CMC 7350 CURRENT FLOW TEST SET
DESCRIPTION AND OPERATION

Figure 1 CMC 7350 Current Flow Test Set

1. GENERAL

1.01 This Section is issued to present the description and operating procedures for the CMC 7350 CURRENT FLOW TEST SET *(see Figure 1)*.

2. DESCRIPTION

2.01 The Current Flow Test Set is a solid-state direct current (dc) regulating and measuring device used for testing and adjusting relays and other apparatus with specified current flow and/or voltage requirements.

2.02 Due to the number of current control channels (six) and the low current range, the Test Set is particularly useful for adjusting polar relays.

2.03 The Test Set current measuring and adjusting capability ranges are:

0-19.99 mA adjustable to 0.01 mA
(Range Switch 20)

0-100.0 mA adjustable to 0.1 mA
(Range Switch 100)

0-199.9 mA adjustable to 0.1 mA
(Range Switch 200)

0-1000 mA adjustable to 1.0 mA
(Range Switch 1000)

2.04 The dc voltage measuring capability extends to 200 volts in 1/10 volt increments. Voltages cannot be measured in the 1000V range (Range Switch 1000 depressed). The Test Set cannot be used for measuring ac voltage.

2.05 The Test Set's push-button operation reduces testing time and simplifies testing. Polarity reversal is indicated by a "–" symbol on the digit display panel when the CMC 7350 is in the V (voltage) mode. The digital display panel provides an over range indication for use as a guide in selecting the proper range. When the meter is over-scaled on a given range, the display blinks.

NOTE: The meters supplied in these Test Sets may use LED or Sperry displays. The meter type selected is based strictly upon availability and has no effect on the performance of the Test Set. CMC cannot guarantee which meter type will be supplied on any given instrument.

2.06 Various connecting configurations can be selected through use of the function switches. The unique solid-state Current Regulating Network (CRN) is short-circuit proof in all modes of operation.

2.07 The Test Set is protected by three AGC 1.5 Ampere fuses; one each in the T and R leads of the TEST jack and one in the T lead of the MEASURE jack. The fuses are located in the front of the Test Set, directly above the TEST jacks. They can be accessed for changing, if necessary, by unscrewing the fuse caps on the front of the Test Set.

2.08 A dual-tone signaling device is built into the Test Set for monitoring contact opening or closure. This circuit operation is independent of the dc potentials present on relay contacts, usually eliminating the need to isolate or disconnect the apparatus under test.

2.09 The Test Set operates on 48V central office battery and is compatible with all types of telephone switching equipment. It is compact, lightweight and can be strapped to a rolling ladder when required.

2.10 All circuitry is mounted on printed circuit boards. Modular construction simplifies servicing and calibration.

2.11 Since the Test Set incorporates 100% solid-state circuitry, it is a long life test set designed to operate trouble-free. A periodic test for accuracy should be made due to the importance of the Test Set's application. A routine factory calibration test and inspection should be performed every six months.

Controls

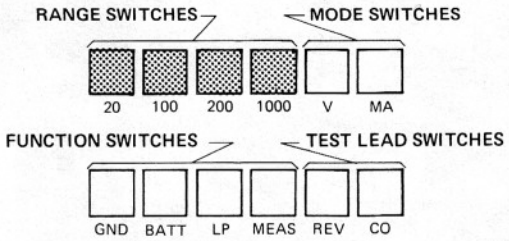
2.12 CONTROL POTENTIOMETERS: Each of the six, ten-turn control potentiometers may be adjusted to set a specific current value desired when its corresponding control switch (see Paragraph 2.13) is operated. To make a current adjustment, the test leads must be either shorted or connected to a relay or resistive load. The unique Current Regulating Network (CRN) will maintain the current independent of the load value.

IMPORTANT: After the current value is selected, the locking lever on the potentiometer should be operated to the left to prevent any knob rotation.

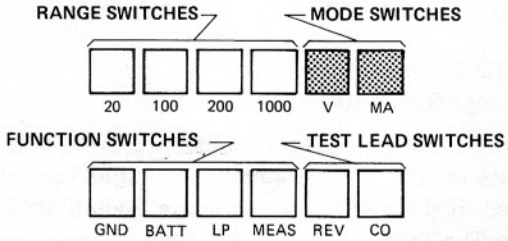
2.13 CONTROL SWITCHES: Each of the six control switches is used to switch on a current-control potentiometer to a value within the coarse adjustment range preset on the range switch (see Paragraph 2.14). The sixth control switch (SOAK) bypasses the range switch, placing the Unit in the 1000 mA range. The control switches can be locked in the operated position by rotating the push-button one-quarter turn in either direction while the switch is depressed. The switches can be released by rotating the push-button one-quarter turn in either direction.

2.14 RANGE SWITCHES: The four range switches are used for setting the correct range in the current mode.

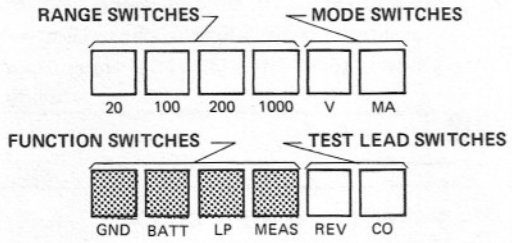
NOTE: When two mA values are such that they fall in two different ranges, select the range for the larger value and leave the Test Set in this range for both values.



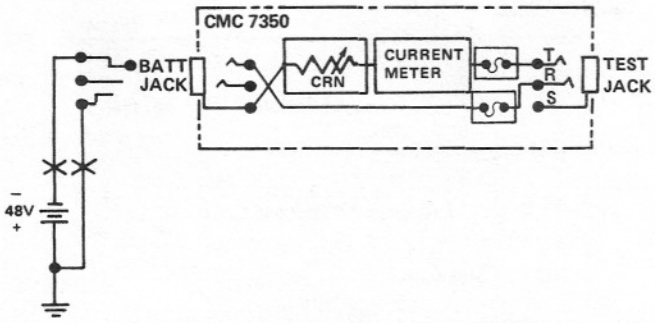
2.15 MODE SWITCHES: The two mode switches are used to select the units to be measured by the digital panel meter.



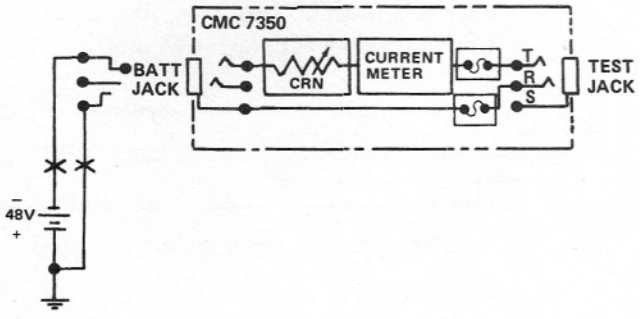
2.16 FUNCTION SWITCHES:



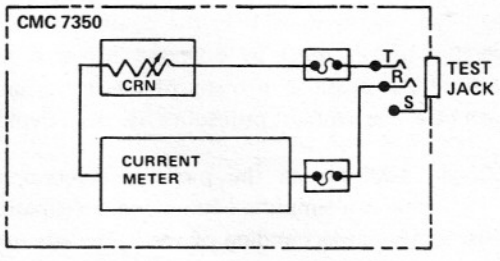
(a) When the GND switch is operated, the tip test lead is connected through the Current Regulating Network (CRN) to office ground, thus supplying an adjustable current to ground. The ring test lead is connected to office battery.



(b) When the BATT switch is operated, the tip test lead is connected through the current control network to office battery, thus supplying an adjustable current flow from battery.

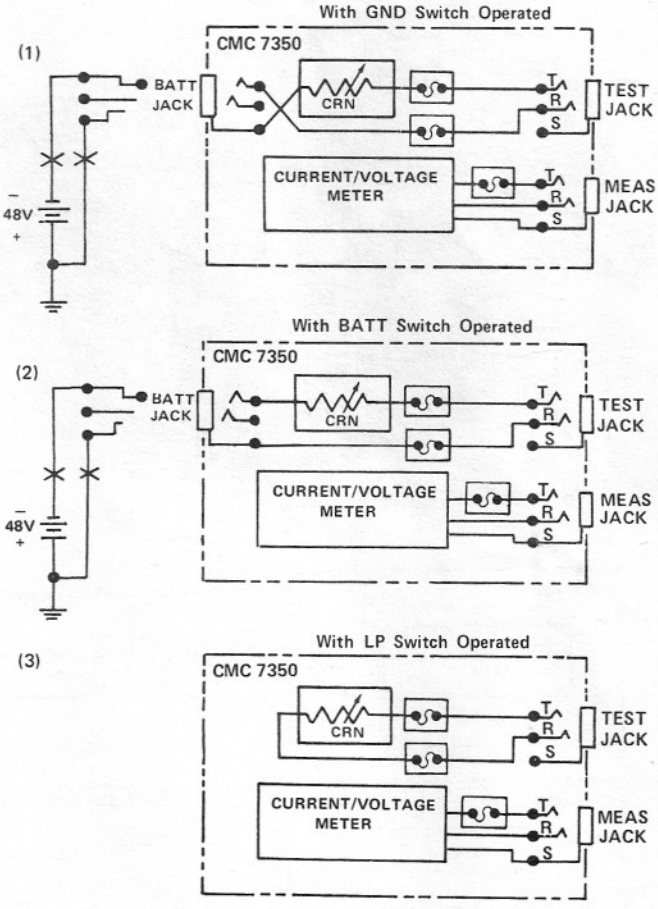


(c) When the LP switch is operated, the tip test lead is connected to the positive input of the Current Regulating Network (CRN). The ring test lead is connected to the negative input.

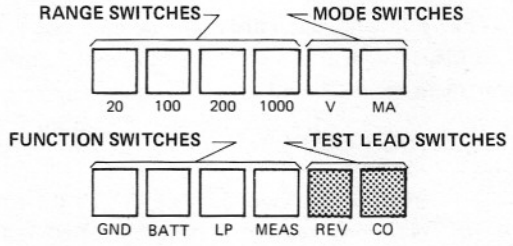


(d) When the MEAS switch is operated, the meter and ranging circuit are switched to the MEAS jack and the Current Regulating Network (CRN) remains connected to the test jack and is independent of the meter circuit. The meter can be used as a milliammeter or a voltmeter. Three configurations are shown.

NOTE: The meter cannot be used to measure ac voltage or current.



2.17 TEST LEAD SWITCHES:

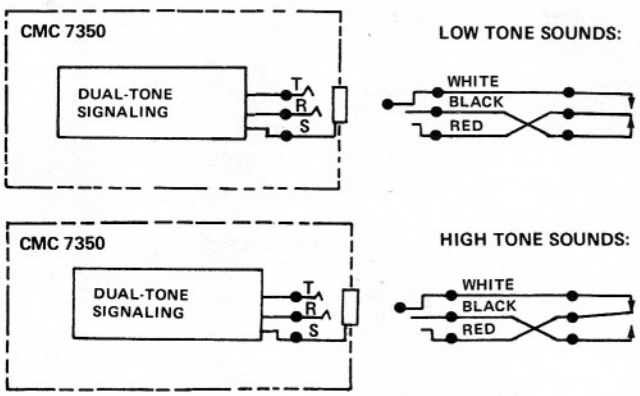


(a) When the REV switch is operated, the tip and ring test leads are reversed.

(b) When the CO switch is operated, the test leads are cut off or disconnected.

2.18 With the tone cord plugged into the TONE jack, shorting the black (ring) and red (sleeve) leads will cause the low tone to sound. For convenience, the black lead is associated with the back contact of polar relays, and the normally made spring contacts of "C" combinations. Shorting the white (tip) and red lead will cause the high tone to sound.

NOTE: The volume of the tone can be adjusted to a pleasant level through the hole in the front of the Test Set case.

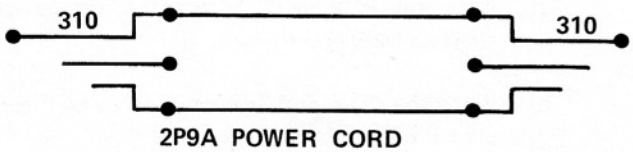


3. TEST CORDS

3.01 The following test cords and connecting devices are included with the Test Set and stored in a compartment inside the lid.

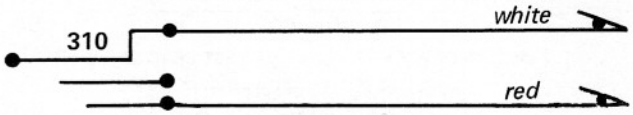
(a) Power Cord:

2P9A – Two-conductor cord, each end equipped with a 310 plug. Used when 48V power jacks are equipped.



2P9A POWER CORD

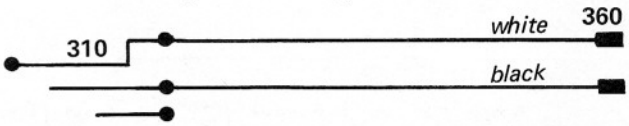
2W12A – Two-conductor cord, one end equipped with a 310 plug, the other end equipped with alligator clips. Used when 48V power terminals (33B type) are equipped.



2W12A POWER CORD CLIPS

(b) Test Cord:

2W17A – Two-conductor cord, one end equipped with a 310 plug, the other end equipped with 360 tools. Color-coded, White for tip, Black for ring.



2W17A TEST/MEASURE CORD

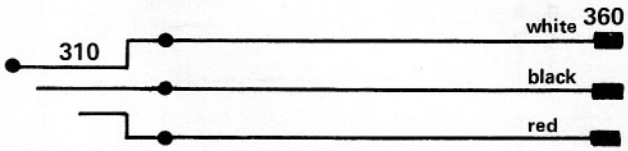
(c) Meas Cord:

2W17A – Same as Test Cord

(d) Tone Cord:

3W4A – Three-conductor cord, one end equipped with a 310 plug, the other end equipped with three 360 tools for use with various types of clips or W.E. Co. 587A tool.

CMC 0090 – Three-conductor cord, one end equipped with a 310 plug, the other end equipped with a W.E. Co. 587A tool.



3W4A DUAL TONE SIGNAL CORD

(e) Connecting Devices:

Two 419A tools
Five alligator clips for use with 360 tools.

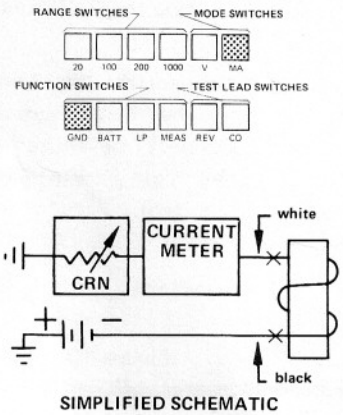
4. TEST ARRANGEMENTS

4.01 Figures 2 through 15 show typical test arrangements which can be obtained with the Current Flow Test Set. The figures show how the connections are made and which controls must be operated for each arrangement. Options are possible in many of the test arrangements. In each case, the simplest procedure has been depicted.

4.02 In addition to the pictorial diagram, each figure includes a simplified functional schematic drawing to assist in the understanding of the Test Set's operation and connecting options.

4.03 Figures 8 and 9 show the basic arrangements for using the dual-tone signal. It may be used in conjunction with all test arrangements when contact closure is desired.

4.04 In the figures, controls which must be operated for a specific operation are shaded. Controls which must be momentarily operated are identified with an explanation of their function. Lead identification (Black/White) of the TEST and MEASURE cords are indicated when required.



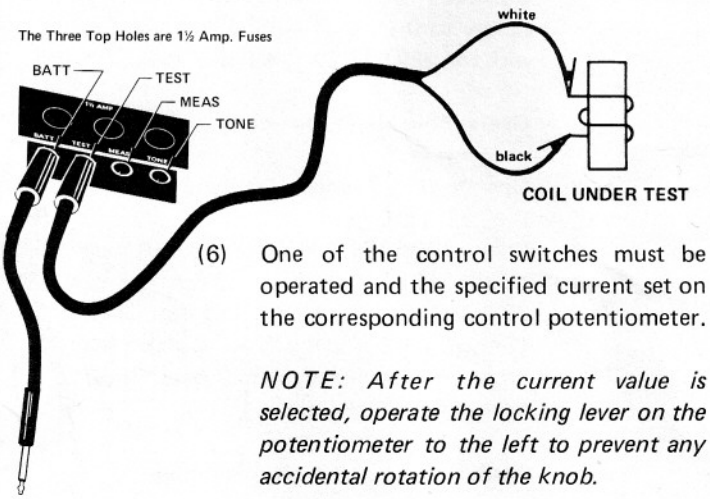
(1) Connect 48V central office battery to the Test Set BATT jack with the 2P9A or 2W12A Power Cord.

(2) Operate the MA mode switch.

(3) Operate the GND function switch.

(4) Connect the 2W17A Test Cord 310 plug to the TEST jack on the Test Set and the Black and White leads on the other end (two 360 tools equipped with alligator clips) to the relay winding.

(5) One of the four range switches must be operated for coarse current adjustment.



(6) One of the control switches must be operated and the specified current set on the corresponding control potentiometer.

NOTE: After the current value is selected, operate the locking lever on the potentiometer to the left to prevent any accidental rotation of the knob.

Figure 2 — Relay under test has neither battery nor ground connected to its winding.

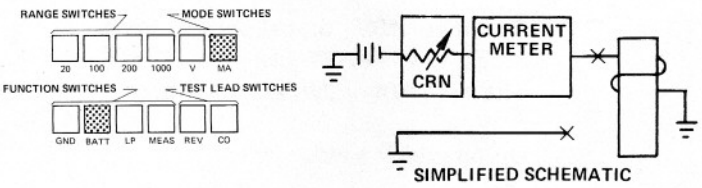
(1) Connect 48V central office battery supply to the BATT jack of the Test Set with the 2P9A or 2W12A Power Cord.

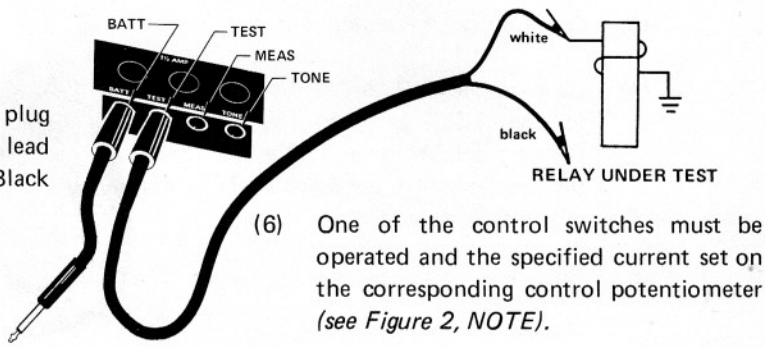
(2) Operate the BATT function switch.

(3) Operate the MA mode switch.

(4) Connect the 2W17A Test Cord 310 plug to the TEST jack. Connect the White lead alligator clip to the relay winding (Black lead not required).

(5) Select the appropriate current range.





(6) One of the control switches must be operated and the specified current set on the corresponding control potentiometer *(see Figure 2, NOTE).*

Figure 3 — Relay under test has one side of its winding connected to ground.

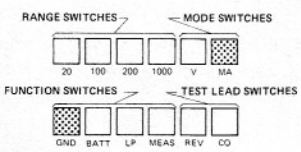
(1) Connect 48V central office battery supply to the BATT jack of the Test Set with the 2P9A or 2W12A Power Cord.

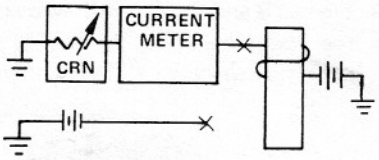
(2) Operate the MA mode switch.

(3) Operate the GND function switch.

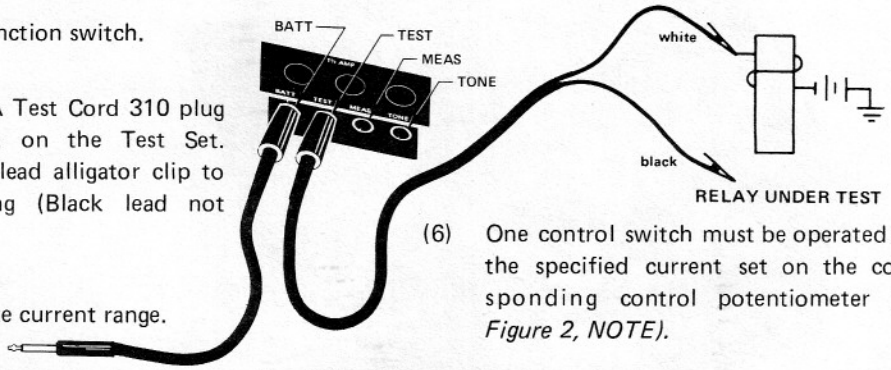
(4) Connect the 2W17A Test Cord 310 plug to the TEST jack on the Test Set. Connect the White lead alligator clip to the relay winding (Black lead not required).

(5) Select the appropriate current range.





SIMPLIFIED SCHEMATIC



RELAY UNDER TEST

(6) One control switch must be operated and the specified current set on the corresponding control potentiometer *(see Figure 2, NOTE).*

Figure 4 — Relay under test has one side of its winding connected to battery.

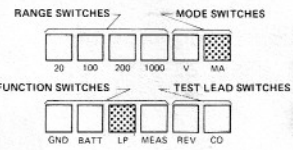
(1) Connect 48V central office battery supply to the BATT jack of the Test Set with the 2P9A or 2W12A Power Cord.

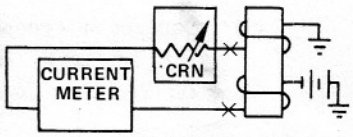
(2) Operate the MA mode switch.

(3) Operate the LP function switch.

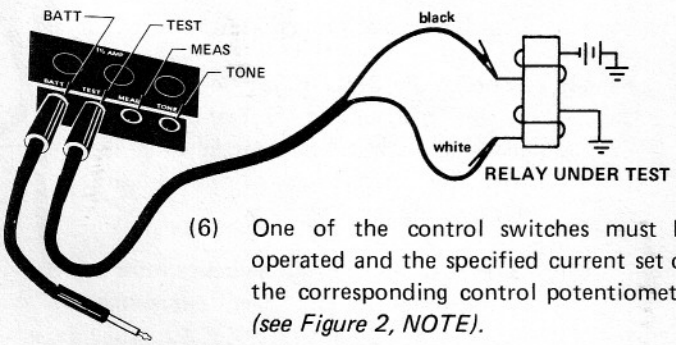
(4) Connect the 2W17A Test Cord 310 plug to the TEST jack on the Test Set or 3P35A Cord for use in Switch Test jacks. Connect the Black and White leads on the other end (equipped with alligator clips) to the relay windings.

(5) Select the appropriate current range.





SIMPLIFIED SCHEMATIC



RELAY UNDER TEST

(6) One of the control switches must be operated and the specified current set on the corresponding control potentiometer *(see Figure 2, NOTE).*

Figure 5 — Relay under test has battery and ground connected to its windings.

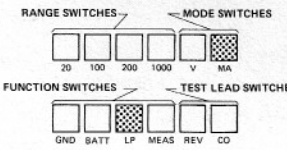
(1) Connect 48V central office battery supply to the BATT jack of the Test Set with the 2P9A or 2W12A Power Cord.

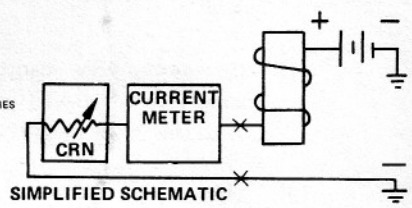
(2) Operate the MA mode switch.

(3) Operate the LP function switch.

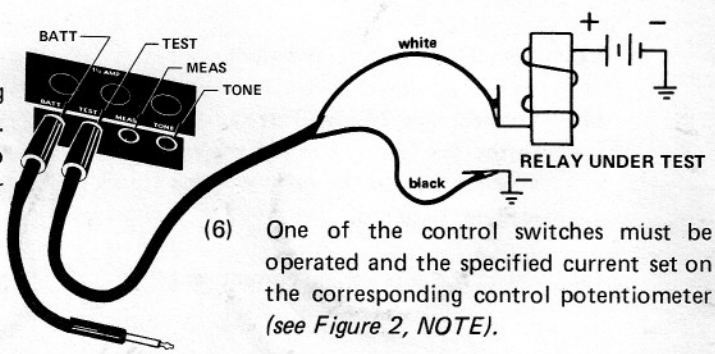
(4) Connect the 2W17A Test Cord 310 plug to the TEST jack on the Test Set. Connect the White lead alligator clip to the relay winding, the Black lead alligator clip to C.O. ground.

(5) Select the appropriate current range.





SIMPLIFIED SCHEMATIC



RELAY UNDER TEST

(6) One of the control switches must be operated and the specified current set on the corresponding control potentiometer *(see Figure 2, NOTE).*

Figure 6 — Relay under test has one side of its winding connected to positive battery.

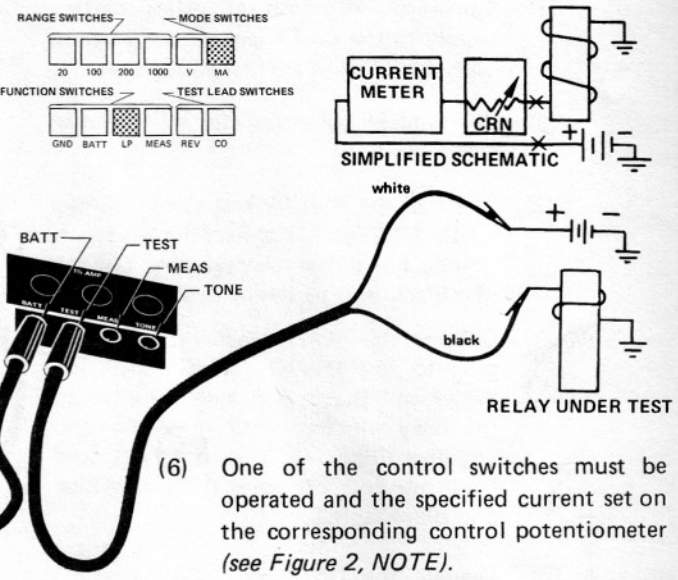
(1) Connect 48V central office battery supply to the BATT jack of the Test Set with the 2P9A or 2W12A Power Cord.

(2) Operate the MA mode switch.

(3) Operate the LP function switch.

(4) Connect the 2W17A Test Cord 310 plug to the TEST jack on the Test Set. Connect the Black lead alligator clip to the relay winding, the White lead alligator clip to positive 48 volt battery supply.

(5) Select the appropriate current range.



(6) One of the control switches must be operated and the specified current set on the corresponding control potentiometer *(see Figure 2, NOTE).*

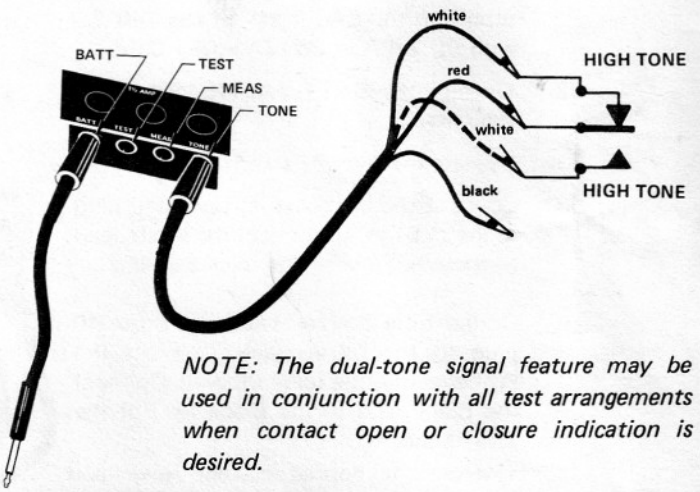
Figure 7 — One side of relay winding grounded. Positive battery supplied through Test Set.

(1) Connect 48V central office battery supply to the BATT jack of the Test Set with the 2P9A or 2W12A Power Cord.

(2) Connect the 3W4A Tone Cord 310 plug to the TONE jack on the Test Set. Connect the Red lead (common) alligator clip to the armature contact. Connect the White lead alligator clip as follows for tone:

(a) For opening arrangement, connect to the break spring contact.

(b) For closure arrangement, connect to the make spring contact.



NOTE: The dual-tone signal feature may be used in conjunction with all test arrangements when contact open or closure indication is desired.

Figure 8 — Circuit arrangement for using single tone signal to indicate contact closure or opening.

(1) Connect 48V central office battery supply to the BATT jack of the Test Set with the 2P9A or 2W12A Power Cord.

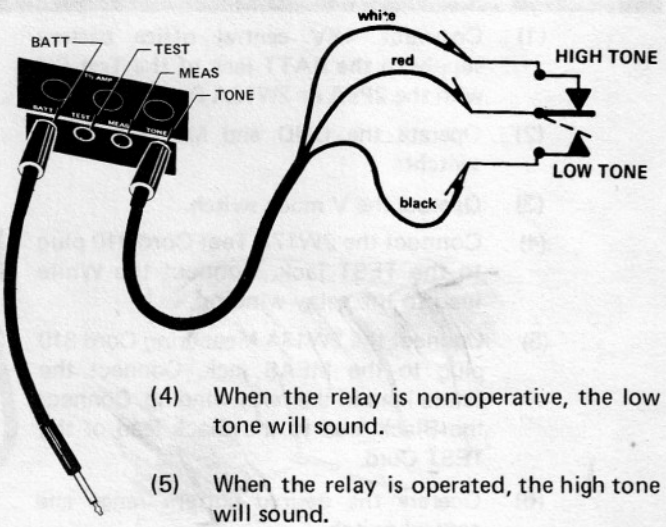
(2) Connect the 3W4A Tone Cord 310 plug to the TONE jack on the Test Set.

(3) Connect the leads equipped with alligator clips as follows:

White — to break contact

Red — to armature contact

Black — to make contact



(4) When the relay is non-operative, the low tone will sound.

(5) When the relay is operated, the high tone will sound.

Figure 9 — Circuit arrangement for using dual-tone signals to indicate contact opening and closure on one spring combination.

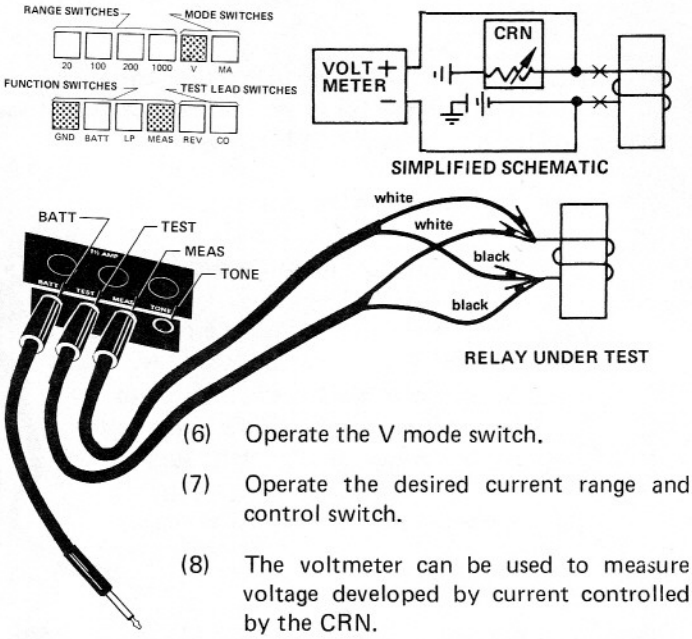
(1) Connect 48V central office battery supply to the BATT jack of the Test Set with the 2P9A or 2W12A Power Cord.

(2) Set control potentiometer to minimum setting.

(3) Connect the 2W17A Test Cord 310 plug to the TEST jack. Connect the White lead to one side of the relay winding. Connect the Black lead to the other winding lead.

(4) Connect the 2W17A Measuring Cord 310 plug to the MEAS jack. Connect the White and Black lead alligator clips to the relay winding. Positive (White) and negative (Black) TEST and MEAS cord leads must be connected White to White, and Black to Black.

(5) Operate the GND and MEAS function switches.



(6) Operate the V mode switch.

(7) Operate the desired current range and control switch.

(8) The voltmeter can be used to measure voltage developed by current controlled by the CRN.

Figure 10 — Circuit for reading voltage when the relay under test has neither battery nor ground connected to its windings.

(1) Connect 48V central office battery supply to the BATT jack of the Test Set with the 2P9A or 2W12A Power Cord.

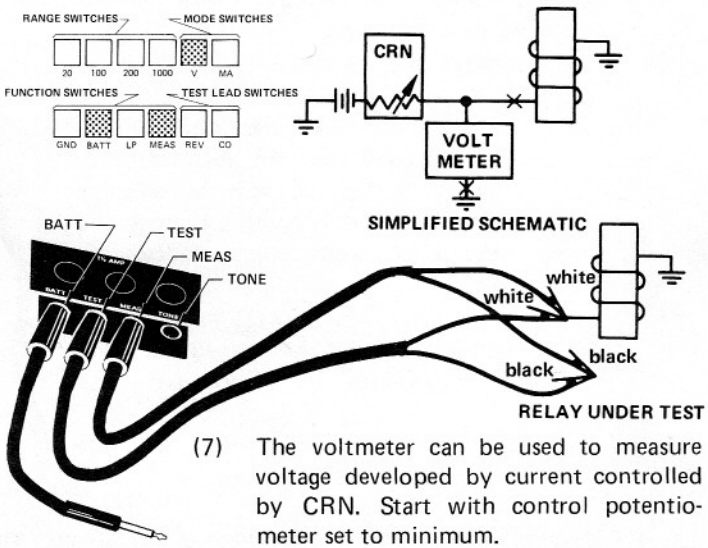
(2) Operate the BATT and MEAS function switches.

(3) Operate the V mode switch.

(4) Connect the 2W17A Test Cord 310 plug to the TEST jack. Connect the White lead to the other end of the relay winding.

(5) Connect the 2W17A Measuring Cord 310 plug to the MEAS jack. Connect the White lead to the relay winding. Connect the Black lead to the Black lead of the TEST Cord.

(6) Operate the desired current range and control switch.



(7) The voltmeter can be used to measure voltage developed by current controlled by CRN. Start with control potentiometer set to minimum.

Figure 11 — Circuit for reading voltage when the relay under test has one side of its winding connected to ground.

(1) Connect 48V central office battery supply to the BATT jack of the Test Set with the 2P9A or 2W12A Power Cord.

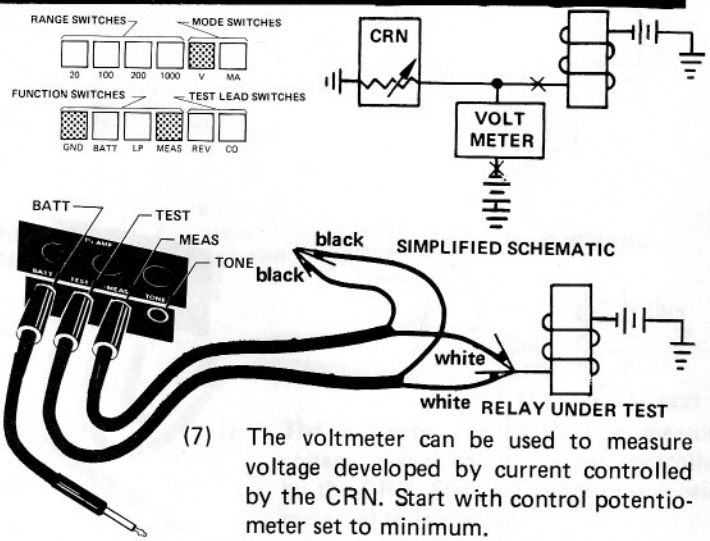
(2) Operate the GND and MEAS function switches.

(3) Operate the V mode switch.

(4) Connect the 2W17A Test Cord 310 plug to the TEST jack. Connect the White lead to the relay winding.

(5) Connect the 2W17A Measuring Cord 310 plug to the MEAS jack. Connect the White lead to the relay winding. Connect the Black lead to the Black lead of the TEST Cord.

(6) Operate the desired current range and control switch.



(7) The voltmeter can be used to measure voltage developed by current controlled by the CRN. Start with control potentiometer set to minimum.

Figure 12 — Circuit for reading voltage when the relay under test has one side of its winding connected to battery.

(1) Connect 48V central office battery supply to the BATT jack of the Test Set with the 2P9A or 2W12A Power Cord.

(2) Operate the V mode switch.

(3) Operate the MEAS function switch.

(4) Connect the 2W17A Measuring Cord 310 plug to the MEAS jack. Connect the Black and White lead alligator clips to terminals between the voltage to be measured (dc only).

(5) Full scale voltage is 199.9V dc.

(6) If an over range voltage is encountered, the display will blink.

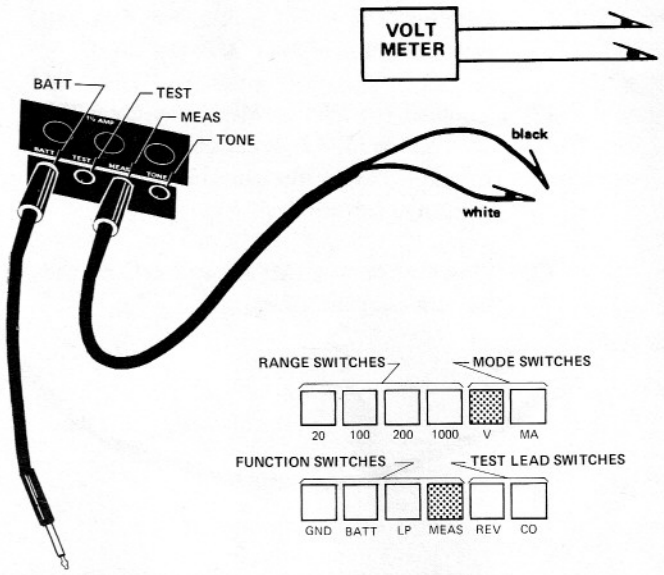


Figure 13 — Circuit for the measurement of external voltages. (Resistance of the Test Set in the 100 volt range is approximately 100,000 ohms).

(1) Connect 48V central office battery supply to the BATT jack of the Test Set with the 2P9A or 2W12A Power Cord.

(2) Operate the LP and MA function switches and one of the four range switches.

(3) Connect 2W17A Test Cord 310 plug to TEST jack. Connect White lead on Test Cord to battery's positive (+) terminal. Connect Black lead to battery's negative (-) terminal.

(4) Connect 2W17A Measuring Cord 310 plug to MEAS jack. Connect the White and Black leads to the positive (+) and negative (−) battery terminals respectively.

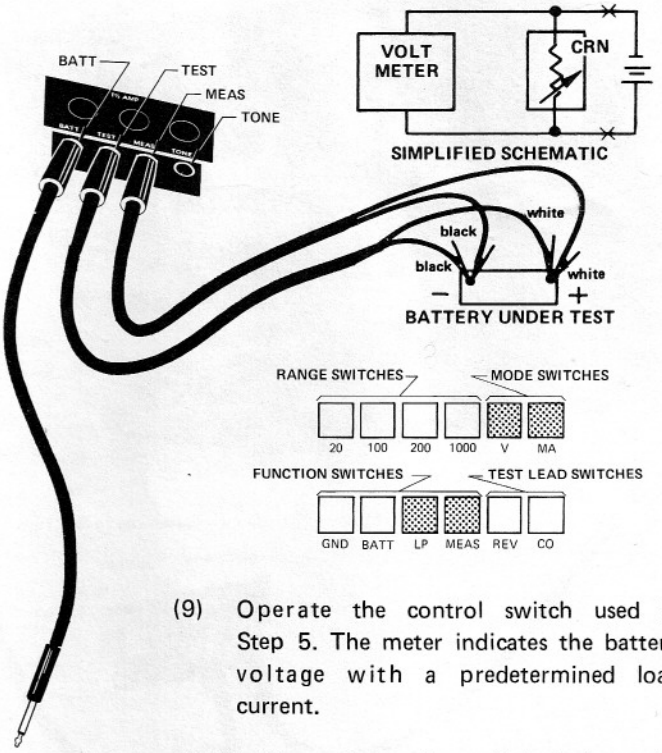
(5) Operate a control switch and adjust the corresponding control potentiometer for desired load current.

NOTE: The Test Set will not read load current with less than a 2 volt source voltage.

(6) Release control switch.

(7) Operate the V mode switch (MA mode switch releases).

(8) Operate the MEAS function switch. The panel meter now indicates the no-load battery voltage.



(9) Operate the control switch used in Step 5. The meter indicates the battery voltage with a predetermined load current.

NOTE: The set can be switched from the MEAS and V modes to the LP and MA modes to change the desired load current. THE LP SWITCH MUST BE OPERATED FIRST.

CAUTION: Some types of batteries, when subjected to current demands in excess of their ratings, can be damaged. Check the manufacturer's specifications before performing this test.

Figure 14 — Circuit for measurement of dry-cell voltages with a resistive load applied to the battery.

(1) Connect 48V central office battery supply to the BATT jack of the Test Set with the 2P9A or 2W12A Power Cord.

(2) Connect the 2W17A Measuring Cord 310 plug to the MEAS jack. Connect the leads alligator clips to the current source to be measured (dc only).

(3) Operate the MA, MEAS and one of the current range switches.

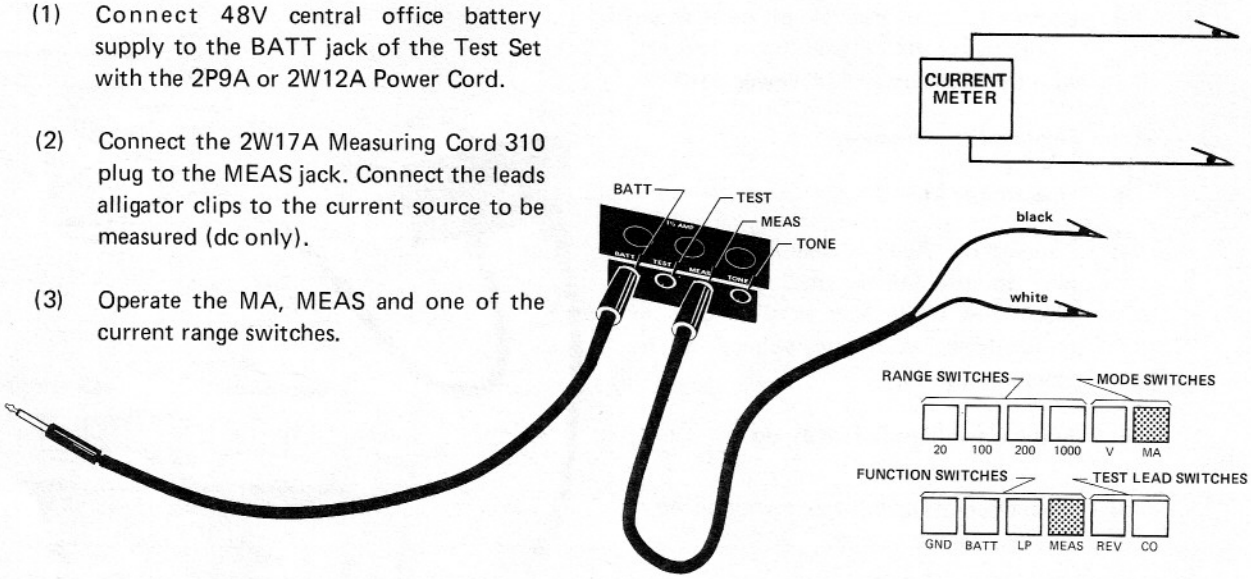
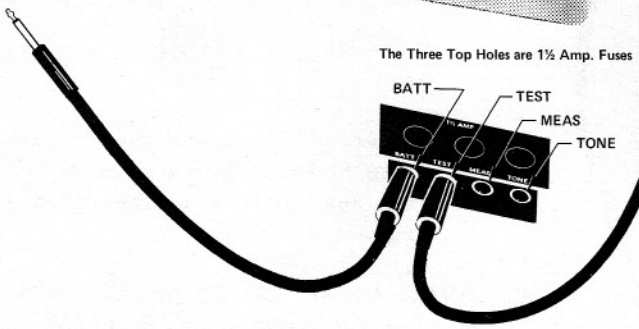
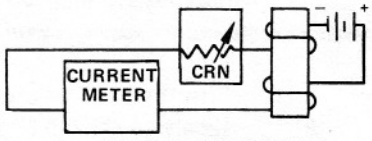


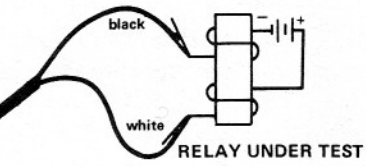
Figure 15 — Circuit for measurement of current independent of the current adjusting network.

The Three Top Holes are 1½ Amp. Fuses

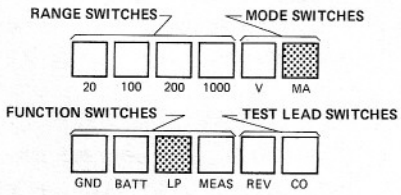




SIMPLIFIED SCHEMATIC



RELAY UNDER TEST



(1) Connect 48V central office battery supply to the BATT jack of the Test Set with the 2P9A or 2W12A Power Cord.

(2) Operate the MA mode switch.

(3) Operate the LP function switch.

(4) Connect the 2W17A Test Cord (310 plug) to the Test jack on the Test Set. Connect the Black and White leads on the other end (equipped with alligator clips) to the relay windings.

(5) Select the appropriate current range.

(6) One of the control switches must be operated and the specified current set on the corresponding control potentiometer.

Figure 16 — Relay under test has a floating power supply (dry-cell battery, etc.)

United States Patent [19]

Morrison et al.

[11] **3,894,284**

[45] **July 8, 1975**

[54] **CURRENT FLOW TEST APPARATUS**

[75] Inventors: **Ralph Morrison,** Pasadena; **Orrin B. O'Dea,** Garden Grove, both of Calif.

[73] Assignee: **Communication Mfg. Co.,** Long Beach, Calif.

[22] Filed: **Apr. 29, 1974**

[21] Appl. No.: **465,350**

[52] **U.S. Cl.** ..... **324/28 R;** 178/69

[51] **Int. Cl.** **G01r 31/02**

[58] **Field of Search** 324/28; 178/69; 179/175; 317/148.5

[56] **References Cited**

UNITED STATES PATENTS

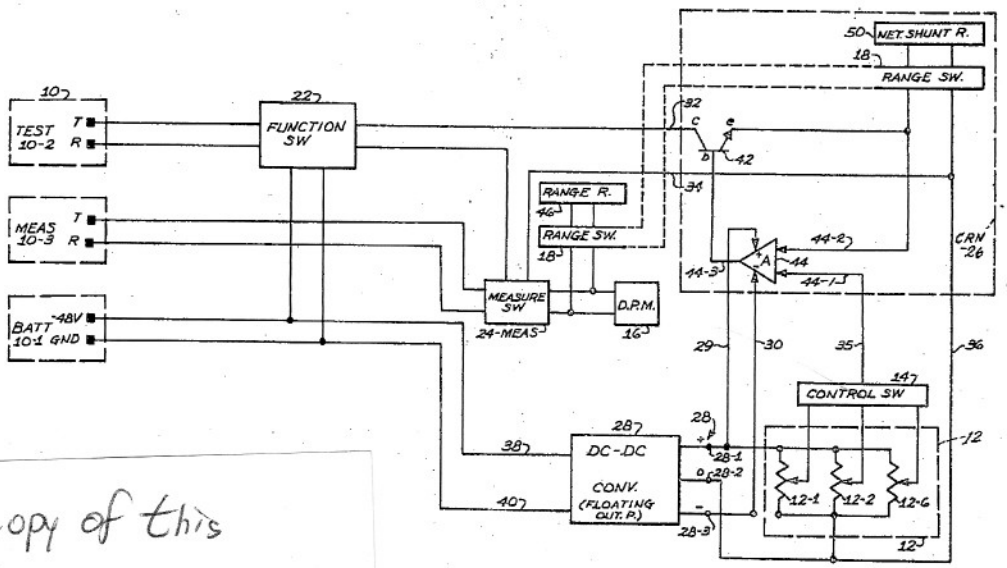
2,478,945	8/1949	Rose	324/28 R
2,478,946	8/1949	Rose	324/28 R
3,217,243	11/1965	Franklin	324/28 R
3,355,659	11/1967	Burgess	324/28 R
3,678,372	7/1972	Elder	324/28

Primary Examiner—Alfred E. Smith
Assistant Examiner—Michael J. Tokar
Attorney, Agent, or Firm—Christie, Parker & Hale

[57] **ABSTRACT**

The current flow test apparatus has a test connector with first and second test terminal connectors. A power connector has first and second power terminal connectors, a transistorized active current regulating circuit has a power supply input for receiving power, first and second signal input/output circuits and a reference input. The regulating circuit responds to the level of signal at the reference input for regulating proportionately the level of current passing between the input/output circuits of the regulating circuit. Manually adjustable potentiometers set the signal at the reference input to various levels. A power supply has first and second input circuits, respectively, connected to the first and second power terminal connectors for receiving power and an output circuit coupled to the power supply input of the regulating circuit. The power supply provides electrical power to the regulating circuit and significantly includes a transformer for providing a D.C. isolation between the output and input circuits of the power supply. Manually operable mode switching circuits selectively couple the first and second input/output circuits of the current regulating circuit, separately, to the first and second test terminal connectors and to the first and second power terminal connectors, in various combinations. A visual indicator indicates the current passing between the first and second input/output circuits of the current regulating circuit.

15 Claims, 17 Drawing Figures



Get a copy of this Patent from Google-Patents
It includes a circuit description written by a lawyer
Steve Flocke