

INSTRUCTIONS

**INSTRUCTION MANUAL
FOR
Type 2858
AC VOLTAGE/CURRENT STANDARD**

YOKOGAWA ELECTRIC WORKS, LTD.

**INSTRUCTION MANUAL
FOR
Type 2858
AC VOLTAGE/CURRENT STANDARD**

Type 2858 AC Voltage/Current Standard is a most reliable instrument developed by YEW's latest techniques and long experience. To operate your Type 2858 at its full capability for a longer life, please read carefully the instructions contained in this manual

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Introduction

The Type 2858 AC voltage/current standard is capable of providing a stabilized reference voltage or current at a high accuracy over a wide range. The desired voltage or current is obtained through simple dial operation.

The output range is from 10 to 1000 V or 100 mA to 50 A available at an accuracy of $\pm 0.1\%$ of the rated value. The maximum output obtainable is about 50 VA in voltage range and is about 40 VA in current range. A protective circuit is provided to automatically shut off the output in the event of overload or misoperation.

The instrument has a built-in low distortion factor sine wave oscillator, thus providing a fixed frequency

of 50, 60 or 400 Hz, or a continuously variable frequency in the range of 40 to 500 Hz.

On-off control on the output and operation of the protective circuit are performed not by means of mechanical relay but by an electrical signal supplied from a logic circuit. (This scheme is patent pending) In Type 2858, therefore, failure due to mechanical loose contact is eliminated.

The Type 2858 AC voltage/current standard is suited for use in test and calibration of AC electrical indicating instruments, various power transducers, test of AC electric devices such as motors and transformers, test of various electric parts and components and also aircraft instruments, etc.

CAUTION AGAINST HIGH TENSION

Note that this instrument is capable of supplying high voltage up to 50 VA and heavy current up to 40VA. The following care should be strictly observed.

1. Before touching the output terminal for connection or disconnection of lead.
 - Be sure that the output setting dial is in 0 position.
 - Be sure that the output monitor indicates 0.
2. Be sure not to open the load when the instrument is in operation for current supply. If doing this, a high voltage corresponding to 40 VA is instantaneously produced. For example, in 100 mA range, a maximum voltage of 400 V will come out.
3. Be sure not to remove the case while power is on.
4. Be sure that power switch is in OFF position when power cord is disconnected from the receptacle.
5. Short-circuit deviation unit connector with the connector (Supplied as a spake) on the rear panel when not combined Type 2858 with Type 2859 Deviation Unit.

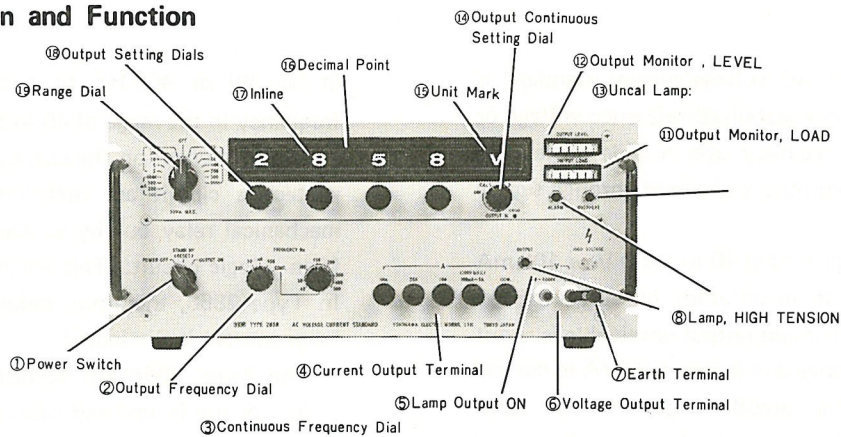
- Be careful that 10, 20 and 50A current output terminals are always in switch-on state, regardless of Range Dial set position.

- When connecting a inductive load, output setting dial should be set to null, and output on/off switch to off.

- Do not change over the Power Switch OFF \rightleftharpoons STAND BY in the event of connecting the load between 10, 20, or 50A current output terminals. If doing this, about 150% of rating current is instantaneously produced.

Parts Identification and Function

[Front Panel]



① Power Switch

This switch has the following positions.

OFF	Power is off.
STAND BY: (RESET)	Power is on but no output is available
OUTPUT ON	Power is on and output is supplied.

② Output Frequency Dial

A fixed frequency of 50, 60 or 400 Hz, or a continuously variable frequency between 40 and 500 Hz is selectable on this dial. When EXT position is selected, an external oscillator can be used.

③ Continuous Frequency Dial

The desired frequency can be obtained in the range of 40 to 500 Hz. If the frequency is changed during output ON, the output may automatically turn off due to hunting produced in the oscillator.

④ Current Output Terminal

COM - 100 mA~5 A terminals are used for a current output of 100 mA to 5 A. Other current outputs are derived from COM and corresponding terminals. COM of voltage terminal and COM of current terminal are internally short-circuited.

⑤ Lamp, Output ON

This lamp is illuminated when the output is ON.

⑥ Voltage Output Terminal

The voltage output of any range is taken out from this terminal.

⑦ Earth Terminal

This terminal is connected to the outer case of the instrument.

⑧ Lamp, HIGH TENSION

This lamp is illuminated when the range dial is set at 500 V.

1000 V or 100 mA range (in 100 mA range, a high voltage is produced).

When this lamp is illuminated, output is not ON unless No. 1 dial is set at 0 position.

⑨ Lamp, ALARM

This lamp is illuminated for about when the following states occur.

- A load of more than maximum output of the instrument is connected.
- The voltage output terminal is short-circuited during voltage output operation.
- The current output terminal opened during current output operation.
- An inadequate value is selected on the setting dial.
- The output frequency is changed when output is ON.

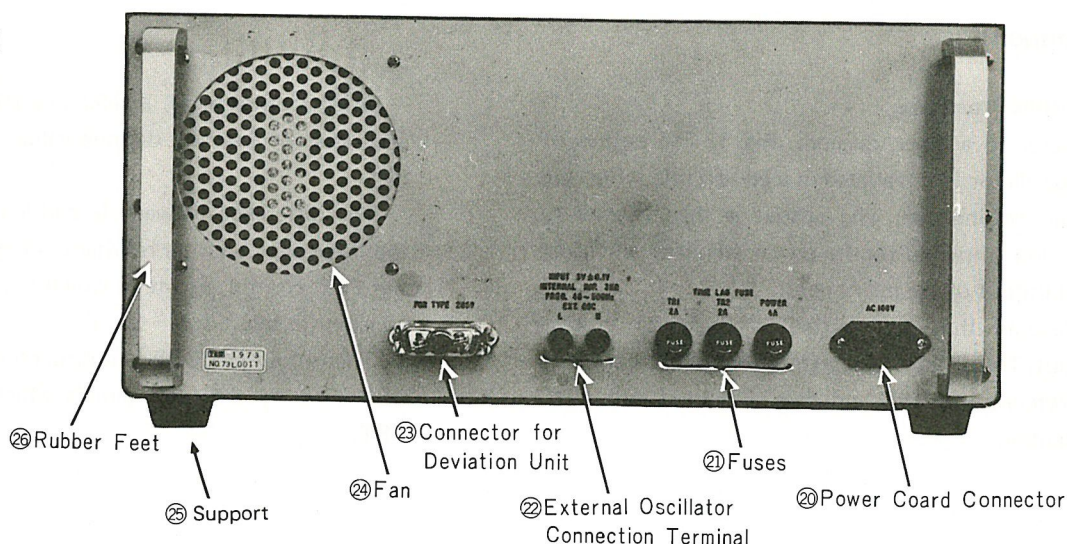
The output is automatically shut off simultaneously when this lamp is illuminated. OUTPUT ON switch is disabled during illumination of the lamp. Or unless the cause of alarm state is removed, the output is not turned on as a result to operation of the alarm circuit even when the switch is closed again.

⑩ Lamp, OVERHEAT

When the output transistor is over-heated in excess of a certain definite temperature, this lamp is illuminated and the output is automatically shut off. The lamp is kept illuminated until the output transistor is cooled, and no output is available.

⑪ Output Monitor, LOAD

[Rear Panel]



- ②⑥ Rubber Feet
 - ②⑤ Support
 - ②④ Fan
 - ②③ Connector for Deviation Unit
 - ②② External Oscillator Connection Terminal
 - ②① Fuses
 - ②① Power Cord Connector
- This monitor indicates output load status, on condition that the maximum output (VA) corresponds to 100%.
- Voltage Output: The output load current is indicated.
- Current Output: The output load voltage is indicated.
- ①② Output Monitor, LEVEL
This function is operated when output is ON, to indicated percentage set value, based on 100% (maximum value) of each range.
 - ①③ Uncal Lamp:
The lamp lights when Output Continuous Setting Dial is set to 0~100%.
 - ①④ Output Continuous Setting Dial
CAL Position: The value set on the output setting dial ①⑧ is accurately produced.
0~100% Position: The output is continuously variable in the range of 0~100%, based on 100% value of the output setting dial ①⑧.
 - ①⑤ Unit Mark
mA, A, and V are provided. The unit is changed when changing the range dial position.
 - ①⑥ Decimal Point
The decimal point is indicated by incandescent lamp, and is automatically shifted when the range dial position is changed.
 - ①⑦ Inline
The value being set on the output setting dial

- is indicated.
- ①⑧ Output Setting Dials
The desired voltage or current value is set on these dials.
No. 1 Dial: 0~10 in 11 steps, with stopper
No. 2, 3, 4 Dials: 0~9 in 10 steps, endless
- ①⑨ Range Dial
The following ranges are provided.
Voltage: 10~1000 V in 7 ranges
Current: 100 mA~50 A in 9 ranges
- ②① Power Cord Connector
A rated AC 50/60 Hz power is connected to the instrument by way of this connector.
- ②① Fuses
One 4A fuse for power supply and two 2A fuses for output transistor are provided.
- ②② External Oscillator Connection Terminal
This terminal is used when the instrument is driven from an external oscillator.
- ②③ Connector for Deviation Unit
For connection of Type 2859 Deviation Unit. This connector is short-circuited when not combined Type 2858 with Type 2859.
- ②④ Fan
The main amplifier and output transistor are cooled by this fan.
- ②⑤ Support
For supporting the instrument when placed in vertical position for storage
- ②⑥ Rubber Feet
These feet are removed when the instrument is mounted on a rack.

Operation

Operating Procedure:

Refer to a block diagram, Fig. 1. The output of the oscillator is attenuated at a certain rate set on the output setting dial. The output is then applied to FET and amplified by the power amplifier and given as an output of the instrument.

Assume that dial setting is made for voltage output. The output is applied to the AC-DC converter via reference resistor and thus converted into a DC current i_o .

On the other hand, a reference DC voltage is set accurately at a certain definite value i_s on the setting dial.

The difference between i_o and i_s is integrated by the integrator, and the resultant voltage is applied to the FET control circuit in which the output is kept constant to result in $i_o - i_s = 0$.

The output ON/OFF and protection operation are controlled by the logic circuit which is to cut off FET.

Block Diagram:

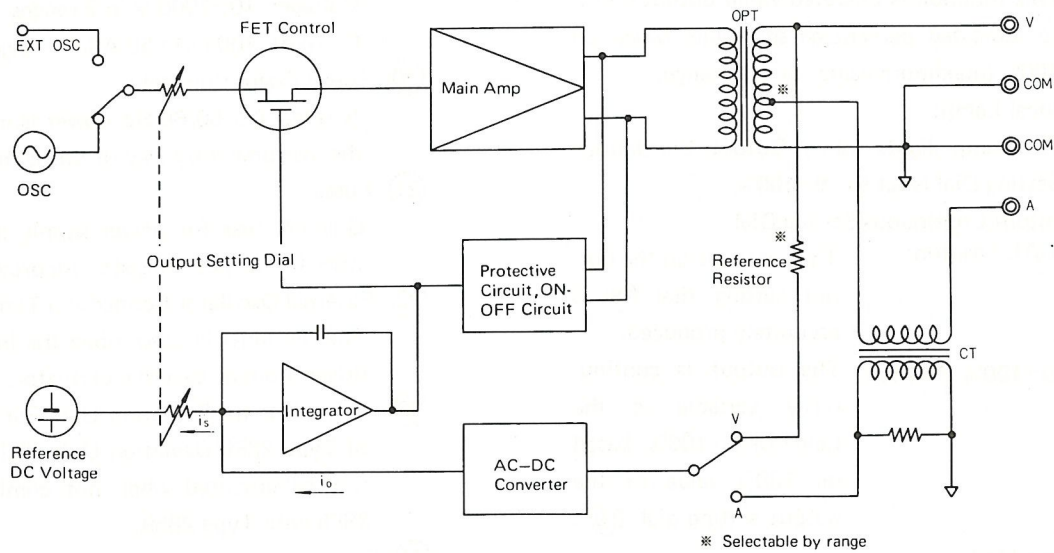


Fig. 1. Block Diagram

Operating Procedure

Installation:

1. Installation

The weight of this instrument is about 30 kg.

Prepare a rugged table to place the instrument.



Fig. 2. Normal Operating Position

The normal operating position is horizontal (Fig. 2). Hold or place the instrument vertical when carrying or storing (Fig. 3).

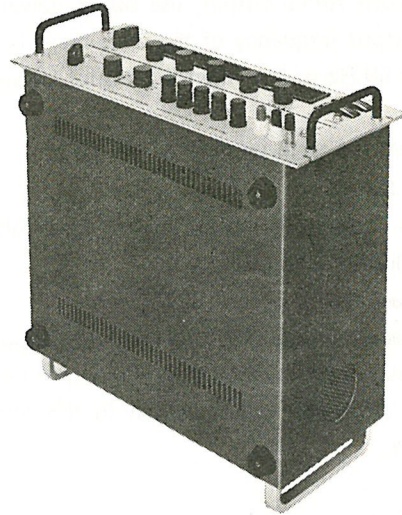


Fig. 3. Carrying or Storage Position

2. Rack Mounting

When the instrument is mounted on a rack, remove rubber feet from the base. Use support

rails at the base so as not to exert the weight of the instrument upon the front panel.

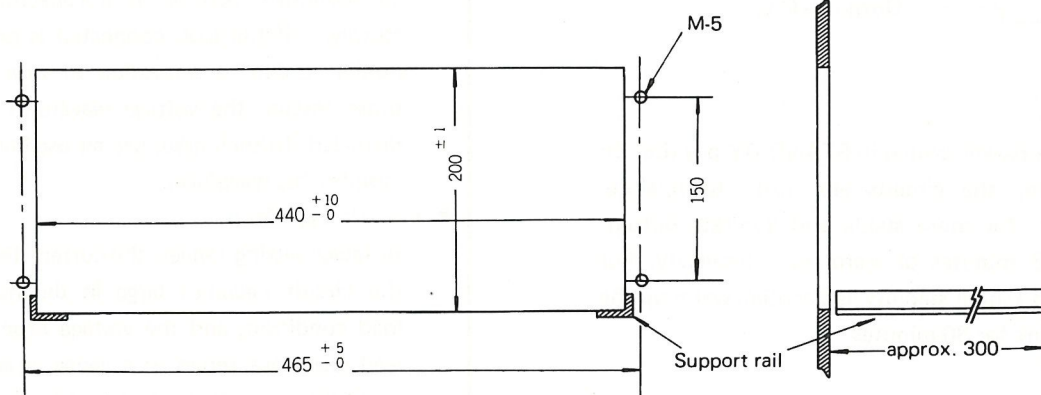


Fig. 4. Rack Mounting Dimensions

Preparation:

1. Connection for Power Supply

First, make sure that the power switch is in OFF position. Connect the power cord (supplied for the instrument) to the power supply connector located on the back panel. The power voltage must be within $\pm 10\%$ of the rated value.

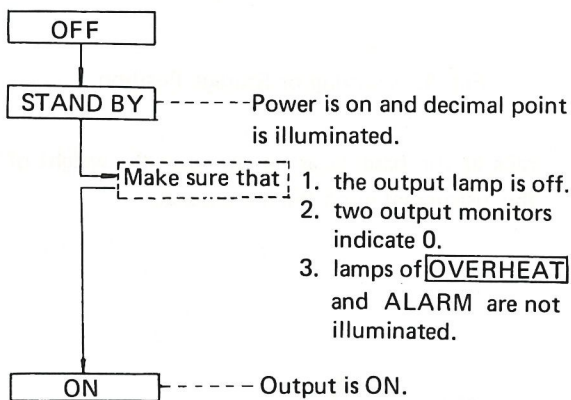
For more stable output, use 60 Hz power when the output frequency of the instrument is 50 Hz, or use 50 Hz power when the output frequency is 60 Hz.

Connect the earth terminal to the ground.

2. Power Switch

Before closing the power switch, the following procedures are necessary.

- (1) Place the range dial to **OFF** position.
 - (2) Place the output setting dial to **0000** position.
 - (3) Disconnect the load from the output terminal.
- Then, close the power switch in the following manner.



3. Warm-up

Place the power switch in STAND BY position. In this state, the circuits are ready to operate. However, for more stable and accurate output, about 15 minutes of warm-up is necessary. For operation where stability is essential, warm up the instrument for 30 minutes.

Voltage Output:

The voltage output is derived from the output terminal in the following manner.

- (1) First, make sure that the output switch is **OFF**, two monitor meters indicate 0, and the setting dial is **0000** position. Then, connect the load.
- (2) Place the output continuous setting dial to **CAL** position.
- (3) Set the desired output frequency.
- (4) Set the desired range on the range dial. (In view of accuracy, it is recommended to select a higher range.)
- (5) Set the power switch at output ON.
- (6) Place the output setting dial to the desired value. A voltage equal to the set value is obtained.
- (7) When it is desired to vary continuously the output from zero to the set value, rotate the output continuous setting dial in the position between 100 % and 0 .

CAUTION

■ High Voltage Output

When the range dial is placed in 500 V or 1000 V position, **HIGH TENSION** lamp is illuminated. Note that no output is available unless No.1 dial is in 0 position.

When handling high voltage output, be sure that all the safety procedures have been made.

■ Nonlinear Load

This instrument is operated normally either at an inductive load or at a capacitive load. However, if the load connected is extremely nonlinear due to saturation of iron core or other reason, the voltage waveform may be distorted. In such case, use an oscilloscope to monitor the waveform.

■ Line Voltage Drop

In lower setting ranges, the current flowing in the circuit becomes large in the maximum load condition, and the voltage drop due to lead resistance serves as a cause of error. To avoid this, use of a lead wire with a sufficiently large diameter is desirable.

■ Connection at Current Terminals

Avoid connecting a load to the current terminal when the instrument is in operation for voltage supply.

Current Output:

A current output of 100 mA to 5 A is available from **COM** – **100 mA~5 A** terminal, and other current outputs of 10, 20 and 50 A are obtained from the corresponding terminals. The procedures are as follows.

- (1) Make sure that the two monitor meters indicate 0, and the setting dial is in 0000 position. Then, a load is connected.
- (2) Place the output continuous setting dial in **CAL** position.
- (3) Set the desired output frequency value.
- (4) The desired range is set on the range dial. (From accuracy point of view, select a higher range.)
- (5) Set the power switch at output ON.
- (6) Rotate the output setting dial to the desired position. A current output of the set value is obtained.
- (7) When it is desired to vary the output from zero to the set value continuously, place the output continuous setting dial to the desired position between 100 % and 0.

CAUTION

High Tension

When 100 mA position is selected on the range dial, the voltage drop across the output terminal is increased with increase in the load connected. When it comes to 40 VA output, a high voltage of 400 V appears at the terminal. This is as hazardous as in the case of high voltage output operation.

In the high tension state, the lamp **HIGH TENSION** is illuminated, and the output is not ON unless No.1 dial is set to 0 position.

Nonlinear Load

This instrument is operated normally either at an inductive load or at a capacitive load. However, if the load used is extremely nonlinear due to saturation of iron core or other reason, the voltage waveform may be distorted. In such event, use an oscilloscope to monitor the waveform.

Line Loss

When a large current range is selected, the loss due to lead resistance becomes large. To avoid this, use the cord which is supplied as accessory. Although such loss does not become an

error, the output capacity is lowered corresponding to the loss.

Temperature Rise in Output Transistor

The smaller the load (near short-circuiting condition), the higher will become the temperature of the output transistor of the power amplifier. In the event of high temperature, especially when ambient temperature is high, the lamp **OVERHEAT** may be illuminated.

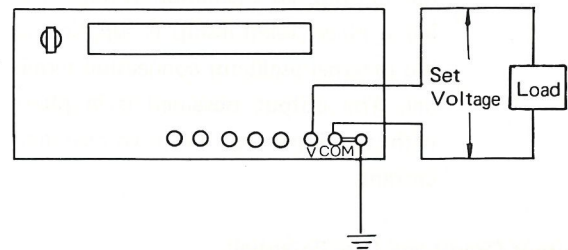
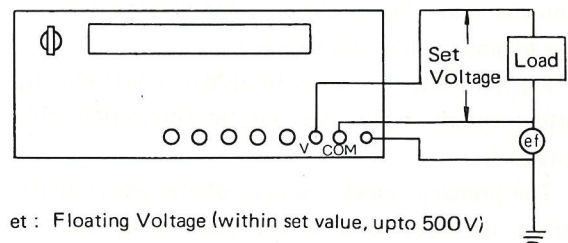


Fig. 5. Voltage Output



ef : Floating Voltage (within set value, upto 500 V)

Fig. 6. Voltage Output (Floating)

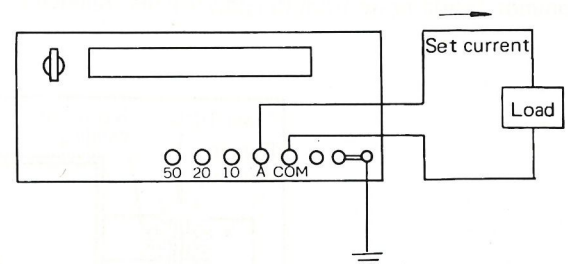
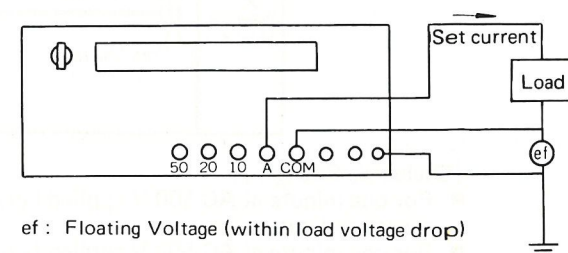


Fig. 7. Current Output



ef : Floating Voltage (within load voltage drop)

Fig. 8. Current Output (Floating)

Use of External Oscillator:

When an external oscillator is used to drive the instrument, make connections as shown in Fig. 9, and set the following values on the oscillator.

1. Oscillation Frequency: 40~500 Hz
2. Output Voltage : 3 ± 0.1 V (sine wave)

Note: 1. The input impedance of this instrument is $3\text{ k}\Omega$ (pure resistance).

2. When more than two units of Type 2858 are to be driven in a certain phase relationship, an oscillation voltage having a phase relationship is supplied to the external oscillator connection terminal. The output obtained is in phase with the input for both voltage and current.

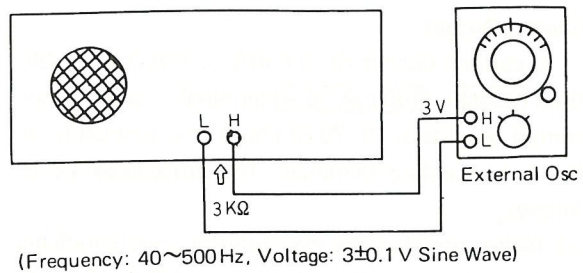


Fig. 9. Use of External Oscillator

CAUTION

A voltage of 3 ± 0.1 V and frequency of 40 to 500 Hz should be applied to the external oscillator connection terminal. If so, the instrument may be damaged.

Output Circuit and Case Potential:

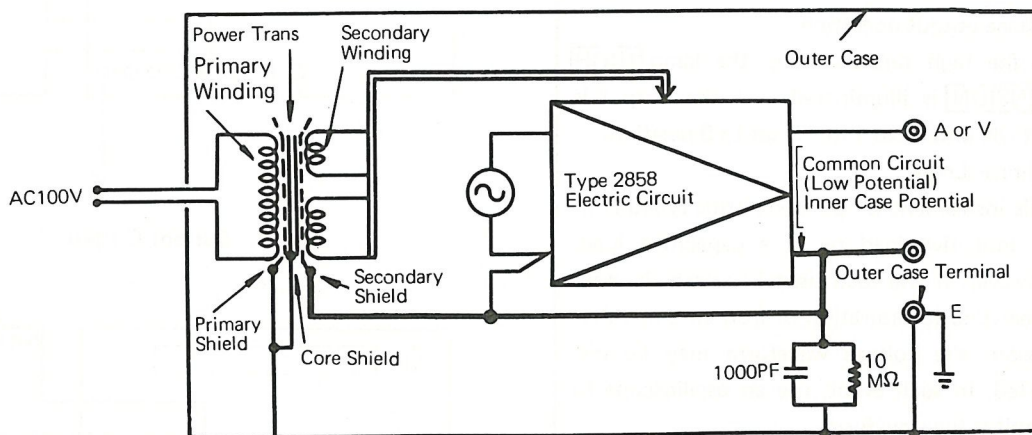
The output terminal of this instrument can be used either in the floating state or in the one line grounded state. For operation in the floating state, be sure to ground the earth terminal.

Fig. 10 shows in block form the power circuit, output circuit, outer case, etc, in connection with potential.

The primary shield and core of the power transformer are connected to the outer case, and the secondary winding is connected to a common circuit by way of the secondary shield. Therefore the common mode noise from the power line is removed.

The common circuit and inner case stand at the same potential, and are connected to the outer case via 1000 PF capacitor and $10\text{ M}\Omega$ resistor. This resistor and capacitor serve to stabilize the common circuit [COM] to operate as the low potential side.

The outer case is connected to the earth terminal \perp which is located adjacent to the output terminal. Connect between [COM] and \perp terminals by short-bar for operation excepting in the floating state.



[Dielectric Strength]

- For one minute at AC 500 V applied between power source and output terminal between power source and outer case
- For one minute at AC 500 V applied between common circuit (com) and outer case

Fig. 10. Output Circuit and Case Potential

Response:

In Type 2858, the output ON-OFF is done by the FET control circuit. Therefore FET is in the cutoff state when the output is OFF.

When the output is ON, the lock circuit of the integrator is opened, and the instrument is reset gradually for operation state. Hence the response time from OFF to ON (namely, the time required for the output to reach $\pm 0.1\%$ of the set value) is as follows.

1. approx. 0.3 sec when the dial setting is at 100 %
2. approx. 5 sec when the dial setting is at 10 %.

The response time toward OFF is approx. 0.1 s regardless of the set value because the FET control circuit is cut off after adding a signal in logic circuit to the integrator.

The response when the output setting dial position is changed in the ON state is as quick as 50 ms or less.

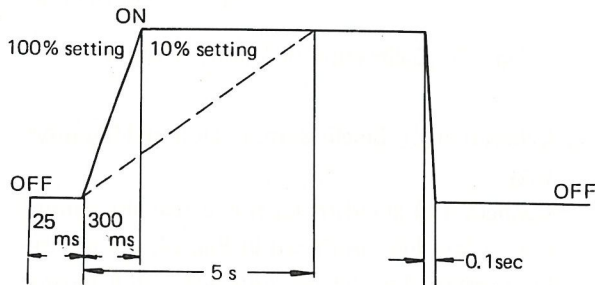


Fig. 11. Response from OFF to ON at 100% and 10% Setting

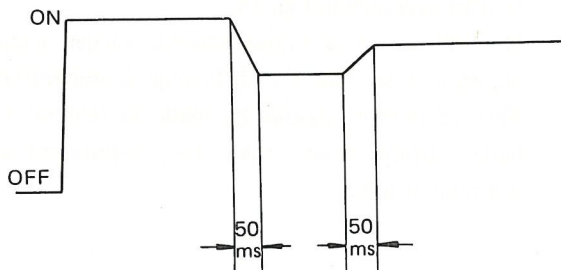


Fig. 12. Response when set value is changed in ON state (change of 1st. and 2nd dials)

Safety Provisions:

This instrument has the following safety provisions to prevent abnormal voltage which may be produced due to misoperation or other reasons.

- In the event of overload:
When it comes to overload condition at the output terminal, the output is automatically shut off. The output is not ON again unless the load is corrected.
- Set Range Protection:
If an excess value (above approx. 105 %) is set on the output setting dial, the output is automatically turned off. Output is not delivered when set at output ON after Reset position.
- High Voltage Setting Range:
In the high voltage setting range (500 V, 1000 V) and the small current range (100 mA) in which a high voltage is produced, the output is not ON unless placing No.1 dial to 0 position. To this effect, an ON stop circuit is provided in the logic circuit, and generation of an unexpected high voltage is avoided.
- Removal of Case:
A high voltage is present inside the instrument while power is on. To avoid danger, a micro-switch is provided so as to disconnect power supply automatically when the case is removed.

Calibration

It is recommended to calibrate the instrument once in about 6 months in order to maintain the accuracy of the instrument.

For this calibration, the following instruments and standard are required.

Precision AC Voltmeter	: measuring range 100 mV~1000 V accuracy $\pm 0.05\%$
Current Transformer	: primary rating 2/5/10/20/50A secondary rating 1 A secondary burden 1 VA accuracy $\pm 0.05\%$
Standard Resistor	: nominal resistance 1 ohm accuracy $\pm 0.05\%$ allowable power 1 W
Lock Nut	: for power supply use
Insulation	
Screwdriver	: for use in sensitivity adjustment

(Ask YEW for these instruments, etc.)

Preparation for Calibration:

Caution

- Installing Place
 1. Place the instrument on an insulated base, such as dry wooden table.
 2. There should be no metallic material or unnecessary lead or the like around the instrument. Keep off persons. It is recommended to set up a sign "High Tension".
- Person to do calibration

It is desirable for the person to be floated from the ground. Keep the Type 2858 instrument and the measuring instruments at the same potential. Be careful not to allow voltage to touch the human body when grounding the instrument.

- Remove six screws from the right and left panels of the instrument body and detach the case.
- Lock the power off microswitch by the use of lock nut.
- Warm up the instrument for about 30 minutes and then make calibration in the following manner and sequence. The adjusting variable resistors are inter-related with each other. Therefore keep the calibration sequence correctly.

Calibration Procedures:

1. Calibration of Voltage Output

The voltage output is calibrated by precisely measuring the voltage across the voltage output terminals as shown in Fig. 13.

The output is adjusted in all the ranges, 10~100 V, by the voltage output fine adjusting variable resistor as shown in Fig. 16.

If a difference is found between ranges, make adjustment so that the difference is minimized. This difference is supposed to be within the rated accuracy.

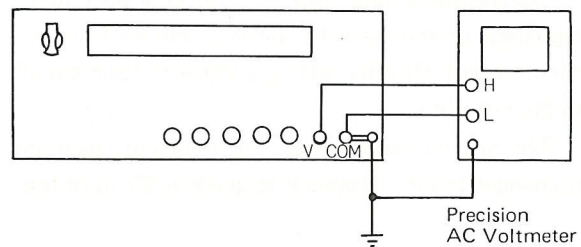


Fig. 13. Calibration of Voltage Output

2. Calibration of Small Current Output (100 mA~1 A)

Connect $1\ \Omega$ standard resistor across the current output terminals as shown in Fig. 14, and precisely measure the voltage drop across the resistor (100 mV~1 V).

The output is adjusted in all the range, 100 mA~1 A, by the current output fine adjusting variable resistor as shown in Fig. 16.

If a difference is found between ranges, make adjustment so that the difference is minimized. This calibration should be made in relation to large current (more than 1 A) calibration as indicated below.

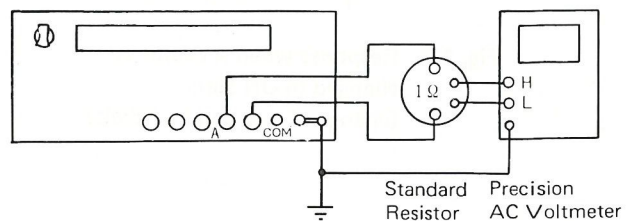


Fig. 14. Calibration of Small Current Output

3. Calibration of Large Current Output (2~50 A)

Connect the $1\ \Omega$ standard resistor to the current output terminal via the current transformer whose secondary rated current is 1 A, as shown in Fig. 15, and precisely measure the voltage drop (1 V) across the resistor.

The output is adjusted in each range of 2 A to 50 A by the current output fine adjusting variable resistor as shown in Fig. 16.

If a difference is found between ranges, continue adjustment until the difference is minimized. Make this adjustment in relation to the calibration of small current output.

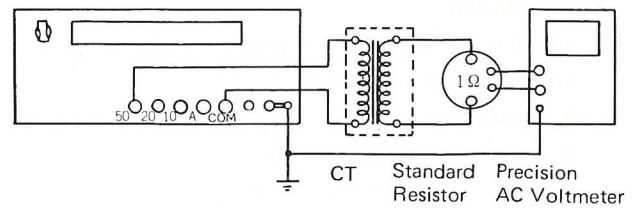


Fig. 15. Calibration of Large Current Output

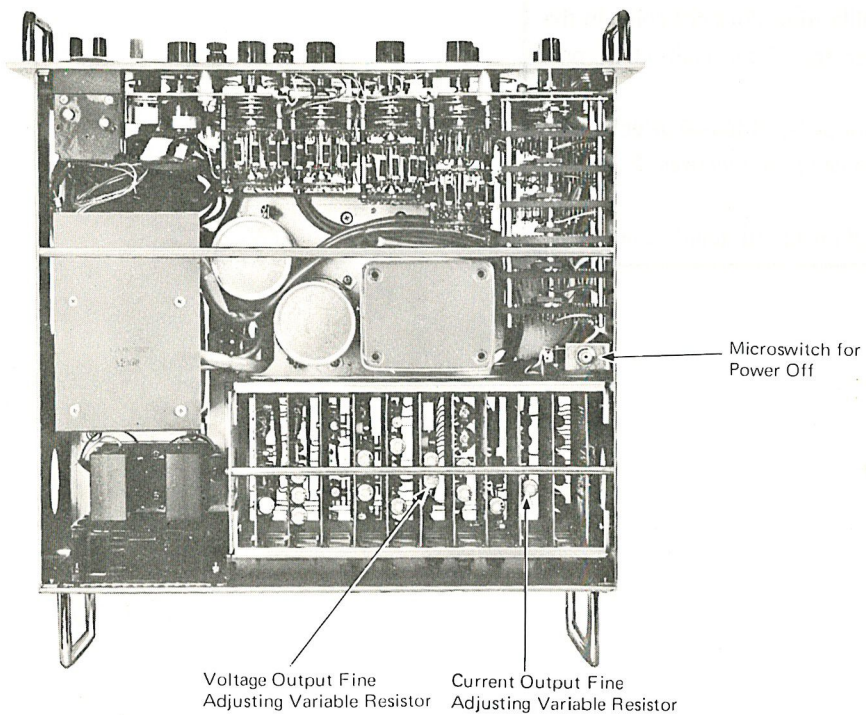


Fig. 16. Variable Resistors for Output Adjustment

Note: If the calibration difference is in excess of the rated accuracy after adjustment with the output fine adjusting variable resistors, contact your nearest dealer or YEW.

Maintenance

1. Avoid using the following places for placement or storage of this instrument.
 - moist place
 - place exposed to direct sun
 - place near heater equipment
2. If the decimal point is not illuminated and the fan is not operated when placing the power switch to **STAND BY** or **ON** position, check the power fuse.
3. If the output monitor meter is scaled out regardless of the value set on the output setting dial, open the power switch and check the load status. If leaving the power switch ON, the circuit may be burnt.

Contact your nearest dealer or YEW in the event:

- (1) The result of calibration does not come in the rated value after the above calibration procedures.
- (2) Normal state cannot be obtained after following the maintenance procedures 2 and 3 above.
- (3) Normal state cannot be obtained in any way.

Type: FET control system

Output Range:

Range	Variable Range *	Min. Resolution
10 V	1.000— 10.500 V	1 mV
20 V	2.00 — 21.00 V	10 mV
50 V	5.00 — 52.50 V	10 mV
100 V	10.00 — 105.00 V	10 mV
200 V	20.0 — 210.0 V	0.1 V
500 V	50.0 — 525.0 V	0.1 V
1,000 V	100.0 —1,050.0 V	0.1 V
100 mA	10.00 — 105.00 mA	0.01 mA
200 mA	20.0 — 210.0 mA	0.1 mA
500 mA	50.0 — 525.0 mA	0.1 mA
1 A	100.0 —1,050.0 mA	0.1 mA
2 A	0.200— 2.100 A	1 mA
5 A	0.500— 5.250 A	1 mA
10 A	1.000— 10.500 A	1 mA
20 A	2.00 — 21.00 A	10 mA
50 A	5.00 — 52.50 A	10 mA

*Note: The upper limit of the variable range shown are approx. 105% of each range value.

Maximum Output: Voltage output; 50 VA

Current output; 40 VA (25 VA on 50 A, 400 Hz range) at the power supply voltage of more than 98 V AC

Accuracy: Within ± 0.1 % of rated value on voltage and current ranges at the following conditions;

Output; 10 to 100 % of rated value

Load; Less than 10 VA

Frequency; 50, 60, or 400 Hz (fixed)

Temperature range; $23 \pm 3^\circ\text{C}$

Power supply; 90 to 110 V AC (95 to 110 V AC on 50 A, 400 Hz range)

Warm-up time; 30 minutes or longer

Distortion Factor: Less than 0.3 % on voltage and current ranges at the following conditions;

Output; 100% of rated value Load, power supply voltage, and frequency are the same conditions as specified in accuracy

Calibration: RMS value calibration at six months interval

Output Selector: Dial No. 1; 0 to 10 in 11 steps (provided with output ON mechanism at initial digit 0 for high voltage setting ranges 100 mA, 500 V and 1,000 V AC to prevent accidental overloading of instrument being calibrated)

Dials Nos. 2, 3 and 4: 0 to 9 in 10 steps

Continuous variable control: Continuously

variable from 0 to 100 % (An arbitrary value of No. 1 through No. 4 dial is set at 100 %)

Decimal Point: Automatically shiftable.

Unit Mark: mA, A and V, automatically changeable

Output Frequency: Built-in oscillator: 50 Hz ± 1 %, 60 Hz ± 1 %, 400 Hz ± 1 %, 40 to 500 Hz, (continuously variable)

External oscillator: 40 to 500 Hz (3 ± 0.1 V, 3 k Ω between input terminals)

Stability: 0.02 %/3hr. after warm-up of 30 minutes at the same conditions specified in accuracy

Frequency Characteristics: Variation of voltage or current output is within ± 0.1 % of rated value on changing from 40 to 500 Hz (added to the accuracy)

Response Time: Less than 1.5 sec. at the output of 40 to 100 % of rated value (time for attaining to within 0.1 % of rated value when shifted from OFF to ON)

Load Characteristics: Load variation; Within ± 0.1 % of rated value at voltage and current output of 10 to 100 % of rated value on changing from no-load to full-load (added to the accuracy)

Distortion factor; The following value is added to the distortion factor for the output of 40 to 100 % of rated value on changing from no-load to full-load

Voltage output, Less than +0.2 %

Current output, Less than +0.7 %

Ambient Temperature Influence: Within ± 0.1 % of rated value at 0 to 40°C (32 to 104°F)

Output Terminal: Impedance; 10 M Ω shunted by 1,000 pF between COM terminal and case

Floating voltage; Within setting output range with max. 500 V AC on voltage output, Within voltage drop between output terminals on current output

Insulation Resistance: More than 100 M Ω at 500 V DC between power supply and output terminal, and between power supply and case

Dielectric Voltage: 500 V AC for one minute between power supply and output terminal (COM. side), and between power supply and case

Power Supply: 100 V, 115 V, 200 V, 215 V & 230 V AC ± 10 %, both 50 and 60 Hz

Power Consumption: Approx. 200 VA at full-load
Approx. 120 VA at no-load

Dimensions and Weight: Approx. 200 (H) x 480 (W)

x 380 (D) mm, (Approx. 7 &/8 x 18 7 /8 x 15")
Approx. 30 kg (Approx. 66.11 bs), (Available for
rack-mount)

Accessories supplied at no extra cost:

- Large current cord (1.5 m) 2 pcs.
- Power supply cord (2 m) 1 pc.
- Fuses (TIMELAG) 4 A 2 pcs.
- Fuses (TIMELAG) 2 A 4 pcs.
- Lamp (15 V, 30 mA) 3 pcs.
- Instruction manual 1 copy

Unit: mm (Approx. inch)

Main Products

Electrical Measuring and Recording Instruments:

Electrical Indicating Instruments; Laboratory Standard, Portable Instruments, Panel & Switchboard Instruments.

Transducers; AC Voltage, AC Current, Watt, Reactive Power, Phase, and Frequency Transducers. **Tachometers;** Photo Tachometers, Panel & Switchboard Tachometers.

Temperature Measuring Instruments; Digital Thermometers, Thermocouple Thermometers, Thermistor Thermometers. Surface Temperature Indicators. **Precision Measuring Instruments;** DC Galvanometers, DC Potentiometers, DC Bridges.

Resistors; Standard Resistors, Dial Resistors, Slide Resistors. **Digital Measuring Instruments;** Digital Voltmeter, Digital Multimeter, Digital Power Meters, Data Acquisition Systems.

Standard Instruments; DC & AC Voltage & Current Standards, Standard Watt Converter. **Oscillographs;** Photocorders (Electromagnetic Oscillographs). **Recorders;** Direct-Acting Electrical Recorders, Pen Recorders, X-Y Recorders.

Peripheral Equipment for Oscillographs and Recorders; Series Resistor, Shunt Resistor, DC Amplifiers, Strain Amplifiers, Logarithmic Converter, F-V Converter. **Field Testers;** Circuit Testers, Insulation Testers, Earth Resistance Testers, Sound Level Meters.

Magnetic Material Testing Equipment; Gauss Meter, Electronic Fluxmeter, Epstein Iron Loss Test Sets, DC Hysteresis Loop Tracers. **Analog Computers;** Analog Computer, Logic Assembly.

Industrial Process Instruments:

EBS Series Electronic Instruments, ERB Series Electronic Instruments, PCI Series Pneumatic Instruments, for measurement and control of Temperature, Pressure, Flow, Liquid Level, Density, Humidity, Dewpoint, Displacement, Velocity, Electrical Quantity, etc.

Analytical Instruments:

Instruments for Liquid Analysis; pH Meters, Turbidity Measuring Instruments, Liquid Density Measuring Instruments, Solution Conductivity Measuring Instruments, Viscosity Measuring Instruments, Process Titrator, Residual Chlorin Analyzer. **Instruments for Gas Analysis;** Gas Chromatographs, Petroleum Sulfur Analyzer. **Radiation Instruments;** β Ray Thickness Gauge, γ Ray Density Meter.

Digital Control Systems:

Direct Digital Control Systems, Computer Control Systems, Digital Blending Control Systems.

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YOKOGAWA ELECTRIC WORKS, LTD.

9-32, Nakacho 2-Chome, Musashino-shi, Tokyo, 180 JAPAN
Phone: Tokyo 0422-54-1111 Telex: 02822-327 YEW MTJ
Cable Address: TLX 2822-327 YOKOGAWA TOKYO

YOKOGAWA ELECTRIC (EUROPE) B.V.

Nederhoven 17-19-21, Buitenveldert, Amsterdam, The Netherlands
Phone: 020-423194 Telex: 44-14094 YEW NL

YOKOGAWA CORPORATION OF AMERICA

5, Westchester Plaza Elmsford, New York 10523 U.S.A.
Phone: 914-592-6767 Telex: 710-567-1256 YCA EMFD.