Service Manual R8062
Type MYTU

Field Failure Relay

GEC ALSTHOM

T&D

Section 1 DESCRIPTION

The MYTU relay detects the loss of field supply or reduction in the field current of a synchronous generator beyond the machine stability limit.

It is basically a single phase mho relay with off-set adjustment (See Fig.1). A built in timer enables the relay to be co-ordinated with other devices and to avoid the possibility of maloperation on synchronisation surges.

Four changeover contacts are available, two with the set time delay and two without. An led provides indication of operation of the time delayed contacts.

Pressing a test button causes the contacts to operate at the appropriate time and the led is also lit after the set time delay.

The contacts are self reset and the led is made to reset via a push button.

Section 2 INSTALLATION

2.1 Protective relays, although generally of robust construction, require careful treatment prior to installation and a wise selection of site. By observing a few simple rules the possibility of premature failure is eliminated and a high degree of performance can be expected.

2.2 The relays are despatched, either individually or as part of a panel/rack mounted assembly, in cartons specifically designed to protect them from damage.

Relays should be examined immediately they are received to ensure that no damage has been sustained in transit. If damage due to rough handling is evident, a claim should be made to the Transport Company concerned immediately and GEC ALSTHOM PROTECTION & CONTROL should be promptly notified. Relays which are supplied unmounted and not intended for immediate installation should be returned to their protective polythene bags.

2.3 Care must be taken when unpacking and installing the relays so that none of the parts are damaged or their settings altered and must only be handled by skilled persons.

Relays which have been removed from their cases should not be left in situations where they are exposed to dust or damp. This particularly applies to installations which are being carried out at the same time as constructional work.

2.4 If relays are not installed immediately upon receipt they should be stored in a place free from dust and moisture in their original cartons and where de-humidifier bags have been included in the packing they should be retained. The action of the de-humidifier crystals will be impaired if the bag has been exposed to damp ambient conditions and may be restored by gently heating the bag for about an hour prior to replacing it in the carton.

Dust which collects on a carton may, on subsequent upacking, find its way into the relay; in damp conditions the carton and packing may become impregnated with moisture and the de-humidifying agent will lose its efficiency.

The storage temperature range is -25°C to +70°C.

2.5 The installation should be clean, dry and reasonably free from dust and excessive vibration. The site should preferably be well illuminated to facilitate inspection.

An outline diagram is normally supplied showing panel cut-outs and hole centres. For individually mounted relays these dimensions will also be found in publication R-6062.

Publication R-7012 Parts Catalogue and Assembly Instructions.will be useful when individual relays are to be assembled as a composite rack or panel mounted assembly.

Publication R-6001 is a leaflet on the Modular Integrated Draw-out System of protective relays.

Publication R-6014 is a list of recommended suppliers for the pre-insulated connectors.

Section 3 APPLICATION AND SELECTION OF SETTINGS

The satisfactory application of the MYTU field failure relay requires a full knowledge of the operating parameters of the machine during normal operating conditions. The maximum rotor angle at which the machine can operate within the stability limit, and whether the machine has been designed for operation under line charging conditions, that is leading power factors, are required. Once the operating conditions of the machine have been established, it is possible to determine the required offset and circle diameter for the circular characteristic of the relay from a knowledge of the machine transient and synchronous reactances.

The general practice is to use an offset setting Z1 (See Figure 1(a) equal to half the machine transient reactance (Xd')/2 and a circle diameter Z2–Z1 (See 2 Figure 1(a) equal to the synchronous reactance of the machine (Xs) for rotor angles up to 90°, and when the machine cannot be operated at leading power factors. Nevertheless when the machine has been designed to operate at leading power factors and it is provided with high speed, fast acting voltage regulators that permit the operation of the machine at rotor angles up to 120°, the above settings are modified to three quarters of the machine transient reactance 3(Xd')/4 for the offset and half the machine synchronous reactance (Xs)/2 for the circle diameter.

The following worked example indicates the method to be used in estimating the required relay settings. The characteristics of the machine to be used are as follows:

Voltage	:	11kV 3 phase 50Hz
Output	:	30 MVA 0.8 power factor
Machine transient reactance Xd'	:	19%
Machine synchronous reactance	:	200%
Current transformer ratio	:	1500/5
Voltage transformer ratio	:	11000/110

3.1 Typical relay settings

(i) For rotor angles up to 90° and no leading power factors

Offset = Xd'/2 Circle diameter = Xs

(ii) For rotor angles up to 120° and leading power factors

Offset = 3(Xd')/4 Circle diameter = Xs /2

Relay to be set for condition (i) above.

3.2 Offset setting

Machine transient reactance Xd' in secondary is

$$\frac{19 \times 11^2}{100 \times 30} \times \frac{1500/5}{11000/110} = 2.3\ \Omega$$

Required offset setting = Xd'/2 = 2.3/2 = 1.15Ω

Relay setting Z1 represents the required offset setting and is given by:

Equation 1

Z1 = K1 x K2 x K3 Ω

The range of K1,K2 and K3 switch settings are as follows:

$$K1 = \frac{3.75 + \Sigma}{In}\ \Omega$$

Where In = relay rated current and Σ = summation of selected values for 0, 0.25. 0.5, 1, 1, 2,5, 5, 10, 10, 25, & 50.

K2 = –1 or +1

K3 = 0 or 1

For field failure protection, the mho circle should lie on the negative X axis on the XR diagram. Therefore set K2 = +1

An offset setting is required on the mho circle to prevent relay operation during power swing conditions. Therefore set K3 = 1

Set the single DIL switch to the left hand position to select the full mho circle instead of the cut-off characteristic.

The recommended characteristic for field failure applications is therefore as shown in Figure 1a

Substituting K2 = +1 & K3 = 1 in equation 1 gives K1 = Z1 = 1.15 Ω

Set K1 to the nearest ohmic value above the required setting of 1.15 ohms

But $K1 = \frac{3.75 + \Sigma}{In}$

therefore set Σ > (K1 x In) – 3.75 > 1.15In – 3.75 > 2

Select values 1 & 1 on the K1 DIL switches to achieve Σ = 1 + 1 = 2

therefore selected K1 setting $= \frac{3.75 + \Sigma}{In} = \frac{3.75 + 2}{5} = 1.15$

and selected Z1 setting = K1 x K2 x K3 = 1.15 x 1 x 1 = 1.15Ω

3.3 Circle diameter setting

Machine synchronous reactance Xs in secondary ohms:

$$= \frac{200 \times 11^2}{100 \times 30} \times \frac{1500/5}{11000/110} = 24.2\ \Omega$$

Required circle diameter = Xs = 24.2Ω

Relay setting (Z2 - Z1) represents the required circle diameter setting, therefore set $Z2 - Z1 = 24.2\Omega$

ie. $Z2 = 24.2 + Z1 = 24.2 + 1.15 = 25.35\Omega$

The setting for Z2 is determined by a column of DIL switches in accordance with the expression:

$$Z2 = \frac{10 + \Sigma}{In} \text{ ohms}$$

where Σ = summation of selected values for 0, 0.625, 1.25, 2.5, 5, 10, 10, 25, 50, 100 & 100.

Set Z2 to the nearest ohmic value above the required setting of 25.35 Ω.

ie. set $= 25.35\ In - 10 = 116.75\Omega$

Select the values 100, 5 & 0.625 on the Z2 DIL switches to achieve

$= 100 + 10 + 5 + 1.25 + 0.625 = 116.875\ \Omega$

Therefore the selected Z2 setting $= \frac{10 + \Sigma}{In}$

$$= \frac{10 + 116.875}{5} = 25.375\Omega$$

and selected circle diameter setting = $Z2 - Z1 = 25.375 - 1.15 = 24.225\ \Omega$

3.4 Time delay setting

The relay is normally set to operate after a time delay (t) to avoid maloperation due to synchronous surges and transient conditions. The time delay must also be shorter than the thermal limits of the rotor and stator windings.

A typical setting of 5 seconds is normally applied. This will vary with different applications depending on machine parameters and the nature of the external network.

Section 4 COMMISSIONING

4.1 Commissioning preliminaries

4.1.1 Electrostatic discharge

The relay uses components which are sensitive to electrostatic discharges. When handling the withdrawn module, care should be taken to avoid contact with components and electrical connections. When removed from its case for storage the module should be placed in an electrically conducting anti-static bag.

4.1.2 Inspection

Carefully examine the module and case to see that no damage has occurred during transit.

Check that the relay serial number on the module, case and cover are identical.. Also check that the rating information is correct for the system.

4.1.3 Wiring

Check that the external wiring is correct to the relevant relay diagram and/or scheme diagram. The relay external connection diagram number is given on the rating label inside the case.

If a test block type MMLG is provided, the connections should be checked to the scheme diagram, particularly that the supply connections are to the live side of the test block (coloured orange) and with odd terminal numbers (1, 3, 5, 7 etc).

The auxiliary supply volts to the scheme are normally routed via test block terminals 13 and 15.

4.1.4 Earthing

Ensure that the case earthing connection, above the rear terminal block, is connected to the local earth bar.

4.1.5 Insulation tests

These tests may be done by the main plant contractor at an earlier date.

The relay and its associated wiring may be insulation tested between :-

- all electrically isolated circuits
- all circuits and earth.

An electronic or brushless insulation tester should be used giving a dc voltage not exceeding 1000V. Accessible terminals of the same circuit should first be strapped together. Deliberate circuit earthing links removed for the tests must subsequently be replaced.

4.2 Commissioning tests

4.2.1 Equipment required

1 Double pole switch
1 Time interval meter
2 Variacs (1 suitable for 2x relay rated current)
1 Phase shifter giving 100 to 200V on the secondary side
1 Phase angle meter able to respond to currents from 0.2 to 2x rated current
1 Voltmeter
1 Ammeter
1 Variable resistor suitable for 2x rated current
(About 100 ohms for 1 amp relay or 20 ohms for 5 amp relay).

NOTE: For 5 amp relays a ct could be used to step up the current, with a 100Ω, 2A rated resistor being used.

4.2.2 Auxiliary supply

The auxiliary supply should be checked at terminals 17 (+ if dc) and 18 with the module removed. If a test block type MMLG is fitted the auxiliary supply may be routed through it.

Removal of the cover provides isolation of one connection. If the test plug type MMLB01 is to be used, the links to provide ct shorting must be in place before it is inserted.

Links can then be put on it to restore auxiliary supplies to the relay.

The scheme connection diagram must be referred to.

For supplies greater than 125V ac or dc an external regulating device can be used giving about 110V dc at the relay.

Alternatively an MSTZ which has a nominal output of 30V dc for dc inputs up to 250V may be used.

4.2.3 Test feature

Set the time delay setting to about 1 second. Check that pressing the test push button causes the trip led to light after about one second and that the instantaneous and time delayed contacts operate correctly. (See Figure 2). Set the time delay to the minimum setting.

4.2.4 Characteristic checks

The relay should now be connected to the test circuit, as shown in Figure 3, taking care to note the correct connections of the phase angle meter.

It should be noted that although the relay has a characteristic as given in Figure 1(a) in terms of system primary impedances, the relay itself has a circular characteristic impedance located on the resistive (unity power factor) axis as shown in Figure 4, in terms of voltage and current being applied to the relay terminals.

The required impedance settings should now be put on the relay as described in Section 3. The small switches are set to the left or right to select required numbers or functions. Σ is the sum of selected numbers in a particular formula. Set the time delay 't' to the minimum of 0.5s by selecting all switches to the right.

If the characteristic with a cut off on the circle is to be used it should not be selected yet.

4.2.4.1 To check Z2 setting.

With the rated dc (or ac) auxiliary supply switched on, apply rated volts and rated current to the relay. Adjust the phase shifting transformer as necessary to make the voltage and current in phase. Reduce the current to zero and reset the relay. Slowly increase the current until the relay first operates, but do not exceed the current rating of the load resistor (2 x rated I) or the continuous rating of the relay (3 x rated I). At the point of operation of the relay, note the voltage and current.

Calculate the applied impedance $\frac{V}{I} \times \frac{1}{\sqrt{3}}$

This should be within ±10% of the relay Z2 setting under commissioning test conditions. Check that when the current is reduced by 5% from that recorded, the relay can be reset. It should be noted that when the current is at a low value, the applied impedance is on the resistive axis but beyond the impedance setting of the relay.

With reference to Figure 4, as the current is increased, the impedance travels towards the point of origin, passing through point A, until the relay operates at point B. If the relay has a Z2 setting below 35Ω(1A relay) or 7Ω(5A relay), operations may not be obtained at 110V and 2 x rated current. With 2 x rated current applied, the voltage should now be reduced until the relay operates. If the relay cannot be made to operate, the 'in phase' of voltage and current should be checked and the polarity of the phase angle meter and test connections affirmed. Applying an impedance of say 80% of the Z2 setting, and rotating the phase shifting transformer through a full 360°, will help determine the position of the circle relative to the test circuit and phase angle measurement.

4.2.4.2 To check the relay characteristic angle (RCA)

The K2 switch should be in the standard application '+1' position for this test. Reduce the voltage approximately 10% less than that required for relay operation in Section 4.2.2.1. above. The impedance presented to the relay is now at position C in Figure 4. With the voltage and current kept constant, rotate the phase shifter transformer until the relay contacts open. Press the relay reset. Slowly rotate the phase-shifter back until the relay just re-operates (point C1 or C2 in Figure 4). Note the phase angle between the current and voltage. Continue rotating the phase shifter in the same direction, passing through the 'in phase' condition, until the relay contacts re-open and it can be reset. Creep back with the phase shifter until the relay once again just operates. Note the new phase angle. Record the I leading V angle as $\varnothing_1$ and I lagging V angle as $\varnothing_2$. The mean of these two angles should be within ±5° of 0° (the in-phase condition).

4.2.4.3 To check the Z1 setting

a) Standard field failure characteristic (Figure 1(a) relative to system).

Ensure K2 = +1 and K3 = 1

Apply rated volts and rated current to the relay and adjust the phase shifter until they are both in phase. Decrease the current to zero and reset the relay. Increase the current until the relay just operates as in Section 4.2.4.1. The impedance applied to the relay is now at point B in Figure 4.

Increase the current up to the maximum of 2 x or 3 x rated I, as dictated by the load resistor or relay continuous rating, or until the relay contacts open and can be reset. If necessary, reduce the voltage, decreasing the impedance until the relay can be reset. The impedance is now within the 'offset' as at point D in Figure 4.

Either increase the voltage slowly, or decrease the current, increasing the impedances, until the relay just operates. The impedance is now at point E in Figure 4. Note the voltage and the current.

Calculate the applied impedance $\frac{V}{I} \times \frac{1}{\sqrt{3}}$

which should be within ±10% of the relay Z1 setting under commissioning test conditions.

From the point of pick up, decrease the voltage by 5%. The relay should now drop off and be capable of being reset.

(b) Alternative relay application with no offset

K3 = 0 (since Z1 = K1.K2.K3, Z1 = 0)

With no offset, the relay will operate nominally for all impedances from 0 to the Z2 setting on the resistive axis when both current and voltage is in phase. The system characteristic is given in Figure 1(b).

Starting with both current and voltage in phase and at levels required in test 4.2.4.1 to determine the Z1 reach point, and with the output contacts being monitored, increase the current slowly to a maximum of preferably 3 x relay rated current. This reduces the impedance to the relay. The relay contacts should remain operated. Now reduce the voltage to say 10V, or even below, therefore applying a very low impedance to the relay, that approaches the intersection of the reactive and resistive axis. The relay should remain operative.

Adjust the phase shifting transformer so that the current leads (or lags) the voltage by more than 95°. Check that the relay drops off and can be reset. Rotate the phase angle from 90° lag through the 180° antiphase condition, through to 90° lead. Check that the relay remains inoperative through this 180° band.

If the 14° cut off characteristic is selected on the bottom switch (directly above the 'trip light emitting diode'), rotate the phase shifter back from the non-operate area until operation once again takes place. This should take place at 76° lead and lag, with a tolerance of ±5°. The relay contacts should reset when the angle is increased by typically 4° from the two measured pick-up angles.

(c) Alternative application but with a reverse looking offset

K2 = –1, K3 = 1.

The system impedance characteristic is now shown in Figure 1(c). Provided the circular characteristic is selected on the bottom switch (directly above the 'trip light emitting diode') the offset can be seen to extend above the resistive axis by the Z1 impedance setting. This can be checked on the test circuit as follows:

With rated I and rated volts applied to the relay, adjust the phase shifter until the current leads/lags the voltage by 180° (or reverse the connections to terminals 27 and 28 in order to maintain 0° on the phase angle indicator.)

Reduce the current to zero and reset the relay. Increase the current until the relay operates or to a maximum continuous rating of 2 x relay rated I (resistor) or 3 x rated current (relay). If necessary, reduce the voltage until operation is obtained.

Calculate the applied impedance $\frac{V}{I} \times \frac{1}{\sqrt{3}}$

which should be within ±10% of the Z1 reverse offset setting.

If a reverse offset is selected as above, but a 'cut off' characteristic is required, it is suggested that the Z1 reach point is first checked as above (Section c), before cut off selection. The current can then be doubled, or the voltage halved, to make the impedance applied half of the measured Z1 impedance. The relay is then operating strongly. When the directional 'cut-off' characteristic is now selected, the relay should be capable of being reset. The phase-shifter should be rotated (in both directions in turn) until the relay just operates. This should occur at nominally 76° lead and lag (104° from the condition above) with a tolerance of ±5%. The difference between pick up and drop off should be typically 4°.

4.2.4.4 Timing checks

Put the required time delay setting on the relay. Use one pole of the double pole switch to apply current and the other pole to start the time interval meter. Use the appropriate time delay contact to stop the timer. Apply a fault using rated current with the voltage in phase and of a value that gives a point well inside the characteristic. The times obtained should be within + 3% (or + 30ms if greater) of the set time. Take three timing shots to check for consistency. The reset time can be measured by arranging the time interval meter to start on removing the current and to stop when the relay contact opens. The time obtained should be less than 100ms.

Make sure the in service setting chart is completed.

4.2.4.5 System load checks

To enable this to be done the following temporary settings have to be put on the relay :

Z2 = maximum,ie. all switches to the left.
K1 = maximum,ie. all switches to the left.
K2 = −1 and K3 = 1.

The largest shaped characteristic possible has now been selected. Isolation of the trip contacts should be obtained. The time delay could be reduced for the check or an instantaneous contact monitored.

A load current of 30% or greater should be maintained for the following tests.

With the power factor of the machine lagging or at unity, the relay should not operate.

The excitation of the machine should be adjusted so that the power factor of load slowly changes to a leading power factor condition. The relay should operate when I leads V by nominally 14°, but with a realistic tolerance, when I leads V between 0 and 30° (between unity and 0.866 power factor).

If correct operation is not obtained, the connections to the vts and cts and relative polarities are suspect. A phase angle meter should be connected to the relay supplies as indicated in Figure 5. Care must be taken not to open-circuit the cts at any time. With the machine at unity power factor, the current into terminal 27 of the relay should lead the voltage applied to terminals 22/26 (relative to terminals 21/24) by 90°. If doubt exists as to the polarity of the phase angle meter, or relay, both can be checked by using the circuit given in Figure 6.

Restore the relay to its required settings and restore the trip circuit.

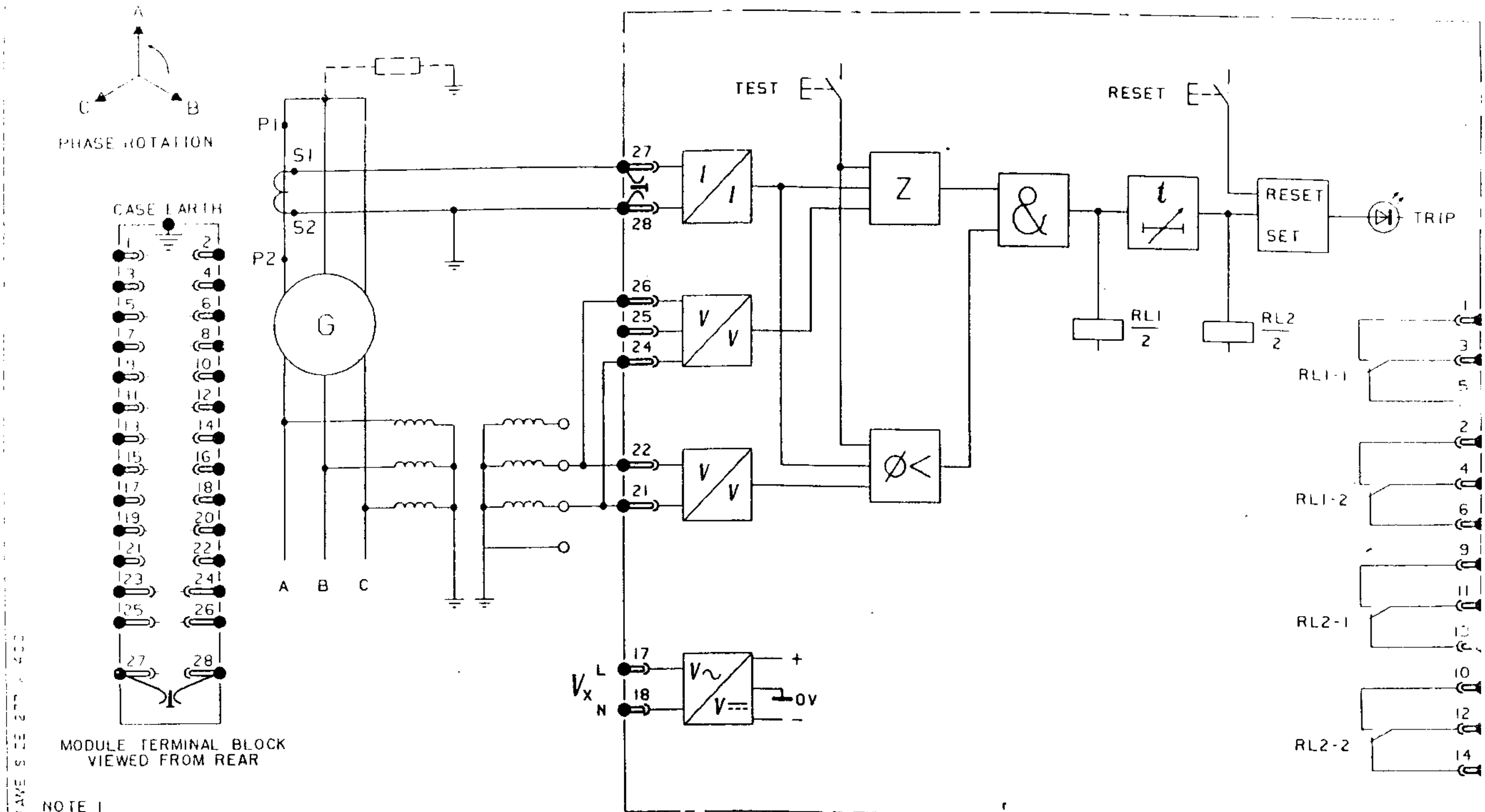
Section 5 MAINTENANCE

Periodic maintenance is not necessary. However, periodic inspection and test is recommended. This should be carried out every 12 months or more often if the relay is operated frequently or is mounted in poor environmental conditions.

5.1 Repeat commissioning tests to prove correct operation or for more limited testing operate the test pushbutton having previously isolated the tripping circuits from the relay output.

Section 6 PROBLEM ANALYSIS

Should any problems be experienced with the relay, the commissioning tests should be repeated. If the relay is found to be faulty it should be returned to GEC ALSTHOM PROTECTION & CONTROL for repair and recalibration since there are no user serviceable parts inside.



NOTE 1

(a) C.T. SHORTING LINKS MAKE BEFORE (b) & (c) DISCONNECT

(b) SHORT TERMINALS BREAK BEFORE (c).

(c) LONG TERMINALS

A	B	
DATE	8.6.87	

FIGURE 2a

GEC Measurements © THE GENERAL ELECTRIC COMPANY, p.l.c., ST. LEONARDS WORKS

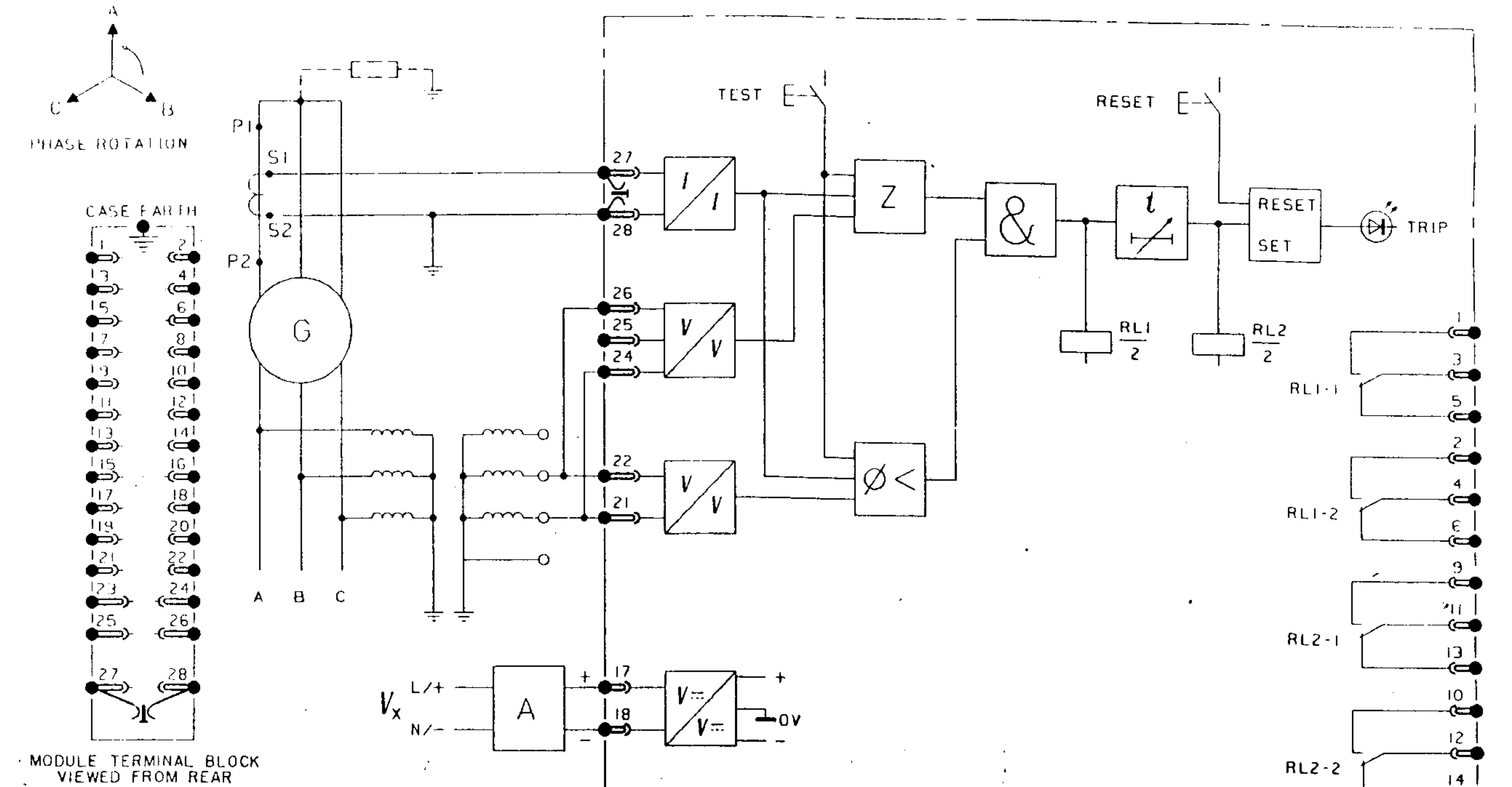
TITLE BLOCK DIAGRAM FIELD FAILURE PROTECTION RELAY

CUSTOMER

DRG NO	SHEET NO	NEXT SHT
F10 MYTU01 501	1	

WHEN QUOTING THE DRAWING NUMBER PLEASE STATE THE LATEST LETTER OF ISSUE

A3



NOTE 1

(a) C.T. SHORTING LINKS MAKE BEFORE (b) & (c) DISCONNECT

(b) SHORT TERMINALS BREAK BEFORE (c).

(c) LONG TERMINALS

A: AUXILIARY SUPPLY UNIT ONLY REQUIRED FOR A.C AND D.C SUPPLIES FOR V_x >125 VOLTS AND IS FOR USE WITH 110 VOLT D.C. RELAY

FIGURE 2b

A	B		C	
DATE	8 87	3HT AMENDED	12.5. 89.	NEXT SHT. 2 ADDED

GEC Measurements © THE GENERAL ELECTRIC COMPANY, p.l.c., OF EN... ST. LEONARDS WORKS

TITLE BLOCK DIAGRAM FIELD FAILURE PROTECTION RELAY D.C.

CUSTOMER

DRG NO F10 MYTU01 502 | SHEET NO 1 | NEXT SHT 2

WHEN QUOTING THE DRAWING NUMBER PLEASE STATE THE LA... LETTER OF ISSUE

A3 297 X

ORIGINAL DRG FRAME SIZE 297 X 420

4.2.4.2 Characteristic angle check

θ_1 measured = ________ ° I lead V

θ_2 measured = ________ ° I lag V

∴ characteristic angle = ________ ° I lead/lag V (delete as appropriate)

4.2.4.3 Relay Z1 setting

K1.K2.K3 = ________ Ω

Measured Z1 boundary

K2 = +1 ☐ I & V in phase

K2 = −1 ☐ I & V 180° out of phase

I = ________ A V= ________ V

$Z2 = \frac{V}{I} \times \frac{1}{\sqrt{3}} =$ ________ Ω

Cut off characteristics used? Yes ☐ No ☐

Measured angles ________ ° I lead V ________ ° I lag V

4.2.4.4 Timing tests

Set time ________ s

Measured time = ________ ________ ________ s

Reset time = ________ ________ ________ ms

4.2.4.5 System load check

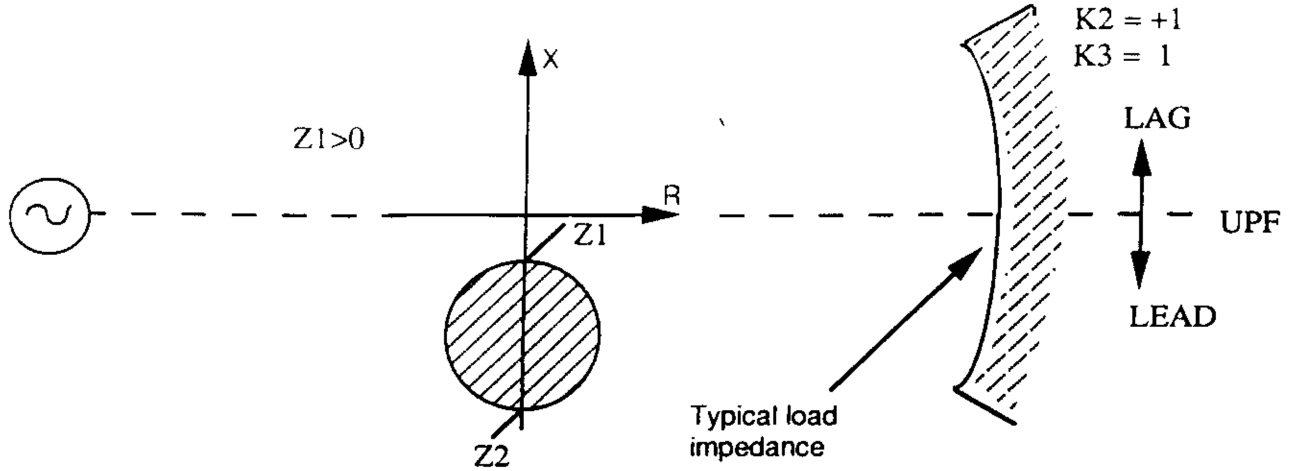
Measured secondary load I ________ A

Relay operates at ________ leading power factor = ________ ° leading

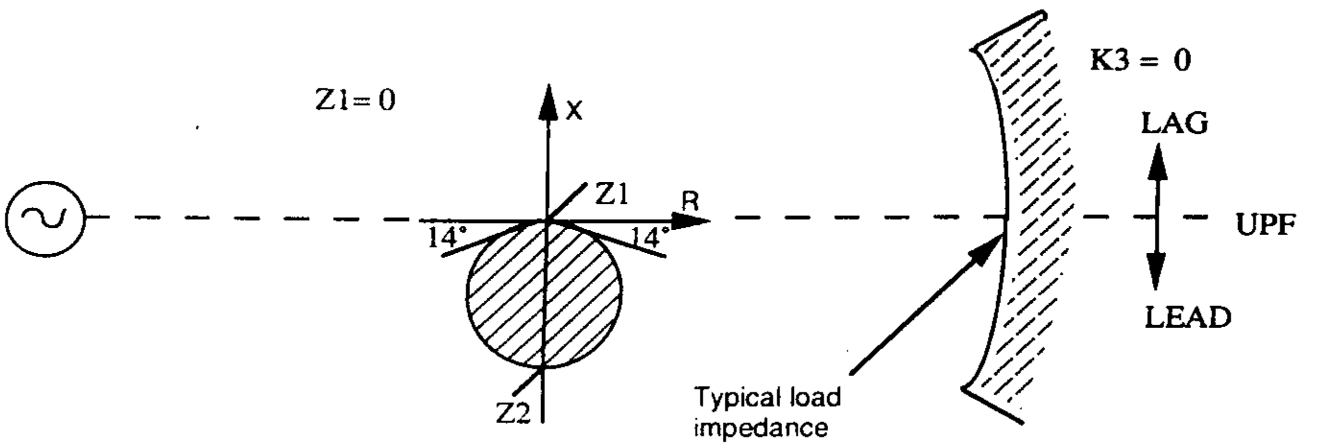
In service settings restored ☐

Remarks:–

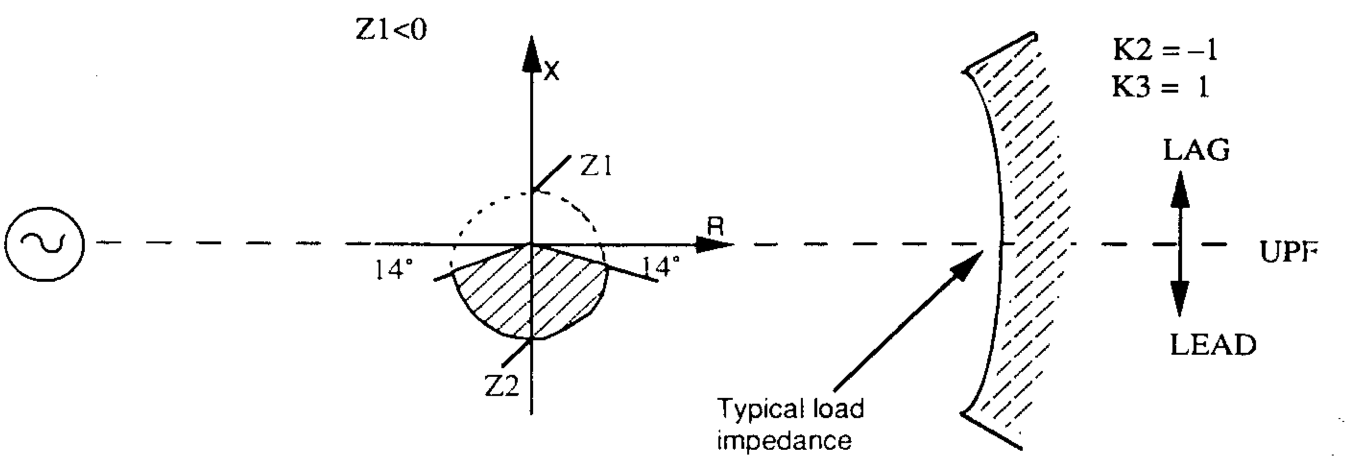
----------------------------------	----------------------------------
Commissioning Engineer	Customer Witness
----------------------------------	----------------------------------
Company	Company
----------------------------------	----------------------------------
Date	Date



(a) Normal field failure relay characteristics

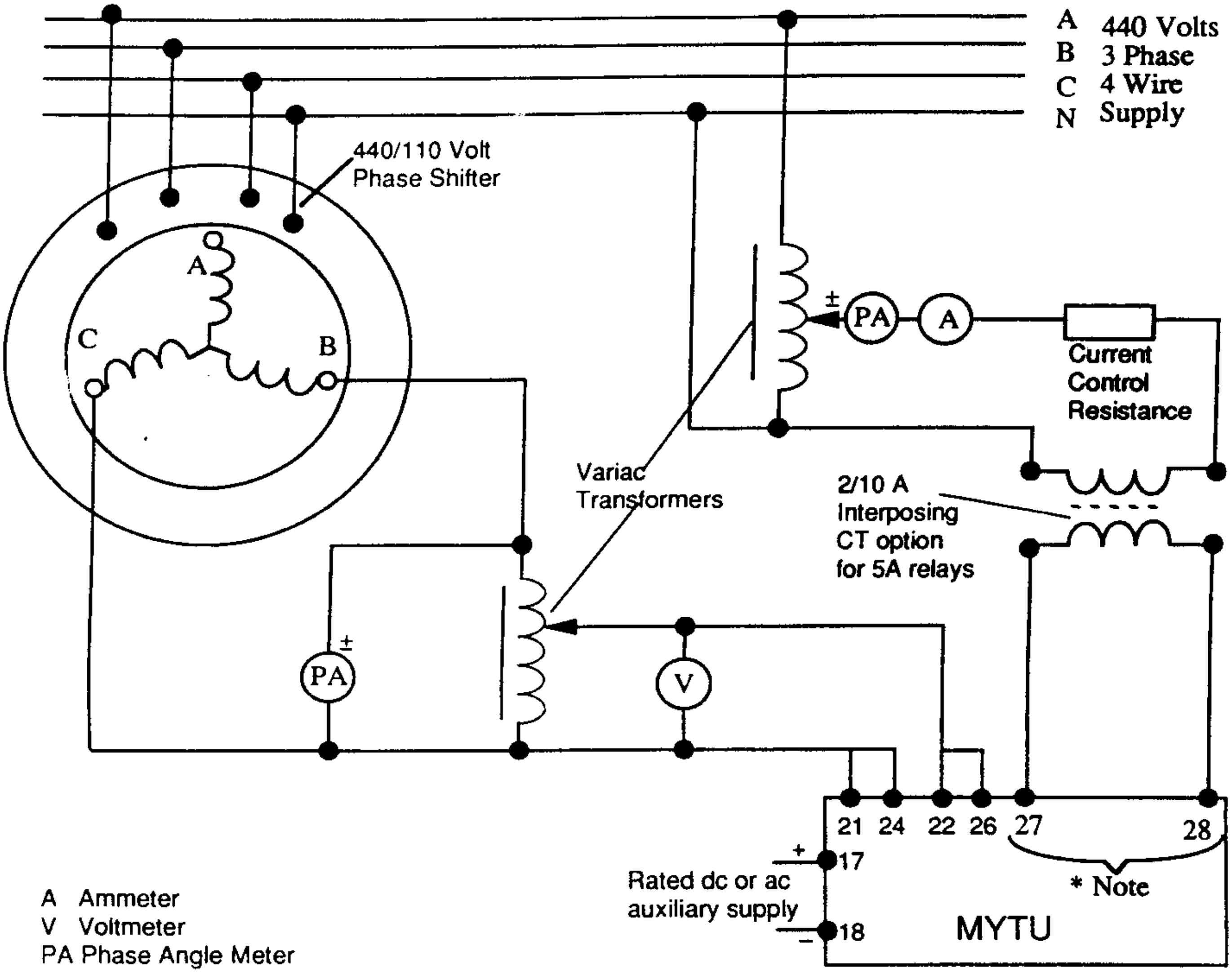


(b) Alternative relay application



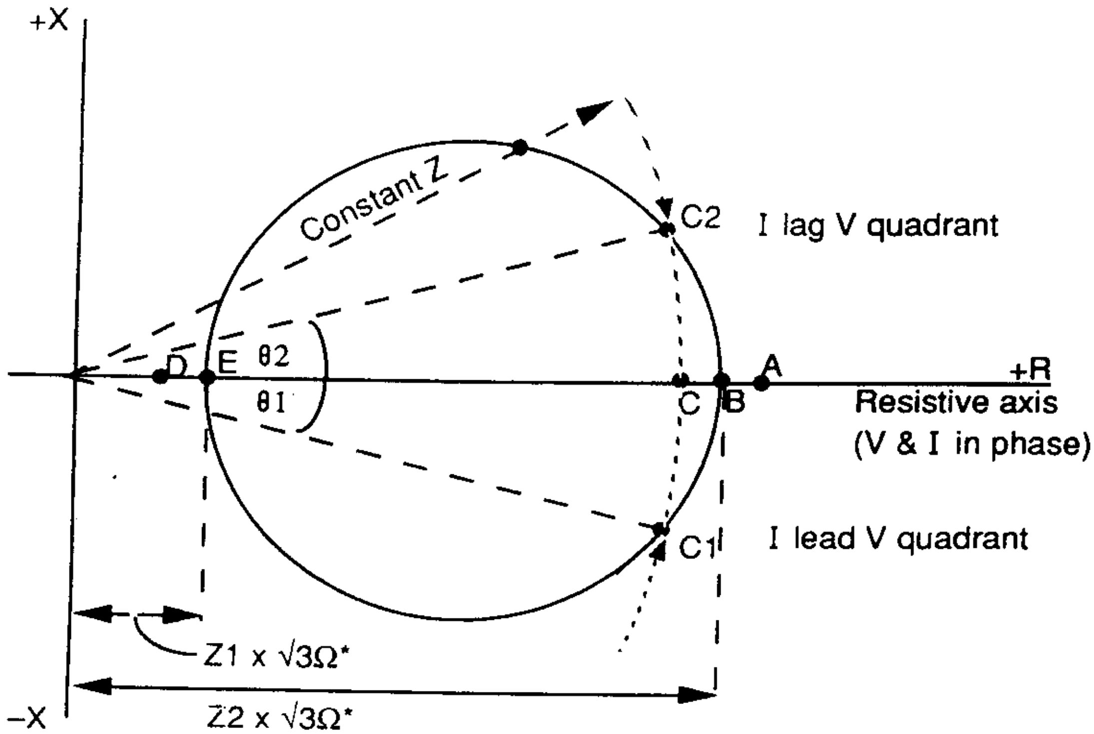
(c) Characteristic used during system on load check or on an alternative relay application

FIGURE 1 System impedance characteristics



* Note: The polarity of these connections is intentionally reversed from that given in the system connection diagram.

FIGURE 3 Circuit diagram for secondary injection tests



*NB Since the relay is connected phase to phase on the vts of the system, the Z seen by the relay is √3 times higher than the positive sequence Z of the system, and the relay settings.

FIGURE 4 Relay characteristic under secondary injection test conditions

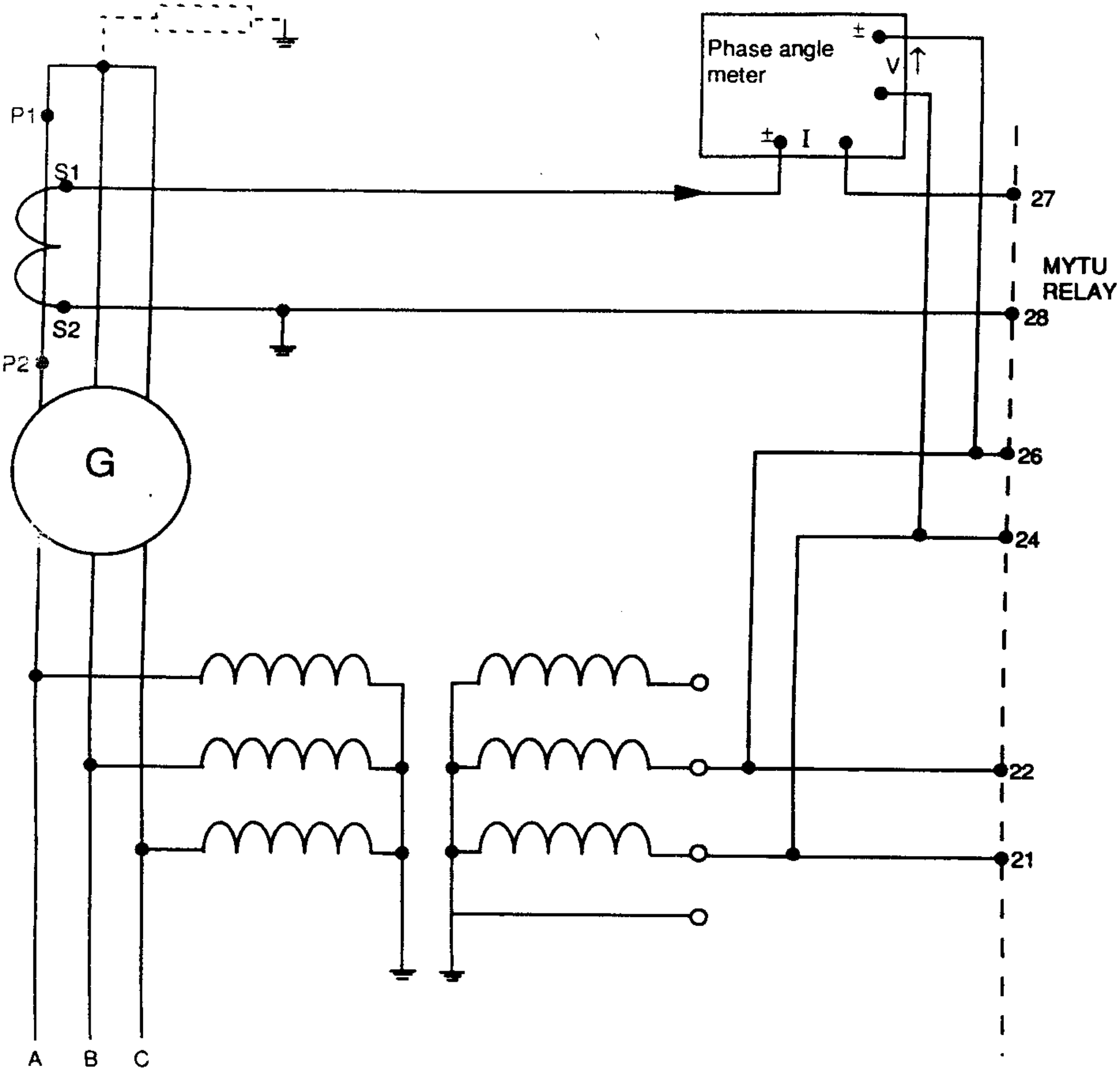
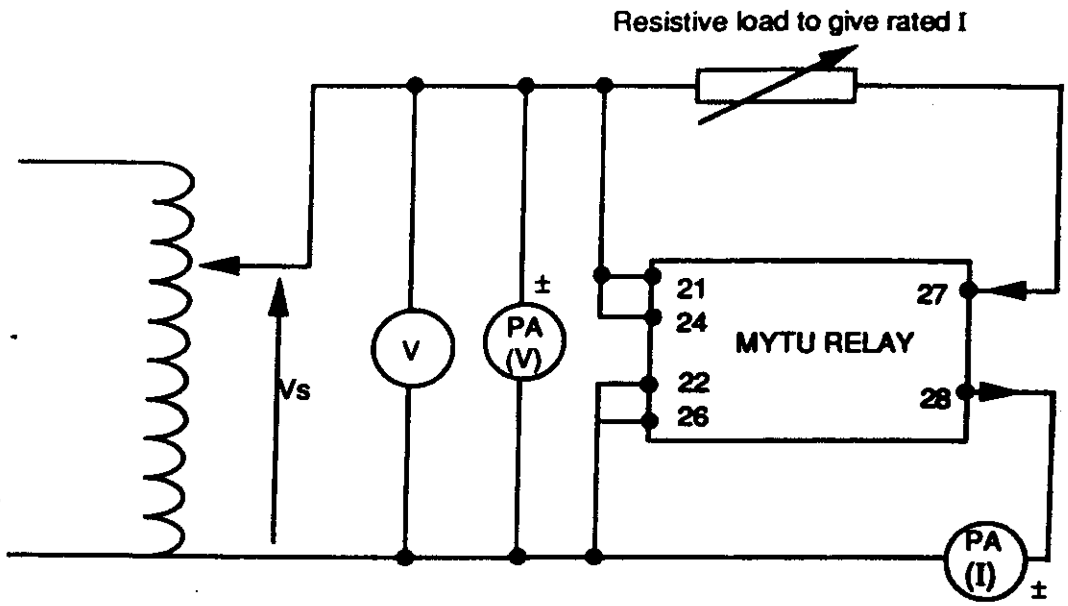

Phase angle meter
±
V
±
I
P1
S1
S2
P2
G
27
MYTU RELAY
28
26
24
22
21
A
B
C

FIGURE 5



Select all settings as for system on load check (ie. cut off characteristic) since there is a resistive load, the phase angle indicator should read nominally 0°, and the relay should operate.

Note that the auxiliary supply voltage must also be connected to the relay.

FIGURE 6 Standard polarity test of MYTU relay/phase angle indicator

STATION ______ CIRCUIT ______
RELAY MODEL NO ______ SERIAL NO ______

AUXILIARY SUPPLY Vx ______ V AC ☐ DC ☐
RATED CURRENT ______ A 50Hz ☐ 60Hz ☐
VT ratio ______ : ______ CT ratio ______ : ______
MACHINE TRANSIENT REACTANCE Xd = ______ %
MACHINE SYNCHRONOUS REACTANCE Xs = ______ %

3.1 Required relay characteristics

(i) For rotor angles up to 90° and no leading power factors ☐

Offset = $\frac{Xd}{2}$ Circle diameter = Xs

(ii) For rotor angles up to 120° and leading power factors ☐

Offset = $\frac{3Xd}{4}$ Circle diameter = $\frac{Xs}{2}$

Calculated required relay secondary impedance settings

3.2 Offset Z1 ______ Ω
3.3 Circle diameter setting ______ Ω
Outer impedance Z2 ______ Ω

Actual relay settings

Chart of in service settings filled in ☐

Commissioning tests

4.1.2 Visual inspection ☐
4.1.5 Insulation tests ☐
4.2.2 Auxiliary supply measured on terminals 17 & 18 ______ Volts ______
4.2.3 Test feature satisfactory ☐
4.2.4.1 Relay Z2 setting = ______ Ω

Measured Z2 boundary with I and V in phase

I = ______ A V= ______ V

$Z2 = \frac{V}{I} \times \frac{1}{\sqrt{3}} =$ ______ Ω

With I reduced 5%, relay drops off ☐

CHART OF IN SERVICE SETTINGS

Σ = The sum of numbers by switches set to the left.

Indicate switches set to the left by | x | |

$Z2 = \left[\frac{(10+\Sigma)}{In}\right] \Omega$ = ...

0.625			0
1.25			0
2.5			0
5			0
10			0
10			0
25			0
50			0
100			0
100			0

$t = (0.5+\Sigma)$sec = ...

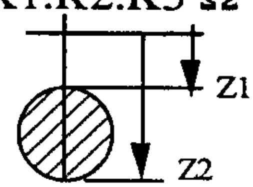
0.05			0
0.1			0
0.2			0
0.2			0
0.5			0
1			0
2			0
2			0
5			0
10			0

$K1 = \left[\frac{(3.75+\Sigma)}{In}\right] \Omega$ = ...

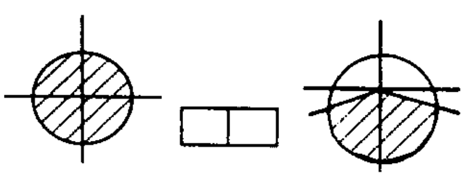
0.25			0
0.5			0
1.0			0
1.0			0
2.5			0
5			0
10			0
10			0
25			0
50			0

MYTU01
No.

$Z1 = K1.K2.K3\ \Omega$



K2	−1		+1
K3	0		1



In = ... Amps
Vx = ...Volts

Trip   Reset   Test

Repair Form

Please complete this form and return it to GEC ALSTHOM T&D PROTECTION & CONTROL LIMITED with the equipment to be repaired. This form may also be used in the case of application queries.

GEC ALSTHOM T&D PROTECTION & CONTROL LIMITED
St. Leonards Works
Stafford
ST17 4LX

For: After Sales Service Department

Customer Ref: ____________ Model No: ____________

GECA Contract Ref: ____________ Serial No: ____________

Date: ____________

1. What parameters were in use at the time the fault occurred?

   AC volts ________ Main VT/Test set

   DC volts ________ Battery/Power supply

   AC current ________ Main CT/Test set

   Frequency ________

2. Which type of test set was being used? ____________

3. Were all the external components fitted where required? Yes/No
   (Delete as appropriate.)

4. List the relay settings being used

   ____

   ____

   ____

5. What did you expect to happen?

   ____

   ____

   ____

6. What did happen?

   ____

   ____

   ____

pto

How did the fault occur?

Instant Yes/No Intermittent Yes/No

Time delayed Yes/No (Delete as appropriate.)

By how long? ____________

8. What indications if any did the relay show?

____

____

9. Was there any visual damage?

____

10. Any other remarks which may be useful:

____

____

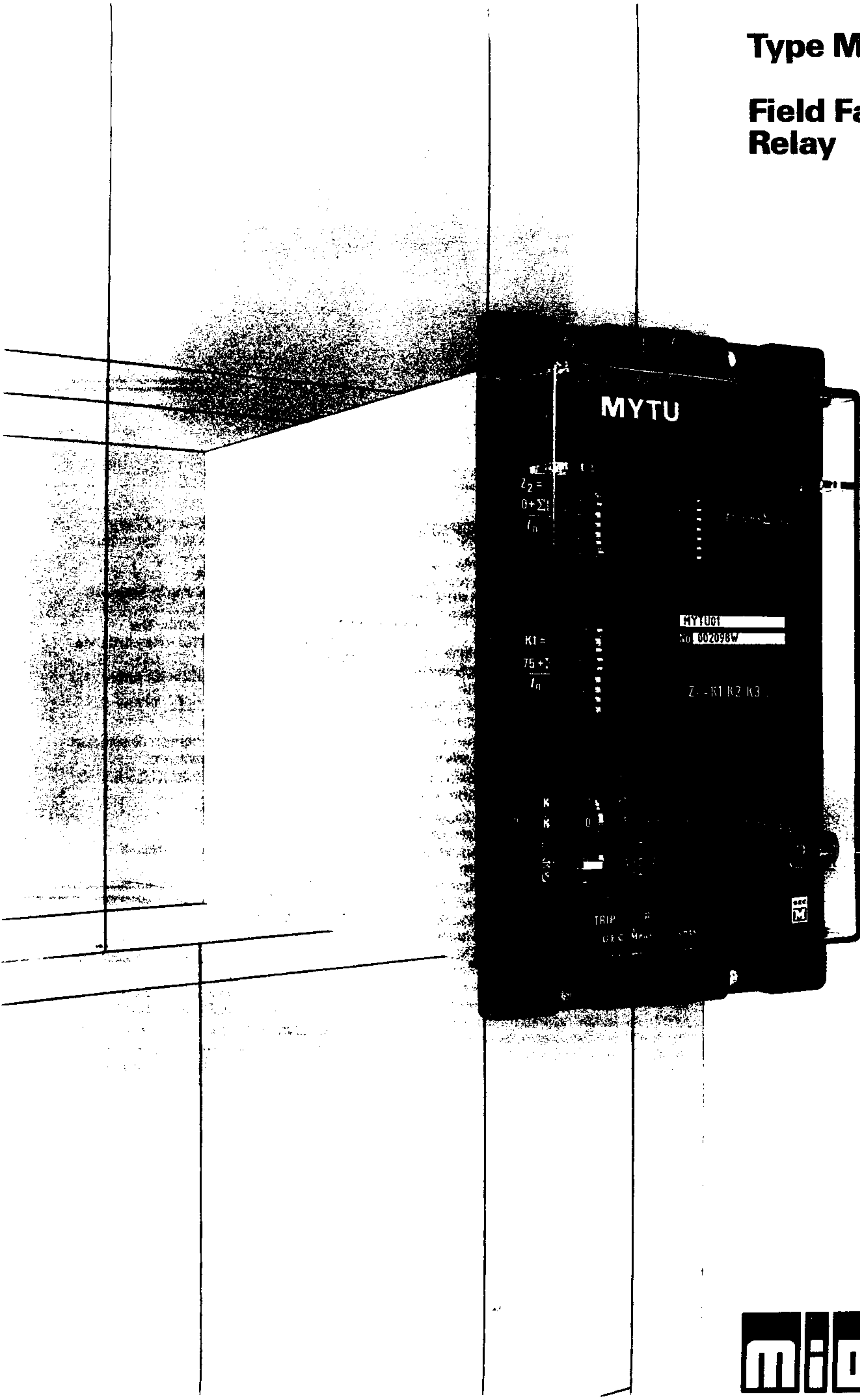
Signature: ________________________ Title: ________________________

Name (in capitals) ________________________ Company Name: ________________________

T&D

Type MYTU

Field Failure Relay



MIDOS

14

MIDOS

Type MYTU

FEATURES

Shapeable characteristic.
Wide setting range.
Compact design.
Built-in timer.

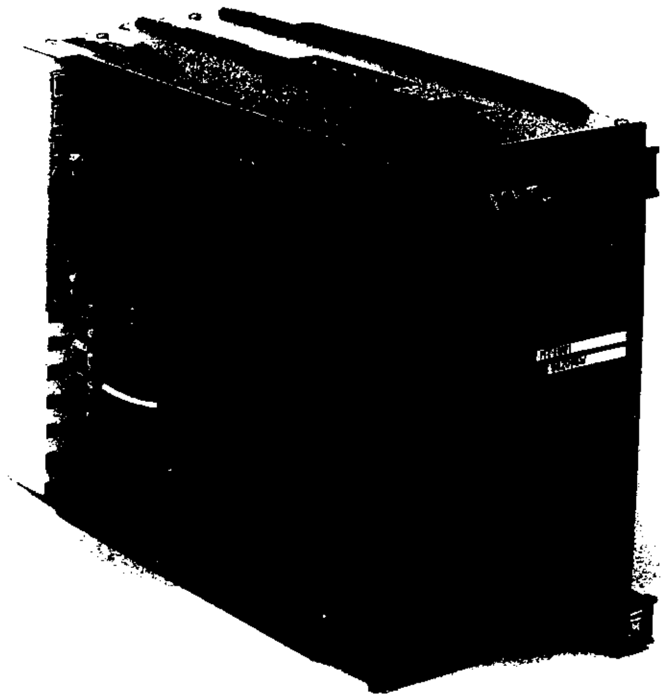


Figure 1. Type MYTU relay withdrawn from case.

APPLICATION AND DESCRIPTION

Type MYTU is an impedance relay with a shapeable characteristic which can easily be converted into a mho or an offset mho characteristic with a full or partially cut-off circle.

The operating zone of the characteristic is selected by frontplate setting adjustments which are designed to provide a comprehensive coverage of the generator impedance under field failure conditions.

A built-in timer is provided to enable the relay to be coordinated with other devices and to avoid the possibility of mal-operation on synchronisation surges.

During a field failure condition, it is possible to have transient torque reversals which can cause the impedance measured by the relay to enter and leave the relay characteristic several times before finally settling inside the relay characteristic. An instantaneous output relay is also provided in addition to the time delayed output to cater for the above condition. The instantaneous output can be used to operate on external time delay equipment suitably designed to allow tripping without continual partial operation and resetting of the timer. For these applications, the time delayed output of the MYTU relay can be used for backup trip or alarm.

Figures 2 and 3 are block diagrams of the relay (ac and dc respectively); Figure 4 shows the choice of characteristics available in the relay.

RELAY SETTINGS

The two basic settings of the relay are Z1 and Z2, which represent two points on the circular characteristic of the relay along the reactance axis of the impedance diagram. The settings are measured from the origin of the impedance diagram and the setting difference between Z1 and Z2 represents the diameter of the circle.

The ohmic settings of Z1 and Z2 are chosen by DIL switches with the following ranges:

For rated current $In = 1A$

$Z1 = 0$ or ± 3.75 to 109 ohms in steps of 0.25 ohm.

The settings for Z1 are set by the switches for K1, K2 and K3 in accordance with the expression:

$$Z1 = K1 \times K2 \times K3 \text{ ohms}$$

where $K1 = \dfrac{3.75 + \Sigma}{I_n}$ ohms

and Σ = summation of selected values from: 0,0.25,0.5,1,1,2.5,5,10,10, 25,50

$K2 = -1$ or $+1$

$K3 = 0$ or 1

$Z2 = 10$ to 314.375 ohms in steps of 0.625 ohm.

The settings for Z2 are set by a column of DIL switches in accordance with the expression: $Z2 = \dfrac{10 + \Sigma}{I_n}$ ohms

where Σ = summation of selected values from: 0,0.625,1.25,2.5,5,10, 10,25,50,100,100

The use of the full mho circle or the cut-off characteristic is selected by a single dil switch. The time delay setting range of t is from 0.5s to 21.55s in steps of 0.05s by adjustment of dil switches.

An led is provided on the front panel to indicate that the relay has operated, together with reset and test push-buttons.

It should be noted that, when pushed, the test button will cause the relay to operate after the set time delay and that circuit breakers may operate if adequate precautions are not taken.

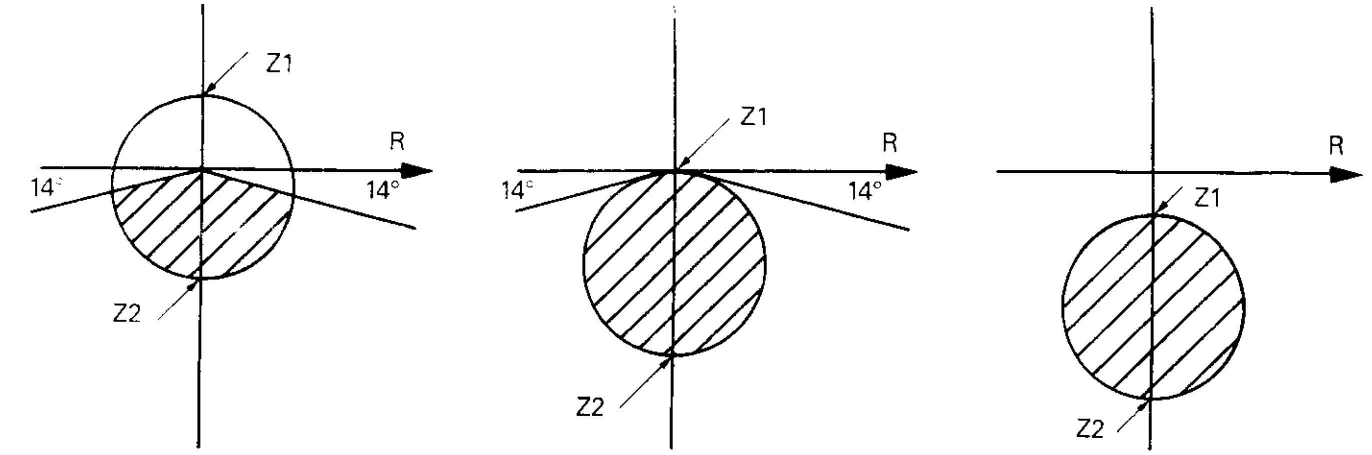


Figure 4 ·· ·lay Type MYTU: characteristics.

TECHNICAL DATA

Auxiliary voltage rating

	Operating range				
	V_X	V_{min}	V_{max} (AC)	V_{max} (DC)	Frequency (ac version)
	24	21.6	26.4	28.8	50-60Hz
	30	24	33	36	50-60Hz
	48	38.4	52.8	57.6	50-60Hz
	110	88	121	132	50-60Hz
	125	100	137.5	150	50-60Hz
AC (uses 110V dc ralay with auxiliary power supply unit)	160/220	128	242		50-60Hz
DC (uses 110V dc relay with auxiliary power supply unit)	160/250	128	275		

CT and VT ratings

Rated current I_n	1A or 5A	
Continuous rating	3 x I_n	
1 second rating	80 x I_n	
Continuous maximum rating	26-25:	120V
at terminals	26-24,22-21:	200V
Rated frequency	50Hz or 60Hz	
Drop off ratio	⩾0.95	
Reset time	⩽100ms	

Contacts 2 changeover instantaneous outputs.
2 changeover time delayed outputs.

Ratings

Carry continuously	5A
Make and carry for 0.5s	30A at 110V dc
Breaking capacity (10^5 operations)	0.3A at 110V dc L/R=40ms

Burdens

Measuring input	
Burden at rated current I_n	<0.3 VA
Burden at 150V	<0.75 VA
Auxiliary voltage	
Relay de-energised	<35mA (dc)
	<60mA (ac)
Relay energised	As above plus 2W

Accuracy

Detector circuits Z1,Z2:	
Basic accuracy	⩽4%
Consistency	⩽1%
Timing circuits:	
Basic accuracy	⩽3%, not less than 30ms
Consistency	⩽1.5%, not less than 30ms

Error due to influencing quantities

	Auxiliary voltage	Temperature	Frequency
Detector circuit	±2.5%	±2.5%	±2.5%
Timing circuit	±1.5%	±1.5%	±1.5%

Type MYTU relays are housed in size 4 MIDOS cases (see Figure 5).

INFORMATION REQUIRED WITH ORDER

Rated current
Rated frequency
Auxiliary voltage
AC or dc
Case mounting: flush
semi-projecting
rear flange

Insulation IEC 255-5	2kV rms for 1 minute between all case terminals connected together and the case earth terminal. 2kV rms for 1 minute between independent circuits including contact circuits. 1kV rms for 1 minute across normally open outgoing contact pairs.
High frequency disturbance test The relay complies with IEC 255-22-1	1MHz burst decaying to 50% of peak value after 3 to 6 cycles. Repetition rate: 400 per second. 2.5kV peak between independent circuits and between circuits and case earth. 1.0kV peak across input circuits.
High voltage impulse IEC 255-5	5kV peak, 1.2/50μs, 0.5J between all terminals and case earth and between adjacent terminals.
Environmental withstand	
Temperature IEC 68-2-1 IEC 68-2-2	Storage and transit −25°C to +70°C Operating −25°C to +55°C
Humidity IEC 68-2-3	56 days (at 93% RH and +40°C)
Enclosure protection IEC 529	IP 50 (dust protected)
Vibration BS 142 Section 2.2	Category S2, 0.5g between 10Hz and 300Hz
Mechanical durability	100,000 operations minimum

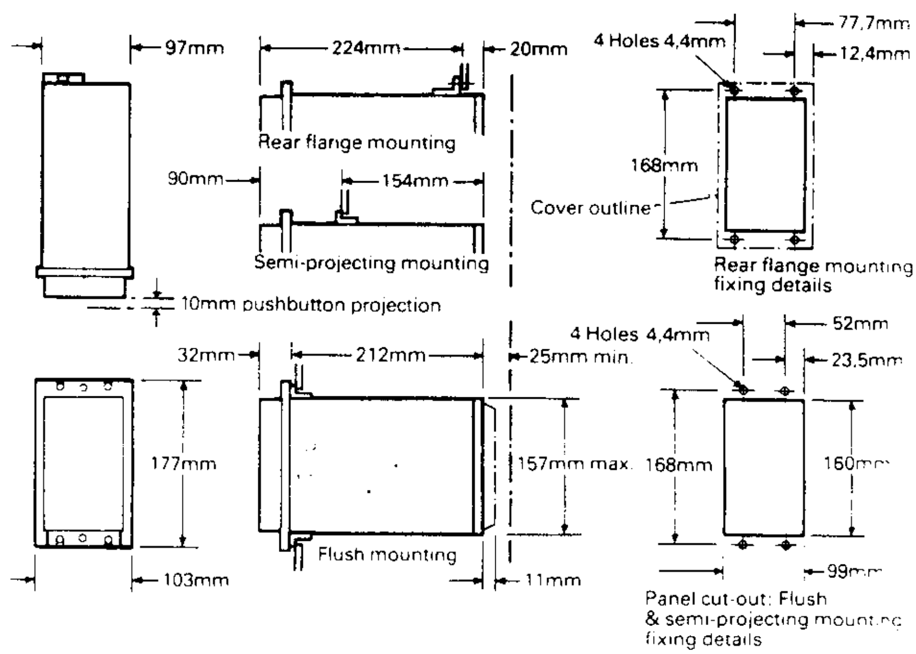
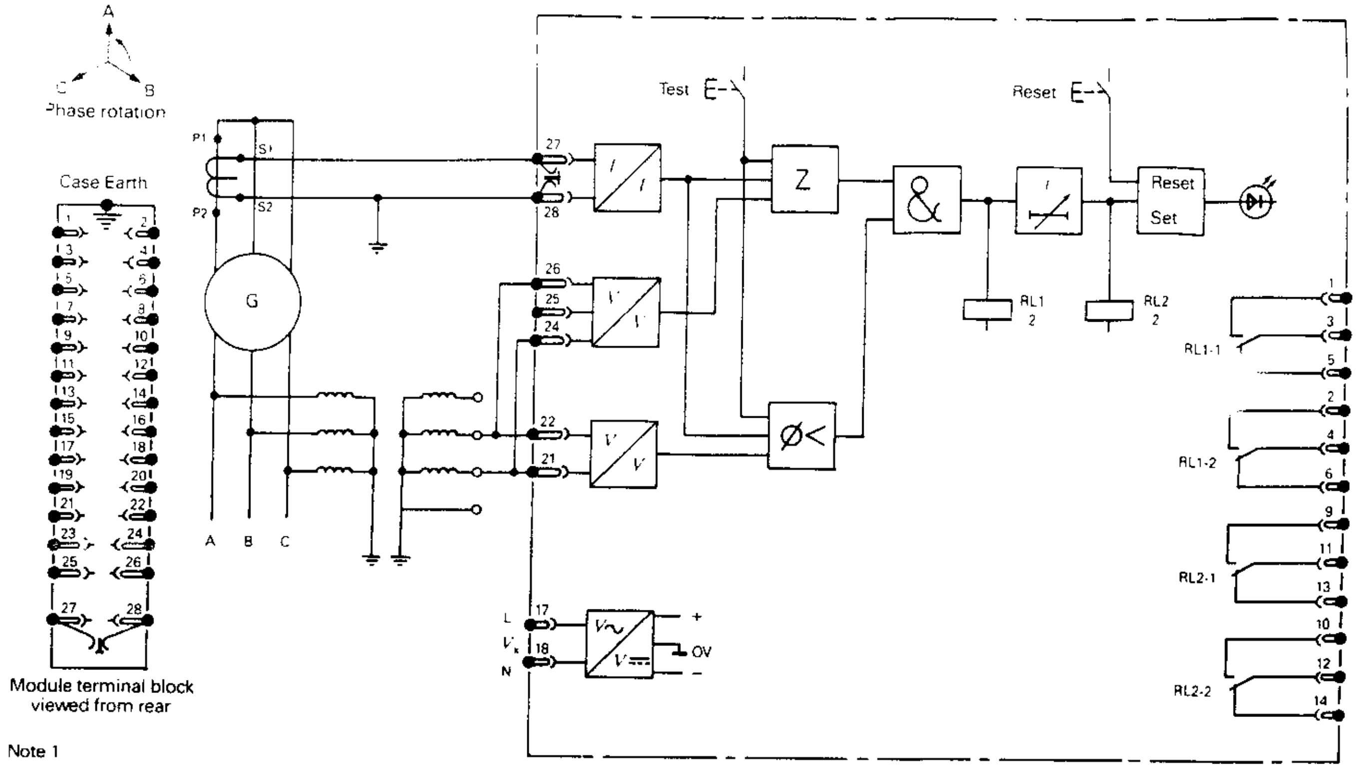


Figure 5 Case outline size 4



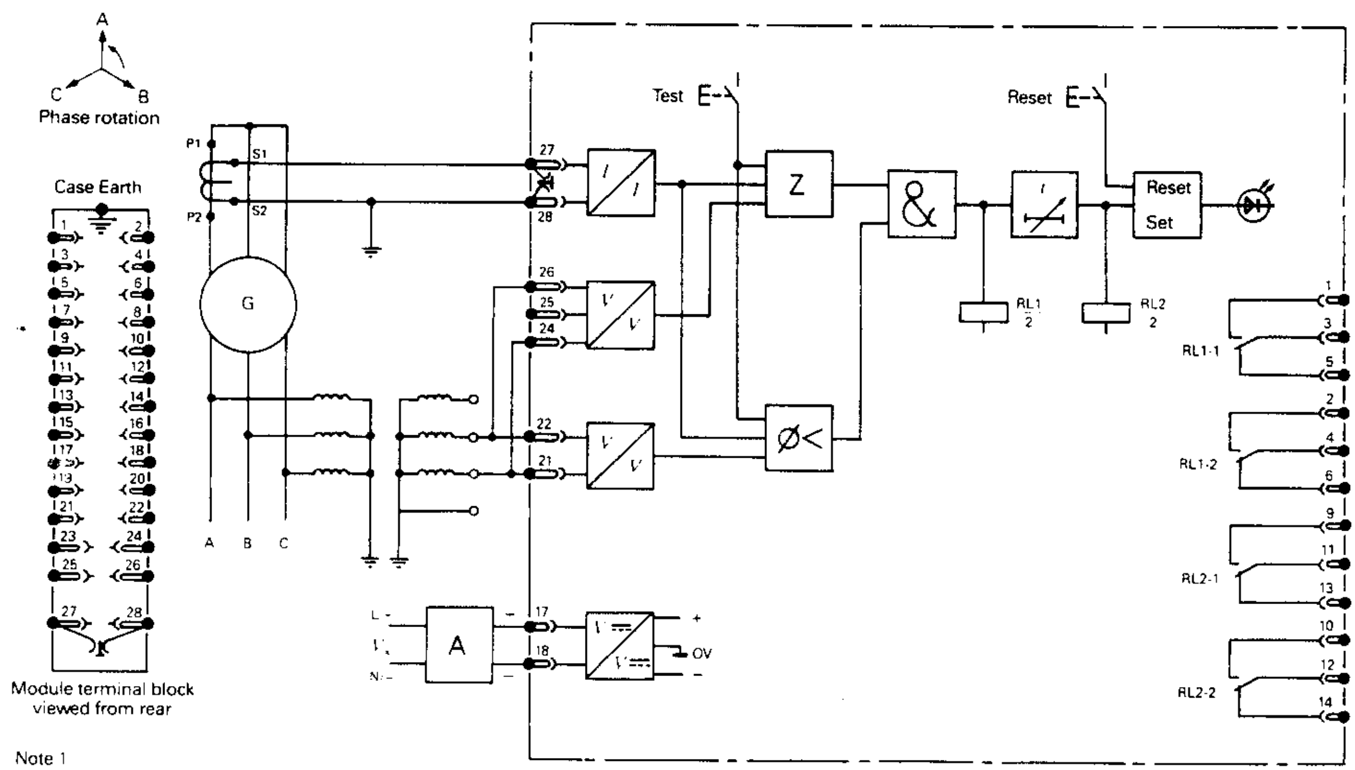
Note 1

(a) C T shorting links make before (b) & (c) disconnect

(b) Short terminals break before (c)

(c) Long terminals

Figure 2. Relay Type MYTU: block diagram, ac relay



Note 1

(a) C T shorting links make before (b) & (c) disconnect

(b) Short terminals break before (c)

(c) Long terminals

A: Auxiliary supply unit required for ac and dc power supplies for $V_x >$ 125 volts and for use with 110V dc relay

Figure 3. Relay T· ·e MYTU: block diagram, dc relay

GEC ALSTHOM

T&D

GEC ALSTHOM PROTECTION & CONTROL LIMITED
St Leonards Works, Stafford ST17 4LX, England
Tel: 0785 223251 Telex: 36240 Fax: 0785 212232

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