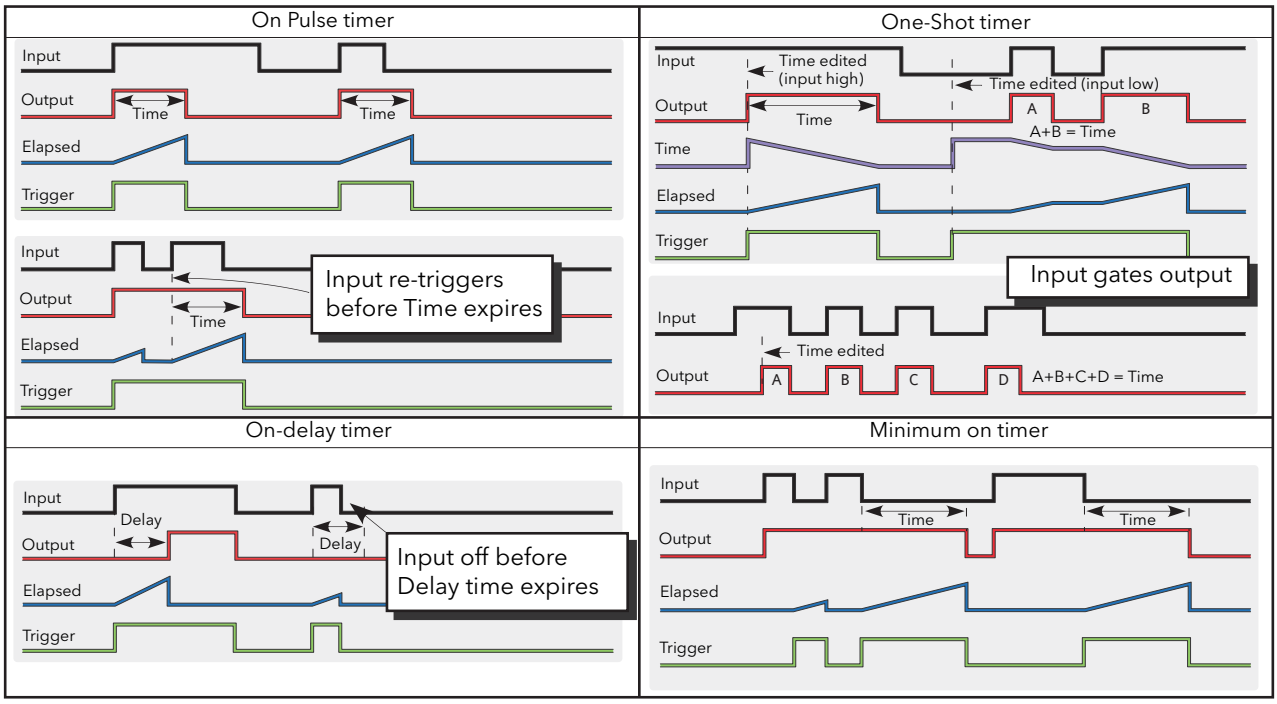



Figure 6.26.2 Timer examples

## 6.27 TOTALISER MENU

The totaliser is an instrument function used to calculate a total quantity by integrating a flow rate input over time. The maximum value of the totaliser is +/- 99999. The outputs from a totaliser are its integrated value, and an alarm state.

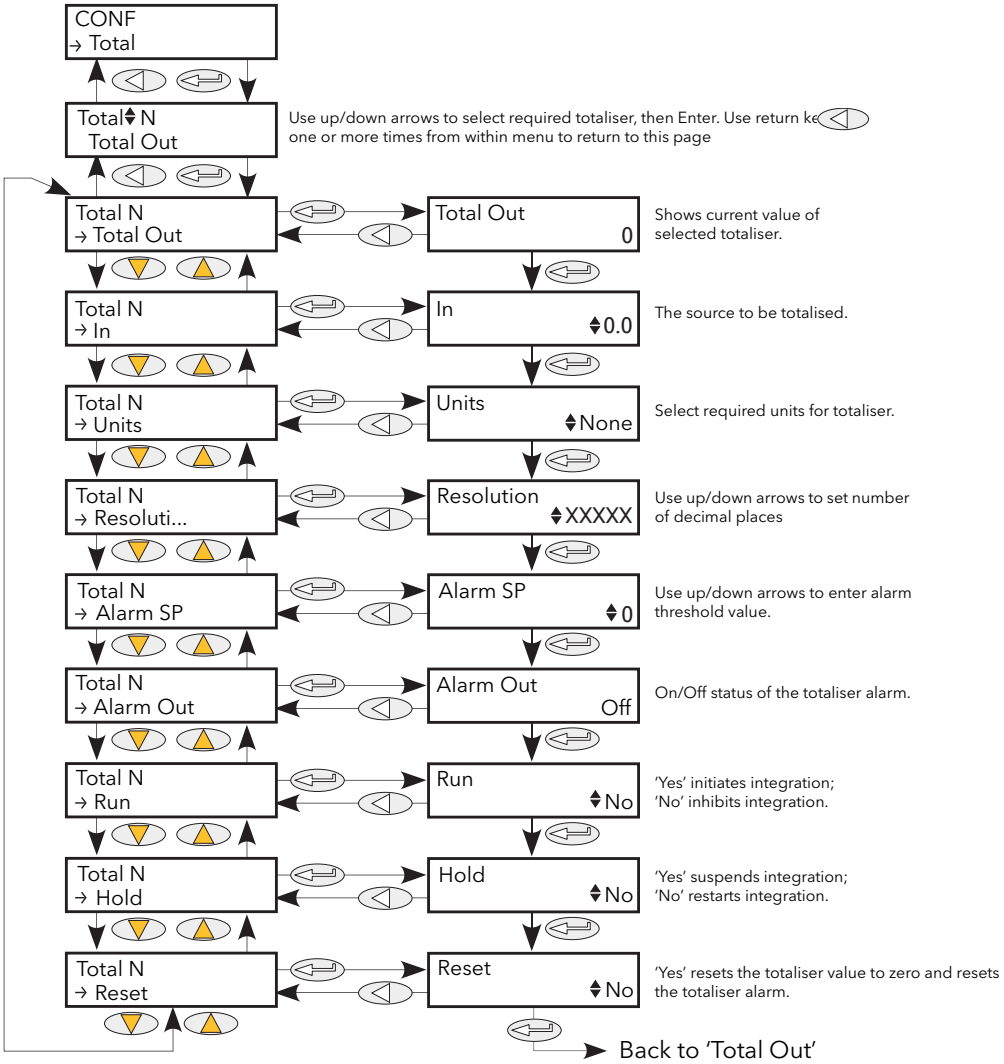



Figure 6.27 Totaliser menu

| | |
|---|---|
| Total Out | The integrated total between $-10^{10}$ and $+10^{10}$ (i.e. ± 10,000,000,000) |
| In | The parameter to be totalised. |
| Units | Units of the totalised measurement. |
| Resolution | Set the number of decimal places for the totaliser value. |
| AlarmSP | Totaliser alarm setpoint. This threshold is applied to the totalised measurement. When totalising positive values, a positive AlarmSP value must be entered; the totaliser alarm being triggered when the totaliser value reaches or exceeds AlarmSP. When totalising negative values, a negative value must be entered; the totaliser alarm being triggered when the totaliser value reaches or goes more negative than AlarmSP. If set to zero, the alarm is disabled. |
| AlarmOut | The on/off status of the totaliser alarm. |
| Run | Yes initiates integration; No inhibits integration. |
| Hold | Yes suspends integration; No restarts integration. |
| Reset | Yes resets the totaliser value to zero and resets the totaliser alarm. |

## 6.28 USER VALUE MENU

This provides storage for a user-defined constant. Typical uses are as a source for a maths function, or as storage for values written over the communications link.

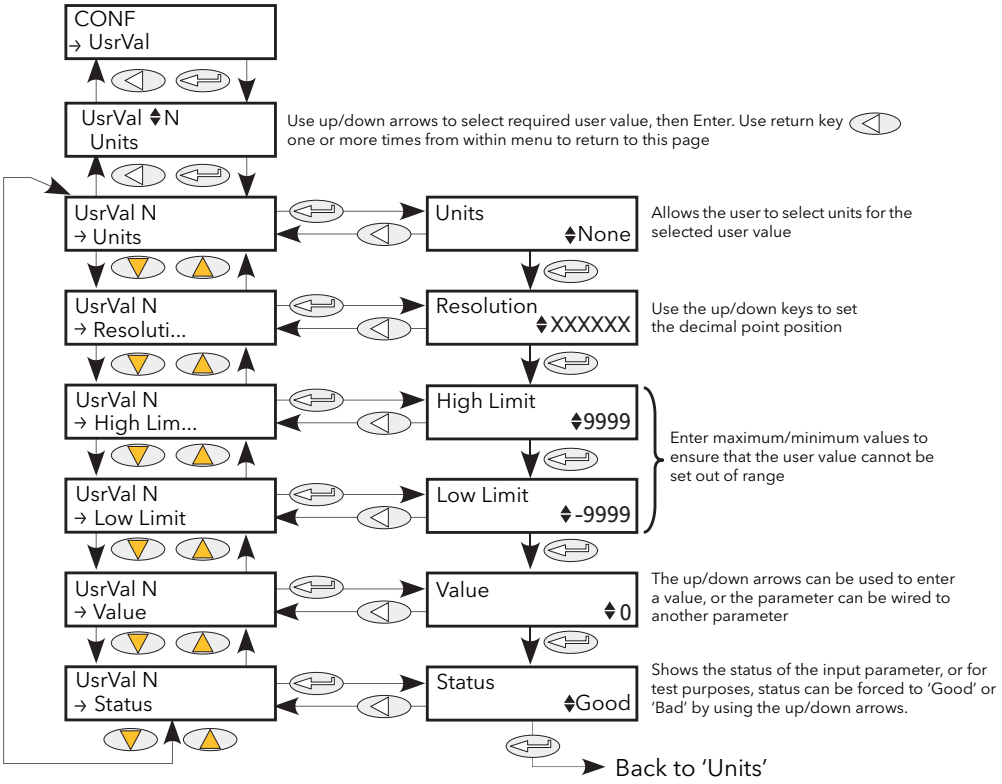



Figure 6.28 User Value menu

| | |
|---|---|
| Units | Allows the selection of User value units. |
| Resolution | Set the number of decimal places for the User Value value. |
| High/Low Limit | Allows the user to set limits to prevent the user value from being set out-of-bounds. |
| Value | Allows the user to enter a value, or the parameter is wired to a suitable parameter. |
| Status | If this parameter is wired, it can be used to force a Good or Bad status onto the User Value for test purposes (e.g. fallback strategy).<br>If not wired, it reflects the status of the Value input if this input is wired. |

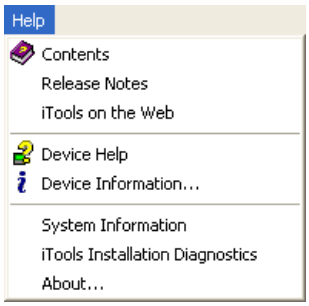
# 7 USING ITOOLS

iTools software running on a pc allows quick and easy access to the configuration of the unit. The parameters used are the same as those described in section 6 above, with the addition of various diagnostic parameters.

iTools also gives the user the ability to create software wiring between function blocks, something that is not possible from the operator interface. Such wiring is carried out using the Graphical wiring Editor feature.

In addition to the guidance given here, there are two on-line Help systems available within iTools: Parameter help and iTools help. Parameter help is accessed by clicking on 'Help' in the toolbar (opens the complete parameter help system), by right-clicking on a parameter and selecting 'Parameter Help' from the resulting context menu, or by clicking on the Help menu and selecting 'Device Help'. iTools help is accessed by clicking on the Help menu, and selecting 'Contents'. iTools help is also available in manual format under part number HA028838, either as a physical manual or as a pdf file.


Tool bar icon for parameter help




Help menu

Figure 7 Help access

## 7.1 iTools CONNECTION

The following descriptions assume that iTools software has been correctly installed on the pc.

### 7.1.1 Serial communications

Once the serial link has been correctly wired, start iTools and click on the Scan toolbar icon. The iTools scanning feature initiates a search for compatible instruments, and a 'thumbnail' of each one found appears in the 'Panel Views' pane, normally located at the bottom of the screen. The scan can be stopped at any time by clicking on the Scan toolbar icon a second time.


Note: Section 7.2 contains more details of the scan process.

### 7.1.2 Ethernet (Modbus TCP) communications

Notes:

1. This section is only applicable for Modbus/TCP single port communication module. Modbus/TCP dual port communication module does not support iTools connection.
2. The following description is based on windows XP. Windows 'Vista' is similar.

It is first necessary to determine the IP address of the unit, as described under 'Comms menu' in section 6.6. This can be done from either the Engineer menu or the Config menu.

Once the Ethernet link has been correctly installed, carry out the following actions at the pc:

1. Click on 'Start'
2. Click on 'Control Panel'. (If Control Panel opens in 'Category View' select 'Classic View' instead.)
3. Double-click on 'iTools'.
4. Click on the TCP/IP tab in the Registry settings configuration.
5. Click on Add... The 'New TCP/IP Port' dialogue box opens.
6. Type-in a name for the port, then click Add...
7. Type the IP address of the unit in the 'Edit Host' box which appears. Click OK.
8. Check the details in the 'New TCP/IP Port' box, then click on 'OK'.
9. Click on 'OK' in the 'Registry settings' box to confirm the new port.

(Continued)

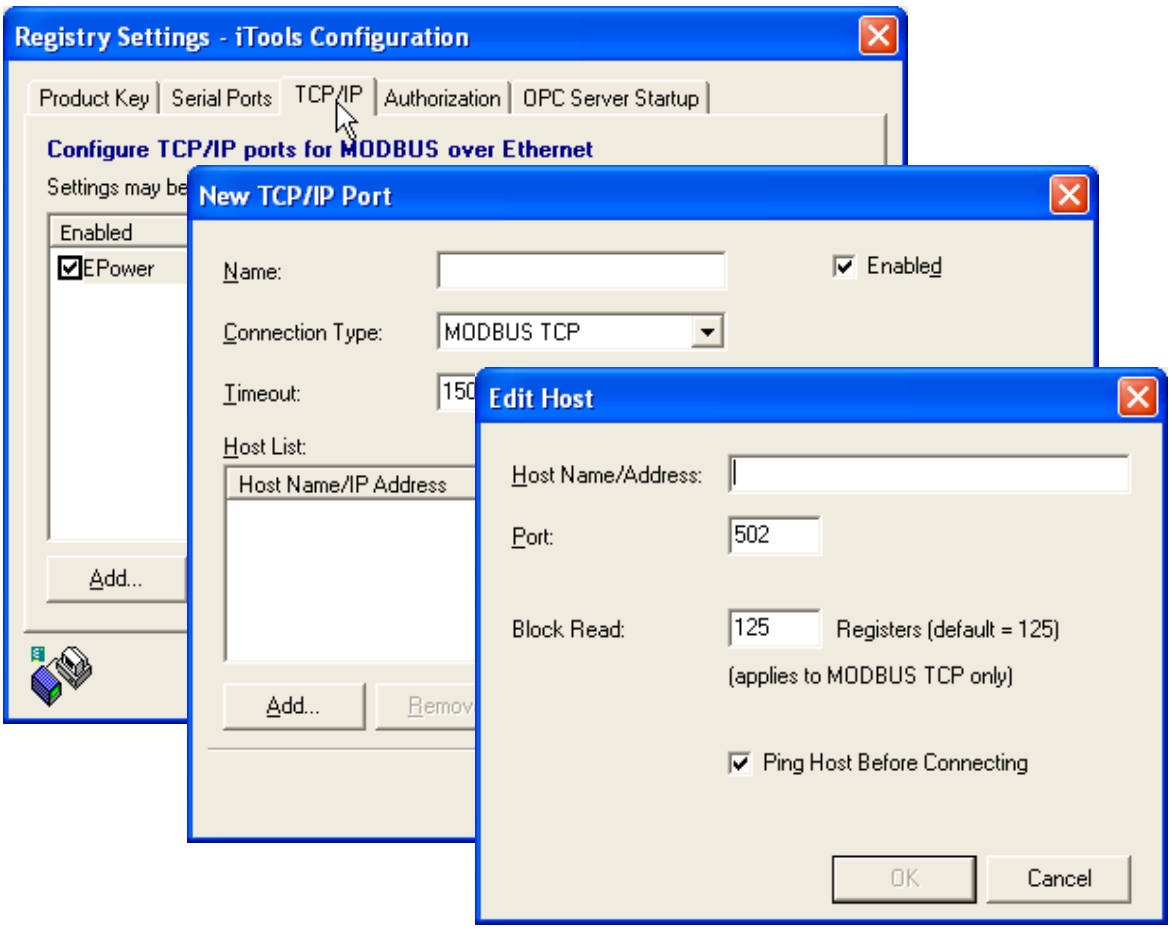



Figure 7.1.2a Adding a new Ethernet port

### 7.1.2 Ethernet (Modbus TCP) communications (cont.)

To check that the pc can now communicate with the instrument, Click 'Start'. 'All Programs', 'Accessories', 'Command Prompt'.

When the Command Prompt box appears, type in: Ping<Space>IP1.IP2.IP3.IP4<Enter> (where IP1 to IP4 are the IP address of the instrument).

If the Ethernet link to the instrument is operating correctly, the 'successful' reply arrives. Otherwise, the 'failed' reply arrives, in which case, the Ethernet link, IP address, and pc port details should be verified.

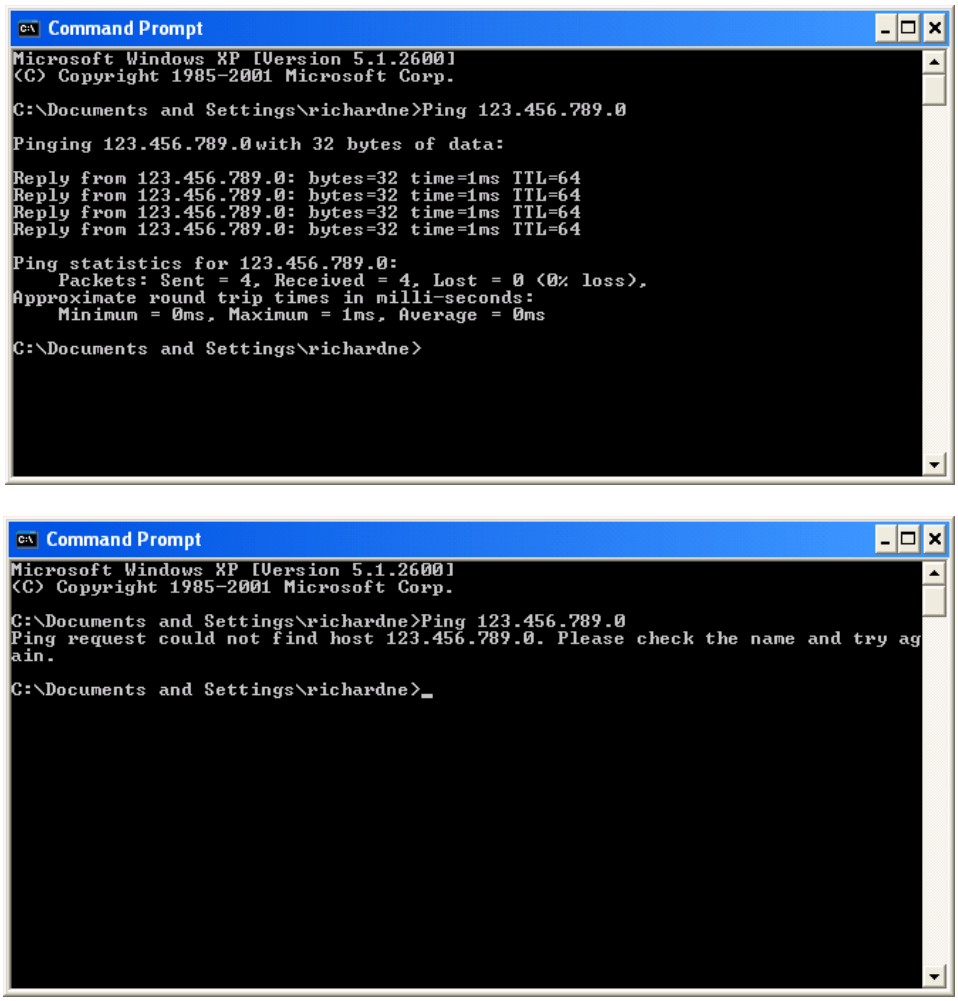



Figure 7.1.2a Command prompt 'Ping' screens (typical)

Once the Ethernet link to the instrument has been verified, iTools can be started (or shut down and restarted), and the Scan toolbar icon used, to 'find' the instrument. The scan can be stopped at any time by clicking on the Scan icon a second time.


See section 7.2 for more details of the scan procedure.

### 7.1.3 Direct Connection

This section describes how to connect a pc directly to a Driver Module which, for this purpose, must be fitted with the Ethernet communications option.

> Note: This section is only applicable for Modbus/TCP single port communication modules. Modbus/TCP dual port communication module does not support an iTools connection.

**WIRING**

PC Ethernet connector.

Connection is made from the Ethernet connector on the front of the Driver Module to an Ethernet RJ45 connector, usually located at the rear of the pc. The cable should be a 'cross-over' cable type.

Once wired correctly, and powered up, it is necessary to enter a suitable IP address and subnet mask into the Comms configuration of the Driver Module. This information can be found as follows:

1. At the pc, click 'Start'. 'All Programs', 'Accessories', 'Command Prompt'
2. When the Command Prompt box appears, type in: IPConfig<Enter>

   The response is a display, such as that shown below, giving the IP address and Subnet mask of the pc. Choose an address in the range covered by these two values.

   A subnet mask element of 255 means that the equivalent element of the IP address must be used unchanged. A subnet mask element of 0 means that the equivalent element of the IP address may take any value between 1 and 255 (0 is not allowed). In the example below, the range of IP addresses which may be chosen for the Driver Module is 123.456.789.2 to 123.456.789.255. (123.456.789.0 is not allowed and 123.456.789.1 is the same as the pc's address, and may therefore not be used.)

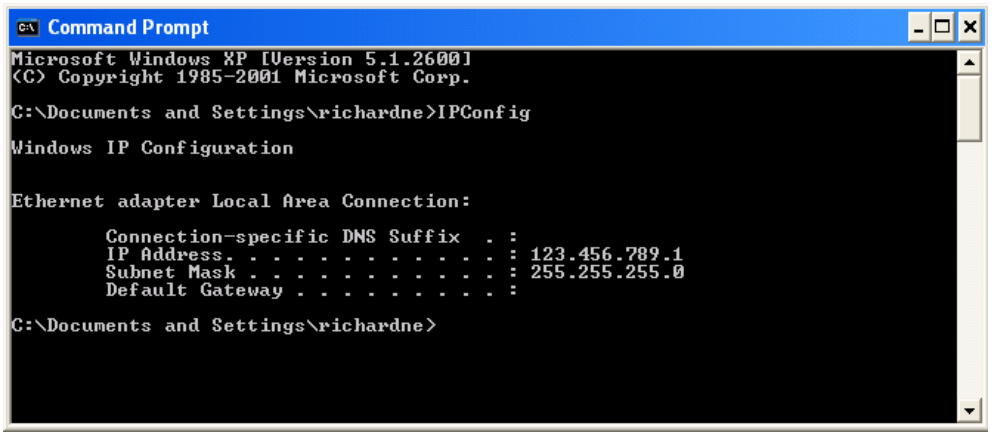


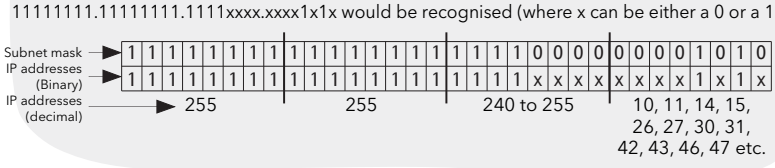

Figure 7.1.3a IP Config command

3. In Comms configuration (section 6.6) enter the selected IP address and the subnet mask (as it appears in the command prompt window) in the relevant parts of the configuration menu.
4. Check communications by 'pinging' as described in section 7.1.2 above.

Once the link to the instrument has been verified, iTools can be started (or shut down and re-started), and the Scan toolbar icon used, to 'find' the instrument. The scan can be stopped at any time by clicking on the Scan icon a second time. See section 7.2 for more details of the scan procedure.

**Subnet Masks and IP addresses.**

Subnet Masks are most readily understood when looked at in binary format.
For example, a mask of 255.255.240.10 can be re-written as:
11111111.11111111.11110000.00001010. In such a case, IP addresses
11111111.11111111.1111xxxx.xxxx1x1x would be recognised (where x can be either a 0 or a 1).



## 7.2 SCANNING FOR INSTRUMENTS

Clicking on the 'Scan' toolbar icon causes a dialogue box (shown below) to appear. This allows the user to define a search range of addresses.

Notes:

1. The relevant instrument address is that entered in the Comms User menu 'Address' item, and it can take any value between 1 and 254 inclusive, as long as it is unique to the comms link.
2. The default selection (Scan all device addresses...) will detect any instrument on the serial link, which has a valid address.

As the search progresses, any instruments detected by the scan appear as thumbnails (faceplates) in the 'Panel Views' area, normally located at the bottom of the iTools screen. (options/Panel Views position allows this area to be moved to the top of the window, or the Close icon can be used to close it. Once closed it can be re-opened by clicking on 'Panel Views' in the 'View' menu.)

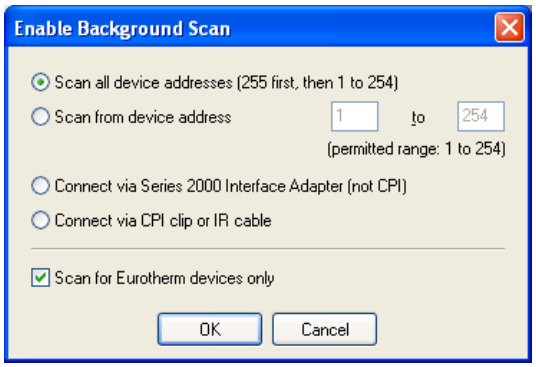



Figure 7.2a Scan range enable

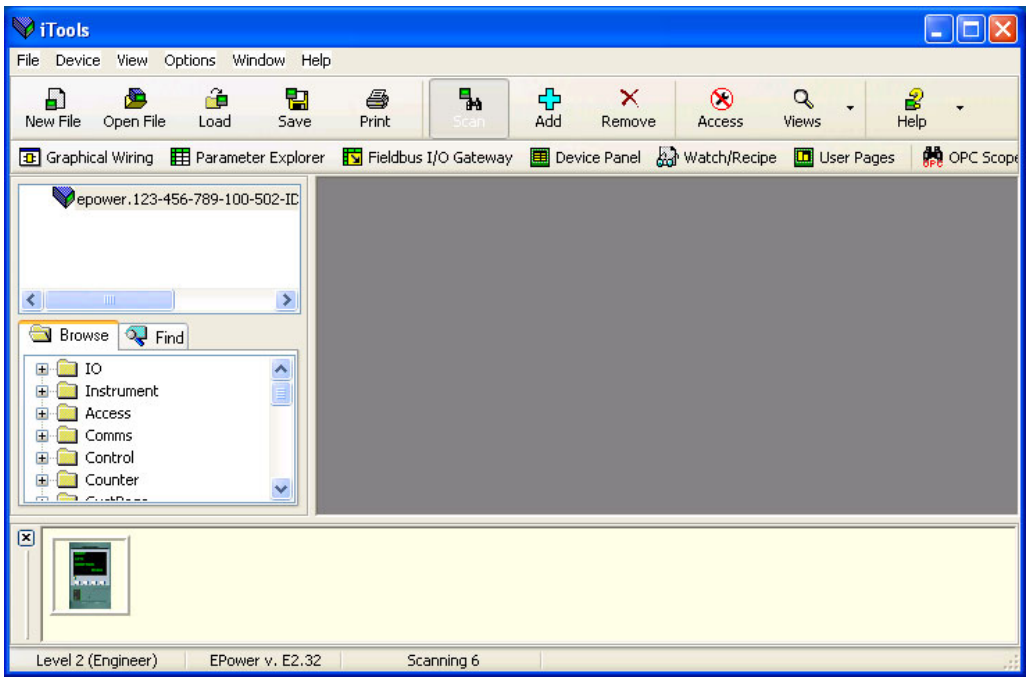



Figure 7.2b iTools initial window with one instrument detected

## 7.3 GRAPHICAL WIRING EDITOR

Clicking on the Graphical wiring Editor toolbar icon causes the Graphical wiring window for the current instrument configuration to open. Initially, this reflects the function block wiring as set in the Quick Start menu.

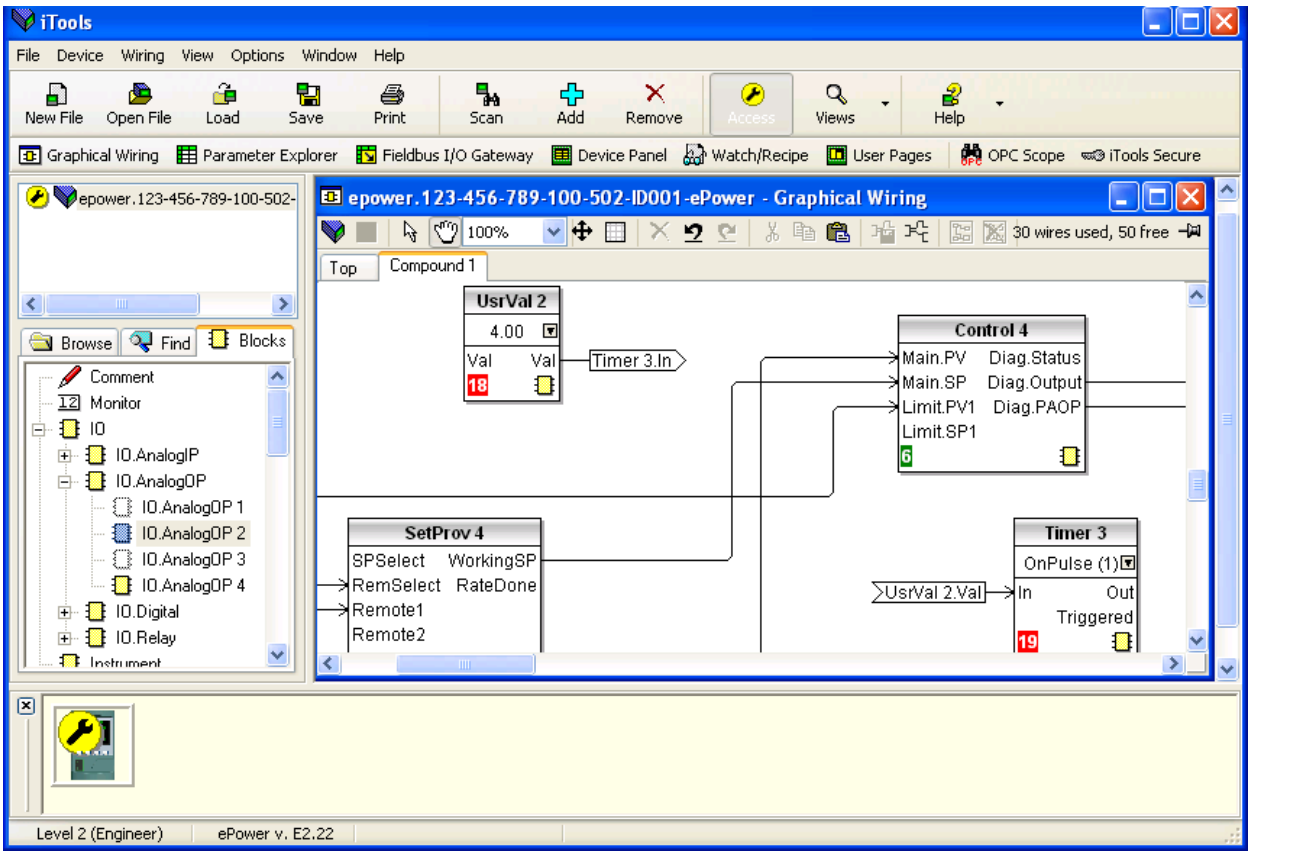
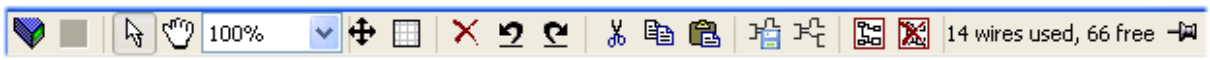



Figure 7.3 Graphical wiring Editor

The graphical wiring editor allows:

1. Function blocks, notes, comments etc. to be 'drag and dropped' into the wiring diagram from the tree list (left pane).
2. Parameters to be wired to one another by clicking on the output, the clicking on the required input.
3. Viewing and/or editing of parameter values by right-clicking on a function block and selecting 'Function Block View'.
4. The user to select parameter lists and to switch between parameter and wiring editors.
5. Completed wiring to be downloaded to the instrument (function blocks and wiring items with dashed outlines are new, or have been edited since the last download).

### 7.3.1 Toolbar

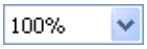




Download wiring to Instrument.


Mouse Select. Select nor mal mouse operation. Mutually exclusive with 'Pan', below.


Mouse Pan. When active, this causes the mouse cursor to become a hand-shaped icon. Allows the graphical wiring diagram to be click-dragged within the GWE window aperture.

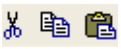


Zoom. Allows the magnification of the wiring diagram to be edited.


Pan tool. Whilst left-clicked, the cursor appears as a rectangle, representing the position of GWE window aperture over the whole wiring diagram. Click dragging allows this aperture to be moved freely about the diagram. Rectangle size depends on Zoom (magnification) factor.


Show/Hide grid. This icon toggles a background alignment grid on and off.


Undo, Redo. Allows the user to undo the last action, or once an undo action has taken place, to undo the undo. Short cuts are <Ctrl>+<Z> for undo; <Ctrl>+<R> for re-do.


Cut, Copy, Paste. Normal Cut (copy and delete), Copy (copy without delete) and Paste (insert into) functions. Short cuts are <Ctrl>+<X> for cut; <Ctrl>+<C> for copy and <Ctrl>+<V> for Paste.


Copy diagram fragment; Paste diagram fragment. Allows a part of the wiring diagram to be selected, named and saved to file. The fragment may then be pasted into any wiring diagram, including the source diagram.


Create compound; Flatten compound. These two icons allow compounds to be created and 'uncreated' respectively.

### 7.3.2 Wiring editor operating details

#### COMPONENT SELECTION

Single wires are shown with boxes at 'corners' when selected. When more than one wire is selected, as part of a group, the wire colour changes to magenta. All other items have a dashed line drawn round them when selected.

Clicking on a single item selects it. An Item can be added to the selection by holding down the control key (ctrl) whilst clicking on the item. (A selected item can be deselected in the same way.) If a block is selected, then all its associated wires are also selected.

Alternatively, the mouse can be click-dragged on the background to create a 'rubber band' round the relevant area; anything within this area being selected when the mouse is released.

<Ctrl>+<A> selects all items on the active diagram.

#### BLOCK EXECUTION ORDER

The order in which the blocks are executed by the instrument depends on the way in which they are wired. The order is automatically worked out, for each 'Task' (or network block) so that the blocks use the most recent data. Each block displays its place in its sequence in a coloured block in the bottom left-hand corner (figure 7.3.2a). The colour of the block represents the Task within which the block is running: red = task one, green = task two, black = task 3 and blue = task 4.

## 7.3.2 WIRING EDITOR OPERATING DETAILS (Cont.)

### FUNCTION BLOCKS

A Function Block is an algorithm which may be wired to and from other function blocks to make a control strategy. Each function block has inputs and outputs. Any parameter may be wired from, but only parameters that are alterable in Operator Mode may we wired to. A function block includes any parameters that are needed to configure or operate the algorithm. The inputs and outputs which are considered to be of most use are always shown. In most cases all of these need to be wired before the block can perform a useful task.

If a function block is not faded in the tree (left hand pane) it can be dragged onto the diagram. The block can be dragged around the diagram using the mouse.

A Maths block is shown below as an example. When block type information is alterable (as in this case) click on the box with the down arrow in it to display a dialogue box allowing the value to be edited.

If it is required to wire from a parameter, which is not shown as a recommended output, click on the 'Click to Select Output' icon in the bottom right hand corner to display a full list of parameters in the block (figure 7.3.2c, below). Click on one of these to start a wire.

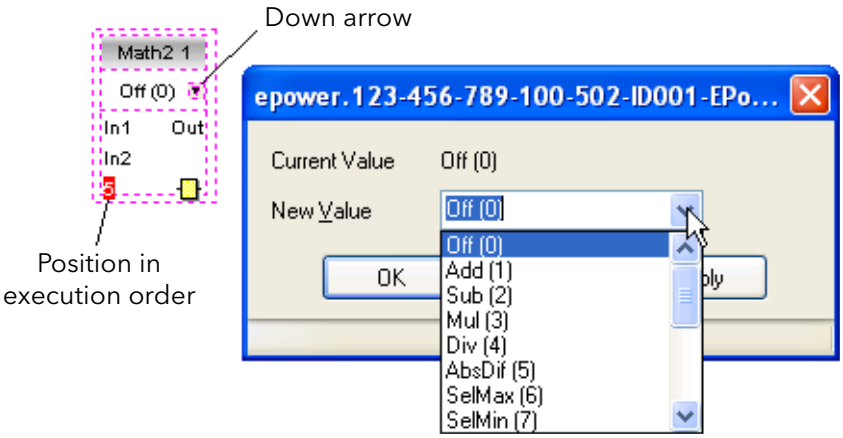



Figure 7.3.2a Function block example

Function Block context menu

Right click in the function block to display the context menu.

Function block View — Displays a list of parameters associated with the function block. 'Hidden' parameters can be displayed by de-selecting 'Hide Parameters and Lists when not Relevant' in the Options menu 'Parameter availability Settings...' item.

Re-Route wires — Redraws all wiring associated with the function block.

Re-Route Input wires — Redraws all Input wiring associated with the function block.

Re-Route Output wires — Redraws all Output wiring associated with the function block.

Show Wires Using Tags — Wires are not drawn, but their Start and End destinations are indicated by tags instead. Reduces wire 'clutter' in diagrams, where source and destination are widely separated.

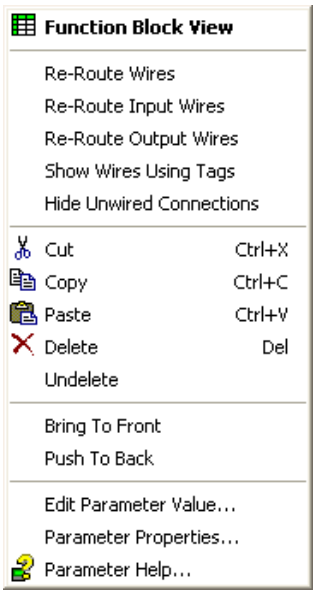
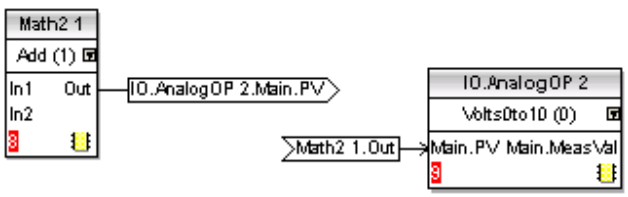



Figure 7.3.2b Function block context menu



## 7.3.2 WIRING EDITOR OPERATING DETAILS (Cont.)

### FUNCTION BLOCK CONTEXT MENU (Cont.)

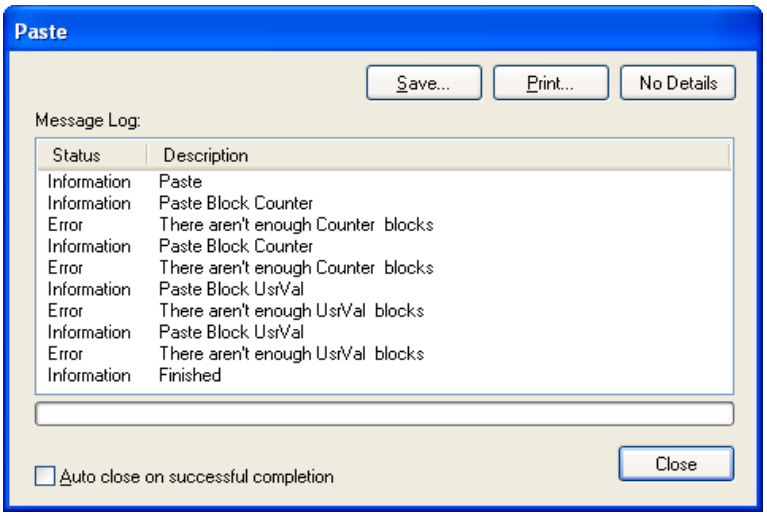
Hide Unwired Connections

Displays only those parameters which are wired.

Cut — Allows one or more selected items to be moved to the Clipboard ready for pasting into another diagram or compound, or for use in a Watch window, or OPC scope. The original items are greyed out, and function blocks and wires are shown dashed until next download, after which they are removed from the diagram. Short cut = <ctrl>+<X>. Cut operations carried out since the last download can be 'undone' by using the 'Undo' toolbar icon, by selecting 'Undelete' or by using the short cut <ctrl>+<Z>.

Copy — Allows one or more selected items to be copied to the Clipboard ready for pasting into another diagram or compound, or for use in a Watch window, or OPC scope. The original items remain in the current wiring diagram. Short cut = <ctrl>+<C>. If items are pasted to the same diagram from which they were copied, the items will be replicated with different block instances. Should this result in more instances of a block than are available, an error display appears showing details of which items couldn't be copied.

Paste — Copies items from the Clipboard to the current wiring diagram. <Ctrl>+<V>. If items are pasted to the same diagram from which they were copied, the items will be replicated with different block instances. Should this result in more instances of a block than are available, a Paste error display appears showing details of which items couldn't be copied.




Delete — Marks all selected items for deletion. Such items are shown dashed until next download, after which they are removed from the diagram. Short cut = <Del>.

Undelete — Reverses 'Delete' and 'Cut' operations carried out on selected item(s) since the last download.

Bring To Front — Brings selected items to the front of the diagram.

Push To back — Sends the selected items to the back of the diagram.

Edit Parameter Value...

This menu item is active if the cursor is hovering over an editable parameter. Selecting this menu item causes a pop-up window to appear, which allows the user to edit the parameter value.

Parameter Properties...

This menu item is active if the cursor is hovering over an editable parameter. Selecting this menu item causes a pop-up window to appear, which allows the user to view the parameter properties, and also, to view the parameter Help (by clicking on the 'Help' tab.

Parameter Help... — Produces Parameter Properties and Help information for the selected function block or parameter, depending on the hover position of the cursor, when the right-click occurs.

## 7.3.2 WIRING EDITOR OPERATING DETAILS (Cont.)

### WIRES

To make a wire

1. Drag two (or more) blocks onto the diagram from the function block tree.
2. Start a wire by either clicking on a recommended output or clicking on the 'Click to Select output' icon at the bottom right corner of the block to bring up the connection dialogue, and clicking on the required parameter. Recommended connections are shown with a green plug symbol; other parameters which are available being shown in yellow. Clicking on the red button causes all parameters to be shown. To dismiss the connection dialogue either press the escape key on the keyboard, or click the cross at the bottom left of the dialogue box.
3. Once the wire has started a dashed wire is drawn from the output to the current mouse position. To complete the wire click on the required destination parameter.
4. Wires remain dashed until they are downloaded

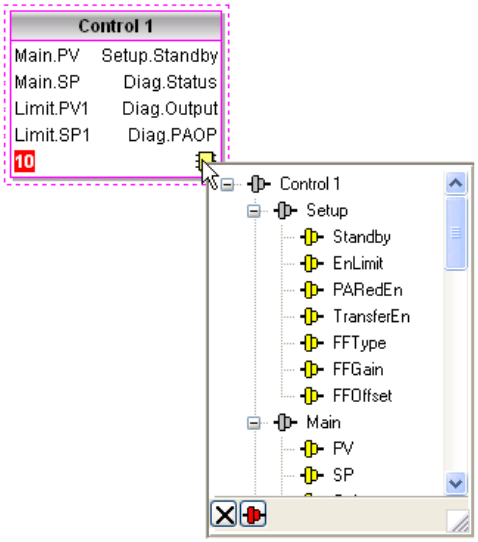



Figure 7.3.2c Output selection dialogue box

Routing wires

When a wire is placed it is auto-routed. The auto routing algorithm searches for a clear path between the two blocks. A wire can be auto-routed again using the context menus or by double clicking the wire. A wire segment can be edited manually by click-dragging. If the block to which it is connected is moved, the end of the wire moves with it, retaining as much of the path as possible.

If a wire is selected by clicking on it, it is drawn with small boxes on its corners.

Wire Context Menu

Right click on a wire to display the wire block context menu:

| | |
|---|---|
| Force Exec Break | When wires form a loop, a break point must be introduced, where the value written to the block comes from a source which was last executed during the previous cycle. A break is automatically placed by iTools, and appears in red. Force Exec Break allows the user to define where a break must be placed. Surplus breaks appear in black. |
| Task Break | Each Network block, and associated I/O blocks, wiring etc. represents a 'task', which is normally associated with a particular power phase (Network Block one is associated with phase one, Network Block two with phase two and so on). Different tasks are thus often synchronised with different phases. A task break ensures that for any wiring between tasks, the timing is delayed as necessary to avoid phasing problems. Task breaks appear in blue. |
| Re-Route wire | Replaces the current wire route with a new route generated from scratch. |
| Use Tags | Toggles between wire and tag mode between parameters. Tag mode is useful for sources and destinations which are widely separated. |
| Find Start | Goes to the source of the wire. |
| Find End | Goes to the destination of the wire. |
| Cut, Copy, Paste | Not used in this context. |

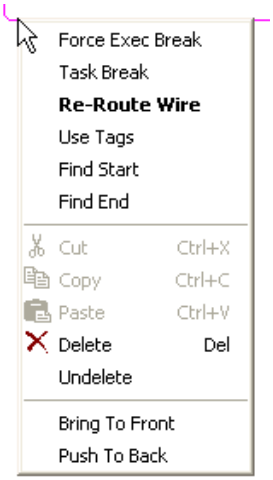



Figure 7.3.2d Wire Context Menu

## 7.3.2 WIRING EDITOR OPERATING DETAILS (Cont.)

### WIRE CONTEXT MENU (Cont.)

| | |
|---|---|
| Delete | Marks the wire for deletion. The wire is redrawn as a dashed line (or dashed tags) until next download. Operation can be reversed until after next download. |
| Undelete | Reverses the effect of the Delete operation up until the next download, after which, Undelete is disabled. |
| Bring to Front | Brings the wire to the front of the diagram. |
| Push to Back | Sends the wire to the back of the diagram. |

Wire Colours

| | |
|---|---|
| Black | Normal functioning wire |
| Red | The wire is connected to a non-changeable parameter. Values are rejected by the destination block. |
| Magenta | A normal functioning wire is being hovered-over by the mouse cursor. |
| Purple | A red wire is being hovered-over by the mouse cursor. |
| Green | New Wire (dashed green wire changes to solid black after being downloaded.) |

### THICK WIRES

When attempting to wire between blocks which are located in different tasks, if no task break is inserted, then all the affected wires are highlighted by being drawn with a much thicker line than usual. Thick wires still execute, but the results are unpredictable, as the unit cannot resolve the strategy.

### COMMENTS

Comments are added to a wiring diagram by click-dragging them from the Function Block tree onto the diagram. As soon as the mouse is released, a dialogue box opens to allow the comment text to be entered.

Carriage returns are used to control the width of the comment. Once text entry is complete, 'OK' causes the comment to appear on the diagram. There are no restrictions on the size of a comment. Comments are saved to the instrument along with the diagram layout information.

Comments can be linked to function blocks and wires by clicking on the chain icon at the bottom right-hand corner of the comment box and then clicking again on the required block or wire. A dashed line is drawn to the top of the block or to the selected wire segment (figure 7.3.2f).

Note: once the comment has been linked, the Chain icon disappears. It re-appears when the mouse cursor is hovered over the bottom right-hand corner of the comment box, as shown in figure 7.3.2f, below.

Comment Context Menu

| | |
|---|---|
| Edit | Opens the Comment dialogue box to allow the comment text to be edited. |
| Unlink | Deletes the current link from the comment. |
| Cut | Moves the comment to the Clipboard, ready to be pasted elsewhere. Short cut = <ctrl>+<X>. |
| Copy | Copies the comment from the wiring diagram to the Clipboard, ready to be pasted elsewhere. Short cut = <ctrl>+<C>. |
| Paste | Copies a comment from the Clipboard to the wiring diagram. Short cut = <ctrl>+<V>. |
| Delete | Marks the comment for deletion at next download. |
| Undelete | Undoes the Delete command if download has not taken place since. |

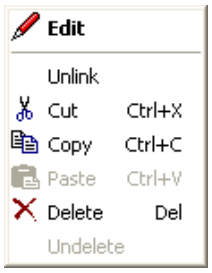



Figure 7.3.2e
Comment context menu

## 7.3.2 WIRING EDITOR OPERATING DETAILS (Cont.)

### MONITORS

Monitor points are added to a wiring diagram by click-dragging them from the Function Block tree onto the diagram. A monitor shows the current value (updated at the iTools parameter list update rate) of the parameter to which it is linked. By default the name of the parameter is shown. To hide the parameter name either double click on the monitor box or 'Show Names' in the context (right-click) menu can be used to toggle the parameter name on and off.

Monitors are linked to function blocks and wires by clicking on the chain icon at the bottom right-hand corner of the box and then clicking again on the required parameter. A dashed line is drawn to the top of the block or the selected wire segment.

Note: once the monitor has been linked, the Chain icon disappears. It re-appears when the mouse cursor is hovered over the bottom right-hand corner of the monitor box.

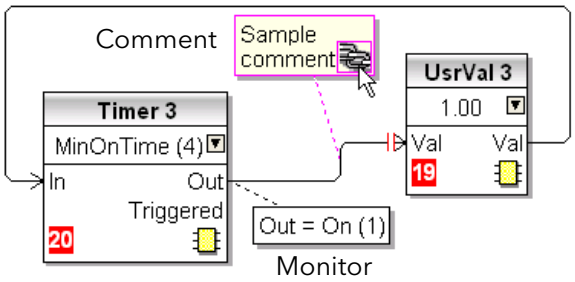



Figure 7.3.2f Comment and Monitor appearance

Monitor Context Menu

| | |
|---|---|
| Show names | Toggles parameter names on and off in the monitor box. |
| Unlink | Deletes the current link from the monitor. |
| Cut | Moves the monitor to the Clipboard, ready to be pasted elsewhere. Short cut = <ctrl>+<X>. |
| Copy | Copies the monitor from the wiring diagram to the Clipboard, ready to be pasted elsewhere. Short cut = <ctrl>+<C>. |
| Paste | Copies a monitor from the Clipboard to the wiring diagram. Short cut = <ctrl>+<V>. |
| Delete | Marks the monitor for deletion at next download. |
| Undelete | Undoes the Delete command if download has not taken place since. |
| Bring to Front | Moves the item to the 'top' layer of the diagram. |
| Push to Back | Moves the item to the 'bottom' layer of the diagram. |
| Parameter Help | Shows parameter help for the item. |

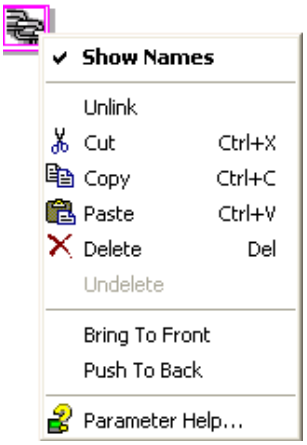



Figure 7.3.2g
Monitor context menu

### DOWNLOADING

When the wiring editor is opened the current wiring and diagram layout is read from the instrument. No changes are made to the instrument function block execution or wiring until the download button is pressed. Any changes made using the operator interface after the editor is opened are lost on download.

When a block is dropped onto the diagram, instrument parameters are changed to make the parameters for that block available. If changes are made and the editor is closed without saving them there is a delay while the editor clears these parameters.

During download, the wiring is written to the instrument which then calculates the block execution order and starts executing the blocks. The diagram layout including comments and monitors is then written into instrument flash memory along with the current editor settings. When the editor is reopened, the diagram is shown positioned as it was when it was last downloaded.

## 7.3.2 WIRING EDITOR OPERATING DETAILS (Cont.)

### COLOURS

Items on the diagram are coloured as follows:

| | |
|---|---|
| Red | Items which totally or partially obscure other items and items which are totally or partially obscured by other items. Wires that are connected to unalterable or non-available parameters. Execution breaks. Block execution orders for Task 1. |
| Blue | Non-available parameters in function blocks. Block execution orders for Task 4. Task breaks. |
| Green | Items added to the diagram since last download are shown as green dashed lines. Block execution orders for Task 2. |
| Magenta | All selected items, or any item over which the cursor is hovering. |
| Purple | Red wires when being hovered over by the mouse cursor. |
| Black | All items added to the diagram before the last download. Block execution orders for Task 3. Redundant execution breaks. Monitor and comment text. |

### DIAGRAM CONTEXT MENU

| | |
|---|---|
| Cut | Active only when the right click occurs within the bounding rectangle which appears when more than one item is selected. Moves the selection off the diagram to the Clipboard. Short cut = <ctrl>+<X>. |
| Copy | As for 'Cut', but the selection is copied, leaving the original on the diagram. Short cut = <ctrl>+<C>. |
| Paste | Copies the contents of the Clipboard to the diagram. Short cut = <ctrl>+<V>. |
| Re-Route wires | Reroutes all selected wires. If no wires are selected, all wires are re-routed. |
| Align Tops | Aligns the tops of all blocks in the selected area. |
| Align Lefts | Aligns the left edges of all blocks in the selected area. |
| Space Evenly | Spaces selected items such that their top left corners are spaced evenly across the width of the diagram. Click on the item which is to be the left-most item, then <ctrl>+<left click> the remaining items in the order in which they are to appear. |
| Delete | Marks the item for deletion at next download time. Can be 'Undeleted' up until download occurs. |
| Undelete | Reverses the action of 'Delete' on the selected item. |
| Select All | Selects all items on the current diagram. |
| Create Compound | Active only when the right click occurs, in the top level diagram, within the bounding rectangle which appears when more than one item is selected. Creates a new wiring diagram as described in 'Compound', below. |
| Rename | Allows a new name to entered for the current wiring diagram. This name appears in the relevant tab. |
| Copy Graphic | Copies the selected items (or the whole diagram if no items are selected) to the clipboard as a Windows metafile, suitable for pasting into a documentation application. Wiring entering/leaving the selection (if any) are drawn in tag mode. |
| Save Graphic... | As for 'Copy Graphic' above, but saves to a user-specified file location instead of the clipboard. |
| Copy Fragment To File... | Copies selected items to a user-named file in folder 'My iTools Wiring Fragments' located in 'My Documents'. |
| Paste Fragment From File | Allows the user to select a stored fragment for inclusion in the wiring diagram. |
| Centre | Places the display window at the centre of the selected items. If 'Select All' has previously been clicked-on, then the display widow is placed over the centre of the diagram. |

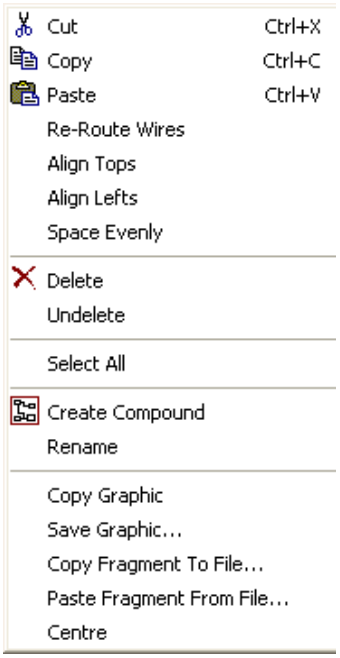



Figure 7.3.2h
Diagram context menu

## 7.3.2 WIRING EDITOR OPERATING DETAILS (Cont.)

### COMPOUNDS

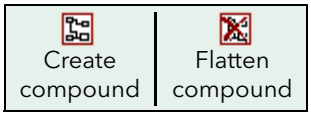
Compounds are used to simplify the top level wiring diagram, by allowing the placing of any number of function blocks within one 'box', the inputs and outputs of which operate in the same way as those of a normal function block.

Each time a compound is created, a new tab appears at the top of the wiring diagram. Initially compounds and their tabs are named 'Compound 1', 'Compound 2', etc. but they can be renamed by right clicking either on the compound in the top level diagram, or anywhere within an open Compound, selecting 'Rename' and typing in the required text string (16 characters max.).

Compounds cannot contain other compounds (i.e. they can be created only in the top level diagram).

Compound creation

1. Empty compounds are created within the top level diagram by clicking on the 'Create Compound' toolbar icon.
2. Compounds can also be created by highlighting one or more function blocks in the top level diagram and then clicking on the 'Create Compound' toolbar icon. The highlighted items are moved from the top level diagram into a new compound.




3. Compounds are 'uncreated' (flattened), by highlighting the relevant item in the top level menu and then clicking on the 'Flatten Compound' toolbar icon. All the items previously contained within the compound appear on the top level diagram.
4. Wiring between top level and compound parameters is carried out by clicking on the source parameter, then clicking on the compound (or the compound tab) and then clicking on the destination parameter. Wiring from a compound parameter to a top level parameter or from compound to compound is carried out in similar manner.
5. Unused function blocks can be moved into compounds by dragging from the tree view. Existing blocks can be dragged from the top level diagram, or from another compound, onto the tab associated with the destination compound. Blocks are moved out of compounds to the top level diagram or to another compound in a similar way. Function blocks can also be 'cut and pasted'.
6. Default compound names (e.g. 'Compound 2') are used only once, so that if, for example, Compounds 1 and 2 have been created, and Compound 2 is subsequently deleted, then the next compound to be created will be named 'Compound 3'.
7. Top level elements can be click-dragged into compounds.

## 7.3.2 WIRING EDITOR OPERATING DETAILS (Cont.)

### TOOL TIPS

Hovering the cursor over the block displays 'tooltips' describing that part of the block beneath the cursor. For function block parameters the tooltip shows the parameter description, its OPC name, and, if downloaded, its value. Similar tooltips are shown when hovering over inputs, outputs and over many other items on the iTools screen.

A Function Block is enabled by dragging the block onto the diagram, wiring it, and finally downloading it to the instrument. Initially blocks and associated wires are drawn with dashed lines, and when in this state the parameter list for the block is enabled but the block is not executed by the instrument.

The block is added to the instrument function block execution list when the 'Download' icon is operated and the items are redrawn using solid lines.

If a block which has been downloaded is deleted, it is shown on the diagram in a ghosted form until the download button is pressed. (This is because it and any wires to/from it are still being executed in the instrument. On download it will be removed from the instrument execution list and the diagram.) A ghosted block can be 'undeleted' as described in 'Context menu', above.

When a dashed block is deleted it is removed immediately.

## 7.4 PARAMETER EXPLORER

This view is displayed:

1. by clicking on the 'Parameter Explorer' toolbar icon, Parameter Explorer
2. by double clicking on the relevant block in the tree pane or in the graphical wiring editor
3. by selecting 'Function Block View' from the Function block context menu in the Graphical wiring Editor.

4. by selecting 'parameter Explorer from the 'View' menu
5. by using the short cut <Alt>+<Enter>

In each case the function block parameters appear in the iTools window in tabular form, such as the example in figure 7.4a, below.

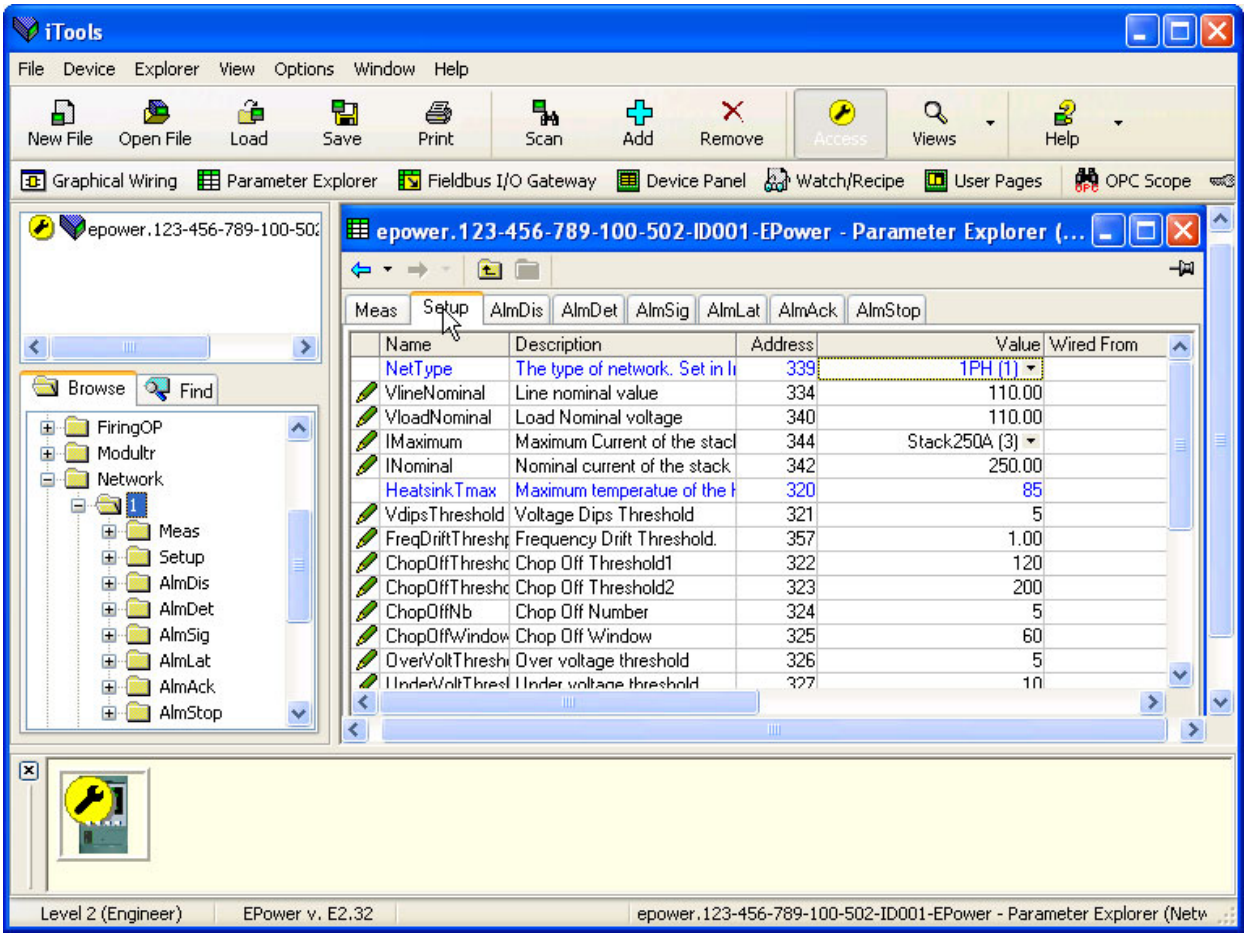



Figure 7.4a Parameter table example

The figure above shows the default table layout. Columns can be added/deleted from the view using the 'Columns' item of the Explorer or context menus (figure 7.4b).

## 7.4 PARAMETER EXPLORER (Cont.)

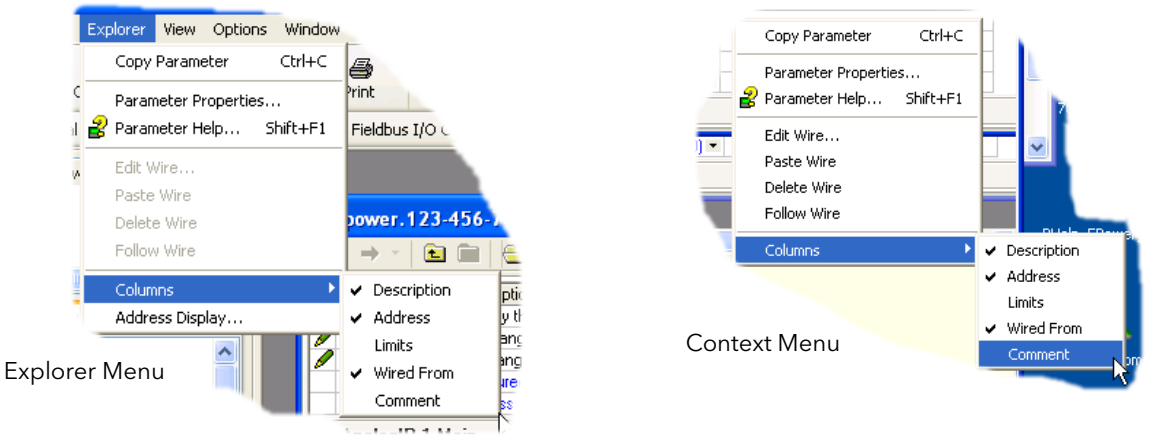
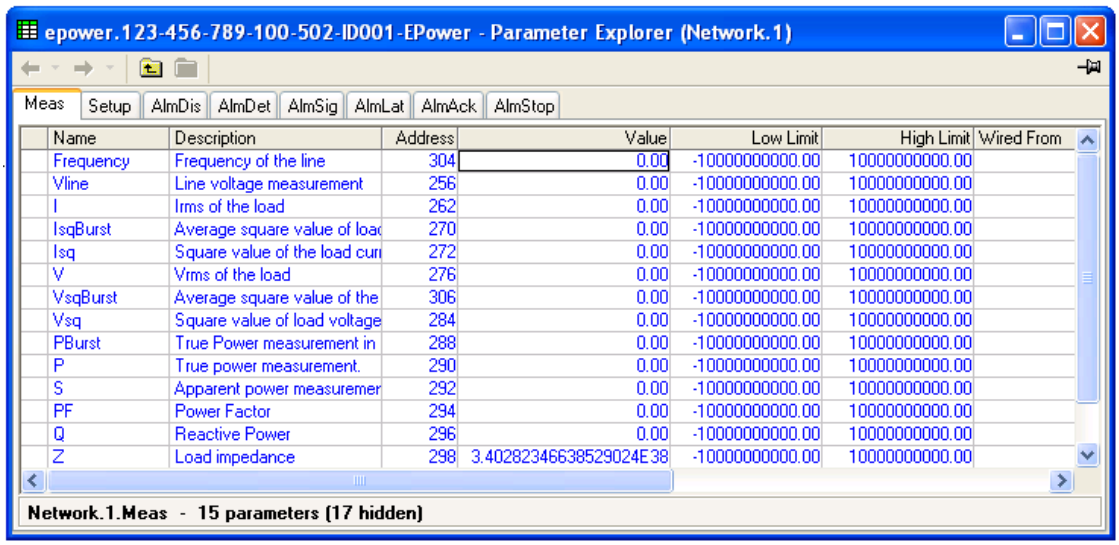



Figure 7.4b Column enable/disable

### 7.4.1 Parameter explorer detail

Figure 7.4.1a shows a typical parameter table. This particular parameter has a number of subfolders associated with it, and each of these is represented by a 'tab' across the top of the table.




| Name | Description | Address | Value | Low Limit | High Limit | Wired From |
|---|---|---|---|---|---|---|
| Frequency | Frequency of the line | 304 | 0.00 | -10000000000.00 | 10000000000.00 | |
| Vline | Line voltage measurement | 256 | 0.00 | -10000000000.00 | 10000000000.00 | |
| I | Irms of the load | 262 | 0.00 | -10000000000.00 | 10000000000.00 | |
| IsqBurst | Average square value of loa | 270 | 0.00 | -10000000000.00 | 10000000000.00 | |
| Isq | Square value of the load cur | 272 | 0.00 | -10000000000.00 | 10000000000.00 | |
| V | Vrms of the load | 276 | 0.00 | -10000000000.00 | 10000000000.00 | |
| VsqBurst | Average square value of the | 306 | 0.00 | -10000000000.00 | 10000000000.00 | |
| Vsq | Square value of load voltage | 284 | 0.00 | -10000000000.00 | 10000000000.00 | |
| PBurst | True Power measurement in | 288 | 0.00 | -10000000000.00 | 10000000000.00 | |
| P | True power measurement. | 290 | 0.00 | -10000000000.00 | 10000000000.00 | |
| S | Apparent power measuremer | 292 | 0.00 | -10000000000.00 | 10000000000.00 | |
| PF | Power Factor | 294 | 0.00 | -10000000000.00 | 10000000000.00 | |
| Q | Reactive Power | 296 | 0.00 | -10000000000.00 | 10000000000.00 | |
| Z | Load impedance | 298 | 3.402823466385290 24E38 | -10000000000.00 | 10000000000.00 | |

Figure 7.4.1a Typical parameter table

Notes:

1. Parameters in blue are non-editable (Read only). In the example above all the parameters are read only. Read/write parameters are in black and have a 'pencil' symbol in the 'read/Write access column at the left edge of the table. A number of such items are shown in figure 7.4a, above.
2. Columns. The default explorer window (figure 7.4a) contains the columns 'Name', 'Description', 'Address', 'Value', and 'Wired From'. As can be seen from figure 7.4b, the columns to be displayed can be selected, to a certain extent, using either the 'Explorer' menu or the context menu. 'Limits' have been enabled for the example above.
3. Hidden Parameters. By default, iTools hides parameters which are considered irrelevant in the current context. Such hidden parameters can be shown in the table using the 'Parameter availability' settings item of the options menu (figure 7.4b). Such items are displayed with a shaded background.
4. The full pathname for the displayed parameter list is shown at the bottom left hand corner of the window.

### 7.4.1 PARAMETER EXPLORER DETAIL (Cont.)

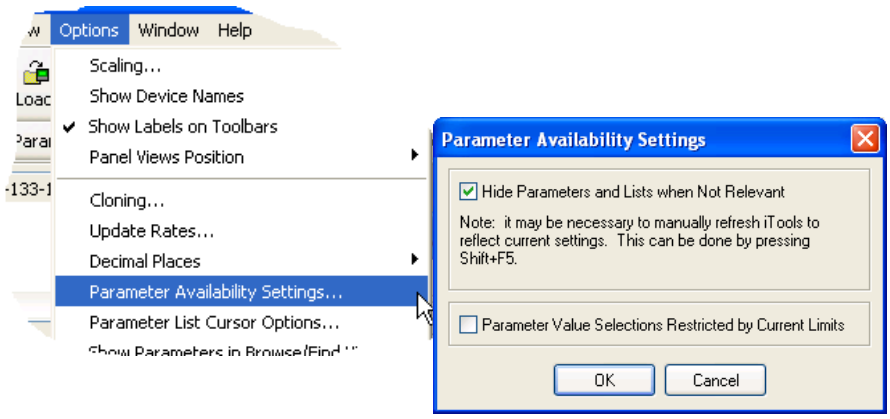



Figure 7.4.1b Show/Hide parameters

Back to: and Forward to:. The parameter explorer contains a history buffer of up to 10 lists that have been browsed in the current instance of the window. The 'Back to: (list name)' and 'Forward to: (list name)' icons allow easy retracing or repeating of the parameter list view sequence.
If the mouse cursor is hovered over the tool icon, the name of the parameter list which will appear if the icon is clicked-on appears. Clicking on the arrow head displays a pick list of up to 10 previously visited lists which the user can select. Short cut = <ctrl>+<B> for 'Back to' or <ctrl>+<F> for 'Forward to'.

Go Up a Level, Go Down a Level. For nested parameters, these buttons allow the user to navigate 'vertically' between levels. Short cut = <ctrl>+<U> for 'Go Up a Level' or <ctrl>+<D> for 'Go Down a Level'.

Push pin to give the window global scope. Clicking on this icon causes the current parameter list to be permanently displayed, even if another instrument becomes the 'current device'.

### 7.4.2 Explorer tools

A number of tool icons appear above the parameter list: Context Menu


| | |
|---|---|
| Copy Parameter | Copies the clicked-on parameter to the clipboard |
| Parameter properties | Displays parameter properties for the clicked-on parameter |
| Parameter Help... | Displays help information for the clicked-on parameter |
| Edit/Paste/Delete/Follow Wire | Not used in this application |
| Columns | Allows the user to enable/disable a number of parameter table columns (figure 7.4b). |

## 7.5 FIELDBUS GATEWAY Fieldbus I/O Gateway

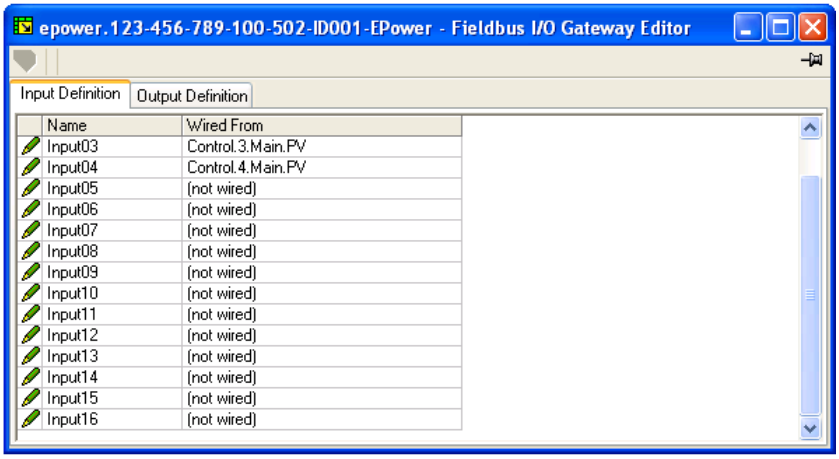



Figure 7.5a Typical Fieldbus Gateway Parameter list

A Profibus master may be required to work with slaves from different manufacturers and with different functions. Also, there are many parameters which are not required by the network master. Fieldbus Gateway allows the user to define which Input and output parameters are to be available over the Profibus link. The master may then map the selected device parameters into, for example, PLC input/output registers, or, in the case of a supervisory (SCADA) package, to a personal computer.

Values from each slave, (the 'Input Data'), are read by the master, which then runs a control program such as a ladder logic program. The program generates a set of values, (the 'Output Data') and loads them into a pre-defined set of registers for transmission to the slaves. This process is called an 'I/O data exchange' and is repeated continuously, to give a cyclical I/O data exchange.

As shown in figure 7.5a, above, there are two tabs within the editor, called 'Input definition' and 'Output definition'. 'Inputs' are values sent from the controller to the Profibus master. 'Outputs' are values received from the master and used by the controller, (e.g. set points written from the master).

Note: Values from Profibus over write changes made at the operator interface.

The procedure for selecting variables is the same for both input and output definition tabs:

1. Double click the next available position, in the 'Wired From' column, in the input or output data table and select the variable to assign to it. A pop-up (figure 7.5b) provides a browser from which a list of parameters can be opened.
2. Double click the parameter to assign it to the input definition.
3. Alternatively, drag and drop the parameter from the browser list.

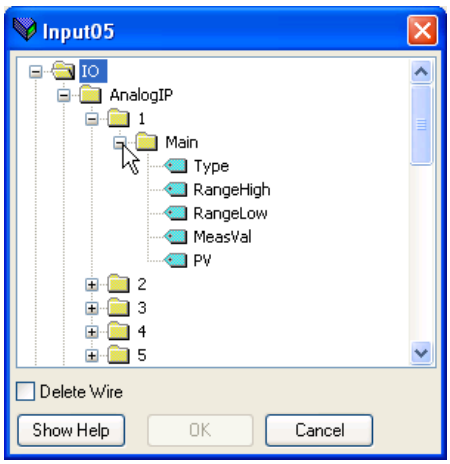



Figure 7.5b Browser window

Note: Gaps may be left in the table if so desired.

To delete a wire, double click in the 'Wired From' column of the Input/Output Definition window to open the pop up browser window, Figure 7.5b. Tick the 'Delete Wire' box.

## 7.5 FIELDBUS GATEWAY(Cont.)

When all the required parameters have been added to the lists, notes of how many 'wired' entries are included in the input and output areas should be made as this information is needed when setting up the Profibus Master.

Notes:

1. A maximum of 32 input and 16 output parameters may be set using the Gateway Editor.
2. No checks are made that output variables are writeable, and if a read only variable is included in the output list any values sent to it will be ignored with no error indication.
3. For Modbus only:
   As shown in figure 7.5b, 'Block Read' and 'Block Write' requests both access the same memory location (0C06), which 'points' to the relevant input definition table or output definition table according to whether the instruction is a read or a write. If a value is written to a parameter at a particular location in the output definition table, and the value of the parameter in the same location in the input definition table is then read, the read value is normally different from the write value because the parameter at a location in the input table is not usually the same as the parameter at that location in the output table (unless the same parameter is placed at the same location in both tables).

Once the changes have been made to the Input and Output definition lists, they must be downloaded to the controller unit. This is done (for both tables simultaneously) by clicking on the 'Update device Flash Memory' button on the top left of the Fieldbus Gateway Editor window. The controller performs a restart after this operation.

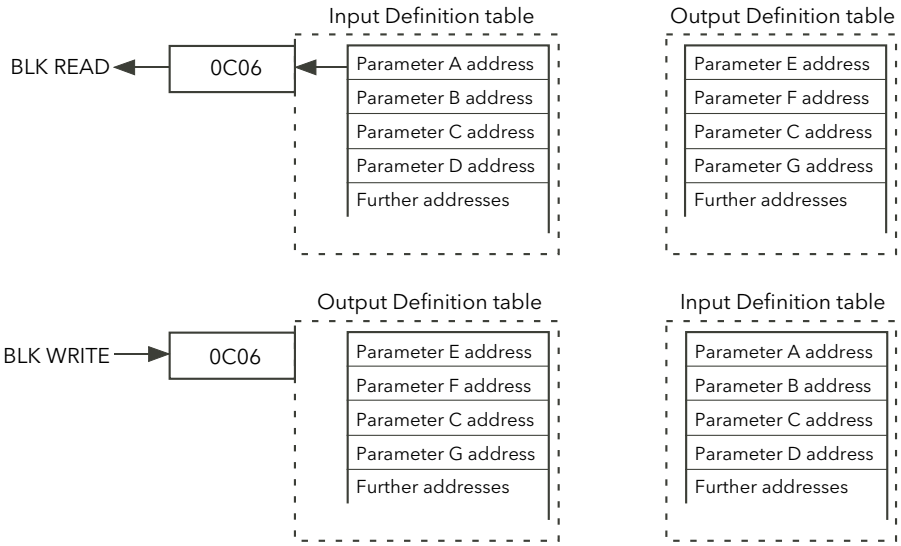



Figure 7.5b Block read and block write (note 3)

### EE CHECKSUM FAIL ERROR

***NOTICE***

For software versions prior to version 3 only.

The EEPROM, used to retain configuration parameters whilst power is off, has a lifetime of at least 100,000 writes. If the Fieldbus Gateway is configured to include such configuration parameters (see list below), then the lifetime of the EEPROM may be reduced. In this case an 'EE Checksum Fail Error' message appears at power up, and the Driver Module will fail to start, and will have to be replaced.

It is therefore recommended that an alternative method is used when communicating with these parameters. For example, rather than writing directly to the parameter Control.MainSP (saved in EEPROM) it is possible to use a SetProv block and write into SetProv.Remote 1 (not saved in EEPROM) instead.

For software version 3.0 onwards, no parameters modified via the I/O Gateway will be saved in EEPROM. Saving to EEPROM will be achieved by other wiring methods.

## 7.5 FIELDBUS GATEWAY (Cont.)

**EE CHECKSUM FAIL ERROR (Cont.)**

The following is a list of parameters which are stored in EEPROM, and which could therefore BE included in the IO Gateway.

Access.ClearMemory
Access.ConfigurationPasscode
Access.EngineerPasscode
Access.IM
Access.Keylock
Access.QuickStartPasscode
AlmDis.Alarm.ExternIn
AlmDis.AnalogOP.OutputFault
AlmDis.Control.ClosedLoop
AlmDis.Control.Limitation
AlmDis.Control.PVTransfer
AlmDis.LTC.Fuse
AlmDis.LTC.Temp
AlmDis.Network.ChopOff
AlmDis.Network.FreqFault
AlmDis.Network.FuseBlown
AlmDis.Network.MainsVoltFault
AlmDis.Network.MissMains
AlmDis.Network.NetworkDips
AlmDis.Network.OpenThyr
AlmDis.Network.OverCurrent
AlmDis.Network.OverTemp
AlmDis.Network.PB24VFail
AlmDis.Network.PLF
AlmDis.Network.PLU
AlmDis.Network.PreTemp
AlmDis.Network.ThyrSC
AlmDis.Network.TLF
AlmDis.PLM.PrOverPs
AlmLat.Alarm.ExternIn
AlmLat.AnalogOP.OutputFault
AlmLat.Control.ClosedLoop
AlmLat.Control.Limitation
AlmLat.Control.PVTransfer
AlmLat.LTC.Fuse
AlmLat.LTC.Temp
AlmLat.Network.FreqFault
AlmLat.Network.FuseBlown
AlmLat.Network.MainsVoltFault
AlmLat.Network.MissMains
AlmLat.Network.NetworkDips
AlmLat.Network.OverCurrent
AlmLat.Network.OverTemp
AlmLat.Network.PB24VFail
AlmLat.Network.PLF
AlmLat.Network.PLU
AlmLat.Network.PreTemp
AlmLat.Network.ThyrSC
AlmLat.Network.TLF
AlmLat.PLM.PrOverPs
AlmStop.Alarm.ExternIn
AlmStop.AnalogOP.OutputFault
AlmStop.Control.ClosedLoop
AlmStop.Network.MainsVoltFault
AlmStop.Network.PLF
AlmStop.Network.PLU
AlmStop.Network.PreTemp
AlmStop.Network.TLF
AnSwitch.Fallback
AnSwitch.FallbackVal
AnSwitch.HighLimit
AnSwitch.In1
AnSwitch.In2
AnSwitch.In3
AnSwitch.In4
AnSwitch.In5
AnSwitch.In6
AnSwitch.In7
AnSwitch.In8
AnSwitch.LowLimit
AnSwitch.Select
Counter.Clock
Counter.Direction
Counter.Enable
Counter.Target
Digital.Invert
Digital.Type
Energy.AutoScaleUnits
Energy.PulseLen
Energy.PulseScale
Energy.TotEnergyUnit
Energy.Type
Energy.UsrEnergyUnit
Faultdet.GlobalDis
FiringOP.DelayedTrigger
FiringOP.LoadType
FiringOP.SafetyRamp
FiringOP.SoftStart
FiringOP.SoftStop
IPMonitor.AlarmDays
IPMonitor.AlarmTime
IPMonitor.In
IPMonitor.Reset
IPMonitor.Threshold
Lgc2.FallbackType
Lgc2.Hysteresis
Lgc2.In1
Lgc2.In2
Lgc2.Invert
Lgc2.Oper
Lgc8.In1
Lgc8.In2
Lgc8.In3
Lgc8.In4
Lgc8.In5
Lgc8.In6
Lgc8.In7
Lgc8.In8
Lgc8.InInvert
Lgc8.NumIn
Lgc8.Oper
Lgc8.OutInvert
Limit.Control.SP1
Limit.Control.SP2
Limit.Control.SP3

## 7.5 FIELDBUS GATEWAY (Cont.)

### EE CHECKSUM FAIL ERROR (Cont.)

Limit.Control.TI
Main.AnalogIP.RangeHigh
Main.AnalogIP.RangeLow
Main.AnalogIP.Type
Main.AnalogOP.RangeHigh
Main.AnalogOP.RangeLow
Main.AnalogOP.Type
Main.Control.SP
Main.Control.TI
Main.Control.TransferSpan
Main.PLM.Period
Main.PLM.Type
MainPrm.LTC.S1
MainPrm.LTC.S2
MainPrm.LTC.S3
MainPrm.LTC.TapNb
MainPrm.LTC.Type
Math2.Fallback
Math2.FallbackVal
Math2.HighLimit
Math2.In1
Math2.In1Mul
Math2.In2
Math2.In2Mul
Math2.LowLimit
Math2.Oper
Math2.Resolution
Math2.Select
Math2.Units
Modultr.CycleTime
Modultr.LgcMode
Modultr.MinOnTime
Modultr.Mode
Modultr.SwitchPA
Network.PLM.Ps
PLMChan
PLMChan.Group
PLMChan.ShedFactor
RmtPanel.Comms.Address
RmtPanel.Comms.Baud
SetProv.DisRamp
SetProv.HiRange
SetProv.Limit
SetProv.LocalSP
SetProv.RampRate
SetProv.RemSelect
SetProv.SPSelect
SetProv.SPTrack
SetProv.SPUnits
Setup.Control.BleedScale
Setup.Control.EnLimit
Setup.Control.FFGain
Setup.Control.FFOffset
Setup.Control.FFType
Setup.Control.NominalPV
Setup.Control.TransferEn
Setup.Network.ChopOffNb
Setup.Network.ChopOffThreshold1
Setup.Network.ChopOffThreshold2
Setup.Network.ChopOffwindow
Setup.Network.FreqDriftThreshold
Setup.Network.HeaterType
Setup.Network.HeatsinkPreTemp
Setup.Network.IextScale
Setup.Network.IMaximum
Setup.Network.INominal
Setup.Network.OverIThreshold
Setup.Network.OverVoltThreshold
Setup.Network.PLFSensitivity
Setup.Network.PLUthreshold
Setup.Network.UnderVoltThreshold
Setup.Network.VdipsThreshold
Setup.Network.VextScale
Setup.Network.VlineNominal
Setup.Network.VloadNominal
Setup.Network.VMaximum
Station.PLM.Address
Timer.In
Timer.Time
Timer.Type
Total.AlarmSP
Total.Hold
Total.In
Total.Reset
Total.Resolution
Total.Run
Total.Units
User.Comms.Address
User.Comms.Baud
User.Comms.DCHP_enable
User.Comms.Default_Gateway_1
User.Comms.Default_Gateway_2
User.Comms.Default_Gateway_3
User.Comms.Default_Gateway_4
User.Comms.Delay
User.Comms.Extension_Cycles
User.Comms.IP_address_1
User.Comms.IP_address_2
User.Comms.IP_address_3
User.Comms.IP_address_4
User.Comms.Network_Version
User.Comms.Parity
User.Comms.Pref_Mstr_IP_1
User.Comms.Pref_Mstr_IP_2
User.Comms.Pref_Mstr_IP_3
User.Comms.Pref_Mstr_IP_4
User.Comms.Protocol
User.Comms.ShowMac
User.Comms.Subnet_Mask_1
User.Comms.Subnet_Mask_2
User.Comms.Subnet_Mask_3
User.Comms.Subnet_Mask_4
User.Comms.UnitIdent
UsrVal.HighLimit
UsrVal.LowLimit
UsrVal.Resolution
UsrVal.Status
UsrVal.Units
UsrVal.Val
Wire.Dest
Wire.Src

## 7.6 DEVICE PANEL Device Panel

When this toolbar icon is clicked on, a representation of the connected instrument (either on-line, or a clone) appears in the iTools window. The operator interface acts as in the real instrument (note 1), but instead of operating the push-buttons by hand, the relevant items are clicked on, using the mouse. Changes made at the operator interface are reflected at the iTools screen and *vice-versa*.

The display can be scaled as required by click/dragging on the sides/bottom or corners.

Notes:

1. An up/down arrow key appears above the display for operations (e.g. acknowledging system alarms) which require simultaneous operation of the up and down arrow keys. 
2. Real instruments can be recognised by the fact that the representation of the display is in green, whereas for cloned instruments, the display is shown in white (see figure 7.6 below).


Figure 7.6 Device panel display on-line (left) and clone (right).

## 7.7 WATCH/RECIPE EDITOR Watch/Recipe

The watch/recipe editor is opened by clicking on the Watch/Recipe tool icon, by selecting 'Watch/Recipe' in the 'Views' menu or by using the short cut <ctrl>+<A>. The window is in two parts: the left part containing the watch list; the right-hand part containing one or more data sets, initially empty and unnamed.

The Watch/Recipe window is used:

1. To monitor a list of parameters. This list can contain parameters from many different, and otherwise unrelated parameter lists within the same device. It cannot contain parameters from different devices.
2. To create 'data sets' of parameter values which can be selected and downloaded to the device in the sequence defined in the recipe. The same parameter may be used more than once in a recipe.

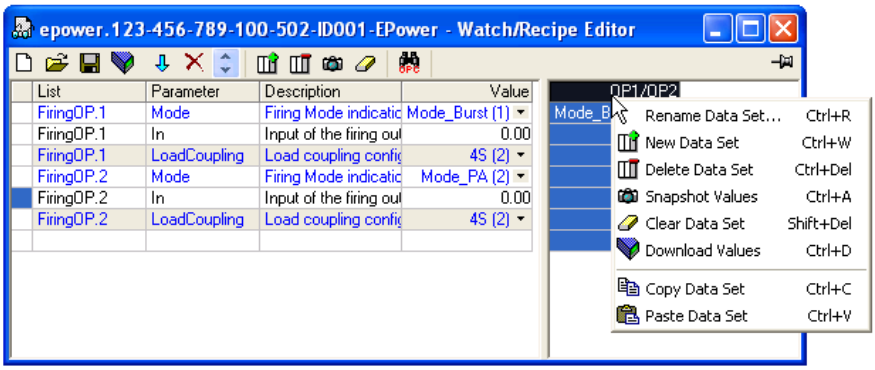



Figure 7.7 Watch/Recipe Editor window (with context menu)

### 7.7.1 Creating a Watch List

After opening the window, parameters can be added to it as described below. The values of the parameters update in real-time, allowing the user to monitor a number of values simultaneously.

#### ADDING PARAMETERS TO THE WATCH LIST

1. Parameters can be click-dragged into the watch list from another area of the iTools window (for example, the parameter explorer window, the graphical wiring editor, the browse tree). The parameter is placed either in an empty row at the bottom of the list, or if it is dragged on top of an already existing parameter, it is inserted above this parameter, with the remaining parameters being moved down one place.
2. Parameters can be dragged from one position in the list to another. In such a case, a copy of the parameter is produced, the source parameter remaining in its original position.
3. Parameters can be copied <ctrl>+<C> and pasted <ctrl>+<V> either within the list, or from a source external to it, for example the parameter browse window or the graphical wiring editor.
4. The 'Insert item...' tool button the 'Insert Parameter' item in the Recipe or context menu or the short cut <Insert> can be used to open a browse window from which a parameter is selected for insertion above the currently selected parameter.

#### DATA SET CREATION

Once all the required parameters have been added to the list, select the empty data set by clicking on the column header. Fill the data set with current values using one of the following methods:

1. Clicking on the 'Capture current values into a data set' tool icon (also known as the 'Snapshot Values' tool).
2. Selecting 'Snapshot Values' from the Recipe or Context (right-click) menu.
3. Using the short cut <ctrl>+<A>.

## 7.7.1 CREATING A WATCH LIST (Cont.)

### DATA SET CREATION (Cont.)

Individual data values can now be edited by typing directly into the grid cells. Data values can be left blank or cleared, in which case, no values will be written for those parameters at download. Data values are cleared by deleting all the characters in the cell then either moving to a different cell or typing <Enter>.

The set is called 'Set 1' by default, but it can be renamed by either by using the 'Rename data set...' item in the Recipe or context menus, or by using the short cut <ctrl>+<R>.

New, empty data sets can be added using one of the following:

1. Clicking on the 'Create a new empty data set' toolbar icon.
2. Selecting 'New Data Set' in the Recipe or context menus
3. Using the short cut <ctrl>+<W>

Once created, the data sets are edited as described above.

Finally, once all the required data sets have been created, edited and saved, they can be downloaded the instrument, one at a time, using the Download tool, the 'Download Values' item in the Recipe or context menus, or the short cut <ctrl>+<D>.

## 7.7.2 Watch Recipe toolbar icons

Create a new watch/recipe list. Creates a new list by clearing out all parameters and data sets from an open window. If the current list has not been saved, confirmation is requested. Short cut <ctrl>+<N>

Open an existing watch/recipe file. If the current list or data set has not been saved, confirmation is requested. A file dialogue box then opens allowing the user to select a file to be opened. Short cut <ctrl>+<O>

Save the current watch/recipe list. Allows the current set to be saved to a user specified location. Short cut <ctrl>+<S>.

Download the selected data set to the device. Short cut <ctrl>+<D>

Insert item ahead of selected item. Short cut <Insert>.

Remove recipe parameter. Short cut <ctrl>+<Delete>.

Move selected item. Up arrow moves selected parameter up the list; down arrow move the selected parameter down the list.

Create a new empty data set. Short cut <ctrl>+<w>.

Delete an empty data set. Short cut <ctrl>+<Delete>

Capture current values into a data set. Fills the selected data set with values. Short cut <ctrl>+<A>.

Clear the selected data set. Removes values from the selected data set. Short cut <Shift>+<Delete>.

Open OPC Scope. Opens a separate utility that allows trending, data logging and Dynamic Data Exchange (DDE). OPC Scope is an OPC explorer program that can connect to any OPC server that is in the windows registry.
(OPC is an acronym for 'OLE for Process Control, where OLE stands for 'Object Linking and Embedding'.)

## 7.7.3 Watch/Recipe Context Menu

The Watch/Recipe Context menu items have the same functions as described above for toolbar items.

## 7.8 USER PAGES User Pages

Up to four user pages, each with four lines can be created and downloaded to the unit. These allow the operator interface to display particular sets of values, in various formats. Figure 7.8 below, shows the initial display when 'User Pages' is first clicked-on.

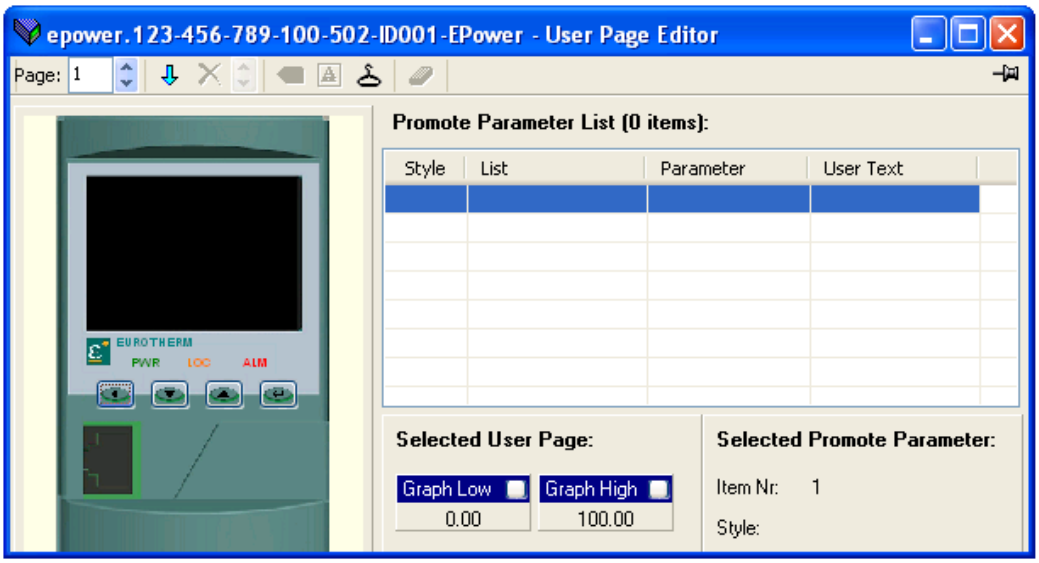
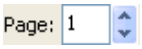



Figure 7.8 Blank User Page

### 7.8.1 User Page creation

1. Click on the up/down arrow to select the required Page number for configuration. 

2. Double-click one of the cells in the 'Promote Parameter List' to display the 'Select Item Style' window (figure 7.8.1a).
3. Click on the required style then on 'OK'.
4. A parameter Browse window appears (figure 7.8.1b) for the selected row (1 in the figure), allowing the user to select a parameter.
5. Click 'OK' to insert the parameter into the list.
6. If required, click on white square on the relevant 'Graph Low' or 'Graph High' title bar, and set the low and high values to appear with an associated bargraph (figure 7.8.1c).

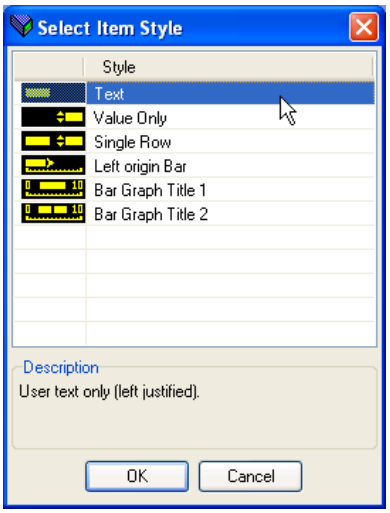



Figure 7.8.1a Style selection

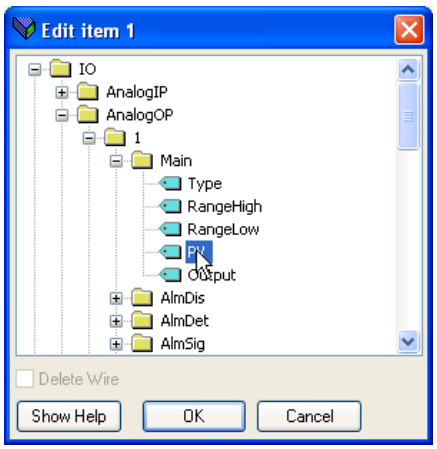



Figure 7.8.1b Parameter browse

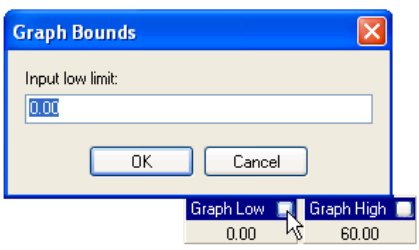



Figure 7.8.1c Graph limit setting.

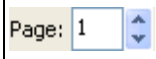
### 7.8.2 Style examples


Figure 7.8.2a
Text, Value only, single Row and Left origin Bar styles


Figure 7.8.2b
Bar Graph Title 1, Left origin bar and Bar Graph Title 2 styles

| | |
|---|---|
| Text | If 'Text' is selected, a text entry window appears allowing the user to enter the text to appear on the selected line of the display. The display can accommodate 10 characters - any further characters are hidden. This style is shown as line one in figure 7.8.2a. |
| Value only | Displays the value of the selected parameter, right justified. No User text may be entered for this style. This style is shown as line two in figure 7.8.2a. |
| Single Row | Displays the parameter mnemonic (left justified) and the parameter value (right justified). User text may be entered, but this will over-write the parameter mnemonic. This style is shown as line three in figure 7.8.2a. |
| Left origin Bar | Displays the parameter value as a left-hand zero bargraph. This style is shown as line four in figure 7.8.2a, and line two in figure 7.8.2b. |
| Bar Graph Title 1 | Supplies low limit (left justified), parameter mnemonic (centred) and high limit (right justified) displays, normally associated with a Left origin Bar on the line below or above. User text may be entered. As the number of entered characters increases, this overwrites firstly the mnemonic, then the range values. This style is shown as line one in figure 7.8.2b. |
| Bar Graph Title 2 | Similar to Bar Graph Title 1, but includes a numeric value for the parameter as well as its mnemonic. User text may be entered. As the number of entered characters increases, this over-writes firstly the mnemonic, then the range values. If the number of entered characters plus the number of value characters exceeds 10, then the user text is hidden, leaving just the parameter value. This style is shown as line three in figure 7.8.2b. |

**8.4 PARAMETER TABLE (Cont.)**

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|
| **7.8.3 User Pages Tools** | | | | |
|  | Select Page. Use the up/down arrows to select page 1 to page 4 for configuration. | | | |
|  | Insert item ahead of selected item. Opens a browser to allow the user to select a parameter for insertion in the table. The insertion point is above the currently selected item. If the Parameter list is full, the toolbar icon is disabled ('greyed out'). Short cut <Insert> | | | |
|  | Remove selected item. Removes the selected item on the list (without confirmation). Short cut <ctrl>+<Delete> | | | |
|  | Move selected item. Click on the arrows to change the parameter order, and thus the order in which the parameters appear at the operator interface. | | | |
|  | Edit parameter for selected item. Opens a browser to allow the user to select a parameter to replace the highlighted parameter in the table. Short cut <ctrl>+<E>. | | | |
|  | Edit user text for selected item. Allows the user to edit the user text which appears at the operator interface. Only the first 10 characters are displayed. For parameters that do not support user text '(no user text)' appears in the 'User Text' column. Short cut <ctrl>+<T>. | | | |
|  | Edit style for selected item. Clicking on this toolbar icon calls the Style Selection page allowing the user to edit the current style for the selected parameter. Short cut <ctrl>+<S>. | | | |
|  | Remove all items from this page. After confirmation, this removes ALL items from the parameter list, not just the highlighted ones. Short cut <ctrl>+<X>. | | | |
| | Note: Most if the above functions are also to be found in the 'Pages' menu, in the context menu, along with 'Parameter Help' and 'Parameter properties...' items. | | | |

**8.4 PARAMETER TABLE (Cont.)**

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|

# 8 PARAMETER ADDRESSES (MODBUS)

## 8.1 INTRODUCTION

The iTools address fields display each parameter's Modbus address to be used when addressing integer values over the serial communications link. In order to access these values as IEEE floating point values, the calculation: IEEE address = {(Modbus address x 2) + hex 8000} should be used. The Communications manual HA179770 gives details of how to establish a suitable communications link.

Notes:

1. Certain parameters may have values which exceed the maximum value that can be read from or written to using a 16-bit integer communications. Such parameters have a scaling factor applied to them as described in section 8.3.
2. When using 16-bit scaled integer modbus addressing, time parameters can be read from or written to in 10ths of minutes, or in 10ths of seconds as defined in the parameter Instrument.config. TimerRes.

## 8.2 PARAMETER TYPES

The following parameter types are used:

| | |
|---|---|
| bool | Boolean |
| uint8 | Unsigned 8-bit integer |
| int16 | Signed 16-bit integer |
| uint16 | Unsigned 16-bit integer |
| int32 | Signed 32-bit integer |
| uint32 | Unsigned 32-bit integer |
| time32 | Unsigned 32-bit integer (time in milliseconds) |
| float32 | IEEE 32-bit floating point |
| string | String - an array of unsigned 8-bit integers. |

**8.4 PARAMETER TABLE (Cont.)**

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|

## 8.3 PARAMETER SCALING

Some parameters might have values which exceed the maximum value (32767) that can be read/written via 16-bit scaled integer comms. For this reason, the following parameters are read/written with a scaling factor applied to them when using scaled integer comms:

| Parameter Name | Scaling Factor |
|---|---|
| Network.1-4.Meas.PBurst | Kilo with 1 decimal place |
| Network.1-4.Meas.P | Kilo with 1decimal place |
| Network.1-4.Meas.S | Kilo with 1decimal place |
| Network.1-4.Meas.Q | Kilo with 1decimal place |
| Network.1-4.Meas.IsqBurst | Kilo with 1decimal place |
| Network.1-4.Meas.Isq | Kilo with 1decimal place |
| Network.1-4.Meas.IsqMax | Kilo with 1decimal place |
| Network.1-4.Meas.VsqBurst | Kilo with 1decimal place |
| Network.1-4.Meas.Vsq | Kilo with 1decimal place |
| Network.1-4.Meas.VsqMax | Kilo with 1decimal place |
| PLM.Network.Pmax | Mega with 2 decimal places |
| PLM.Network.Pt | Mega with 2 decimal places |
| PLM.Network.Ps | Mega with 2 decimal places |
| PLM.Network.Pr | Mega with 2 decimal places |
| PLMChan.1-4.PZmax | Kilo with 1 decimal place |

### 8.3.1 Conditional scaling

The parameters listed below are conditionally re-scaled as kilo values with 1 decimal place:

| Parameter Name | Condition |
|---|---|
| Control.n.Setup.NominalPV | When Control.n.Main.PV is wired from Network.n.Meas.P, Vsq or Isq |
| Control.n.Main.PV | When wired from Network.n.Meas.P, Vsq or Isq |
| Control.n.Main.TransferPV | When wired from Network.n.Meas.P, Vsq or Isq |
| Control.n.Main.TransferSpan | When Control.n.Main.PV is wired from Network.n.Meas.P, Vsq or Isq |
| Control.n.Limit.PV1 | When wired from Network.n.Meas.P, Vsq or Isq |
| Control.n.Limit.PV2 | When wired from Network.n.Meas.P, Vsq or Isq |
| Control.n.Limit.PV3 | When wired from Network.n.Meas.P, Vsq or Isq |
| Control.n.Limit.SP1 | When Control.n.Limit.PV1 is wired from Network.n.Meas.P, Vsq or Isq |
| Control.n.Limit.SP2 | When Control.n.Limit.PV2 is wired from Network.n.Meas.P, Vsq or Isq |
| Control.n.Limit.SP3 | When Control.n.Limit.PV3 is wired from Network.n.Meas.P, Vsq or Isq |
| SetpProv.n.Remote1 | When in Engineering units AND Control.m.Main.PV is wired from Network.m.Meas.P, Vsq or Isq (where m = the instance of the Control block to which SetpProv.n is wired) |
| SetpProv.n.Remote2 | When in Engineering units AND Control.m.Main.PV is wired from Network.m.Meas.P, Vsq or Isq (where m =the instance of the Control block to which SetpProv.n is wired) |
| SetpProv.n.LocalSP | When in Engineering units AND Control.m.Main.PV is wired from Network.m.Meas.P, Vsq or Isq (where m = the instance of the Control block to which SetpProv.n is wired) |

**8.4 PARAMETER TABLE (Cont.)**

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|

## 8.4 PARAMETER TABLE

The following table is arranged in alphabetical function block order:

| | | | |
|---|---|---|---|
| Access | Firing O/P 4 | IP Monitor 2 | Predictive Load Manager |
| Comms | Instrument | IP Monitor 3 | PLM Chan 1 |
| Control 1 | Analogue I/P 1 | IP Monitor 4 | PLM Chan 2 |
| Control 2 | Analogue I/P 2 | LGC2 1 | PLM Chan 3 |
| Control 3 | Analogue I/P 3 | LGC2 2 | PLM Chan 4 |
| Control 4 | Analogue I/P 4 | LGC2 3 | QuickStart |
| Counter 1 | Analogue I/P 5 | LGC2 4 | Set Prov 1 |
| Counter 2 | Analogue O/P 1 | Lgc8 1 | Set Prov 2 |
| Counter 3 | Analogue O/P 2 | Lgc8 2 | Set Prov 3 |
| Counter 4 | Analogue O/P 3 | Lgc8 3 | Set Prov 4 |
| Customer Page 1 | Analogue O/P 4 | Lgc8 4 | Timer 1 |
| Customer Page 2 | I/O Digital 1 | LTC | Timer 2 |
| Customer Page 3 | I/O Digital 2 | Maths2 1 | Timer 3 |
| Customer Page 4 | I/O Digital 3 | Maths2 2 | Timer 4 |
| Energy 1 | I/O Digital 4 | Maths2 3 | Totaliser 1 |
| Energy 2 | I/O Digital 5 | Maths2 4 | Totaliser 2 |
| Energy 3 | I/O Digital 6 | Modulator 1 | Totaliser 3 |
| Energy 4 | I/O Digital 7 | Modulator 2 | Totaliser 4 |
| Energy 5 | I/O Digital 8 | Modulator 3 | User Value 1 |
| Event Log | I/O Relay 1 | Modulator 4 | User Value 2 |
| Fault detection | I/O Relay 2 | Network 1 | User Value 3 |
| Firing O/P 1 | I/O Relay 3 | Network 2 | User Value 4 |
| Firing O/P 2 | I/O Relay 4 | Network 3 | |
| Firing O/P 3 | IP Monitor 1 | Network 4 | |

### 8.4 PARAMETER TABLE (Cont.)

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|
| Access.ClearMemory | Cold Start the Instrument | uint8 | 07EA | 2026 |
| Access.ConfigurationPasscode | Configuration Code (Default = 3) | int16 | 07E5 | 2021 |
| Access.EngineerPasscode | Engineer Code (Default = 2) | int16 | 07E4 | 2020 |
| Access.Goto | Goto | uint8 | 07E2 | 2018 |
| Access.IM | Instrument Mode<br>(0= Operating, 1 = Standby, 2 = Configuration) | uint8 | 00C7 | 199 |
| Access.Keylock | Lock Instrument (0 = none, 1 = All, 2 = Edit) | uint8 | 07E9 | 2025 |
| Access.Passcode | Passcode Request | int16 | 07E3 | 2019 |
| Access.QuickStartPasscode | Quick Start Code (Default = 4) | int16 | 07E6 | 2022 |
| Comms.RmtPanel.Address | Address (1 to 254) | uint8 | 0796 | 1942 |
| Comms.RmtPanel.Baud | Baud Rate (0 = 9600, 1 = 19,200) | uint8 | 0797 | 1943 |
| Comms.User.Address | Comms Address (Range depends on protocol) | uint8 | 076C | 1900 |
| Comms.User.Baud | Baud Rate<br>(0 = 9600, 1 = 19,200, 2 = 4800, 3 = 2400, 4 = 1200<br>10 = 125kb, 250kb, 500kb, 13 = 1Mb) | uint8 | 076D | 1901 |
| Comms.User.DCHP_enable | DHCP Type (0 = fixed, 1 = dynamic) | bool | 0780 | 1920 |
| Comms.User.Default_Gateway_1 | 1st byte of Default Gateway | uint8 | 0778 | 1912 |
| Comms.User.Default_Gateway_2 | 2nd byte of Default Gateway | uint8 | 0779 | 1913 |
| Comms.User.Default_Gateway_3 | 3rd byte of Default Gateway | uint8 | 077A | 1914 |
| Comms.User.Default_Gateway_4 | 4th byte of Default Gateway | uint8 | 077B | 1915 |
| Comms.User.Delay | TX Delay time (0 = off, 1 = on) | uint8 | 076F | 1903 |
| Comms.User.Extension_Cycles | Number of CC Link Extension Cycles | uint8 | 0799 | 1945 |
| Comms.User.Id | Comms Identity<br>(0 = none, 1 = EIA485, 5 = Ethernet, 10 = Network) | uint8 | 076A | 1898 |
| Comms.User.IP_address_1 | 1st byte of IP address. | uint8 | 0770 | 1904 |
| Comms.User.IP_address_2 | 2nd byte of IP address. | uint8 | 0771 | 1905 |
| Comms.User.IP_address_3 | 3rd byte of IP address. | uint8 | 0772 | 1906 |
| Comms.User.IP_address_4 | 4th byte of IP address. | uint8 | 0773 | 1907 |
| Comms.User.MAC1 | MAC address 1 | uint8 | 0789 | 1929 |
| Comms.User.MAC2 | MAC address 2 | uint8 | 078A | 1930 |
| Comms.User.MAC3 | MAC address 3 | uint8 | 078B | 1931 |
| Comms.User.MAC4 | MAC address 4 | uint8 | 078C | 1932 |
| Comms.User.MAC5 | MAC address 5 | uint8 | 078D | 1933 |
| Comms.User.MAC6 | MAC address 6 | uint8 | 078E | 1934 |
| Comms.User.NetStatus | Fieldbus Status | uint8 | 0795 | 1941 |
| Comms.User.Network | Ethernet Network status | int16 | 0781 | 1921 |
| Comms.User.Network_Version | CC Link Network Version | uint8 | 0798 | 1944 |
| Comms.User.Occupied_Stations | Occupied Stations | uint8 | 079A | 1946 |
| Comms.User.Parity | Parity setting (0 = none, 1 = even, 2 = odd) | uint8 | 076E | 1902 |
| Comms.User.PNDevNum | Profibus staftion number | uint8 | 0C01 | 3073 |
| Comms.User.PNinitMode | Profibus initialise mode | uint8 | 0C00 | 3072 |
| Comms.User.Pref_Mstr_IP_1 | 1st byte of Preferred Master IP address | uint8 | 077C | 1916 |
| Comms.User.Pref_Mstr_IP_2 | 2nd byte of Preferred Master IP address | uint8 | 077D | 1917 |
| Comms.User.Pref_Mstr_IP_3 | 3rd byte of Preferred Master IP address | uint8 | 077E | 1918 |
| Comms.User.Pref_Mstr_IP_4 | 4th byte of Preferred Master IP address | uint8 | 077F | 1919 |
| Comms.User.Protocol | Comms Protocol<br>(0 = Modbus, 5 = Ethernet, 10 = Network,11 = Profibus,<br>12 = DeviceNet, 13 = CanOpen, 14 = CCLink,<br>16 = Ethernet IP, 17 = Modbus TCP) | uint8 | 076B | 1899 |
| Comms.User.ShowMac | Show MAC address | bool | 0788 | 1928 |
| Comms.User.Subnet_Mask_1 | 1st byte of Subnet mask | uint8 | 0774 | 1908 |
| Comms.User.Subnet_Mask_2 | 2nd byte of Subnet mask | uint8 | 0775 | 1909 |
| Comms.User.Subnet_Mask_3 | 3rd byte of Subnet mask | uint8 | 0776 | 1910 |
| Comms.User.Subnet_Mask_4 | 4th byte of Subnet mask | uint8 | 0777 | 1911 |
| Comms.User.UnitIdent | Unit Identity Enable (0 = Strict, 1 = Loose, 2 = Instr.) | uint8 | 0787 | 1927 |
| Control.1.AlmAck.ClosedLoop | Process alarm ack: Closed loop break<br>(0 = No Ack, 1 = Ack) | uint8 | 03B7 | 951 |
| Control.1.AlmAck.Limitation | Indication alarm ack: Limitation<br>(0 = No Ack, 1 = Ack) | uint8 | 03B9 | 953 |

### 8.4 PARAMETER TABLE (Cont.)

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|
| Control.1.AlmAck.PVTransfer | Indication alarm ack: PV transfer (0 = No Ack, 1 = Ack) | uint8 | 03B8 | 952 |
| Control.1.AlmDet.ClosedLoop | Process alarm detection status: Closed loop break (0 = Inactive, 1 = Active) | uint8 | 03AE | 942 |
| Control.1.AlmDet.Limitation | Indication alarm detection status: Limitation (0 = Inactive, 1 = Active) | uint8 | 03B0 | 944 |
| Control.1.AlmDet.PVTransfer | Indication alarm detection status: PV transfer (0 = Inactive, 1 = Active) | uint8 | 03AF | 943 |
| Control.1.AlmDis.ClosedLoop | Process alarm: Closed loop break (0 = Enable, 1 = Disable) | uint8 | 03AB | 939 |
| Control.1.AlmDis.Limitation | Indication alarm: Limitation (0 = Enable, 1 = Disable) | uint8 | 03AD | 941 |
| Control.1.AlmDis.PVTransfer | Indication alarm: PV transfer (0 = Enable, 1 = Disable) | uint8 | 03AC | 940 |
| Control.1.AlmLat.ClosedLoop | Process alarm latch: Closed loop break (0 = No Latch, 1 = Latch) | uint8 | 03B4 | 948 |
| Control.1.AlmLat.Limitation | Indication alarm latch: Limitation (0 = No Latch, 1 = Latch) | uint8 | 03B6 | 950 |
| Control.1.AlmLat.PVTransfer | Indication alarm latch: PV transfer (0 = No Latch, 1 = Latch) | uint8 | 03B5 | 949 |
| Control.1.AlmSig.ClosedLoop | Process alarm signalling status: Closed loop break (0 = Not latched, 1 = Latched) | uint8 | 03B1 | 945 |
| Control.1.AlmSig.Limitation | Indication alarm signalling status: Limitation (0 = Not latched, 1 = Latched) | uint8 | 03B3 | 947 |
| Control.1.AlmSig.PVTransfer | Indication alarm signalling status: PV transfer (0 = Not latched, 1 = Latched) | uint8 | 03B2 | 946 |
| Control.1.AlmStop.ClosedLoop | Process alarm stop: Closed loop break (0 = No Stop, 1 = Stop) | uint8 | 03BA | 954 |
| Control.1.AlmStop.Limitation | Indication alarm stop: Limitation | uint8 | 03BC | 956 |
| Control.1.AlmStop.PVTransfer | Indication alarm stop: PV transfer | uint8 | 03BB | 955 |
| Control.1.Diag.Output | Output of the controller | float32 | 03A9 | 937 |
| Control.1.Diag.PAOP | Phase angle output for PA reduction in burst firing | float32 | 03AA | 938 |
| Control.1.Diag.Status | Status of the controller (0 = Main PV, 1 = Transfr, 4 = Limit 1, 5 = Limit 2, 6 = Limit 3) | uint8 | 03A8 | 936 |
| Control.1.Limit.PV1 | Threshold Limit PV1 | float32 | 03A1 | 929 |
| Control.1.Limit.PV2 | Threshold Limit PV2 | float32 | 03A2 | 930 |
| Control.1.Limit.PV3 | Threshold Limit PV3 | float32 | 03A3 | 931 |
| Control.1.Limit.SP1 | Threshold limit setpoint 1 | float32 | 03A4 | 932 |
| Control.1.Limit.SP2 | Threshold limit setpoint 2 | float32 | 03A5 | 933 |
| Control.1.Limit.SP3 | Threshold limit setpoint 3 | float32 | 03A6 | 934 |
| Control.1.Limit.TI | Integral time of the limit loop | float32 | 03A7 | 935 |
| Control.1.Main.PV | The main PV of the controller | float32 | 039C | 924 |
| Control.1.Main.SP | Main SP to control at | float32 | 039D | 925 |
| Control.1.Main.TI | Integral time of the main loop | float32 | 03A0 | 928 |
| Control.1.Main.TransferPV | The transfer (proportional limit) PV | float32 | 039E | 926 |
| Control.1.Main.TransferSpan | The transfer (proportional limit) span | float32 | 039F | 927 |
| Control.1.Setup.EnLimit | Enable Threshold Limit (0 = No, 1 = Yes) | uint8 | 0396 | 918 |
| Control.1.Setup.FFGain | Feedforward gain | float32 | 0399 | 921 |
| Control.1.Setup.FFOffset | Feedforward offset | float32 | 039A | 922 |
| Control.1.Setup.FFType | Defines the type of Feed Forward to be used (0 = Off, 1 = Trim, 2 = FFOnly) | uint8 | 0398 | 920 |
| Control.1.Setup.NominalPV | Nominal PV of this phase of power control | float32 | 0395 | 917 |
| Control.1.Setup.Standby | Put controller into standby (0 = No, 1 = Yes) | uint8 | 0394 | 916 |
| Control.1.Setup.TransferEn | Enable Transfer (Proportional limit) (0 = N0, 1 = Yes) | uint8 | 0397 | 919 |
| | Control 2. See Control 1 for enumeration values | | | |
| Control.2.AlmAck.ClosedLoop | Process alarm ack: Closed loop break | uint8 | 03E9 | 1001 |
| Control.2.AlmAck.Limitation | Indication alarm ack: Limitation | uint8 | 03EB | 1003 |
| Control.2.AlmAck.PVTransfer | Indication alarm ack: PV transfer | uint8 | 03EA | 1002 |
| Control.2.AlmDet.ClosedLoop | Process alarm detection status: Closed loop break | uint8 | 03E0 | 992 |
| Control.2.AlmDet.Limitation | Indication alarm detection status: Limitation | uint8 | 03E2 | 994 |
| Control.2.AlmDet.PVTransfer | Indication alarm detection status: PV transfer | uint8 | 03E1 | 993 |

**8.4 PARAMETER TABLE (Cont.)**

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|
| Control.2.AlmDis.ClosedLoop | Process alarm: Closed loop break | uint8 | 03DD | 989 |
| Control.2.AlmDis.Limitation | Indication alarm: Limitation | uint8 | 03DF | 991 |
| Control.2.AlmDis.PVTransfer | Indication alarm: PV transfer | uint8 | 03DE | 990 |
| Control.2.AlmLat.ClosedLoop | Process alarm latch: Closed loop break | uint8 | 03E6 | 998 |
| Control.2.AlmLat.Limitation | Indication alarm latch: Limitation | uint8 | 03E8 | 1000 |
| Control.2.AlmLat.PVTransfer | Indication alarm latch: PV transfer | uint8 | 03E7 | 999 |
| Control.2.AlmSig.ClosedLoop | Process alarm signalling status: Closed loop break | uint8 | 03E3 | 995 |
| Control.2.AlmSig.Limitation | Indication alarm signalling status: Limitation | uint8 | 03E5 | 997 |
| Control.2.AlmSig.PVTransfer | Indication alarm signalling status: PV transfer | uint8 | 03E4 | 996 |
| Control.2.AlmStop.ClosedLoop | Process alarm stop: Closed loop break | uint8 | 03EC | 1004 |
| Control.2.AlmStop.Limitation | Indication alarm stop: Limitation | uint8 | 03EE | 1006 |
| Control.2.AlmStop.PVTransfer | Indication alarm stop: PV transfer | uint8 | 03ED | 1005 |
| Control.2.Diag.Output | Output of the controller | float32 | 03DB | 987 |
| Control.2.Diag.PAOP | Phase angle output for PA reduction in burst firing | float32 | 03DC | 988 |
| Control.2.Diag.Status | Status of the controller | uint8 | 03DA | 986 |
| Control.2.Limit.PV1 | Threshold Limit PV1 | float32 | 03D3 | 979 |
| Control.2.Limit.PV2 | Threshold Limit PV2 | float32 | 03D4 | 980 |
| Control.2.Limit.PV3 | Threshold Limit PV3 | float32 | 03D5 | 981 |
| Control.2.Limit.SP1 | Threshold limit setpoint 1 | float32 | 03D6 | 982 |
| Control.2.Limit.SP2 | Threshold limit setpoint 2 | float32 | 03D7 | 983 |
| Control.2.Limit.SP3 | Threshold limit setpoint 3 | float32 | 03D8 | 984 |
| Control.2.Limit.TI | Integral time of the limit loop | float32 | 03D9 | 985 |
| Control.2.Main.PV | The main PV of the controller | float32 | 03CE | 974 |
| Control.2.Main.SP | Main SP to control at | float32 | 03CF | 975 |
| Control.2.Main.TI | Integral time of the main loop | float32 | 03D2 | 978 |
| Control.2.Main.TransferPV | The transfer (proportional limit) PV | float32 | 03D0 | 976 |
| Control.2.Main.TransferSpan | The transfer (proportional limit) span | float32 | 03D1 | 977 |
| Control.2.Setup.EnLimit | Enable Threshold Limit | uint8 | 03C8 | 968 |
| Control.2.Setup.FFGain | Feedforward gain | float32 | 03CB | 971 |
| Control.2.Setup.FFOffset | Feedforward offset | float32 | 03CC | 972 |
| Control.2.Setup.FFType | Defines the type of Feed Forward to be used | uint8 | 03CA | 970 |
| Control.2.Setup.NominalPV | Nominal PV of this phase of power control | float32 | 03C7 | 967 |
| Control.2.Setup.Standby | Put controller into standby | uint8 | 03C6 | 966 |
| Control.2.Setup.TransferEn | Enable Transfer (Proportional limit) | uint8 | 03C9 | 969 |
| | Control 3. See Control 1 for enumeration values | | | |
| Control.3.AlmAck.ClosedLoop | Process alarm ack: Closed loop break | uint8 | 041B | 1051 |
| Control.3.AlmAck.Limitation | Indication alarm ack: Limitation | uint8 | 041D | 1053 |
| Control.3.AlmAck.PVTransfer | Indication alarm ack: PV transfer | uint8 | 041C | 1052 |
| Control.3.AlmDet.ClosedLoop | Process alarm detection status: Closed loop break | uint8 | 0412 | 1042 |
| Control.3.AlmDet.Limitation | Indication alarm detection status: Limitation | uint8 | 0414 | 1044 |
| Control.3.AlmDet.PVTransfer | Indication alarm detection status: PV transfer | uint8 | 0413 | 1043 |
| Control.3.AlmDis.ClosedLoop | Process alarm: Closed loop break | uint8 | 040F | 1039 |
| Control.3.AlmDis.Limitation | Indication alarm: Limitation | uint8 | 0411 | 1041 |
| Control.3.AlmDis.PVTransfer | Indication alarm: PV transfer | uint8 | 0410 | 1040 |
| Control.3.AlmLat.ClosedLoop | Process alarm latch: Closed loop break | uint8 | 0418 | 1048 |
| Control.3.AlmLat.Limitation | Indication alarm latch: Limitation | uint8 | 041A | 1050 |
| Control.3.AlmLat.PVTransfer | Indication alarm latch: PV transfer | uint8 | 0419 | 1049 |
| Control.3.AlmSig.ClosedLoop | Process alarm signalling status: Closed loop break | uint8 | 0415 | 1045 |
| Control.3.AlmSig.Limitation | Indication alarm signalling status: Limitation | uint8 | 0417 | 1047 |
| Control.3.AlmSig.PVTransfer | Indication alarm signalling status: PV transfer | uint8 | 0416 | 1046 |
| Control.3.AlmStop.ClosedLoop | Process alarm stop: Closed loop break | uint8 | 041E | 1054 |
| Control.3.AlmStop.Limitation | Indication alarm stop: Limitation | uint8 | 0420 | 1056 |
| Control.3.AlmStop.PVTransfer | Indication alarm stop: PV transfer | uint8 | 041F | 1055 |
| Control.3.Diag.Output | Output of the controller | float32 | 040D | 1037 |
| Control.3.Diag.PAOP | Phase angle output for PA reduction in burst firing | float32 | 040E | 1038 |
| Control.3.Diag.Status | Status of the controller | uint8 | 040C | 1036 |
| Control.3.Limit.PV1 | Threshold Limit PV1 | float32 | 0405 | 1029 |
| Control.3.Limit.PV2 | Threshold Limit PV2 | float32 | 0406 | 1030 |
| Control.3.Limit.PV3 | Threshold Limit PV3 | float32 | 0407 | 1031 |

### 8.4 PARAMETER TABLE (Cont.)

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|
| Control.3.Limit.SP1 | Threshold limit setpoint 1 | float32 | 0408 | 1032 |
| Control.3.Limit.SP2 | Threshold limit setpoint 2 | float32 | 0409 | 1033 |
| Control.3.Limit.SP3 | Threshold limit setpoint 3 | float32 | 040A | 1034 |
| Control.3.Limit.TI | Integral time of the limit loop | float32 | 040B | 1035 |
| Control.3.Main.PV | The main PV of the controller | float32 | 0400 | 1024 |
| Control.3.Main.SP | Main SP to control at | float32 | 0401 | 1025 |
| Control.3.Main.TI | Integral time of the main loop | float32 | 0404 | 1028 |
| Control.3.Main.TransferPV | The transfer (proportional limit) PV | float32 | 0402 | 1026 |
| Control.3.Main.TransferSpan | The transfer (proportional limit) span | float32 | 0403 | 1027 |
| Control.3.Setup.EnLimit | Enable Threshold Limit | uint8 | 03FA | 1018 |
| Control.3.Setup.FFGain | Feedforward gain | float32 | 03FD | 1021 |
| Control.3.Setup.FFOffset | Feedforward offset | float32 | 03FE | 1022 |
| Control.3.Setup.FFType | Defines the type of Feed Forward to be used | uint8 | 03FC | 1020 |
| Control.3.Setup.NominalPV | Nominal PV of this phase of power control | float32 | 03F9 | 1017 |
| Control.3.Setup.Standby | Put controller into standby | uint8 | 03F8 | 1016 |
| Control.3.Setup.TransferEn | Enable Transfer (Proportional limit) | uint8 | 03FB | 1019 |
| | Control 4. See Control 1 for enumeration values | | | |
| Control.4.AlmAck.ClosedLoop | Process alarm ack: Closed loop break | uint8 | 044D | 1101 |
| Control.4.AlmAck.Limitation | Indication alarm ack: Limitation | uint8 | 044F | 1103 |
| Control.4.AlmAck.PVTransfer | Indication alarm ack: PV transfer | uint8 | 044E | 1102 |
| Control.4.AlmDet.ClosedLoop | Process alarm detection status: Closed loop break | uint8 | 0444 | 1092 |
| Control.4.AlmDet.Limitation | Indication alarm detection status: Limitation | uint8 | 0446 | 1094 |
| Control.4.AlmDet.PVTransfer | Indication alarm detection status: PV transfer | uint8 | 0445 | 1093 |
| Control.4.AlmDis.ClosedLoop | Process alarm: Closed loop break | uint8 | 0441 | 1089 |
| Control.4.AlmDis.Limitation | Indication alarm: Limitation | uint8 | 0443 | 1091 |
| Control.4.AlmDis.PVTransfer | Indication alarm: PV transfer | uint8 | 0442 | 1090 |
| Control.4.AlmLat.ClosedLoop | Process alarm latch: Closed loop break | uint8 | 044A | 1098 |
| Control.4.AlmLat.Limitation | Indication alarm latch: Limitation | uint8 | 044C | 1100 |
| Control.4.AlmLat.PVTransfer | Indication alarm latch: PV transfer | uint8 | 044B | 1099 |
| Control.4.AlmSig.ClosedLoop | Process alarm signalling status: Closed loop break | uint8 | 0447 | 1095 |
| Control.4.AlmSig.Limitation | Indication alarm signalling status: Limitation | uint8 | 0449 | 1097 |
| Control.4.AlmSig.PVTransfer | Indication alarm signalling status: PV transfer | uint8 | 0448 | 1096 |
| Control.4.AlmStop.ClosedLoop | Process alarm stop: Closed loop break | uint8 | 0450 | 1104 |
| Control.4.AlmStop.Limitation | Indication alarm stop: Limitation | uint8 | 0452 | 1106 |
| Control.4.AlmStop.PVTransfer | Indication alarm stop: PV transfer | uint8 | 0451 | 1105 |
| Control.4.Diag.Output | Output of the controller | float32 | 043F | 1087 |
| Control.4.Diag.PAOP | Phase angle output for PA reduction in burst firing | float32 | 0440 | 1088 |
| Control.4.Diag.Status | Status of the controller | uint8 | 043E | 1086 |
| Control.4.Limit.PV1 | Threshold Limit PV1 | float32 | 0437 | 1079 |
| Control.4.Limit.PV2 | Threshold Limit PV2 | float32 | 0438 | 1080 |
| Control.4.Limit.PV3 | Threshold Limit PV3 | float32 | 0439 | 1081 |
| Control.4.Limit.SP1 | Threshold limit setpoint 1 | float32 | 043A | 1082 |
| Control.4.Limit.SP2 | Threshold limit setpoint 2 | float32 | 043B | 1083 |
| Control.4.Limit.SP3 | Threshold limit setpoint 3 | float32 | 043C | 1084 |
| Control.4.Limit.TI | Integral time of the limit loop | float32 | 043D | 1085 |
| Control.4.Main.PV | The main PV of the controller | float32 | 0432 | 1074 |
| Control.4.Main.SP | Main SP to control at | float32 | 0433 | 1075 |
| Control.4.Main.TI | Integral time of the main loop | float32 | 0436 | 1078 |
| Control.4.Main.TransferPV | The transfer (proportional limit) PV | float32 | 0434 | 1076 |
| Control.4.Main.TransferSpan | The transfer (proportional limit) span | float32 | 0435 | 1077 |
| Control.4.Setup.EnLimit | Enable Threshold Limit | uint8 | 042C | 1068 |
| Control.4.Setup.FFGain | Feedforward gain | float32 | 042F | 1071 |
| Control.4.Setup.FFOffset | Feedforward offset | float32 | 0430 | 1072 |
| Control.4.Setup.FFType | Defines the type of Feed Forward to be used | uint8 | 042E | 1070 |
| Control.4.Setup.NominalPV | Nominal PV of this phase of power control | float32 | 042B | 1067 |
| Control.4.Setup.Standby | Put controller into standby | uint8 | 042A | 1066 |
| Control.4.Setup.TransferEn | Enable Transfer (Proportional limit) | uint8 | 042D | 1069 |
| Counter.1.ClearOverflow | Clear OverFlow Flag (0 = No, 1 = Yes) | bool | 0A12 | 2578 |
| Counter.1.Clock | Clock Input | bool | 0A0E | 2574 |

### 8.4 PARAMETER TABLE (Cont.)

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|
| Counter.1.Count | Count Value | int32 | 0A10 | 2576 |
| Counter.1.Direction | Direction of Count (0 = Up, 1 = Down) | bool | 0A0B | 2571 |
| Counter.1.Enable | Enable the Counter (0 = N0, 1 = Yes) | bool | 0A0A | 2570 |
| Counter.1.OverFlow | Overflow Flag (0 = No, 1 = Yes) | bool | 0A0D | 2573 |
| Counter.1.Reset | Counter Reset (0 = No, 1 = Yes) | bool | 0A11 | 2577 |
| Counter.1.RippleCarry | Ripple Carry Enable Output (0 = Off, 1 = On) | bool | 0A0C | 2572 |
| Counter.1.Target | Counter Target | int32 | 0A0F | 2575 |
| Counter.2.ClearOverflow | Clear OverFlow Flag (0 = No, 1 = Yes) | bool | 0A25 | 2597 |
| Counter.2.Clock | Clock Input | bool | 0A21 | 2593 |
| Counter.2.Count | Count Value | int32 | 0A23 | 2595 |
| Counter.2.Direction | Direction of Count (0 = Up, 1 = Down) | bool | 0A1E | 2590 |
| Counter.2.Enable | Enable the Counter (0 = No, 1 = Yes) | bool | 0A1D | 2589 |
| Counter.2.OverFlow | Overflow Flag (0 = No, 1 = Yes) | bool | 0A20 | 2592 |
| Counter.2.Reset | Counter Reset (0 = No, 1 = Yes) | bool | 0A24 | 2596 |
| Counter.2.RippleCarry | Ripple Carry Enable Output (0 = Off, 1 = On) | bool | 0A1F | 2591 |
| Counter.2.Target | Counter Target | int32 | 0A22 | 2594 |
| Counter.3.ClearOverflow | Clear OverFlow Flag (0 = No, 1 = Yes) | bool | 0A38 | 2616 |
| Counter.3.Clock | Clock Input | bool | 0A34 | 2612 |
| Counter.3.Count | Count Value | int32 | 0A36 | 2614 |
| Counter.3.Direction | Direction of Count (0 = Up, 1 = Down) | bool | 0A31 | 2609 |
| Counter.3.Enable | Enable the Counter (0 = No, 1 = Yes) | bool | 0A30 | 2608 |
| Counter.3.OverFlow | Overflow Flag (0 = No, 1 = Yes) | bool | 0A33 | 2611 |
| Counter.3.Reset | Counter Reset (0 = No, 1 = Yes) | bool | 0A37 | 2615 |
| Counter.3.RippleCarry | Ripple Carry Enable Output (0 = Off, 1 = On) | bool | 0A32 | 2610 |
| Counter.3.Target | Counter Target | int32 | 0A35 | 2613 |
| Counter.4.ClearOverflow | Clear OverFlow Flag (0 = No, 1 = Yes) | bool | 0A4B | 2635 |
| Counter.4.Clock | Clock Input | bool | 0A47 | 2631 |
| Counter.4.Count | Count Value | int32 | 0A49 | 2633 |
| Counter.4.Direction | Direction of Count (0 = Up, 1 = Down) | bool | 0A44 | 2628 |
| Counter.4.Enable | Enable the Counter (0 = No, 1 = Yes) | bool | 0A43 | 2627 |
| Counter.4.OverFlow | Overflow Flag (0 = No, 1 = Yes) | bool | 0A46 | 2630 |
| Counter.4.Reset | Counter Reset (0 = No, 1 = Yes) | bool | 0A4A | 2634 |
| Counter.4.RippleCarry | Ripple Carry Enable Output (0 = Off, 1 = On) | bool | 0A45 | 2629 |
| Counter.4.Target | Counter Target | int32 | 0A48 | 2632 |
| CustPage.1.CISP1 | Parameter 1 | uint32 | 07F8 | 2040 |
| CustPage.1.CISP2 | Parameter 2 | uint32 | 07F9 | 2041 |
| CustPage.1.CISP3 | Parameter 3 | uint32 | 07FA | 2042 |
| CustPage.1.CISP4 | Parameter 4 | uint32 | 07FB | 2043 |
| CustPage.1.Style1 | Custom Line 1 Style | uint8 | 07FC | 2044 |
| CustPage.1.Style2 | Custom Line 2 Style | uint8 | 07FD | 2045 |
| CustPage.1.Style3 | Custom Line 3 Style | uint8 | 07FE | 2046 |
| CustPage.1.Style4 | Custom Line 4 Style | uint8 | 07FF | 2047 |
| CustPage.1.UserText1 | Custom Text 1 | string | 4000 | 16384 |
| CustPage.1.UserText2 | Custom Text 2 | string | 4005 | 16389 |
| CustPage.1.UserText3 | Custom Text 3 | string | 400A | 16394 |
| CustPage.1.UserText4 | Custom Text 4 | string | 400F | 16399 |
| CustPage.2.CISP1 | Parameter 1 | uint32 | 080C | 2060 |
| CustPage.2.CISP2 | Parameter 2 | uint32 | 080D | 2061 |
| CustPage.2.CISP3 | Parameter 3 | uint32 | 080E | 2062 |
| CustPage.2.CISP4 | Parameter 4 | uint32 | 080F | 2063 |
| CustPage.2.Style1 | Custom Line 1 Style | uint8 | 0810 | 2064 |
| CustPage.2.Style2 | Custom Line 2 Style | uint8 | 0811 | 2065 |
| CustPage.2.Style3 | Custom Line 3 Style | uint8 | 0812 | 2066 |
| CustPage.2.Style4 | Custom Line 4 Style | uint8 | 0813 | 2067 |
| CustPage.2.UserText1 | Custom Text 1 | string | 4014 | 16404 |
| CustPage.2.UserText2 | Custom Text 2 | string | 4019 | 16409 |
| CustPage.2.UserText3 | Custom Text 3 | string | 401E | 16414 |

### 8.4 PARAMETER TABLE (Cont.)

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|
| CustPage.2.UserText4 | Custom Text 4 | string | 4023 | 16419 |
| CustPage.3.CISP1 | Parameter 1 | uint32 | 0820 | 2080 |
| CustPage.3.CISP2 | Parameter 2 | uint32 | 0821 | 2081 |
| CustPage.3.CISP3 | Parameter 3 | uint32 | 0822 | 2082 |
| CustPage.3.CISP4 | Parameter 4 | uint32 | 0823 | 2083 |
| CustPage.3.Style1 | Custom Line 1 Style | uint8 | 0824 | 2084 |
| CustPage.3.Style2 | Custom Line 2 Style | uint8 | 0825 | 2085 |
| CustPage.3.Style3 | Custom Line 3 Style | uint8 | 0826 | 2086 |
| CustPage.3.Style4 | Custom Line 4 Style | uint8 | 0827 | 2087 |
| CustPage.3.UserText1 | Custom Text 1 | string | 4028 | 16424 |
| CustPage.3.UserText2 | Custom Text 2 | string | 402D | 16429 |
| CustPage.3.UserText3 | Custom Text 3 | string | 4032 | 16434 |
| CustPage.3.UserText4 | Custom Text 4 | string | 4037 | 16439 |
| CustPage.4.CISP1 | Parameter 1 | uint32 | 0834 | 2100 |
| CustPage.4.CISP2 | Parameter 2 | uint32 | 0835 | 2101 |
| CustPage.4.CISP3 | Parameter 3 | uint32 | 0836 | 2102 |
| CustPage.4.CISP4 | Parameter 4 | uint32 | 0837 | 2103 |
| CustPage.4.Style1 | Custom Line 1 Style | uint8 | 0838 | 2104 |
| CustPage.4.Style2 | Custom Line 2 Style | uint8 | 0839 | 2105 |
| CustPage.4.Style3 | Custom Line 3 Style | uint8 | 083A | 2106 |
| CustPage.4.Style4 | Custom Line 4 Style | uint8 | 083B | 2107 |
| CustPage.4.UserText1 | Custom Text 1 | string | 403C | 16444 |
| CustPage.4.UserText2 | Custom Text 2 | string | 4041 | 16449 |
| CustPage.4.UserText3 | Custom Text 3 | string | 4046 | 16454 |
| CustPage.4.UserText4 | Custom Text 4 | string | 404B | 16459 |
| Energy.1.AutoScaleUnits | Autoscale energy units (0 = No, 1 = Yes) | bool | 0B0F | 2831 |
| Energy.1.Hold | Hold the output of the counter | bool | 0B05 | 2821 |
| Energy.1.Input | Input to totalise | float32 | 0B06 | 2822 |
| Energy.1.prvTotEnergy | Internal value of the Energy in Watt-hours | float32 | 0B10 | 2832 |
| Energy.1.prvUsrEnergy | Internal value of the Energy in Watt-hours | float32 | 0B11 | 2833 |
| Energy.1.Pulse | Pulsed output | bool | 0B09 | 2825 |
| Energy.1.PulseLen | Length of the pulse in ms | uint16 | 0B0A | 2826 |
| Energy.1.PulseScale | Amount of energy per pulse<br>(0 = Disabled, 1 = 1, 2 = 10, 3 = 100, 4 = 1k<br>5 = 10k, 6 = 100k, 7 = 1M) | uint8 | 0B0C | 2828 |
| Energy.1.Reset | Set the user counter back to zero | bool | 0B07 | 2823 |
| Energy.1.TotEnergy | The global energy | float32 | 0B08 | 2824 |
| Energy.1.TotEnergyUnit | Total energy counter units multiplier.<br>(0 = 1; 1 = 10, 2 = 100, 3 = 1k, 4 = 10k, 5 = 100k<br>6 = 1M. 7 = 10M, 8 = 100M, 9 = 1G) | uint8 | 0B0D | 2829 |
| Energy.1.Type | Type of energy counter (0 = Normal, 1 = Global) | bool | 0B0E | 2830 |
| Energy.1.UsrEnergy | User resetable energy | float32 | 0B04 | 2820 |
| Energy.1.UsrEnergyUnit | User energy units multiplier.<br>(0 = 1; 1 = 10, 2 = 100, 3 = 1k, 4 = 10k, 5 = 100k<br>6 = 1M. 7 = 10M, 8 = 100M, 9 = 1G) | uint8 | 0B0B | 2827 |
| Energy.2.AutoScaleUnits | Autoscale the unit of the energy (0 = No, 1 = Yes) | bool | 0B23 | 2851 |
| Energy.2.Hold | Hold the output of the counter | bool | 0B19 | 2841 |
| Energy.2.Input | Input to totalise | float32 | 0B1A | 2842 |
| Energy.2.prvTotEnergy | Internal value of the Energy in Watt-hours | float32 | 0B24 | 2852 |
| Energy.2.prvUsrEnergy | Internal value of the Energy in Watt-hours | float32 | 0B25 | 2853 |
| Energy.2.Pulse | Pulsed output | bool | 0B1D | 2845 |
| Energy.2.PulseLen | Length of the pulse in ms | uint16 | 0B1E | 2846 |
| Energy.2.PulseScale | Amount of energy per pulse (as 'Energy 1') | uint8 | 0B20 | 2848 |
| Energy.2.Reset | Set the user counter back to zero | bool | 0B1B | 2843 |
| Energy.2.TotEnergy | The global energy | float32 | 0B1C | 2844 |
| Energy.2.TotEnergyUnit | Total energy counter units (as 'Energy 1') | uint8 | 0B21 | 2849 |
| Energy.2.Type | Type of energy counter (0 = Normal, 1 = Global) | bool | 0B22 | 2850 |
| Energy.2.UsrEnergy | User resetable energy | float32 | 0B18 | 2840 |

### 8.4 PARAMETER TABLE (Cont.)

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|
| Energy.2.UsrEnergyUnit | User energy units multiplier (as 'Energy 1') | uint8 | 0B1F | 2847 |
| Energy.3.AutoScaleUnits | Autoscale the unit of the energy (0 = No, 1 = Yes) | bool | 0B37 | 2871 |
| Energy.3.Hold | Hold the output of the counter | bool | 0B2D | 2861 |
| Energy.3.Input | Input to totalize | float32 | 0B2E | 2862 |
| Energy.3.prvTotEnergy | Internal value of the Energy in Watt-hours | float32 | 0B38 | 2872 |
| Energy.3.prvUsrEnergy | Internal value of the Energy in Watt-hours | float32 | 0B39 | 2873 |
| Energy.3.Pulse | Pulsed output | bool | 0B31 | 2865 |
| Energy.3.PulseLen | Length of the pulse in ms | uint16 | 0B32 | 2866 |
| Energy.3.PulseScale | Amount of energy per pulse (as 'Energy 1') | uint8 | 0B34 | 2868 |
| Energy.3.Reset | Set the user counter back to zero | bool | 0B2F | 2863 |
| Energy.3.TotEnergy | The global energy | float32 | 0B30 | 2864 |
| Energy.3.TotEnergyUnit | Total energy counter units (as 'Energy 1') | uint8 | 0B35 | 2869 |
| Energy.3.Type | Type of energy counter (0 = Normal, 1 = Global) | bool | 0B36 | 2870 |
| Energy.3.UsrEnergy | User resetable energy | float32 | 0B2C | 2860 |
| Energy.3.UsrEnergyUnit | User energy units multiplier (as 'Energy 1') | uint8 | 0B33 | 2867 |
| Energy.4.AutoScaleUnits | Autoscale the unit of the energy (0 = No, 1 = Yes) | bool | 0B4B | 2891 |
| Energy.4.Hold | Hold the output of the counter | bool | 0B41 | 2881 |
| Energy.4.Input | Input to totalize | float32 | 0B42 | 2882 |
| Energy.4.prvTotEnergy | Internal value of the Energy in Watt-hours | float32 | 0B4C | 2892 |
| Energy.4.prvUsrEnergy | Internal value of the Energy in Watt-hours | float32 | 0B4D | 2893 |
| Energy.4.Pulse | Pulsed output | bool | 0B45 | 2885 |
| Energy.4.PulseLen | Length of the pulse in ms | uint16 | 0B46 | 2886 |
| Energy.4.PulseScale | Amount of energy per pulse (as 'Energy 1') | uint8 | 0B48 | 2888 |
| Energy.4.Reset | Set the user counter back to zero | bool | 0B43 | 2883 |
| Energy.4.TotEnergy | The global energy | float32 | 0B44 | 2884 |
| Energy.4.TotEnergyUnit | Total energy counter units (as 'Energy 1') | uint8 | 0B49 | 2889 |
| Energy.4.Type | Type of energy counter (0 = Normal, 1 = Global) | bool | 0B4A | 2890 |
| Energy.4.UsrEnergy | User resetable energy | float32 | 0B40 | 2880 |
| Energy.4.UsrEnergyUnit | User energy units multiplier (as 'Energy 1') | uint8 | 0B47 | 2887 |
| Energy.5.AutoScaleUnits | Autoscale the unit of the energy (0 = No, 1 = Yes) | bool | 0B5F | 2911 |
| Energy.5.Hold | Hold the output of the counter | bool | 0B55 | 2901 |
| Energy.5.Input | Input to totalize | float32 | 0B56 | 2902 |
| Energy.5.prvTotEnergy | Internal value of the Energy in Watt-hours | float32 | 0B60 | 2912 |
| Energy.5.prvUsrEnergy | Internal value of the Energy in Watt-hours | float32 | 0B61 | 2913 |
| Energy.5.Pulse | Pulsed output | bool | 0B59 | 2905 |
| Energy.5.PulseLen | Length of the pulse in ms | uint16 | 0B5A | 2906 |
| Energy.5.PulseScale | Amount of energy per pulse (as 'Energy 1') | uint8 | 0B5C | 2908 |
| Energy.5.Reset | Set the user counter back to zero | bool | 0B57 | 2903 |
| Energy.5.TotEnergy | The global energy | float32 | 0B58 | 2904 |
| Energy.5.TotEnergyUnit | Total energy counter units (as 'Energy 1') | uint8 | 0B5D | 2909 |
| Energy.5.Type | Type of energy counter (0 = Normal, 1 = Global) | bool | 0B5E | 2910 |
| Energy.5.UsrEnergy | User resetable energy | float32 | 0B54 | 2900 |
| Energy.5.UsrEnergyUnit | User energy units multiplier (as 'Energy 1') | uint8 | 0B5B | 2907 |
| EventLog.Event01ID | Event 1 identification | uint8 | 070F | 1807 |
| EventLog.Event01Type | Event 1 type | uint8 | 070E | 1806 |
| EventLog.Event02ID | Event 2 Identification | uint8 | 0711 | 1809 |
| EventLog.Event02Type | Event 2 type | uint8 | 0710 | 1808 |
| EventLog.Event03ID | Event 3 Identification | uint8 | 0713 | 1811 |
| EventLog.Event03Type | Event 3 type | uint8 | 0712 | 1810 |
| EventLog.Event04ID | Event 4 Identification | uint8 | 0715 | 1813 |
| EventLog.Event04Type | Event 4 type | uint8 | 0714 | 1812 |
| EventLog.Event05ID | Event 5 Identification | uint8 | 0717 | 1815 |
| EventLog.Event05Type | Event 5 type | uint8 | 0716 | 1814 |
| EventLog.Event06ID | Event 6 Identification | uint8 | 0719 | 1817 |
| EventLog.Event06Type | Event 6 type | uint8 | 0718 | 1816 |
| EventLog.Event07ID | Event 7 Identification | uint8 | 071B | 1819 |
| EventLog.Event07Type | Event 7 type | uint8 | 071A | 1818 |
| EventLog.Event08ID | Event 8 Identification | uint8 | 071D | 1821 |

## 8.4 PARAMETER TABLE (Cont.)

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|
| EventLog.Event08Type | Event 8 type | uint8 | 071C | 1820 |
| EventLog.Event09ID | Event 9 Identification | uint8 | 071F | 1823 |
| EventLog.Event09Type | Event 9 type | uint8 | 071E | 1822 |
| EventLog.Event10ID | Event 10 Identification | uint8 | 0721 | 1825 |
| EventLog.Event10Type | Event 10 type | uint8 | 0720 | 1824 |
| EventLog.Event11ID | Event 11 Identification | uint8 | 0723 | 1827 |
| EventLog.Event11Type | Event 11 type | uint8 | 0722 | 1826 |
| EventLog.Event12ID | Event 12 Identification | uint8 | 0725 | 1829 |
| EventLog.Event12Type | Event 12 type | uint8 | 0724 | 1828 |
| EventLog.Event13ID | Event 13 Identification | uint8 | 0727 | 1831 |
| EventLog.Event13Type | Event 13 type | uint8 | 0726 | 1830 |
| EventLog.Event14ID | Event 14 Identification | uint8 | 0729 | 1833 |
| EventLog.Event14Type | Event 14 type | uint8 | 0728 | 1832 |
| EventLog.Event15ID | Event 15 Identification | uint8 | 072B | 1835 |
| EventLog.Event15Type | Event 15 type | uint8 | 072A | 1834 |
| EventLog.Event16ID | Event 16 Identification | uint8 | 072D | 1837 |
| EventLog.Event16Type | Event 16 type | uint8 | 072C | 1836 |
| EventLog.Event17ID | Event 17 Identification | uint8 | 072F | 1839 |
| EventLog.Event17Type | Event 17 type | uint8 | 072E | 1838 |
| EventLog.Event18ID | Event 18 Identification | uint8 | 0731 | 1841 |
| EventLog.Event18Type | Event 18 type | uint8 | 0730 | 1840 |
| EventLog.Event19ID | Event 19 Identification | uint8 | 0733 | 1843 |
| EventLog.Event19Type | Event 19 type | uint8 | 0732 | 1842 |
| EventLog.Event20ID | Event 20 Identification | uint8 | 0735 | 1845 |
| EventLog.Event20Type | Event 20 type | uint8 | 0734 | 1844 |
| EventLog.Event21ID | Event 21 Identification | uint8 | 0737 | 1847 |
| EventLog.Event21Type | Event 21 type | uint8 | 0736 | 1846 |
| EventLog.Event22ID | Event 22 Identification | uint8 | 0739 | 1849 |
| EventLog.Event22Type | Event 22 type | uint8 | 0738 | 1848 |
| EventLog.Event23ID | Event 23 Identification | uint8 | 073B | 1851 |
| EventLog.Event23Type | Event 23 type | uint8 | 073A | 1850 |
| EventLog.Event24ID | Event 24 Identification | uint8 | 073D | 1853 |
| EventLog.Event24Type | Event 24 type | uint8 | 073C | 1852 |
| EventLog.Event25ID | Event 25 Identification | uint8 | 073F | 1855 |
| EventLog.Event25Type | Event 25 type | uint8 | 073E | 1854 |
| EventLog.Event26ID | Event 26 Identification | uint8 | 0741 | 1857 |
| EventLog.Event26Type | Event 26 type | uint8 | 0740 | 1856 |
| EventLog.Event27ID | Event 27 Identification | uint8 | 0743 | 1859 |
| EventLog.Event27Type | Event 27 type | uint8 | 0742 | 1858 |
| EventLog.Event28ID | Event 28 Identification | uint8 | 0745 | 1861 |
| EventLog.Event28Type | Event 28 type | uint8 | 0744 | 1860 |
| EventLog.Event29ID | Event 29 Identification | uint8 | 0747 | 1863 |
| EventLog.Event29Type | Event 29 type | uint8 | 0746 | 1862 |
| EventLog.Event30ID | Event 30 Identification | uint8 | 0749 | 1865 |
| EventLog.Event30Type | Event 30 type | uint8 | 0748 | 1864 |
| EventLog.Event31ID | Event 31 Identification | uint8 | 074B | 1867 |
| EventLog.Event31Type | Event 31 type | uint8 | 074A | 1866 |
| EventLog.Event32ID | Event 32 Identification | uint8 | 074D | 1869 |
| EventLog.Event32Type | Event 32 type | uint8 | 074C | 1868 |
| EventLog.Event33ID | Event 33 Identification | uint8 | 074F | 1871 |
| EventLog.Event33Type | Event 33 type | uint8 | 074E | 1870 |
| EventLog.Event34ID | Event 34 Identification | uint8 | 0751 | 1873 |
| EventLog.Event34Type | Event 34 type | uint8 | 0750 | 1872 |
| EventLog.Event35ID | Event 35 Identification | uint8 | 0753 | 1875 |
| EventLog.Event35Type | Event 35 type | uint8 | 0752 | 1874 |
| EventLog.Event36ID | Event 36 Identification | uint8 | 0755 | 1877 |
| EventLog.Event36Type | Event 36 type | uint8 | 0754 | 1876 |
| EventLog.Event37ID | Event 37 Identification | uint8 | 0757 | 1879 |
| EventLog.Event37Type | Event 37 type | uint8 | 0756 | 1878 |
| EventLog.Event38ID | Event 38 Identification | uint8 | 0759 | 1881 |
| EventLog.Event38Type | Event 38 type | uint8 | 0758 | 1880 |

**Event ID**

| | |
|---|---|
| 0 = No entry | 161 = InvPwrModRev |
| 1 = Conf Exit | 162 = HW Mismatch |
| 2 = Conf Entry | 163 = Pwr1 Ribbon |
| 3 = Power down | 164 = Pwr2 Ribbon |
| 4 = Coldstart | 165 = Pwr3 Ribbon |
| 5 = QuickStart Exit | 166 = Pwr4 Ribbon |
| 6 = QuickStart Entry | 167 = Pwr1EEprom |
| 7 = Global Avk | 168 = Pwr2EEprom |
| 21 = Missing Mains | 169 = Pwr3EEprom |
| 22 = Thy Short cct. | 170 = Pwr4EEprom |
| 23 = Thy open cct. | 171 = Log Fault |
| 24 = Fuse Blown | 172 = PWR1cal |
| 25 = Over Temp | 173 = PWR2cal |
| 26 = Netw Dip | 174 = PWR3cal |
| 27 = Mains Freq | 175 = PWR4cal |
| 28 = PMod 24 | 176 = Watchdog |
| 51 = TLF | 177 = StdIOCal |
| 52 = Chop Off | 178 = Opt1IOCal |
| 53 = PLF | 179 = Opt2IOCal |
| 54 = PLU | 180 = Opt3IOCal |
| 55 = Main V Fault | 191 = Ph1Wdog |
| 56 = Temp Pre-Alarm | 192 = Ph1ComErr |
| 57 = Input Brk | 193 = Ph1ComTout |
| 58 = Out Fault | 194 = Ph2Wdog |
| 59 = ClosedLp | 195 = Ph2ComErr |
| 81 = PrcValTh | 196 = Ph2ComTout |
| 82 = Limit Act | 197 = Ph3Wdog |
| 83 = Load Overl | 198 = Ph3ComErr |
| 84 = LMoverSch | 199 = Ph3ComTout |
| 111 = High | 211 = Fuse Blown |
| 112 = Low | 212 = WdogFault |
| 113 = Dev Band | 213 = PwrRailFail |
| 114 = Dev Low | 214 = CommsTout |
| 115 = Dev High | 215 = Comms Err |
| 131 = Fuse Config | 241 = InvRamCsum |
| 132 = Restart Fail | 242 = DSPnoRSP |
| 151 = InvPAdata | 242 = DSPWdog |
| 152 = Inv wires | |

**Event types**

| | |
|---|---|
| 1 = Instrument | 33 = Ind Alm N3 InAct |
| 2 = Sys Alm N1 Act | 34 = Ind Alm N3 Ackd |
| 3 = Sys Alm N1 InAct | 35 = Ind Alm N4 Act |
| 4 = Sys Alm N1 Ackd | 36 = Ind Alm N4 InAct |
| 5 = Sys Alm N2 Act | 37 = Ind Alm N4 Ackd |
| 6 = Sys Alm N2 InAct | 38 = Prc Alm Ex1Act |
| 7 = Sys Alm N2 Ackd | 39 = Prc Alm Ex1InAct |
| 8 = Sys Alm N3 Act | 40 = Prc Alm Ex1Ackd |
| 9 = Sys Alm N3 InAct | 41 = Prc Alm Ex2Act |
| 10 = Sys Alm N3 Ackd | 42 = Prc Alm Ex2InAct |
| 11 = Sys Alm N4 Act | 43 = Prc Alm Ex2Ackd |
| 12 = Sys Alm N4 InAct | 44 = Prc Alm Ex3Act |
| 13 = Sys Alm N4 Ackd | 45 = Prc Alm Ex3InAct |
| 14 = Prc Alm N1 Act | 46 = Prc Alm Ex3Ackd |
| 15 = Prc Alm N1 InAct | 47 = Prc Alm Ex4Act |
| 16 = Prc Alm N1 Ackd | 48 = Prc Alm Ex4InAct |
| 17 = Prc Alm N2 Act | 49 = Prc Alm Ex4Ackd |
| 18 = Prc Alm N2 InAct | 50 = Err Fatal |
| 19 = Prc Alm N2 Ackd | 51 = Err Config |
| 20 = Prc Alm N3 Act | 52 = Err General |
| 21 = Prc Alm N3 InAct | 53 = Err Netw1 |
| 22 = Prc Alm N3 Ackd | 54 = Err Netw2 |
| 23 = Prc Alm N4 Act | 55 = Err Netw3 |
| 24 = Prc Alm N4 InAct | 56 = Err Netw4 |
| 25 = Prc Alm N4 Ackd | 57 = Err Pwr1 |
| 26 = Ind Alm N1 Act | 58 = Err Pwr2 |
| 27 = Ind Alm N1 InAct | 59 = Err Pwr3 |
| 28 = Ind Alm N1 Ackd | 60 = Err Pwr4 |
| 29 = Ind Alm N2 Act | 61 = Err DSP |
| 30 = Ind Alm N2 InAct | 62 = Err Restart |
| 32 = Ind Alm N3 Act | 63 = Err Standby |

### 8.4 PARAMETER TABLE (Cont.)

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|
| EventLog.Event39ID | Event 39 Identification | uint8 | 075B | 1883 |
| EventLog.Event39Type | Event 39 type | uint8 | 075A | 1882 |
| EventLog.Event40ID | Event 40 Identification | uint8 | 075D | 1885 |
| EventLog.Event40Type | Event 40 type | uint8 | 075C | 1884 |
| EventLog.Status | Status word to indicate instrument errors via comms | uint8 | 075F | 1887 |
| Faultdet.AlarmStatus1 | Alarm Status Word 1 | uint16 | 06A8 | 1704 |
| Faultdet.AlarmStatus2 | Alarm Status Word 2 | uint16 | 06A9 | 1705 |
| Faultdet.AnyFuseAl | Any Fuse Blown alarm | uint8 | 06A3 | 1699 |
| Faultdet.AnyNetwAl | Any Network Process Alarm | uint8 | 06A2 | 1698 |
| Faultdet.GeneralAck | Global Acknowledge | uint8 | 069F | 1695 |
| Faultdet.GlobalDis | Global Disable all alarms | uint8 | 06A4 | 1700 |
| Faultdet.StratStatus | Strategy Status Word<br>Bit 0 = Network 1 not firing<br>Bit 1 = Network 1 not synchronised<br>Bit 2 = Network 2 not firing<br>Bit 3 = Network 2 not synchronised<br>Bit 4 = Network 3 not firing<br>Bit 5 = Network 3 not synchronised<br>Bit 6 = Network 4 not firing<br>Bit 7 = Network 4 not synchronised<br>Bit 8= Strategy in Standby Mode<br>Bit 9 = Strategy in Telemetry Mode<br>Bits 10 to 15 Reserved. | uint16 | 06A6 | 1702 |
| Faultdet.Watchdog | Indicates Watchdog Relay Status (1 = Active) | uint8 | 06A7 | 1703 |
| FiringOP.1.DelayedTrigger | Delayed Triggering for transformer loads | uint8 | 04BA | 1210 |
| FiringOP.1.Enable | Enable of the firing output block | uint8 | 04BE | 1214 |
| FiringOP.1.In | Input of the firing output block | float32 | 04BB | 1211 |
| FiringOP.1.LoadCoupling | Load coupling configuration<br>(0 = 3S, 1 = 3D, 2 = 4S, 3 = 6D) | uint8 | 04B4 | 1204 |
| FiringOP.1.LoadType | Load type configuration (0 = Resistive, 1 = XFMR) | uint8 | 04B5 | 1205 |
| FiringOP.1.Mode | Firing Mode indication<br>(0 = IHC, 1 = Burst, 2 = PA, 3 = None) | uint8 | 04B6 | 1206 |
| FiringOP.1.PaLimitIn | Phase angle input for PA reduction in burst firing | float32 | 04BC | 1212 |
| FiringOP.1.SafetyRamp | Safety ramp duration | float32 | 04B7 | 1207 |
| FiringOP.1.SafetyRampStatus | Status of the safety ramp (0 = Ramping, 1 = Finished) | uint8 | 04BD | 1213 |
| FiringOP.1.SoftStart | Soft start duration | float32 | 04B8 | 1208 |
| FiringOP.1.SoftStop | Soft stop duration (0 = Off, 1 = On) | float32 | 04B9 | 1209 |
| FiringOP.2.DelayedTrigger | Delayed Triggering for transformer loads | uint8 | 04CF | 1231 |
| FiringOP.2.Enable | Enable of the firing output block | uint8 | 04D3 | 1235 |
| FiringOP.2.In | Input of the firing output block | float32 | 04D0 | 1232 |
| FiringOP.2.LoadCoupling | Load coupling configuration<br>(0 = 3S, 1 = 3D, 2 = 4S, 3 = 6D) | uint8 | 04C9 | 1225 |
| FiringOP.2.LoadType | Load type configuration (0 = Resistive, 1 = XFMR) | uint8 | 04CA | 1226 |
| FiringOP.2.Mode | Firing Mode indication<br>(0 = IHC, 1 = Burst, 2 = PA, 3 = None) | uint8 | 04CB | 1227 |
| FiringOP.2.PaLimitIn | Phase angle input for PA reduction in burst firing | float32 | 04D1 | 1233 |
| FiringOP.2.SafetyRamp | Safety ramp duration | float32 | 04CC | 1228 |
| FiringOP.2.SafetyRampStatus | Status of the safety ramp (0 = Ramping, 1 = Finished) | uint8 | 04D2 | 1234 |
| FiringOP.2.SoftStart | Soft start duration | float32 | 04CD | 1229 |
| FiringOP.2.SoftStop | Soft stop duration (0 = Off, 1 = On) | float32 | 04CE | 1230 |
| FiringOP.3.DelayedTrigger | Delayed Triggering for transformer loads | uint8 | 04E4 | 1252 |
| FiringOP.3.Enable | Enable of the firing output block | uint8 | 04E8 | 1256 |
| FiringOP.3.In | Input of the firing output block | float32 | 04E5 | 1253 |
| FiringOP.3.LoadCoupling | Load coupling configuration<br>(0 = 3S, 1 = 3D, 2 = 4S, 3 = 6D) | uint8 | 04DE | 1246 |
| FiringOP.3.LoadType | Load type configuration (0 = Resistive, 1 = XFMR) | uint8 | 04DF | 1247 |
| FiringOP.3.Mode | Firing Mode indication<br>(0 = IHC, 1 = Burst, 2 = PA, 3 = None) | uint8 | 04E0 | 1248 |

### 8.4 PARAMETER TABLE (Cont.)

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|
| FiringOP.3.PaLimitIn | Phase angle input for PA reduction in burst firing | float32 | 04E6 | 1254 |
| FiringOP.3.SafetyRamp | Safety ramp duration | float32 | 04E1 | 1249 |
| FiringOP.3.SafetyRampStatus | Status of the safety ramp (0 = Ramping, 1 = Finished) | uint8 | 04E7 | 1255 |
| FiringOP.3.SoftStart | Soft start duration | float32 | 04E2 | 1250 |
| FiringOP.3.SoftStop | Soft stop duration (0 = Off, 1 = On) | float32 | 04E3 | 1251 |
| FiringOP.4.DelayedTrigger | Delayed Triggering for transformer loads | uint8 | 04F9 | 1273 |
| FiringOP.4.Enable | Enable of the firing output block | uint8 | 04FD | 1277 |
| FiringOP.4.In | Input of the firing output block | float32 | 04FA | 1274 |
| FiringOP.4.LoadCoupling | Load coupling configuration (0 = 3S, 1 = 3D, 2 = 4S, 3 = 6D) | uint8 | 04F3 | 1267 |
| FiringOP.4.LoadType | Load type configuration (0 = Resistive, 1 = XFMR) | uint8 | 04F4 | 1268 |
| FiringOP.4.Mode | Firing Mode indication. (0 = IHC, 1 = Burst, 2 = PA, 3 = None) | uint8 | 04F5 | 1269 |
| FiringOP.4.PaLimitIn | Phase angle input for PA reduction in burst firing | float32 | 04FB | 1275 |
| FiringOP.4.SafetyRamp | Safety ramp duration | float32 | 04F6 | 1270 |
| FiringOP.4.SafetyRampStatus | Status of the safety ramp (0 = Ramping, 1 = Finished) | uint8 | 04FC | 1276 |
| FiringOP.4.SoftStart | Soft start duration | float32 | 04F7 | 1271 |
| FiringOP.4.SoftStop | Soft stop duration (0 = Off, 1 = On) | float32 | 04F8 | 1272 |
| Instrument.Configuration.IOModules | Number of Option IO Modules fitted | uint8 | 08A1 | 2209 |
| Instrument.Configuration.PwrModType | Type of module. (0 = None, 1 = External. 2 = Internal 3 = MC Air cooled; 4 = MC Water cooled) | uint8 | 08B4 | 2228 |
| Instrument.Configuration.LoadCoupling | Load coupling configuration (0 = 3S, 1 = 3D, 2 = 4S, 3 = 6D) | uint8 | 089A | 2202 |
| Instrument.Configuration. LoadCoupling2ndNetwork | Load 2 coupling configuration (as Load Coupling) | uint8 | 08A2 | 2210 |
| Instrument.Configuration.LoadMFitted | Load Management Card Fitted (0 = No, 1 = Yes) | bool | 08A4 | 2212 |
| Instrument.Configuration.NetType | The type of network (0 = 3Ph, 1 = 1Ph, 2 = 2Ph) | uint8 | 0897 | 2199 |
| Instrument.Configuration.PowerModules | Number of power modules fitted | uint8 | 0896 | 2198 |
| Instrument.Configuration.PwrMod1Rev | Power Module 1 Revision (0 = invalid) | uint8 | 089C | 2204 |
| Instrument.Configuration.PwrMod2Rev | Power Module 2 Revision (0 = invalid) | uint8 | 089D | 2205 |
| Instrument.Configuration.PwrMod3Rev | Power Module 3 Revision (0 = invalid) | uint8 | 089E | 2206 |
| Instrument.Configuration.PwrMod4Rev | Power Module 4 Revision (0 = invalid) | uint8 | 089F | 2207 |
| Instrument.Configuration.RemotePV | Remote PV | float32 | 08A3 | 2211 |
| Instrument.Configuration.TimerRes | Sets resolution of time parameters (0 = 0.1sec, 1 = 0.1 min) | uint8 | 08A0 | 2208 |
| Instrument.Display.Language | Selected Language (1 = Eng, 2 = Fra, 4 = Ger, 8 = Ita, 16 = Spa) | uint8 | 0879 | 2169 |
| Instrument.Display.SerialNo | Serial Number | int32 | 087A | 2170 |
| Instrument.ID | Instrument Identifier (E190h) | int16 | 007A | 122 |
| Instrument.Mode | Instrument Mode (0 = Operator mode, 1 = Standby, 2 = Config) | uint8 | 00C7 | 199 |
| IO.AnalogIP.1.Main.MeasVal | Measured value | float32 | 05D3 | 1491 |
| IO.AnalogIP.1.Main.PV | Process variable | float32 | 05D4 | 1492 |
| IO.AnalogIP.1.Main.RangeHigh | High input range for scaling to process units | float32 | 05D1 | 1489 |
| IO.AnalogIP.1.Main.RangeLow | Low input range for scaling to process units | float32 | 05D2 | 1490 |
| IO.AnalogIP.1.Main.Type | Specify the input type<br>0 = 0 to 10V 1 = 1 to 5V 2 = 2 to 10V<br>3 = 0 to 5V 4 = 0 to 20mA 5 = 4 to 20mA. | uint8 | 05D0 | 1488 |
| IO.AnalogIP.2.Main.MeasVal | Measured value | float32 | 05E2 | 1506 |
| IO.AnalogIP.2.Main.PV | Process variable | float32 | 05E3 | 1507 |
| IO.AnalogIP.2.Main.RangeHigh | High input range for scaling to process units | float32 | 05E0 | 1504 |
| IO.AnalogIP.2.Main.RangeLow | Low input range for scaling to process units | float32 | 05E1 | 1505 |
| IO.AnalogIP.2.Main.Type | Specify the input type (as IP1 above) | uint8 | 05DF | 1503 |
| IO.AnalogIP.3.Main.MeasVal | Measured value | float32 | 05F1 | 1521 |
| IO.AnalogIP.3.Main.PV | Process variable | float32 | 05F2 | 1522 |
| IO.AnalogIP.3.Main.RangeHigh | High input range for scaling to process units | float32 | 05EF | 1519 |
| IO.AnalogIP.3.Main.RangeLow | Low input range for scaling to process units | float32 | 05F0 | 1520 |

### 8.4 PARAMETER TABLE (Cont.)

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|
| IO.AnalogIP.3.Main.Type | Specify the input type (as IP1 above) | uint8 | 05EE | 1518 |
| IO.AnalogIP.4.Main.MeasVal | Measured value | float32 | 0600 | 1536 |
| IO.AnalogIP.4.Main.PV | Process variable | float32 | 0601 | 1537 |
| IO.AnalogIP.4.Main.RangeHigh | High input range for scaling to process units | float32 | 05FE | 1534 |
| IO.AnalogIP.4.Main.RangeLow | Low input range for scaling to process units | float32 | 05FF | 1535 |
| IO.AnalogIP.4.Main.Type | Specify the input type (as IP1 above) | uint8 | 05FD | 1533 |
| IO.AnalogIP.5.Main.MeasVal | Measured value | float32 | 060F | 1551 |
| IO.AnalogIP.5.Main.PV | Process variable | float32 | 0610 | 1552 |
| IO.AnalogIP.5.Main.RangeHigh | High input range for scaling to process units | float32 | 060D | 1549 |
| IO.AnalogIP.5.Main.RangeLow | Low input range for scaling to process units | float32 | 060E | 1550 |
| IO.AnalogIP.5.Main.Type | Specify the input type (as IP1 above) | uint8 | 060C | 1548 |
| IO.AnalogOP.1.AlmAck.OutputFault | Process alarm acknowledge: Output Fault (0 = NoAck, 1 = Ack) | uint8 | 0624 | 1572 |
| IO.AnalogOP.1.AlmDet.OutputFault | Process alarm detection status: Output Fault (0 = Inactive; 1 = Active) | uint8 | 0621 | 1569 |
| IO.AnalogOP.1.AlmDis.OutputFault | Process alarm: Output Fault (0 = Enable, 1 = Disable) | uint8 | 0620 | 1568 |
| IO.AnalogOP.1.AlmLat.OutputFault | Process alarm latch request: Output Fault (0 = NoLatch, 1 = Latch) | uint8 | 0623 | 1571 |
| IO.AnalogOP.1.AlmSig.OutputFault | Process alarm signalling status: Output Fault (0 = Not Latched, 1 = Latched) | uint8 | 0622 | 1570 |
| IO.AnalogOP.1.AlmStop.OutputFault | Process alarm stop request: Output Fault (0 = No stop, 1 = Stop) | uint8 | 0625 | 1573 |
| IO.AnalogOP.1.Main.MeasVal | Measured value | float32 | 061F | 1567 |
| IO.AnalogOP.1.Main.PV | Process variable | float32 | 061E | 1566 |
| IO.AnalogOP.1.Main.RangeHigh | High input range for scaling from process units | float32 | 061C | 1564 |
| IO.AnalogOP.1.Main.RangeLow | Low input range for scaling from process units | float32 | 061D | 1565 |
| IO.AnalogOP.1.Main.Type | Specify the output type<br>0 = 0 to 10V 1 = 1 to 5 V 2 = 2 to 10V,<br>3 = 0 to 5V 4 = 0 to 20mA 5 = 4 to 20mA | uint8 | 061B | 1563 |
| IO.AnalogOP.2.AlmAck.OutputFault | Process alarm acknowledge: Output Fault (as OP.1) | uint8 | 0639 | 1593 |
| IO.AnalogOP.2.AlmDet.OutputFault | Process alarm detection status: Output Fault (as OP.1) | uint8 | 0636 | 1590 |
| IO.AnalogOP.2.AlmDis.OutputFault | Process alarm: Output Fault (as OP.1) | uint8 | 0635 | 1589 |
| IO.AnalogOP.2.AlmLat.OutputFault | Process alarm latch request: Output Fault (as OP.1) | uint8 | 0638 | 1592 |
| IO.AnalogOP.2.AlmSig.OutputFault | Process alarm signalling status: Output Fault (as OP.1) | uint8 | 0637 | 1591 |
| IO.AnalogOP.2.AlmStop.OutputFault | Process alarm stop request: Output Fault (as OP.1) | uint8 | 063A | 1594 |
| IO.AnalogOP.2.Main.MeasVal | Measured value | float32 | 0634 | 1588 |
| IO.AnalogOP.2.Main.PV | Process variable | float32 | 0633 | 1587 |
| IO.AnalogOP.2.Main.RangeHigh | High input range for scaling from process units | float32 | 0631 | 1585 |
| IO.AnalogOP.2.Main.RangeLow | Low input range for scaling from process units | float32 | 0632 | 1586 |
| IO.AnalogOP.2.Main.Type | Specify the output type (as OP.1) | uint8 | 0630 | 1584 |
| IO.AnalogOP.3.AlmAck.OutputFault | Process alarm acknowledge: Output Fault (as OP.1) | uint8 | 064E | 1614 |
| IO.AnalogOP.3.AlmDet.OutputFault | Process alarm detection status: Output Fault (as OP.1) | uint8 | 064B | 1611 |
| IO.AnalogOP.3.AlmDis.OutputFault | Process alarm: Output Fault (as OP.1) | uint8 | 064A | 1610 |
| IO.AnalogOP.3.AlmLat.OutputFault | Process alarm latch request: Output Fault (as OP.1) | uint8 | 064D | 1613 |
| IO.AnalogOP.3.AlmSig.OutputFault | Process alarm signalling status: Output Fault (as OP.1) | uint8 | 064C | 1612 |
| IO.AnalogOP.3.AlmStop.OutputFault | Process alarm stop request: Output Fault (as OP.1) | uint8 | 064F | 1615 |
| IO.AnalogOP.3.Main.MeasVal | Measured value | float32 | 0649 | 1609 |
| IO.AnalogOP.3.Main.PV | Process variable | float32 | 0648 | 1608 |
| IO.AnalogOP.3.Main.RangeHigh | High input range for scaling from process units | float32 | 0646 | 1606 |
| IO.AnalogOP.3.Main.RangeLow | Low input range for scaling from process units | float32 | 0647 | 1607 |
| IO.AnalogOP.3.Main.Type | Specify the output type (as OP.1) | uint8 | 0645 | 1605 |
| IO.AnalogOP.4.AlmAck.OutputFault | Process alarm acknowledge: Output Fault (as OP.1) | uint8 | 0663 | 1635 |
| IO.AnalogOP.4.AlmDet.OutputFault | Process alarm detection status: Output Fault (as OP.1) | uint8 | 0660 | 1632 |
| IO.AnalogOP.4.AlmDis.OutputFault | Process alarm: Output Fault (as OP.1) | uint8 | 065F | 1631 |
| IO.AnalogOP.4.AlmLat.OutputFault | Process alarm latch request: Output Fault (as OP.1) | uint8 | 0662 | 1634 |
| IO.AnalogOP.4.AlmSig.OutputFault | Process alarm signalling status: Output Fault (as OP.1) | uint8 | 0661 | 1633 |

### 8.4 PARAMETER TABLE (Cont.)

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|
| IO.AnalogOP.4.AlmStop.OutputFault | Process alarm stop request: Output Fault (as OP.1) | uint8 | 0664 | 1636 |
| IO.AnalogOP.4.Main.MeasVal | Measured value | float32 | 065E | 1630 |
| IO.AnalogOP.4.Main.PV | Process variable | float32 | 065D | 1629 |
| IO.AnalogOP.4.Main.RangeHigh | High input range for scaling from process units | float32 | 065B | 1627 |
| IO.AnalogOP.4.Main.RangeLow | Low input range for scaling from process units | float32 | 065C | 1628 |
| IO.AnalogOP.4.Main.Type | Specify the output type (as OP.1) | uint8 | 065A | 1626 |
| IO.Digital.1.Invert | Invert the sense of the digital IO (0 = No; 1 = Invert) | bool | 0559 | 1369 |
| IO.Digital.1.MeasVal | Measured value (for outputs, 1 = output high) | bool | 055A | 1370 |
| IO.Digital.1.PV | Process variable | bool | 055B | 1371 |
| IO.Digital.1.Type | Specify the digital IO type<br>0 = Logic input; 1 = Contact input; 2 = Logic output. | uint8 | 0558 | 1368 |
| IO.Digital.2.Invert | Invert the sense of the digital IO (0 = No; 1 = Invert) | bool | 0568 | 1384 |
| IO.Digital.2.MeasVal | Measured value (for outputs, 1 = output high) | bool | 0569 | 1385 |
| IO.Digital.2.PV | Process variable | bool | 056A | 1386 |
| IO.Digital.2.Type | As IO.Digital.1.Type | uint8 | 0567 | 1383 |
| IO.Digital.3.Invert | Invert the sense of the digital IO (0 = No; 1 = Invert) | bool | 0577 | 1399 |
| IO.Digital.3.MeasVal | Measured value (for outputs, 1 = output high) | bool | 0578 | 1400 |
| IO.Digital.3.PV | Process variable | bool | 0579 | 1401 |
| IO.Digital.3.Type | As IO.Digital.1.Type | uint8 | 0576 | 1398 |
| IO.Digital.4.Invert | Invert the sense of the digital IO (0 = No; 1 = Invert) | bool | 0586 | 1414 |
| IO.Digital.4.MeasVal | Measured value (for outputs, 1 = output high) | bool | 0587 | 1415 |
| IO.Digital.4.PV | Process variable | bool | 0588 | 1416 |
| IO.Digital.4.Type | As IO.Digital.1.Type | uint8 | 0585 | 1413 |
| IO.Digital.5.Invert | Invert the sense of the digital IO (0 = No; 1 = Invert) | bool | 0595 | 1429 |
| IO.Digital.5.MeasVal | Measured value (for outputs, 1 = output high) | bool | 0596 | 1430 |
| IO.Digital.5.PV | Process variable | bool | 0597 | 1431 |
| IO.Digital.5.Type | As IO.Digital.1.Type | uint8 | 0594 | 1428 |
| IO.Digital.6.Invert | Invert the sense of the digital IO (0 = No; 1 = Invert) | bool | 05A4 | 1444 |
| IO.Digital.6.MeasVal | Measured value (for outputs, 1 = output high) | bool | 05A5 | 1445 |
| IO.Digital.6.PV | Process variable | bool | 05A6 | 1446 |
| IO.Digital.6.Type | As IO.Digital.1.Type | uint8 | 05A3 | 1443 |
| IO.Digital.7.Invert | Invert the sense of the digital IO (0 = No; 1 = Invert) | bool | 05B3 | 1459 |
| IO.Digital.7.MeasVal | Measured value (for outputs, 1 = output high) | bool | 05B4 | 1460 |
| IO.Digital.7.PV | Process variable | bool | 05B5 | 1461 |
| IO.Digital.7.Type | As IO.Digital.1.Type | uint8 | 05B2 | 1458 |
| IO.Digital.8.Invert | Invert the sense of the digital IO (0 = No; 1 = Invert) | bool | 05C2 | 1474 |
| IO.Digital.8.MeasVal | Measured value | bool | 05C3 | 1475 |
| IO.Digital.8.PV | Process variable | bool | 05C4 | 1476 |
| IO.Digital.8.Type | As IO.Digital.1.Type | uint8 | 05C1 | 1473 |
| IO.Relay.1.MeasVal | Measured value | bool | 0670 | 1648 |
| IO.Relay.1.PV | Process Variable | bool | 066F | 1647 |
| IO.Relay.2.MeasVal | Measured value | bool | 067C | 1660 |
| IO.Relay.2.PV | Process Variable | bool | 067B | 1659 |
| IO.Relay.3.MeasVal | Measured value | bool | 0688 | 1672 |
| IO.Relay.3.PV | Process Variable | bool | 0687 | 1671 |
| IO.Relay.4.MeasVal | Measured value | bool | 0694 | 1684 |
| IO.Relay.4.PV | Process Variable | bool | 0693 | 1683 |
| IPMonitor.1.AlarmDays | Alarm time (in days) above threshold | uint8 | 0A5F | 2655 |
| IPMonitor.1.AlarmTime | Alarm time above threshold | time32 | 0A5D | 2653 |
| IPMonitor.1.DaysAbove | Days Above Threshold | uint8 | 0A5E | 2654 |
| IPMonitor.1.In | Input | float32 | 0A57 | 2647 |
| IPMonitor.1.InStatus | Input Status (0 = Good, 1 = Bad) | bool | 0A60 | 2656 |

### 8.4 PARAMETER TABLE (Cont.)

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|
| IPMonitor.1.Max | Maximum value | float32 | 0A59 | 2649 |
| IPMonitor.1.Min | Minimum value | float32 | 0A5A | 2650 |
| IPMonitor.1.Out | Timer Alarm Output (0 = Off, 1 = On) | bool | 0A5C | 2652 |
| IPMonitor.1.Reset | Reset All Monitor Functions (0 = No, 1 = Yes) | bool | 0A58 | 2648 |
| IPMonitor.1.Threshold | Timer Threshold Value | float32 | 0A56 | 2646 |
| IPMonitor.1.TimeAbove | Time in Hours Above Threshold | time32 | 0A5B | 2651 |
| IPMonitor.2.AlarmDays | Alarm time (in days) above threshold | uint8 | 0A75 | 2677 |
| IPMonitor.2.AlarmTime | Alarm time above threshold | time32 | 0A73 | 2675 |
| IPMonitor.2.DaysAbove | Days Above Threshold | uint8 | 0A74 | 2676 |
| IPMonitor.2.In | Input | float32 | 0A6D | 2669 |
| IPMonitor.2.InStatus | Input Status (0 = Good, 1 = Bad) | bool | 0A76 | 2678 |
| IPMonitor.2.Max | Maximum value | float32 | 0A6F | 2671 |
| IPMonitor.2.Min | Minimum value | float32 | 0A70 | 2672 |
| IPMonitor.2.Out | Timer Alarm Output (0 = Off, 1 = On) | bool | 0A72 | 2674 |
| IPMonitor.2.Reset | Reset All Monitor Functions (0 = No, 1 = Yes) | bool | 0A6E | 2670 |
| IPMonitor.2.Threshold | Timer Threshold Value | float32 | 0A6C | 2668 |
| IPMonitor.2.TimeAbove | Time in Hours Above Threshold | time32 | 0A71 | 2673 |
| IPMonitor.3.AlarmDays | Alarm time (in days) above threshold | uint8 | 0A8B | 2699 |
| IPMonitor.3.AlarmTime | Alarm time above threshold | time32 | 0A89 | 2697 |
| IPMonitor.3.DaysAbove | Days Above Threshold | uint8 | 0A8A | 2698 |
| IPMonitor.3.In | Input | float32 | 0A83 | 2691 |
| IPMonitor.3.InStatus | Input Status (0 = Good, 1 = Bad) | bool | 0A8C | 2700 |
| IPMonitor.3.Max | Maximum value | float32 | 0A85 | 2693 |
| IPMonitor.3.Min | Minimum value | float32 | 0A86 | 2694 |
| IPMonitor.3.Out | Timer Alarm Output (0 = Off, 1 = On) | bool | 0A88 | 2696 |
| IPMonitor.3.Reset | Reset All Monitor Functions (0 = No, 1 = Yes) | bool | 0A84 | 2692 |
| IPMonitor.3.Threshold | Timer Threshold Value | float32 | 0A82 | 2690 |
| IPMonitor.3.TimeAbove | Time in Hours Above Threshold | time32 | 0A87 | 2695 |
| IPMonitor.4.AlarmDays | Alarm time (in days) above threshold | uint8 | 0AA1 | 2721 |
| IPMonitor.4.AlarmTime | Alarm time above threshold | time32 | 0A9F | 2719 |
| IPMonitor.4.DaysAbove | Days Above Threshold | uint8 | 0AA0 | 2720 |
| IPMonitor.4.In | Input | float32 | 0A99 | 2713 |
| IPMonitor.4.InStatus | Input Status (0 = Good, 1 = Bad) | bool | 0AA2 | 2722 |
| IPMonitor.4.Max | Maximum value | float32 | 0A9B | 2715 |
| IPMonitor.4.Min | Minimum value | float32 | 0A9C | 2716 |
| IPMonitor.4.Out | Timer Alarm Output (0 = No, 1 = Yes) | bool | 0A9E | 2718 |
| IPMonitor.4.Reset | Reset All Monitor Functions (0 = No, 1 = Yes) | bool | 0A9A | 2714 |
| IPMonitor.4.Threshold | Timer Threshold Value | float32 | 0A98 | 2712 |
| IPMonitor.4.TimeAbove | Time in Hours Above Threshold | time32 | 0A9D | 2717 |
| Lgc2.1.FallbackType | Fallback Condition (False good, False bad, True Good, True Bad) | uint8 | 0AB7 | 2743 |
| Lgc2.1.Hysteresis | Hysteresis | float32 | 0ABB | 2747 |
| Lgc2.1.In1 | Input Value 1 | float32 | 0AB5 | 2741 |
| Lgc2.1.In2 | Input Value 2 | float32 | 0AB6 | 2742 |
| Lgc2.1.Invert | Sense of Input Value | uint8 | 0AB8 | 2744 |
| Lgc2.1.Oper | Logic Operation (If True; Output = 1 (on))<br>0 = Off 1 = AND 2 = OR 3 = XOR 4 = LATCH<br>5 = (Ip1 = Ip2?) 6 = (Ip1≠Ip2?) 7 = (Ip1 > Ip2?),<br>8 = (Ip1 <Ip2?) 9 = (Ip1 ≥ Ip2?) 10 = (Ip1≤Ip2)? | uint8 | 0AB4 | 2740 |
| Lgc2.1.Out | The Result (0 = Off, 1 = On) | bool | 0AB9 | 2745 |
| Lgc2.1.Status | Output Status (0 = Good, 1 = Bad) | bool | 0ABA | 2746 |
| Lgc2.2.FallbackType | Fallback Condition (as Lgc2.1) | uint8 | 0AC1 | 2753 |
| Lgc2.2.Hysteresis | Hysteresis | float32 | 0AC5 | 2757 |
| Lgc2.2.In1 | Input Value 1 | float32 | 0ABF | 2751 |
| Lgc2.2.In2 | Input Value 2 | float32 | 0AC0 | 2752 |
| Lgc2.2.Invert | Sense of Input Value | uint8 | 0AC2 | 2754 |
| Lgc2.2.Oper | Logic Operation (as Lgc2.1) | uint8 | 0ABE | 2750 |
| Lgc2.2.Out | The Result (0 = Off, 1 = On) | bool | 0AC3 | 2755 |

### 8.4 PARAMETER TABLE (Cont.)

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|
| Lgc2.2.Status | Output Status (0 = Good, 1 = Bad) | bool | 0AC4 | 2756 |
| Lgc2.3.FallbackType | Fallback Condition (as Lgc2.1) | uint8 | 0ACB | 2763 |
| Lgc2.3.Hysteresis | Hysteresis | float32 | 0ACF | 2767 |
| Lgc2.3.In1 | Input Value 1 | float32 | 0AC9 | 2761 |
| Lgc2.3.In2 | Input Value 2 | float32 | 0ACA | 2762 |
| Lgc2.3.Invert | Sense of Input Value | uint8 | 0ACC | 2764 |
| Lgc2.3.Oper | Logic Operation (as Lgc2.1) | uint8 | 0AC8 | 2760 |
| Lgc2.3.Out | The Result (0 = Off, 1 = On) | bool | 0ACD | 2765 |
| Lgc2.3.Status | Output Status (0 = Good, 1 = Bad) | bool | 0ACE | 2766 |
| Lgc2.4.FallbackType | Fallback Condition (as Lgc2.1) | uint8 | 0AD5 | 2773 |
| Lgc2.4.Hysteresis | Hysteresis | float32 | 0AD9 | 2777 |
| Lgc2.4.In1 | Input Value 1 | float32 | 0AD3 | 2771 |
| Lgc2.4.In2 | Input Value 2 | float32 | 0AD4 | 2772 |
| Lgc2.4.Invert | Sense of Input Value | uint8 | 0AD6 | 2774 |
| Lgc2.4.Oper | Logic Operation (as Lgc2.1) | uint8 | 0AD2 | 2770 |
| Lgc2.4.Out | The Result (0 = Off, 1 = On) | bool | 0AD7 | 2775 |
| Lgc2.4.Status | Output Status (0 = Good, 1 = Bad) | bool | 0AD8 | 2776 |
| Lgc8.1.In1 | Input 1 Value (0 = Off, 1 = On) | bool | 09B1 | 2481 |
| Lgc8.1.In2 | Input 2 Value (0 = Off, 1 = On) | bool | 09B2 | 2482 |
| Lgc8.1.In3 | Input 3 Value (0 = Off, 1 = On) | bool | 09B3 | 2483 |
| Lgc8.1.In4 | Input 4 Value (0 = Off, 1 = On) | bool | 09B4 | 2484 |
| Lgc8.1.In5 | Input 5 Value (0 = Off, 1 = On) | bool | 09B5 | 2485 |
| Lgc8.1.In6 | Input 6 Value (0 = Off, 1 = On) | bool | 09B6 | 2486 |
| Lgc8.1.In7 | Input 7 Value (0 = Off, 1 = On) | bool | 09B7 | 2487 |
| Lgc8.1.In8 | Input 8 Value (0 = Off, 1 = On) | bool | 09B8 | 2488 |
| Lgc8.1.InInvert | Invert Selected Inputs | uint8 | 09AF | 2479 |
| Lgc8.1.NumIn | Number of Inputs | uint8 | 09B0 | 2480 |
| Lgc8.1.Oper | Operation (0 = Off, 1 = AND, 2 = OR, 3 = XOR) | uint8 | 09AE | 2478 |
| Lgc8.1.Out | Output Value | bool | 09B9 | 2489 |
| Lgc8.1.OutInvert | Invert the Output (0 = No, 1 = Yes) | bool | 09BA | 2490 |
| Lgc8.2.In1 | Input 1 Value (0 = Off, 1 = On) | bool | 09C8 | 2504 |
| Lgc8.2.In2 | Input 2 Value (0 = Off, 1 = On) | bool | 09C9 | 2505 |
| Lgc8.2.In3 | Input 3 Value (0 = Off, 1 = On) | bool | 09CA | 2506 |
| Lgc8.2.In4 | Input 4 Value (0 = Off, 1 = On) | bool | 09CB | 2507 |
| Lgc8.2.In5 | Input 5 Value (0 = Off, 1 = On) | bool | 09CC | 2508 |
| Lgc8.2.In6 | Input 6 Value (0 = Off, 1 = On) | bool | 09CD | 2509 |
| Lgc8.2.In7 | Input 7 Value (0 = Off, 1 = On) | bool | 09CE | 2510 |
| Lgc8.2.In8 | Input 8 Value | bool | 09CF | 2511 |
| Lgc8.2.InInvert | Invert Selected Inputs | uint8 | 09C6 | 2502 |
| Lgc8.2.NumIn | Number of Inputs | uint8 | 09C7 | 2503 |
| Lgc8.2.Oper | Operation (0 = Off, 1 = AND, 2 = OR, 3 = XOR) | uint8 | 09C5 | 2501 |
| Lgc8.2.Out | Output Value | bool | 09D0 | 2512 |
| Lgc8.2.OutInvert | Invert the Output (0 = No, 1 = Yes) | bool | 09D1 | 2513 |
| Lgc8.3.In1 | Input 1 Value (0 = Off, 1 = On) | bool | 09DF | 2527 |
| Lgc8.3.In2 | Input 2 Value (0 = Off, 1 = On) | bool | 09E0 | 2528 |
| Lgc8.3.In3 | Input 3 Value (0 = Off, 1 = On) | bool | 09E1 | 2529 |
| Lgc8.3.In4 | Input 4 Value (0 = Off, 1 = On) | bool | 09E2 | 2530 |
| Lgc8.3.In5 | Input 5 Value (0 = Off, 1 = On) | bool | 09E3 | 2531 |
| Lgc8.3.In6 | Input 6 Value (0 = Off, 1 = On) | bool | 09E4 | 2532 |
| Lgc8.3.In7 | Input 7 Value (0 = Off, 1 = On) | bool | 09E5 | 2533 |
| Lgc8.3.In8 | Input 8 Value (0 = Off, 1 = On) | bool | 09E6 | 2534 |
| Lgc8.3.InInvert | Invert Selected Inputs | uint8 | 09DD | 2525 |
| Lgc8.3.NumIn | Number of Inputs | uint8 | 09DE | 2526 |
| Lgc8.3.Oper | Operation (0 = Off, 1 = AND, 2 = OR, 3 = XOR) | uint8 | 09DC | 2524 |
| Lgc8.3.Out | Output Value | bool | 09E7 | 2535 |
| Lgc8.3.OutInvert | Invert the Output (0 = No, 1 = Yes) | bool | 09E8 | 2536 |
| Lgc8.4.In1 | Input 1 Value (0 = Off, 1 = On) | bool | 09F6 | 2550 |

**8.4 PARAMETER TABLE (Cont.)**

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|
| Lgc8.4.In2 | Input 2 Value (0 = Off, 1 = On) | bool | 09F7 | 2551 |
| Lgc8.4.In3 | Input 3 Value (0 = Off, 1 = On) | bool | 09F8 | 2552 |
| Lgc8.4.In4 | Input 4 Value (0 = Off, 1 = On) | bool | 09F9 | 2553 |
| Lgc8.4.In5 | Input 5 Value (0 = Off, 1 = On) | bool | 09FA | 2554 |
| Lgc8.4.In6 | Input 6 Value (0 = Off, 1 = On) | bool | 09FB | 2555 |
| Lgc8.4.In7 | Input 7 Value (0 = Off, 1 = On) | bool | 09FC | 2556 |
| Lgc8.4.In8 | Input 8 Value (0 = Off, 1 = On) | bool | 09FD | 2557 |
| Lgc8.4.InInvert | Invert Selected Inputs | uint8 | 09F4 | 2548 |
| Lgc8.4.NumIn | Number of Inputs | uint8 | 09F5 | 2549 |
| Lgc8.4.Oper | Operation (0 = Off, 1 = AND, 2 = OR, 3 = XOR) | uint8 | 09F3 | 2547 |
| Lgc8.4.Out | Output Value | bool | 09FE | 2558 |
| Lgc8.4.OutInvert | Invert the Output (0 = No, 1 = Yes) | bool | 09FF | 2559 |
| LTC.AlmAck.Fuse | System alarm ack: Fuse blown | uint8 | 0AF2 | 2802 |
| LTC.AlmAck.Temp | System alarm ack: Over Temp | uint8 | 0AF3 | 2803 |
| LTC.AlmDet.Fuse | System alarm detection status: Fuse Blown | uint8 | 0AEC | 2796 |
| LTC.AlmDet.Temp | System alarm detection status: Over Temp | uint8 | 0AED | 2797 |
| LTC.AlmDis.Fuse | System alarm Disable: External Fuse blown | uint8 | 0AEA | 2794 |
| LTC.AlmDis.Temp | System alarm Disable: External Over Temp | uint8 | 0AEB | 2795 |
| LTC.AlmLat.Fuse | System alarm latch: External Fuse Blown | uint8 | 0AF0 | 2800 |
| LTC.AlmLat.Temp | System alarm latch: External Over Temp | uint8 | 0AF1 | 2801 |
| LTC.AlmSig.Fuse | System alarm signalling status: external Fuse Blown | uint8 | 0AEE | 2798 |
| LTC.AlmSig.Temp | System alarm signalling status: external Over Temp | uint8 | 0AEF | 2799 |
| LTC.AlmStop.Fuse | System alarm stop: Fuse Blown | uint8 | 0AF4 | 2804 |
| LTC.AlmStop.Temp | System alarm stop: Over Temp | uint8 | 0AF5 | 2805 |
| LTC.MainPrm.AlFuseIn | External Fuse Fail Alarm Input (1 = Active) | uint8 | 0AE8 | 2792 |
| LTC.MainPrm.AlTempIn | External Temperature Failure Alarm Input (1 = active) | uint8 | 0AE9 | 2793 |
| LTC.MainPrm.IP | Input of LTC block. | float32 | 0ADE | 2782 |
| LTC.MainPrm.OP1 | Output1 of the block. | float32 | 0AE4 | 2788 |
| LTC.MainPrm.OP2 | Output2 of the block. | float32 | 0AE5 | 2789 |
| LTC.MainPrm.OP3 | Output3 of the block. | float32 | 0AE6 | 2790 |
| LTC.MainPrm.OP4 | Output4 of the block. | float32 | 0AE7 | 2791 |
| LTC.MainPrm.PAOP | Phase angle input for PA reduction in burst firing | float32 | 0ADF | 2783 |
| LTC.MainPrm.S1 | Turn ratio of tap1. | float32 | 0AE0 | 2784 |
| LTC.MainPrm.S2 | Turn ratio of tap2. | float32 | 0AE1 | 2785 |
| LTC.MainPrm.S3 | Turn ratio of tap3. | float32 | 0AE2 | 2786 |
| LTC.MainPrm.S4 | Turn ratio of tap4. | float32 | 0AE3 | 2787 |
| LTC.MainPrm.TapNb | Transformer tap number (2 = 2, 3 = 3, 4 = 4) | uint8 | 0ADD | 2781 |
| LTC.MainPrm.Type | LTC Type (0 = Primary, 1 = Secondary) | uint8 | 0ADC | 2780 |
| Math2.1.Fallback | Fallback strategy<br>0 = ClipBad 1 = ClipGood 2 = FallBad<br>3 = FallGood 4 = UpscaleBad 6 = DownscaleBad | uint8 | 08C2 | 2242 |
| Math2.1.FallbackVal | Fallback Value | float32 | 08BB | 2235 |
| Math2.1.HighLimit | Output High Limit | float32 | 08BC | 2236 |
| Math2.1.In1 | Input 1 Value | float32 | 08B7 | 2231 |
| Math2.1.In1Mul | Input 1 Scale | float32 | 08B6 | 2230 |
| Math2.1.In2 | Input 2 Value | float32 | 08B9 | 2233 |
| Math2.1.In2Mul | Input 2 Scale | float32 | 08B8 | 2232 |
| Math2.1.LowLimit | Output Low Limit | float32 | 08BD | 2237 |
| Math2.1.Oper | Operator<br>0 = None 6 = SelMax 12 = Log<br>1 = Add 7 = SelMin 13 = Ln<br>2 = Sub 8 = HotSwap 14 = Exp<br>3 = Mul 9 = SmpHld 15 = 10 x<br>4 = Div 10 = Power 51 = Sel 1<br>5 = AbsDif 11 = Sqrt | uint8 | 08BA | 2234 |
| Math2.1.Out | Output Value | float32 | 08BF | 2239 |
| Math2.1.Resolution | Output Resolution uint8<br>(0 = X, 1 = X.X, 2 = X.XX, 3 = X.XXX, 4 = X.XXXX) | 08C0 | 2240 | |
| Math2.1.Select | Select Between Input 1 (0) and Input 2 (1) | bool | 08C3 | 2243 |

**8.4 PARAMETER TABLE (Cont.)**

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|
| Math2.1.Status | Status (Good = 0; Bad = 1) | bool | 08BE | 2238 |
| Math2.1.Units | Output Units (0 = None, 1 = Temp, 2 = V, 3 = mV 4 = A, 5 = mA, 6 = pH, 7 = mmHg) | uint8 | 08C1 | 2241 |
| Math2.2.Fallback | Fallback strategy (as for Math2.1) | uint8 | 08DA | 2266 |
| Math2.2.FallbackVal | Fallback Value | float32 | 08D3 | 2259 |
| Math2.2.HighLimit | Output High Limit | float32 | 08D4 | 2260 |
| Math2.2.In1 | Input 1 Value | float32 | 08CF | 2255 |
| Math2.2.In1Mul | Input 1 Scale | float32 | 08CE | 2254 |
| Math2.2.In2 | Input 2 Value | float32 | 08D1 | 2257 |
| Math2.2.In2Mul | Input 2 Scale | float32 | 08D0 | 2256 |
| Math2.2.LowLimit | Output Low Limit | float32 | 08D5 | 2261 |
| Math2.2.Oper | Operator (as for Math2.1) 2258 | | uint8 | 08D2 |
| Math2.2.Out | Output Value | float32 | 08D7 | 2263 |
| Math2.2.Resolution | Output Resolution (as for Math2.1) | uint8 | 08D8 | 2264 |
| Math2.2.Select | Select Between Input 1 (0) and Input 2 (1) | bool | 08DB | 2267 |
| Math2.2.Status | Status (Good = 0; Bad = 1) | bool | 08D6 | 2262 |
| Math2.2.Units | Output Units (as for Math2.1) | uint8 | 08D9 | 2265 |
| Math2.3.Fallback | Fallback strategy (as for Math2.1) | uint8 | 08F2 | 2290 |
| Math2.3.FallbackVal | Fallback Value | float32 | 08EB | 2283 |
| Math2.3.HighLimit | Output High Limit | float32 | 08EC | 2284 |
| Math2.3.In1 | Input 1 Value | float32 | 08E7 | 2279 |
| Math2.3.In1Mul | Input 1 Scale | float32 | 08E6 | 2278 |
| Math2.3.In2 | Input 2 Value | float32 | 08E9 | 2281 |
| Math2.3.In2Mul | Input 2 Scale | float32 | 08E8 | 2280 |
| Math2.3.LowLimit | Output Low Limit | float32 | 08ED | 2285 |
| Math2.3.Oper | Operator (as for Math2.1) | uint8 | 08EA | 2282 |
| Math2.3.Out | Output Value | float32 | 08EF | 2287 |
| Math2.3.Resolution | Output Resolution (as for Math2.1) | uint8 | 08F0 | 2288 |
| Math2.3.Select | Select Between Input 1 (0) and Input 2 (1) | bool | 08F3 | 2291 |
| Math2.3.Status | Status (Good = 0; Bad = 1) | bool | 08EE | 2286 |
| Math2.3.Units | Output Units (as for Math2.1) | uint8 | 08F1 | 2289 |
| Math2.4.Fallback | Fallback strategy (as for Math2.1) | uint8 | 090A | 2314 |
| Math2.4.FallbackVal | Fallback Value | float32 | 0903 | 2307 |
| Math2.4.HighLimit | Output High Limit | float32 | 0904 | 2308 |
| Math2.4.In1 | Input 1 Value | float32 | 08FF | 2303 |
| Math2.4.In1Mul | Input 1 Scale | float32 | 08FE | 2302 |
| Math2.4.In2 | Input 2 Value | float32 | 0901 | 2305 |
| Math2.4.In2Mul | Input 2 Scale | float32 | 0900 | 2304 |
| Math2.4.LowLimit | Output Low Limit | float32 | 0905 | 2309 |
| Math2.4.Oper | Operation (as for Math2.1) | uint8 | 0902 | 2306 |
| Math2.4.Out | Output Value | float32 | 0907 | 2311 |
| Math2.4.Resolution | Output Resolution (as for Math2.1) | uint8 | 0908 | 2312 |
| Math2.4.Select | Select Between Input 1 (0) and Input 2 (1) | bool | 090B | 2315 |
| Math2.4.Status | Status (0 = Good, 1 = Bad) | bool | 0906 | 2310 |
| Math2.4.Units | Output Units (as for Math2.1) | uint8 | 0909 | 2313 |
| Modultr.1.CycleTime | Cycle time for fixed modulator | uint16 | 045F | 1119 |
| Modultr.1.In | Input of the modulator block | float32 | 045D | 1117 |
| Modultr.1.LgcMode | Logic mode cycle selection (0 = 1/2 cycle, 1 = Full cycle) | uint8 | 0460 | 1120 |
| Modultr.1.MinOnTime | Minimum on time for variable modulator | uint16 | 045E | 1118 |
| Modultr.1.Mode | Modulator mode (0 = IHC, 1 = BurstVar, 2 = BurstFix, 3 = Lgc, 4 = PA) | uint8 | 0462 | 1122 |
| Modultr.1.Out | Modulator logical output | float32 | 045C | 1116 |
| Modultr.1.PLMin | Load management interface input | uint16 | 0461 | 1121 |
| Modultr.1.SwitchPA | Switch Burst PA (0 = Burst, 1 = PA) | uint8 | 0466 | 1126 |

### 8.4 PARAMETER TABLE (Cont.)

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|
| Modultr.2.CycleTime | Cycle time for fixed modulator | uint16 | 0475 | 1141 |
| Modultr.2.In | Input of the modulator block | float32 | 0473 | 1139 |
| Modultr.2.LgcMode | Logic mode cycle selection (as Modultr1) | uint8 | 0476 | 1142 |
| Modultr.2.MinOnTime | Minimum on time for variable modulator | uint16 | 0474 | 1140 |
| Modultr.2.Mode | Modulator mode (as Modultr1) | uint8 | 0478 | 1144 |
| Modultr.2.Out | Modulator logical output | float32 | 0472 | 1138 |
| Modultr.2.PLMin | Load management interface input | uint16 | 0477 | 1143 |
| Modultr.2.SwitchPA | Switch Burst PA (as Modultr1) | uint8 | 047C | 1148 |
| Modultr.3.CycleTime | Cycle time for fixed modulator | uint16 | 048B | 1163 |
| Modultr.3.In | Input of the modulator block | float32 | 0489 | 1161 |
| Modultr.3.LgcMode | Logic mode cycle selection (as Modultr1) | uint8 | 048C | 1164 |
| Modultr.3.MinOnTime | Minimum on time for variable modulator | uint16 | 048A | 1162 |
| Modultr.3.Mode | Modulator mode (as Modultr1) | uint8 | 048E | 1166 |
| Modultr.3.Out | Modulator logical output | float32 | 0488 | 1160 |
| Modultr.3.PLMin | Load management interface input | uint16 | 048D | 1165 |
| Modultr.3.SwitchPA | Switch Burst PA (as Modultr1) | uint8 | 0492 | 1170 |
| Modultr.4.CycleTime | Cycle time for fixed modulator | uint16 | 04A1 | 1185 |
| Modultr.4.In | Input of the modulator block | float32 | 049F | 1183 |
| Modultr.4.LgcMode | Logic mode cycle selection (as Modultr1) | uint8 | 04A2 | 1186 |
| Modultr.4.MinOnTime | Minimum on time for variable modulator | uint16 | 04A0 | 1184 |
| Modultr.4.Mode | Modulator mode (as Modultr1) | uint8 | 04A4 | 1188 |
| Modultr.4.Out | Modulator logical output | float32 | 049E | 1182 |
| Modultr.4.PLMin | Load management interface input | uint16 | 04A3 | 1187 |
| Modultr.4.SwitchPA | Switch Burst PA (as Modultr1) | uint8 | 04A8 | 1192 |
| Network.1.AlmAck.ChopOff | Process alarm ack: Chop Off (0 = NoAck, 1 = Ack) | uint8 | 0187 | 391 |
| Network.1.AlmAck.FreqFault | System alarm ack: Frequency Fault (as ChopOff) | uint8 | 0184 | 388 |
| Network.1.AlmAck.FuseBlown | System alarm ack: Fuse Blown (as ChopOff) | uint8 | 0181 | 385 |
| Network.1.AlmAck.MainsVoltFault | Process alarm ack: Mains Voltage Fault (as ChopOff) | uint8 | 018A | 394 |
| Network.1.AlmAck.MissMains | System alarm ack: Missing Mains (as ChopOff) | uint8 | 017E | 382 |
| Network.1.AlmAck.NetworkDips | System alarm ack: Mains Voltage Dips (as ChopOff) | uint8 | 0183 | 387 |
| Network.1.AlmAck.OpenThyr | System alarm ack: Open Thyristor (as ChopOff) | uint8 | 0180 | 384 |
| Network.1.AlmAck.OverCurrent | Indication alarm ack: Over Current (as ChopOff) | uint8 | 018C | 396 |
| Network.1.AlmAck.OverTemp | System alarm ack: Over Temperature (as ChopOff) | uint8 | 0182 | 386 |
| Network.1.AlmAck.PB24VFail | System alarm ack: Power Board 24V Failure (as ChopOff) | uint8 | 0185 | 389 |
| Network.1.AlmAck.PLF | Process alarm ack: Partial Load Failure (as ChopOff) | uint8 | 0188 | 392 |
| Network.1.AlmAck.PLU | Process alarm ack: Partial Load Unbalance (as ChopOff) | uint8 | 0189 | 393 |
| Network.1.AlmAck.PreTemp | Process alarm ack: Pre-Temperature (as ChopOff) | uint8 | 018B | 395 |
| Network.1.AlmAck.ThyrSC | System alarm ack: Thyristor Short Circuit (as ChopOff) | uint8 | 017F | 383 |
| Network.1.AlmAck.TLF | Process alarm ack: Total Load Failure (as ChopOff) | uint8 | 0186 | 390 |
| Network.1.AlmDet.ChopOff | Process alarm detection status: Chop Off (0 = Inactive, 1 = Active) | uint8 | 015A | 346 |
| Network.1.AlmDet.FreqFault | System alarm detection status: Frequency Fault (0 = Inactive, 1 = Active) | uint8 | 0157 | 343 |
| Network.1.AlmDet.FuseBlown | System alarm detection status: Fuse Blown (0 = Inactive, 1 = Active) | uint8 | 0154 | 340 |
| Network.1.AlmDet.MainsVoltFault | Process alarm detection Status: Mains Voltage Fault (0 = Inactive, 1 = Active) | uint8 | 015D | 349 |
| Network.1.AlmDet.MissMains | System alarm detection status: Missing Mains (0 = Inactive, 1 = Active) | uint8 | 0151 | 337 |
| Network.1.AlmDet.NetworkDips | System alarm detection status: Mains Voltage Dips (0 = Inactive, 1 = Active) | uint8 | 0156 | 342 |
| Network.1.AlmDet.OpenThyr | System alarm detection status: Open Thyristor (0 = Inactive, 1 = Active) | uint8 | 0153 | 339 |
| Network.1.AlmDet.OverCurrent | Indication alarm detection Status: Over Current (0 = Inactive, 1 = Active) | uint8 | 015F | 351 |
| Network.1.AlmDet.OverTemp | System alarm detection status: Over Temperature | uint8 | 0155 | 341 |

### 8.4 PARAMETER TABLE (Cont.)

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|
| | (0 = Inactive, 1 = Active) | | | |
| Network.1.AlmDet.PB24VFail | System alarm detection status:<br>Power Board 24V Failure (0 = Inactive, 1 = Active) | uint8 | 0158 | 344 |
| | (0 = Inactive, 1 = Active) | | | |
| Network.1.AlmDet.PLF | Process alarm detection status: Partial Load Failure<br>(0 = Inactive, 1 = Active) | uint8 | 015B | 347 |
| Network.1.AlmDet.PLU | Process alarm detection status:<br>Partial Load Unbalance (0 = Inactive, 1 = Active) | uint8 | 015C | 348 |
| Network.1.AlmDet.PreTemp | Process alarm detection Status: Pre-Temperature<br>(0 = Inactive, 1 = Active) | uint8 | 015E | 350 |
| Network.1.AlmDet.ThyrSC | System alarm detection status:<br>Thyristor Short Circuit (0 = Inactive, 1 = Active) | uint8 | 0152 | 338 |
| Network.1.AlmDet.TLF | Process alarm detection status: Total Load Failure<br>(0 = Inactive, 1 = Active) | uint8 | 0159 | 345 |
| Network.1.AlmDis.ChopOff | Process alarm: Chop Off (0 = Enable, 1 = Disable) | uint8 | 014B | 331 |
| Network.1.AlmDis.FreqFault | System alarm: Frequency Fault (as for ChopOff) | uint8 | 0148 | 328 |
| Network.1.AlmDis.FuseBlown | System alarm: Fuse Blown (as for ChopOff) | uint8 | 0145 | 325 |
| Network.1.AlmDis.MainsVoltFault | Process alarm: Mains Voltage Fault (as for ChopOff) | uint8 | 014E | 334 |
| Network.1.AlmDis.MissMains | System alarm: Missing Mains (as for ChopOff) | uint8 | 0142 | 322 |
| Network.1.AlmDis.NetworkDips | System alarm: Mains Voltage Dips (as for ChopOff) | uint8 | 0147 | 327 |
| Network.1.AlmDis.OpenThyr | System alarm: Open Thyristor (as for ChopOff) | uint8 | 0144 | 324 |
| Network.1.AlmDis.OverCurrent | Indication alarm: Over Current (as for ChopOff) | uint8 | 0150 | 336 |
| Network.1.AlmDis.OverTemp | System alarm: Over Temperature (as for ChopOff) | uint8 | 0146 | 326 |
| Network.1.AlmDis.PB24VFail | System alarm: Power Board 24V Failure<br>(as for ChopOff) | uint8 | 0149 | 329 |
| Network.1.AlmDis.PLF | Process alarm: Partial Load Failure (as for ChopOff) | uint8 | 014C | 332 |
| Network.1.AlmDis.PLU | Process alarm: Partial Load Unbalance<br>(as for ChopOff) | uint8 | 014D | 333 |
| Network.1.AlmDis.PreTemp | Process alarm: Pre-Temperature (as for ChopOff) | uint8 | 014F | 335 |
| Network.1.AlmDis.ThyrSC | System alarm: Thyristor Short Circuit<br>(as for ChopOff) | uint8 | 0143 | 323 |
| Network.1.AlmDis.TLF | Process alarm: Total Load Failure (as for ChopOff) | uint8 | 014A | 330 |
| Network.1.AlmLat.ChopOff | Process alarm latch: Chop Off<br>(0 = NoLatch, 1 = Latch) | uint8 | 0178 | 376 |
| Network.1.AlmLat.FreqFault | System alarm latch: Frequency Fault (as for ChopOff) | uint8 | 0175 | 373 |
| Network.1.AlmLat.FuseBlown | System alarm latch: Fuse Blown (as for ChopOff) | uint8 | 0172 | 370 |
| Network.1.AlmLat.MainsVoltFault | Process alarm latch: Mains Voltage Fault<br>(as for ChopOff) | uint8 | 017B | 379 |
| Network.1.AlmLat.MissMains | System alarm latch: Missing Mains (as for ChopOff) | uint8 | 016F | 367 |
| Network.1.AlmLat.NetworkDips | System alarm latch: Mains Voltage Dips | uint8 | 0174 | 372 |
| Network.1.AlmLat.OpenThyr | System alarm latch: Open Thyristor (as for ChopOff) | uint8 | 0171 | 369 |
| Network.1.AlmLat.OverCurrent | Indication alarm latch: Over Current<br>(as for ChopOff) | uint8 | 017D | 381 |
| Network.1.AlmLat.OverTemp | System alarm latch: Over Temperature<br>(as for ChopOff) | uint8 | 0173 | 371 |
| Network.1.AlmLat.PB24VFail | System alarm latch: Power Board 24V Failure<br>(as for ChopOff) | uint8 | 0176 | 374 |
| Network.1.AlmLat.PLF | Process alarm latch: Partial Load Failure<br>(as for ChopOff) | uint8 | 0179 | 377 |
| Network.1.AlmLat.PLU | Process alarm latch: Partial Load Unbalance<br>(as for ChopOff) | uint8 | 017A | 378 |
| Network.1.AlmLat.PreTemp | Process alarm latch: Pre-Temperature<br>(as for ChopOff) | uint8 | 017C | 380 |
| Network.1.AlmLat.ThyrSC | System alarm latch: Thyristor Short Circuit<br>(as for ChopOff) | uint8 | 0170 | 368 |
| Network.1.AlmLat.TLF | Process alarm latch: Total Load Failure<br>(as for ChopOff) | uint8 | 0177 | 375 |
| Network.1.AlmSig.ChopOff | Process alarm signalling status: Chop Off<br>(0 = Not latched, 1 = Latched) | uint8 | 0169 | 361 |

### 8.4 PARAMETER TABLE (Cont.)

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|
| Network.1.AlmSig.FreqFault | System alarm signalling status: Frequency Faultuint8<br>0 = Not Latched 1 = Ph1 latched<br>2 = Ph2 latched 3 = Ph1&Ph2 latched<br>4 = Ph3 latched 5 = Ph1&Ph3 latched<br>6 = Ph2&Ph3 latched 7 = Ph1, Ph2 7 Ph3 latched | 0166 | 358 | |
| Network.1.AlmSig.FuseBlown | System alarm signalling status: Fuse Blown (As FreqFault) | uint8 | 0163 | 355 |
| Network.1.AlmSig.MainsVoltFault | Process alarm signalling status: Mains Voltage Fault (As FreqFault) | uint8 | 016C | 364 |
| Network.1.AlmSig.MissMains | System alarm signalling status: Missing Mains (As FreqFault) | uint8 | 0160 | 352 |
| Network.1.AlmSig.NetworkDips | System alarm signalling status: Mains Voltage Dips (As FreqFault) | uint8 | 0165 | 357 |
| Network.1.AlmSig.OpenThyr | System alarm signalling status: Open Thyristor (As FreqFault) | uint8 | 0162 | 354 |
| Network.1.AlmSig.OverCurrent | Indication alarm signalling status: Over Current (As FreqFault) | uint8 | 016E | 366 |
| Network.1.AlmSig.OverTemp | System alarm signalling status: Over Temperature (As FreqFault) | uint8 | 0164 | 356 |
| Network.1.AlmSig.PB24VFail | System alarm signalling status: Power Board 24V Failure (As FreqFault) | uint8 | 0167 | 359 |
| Network.1.AlmSig.PLF | Process alarm signalling status: Partial Load Failure (As FreqFault) | uint8 | 016A | 362 |
| Network.1.AlmSig.PLU | Process alarm signalling status: Partial Load Unbalance (As ChopOff) | uint8 | 016B | 363 |
| Network.1.AlmSig.PreTemp | Process alarm signalling status: Pre-Temperature (As FreqFault) | uint8 | 016D | 365 |
| Network.1.AlmSig.ThyrSC | System alarm signalling status: Thyristor Short Circuit (As FreqFault) | uint8 | 0161 | 353 |
| Network.1.AlmSig.TLF | Process alarm signalling status: Total Load Failure (As FreqFault) | uint8 | 0168 | 360 |
| Network.1.AlmStop.ChopOff | Process alarm stop: Chop Off For all Stop parameters:<br>0 = No stop<br>1 = Stop | uint8 | 0196 | 406 |
| Network.1.AlmStop.FreqFault | System alarm stop: Frequency Fault | uint8 | 0193 | 403 |
| Network.1.AlmStop.FuseBlown | System alarm stop: Fuse Blown | uint8 | 0190 | 400 |
| Network.1.AlmStop.MainsVoltFault | Process alarm stop: Mains Voltage Fault | uint8 | 0199 | 409 |
| Network.1.AlmStop.MissMains | System alarm stop: Missing Mains | uint8 | 018D | 397 |
| Network.1.AlmStop.NetworkDips | System alarm stop: Mains Voltage Dips | uint8 | 0192 | 402 |
| Network.1.AlmStop.OpenThyr | System alarm stop: Open Thyristor | uint8 | 018F | 399 |
| Network.1.AlmStop.OverCurrent | Indication alarm stop: Over Current | uint8 | 019B | 411 |
| Network.1.AlmStop.OverTemp | System alarm stop: Over Temperature | uint8 | 0191 | 401 |
| Network.1.AlmStop.PB24VFail | System alarm stop: Power Board 24V Failure | uint8 | 0194 | 404 |
| Network.1.AlmStop.PLF | Process alarm stop: Partial Load Failure | uint8 | 0197 | 407 |
| Network.1.AlmStop.PLU | Process alarm stop: Partial Load Unbalance | uint8 | 0198 | 408 |
| Network.1.AlmStop.PreTemp | Process alarm stop: Pre-Temperature | uint8 | 019A | 410 |
| Network.1.AlmStop.ThyrSC | System alarm stop: Thyristor Short Circuit | uint8 | 018E | 398 |
| Network.1.AlmStop.TLF | Process alarm stop: Total Load Failure | uint8 | 0195 | 405 |
| Network.1.Meas.Frequency | Frequency of the line | float32 | 0118 | 280 |
| Network.1.Meas.HtSinkTemp | Heatsink 1 temperature | float32 | 011A | 282 |
| Network.1.Meas.HtSinkTmp2 | Heatsink 2 temperature | float32 | 011B | 283 |
| Network.1.Meas.HtSinkTmp3 | Heatsink 3 temperature | float32 | 011C | 284 |
| Network.1.Meas.I | Irms of the load | float32 | 0103 | 259 |
| Network.1.Meas.I2 | Irms2 of the load | float32 | 0104 | 260 |
| Network.1.Meas.I3 | Irms3 of the load | float32 | 0105 | 261 |
| Network.1.Meas.Iavg | Average value of Irms | float32 | 0106 | 262 |
| Network.1.Meas.IrmsMax | Maximum rms current in a 3 phase network. | float32 | 0120 | 288 |
| Network.1.Meas.Isq | Square value of the load current | float32 | 0108 | 264 |
| Network.1.Meas.IsqBurst | Average square value of load current in burst firing | float32 | 0107 | 263 |
| Network.1.Meas.IsqMax | Maximum squared current in a 3 phase network. | float32 | 0109 | 265 |
| Network.1.Meas.P | True power measurement. | float32 | 0111 | 273 |

### 8.4 PARAMETER TABLE (Cont.)

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|
| Network.1.Meas.PBurst | True Power measurement in burst firing | float32 | 0110 | 272 |
| Network.1.Meas.PF | Power Factor | float32 | 0113 | 275 |
| Network.1.Meas.Q | Reactive Power | float32 | 0114 | 276 |
| Network.1.Meas.S | Apparent power measurement | float32 | 0112 | 274 |
| Network.1.Meas.V | Vrms of the load | float32 | 010A | 266 |
| Network.1.Meas.V2 | Vrms2 of the load | float32 | 010B | 267 |
| Network.1.Meas.V3 | Vrms3 of the load | float32 | 010C | 268 |
| Network.1.Meas.Vavg | Average value of Vrms | float32 | 010D | 269 |
| Network.1.Meas.Vline | Line voltage measurement | float32 | 0100 | 256 |
| Network.1.Meas.Vline2 | Line voltage measurement | float32 | 0101 | 257 |
| Network.1.Meas.Vline3 | Line voltage measurement | float32 | 0102 | 258 |
| Network.1.Meas.VrmsMax | Maximum rms voltages in the 3 phase network. | float32 | 0121 | 289 |
| Network.1.Meas.Vsq | Square value of load voltage | float32 | 010E | 270 |
| Network.1.Meas.VsqBurst | Average square value of the load voltage in burst firing | float32 | 0119 | 281 |
| Network.1.Meas.VsqMax | Maximum squared voltages in the 3 phase network. | float32 | 010F | 271 |
| Network.1.Meas.Z | Load impedance | float32 | 0115 | 277 |
| Network.1.Meas.Z2 | Load impedance2 | float32 | 0116 | 278 |
| Network.1.Meas.Z3 | Load impedance3 | float32 | 0117 | 279 |
| Network.1.Setup.ChopOffNb | Chop Off Number | uint8 | 0126 | 294 |
| Network.1.Setup.ChopOffThreshold1 | Chop Off Threshold1 | uint8 | 0124 | 292 |
| Network.1.Setup.ChopOffThreshold2 | Chop Off Threshold2 | uint16 | 0125 | 293 |
| Network.1.Setup.ChopOffWindow | Chop Off Window | uint16 | 0127 | 295 |
| Network.1.Setup.FreqDriftThreshold | Frequency Drift Threshold. | float32 | 013F | 319 |
| Network.1.Setup.HeaterType | Heater type of the load | uint8 | 012F | 303 |
| Network.1.Setup.HeatsinkPreTemp | Heatsink pre alarm temperature threshold | uint8 | 012A | 298 |
| Network.1.Setup.HeatsinkTmax | Maximum temperature of the heatsink | uint8 | 0122 | 290 |
| Network.1.Setup.IextScale | External current scale adjustment | float32 | 0132 | 306 |
| Network.1.Setup.IMaximum | Maximum Current of the stack<br>0 = Ext100A 8 = 400A 16 = Ext1300A<br>1 = Ext160A 9 = 630A 17 = Ext1700A<br>2 = Ext250A 10 = 500A 18 = Ext2000A<br>3 = Ext400A 11 = Ext 500A 19 = Ext3000A<br>4 = Ext630A 12 = 50A 20 = Ext4000A<br>5 = 100A 13 = Ext50A 21 = Ext5000A<br>6 = 160A 14 = Ext800A<br>7 = 250A 15 = Ext1000A | uint8 | 0136 | 310 |
| Network.1.Setup.INominal | Nominal current of the stack | float32 | 0135 | 309 |
| Network.1.Setup.NetType | The type of network. Set in Instrument.Configuration. (0 = 3Ph, 1 = 1Ph, 2 = 2Ph) | uint8 | 0133 | 307 |
| Network.1.Setup.OverIThreshold | Over Current Threshold | uint16 | 012E | 302 |
| Network.1.Setup.OverVoltThreshold | Over voltage threshold | uint8 | 0128 | 296 |
| Network.1.Setup.PLFAdjusted | Partial load failure adjusted acknowledge (0 = Not adjusted, 1 = Adjusted) | uint8 | 012B | 299 |
| Network.1.Setup.PLFAdjustReq | Partial load failure adjustment request (0 = No, 7 = Request) | uint8 | 0131 | 305 |
| Network.1.Setup.PLFSensitivity | Partial load failure sensitivity | uint8 | 012C | 300 |
| Network.1.Setup.PLUthreshold | Partial load unbalance threshold | uint8 | 012D | 301 |
| Network.1.Setup.UnderVoltThreshold | Under voltage threshold | uint8 | 0129 | 297 |
| Network.1.Setup.VdipsThreshold | Voltage Dips Threshold | uint8 | 0123 | 291 |
| Network.1.Setup.VextScale | External voltage scale adjustment | float32 | 0140 | 320 |
| Network.1.Setup.VlineNominal | Line nominal value | float32 | 0130 | 304 |
| Network.1.Setup.VloadNominal | Load Nominal voltage | float32 | 0134 | 308 |
| Network.1.Setup.VMaximum | Maximum Voltage of the stack (0 = 600V, 1 = 690V) | uint8 | 0141 | 321 |
| Network.1.Setup.Zref | PLF reference load impedance phase 1 | float32 | 0139 | 313 |
| Network.1.Setup.Zref2 | PLF reference load impedance phase 2 | float32 | 013A | 314 |
| Network.1.Setup.Zref3 | PLF reference load impedance phase 3 | float32 | 013B | 315 |
| | Network 2. See Network 1 for enumeration values | | | |
| Network.2.AlmAck.ChopOff | Process alarm ack: Chop Off | uint8 | 022C | 556 |
| Network.2.AlmAck.FreqFault | System alarm ack: Frequency Fault | uint8 | 0229 | 553 |

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|---|---|---|---|---|
| Network.2.AlmAck.FuseBlown | System alarm ack: Fuse Blown | uint8 | 0226 | 550 |
| Network.2.AlmAck.MainsVoltFault | Process alarm ack: Mains Voltage Fault | uint8 | 022F | 559 |
| Network.2.AlmAck.MissMains | System alarm ack: Missing Mains | uint8 | 0223 | 547 |
| Network.2.AlmAck.NetworkDips | System alarm ack: Mains Voltage Dips | uint8 | 0228 | 552 |
| Network.2.AlmAck.OpenThyr | System alarm ack: Open Thyristor | uint8 | 0225 | 549 |
| Network.2.AlmAck.OverCurrent | Indication alarm ack: Over Current | uint8 | 0231 | 561 |
| Network.2.AlmAck.OverTemp | System alarm ack: Over Temperature | uint8 | 0227 | 551 |
| Network.2.AlmAck.PB24VFail | System alarm ack: Power Board 24V Failure | uint8 | 022A | 554 |
| Network.2.AlmAck.PLF | Process alarm ack: Partial Load Failure | uint8 | 022D | 557 |
| Network.2.AlmAck.PLU | Process alarm ack: Partial Load Unbalance | uint8 | 022E | 558 |
| Network.2.AlmAck.PreTemp | Process alarm ack: Pre-Temperature | uint8 | 0230 | 560 |
| Network.2.AlmAck.ThyrSC | System alarm ack: Thyristor Short Circuit | uint8 | 0224 | 548 |
| Network.2.AlmAck.TLF | Process alarm ack: Total Load Failure | uint8 | 022B | 555 |
| Network.2.AlmDet.ChopOff | Process alarm detection status: Chop Off | uint8 | 01FF | 511 |
| Network.2.AlmDet.FreqFault | System alarm detection status: Frequency Fault | uint8 | 01FC | 508 |
| Network.2.AlmDet.FuseBlown | System alarm detection status: Fuse Blown | uint8 | 01F9 | 505 |
| Network.2.AlmDet.MainsVoltFault | Process alarm detection Status: Mains Voltage Fault | uint8 | 0202 | 514 |
| Network.2.AlmDet.MissMains | System alarm detection status: Missing Mains | uint8 | 01F6 | 502 |
| Network.2.AlmDet.NetworkDips | System alarm detection status: Mains Voltage Dips | uint8 | 01FB | 507 |
| Network.2.AlmDet.OpenThyr | System alarm detection status: Open Thyristor | uint8 | 01F8 | 504 |
| Network.2.AlmDet.OverCurrent | Indication alarm detection Status: Over Current | uint8 | 0204 | 516 |
| Network.2.AlmDet.OverTemp | System alarm detection status: Over Temperature | uint8 | 01FA | 506 |
| Network.2.AlmDet.PB24VFail | System alarm detection status:Power Board 24V Failure | uint8 | 01FD | 509 |
| Network.2.AlmDet.PLF | Process alarm detection status: Partial Load Failure | uint8 | 0200 | 512 |
| Network.2.AlmDet.PLU | Process alarm detection status: Partial Load Unbalance | uint8 | 0201 | 513 |
| Network.2.AlmDet.PreTemp | Process alarm detection Status: Pre-Temperature | uint8 | 0203 | 515 |
| Network.2.AlmDet.ThyrSC | System alarm detection status: Thyristor Short Circuit | uint8 | 01F7 | 503 |
| Network.2.AlmDet.TLF | Process alarm detection status: Total Load Failure | uint8 | 01FE | 510 |
| Network.2.AlmDis.ChopOff | Process alarm: Chop Off | uint8 | 01F0 | 496 |
| Network.2.AlmDis.FreqFault | System alarm: Frequency Fault | uint8 | 01ED | 493 |
| Network.2.AlmDis.FuseBlown | System alarm: Fuse Blown | uint8 | 01EA | 490 |
| Network.2.AlmDis.MainsVoltFault | Process alarm: Mains Voltage Fault | uint8 | 01F3 | 499 |
| Network.2.AlmDis.MissMains | System alarm: Missing Mains | uint8 | 01E7 | 487 |
| Network.2.AlmDis.NetworkDips | System alarm: Mains Voltage Dips | uint8 | 01EC | 492 |
| Network.2.AlmDis.OpenThyr | System alarm: Open Thyristor | uint8 | 01E9 | 489 |
| Network.2.AlmDis.OverCurrent | Indication alarm: Over Current | uint8 | 01F5 | 501 |
| Network.2.AlmDis.OverTemp | System alarm: Over Temperature | uint8 | 01EB | 491 |
| Network.2.AlmDis.PB24VFail | System alarm: Power Board 24V Failure | uint8 | 01EE | 494 |
| Network.2.AlmDis.PLF | Process alarm: Partial Load Failure | uint8 | 01F1 | 497 |
| Network.2.AlmDis.PLU | Process alarm: Partial Load Unbalance | uint8 | 01F2 | 498 |
| Network.2.AlmDis.PreTemp | Process alarm: Pre-Temperature | uint8 | 01F4 | 500 |
| Network.2.AlmDis.ThyrSC | System alarm: Thyristor Short Circuit | uint8 | 01E8 | 488 |
| Network.2.AlmDis.TLF | Process alarm: Total Load Failure | uint8 | 01EF | 495 |
| Network.2.AlmLat.ChopOff | Process alarm latch: Chop Off | uint8 | 021D | 541 |
| Network.2.AlmLat.FreqFault | System alarm latch: Frequency Fault | uint8 | 021A | 538 |
| Network.2.AlmLat.FuseBlown | System alarm latch: Fuse Blown | uint8 | 0217 | 535 |
| Network.2.AlmLat.MainsVoltFault | Process alarm latch: Mains Voltage Fault | uint8 | 0220 | 544 |
| Network.2.AlmLat.MissMains | System alarm latch: Missing Mains | uint8 | 0214 | 532 |
| Network.2.AlmLat.NetworkDips | System alarm latch: Mains Voltage Dips | uint8 | 0219 | 537 |
| Network.2.AlmLat.OpenThyr | System alarm latch: Open Thyristor | uint8 | 0216 | 534 |
| Network.2.AlmLat.OverCurrent | Indication alarm latch: Over Current | uint8 | 0222 | 546 |
| Network.2.AlmLat.OverTemp | System alarm latch: Over Temperature | uint8 | 0218 | 536 |
| Network.2.AlmLat.PB24VFail | System alarm latch: Power Board 24V Failure | uint8 | 021B | 539 |
| Network.2.AlmLat.PLF | Process alarm latch: Partial Load Failure | uint8 | 021E | 542 |
| Network.2.AlmLat.PLU | Process alarm latch: Partial Load Unbalance | uint8 | 021F | 543 |
| Network.2.AlmLat.PreTemp | Process alarm latch: Pre-Temperature | uint8 | 0221 | 545 |
| Network.2.AlmLat.ThyrSC | System alarm latch: Thyristor Short Circuit | uint8 | 0215 | 533 |
| Network.2.AlmLat.TLF | Process alarm latch: Total Load Failure | uint8 | 021C | 540 |
| Network.2.AlmSig.ChopOff | Process alarm signalling status: Chop Off | uint8 | 020E | 526 |
| Network.2.AlmSig.FreqFault | System alarm signalling status: Frequency Fault | uint8 | 020B | 523 |
| Network.2.AlmSig.FuseBlown | System alarm signalling status: Fuse Blown | uint8 | 0208 | 520 |
| Network.2.AlmSig.MainsVoltFault | Process alarm signalling status: Mains Voltage Fault | uint8 | 0211 | 529 |
| Network.2.AlmSig.MissMains | System alarm signalling status: Missing Mains | uint8 | 0205 | 517 |

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|---|---|---|---|---|
| Network.2.AlmSig.NetworkDips | System alarm signalling status: Mains Voltage Dips | uint8 | 020A | 522 |
| Network.2.AlmSig.OpenThyr | System alarm signalling status: Open Thyristor | uint8 | 0207 | 519 |
| Network.2.AlmSig.OverCurrent | Indication alarm signalling status: Over Current | uint8 | 0213 | 531 |
| Network.2.AlmSig.OverTemp | System alarm signalling status: Over Temperature | uint8 | 0209 | 521 |
| Network.2.AlmSig.PB24VFail | System alarm signalling status: Power Board 24V Failure | uint8 | 020C | 524 |
| Network.2.AlmSig.PLF | Process alarm signalling status: Partial Load Failure | uint8 | 020F | 527 |
| Network.2.AlmSig.PLU | Process alarm signalling status: Partial Load Unbalance | uint8 | 0210 | 528 |
| Network.2.AlmSig.PreTemp | Process alarm signalling status: Pre-Temperature | uint8 | 0212 | 530 |
| Network.2.AlmSig.ThyrSC | System alarm signalling status: Thyristor Short Circuit | uint8 | 0206 | 518 |
| Network.2.AlmSig.TLF | Process alarm signalling status: Total Load Failure | uint8 | 020D | 525 |
| Network.2.AlmStop.ChopOff | Process alarm stop: Chop Off | uint8 | 023B | 571 |
| Network.2.AlmStop.FreqFault | System alarm stop: Frequency Fault | uint8 | 0238 | 568 |
| Network.2.AlmStop.FuseBlown | System alarm stop: Fuse Blown | uint8 | 0235 | 565 |
| Network.2.AlmStop.MainsVoltFault | Process alarm stop: Mains Voltage Fault | uint8 | 023E | 574 |
| Network.2.AlmStop.MissMains | System alarm stop: Missing Mains | uint8 | 0232 | 562 |
| Network.2.AlmStop.NetworkDips | System alarm stop: Mains Voltage Dips | uint8 | 0237 | 567 |
| Network.2.AlmStop.OpenThyr | System alarm stop: Open Thyristor | uint8 | 0234 | 564 |
| Network.2.AlmStop.OverCurrent | Indication alarm stop: Over Current | uint8 | 0240 | 576 |
| Network.2.AlmStop.OverTemp | System alarm stop: Over Temperature | uint8 | 0236 | 566 |
| Network.2.AlmStop.PB24VFail | System alarm stop: Power Board 24V Failure | uint8 | 0239 | 569 |
| Network.2.AlmStop.PLF | Process alarm stop: Partial Load Failure | uint8 | 023C | 572 |
| Network.2.AlmStop.PLU | Process alarm stop: Partial Load Unbalance | uint8 | 023D | 573 |
| Network.2.AlmStop.PreTemp | Process alarm stop: Pre-Temperature | uint8 | 023F | 575 |
| Network.2.AlmStop.ThyrSC | System alarm stop: Thyristor Short Circuit | uint8 | 0233 | 563 |
| Network.2.AlmStop.TLF | Process alarm stop: Total Load Failure | uint8 | 023A | 570 |
| Network.2.Meas.Frequency | Frequency of the line | float32 | 01BD | 445 |
| Network.2.Meas.HtSinkTemp | Heatsink 1 temperature | float32 | 01BF | 447 |
| Network.2.Meas.HtSinkTmp2 | Heatsink 2 temperature | float32 | 01C0 | 448 |
| Network.2.Meas.HtSinkTmp3 | Heatsink 3 temperature | float32 | 01C1 | 449 |
| Network.2.Meas.I | Irms of the load | float32 | 01A8 | 424 |
| Network.2.Meas.I2 | Irms2 of the load | float32 | 01A9 | 425 |
| Network.2.Meas.I3 | Irms3 of the load | float32 | 01AA | 426 |
| Network.2.Meas.Iavg | Average value of Irms | float32 | 01AB | 427 |
| Network.2.Meas.IrmsMax | Maximum rms current in a 3 phase network. | float32 | 01C5 | 453 |
| Network.2.Meas.Isq | Square value of the load current | float32 | 01AD | 429 |
| Network.2.Meas.IsqBurst | Average square value of load current in burst firing | float32 | 01AC | 428 |
| Network.2.Meas.IsqMax | Maximum squared current in a 3 phase network. | float32 | 01AE | 430 |
| Network.2.Meas.P | True power measurement. | float32 | 01B6 | 438 |
| Network.2.Meas.PBurst | True Power measurement in burst firing | float32 | 01B5 | 437 |
| Network.2.Meas.PF | Power Factor | float32 | 01B8 | 440 |
| Network.2.Meas.Q | Reactive Power | float32 | 01B9 | 441 |
| Network.2.Meas.S | Apparent power measurement | float32 | 01B7 | 439 |
| Network.2.Meas.V | Vrms of the load | float32 | 01AF | 431 |
| Network.2.Meas.V2 | Vrms2 of the load | float32 | 01B0 | 432 |
| Network.2.Meas.V3 | Vrms3 of the load | float32 | 01B1 | 433 |
| Network.2.Meas.Vavg | Average value of Vrms | float32 | 01B2 | 434 |
| Network.2.Meas.Vline | Line voltage measurement | float32 | 01A5 | 421 |
| Network.2.Meas.Vline2 | Line voltage measurement | float32 | 01A6 | 422 |
| Network.2.Meas.Vline3 | Line voltage measurement | float32 | 01A7 | 423 |
| Network.2.Meas.VrmsMax | Maximum rms voltages in the 3 phase network. | float32 | 01C6 | 454 |
| Network.2.Meas.Vsq | Square value of load voltage | float32 | 01B3 | 435 |
| Network.2.Meas.VsqBurst | Average square value of the load voltage in burst firing | float32 | 01BE | 446 |
| Network.2.Meas.VsqMax | Maximum squared voltages in the 3 phase network. | float32 | 01B4 | 436 |
| Network.2.Meas.Z | Load impedance | float32 | 01BA | 442 |
| Network.2.Meas.Z2 | Load impedance2 | float32 | 01BB | 443 |
| Network.2.Meas.Z3 | Load impedance3 | float32 | 01BC | 444 |
| Network.2.Setup.ChopOffNb | Chop Off Number | uint8 | 01CB | 459 |
| Network.2.Setup.ChopOffThreshold1 | Chop Off Threshold1 | uint8 | 01C9 | 457 |
| Network.2.Setup.ChopOffThreshold2 | Chop Off Threshold2 | uint16 | 01CA | 458 |
| Network.2.Setup.ChopOffWindow | Chop Off Window | uint16 | 01CC | 460 |
| Network.2.Setup.FreqDriftThreshold | Frequency Drift Threshold. | float32 | 01E4 | 484 |
| Network.2.Setup.HeaterType | Heater type of the load | uint8 | 01D4 | 468 |
| Network.2.Setup.HeatsinkPreTemp | Heatsink pre alarm temperature threshold | uint8 | 01CF | 463 |

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|---|---|---|---|---|
| Network.2.Setup.HeatsinkTmax | Maximum temperature of the heatsink | uint8 | 01C7 | 455 |
| Network.2.Setup.IextScale | External current scale adjustment | float32 | 01D7 | 471 |
| Network.2.Setup.IMaximum | Maximum Current of the stack | uint8 | 01DB | 475 |
| Network.2.Setup.INominal | Nominal current of the stack | float32 | 01DA | 474 |
| Network.2.Setup.NetType | The type of network.Set in Instrument.Configuration. | uint8 | 01D8 | 472 |
| Network.2.Setup.OverIThreshold | Over Current Threshold | uint16 | 01D3 | 467 |
| Network.2.Setup.OverVoltThreshold | Over voltage threshold | uint8 | 01CD | 461 |
| Network.2.Setup.PLFAdjusted | Partial load failure adjusted acknowledge | uint8 | 01D0 | 464 |
| Network.2.Setup.PLFAdjustReq | Partial load failure adjustment request | uint8 | 01D6 | 470 |
| Network.2.Setup.PLFSensitivity | Partial load failure sensitivity | uint8 | 01D1 | 465 |
| Network.2.Setup.PLUthreshold | Partial load unbalance threshold | uint8 | 01D2 | 466 |
| Network.2.Setup.UnderVoltThreshold | Under voltage threshold | uint8 | 01CE | 462 |
| Network.2.Setup.VdipsThreshold | Voltage Dips Threshold | uint8 | 01C8 | 456 |
| Network.2.Setup.VextScale | External voltage scale adjustment | float32 | 01E5 | 485 |
| Network.2.Setup.VlineNominal | Line nominal value | float32 | 01D5 | 469 |
| Network.2.Setup.VloadNominal | Load Nominal voltage | float32 | 01D9 | 473 |
| Network.2.Setup.VMaximum | Maximum Voltage of the stack | uint8 | 01E6 | 486 |
| Network.2.Setup.Zref | PLF reference load impedance phase 1 | float32 | 01DE | 478 |
| Network.2.Setup.Zref2 | PLF reference load impedance phase 2 | float32 | 01DF | 479 |
| Network.2.Setup.Zref3 | PLF reference load impedance phase 3 | float32 | 01E0 | 480 |
| | Network 3. See Network 1 for enumeration values | | | |
| Network.3.AlmAck.ChopOff | Process alarm ack: Chop Off | uint8 | 02D1 | 721 |
| Network.3.AlmAck.FreqFault | System alarm ack: Frequency Fault | uint8 | 02CE | 718 |
| Network.3.AlmAck.FuseBlown | System alarm ack: Fuse Blown | uint8 | 02CB | 715 |
| Network.3.AlmAck.MainsVoltFault | Process alarm ack: Mains Voltage Fault | uint8 | 02D4 | 724 |
| Network.3.AlmAck.MissMains | System alarm ack: Missing Mains | uint8 | 02C8 | 712 |
| Network.3.AlmAck.NetworkDips | System alarm ack: Mains Voltage Dips | uint8 | 02CD | 717 |
| Network.3.AlmAck.OpenThyr | System alarm ack: Open Thyristor | uint8 | 02CA | 714 |
| Network.3.AlmAck.OverCurrent | Indication alarm ack: Over Current | uint8 | 02D6 | 726 |
| Network.3.AlmAck.OverTemp | System alarm ack: Over Temperature | uint8 | 02CC | 716 |
| Network.3.AlmAck.PB24VFail | System alarm ack: Power Board 24V Failure | uint8 | 02CF | 719 |
| Network.3.AlmAck.PLF | Process alarm ack: Partial Load Failure | uint8 | 02D2 | 722 |
| Network.3.AlmAck.PLU | Process alarm ack: Partial Load Unbalance | uint8 | 02D3 | 723 |
| Network.3.AlmAck.PreTemp | Process alarm ack: Pre-Temperature | uint8 | 02D5 | 725 |
| Network.3.AlmAck.ThyrSC | System alarm ack: Thyristor Short Circuit | uint8 | 02C9 | 713 |
| Network.3.AlmAck.TLF | Process alarm ack: Total Load Failure | uint8 | 02D0 | 720 |
| Network.3.AlmDet.ChopOff | Process alarm detection status: Chop Off | uint8 | 02A4 | 676 |
| Network.3.AlmDet.FreqFault | System alarm detection status: Frequency Fault | uint8 | 02A1 | 673 |
| Network.3.AlmDet.FuseBlown | System alarm detection status: Fuse Blown | uint8 | 029E | 670 |
| Network.3.AlmDet.MainsVoltFault | Process alarm detection Status: Mains Voltage Fault | uint8 | 02A7 | 679 |
| Network.3.AlmDet.MissMains | System alarm detection status: Missing Mains | uint8 | 029B | 667 |
| Network.3.AlmDet.NetworkDips | System alarm detection status: Mains Voltage Dips | uint8 | 02A0 | 672 |
| Network.3.AlmDet.OpenThyr | System alarm detection status: Open Thyristor | uint8 | 029D | 669 |
| Network.3.AlmDet.OverCurrent | Indication alarm detection Status: Over Current | uint8 | 02A9 | 681 |
| Network.3.AlmDet.OverTemp | System alarm detection status: Over Temperature | uint8 | 029F | 671 |
| Network.3.AlmDet.PB24VFail | System alarm detection status: Power Board 24V Failure | uint8 | 02A2 | 674 |
| Network.3.AlmDet.PLF | Process alarm detection status: Partial Load Failure | uint8 | 02A5 | 677 |
| Network.3.AlmDet.PLU | Process alarm detection status: Partial Load Unbalance | uint8 | 02A6 | 678 |
| Network.3.AlmDet.PreTemp | Process alarm detection Status: Pre-Temperature | uint8 | 02A8 | 680 |
| Network.3.AlmDet.ThyrSC | System alarm detection status: Thyristor Short Circuit | uint8 | 029C | 668 |
| Network.3.AlmDet.TLF | Process alarm detection status: Total Load Failure | uint8 | 02A3 | 675 |
| Network.3.AlmDis.ChopOff | Process alarm: Chop Off | uint8 | 0295 | 661 |
| Network.3.AlmDis.FreqFault | System alarm: Frequency Fault | uint8 | 0292 | 658 |
| Network.3.AlmDis.FuseBlown | System alarm: Fuse Blown | uint8 | 028F | 655 |
| Network.3.AlmDis.MainsVoltFault | Process alarm: Mains Voltage Fault | uint8 | 0298 | 664 |
| Network.3.AlmDis.MissMains | System alarm: Missing Mains | uint8 | 028C | 652 |
| Network.3.AlmDis.NetworkDips | System alarm: Mains Voltage Dips | uint8 | 0291 | 657 |
| Network.3.AlmDis.OpenThyr | System alarm: Open Thyristor | uint8 | 028E | 654 |
| Network.3.AlmDis.OverCurrent | Indication alarm: Over Current | uint8 | 029A | 666 |
| Network.3.AlmDis.OverTemp | System alarm: Over Temperature | uint8 | 0290 | 656 |
| Network.3.AlmDis.PB24VFail | System alarm: Power Board 24V Failure | uint8 | 0293 | 659 |
| Network.3.AlmDis.PLF | Process alarm: Partial Load Failure | uint8 | 0296 | 662 |

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|---|---|---|---|---|
| Network.3.AlmDis.PLU | Process alarm: Partial Load Unbalance | uint8 | 0297 | 663 |
| Network.3.AlmDis.PreTemp | Process alarm: Pre-Temperature | uint8 | 0299 | 665 |
| Network.3.AlmDis.ThyrSC | System alarm: Thyristor Short Circuit | uint8 | 028D | 653 |
| Network.3.AlmDis.TLF | Process alarm: Total Load Failure | uint8 | 0294 | 660 |
| Network.3.AlmLat.ChopOff | Process alarm latch: Chop Off | uint8 | 02C2 | 706 |
| Network.3.AlmLat.FreqFault | System alarm latch: Frequency Fault | uint8 | 02BF | 703 |
| Network.3.AlmLat.FuseBlown | System alarm latch: Fuse Blown | uint8 | 02BC | 700 |
| Network.3.AlmLat.MainsVoltFault | Process alarm latch: Mains Voltage Fault | uint8 | 02C5 | 709 |
| Network.3.AlmLat.MissMains | System alarm latch: Missing Mains | uint8 | 02B9 | 697 |
| Network.3.AlmLat.NetworkDips | System alarm latch: Mains Voltage Dips | uint8 | 02BE | 702 |
| Network.3.AlmLat.OpenThyr | System alarm latch: Open Thyristor | uint8 | 02BB | 699 |
| Network.3.AlmLat.OverCurrent | Indication alarm latch: Over Current | uint8 | 02C7 | 711 |
| Network.3.AlmLat.OverTemp | System alarm latch: Over Temperature | uint8 | 02BD | 701 |
| Network.3.AlmLat.PB24VFail | System alarm latch: Power Board 24V Failure | uint8 | 02C0 | 704 |
| Network.3.AlmLat.PLF | Process alarm latch: Partial Load Failure | uint8 | 02C3 | 707 |
| Network.3.AlmLat.PLU | Process alarm latch: Partial Load Unbalance | uint8 | 02C4 | 708 |
| Network.3.AlmLat.PreTemp | Process alarm latch: Pre-Temperature | uint8 | 02C6 | 710 |
| Network.3.AlmLat.ThyrSC | System alarm latch: Thyristor Short Circuit | uint8 | 02BA | 698 |
| Network.3.AlmLat.TLF | Process alarm latch: Total Load Failure | uint8 | 02C1 | 705 |
| Network.3.AlmSig.ChopOff | Process alarm signalling status: Chop Off | uint8 | 02B3 | 691 |
| Network.3.AlmSig.FreqFault | System alarm signalling status: Frequency Fault | uint8 | 02B0 | 688 |
| Network.3.AlmSig.FuseBlown | System alarm signalling status: Fuse Blown | uint8 | 02AD | 685 |
| Network.3.AlmSig.MainsVoltFault | Process alarm signalling status: Mains Voltage Fault | uint8 | 02B6 | 694 |
| Network.3.AlmSig.MissMains | System alarm signalling status: Missing Mains | uint8 | 02AA | 682 |
| Network.3.AlmSig.NetworkDips | System alarm s | uint8 | 02AF | 687 |
| Network.3.AlmSig.OpenThyr | System alarm s | uint8 | 02AC | 684 |
| Network.3.AlmSig.OverCurrent | Indication alar | uint8 | 02B8 | 696 |
| Network.3.AlmSig.OverTemp | System alarm signalling status: Over Temperature | uint8 | 02AE | 686 |
| Network.3.AlmSig.PB24VFail | System alarm signalling status: Power Board 24V Failure | uint8 | 02B1 | 689 |
| Network.3.AlmSig.PLF | Process alarm signalling status: Partial Load Failure | uint8 | 02B4 | 692 |
| Network.3.AlmSig.PLU | Process alarm signalling status: Partial Load Unbalance | uint8 | 02B5 | 693 |
| Network.3.AlmSig.PreTemp | Process alarm signalling status: Pre-Temperature | uint8 | 02B7 | 695 |
| Network.3.AlmSig.ThyrSC | System alarm signalling status: Thyristor Short Circuit | uint8 | 02AB | 683 |
| Network.3.AlmSig.TLF | Process alarm signalling status: Total Load Failure | uint8 | 02B2 | 690 |
| Network.3.AlmStop.ChopOff | Process alarm stop: Chop Off | uint8 | 02E0 | 736 |
| Network.3.AlmStop.FreqFault | System alarm stop: Frequency Fault | uint8 | 02DD | 733 |
| Network.3.AlmStop.FuseBlown | System alarm stop: Fuse Blown | uint8 | 02DA | 730 |
| Network.3.AlmStop.MainsVoltFault | Process alarm stop: Mains Voltage Fault | uint8 | 02E3 | 739 |
| Network.3.AlmStop.MissMains | System alarm stop: Missing Mains | uint8 | 02D7 | 727 |
| Network.3.AlmStop.NetworkDips | System alarm stop: Mains Voltage Dips | uint8 | 02DC | 732 |
| Network.3.AlmStop.OpenThyr | System alarm stop: Open Thyristor | uint8 | 02D9 | 729 |
| Network.3.AlmStop.OverCurrent | Indication alarm stop: Over Current | uint8 | 02E5 | 741 |
| Network.3.AlmStop.OverTemp | System alarm stop: Over Temperature | uint8 | 02DB | 731 |
| Network.3.AlmStop.PB24VFail | System alarm stop: Power Board 24V Failure | uint8 | 02DE | 734 |
| Network.3.AlmStop.PLF | Process alarm stop: Partial Load Failure | uint8 | 02E1 | 737 |
| Network.3.AlmStop.PLU | Process alarm stop: Partial Load Unbalance | uint8 | 02E2 | 738 |
| Network.3.AlmStop.PreTemp | Process alarm stop: Pre-Temperature | uint8 | 02E4 | 740 |
| Network.3.AlmStop.ThyrSC | System alarm stop: Thyristor Short Circuit | uint8 | 02D8 | 728 |
| Network.3.AlmStop.TLF | Process alarm stop: Total Load Failure | uint8 | 02DF | 735 |
| Network.3.Meas.Frequency | Frequency of the line | float32 | 0262 | 610 |
| Network.3.Meas.HtSinkTemp | Heatsink 1 temperature | float32 | 0264 | 612 |
| Network.3.Meas.HtSinkTmp2 | Heatsink 2 temperature | float32 | 0265 | 613 |
| Network.3.Meas.HtSinkTmp3 | Heatsink 3 temperature | float32 | 0266 | 614 |
| Network.3.Meas.I | Irms of the load | float32 | 024D | 589 |
| Network.3.Meas.I2 | Irms2 of the load | float32 | 024E | 590 |
| Network.3.Meas.I3 | Irms3 of the load | float32 | 024F | 591 |
| Network.3.Meas.Iavg | Average value of Irms | float32 | 0250 | 592 |
| Network.3.Meas.IrmsMax | Maximum rms current in a 3 phase network. | float32 | 026A | 618 |
| Network.3.Meas.Isq | Square value of the load current | float32 | 0252 | 594 |
| Network.3.Meas.IsqBurst | Average square value of load current in burst firing | float32 | 0251 | 593 |
| Network.3.Meas.IsqMax | Maximum squared current in a 3 phase network. | float32 | 0253 | 595 |
| Network.3.Meas.P | True power measurement. | float32 | 025B | 603 |
| Network.3.Meas.PBurst | True Power measurement in burst firing | float32 | 025A | 602 |

$$P_{\max} = \sum_{i=1}^{n} R_i H$$

| | | | | |
|---|---|---|---|---|
| Network.3.Meas.PF | Power Factor | float32 | 025D | 605 |
| Network.3.Meas.Q | Reactive Power | float32 | 025E | 606 |
| Network.3.Meas.S | Apparent power measurement | float32 | 025C | 604 |
| Network.3.Meas.V | Vrms of the load | float32 | 0254 | 596 |
| Network.3.Meas.V2 | Vrms2 of the load | float32 | 0255 | 597 |
| Network.3.Meas.V3 | Vrms3 of the load | float32 | 0256 | 598 |
| Network.3.Meas.Vavg | Average value of Vrms | float32 | 0257 | 599 |
| Network.3.Meas.Vline | Line voltage measurement | float32 | 024A | 586 |
| Network.3.Meas.Vline2 | Line voltage measurement | float32 | 024B | 587 |
| Network.3.Meas.Vline3 | Line voltage measurement | float32 | 024C | 588 |
| Network.3.Meas.VrmsMax | Maximum rms voltages in the 3 phase network. | float32 | 026B | 619 |
| Network.3.Meas.Vsq | Square value of load voltage | float32 | 0258 | 600 |
| Network.3.Meas.VsqBurst | Average square value of the load voltage in burst firing | float32 | 0263 | 611 |
| Network.3.Meas.VsqMax | Maximum squared voltages in the 3 phase network. | float32 | 0259 | 601 |
| Network.3.Meas.Z | Load impedance | float32 | 025F | 607 |
| Network.3.Meas.Z2 | Load impedance2 | float32 | 0260 | 608 |
| Network.3.Meas.Z3 | Load impedance3 | float32 | 0261 | 609 |
| Network.3.Setup.ChopOffNb | Chop Off Number | uint8 | 0270 | 624 |
| Network.3.Setup.ChopOffThreshold1 | Chop Off Threshold1 | uint8 | 026E | 622 |
| Network.3.Setup.ChopOffThreshold2 | Chop Off Threshold2 | uint16 | 026F | 623 |
| Network.3.Setup.ChopOffWindow | Chop Off Window | uint16 | 0271 | 625 |
| Network.3.Setup.FreqDriftThreshold | Frequency Drift Threshold. | float32 | 0289 | 649 |
| Network.3.Setup.HeaterType | Heater type of the load | uint8 | 0279 | 633 |
| Network.3.Setup.HeatsinkPreTemp | Heatsink pre alarm temperature threshold | uint8 | 0274 | 628 |
| Network.3.Setup.HeatsinkTmax | Maximum temperature of the heatsink | uint8 | 026C | 620 |
| Network.3.Setup.IextScale | External current scale adjustment | float32 | 027C | 636 |
| Network.3.Setup.IMaximum | Maximum Current of the stack | uint8 | 0280 | 640 |
| Network.3.Setup.INominal | Nominal current of the stack | float32 | 027F | 639 |
| Network.3.Setup.NetType | The type of network. Set in Instrument.Configuration. | uint8 | 027D | 637 |
| Network.3.Setup.OverIThreshold | Over Current Threshold | uint16 | 0278 | 632 |
| Network.3.Setup.OverVoltThreshold | Over voltage threshold | uint8 | 0272 | 626 |
| Network.3.Setup.PLFAdjusted | Partial load failure adjusted acknowledge | uint8 | 0275 | 629 |
| Network.3.Setup.PLFAdjustReq | Partial load failure adjustment request | uint8 | 027B | 635 |
| Network.3.Setup.PLFSensitivity | Partial load failure sensitivity | uint8 | 0276 | 630 |
| Network.3.Setup.PLUthreshold | Partial load unbalance threshold | uint8 | 0277 | 631 |
| Network.3.Setup.UnderVoltThreshold | Under voltage threshold | uint8 | 0273 | 627 |
| Network.3.Setup.VdipsThreshold | Voltage Dips Threshold | uint8 | 026D | 621 |
| Network.3.Setup.VextScale | External voltage scale adjustment | float32 | 028A | 650 |
| Network.3.Setup.VlineNominal | Line nominal value | float32 | 027A | 634 |
| Network.3.Setup.VloadNominal | Load Nominal voltage | float32 | 027E | 638 |
| Network.3.Setup.VMaximum | Maximum Voltage of the stack | uint8 | 028B | 651 |
| Network.3.Setup.Zref | PLF reference load impedance phase 1 | float32 | 0283 | 643 |
| Network.3.Setup.Zref2 | PLF reference load impedance phase 2 | float32 | 0284 | 644 |
| Network.3.Setup.Zref3 | PLF reference load impedance phase 3 | float32 | 0285 | 645 |

Network 4. See Network 1 for enumeration values

| | | | | |
|---|---|---|---|---|
| Network.4.AlmAck.ChopOff | Process alarm ack: Chop Off | uint8 | 0376 | 886 |
| Network.4.AlmAck.FreqFault | System alarm ack: Frequency Fault | uint8 | 0373 | 883 |
| Network.4.AlmAck.FuseBlown | System alarm ack: Fuse Blown | uint8 | 0370 | 880 |
| Network.4.AlmAck.MainsVoltFault | Process alarm ack: Mains Voltage Fault | uint8 | 0379 | 889 |
| Network.4.AlmAck.MissMains | System alarm ack: Missing Mains | uint8 | 036D | 877 |
| Network.4.AlmAck.NetworkDips | System alarm ack: Mains Voltage Dips | uint8 | 0372 | 882 |
| Network.4.AlmAck.OpenThyr | System alarm ack: Open Thyristor | uint8 | 036F | 879 |
| Network.4.AlmAck.OverCurrent | Indication alarm ack: Over Current | uint8 | 037B | 891 |
| Network.4.AlmAck.OverTemp | System alarm ack: Over Temperature | uint8 | 0371 | 881 |
| Network.4.AlmAck.PB24VFail | System alarm ack: Power Board 24V Failure | uint8 | 0374 | 884 |
| Network.4.AlmAck.PLF | Process alarm ack: Partial Load Failure | uint8 | 0377 | 887 |
| Network.4.AlmAck.PLU | Process alarm ack: Partial Load Unbalance | uint8 | 0378 | 888 |
| Network.4.AlmAck.PreTemp | Process alarm ack: Pre-Temperature | uint8 | 037A | 890 |
| Network.4.AlmAck.ThyrSC | System alarm ack: Thyristor Short Circuit | uint8 | 036E | 878 |
| Network.4.AlmAck.TLF | Process alarm ack: Total Load Failure | uint8 | 0375 | 885 |
| Network.4.AlmDet.ChopOff | Process alarm detection status: Chop Off | uint8 | 0349 | 841 |
| Network.4.AlmDet.FreqFault | System alarm detection status: Frequency Fault | uint8 | 0346 | 838 |

| | | | | |
|---|---|---|---|---|
| Network.4.AlmDet.FuseBlown | System alarm detection status: Fuse Blown | uint8 | 0343 | 835 |
| Network.4.AlmDet.MainsVoltFault | Process alarm detection Status: Mains Voltage Fault | uint8 | 034C | 844 |
| Network.4.AlmDet.MissMains | System alarm detection status: Missing Mains | uint8 | 0340 | 832 |
| Network.4.AlmDet.NetworkDips | System alarm detection status: Mains Voltage Dips | uint8 | 0345 | 837 |
| Network.4.AlmDet.OpenThyr | System alarm detection status: Open Thyristor | uint8 | 0342 | 834 |
| Network.4.AlmDet.OverCurrent | Indication alarm detection Status: Over Current | uint8 | 034E | 846 |
| Network.4.AlmDet.OverTemp | System alarm detection status: Over Temperature | uint8 | 0344 | 836 |
| Network.4.AlmDet.PB24VFail | System alarm detection status: Power Board 24V Failure | uint8 | 0347 | 839 |
| Network.4.AlmDet.PLF | Process alarm detection status: Partial Load Failure | uint8 | 034A | 842 |
| Network.4.AlmDet.PLU | Process alarm detection status: Partial Load Unbalance | uint8 | 034B | 843 |
| Network.4.AlmDet.PreTemp | Process alarm detection Status: Pre-Temperature | uint8 | 034D | 845 |
| Network.4.AlmDet.ThyrSC | System alarm detection status: Thyristor Short Circuit | uint8 | 0341 | 833 |
| Network.4.AlmDet.TLF | Process alarm detection status: Total Load Failure | uint8 | 0348 | 840 |
| Network.4.AlmDis.ChopOff | Process alarm: Chop Off | uint8 | 033A | 826 |
| Network.4.AlmDis.FreqFault | System alarm: Frequency Fault | uint8 | 0337 | 823 |
| Network.4.AlmDis.FuseBlown | System alarm: Fuse Blown | uint8 | 0334 | 820 |
| Network.4.AlmDis.MainsVoltFault | Process alarm: Mains Voltage Fault | uint8 | 033D | 829 |
| Network.4.AlmDis.MissMains | System alarm: Missing Mains | uint8 | 0331 | 817 |
| Network.4.AlmDis.NetworkDips | System alarm: Mains Voltage Dips | uint8 | 0336 | 822 |
| Network.4.AlmDis.OpenThyr | System alarm: Open Thyristor | uint8 | 0333 | 819 |
| Network.4.AlmDis.OverCurrent | Indication alarm: Over Current | uint8 | 033F | 831 |
| Network.4.AlmDis.OverTemp | System alarm: Over Temperature | uint8 | 0335 | 821 |
| Network.4.AlmDis.PB24VFail | System alarm: Power Board 24V Failure | uint8 | 0338 | 824 |
| Network.4.AlmDis.PLF | Process alarm: Partial Load Failure | uint8 | 033B | 827 |
| Network.4.AlmDis.PLU | Process alarm: Partial Load Unbalance | uint8 | 033C | 828 |
| Network.4.AlmDis.PreTemp | Process alarm: Pre-Temperature | uint8 | 033E | 830 |
| Network.4.AlmDis.ThyrSC | System alarm: Thyristor Short Circuit | uint8 | 0332 | 818 |
| Network.4.AlmDis.TLF | Process alarm: Total Load Failure | uint8 | 0339 | 825 |
| Network.4.AlmLat.ChopOff | Process alarm latch: Chop Off | uint8 | 0367 | 871 |
| Network.4.AlmLat.FreqFault | System alarm latch: Frequency Fault | uint8 | 0364 | 868 |
| Network.4.AlmLat.FuseBlown | System alarm latch: Fuse Blown | uint8 | 0361 | 865 |
| Network.4.AlmLat.MainsVoltFault | Process alarm latch: Mains Voltage Fault | uint8 | 036A | 874 |
| Network.4.AlmLat.MissMains | System alarm latch: Missing Mains | uint8 | 035E | 862 |
| Network.4.AlmLat.NetworkDips | System alarm latch: Mains Voltage Dips | uint8 | 0363 | 867 |
| Network.4.AlmLat.OpenThyr | System alarm latch: Open Thyristor | uint8 | 0360 | 864 |
| Network.4.AlmLat.OverCurrent | Indication alarm latch: Over Current | uint8 | 036C | 876 |
| Network.4.AlmLat.OverTemp | System alarm latch: Over Temperature | uint8 | 0362 | 866 |
| Network.4.AlmLat.PB24VFail | System alarm latch: Power Board 24V Failure | uint8 | 0365 | 869 |
| Network.4.AlmLat.PLF | Process alarm latch: Partial Load Failure | uint8 | 0368 | 872 |
| Network.4.AlmLat.PLU | Process alarm latch: Partial Load Unbalance | uint8 | 0369 | 873 |
| Network.4.AlmLat.PreTemp | Process alarm latch: Pre-Temperature | uint8 | 036B | 875 |
| Network.4.AlmLat.ThyrSC | System alarm latch: Thyristor Short Circuit | uint8 | 035F | 863 |
| Network.4.AlmLat.TLF | Process alarm latch: Total Load Failure | uint8 | 0366 | 870 |
| Network.4.AlmSig.ChopOff | Process alarm signalling status: Chop Off | uint8 | 0358 | 856 |
| Network.4.AlmSig.FreqFault | System alarm signalling status: Frequency Fault | uint8 | 0355 | 853 |
| Network.4.AlmSig.FuseBlown | System alarm signalling status: Fuse Blown | uint8 | 0352 | 850 |
| Network.4.AlmSig.MainsVoltFault | Process alarm signalling status: Mains Voltage Fault | uint8 | 035B | 859 |
| Network.4.AlmSig.MissMains | System alarm signalling status: Missing Mains | uint8 | 034F | 847 |
| Network.4.AlmSig.NetworkDips | System alarm signalling status: Mains Voltage Dips | uint8 | 0354 | 852 |
| Network.4.AlmSig.OpenThyr | System alarm signalling status: Open Thyristor | uint8 | 0351 | 849 |
| Network.4.AlmSig.OverCurrent | Indication alarm signalling status: Over Current | uint8 | 035D | 861 |
| Network.4.AlmSig.OverTemp | System alarm signalling status: Over Temperature | uint8 | 0353 | 851 |
| Network.4.AlmSig.PB24VFail | System alarm signalling status: Power Board 24V Failure | uint8 | 0356 | 854 |
| Network.4.AlmSig.PLF | Process alarm signalling status: Partial Load Failure | uint8 | 0359 | 857 |
| Network.4.AlmSig.PLU | Process alarm signalling status: Partial Load Unbalance | uint8 | 035A | 858 |
| Network.4.AlmSig.PreTemp | Process alarm signalling status: Pre-Temperature | uint8 | 035C | 860 |
| Network.4.AlmSig.ThyrSC | System alarm signalling status: Thyristor Short Circuit | uint8 | 0350 | 848 |
| Network.4.AlmSig.TLF | Process alarm signalling status: Total Load Failure | uint8 | 0357 | 855 |
| Network.4.AlmStop.ChopOff | Process alarm stop: Chop Off | uint8 | 0385 | 901 |
| Network.4.AlmStop.FreqFault | System alarm stop: Frequency Fault | uint8 | 0382 | 898 |
| Network.4.AlmStop.FuseBlown | System alarm stop: Fuse Blown | uint8 | 037F | 895 |
| Network.4.AlmStop.MainsVoltFault | Process alarm stop: Mains Voltage Fault | uint8 | 0388 | 904 |
| Network.4.AlmStop.MissMains | System alarm stop: Missing Mains | uint8 | 037C | 892 |

| | | | | |
|---|---|---|---|---|
| Network.4.AlmStop.NetworkDips | System alarm stop: Mains Voltage Dips | uint8 | 0381 | 897 |
| Network.4.AlmStop.OpenThyr | System alarm stop: Open Thyristor | uint8 | 037E | 894 |
| Network.4.AlmStop.OverCurrent | Indication alarm stop: Over Current | uint8 | 038A | 906 |
| Network.4.AlmStop.OverTemp | System alarm stop: Over Temperature | uint8 | 0380 | 896 |
| Network.4.AlmStop.PB24VFail | System alarm stop: Power Board 24V Failure | uint8 | 0383 | 899 |
| Network.4.AlmStop.PLF | Process alarm stop: Partial Load Failure | uint8 | 0386 | 902 |
| Network.4.AlmStop.PLU | Process alarm stop: Partial Load Unbalance | uint8 | 0387 | 903 |
| Network.4.AlmStop.PreTemp | Process alarm stop: Pre-Temperature | uint8 | 0389 | 905 |
| Network.4.AlmStop.ThyrSC | System alarm stop: Thyristor Short Circuit | uint8 | 037D | 893 |
| Network.4.AlmStop.TLF | Process alarm stop: Total Load Failure | uint8 | 0384 | 900 |
| Network.4.Meas.Frequency | Frequency of the line | float32 | 0307 | 775 |
| Network.4.Meas.HtSinkTemp | Heatsink 1 temperature | float32 | 0309 | 777 |
| Network.4.Meas.HtSinkTmp2 | Heatsink 2 temperature | float32 | 030A | 778 |
| Network.4.Meas.HtSinkTmp3 | Heatsink 3 temperature | float32 | 030B | 779 |
| Network.4.Meas.I | Irms of the load | float32 | 02F2 | 754 |
| Network.4.Meas.I2 | Irms2 of the load | float32 | 02F3 | 755 |
| Network.4.Meas.I3 | Irms3 of the load | float32 | 02F4 | 756 |
| Network.4.Meas.Iavg | Average value of Irms | float32 | 02F5 | 757 |
| Network.4.Meas.IrmsMax | Maximum rms current in a 3 phase network. | float32 | 030F | 783 |
| Network.4.Meas.Isq | Square value of the load current | float32 | 02F7 | 759 |
| Network.4.Meas.IsqBurst | Average square value of load current in burst firing | float32 | 02F6 | 758 |
| Network.4.Meas.IsqMax | Maximum squared current in a 3 phase network. | float32 | 02F8 | 760 |
| Network.4.Meas.P | True power measurement. | float32 | 0300 | 768 |
| Network.4.Meas.PBurst | True Power measurement in burst firing | float32 | 02FF | 767 |
| Network.4.Meas.PF | Power Factor | float32 | 0302 | 770 |
| Network.4.Meas.Q | Reactive Power | float32 | 0303 | 771 |
| Network.4.Meas.S | Apparent power measurement | float32 | 0301 | 769 |
| Network.4.Meas.V | Vrms of the load | float32 | 02F9 | 761 |
| Network.4.Meas.V2 | Vrms2 of the load | float32 | 02FA | 762 |
| Network.4.Meas.V3 | Vrms3 of the load | float32 | 02FB | 763 |
| Network.4.Meas.Vavg | Average value of Vrms | float32 | 02FC | 764 |
| Network.4.Meas.Vline | Line voltage measurement | float32 | 02EF | 751 |
| Network.4.Meas.Vline2 | Line voltage measurement | float32 | 02F0 | 752 |
| Network.4.Meas.Vline3 | Line voltage measurement | float32 | 02F1 | 753 |
| Network.4.Meas.VrmsMax | Maximum rms voltages in the 3 phase network. | float32 | 0310 | 784 |
| Network.4.Meas.Vsq | Square value of load voltage | float32 | 02FD | 765 |
| Network.4.Meas.VsqBurst | Average square value of the load voltage in burst firing | float32 | 0308 | 776 |
| Network.4.Meas.VsqMax | Maximum squared voltages in the 3 phase network. | float32 | 02FE | 766 |
| Network.4.Meas.Z | Load impedance | float32 | 0304 | 772 |
| Network.4.Meas.Z2 | Load impedance2 | float32 | 0305 | 773 |
| Network.4.Meas.Z3 | Load impedance3 | float32 | 0306 | 774 |
| Network.4.Setup.ChopOffNb | Chop Off Number | uint8 | 0315 | 789 |
| Network.4.Setup.ChopOffThreshold1 | Chop Off Threshold1 | uint8 | 0313 | 787 |
| Network.4.Setup.ChopOffThreshold2 | Chop Off Threshold2 | uint16 | 0314 | 788 |
| Network.4.Setup.ChopOffWindow | Chop Off Window | uint16 | 0316 | 790 |
| Network.4.Setup.FreqDriftThreshold | Frequency Drift Threshold. | float32 | 032E | 814 |
| Network.4.Setup.HeaterType | Heater type of the load | uint8 | 031E | 798 |
| Network.4.Setup.HeatsinkPreTemp | Heatsink pre alarm temperature threshold | uint8 | 0319 | 793 |
| Network.4.Setup.HeatsinkTmax | Maximum temperature of the heatsink | uint8 | 0311 | 785 |
| Network.4.Setup.IextScale | External current scale adjustment | float32 | 0321 | 801 |
| Network.4.Setup.IMaximum | Maximum Current of the stack | uint8 | 0325 | 805 |
| Network.4.Setup.INominal | Nominal current of the stack | float32 | 0324 | 804 |
| Network.4.Setup.NetType | The type of network. Set in Instrument.Configuration. | uint8 | 0322 | 802 |
| Network.4.Setup.OverIThreshold | Over Current Threshold | uint16 | 031D | 797 |
| Network.4.Setup.OverVoltThreshold | Over voltage threshold | uint8 | 0317 | 791 |
| Network.4.Setup.PLFAdjusted | Partial load failure adjusted acknowledge | uint8 | 031A | 794 |
| Network.4.Setup.PLFAdjustReq | Partial load failure adjustment request | uint8 | 0320 | 800 |
| Network.4.Setup.PLFSensitivity | Partial load failure sensitivity | uint8 | 031B | 795 |
| Network.4.Setup.PLUthreshold | Partial load unbalance threshold | uint8 | 031C | 796 |
| Network.4.Setup.UnderVoltThreshold | Under voltage threshold | uint8 | 0318 | 792 |
| Network.4.Setup.VdipsThreshold | Voltage Dips Threshold | uint8 | 0312 | 786 |
| Network.4.Setup.VextScale | External voltage scale adjustment | float32 | 032F | 815 |

| | | | | |
|---|---|---|---|---|
| Network.4.Setup.VlineNominal | Line nominal value | float32 | 031F | 799 |
| Network.4.Setup.VloadNominal | Load Nominal voltage | float32 | 0323 | 803 |
| Network.4.Setup.VMaximum | Maximum Voltage of the stack | uint8 | 0330 | 816 |
| Network.4.Setup.Zref | PLF reference load impedance phase 1 | float32 | 0328 | 808 |
| Network.4.Setup.Zref2 | PLF reference load impedance phase 2 | float32 | 0329 | 809 |
| Network.4.Setup.Zref3 | PLF reference load impedance phase 3 | float32 | 032A | 810 |
| PLM.AlmAck.PrOverPs | Indication alarm acknowledge: Pr Over Ps (0 = NoAck, 1 = Ack) | uint8 | 06C6 | 1734 |
| PLM.AlmDet.PrOverPs | Indication alarm detection status: Pr Over Ps (0 = Inactive, 1 = Active) | uint8 | 06C3 | 1731 |
| PLM.AlmDis.PrOverPs | Indication alarm: Pr Over Ps (0 = Enable, 1 = Disable) | uint8 | 06C2 | 1730 |
| PLM.AlmLat.PrOverPs | Indication alarm latch request: Pr Over Ps (0 = NoLatch, 1 = Latch) | uint8 | 06C5 | 1733 |
| PLM.AlmSig.PrOverPs | Indication alarm signalling status: Pr Over Ps (0 = Not latched, 1 = Latched) | uint8 | 06C4 | 1732 |
| PLM.AlmStop.PrOverPs | Indication alarm stop request: Pr Over Ps (0 = NoStop, 1 = Stop) | uint8 | 06C7 | 1735 |
| PLM.Main.Period | Modulation period | uint16 | 06B2 | 1714 |
| PLM.Main.Type | Load Management Type (0 = None, 1 = Sharing, 2 = IncrT1, 3 = IncrT2, 4 = RotIncr, 5 = Distr, 6 = IncrDistr, 7 = RotIncrDistr) | uint8 | 06B1 | 1713 |
| PLM.Network.Efficiency | Load management efficiency factor | uint8 | 06C0 | 1728 |
| PLM.Network.MasterAddr | Address of elected master on the LM network | uint8 | 06C1 | 1729 |
| PLM.Network.Pmax | Max power installed on the PLM network | float32 | 06BC | 1724 |
| PLM.Network.Pr | Total power on the network after load shedding | float32 | 06BF | 1727 |
| PLM.Network.Ps | Total amount of power allowed from the network | float32 | 06BE | 1726 |
| PLM.Network.Pt | Total demanded power on the network | float32 | 06BD | 1725 |
| PLM.Network.TotalChannels | Total number of channels on the network | uint8 | 06BB | 1723 |
| PLM.Network.TotalStation | Total number of stations on the LM link | uint8 | 06BA | 1722 |
| PLM.Station.Address | Load management address | uint8 | 06B3 | 1715 |
| PLM.Station.NumChan | Number of channels for this station | uint8 | 06B5 | 1717 |
| PLM.Station.PLMOut1 | PLM Slot1 Interface output | uint16 | 06B6 | 1718 |
| PLM.Station.PLMOut2 | PLM Slot2 Interface output | uint16 | 06B7 | 1719 |
| PLM.Station.PLMOut3 | PLM Slot3 Interface output | uint16 | 06B8 | 1720 |
| PLM.Station.PLMOut4 | PLM Slot4 Interface output | uint16 | 06B9 | 1721 |
| PLM.Station.Status | Master or slave station status (0 = Pending, 1 = IsMaster, 2 = IsSlave, 3 = DupplAddr) | uint8 | 06B4 | 1716 |
| PLMChan.1.Group | Group in which the channel operates | uint8 | 06D3 | 1747 |
| PLMChan.1.PLMIn | PLM Channel Interface Input | uint16 | 06D5 | 1749 |
| PLMChan.1.PLMOut | PLM Channel Interface Output | uint16 | 06D6 | 1750 |
| PLMChan.1.PZMax | Total Power installed on the channel | float32 | 06D2 | 1746 |
| PLMChan.1.ShedFactor | Shed Factor of the Channel | uint8 | 06D4 | 1748 |
| PLMChan.2.Group | Group in which the channel operates | uint8 | 06E2 | 1762 |
| PLMChan.2.LMIn | PLM Channel Interface Input | uint16 | 06E4 | 1764 |
| PLMChan.2.LMOut | PLM Channel Interface Output | uint16 | 06E5 | 1765 |
| PLMChan.2.PZMax | Total Power installed on the channel | float32 | 06E1 | 1761 |
| PLMChan.2.ShedFactor | Shed Factor of the Channel | uint8 | 06E3 | 1763 |
| PLMChan.3.Group | Group in which the channel operates | uint8 | 06F1 | 1777 |
| PLMChan.3.LMIn | PLM Channel Interface Input | uint16 | 06F3 | 1779 |
| PLMChan.3.LMOut | PLM Channel Interface Output | uint16 | 06F4 | 1780 |
| PLMChan.3.PZMax | Total Power installed on the channel | float32 | 06F0 | 1776 |
| PLMChan.3.ShedFactor | Shed Factor of the Channel | uint8 | 06F2 | 1778 |
| PLMChan.4.Group | Group in which the channel operates | uint8 | 0700 | 1792 |
| PLMChan.4.LMIn | PLM Channel Interface Input | uint16 | 0702 | 1794 |
| PLMChan.4.LMOut | PLM Channel Interface Output | uint16 | 0703 | 1795 |
| PLMChan.4.PZMax | Total Power installed on the channel | float32 | 06FF | 1791 |
| PLMChan.4.ShedFactor | Shed Factor of the Channel | uint8 | 0701 | 1793 |
| QStart.AnalogIP1Func | Analogue input 1 function | uint8 | 084A | 2122 |

| | | | | |
|---|---|---|---|---|
| | 0 = Unused 1 = Setpoint<br>2 = SetpointLimit 3 = CurrentLimit<br>4 = VoltageLimit 5 = PowerLimit<br>6 = Transfer | | | |
| QStart.AnalogIP2Func | Analog input 2 function (as AnalogIP1) | uint8 | 084B | 2123 |
| QStart.AnalogOP1Func | Analogue output 1 function<br>0 = Unused 1 = True Power 2 = IRMS<br>3 = VRMS 4 = Resistance | uint8 | 0848 | 2120 |
| QStart.DigitalIP2Func | Digital 2 Input function (0 = Unused, 1 = SPSelect 2 = Alarm Ack, 3 = Custom) | uint8 | 0849 | 2121 |
| QStart.Energy | Activate the computation of the energy | uint8 | 0857 | 2135 |
| QStart.Feedback | Main PV for the control block<br>0 = Open 1 = $V^2$ 2 = $I^2$,<br>3 = True Power 4 = VRMS 5 = IRMS | uint8 | 0847 | 2119 |
| QStart.Finish | Finished Quick start configuration (0 = No, 1 = Yes) | uint8 | 0846 | 2118 |
| QStart.FiringMode | Firing Mode<br>0 = None 1 = Phase angle 2 = Logic<br>3 = Burst Var 4 = Burst fix5 = HC<br>6 = Custom | uint8 | 084E | 2126 |
| QStart.LoadCurrent | Nominal Current<br>0 = 16A 1 = 25A 2 = 40A 3 = 50A 4 = 80A<br>5 = 100A 6 = 125A 7 = 160A 8 = 200A 9 = 250A<br>10 = 250A 11 = 315A 12 = 400A 13 = Custom 14 =Ext. | uint8 | 084C | 2124 |
| QStart.LoadCurrentVal | Nominal Current | uint16 | 0856 | 2134 |
| QStart.LoadType | Load Type (0 = Resistive, 1 = transformer) | uint8 | 0851 | 2129 |
| QStart.LoadVoltage | Load Voltage<br>0 = 100V 1 = 110V 2 = 115V 3 = 120V 4 = 127V<br>5 = 200V 6 = 208V 7 = 220V 8 = 230V 9 = 240V<br>10 = 277V 11 = 380V 12 = 400V 13 = 415V 14 =440V<br>15 = 460V 16 = 480V 17 = 500V 18 = 575V 19 = 600V<br>20 = 660V 21 = 690V 22 = Custom | uint8 | 084D | 2125 |
| QStart.Relay1 | Relay 1 function (0 = Unused, 1 = Any alarm, 2 = Network alarm, 3 = Fuse blown) | uint8 | 0850 | 2128 |
| QStart.Transfer | Transfer Mode (0 = None, 1 = $V^2$, 2 = $I^2$) | uint8 | 084F | 2127 |
| SetProv.1.DisRamp | External input for enabling or disabling a ramp (0 = No, 1 = Yes) | uint8 | 050C | 1292 |
| SetProv.1.EngWorkingSP | Working Setpoint when in engineering units | float32 | 0515 | 1301 |
| SetProv.1.HiRange | High range of a setpoint | float32 | 0513 | 1299 |
| SetProv.1.Limit | Setpoint limit scalar | float32 | 0511 | 1297 |
| SetProv.1.LocalSP | Local setpoint | float32 | 0508 | 1288 |
| SetProv.1.RampRate | Ramp rate for the setpoint. | float32 | 050B | 1291 |
| SetProv.1.Remote1 | Remote setpoint 1 | float32 | 050E | 1294 |
| SetProv.1.Remote2 | Remote setpoint 2 | float32 | 050F | 1295 |
| SetProv.1.RemSelect | Remote setpoint selection | uint8 | 0510 | 1296 |
| SetProv.1.SPSelect | Setpoint select | uint8 | 050A | 1290 |
| SetProv.1.SPTrack | Enable Setpoint tracking | uint8 | 0512 | 1298 |
| SetProv.1.SPUnits | units of the setpoint | uint8 | 0514 | 1300 |
| SetProv.1.WorkingSP | Working or active setpoint | float32 | 0509 | 1289 |
| SetProv.2.DisRamp | External input for enabling or disabling a ramp (0 = No, 1 = Yes) | uint8 | 0520 | 1312 |
| SetProv.2.EngWorkingSP | Working Setpoint when in engineering units | float32 | 0529 | 1321 |
| SetProv.2.HiRange | High range of a setpoint | float32 | 0527 | 1319 |
| SetProv.2.Limit | Setpoint limit scalar | float32 | 0525 | 1317 |
| SetProv.2.LocalSP | Local setpoint | float32 | 051C | 1308 |
| SetProv.2.RampRate | Ramp rate for the setpoint. | float32 | 051F | 1311 |
| SetProv.2.Remote1 | Remote setpoint 1 | float32 | 0522 | 1314 |
| SetProv.2.Remote2 | Remote setpoint 2 | float32 | 0523 | 1315 |
| SetProv.2.RemSelect | Remote setpoint selection | uint8 | 0524 | 1316 |
| SetProv.2.SPSelect | Setpoint select | uint8 | 051E | 1310 |
| SetProv.2.SPTrack | Enable Setpoint tracking | uint8 | 0526 | 1318 |
| SetProv.2.SPUnits | units of the setpoint | uint8 | 0528 | 1320 |
| SetProv.2.WorkingSP | Working or active setpoint | float32 | 051D | 1309 |
| SetProv.3.DisRamp | External input for enabling or disabling a ramp | uint8 | 0534 | 1332 |

| | | | | |
|---|---|---|---|---|
| SetProv.3.EngWorkingSP | Working Setpoint when in engineering units | float32 | 053D | 1341 |
| SetProv.3.HiRange | High range of a setpoint | float32 | 053B | 1339 |
| SetProv.3.Limit | Setpoint limit scalar | float32 | 0539 | 1337 |
| SetProv.3.LocalSP | Local setpoint | float32 | 0530 | 1328 |
| SetProv.3.RampRate | Ramp rate for the setpoint. | float32 | 0533 | 1331 |
| SetProv.3.Remote1 | Remote setpoint 1 | float32 | 0536 | 1334 |
| SetProv.3.Remote2 | Remote setpoint 2 | float32 | 0537 | 1335 |
| SetProv.3.RemSelect | Remote setpoint selection | uint8 | 0538 | 1336 |
| SetProv.3.SPSelect | Setpoint select | uint8 | 0532 | 1330 |
| SetProv.3.SPTrack | Enable Setpoint tracking | uint8 | 053A | 1338 |
| SetProv.3.SPUnits | units of the setpoint | uint8 | 053C | 1340 |
| SetProv.3.WorkingSP | Working or active setpoint | float32 | 0531 | 1329 |
| SetProv.4.DisRamp | External input for enabling or disabling a ramp (0 = No, 1 = Yes) | uint8 | 0548 | 1352 |
| SetProv.4.EngWorkingSP | Working Setpoint when in engineering units | float32 | 0551 | 1361 |
| SetProv.4.HiRange | High range of a setpoint | float32 | 054F | 1359 |
| SetProv.4.Limit | Setpoint limit scalar | float32 | 054D | 1357 |
| SetProv.4.LocalSP | Local setpoint | float32 | 0544 | 1348 |
| SetProv.4.RampRate | Ramp rate for the setpoint. | float32 | 0547 | 1351 |
| SetProv.4.Remote1 | Remote setpoint 1 | float32 | 054A | 1354 |
| SetProv.4.Remote2 | Remote setpoint 2 | float32 | 054B | 1355 |
| SetProv.4.RemSelect | Remote setpoint selection | uint8 | 054C | 1356 |
| SetProv.4.SPSelect | Setpoint select | uint8 | 0546 | 1350 |
| SetProv.4.SPTrack | Enable Setpoint tracking | uint8 | 054E | 1358 |
| SetProv.4.SPUnits | units of the setpoint | uint8 | 0550 | 1360 |
| SetProv.4.WorkingSP | Working or active setpoint | float32 | 0545 | 1349 |
| Timer.1.ElapsedTime | Elapsed Time | time32 | 0916 | 2326 |
| Timer.1.In | Trigger/Gate input (0 = Off, 1 = On) | bool | 091B | 2331 |
| Timer.1.Out | Output (0 = Off, 1 = On) | bool | 0917 | 2327 |
| Timer.1.Time | Time | time32 | 0918 | 2328 |
| Timer.1.Triggered | Triggered Flag (0 = Off, 1 = On) | bool | 0919 | 2329 |
| Timer.1.Type | Type of Timer (0 = Off, 1 = OnPulse, 2 = OnDelay, 3 = One shot, 4 = MinOnTime) | uint8 | 091A | 2330 |
| Timer.2.ElapsedTime | Elapsed Time | time32 | 0927 | 2343 |
| Timer.2.In | Trigger/Gate input (0 = Off, 1 = On) | bool | 092C | 2348 |
| Timer.2.Out | Output (0 = Off, 1 = On) | bool | 0928 | 2344 |
| Timer.2.Time | Time | time32 | 0929 | 2345 |
| Timer.2.Triggered | Triggered Flag (0 = Off, 1 = On) | bool | 092A | 2346 |
| Timer.2.Type | Type of Timer (As Timer.1.Type) | uint8 | 092B | 2347 |
| Timer.3.ElapsedTime | Elapsed Time | time32 | 0938 | 2360 |
| Timer.3.In | Trigger/Gate input (0 = Off, 1 = On) | bool | 093D | 2365 |
| Timer.3.Out | Output (0 = Off, 1 = On) | bool | 0939 | 2361 |
| Timer.3.Time | Time | time32 | 093A | 2362 |
| Timer.3.Triggered | Triggered Flag (0 = Off, 1 = On) | bool | 093B | 2363 |
| Timer.3.Type | Type of Timer (As Timer.1.Type) | uint8 | 093C | 2364 |
| Timer.4.ElapsedTime | Elapsed Time | time32 | 0949 | 2377 |
| Timer.4.In | Trigger/Gate input (0 = Off, 1 = On) | bool | 094E | 2382 |
| Timer.4.Out | Output (0 = Off, 1 = On) | bool | 094A | 2378 |
| Timer.4.Time | Time | time32 | 094B | 2379 |
| Timer.4.Triggered | Triggered Flag (0 = Off, 1 = On) | bool | 094C | 2380 |
| Timer.4.Type | Type of Timer (As Timer.1.Type) | uint8 | 094D | 2381 |
| Total.1.AlarmOut | Alarm Output (0 = Off, 1 = On) | bool | 095C | 2396 |
| Total.1.AlarmSP | Alarm Setpoint | float32 | 095A | 2394 |
| Total.1.Hold | Hold (0 = No, 1 = Yes) | bool | 0961 | 2401 |
| Total.1.In | Input Value | float32 | 095F | 2399 |
| Total.1.Reset | Reset (0 = No, 1 = Yes) | bool | 0962 | 2402 |
| Total.1.Resolution | Resolution (0 = X, 1 = X.X, 2 = X.XX, 3 = X.XXX, 4 = X.XXX) | uint8 | 095E | 2398 |
| Total.1.Run | Run (0 = No, 1 = Yes) | bool | 0960 | 2400 |
| Total.1.TotalOut | Totalised Output | float32 | 095B | 2395 |

| | | | | |
|---|---|---|---|---|
| Total.1.Units | Units<br>0 = None 1 = Temp 2 = V 3 = mV,<br>4 = A 5 = mA 6 = pH 7 = mmHg | uint8 | 095D | 2397 |
| Total.2.AlarmOut | Alarm Output (0 = Off, 1 = On) | bool | 0971 | 2417 |
| Total.2.AlarmSP | Alarm Setpoint | float32 | 096F | 2415 |
| Total.2.Hold | Hold (0 = No, 1 = Yes) | bool | 0976 | 2422 |
| Total.2.In | Input Value | float32 | 0974 | 2420 |
| Total.2.Reset | Reset (0 = No, 1 = Yes) | bool | 0977 | 2423 |
| Total.2.Resolution | Resolution (as Total.1) | uint8 | 0973 | 2419 |
| Total.2.Run | Run (0 = No, 1 = Yes) | bool | 0975 | 2421 |
| Total.2.TotalOut | Totalised Output | float32 | 0970 | 2416 |
| Total.2.Units | Units (as Total.1) | uint8 | 0972 | 2418 |
| Total.3.AlarmOut | Alarm Output (0 = Off, 1 = On) | bool | 0986 | 2438 |
| Total.3.AlarmSP | Alarm Setpoint | float32 | 0984 | 2436 |
| Total.3.Hold | Hold (0 = No, 1 = Yes) | bool | 098B | 2443 |
| Total.3.In | Input Value | float32 | 0989 | 2441 |
| Total.3.Reset | Reset (0 = No, 1 = Yes) | bool | 098C | 2444 |
| Total.3.Resolution | Resolution (as Total.1) | uint8 | 0988 | 2440 |
| Total.3.Run | Run (0 = No, 1 = Yes) | bool | 098A | 2442 |
| Total.3.TotalOut | Totalised Output | float32 | 0985 | 2437 |
| Total.3.Units | Units (as Total.1) | uint8 | 0987 | 2439 |
| Total.4.AlarmOut | Alarm Output (0 = Off, 1 = On) | bool | 099B | 2459 |
| Total.4.AlarmSP | Alarm Setpoint | float32 | 0999 | 2457 |
| Total.4.Hold | Hold (0 = No, 1 = Yes) | bool | 09A0 | 2464 |
| Total.4.In | Input Value | float32 | 099E | 2462 |
| Total.4.Reset | Reset (0 = No, 1 = Yes) | bool | 09A1 | 2465 |
| Total.4.Resolution | Resolution (as Total.1) | uint8 | 099D | 2461 |
| Total.4.Run | Run (0 = No, 1 = Yes) | bool | 099F | 2463 |
| Total.4.TotalOut | Totalised Output | float32 | 099A | 2458 |
| Total.4.Units | Units (as Total.1) | uint8 | 099C | 2460 |
| UsrVal.1.HighLimit | User Value High Limit | float32 | 07A4 | 1956 |
| UsrVal.1.LowLimit | User Value Low Limit | float32 | 07A5 | 1957 |
| UsrVal.1.Resolution | User Value Display Resolution<br>(0 = X, 1 = X.X, 2 = X.XX, 3 = X.XX, 4 = X.XXX) | uint8 | 07A3 | 1955 |

## 8.4 PARAMETER TABLE (Cont.)

| Parameter path | Description | Type | Hex | Dec |
|---|---|---|---|---|
| UsrVal.1.Status | User Value Status (0 = Good, 1 = Bad) | bool | 07A7 | 1959 |
| UsrVal.1.Units | Units of the value<br>0 = None 1 = Temp 2 = V 3 = mV<br>4 = A 5 = mA 6 = pH 7 = mmHg | uint8 | 07A2 | 1954 |
| UsrVal.1.Val | The User Value | float32 | 07A6 | 1958 |
| UsrVal.2.HighLimit | User Value High Limit | float32 | 07B4 | 1972 |
| UsrVal.2.LowLimit | User Value Low Limit | float32 | 07B5 | 1973 |
| UsrVal.2.Resolution | User Value Display Resolution (as User Val 1) | uint8 | 07B3 | 1971 |
| UsrVal.2.Status | User Value Status (as User Val 1) | bool | 07B7 | 1975 |
| UsrVal.2.Units | Units of the value (as User Val 1) | uint8 | 07B2 | 1970 |
| UsrVal.2.Val | The User Value | float32 | 07B6 | 1974 |
| UsrVal.3.HighLimit | User Value High Limit | float32 | 07C4 | 1988 |
| UsrVal.3.LowLimit | User Value Low Limit | float32 | 07C5 | 1989 |
| UsrVal.3.Resolution | User Value Display Resolution (as UserVal.1) | uint8 | 07C3 | 1987 |
| UsrVal.3.Status | User Value Status (as UserVal.1) | bool | 07C7 | 1991 |
| UsrVal.3.Units | Units of the value (as UserVal.1) | uint8 | 07C2 | 1986 |
| UsrVal.3.Val | The User Value | float32 | 07C6 | 1990 |
| UsrVal.4.HighLimit | User Value High Limit | float32 | 07D4 | 2004 |
| UsrVal.4.LowLimit | User Value Low Limit | float32 | 07D5 | 2005 |
| UsrVal.4.Resolution | User Value Display Resolution (as UserVal.1) | uint8 | 07D3 | 2003 |
| UsrVal.4.Status | User Value Status (as UserVal.1) | bool | 07D7 | 2007 |
| UsrVal.4.Units | Units of the value (as UserVal.1) | uint8 | 07D2 | 2002 |
| UsrVal.4.Val | The User Value | float32 | 07D6 | 2006 |

# 9 PREDICTIVE LOAD MANAGEMENT OPTION

## 9.1 GENERAL DESCRIPTION

The Predictive Load Management (PLM) system is an assembly of a number of units ('stations') working together in order to minimize transient power demands which could appear on the mains if all the units were independent. The Predictive Load Management system is described in three sections, viz: Load sequencing (section 9.2), Load sharing (section 9.3) and Load shedding (section 9.4)

### 9.1.1 Load Management layout

A Predictive Load Management system can consist of up to 63 Stations, running a maximum of 64 channels, distributed around the shop floor (maximum cumulative cable length = 100 metres). Each Station manages either up to four single channels, two, 2-leg channels, or one 3-phase channel. One or more of these channels can participate in Load Management whilst other channels run independently. Where more than 64 channels are required, two or more independent networks (each with its own master) must be created.

The PLM connector is located behind the driver module door, and Stations are linked together as shown in figures 2.2.1a and 2.2.1d (location and pinout details respectively).

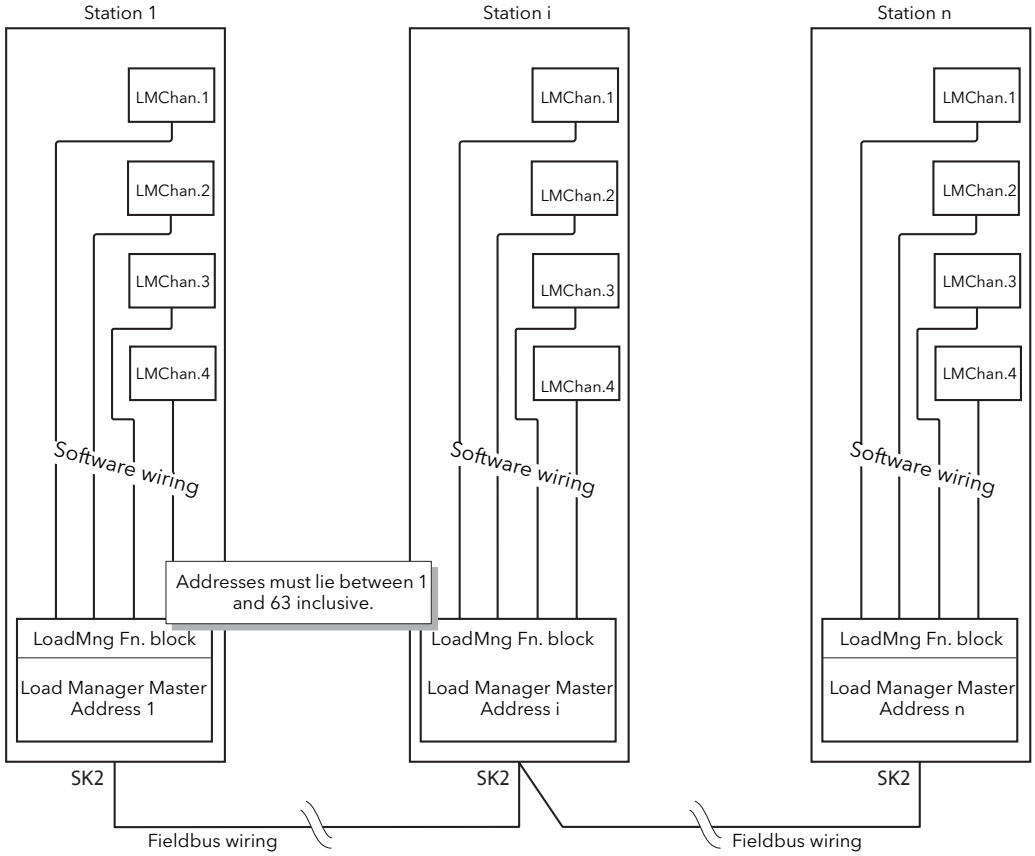


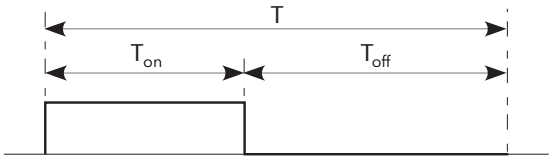

Figure 9.1.1 Predictive Load Management layout (typical)

Notes:

1. Each Station Address must be unique to the PLM communication link, and must be set between 1 and 63 inclusive. Address 0 disables Load Management communications.
2. The figure above shows all four channels used. In reality, any number between 1 and 4 can be set up for Load Management.
3. The Station with the lowest address is deemed to be the master.

### 9.1.2 Power modulation and accuracy

Fixed modulation is automatically selected for all channels participating to the Load Management. The Modulation period T is constant and is selected (between 50 and 1000 mains periods) during configuration.




$$\text{Duty cycle} = \eta = \frac{T_{on}}{T}$$

Figure 9.1.2 Modulation period definitions

$T_{on}$ and $T_{off}$ are related to the Modulation Period (T) and each corresponds to an integer number of mains periods. The duty cycle ($\eta = T_{on}/T$) defines the power delivered to the load during the Modulation period. T is selected during configuration and its value determines the accuracy of the power control. The default value is 100 cycles.

| T (cycles) | Accuracy |
|---|---|
| 50 | 2% |
| 100 | 1% |
| 200 | 0.5% |
| 500 | 0.2% |
| 1000 | 0.1% |

Table 9.1.2 Accuracy versus modulation period

Note: The value of 'T' is chosen according to the thermal inertia (speed of response) of the load. For loads with high thermal inertia, a long modulation period may be chosen, as the control integration time may be several minutes. Where the load has low inertia, long modulation periods can make the control process unstable if the modulation period approaches the integration time.

## 9.2 LOAD SEQUENCING

Load sequencing is a time-dependent distribution of Energy through the Load (independent of the installed power per load) in order to avoid big spikes of power demand at the beginning of each conduction period. There are a number of different load sequencing types as described below. Which particular type is chosen depends on the loads being driven. The selection is made in the LoadMng 'Main' area of configuration (section 6.21.1).

### 9.2.1 Incremental control type 1

With this kind of control, several Loads receive a common Setpoint. One channel is modulated with the required Duty Cycle η. The remaining channels are at 100% (Full conduction) or at 0% (No conduction). The total power distributed to the Loads is equal to the Setpoint.

For example for 11 Channels and setpoint of 50% (i.e. input of Master channel 1 = 0.5), channels 1 to 5 are continuously on and channels 7 to 11 are continuously off. Channel 6 modulates with a duty cycle of 50% (figure 9.2.1)

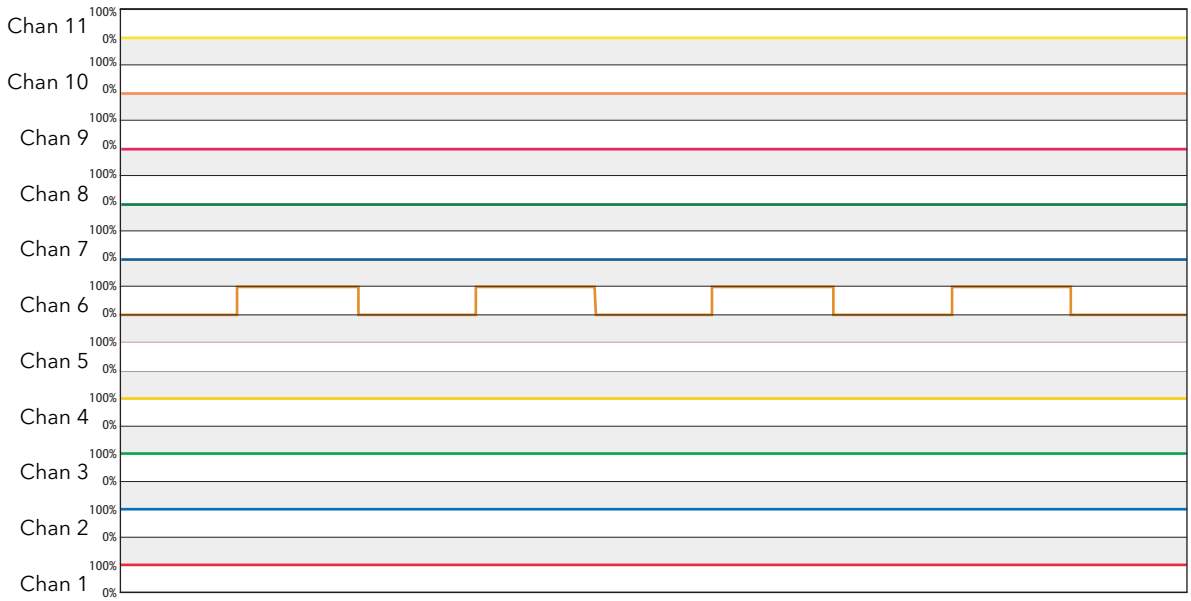



Figure 9.2.1 Incremental control type 1 example

### 9.2.2 Incremental control type 2

This kind of control, is similar to Incremental control type 1, but the modulated channel is always channel 1. Other channels are always either at 100% (Full conduction) or at 0% (No conduction). The total power distributed to the Loads is equal to the Setpoint.

For example for 11 Channels and setpoint of 50% (i.e. input of Master channel 1 = 0.5), channels 2 to 6 are continuously on and channels 7 to 11 are continuously off. Channel 1 modulates with a duty cycle of 50% (figure 9.2.2)

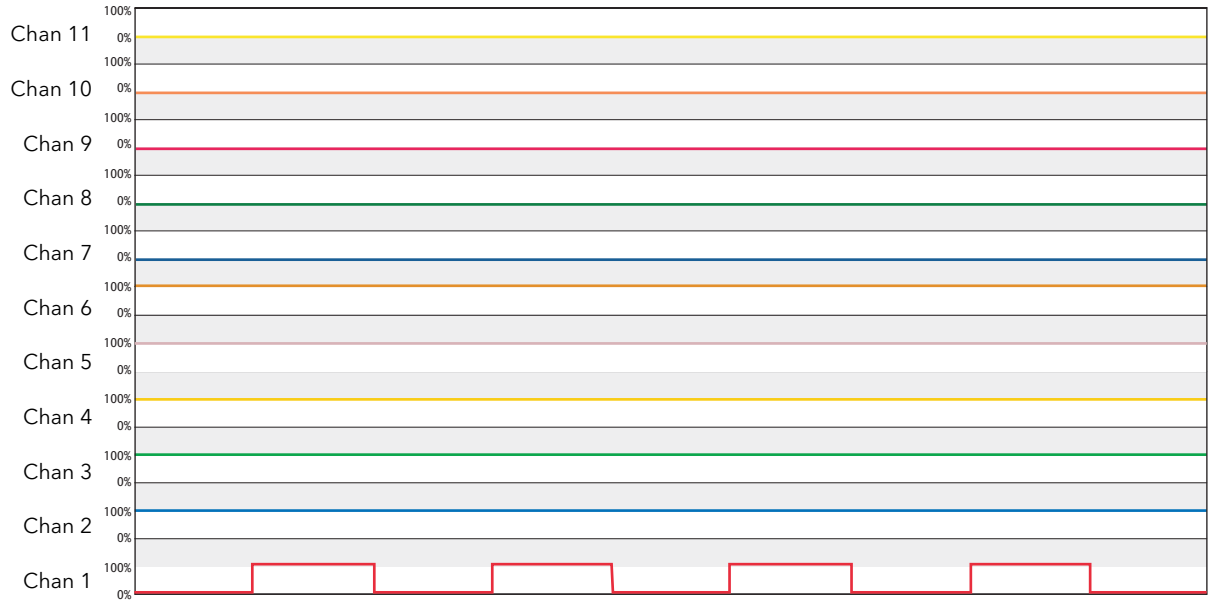



Figure 9.2.2 Incremental control type 2 example

### 9.2.3 Rotating Incremental control

This kind of control, is similar to Incremental control type 1, but the modulated channel varies. Non-modulating channels are always either at 100% (Full conduction) or at 0% (No conduction). The total power distributed to the Loads is equal to the Setpoint.

Figure 9.2.3 shows the process for 11 Channels and setpoint = 50% (i.e. input of Master channel 1 = 0.5).

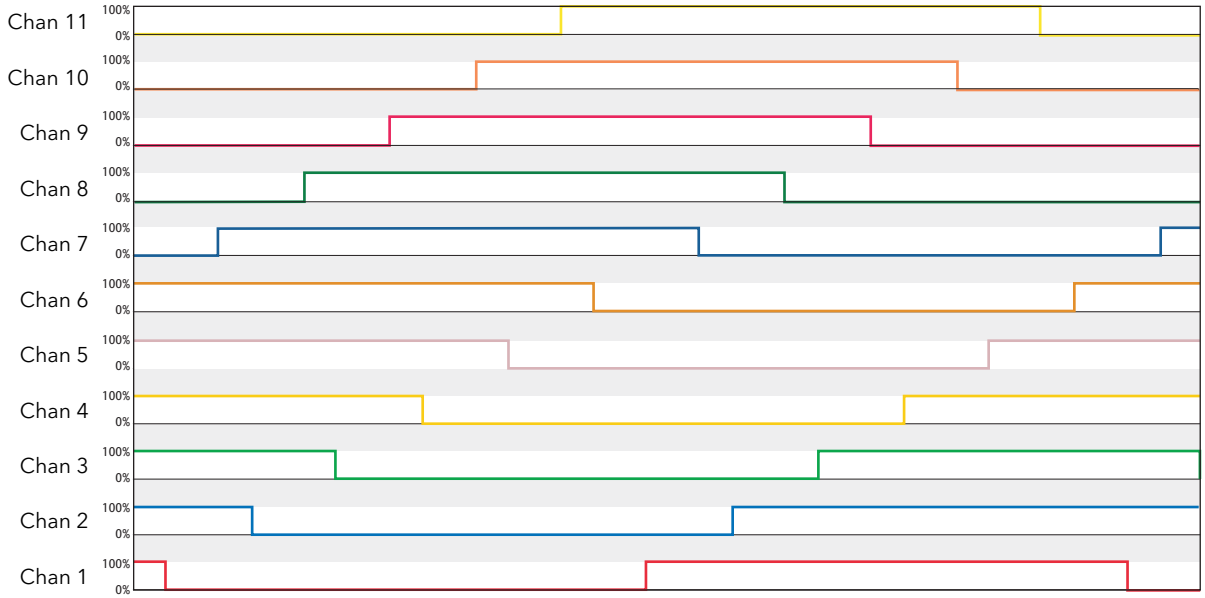



Figure 9.2.3 Rotating incremental control example

### 9.2.4 Distributed control

With this kind of control, each Load has its own setpoint. In order to avoid simultaneous firing in more than one load, the modulation periods are staggered by a time given by $\tau = T/N$, where T is the modulation period configured by the user, and N is the number of channels.

Note: Load Sharing, described in section 9.3, below is a more efficient solution to this problem.

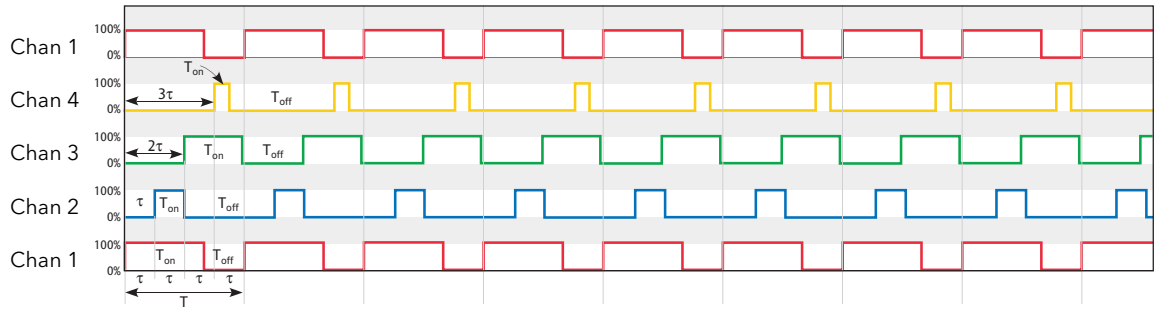



Figure 9.2.4 Distributed control (4 channels) example

### 9.2.5 Incremental/Distributed control

With this kind of control, Loads are grouped together, with each group having a single setpoint which applies to all the channels in that group. Incremental control type 2 is applied within each group and distributed control is applied to the groups.

> Note: The assigning of channels to groups is carried out, for each relevant Load Management channel, via its parameter LMChan 'Group'.

The example in figure 9.2.5a shows 11 channels distributed within two groups.

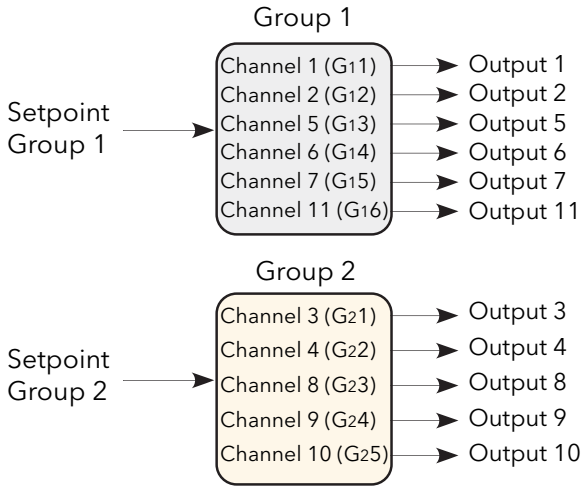



Figure 9.2.5a Channel distribution within groups example

For the six channels in group 1, assuming a set point of 60% (i.e. input of the first channel of group 1 = 0.6). Channel $G_1 1$ modulates at 60%; channels $G_1 2$ to $G_1 4$ are continuously on (100%) and channels $G_1 5$ and $G_1 6$ are continuously off. That is, channel 1 modulates at 60%, channels 2, 5 and 6 are on, and channels 7 and 11 are off.

### 9.2.5 INCREMENTAL DISTRIBUTED CONTROL (Cont.)

Similarly for the five channels in group 2, assuming a setpoint of 35% (i.e. unput of the first channel of group 2 =0.35), Channel $G_2$1 modulates at 75%; $G_2$2 is continuously on and $G_2$3, $G_2$4 and $G_2$5 are continuously off. That is, channel 3 is modulating at 75% (off), Channel 4 is continuously on and channels 8, 9 and 10 are continuously off.

The modulation period of group 2 is delayed with respect to that of group 1 bt $\tau = T/g$, where $g = 2$ (i.e. $\tau = T/2$).

Note: the modulation period T is a constant for all groups.

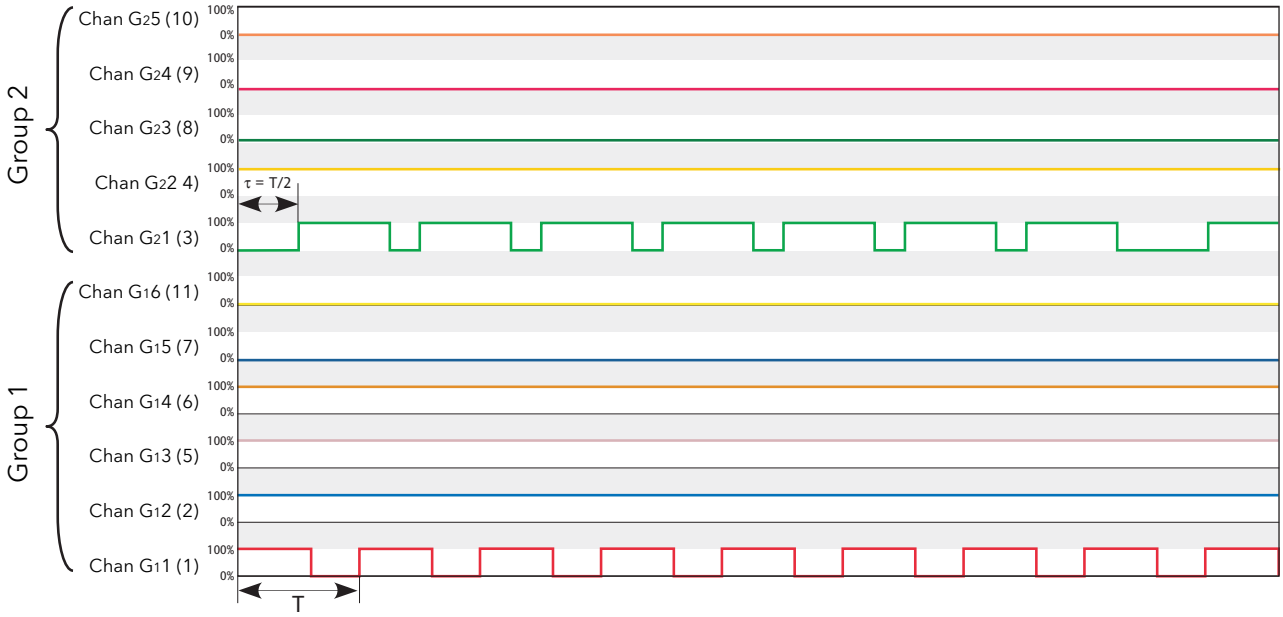



Figure 9.2.5b Incremental distributed control example (two groups)

### 9.2.6 Rotating Incremental Distributed control

This method of control is similar to 'Incremental distributed control', described above, but within each group, the modulating channel number is incremented every modulation period.

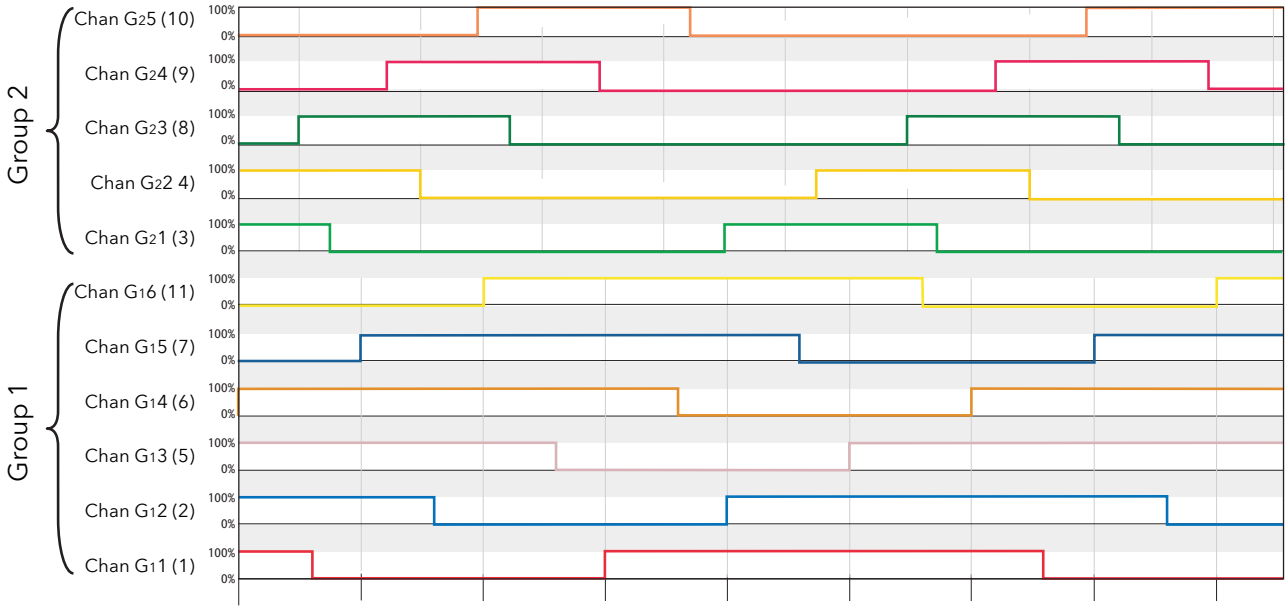



Figure 9.2.6 Rotating Incremental distributed control example (two groups)

## 9.3 LOAD SHARING

Load Sharing controls the time distribution of Total Power amongst loads, taking into account the amount of Power required by each load.

### 9.3.1 Total power demand

Each burst of power is defined by three parameters

1. P (Maximum load power) (Depends on line voltage and load impedance: $P=V^2/Z$)
2. η (Duty cycle ($T_{on}/T$))
3. D (Delay time).

Where more than one load (channel) is being used, the Total power demand varies in a complex way, as can be seen in the simple example, with just two channels, shown in figure 9.3.1 below.

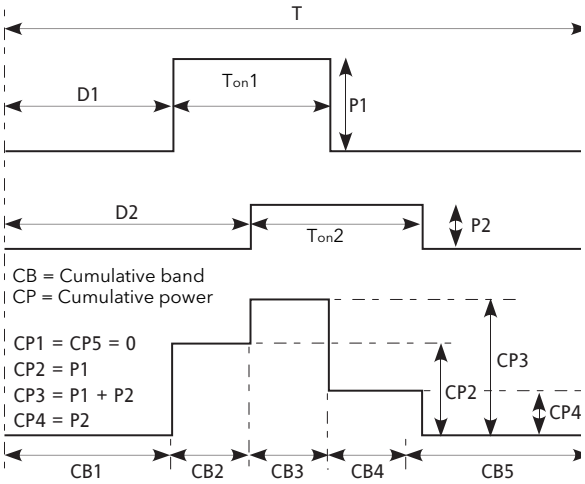



Figure 9.3.1 Total power demand example

### 9.3.2 Sharing Efficiency Factor (F)

The Sharing Efficiency Factor (F) is defined as follows:

$$F = \frac{P_{max} - (CP_{max} - CP_{min})}{P_{max}}$$

Where $CP_{max}$ is the maximum of all the Cumulative Powers and $CP_{min}$ the minimum. Sharing Efficiency increases as F approaches 1. That is, the closer $CP_{max}$ and $CP_{min}$ are to $P_t$, the higher the sharing efficiency.

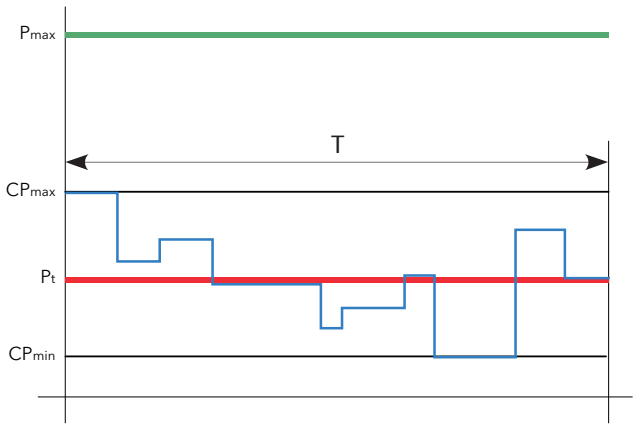



Figure 9.3.2 Sharing efficiency definitions

### 9.3.3 Sharing algorithm

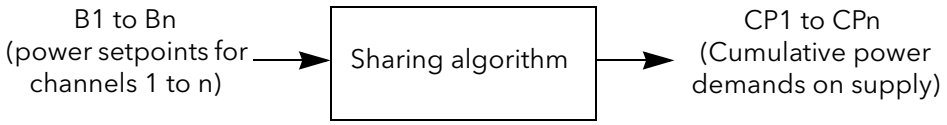



Figure 9.3.3a Sharing algorithm overview

The goal of the "Efficient Power" algorithm is to keep the value of F as close as possible to 1. To achieve this, the following parameters are manipulated:

1. The Delay time (D) for each load modulation
2. The order in which loads are modulated.

The algorithm itself is made of several steps which are computed before each modulation period.

1. The master determines the total number of channels (n)
2. The master determines the setpoint (Power Demand) for each channel. This gives the Duty Cycle and the Max Power of the Load PZmax.
3. Burst Image Initialisation. Each Burst ($B_i$) is seen as a Rectangle ($R_i$), where i is between 1 and 'n' inclusive. Eventually, these i rectangles will be placed in time, but initially they are not placed.
4. Cumulative Band Initialisation
5. Calculation of Pt and Pmax from the following equations, where L = duty cycle and H = load power:

$$P_t = \sum_{i=1}^{n} (R_i L \times R_i H)$$

6. Rectangle placement. Each rectangle is placed and the bands modified in consequence.

The same algorithm is performed several times and iteratively for all the rectangles. From the result, the solution with the best Efficiency Factor is taken as definitive result.

## 9.4 LOAD SHEDDING

Load Shedding controls the total power distribution amongst loads by reducing the amount of Power distributed for each load so that the global power demanded is less than a given maximum (Ps). Load Shedding and Load Sharing may be used together if required.

### 9.4.1 Definitions

Pz = the power installed on a particular channel (zone). For channel 'i', Pz is given by the following equation:

$$Pzi_{\max} = \frac{V_i^2}{R_i}$$

This parameter (PZMax) is available to the user in the Block 'LMChan'.

The Total Installed Power is the sum of all the relevant Maximum Load Powers. Thus, for n channels, the total Installed Power on the network ($P_{max}$) is given by:

$$P_{\max} = \sum_{i=1}^{n} PZi_{\max}$$

$P_{max}$ is available to the user in the Block 'LoadMng.Network'.

The actual power demanded on channel 'i' depends on the duty cycle as follows:

$Pt_i = \eta_i \times PZi_{max}$

$Pt_i$ is available to the user as parameter 'PBurst' in the Block 'Network.Meas'* if no shedding is applied.

* Note: Not to be confused with 'LoadMng.Network'.

The total power demanded on the Network is:

$$Pt = \sum_{i=1}^{n} Pt_i$$

This parameter (Pt) is available to the user in the Block 'LoadMng.Network', and represents the Mean Power which would be dissipated in the Load during one Modulation Period, if Load Shedding were not applied.

### 9.4.2 Reduction of power demand

A further parameter (Ps) is available to the user in the Block 'LoadMng.Network'. Ps is used to restrict the power demanded from the network to an absolute maximum value

For example the total installed power could be 2.5MW, but the user wishes to restrict the delivered power to below a tariff band of 2MW. In such a case Ps would be set to 2MW and power would be shed throughout the network in order to keep the total demand below 2MW.

If Ps > Pmax, load shedding is disabled.

If Ps≥Pt, no reduction is applied. If Ps<Pt, each duty cycle (η) is reduced by multiplying it by a reduction factor 'r' given by the equation below. The reduction factor is applied to each channel.

$$r = \frac{Ps}{Pt}$$

## 9 4 2 REDUCTION OF POWER DEMAND (Cont.)

The resulting Power for a given channel (i) is:

$Pr_i = r \times \eta_i \times Pt_i$

The parameter $Pr_i$ is available to the user as 'PBurst' in the Block 'Network.Meas' for each channel.

The resulting power is then:

$$Pr = \sum_{i=1}^{n} Pr_i$$

This parameter 'Pr' is available to the user in the Block LoadMng.Network.

Note: if all Shedding Ability Factors (see below) are zero, Pr must be close to Ps

### SHEDDING ABILITY FACTOR

For some applications, the power demand must be maintained for particular channels. For this reason a parameter called 'Shedding Ability Factor' can be configured for each channel, to define the threshold at which any reducing factor is applied to the channel.

This parameter (ShedFactor) is available to the user in the Block 'LMChan'

The reduction coefficient (r) is recalculated for each channel, in the following way, where 's' is the ShedFactor:

If $s_i > r$, then $r_i = s_i$; If $s_i <= r$, then $r_i = r$

For example, if $s_i = 100\%$ no reducing coefficient is applied to channel 'i'; if $s_i = 0\%$ the reducing coefficient r is always applied, as it is, to channel 'i'.

The resulting Power for a given channel is now: $Pr_i = r_i \times \eta_i \times Pt_i$

with: $Ps \leq Pr \leq Pt$

Note: If Pr is greater than Ps, due to the shedding ability coefficient applied to some channels on the Network, an indication alarm 'PrOverPs' is issued (see below).

### 9.4.3 Load shedding comparisons

In this imaginary example, the Network consists of 32 Channels. The Power ($PZMax_i$) and the Setpoint or Duty Cycle (Power demand $\eta_i$) have the values given below during the relevant modulation period of 100 mains cycles. The total installed Power on the Network is Pmax = 1.285MW and the Demanded Power is Pt = 433kW

| Channel No. | Setpoint | Power | Channel No. | Setpoint | Power |
|---|---|---|---|---|---|
| 1 | 10% | 58kW | 17 | 45% | 69kW |
| 2 | 15% | 9kW | 18 | 9% | 32kW |
| 3 | 56% | 7kW | 19 | 25% | 65kW |
| 4 | 45% | 56kW | 20 | 45% | 98kW |
| 5 | 1% | 12kW | 21 | 12% | 96kW |
| 6 | 15% | 4kW | 22 | 18% | 85kW |
| 7 | 45% | 25kW | 23 | 45% | 74kW |
| 8 | 78% | 23kW | 24 | 56% | 5kW |
| 9 | 52% | 45kW | 25 | 6% | 2kW |
| 10 | 54% | 12kW | 26 | 39% | 8kW |
| 11 | 56% | 45kW | 27 | 96% | 7kW |
| 12 | 4% | 78kW | 28 | 65% | 74kW |
| 13 | 5% | 36kW | 29 | 58% | 85kW |
| 14 | 58% | 25kW | 30 | 9% | 65kW |
| 15 | 78% | 14kW | 31 | 7% | 5kW |
| 16 | 12% | 58kW | 32 | 56% | 8kW |

Table 9.4.3 Channel parameters

**WITHOUT LOAD SHARING, SYNCHRONISED**

This is the worst case. The simulation in figure 9.4.3a shows the Power profile on the Modulation Period if all the channels are started at the same time (i.e. with no incremental control applied).

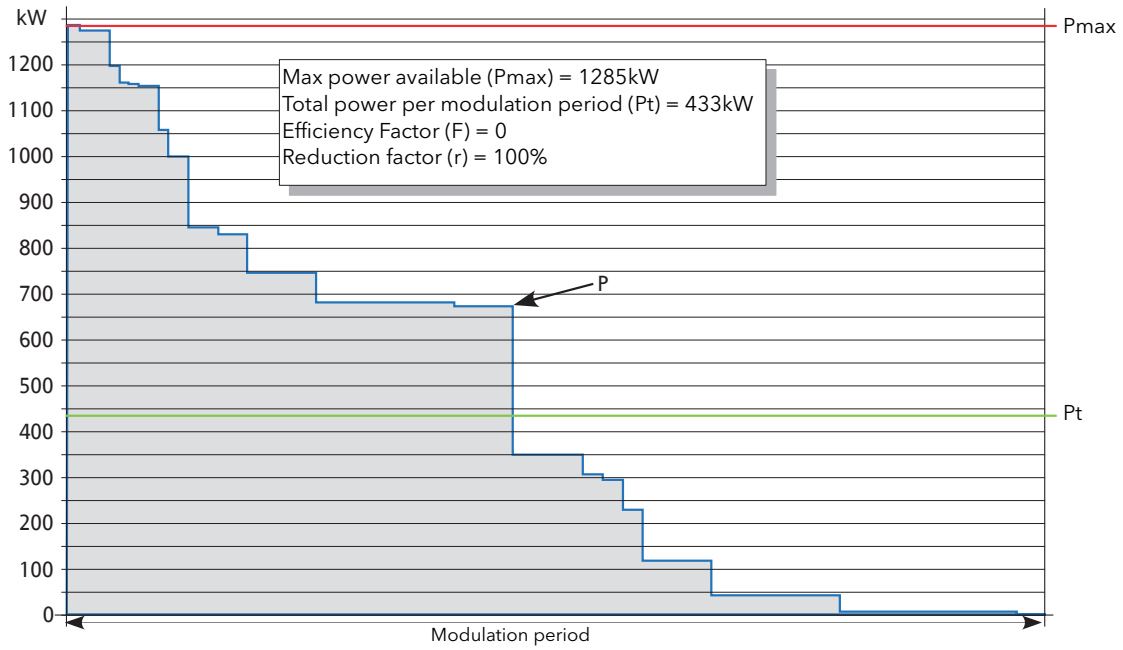



Figure 9.4.3a Synchronised without load sharing (r = 100%)

## 9.4.3 LOAD SHEDDING COMPARISONS (Cont.)

### WITHOUT LOAD SHARING, SYNCHRONISED, REDUCTION FACTOR 50%

Similar to the previous example, but the authorised Power has been set to Ps = 216kW. (Reduction factor 'r' is 50% (0.5).

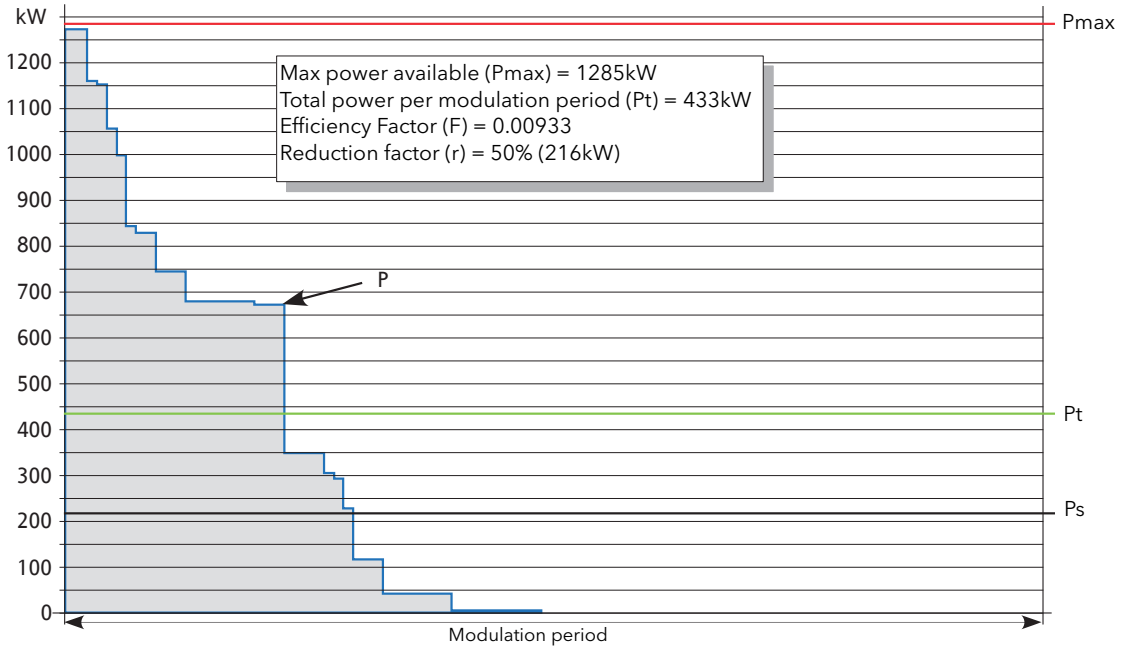



Figure 9.4.3b Synchronised without load sharing (r = 50%)

### WITHOUT LOAD SHARING NOT SYNCHRONISED

Because modulation periods start at different times, the power profile may be 'good' for some modulation periods, but poor for others.

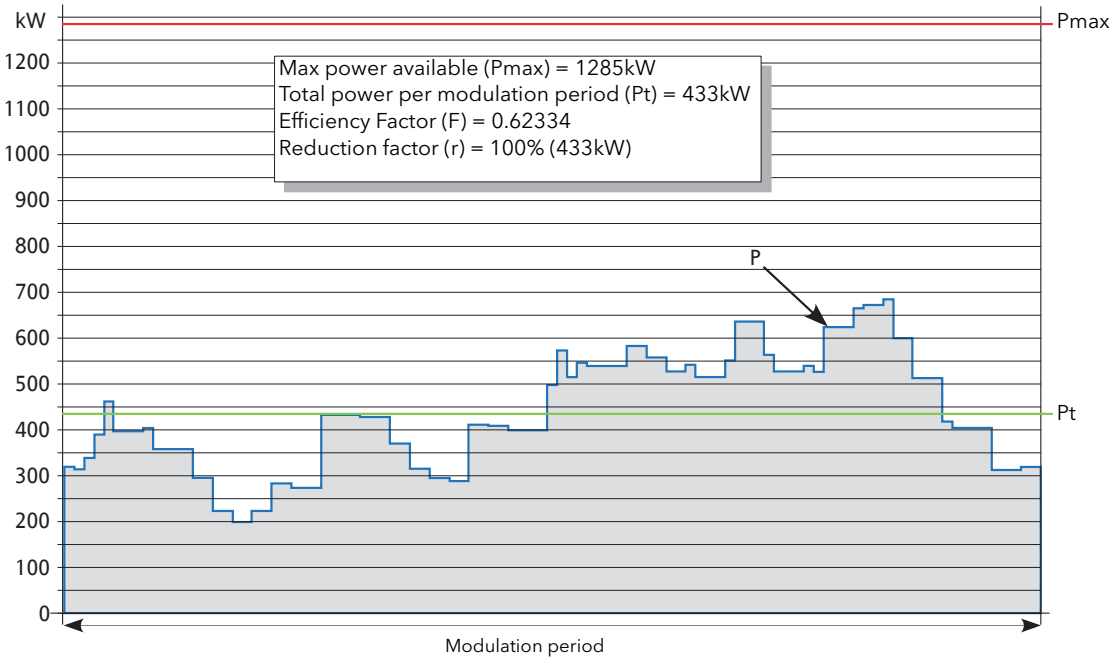



Figure 9.4.3c Non-synchronised without load sharing (r = 100%)

## 9.4.3 LOAD SHEDDING COMPARISONS (Cont.)

### WITHOUT LOAD SHARING, NON-SYNCHRONISED, REDUCTION FACTOR 50%

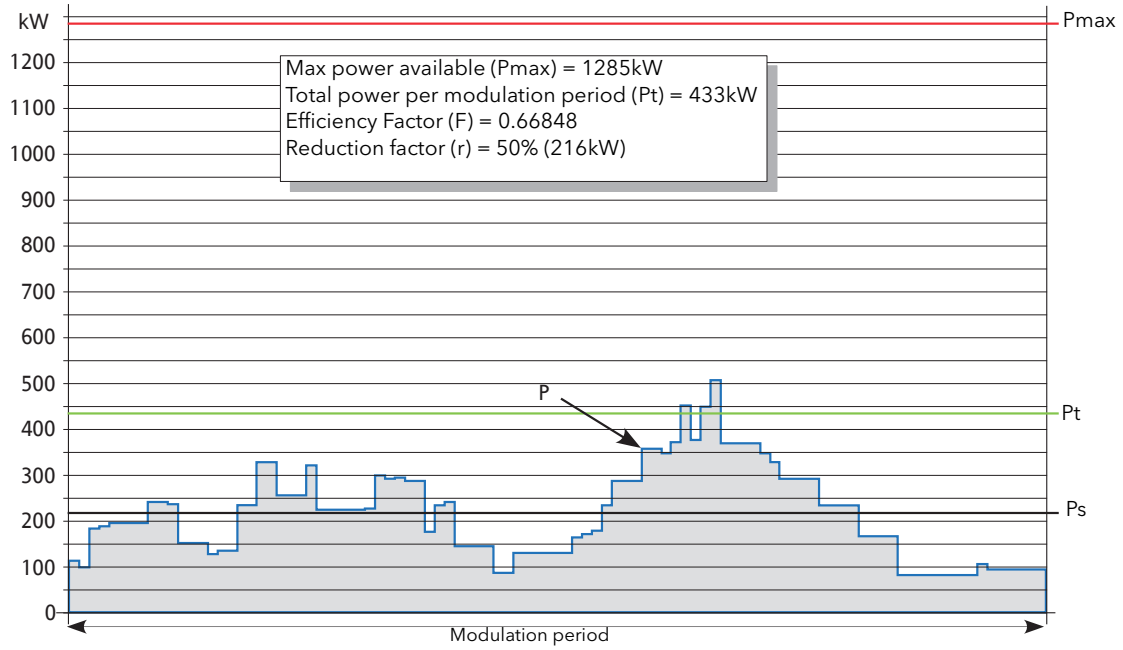



Figure 9.4.3d Non-synchronised without load sharing (r = 50%)

### WITH LOAD SHARING

In this example, the Sharing algorithm has been applied. The total power and power demand are the same as in previous examples, but the power profile is approximately flat, with a value close to Pt.

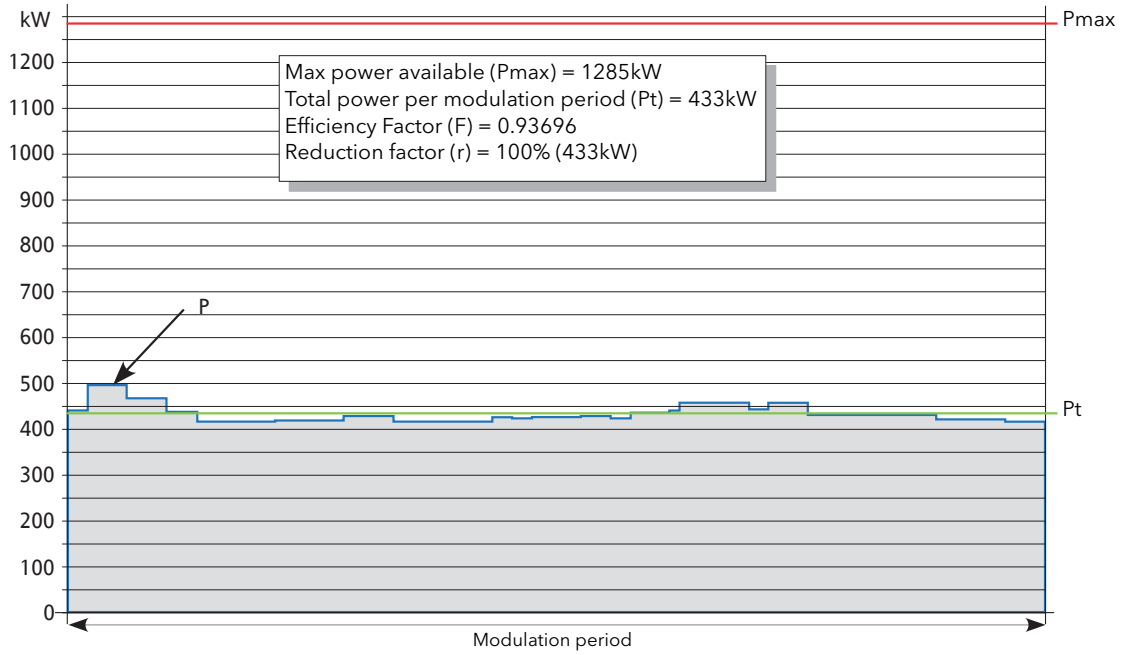



Figure 9.4.3e Load sharing (r = 100%)

## 9 4 3 LOAD SHEDDING COMPARISONS (Cont.)

### WITH LOAD SHARING, REDUCTION FACTOR = 50%

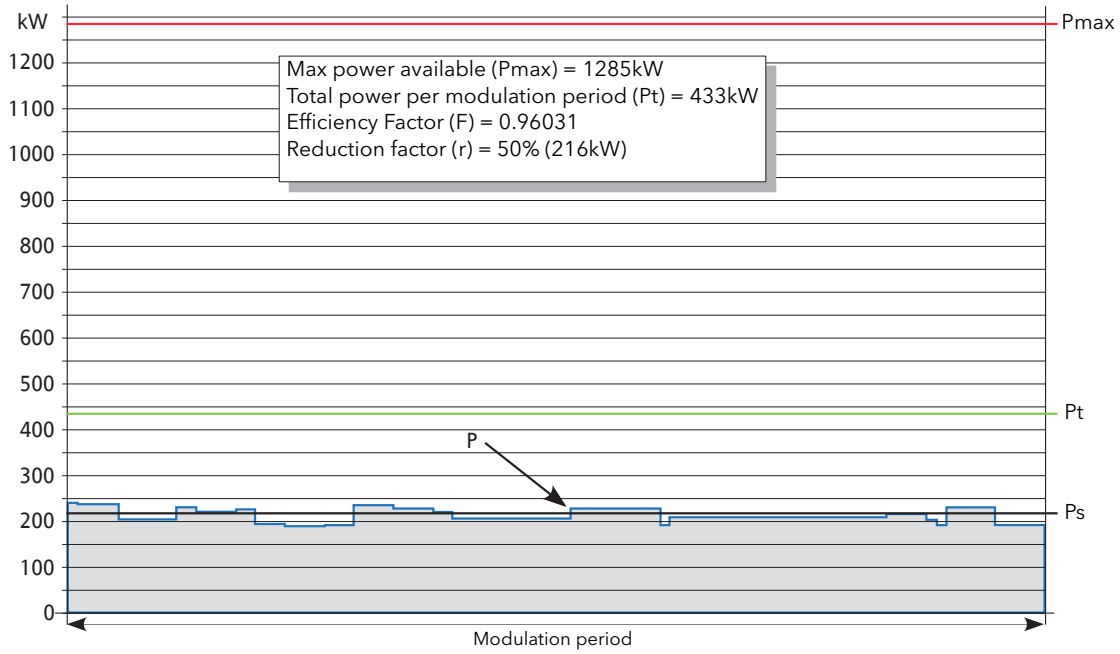



Figure 9.4.3f With load sharing (r = 50%)

In this example, it can be seen that the Sharing algorithm has been re-calculated with the new values. This gives a different shape to the global power distribution but, as with the previous example, the power profile is approximately flat, with a value close to Ps.

## 9.5 CONFIGURATION

### 9.5.1 iTools Graphical wiring

Load Management configuration is carried out in the following stages:

**STANDARD POWER CONTROL LOOP**

Each Channel is built and configured from standard blocks. Figure 9.5.1a shows a typical example.

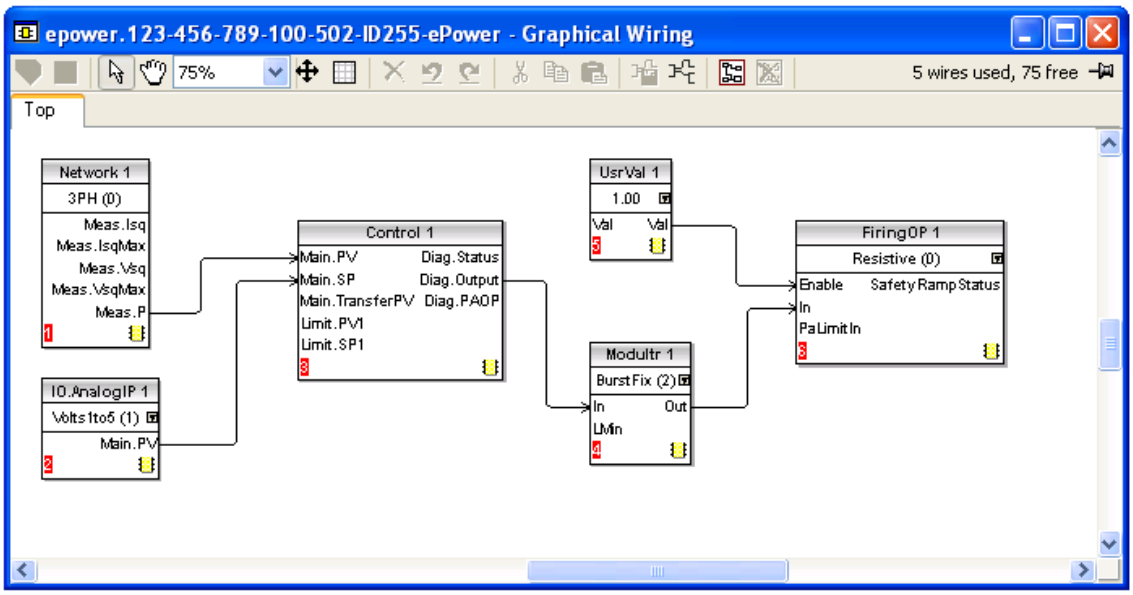



Figure 9.5.1a Control loop wiring in iTools

Each channel may be of any type, single phase, 2-legs or three phase.

Note: Load Management sets the Modulator type to 'BurstFix'. Similarly, Burst length is defined by the LM Master.

**LOAD MANAGEMENT CHANNELS (LMCHAN 1 TO LMCHAN 4)**

For each Channel, the Modulator Block input 'LMIn' must be wired to the LMout parameter of an LMChan Block. Each channel is then managed by its own LMChan block. Figure 9.5.1b shows a configuration of three single phase control channels.

**GLOBAL LOAD MANAGEMENT CONTROL (LOADMNG)**

The LoadMng Block is added. Each LMChan LmIn parameter is wired to a LoadMng LMout parameter. Figure 9.5.1c shows the complete configuration

Notes:

1. If a channel is not wired to a slot of the LoadMng block, it doesn't participate to the Load Management process.
2. On a Given Station, it is allowed to mix channels which participate to the PLM process, and channels which do not.

**CALCULATION AND COMMUNICATIONS**

The Unit performs all the operations needed by the Predictive Load Management process transparently to the user.

## 9 5 1 iTOOLS GRAPHICAL WIRING (Cont.)

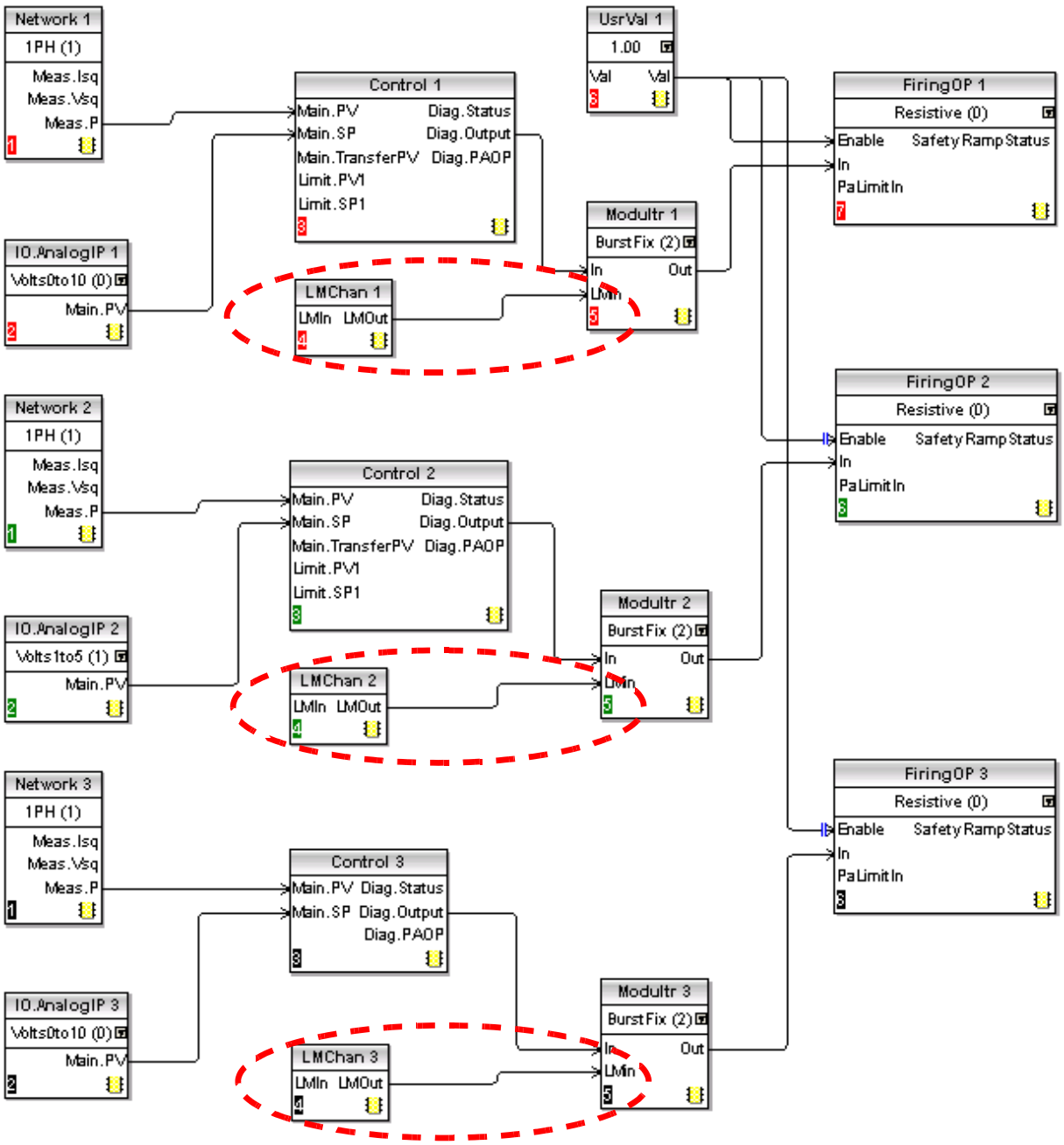



Figure 9.5.1b LMChan blocks

## 9 5 1 iTOOLS GRAPHICAL WIRING (Cont.)

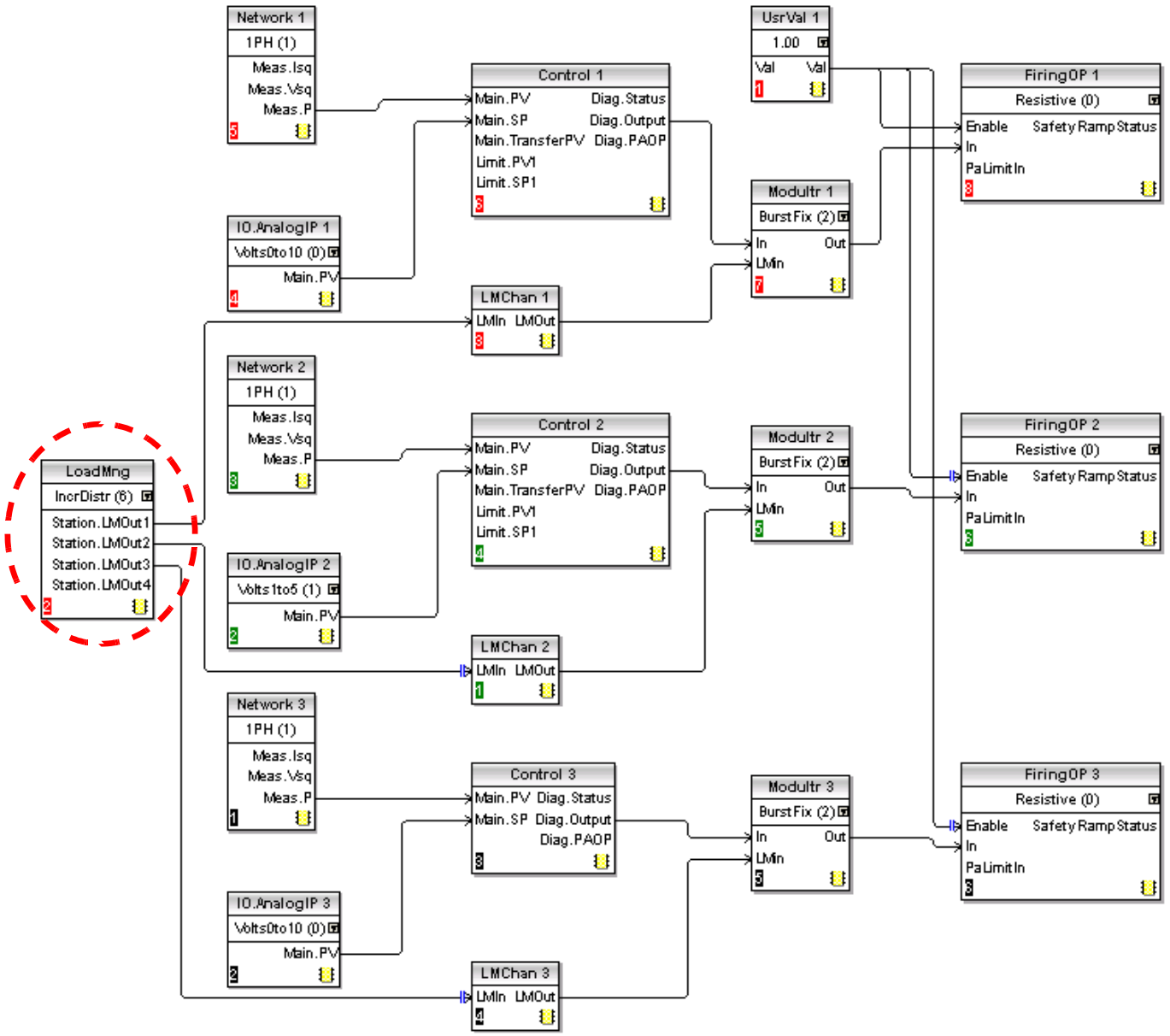



Figure 9.5.1c LoadMng blocks

### 9.5.2 Predictive Load Management function block details

Full details of Load Management parameters are to be found in sections 6.21 and 6.19 above.

**LM TYPE**

Configures the type of Load Management, as load sharing or load sequencing (or off).

| | |
|---|---|
| Function block location | LoadMng.Main |
| Parameter name | Type |
| Accessible | Always |
| Minimum access level for editing | Config |
| Type | Enumeration |
| Values | 0: (LMNo). Load Management disabled<br>1: (Sharing). Load sharing enabled. See section 9.3<br>2: (IncrT1). Incremental control type 1 (section 9.2.1).<br>3: (IncrT2). Incremental control type 2 (section 9.2.2).<br>4: (RotIncr). Rotating incremental control (section 9.2.3).<br>5: (Distrib). Distributed control (section 9.2.4).<br>6: (DistIncr). Incremental distributed control (section 9.2.5). |

Note: If Type is not 'LMNo' and 'Address' is non-zero, the Master impose its own Type of Load Management on the associated slaves.

**PERIOD**

This configures the modulation period for the Station. This is used only by the PLM master and is imposed on all slaves. It is recommended that all slaves are configured to have the same modulation period so that should the master lose control, the newly elected master will inherit the period from the previous master. If the period is different, the new master imposes its own period on the network at the next power-cycle.

'Period' may be set in the range of 50 to 1000 mains periods. The accuracy of the power control is related to this value. To increase the accuracy you must increase the period (section 9.1.2).

| | |
|---|---|
| Function block location | LoadMng.Main |
| Parameter name | Period |
| Accessible | Always |
| Minimum access level for editing | Config |
| Type | Uint16 |
| Values | Min = 50; Max = 1000 mains periods |

## 9.5.2 PREDICTIVE LOAD MANAGEMENT FUNCTION BLOCK DETAILS (Cont.)

**ADDRESS**

Address of the Station on the Network. This must be configured before Predictive Load Management (PLM) will operate. The default on delivery is 0 which means that PLM is inhibited. The address may be set in a range of 1 to 63, the lowest address on the network will negotiate to become the Network Master.

| | |
|---|---|
| Function block location | LoadMng.Station |
| Parameter name | Address |
| Accessible | Always |
| Minimum access level for editing | Config |
| Type | Uint8 |
| Values | Min = 1; Max = 63. 0 = PLM disabled for this Station (default). |

**Ps**

The total amount of power allowed on the Network using Load Shedding. Configured by the user in order to restrict the power demanded from the network.

For example the total installed power could be 2.5MW but it is required that the delivered power be restricted to below a tariff band of 2MW. In such a case Ps would be set to 2MW and power would be shed across the network to ensure that the total demand remains below 2MW.

If Ps is set to a value greater than Pmax, Load Shedding is disabled. The default value for this parameter is set to 5MW. For almost applications, this disables the Load Shedding function

| | |
|---|---|
| Function block location | LoadMng.Network |
| Parameter name | Ps |
| Accessible | With Sharing or Distributed Control only. |
| Minimum access level for editing | Engineer |
| Type | Float32 |
| Values | 0 to 99999 watts |

**SHEDFACTOR**

This defines, for each channel, the threshold at which the reducing factor is applied to the modulator for load shedding.

| | |
|---|---|
| Function block location | LMChan |
| Parameter name | ShedFactor |
| Accessible | With Sharing or Distributed Control only. |
| Minimum access level for editing | Engineer |
| Type | Uint8 |
| Values | 0 to 100% |

## 9.5.2 PREDICTIVE LOAD MANAGEMENT FUNCTION BLOCK DETAILS (Cont.)

**GROUP**

This allows the channel to be allocated to a specific group for Incremental Distributed and Rotating Incremental Distributed control types.

| | |
|---|---|
| Function block location | LMChan |
| Parameter name | Group |
| Accessible | With 'Incremental Distributed' and 'Rotating Incremental Distributed' |
| Minimum access level for editing | Config |
| Type | Uint8 |
| Values | 0 to 7 |

**PZMAX**

Total Power installed on the channel (the sum of all the maximum load powers)

| | |
|---|---|
| Function block location | LMChan |
| Parameter name | PZMax |
| Accessible | Always. |
| Minimum access level for editing | Read only |
| Type | Float32 |
| Values | Any (Watts) |

**STATUS**

Indicates the current status of the Station.

| | |
|---|---|
| Function block location | LoadMng.Station |
| Parameter name | Status |
| Accessible | Always. |
| Minimum access level for editing | Read only |
| Type | Enumeration |
| Values | 0 (Pending). The election of a master is in progress (section 9.6)<br>1 (IsMaster). This unit (Station) is the Master.<br>2 (IsSlave). This unit is a Slave.<br>3 (DuplAddr). This Station has the same address as one or more others.<br>All such Stations are disabled from taking part in Load Management. |

Note: If 'Pending' appears permanently, there is a configuration error in the network.

## 9.5.2 LOAD MANAGEMENT FUNCTION BLOCK DETAILS (Cont.)

### NUMCHAN

This parameter indicates how many channels on this Station, are participating in the Load Management process. See also 'TotalChannels', below.

| | |
|---|---|
| Function block location | LoadMng.Station |
| Parameter name | NumChan |
| Accessible | Always |
| Minimum access level for editing | Read only |
| Type | Uint8 |
| Values | Min = 1; Max = 4. |

Note: It is not necessary that all channels in a Station participate in the Load Management process.

### TOTALSTATION

This parameter indicates how many Stations are participating in the Load Management process on this PLM link.

| | |
|---|---|
| Function block location | LoadMng.Network |
| Parameter name | TotalStation |
| Accessible | Always |
| Minimum access level for editing | Read only |
| Type | Uint8 |
| Values | Min = 1; Max = 63 |

### TOTALCHANNELS

This shows how many Channels are participating in the Load Management process on this PLM link.

| | |
|---|---|
| Function block location | LoadMng.Network |
| Parameter name | TotalChannels |
| Accessible | Always |
| Minimum access level for editing | Read only |
| Type | Uint8 |
| Values | Min = 1; Max = 64. |

## 9.5.2 LOAD MANAGEMENT FUNCTION BLOCK DETAILS (Cont.)

**PMAX**

Indicates the total amount of power which is installed on the Load Management Network and is currently participating in the Load Management strategy.

| | |
|---|---|
| Function block location | LoadMng.Network |
| Parameter name | Pmax |
| Accessible | Always |
| Minimum access level for editing | Read only |
| Type | Float32 |
| Values | No limits (Watts) |

**PT**

Indicates the total amount of power that has been demanded from the network. (The sum of the powers demanded by each channel participating in the Load Management strategy.)

| | |
|---|---|
| Function block location | LoadMng.Network |
| Parameter name | Pt |
| Accessible | Always |
| Minimum access level for editing | Read only |
| Type | Float32 |
| Values | No limits (Watts) |

**PR**

Indicates the total amount of power that has actually been delivered through the network. This value could be larger than Ps depending upon the Shed Factors of all channels.

| | |
|---|---|
| Function block location | LoadMng.Network |
| Parameter name | Pr |
| Accessible | Always |
| Minimum access level for editing | Read only |
| Type | Float32 |
| Values | No limits (Watts) |

**EFFICIENCY**

Indicates how efficiently Load Management is operating as a percentage value. This (F) is calculated from the equation: F = (Pmax -(PtMax-PtMin))/Pmax
where: PtMax = the maximum peak value of total power during the modulation period.
PtMin = the minimum peak value of total power during the modulation period.

| | |
|---|---|
| Function block location | LoadMng.Network |
| Parameter name | Efficiency |
| Accessible | Always |
| Minimum access level for editing | Read only |
| Type | Uint8 |
| Values | 0 to 100% |

### 9.5.2 LOAD MANAGEMENT FUNCTION BLOCK DETAILS (Cont.)

**MASTER ADDRESS**

Address of elected Master on the PLM network. (Normally the lowest address on the PLM link.) If this Station is master, this address is the same as the Station's PLM address, otherwise it is different.

| | |
|---|---|
| Function block location | LoadMng.Network |
| Parameter name | MasterAddr |
| Accessible | Always |
| Minimum access level for editing | Read only |
| Type | Uint8 |
| Values | 1 to 63 |

## 9.6 MASTER ELECTION

This mechanism ensures that the Active Station with the lowest address is elected the Master. The election process can be initiated in any of the circumstances detailed below. During the election process, the Station Status is 'Pending'.

As soon a Station has been recognized as Master, its Status changes to 'IsMaster'. As soon a Station has been recognized as Slave, its Status changes to 'IsSlave'.

### 9.6.1 Master Election triggers

1. The election process starts at Initialisation Time and continues until all Stations have found the Master.
2. The election process is initiated if a Station has not received a firing demand for 100ms or more.
3. It is assumed that, if a Master has lost control, it will be re-initialised before being re-inserted into the Network, automatically activating the Master election process.
4. A new Station inserted into the System automatically triggers the Master election.

Notes:

1. The Election mechanism is asynchronous and may be triggered at any time.
2. During the Election mechanism, Duplicate Address detection is performed. If an address is recognised as duplicate, the Status of the Station changes to 'DupplAddr'.

## 9.7 ALARM INDICATION

**PROVERPS**

Indication Alarm: Pr over Ps:

This tells the user that the real Power Pr is greater than the requested 'shed power' Ps. This is the case where a shed factor has been applied to one or more channels. Alternatively, the alarm may be caused by the false calibration of one or more channels.

This parameter appears only at the Master Station.

## 9.8 TROUBLE SHOOTING

### 9.8.1 Wrong Station status

**DUPLICATE LM ADDRESS**

One or more Stations have the same PLM address. These Stations are excluded from the PLM process.

> Note: Zero is not a valid PLM address. When the PLM address is set to zero, the Station is excluded from the PLM process.

**STATION STATUS PERMANENTLY 'PENDING'**

PLM Address is set to 0

Hardware wiring error. Ensure that all 'High' pins are correctly daisy chained and that all 'Low' pins are correctly daisy-chained. If there is a break, it is likely that two or more masters will be elected and be working in opposition with one another.

PLM option board not fitted correctly

**STATION TYPE MISMATCH**

There is nothing to prevent single-phase and three-phase units being mixed. This should be avoided by grouping the single-phase units on one PLM Network, and the three-phase units on another.

# 10 ALARMS

**DANGER**

EPower 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 EPower supplier for advice.

## 10.1 SYSTEM ALARMS

System alarms are considered to be 'Major Events' which prevent proper operation of the system, and the relevant module is placed in standby mode. In some configurations (e.g. four × single-phase) it is possible that a system alarm generated in one power module will set only that module into standby mode, and the other three phases will continue as normal.

The following subsections describe each of the possible system alarms.

### 10.1.1 Missing mains

Supply power is missing from the relevant power module. If one or more phase out of two or three phase systems are missing, the system stops firing altogether, in order to avoid unbalanced firing. The alarm trigger depends on the type of load coupling.

### 10.1.2 Thyristor short circuit

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

### 10.1.3 Thyristor open circuit

This fault means that no current flow occurs, even when the thyristor(s) should be firing. The fault is detected is by measuring the load voltage, so the fault is not detected if the remote sensing option is fitted.

### 10.1.4 Fuse blown

High speed fuses are fitted in series with the thyristors in order to protect them.

### 10.1.5 Over temperature

The thyristor heat sink temperature is measured and if it is considered to be too high for the current application, the over temperature alarm is set and firing is inhibited. Hysteresis is built in to the measurement system to ensure that the heat sink is allowed to cool properly before firing can re-commence.

### 10.1.6 Network dips

This detects a reduction is 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 can be defined by the user in the Network.Setup menu, as described in section 6.20.2.

### 10.1.7 Mains frequency fault

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 0.18% of base frequency, or by more than 0.9% of the frequency measured last cycle. Firing stops until the supply frequency returns to a satisfactory state.

### 10.1.8 Power board 24V fail

The 24 Volt supply rail in the power module has failed. The power module stops firing immediately, and does not restart until the fault is rectified.

## 10.2 PROCESS ALARMS

Process Alarms are related to the application and can be configured either to stop the power module 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.

### 10.2.1 Total Load Failure (TLF)

No load is connected to one or more power controllers.

The detection is based on RMS load current and RMS load voltage of the last mains half cycle. In case of total load failure, a load voltage is measured even though load current is equal or close to zero. This method might not indicate the failed phase accurately in all load configurations (e.g. closed delta configuration for 3 phase load).

### 10.2.2 Analogue Output Fault

This indicates that the output of this block has failed. This could be due to a short or open-circuit.

### 10.2.3 Chop Off

Triggered by one of two user configurable parameters *viz*: ChopOff1 Threshold and ChopOff2 Threshold (to be found in the Network.setup area of configuration (section 6.20.2)).

'ChopOff1 Threshold' triggers the chop off alarm when the load current meets or exceeds the threshold for more than 5 seconds. Firing stops, and will not re-start until the alarm is acknowledged. The threshold can be set to any value between 100% and 150% of the nominal load current.

'ChopOff2 Threshold' triggers the chop-off alarm if the load current meets or exceeds the ChopOff1 threshold more than 'Number Chop Off' times in 'Window Chop Off' seconds, where 'Number Chop Off' is configurable between 1 and 16, and 'Window Chop Off' can take values between 1 and 65535 seconds (both values inclusive).

Firing stops in the relevant power module, each time the threshold is met or exceeded. Firing restarts after 100ms providing that the threshold has not been exceeded the specified number of times within the specified number of seconds. Otherwise, firing remains disabled until the alarm is acknowledged.

> Note: for two- or three-phase systems the over-current measurements relate to the maximum current in any phase, regardless of which phase may be at fault.

### 10.2.4 Mains Voltage Fault

Two thresholds 'OverVoltThreshold' and 'UnderVoltThreshold' can be configured as a percentage of VLineNominal. Both parameters are to be found in the Network.Setup area of configuration (section 6.20.2).

The threshold check of each line voltage is implemented in the corresponding network task of the power controller. This fault is indicated within 1 mains cycle period.

> Note: This Alarm is returned FALSE if the MissingMains Alarm is set on this phase.

### 10.2.5 Temperature pre-Alarm

This function acts as a warning which becomes active when unexpectedly high operational temperatures are reached. The warning becomes active before unit operation stops.

HeatsinkPreTemp threshold is configured (between 30°C and 107°C) and if this value is exceeded by the heat sink in any Power module, the alarm is triggered. A hysteresis of 2°C is applied to avoid fast toggling. The parameter is to be found in Network.Setup, as described in section 6.20.2.

### 10.2.6 Closed loop break

This parameter is set to TRUE if the control process cannot be performed. This is normally due to an external constraint which means the control loop cannot achieve setpoint despite the loop demanding 100% power. A closed loop break detection is enabled when the loop is demanding its output, if the Active error (SP-PV) is higher than 10% for 2 integral times the closed loop break is signalled.

### 10.2.7 Partial Load Failure (PLF)

See also 'PARTIAL LOAD FAILURE CALCULATIONS' in section 6.20.2.

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).

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 Network.Setup, as described in section 6.20.2.

For three-phase loads, the impedance reference can be set only if the load is balanced.

Note: This Alarm is returned FALSE if the TLF (Total Load Failure) Alarm is set on this phase.

### 10.2.8 Partial Load Unbalance (PLU)

This alarm is applicable only to three-phase load configurations and indicates when the difference between highest and lowest current value reaches a threshold (PLUthreshold) configurable between 5% and 50% of the highest load current. PLUthreshold appears in Network.Setup, as described in section 6.20.2.

## 10.3 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.

### 10.3.1 Process Value Transfer active

Indicates when a transfer control mode (e.g. $V^2$ <> $I^2$ P <> $I^2$ or $V^2$ <> $I^2$) is active.

### 10.3.2 Limitation active

Indicates when the internal firing control loop limits the firing output ($I^2$ or $V^2$) (in order not to exceed the adjusted maximum value)

### 10.3.3 Load Over-Current

Indicates when a configurable RMS load current threshold (OverIthreshold) is reached or exceeded. The parameter is found in the Network.Setup area of configuration (section 6.20.2) and is configurable as 10% to 400% of Nominal Current.

### 10.3.4 Over Load Shedding (Ps over Pr) alarm

Applies only to units fitted with the Load Management option (section 9).

Load Shedding reduces the global power demand Pt to a given level Ps. Load Shedding and Load Sharing may be applied simultaneously if required.

Ps is the reduced Power; Pt is the total demanded Power. If Ps>=Pt, no reduction is applied. If Ps<Pt, each Duty Cycle is reduced by multiplying it by a reduction factor (r = Ps/Pt):

For some applications, the Power Demand can not be reduced for particular channels, so each load can be allocated a 'Shed factor' during configuration.

The Reduction coefficient (r) is recalculated for each Channel, such that if $s_i > r$ then $r_i = s_i$, but if $s_i \leq r$, then $r_i = r$. Thus if $s_i$ = 100% the reducing coefficient is never applied; if $s_i$ = 0% the reducing coefficient r is always applied as it is.

Thus, the consumed Power is not Ps as requested, but Pr where $Ps \leq Pr \leq Pt$. The alarm Ps over Pt becomes active when $Pr \geq Ps$, to alert the user to the fact that the actual power is greater than the shed power requested.

Note: This alarm appears only at the Load Management master station.

# 11 TECHNICAL SPECIFICATION

STANDARDS: The product is designed and produced to comply with:

| Standard symbol | Standard details |
|---|---|
| CE | EN60947-4-3:2014 (identical to IEC60947-4-3:2014)<br>Low-voltage switchgear and controlgear - Part 4-3:Contactors and motor-starters - AC semiconductor controllers and contactors for non-motor loads.<br>Declaration of conformity available on request. |
| c UL US LISTED | UL60947-4-1 ; CAN/CSA C22.2 NO.60947-4-1-14<br>Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-Starters - Electromechanical Contactors and Motor-Starters<br>U.L. File N° E86160 |
| EAC | GOST IEC60947-4-3 : 2014 (identical to IEC 60947-4 3:1999+AMD1:2006+AMD2:2011)<br>EAC Declaration of conformity for the Customs Union EurAsEC<br>Other Russian approval: Pattern approval. |
| | Regulatory Compliance Mark (RCM)<br>For Australian Communication and Media Authority based on compliance to EN60947-4-3:2014. |

INSTALLATION CATEGORIES

| | Installation Category | Rated impulse withstand voltage (Uimp) | Rated insulation voltage (Ui) | Maximum value of rated operational voltage to earth |
|---|---|---|---|---|
| Communications | II | 0.5kV | 50V | 50V |
| Standard and optional IO | II | 0.5kV | 50V | 50V |
| Driver module power supply & Auxiliary (Fan) supply | II | 2.5kV | 230V | 300V |
| Relays | III | 4kV | 230V | 300V |
| Power Modules (up to 600V) | III | 6kV | 600V | 600V |
| Power Modules (up to 690V) | II | 6kV | 690V | 600V |

**DANGER**

Do not exceed the device's ratings.

The insulation barriers of the equipment have been designed for the rating as defined in the table above at an altitude of 2000m maximum.

## DRIVER

**WARNING**

The Driver Module power supply can work from any supply voltage between 85V ac and 265V ac. The fans (if fitted) on the power modules are specified for use at 115V ac or 230V ac, as defined at time of order. It must therefore be ensured that the fan voltage matches the supply voltage, or the fan will either fail within a short period, or it will be ineffective at cooling.

Driver Module Power Supply & Auxiliary (Fan) Supply

| | |
|---|---|
| Rated control supply voltage (Us): | 100 to 240 V ac (+10% - 15%) |
| Frequency range: | 47 to 63 Hz |
| Power requirement: | 60W + Power Module fans (15W each for 400/500/630A power modules; 10W each for 160A/250A modules). |

## Power Module

| | | |
|---|---|---|
| Number of modules: | | Up to four identical units per Driver Module. |
| Rated operational voltages (Ue): | | 100 to 600 V ac (+10% - 15%) (CE and UL units) or<br>100 to 690 V ac (+10% - 15%) (CE units only), as specified at time of order. |
| Frequency range: | | 47 to 63 Hz |
| Rated operational currents (Ie); | | 16 to 630 A depending on power module. |
| Power dissipation: | | 1.3W per Amp, per phase. |
| Cooling | | |
| Up to and including 100A: | | Natural convection |
| Above 100A: | | Fan cooling. Fans are connected in parallel to driver module connector (figure 2.2.1a). |
| Fan supply voltage: | | 115 or 230V ac, as specified at time of order (see 'Caution' above). |
| Fan power requirement: | | 10 W for 160A/250A modules; 15W for 400A, 500 and 630A modules. |
| Utilization categories | | AC51: Non-inductive or slightly inductive loads, resistance furnaces<br>AC56a: Switching of transformers. |
| Overload conditions | | AC51: 1 x Ie continous<br>AC56a: 1xIe continuous |
| Rated Duty | | Uninterrupted duty / continuous operation |
| Form designation | | Form 4 (Semiconductor controller) |
| Rated conditional short-circuit current:<br>See paragraph 12.3 for details | CE | 92kA all modules except:98kA for 500A modules;105kA for 630A modules.<br>690 Volts Maximum; coordination type 1. |
| | UL | UL SCCR Rated: 100kA RMS symmetrical amperes, 600 Volts ac Maximum coordination type 1<br>EPower units do not incorporate branch-circuit protection. It is the user's responsibility to incorporate branch-circuit protection upstream of the EPower unit. The installation must comply in its entirety with all applicable local safety and emissions regulations.<br>The above branch-circuit protection is necessary in order to meet NEC requirements. |
| Load Types | | Single or multiphase control of resistive loads (low/high temperature coefficient and non-aging/aging types) and transformer primaries. Load voltage/current feedback either internal (standard) or external (option for use with transformer secondaries for example). |

## 11 TECHNICAL SPECIFICATION (Cont.)

PHYSICAL

Dimensions and fixing centres — See figures 2.1.1b to 2.1.1e for details

Weight — See accompanying table.

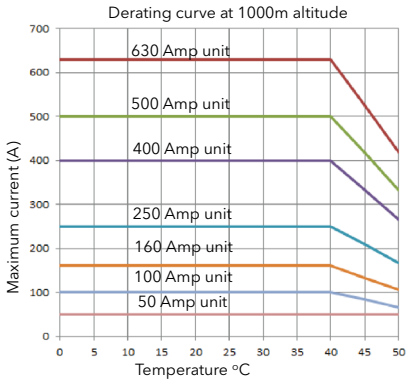
| Current | Weight (including 2 kg (4.4 lb) for driver module) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 phase | | 2 phases | | 3 phases | | 4 phases | |
| | kg | lb | kg | lb | kg | lb | kg | lb |
| 50/100 A | 6.5 | 14.3 | 11.0 | 24.3 | 15.5 | 34.2 | 20.0 | 44.1 |
| 160 A | 6.9 | 15.2 | 11.8 | 26.0 | 16.7 | 36.8 | 21.6 | 47.6 |
| 250 A | 7.8 | 17.2 | 13.6 | 30.0 | 19.4 | 42.8 | 25.2 | 55.6 |
| 400 A | 11.8 | 26.0 | 21.6 | 47.6 | 31.4 | 69.2 | 41.2 | 90.8 |
| 500 A | 14.0 | 30.9 | 26.0 | 57.3 | 38.0 | 83.8 | 50.0 | 110.2 |
| 630 A | 14.5 | 32.0 | 27.0 | 59.5 | 39.5 | 87.1 | 52.0 | 114.6 |

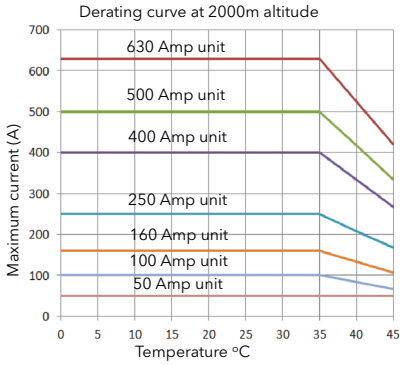
Weights ± 50gm (2 oz)

| lb | oz |
|---|---|
| 0.1 | 1.6 |
| 0.2 | 3.2 |
| 0.3 | 4.8 |
| 0.4 | 6.4 |
| 0.5 | 8.0 |
| 0.6 | 9.6 |
| 0.7 | 11.2 |
| 0.8 | 12.8 |
| 0.9 | 14.4 |

ENVIRONMENT

| | | | |
|---|---|---|---|
| Temperature limits | Operating: | | 0°C to 40 °C maximum at 1000m<br>0°C to 35°C maximum at 2000m<br>(Refer to de-rating curve for upper temperature) |
| | Storage: | | -25°C to +70°C |
| Altitude (maximum) | | | 1000 metres at 40 °C<br>2000 metres at 35°C<br>(Refer to de-rating curve for upper temperature) |
| Humidity limits | | | 5% to 95% RH (non-condensing) |
| Pollution degree | | | Pollution degree 2 |
| Atmosphere | | | Non-explosive, non corrosive and non-conductive. |
| Protection | | CE | (according to EN60529)<br>IP10 With internal lug terminals of size as given in Table 2.2.2a Line/Load termination details<br>IP00 with power connection adapter (see Table 2.2.2b Power connection adapter termination details) |
| | | UL | Open type |
| External wiring | | CE | Must comply with IEC60364-1 and IEC60364-5-54 and all applicable local regulations.<br>Cross sections must comply with Table 9 & 10 of IEC60947-1. |
| | | UL | Wiring must comply with NEC and all applicable local regulations.<br>Used cables must be rated 75°C stranded copper only.<br>Connection must be made by using listed lugs. |
| Shock (EN60068-2-29) | | | 10g peak; 6ms duration; 100 bumps |
| Vibration (EN60068-2-6) | | | 67 to 150 Hz at 1g. |




EMC

Standard — EN60947-4-3:2014
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.

EMC TEST RESULTS (According to EN60947-4-3:2014)

| EMC immunity tests | Level | | Criteria | |
|---|---|---|---|---|
| | Requested | Achieved | Requested | Achieved |
| Electrostatic discharge<br>(test method of EN 61000-4-2) | Air discharge mode 8kV<br>Contact discharge mode 4kV | Air discharge mode 8kV<br>Contact discharge mode 4kV | 2 | 2 |
| Radiated radio-frequency electromagnetic field test<br>(test method of EN 61000-4-3) | 10V/m from 80MHz to 1GHz<br>and from 1,4GHz to 2GHz | 10V/m from 80MHz to 3GHz | 1 | 1 |
| Fast transient/burst test (5/50 ns)<br>(test method of EN 61000-4-4) | Power ports 2kV / 5kHz<br>Signal ports 1kV / 5kHz | Power ports 2kV / 5 kHz<br>Signal ports 2kV / 5 kHz | 2 | 1 |
| Surge Voltage test (1,2/50 µs – 8/20 µs)<br>(test method of EN 61000-4-5) | 2kV line to earth<br>1kV line to line | 2kV line to earth<br>1kV line to line | 2 | 2 |
| Conducted radio-frequency test<br>(test method of EN 61000-4-6) | 10V (140dBµV)<br>from 0,15MHz to 80 MHz | 10V (140dBµV)<br>from 0,15MHz to 80 MHz | 1 | 1 |
| Voltage dips test<br>(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<br>(test method of EN 61000-4-11) | 0% during 250/300 cycles | 0% during 250/300 cycles | 3 | 2 |

| Test | Frequency (MHz) | Limit level for class A industrial[1] | | Comments |
|---|---|---|---|---|
| | | Quasi peak dB (µV) | Average dB (µV) | |
| Radiated radio frequency emission test<br>According to EN60947-4-3:2014<br>(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<br>According to EN 60947-4-3:2014 for rated power <20 kVA<br>(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.<br>This is in line with the rest of the industry[2] |
| | 5 to 30 | 73 | 60 | |
| Conducted radio frequency emission test<br>According to EN 60947-4-3:2014 for rated power >20kVA<br>(test method of CISPR11) | 0.15 to 0.5 | 100 | 90 | |
| | 0.5 to 5 | 86 | 76 | |
| | 5 to 30 | 90 to 73 [3] | 80 to 60 [3] | |

1. 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.

2. A technical note TN1618 (available upon costumer's request) describes the recommended filter structures which reduce Conducted radio-frequency emissions.

3. Decrease with log of frequency.

OPERATOR INTERFACE

| | |
|---|---|
| Display: | Four lines of up to 10 characters each. Display pages can be used to view process variable values and to view and edit the configuration of the unit. (Editing of the configuration is better carried out using configuration software (iTools).) In addition to the standard displays, up to four 'custom' pages can be defined which allow bargraph displays, text entry etc. |
| Character format: | Seven high x five wide yellow-green LCD dot matrix array. |
| Push buttons | Four push buttons provide page and item entry and scroll facilities. |
| LED indicators (beacons) | Three indicators (PWR. LOC and ALM) are supplied to indicate that power is applied, that Local Control is selected and that there is one or more active alarm, respectively. |

## 11 TECHNICAL SPECIFICATION (Cont.)

### STANDARD INPUTS/OUTPUTS (SK1)

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

| | | |
|---|---|---|
| Number of inputs/outputs | | |
| | Number of analogue inputs: | 2 |
| | Number of analogue outputs | 1 |
| | Number of digital inputs/outputs: | 2 (each configurable as an input or an output). |
| | 10V (Potentiometer) supply: | 1 |
| Update rate | | Twice the mains frequency applied to power module 1. Defaults to 83.2 Hz (12 ms) if no power applied to power module 1 or if supply frequency lies outside the range 47 to 6 3Hz.) |
| Termination | | Removable 10-way connector. (5.08 mm. pitch) |

### ANALOGUE INPUTS

| | | |
|---|---|---|
| | Performance: | See tables 11.a and 11.b. |
| | Input types: | Each input is configurable as one of: 0 to 10V, 1 to 5V, 2 to 10V, 0 to 5V, 0 to 20mA, 4 to 20 mA. |
| Absolute maxima | + terminal: | ±16V or ±40mA |
| | - terminal: | ±1.5V or ±300mA |

### ANALOGUE OUTPUTS

| | | |
|---|---|---|
| | Performance: | See tables 11c and 11d. |
| | Output types: | Each output is configurable as one of: 0 to 10V, 1 to 5 V, 2 to 10V, 0 to 5V, 0 to 20mA, 4 to 20 mA. |
| Absolute maxima | + terminal: | (-0.7V or -300mA) or (+16V or + 40mA) |
| | 0V terminal: | ±2A |

### 10V (POTENTIOMETER) SUPPLY)

| | | |
|---|---|---|
| | Output voltage: | 10.3V ± 0.3V @ 5.5mA |
| | Short circuit o/p current: | 15mA max. |
| | Ambient temperature drift: | ± 0.012%/ °C (typ); ±0.04%/ °C (max.) |
| Absolute maxima | Pin 1: | (-0.7V or -300mA) or (+16V or + 40mA) |

### DIGITAL I/O

| | | |
|---|---|---|
| | Hardware response time: | 100µs |
| Voltage inputs | | |
| | Active level (high): | 4.4V<Vin<30V |
| | Non-active level (low): | -30V<Vin<+2.3V |
| | Input impedance: | 10kΩ |
| Contact closure inputs | | |
| | Source current: | 10mA min; 15mA max. |
| | Open contact (non active) resistance: | >500Ω |
| | Closed contact (active) resistance: | <150Ω |
| Current source output | | |
| | Source current: | 9mA<$I_{source}$ <14mA @ 14V<br>10mA<$I_{source}$ <15mA @ 0V<br>9mA<$I_{source}$ <14mA @ -15V |
| | Open circuit voltage: | <14V |
| | Internal pull-down resistance: | 10kΩ (to 0 V) |
| Absolute Maxima | + terminal: | ±30V or ±25mA |
| | 0V terminal | ±2A |

Notes:

1. Absolute maximum ratings refer to externally applied signals
2. The 10V potentiometer supply is designed to supply two 5kΩ potentiometers connected in parallel with one another.
3. The maximum current for any 0V terminal is ±2A.
4. PLC compatibility : Digital inputs are not 100% compliant with IEC 61131-2 (It is recommended that the user check compatibility before use

**DANGER**

The I/O Input & Output, the Communications ports are SELV circuit. They must be connected to SELV or PELV circuit.

## 11 TECHNICAL SPECIFICATION (Cont.)

| Analogue input: Voltage input performance | | |
|---|---|---|
| Parameter | Typical | Max/Min |
| Total voltage working input span (note 1) | | -0.25V to + 12.5V |
| Resolution (noise free) (note 2) | 13 bits | |
| Calibration error (notes 3, 4) | <0.25% | <0.5% |
| Linearity error (note 3) | | ±0.1% |
| Ambient temperature error (note 3) | | <0.01%/°C |
| Input resistance (+'ve terminal to 0V) | | >140kΩ |
| Input resistance (-'ve terminal to 0V) | 150Ω | |
| Allowable voltage (-'ve terminal to 0V) | | ±1V |
| Series mode rejection of mains interference | 46dB | >30dB |
| Common mode dc rejection | 46dB | >40dB |
| Hardware response time | 5ms | |
| Note 1: w.r.t. to the relevant -'ve input<br>Note 2: w.r.t. total working span | Note 3: % of effective range (0 to 5V, 0 to 10V)<br>Note 4: After warm up. Ambient = 25 °C | |

Table 11.a Analogue input specification table (voltage inputs)

| Analogue input current input performance | | |
|---|---|---|
| Parameter | Typical | Max/Min |
| Total current working input span | | -1mA to +25mA |
| Resolution (noise free) (note 1) | 12 bits | |
| Calibration error (notes 2, 3) | <0.25% | <0.5% |
| Linearity error (note 2) | | ±0.1% |
| Ambient temperature error (note 2) | | <0.01%/°C |
| Input resistance (+'ve to -'ve terminal) | 235Ω | |
| Input resistance (-'ve terminal to 0V) | 150Ω | |
| Allowable voltage (-'ve terminal to 0V) | | <±1V |
| Series mode rejection of mains interference | 46dB | >30dB |
| Common mode dc rejection | 46dB | >40dB |
| Hardware response time | 5ms | |
| Note 1: w.r.t. total working span<br>Note 2: % of effective range (0 to 20mA) | Note 3: After warm up. Ambient = 25 °C | |

Table 11.b Analogue input specification table (current inputs)

| Analogue output: Voltage output performance | | |
|---|---|---|
| Parameter | Typical | Max/Min |
| Total voltage working span (within ±20mA (typ.) current span) | | -0.5V to +12.5V |
| Short circuit current | | <24mA |
| Resolution (noise free) (note 1) | 12.5 bits | |
| Calibration error (note 2, note 3) | <0.25% | <0.5% |
| Linearity error (note 2) | | <±0.1% |
| Ambient temperature error (note 2) | | <0.01%°C |
| Minimum load resistance | | >800Ω |
| DC output impedance | | <2Ω |
| Hardware response time (10% to 90%) | 20ms | <25ms |
| Note 1: w.r.t. total working span<br>Note 2: % of effective range (0 to 5V, 0 to 10V) | Note 3: After warm up. Ambient = 25 °C | |

Table 11.c Analogue output specification table (voltage outputs)

## 11 TECHNICAL SPECIFICATION (Cont.)

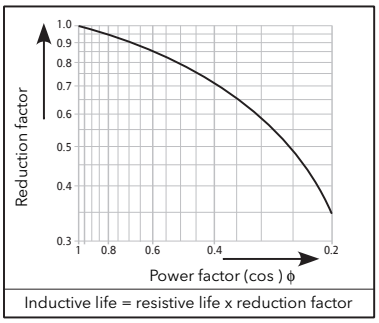
| Analogue output: Current output performance | | |
|---|---|---|
| Parameter | Typical | Max/Min |
| Total current working span (within -0.3V to +12.5V voltage span) | | -24mA to +24mA |
| Open circuit voltage | | <16V |
| Resolution (noise free) (note 1) | 12.5 bits | |
| Calibration error (note 2, note 3) | <0.25% | <0.5% |
| Linearity error (note 2) | | <±0.1% |
| Ambient temperature error (note 2) | | <0.01%°C |
| Maximum load resistance | | <550Ω |
| DC output conductance | | <1µA/V |
| Hardware response time (10% to 90%) | 20ms | <25ms |
| Note 1: w.r.t. total working span<br>Note 2: % of effective range (0 to 20mA) | Note 3: After warm up. Ambient = 25 °C | |

Table 11.d Analogue output specification table (current outputs)

RELAY SPECIFICATION

| | | |
|---|---|---|
| Contact life | Resistive loads: | 100,000 operations (de-rate with inductive loads as per figure). |
| High power use | Current: | <2A (resistive loads) |
| | Voltage: | <264V RMS (UL: voltage 250Vac.) |
| Low power use | Current: | >1mA |
| | Voltage: | >1V |
| Contact configuration | | Single pole change-over (one set of Common, Normally open and Normally Closed contacts) |
| Termination | Relay 1 (standard): | 3-way connector on underside of Driver Module (figure 2.2.1b) |
| | Watchdog relay (standard): | 3-way connector on underside of Driver Module (figure 2.2.1b) |
| | Relays two to four (option): | 12-way option module connector (figure 2.2.1a) |
| Installation Category | | Installation category III, assuming that nominal phase to earth voltage is ≤ 300V RMS. Isolation between different relays' contacts is double isolation, in accordance with the installation category and phase to earth voltage specified above. |
| Absolute maximum switching capability | | <2A at 240V RMS (resistive loads) |

Note: Normally Closed and Normally open refer to the relay when the coil is not energised.



Inductive life = resistive life x reduction factor

OPTIONAL INPUT/OUTPUT MODULES (SK3, SK4, SK5)

Up to three input/output modules can be fitted, each containing the inputs and outputs detailed below. Unless otherwise stated below, the specification for the optional I/O (including relays) is as given above for the standard I/O.

| | |
|---|---|
| Termination | Removable 12-way (5.08mm pitch) connector per module. |
| Number of modules | Up to three |
| Number of inputs | One analogue input and two digital inputs per module |
| Number of outputs | One analogue output per module |
| Number of relays | 1 set of common, normally open and normally closed contacts per module. |
| 10V potentiometer supply o/p voltage: | 10.0V ± 0.3V at 5.5 mA |

**DANGER**

The relays outputs are compliant to the SELV requirements; they can be connected to SELV, PELV circuit or to voltage up to 230V (maximum value of rated operational voltage to earth:300V).

## 11 TECHNICAL SPECIFICATION (Cont.)

### MAINS NETWORK MEASUREMENTS

All network measurements are calculated over a full mains cycle, but internally updated every half-cycle. For this reason, power control, current limits and alarms all run at the mains half-cycle rate. The calculations are based on waveform samples taken at a rate of 20kHz. Measurements on each phase are synchronised to its own phase and if the line voltage cannot be detected, the measurements stop for that phase. It should be noted that, depending on the configuration, the phase voltage referred to is one of:
a. the line voltage referenced to neutral in four star,
b. the line voltage referenced to neutral or another phase for single phase or
c. the line voltage referenced to the phase applied to the next adjacent power module for three phase star or delta configurations.

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): | ±0.5% of Nominal Vline. |
| Load RMS voltage (V): | ±0.5% of Nominal V for voltage readings >1% of Nominal V. Unspecified for readings lower than 1%Vnom. |
| Thyristor RMS current ($I_{RMS}$): | ±0.5% of Nominal $I_{RMS}$ for current readings > 3.3% of Nominal $I_{RMS}$. Unspecified for readings = 3.3% Nominal $I_{RMS}$ (see note). |
| Load RMS voltage squared (Vsq): | ±1% of (Nominal V)$^2$ |
| Thyristor RMS current squared (Isq): | ±1% of (Nominal I)$^2$ |
| True load power (P): | ±1% of (Nominal V) × (Nominal I) |
| Frequency resolution | 0.1 Hz |
| Measurement resolution | 11 bits of Nominal value (noise free) |
| Measurement drift with ambient temp. | <0.02% of reading / °C |

Further parameters (S, PF, Q, Z, Iavg, IsqBurst, IsqMax, Vavg, Vsq Burst, VsqMax and PBurst) are derived from the above, for each network (if relevant). See section 6.20.1 (Meas submenu) for further details.

> Note: For external current feedback, the above specification does not include errors associated with external current transformers.

### EXTERNAL CURRENT TRANSFORMER

| | |
|---|---|
| Ratio: | Chosen such that the full scale output from the current transformer is 5 Amps. |

### COMMUNICATIONS

| | | |
|---|---|---|
| CC-Link | Protocol: | CC-Link version 1.1 |
| | Connector: | 5 way |
| | Indicators: | RUN and ERR |
| DeviceNet | Protocol: | DeviceNet |
| | Connector: | Five way |
| | Indicators: | Network status and Module status |
| Modbus/TCP | Type: | 10baseT (IEEE801) |
| | Protocol: | Modbus TCP |
| | Connector: | RJ45 single port and dual port |
| | Indicators: | Tx activity (green) and communications activity (yellow) |
| EtherNet/IP | Protocol: | EtherNet/IP |
| | Connector: | RJ45 single port and dual port |
| | Indicators: | NS (Network status), MS (Module status) and LINK (Link status) |
| Modbus RTU | Protocol: | Modbus RTU slave |
| | Transmission standard: | Three-wire EIA485 |
| | Connector: | Twin, parallel-wired RJ45 |
| | Indicators: | Tx activity (green) and Rx activity (yellow) |
| | Isolation (EN60947-4-3): | Installation category II, Pollution degree 2 |
| | Terminals to ground: | 50V RMS or dc to ground (double isolation). |
| Profibus | Protocol: | Profibus DPV1 |
| | Connector: | 9 way D-type |
| | Indicators: | Mode and Status. |
| Profinet | Protocol: | Profinet I/O |
| | Connector: | RJ45 single port and dual port |
| | Indicators: | Link, Network Status and Module Status |

# 12 MAINTENANCE

## 12.1 SAFETY

**DANGER**

1. If the product (EPower) is used in a manner not specified by the manufacturer, the protection provided by the product might be impaired.
2. Any adjustment, maintenance and repair of the opened apparatus under voltage, is forbidden for safety reasons.
3. The product must be installed and maintained by suitably qualified personnel, authorized to work in an industrial low voltage environment.
4. The product is not suitable for isolation applications, within the meaning of EN60947-1.
5. 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.
6. The mains supply fuse within the Driver Module is not replaceable. If it is suspected that the fuse is faulty, the manufacturer's local service centre should be contacted for advice.

**CAUTION**

1. Under some circumstances, the EPower 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.
   Ensure that any contact with hot surfaces is avoided.
   Do not allow flammable or heat-sensitive parts in the immediate vicinity of hot surfaces
   Give consideration to additional warnings and barriers to prevent injury.

## 12.2 PREVENTIVE MAINTENANCE

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

**DANGER**

The protective earth ground connections must be tightened according to the torque values defined in table 2.2.1. Appropriate regular inspections must be performed. Periodicity depends on the local environment, but should not exceed 1 year.

**DANGER**

1. Power terminals must be tightened according to the torque values defined in Table 2.2.2.. Appropriate regular inspections must be performed. Periodicity depends on the local environment, but should not exceed 1 year.
2. The tightening torques for supplemental (high speed) fuses should be checked according to value defined in table 12.3. Ceramic fuse bodies should be checked for visible cracks. Appropriate regular inspections must be performed. Periodicity depends on the local environment, but should not exceed 1 year.

**WARNING**

1. To maintain maximum cooling efficiency, the heat-sink and fans must be cleaned regularly and fan operation need to be checked. Periodicity depends on the local environment, but should not exceed 1 year.

**CAUTION**

Fans have limited lifetime which depends on environment. As preventive maintenance their periodic replacement need to be considered.

***NOTICE***

In order to maintain protection against damage due to electrostatic discharge, any ribbon cable which is chafed, scratched or otherwise damaged must be replaced. Periodicity depends on the local environment, but should not exceed 1 year.

## 12.3 THYRISTOR PROTECTION FUSES

The thyristors in the Power modules are protected against excess currents by high-speed fuses (supplemental fuse) within the power modules.

U.L. : With the high speed fuses (supplemental fuse) as described in the table 12.3 below, EPower is suitable for use on a circuit capable of delivering not more than 100kA RMS symmetrical amperes, 600 Volts ac Maximum. (Coordination Type 1)

CE : With the high speed fuses (supplemental fuse) as described in the table 12.3 below, EPower is suitable for use on a circuit capable of delivering not more than 92kA all modules except:98kA for 500A modules;105kA for 630A modules ; 690 Volts Maximum. (Coordination Type 1)

**DANGER**

1. According to the CE and UL certifications, high speed fuses (supplemental fuses) are mandatory for compliant installation and protection of the EPower controller against short circuit. See paragraph 12.3 for details
2. The EPower's rated short-circuit conditional current is defined for co-ordination type 1. 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.

**DANGER**

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. Branch circuit shall be rated according to maximum current in each phase.
   CE: branch-circuit protection must be selected according to IEC 60364-4-43 or applicable local regulations.
   UL: branch-circuit protection must be selected according to NEC article 210.20, it is necessary for compliance with National Electric Code(NEC) requirements.
2. The tightening torques for supplemental (high speed) fuses should be checked according to value defined in table 12.3. Ceramic fuse bodies should be checked for visible cracks. Appropriate regular inspections must be performed. Periodicity depends on the local environment, but should not exceed 1 year.

| Power module rating | Eurotherm Spare Part Reference | Fuse rating | Manufacturer catalog number | Manufacturer | Fixing size | Tightening torque |
|---|---|---|---|---|---|---|
| 50A, 100A & 160A | SUBEPWR/FUSE160A | 315 A | DN000UB69V315L | Mersen | M8 | 12 Nm (8.9 ft lb) |
| | | | 170M1322 | EATON COOPER BUSSMAN | M8 | 12 Nm (8.9 ft lb) |
| 250A | SUBEPWR/FUSE250A | 350 A | 170M1373 | | M8 | 12 Nm (8.9 ft lb) |
| 400A | SUBEPWR/FUSE400A | 550 A | 170M3422 | | M8 | 15 Nm (11.1 ft lb) |
| 500A | SUBEPWR/FUSE500A | 630 A | 170M5412 | | M10 | 15 Nm (11.1 ft lb) |
| 630A | SUBEPWR/FUSE630A | 900 A | 170M6413 | | M12 | 25Nm (18.5 ft lb) |

Table 12.3 Protection fuse details

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# APPENDIX A REMOTE DISPLAY UNIT

## A1 INTRODUCTION

This appendix describes the recommended 32h8e remote display unit for the EPower unit.

This instrument is a horizontal 1/8 DIN indicator and alarm unit that performs the dual function of remote display and independent 'policeman' (to disconnect power should an over temperature or other excess process condition occur). The unit is intended for indoor use in a permanent installation, enclosed in an electrical panel. To ensure IP65 and NEMA 4 front sealing against dust and water, the panel should have a non-textured surface.

Communications between the unit and EPower are via RJ45 'Panel comms port' located on the underside of the controller module. The communications standard is 3-wire EIA485, and It uses Modbus protocol.

The display unit comes complete with one relay output (OP1) and one analogue output (OP3).

## A1.1 SAFETY AND EMC INFORMATION NOTES

**DANGER**

1. Do not use the 32h8e remote display unit for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.
2. The 32h8e remote display unit must be installed, connected and used in compliance with prevailing standards and/or installation regulations
3. If the 32h8e remote display unit is used in a manner not specified by the manufacturer, the protection provided by the product might be impaired.
4. Any adjustment, maintenance and repair of the opened apparatus (32h8e remote display unit) under voltage, is forbidden for safety reasons.
5. The 32h8e remote display unit must be installed and maintained by suitably qualified personnel, authorized to work in an industrial low voltage environment.
6. insulation barriers inside 32h8e remote display unit has been designed to conform to EN 61010 for an altitude of 2000m maximum and installation category II. The rated impulse voltage for equipment on nominal 230V supply is 2500V.
7. Voltage rating of 32h8e remote display unit.
   The maximum continuous voltage applied between any of the following terminals must not exceed 240Vac:
   relay output to logic, dc or sensor connections
   any connection to a protective earth ground
8. Live sensors.
   The 32h8e remote display unit is designed to operate if the temperature sensor is connected directly to an electrical heating element. However, you must ensure that service personnel do not touch connections to these inputs while they are live. With a live sensor, all cables, connectors and switches for connecting the sensor must be mains rated for use in 240Vac CATII
   32h8e remote display unit analogue inputs are not isolated from digital inputs or from logic outputs.
9. Do not connect AC supply to low voltage sensor input or low-level inputs and outputs of 32h8e remote display unit.
10. Wiring must comply with all local wiring regulations, i.e. IEC 60364-5-52 and USA, NEC Class 1 wiring methods
11. Enclosure of Live Parts
    To prevent hands or metal tools touching parts that may be electrically live, the 32h8e remote display unit must be installed in an enclosure.

## A1.1 SAFETY AND EMC INFORMATION (Cont.)

**DANGER**

12. The 32h8e remote display unit has been designed for pollution degree 2 according to IEC61010 definition: Normally, only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation may be expected.
    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.
13. Power Isolation
    The installation must include a power isolating switch or circuit breaker. This device must be in close proximity of the 32h8e remote display unit, within easy reach of the operator and marked as the disconnecting device for the instrument.
14. Charged capacitors
    Before removing a 32h8e remote display unit from its sleeve, disconnect the supply and wait at least two minutes to allow capacitors to discharge. Avoid touching the exposed electronics of the instrument when withdrawing it from the sleeve.
15. Before carrying out any wiring to the 32h8e remote display unit, it must be ensured that all relevant power and control cables, leads or harnesses are isolated from voltage sources.
16. . Grounding of the temperature sensor shield.
    In some installations it is common practice to replace the temperature sensor while the 32h8e remote display unit is still powered up. Under these conditions, as additional protection against electric shock, we recommend that the shield of the temperature sensor is grounded. Do not rely on grounding through the framework of the machine.

**DANGER**

The cables used to connect the line supply of 32h8e remote display unit 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.

**Reasonable use and responsibility**

The safety and EMC of any system incorporating this product is the responsibility of the assembler/installer of the system.

The information contained in this manual is subject to change without notice. While every effort has been made to ensure the accuracy of the information, your supplier shall not be held liable for errors contained herein.

32h8e remote display unit is intended for industrial temperature and process control applications when it will meet the requirements of the European Directives on Safety and EMC.

Use in other applications, or failure to observe the installation instructions of this manual may impair safety or EMC. The installer must ensure the safety and EMC of any particular installation.

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

Eurotherm shall not be held responsible for any damage, injury, losses or expenses caused by inappropriate use of the product (EPower), or failure to comply with these instructions.

**WARNING**

1. Safety and EMC
   Safety and EMC protection can be seriously impaired if the unit is not used in the manner specified. The installer must ensure the safety and EMC of the installation.
   The 32h8e remote display unit complies with the European Low Voltage Directive 2014/35/EU, by the application of the safety standard EN 61010.
2. Electrostatic discharge precautions.
   Always observe all electrostatic precautions before handling the unit. When the 32h8e remote display unit is removed from its sleeve, some of the exposed electronic components are vulnerable to damage by electrostatic discharge from someone directly handling the controller.
3. Service and repair.
   The 32h8e remote display unit has no user serviceable parts. Contact your supplier for repair
4. Electromagnetic compatibility.
   The 32h8e remote display unit conforms with the essential protection requirements of the EMC Directive 2014/35/EU. It satisfies the general requirements of the industrial environment defined in EN 61326.
5. Installation requirements for EMC.
   To comply with the European EMC directive certain installation precautions are necessary:
   • General guidance. Refer to EMC Installation Guide, Part no. HA025464.
   • Relay outputs. It may be necessary to fit a suitable filter to suppress conducted emissions.
   • Table top installation. If using a standard power socket, compliance with commercial and light industrial emissions standard is required. To comply with conducted emissions standard, a suitable mains filter must be installed.
6. Wiring.
   It is important to connect the controller in accordance with the wiring data given in this guide. Take particular care not to connect AC supplies to the low voltage sensor input or other low-level inputs and outputs. Only use copper conductors for connections (except thermocouple inputs) and ensure that the wiring of installations complies with all local wiring regulations. For example, in the UK use the latest version of the IEE wiring regulations, (BS7671). In the USA use NEC Class 1 wiring methods.
7. Routing of wires.
   To minimise the pick-up of electrical noise, the low voltage DC connections and the sensor input wiring should be routed away from high-current power cables. Where it is impractical to do this, use shielded cables with the shield grounded. In general, keep cable lengths to a minimum.
8. Hazard of Incorrect Configuration.
9. Incorrect configuration can result in damage to the process and/or personal injury and must be carried out by a competent person authorised to do so. It is the responsibility of the person commissioning the controller to ensure the configuration is correct.
10. Loss of Communications
    If the output is not wired, but written to by communications, it will continue to be controlled by the communications messages. In this case take care to allow for the loss of communications

**WARNING**

11. The designer of any control scheme must consider the potential failure modes which could occur and provide a means to achieve a safe state during and after a failure.
    Independent or redundant devices must be provided for critical control functions.
    The control scheme may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
    Each implementation of this equipment must be individually and thoroughly tested for its intended operation before being placed into service.

**WARNING**

12.In temperature control applications a danger could be present if the heating remains constantly on. Apart from potentially spoiling the end product, this could damage the process machinery being controlled, or cause a fire hazard. Consider the following examples:

- a temperature sensor becoming detached from the process
- thermocouple wiring becoming short circuit
- the controller operating with its heating output constantly on
- an external valve or contactor sticking in the heating condition
- the controller setpoint set too high

The alarm relays within the controller will not give over-temperature protection under all conditions. The installer must, therefore, fit a separate over-temperature protection device, with an independent temperature sensor, to isolate the heating circuit should an over-temperature condition occur.

**CAUTION**

1. Unpacking and storage - The packaging should contain an instrument mounted in its sleeve, two mounting brackets for panel installation and an Installation sheet. Certain ranges are supplied with an input adapter.
   If upon receipt, the packaging or the instrument is damaged, do not install the product instead contact your supplier.
   If the instrument is to be stored before use, protect from humidity and dust in an ambient temperature range of −30C° to +75°C.
2. Cleaning - Do not use water or water based products to clean labels or they will become illegible. Isopropyl alcohol may be used to clean labels. A mild soap solution may be used to clean other exterior surfaces of the product.

**SYMBOLS**

Symbols used on the instrument are defined in the table below

| | |
|---|---|
|  | Caution<br>refer to accompanying document |
|  | Equipment protected throughout by<br>DOUBLE ISOLATION |

## A2 MECHANICAL INSTALLATION

A location should be chosen which is subject to minimum vibrations; the allowable ambient temperature range is 0 to 55°C (32 to 131°F) and the acceptable humidity range is 5 to 95% RH non-condensing.

To remove the indicator from its Sleeve, ease the latching ears outwards and pull the unit forward. When plugging back in ensure that the latching ears click into place (maintains the IP65 sealing).

1. An aperture with dimensions as shown in figure A2 should be made in the panel.
2. If it is not already in place, fit the IP65 sealing gasket behind the front bezel of the unit
3. From the front of the panel, insert the unit, through the cut-out.
4. Spring the panel retaining clips into place and secure the unit in position by pushing both retaining clips forwards, until they bear on the back of the panel.
5. Peel off the protective cover from the display.

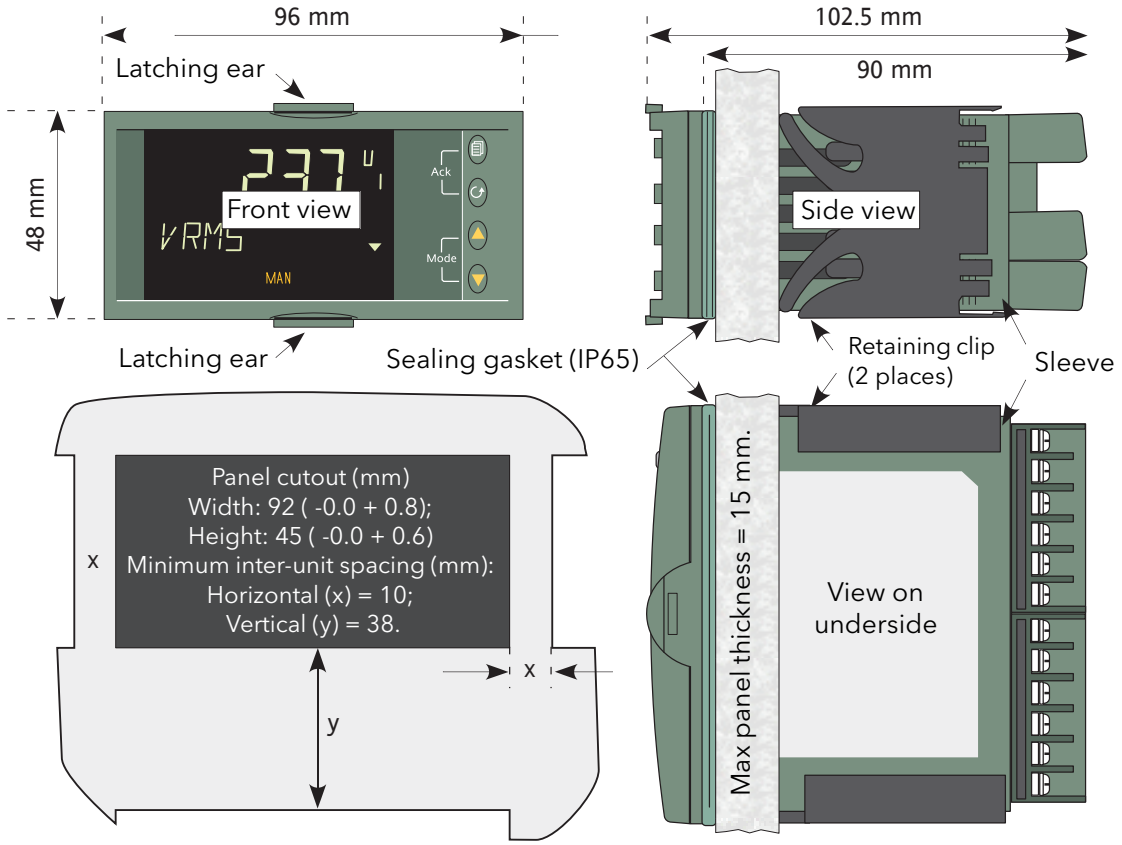



Figure A2 Installation dimensions drawing

# A3 ELECTRICAL INSTALLATION

## A3.1 PINOUT

Figure A3.1, below shows the rear terminal arrangement.

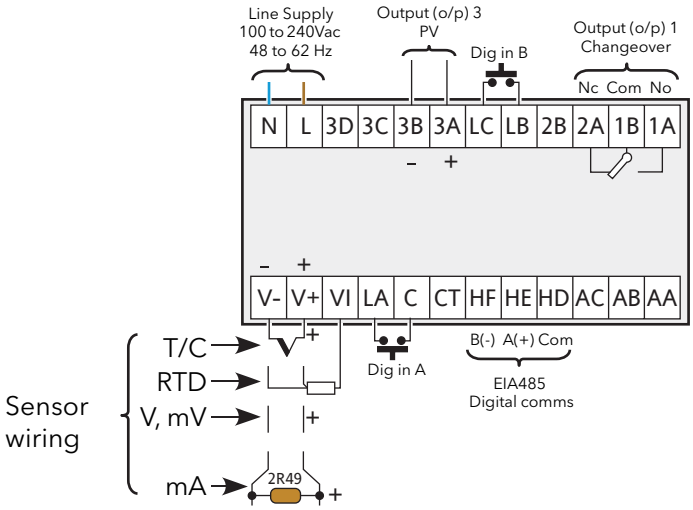



Figure A3.1 Terminal arrangement

## A3.2 WIRING

### A3.2.1 Termination details

The screw terminals accept wire sizes from 0.5 to 1.5 mm (16 to 22AWG). Hinged insulating covers prevent accidental contact with live wires. The recommended maximum rear terminal screw torque is 0.4Nm.

### A3.2.2 Supply voltage

Please read the safety notes in section A1.1 of this manual. Additionally:

1. Only copper conductors may be used.
2. The power supply input is not fuse protected. Fusing must be provided externally by a type T fuse with a 2 Amp, 250V rating.

#### SUPPLY VOLTAGE RANGE

100 to 240Vac, -15%, +10%, 48 to 62 Hz

## A3.2.3 Signal wiring

Notes:

1. Input wires should not be run in proximity with power cables
2. When shielded cable is used, it should be grounded at one point only
3. Any external components (such as Zener barriers) connected between sensor and input terminals may cause errors in measurement due to excessive and/or unbalanced lead resistance and leakage currents.

**WARNING**

Live sensors

The 32h8e remote display unit is designed to operate if the temperature sensor is connected directly to an electrical heating element. However, you must ensure that service personnel do not touch connections to these inputs while they are live. With a live sensor, all cables, connectors and switches for connecting the sensor must be mains rated for use in 240Vac CATII

32h8e remote display unit analogue inputs are not isolated from digital inputs or from logic outputs.

**ANALOGUE (MEASURING) INPUTS**

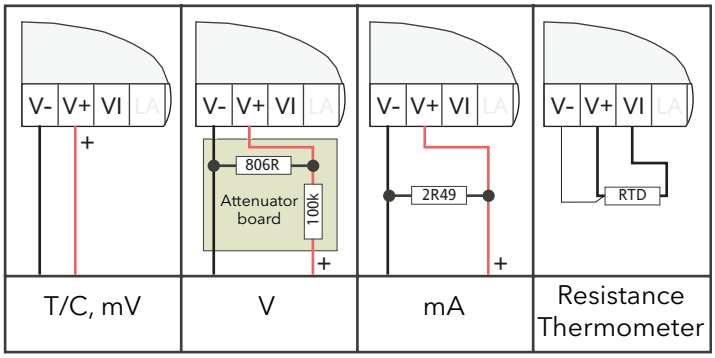



Figure A3.2.3a Input wiring

Notes:

1. For thermocouple inputs, compensation cable suitable for the thermocouple type must be used, preferably shielded.
2. For voltage inputs an attenuator board must be fitted as shown. A suitable board is available from the manufacturer.
3. For resistance temperature detectors, the resistance element is wired across V+ and VI; the lead compensation wire being terminated at V-. The resistance of all three wires must be equal. Line resistances greater than 22 Ohms cause measurement errors.

## OUTPUT WIRING

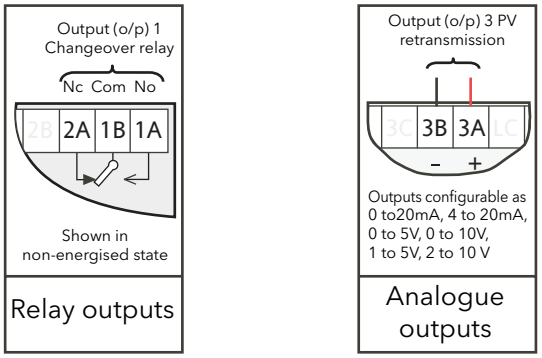



Figure A3.2.3b Output wiring

### A3.2.4 Digital communications wiring

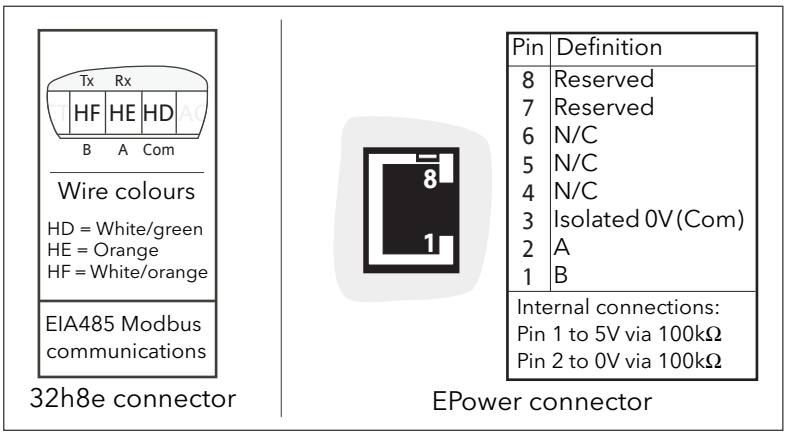



Figure A3.2.4 Digital communications pinouts

## A3.3 OVER TEMPERATURE APPLICATION WIRING

Figure A3.3 shows a typical application where the Remote Display Unit is used to trip the main contactor to the EPower units if it detects an over-temperature.

The figure is intended for guidance only, and does not show detailed EPower wiring, this being discussed in depth in section A2 of this manual.

Notes:

1. When switching inductive loads, the 22nF/100 Ohm snubber (supplied with the instrument) should be wired across the relay connections as shown.
2. Snubbers pass 0.6mA at 110V and 1.2mA at 230Vac. This is sometimes sufficient to hold high impedance loads on. Snubbers should not be used in such cases.

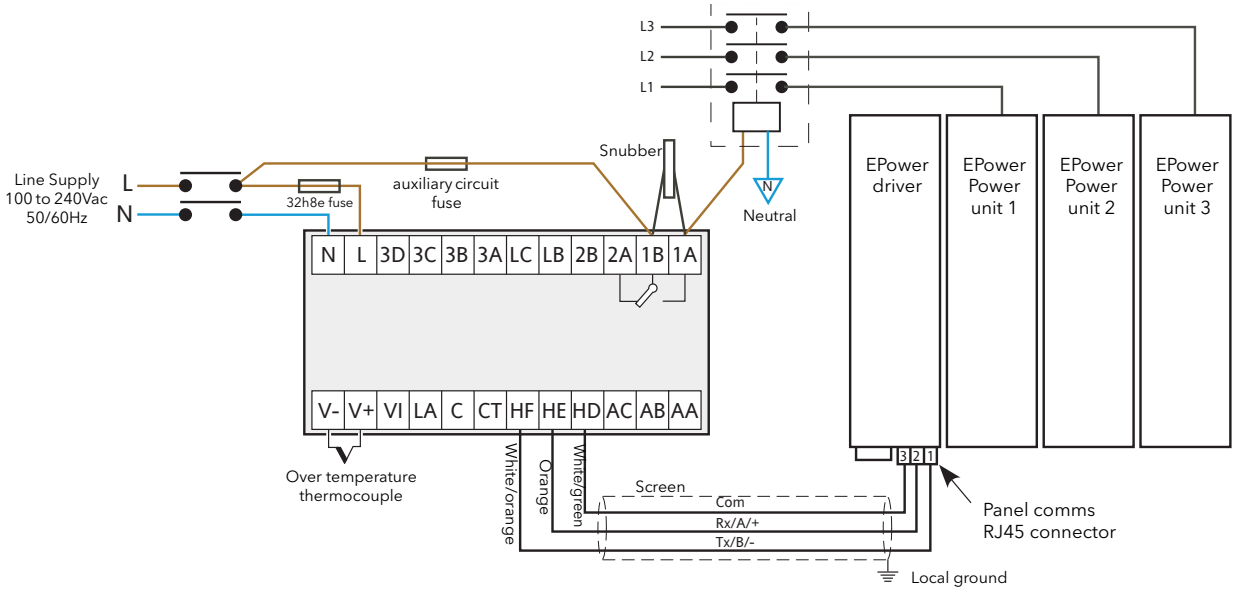



Figure A3.3 Typical wiring

## A4 FIRST SWITCH ON

At first switch on, after the start-up sequence, the initial configuration page is displayed.

> Note: the following 'quickstart' description apples only to new (not previously configured) instruments. If the instrument has previously been configured (either at the factory or subsequently) the instruments starts up showing the relevant process value.

The initial display shows 'Set1' on the top line, with a coded display below (figure A4) with its first item flashing. The lower line is decoded as shown in table A4a.

The 'mode' (up/down arrows) are used to scroll through the available choices for each item. Once the required value is displayed, the scroll key is used to select the next character for editing. Once all five characters have been edited, further operations of the scroll key call the range high display (allowing the high range value to be edited using the mode keys), then the range low display (allowing the low range value to be edited). A further operation calls the Set2 display, which is decoded in table A4b.

After Set2 parameters have been edited, a further operation of the scroll key invites the user to Exit. Operating the scroll key returns to the Set1 display; operating a mode key to display 'yes' quits the quickstart menu and causes the unit to enter operating mode.


Figure A4 Set 1 display

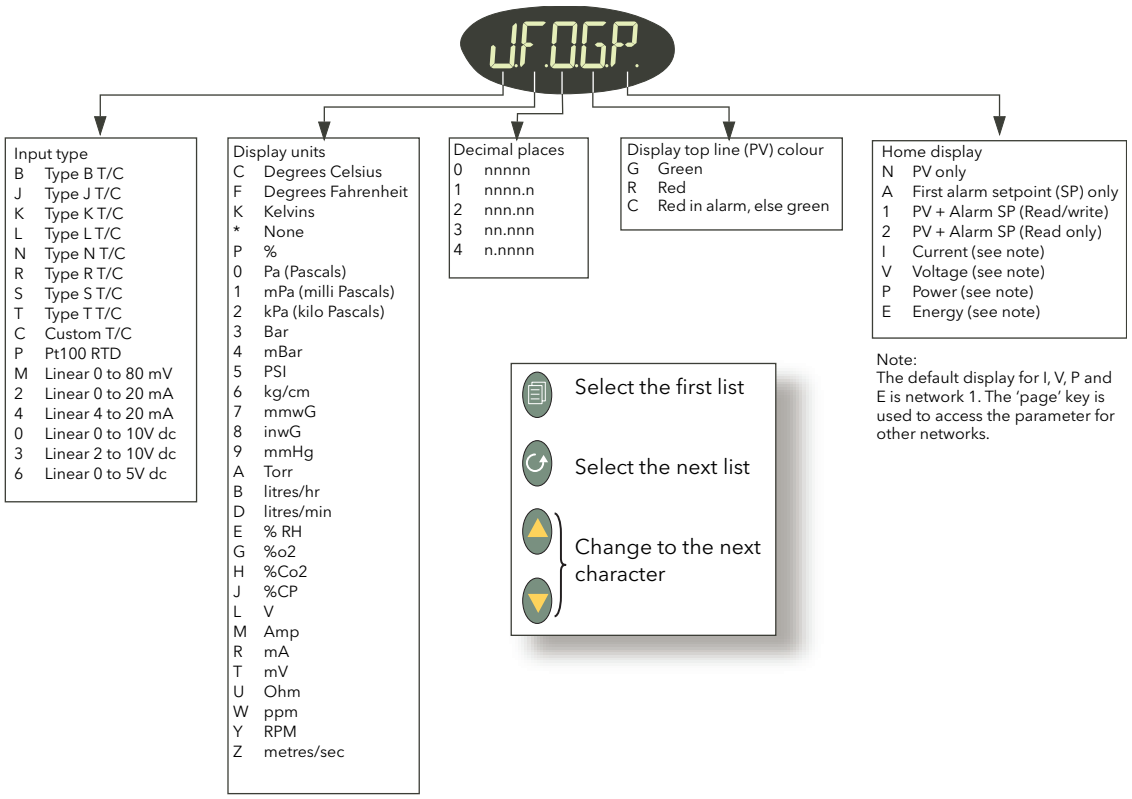



Table A4a Set 1 parameter coding

## A4 FIRST SWITCH ON (Cont.)

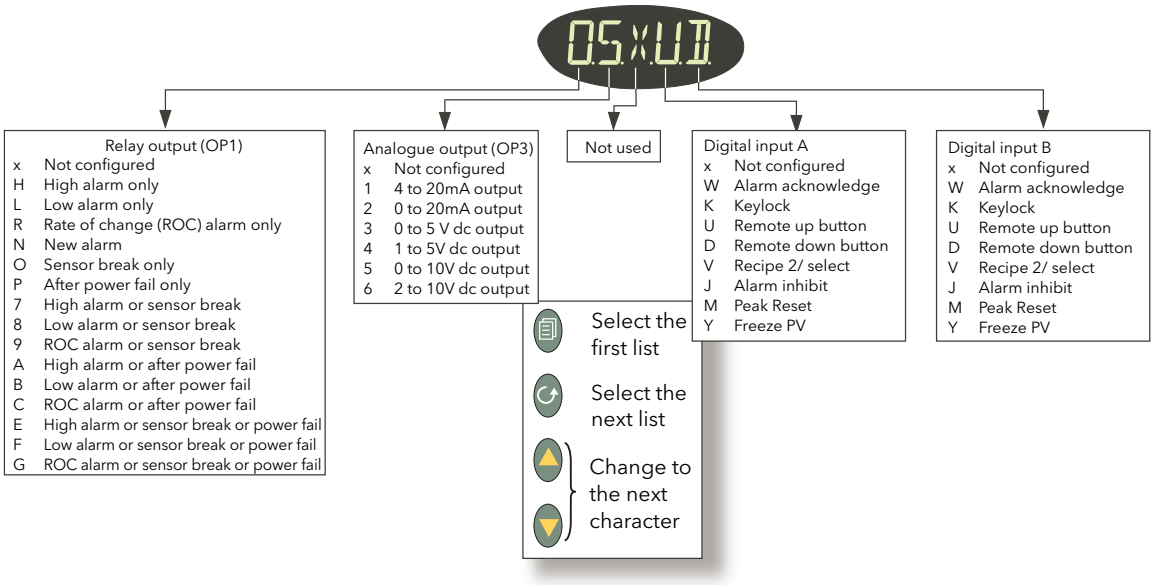



Table A4b Set 2 parameter coding

Notes:

1. In order for the unit to act as an over-temperature 'police officer', the OP1 alarm type should be selected as a high alarm.
2. The relay output automatically operates in fail-safe mode, in that it is de-energised in Alarm. It will thus enter an alarm state when power is removed from the unit.
3. To re-enter quickstart mode,
   Remove power from the unit
   Keeping the 'Page' key operated continuously, restore power and wait until a password is requested. Release the 'Page' key and use the up/down arrow keys to enter the quickstart password (default = 4).

## A5 OPERATING MODE

### A5.1 FRONT PANEL LAYOUT

When the instrument starts, or after quitting the quickstart procedure, the Operator level 1 display is entered and the page defined as the 'Home' page in 'Set 1' is displayed (unless there are any errors, in which case the unit displays the relevant error messages). Figure A5.1, below, shows the home page for the case where 'V' has been selected as Home display in 'Set 1'.

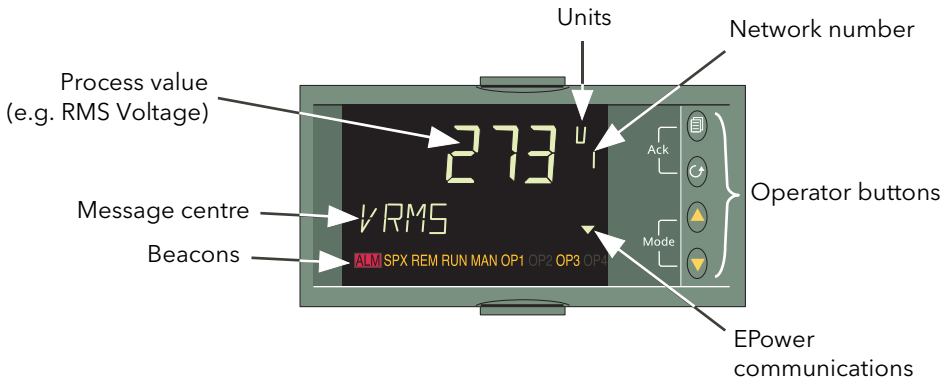



Figure A5.1 Display panel details

## A5.1 FRONT PANEL LAYOUT (Cont.)

### A5.1.1 Front panel details

| | | |
|---|---|---|
| Process Variable | Normally shows the value of the selected process variable. Where EPower variables are being displayed, the value for network 1 is displayed by default. Other network values are accessed by using the 'Page' key.<br>If the instrument is in an error state, then an indication of what the error might be is flashed on and off instead (e.g. 'Sbr' is flashed if an input sensor break has been detected).<br>Set1 PV colour allows this part of the display to be selected as permanently green ('G', permanently red ('R'), or normally green but red in error or alarm states ('C'). | |
| Units | Displays the units associated with the currently displayed process value. | |
| Network number | For EPower parameters, shows the network for the currently displayed process variable. | |
| Message centre | This displays scrolling event and/or alarm messages (e.g. 'INPUT SENSOR BROKEN') | |
| Beacons | ALM | Indicates an active alarm. Flashes if alarm unacknowledged. |
| | SPX | Alternative setpoint. Not used in this application. |
| | REM* | Illuminated when 'Remote Setpoint' is selected for this EPower network. |
| | RUN | Timer or programmer running/held. Not used in this application. |
| | MAN* | Illuminated when 'Local Setpoint' is selected for this EPower network. |
| | OP1 | Illuminated if output 1 (relay) is active. |
| | OP2 | Illuminated if output 2 is active. Not used in this application. |
| | OP3 | Illuminated if output 3 has been configured to retransmit the process value. |
| | OP4 | Illuminated if output 4 is active. Not used in this application. |
| Operator buttons | Four buttons to allow navigation and configuration functions.: | |
| |  | Page key. Toggles between process variable and summary parameters. Also used (simultaneously with the Scroll key) to acknowledge alarms. |
| |  | Scroll key. Press to select new parameter. Hold down to scroll through parameters. Also used (simultaneously with the Page key) to acknowledge alarms. |
| |  | Up Arrow. Used to change (increase) a parameter value. |
| |  | Down Arrow. Used to change (decrease) a parameter value. |
| Comms indicator |  | If flashing, this arrow head indicates that communications with EPower are active. |

* See REM/MAN BEACONS (below) for more details.

## A5.1.1 FRONT PANEL DETAILS (Cont.)

### REM/MAN BEACONS

Table A5.1.1 summarises the operating characteristics of the 'REM' and 'MAN' beacons which depend on the network with which the currently displayed value is associated, and on which SetProv function blocks are enabled (if any).

| | |
|---|---|
| Network 1 | If no SetProv blocks are enabled, then MAN always illuminated.<br>Otherwise REM/MAN operation depends on SetProv1 'SPselect' parameter. |
| Network 2 | If no SetProv blocks are enabled, then MAN always illuminated.<br>If SetProv.1 and SetProv.2 are enabled, REM/MAN operation depends on SetProv.2 'SPselect' parameter.<br>If SetProv.1 and SetProv.3 are enabled, REM/MAN operation depends on SetProv.3 'SPselect' parameter.<br>If only SetProv.1 enabled: REM/MAN operation depends on SetProv1 'SPselect' parameter. |
| Network 3 | If no SetProv blocks enabled, then MAN always illuminated.<br>If SetProv.1 and SetProv.3 are enabled, REM/MAN operation depends on SetProv.3 'SPselect' parameter.<br>If only SetProv.1 enabled, REM/MAN operation depends on SetProv1 'SPselect' parameter. |
| Network 4 | If no SetProv blocks enabled, then MAN always illuminated.<br>If SetProv.1 and SetProv.4 are enabled, REM/MAN operation depends on SetProv.4 'SPselect' parameter.<br>If only SetProv.1 enabled, REM/MAN operation depends on SetProv1 'SPselect' parameter. |

Table A5.1.1 REM/MAN beacon characteristics

## A5.2 LEVEL 1 OPERATION

Level 1 operation is entered when Set2 is quit, or after applying power to the instrument (other than at first power-up).

Level 1 operation allows the user to scroll through the various parameters associated with the instrument on a Read-only basis. The parameters which appear depend on the configuration. Figure A5.2a is an example showing the display pages where the home page (set 1) is PV only and the configuration comprises one or more single phase EPower units. Figure A5.2b is an example giving the parameters for a 2x2 leg, three-phase configuration.

## A5.2 LEVEL 1 OPERATION (Cont.)

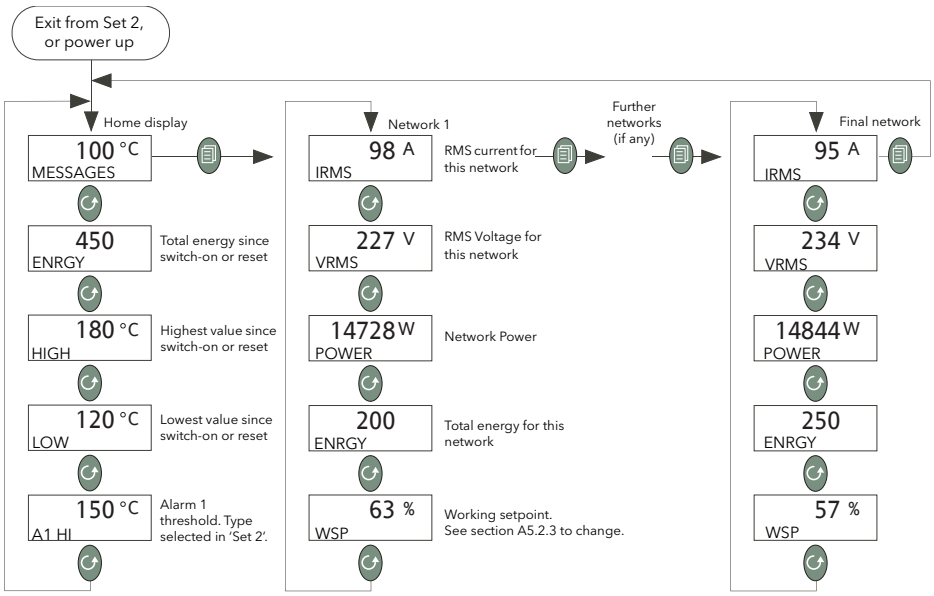



Figure A5.2a Single phase example configuration

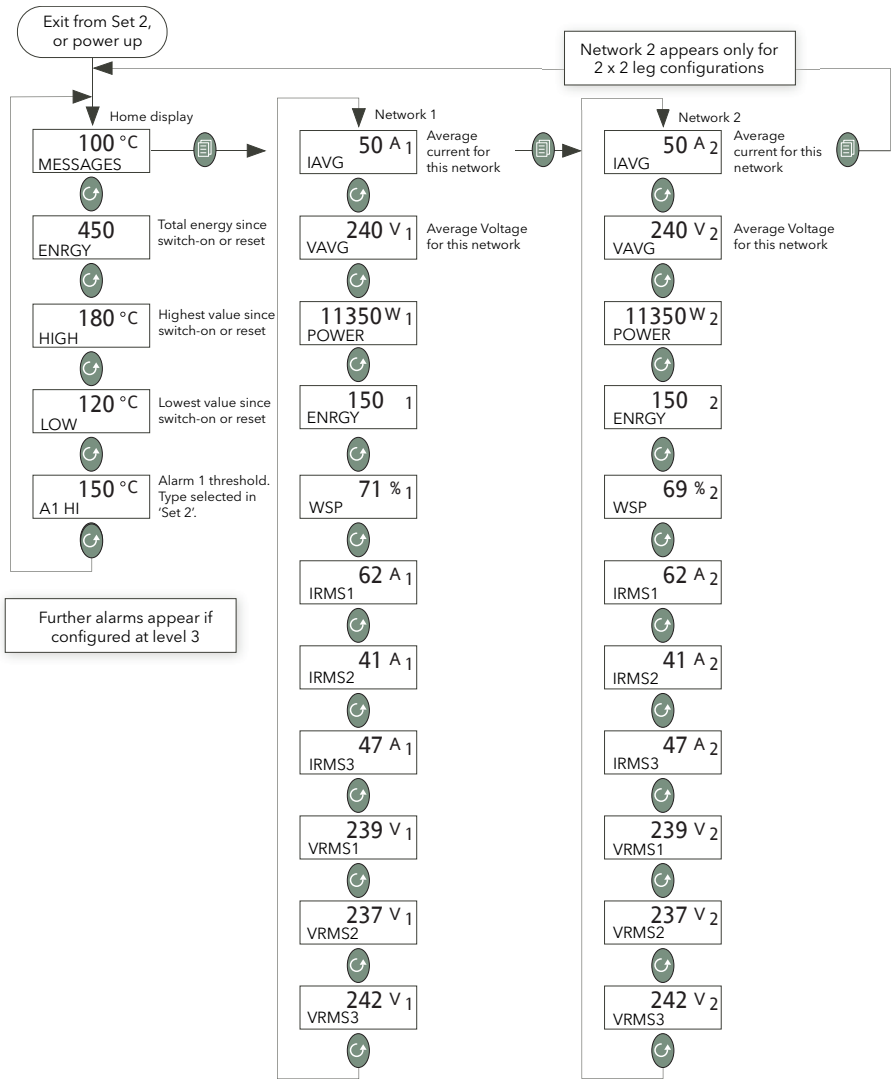



Figure A5.2b Three-phase (2x2leg) example configuration

## A5.2 LEVEL 1 OPERATION (Cont.)

### A5.2.1 Process Parameters

| | |
|---|---|
| ENRGY | Energy. Shows the global energy counter in the EPower instrument. This is only available if the Energy Counter feature is enabled in the connected EPower instrument. |
| HIGH | Peak High. Shows the highest reading that the indicator has recorded since switch on or since reset (Level 2). |
| LOW | Peak Low. Shows the lowest reading that the indicator has recorded since switch on or since reset (Level 2). |
| A1 (*Type*) | Alarm 1 type and setpoint. Indicates the threshold value for alarm 1. 'Type' = 'Hi', 'Lo' or 'ROC' according to configuration (Set 2). This parameter does not appear if it is 'Unconfigured' in Set 2. |
| An (*Type*) | ('n' = 2, 3 or 4) Further alarm types and threshold values, as configured in level 3 configuration. |

### A5.2.2 EPower Network summary parameters

| | |
|---|---|
| IRMS | The RMS value of load current (Amps), for this network. |
| VRMS | The RMS value of load voltage (Volts) for this network |
| POWER | Either P or PBurst according to network type. Watts or kilowatts |
| ENRGY | Energy. Shows the energy for this network. This is only available if the Energy Counter feature is enabled in the connected EPower instrument. |
| WSP | Working setpoint. WSP is the working setpoint currently being used by the EPower unit and is either the Local setpoint, or the remote setpoint (from an analogue input or via a communications link). |
| SP | Target setpoint (% or Engineering units) for the network in use. It may be edited via the remote panel either directly setting the Control Setpoint (if EPower's SetProv function block is not enabled) or setting the local setpoint of the SetProv function block (if it is enabled and its SPSelect parameter is set to 'Local'). If the value is greater than 99999, the displayed value is divided by 1000 and shown with suffix 'K' in the format 'nnnn.nK' ('K' = kilo). (E.G. a value of 1000000 would be displayed as '1000.0K'. |
| SP.SEL | Setpoint Select. Available only in level 2 and if the associated SetProv function block in EPower is enabled, allowing the user to select between local (LSP) and remote setpoints (rSP). |
| E.RST | Energy Reset. Available only in level 2 and if the Energy Counter is enabled in EPower. User Energy total can be reset. |
| IRMS1 (2) (3) | RMS Load current for phase 1 (2) (3). (3-phase networks only) |
| VRMS1 (2) (3) | RMS Load voltage for phase 1 (2) (3). (3-phase networks only) |
| IAVG | Average load current (3-phase networks only) |
| VAVG | Average load voltage (3-phase networks only) |

### A5.2.3 Setpoint editing from the 32h8E

Operating the up or down arrow key from any of the power summary displays (e.g. IRMS) takes the user to the WSP display. Further operation of the up or down arrow causes the display to switch to 'SP' provided that the unit is operationg in Local mode (MAN illuminated) rather than Remote mode (REM illuminated). In Rmote mode, the SP parameter does not appear.

The mode can be changed between local and remote from the SPSEL parameter at level 2, or from the EPower operator interface, iTools or over a comms link.

Once in SP, the up and down arrows are used to edit the setpoint value. Once this is complete, the display times out to the original power summary SP page after a few seconds. Figure A5.2.3 attempts to show this process.

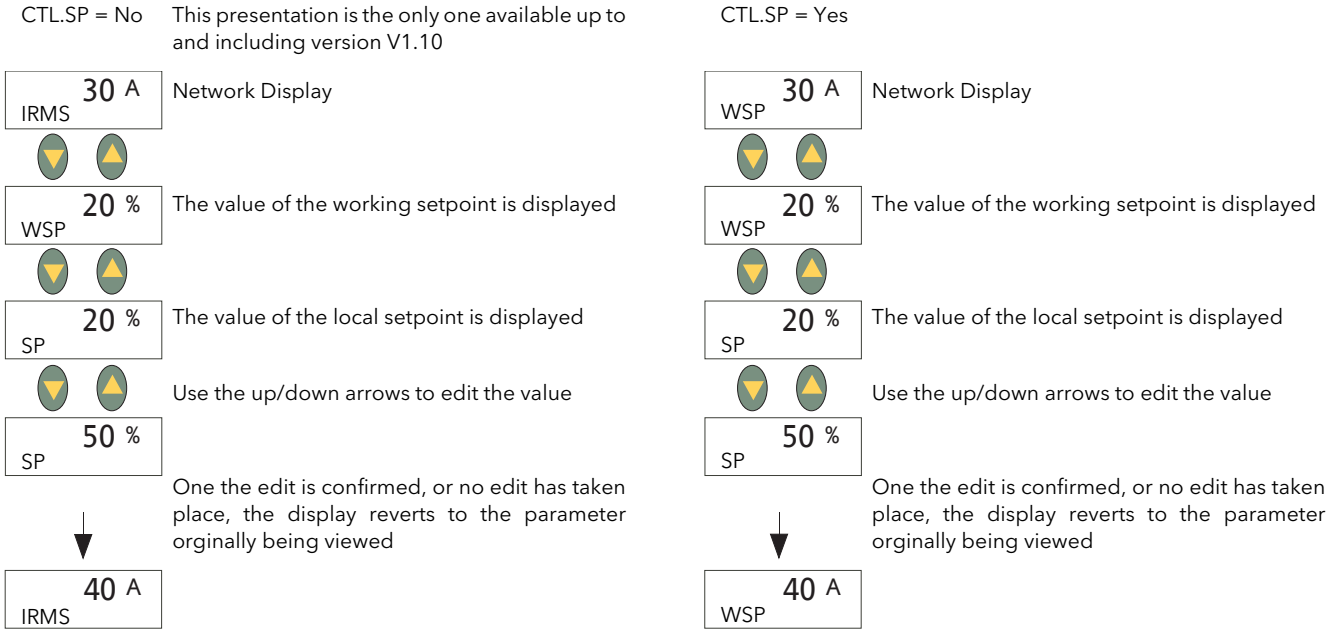



Figure A5.2.3 Setpoint editing

## A5.3 LEVEL 2 OPERATION

To switch to level 2 parameters (figure A5.3a):

1. From any display press and hold the page key until the Lev 1 display appears
2. Operate the up or down arrow to display 'Lev 2'
3. After a few seconds, the 'Code' page appears. Use the up arrow key twice to enter the value '2'
4. After a few seconds the display reverts to the home display.

To return to level 1:

1. From any display press and hold the page key until the Lev 2 display appears
2. Operate the up or down arrow to display 'Lev 1'
3. After a few seconds the display reverts to the home display.

The scroll key is used to enter the parameter display from the home display.

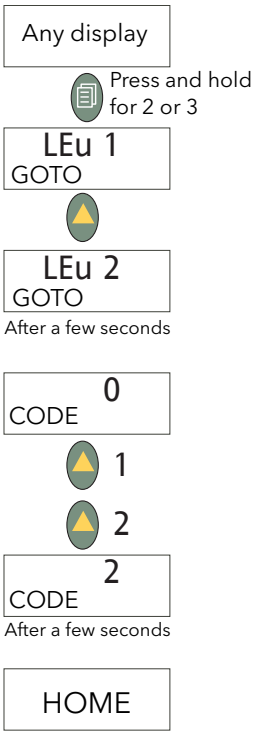



Figure A5.3a Selecting level 2

### A5.3.1 Level 2 parameters

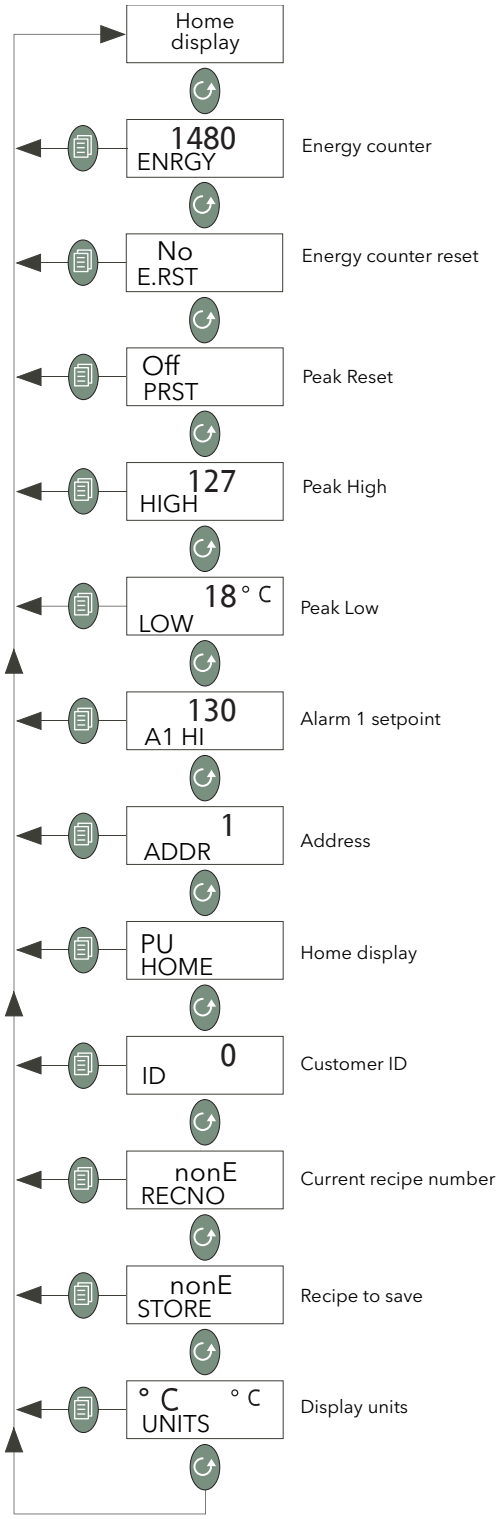



Figure A5.3.1 Level 2 parameter menu

| | |
|---|---|
| ENRGY | Energy counter. Shows the global energy counter in the EPower instrument. This is only available if the Energy Counter feature is enabled in the connected EPower instrument. |
| E.RST | Energy Reset. Allows the energy counter to be reset. Only available only if the Energy Counter is enabled in EPower. Set to 'yes' to reset. Automatically returns to 'no'. |

| | |
|---|---|
| PRST | Peak Reset. Allows the high and low peak values to be reset (to the current value). Set to 'On' to reset. Automatically returns to 'Off'. |
| HIGH | Peak High. Shows the highest reading that the indicator has recorded since switch on or since reset (Level 2). |
| LOW | Peak Low. Shows the lowest reading that the indicator has recorded since switch on or since reset (Level 2). |
| A1 (*Type*) | Alarm 1 type and setpoint. Indicates the threshold value for alarm 1. 'Type' = 'Hi', 'Lo' or 'ROC' according to configuration (Set 2). This parameter does not appear if it is 'Unconfigured' in Set 2. |
| An (*Type*) | ('n' = 2, 3 or 4) Further alarm types and threshold values, as configured in level 3 configuration. |
| ADDR | Address. Modbus address (1 to 254) for the instrument |
| HOME | Home display.<br>PU = process variable — Alm = Alarm threshold<br>PU.AL = Process variable + Alarm SP — P.A.ro = PV + Alarm SP (read only)<br>EP.I = EPower Current — EP.U = EPower Voltage<br>EP.P = EPower Power |
| ID | Customer ID Customised instrument identification number (0 to 9999) |
| RECNO | Current Recipe Number. The current recipe number (1 to 5) or 'nonE' if no recipe running, or FAiL if there are no recipes available. See section A6.2 for further details. |
| STORE | Recipe to save. Takes a 'snapshot' of the current recipe values and saves them in a recipe number from 1 to 5. 'nonE' does not save; 'donE' appears after a successful save. See section A6.2 for further details. |
| UNITS | Display units. Table A5.3.1, below, shows the available units in down-arrow scroll order. |

| Unit | Definition | Display | Unit | Definition | Display | Unit | Definition | Display |
|---|---|---|---|---|---|---|---|---|
| nonE | No units | | m-S | Milliseconds | m-S | L-H | Litres per hour | L-H |
| °k | Kelvins | K | rPm | Revs/minute | rPm | torr | Torr | tor |
| °F | Degrees Fahrenheit | °F | PPm | Parts per milion | PPm | mmHg | mm of mercury | HG |
| °C | Degrees Celsius | °C | Ohm | Ohms | Ohm | inwG | inches of water gauge | inch |
| kG | Kilograms | kg | mU | Millivolts | mU | mmwG | mm of water gauge | mmH2O |
| GrAm | Grams | G | mA | MilliAmps | mA | kGcm | Kilograms/square cm | kg/cm² |
| mG | Milligrams | mG | Amp | Amps | A | PSi | Pounds/square inch | PSI |
| mpH | Miles/hour | mPH | Uolt | Volts | U | mbAr | Millibar | bAr |
| P.PH | %ph | %PH | P.CP | % carbon potential | %CP | bAr | Bar | bAr |
| PH | pH | PH | P.CO2 | % carbon dioxide | %CO2 | kPA | KiloPascals | kPA |
| hrs | Hours | hrS | P.O2 | % oxygen | %O2 | mPa | MegaPascals | mPA |
| min | Minutes | min | P.rH | % relative humidity | %rH | PA | Pascals | PA |
| SEC | Seconds | SEC | L-m | Litres per minute | L-m | PErc | Percent | % |

## A5.4 LEVEL 3 AND CONF LEVEL OPERATION

To switch to level 3 parameters (figure A5.4):

1. From any display press and hold the page key until 'Lev 3' appears ('Lev1' or 'Lev2' appears first - keep holding).
2. If required, operate the up arrow to display 'ConF'
3. In either case, after a few seconds, the 'Code' page appears. Use the up arrow key twice to enter the value '3' (to enter level 3) or '4' (to enter Configuration level).
4. After a few seconds the display reverts to the home display.

To return to lower access levels:

1. From any display press and hold the page key until 'Lev 3' or 'ConF' appears
2. Operate the down arrow one or more times to display the required access level.
3. After a few seconds the display reverts to the home display.

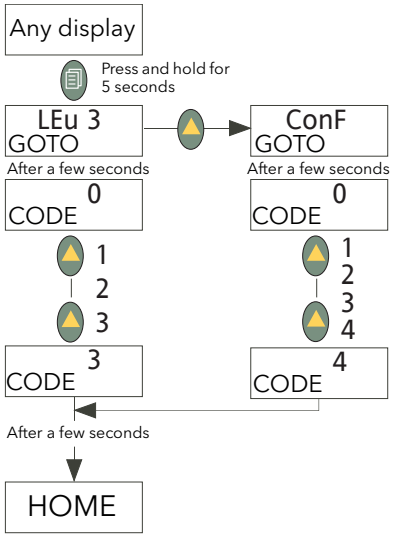



Figure A5.4 Selecting level 3 or Conf

### A5.4.1 Level 3/Conf parameters

Most Level 3 and/or Configuration level parameters associated with the remote panel indicator are described in the 3200i Engineering Handbook (HA029006) available from the manufacturer. There are a number of additional parameters associated with the 32h8e, which are described below.

Level 3 access level makes those operating parameters, which are not Read only available to the user. Examples are Input Filter Time Constant, Alarm Delay time, and so on. Level 3 is used, typically, when commissioning the indicator.

Configuration level enables the fundamental characteristics of the indicator to be changed. This includes the quick-start code parameters amongst others.

The menu structures for Level 3 and Configuration levels are identical (see figure A5.4.1a) but there are more parameters available within each 'heading' at Configuration level.

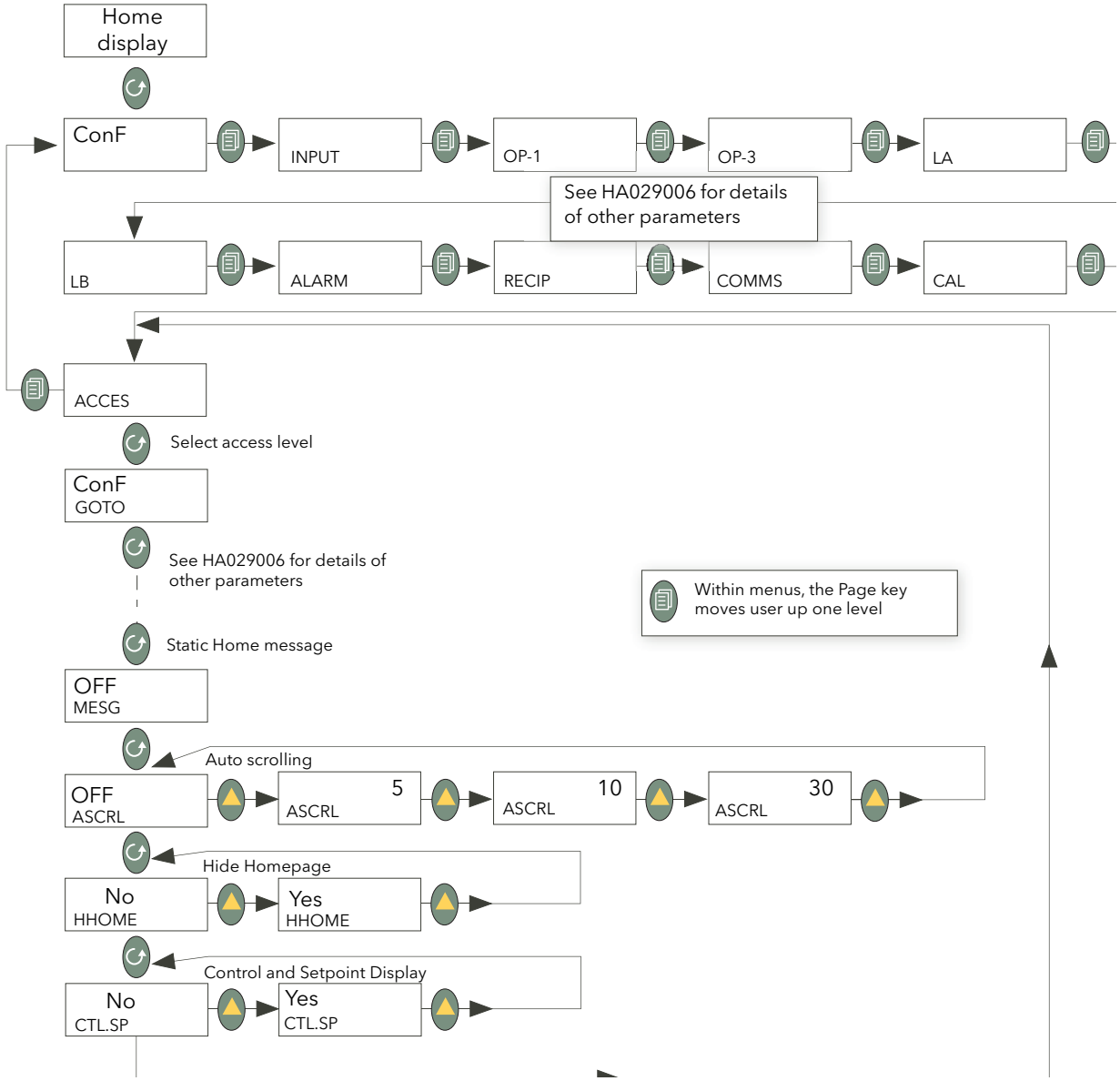



Figure A5.4.1a Level 3 and configuration level menu structure.

| | |
|---|---|
| ASCRL | Auto scrolling. The up (or down) arrow is used to scroll through the values available, these being 'Off' (No scrolling) or 5, 10 or 30 seconds (where the selected time value specifies the time between scrolls). See 'AUTO SCROLL' below for further details. |
| HHOME | Hide Homepage. If set to 'Yes', the home page is never displayed, so the associated parameters can never be viewed at lower access levels. |
| CTL.SP | Control and Setpoint Display. If set to 'Yes' the EPower control parameters (Current, Voltage, or Power) can be viewed, in Operator level, simultaneously with it's associated Setpoint. When displaying an EPower control parameter, the bottom line of the display is used to display the working setpoint.<br>When set to 'No', the bottom line of the display is used to display the parameter name and parameter description (as per other indicator displays).<br>Also see section A5.2.3. |

For all other parameters, refer to the 3200i Engineering Handbook (HA029006).

## 5.4.1 LEVEL 3/CONF PARAMETERS (Cont.)

### AUTO SCROLLING

This causes the EPower summary parameters to scroll through continuously, at a frequency defined by the value selected for the ASCRL parameter. The actual order of parameter appearance depends on level of access, and complexity of network.

Note: The 3-phase parameters IRMS1, IRMS2, IRMS3, VRMS1, VRMS2, VRMS3 are not included in autoscrolling sequences.

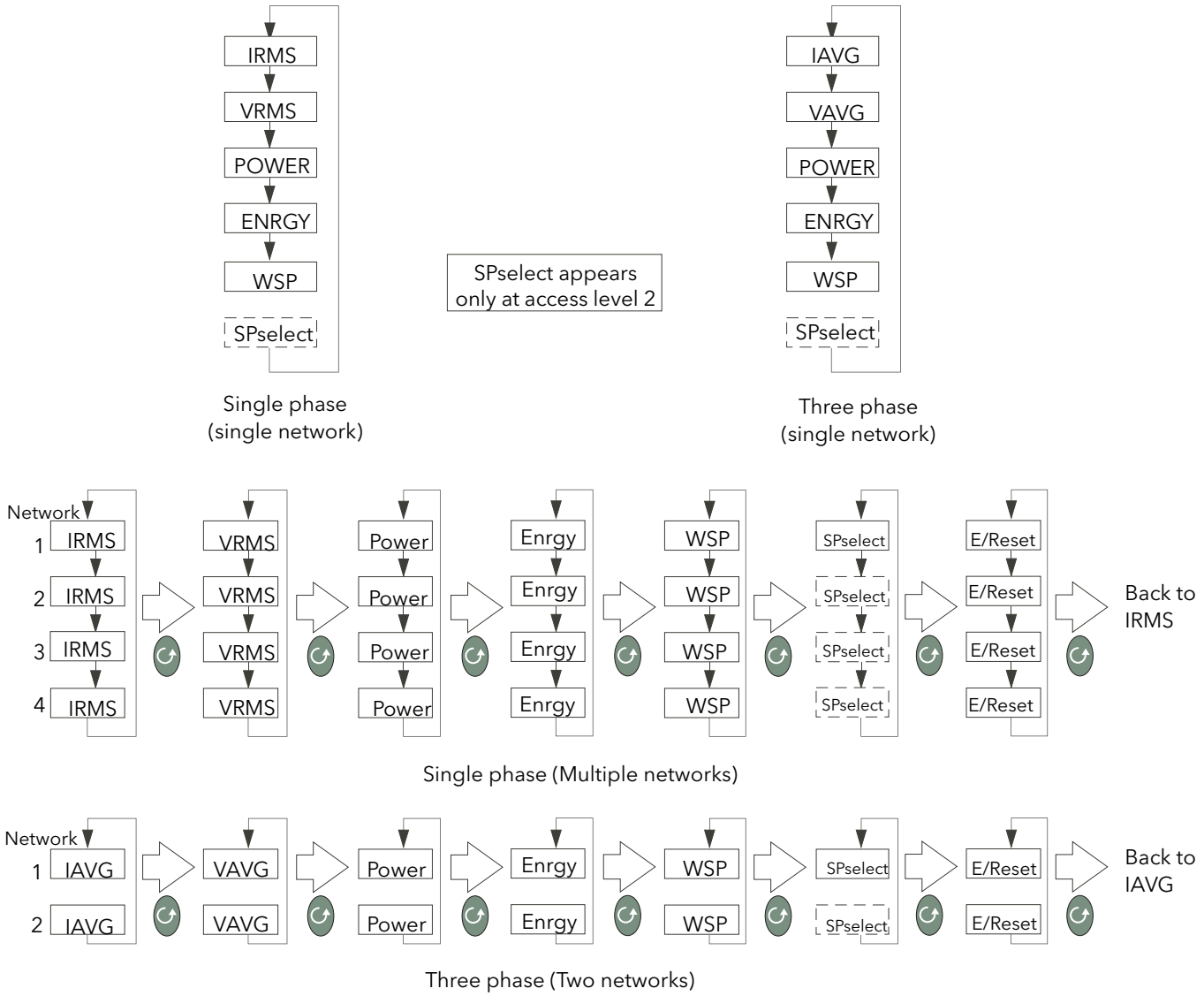



Figure A5.4.1b Various scrolling sequences

Note: For single networks, each EPower summary value (parameter) is displayed in turn. For multiple networks, the same parameter is displayed for each network in turn, the scroll key being used to select a different parameter if required.

# A6 OTHER FEATURES

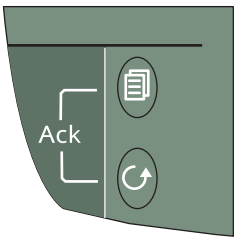
## A6.1 ALARMS AND ERRORS

### A6.1.1 Alarm indication

Up to four alarms can be set up in configuration level (refer to HA029006 for full details). Each alarm can be configured as 'nonE' (off), HI (high), Lo (low), r.roc (rising rate-of-change) or F.roc (falling rate-of-change).

If any alarm occurs the ALM beacon flashes, any output associated with the alarm becomes active, and the message area of the display shows a scrolling text message describing the alarm state. If the display is configured to go red on alarm (Set 2), the PV colour changes to flashing red.

### A6.1.2 Alarm acknowledgement




Alarms are acknowledged by operating the Page key and the Scroll key simultaneously.

Further to this a global acknowledge of EPower alarms occurs when:

1. The indicator home page is selected, or
2. When the EPower Home page is displayed and the Home page is hidden

The results of alarm acknowledgement are as follows:

1. For EPower alarms, the alarm indication at the EPower operator interface is acknowledged (removed). The alarm indication remains at the 32h8e until the alarm is no longer active.
2. For Temperature (Process) auto-latching alarms, the alarm beacon and Process value stop flashing. Any output assigned to the alarm continues to operate until the alarm trigger is no longer active. If configured to change colour (Set 2), the process value returns to green only when the alarm trigger is no longer active.
3. For Temperature (Process) manual-latching alarms, acknowledgement has no effect, and the alarm indication continues until the alarm trigger is no longer active.
4. When EPower and auto-latching process alarms are both present, acknowledgement causes the beacon and Process Value (PV) display to stop flashing. Should the Process Value alarm subsequently go non-active, leaving only the EPower alarm, the beacon and PV display will resume flashing. For manual-latching alarms, acknowledge is ignored and the alarm indication continues until the alarm trigger is no longer active.

Note: Alarm parameters can be configured in Configuration mode, as described in the 3200i Engineering handbook HA029006.

### A6.1.3 Sensor Break detection and indication

An alarm condition (Sbr) is indicated if the indicator detects a break, or over range condition in the temperature sensor circuit.

Notes:

1. For a resistance thermometer a sensor break is indicated if any of the three wires is broken.
2. mA sensor breaks are not detected because the effect is masked by the resistor across the input.
3. For Volt inputs, sensor breaks might not always be detected, because the effect is masked by the attenuator (potential divider) board connected across the input.

### A6.1.4 Error indication

The following error indications can appear, flashing, in the top line of the display:

| | |
|---|---|
| Com.Er | Communication error. Modbus transactions between the 32h8e and the EPower driver module fail. Can be caused by a break in the physical communications link, by the EPower module being powered down etc. |
| EP.CnF | The number of power modules is selected as zero. The indicator can therefore not show Current, Voltage or Power values. |
| EP.Er | One or more 'Fatal', 'Config' or 'Standby' error has been detected. |

The error condition(s) must be cleared before the 32h8e will respond to operator keystrokes.

### A6.1.5 EPower Event and Alarm Messages

The messages shown below are generated by the EPower module and are displayed as scrolling text strings in the 'Message centre' area of the display.

| | |
|---|---|
| MISS MAINS | Supply power to one or more power modules is not connected, or is isolated. |
| THYR SC | A thyristor short circuit has been detected. In such a case, current flows even when the thyristor is not 'firing'. |
| OPEN THYR | A thyristor open circuit has been detected. In such a case, no current flows even when the thyristor is 'firing'. |
| FUSE BLOWN | One or more of the thyristor protection fuses has ruptured. |
| OVER TEMP | The thyristor heat sink temperature has exceeded the specified limit, and the thyristor has been shut down. The temperature must fall to below the specified limit (including the hysteresis value) before firing can re-commence. |
| VOLT DIPS | This detects a reduction in supply voltage. Detection threshold is set up in EPower configuration (Network/Setup). |
| FREQ FAULT | Supply frequency is below 47Hz or above 63Hz. Firing stops until the supply frequency has returned to a value between 47Hz and 63Hz. |
| PB 24V | The 24V power rail in a power module has failed. Firing stops and restarts only when the problem has been resolved. |
| TLF | Total load failure. The load connection from one or more power modules is missing or open circuit. |
| CHOP OFF | Triggered if the load current meets or exceeds a specified threshold for more than five seconds. Firing stops until either the alarm is acknowledged or until 100mS has elapsed, according to configuration. See Network/Setup for further details. |
| PLF | Partial Load Failure. The alarm is triggered if a change in static load impedance is detected over a mains cycle (phase angle mode) or burst period (burst or logic mode). The sensitivity of the measurement can be configured as described in the Network/Setup area of EPower configuration. |
| PLU | Partial Load Unbalance. This alarm is triggered when the difference between the maximum and minimum currents of a three-phase system exceeds a configurable threshold. See Network/Setup for further details. |
| VOLT FAULT | One or more phases missing or out of limits. |
| PRE TEMP | Acts as a warning that the operating temperature is unexpectedly high. This alarm becomes active before unit operation is stopped. |
| PMOD WDOG | One or more power module watchdogs has performed a reset. |
| PMOD COM ERR | A power module communications error has been detected. Typically this would be caused by a damaged inter-module ribbon cable. |
| PMOD T OUT | A power module communications time out error has occurred. Typically this would be caused by a damaged inter-module ribbon cable. |
| CLOSED LP | The control loop cannot achieve setpoint, despite the loop demanding 0% or 100% power. Typically caused by external constraints on the load. |
| OUT FAULT | A short circuit has been detected in the output circuit. Firing is inhibited. |

## A6.2 RECIPES

Note: Level two access (section A5.3) is required in order for the user to be able to save and/or restore 'recipes' as described below.

It is possible to store operating values by tacking a 'snapshot' of the current settings and storing these snapshots in one of up to five 'recipes'. An example would be to store several sets of alarm setpoint values, one of which can then be recalled for a particular process.

To store values in a recipe:

1. In the level two list of parameters (figure A5.3.1), press the scroll key repeatedly (or hold continuously) until 'STORE' appears.
2. Select a recipe number using the up/down arrow keys. After a few seconds the word donE appears to indicate that the current parameter values have been saved to the selected recipe number. Previous values are over-written without confirmation.

To retrieve a recipe:

1. In the level two list of parameters (figure A5.3.1), press the scroll key repeatedly (or hold continuously) until 'RECNO' appears, along with a number (between 1 and 5 inclusive) indicating which recipe was last selected.
2. Select the required recipe number using the up/down arrow keys. After a few seconds the recipe number will blink, to indicate that the load is complete. If the selected recipe is empty, the word FAIL appears instead of the recipe number.

## A6.3 EPOWER SETPROV CONFIGURATIONS

If EPower is configured via QuickStart and the analogue input has been set to 'Setpoint', then, in a multiple network configuration, QuickStart will wire SetProv1 'workingSP' to the 'Main.SP' of all the networks' Control blocks so that all the control blocks share the same setpoint.

Figure A6.3, below shows two examples of this, as displayed in the iTools Graphical wiring editor.

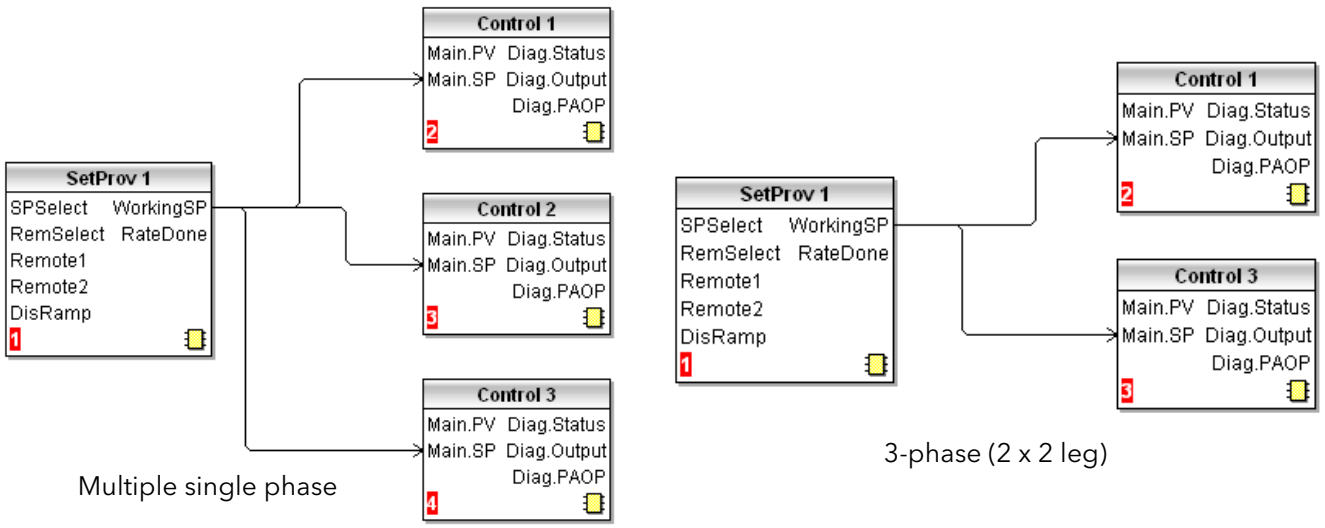



Figure A6.3 Setpoint to Control block wiring (iTools graphical wiring editor display)

## A6.3 EPOWER SETPROV CONFIGURATIONS (Cont.)

If EPower is configured using QuickStart, and the analogue input is not set to 'Setpoint', then none of the Set-Prov function blocks is enabled and each control block setpoint can be set locally.

If EPower is configured using the iTools Graphical wiring editor, then it is possible to enable all of the SetProv function blocks, thus allowing each control block to have individual local or remote setpoints. This flexibility has an effect on the operation of the REM and MAN beacons, as described in section A5.1.1.

### A6.3.1 Setpoint availability

#### MULTIPLE SINGLE PHASE CONFIGURATION

Figure A6.3.1a shows three examples of different single phase setpoint configurations. Figure A6.3.1b, is similar, but shows three-phase 2 x 2 leg examples.

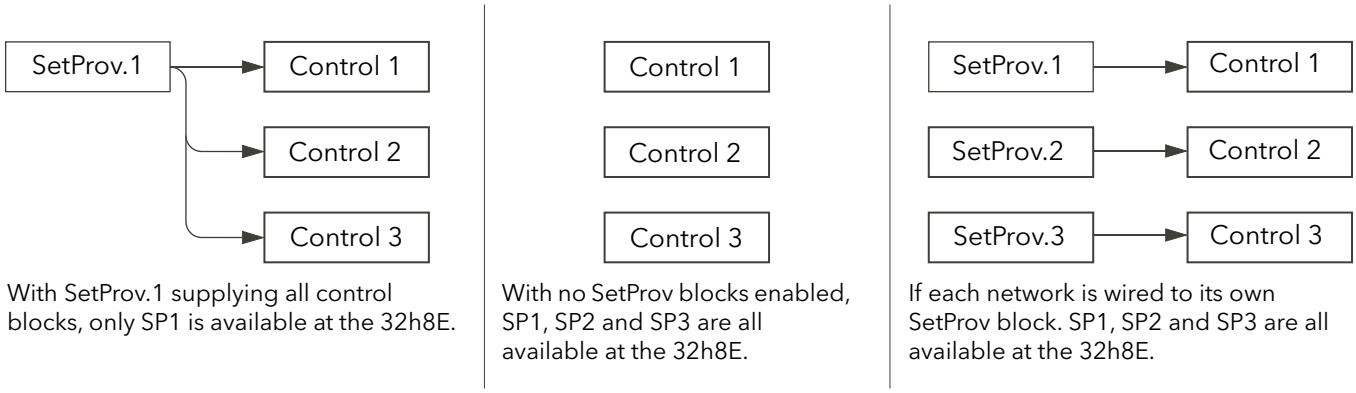



Figure A6.3.1a Setpoint availability (multiple single phases)

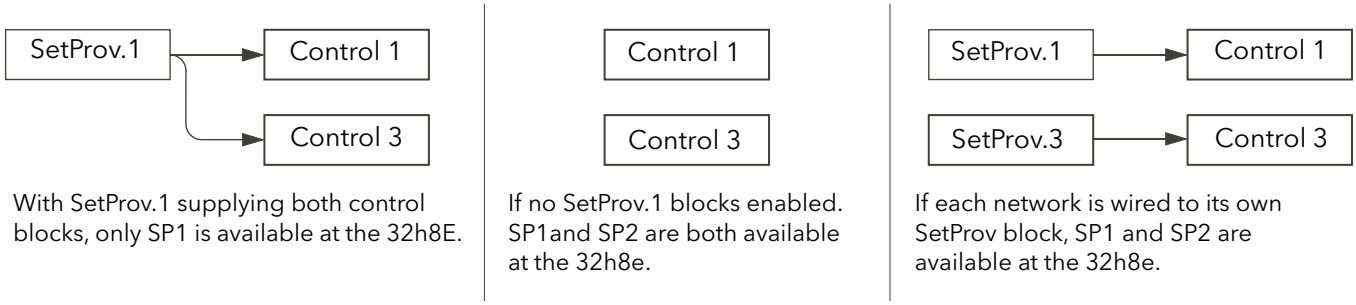



Figure A6.3.1b Setpoint availability (three-phase 2 x 2 leg)

## A6.4 PV RETRANSMISSION

EPower parameters may be communicated to a Fieldbus Network Master i.e. SCADA package, PLC or DCS system. The 32h8e is intended as an independent policeman, and its process PV may also be communicated to the Fieldbus network master. To this end, the 32h8e PV is written every 1/2 second to the EPower's Instrument.Config.RemotePV parameter, which can then be transmitted to the master device.

PV retransmission is also provided as an analogue (V or mA) signal at the analogue output OP3. This may be used as a back-up to the digitally communicated parameter in the event of a failure of the communications link.

## A6.5 DIGITAL ALARM OPTIONS

The following source parameters can be logically OR'ed together to give a digital output state.

1.SRC.A
1.SRC.B
1.SRC.C
1.SRC.D
EP.AL

1.SRC.A to 1.SRC.D are described in the Engineering Handbook (HA029006); EP.AL is defined as: All EPower alarms.

Note: the ALL.A (All Alarms) parameter includes the above EP.AL as well as the indicator alarms.

## A6.6 HOME PAGE TIMEOUT

The 32h8e normally forces the display to return to the Home page after a period of keyboard inactivity.

If, however, the current focus is on an EPower parameter, then the HOME Page timeout is not imposed, thus allowing the user to display a specific Network parameter indefinitely (providing that auto-scrolling is disabled).

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# APPENDIX B THREE PHASE FEEDBACK

## B1 TRANSFORMER REPRESENTATION AND LABELLING

Figure B1, shows a common way of showing typical three phase transformers of various types. Each type is useful for particular applications, for example a Delta primary helps with a more even distribution of loading if the secondary loads are not well matched, whilst a Star wound secondary provides a convenient Earth or Neutral tap for connection near the transformer.

For closed systems, windings corresponding to a particular phase are marked with a prefix number indicating that phase, for example '1P' and '3S' represent phase one primary and phase three secondary respectively. For open Delta systems, each winding is identified by two labels; for example, 1S1 and 1S2 represent the two ends of phase one secondary whilst 2P1 and 2P2 would represent the phase two primary.

The voltages and currents in any one phase are tightly coupled and the primary and secondary voltages are (more-or-less) in phase with one another. Each phase is 120 degrees out of phase with the other two.

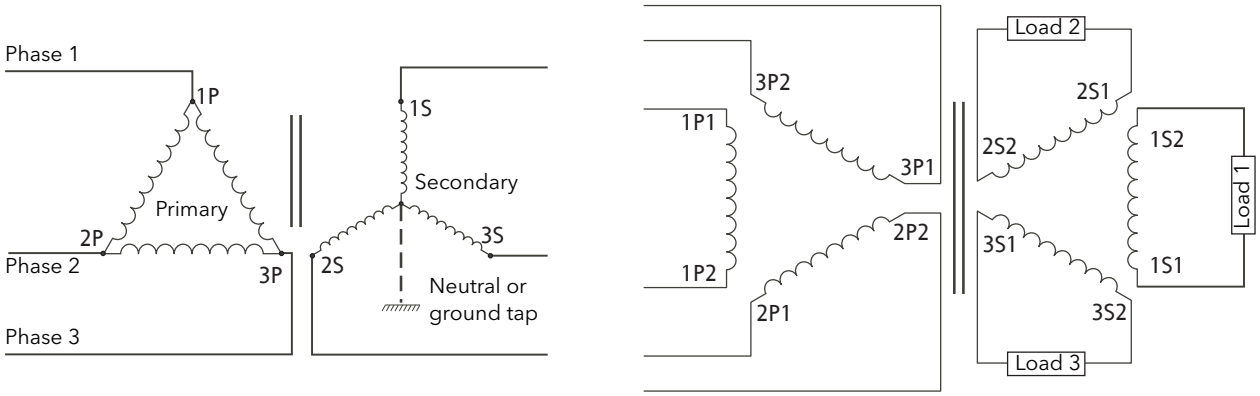


Figure B1 Figure B1Typical transformer winding labelling

## B2 EXTERNAL FEEDBACK PHASING

**WARNING**

1. External feedback connections must be correctly phased (figure 2.2.2b) or the unit might switch to full conduction at start-up.
2. With external feedback: The current transformer should be chosen such that its full-scale output is 5 amps.

External feedback consists of both current measurement (using a current transformer) and voltage measurements across the load (tap locations depend on the network layout). The signals from these feedback elements are terminated at a connector located on the underside of the power units, as shown in figure B2.

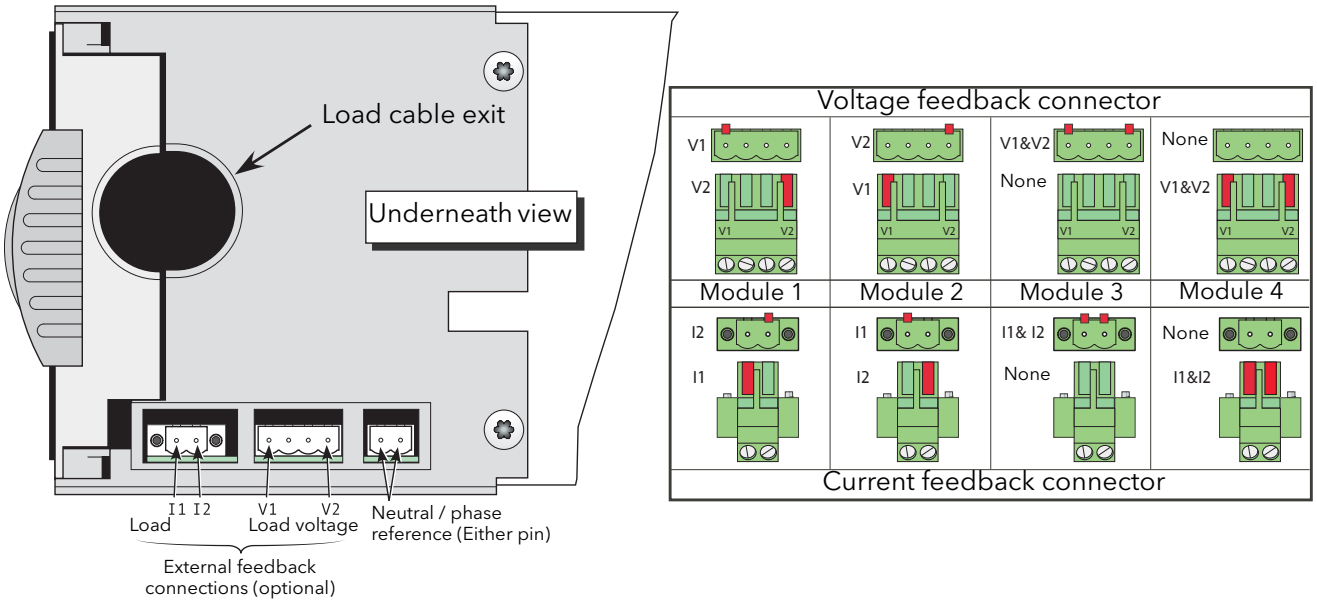


Figure B2 External feedback connector locations and pinout

## B2.1 CURRENT TRANSFORMER CONNECTION

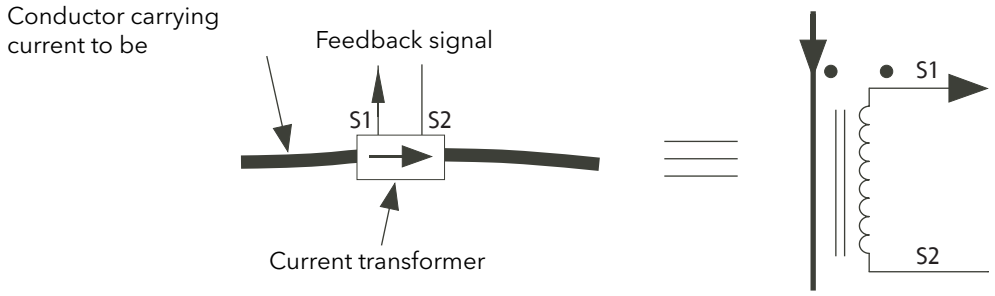


Figure B2.1a Current transformer labelling

The current transformer terminal S1 must be connected to terminal I1 of the relevant power unit; the current transformer terminal S2 must be connected to the power unit terminal I2.

Note: S1 and S2 here are not related to the load transformer secondary labels S1 and S2.

The arrow on the current transformer must point towards the load, if the associated voltage tapping is connected to V1; The arrow on the current transformer must point away from the load if the voltage tapping is connected to V2. Figure B2.1b shows some correct and some incorrect examples.

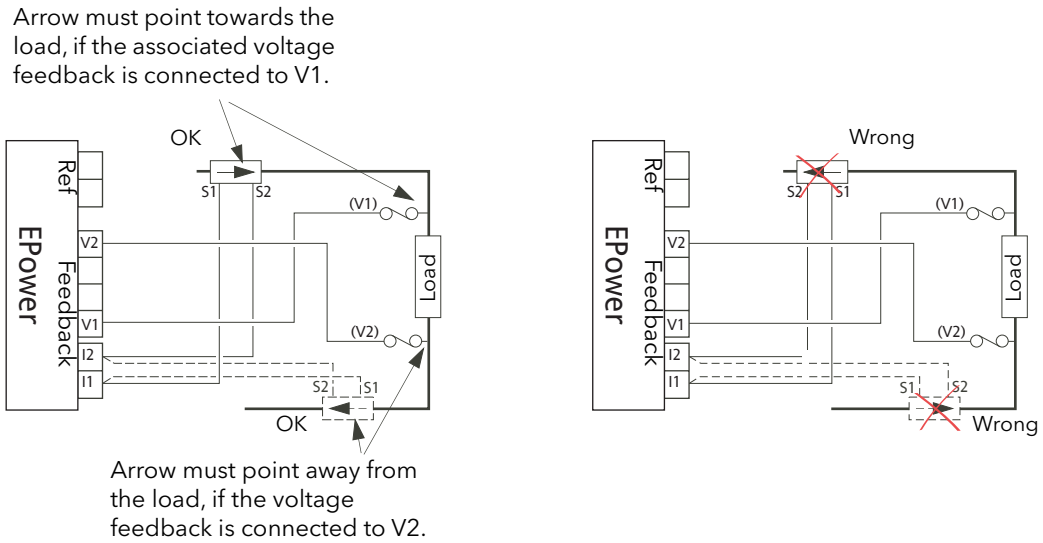


Figure B2.1b Current transformer orientation

**DANGER**

The cables used to connect the remote voltage sensing inputs (if fitted) and the cable used to connect the reference input in 4S, 6D and two-leg configurations must be correctly protected by branch-circuit protection. It is the responsibility of the user to add branch-circuit protection. Such branch-circuit must comply with applicable local regulations.

UL: The above-mentioned branch-circuit protection is necessary for compliance with National Electric Code (NEC) requirements.

Note:

1. In each part of the drawing above, the two positions (i.e. solid and dashed) for the current transformer are alternatives - only one should be used in any one phase.

## B2.2 FEEDBACK EXAMPLES FOR TYPICAL THREE PHASE NETWORKS

**DANGER**

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. Branch circuit shall be rated according to maximum current in each phase.

CE: branch-circuit protection must be selected according to IEC 60364-4-43 or applicable local regulations.

UL: branch-circuit protection must be selected according to NEC article 210.20, it is necessary for compliance with National Electric Code (NEC) requirements.

Note:

1. The figures below are intended only as theoretical examples. In order to comply with CE and NEC requirements, branch circuit protection must be incorporated by the user, upstream of the equipment. Such protection is not shown in the figures below, for the sake of clarity. The installation, in its entirety, must comply with all applicable local safety and emissions regulations.
2. For pdf viewers, the colours used in the figures below are used only to improve clarity. No polarity should be inferred (e.g. blue wires are not necessarily neutral; red is not positive etc.).

### B2.2.1 Two phase control with Delta-Star transformer and 3S load

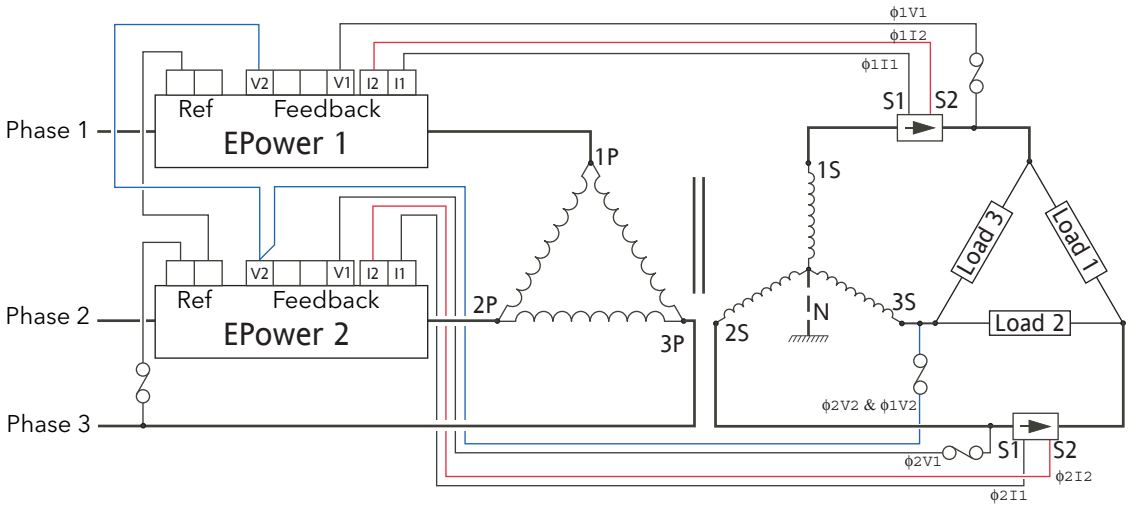


Figure B2.2.1 Two phase control with Delta-Star transformer and 3S load

## B2.2.2 Two phase control with Delta-Star transformer and 3D load

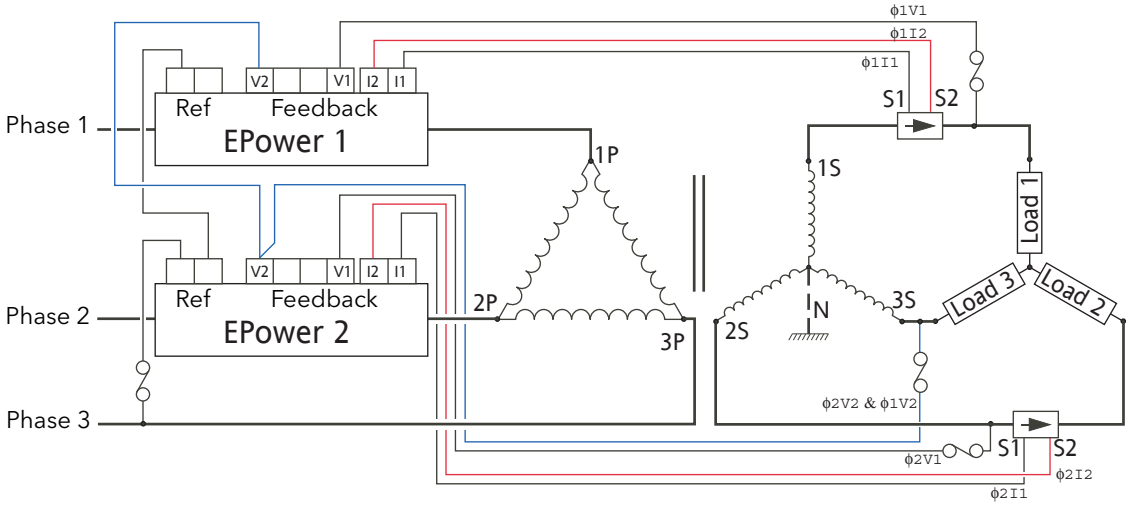


Figure B2.2.2 Two phase control with Delta-Star transformer and 3D load

## B2.2.3 Three phase control with Delta-Star transformer and 3S load

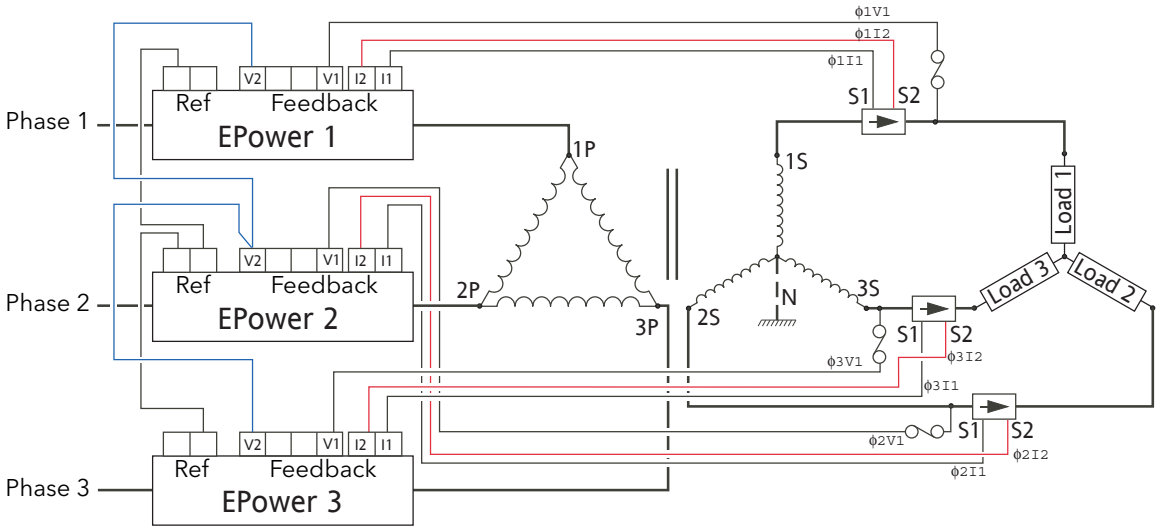


Figure B2.2.3 Three phase control with Delta-Star transformer and 3S load

## B2.2.4 Three phase control with Delta-Star transformer and 3D load

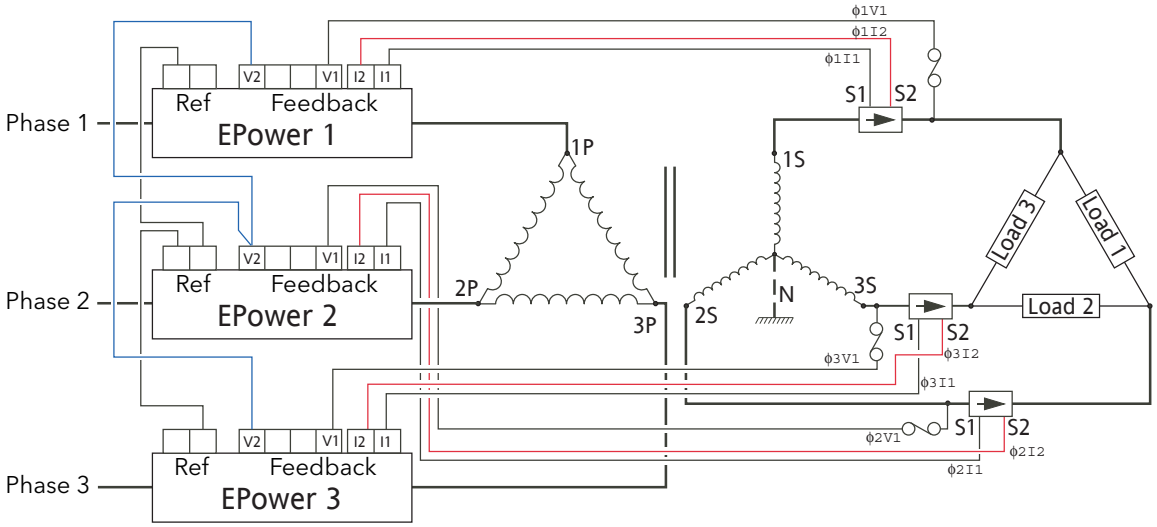


Figure B2.2.4 Three phase control with Delta-Star transformer and 3D load

## B2.2.5 Three phase control with Star-Star transformer and 4S load

**CAUTION**

In burst mode and primary of transformer load, the star-star configuration is not recommended as it may become unstable, high speed fuse may blow.

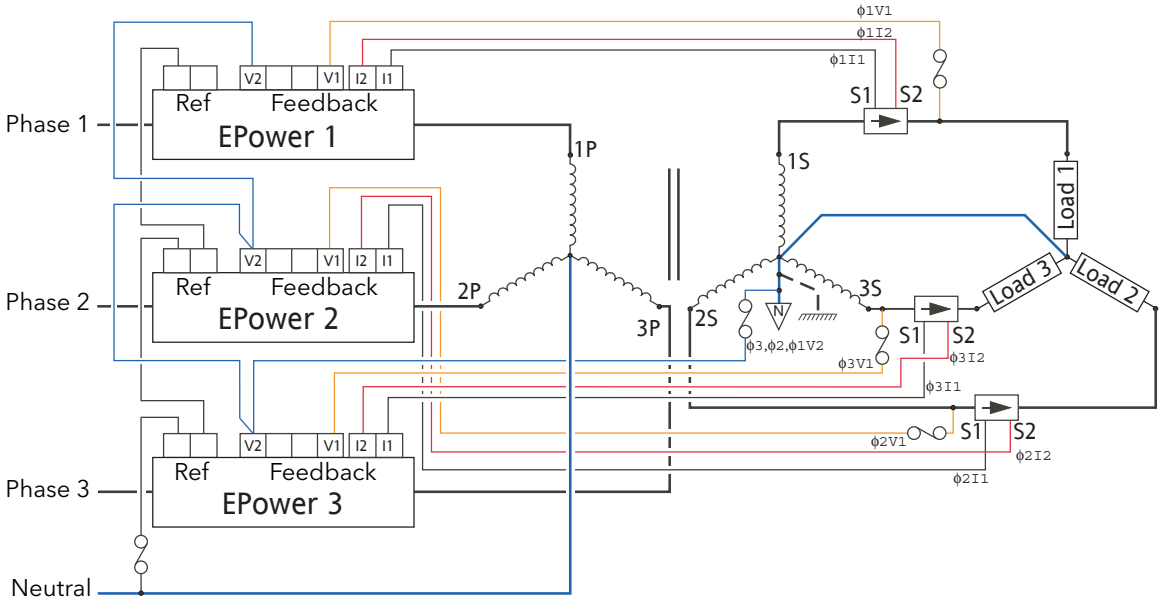


Figure B2.2.5 Three phase control with Delta-Star transformer (primary and secondary with neutral tap) and 4S load

## B2.2.6 Three phase control with Delta-Delta transformer and 3S load

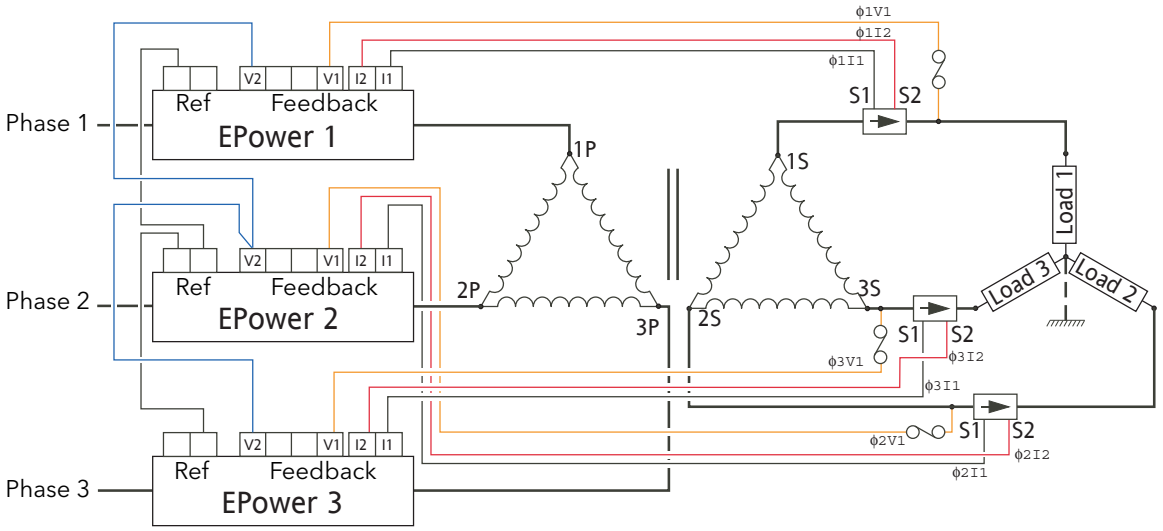


Figure B2.2.6 Three phase control with Delta-Delta transformer and 3S load

## B2.2.7 Three phase control with 6D primary and 4S secondary with 4S load

Commonly used in salt baths and other heat treatment applications, this configuration results in lower thyristor currents (and therefore costs) at the expense of higher cabling costs.

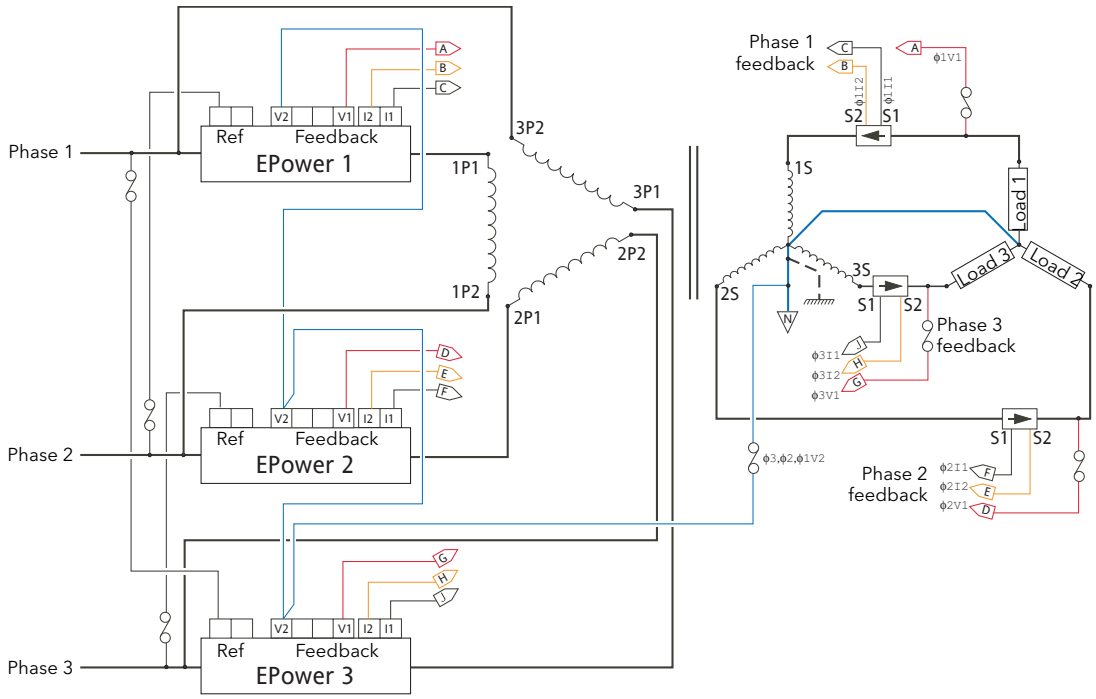


Figure B2.2.7 Three phase control with open delta primary and four-wire star secondary, driving 4S load.

## B2.2.8 Three phase control with 6D primary /secondary with three independent loads

Rarely used - not recommended because this configuration is not fault tolerant.

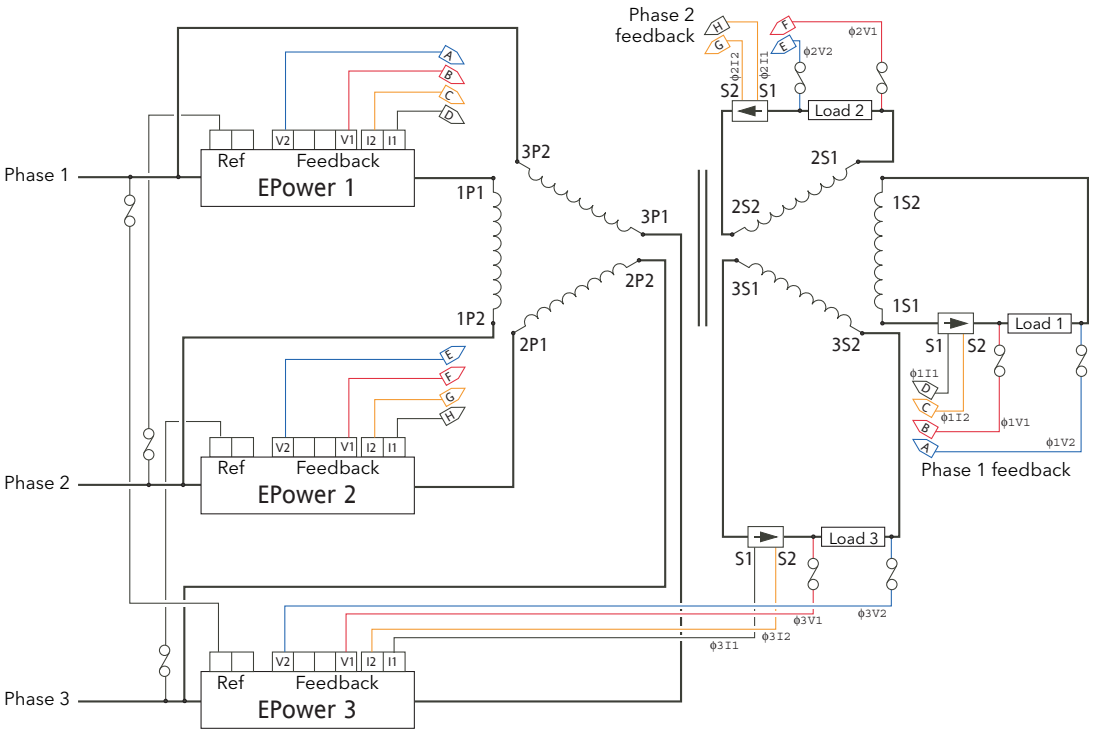


Figure B2.2.8 Three phase control with open delta primary/secondary and four-wire star secondary, driving three independent, floating loads

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# Index

## Symbols



## Numerics



## A



## B



## C

## D

## M



## N

## Q



## R

## U



## V



## W



## X



## Z

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