

INSTRUCTION MANUAL

DIGITAL LEVEL METER

MODEL 1901

KIKUSUI ELECTRONICS CORPORATION

782921

Power Requirements of this Product

Power requirements of this product have been changed and the relevant sections of the Operation Manual should be revised accordingly.

(Revision should be applied to items indicated by a check mark)

Input voltage

The input voltage of this product is _____ VAC,
and the voltage range is _____ to _____ VAC. Use the product within this range only.

Input fuse

The rating of this product's input fuse is _____A, _____VAC, and _____.

WARNING

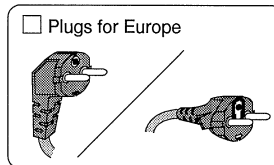
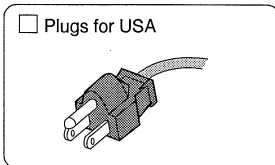
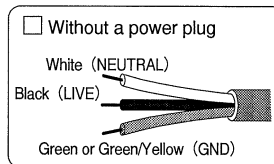
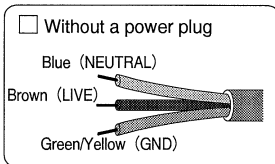
- To avoid electrical shock, always disconnect the AC power cable or turn off the switch on the switchboard before attempting to check or replace the fuse.
- Use a fuse element having a shape, rating, and characteristics suitable for this product. The use of a fuse with a different rating or one that short circuits the fuse holder may result in fire, electric shock, or irreparable damage.

AC power cable

The product is provided with AC power cables described below. If the cable has no power plug, attach a power plug or crimp-style terminals to the cable in accordance with the wire colors specified in the drawing.

WARNING

- The attachment of a power plug or crimp-style terminals must be carried out by qualified personnel.



Provided by Kikusui agents

Kikusui agents can provide you with suitable AC power cable.
For further information, contact your Kikusui agent.

Another Cable _____

TABLE OF CONTENTS

	<u>PAGE</u>
1. GENERAL	1
2. SPECIFICATIONS	2
3. OPERATION METHOD	5
3.1 Explanation of Front Panel	5
3.2 Explanation of Rear Panel	7
3.3 Measuring Procedure	12
3.4 Operation Explanation	12
4. OPERATING PRINCIPLE	14
5. MAINTENANCE	16
5.1 To Gain Access to Chassis	16
5.2 Layout of Adjustments	16
5.3 Calibration	17

782922

1. GENERAL

Model 1901 Digital Level Meter measures an AC voltage for a wide range of -60.0 dB to +20.0 dB at a high accuracy of ± 0.1 dB with an auto-range feature which eliminates manual range selection. The measured value can be directly read in decibel value.

The unit of measure can be either dBm which is referenced to 1 mW 600 Ω , dBv which is referenced to 1 V as 0 dB and is widely used in audio engineering, or dB which is used for determination of relative levels.

As the Level Meter provides a BCD output, it can be used in combination with the Digital Comparator (option) for GO/NO-GO judgement.

2. SPECIFICATIONS

Instrument name: Digital Level Meter

Model No.: 1901

Measuring function: AC voltage measurement

Measuring range: -60.0 dB ~ +20.0 dB

Unit of measure: dBm Referenced to 1 mW (rms value of
sinusoidal wave), 600 Ω
dBv Referenced to 1 V as 0 dBv
dB Measurement of relative value,
variable range approximately 12 dB

Measuring accuracy: Absolute value measurement (dBm, dBv)
20 Hz ~ 50 kHz Within ± 0.1 dB
50 kHz ~ 100 kHz Within ± 0.2 dB
Relative value measurement (dB)
Within absolute value measuring accuracy
 ± 0.1 dB
Stability: Within ± 0.1 dB for $\pm 10\%$ change in
AC line voltage

Input terminals: 5-WAY type, 3/4 inch (19 mm) spacing

Input impedance: 1 M Ω , 50 pF or less

Maximum input voltage: AC ± 100 V peak-to-peak
DC ± 100 V

Display system: Memory display with LEDs
OVER indication (when +20.0 dB or over)
UNDER indication (when -60.0 dB or less)
ZERO blanking

Readout: 3 digits, "+", "-"

BCD output: Fan-out 1 (TTL output)
3 digits
"+" "-" signal
Print command signal
Time interval signal

Sampling time: Approx. 0.3 sec/sample

Ambient temperature: 5 $^{\circ}$ C ~ 35 $^{\circ}$ C

Power requirements: 100 V $\pm 10\%$, 50/60 Hz AC, approx. 14 VA
(Convertible to 110/120/200/220/230/240 V)

Insulation resistance: 50 MΩ or over, with 500 V DC

Withstanding voltage: 1000 V AC, 1 minute

Dimensions: 200 (W) × 80 (H) × 250 (D) mm

(Maximum dimensions): 220 (W) × 90 (H) × 295 (D) mm
(345 (D) mm when in carrying state)

Weight: Approx. 2.4 kg

3. OPERATION METHOD

3.1 Explanation of Front Panel

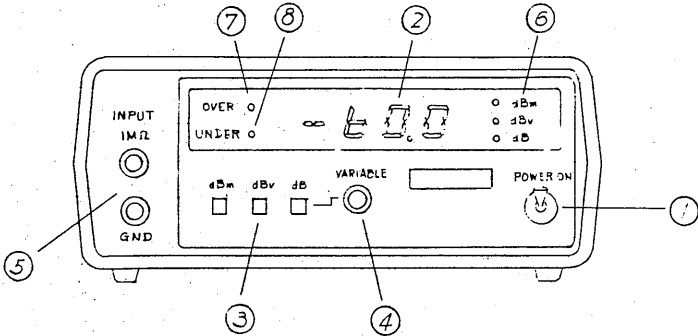


Figure 1

- ① POWER: Main power switch of the instrument. When this switch is turned ON, the readout becomes luminous.
- ② READOUT: Displays a 3-digit numeral and a polarity sign ("+" or "-"). The decimal point is fixed between 10^0 column and 10^1 column. If the 10^2 column is zero, it is blanked out and not displayed.
- ③ dBm/dBv/dB selector buttons: Selects a unit of measure among dBm, dBv and dB. The corresponding LED light ⑥ turns on.

- ④ VARIABLE: This control is effective only when "dB" is selected by the dBm/dBv/dB buttons ③. With this control the level can be shifted for a range of approximately +0.8 to -11.2 dB with respect to the dBm indication or for a range of approximately +3.0 dB to -9.0 dB with respect to the dBv indication. This feature is very advantageous when measuring a relative value by setting to "0.0" the 10^0 and 10^1 columns.
- ⑤ INPUT 1MΩ: Terminals for applying the input signal. The GND terminal is connected to the instrument chassis.
- ⑥ dBm/dBv/dB indicator lights: LED lights which indicate the unit of measure selected by dBm/dBv/dB selector buttons ③.
- ⑦ OVER: LED light which turns on when the readout ② has overflowed due to an input of "+20.0" or over.
- ⑧ UNDER: LED light which turns on when the readout ② has underflowed due to an input of "-60.0" or less.

3.2 Explanation of Rear Panel

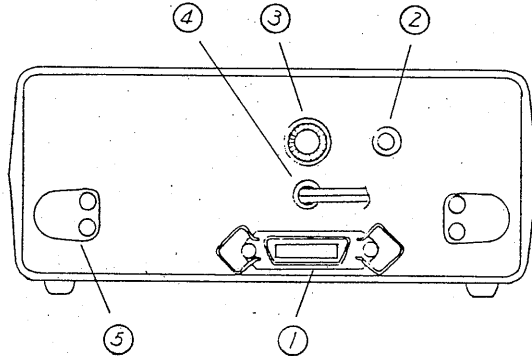


Figure 2

- ① DATA OUTPUT: Connector which provides the measured data signal.
The connector is a 57-Series 24-pin receptacle
(57-40240) manufactured by Amphenol.

(a) Connector wiring table

Table 1

Pin No.	Output code	Pin No.	Output code
1	tm signal	13	
2		14	"+" "-" signal
3	10^2 column 8	15	10^2 column 1
4	10^2 column 4	16	10^2 column 2
5	10^1 column 8	17	10^1 column 1
6	10^1 column 4	18	10^1 column 2
7	10^0 column 8	19	10^0 column 1
8	10^0 column 4	20	10^0 column 2
9		21	
10	Print command signal	22	
11		23	
12	GND	24	

(b) All output codes of the measured results are of the TTL level, fan-out 1.

- o The display signals of all digits (10^0 column ~ 10^2 column) are of a BCD (8-4-2-1) code, positive logic.
- o The "+"/"-" signal is HI for "+" and IO for "-".
- o The print command signal instructs printing by falling from the HI state to the IO state.

- o t_m signal: This instrument is incorporated with an auto-range feature of 20-dB steps, 4 ranges. By measuring with time interval of HI period of the t_m signal, a resolution of approximately 23 dB for each range is attained.

Assuming that one period of t_m to be t_s , $t_s/50$ becomes 1 dB and, therefore, the decibel value is $t_m \div t_s/50$.

Example 1: Assume that the reading is +10.0 dB (0 dB ~ +20 dB range). Assuming that T_s is 333.33 msec and T_m is 66.80 msec, the decibel value can be calculated as follows:

$$\text{dB} = 66.80 \text{ msec} \div 333.33 \text{ msec}/50 \approx 10.02 \text{ (dB)}$$

Example 2: Assume that the reading is -30.0 dB (-40 dB ~ -20 dB range). Assuming that T_s is 333.33 msec and T_m is 66.80 msec, the decibel value can be calculated as follows:

$$\text{dB} = 66.80 \text{ msec} \div 333.33 \text{ msec}/50 \approx 10.02 \text{ (dB)}$$

Since the -40 dB ~ -20 dB range is used, the dB value can be determined as follows:

$$-40 \text{ dB} + 10.02 \text{ dB} = -29.98 \text{ (dB)}$$

Note: When the signal level is lower than -60 dB, the t_m signal is not output.

(c) Timing chart

One sampling period is one cycle period of print command signal, which is approximately 0.3 sec/sample. When the input signal is applied, the auto-range circuit operates at a rate of 0.3 sec/step in order to select automatically an appropriate range.

Measurement is done within a period of approximately 200 msec from the start point "a". The measured value is displayed at point "b" and it is held until the next latch signal point "c" arrives.

The "+"/"- data is either (1) with the signal becoming the HI state after point "b" or (2) with the signal becoming the HI state after point "d".

The period during which the data can be output to an external circuit is period "ti" shown in Figure 3.

For the print command signal, use the fall point f within a period of b to e.

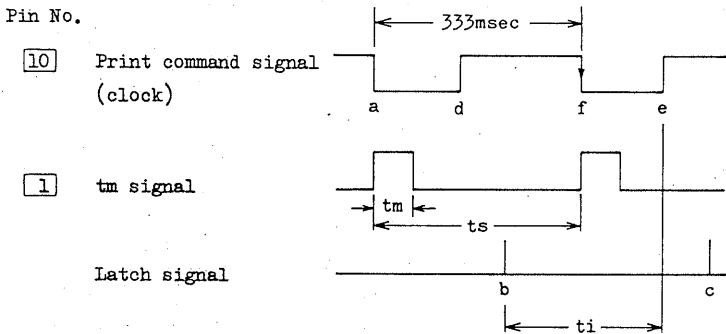


Figure 3

- ② GND: The GND terminal is connected to the signal GND line and chassis.
- ③ FUSE: Fuse in the AC input line.
Slow blow type, 0.5 A.
- ④ AC power cord: Connect to an AC line outlet (100 V, 50/60 Hz AC).
- ⑤ Cord hooks: Take-up the power cord.

3.3 Measuring Procedure

- 1) Connect the AC power cord to an outlet of 100 V AC line (or other voltage to which the instrument has been converted).
Turn-ON the POWER switch, and the readout will become luminous.
- 2) Press the required one of the dBm/dBv/dB selector buttons.
Apply to the input terminal the signal to be measured, and the readout will display the signal level in the selected decibel value.

3.4 Operation Explanations

- 1) Auto-range operation:

This instrument is incorporated with an auto-range function of 20-dB step, 4 ranges. In order that the auto-range operation does not become unstable at the range switch points (-40 dB, -20 dB, 0 dB), the operation is provided with hysteresis characteristics of approximately 3 dB. When the input voltage rises from -60.0 dB, the range is not switched at -40.0 dB but it is switched at approximately -37.0 dB. When the input voltage falls from -30.0 dB, however, the range is switched at -40.0 dB.

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2) Response time:

The sampling rate of this instrument is approximately 0.3 sec/sample. A certain period (1 ~ 2 seconds) is required before the readout indication becomes stable, including the switching period (approximately 0.3 sec/step) of the auto-range operation (4 ranges).

The response time affects the measurement primarily at lower frequencies. Down to approximately 20 Hz, fluctuation of readout indication is well suppressed; at approximately 10 Hz, the indication ripple is approximately ± 0.1 dB.

3) Waveform errors:

This instrument is a mean-value indication type and indicates a value proportional to the mean value of the measured AC signal. The indication is calibrated with a sine wave signal. If the measured signal waveform is unreasonably deviated from the sine wave, significant errors may be introduced.

4) Input impedance:

The input impedance of this instrument is 1 M Ω , 50 pF. Note that, when the impedance of the measuring cable is high, the indication of the measured voltage at a higher frequency range may drop and the measurement may be disturbed by external noise.

4. OPERATING PRINCIPLE

A block diagram of this instrument is shown in Figure 4.

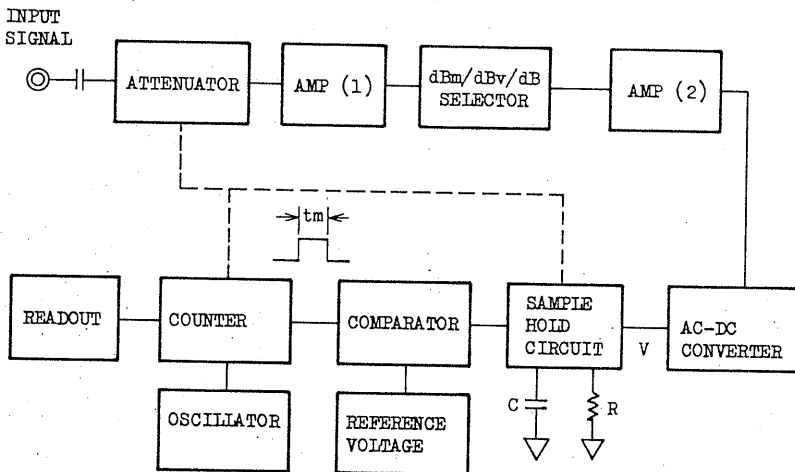


Figure 4

The AC input signal is attenuated to an appropriate level by the attenuator (auto-range) and amplified by an amplifier (1). The amplified signal is conditioned by the dBm/dBv/dB selector circuit for calibration in the required unit of measure. The calibrated signal is amplified by amplifier (2), and the amplifier output is converted from the AC signal into a DC signal by an AC-DC converter. With this DC signal voltage, capacitor C of the sample hold circuit is charged and then it is discharged through resistor R with the timing dictated

by the oscillator. The period "tm" in which the voltage drops to the reference voltage is measured. There is a logarithmic relationship between period and voltage as follows:

$$t_m \propto \log V$$

Thus, a time interval value which is a logarithmic function of a voltage can be obtained.

Now, decibel (dB) also is a logarithmic function of the ratio between two voltages as follows:

$$20 \times \log_{10} \frac{\text{input voltage}}{\text{reference voltage}}$$

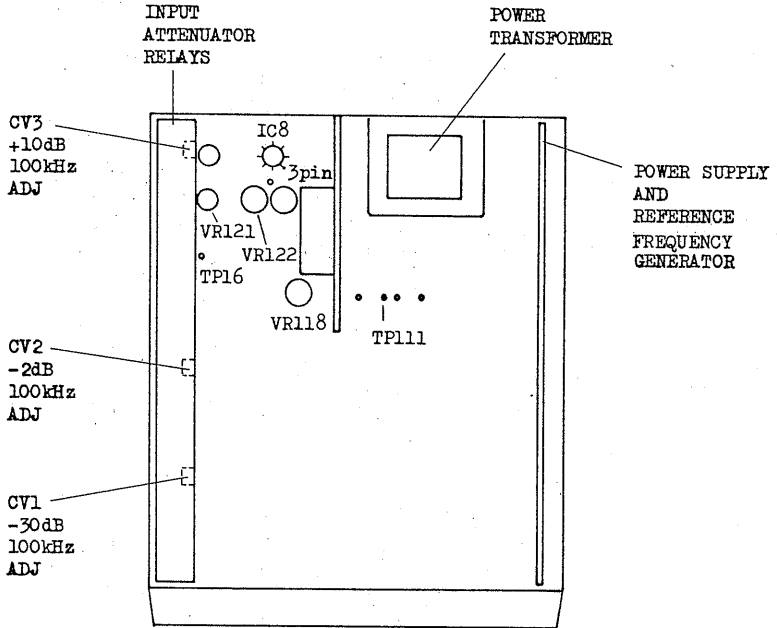
Therefore, an AC voltage can be directly read by measuring the period "tm" with a digital counter.

5. MAINTENANCE

5.1 To Gain Access to Chassis

To gain access to the internal chassis, remove the top and bottom cover upon undoing the eight clamping-screws at both sides of the casing.

5.2 Layout of Adjustments and Other Components



Front panel

Figure 5

5.3 Calibration

(1) Absolute-value Calibration

Set the dBm/dBv/dB selector buttons ③ in the dBm state, and apply a sine wave signal of 7.746 Vrms, 1 kHz. So adjust potentiometer VR118 that the DC voltage of TP16 becomes 10 times (20 dB) of the voltage of pin 3 of IC8. Next, connect a frequency counter to TP111, and so adjust potentiometer VR122 that the period "tm" becomes +20 dB ± 0.02 dB. (For conversion between period and dB, refer to Para. 3.2 (1).) Then, gradually reduce the input and so adjust potentiometer VR121 that the period "tm" becomes +1 dB ± 0.02 dB.

(2) Frequency Calibration

Applying an input signal of 100 kHz at 24.495 mV, 244.95 mV and 2.4495 V, so adjust the trimmer capacitors CV1, CV2 and CV3, in the due order, that the indication becomes -30 dB, -10 dB and +10 dB, respectively.