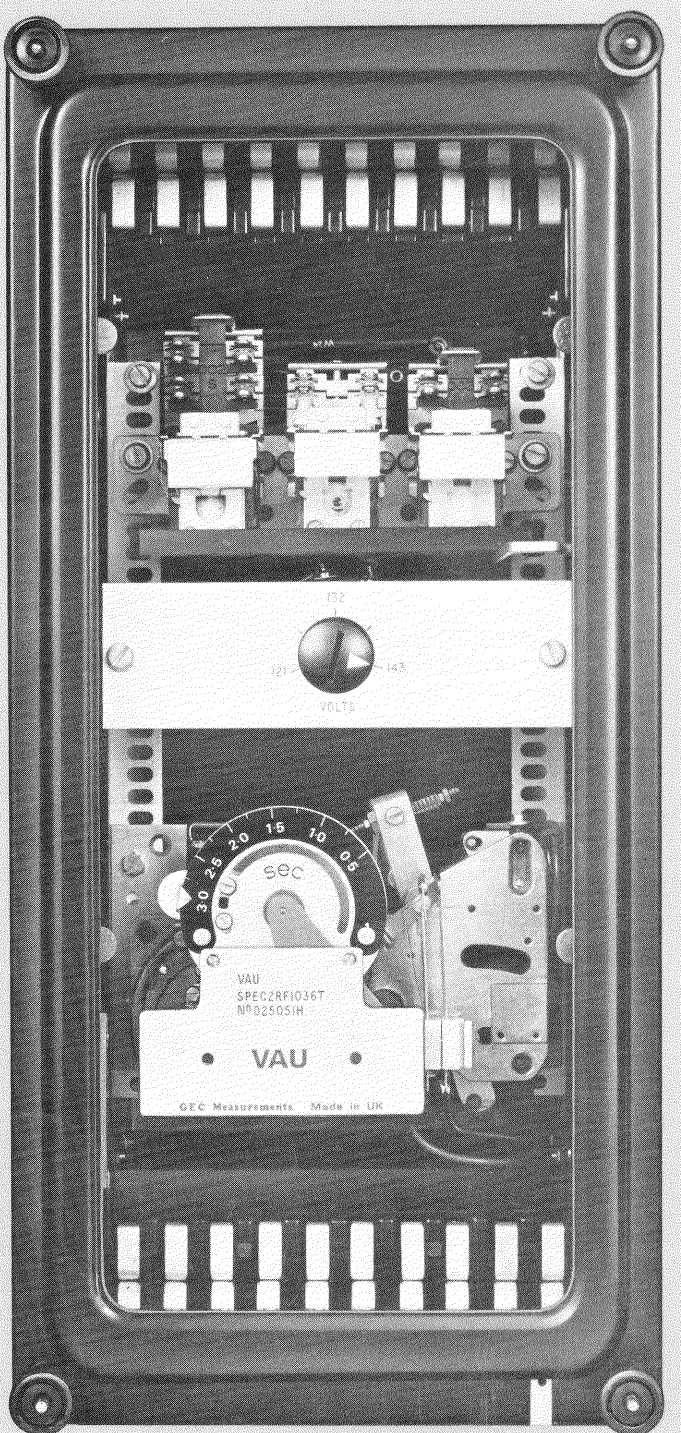
GEC Measurements

# Types VAG and VAU

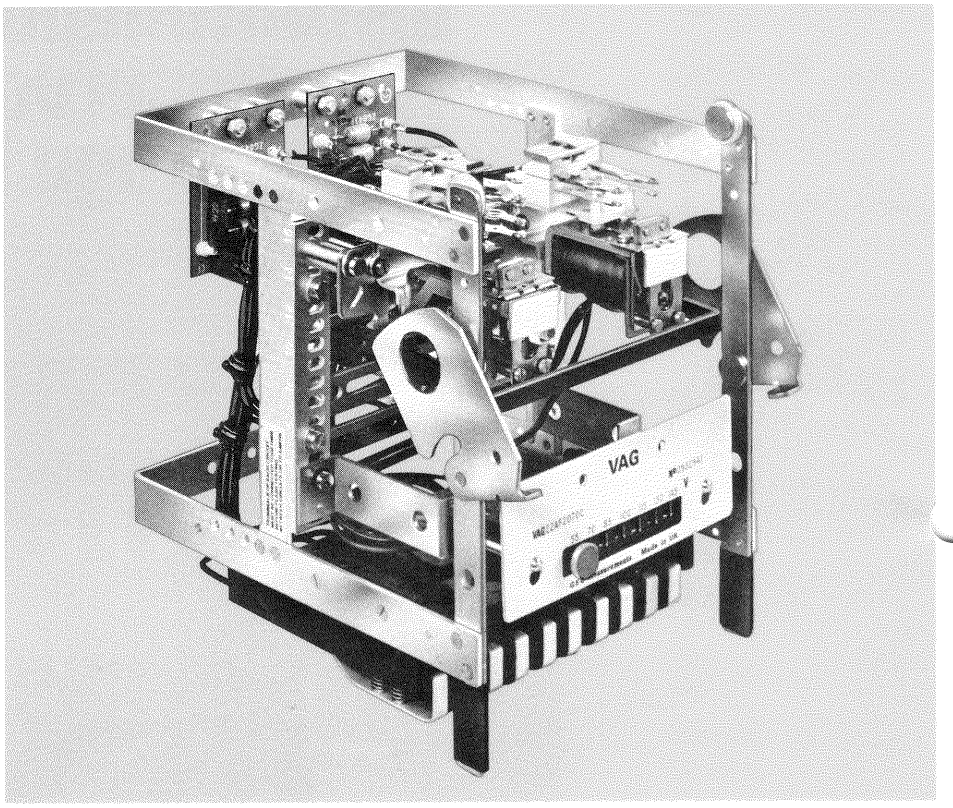
# Instantaneous and Definite Time Undervoltage and Overvoltage Relays



# Types VAG and VAU

## FEATURES

* Versatile design
* High speed operation
* Compact construction
* High contact ratings
* Resistant to mechanical shock




## APPLICATION

The VAG relays are applied for instantaneous overvoltage and undervoltage protection of plant and feeder systems. Type VAU relays are similarly applied when a definite time delay is required in addition to voltage measurement.

## CONSTRUCTION AND OPERATION

The relays are based on attracted armature elements of robust construction providing positive action without chatter. When required these elements may be provided with a hand reset indicator.

Undervoltage relays have a calibrated drop-off setting and overvoltage relays a calibrated pick-up setting.

When auxiliary relays are fitted they will normally be energised by means of a measuring element contact when the measuring element operates. If a mechanical indicator is required it will be fitted to the auxiliary element in preference to the measuring element.

### Type VAG11

Overvoltage and undervoltage relays with a fixed single setting. They are suitable for operation from d.c. or, when a rectifier is fitted, from a.c.

A typical circuit diagram is shown in Figure 1.

### Type VAG12

Overvoltage and undervoltage relays with seven adjustable settings, provided either by a series of tapped resistors, or, for some a.c. operated relays, by a tapped autotransformer. As for the type VAG11 relay, only two pairs of contacts are provided as standard. The arrangements for providing multiple settings by means of tapped resistors and tapped autotransformer are shown in Figures 3 and 5 respectively.

### Type VAG21

This type comprises a VAG11 single setting element for measuring overvoltage or undervoltage, plus an auxiliary VAA element used to provide an overall drop-off/pick-up setting ratio of 90%, the principal distinguishing feature of this relay type.

As shown in Figure 2, the auxiliary element is initiated by the VAG measuring element and has a contact which is used to introduce an additional resistor in series with the measuring element after operation. This lowers the current in the latter, so raising its inherent drop-off/pick-up ratio to an effective value of 90%.

of this type use the VAG12 measuring element, providing multiple settings, but also have an auxiliary VAA element to give an effective drop-off/pick-up setting ratio of 90%.
The simple technique used in the type VAG21 for obtaining this ratio is not feasible in the arrangement for providing multiple settings by means of a series of tapped resistors. Instead a contact of the VAA follower element is used to short-circuit a portion of the VAG measuring element coil, as shown in Figure 3.

By careful design, this de-sensitises the measuring element after operation just sufficiently to raise the effective drop-off/pick-up setting ratio to 90%.

For those relays which are provided with multiple settings by means of a tapped autotransformer, the technique of introducing additional series resistance after operation to obtain a 90% drop-off/pick-up ratio is applicable, as shown for the measuring element circuit in Figure 5.

### Type VAG31

Triple pole version of the VAG11 relay.

### Type VAU

Type VAU relays each include a time delay element, type VAT, in addition

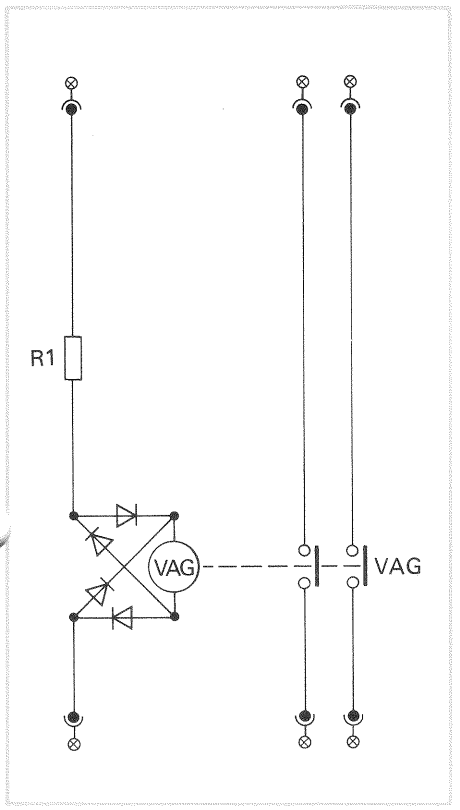



Figure 1 TYPICAL CIRCUIT DIAGRAM FOR VAG11 OVERVOLTAGE RELAY
For a.c. voltage measurement. The bridge rectifier is omitted in relays designed for d.c. supplies.

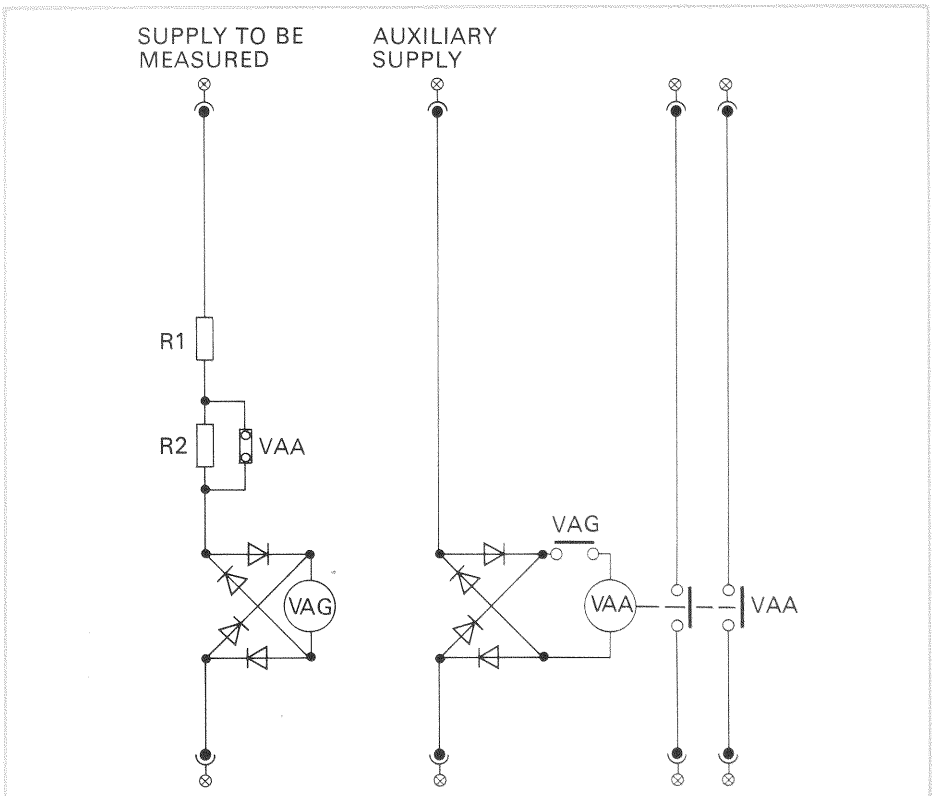


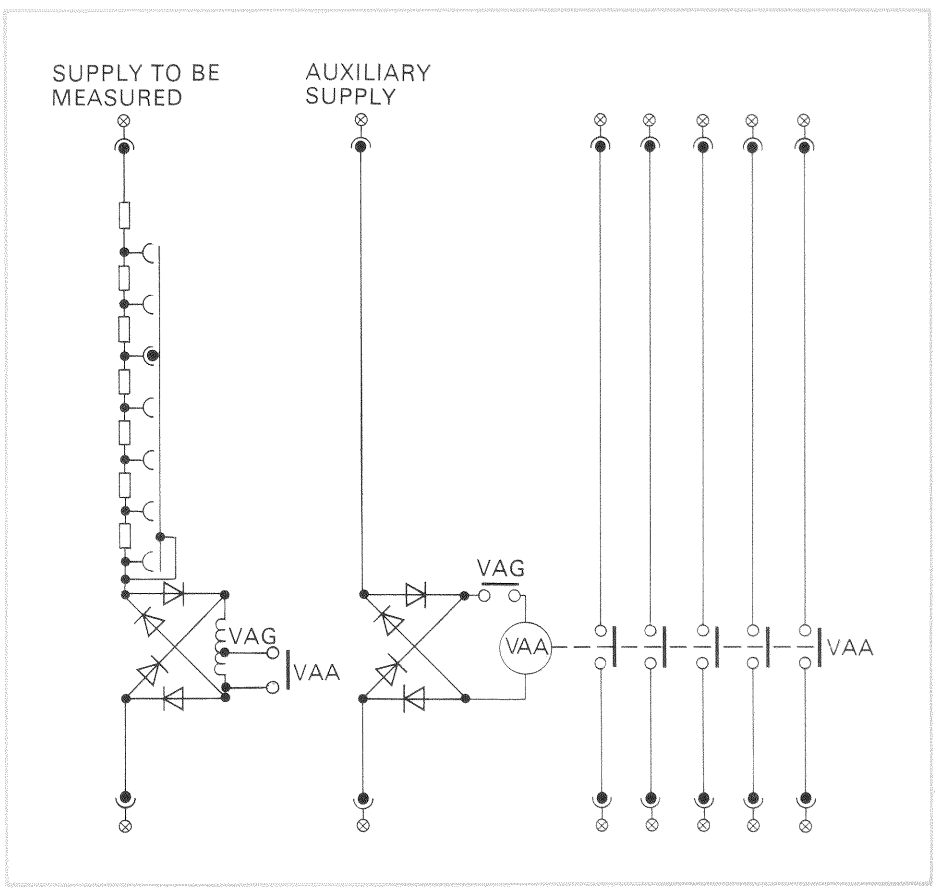

Figure 2 TYPICAL CIRCUIT DIAGRAM FOR VAG21 OVERVOLTAGE RELAY
For a.c. voltage measurement and auxiliary supplies. The respective bridge rectifier is omitted in relays designed for d.c. supplies.

definite time overvoltage and undervoltage relays.

Table 1 shows in summary the features corresponding to each relay type designation. The time delay element may be energised from a d.c. supply, or from an a.c. supply for which it is fitted with an internal bridge rectifier.

The timing element contains an electromagnet which charges the driving spring through 180 degrees via a simple cam system. The driving spring is mounted on the main shaft which carries a calibrated circular scale and two adjustable contact operating arms. As the spring rotates this shaft, rollers on each of the arms operate the two pairs of contacts. Each of these contact operating arms is independently adjustable to give either the same setting or one passing and one final time setting.

The time is accurately regulated by a copper cup which rotates in the strong magnetic field of a totally enclosed brake magnet and is geared to the main shaft. By using different gear ratios various time ranges can be



## Contacts

The specified contact arrangements are basically the standard arrangements available.

For applications requiring either more contacts, or hand reset contacts or heavier duty contacts with magnetic blow-out feature, it is generally possible to supply these relays on request, fitted with an extra auxiliary follower element to provide the particular contact arrangement.

Provision of such an element, which has no measurement function, does not alter the basic type designation for the overall relay.

When an extra follower element is required it should be noted that:

* one of the contacts available for external use in the standard relay, may have to be used to initiate the follower element
* the case required for such an arrangement may have to be larger than those described for the standard relay designs.

In some instances it is possible to provide an instantaneous element contact, as well as the time delayed element contacts, for external use, as shown for example in Figure 4.

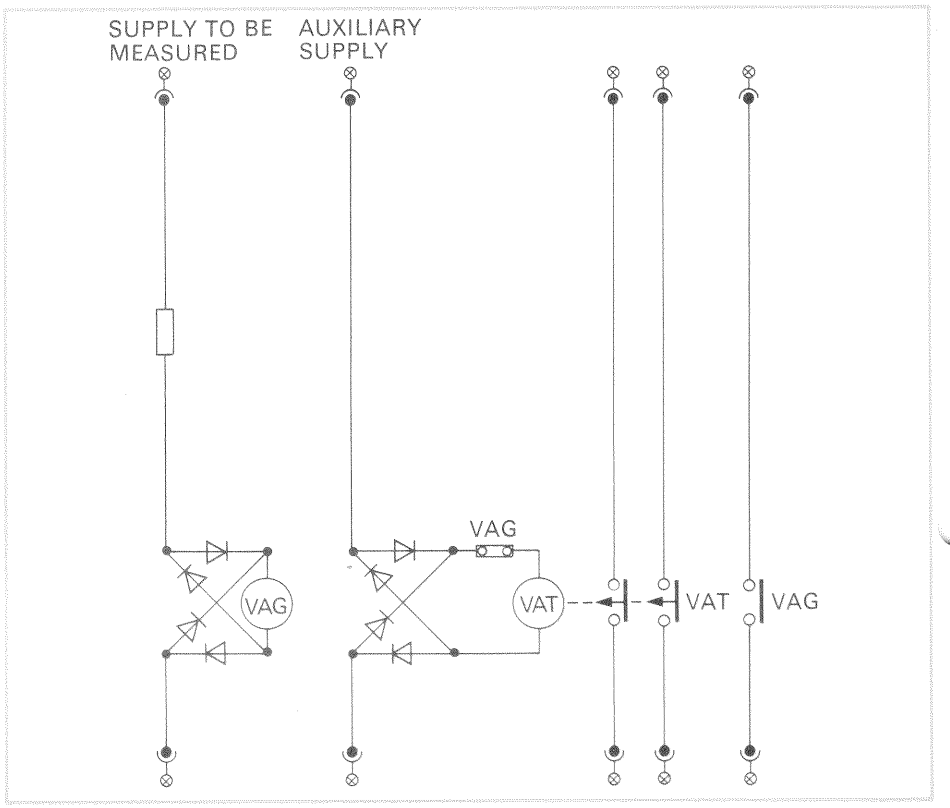



Figure 4 TYPICAL CIRCUIT DIAGRAM FOR VAU21 DEFINITE TIME UNDERVOLTAGE RELAY
For a.c. voltage measurement and auxiliary supplies.
The respective rectifier is omitted in relays designed for d.c. supplies.

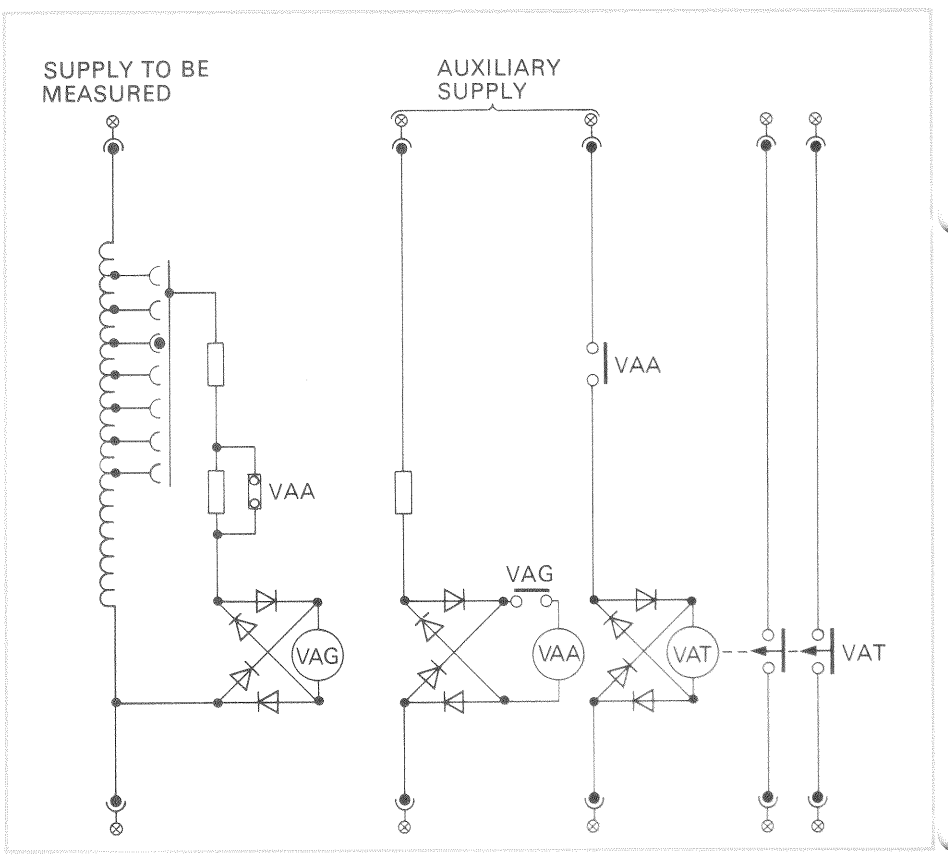



Figure 5 TYPICAL CIRCUIT DIAGRAM FOR VAU22

## TECHNICAL DATA

### Ratings

| | |
|---|---|
| Measured voltage (Vn): | d.c.: 30, 110, 125, 220 or 250V<br>a.c.: 63·5, 66·4, 110, 115, 120, 220, 240, 250, 380, 400, 415 or 440V |
| Auxiliary voltage (Vx): | d.c.: 24, 30, 48/50, 110, 125, 220 or 250V<br>a.c.: 110, 240 or 440V |
| Frequency: | 50Hz or 60Hz |
| **Settings** (Vs) | The settings and setting ranges specified are standard, but other settings can be supplied on request.<br>For clarity the settings and setting ranges are specified in percentage values, but broadly equivalent settings calibrated in voltage can be supplied when required. |

| | | |
|---|---|---|
| VAG11 | | |
| Undervoltage: | Single drop-off setting: | within the range 25% to 63% Vn |
| | Resetting (pick-up): | nominally 90% Vn |
| Overvoltage: | Single pick-up setting: | within the range 110% to 140% Vn |
| | Resetting (drop-off): | within the range 30% to 70% Vs |
| VAG12 | | |
| Undervoltage: | Setting range: | 30% to 60% Vn in 5% steps |
| | Resetting (pick-up): | nominally 90% Vn |
| Overvoltage: | Setting range: | 110% to 140% Vn in 5% steps |
| | Resetting (drop-off): | within the range 30% to 70% of selected Vs |
| VAG21 | | |
| Undervoltage: | Single drop-off setting: | within the range 63% to 80% Vn |
| | Resetting (pick-up): | nominally 90% Vn |
| Overvoltage: | Single pick-up setting: | within the range 110% to 140% Vn |
| | Resetting (drop-off): | nominally 90% Vs<br>Note: Minimum pick-up setting to ensure resetting at 105% Vn is 115% Vn |
| VAG22 | | |
| Undervoltage: | Setting range: | 50% to 80% Vn in 5% steps, or20% to 80% Vn in 10% steps |
| | Resetting (pick-up): | nominally 110% Vs, that is, nominally not greater than 90% Vn for all settings. |
| Overvoltage: | Setting range: | 110% to 140% Vn in 5% steps, or 110% to 180% Vn in 10% steps |
| | Resetting (drop-off): | nominally 90% Vs<br>Note: Using settings less than 120% Vn, the relay may not reset at Vn. |

| | |
|---|---|
| VAU | |
| Voltage measuring elements: | As for respective VAG element indicated in Table 1. |
| Time delay element: | 0·2 – 1·0s<br>0·5 – 3·0s<br>1·0 – 5·0s<br>2·0 – 10·0s } Alternative continuously adjustable<br>5·0 – 25s<br>10·0 – 60s<br>20·0 – 120s |

**Relay setting accuracy** ± 5%

**Operation time**

| | |
|---|---|
| VAG11 or 12 Undervoltage<br>VAG11 or 12 Overvoltage | 0·005 to 0·02 seconds at zero volts<br>0·06 seconds at 110% of setting voltage |
| VAG21 or 22 Undervoltage | 0·04 seconds or less when switching from rated voltage to at least 10% below setting |
| VAG21 or 22 Overvoltage | 0·07 seconds at 110% of setting voltage |
| VAU | The operating time is controlled by the time delay element settings. |

**Operation indicator** A hand reset indicator, which shows when an undervoltage or overvoltage condition (as appropriate) has been detected, can be fitted if required.

**Thermal withstand** Continuous

**Burdens**

Voltage measuring elements: The burden at rated voltage is dependent on the particular design and the setting. Relays include resistors in series with operating coils to reduce the total temperature co-efficient. Typical burdens are:

| | |
|---|---|
| Undervoltage elements | 1 to 5 watt |
| Overvoltage elements | 0·2 to 1 watt |

Auxiliary voltage elements:

| | |
|---|---|
| VAG21 and VAG22 | 3 watts d.c. or 3·5VA a.c. at rated voltage |
| VAU | 10 watts d.c. or 25VA a.c. at rated voltage |

**Contacts**

| | |
|---|---|
| VAG11 and VAG12 | 2 make, self-resetting, or<br>1 make plus 1 break self-resetting |
| VAG21 and VAG22<br>With d.c. auxiliary supply: | Up to 5 pairs, self-resetting, in any combination with maximum of 3 break type. |
| With a.c. auxiliary supply: | 3 make, self-resetting, or<br>2 make plus 1 break, self-resetting. |
| VAU | 2 pairs of time-delayed, self-resetting contacts, in any combination of make and break<br><br>Plus one instantaneous contact on VAG element<br>– break pattern if undervoltage relay<br>– make pattern if overvoltage relay |

**Contact rating**

For standard contacts

| | Make and carry continuously | Make and carry for 3 seconds | Break |
|---|---|---|---|
| a.c. | 1250VA with maxima of 5A and 660V | 7500VA with maxima of 30A and 660V | 1250VA with maxima of 5A and 660V |
| d.c. | 1250 watts with maxima of 5A and 660V | 7500 watts with maxima of 30A and 660V | 100 watts (resistive)<br>50 watts (inductive)<br>with maxima of 5A and 660V |

The break rating for a break contact on the VAG measuring element or the VAT timing element is half that given in the above table and subject to a maximum of 440V.

**Insulation**

## CASES

Relays are supplied in moulded non-drawout (N type) or drawout (D type) cases available for flush or projecting mounting, finished phenolic black as standard.

Standard relays are finished to BS2011/20/040/04 and are satisfactory for normal tropical use. Relays for use in exceptionally severe environmental conditions can be finished to BS2011/20/050/56 at extra cost.

## INFORMATION REQUIRED WITH ORDER

Relay type
Rated measured voltage
Rated auxiliary voltage
Operating voltage or setting range (% or V)
Time delay setting range (VAU)
Contact arrangement
Operation indicator – if required
Case type, size and mode of mounting

| Instantaneous relay type | No. of poles | Features | | | Relay type reference when time delay element included |
|---|---|---|---|---|---|
| | | Single setting | Multiple settings | 90% D.O./P.U. | |
| VAG11 | 1 | ● | — | — | VAU21 |
| VAG12 | 1 | — | ● | — | VAU22 |
| VAG21 | 1 | ● | — | ● | VAU31 |
| VAG22 | 1 | — | ● | ● | VAU32 |
| VAG31 | 3 | ● | — | — | VAU41* |

* Uses single time delay element, common to all three measuring elements

Table 1 KEY TO PRINCIPAL RELAY VERSIONS

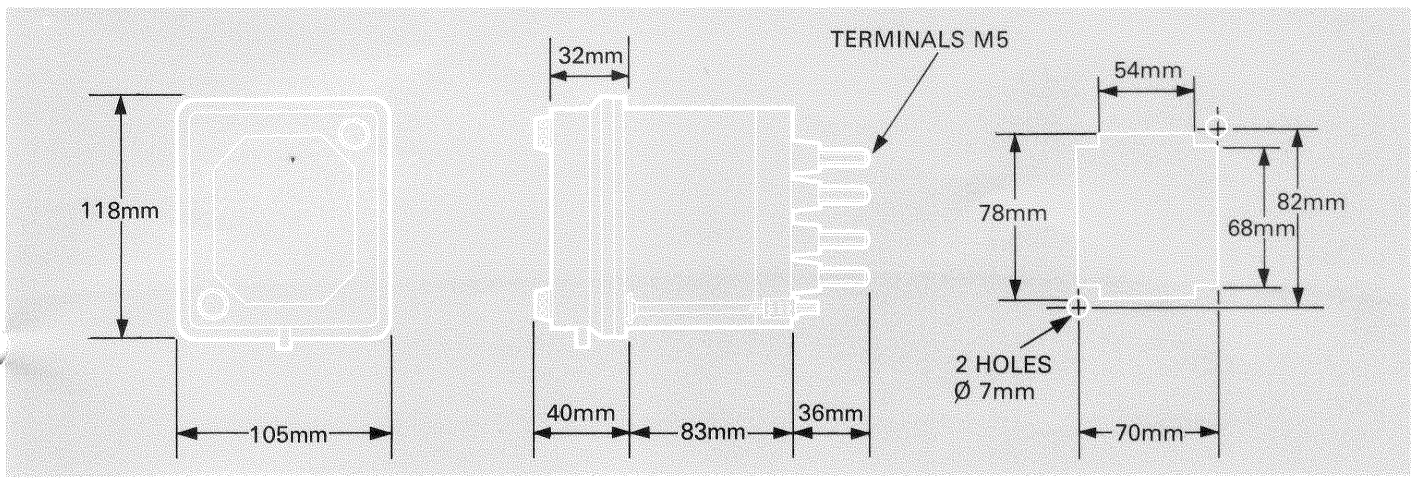
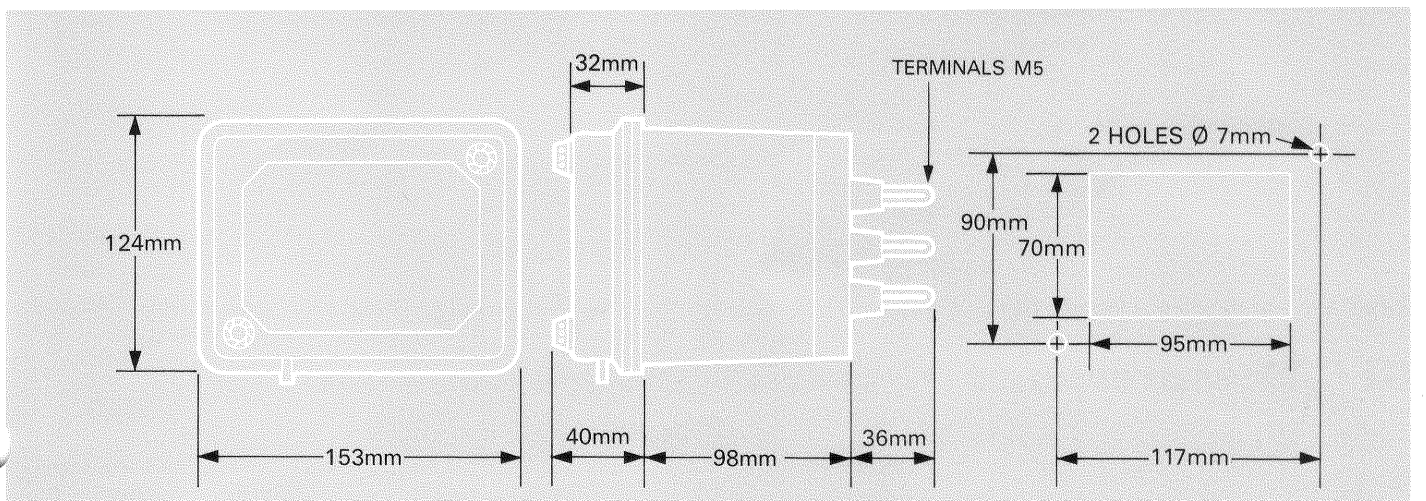



Figure 6 ½N CASE – VAG11 and 21 ONLY



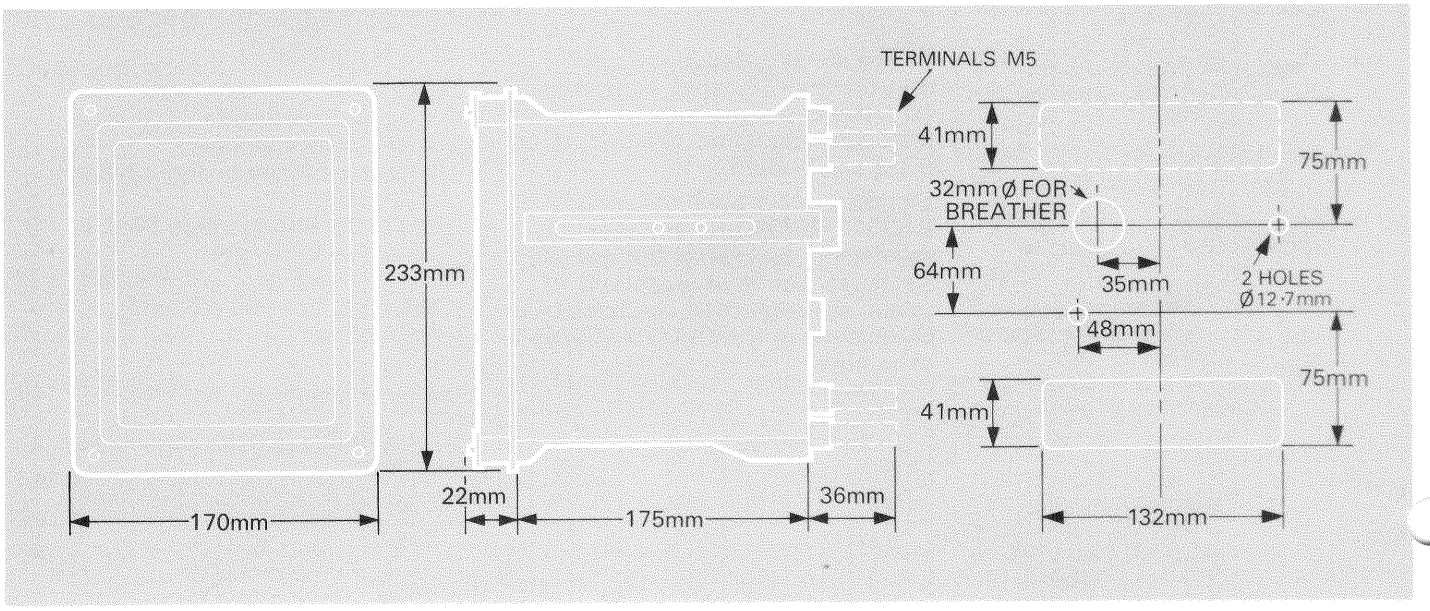



Figure 8 1D CASE

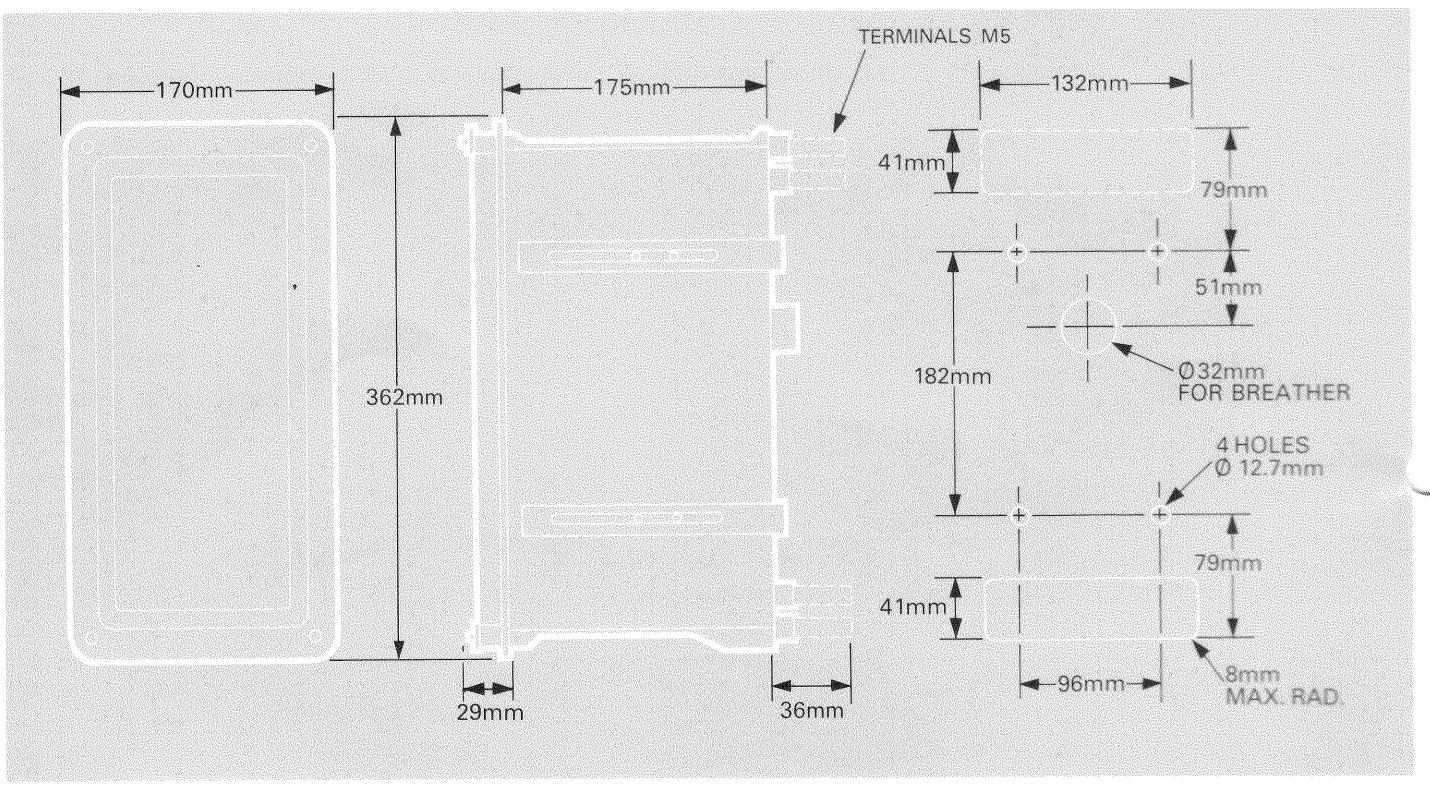



Figure 9 1½D CASE

Our policy is one of continuous product development and the right is reserved to supply equipment which may vary slightly from that described.

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