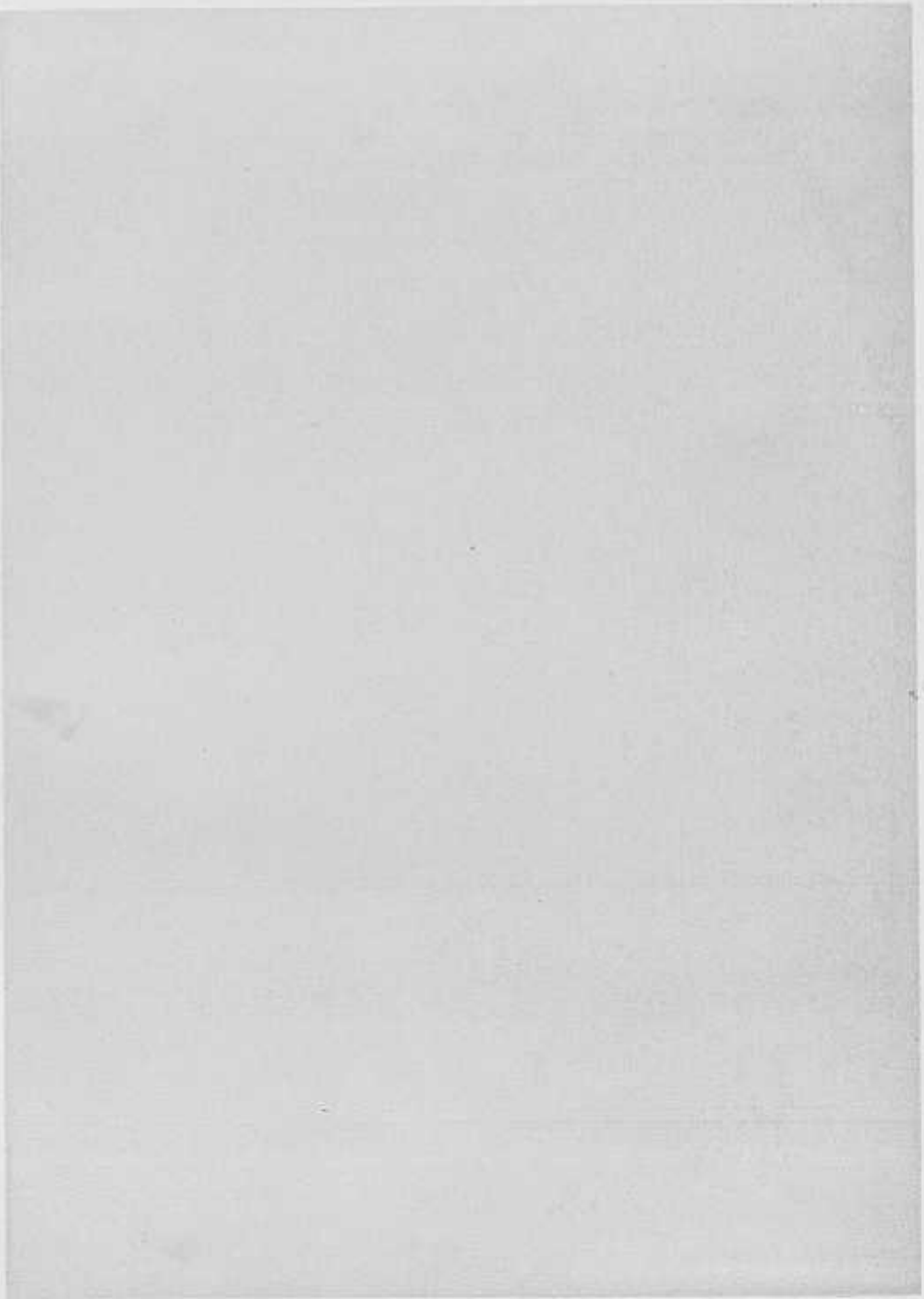
ENGLISH ELECTRIC

COMMISSIONING INSTRUCTIONS



TYPE CAEM 33

COMMISSIONING INSTRUCTIONS FOR SECOND ROTOR EARTH FAULT RELAY - CAEM33

1. Application:

When a single E/F is detectedin the D.C. field circuit of a machine, the machine has to be taken out of service at the first opportunity. This is because, if allowed to run with an E/F on the 'rotor', a subsequent second E/F can cause severe damage to the machine. However, a relay which can detect such a second E/F and trip out the machine can make it possible to run the machine even with a single E/F, without any such risks, thus helping to preserve the generation capacity. English Electric type CAEM33 has been designed for the above application.

2. Recommendation:

Second rotor E/F relays are generally recommended for machines of capacity about 30 MW and above whose field voltage is about 200 - 250 volts and above.

3. Principle of operation:

The heart of the second rotor E/F detection scheme is a very sensitive transductor element. The AC winding of the transductor is connected in series with a rectified A.C. voltage relay 'A'. The DC winding of the transductor on the other hand is connected in series with the rotor E/F circuit.

Under normal conditions - i.e. with no DC flowing, the AC winding of the transductor presents a high impedance, and the AC voltage applied is mostly dropped across this winding. Hence, the relay 'A' remains de-energised. When the second rotor E/F occure, a d.c. current flows through the transductor d.c. winding which causes the impedance of the AC winding to reduce considerably by driving the transductor core into saturation. Hence, the applied voltage is fully available across the relay 'A' and the latter operates.

In the event of the AC supply failing, another rectified AC relay 'E', connected across the supply, disconnects the DC winding of the transductor, shorts the relay 'A', and gives an alarm.

Parasitic AC currents flowing through the E/F path should not cause mal-operation of the CAEM33 relay while in service. To ensure this, the AC winding of the transductor of this relay is made in two halves, and the two are connected in series in opposition so that any AC currents reflected from the Rotor E/F circuit are cancelled out on the AC side of the transductor, and have therefore no effect on the operation of the rectified AC, output element 'A' of the CAEM33 relay. To minimise the effects of those parasitic AC currents further, a choke is also provided in series with the CAEM33 relay, as shown in the enclosed sketch.

Further, to protect the CAEM33 relay from possible overheating during a second rotor E/F, a built-in AC auxiliary relay with hand reset contacts is provided in the CAEM relay. A normally closed contact of this auxiliary isolates the CAEM33 relay as soon as the latter operates and also reinforces the tripimpluse.

4. Description of Scheme:

The schame of connections is as shown in the enclosed sketch. From the sketch it will be seen that the following equipment will be required.

a) Per Generator Circuit (i.e. on each panel)

One : 12 way, 4 position, selector switch (with 4 spare ways), lockable in any one position, but, key trapped in all positions except position 1.

One : Lamp 'Second rotor E/F protection in service'

b) Common equipment for a Generator Station: (i.e. on a common panel)

One : Type CAEM33 second rotor E/F relay

One : Milli ammeter with scale 1-0-1 m.A.

One : Sensitivity selector switch for the milli-ammeter, along with two resistors for sensitivity selection.

One : Potentiometer for coarse balancing

One : Potentiometer for fine balancing with one fixed resistor.

One : Choke for suppressing AC components.

A set of bus wires will be run between the panel containing the common equipment and the individual generator panels. The selector switch SW1 on the individual generator panels will have 4 positions as follows:

Position 1 : First Rotor E/F
" 2 : Balance
" 3 : Test
" 4 : Second Rotor E/F

Normally selector switches of all generator panels will be put in position - 1, in which the first rotor E/F relay type VAEM21 will be in service. On the occurrance of the first rotor E/F of any one machine, the selector switch of the concerned machine is put in position 2 connecting the coarse control potentiometer across the field winding circuit of the affected machine. Simultaneously, the milliammeter is also inserted in the circuit. As can be seen from the simplified diagram attached, the portions of the field winding on either side of the first rotor E/F and the coarse control potentiometer forms a DC bridge with the milliammeter connected accross a pair of opposite nodes.

By adjustment of the coarse/fine control and the range selector switch SW2 of the milliammeter, the bridge is balanced for null point.

The Selector Switch SW1 is then put in position-3, in which the milliammeter is replaced by the CAEM33 relay, but the latter's trip circuit is kept isolated. After making sure that the relay does not pick-up (if it picks up this would indicate incorrect balancing and further balancing would be required), the switch SW1 is turned to position 4, thereby putting the CAEM33 relay fully in service.

5. Technical Data:

a)	Field circuit voltage	:	250V, 450V, 650V and 850V
b)	Burden	:	Less than 3.5VA at 230V under normal condition. During operation the burden increases to approximately 15VA (Maximum).
c)	Auxiliary voltage	:	Single phase 230/240V, 50 HZ.
d)	Operating time	:	40 - 60 m. secs. at 5 times pick-up.
e)	Relay setting	:	Fixed pick-up setting of 1 m.A.
d)	Contacts	:	1 No. for trip 1 No. for trip alarm 1 NC for AC failure alarm All above contacts are potential free.
g)	Case	:	1D vertical drawout.

6. Operating time:

The relay operating time at 5 times. Pick-up is between 40- 60 m. secs.

7. Installation:

7.1 Location

The location should be dry, clean, free from dust and excessive vibrations and reasonably well illuminated to facilitate inspection.

7.2 Mounting:

The relay case should be mounted in a vertical panel surface (within $\pm$ 5°), so that the unit is practically horizontal.

8. Commissioning:

The following tests are recommended for the initial commissioning of CAEM33 relays.

i. General Inspection

ii. Wiring checks

iii. Insulation Tests

iv. Operational tests

v. Trip and alarm circuit checks

vi. Scheme check

8.1 General Inspection:

Wipe away any dust that has collected on the outside of the relay before opening the cover. Make a general inspection of the relay to ensure that all moving parts are free to move and that there are no signs of damage anywhere. Check that there are no loose connections of terminals and that the equipment is clean and free from dust. General inspection is normally carried out after disconnecting the tripping supply.

8.2 Wiring Checks:

Make a thorough check for the internal and external wiring of the relay. The internal wiring can be checked by ref. to the relay wiring diagram which is supplied for each relay. The external wiring should be checked with the help of schematic diagrams (showing reference number of inter-connecting wires, relay terminal nos. etc.) supplied by the relay panel manufacturers.

8.3 Insulation test:

Isolate wiring from earth. Find all relay terminals together and measure the insulation resistance to earth with 1000V megger. Reconnect all wiring according to the schematic diagram. It is especially important that D.C. supplies are wired with correct polarity.

8.4 Electrical Tests:

8.4.1 Apply AC auxiliary voltage between terminals 7 and 8 of the relay and check whether relay 'B' operates satisfactorily between 80% to 115% of nominal voltage.

8.4.2 With the AC auxiliary voltage applied, inject current at terminals 9 and 10 of the relay and check that unit 'A' operates for 1 mA.

8.5 Trip and Alarm Circuit Check:

During electrical tests, the trip and alarm circuits are usually rendered inoperative by removal of isolating links, relay trip latches etc. It is thus essential that on completion of these tests, the tripping, intertripping and alarm circuits are checked.

Close the relay contacts by hand after restoring all the links and latches to their original positions and check that the correct sequence of events is initiated and the right alarm comes in.

8.6 Scheme Check

The purpose of this test is to check First and Second Rotor E/F protection along with associated wiring.

Field system connections brought on SW-1 should first be isolated. Trip leads for unit tripping should also be isolated. In this test the field system is replaced by a replica field system in the form of a potential divider. Two 1K/1W potentiometers in parallel with station d.c. can be used as shown in the fig. 4.

With SW-1 at '1st Rotor E/F' position close switch 'S_1'. Check that VAEM-21 operates. Shift SW-1 to 'Balance'. Obtain balance on the mA meter by coarse/fine adjustment of potentiometers P_1 and P_2. Check on test that CAEM33 does not operate. Put SW-1 on '2nd Rotor E/F' position. Check operation of CAEM33 by closure of switch S2 thus creating an unbalance which simulates a second rotor E/F. Having completed this test restore all original connections.

9. Maintenance

9.1 Inspection:

Drawout case:

To inspect the relay, loosen the cover nuts and remove the cover. Rotate the latches which then provide finger holes for withdrawing the relay chassis. The action of rotating the latches operates a switch which isolates the trip circuit.

Dust filter:

Dust filters should be examined at least once in a year. If necessary the filter element should be cleaned as follows:

Remove the filter unit from the relay case. Remove the white/black nylon filter element. Wash the element in detergent, rinse and dry. Dip the element in light machine oil and shake off excess oil. Replace the filter unit in the relay case.

Attracted Armature Units:

The attracted armature relays are very simple and robust and rarely go wrong. Unless the relay is not operating correctly or damage has occurred it should be left undisturbed.

Electrical tests can be carried out once a year, if desired, to verify that the relay operates satisfactorily and that the pick-up is within the specified tolerance.

Contacts should be examined to ensure that they are clean. If it is necessary to clean them a burnishing tool should be used. It is most important that files or abrasive materials are NOT used for cleaning contacts.

The GEC Measurements relay tool kit contains a burnishing tool suitable for cleaning contacts. Details of the kit and instructions for its use are given in Publication MS/3803. If the contacts are badly damged, either return the relay to the factory or replace the contacts and process as set out in 'Mechanical settings'.

Mechanical Setting:

Attracted armature units will not fucntion correctly unless contact pressures, armature gaps etc. are withinthe manufacturing tolerances. These settings will not change during normal use and it is not necessary to make any routine checks on them. However, if parts have been replaced or repaired the settings must be readjusted.

Contacts:

When replacing contacts they should be bent slightly adjacent to the insulating blocks, so that they exert a pressure on the push-rods or support arms.

Before commencing with the settings ensure that

The armature platform is level
The bottom contacts are sitting on the push-rod shoulders.
The push rods are vertical
The contact tips are level when viewed from front.

With a 0.010" feeler gauge between the armature and the core face, close the armature by exerting pressure above the centre line of the core face. Adjust the top contact and support so that the contacts just touch. This gives a follow through of 0.020".

Set the contact gap to 0.070"/0.080" by adjusting the armature stop.

Using a gramme gauge, check that the top contact lifts off its support when a pressure of 15/20 grammes is exerted and that the bottom contact touches the top contact when a pressure of 20/25 grammes is applied. The pressure should be taken with the arm of the gauge placed under the tips of the contact. Any adjustment is obtained by increasing or decreasing the bend put into the contact at the start of the setting procedure. Check all setting.

Operation Indicators:

The sheild must be perfectly free to drop when the contacts are about to touch or just before they touch, but never after. This enables that the contacts do not close without the operation indicator being displayed.

Adjustment is made by bending the spring catch, which locates in a notch in the armature.

Contacts:

Two pairs of normally open self reset contacts and one pair of normally closed self reset contacts for thea.c. failure alarm.

Contact Ratings:

	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 660 volts.
D.C.	1250 watts with maxima of 5A 660 volts.	7500 watts with maxima of 30 amps and 660 volts.	110 watts (resistive) 50 watts (inductive) with maxima of 5A and 660 volts.

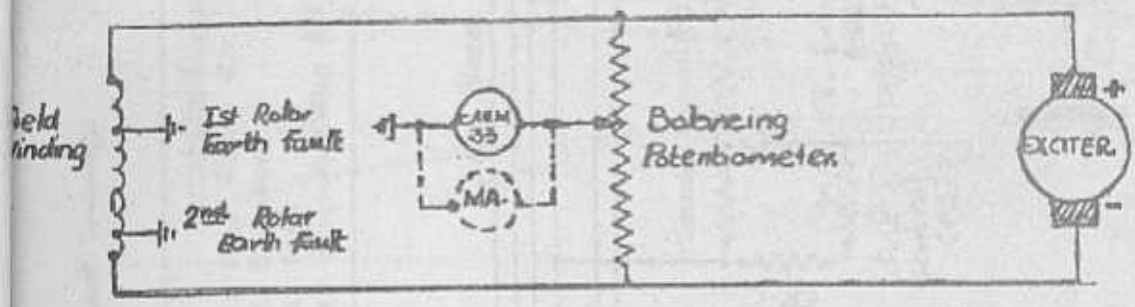

Field winding
1st Rotor Earth Fault
2nd Rotor Earth Fault
CAEM 33
MA
Balancing Potentiometer
EXCITER
+
-

FIG. 1

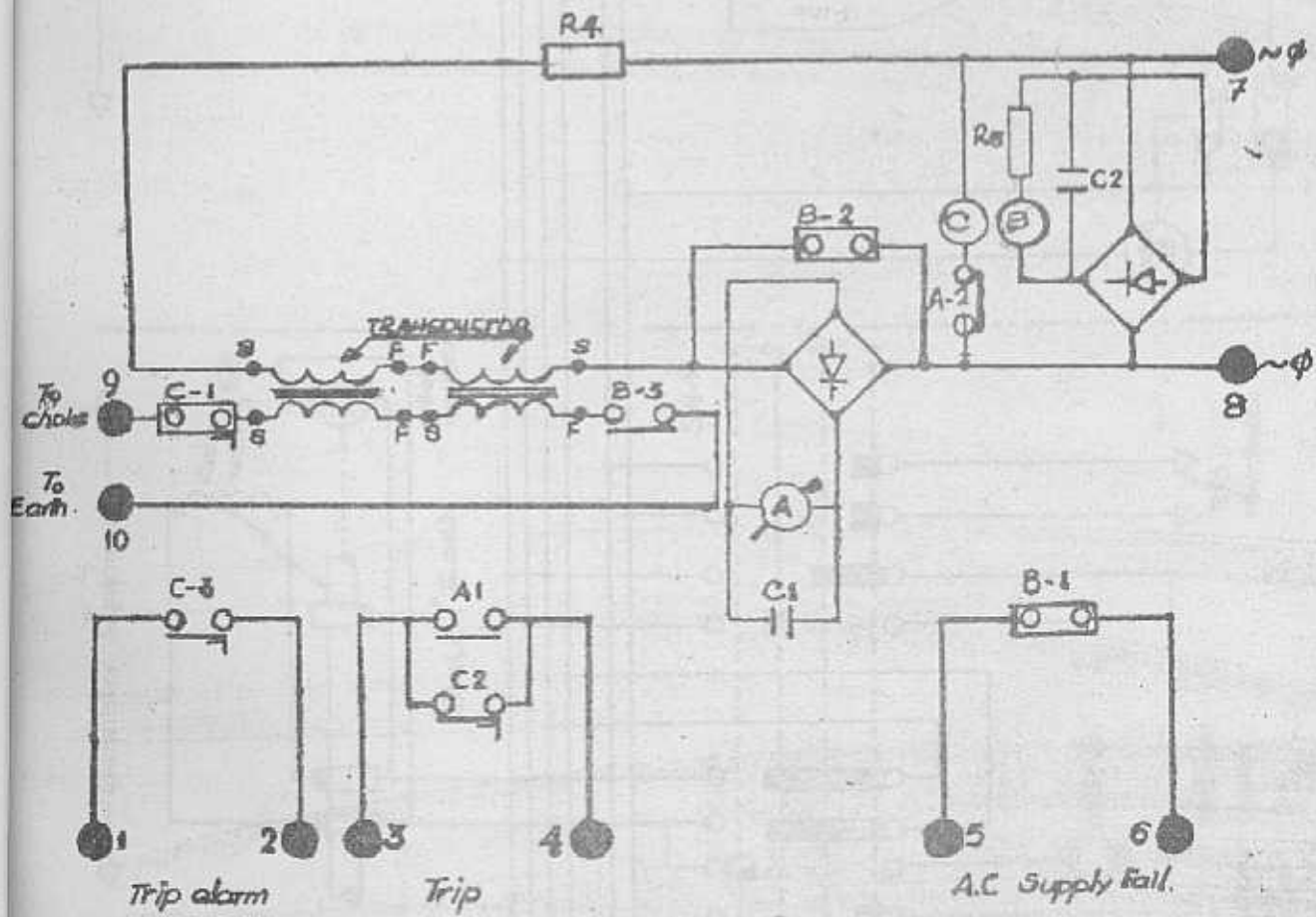

R4
~φ
7
R5
C2
B-2
C
B
A-2
TRANSDUCTOR
S
F F
S
To Choke
9
C-1
S
F S
F
B-3
~φ
8
To Earth
10
A
C1
C-3
A1
C2
B-1
1
2
3
4
5
6
Trip alarm
Trip
A.C Supply Fail.

FIG. 3

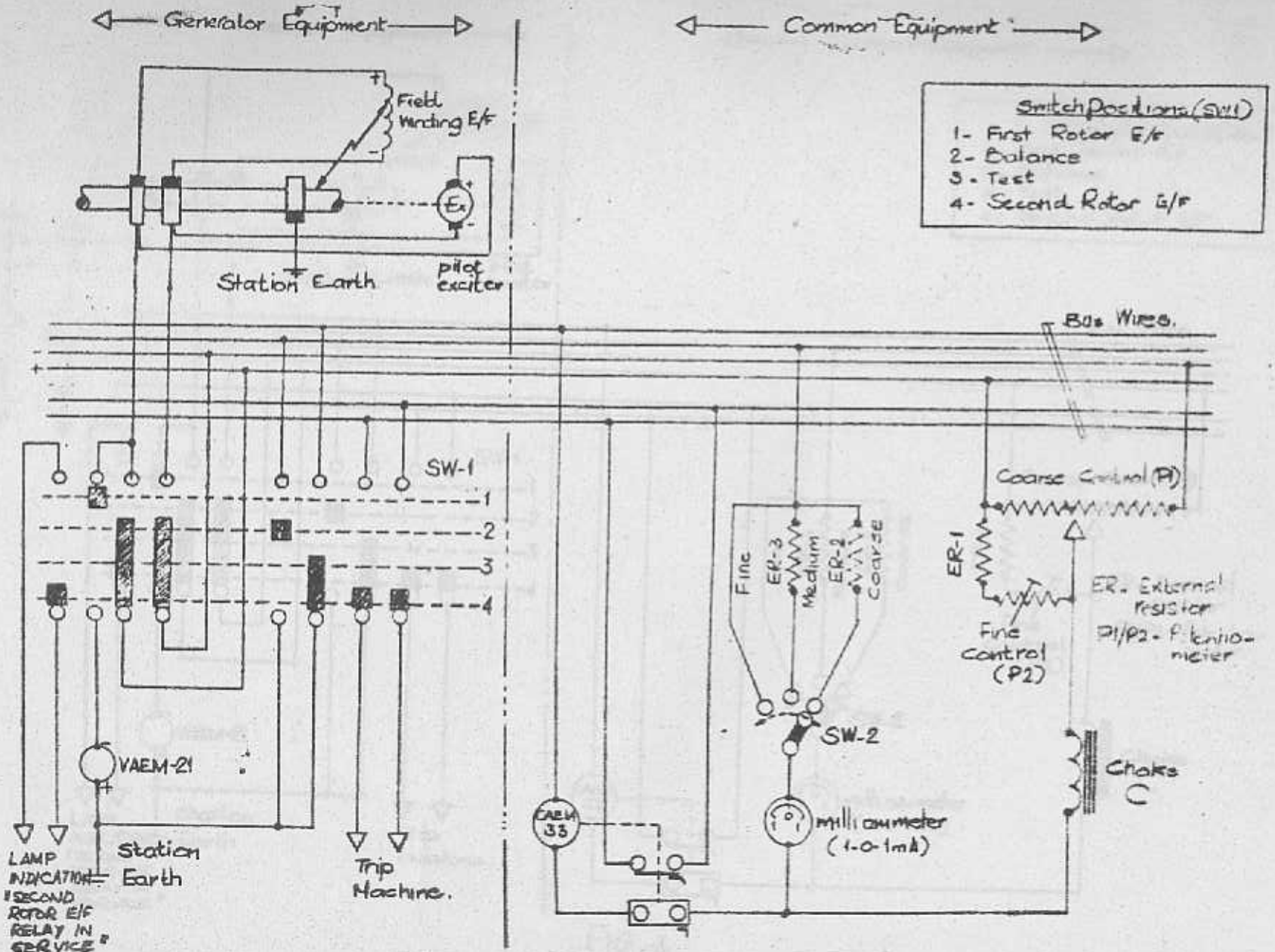

Generator Equipment
Common Equipment
Switch Positions (SW1)
1- First Roter E/F
2- Balance
3- Test
4- Second Rotor E/F
Field winding E/F
Station Earth
pilot exciter
Bus Wires.
SW-1
1
2
3
4
VAEM-21
LAMP INDICATION "SECOND ROTOR E/F RELAY IN SERVICE"
Station Earth
Trip Machine.
Fine
ER-3
Medium
ER-2
Coarse
SW-2
VAEM 33
milliammeter (1-0-1mA)
Coarse Control (P1)
ER-1
Fine control (P2)
ER- External resistor
P1/P2 - Potentiometer
Choke

FIG. 2

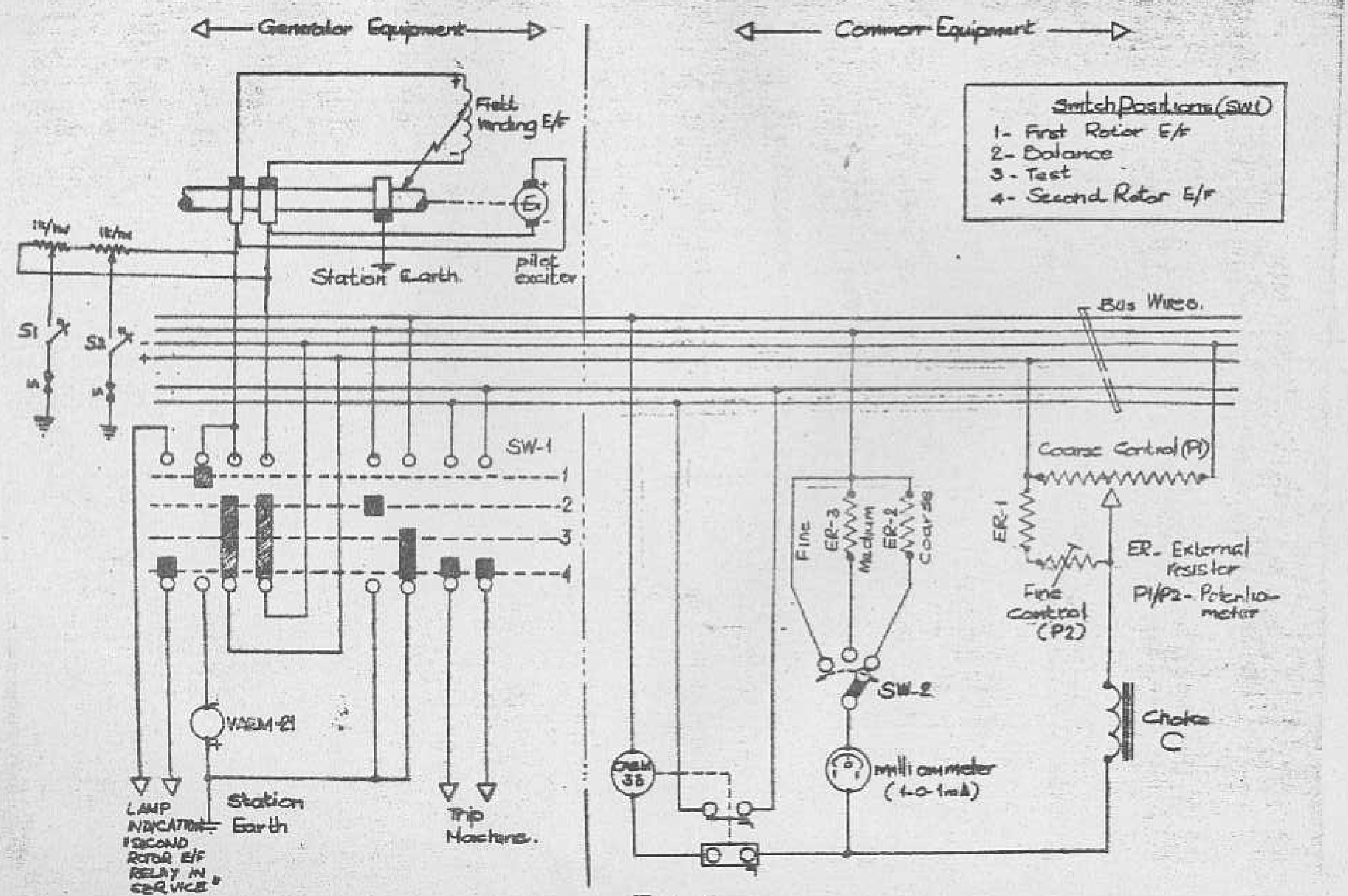

Generator Equipment
Common Equipment
Switch Positions (SW1)
1- First Rotor E/F
2- Balance
3- Test
4- Second Rotor E/F
Field Winding E/F
Station Earth
pilot exciter
S1
S2
Bus Wires.
SW-1
Coarse Control (P1)
ER-1
ER. External resistor
P1/P2- Potentiometer
Fine Control (P2)
Fine
ER-3
Medium
ER-2
Coarse
SW-2
Choke
C
VAEM-21
CAEM 38
milli ammeter
(1-0-1mA)
LAMP INDICATION "SECOND ROTOR E/F RELAY IN SERVICE"
Station Earth
Trip Machines.

FIG. 4

THE ENGLISH ELECTRIC COMPANY OF INDIA LTD.
HEAD OFFICE : PALLAVARAM, MADRAS-600 043.
WORKS : PALLAVARAM, MADRAS-600 043 & HOSUR-635 126.
OFFICES :
P.O. BOX 2540, BANGALORE-560 025 ● P.O. BOX 117, LUCKNOW -226 001
P.O. BOX 11112, BOMBAY -400 020 ● P.O. BOX 3306, MADRAS -600 034
P.O. BOX 2224, CALCUTTA -700 001 ● P.O. BOX 207, NEW DELHI-110 001

2/89