



**Type DTH 31, 32 DTTM 11, 12
High Speed Biased Differential Relays**

ALSTOM

Type DTH 31, 32 DTTM 11, 12 High Speed Biased Differential Relays

DTH relay
withdrawn from case



Features

- High speed.
- Low burden.
- Immunity to magnetising inrush.
- Immunity to transients and surges
- Compact in size.
- Single pole version with separate flags for differential/highset operation available.

Application

DTH 31 and DTH 32 are triple pole high speed biased differential relays – DTTM 11/DTTM 12 are single pole versions of DTH 31/DTH 32 respectively – designed to protect large power transformers, auto transformers and generator transformers against internal faults. Biased to provide stability during heavy through-faults, the relays utilise second harmonic restraint to prevent operation by normal magnetising in-rush currents produced when the transformer is energised.

In addition, type DTH/DTTM relays employ fifth harmonic by-pass circuit to avoid possible mal-operation under over-excited conditions.

An instantaneous highset circuit overrides the biased differential circuit to clear heavy internal faults in about one cycle.

Type DTH 31/DTTM 11 is applicable for two-winding transformers and type DTH 32/DTTM 12 for three winding transformers.

Extremely low burdens are achieved by the use of input devices which convert current to voltage (transactors). Static circuitry is employed throughout, and a single attracted armature unit provides the output. These relays have the advantage of small dimensions and increased reliability over their electro-mechanical equivalents. Ideally, the CT primary rating should agree with the protected power transformer's full load rating, and with the transformation ratio. This

ensures the secondary currents flowing in the interconnecting pilots are balanced and matched with the relay rating.

When interposing CTs are used for ratio correction, the main CT secondary should preferably be star connected and the phase angle correction whenever necessary should be adopted on the interposing CT by connecting them in star/delta.

Description

DTH 31

Figure 1 – block schematic diagram – shows a typical application with a three-phase two-winding transformer.

Input currents I_2 and I_1 from the power transformer line CTs are added vectorially in the centre tapped restraint bias transactor T_1 . Three taps in each half of the transactor primary enable bias settings of 15%, 30% and 45% to be obtained. The output of T_1 is full wave rectified and smoothed to

obtain the restraint bias voltage level V_B . The centre tap of T_1 is connected to the differential circuit which comprises transactors T_2 , T_3 and current transformer T_4 connected in series. A tuned circuit which includes the secondary of T_2 is arranged to resonate at the second harmonic frequency. The output of this circuit is rectified and smoothed to obtain the harmonic restraint voltage level V_H . In addition, outputs of transactor T_3 and current transformer T_4 are rectified and smoothed to obtain the differential voltage V_D and the highset voltage level V_O respectively.

The greater of the two restraining voltage levels V_B and V_H is detected in one comparator and compared in magnitude with the differential operating voltage level V_D in a second comparator stage. When the operate voltage exceeds the restraining voltage by more than a preset amount, the second comparator produces an output to operate the common relay drive circuit. The highset voltage level V_O operates the relay drive circuit if the differential current exceeds ten times the rated current.

DTH 32

Figure 2 – block schematic diagram – shows an application with a three-phase three-winding transformer. Because current reversal is possible, the three inputs I_1 , I_2 , and I_3 cannot be added vectorially. Consequently, inputs to the DTH 32 are fed to separate transactor/rectifier circuits, and the dc voltage outputs added to produce a bias voltage V_B . All other circuitry is similar to that of the DTH 31 relay.

The DTTM 11/DTTM 12 are similar in operation to DTH 31/DTH 32 respectively.

Technical data

Current ratings

1A or 5A at 50 Hz.

Settings

Operate

The relay operates when differential current exceeds 15% relay rated current (fixed).

Bias

The bias setting is adjustable to 15%, 30% or 45% by plugboard taps.

Thermal ratings

The relay will withstand twice rated current continuously, 40 times rated current for 3 s and 100 times rated current for 1 s. Limiting value is 170 times rated current. The limiting value must not be exceeded and can be withstood for a maximum period of 0.25 s.

Operating time

The relay operating time for differential currents in excess of twice rated current is typically about 45 ms.

Harmonic restraint

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

Burdens

DTH 31/DTTM 11

0.33VA per phase at rated current – 1A relay.

1.0VA per phase at rated current – 5A relay.

DTH 32/DTTM 12

0.39VA per phase at rated current – 1A relay.

1.2VA per phase at rated current – 5A relay.

Highset

DTH 31/DTH 32

The highset circuit operates when the differential current exceeds 10 times the rated current.

DTTM 11/DTTM 12

8, 10, 12, 14, 16 x rated current (recommended setting 10 x rated current).

Contacts

Two pairs of normally open self reset contacts rated to make and carry 7500VA for 0.5 s, with maxima of 30A and 660V.

Auxiliary supply

30, 110/125, 220/250V dc.
Relays for use on 110/125 or

220/250V are supplied with suitable external resistors.

CT requirements

Star connected and delta connected current transformers must have a knee-point voltage given by:

$$V_k = 40 I (R_{CT} + 2 R_L)$$

where V_k = Current transformer knee-point voltage (V).

I = Relay rated current (A).

R_{CT} = Resistance of CT secondary winding (Ohms).

R_L = Resistance of each pilot from the relay to the CTs (Ohms).

Magnetising current

Less than $0.03 \times I$ at $V_k/4$

Operation indicators

Independent flags for differential and highset are provided on types DTTM 11 and DTTM 12, common flag indicator for DTH 31/DTH 32.

Insulation

The relay meets the requirements of IS 3231/IEC 255-5 series C- 2 kV for 1 minute.

Impulse voltage

The relay complies with the requirements of IS 8686/IEC 255-4, Appendix E to class III.

High frequency interference

The relay complies with IS 8686/IEC 255-22-1 Appendix C to class III.

Case

Relays are supplied in drawout case suitable for flush mounting and are finished eggshell black and tropicalised. The drawout feature considerably simplifies maintenance and permits testing to be carried out easily and quickly. A cradle mounted isolating switch is provided which automatically isolates the trip circuit when the cradle assembly is withdrawn from the case for maintenance. This prevents any inadvertent tripping of the circuit breaker. The case is fitted

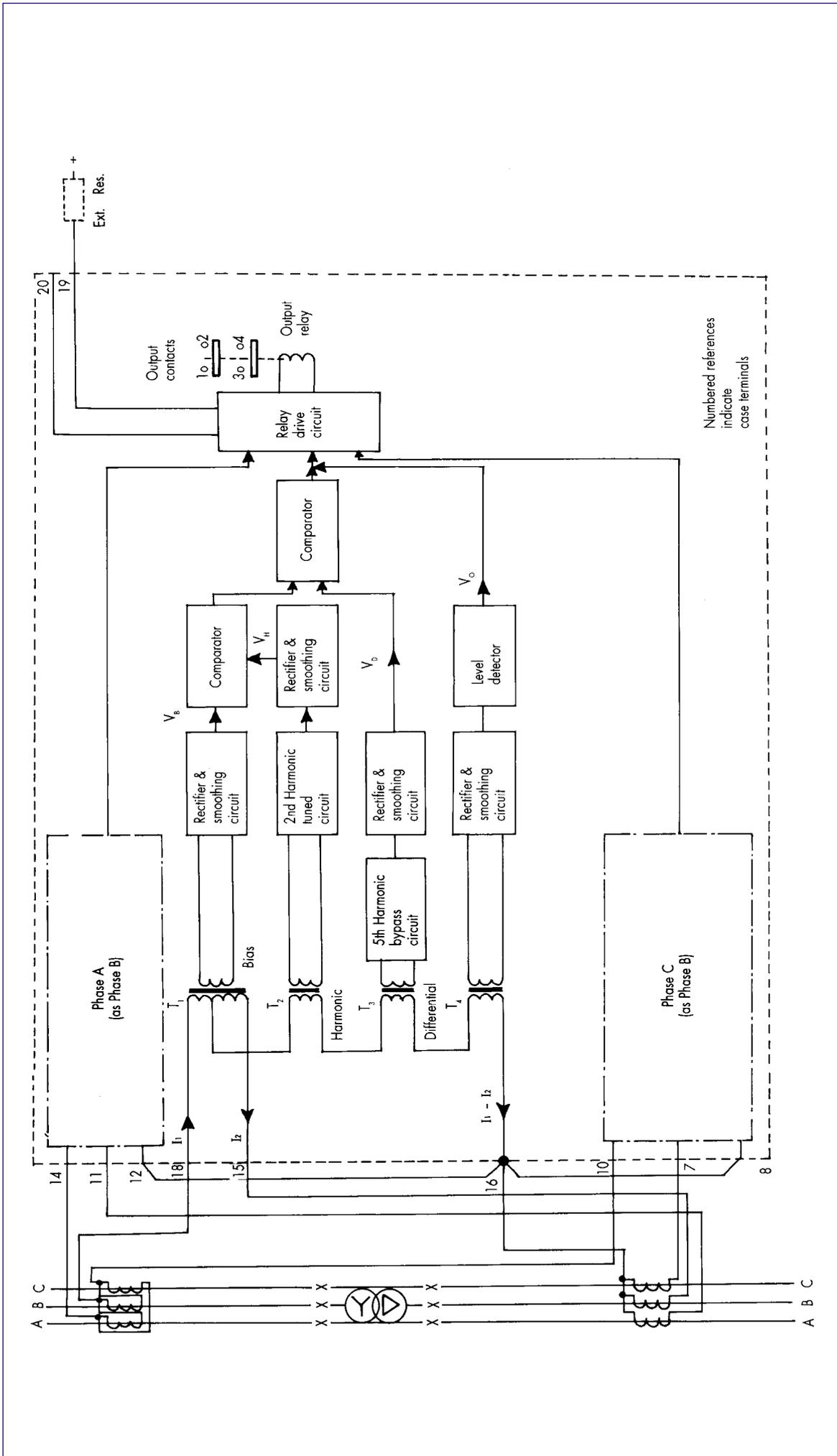


Figure 1:
Block schematic diagram of DTH 31

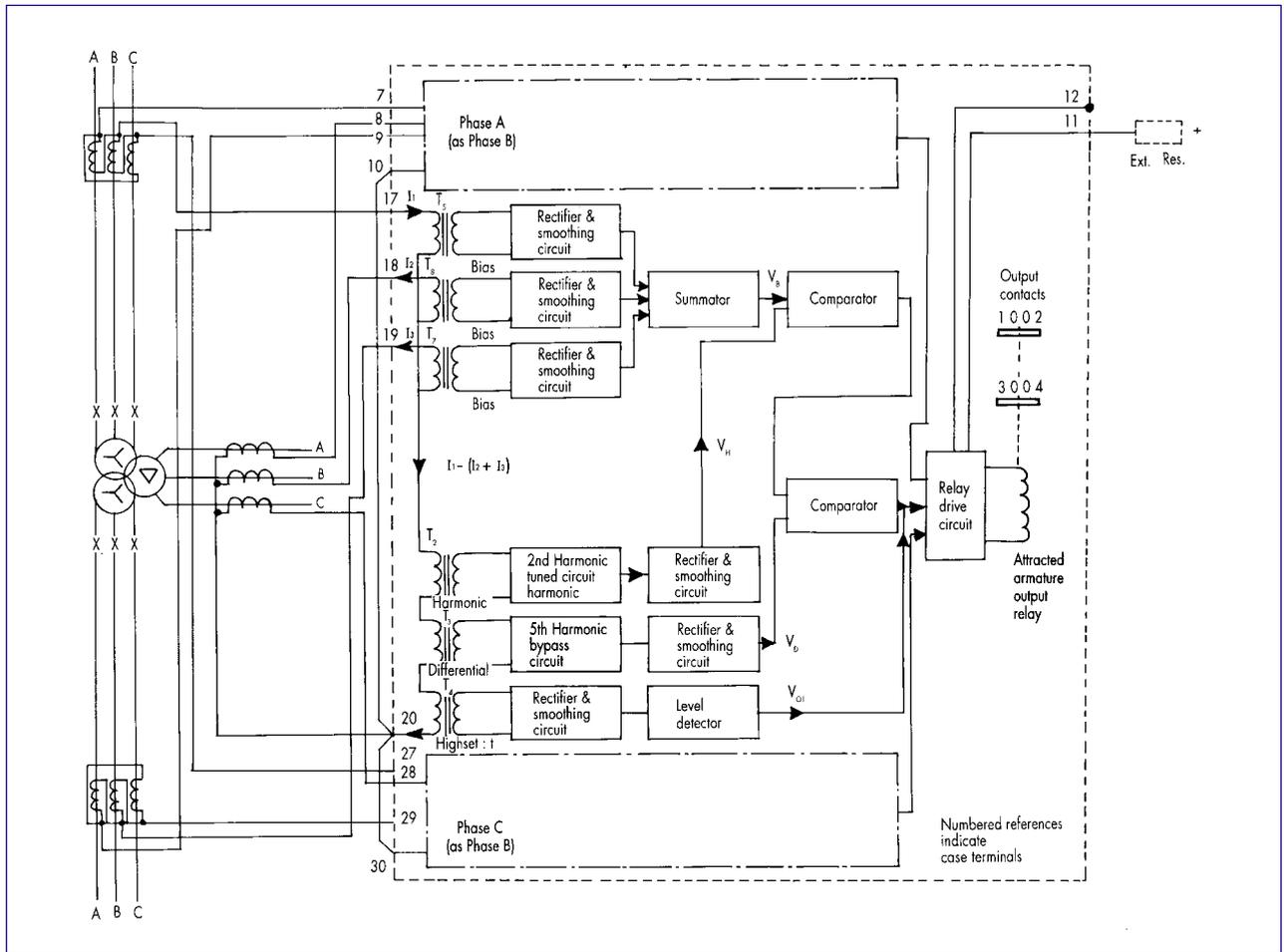


Figure 2:
Block schematic diagram of DTH 32

Dimensions and weights

Relay	Case size	Maximum overall dimensions			Approximate gross weight (Kg.)
		Height (mm)	Width (mm)	Depth (mm)*	
DTH 31	3D Vert.	524	170	203	15
DTH 32	3D Hor.	233	454	203	16
DTTM 11	1½D Vert.	362	170	203	8.3
DTTM 12	1½D Vert.	362	170	203	8.3

* Add 76 mm for maximum length of terminal studs, alternatively, 29 mm for terminal screws.

The approximate gross weights given above are inclusive of cartons, mounting appendages and terminal details.

The relays comply fully with the requirements of IS 3231 and are suitable for use in normal tropical environments.

with CT shorting switches which prevent open circuiting of the CT circuits on withdrawal of the relay unit from the case. A filter breather is fitted which equalises pressure inside and outside the case without admitting dust.

DTH 31 and DTH 32 relays are mounted in 3D vertical and 3D horizontal cases respectively.

DTTM 11 and DTTM 12 relays are mounted in 1½D vertical cases.

Information required with order

1. Differential relay type
DTH 31/32
DTTM 11/12
2. Relay current rating
3. Auxiliary voltage



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