midos

SERVICE MANUAL

MCGG

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SERVICE MANUAL

MCGG

Disk No. RE1U31

CONTENTS

1. DESCRIPTION

Overcurrent relay type MCGG provides a choice of four inverse time and three definite time ranges by switched selection, and is available in the following models:

MODEL NUMBER	MODEL
MCGG 11	Single pole phase fault Single pole earth fault
MCGG 21	Single pole phase fault with Instantaneous element Single pole earth fault with Instantaneous element
MCGG 31	3 pole phase fault
MCGG 41	2 pole phase fault plus earth fault
MCGG 51	2 pole phase fault with instantaneous element plus earth fault
MCGG 61	3 pole phase fault with instantaneous element

The rated current of the relay (I_N) is either 1 Amp or 5 Amp and appears on the module rating card.

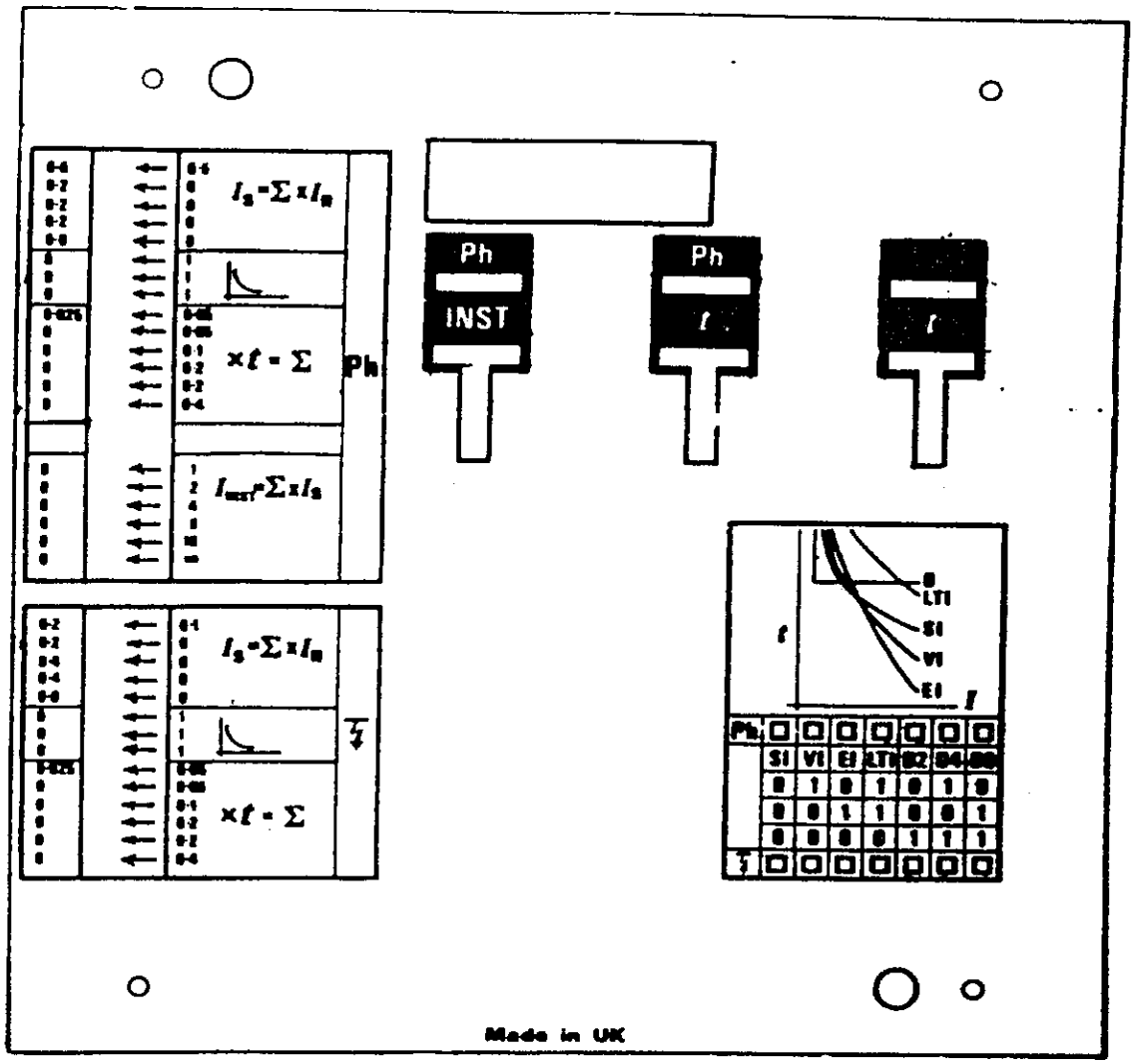
2. SETTINGS

The relay settings are determined by positioning miniature switches on the relay front panel.

If the relay is fitted with an instantaneous element, there will be two groups of switches, the time/current setting switches positioned above the instantaneous element switches.

Note: An MCGG 41 or 51 can be treated as two separate relays, with separate settings for phase and earthfault elements.

FRONT PANEL SETTING SWITCHES.



EXAMPLE : MCGG 51; 2 pole phase fault with instantaneous element plus earth fault.

Operation of the front panel slider switch settings is explained with reference to the above example.

The top four banks of switches are used to set the phase fault element shown by the symbol Ph, and the lower three banks set the earth fault element shown by the symbol $\overline{\zeta}$.

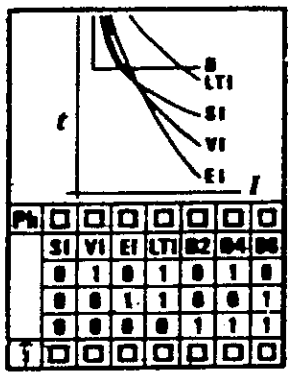
The two groups are identical except that the phase fault group includes a bank of switches (I_{INST}) for setting the instantaneous current level, and the setting range for Is is 0.5 → 2.0 x I_N for the phase fault element against 0.1 - 2.0 x I_N for the earth fault element.

2.1 TIME DELAY CURRENT SETTING SWITCHES $I_S = \Sigma \times I_N$

Five slider switches are used to set the required current setting. Each switch is positioned left or right, the setting level being indicated adjacent to the switch. The overall setting is obtained by adding the indicated values of the individual switch settings, and may be set in 0.1 steps in the range either from 0.5 - 2.0 x I_N or 0.1 - 2.0 x I_N, depending on the model.

2.2 CURVE SELECTION SWITCHES

Three slider switches are used to select the required time curve from the choice of four inverse time and three definite time curves. Details of the curves are given in the front panel diagram reproduced below:



		Switch Position 0 1
SI Standard Inverse $t = \frac{0.14}{(I^{0.02}-1)} S$	0	←
	0	←
	0	←
VI Very Inverse $t = \frac{0.35}{(I-1)} S$	1	→
	0	←
	0	←
EI Extremely Inverse $t = \frac{80}{(I^2-1)} S$	0	←
	1	→
	0	←
LTI Long Time Inverse $t = \frac{120}{(I-1)} S$	1	→
	1	→
	0	←
D2 Definite Time 2 Seconds	0	←
	0	←
	1	→
D4 Definite time 4 seconds	1	→
	0	←
	1	→
D8 Definite time 8 seconds	0	←
	1	→
	1	→

Indication of the selected curve(s) may be given by inserting a small black peg provided with the relay, into the relevant hole in the panel diagram shown above. The peg itself does not alter the selected curve but is an inert indicator provided for the convenience of the customer.

Note : with the switches in position 111 (all set to the right) the relay will select the 8 second definite time range D8.

2.3 TIME MULTIPLIER SETTING SWITCHES xt = Σ

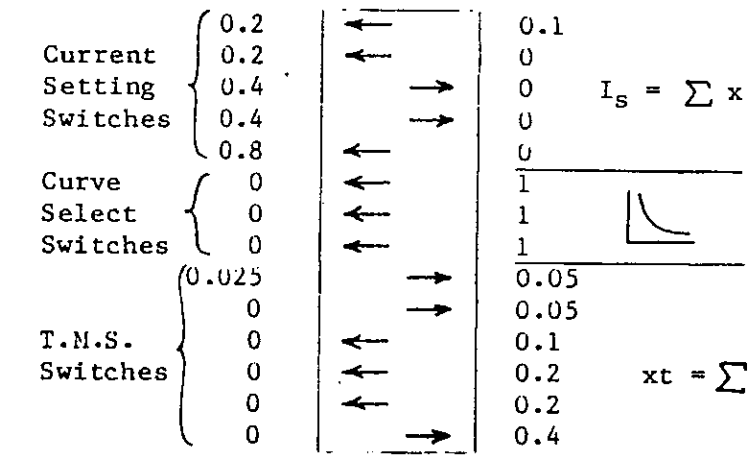
Six slider switches are used to set the required time multiplier setting. The time given by each of the time delayed operating characteristics must be multiplied by the time multiplier to give the actual operating time of the relay. The setting is obtained by adding the indicated values of the individual switch settings, and is indicated by xt = Σ.

Note: Although it is possible to set the switches to give a T.M.S. of 0.025 x t, this setting is outside the operating range of 0.05 to 1.0 x t and should not be used.

2.4 INSTANTANEOUS CURRENT SETTINGS $I_{INST} = \Sigma \times I_S$ (on MCGG21, 51 and 6)

Six slider switches are used to select the required instantaneous current settings between 1 x I_S and 31 x I_S. The selected setting is obtained by adding the indicated values of the individual switch settings. If an instantaneous current setting is not required, then the switches should either be set all to the left (indicating 0), or the bottom switch should be set to the right (indicating ∞).

2.5 RELAY SETTING EXAMPLE MCGG21

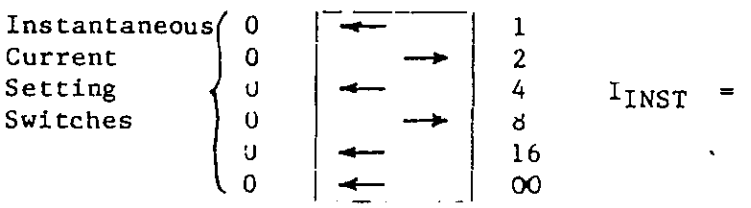


In this case:-

$I_S = (0.2 + 0.2 + 0.8)\ I_n$
$= 1.2 \times I_n$

Standard Inverse curve

TMS = (0.05 + 0.05 + 0.4)x
= 0.5x



$I_{INST} = (8 + 2) \times I_s$
$= 10 \times 1.2 \times I_n$
$= 12 \times I_n$

If the above settings are applied to a 1A relay:-

Current setting	=	1.2A
Curve	=	standard inverse
T.M.S.	=	0.5
Instantaneous current setting	=	12A

3. INSTALLATION

3.1 General Considerations

Protective relays, although generally of robust construction, require careful treatment prior to installation on site. Upon receipt, relays should be examined immediately, to ensure no damage has been sustained in transit.

When handling a relay, great care must be taken, particularly when the relay is removed from its case. Touching the printed circuit board should be avoided, since metal oxide semiconductor (MOS) devices are used, which can be damaged by static electricity discharges from the body. Great care must be taken to avoid damage to the relay flag mechanism, which should only be reset, with the relay cover on, using the reset arm.

If damage has been sustained in transit, a claim should be made to the transport contractors and the nearest branch office of GEC Measurements should be promptly notified. Relays which are supplied unmounted and not intended for immediate installation should be returned to their protective polythene bags.

3.2 Relay Mounting

Relays are dispatched either individually or as part of a panel/rack mounted assembly. If the relays are to be installed into a panel/rack assembly, after receipt, then construction details can be found in Publication R7012.

3.2.1 When the MCGG is used in conjunction with other GECM relays, the following guidelines should be followed for positioning the relays in the modular assembly:

(1) Test facilities : MMLG test block should be positioned at the right of the tier.

(2) Current relays : MCGG overcurrent relay should be adjacent to test block.

(3) Directional control: METI directional relay should be adjacent to, and to the left of the MCGG relay it is controlling.

(4) Other relays : MSTZ and other relays required for the relay scheme, should be positioned to the left of the tier.

3.2.2 For individually mounted relays, an outline diagram is normally supplied showing panel cut-outs and hole centres, these dimensions will also be found in Publication R6002.

3.3 Unpacking

Care must be taken when unpacking and installing the relays so that none of the parts are damaged or their settings altered and the

times be handled by skilled persons only. The installation should be clean, dry and reasonably free from dust and excessive vibration. The site should be well lit to facilitate inspection.

Relays should be examined for any wedges, clamps or rubber bands necessary to secure moving parts to prevent damage during transit and these should be removed after installation and before commissioning.

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.

3.4 Storage

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 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 unpacking, 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.

Storage temperature -25 to +70°C.

4. COMMISSIONING

4.1 Commissioning Preliminaries

4.1.1 Inspection

Carefully examine the module and case to see that no damage has occurred since installation and visually check that any current transformer shorting switches are wired into the correct circuit and are closed with the module withdrawn. Check that the relay serial number on the module, case and cover are identical and that the model number or rating information is correct.

4.1.2 Wiring

Check that the external wiring is correct to the relevant relay diagram or scheme diagram. The relay diagram number appears inside the case.

4.1.3 Insulation

Isolate all wiring from earth and test the insulation of the external wiring with an electronic or brushless Insulation Tester at a d.c. voltage not exceeding 1000V. Terminals of the same circuit should be temporarily strapped together.

4.1.4 Electrostatic Discharges (ESD)

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

4.1.5 Earthing

Ensure that the case earthing connection above the rear terminal block, is used to connect the relay to a local earth bar.

4.1.6 MAIN CURRENT TRANSFORMERS

Do not open the secondary circuit of a live C.T. since the high voltage produced may be lethal to personnel and could damage insulation.

4.1.7 TEST BLOCK TYPE MMLG

If 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 terminals allocated with odd numbers (1, 3, 5, 7, etc.) and also that the DC connection is routed via test block terminals 13 and 15.

4.1.8 TERMINAL ALLOCATION

Terminals of the relay are usually allocated as follows:

		Terminals	
DC Auxiliary Supply	:	13 and 14 (13 positive)	
Time delayed changeover contact	:	1,3,5	
Normally open contact	:	2,4	
Instantaneous changeover contact	:	7,9,11	) For Two phase and Earth
Normally open contact		8,10	) Fault Relay see below

SINGLE PHASE RELAY

AC current inputs	:	27,28
Input for directional control	:	21,22

THREE PHASE DELAY AND TWO PHASE AND EARTH FAULT RELAY:

A.C. current inputs		23,24 : 25,26 : 27,28
Inputs for directional control	:	17,18 : 19,20 : 21,22

TWO PHASE AND EARTH FAULT RELAY:

Time delayed changeover contact (EF) : 10,12,16
Normally open contact (EF) : 11,15

Instantaneous normally open contacts (PhF) : 6,8 : 7,9

4.2 INSTRUCTIONS TO ENSURE RELAY CAN BE COMMISSIONED AT ANY SETTING

TEST EQUIPMENT REQUIRED

Overcurrent Test Set with timing facilities
Multifinger Test Plug type MMLB 01 for use with test block type MMLG when required
Calibrated Multimeter 0-10A AC 0-250V DC

4.2.1 GENERAL

Secondary injection commissioning test should be carried out using a portable single phase overcurrent test equipment, preferably injected via test block type MMLG. It is most important that the test equipment is capable of injecting an undistorted sinusoidal current waveform.

Ensure that the main system current transformers are shorted, before isolating the relay from the current transformers in preparation for secondary injection tests.

4.2.2 D.C. SUPPLY

Remove the relay module from its case. The incoming supply should be checked at the relay case terminals. Relay case terminal 13 should be positive with respect to terminal 14 and the incoming voltage must be within the range specified on the rating card.

For secondary injection testing using test block type MMLG, insert test plug type MMLB01 with the required main CT shorting links fitted. It may then be necessary to link across the front of the test plug to restore the d.c. supply to the relay.

4.2.3 RELAY CT SHORTING SWITCHES

With the relay removed from its case, check that each CT shorting switch is closed by injecting rated current into each phase circuit. The rated current of the relay (I_N) is either 1A or 5A and appears on the module rating card.

4.2.4 ENERGISE RELAY

Isolate the relay trip circuits, insert the module and connect the DC supply to the relay.

4.2 5 CURRENT SENSITIVITY SWITCHES ($I_S = \Sigma \times I_N$)

This test checks that the front panel current selector switches (I_S). operate correctly. The relay operating time is set to be as fast as possible by selecting curve D2 and TMS .05 xt.

Inject single phase current into a convenient phase circuit and slowly increase the current until the time delayed flag (t) operates. Repeat the test for each switch position and check that the pick up current is within the range shown in Table 4.1.

Switch Selections: Current ($I_S = \Sigma \times I_N$) : as shown
Curve (⌊) : D2 Definite Time 2S
TMS ($xt = \Sigma$) : 0.05 x t
Instantaneous ($I_{INST} = \Sigma \times I_S$) : any

I_S SWITCH POSITION	A.C. CURRENT OPERATE LEVEL (AMPS)					
	I_S SENSITIVITY RANGE : 0.1 - 2 x I_N			I_S SENSITIVITY RANGE : 0.5 - 2 x I_N		
	VALUE	I_N = 1A	I_N = 5A	VALUE	I_N = 1A	I_N = 5A
	0.1X	0.10-0.11	0.50-0.55	0.5X	0.50-0.55	2.50-2.75
	0.2X	0.20-0.22	1.00-1.10	0.6X	0.60-0.66	3.00-3.30
	0.3X	0.30-0.33	1.50-1.65	0.7X	0.70-0.77	3.50-3.85
	0.5X	0.50-0.55	2.50-2.75	0.7X	0.70-0.77	3.50-3.85
	0.5X	0.50-0.55	2.50-2.75	0.7X	0.70-0.77	3.50-3.85
	0.9X	0.90-0.99	4.50-4.95	1.3X	1.30-1.43	6.50-7.15

TABLE 4.1

Note The above current operate levels make no allowance for errors in measurement of the A.C. current amplitude.

Three Phase relays: Check at a particular I_S switch position, that the other two phase circuits have the sensitivity shown in Table 4.1.

Two Phase + Earth Fault Relays: Check at a particular I_S switch position that the other phase circuit has the sensitivity shown in Table 4.1. Repeat Test 4.2.5 for the Earth Fault

4.2.6 CURVE SELECTION SWITCHES ( )

Connect the relay time delayed output contacts to both trip the test set, and to stop a timer. Inject single phase current into a convenient phase of each separate time delay element at a current level of 10X rated current.

Check that the operating time for the relay for each curve setting is within the range shown in Table 4.2.

Switch Selections: Current ($I_S = \Sigma \times I_N$) : $1 \times I_N$
Curve ( ) : as shown
TMS ($xt = \Sigma$) : $1 \times t$
Instantaneous ($I_{INST} = \Sigma \times I_S$) : ∞

CURVE SWITCH POSITION ( )	SELECTED CURVE	OPERATING TIME RANGE AT $10 \times I_S$ (SECONDS)	
		NOMINAL	RANGE
	SI Standard Inverse	2.97	2.82-3.12
	VI Very Inverse	1.50	1.42-1.58
	EI Extremely Inverse	0.808	0.747-0.869
	LTI Long Time Inverse	13.3	12.6-14.0
	D2 Definite Time 2S	2.00	1.94-2.06
	D4 Definite Time 4S	4.00	3.88-4.12
	D8 Definite Time 8S	8.00	7.76-8.24

TABLE 4.2

Note: The above operating time ranges make no allowance for errors in measurement of the A.C. current amplitude.

Two phase + earth fault relay: Repeat the above test 4.2.6 for the second independent time delay element.

4.2.7 TIME MULTIPLIER SETTING SWITCHES (x t = $\sum$)

Connect the relay time delayed output contacts to both trip the test set and to stop a timer Inject single phase current into a convenient phase of each separate time delay element at a current level of 10 x rated current.

Measure the operating time on the S.I. curve at the TMS switch positions shown in Table 4.3.

Switch Selections:

Current ($I_S = \sum I_N$)	1 x I_N
Curve (⌊‾)	SI Standard Inverse
TMS (xt = $\sum$)	as shown
Instantaneous ($I_{INST} = \sum$ x I_S)	: ∞

TMS SWITCH POSITION	TMS VALUE	OPERATING TIME RANGE AT 10 x I_N (SECONDS)	
		NOMINAL	RANGE
← ← → ← ← ←	0.125 x t	0.371	0.341-0.402
→ → → ← ← ←	0.2 x t	0.594	0.564-0.625
→ → ← → → →	0.9 x t	2.67	2.62 - 2.73

TABLE 4.3

Note: The above operating time ranges make no allowance for errors in measurement of the A.C. current amplitude.

Two Phase + Earth Fault Relay: Repeat the above test 4.2.7 for the second independent time delay element.

4.2.8 INSTANTANEOUS CURRENT SETTINGS ($I_{INST} = \sum \times I_S$), IF FITTED

WARNING: IT IS NOT DIFFICULT TO DAMAGE THE RELAY BY APPLYING EXCESSIVE CURRENT FOR LONG DURATIONS DURING TESTING. IT IS IMPORTANT TO FOLLOW THE INSTRUCTIONS PRECISELY.

The following test checks that the instantaneous current switches are operative. The Instantaneous Trip output contacts must be connected to trip the test set.

It is recommended that the time delay element is set to operate in 4S and that the time delay output contacts are also wired to trip the test set, to prevent relay damage if current is applied for too long.

The current level should be set and then suddenly applied; DO NOT INCREASE THE CURRENT SLOWLY since this may damage the relay. The test must be repeated for each of the switch positions shown in Table 4.4 initially at a higher current level to check that the instantaneous element operates and then at a lower level at which the element should not trip.

Switch Selections: Current ($I_S = \sum \times I_N$) : $0.5 \times I_N$
Curve (⌊) : D4 Definite Time 4S
TMS ($xt = \sum$) : 1 x t
Instantaneous ($I_{INST} = \sum \times I_S$): as shown

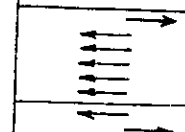
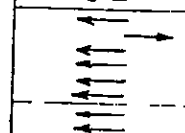
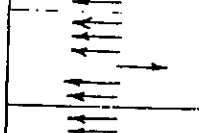
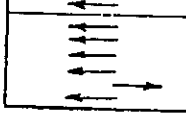
INSTANTANEOUS SWITCHES		CURRENT LEVEL (A)		I_{INST} RESPONSE
POSITION	VALUE	I_N = 1A	I_N = 5A	
	1 x I_S	0.55 0.50	2.75 2.5	TRIP NO TRIP
	2 x I_S	1.05 0.95	5.25 4.75	TRIP NO TRIP
	4 x I_S	2.1 1.9	10.5 9.5	TRIP NO TRIP
	8 x I_S	4.2 3.8	21.0 19.0	TRIP NO TRIP
	16 x I_S	8.4 7.6	42.0 38.0	TRIP NO TRIP

TABLE 4.4

Note: The above current ranges make no allowance for errors in measurement of the A.C. current amplitude.

Two Phase + Earth Fault Relay: Repeat the above test 4 2.8 for the second instantaneous current element, if fitted.

4.3 INSTRUCTIONS TO COMMISSION THE RELAY AT THE SETTINGS CALCULATED FOR THE PARTICULAR APPLICATION

TEST EQUIPMENT REQUIRED

Overcurrent Test Set with timing facilities
Multifinger Test Plug type MMLB 01 for use with test block type MMLG when required
Calibrated Multimeter 0-10A AC 0-250V DC

4.3.1 GENERAL

Secondary injection commissioning tests should be carried out using a portable single phase overcurrent test equipment, preferably injected via test block type MMLG. It is most important that this test equipment is capable of injecting an undistorted sinusoidal current waveform.

If there is any possibility that the relay settings are to be changed during the life of the relay without re-commissioning, then the instructions in section 4.2 should be initially completed.

It is assumed that the wiring connections have been checked.

Ensure that the main system current transformers are shorted, before isolating the relay from the current transformers in preparation for secondary injection tests.

4.3.2 D.C. SUPPLY

If not previously checked, remove the relay from its case and check that the DC voltage between terminals 13 (+ve) and 14 (-ve) is within the range specified on the rating card.

For secondary injection testing using test block type MMLG, insert test plug type MMLB01 with the required main CT shorting links fitted. It may then be necessary to link across the front of the test plug to restore the d.c. supply to the relay.

4.3.3 RELAY CT SHORTING SWITCHES

If not previously checked, and with the relay module removed from its case, check that each CT shorting switch is closed by injecting rated current into each phase circuit. The rated current of the relay (I_N) is either 1A or 5A and appears on the module rating card.

4.3.4 ENERGISE RELAY

Isolate the relay trip circuits, insert the module, connect the DC supply to the relay and record the D.C. voltage at terminals 13 (+ve) and 14.

4.3.5 INSTANTANEOUS CURRENT SETTINGS ($I_{INST} = \Sigma \times I_S$): IF FITTED

WARNING: IT IS NOT DIFFICULT TO DAMAGE THE RELAY BY APPLYING EXCESSIVE CURRENT FOR LONG DURATIONS DURING TESTING. IT IS IMPORTANT TO FOLLOW THE INSTRUCTIONS

The following test will normally follow the Instantaneous Switch selection test 4.2.8 and the same setting

It is recommended that the time delay element is set to operate in 4S and that the time delay output contacts are also connected to trip the test set, to prevent relay damage if current is applied for too long.

The current level should be set and then suddenly applied; DO NOT INCREASE THE CURRENT SLOWLY since this may damage the relay.

Two tests, shown in Table 4.5 below, are specified for the particular x I_S setting required for the application. Initially the higher current level should be applied to check that the instantaneous element operates, and then the lower current level should be applied to check that no trip occurs.

Switch Selections: Current ($I_S = \Sigma \times I_N$) : 0.5 x I_N
Curve ( ) : D4 Definite Time 4S
TMS ($x\ t = \Sigma$) : 1 x t
Instantaneous ($I_{INST} = \Sigma \times I_S$): As specified for the application

INSTANTANEOUS SETTING (xI_S)	CURRENT LEVEL (A), I_N = 1A NO TRIP I_{INST}	TRIP I_{INST}	CURRENT LEVEL (A), I_N = 5A NO TRIP I_{INST}	TRIP I_{INST}
1	0.50	0.55	2.5	2.75
2	0.95	1.05	4.75	5.25
3	1.4	1.6	7.1	7.9
4	1.9	2.1	9.5	10.5
5	2.3	2.7	11.8	13.2
6	2.8	3.2	14.2	15.8
7	3.3	3.7	16.6	18.4
8	3.8	4.2	19	21
9	4.2	4.8	21	24
10	4.7	5.3	23	27
11	5.2	5.8	26	29
12	5.7	6.3	28	32
13	6.1	6.9	30	35
14	6.6	7.4	33	37
15	7.1	7.9	35	40
16	7.6	8.4	38	42
17	8.0	9.0	40	45
18	8.5	9.5	42	48
19	9.0	10.0	45	50
20	9.5	10.5	47	53
21	9.9	11.1	49	56
22	10.4	11.6	52	58
23	10.9	12.1	54	61
24	11.4	12.6	57	63
25	11.8	13.2	59	66
26	12.3	13.7	61	69
27	12.8	14.2	64	71
28	13.3	14.7	66	74
29	13.7	15.3	68	76
30	14.2	15.8	71	79
31	14.7	16.3	73	82

TABLE 4.5

Note: The above current levels make no allowance for errors in measurement of the A.C. current amplitude.

4.3.6 INSTANTANEOUS ELEMENT OPERATING TIME

It is not recommended that the I_{INST} element operating time is checked, due to the possibility of damage to the relay. The tests of section 4.3.5 and the previous works tests provide adequate assurance that the operating time is correct.

4.3.7 CURRENT SENSITIVITY SETTING ($I_S = \Sigma \times I_N$)

The test checks the sensitivity of the relay at the selected setting. The 4 second definite time curve with TMS of 0.05 x t is chosen so that the relay operating time is fast.

Slowly increase the applied single phase current until the time delay flag (t) operates and trips the test set. The minimum value of current to cause operation should be recorded for each phase/earth fault connection and should be within the values recorded below in Table 4.6.

Switch selections: Current ($I_S = \Sigma \times I_N$) : As specified for the application
Curve (⌊) : D4 4 second definite time
TMS ($xt = \Sigma$) : 0.05 x t
Instantaneous ($I_{INST} = \Sigma \times I_S$): As specified for the application

I_S SETTING ($\times I_N$)	AC CURRENT OPERATE LEVEL (AMPS)	
	I_N = 1A	I_N = 5A
0.1X	0.10 - 0.11	0.50 - 0.55
0.2X	0.20 - 0.22	1.00 - 1.10
0.3X	0.30 - 0.33	1.50 - 1.65
0.4X	0.40 - 0.44	2.00 - 2.2
0.5X	0.50 - 0.55	2.50 - 2.75
0.6X	0.60 - 0.66	3.00 - 3.3
0.7X	0.70 - 0.77	3.50 - 3.85
0.8X	0.80 - 0.88	4.00 - 4.4
0.9X	0.90 - 0.99	4.50 - 4.95
1.0X	1.00 - 1.10	5.00 - 5.5
1.1X	1.10 - 1.21	5.50 - 6.05
1.2X	1.20 - 1.32	6.00 - 6.6
1.3X	1.30 - 1.43	6.50 - 7.15
1.4X	1.40 - 1.54	7.00 - 7.7
1.5X	1.50 - 1.65	7.50 - 8.25
1.6X	1.60 - 1.76	8.00 - 8.8
1.7X	1.70 - 1.87	8.50 - 9.35
1.8X	1.80 - 1.98	9.00 - 9.9
1.9X	1.90 - 2.09	9.50 - 10.45
2.0X	2.00 - 2.2	10.00 - 11.0

TABLE 4.6

Note: The above current operate levels make no allowance for errors in measurement of the A.C. current amplitude.

Three Phase Relay: Repeat Test 4.3.7 for the other two phases.

Two Phase + Earth Fault Relay:

4.3.8 CURVE SELECTION ( )

The following test checks the selected curve characteristic at specified points.

WARNING: IT IS NOT DIFFICULT TO OVERLOAD TEST EQUIPMENT IF THE LONG TIME INVERSE CURVE IS SELECTED

Connect the relay time delayed output contacts to both trip the test set, and to stop a timer. Inject single phase current into a convenient phase of each separate time delay element at the current levels specified below, for the particular curve selection specified for the application.

Check that the operating time for the relay is within the range shown in Table 4.7 below.

Table 4.7 details the inverse time operating time curves at 2 x, 5 x, 10 x and 20 x I_S. It is recommended that results are recorded at 10 x followed by 2 x I_S, the others are listed in case these are requested by customer.

Definite time characteristics should be checked at 2 x I_S only.

Switch Selections: Current ($I_S = \sum x\ I_N$) : 1 x I_N
Curve ( )
TMS ($xt = \sum$) : As specified for the application
Instantaneous ($I_{INST} = \sum x\ I_S$): 1 x t
: As specified for the application

Curve Switch Position ( )	Selected Curve	Operating Time at Specified Current (Seconds)							
		2 x I_S		5 x I_S		10 x I_S		20 x I_S	
		Nom.	Range	Nom.	Range	Nom.	Range	Nom.	Range
	SI	10.03	9.52-10.6	4.28	4.06-4.50	2.97	2.82-3.12	2.27	2.15-2.38
	VI	13.50	12.8-14.2	3.38	3.21-3.55	1.50	1.42-1.58	0.71	0.675-0.746
	EI	26.7	24.6-28.7	3.33	3.08-3.59	0.808	0.747-0.869	.201	0.170-0.231
	LTI	120	114 -126	30.0	28.5-31.5	13.3	12.6-14.0	6.32	6.00-6.64
	D2	2.00	1.94-2.06						
	D4	4.00	3.88-4.12						
	D8	8.00	7.76-8.24						

TABLE 4.7

Note: The above operating time ranges make no allowance for errors in measurement of the A.C. current amplitude.

Two Phase + Earth Fault Relay: Repeat test 4.3.8 for the second time delay element.

4.3.9 OPERATING TIME AT FINAL SELECTED SETTINGS

The relay switches should be set to the specified settings and the operating time of the time delay circuit (t) should be measured at 2 x I_S.

The measured time should be within ± 5% or 40 mS of the value computed from the previous time measured at 2 x I_S (in test 4.3.8) multiplied by selected TMS settings.

Switch selection:

Current	$I_S = \Sigma \times I_N$	)
Curve		) As specified for
TMS	$xt = \Sigma$	) the application
Instantaneous	$I_{INST} = \Sigma x\ I_S$	)

Two Phase + Earth Fault Relay: Repeat test 4.3.9 for the second time delay element.

4.3.10 CURVE INDICATOR PEG

Indication of the curve which is selected by the curve selection switches, may be given by inserting the black indicator peg (provided with the relay) into the correct hole as shown on the front panel diagram.

The two phase and earth fault relay is provided with two pegs to indicate both the phase and earth fault curves.

Note: The black peg does NOT alter the selected curve, but is an inert indicator provided for the convenience of the customer. The peg may be discarded if not required by the customer.

4.3.11 FINAL CHECK

Carefully check that all indicating flags and relay output contacts are operating correctly, and that with the relay lid replaced, that the reset mechanism resets the flags.

ADDENDUM COMMISSIONING TEST RECORD DATE _____

MULTIFUNCTION OVERCURRENT RELAY TYPE MCGG

STATION [ ] CIRCUIT [ ]

RELAY MODEL NO. MCGG [ ] SERIAL NO. [ ]

RELAY TYPE 1 PHASE [ ] 2 PHASE + E.F. [ ] 3 PHASE [ ]

INSTANTANEOUS ELEMENT(S) PHASE [ ] E.F. [ ]

RATED CURRENT I_N 1A [ ] 5A [ ]

DC VOLTAGE 30/34V [ ] 48/54V [ ] 110/125V [ ] 220/250V [ ]

FINAL SWITCH SETTINGS

PHASE FAULT(S): CURRENT SENSITIVITY I_S [ ] x I_N
CURVE [ ]
TMS [ ]
INSTANTANEOUS ELEMENT I_{INST} [ ] x I_S

EARTH FAULT : CURRENT SENSITIVITY I_S [ ] x I_N
CURVE [ ]
TMS [ ]
INSTANTANEOUS ELEMENT I_{INST} [ ] x I_S

TEST RESULTS

4.3.3 Relay CT Shorting Switches [ ]

4.3.4 DC Supply Voltage [ ] V

4.3.5 Current level not to trip I_{INST} Phase [ ] A E.F. [ ] A

Current level to trip I_{INST} [ ] A [ ] A

4.3.7 Current Sensitivity at Selected Setting I_S

Ph A [ ] Ph B [ ] Ph C [ ] EF [ ]

4.3.8 Operating Time on Selected Curve Phase EF

Curve [ ] 10 x I_S [ ] [ ]

2 x I_S [ ] [ ]

4.3.9 Operating Time at Final Selected Settings

TMS [ ] 2 x I_S [ ] [ ]

COMMISSIONING ENGINEER

5. MAINTENANCE

Periodic maintenance is not required, however, periodic inspection and test is recommended.

The general condition of the relay should be monitored by periodic visual inspection and general operational tests should be performed.

To completely check the operation of relay, all tests outlined in section 4.3 should be performed. However, for a general assurance of correct operation, the test outlined in section 4.3.9 will suffice.

Note: Correct flag operation should be obtained.

6. PROBLEM ANALYSIS

6.1 General

These instructions enable a fault to be located to sub assembly level. Fault finding at component level is not recommended.

The major reasons for this are as follows:

(1) Fault finding on printed circuit boards (PCB's) requires specialised knowledge and equipment.

(2) Components used in manufacture are subjected to strict quality control procedures and in certain cases selected for particular characteristics. Metal oxide semiconductor (MOS) components are used which require very careful handling.

(3) Damage can be caused to printed circuit board track unless extreme care is used in replacement of components.

(4) Replacement of certain components will require recalibration of the relay.

In the event of a faulty sub-assembly being found, it is recommended that the relay is returned to GEC Measurements or sent to a competent service centre for the work to be carried out. However, replacement sub-assemblies can be made available from GEC Measurements upon request, provided the relay model number and serial number are quoted. Recalibration of the relay is not required after the replacement of a sub-assembly.

Note: Before fault finding on the relay is commenced, all connections and supplies to the relay should be checked to ensure that the fault lies within the relay.

6.2 Procedure

The following tests should only be carried out under laboratory conditions, when a faulty relay has been identified and removed from its case.

6.2.1 Gaining Access to Relay Internal Wiring

With the relay upside down on a clean dry surface, the earth screen covering the solder side of the PCB should be removed, by applying gentle leverage with a small screwdriver (tension should be avoided on the wire connecting the screen to the PCB). The four PCB mounting screws should then be removed and the PCB allowed to fold downwards making sure the switches are free from the front-plate.

6.3 D.C. Supply Check

All measurements in this section are referred to the negative d.c. rail which is monitored on the terminal block connection 14.

Apply rated d.c. voltage to terminals 13(+ve) and 14(-ve) and ensure that this voltage appears across points 1(+ve) and 2(-ive) on the PCB, using a voltmeter. If not, the wiring to the PCB has been disturbed. This can be rectified by ensuring that the wire from terminal 13 goes to point 1 on the PCB and the wire from terminal 14 goes to point 2 on the PCB. The wires can be secured into the GTH connector by pulling the black plastic moulding away from the PCB, pushing the tinned ends of the wires into their holes and pushing the black moulding back towards the P.C.B. This process secures the wires and ensures a good electrical connection.

6.3.1 High D.C. Voltages

When a relay is operated from 48V or 110V supply, check the voltage at GTH pin 21 on the PCB is 36V +5%. If there is a considerable difference from 36V, then the vented enclosure assembly could be faulty. It should be noted however, that a fault in the vented enclosure assembly may result in damage to the main P.C.B.

6.4 A.C. Input Tests

For this test, an a.c. current source, capable of delivering 2x rated current to the relay is required. An a.c. ammeter is also required. The current should be applied to each input of the relay in turn and the ammeter should measure the current flowing from the inhibit contacts for the particular pole of the relay.

RELAY TYPE	APPLY 2X RATED CURRENT TO TERMINALS (2 OR 10A)	MEASURE 20mA +10% AT TERMINALS
1Ø	27 and 28	21 and 22
3Ø and 2Ø + E/F	27 and 28 25 and 26 23 and 24	21 and 22 19 and 20 17 and 18

If 20mA is not obtained at the inhibit terminals, then firstly the relay wiring must be checked, both at the relay contact moulding and at the PCB GTH connectors. If these are sound, then the current transformer of the faulty pole must be replaced.

6.5 Miniature Relay(s) and Flags(s)

Trace the wires from the miniature relay unit to PCB and disconnect at GTH connector. Apply 30V DC across the coil and check for correct operation.

6.5.1 Repair and Replacement

The miniature relay cannot be repaired. If it is proved to be operating incorrectly it must be replaced. The flag assembly can be reset, or damaged parts replaced as required. If any part of the flag/relay assembly is disturbed, the settings of the assembly must be checked and adjustments made where necessary.

To gain acccess to the flag assembly, to replace parts or check the settings, it is necessary to dismantle the module. Once access to the flag assembly, mounted on the front plate of the relay, has been gained, adopt the following procedure.

1. Remove the screw holding the side plate to the top plate and remove the side plate.

   This will reveal the miniature relay and the flag spring. Access is possible through the side of the assembly unless impeded by other components.

2. Remove the 3 screws (2 at the top, 1 at the bottom) holding the printed circuit board to the top and bottom plates. The circuit board, with the miniature relay can now be withdrawn from the flag assembly.

3. Remove the 2 screws holding the flag spring and clamp plate to the bottom plate. The flag spring can now be extracted from the assembly.

   Note that the top and bottom plates cannot be removed from the relay front plate without damaging the adhesive name plate, which covers the heads of the countersunk screws holding the top and bottom plates to the front plate.

   Assembly is in the reverse order of dismantling.

6.5.2 Settings

Flag spring units are supplied pre-bent, and should need no further adjustment before assembly.

With the flag spring and printed circuit board carrying the miniature relay assembled to the top and bottom plates check the settings:

1. Lift the flag spring to the latched position so that the tab on the flag spring rests on the catch on the relay.

2. a. With a gap of 0.4 mm between the inside face of the armature and the core, the flag should remain latched.

   b. With a gap of 0.15 mm the flag should drop. If necessary, carefully bend the tab to fulfil these conditions.

These tests should be performed by positioning an appropriate feeler gauge between the armature and core and then energising the coil with the appropriate voltage to pick up the relay.

3. With the flag in the latched position the spring should exert a force of 10 - 12 grams on the catch. This is checked using a gram gauge, just lifting the flag off the catch.

4. With the flag in the latched position the white stripes on the flag should show evenly through the slots in the nameplate. Adjustment is made by slackening the p.c.b. fixing screws and moving the p.c.b. assembly up or down as necessary then re-tightening the screws. After adjustment off the p.c.b. the catch engagement must be rechecked as in 2.

5. Allow the flag to drop (by energising the relay coil). The red stripes should show evenly through the slots in the nameplate. Adjustment is made by bending the tabs, one on each side of the bottom plate.

6.5.3 Replacement Parts

Spring	GT7001 001
Flag	GT9009 001
Clamp plate	GT2007 001

Printed circuit board GT0020 001

Armature clip:

Several different makes of relay are used, which require different designs of armature clip. When ordering a replacement relay, state that it is for use in a flag assembly and it will be supplied with the correct armature clip.

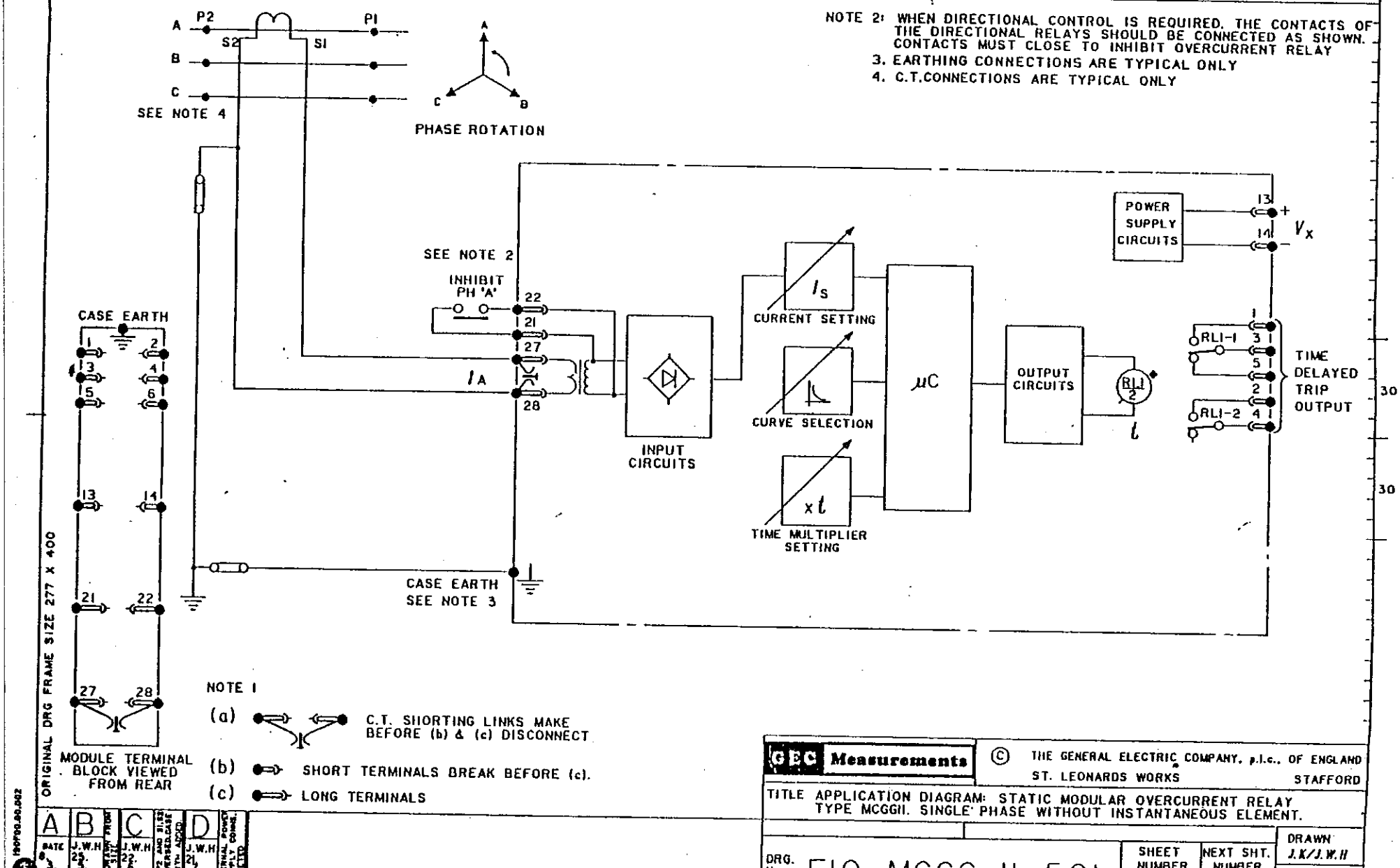
The armature clip is marked by a number in the moulding to indicate which make of relay it fits:

Make of relay	Number on clip	Reference Number
PASI	Blank or 1	GT 6008 001
Haller	2	GT 6007 001

6.6 Printed Circuit Board

Any fault which cannot be traced on the Current Transformer, Miniature Relay or vented enclosure assembly may safely be assumed to be on the printed circuit board, in which case the relay should be returned to GEC Measurements for repair.

DRG. No. FIO MCGG II 501



ORIGINAL DRG FRAME SIZE 277 X 400

A	B	C	D	
DATE	J.W.H	J.W.H	J.W.H	

GEC Measurements

ST. LEONARDS WORKS STAFFORD

TITLE APPLICATION DIAGRAM: STATIC MODULAR OVERCURRENT RELAY TYPE MCGGII. SINGLE PHASE WITHOUT INSTANTANEOUS ELEMENT.

DRG. No. FIO MCGG II 501

SHEET NUMBER

NEXT SHT. NUMBER

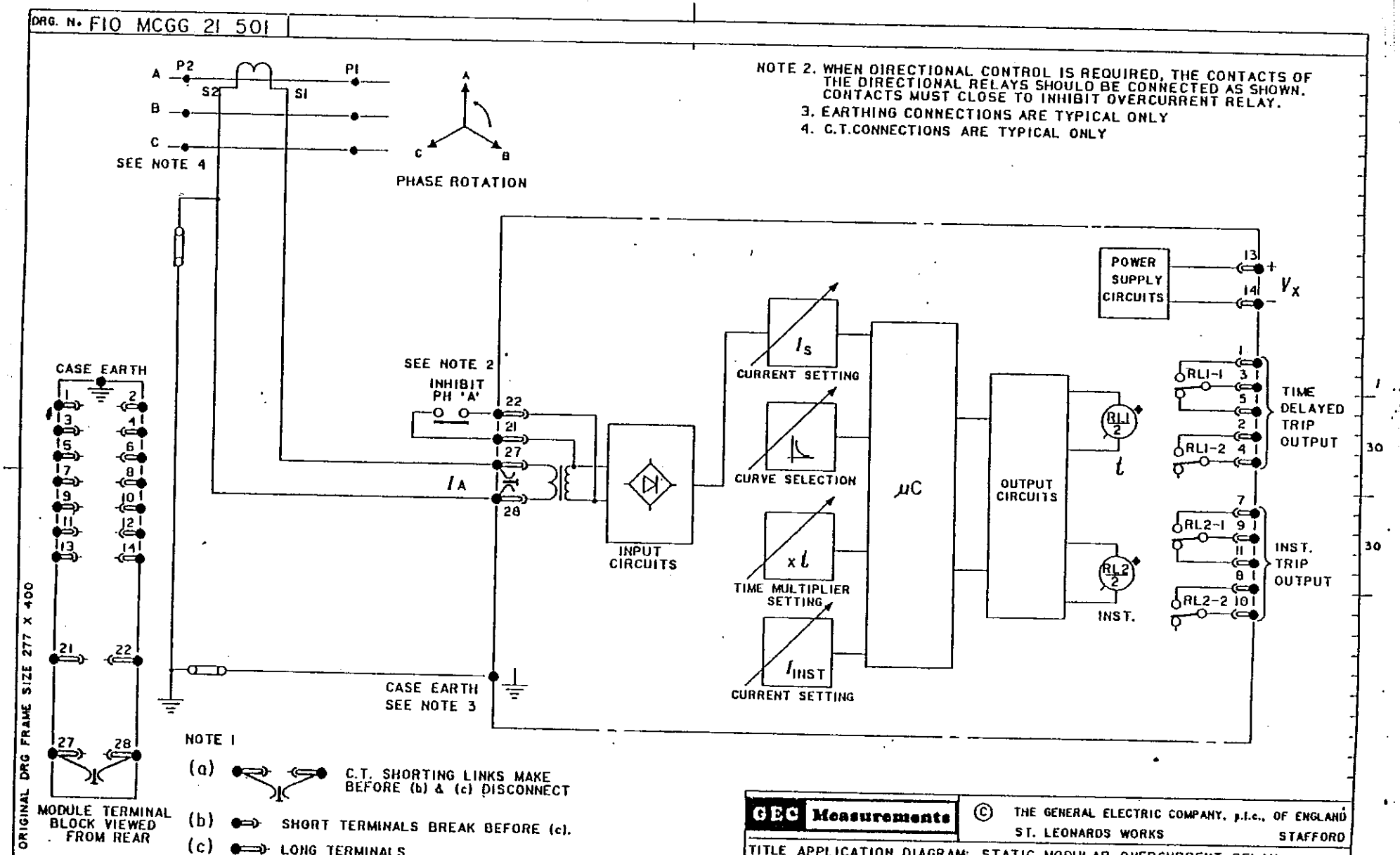
DRAWN J.K/J.W.H

CHECKED A.P.

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

A3 297 X 420

DRG. No. FIO MCGG 21 501



ORIGINAL DRG FRAME SIZE 277 X 400

A	DATE 6.5.82	B	J.W.H 25.5.82	REDRAWN FROM A3 SIZE	C	J.W.H 22.6.82	P1,P2 AND S1,S2 REVERSED. CASE EARTH ADDED	D	J.W.H 21.7.82	INTERNAL POWER SUPPLY CONNS. DELETED

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

GEC Measurements

ST. LEONARDS WORKS STAFFORD

TITLE APPLICATION DIAGRAM: STATIC MODULAR OVERCURRENT RELAY TYPE MCGG21.SINGLE PHASE WITH INSTANTANEOUS ELEMENT.

SCALE

DRG. No. FIO MCGG 21 501

SHEET NUMBER

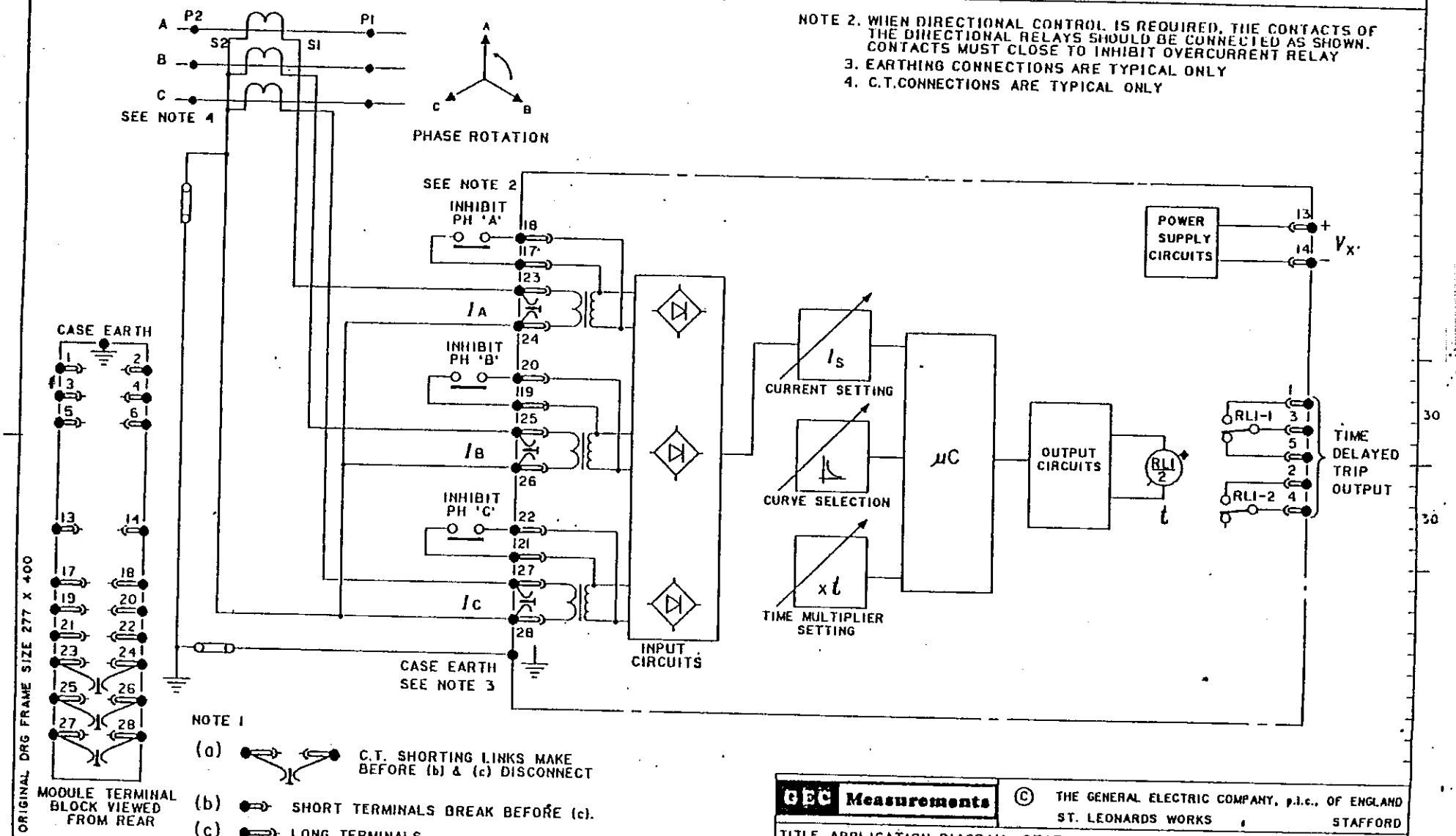
NEXT SHT. NUMBER

DRAWN J.K/J.W.H

CHECKED A.P.

A3 297 X 420

DRG. N. FIO MCGG 31 501



NOTE 2. WHEN DIRECTIONAL CONTROL IS REQUIRED, THE CONTACTS OF THE DIRECTIONAL RELAYS SHOULD BE CONNECTED AS SHOWN. CONTACTS MUST CLOSE TO INHIBIT OVERCURRENT RELAY

3. EARTHING CONNECTIONS ARE TYPICAL ONLY

4. C.T.CONNECTIONS ARE TYPICAL ONLY

NOTE 1

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

(b) SHORT TERMINALS BREAK BEFORE (c).

(c) LONG TERMINALS

ORIGINAL DRG FRAME SIZE 277 X 400

A	B	C	D	
DATE 8.3.82	J.W.H 25.5.82	J.W.H 22.6.82	J.W.H 2.7.82	REDRAWN FROM 'Z' SIZE. / P1,P2 AND S1,S2 REVERSED.CASE EARTH ADDED. / INTERNAL POWER SUPPLY CONNS. DELETED.

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

GEC Measurements

ST. LEONARDS WORKS STAFFORD

TITLE APPLICATION DIAGRAM: STATIC MODULAR OVERCURRENT RELAY TYPE MCGG31. THREE PHASE WITHOUT INSTANTANEOUS ELEMENT

SCALE

DRG. N FIO MCGG 31 501

SHEET NUMBER

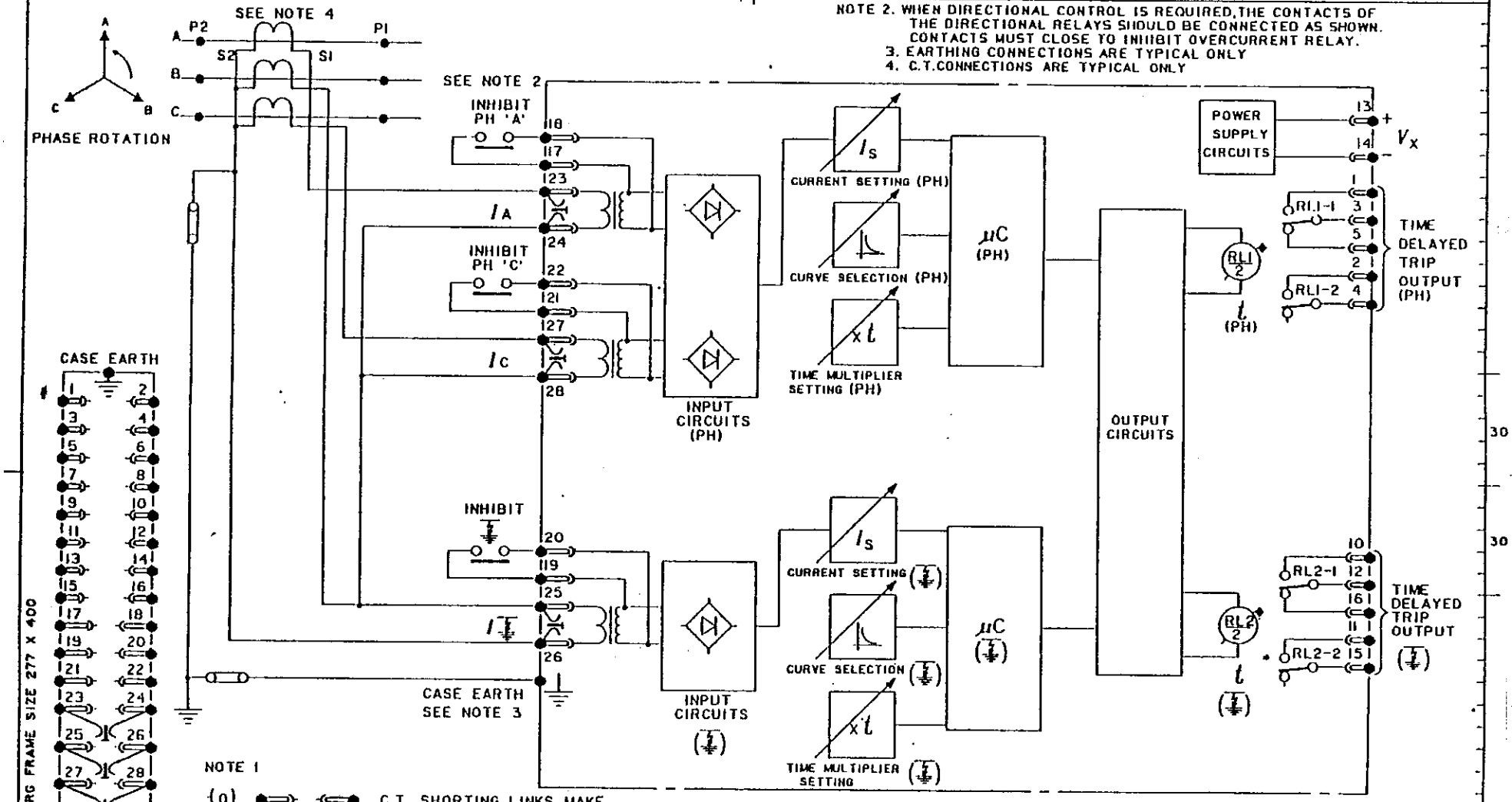
NEXT SHT. NUMBER

DRAWN J.K/J.W.H

CHECKED A.P.

A3 297 X 420

DRG. N. FIO MCGG 41 501



NOTE 2. WHEN DIRECTIONAL CONTROL IS REQUIRED, THE CONTACTS OF THE DIRECTIONAL RELAYS SHOULD BE CONNECTED AS SHOWN. CONTACTS MUST CLOSE TO INHIBIT OVERCURRENT RELAY.
3. EARTHING CONNECTIONS ARE TYPICAL ONLY
4. C.T. CONNECTIONS ARE TYPICAL ONLY

MODULE TERMINAL BLOCK VIEWED FROM REAR

ORIGINAL DRG FRAME SIZE 277 X 400

NOTE 1

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

(b) SHORT TERMINALS BREAK BEFORE (c).

(c) LONG TERMINALS

GEC Measurements

ST. LEONARDS WORKS STAFFORD

TITLE APPLICATION DIAGRAM: STATIC MODULAR OVERCURRENT RELAY TYPE MCGG41. TWO PHASE AND EARTH FAULT WITHOUT INSTANTANEOUS ELEMENT

A DATE 28.5.82	SCALE			DRAWN J.K/J.W.H
	DRG. N FIO MCGG 41 501	SHEET NUMBER 1	NEXT SHT. NUMBER -	CHECKED

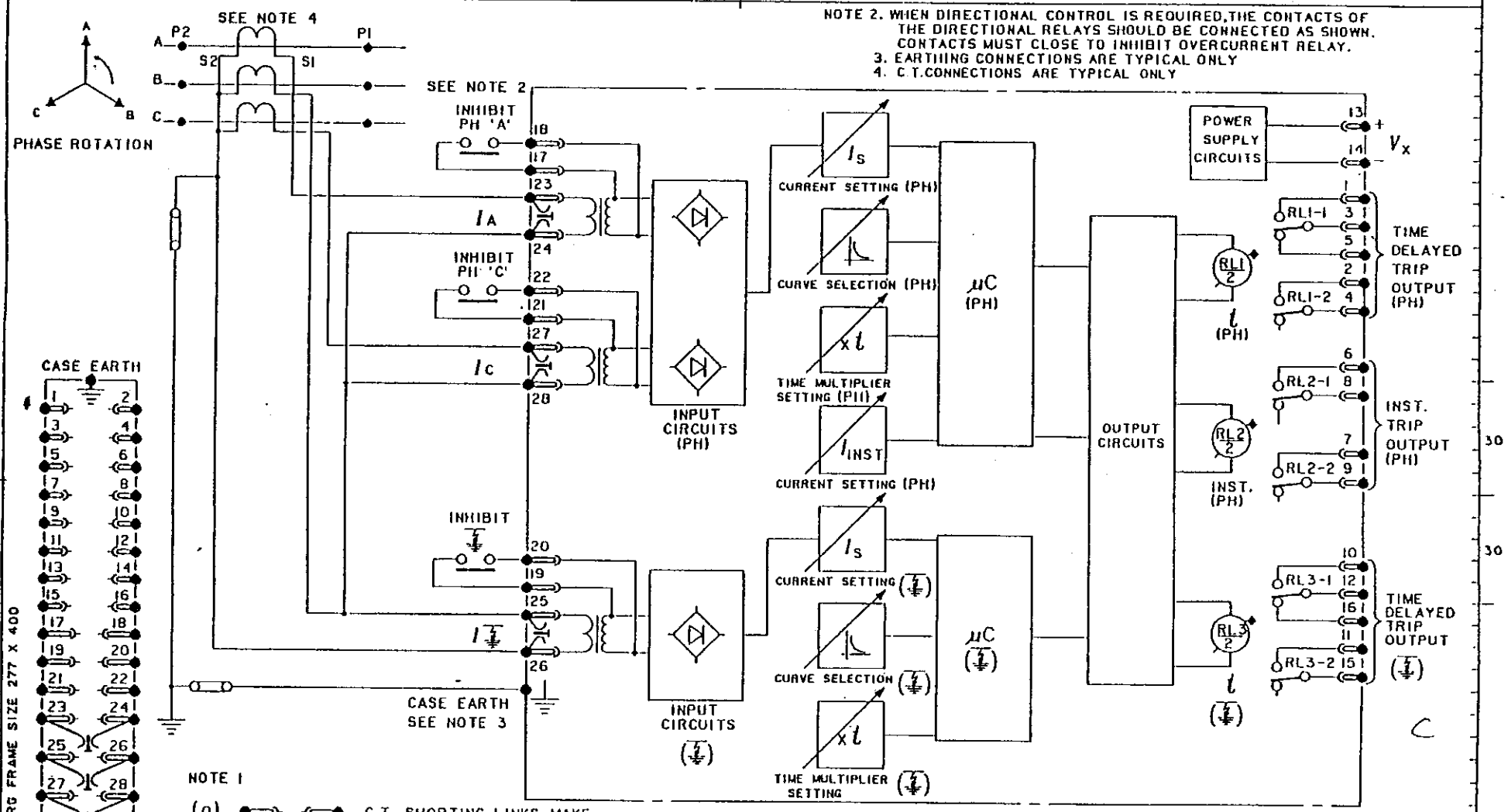
WHEN QUOTING THE DRAWING NUMBER PLEASE STATE THE LATEST LETTER OF ISSUE

A3 297 X 420

30

30

DRG. No. FIO MCGG 51 501



NOTE 2. WHEN DIRECTIONAL CONTROL IS REQUIRED, THE CONTACTS OF THE DIRECTIONAL RELAYS SHOULD BE CONNECTED AS SHOWN. CONTACTS MUST CLOSE TO INHIBIT OVERCURRENT RELAY.
3. EARTHING CONNECTIONS ARE TYPICAL ONLY
4. C.T. CONNECTIONS ARE TYPICAL ONLY

GEC Measurements

S.T. LEONARDS WORKS STAFFORD

TITLE APPLICATION DIAGRAM: STATIC MODULAR OVERCURRENT RELAY TYPE MCGG51. TWO PHASE AND EARTH FAULT WITH INSTANTANEOUS ELEMENT

SCALE

DRG. No. FIO MCGG 51 501

SHEET NUMBER 1

NEXT SHT. NUMBER -

DRAWN J.K/J.W.H

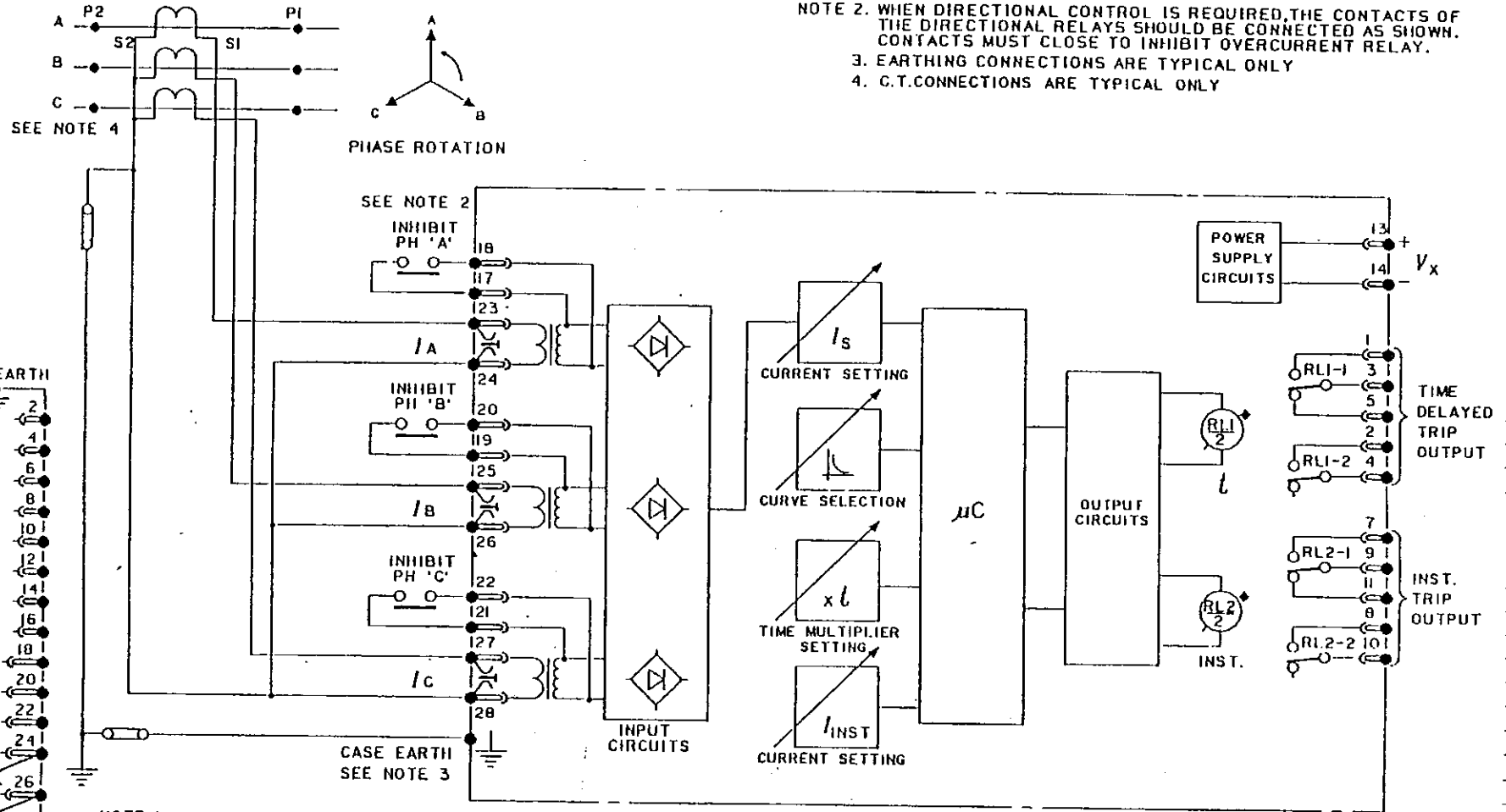
CHECKED

A3 297 X 420

A DATE 28.5.82

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

DRG. No. FIO MCGG 61 501



NOTE 2. WHEN DIRECTIONAL CONTROL IS REQUIRED, THE CONTACTS OF THE DIRECTIONAL RELAYS SHOULD BE CONNECTED AS SHOWN. CONTACTS MUST CLOSE TO INHIBIT OVERCURRENT RELAY.

3. EARTHING CONNECTIONS ARE TYPICAL ONLY

4. C.T. CONNECTIONS ARE TYPICAL ONLY

NOTE 1

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

(b) SHORT TERMINALS BREAK BEFORE (c).

(c) LONG TERMINALS

A	DATE 8.3.82	J.W.H 22.3.82	REDRAWN FROM 7" SIZE	
B	J.W.H 22.6.82		PLT 27 AND 31.32 REVERSED CASE EARTH ADDED	
C	J.W.H 22.6.82			
D	J.W.H 21.7.82		INTERNAL POWER SUPPLY CONNS. DELETED	

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

GEC Measurements

ST. LEONARDS WORKS STAFFORD

TITLE APPLICATION DIAGRAM: STATIC MODULAR OVERCURRENT RELAY TYPE MCGG61. THREE PHASE WITH INSTANTANEOUS ELEMENT.

SCALE -

DRG. N° FIO MCGG 61 501

SHEET NUMBER

NEXT SHT. NUMBER

DRAWN J.K/J.W.H

CHECKED A.P.

A3 297 X 420