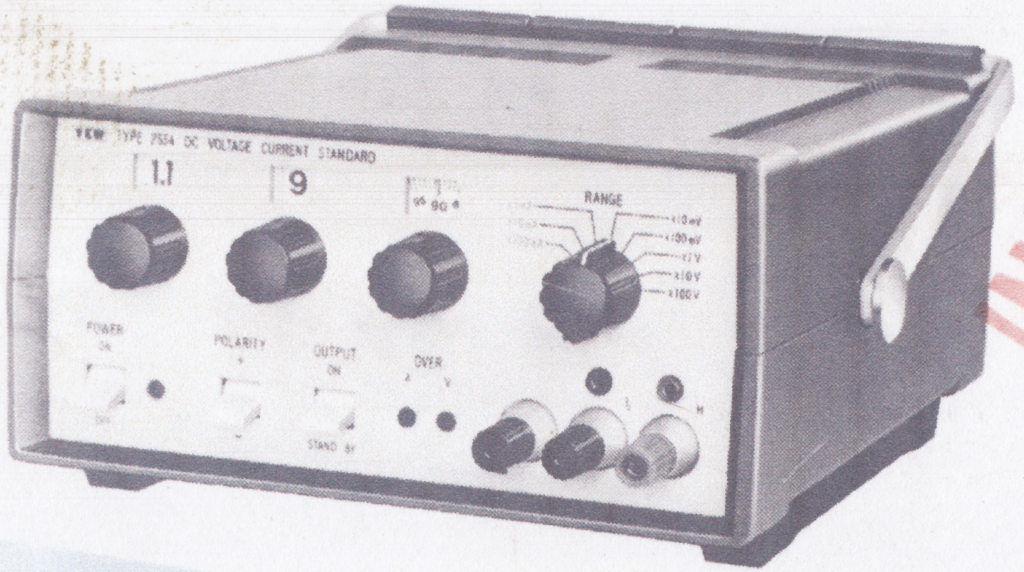
INSTRUCTIONS

DC VOLTAGE CURRENT STANDARD Type 2554



INSTR. 109

YOKOGAWA ELECTRIC WØRKS, LTD.

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1. GENERAL.

1-1. Description.

The YEW Type 2554 Portable DC Voltage/Current Standard delivers accurate DC voltage or current by a simple setting of the front panel switches and dials.

Rechargeable battery operation makes the instrument truly portable permitting it to be used for maintenance of industrial and field instruments where line power is not available. Its circuits are designed so that the output signal is immune to fluctuations of the battery voltage. It can also be operated on AC line power.

Accuracy and stability are ensured by the use of a selected, temperature-compensated zener diode for the reference voltage, and precision wirewound resistors for the divider and output circuits.

The unit provides voltages in 100V, 10V, 1V, 100mV and 10mV ranges, and currents in 100mA, 10mA and 1mA ranges, output can be set to four digits with an accuracy of ±0.05% of setting or ±0.01% of range.

Since accurate voltage or current can be obtained just by setting paddle switches and dials, Type 2554 is a truly versatile instrument, well-suited to applications such as:

- Testing and measurements in the field as well as in laboratories
- Adjustment and testing of electrical components and electronic equipment
- Calibration of DC measuring instruments
- Precision measurement or null-method measurement of DC voltages
- Expanded-scale measurement of minute changes in DC voltages

1-2. Specifications.

Output Ranges and Steps:

Range	Output Voltage/Current	Steps
100V	0 to ±119.99V	10mV
10V	0 to ±11.999V	1mV
1V	0 to ±1.1999V	100μV
100mV	0 to ±119.99mV	10μV
10mV	0 to ±11.999mV	1μV
100mA	0 to ±119.99mA	10μA
10mA	0 to ±11.999mA	1μA
1mA	0 to ±1.1999mA	0.1 μA

Accuracy of Output*:

Range	Accuracy of Output
100V	±(0.05% of setting + 10mV)
10V	±(0.05% of setting + 1mV)
1V	±(0.05% of setting + 100 μV)
100mV	±(0.05% of setting + 10 μV)
10mV	±(0.05% of setting + 2 μV)
100mA	±(0.05% of setting + 10 μA)
10mA	±(0.05% of setting + 1 μA)
1mA	±(0.05% of setting + 0.1 μA)

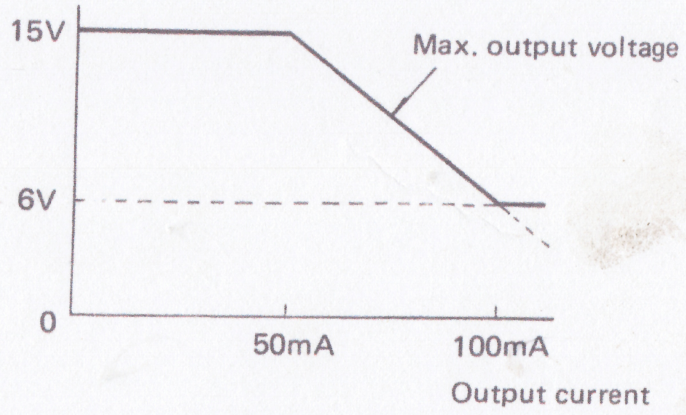
Note: * At a temperature of 23±2°C, relative humidity between 45 and 75%, and rated power supply voltage.

Maximum Output and Internal Resistance:

Range	Max. Output	Internal Resistance
100V	1mA	less than 100mΩ
10V	10mA	less than 50mΩ
1V	10mA	less than 30mΩ
100mV	*2kΩ	approx. 2 Ω
10mV	*2kΩ	approx. 2 Ω
100mA	**6 V	more than 1MΩ
10mA	15 V	more than 3MΩ
1mA	15 V	more than 30MΩ

Note: *1. Minimum load resistance for -0.1% error.

**2. Max. output on 100mA range is as follows:



Noise:

Range	Noise (DC to 1 MHz)
100V	less than 10 mVp-p
10V	less than 1 mVp-p
1V	less than 0.5 mVp-p
100mV	less than 50 μVp-p
10mV	less than 10 μVp-p
100mA	less than 10 μAp-p
10mA	less than 1 μAp-p
1mA	less than 0.1 μAp-p

Overcurrent and Overvoltage Protection:

Range	*Limit Level	**Alarm Level
10mV 100mV	not operated	not operated
1V 10V 100V	approx. 100mA approx. 100mA approx. 100mA	approx. 13mA ±10% approx. 13mA ±10% approx. 1.3mA ±10%
1mA 10mA 100mA	approx. 16V	approx. 16V

Notes: *1. Limit level: Automatically limits output current (or voltage) at the level shown above.

**2. Alarm level: OVER A (or OVER V) lamp lights up at the level shown above.

Temperature Coefficient of Output: ±(0.005% of setting + 0.0005% of range)/°C at 5 to 40°C on all ranges

Warm-up Time: At least 5 minutes after power supply is turned on

Effect of Power Source Voltage Fluctuation: Within ±(0.01% of setting +0.005% of range) for a 10% fluctuation of AC power supply voltage, or DC power source change from 9.6V to 8V

Settling Time: (time for attaining a value within 0.05% of setting and 0.01% of range)

- For Step Up:
  - 100mV, 10mV ranges — less than 0.1sec.
  - 10V, 10mA, 1mA ranges — approx. 1sec.
  - 100V, 100mA ranges — approx. 1.5 sec.
- For Step Down:
  - 100mV 10mV ranges — less than 0.1 sec.
  - 10V 10mA, 1mA ranges — approx. 2 sec.
  - 100mA range — approx. 1 sec.
  - 100V range — approx. 4.5 sec.

Output Polarity: + or − selected by paddle switch

Dielectric Voltage: 1500V AC between case and power line for one minute, 1250V AC between case and output terminals for one minute

Insulation Resistance: 100MΩ at 500V DC between case and power line

Operating Temperature Range: 5 to 40°C (41 to 104°F)

Operating Humidity Range: 20 to 80% (relative humidity)

Power Supply: 100, 115, 200, 215 or 230V AC, or 8V DC (nickel-cadmium battery)

DC Power Source: 8V DC rechatgeable nickel-cadmium battery (built in), Recharging time; approx. 3 hours, Continuous operating time; approx.3 hours at full load

Power Consumption: Approx. 8VA at full load, approx. 15VA under battery recharging

Dimensions: Approx. 100 X 210 X230mm (4-3/8 X 8-1/4 X 9-1/9")

Weight: Approx. 4kg (8.8 lbs)

Accessories Supplied at no Extra Cost:

Power cord (1 pc), Fuses (1A, 2 pcs or 0.5A, 2 psc.), Code 289905 Rechargeable Nickel-Cadmium Battey (1 pc.), Instruction Manual (1 copy)

2. NAMES AND FUNCTIONS OF COMPONENTS.

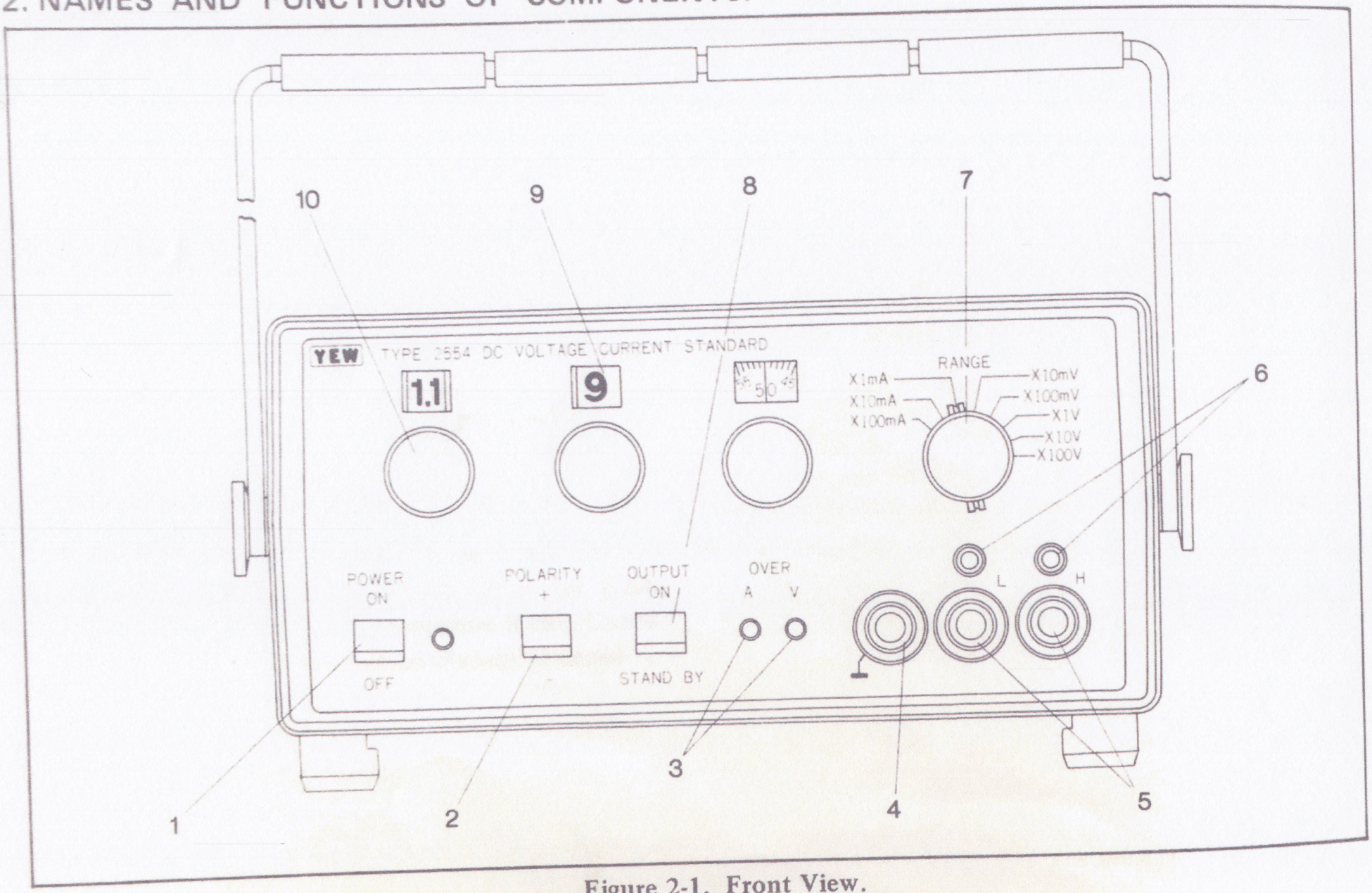


Figure 2-1. Front View.

2-1. Front Panel.

1. **POWER ON/OFF switch:**
   Power source is connected when switched ON.

2. **POLARITY switch:**
   Selects polarity of output voltage or current.

3. **Alarm lamps:**
   OVER A or OVER V lamp lights up when output current or voltage exceeds the alarm level if overload protection is actuated, (see page 8).

4. **Grounding terminal:**
   Connected to the case and to the grounding terminal on the rear panel.

5. **Output terminals:**
   Deliver the voltage or current set on dials.

6. **Junction compensator power supply terminals:**
   Used only when the optional YEW Type 2562 Reference Junction Compensator is attached.

7. **Range selector:**
   Selects one of the following ranges:
   Current: 100mA, 10mA, 1mA
   Voltage: 100V, 10V, 1V, 100mV, 10mV

8. **OUTPUT switch:**
   When switched ON, current or voltage is delivered across OUTPUT terminals. When switched to STAND BY, output is interrupted without cutting power supply to the units circuitry. When POLARITY is "+" the"L" terminal is disconnected in STAND BY mode; it POLARITY is "−", the "H" terminal is disconnected.

9. **In-line display:**
   Indicates output setting.

10. **Output setting dials.**
    Adjust output current or voltage within the range selected. The range of dial settings is as follows:
    First dial. 0 to 1.1 (with lock)
    Second dial: 0 to 10 (without lock)
    Third dial: 0 to 100 (without lock, potentiometer)

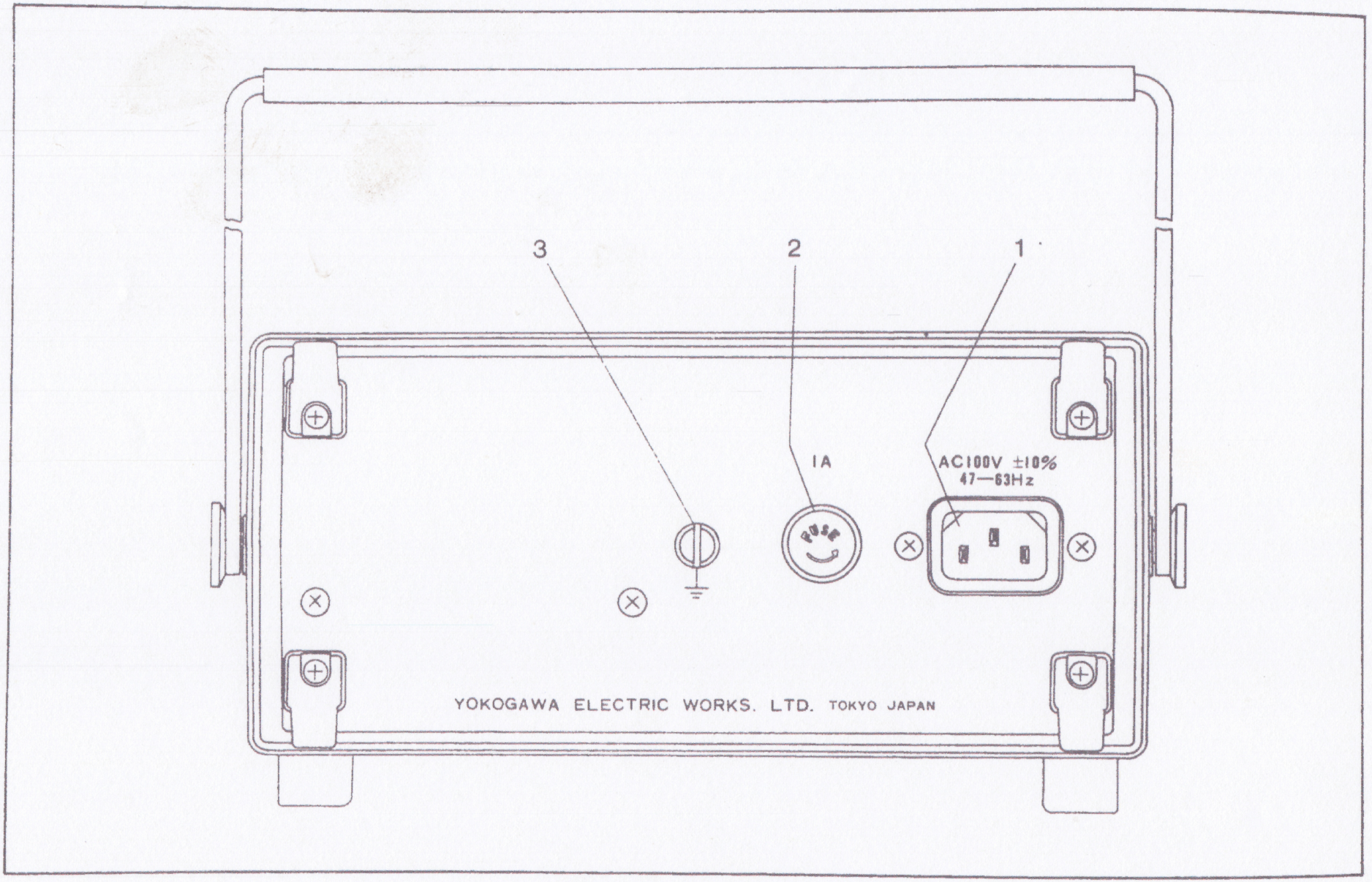


Figure 2-2. Rear View.

2-2. Rear Panel.

1. **Power connector:**
   3-pin system with grounding.

2. **Fuse:**
   1A (AC 100/115V) or 0.5A (AC 200/215/230V)

3. **Grounding terminal:**
   Connected to the case and to the grounding terminal on the front panel.

3. OPERATION.

3-1. Terminal Wiring.

- Connect the grounding terminal to ground.
- Connect load to the output terminals.

CAUTION

To eliminate induction hum from the power line connect the "L" output terminal to the case grounding terminal.
In cases where the "L" side of the load cannot be connected to ground, operate the instrument on battery power, and isolate the case from ground.

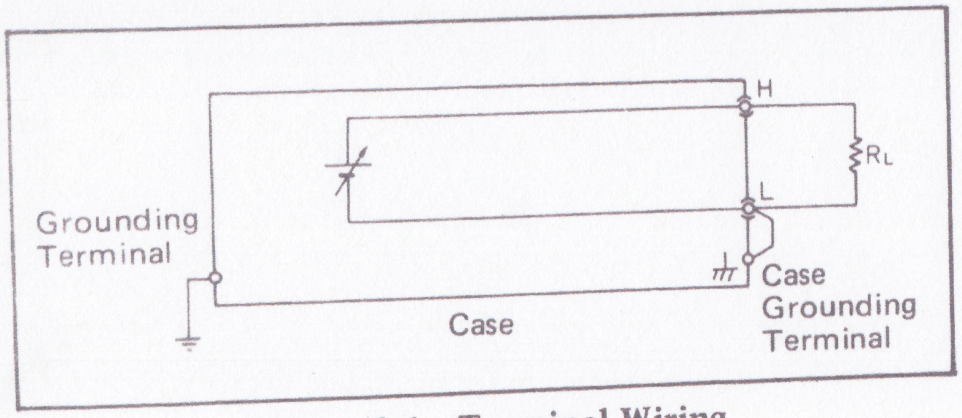


Figure 3-1. Terminal Wiring.

3-2. Warmup.

- Set the output switch to STAND BY.
- Plug the power cord into a power line (This is unnecessary for battery operation).
- Turn the POWER ON/OFF switch to ON, and allow the instrument to warm up for at least five minutes.

3-3. Output Setting.

- Turn the range selector dial to the appropreate position.
- Turn the setting dials to the desired value.
- Turn the output switch to ON. The output shown on the in-line display will be produced across the terminals.
- Turn the output switch to STAND BY when output is not needed.
- Never operate the range selector before turning the output switch to STAND BY, as it may cause excessive voltage to be applied to the circuit being tested.

3-4. Battery Recharging.

- The battery can be recharged simply by connecting the power cord to a power line. This means that the battery is kept charged when the instrument is operated on AC power.
- Time required for recharging is approximately threee hours. Overcharging is automatically prevented.
- Continuous operating time between recharges is approximately three hours at full load (100mA range).
- In order to prolong the life of the battery, power is automatically switched off when the battery voltage drops below a certain level.
- The instrument is automatically switches over to battery operation when the AC power cord is unplugged.

3-5. Battery Replacement.

1. Turn the POWER ON/OFF switch to OFF.
2. Remove the four screws on the bottom of the case, and remove the lower half of the case.
3. Remove the socket connecting the battery to the mainframe, and loosen the screws holding the battery.
4. Replace the battery with a new one. Secure the battery to the mainframe by carrting out the above steps in reverse order. The socket is a fail-safe type which eliminates any danger of connecting the battery with reversed polarity.
5. Reassemble the case and tighten the secrews on the bottom. The instrument is now ready for use.

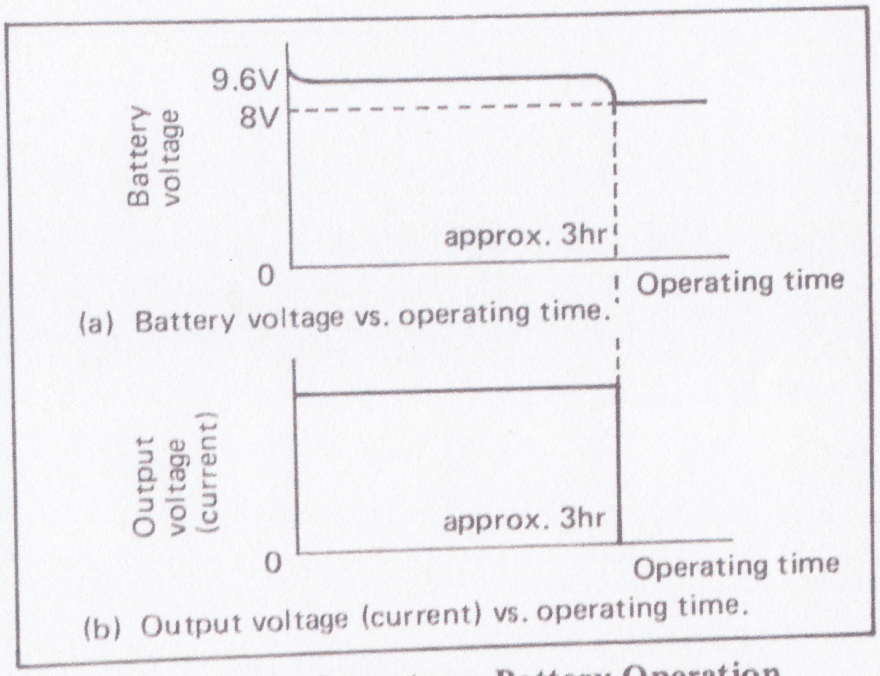


Figure 3-2. Long-term Battery Operation.

3-6. Overload Protection.

Over-voltage Protection:

When the instrument is delivering a standard current, if the output voltage rises above the alarm level shown in Table 3-1, an alarm lamp (OVER V) lights up. If voltage rises to the limit level, an over-voltage protection circuit automatically limits the output voltage.

Over-current Protection:

When the instrument is delivering a standard voltage, if the output current rises above the alarm level shown in Table 3-1, an alarm lamp (OVER A), lights up. If current rises to the limit level, an over-current protection circuit automatically limits the output current.

Output is automatically restored when the overload condition is corrected.

Over-voltage and over-current protection are actuated at the levels shown in Table 3-1. The accuracy of output current or voltage is maintained all the way up to the specified limit level.

The maximum output voltage on the 100mA range is illustrated in Figure 3-3.

Table 3-1. Over-voltage/-current Protection Level.

Range	Alarm Level	Limit Level
100V	Approx. 1.3mA ±10%	Approx. 100mA
10V 1V	Approx. 13mA ±10%	
100mV 10mV	No alarm action	No protective action
100mA	Approx. 16V	Approx. 16V
10mA 1mA		

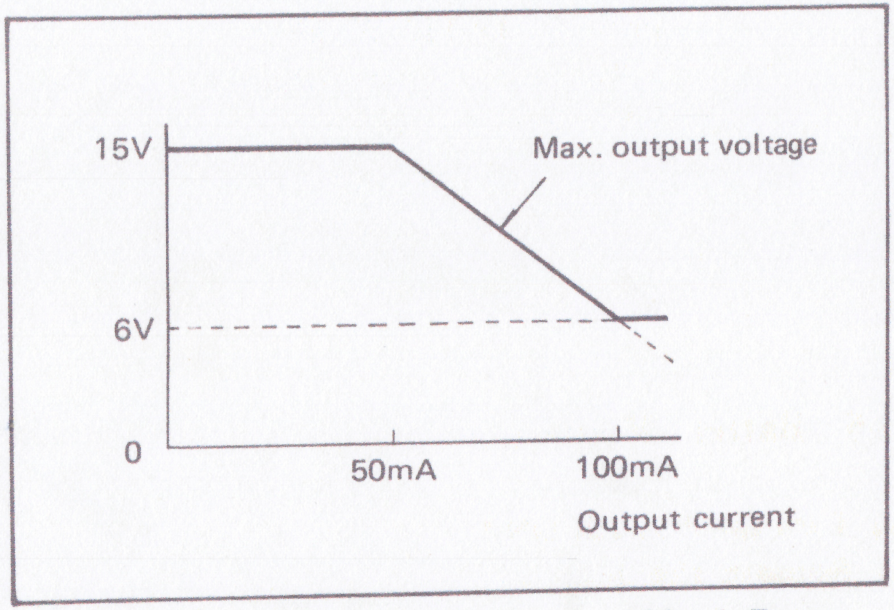


Figure 3-3. Maximum Output on 100mA Range.

4. CIRCUITRY.

4-1. Circuit Composition.

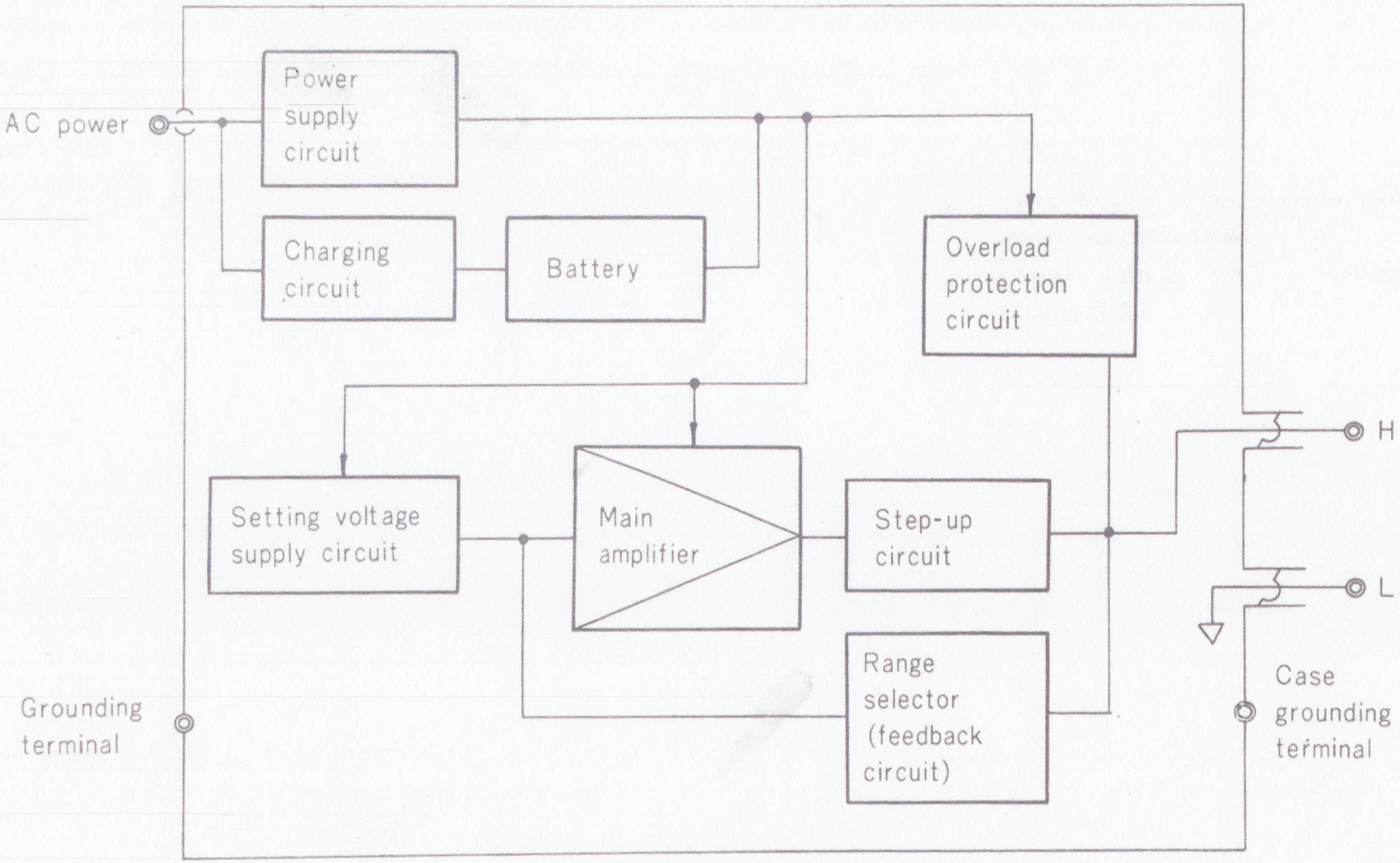


Figure 4-1. Block Diagram.

4-2. Principles of Operation.

Figure 4-2 illustrates the principles of operation of Type 2554. Stabilized voltage e_S obtained from a temperature-compensated zener diode is divided by potentiometer P to E_S. E_S enters high-gain amplifier A, and the output of A, as sensed by a voltage divider (R_1 and R_2) in the constant voltage mode, or by a shunt R_S in the constant current mode, is fedback to the input of A. Since the amplifier gain is very high, the voltage across the input terminals of A can be neglected, and the following relationship hold.

Constant voltage output:

$E_S = (1/n)\, E_O \qquad \therefore E_O = nE_S$

where n is the dividing ratio expressed by the equation

$n = R_2/(R_1 + R_2)$

Constant current output:

$E_S = R_S I_O \qquad \therefore I_O = E_S/R_S$

Thus, the output is determined by E_S and R_S, regardless of the level of amplifier gain or load resistance R_L.

Constant voltage outputs of millivolt order are obtained by voltage division as illustrated in Figure 4-2(c). The circuit is composed of a non-inverting negative-feedback amplifier.

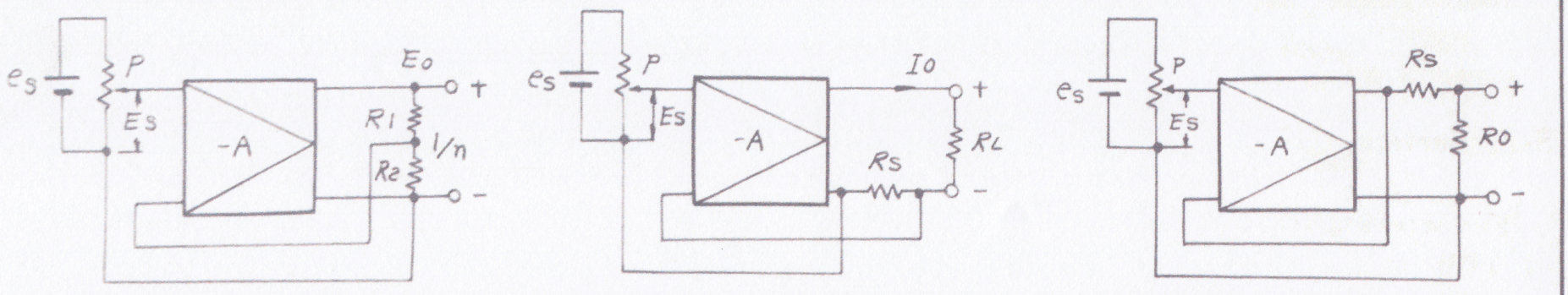


Figure 4-2. Operating Principle.

5. MAINTENANCE AND CALIBRATION.

5-1. Storing.

To insure accurate measurements it is essential to maintain the instrument in good condition. Therefore, the unit should not be stored in any of the following environment.

- Where the instrument may be subjected vibration
- Where dirt particles, dust or corrosive gases are persent in the atmosphere
- Where the instrument is exposed to direct sunlight
- Where humidity is high
- Where ambient temperature varies over a wide range

5-2. Service.

For servicing (repair, maintenance or calibration) of YEW measuring instruments, you may contact any YEW service representative.

Servicing which is out side the scope of the warranty may be performed at the customer's expense.

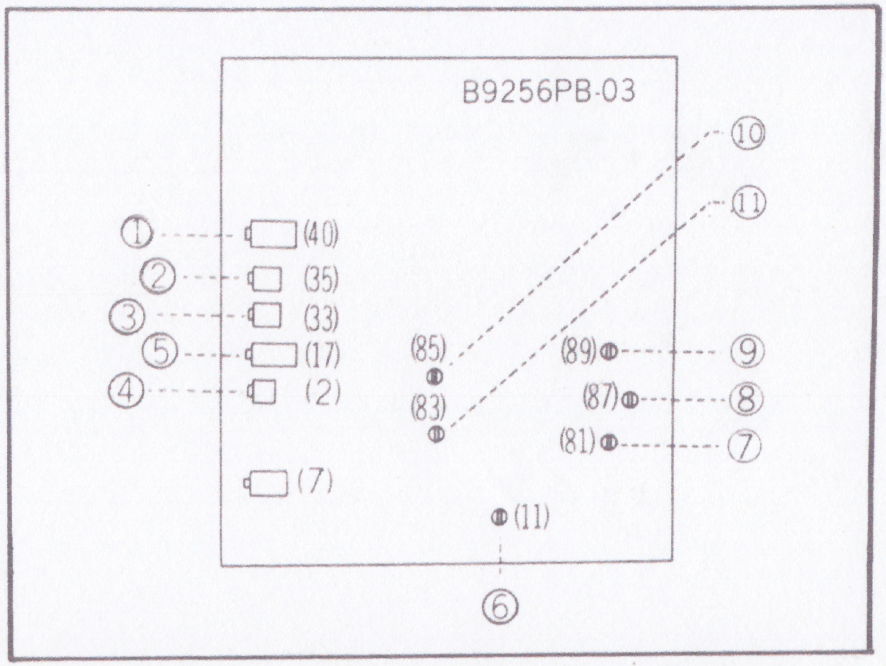


Figure 5-1. Location of Adjustment Resistors.

5-3. Calibration.

To maintain maximum accuracy, it is recommended that the instrument be calibrated at half-year intervals.

a) Preparation for Calibration.

- Since Type 2554 has a setting accuracy of ±0.05%, it should be calibrated using an instrument with an

accuracy better than ±0.01% (YEW Type 2501 Precision Digital Meter or equivalent).

- Remove the four screws on the bottom of the case, and take off the outer case. The adjustment resistors are located as given in Figure 5-1.
- Allow the instrument to warmup for at least five minutes.

b) Procedure of Calibration.

1. Connect a Type 2501 (or equivalent) voltmeter to the output terminals of Type 2554.
2. Zero adjustment of 1V range
   Set the range selector to X1V, and the setting dials to [.0] [0] [00]. Adjust resistor ⑤ so that output is within ±30μV.
3. Calibration of third dial
   Turn the setting dials to [.0] [0] [100], and adjust resistor ⑥ so that the output is 10.00mV.
4. Calibration of 1V range
   Turn the setting dials to [1.0] [0] [00], and adjust resistor ④ so that the output is 1.0000V.
5. Zero adjustment of 10V, 100V and current ranges
   Set the range selector to X10V, and the setting dials to [.0] [0] [00], adjust resistor ① so that the output is within ±0.3mV.
6. Calibration of 10V range
   Set range selector dial to 10V
   Turn the setting dials to [1.0] [0] [00], and adjust resistor ③ so that the output is 10.000V.
7. Calibration of 100V range
   Set the range selector to X100V, and the setting dials to [1.0] [0] [00], adjust resistor ② so that the output is 100.00V.
8. Calibration of 100mA range
   Switch the range selector to X100mA, and connect a 10Ω standard resistor (T/2792) across the output terminals. Turn the setting dials to [1.0] [0] [00], and adjust resistor ⑦ so that the output is 1.0000V.
9. Calibration of 10mA/1mA ranges
   Switch the range selector to X10mA (X1mA) and connect a 100Ω (1kΩ for X1mA) standard resistor (T/2792) across the output terminals. Turn the setting dials to [1.0] [0] [00], and adjust resistor ⑧ (⑨ for X1mA) so that output is 1.0000V.
10. Calibration of 100mV/10mV ranges
    Turn the setting dials to [1.0] [0] [00] and adjust resistor ⑩ (for 100mV) or ⑪ (for 10mV) so that the output is 100mV (10mV).
11. This completes the calibration procedure. Replace the outer case, and the instrument is ready for continued use.

CERTIFICATION

YEW (Yokogawa Electric Works, Ltd.) certifies that this instrument underwent stringent inspections and performance tests before it was shipped from the factory, and was found to meet the specifications given in the specifications section of this document.

YEW also certifies that its calibration measurements are traceable to the Electrotechnical Laboratory of the Ministry of International Trade and Industry (which maintains Japan's primary electrical standards) to the extent allowed by that organization's calibration facilities. Calibration measurements not traceable to that organization are traceable to the calibration facilities of other members of the International Electrotechnical Commission, or to those of International Organization for Standardization (ISO) members.

WARRANTY

YEW warrants this product, for one year from the date of delivery, against defects in materials and workmanship. YEW will repair or replace a product which proves defective during the warranty period due to materials or workmanship defects, provided that the product is returned to YEW or a YEW representative authorized to perform in-warranty repair of the product. YEW reserves the right to determine whether product failures are due to defective materials or workmanship, or to other causes not covered by this warranty. No other warranty is expressed or implied. YEW is not liable for consequential damages.