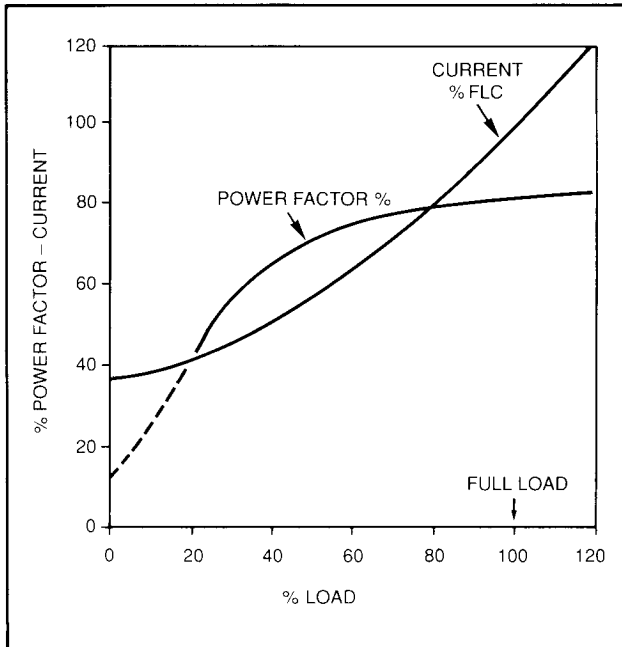


## PAIR Motor Protection Relay

PAIR is designed for use with motors which require protection against both overload and underload conditions. Pump motors, for example, require normal overload protection, but the pump itself can be damaged by 'dry running'. PAIR provides sensitive detection of light load conditions as well as accurate monitoring of overcurrent faults.

Typical characteristics of a squirrel cage motor are shown in the diagram.



Current rises rapidly with load increases above 100% and thus is a good overload indicator. When the motor is lightly loaded, however, current variation is much reduced, whereas phase angle (or power factor) decreases sharply, thus achieving more sensitive indication of underload conditions. PAIR combines measurement of current and phase angle to effect optimum protection over the full load range.

The unit is self-contained with two integral current transformers suitable for load currents up to 32A; additional external CTs can be used for higher ratings. Separate output relays are fitted for independent trip and warning indication of overload or underload faults. Adjustable delays are provided to avoid nuisance tripping as follows:

- T1- Start-up delay, applies to both overcurrent and underload trips.
- T2- power factor underload response time.
- T3- reset delay, applicable in both auto and manual modes.

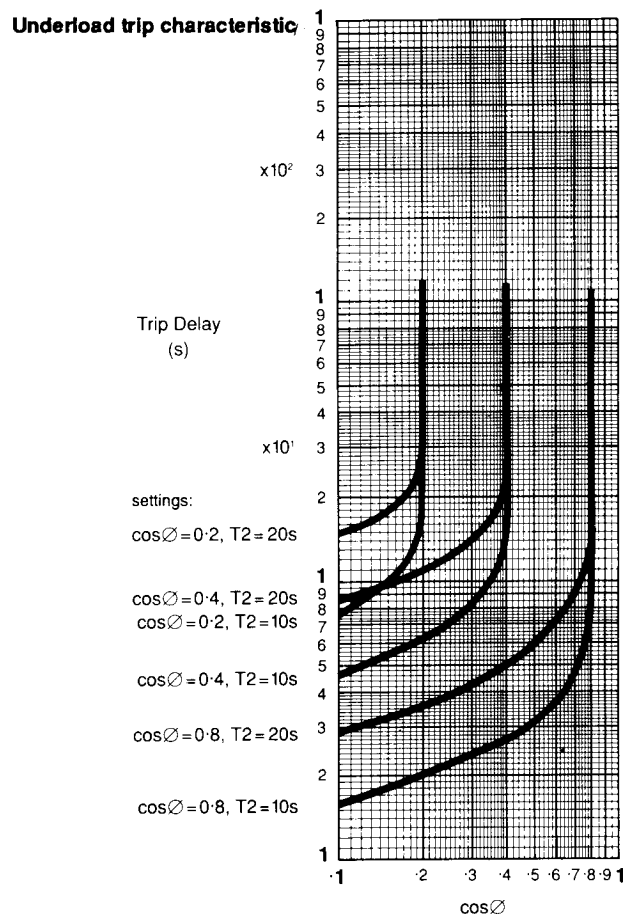
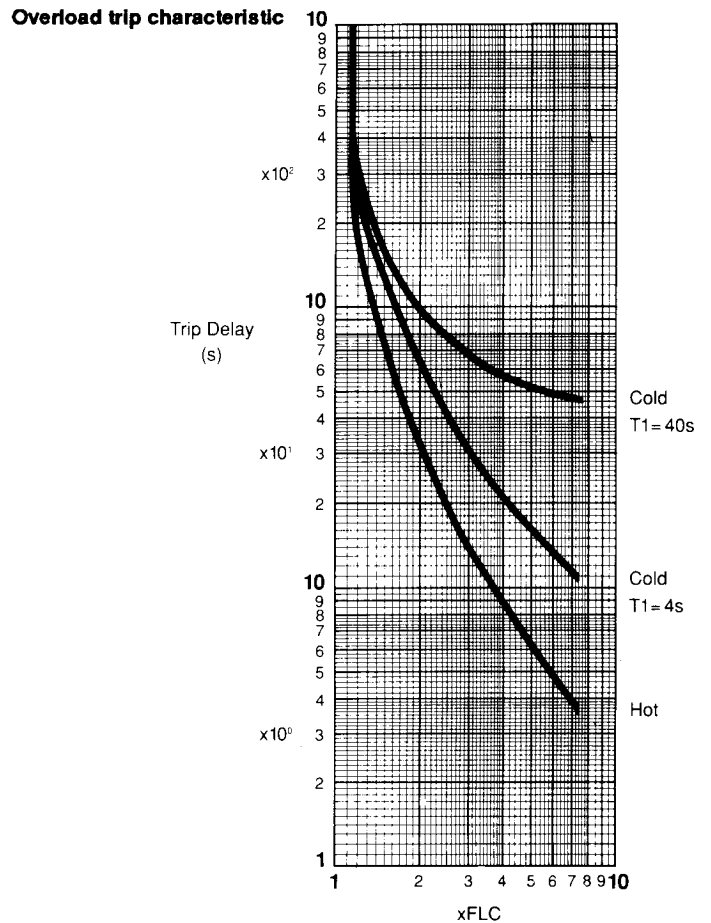
T1 is adjustable over the range 4-40s, and increases the trip time at 6 x FLC by the set delay. When this has elapsed the normal 'hot' response characteristic is effective, thus providing maximum protection during normal running while still accommodating the starting surge associated with motors which have long run-up times.

T1 is initiated by an increase of load current above 10% of maximum span.

Other PAIR features include hand/auto reset selection, with an integral reset button for local operation and terminals for connecting a remote reset contact. Supply, warning and high/low trip status indicators are fitted.

Latching versions of the PAIR contain retentive circuits which are not affected by loss of supply voltage. If the supply is removed following an overload or underload trip, the trip status is remembered when the supply is restored. When in the manual mode, the unit can be reset only by momentarily linking terminals R1 and R2- or by operating the reset button- with supply connected.

## Response characteristics



# Technical Specification

## Technical specification

Supply voltage:	380...415V +10% -15% 50-60Hz 2VA
Load current range:	0,83 - 32,0A via integral CTs Extended range using cascaded CTs - see CT selection table. Calibration accuracy $\pm 10\%$ approx.
Power factor (cos $\phi$ ) range:	0,2 - 0,8 Underload trip operation is inhibited while load current is less than 10% of maximum span.
Output relay:	Ratings (changeover contacts) Resistive load: 5A at 240V 2A at 415V
A.C. inductive load switching (B600)	120V to 415V max. Make: 3600VA Break: 360VA $I_e = 5A$ max.
D.C. inductive load switching (P150)	120V max. Make: 138VA Break: 138VA $I_e = 5A$ max.
Start delay T1:	Adjustable 4-40s. Normal trip response applies after delay has elapsed.
Underload trip delay T2:	Adjustable 1-20s
Reset:	Terminal link for auto/manual mode selection. Button for local reset, terminals for remote - link to reset. Reset delay T3 (hand or auto) is adjustable 1-20m.
<b>Caution:</b>	If supply is removed, non-latching versions reset automatically when supply is restored. Manual reset should be used for latching versions.
Indicators:	Power (Green) - Supply On High (Amber) - Overload trip Low (Amber) - Underload trip Set (Amber) - Overload trip level exceeded/timing in progress
Operations/h:	60 max.
Ambient temperature range:	-10°C to 60°C
Enclosure:	IP20, EN35 top hat rail or surface mounting
Terminal cable capacity:	1 x 4mm <sup>2</sup>

## Order references

<b>PAIR</b>	
Standard	<b>PAIR 400S 000</b>
Latching	<b>PAIR 400L 000</b>
Current transformers - see selection table.	

## Current transformer selection table

FLC adjustment span (A)	Turns on integral CTs	Terminal link S1-S2 fitted	Extended range CTs (2 off required). Order ref. and pry turns
0,83 - 1,67	12 turns	●	-
1,33 - 2,67			
1,25 - 2,5	8 turns	●	-
2 - 4			
2,5 - 5	4 turns	●	-
4 - 8			
5 - 10	2 turns	●	-
8 - 16			
10 - 20	1 turn	●	-
16 - 32			
25 - 50	8 turns	●	01 / 000158 / 505 2 turns
40 - 80			01 / 000158 / 505
50 - 100	8 turns	●	01 / 000158 / 505 1 turn
80 - 160			01 / 000158 / 505
100 - 200	4 turns	●	01 / 000158 / 505 1 turn
160 - 320			01 / 000158 / 505
250 - 500	4 turns	●	01 / 000158 / 300 1 turn
400 - 800			
500 - 1000	4 turns	●	01 / 000158 / 302 1 turn
800 - 1600			
1000 - 2000	4 turns	●	01 / 000158 / 303 1 turn
1500 - 3000			01 / 000158 / 304

CT configurations which result in a scale setting of 0,7 to 0,9 are preferred. Each turn comprises one cable passing through the CT aperture.

## Terminal functions

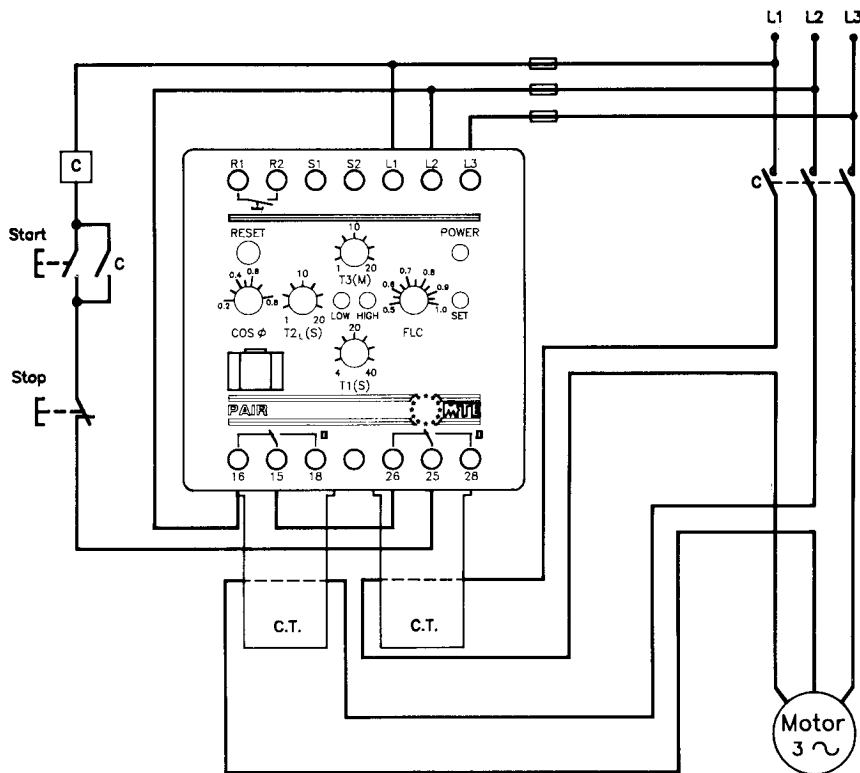
L1	Supply/motor voltage	
L2	380-415V	}
L3		
S1	Current range selection link	}
S2		
R1	Link for auto reset.	}
R2	Momentary closure for remote manual reset. Contact rating 2mA @ 20V d.c.	
15	common	}
16	n.o. (closed when relay is energised)	
18	n.c. (open when relay is energised)	
25	common	}
26	n.o. (closed when relay is energised)	
28	n.c. (open when relay is energised)	

# Technical Specification

## Typical wiring diagrams

### DOL starter, 415V control circuit

Up to 32A using integral current transformers



### Operation:

When power is applied to the PAIR, both output relays energise, closing contacts 15-16 and 25-26, and opening contacts 15-18 and 25-28. The starter circuit is enabled. When the start button is operated, and load current is greater than 10% of maximum setting for the range selected, current and power factor monitoring commences. If either parameter is outside the set level for longer than the set delay, the corresponding output relay (25-26-28 for current, 15-16-18 for power factor) de-energises, turning off the motor. In each case, the normally closed contact can be used for remote warning indication. PAIR also protects against single phasing faults; loss of any incoming phase results in an underload trip, either immediate or with T2 delay, dependent on which phase is lost.

### Installation:

4A HBC fuses should be fitted for control circuit protection, as shown. Power factor correction, where used, must be connected to the incoming supply side of the PAIR. PAIR can be used in conjunction with soft starters but T1 delay must be set equal to the ramp time to avoid nuisance power factor tripping.

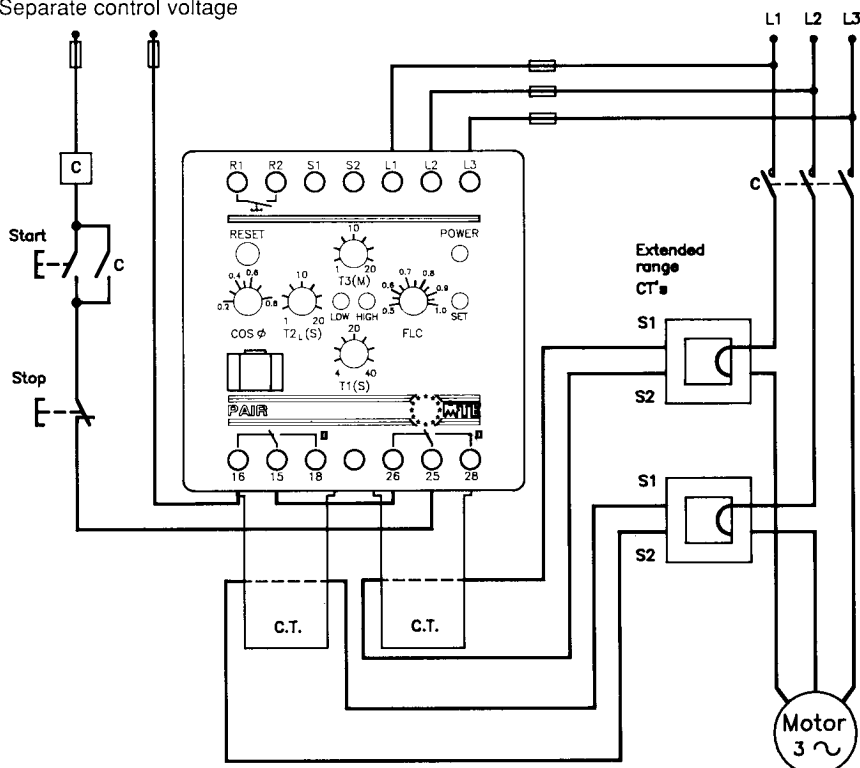
### Setting-up procedure:

- For underload protection, turn  $\cos\phi$ , T2 and T3 adjustments fully anti-clockwise. Run motor with minimum load anticipated in normal operation and slowly rotate  $\cos\phi$  potentiometer until unit just trips (amber LOW indicator On). Reduce setting by 15-20%. Adjust T2 for desired trip response time.
- For overload protection, set FLC and T1 at required values. The current setting is motor FLC divided by maximum current for the selected CT configuration. The trip current will then be in the range 105-120% of set FLC. For example, a 37kW 415V motor is rated at 66A FLC. The preferred CT ratio from the Selection Table is the combination giving an adjustment span of 40-80A. The trip setting is then  $66/80 = 0.825$ . T1 must be set so that the motor can be run up to speed with maximum load; the higher the load inertia the longer the trip delay required.
- Adjust reset delay T3 as required.

### DOL starter, 110V control circuit

Up to 3000A using additional cascaded current transformers

Separate control voltage



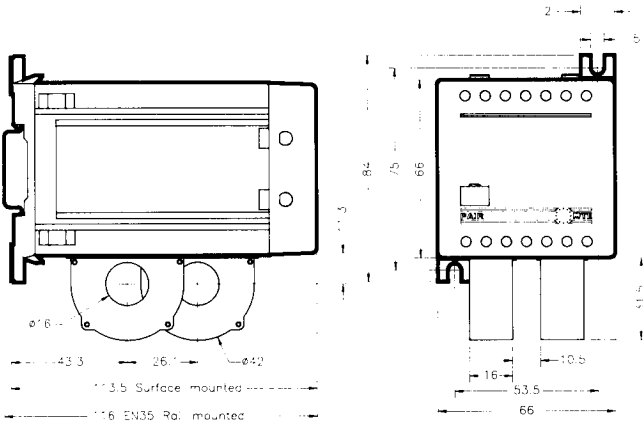
**Important: CT polarity must be observed.**

# Technical Specification

## Dimensions (mm)

PAIR

Weight 0,44kg

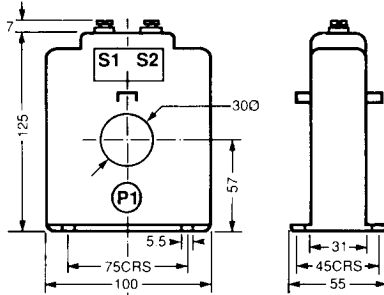


## Extended range current transformers

Order reference

01 000158 505

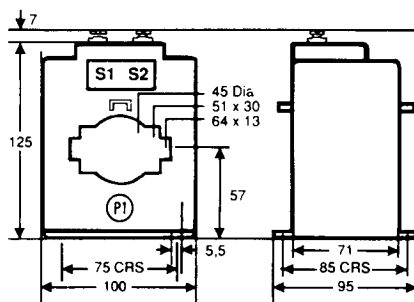
Weight 0,65kg



Order references

01 000158 300

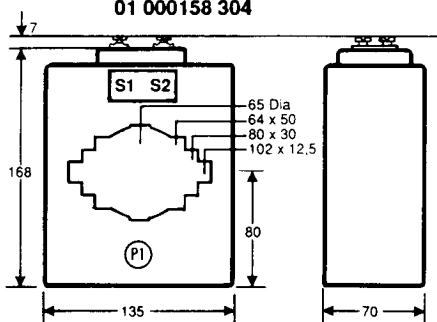
Weight 1kg



Order references

01 000158 302  
01 000158 303  
01 000158 304

Weight 2kg



**Machinery, Low Voltage & EMC Directives:** The products described in this document conform to relevant EU Directives and Standards. They are intended for use by competent personnel with the skills necessary to effect safe and reliable installation. The performance of the overall system in which the products are employed is the sole responsibility of the installer. Whilst every care has been taken in the preparation of this leaflet, no liability is accepted for any consequence of its use. No licence to use any patent should be assumed. All dimensions quoted are approximate only and subject to change without notice, as are other technical features resulting from continual development and improvement.