

INSTRUCTION MANUAL FOR

SPOT OSCILLATOR

MODEL 426A

KIKUSUI ELECTRONICS CORPORATION

KAWASAKI, JAPAN

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1. GENERAL

The 426A Spot Oscillator is used for measurement of frequency response characteristics of stereophonic amplifiers, tape recorders, and other audio equipment. Its features are as follows:

- (1) The required spot frequency can be readily obtained simply by depressing the corresponding one of the keyboard-type pushbuttons.
- (2) Although the 426A is a spot frequency generator, the frequencies of individual ranges (5 ranges) are variable by 10 times. Thus the oscillating frequencies can be preset at any required values.
- (3) The frequency selectors, which are frequently depressed and reset, are made of long-life reed relays ensuring a long durability.
- (4) When used in conjunction with Kikusui Model 445A Scanning Unit, the oscillator can be operated under remote a control mode.

2. SPECIFICATION

Power requirements: AC 100 V $\pm 10\%$, 50/60 Hz, approx. 9 VA

Weight (net): Approx. 3.5 kg

Dimensions: 200 W x 140 H x 285 D (mm)

(Maximum dimensions) 200 W x 155 H x 330 D (mm)

Ambient temperature: 5 °C to 35 °C

Ambient humidity: 85% R.H. max.

Overall oscillating frequency range: 20 Hz - 30 kHz

The number of oscillating spot frequencies:

5 (A, B, C, D, E)

A: 20 Hz - 200 Hz

B: 100 Hz - 1 kHz

C: 200 Hz - 2 kHz

D: 2 kHz - 20 kHz

E: 3 kHz - 30 kHz

Frequency drift: With $\pm 2.5\%$ of set value

Output voltage: 2.5 V rms or more (600 Ω load)

Frequency characteristics of output voltage: Within ± 0.5 dB

(at maximum output voltage and 600 Ω load)

Distortion factor: (at maximum output voltage and 600 Ω load)

(1) 0.05% or below (500 Hz - 5 kHz)

(2) 0.1% or below (200 Hz - 30 kHz)

(3) 0.5% or below (20 Hz - 200 Hz)

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Output impedance: 600 Ω \pm 20%, single-ended

Output attenuation: Continuously variable for 30 dB or over

Attenuation accuracy: Better than \pm 0.5 dB between steps

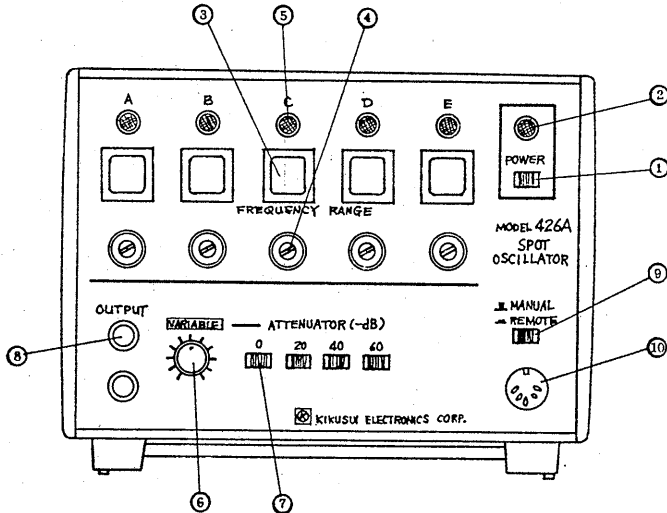
Remote control: With Model 445A, manual switching
and scanning switching of oscillating
frequencies (preset spot frequencies)
can be remotely made.

Accessory: Instruction manual, 1 copy

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3. OPERATION METHOD

3.1 EXPLANATION OF FRONT PANEL



- (1) POWER: AC line power switch of the oscillator. The depressed and locked state is ON. When it is pushed again, the switch is unlocked and turned OFF.
- (2) POWER PILOT LAMP: Lights to indicate power ON. A green LED (light emitting diode) is used as the lamp.

- (3) FREQUENCY RANGE: For selection of oscillating
(A, B, C, D, E spot frequency. A frequency corresponding
frequency selector to the depressed button is generated.
buttons) The buttons are non-lock type.
- (4) SEMI-FIXED RESISTORS For adjustment of each spot frequency.
FOR FREQUENCY The frequency becomes lower as the
ADJUSTMENT: resistor is turned clockwise with a
screwdriver.
- (5) OSCILLATING SPOT For indication of the spot frequency
INDICATOR LAMPS: being generated. The one corresponding
to the depressed FREQUENCY RANGE
button (3) is turned ON. Red LED's
are used as these lamps.
- (6) VARIABLE: For continuously-variable adjustment
of output voltage. The voltage
increases as this knob is turned
clockwise. The variable range is
30 dB or more.
- (7) ATTENUATOR (-dB): Attenuator pushbuttons for 0, -20, -40
and -60 dB with respect to the voltage
set with VARIABLE knob (6).

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- (8) OUTPUT: Output terminals with 600 Ω output impedance. The black terminal is grounded to the oscillator chassis.
- (9) MANUAL/REMOTE SELECTOR: When the oscillator alone is used, this selector switch must be set in the MANUAL position. When used in conjunction with the 445A for remote control, the switch must be set in the REMOTE position.
- (10) REMOTE CONTROL CONNECTOR: When MANUAL/REMOTE selector (9) is set in the REMOTE position, the 445A is connected to this connector with a special cord attached to the equipment. The connector is a DIN 5-pin type.

3.2 OPERATING PROCEDURE

- (1) Depress the POWER switch. The switch will be locked, the POWER PILOT lamp (green LED) will light, and the oscillator will be stabilized in several seconds.

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(2) Set the MANUAL/REMOTE selector in the MANUAL position.

(3) Presetting of spot frequencies (A - E):

Connect a frequency counter to the OUTPUT terminal (8).
Select the range with FREQUENCY RANGE button (3) and
preset the required frequency with VARIABLE knob (4).
Perform the above procedure for the five spot frequencies
of A - E.

(4) Adjustment of output voltage:

Set the output voltage with the VARIABLE knob (6). The
output increases as the knob is turned clockwise. Use the
ATTENUATOR (-dB) buttons (7) to lower the signal level as
required.

(5) Presetting of the oscillator is complete by the above
procedure. Connect the OUTPUT terminal (8) to the
equipment to be tested and select the oscillating frequency
with the FREQUENCY RANGE buttons (3).

(6) Remote control:

For remote control with the 445A, connect it to the
REMOTE CONTROL connector (10) of the oscillator and
set the MANUAL/REMOTE switch (9) in the REMOTE
position.

3.3 PRECAUTIONS IN OPERATION

- o The ambient temperature should be 5 °C to 35 °C. Note that, even when ambient temperature is not higher than 35 °C, temperature inside of the oscillator casing may become abnormally high if the oscillator is exposed to direct sunlight or other heat source.

- o Since a thermistor is employed for oscillating amplitude control, the output voltage may be affected by ambient temperature variation. When a constant output voltage is required for a long operation period, monitor the voltage with an external voltmeter.

- o Match the input impedance of the tested equipment (connected to the output terminal of the oscillator) with the output impedance (600 Ω) of the oscillator. Note that the specified output voltage or frequency characteristics may not be satisfied if the load condition is unsatisfactory due to the use of unreasonably long output lead wires, etc.

- o Do not use or store the oscillator in a dusty, high temperature, or high humidity place.

- o When the MANUAL/REMOTE selector switch is set in the REMOTE position, the FREQUENCY RANGE selector buttons remains idle.

- o When two or more FREQUENCY RANGE buttons are simultaneously depressed or none of them is depressed, the oscillator does not operate normally. Be sure to depress one of them at a time.

- o Note that the frequency becomes lower as the FREQUENCY-SETTING resistor (4) is turned clockwise.

- o When the POWER switch (1) and MANUAL/REMOTE selector switch are operated, either one of the five spots may have been selected and this does not cause any hindrance to operation.

- o Securely depress the FREQUENCY RANGE button for its full stroke. No selection is made if the button is depressed halfway because the circuit is incorporated with an erroneous-touch prevention function.

4. OPERATING PRINCIPLE

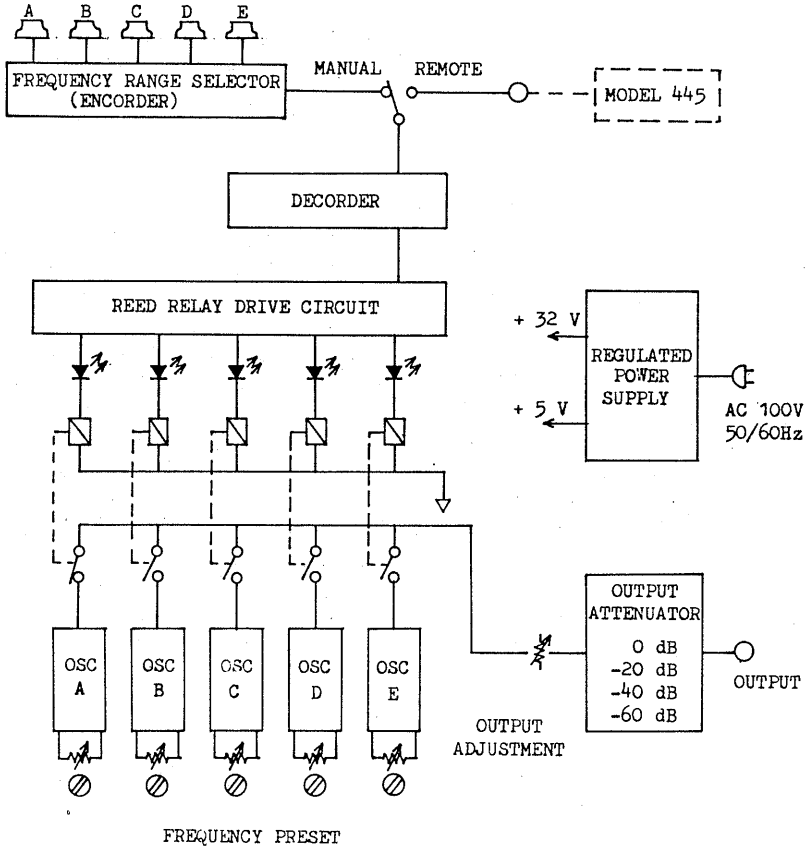


Fig. 1 Block Diagram

o Description of Circuit Operation

As one of the FREQUENCY RANGE selector button (spot selector button) is depressed, a 3-bit digital signal corresponding to the range is generated. This signal is fed to the decoder which selects the required spot frequency.

Although the oscillator provides five spot frequencies, since the above system is employed, only three signal lines are required instead of five signal lines and thus the number of wires is reduced. The spot selection signal is fed to the relay drive circuit which controls the spot indicator lamp (LED) and switches the oscillator circuit of the corresponding spot frequency.

The oscillating spot frequencies are preset with the FREQUENCY SETTING semi-fixed resistors. The output voltage is adjustable with the VARIABLE knob (continuously variable potentiometer) and ATTENUATOR buttons (stepwise change).

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o Operating Principle of Oscillator (Wien Bridge Oscillator)

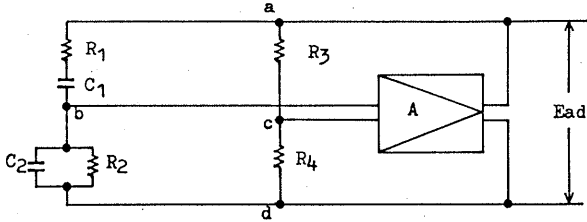


Fig. 2 Oscillator circuit

Referring to Fig. 2, E_{bc} becomes the same phase with E_{ad} when the condition of equation (1) is met and E_{bc} can be expressed with equation (2).

$$f = \frac{1}{2\pi\sqrt{R_1 R_2 C_1 C_2}} \quad (1)$$

$$E_{bc} = \frac{1}{1 + \frac{R_1}{R_2} + \frac{C_2}{C_1}} - \frac{R_4}{R_3 + R_4} > \frac{1}{A} \quad (2)$$

The oscillator oscillates when the state of equation (2) is attained and it is stabilized when the state of equation (3) is reached.

$$\frac{1}{1 + \frac{R_1}{R_2} + \frac{C_2}{C_1}} - \frac{R_4}{R_3 + R_4} = \frac{1}{A} \quad (3)$$

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The conditions for oscillation depend upon equations (1) and (2), or (3) irrespective of amplitude. An oscillator circuit actually is so designed that the condition of equation (2) is maintained until the amplitude is built up to a certain level at which the condition of equation (3) is met. To meet these conditions with the circuit shown in Fig. (2), R_3 and R_4 are required to be automatically varied with respect to amplitude. This instrument employs a thermistor for R_3 .

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5. MAINTENANCE

5.1 INSPECTION OF CHASSIS ASSEMBLY

To gain access to the chassis assembly, remove the screw in the center of the rear panel and two screws at the rear of the bottom panel, remove the rear panel, and pull out the chassis assembly from the case.

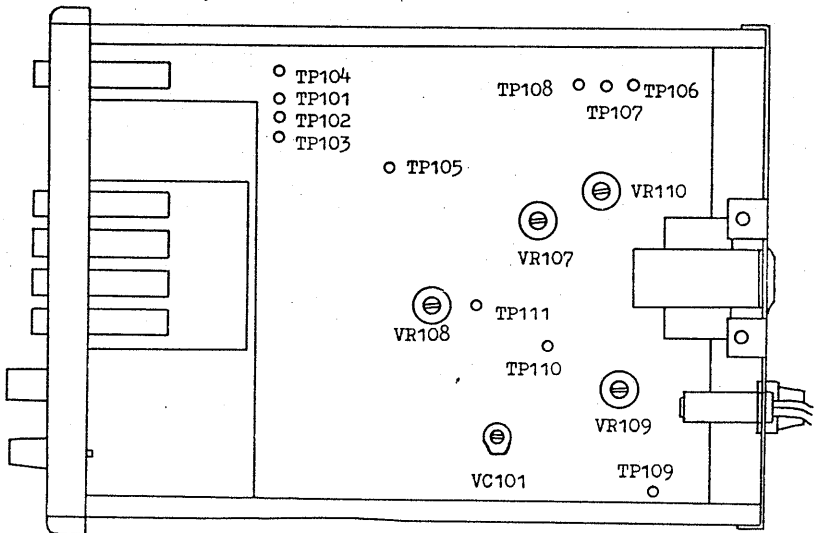


Fig. 3 Locations of adjusting potentiometers

The oscillator has three printed boards. To attain the best reliability, the circuit wires are reduced to the necessary minimum. Locations of the adjusting potentiometers

(semi-fixed resistors) are as shown in Fig. 3.

VR107: Oscillator bias adjustment
VR108: Oscillator output voltage adjustment
VR109: +32 V supply voltage adjustment
VR110: +5 V supply voltage adjustment

5.2 ADJUSTING PROCEDURE

Referring to Fig. 3, make adjustment as below.

- (1) Adjustment of +32 V DC power supply:

Adjust the voltage of TP110 (TP109 is grounded) at
 $+32 \pm 0.5$ V with potentiometer VR109.

- (2) Adjustment of +5 V DC power supply:

Adjust the voltage of TP106 (TP108 is grounded) at
 $+5 \pm 0.2$ V with potentiometer VR110.

- (3) Bias adjustment of oscillating circuit:

Set the MANUAL/REMOTE selector switch in the MANUAL
position. Depress the E spot button of the FREQUENCY

RANGE selector. Connect a load of $600 \Omega \pm 1\%$ to the output terminal. Turn the potentiometer VR107 to a position where the voltage of TP111 (with respect to the ground) is made $+16 \text{ V} \pm 2 \text{ V}$ and the distortion is made minimum.

(4) Adjustment of the oscillator output voltage.

Depress the C spot button of the FREQUENCY RANGE selector. The further adjustment is the same with the above. Then, with the FREQUENCY SETTING potentiometer, adjust the oscillating frequency at $1 \text{ kHz} \pm 3\%$.

Measuring the distortion factor of the signal delivered from the OUTPUT terminal, so adjust with potentiometer VR108 that the output voltage is made $3.0 - 3.2 \text{ V rms}$ and its distortion factor is made minimum.