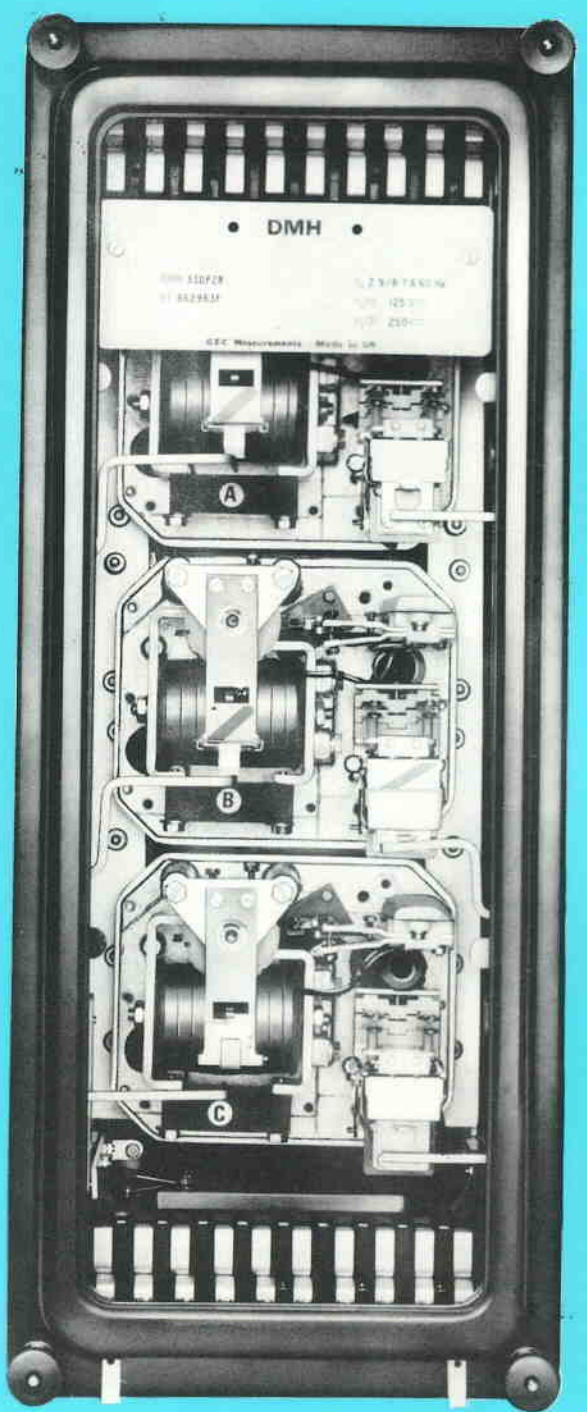
GEC Measurements

Type DMH

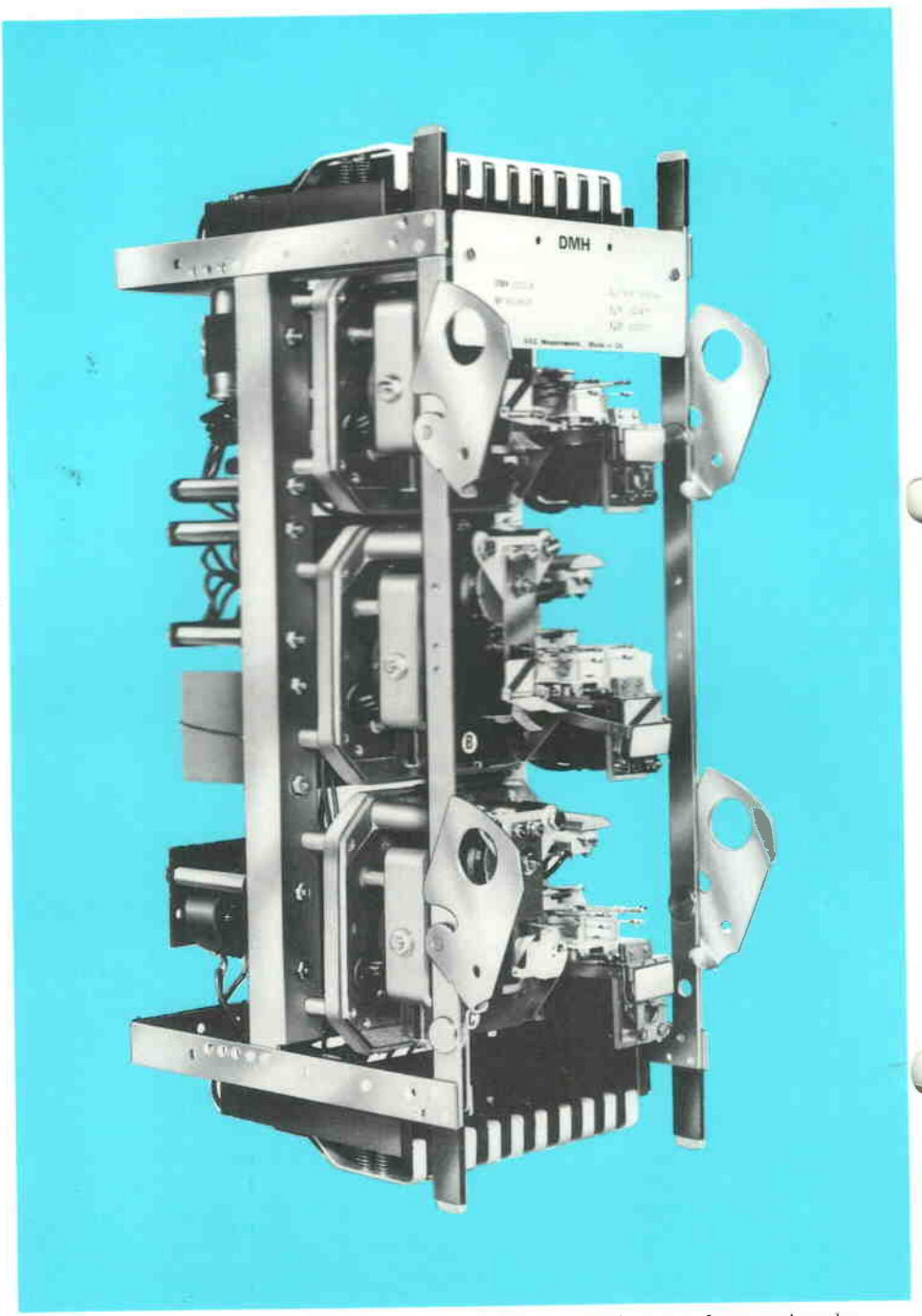
High Speed Biased Differential Relays



Type DMH

FEATURES

* Typical operating time of 40 milliseconds for currents above twice relay rated current.
* Electrically stable during heavy through faults.
* Instantaneous overcurrent protection clears heavy internal faults in one cycle.
* Tapped version available for use with standard ratio current transformers.



APPLICATION

Type DMH relays are high-speed biased differential relays designed to protect large three phase power transformers against internal faults. The relays are biased to provide stability during heavy through faults and utilise second harmonic restraint to prevent operation by magnetising inrush currents produced when the transformer is energised.

Types DMH31A and DMH31B are designed for use with two-winding transformers, types DMH32A and DMH32B for use with three-winding C.T.'s specially manufactured to the required ratio. Types B are provided with tapped internal interposing transformers which enable the relays to be used with standard ratio main C.T.'s not matched to the power transformer ratio.

Relay types DMH33A, DMH33B, DMH34A and DMH34B are designed for applications where difficulty is experienced in accommodating the higher knee-point C.T.'s specified in the design formula. These relays enable the use of lower knee-point C.T.'s, with only a slight increase in operating time over the DMH31 and

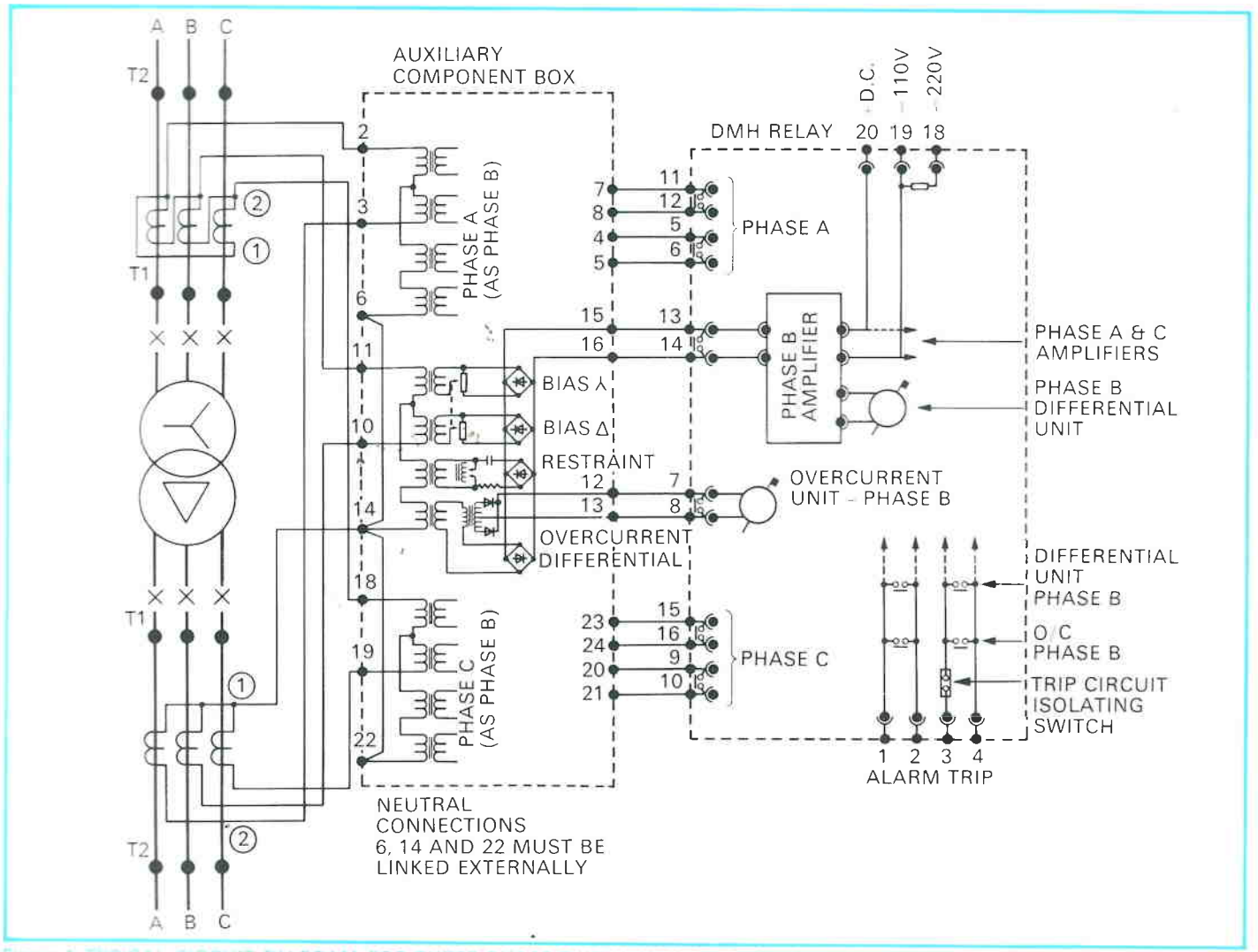


Figure 1 TYPICAL CIRCUIT DIAGRAM FOR THREE-PHASE TWO-WINDING TRANSFORMER DMH 31A RELAY

OPERATION

Types DMH31A, DMH31B, DMH32A and DMH32B

Figures 1 and 2 show circuit diagrams for the DMH31A and DMH32A respectively. Rectifier bridge comparators in each phase feed outputs through transistor amplifiers to sensitive polarised measuring elements of the type shown in Figure 3. The input to each polarised measuring element is the resultant of :

* An operating current which is a function of the differential current.
* A restraining current which is a function of the second harmonic content of the differential current. This prevents operation of the relay by the large magnetising inrush currents produced when the transformer is energised.
* A restraining current which is a function of the through current and stabilises the relay during through

Three polarised measuring elements are each provided with two pairs of normally-open self reset contacts, which complete the trip and alarm circuits without the need for an internal auxiliary relay.

A high set overcurrent element, not provided with harmonic restraint, is included in each phase, to maintain high speed protection under heavy internal faults which can cause saturation of the C.T.'s. Saturation of the C.T.'s can generate harmonics which may tend to restrain the differential element. Overcurrent elements are fed from saturable transformers which prevent their operation if peak inrush currents exceed the over-current setting momentarily. Contacts of the overcurrent elements are paralleled with those of the polarised units to complete the trip and alarm circuits.

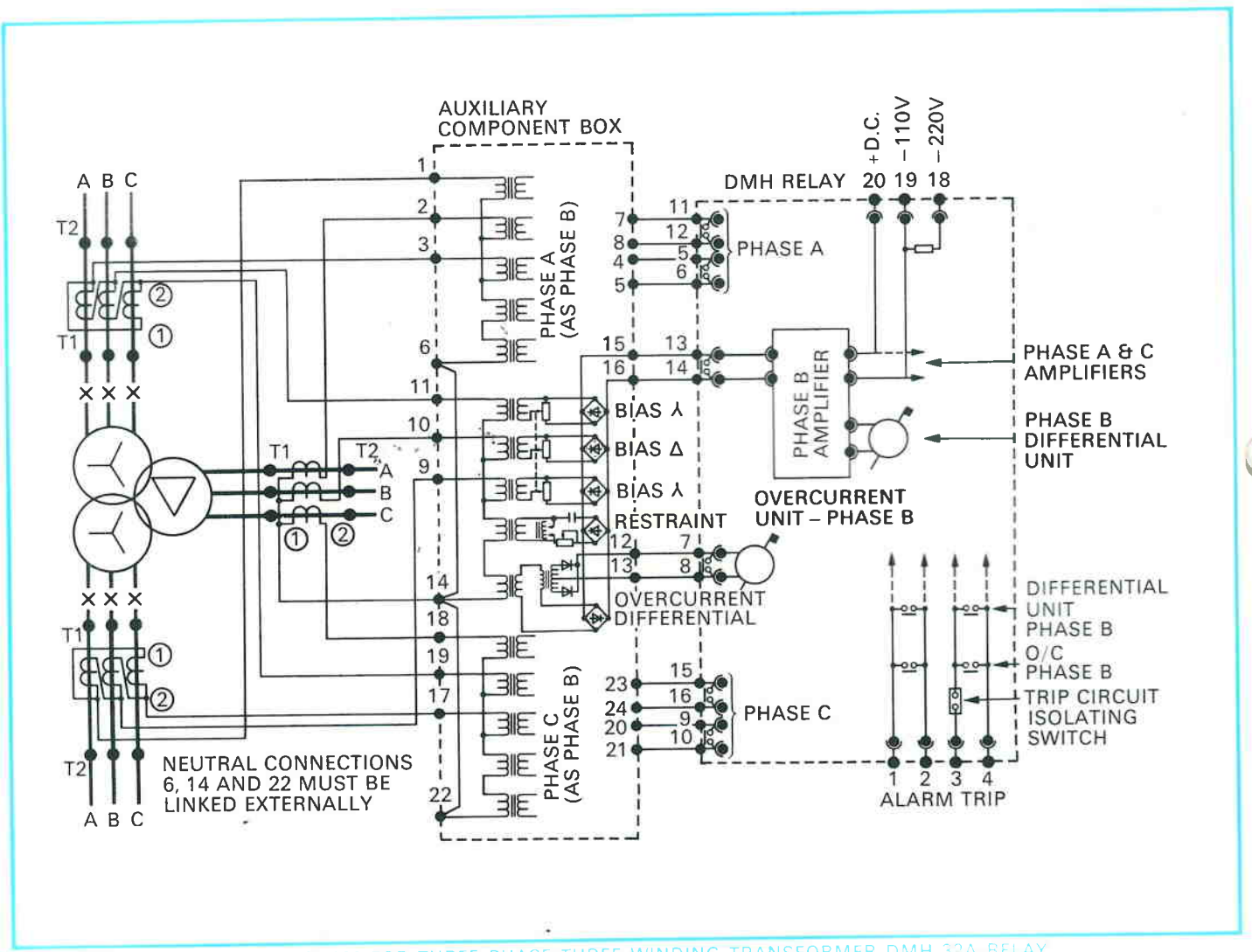
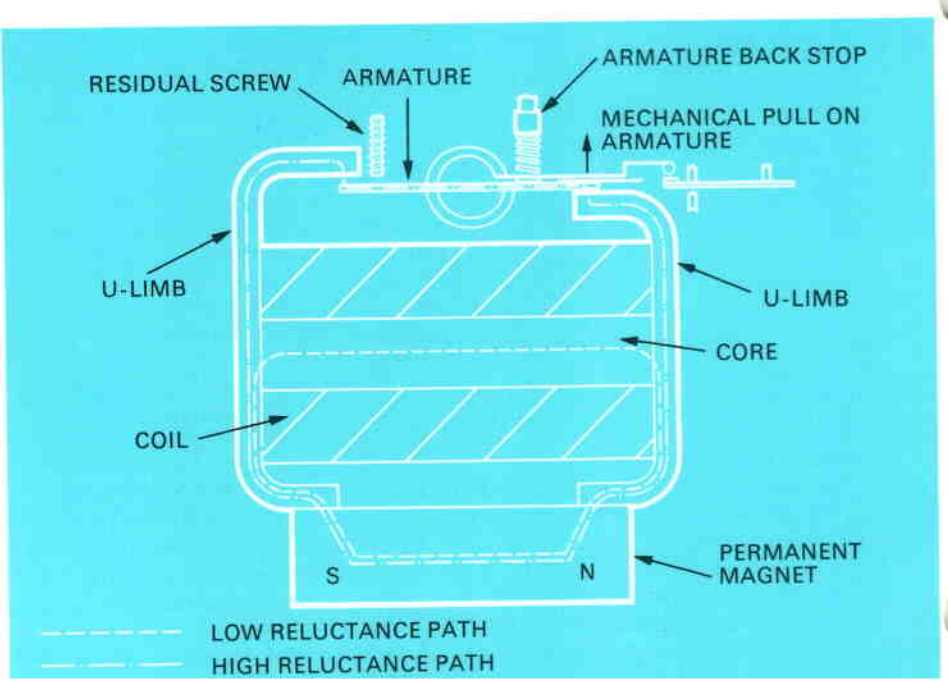


Figure 2 TYPICAL CIRCUIT DIAGRAM FOR THREE-PHASE THREE WINDING TRANSFORMER DMH 32A RELAY

Types DMH33A, DMH33B, DMH34A and DMH34B

These relay types are designed for use with low output C.T.'s and have circuitry generally similar to that previously described, as shown in Figure 4.



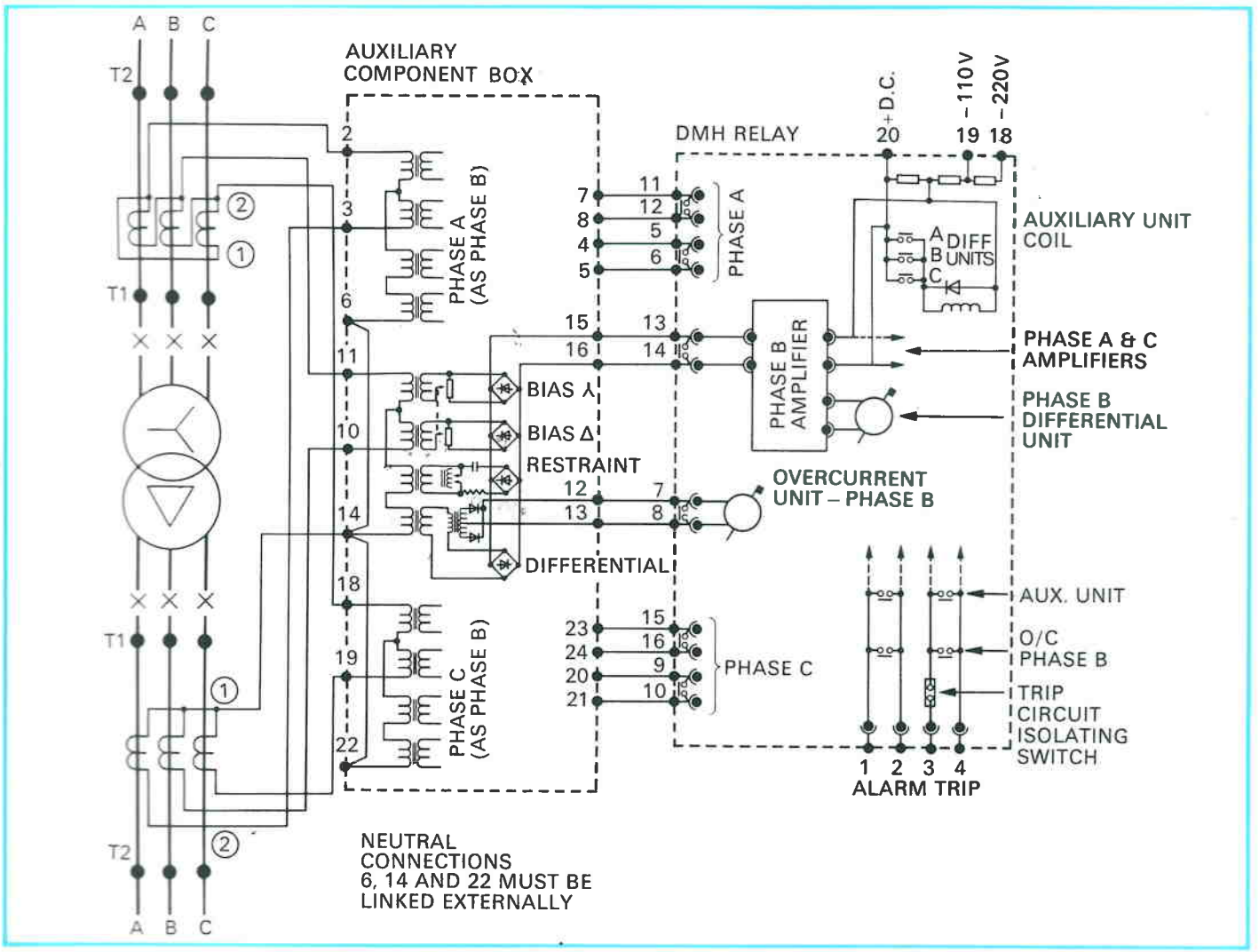


Figure 4 TYPICAL CIRCUIT DIAGRAM FOR DMH 33A RELAY

TECHNICAL DATA

Current rating

DMH31A, 32A, 33A, 34A	1 or 5 amps at 50 or 60 Hz
DMH31B, 32B, 33B, 34B	Taps rated 2.9, 3.2, 3.5, 3.8, 4.2, 4.6, 5.0 and 8.7 amps at 50 or 60 Hz.

Auxiliary supply rating

Taps permit operation from either 125 or 250 volts d.c.
Other voltage ratings available on request.

Current settings

Differential elements
Operate – Differential current 10% ± 1% of rated current (fixed)
Bias – 15%, 30% and 50% of average through current (adjustable by rotary potentiometers)

High Set Overcurrent Elements
The instantaneous overcurrent units operate when the differential current exceeds 8 times the rated current.

Operating time

DMH31A, 31B, 32A, 32B	Less than 50ms for differential currents above twice rated current, as shown in Figure 5.
DMH33A, 33B, 34A, 34B	Less than 70ms for differential currents above twice rated current, as shown in Figure 5.

Thermal withstand

Twice rated current continuously, twenty times rated current for 3 seconds.

Harmonic restraint

Operation is prevented when the second harmonic content of the differential current exceeds 20% of the fundamental.

Relay stability

Stable for through faults up to twenty times full load current, with up to 20% mismatch of line C.T. ratios.

A.C. burden

Operating circuit	5.5 VA per phase at rated current or tap setting current.
Bias circuit	0.5 VA per phase per winding at rated current or tap setting current.

Contacts

DMH31A, 31B, 32A, 32B	Two pairs of normally open self-reset contacts rated to make and carry 3,300 VA for 0.5 seconds with maxima of 30 amps and 660 volts a.c. or d.c.
DMH33A, 33B, 34A, 34B	Two pairs of normally open self reset contacts rated to make and carry 7,500 VA for 3 seconds with maxima of 30 amps and 660 volts a.c. or d.c.

Current transformer requirements

DMH31A, 31B, 32A, 32B	Star connected C.T.'s	$V_K > 60I\left(\frac{6}{I^2} + 2R_L + R_{CT}\right)$
	Delta connected C.T.'s	$V_K > 60I\left(\frac{12}{I^2} + 2R_L + R_{CT}\right)$
DMH33A, 33B, 34A, 34B	Star connected C.T.'s	$V_K > 20I\left(\frac{6}{I^2} + 2R_L + R_{CT}\right)$
	Delta connected C.T.'s	$V_K > 20I\left(\frac{12}{I^2} + 2R_L + R_{CT}\right)$

Where V_K = knee-point voltage (V)
I = rated current (A)
R_L = resistance of leads from relay to CT (ohms)
R_{CT} = resistance of C.T. secondary winding (ohms)

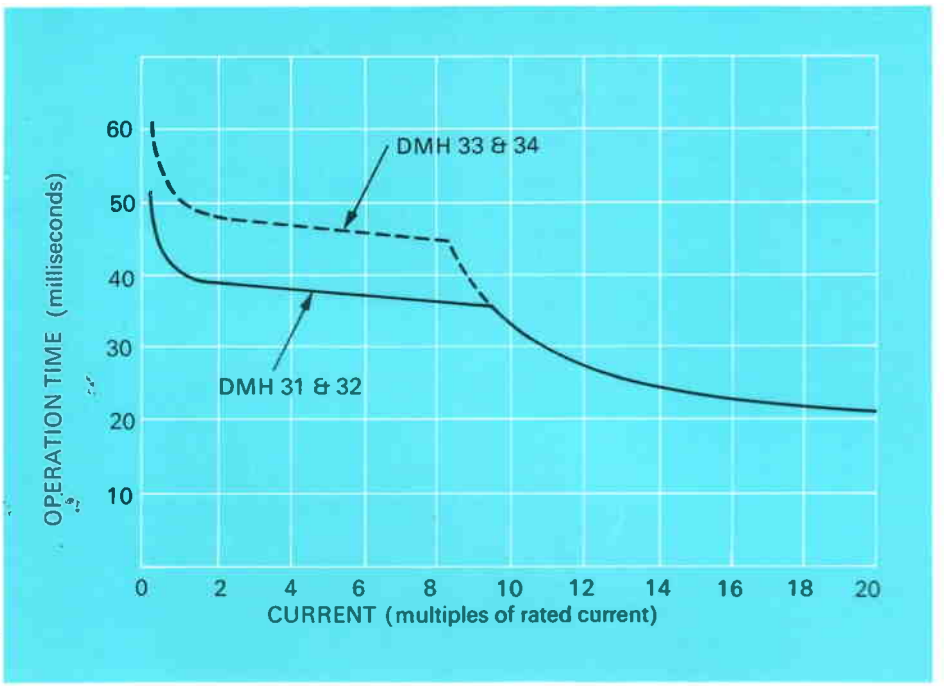


Figure 5 TYPICAL OPERATING TIME/CURRENT CURVES AT 15% BIAS SETTING

CASES

Each complete relay comprises a size 2 drawout case which accommodates the differential and auxiliary units and amplifiers, plus an auxiliary case which houses the interposing current transformers and rectifier bridge comparator devices. The bias setting potentiometers are also contained in the auxiliary component box.

Drawout cases are suitable for flush or projecting mounting. Auxiliary cases are for rear panel mounting. Cases are finished phenolic black as standard.

INFORMATION REQUIRED WITH ORDER

Differential relay type
Current transformer secondary rating (1 amp or 5 amps).
Supply frequency (50 or 60 Hz).
Auxiliary supply voltage (125 or 250 volts d.c. standard).
Case finish and mode of mounting.

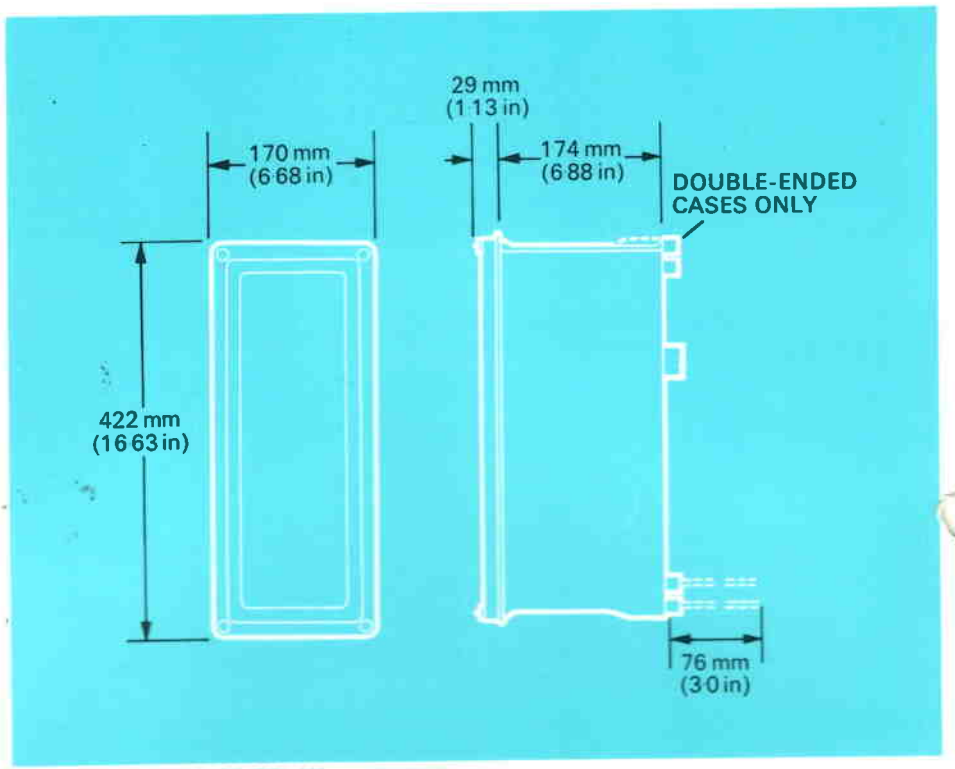


Figure 7 OUTLINE OF RELAY

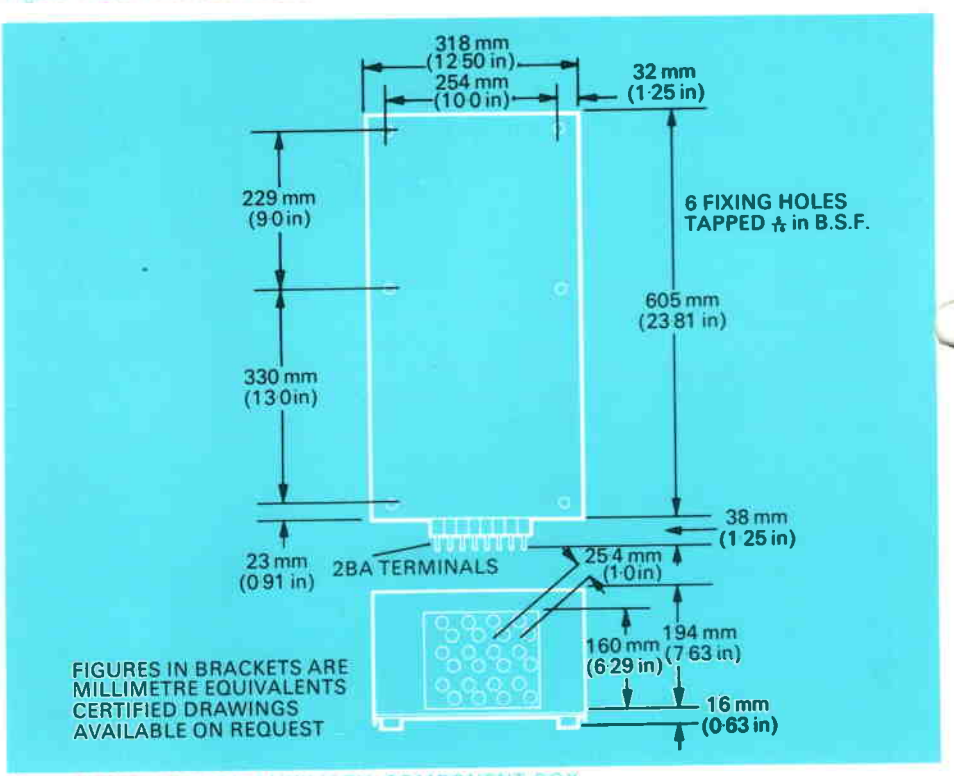


Figure 8 OUTLINE OF AUXILIARY COMPONENT BOX

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