MODEL 415

RC DECADE OSCILLATOR

OPERATION MANUAL

印刷表示使用のこと

KIKUSUI ELECTRONICS CORP.

MODEL 415 RC DECADE OSCILLATOR

INSTRUCTION MANUAL

This is a low frequency osclllator of Wien Bridge type, so designed to provide unbalanced voltage up to 7.75 volts (20 dBm) into the 600 ohms or higher resistance load, by means of large output voltmeter, attenuator and internal termination resistor.

For frequency selection, push button groups in x 1, x 10, x 100,and x 1000 ranges are provided on the panel, to be varied by 1 c/s step from 1 c/s to 11,110 c/s.

Kikusui Electronics Corporation

S P E C I F I C A T I O N S

Power Supply .....V 50/60 c/s Approx. 110 VA

Dimensions 520 (W) x 240 (H) x 254 (D) mm

(Max.) 545 (W) x 260 (H) x 290 (D) mm

Weight Approx. 15 kg

Items supplied with equipment

1 - Instruction Manual

1 - Test Data

Frequency

Range 1 c/s ~ 11,110 c/s

Step 1 c/s, 10 c/s, 100 c/s, 1000 c/s

Accuracy ± (1.5% + 0.1c/s)

Stability In 5 ~ 60 minutes duration after testing

± (1% + 0.1c/s)

Against ± 10% variation in line voltage

± (0.1% + 0.01c/s)

Max. Output (600 ohms pure resistance load) 20 dBm (7.75 V)

Frequency Response ± 0.5 dBm

Distortion (Output 20 dBm)

20 c/s	~	50 c/s	1 %
50 c/s	~	100 c/s	0.5 %
100 c/s	~	200 c/s	0.3 %
200 c/s	~	11110 c/s	0.2 %

Stability (Output Voltage)

Against ± 10% variation in line voltage ± 0.1 dB

Output Impedance 600 ohms ±5 %

Attenuator Accuracy - 10 dB, - 20 dB, - 30 dB ± 0.5 dB

- 40 dB, - 50 dB, - 60 dB ± 1.0 dB

Internal Termination Resistor

600 ohms 1/2 watt 1 %

Output Voltmeter Full-wave rectifier type (Using germanium diodes)

Class 2.5

FUNCTIONS OF CONTROLS AND TERMINALS

Power This is a power switch and when switched ON, the pilot lamp lights. Wait about 20 seconds before starting operation.

x 1000 c/s
x 100 c/s
x 10 c/s
x 1 c/s These are groups of buttons to select oscillation frequency each consisting of 11 buttons, from 0 to 10 totaling to 44 buttons in all. Oscillation frequency is the total of these selected values.

Example	I	II	III	IV	V
1000 c/s group	0	0	0	0	1
100 c/s group	9	9	9	10	0
10 c/s group	9	9	10	0	0
1 c/s group	9	10	0	0	0
Osc. Freq.	999 c/s	1000 c/s			

Level This is a knob to control output voltage continuosly. Turning to clockwise, output voltage increases.

Attenuator This is an attenuator of symmetrical bridged T with 600 ohms characteristic impedance. Figures represent attenuation quantity, increasing as it is turned to clockwise direction. Relation between attenuation quantity (dB) and voltage ratio are as follows.

dB	0	10	20	30	40	50	60
ratio	1	0.316	0.1	0.0316	0.01	0.00316	0.001

Termination This is the switch which connects the 600 ohms internal load resistor to output terminal. When the load of this instrument is pure resistance of 600 ohms, switch to OFF position. Being load resistor so larger than 600 ohms, set it at 600 position.

Output Either of the two output terminals, left or right, can be used. GND terminal is electrically connected to panel.

Output Voltmeter The meter shows the input voltage of the attenuator. It is scaled with V (RMS) and dBm, based on 600 ohms, 1 mW.

OSCLLATION FREQUENCY

Osclation frequency varies according to ambient temperature and inside temperature rise of the instrument after starting. It is approx. +0.005%/°C and the variation after the start reaches to final value within first one hour, being about +0.5%.

One of the push buttons of each group should be pressed down necessarily. Imperfect pressing is apt to cause failure of locking, releasing it from contact. Frequency of RC oscillator of Wien Bridge type comes ideally as:

$$f = \frac{1}{2\pi RC} \qquad f' = \frac{1}{2\pi R'C} \qquad f'' = \frac{1}{2\pi R''C}$$

and the total of both comes to

$$f + f'' = \frac{R' + R''}{2\pi R'R''C} = \frac{\frac{1}{2\pi C}}{\frac{R'R''}{R' + R''}}$$

In this formula the denominator equals to the value of R' and R" parallel combined. Therefore, by connecting resistances in parallel, the instrument generates frequency which is the sum of individual frequency obtainable by independent use.

Push button groups of the instrument are to connect these individual resistance in parallel. Due to proper error (±1%) of each resistance used, there is individual proper error in frequency represented by each button. As such, even if buttons are set as shown in previous page (example II, III IV and V), the values vary within the range of tolerance granted by the specifications ±(1.5% + 0.1c/s) and not always show exactly the same frequency.

For example, if you wanted to get a 1c/s higher frequency than 999 c/s shown in example (1), you can increase x 1c/s column as shown in example (II). In this instance, frequency error almost depends on the mutual deviation of 9c/s and 10c/s buttons, and even in the worst case falls at 10(±1.5% ± 0.1) -9(±1.5% ± 0.1) = ±0.485c/s. While if you take example (I) to (III), the error will be in the same way, ±1.8c/s. In exaples (I) to (IV) or to (V), the error will be in both cases ±15.3c/s.

Accordingly, when an accurate frequency difference is required, operation at as lower figure buttons are possible is recommended. For your guidance, exceptionally for x 1c/s, x 10c/s, x 100c/s, and x 1000c/s groups alone, you may lock "10" button and "1·····9" button at the same time to obtain 0, 1, 2, 3, ·····19.

Output Voltage

Output voltage can be read with output voltmeter and attenuator as follows. As the characteristic impedance of ATTEN is 600 ohms, correct attenuation quantity is obtained only when the load impedance from 600 ohms pure resistance. Therefore, whenever any load impedance from 600 ohms is used, adequate value of series or parallel resistance should necessarily connected to the load, so that combined value will be 600 ohms. Otherwise it is not possible to know voltage of OUTPUT terminals. When load resistance is far higher than 600 ohms, set TERMINATION switch to 600Ω.

LEVEL knob should be used within the range that the indication of output voltmeter stays within 20 dBm. Nevertheless, when ATTEN is 0 dB and the load resistance is sufficiently larger than 600 ohms, it can be increased up to about 15 volts which is equivalent to 20 dBm.

Output impedance is constantly 600 ohms, when TERMINATION is OFF, regardless of the position of ATTEN.

Oscillation voltage diminishes as ambient temperature of thermiater rises. So, when LEVEL knob is held at a fixed position, there will be -1.5 dB change during the first one hour and about -0.5 dB during later several hours, as inside temperature of the instrument rises after starting.

Output Voltage (dBm) shall be worked out by adding voltmeter reading (dBm) with ATTEN reading (dB), for instance, when voltmeter reads 16.2 dBm, ATTEN reads -30 dB, output voltage will be 16.2 - 30 = - 13.8 dBm.

Output voltage (V) is the product of voltmeter reading (V) and voltage ratio of ATTEN. In the same example as above, voltmeter indicates 5 volt and - 30 dB is equal to 0.0316. Therefore, output voltage is 5 x 0.0316 = 0.158V. Besides, - 30 dB is the sum of - 10 dB and - 20 dB (In case of voltage ratio it is product.). So, it may be worked out either. See that voltmeter reading 5 volts is 16.2 dBm and calculate 16.2 - 10 = 6.2 dBm. Then, find on the scale 1.6 volts, which is equivalent to 6.2 dBm to work out 1.6 x 0.1 = 0.16V.

Interchange of V_1 and V_3

The characteristics of V_1 and V_3 have an effect on distortion in output voltage. In case V_1 is inadequate, distortion increases sharply at high frequency while V_3 tend to distort sharply at lower output than 20 dBm. So it is recommended to select V_3, with which the top and bottom of the output wave will be clipped concurrently when output is increased.