INDUSTRIAL SOLID STATE RELAY

TE10S / PDSIO®

Thyristor switching of loads up to 25 kW

User manual

Eutotherm Limited has taken particular care to ensure that these specifications are correct.

However, in order to maintain our ‘leading edge’ we continually strive to improve our products, which may lead to modifications or omissions in the specifications.

We shall not be held responsible for any damage, injury, losses or expenses incurred as a result of such modifications.

TE10S / PDSIO® User Manual

CONTENTS

Page

PDSIO® OPERATING METHOD

PDSIO® (**P**ulse **D**ensity **S**ignalling **I**nput **O**utput) is a Eurotherm process for **transmitting information** about the state of the load and the solid state relay to the controller which drives it over **two control wires**.

The controller **displays** information about **faults** with the thyristor, load, fuse, power supply and, in mode 2 only, the **load current**.

This process is available on Eurotherm **TE10S/PDSIO** solid state relays and Eurotherm controllers (**2000** series).

For operation in PDSIO mode, the corresponding outputs of the 2000 series regulator must be **configured** with specific settings.

For operation in PDSIO mode the TE10S unit code must include the code **PDS1** or **PDS2**.

This manual describes **two modes** of operation for the TE10S/PDSIO SSRs: PDS1 and PDS2.

The **TE10S/PDS1** solid state relays send the following information to the **2100**, **2200** and **2400** controllers:

- heating circuit faults
  (total loss of load, blown fuse or thyristors, loss of power supply)
- solid state relay faults
  (thyristors short-circuited).

In addition to the **TE10S/PDS1** functions, **TE10S/PDS2** solid state relays send the value of the **rms current** in the load during the firing time to **2200** and **2400** controllers.

TECHNICAL SPECIFICATIONS

Power

Nominal current at 45°C	16 A, 25 A, 40 A or 50 A See current derating.
Nominal voltage	Line to line: 240 Vac (190 to 264 V), 480 Vac (80 to 528 V), 500 Vac (80 to 550 V)
Supply frequency	47 to 63 Hz
Configuration	Single-phase load.
Firing mode	Logic (On/Off) Firing at zero crossings.
Cooling	Natural convection
Current in 'off' state	Typically below 30 mA

Environment

Operating temperature	0 to 60°C (see temperature derating) maximum altitude 2000 m
Storage temperature	-10 to 70°C
Operating atmosphere	Non-conductive, non-explosive and non-corrosive Humidity 5 to 95% RH no condensation.
Isolation (1 minute test)	Series 2000 Vac between power and earth 3600 Vac between power and control inputs
Thyristor protection	External high speed fuse (unless controlling short wave infrared heaters). Varistor and RC snubber.
Protection rating	IP20 (as per IEC 529 section 11.4 table 5).
Mounting	Vertical on DIN rail
Weight	350 g (16 A); 500 g (25 A); 850 g (40 A), 1100 g (50 A).
Dimensions	Height 115 mm. Depth 92.5 mm Width 35 mm (16 A), 52.5 mm (25 A), 87.5 mm (40 A), 105 mm (50 A).

Garantee Two years, parts and labour, return to factory.

PDSIO® inputs

Control signal	DC logic signal from the output of Eurotherm series 2000 controllers in the corresponding configuration.
Signal voltage	6 Vdc in normal operation (TE10S/PDSIO connected).
Current consumption	5 to 7 mA in normal operation.
Signal presence	Green light-emitting diode (LED) on front panel of solid state relay.
Fault indication	Red light-emitting diode (LED) on front panel of solid state relay and a fault message on the controller.
Operating current	Minimum load current 4 A.

PDSIO® input Mode 1

Controllers	Eurotherm 2100, 2200, 2400 series.
Information signalled	Load, fuse or thyristor open circuit. Thyristor short circuit .
Fault detection	Control signal increases to 12 V (2100) or 18 V (2200 and 2400).
Number of TE10S controlled	One (2100 and 2200 series); one or two (2400)
Load type	Resistive or short wave infrared heaters.

PDSIO® input Mode 2

Controllers	Eurotherm 2200, 2400 series.
Information signalled	RMSload current (firing), from 4 A to 50 A in 1 A steps. Load, fuse or thyristor open circuit. Thyristor short circuit .
Fault detection	Control signal increases to 18 V (2200 and 2400).
Number of TE10S controlled	One.
Load type	Resistive.

THYRISTOR PROTECTION FUSE

The **high speed** external fuse protects the thyristors.

This fuse **must not** be fitted when controlling **short wave infrared** heaters.

Current rating	Ferraz fuse / Current	Fuse & fuse holder
16 A	K330013 / 20 A	FU1038 / 16A / 00
25 A	M330015 / 32 A	FU1038 / 25A / 00
40 A	B093910 / 50 A	FU1451 / 40A / 00
50 A	T094823 / 63 A	FU2258 / 50A / 00

CURRENT DERATING

Maximum current

To allow for power supply variations and load resistance dispersion, a **safety factor** of **0.8** must be applied to calculate the maximum current from the current rating.

Control of short wave infrared heaters (Mode 1 only)

The derating for TE10S/PDSIO units controlling short wave infrared heaters at nominal power supply voltage is given in the table below (the safety factor has been taken into account).

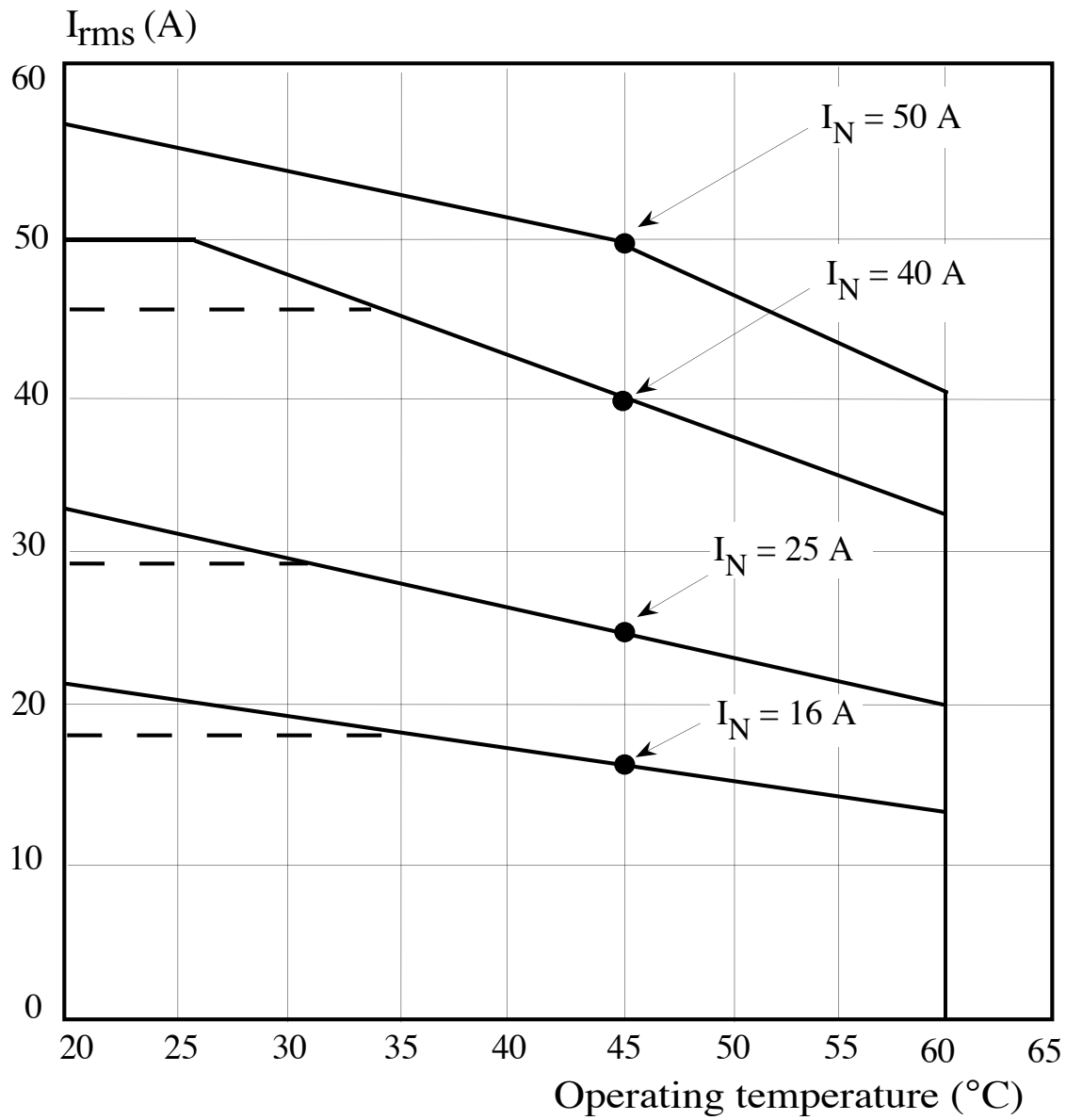
Current rating	Voltage between phases	Maximum current at 45°C
16 A	240 V to 500 V	13 A
25 A		Short wave infrared heaters not permitted
40 A and 50 A	240 V 500 V	28 A 25 A

To control other types of infrared heater (medium wave, fast, etc.) or for special applications, contact your local Eurotherm office.

Permitted current depending on ambient temperature

The current rating, or nominal current (I_N), is the maximum permitted current at 45°C.

To use TE10S at other temperatures, see the permitted current graphs below.



These graphs show the maximum permitted current depending on the ambient temperature. The dotted line shows the limit due to the fuse.

ORDERING CODE

Model /	Current code /	Voltage code /	Input code	/ Manual	// End
TE10S	16A 25A 40A 50A	120V 240V 480V 500V	PDSIO® mode 1: PDS1 PDSIO® mode 2: PDS2	FRA ENG	00

Example code for TE10S solid state relay:
Load current 20 A, voltage between power supply phases 380 V, fault detection and current measurement in PDSIO operation, manual in English.
The code is shown on the label below.

IDENTIFICATION LABEL

The identification label is affixed to the left hand side of the unit.

EUROTHERM Worthing, England +(44) 1903 268500
Serial No.: FC270 -2 -10-04-00 Made in France
TE10S / 25A /480V /PDS2/ ENG // 00
25A @ 45°C 480V
47 - 63 HZ
Input: PDSIO Mode 2
External fuse: Ferraz M330015
Any other fuse invalidates warranty.

74B5 LISTED INDUSTRIAL CONTROL EQUIPMENT

Example identification label for TE10S/PDS2

CONTROL SIGNAL

The control signal for the TE10S / PDSIO® solid state relay comes from the DC logic output of Eurotherm Series 2000 controllers in a specific configuration.

The control **current** consumption is **5** to **7 mA** and the signal is at a voltage of **6 V** in normal operation.

The presence of the control signal is signalled by a **green** light-emitting diode (**LED**) on the front panel of the relay.

Fault detection

After a fault is detected (short circuit in the heating circuit or fault on the solid state relay), the value of the control signal is **increased**:

up to **12 V** for the output of **2100** series controllers
up to **18 V** for the output of **2200** and **2400** series controllers

Number of solid state relays per controller output

Operating mode	Controller type	Number of TE10/PDSIOs
Mode 1	2100 or 2200	1
	2400	1 or 2*
Mode 2	2200 or 2400	1

* Inputs connected in series only
In this case it is impossible to determine from the controller message which solid state relay is faulty

SAFETY DURING INSTALLATION AND USE

Read this manual in full before installing the solid state relays.
Eurotherm Automation shall not be held responsible for any damage or injury, losses or expenses incurred due to inappropriate use of the product or failure to comply with the instructions in this manual.

- TE10S solid state relays must be installed, commissioned and maintained only by qualified staff authorised to work on low voltage industrial electrical facilities.

- Before connecting or disconnecting the unit, check that power and control cables and leads are isolated from voltage sources.

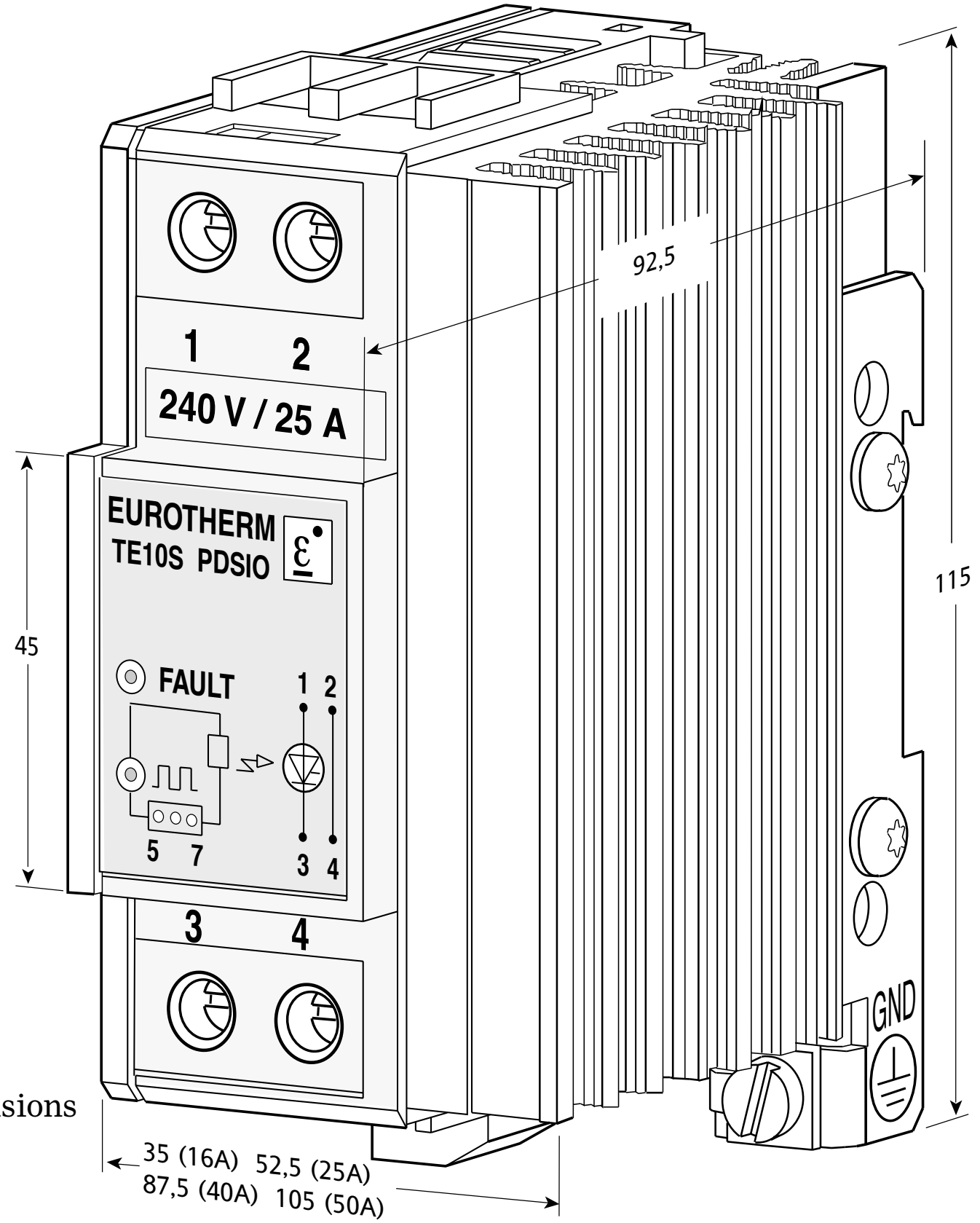
- The protective earth must be connected to the GND screw before any other connections are made and should be the last cable to be disconnected.

- Thyristors are not isolating devices.
  The high speed fuse is only used to protect the thyristors. Under no circumstances can it protect the installation. It is essential to fit a suitable device guaranteeing that the facility is protected and isolated, in compliance with applicable standards and current practice.

- Disconnect the TE10S completely before removing it. Users must not attempt to access the internal components of the product.

- The temperature of the heatsink may exceed 100°C. Avoid touching the heatsink even briefly when the TE10S is operating. The heatsink remains hot for approximately 15 minutes after the unit is switched off.

OVERALL VIEW



INSTALLATION

TE10S/PDSIO solid state relays must be installed in fan-cooled cabinets, ensuring that they are free of condensation and pollution.

The cabinets must be closed and connected to a protective earth in compliance with standard IEC 64 or applicable national standards.

The user is responsible for installing the solid state relays according to best current practice and applicable standards.

TE10S/PDSIO units are mounted on **DIN rails** using a **clip**:

- on **symmetric** DIN rails (EN 50022 - 35 × 7.5 or 35 × 15 mm)
- on **asymmetric** DIN rails (using a BD 173730 dual rail adapter)

Solid state relays must be fitted with the heatsink vertical.
If several solid state relays are fitted in the same cabinet, arrange them such that hot air from one relay is not drawn in by the relay above.

Overall **dimensions** of TE10S/PDSIO units:

Height:	115 mm.
Depth:	92.5 mm
Width:	35 mm (16 A), 52.5 mm (25 A), 87.5 mm (40 A), 105 mm (50 A).

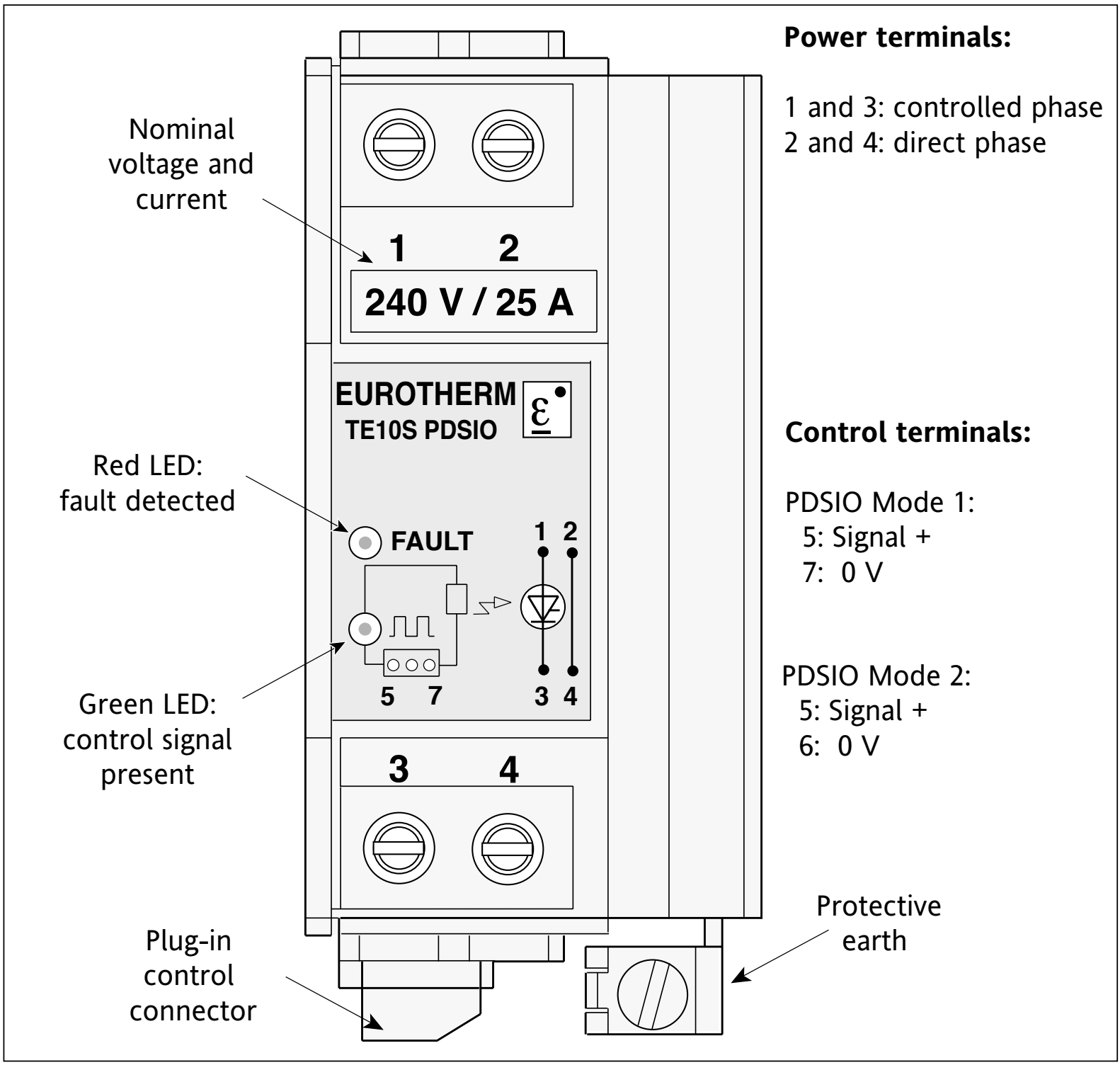
Minimum **spacing** between two adjacent solid state relays:

10 mm up to 45°C
17.5 mm above 45 °C

Solid state relays must be **completely disconnected** before removing them.

LAYOUT

TERMINALS AND CONNECTOR SEEN FROM FRONT PANEL

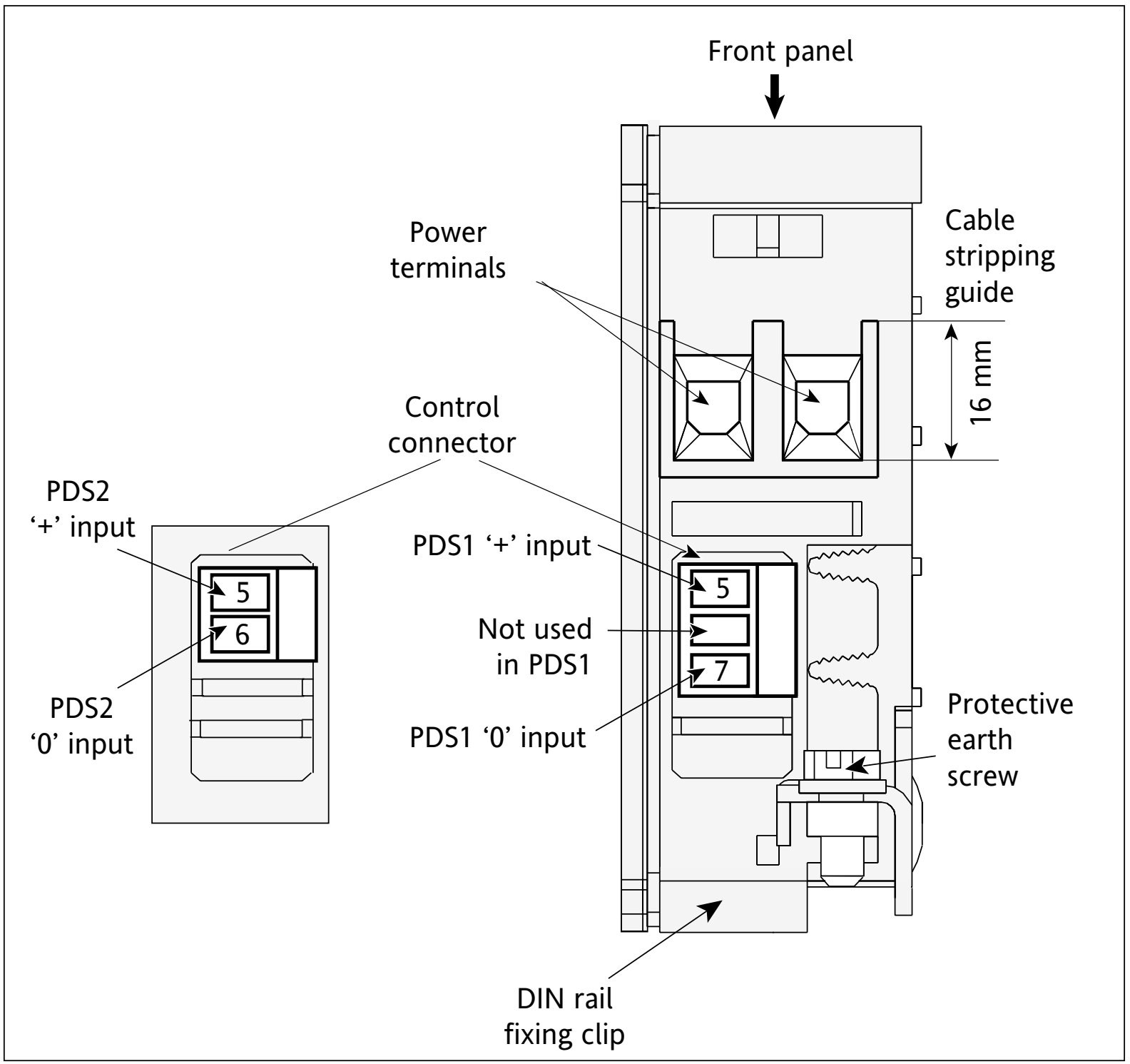


Example showing PDSIO Mode 1 front panel

TERMINALS AND CONNECTOR SEEN FROM BELOW

The control terminals are:

- **5** and **7** for Mode 1
- **5** and **6** for Mode 2.



WIRING

FACILITY PROTECTION

Users must provide protection and electrical isolation for the facility.

Reminder: The high speed fuse only protects the thyristors.

Before connecting or disconnecting any leads from the TE10S, it is essential to check that the power and control cables are **isolated** from power sources.

PROTECTIVE EARTH

Before connecting any other leads, connect the protective earth to the protective earth **screw** marked **GND**.
This screw must be disconnected last when disassembling.
The earth screw should be tightened to a torque of **2 N.m**

SUPPLY AND LOAD

The power terminals are cage terminals for wires from **1.5** to **16 mm²**.
Strip insulation by **16 mm**. Tightening torque **1.2 N.m**

The phase **controlled** by the TE10S thyristors should be connected to power terminal **1**, and the load to terminal **3**.
The **direct** phase (or the **neutral**, depending on the type of supply) may be connected to power terminal **2**, and the load to terminal **4**.

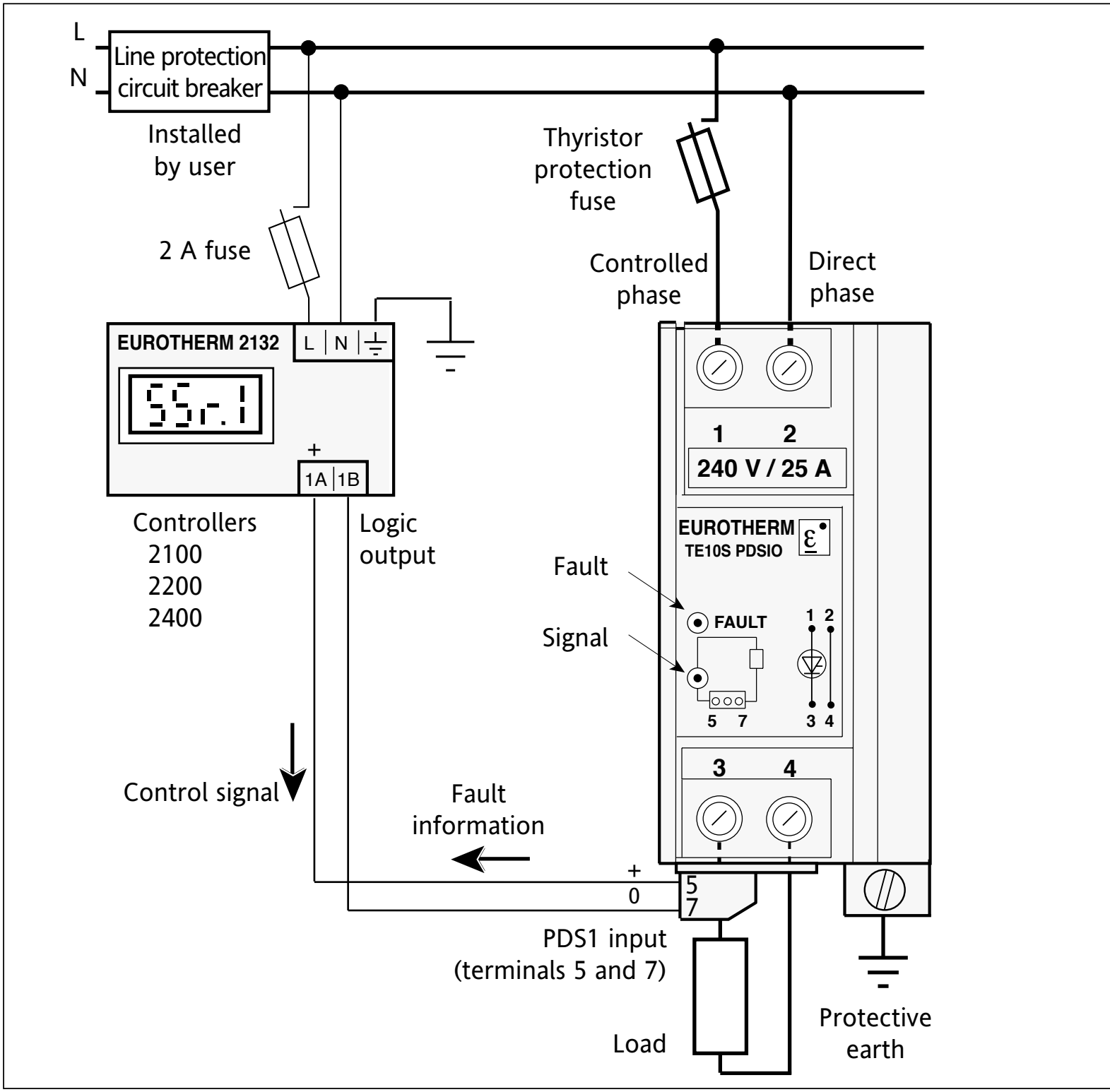
CONTROL

The control terminal block is a plug-in unit for wire from **0.5** to **1.5 mm²**.
Strip insulation by **7 mm**. Tightening torque **0.4 N.m**

For **Mode 1**, terminals **5** and **7** of a three-pin terminal block are used (the central terminal is not used).

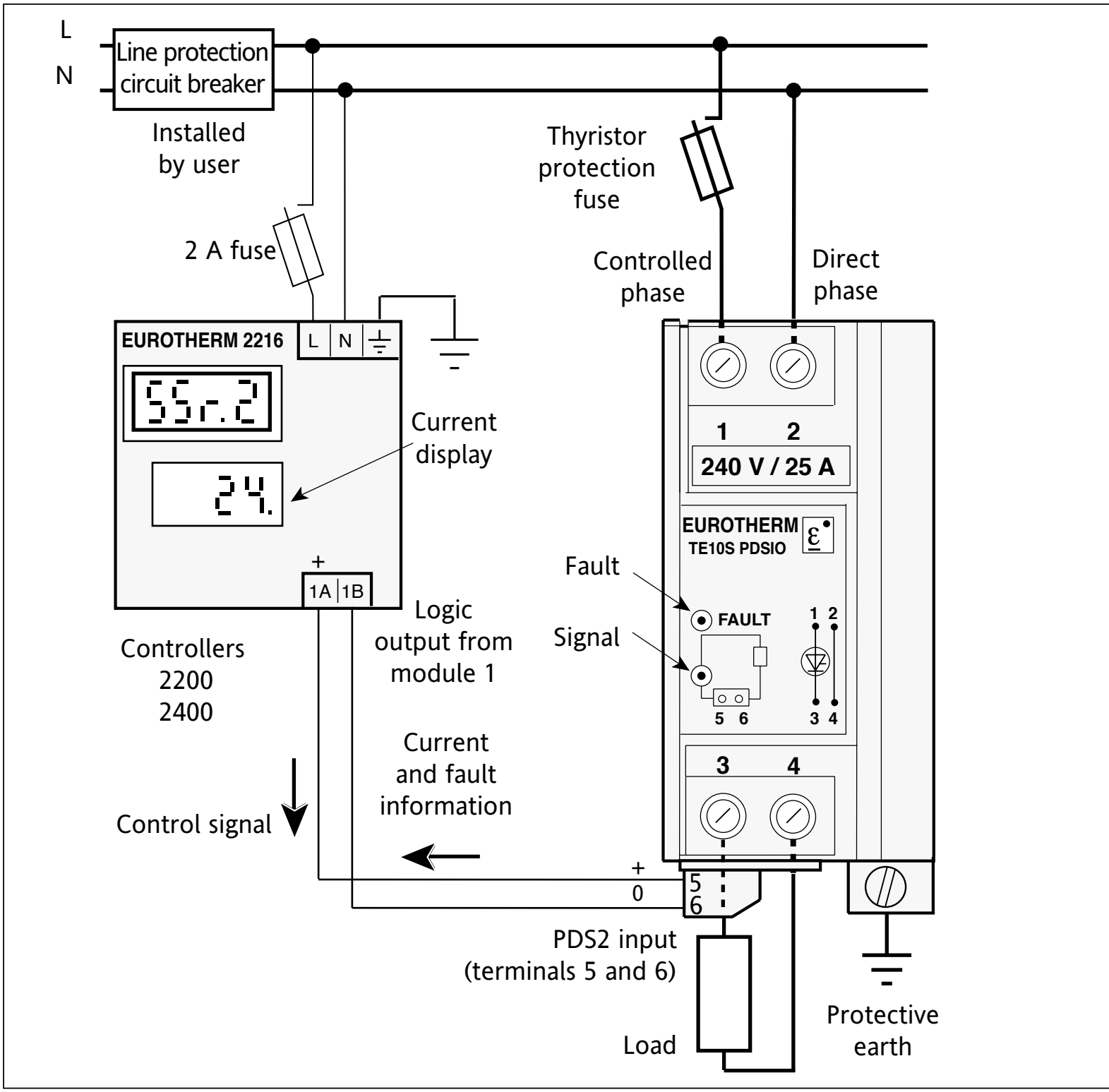
For **Mode 2**, terminals **5** and **6** of a two-pin terminal block are used.

TYPICAL SINGLE-PHASE WIRING (Mode 1)



Example showing TE10S solid state relay (PDS1 input) connected to Eurotherm 2132 controller (SSr.1 configuration)

TYPICAL SINGLE-PHASE WIRING (Mode 2)



Example showing TE10S solid state relay (PDS2 input) connected to Eurotherm 2216 controller (SSr.2 configuration)

CONTROLLER CONFIGURATION

TE10S / PDSIO® solid state relays are driven by logic signals from the Eurotherm 2000 series controllers in a **specific configuration**.

These signals are available on the logic modules of the **2000** series between pins **1A** (+) and **1B**.

The following logic modules are concerned:

- the **standard** module for the **2100** series.
- module **1** only for **2200** and **2400** series.

The controllers **must be configured** for PDSIO operation as shown in the table below:

Series	**Location of logic module for PDSIO configuration**	**Configuration**	
		Mode 1	**Mode 2**
2100	Standard	**SSr.1**	-
2200 and 2400	Logic module 1 in Slot 1	**SSr.1**	**SSr.2**

The controllers can be set to PDSIO configuration in the **Func** parameter, only if the module identification is **LoG**.

FAULT DETECTION

A TE10S/PDSIO solid state relay in conjunction with a 2000 series controller can detect and indicate:

- heating circuit faults
  (load open circuit, blown fuse, absence of power supply)
- solid state relay faults
  (thyristor short circuit, thyristor open circuit).

Faults detected are signalled with the **red 'Fault' LED** on the front panel of the TE10S and indicated by a message on the controller **display**.

FAULT MESSAGES ON CONTROLLER DISPLAY

PDSIO mode	Controller code	Message displayed	Fault
Mode 1	M1	**LdF**	Heating circuit fault, power absent, thyristor fault (open circuit or short circuit).
Mode 2	M2	**SSrF**	Short circuit in TE10S/PDS2 thyristors.
		HtrF	Heating circuit fault, thyristors open circuit power absent.

LED INDICATORS

Normal operation

Green LED:
lit when control signal **present** (ON).

Red LED:
- **flashes** in Mode 1 at the **start** of each firing request.
- **unlit** in Mode 2.

With a setpoint of **0%** both LEDs are **unlit**.
With a setpoint of **100%** only the **green** LED is **lit**.

One or more faults detected

Green LED:
unlit in Mode 1 or 2.

Red LED:
- **lit** during firing in Mode 1;
- **always lit** in Mode 2.

OTHER FAULT SIGNALS

Faults can also be signalled by:

- a **contact** on the controller's alarm relay (series 2100, 2200, 2400); the type of contact (NO or NC) can be configured.`
- a **digital signal** (series 2200 and 2400 controllers).

CURRENT INFORMATION (Mode 2 only)

The current value for the TE10S/PDSIO solid state relay shown on the display of 2200 and 2400 series regulators is the **rms** value during **firing**.

Non-firing time is not taken into account.

The **minimum** current shown by the regulator is **2 A**, but **stable** measurements start at **4 A** and continue up to **50 A** (depending on the rating of the TE10S).

The current measurement (and hence the display of faults on the controller) is only enabled when the **firing time demand** (parameter **OP**) exceeds **7%**, regardless of the current in the solid state relay.

The current value displayed on the controller is given in **1 A** steps.

This resolution enables a partial load failure to be **detected** by using the current threshold alarms (2200 and 2400 series controllers).

The **current alarms** indicate that the load current measured, sent over the PDSIO link, is greater than (**High alarm**) or less than (**Low alarm**) the preset threshold.

The current **alarm** messages are as follows:

LCr: Low current alarm.
HCr: High current alarm.

UL TYPE APPROVAL

TE10S units have passed **UL** approval (USA and Canada)
"Listed Industrial Control Equipment" No. **74B5**.

CE MARKING

TE10S products installed and used in compliance with this user manual meet the essential requirements of the European Low Voltage Directive 73/23 CEE modified by 93/68 CEE.

ELECTROMAGNETIC COMPATIBILITY (EMC)

TE10S products installed and used in compliance with this user manual are certified compliant with the following EMC test standards. A system incorporating these products may be certified compliant with the EMC Directive as far as TE10S products are concerned.

EMC test standards
EN 61000-4-2, EN 61000-4-4, EN 61000-4-3, EN 61000-4-6, ENV 50204, EN 55011.

Protective earthing
For electromagnetic compatibility reasons, ensure that the metal DIN rail on which the TE10S units are installed is in electrical contact with the reference earth (cabinet panel or base).

'Electromagnetic compatibility' installation guide
In order to help you reduce the effects of electromagnetic interference associated with the installation of the product, Eurotherm Automation can supply you with an 'Electromagnetic Compatibility' guide (Ref. HA 025464).

Independent safety mechanism
It is the user's responsibility to fit an independent safety mechanism which must be inspected regularly. This is highly recommended given the value of the equipment controlled by the TE10S.

EUROTHERM LIMITED

http://www.eurotherm.co.uk

UK SALES OFFICE

Eurotherm Limited

Faraday Close, Durrington

Worthing

West Sussex BN13 3PL

Telephone Sales: (01903) 695888

Technical: (01903) 695777

Fax: (01903) 695666

Sales and support in over 30 countries worldwide

For countries not listed overleaf, enquiries/orders to:

Eurotherm Limited

Export Dept.,

Faraday Close, Durrington, Worthing

West Sussex, BN13 3PL

Telephone (01903) 268500

Fax (01903) 265982

Solid State Contactors TE10S
Power Controllers TE10A

EUROTHERM

ADDENDUM

TE10S User Manual Part N°:
HA174780ENG, HA174782ENG,
HA174784ENG, HA175436ENG

TE10A User Manual Part N°:
HA175247ENG, HA175548ENG

NOMINAL CURRENT UP TO 50 A
and
SHORT WAVE INFRARED APPLICATIONS

Part N°. HA175600 ENG - Issue 2.0 - 12/98

TECHNICAL SPECIFICATION

MAXIMUM CURRENT

In order to take into account supply voltage variations and heating element resistance dispersion (all types of heating elements including short wave infrared), a 0.8 safety coefficient must be used on the thyristor unit current rating to determine the maximum value of the load nominal current which the unit can safely control.

SHORT WAVE INFRARED (SWIR) APPLICATIONS

Applications using short wave infrared heaters in Single Cycle, Fast Cycle or Advanced Single Cycle are reserved to 16 A, 25 A and 40 A current rating.
With a safety coefficient of 0.8 the maximum current for SWIR which can be controlled is:

TE10 rating	SWIR maximum controlled current
16 A 25 A 40 A and 50 A	13 A 20 A 32 A

RANGE DIMENSIONS AND WEIGHT

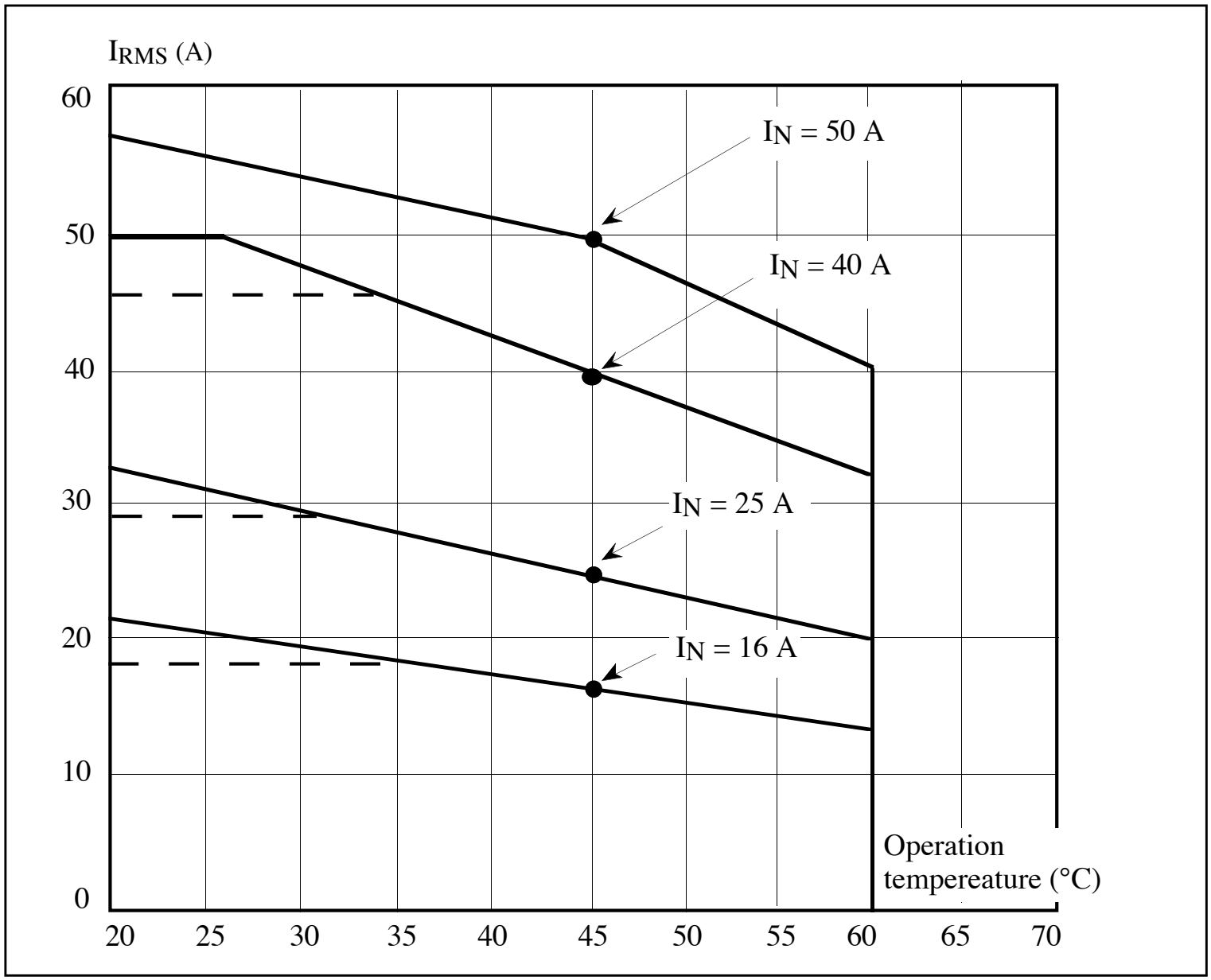
Height 115 mm / Depth 92.5 mm

Models	Nominal current	Width (mm)	Weight (g)
TE10S/DC, TE10S/AC TE10S/PDSIO	16 A 25 A 40 A 50 A	35 52.5 87.5 105	350 500 850 1100
TE10S/PLF TE10A/Burst TE10A/PA	16 A 25 A 40 A 50 A	52.5 70 105 122.5	550 700 900 1200

THYRISTOR PROTECTION FUSE

TE10 rating	Fuse rating	Fuse & fuse-holder	
		Code	Dimensions(mm)
16 A 25 A 40 A 50 A	20 A 32 A 50 A 63 A	FU1038/16A/00 FU1038/25A/00 FU1451/40A/00 FU2258/50A/00	81 x 17.5 x 68 81 x 17.5 x 68 95 x 26 x 86 140 x 35 x 90

Attention! For SWIR applications, the high-speed fuse must not be used



Current derating as a fonction of ambient temperature (I_N = nominal current at 45°C)
Dotted line : limit due to recommended fuse