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.

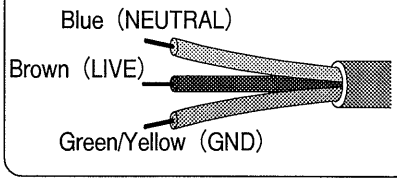
☐ AC power cable

The product is porvided 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.

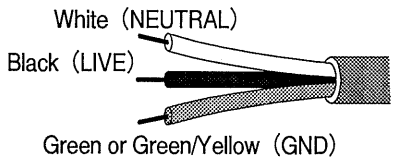
WARNING

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

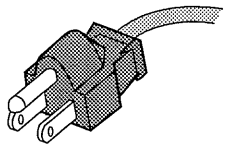
☐ Without a power plug



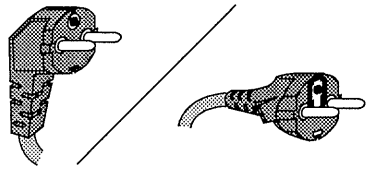
☐ Without a power plug



☐ Plugs for USA



☐ Plugs for Europe



☐ Provided by Kikusui agents

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

☐ Another Cable _____

 Kikusui Part No. Z9-000-027 IB001681

KIKUSUI

TABLE OF CONTENTS

1. GENERAL

The Model 676 Wow & Flutter Meter has been designed to measure wow and flutter of audio tape recorders, video tape recorders, disc record players, cine-sound reproduction devices, and other various sound record/reproduction devices, meeting the measuring systems specified all of the JIS Standards, NAB Standards, and CCIR (DIN) Standards.

Measurement of wow and flutter can be made at a very high sensitivity for a range of 0.005 ~ 1% (in three ranges). Various modes of measurements, such as weighted measurement (measurement with hearing sense compensation) as per JIS, NAB, and CCIR (DIN) Standards, separate measurement of wow and flutter, and combined measurement of wow and flutter.

The Model 676 has a high-sensitivity tape speed meter, which enables reading of the tape speed directly on a meter while wow/flutter measurement is being performed. Thus, the Wow/Flutter Meter is ideal for research and development, manufacturing, inspection, and maintenance of audio and other signal record/reproduction equipment.

The Model 676 also has output terminals for an oscilloscope and a recorder (oscillograph) to observe and analyze waveforms of wow and flutters.

FEATURES

1. Wow and flutter are measurable (directly readable), meeting various specifications.

JIS Standards	... rms value indication.
NAB Standards	... average value indication.
CCIR (DIN) Standards	... peak value indication.

2. The measuring sensitivity is very high. (The minimum measurable input level is 5 mV rms.)

3. An input sensitivity selector and a noise filter are equipped, making measurement less affected by noise.

4. The input level is not required to be adjusted. The only requirement is check that the input indicator LED is lighted.
   (LED : Light Emitting Diode)

5. The measuring center frequency range is wide (3,000 Hz ±10%).

6. Wow and flutter are measurable at a very high sensitivity. (The minimum measurable level is 0.005%.)

7. A large tape speed meter is incorporated, facilitating easy reading and wide range measurement.

8. Wow or flutter can be separately measured.

9. Using an oscilloscope, waveforms and period of wow and flutter can be directly measured.

10. Using a recorder (oscillograph), tape speed (drift), wow and flutter can be recorded as a permanent data.

11. The internal oscillator is stable against temperature variations and provides a highly accurate frequency signal.

12. IC's and transistorized circuits are employed throughout, ensuring a high operation reliability.

13. The Model 676 is compact, light, and easy to operate.

2. SPECIFICATIONS

Nomenclature:	Wow & Flutter Meter
Model No.:	Model 676
Input terminals:	5-way type, 19-mm (3/4") intervals
Measuring center frequency range:	3,000 Hz ±10%
Input level range:	5 mV - 10 V rms (irrespective of amplitude)
Input sensitivity selection:	5 mV - 10 V rms 50 mV - 10 V rms } two ranges
Input impedance:	Approx. 50 kΩ, single-ended. Approx. 10 kΩ when tape speed is zero.
Measuring ranges:	0.005 - 1% (in three ranges) 0 - 0.1%, 0 - 0.3%, 0 - 1% full scale
Indication systems:	JIS Standards ... rms value NAB Standards ... average value CCIR (DIN) Standards ... peak value
Indication accuracy:	Better than ±5% of maximum indication value
Frequency characteristics:	
Weighted characteristics:	As per JIS (C5551), NAB, and CCIR (DIN)
Flat characteristics:	0.5 - 200 Hz +1 dB to -3 dB (with 4 Hz as reference)
Wow and flutter separation characteristics:	Wow ... 0.5 - 6 Hz Flutter ... 6 - 200 Hz

Tape speed indication range:	3,000 Hz ±10% (±300 Hz) ±0.1 - ±10% (in three ranges) 0 - ±1%, 0 - ±3%, 0 - ±10%
Tape speed indication accuracy:	Better than ±10% of maximum indicated value
Output terminals:	5-way type, 19 mm (3/4") intervals
Internal oscillator frequency:	Within 3,000 Hz ±0.05% (±1.5 Hz)
Output impedance:	Within 600Ω ±20%, single-ended
Output voltage:	1.0 V rms or over (at open terminal)
Distortion factor:	Less than 1.0%
Stability:	(For ±10% variation of nominal ____V AC line voltage)
Variation of wow/flutter indication:	Within ±1% of maximum indicated value
Variation of tape speed indication:	Within ±5% of maximum indicated value
Variation of oscillation frequency:	Within 3,000 Hz ±0.04%
Power requirements:	100 V, 50/60 Hz AC, approx. 10 VA
Dimensions (maximum portions):	200 (W) x 160 (H) x 305 (D) mm
Weight:	Approx. 4 kg

Accessories:

Instruction manual 1

3. OPERATION PROCEDURE

3.1 EXPLANATION OF FRONT PANEL (See Fig. 3-1.)

(1) POWER: Main switch of the Meter. When this push-button switch is depressed and locked, the power is supplied and the power pilot LED (green) lights.

(2) INPUT: Input terminals for the signal from record/reproduce device to be tested. The GND terminal is electrically connected to the panel and chassis.

(3) SENSITIVITY PUSH 5 mV: Input sensitivity selector switch. The un-pushed state is for 50 mV rms, and the pushed and locked state is for 5 mV rms of sensitivity. The maximum input voltage, for both state, is 10 V rms.

(4) SET LEVEL: When the signal fed to the input terminal is not less than 5 mV or 50 mV (corresponding to the state of the input selector switch), this LED (green) lights to indicate that the signal is in a measurable state.

(5) MODE: Push-button switches to select the below-mentioned modes of wow and flutter measurements. When the required switch is depressed and locked, measurement is made in the corresponding mode.

- o WEIGHTED: Wow and flutter are measured in the weighted mode (with hearing sense compensation) as per JIS, NAB, and CCIR (DIN) Standards.
- o WOW: Slower varying components alone (0.5 - 6 Hz) of the input signal is separated and measured.
- o FLUTTER: Faster varying components alone (6 - 200 Hz) of the input signal is separated and measured.
- o LINEAR: All components of wow and flutter are inclusively measured as per JIS, NAB, and CCIR (DIN) Standards.

(6) INDICATION: Push-button switches to select indication modes (measuring standards) as mentioned below. When the required button is depressed and locked, indication is made as per corresponding standards.

- o JIS: Wow and flutter are measured as per JIS (Japanese Industrial Standards).
- o NAB: Wow and flutter are measured as per NAB Standards.
- o CCIR: Wow and flutter are measured as per CCIR Standards.

(7) WOW % INDICATOR: Wow and flutter indicating meter with double scales (the upper scale is for 1.0 and the lower scale for 0.3). Readings correspond with setting of the WOW & FLUTTER (%) selector switches. The same indication system is applicable to all standards (JIS, NAB, and CCIR).

(8) TAPE SPEED INDICATOR: Tape speed indicating meter with double scales (0 ~ ±1, 0 ~ ±3). Measuring center frequency is indicated by this meter is percent. Readings correspond with setting of the TAPE SPEED (%) selector switches.

(9) WOW & FLUTTER (%): These push-button switches select wow and flutter measuring ranges for 0.1%, 0.3%, or 1.0% as for the maximum indication value. An appropriate button should be depressed according to the level of wow and flutter to be measured.

(10) TAPE SPEED (%): These push-button switches select the required tape speed measuring range among three ranges of 1%, 3%, and 10% as for the maximum indication value. An appropriate button should be depressed according to the measuring level.

(11) PUSH CAL: This button is depressed for zero adjustment of the tape speed indicating meter. When this button is depressed and locked, wow and flutter measuring circuit is idle and the input impedance (at the INPUT terminal) becomes approximately 10 kΩ.

(12) TAPE SPEED ZERO ADJ: Semi-fixed resistor for zero adjustment of the tape speed indicating meter. Under the state that the PUSH CAL is kept depressed, adjust the tape speed indicating meter at the zero point using a screwdriver. In this case the TAPE SPEED % selector should be set in the 1% position.

(13) STAND: This stand may be raised to improve the readability of the meter.

3.2 EXPLANATION OF REAR PANEL (See Fig. 3-2.)

(14) TO SCOPE: This terminal provides a wow and flutter signal which can be displayed on an oscilloscope for waveform observation and period measurement. The GND terminal is connected to the chassis. The output impedance is approximately 50 kΩ.

(15) TO RECORDER: This terminal is for recording of drift (tape speed), or wow and flutter, using a recorder (oscillograph). The GND terminal is connected to the chassis. The output impedance is approximately 50 kΩ.

(16) DRIFT/DC-200HZ SWITCH: This switch selects recording of either drift (tape speed) or wow and flutter. The DRIFT position is for the former and the DC-200Hz position for the latter.

(17) 3 kHz OUTPUT: This terminal provides a 3 kHz output used as a recording signal. The GND terminal is connected to the chassis.

(18) FUSE: AC line fuse holder. The fuse is a conventional tubular glass fuse (0.1 A).

(19) POWER CORD: AC line power cord. (To be connected to an outlet of nominal 100 V, 50/60 Hz AC.)

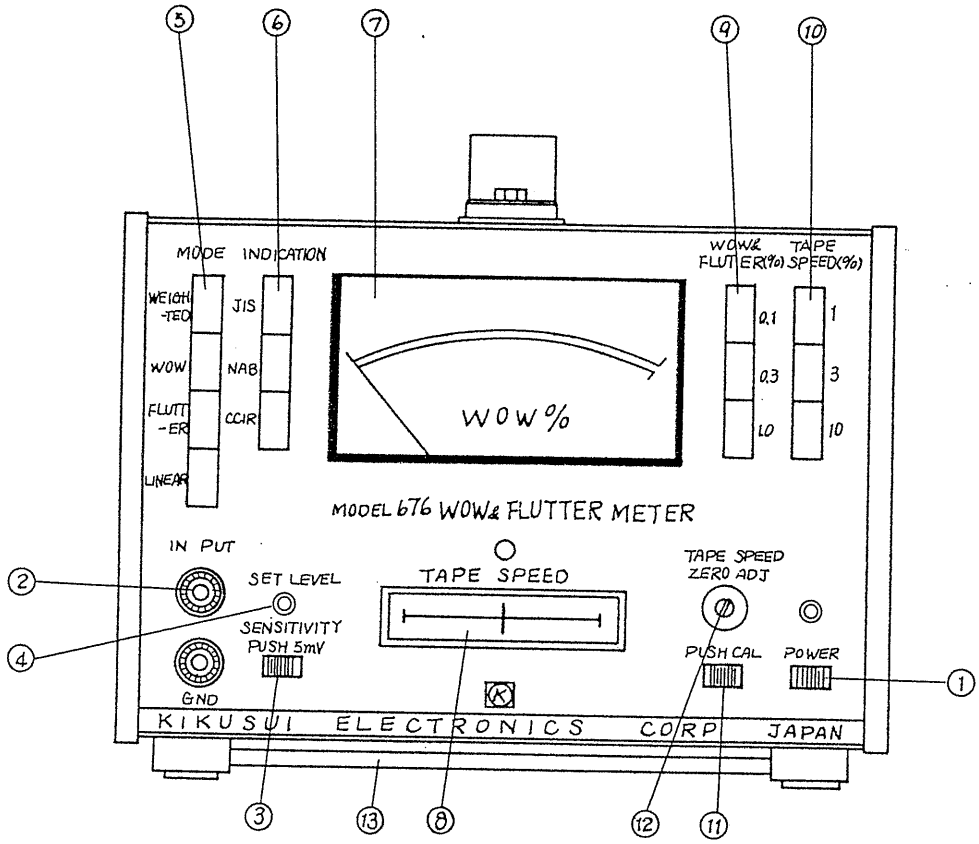


Fig. 3-1 Front panel layout

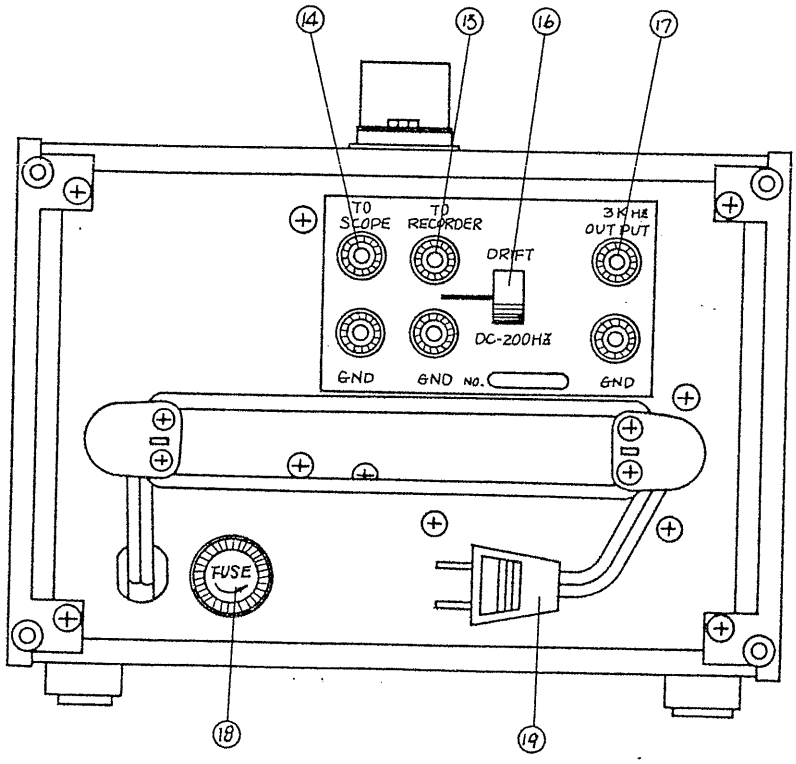


Fig. 3-2 Rear panel layout

3.3 OPERATION PROCEDURE

3.3.1 Set the POWER button in the OFF state, connect the power cord to an AC line output (100 V), and set other switches as below:

MODE:	WEIGHTED or LINEAR position, normally.
INDICATION:	JIS, NAB, or CCIR, as required.
WOW & FLUTTER (%):	1.0
TAPE SPEED (%):	10
PUSH CAL:	Unpushed state
SENSITIVITY PUSH 5 mV:	Unpushed state

3.3.2 In a case an initial recording is required, connect the 3 kHz OUTPUT terminal (on the rear panel) to the input of the tape recorder. In another case that recording has already been made, connect the playback output terminal of the tape recorder to the INPUT connector.

3.3.3 Depress the POWER button to turn on the power. When this is done, the power pilot LED (green) lights. In the case the initial recording is required, make recording for the period required for measurement. The output of the 3 kHz OUTPUT terminal (on the rear panel) is constantly kept supplied irrespective of setting of the other panels.

3.3.4 Apply the reproduced output of the tape recorder (signal to be measured) to the INPUT connector of the Wow & Flutter Meter. If the signal level is not less than 50 mV, the SET LEVEL green LED lights to indicate that the measurement is ready to be made. If the signal level is low, depress the SENSITIVITY PUSH 5 mV button to raise the input sensitivity from 50 mV to 5 mV. Under this state, even if the lamp is lighted, the measurement cannot be successfully made unless the TAPE SPEED meter is indicating a speed within a tolerance of 3,000 Hz ±10%. Check the input signal frequency.

3.3.5 The measurement is ready to be made if the SET LEVEL green LED is lighted and the TAPE SPEED is within the tolerance of 10% from the nominal frequency. Change the WOW & FLUTTER (%) selector buttons in the order of "1.0", "0.3", and "0.1" in accordance with the magnitude of wow and flutter of the measured signal. The tape speed selector buttons must be changed in the order "10", "3", and "1". The tape speed can be directly read simultaneously with the wow and flutter measurement, irrespective of settings of the other selector buttons.

3.3.6 The value of wow and flutter can be directly read on the same scale for all standards of JIS, NAB, and CCIR.

3.3.7 To measure the wow component alone, depress the WOW button of the MODE selector; to measure the flutter component alone, depress the FLUTTER button. In these cases, measurements are made irrespective of the JIS, NAB, or CCIR Standards. Indications alone are separated between wow and flutter.

3.3.8 The waveforms and periods of wow and flutters can be displayed and measured by connecting the output signal of the TO SCOPE terminal to an oscilloscope. To record drift (tape speed), connect the signal of the TO RECORDER terminal to a recorder (oscillograph) and throw the switch to the DRIFT position. For recording of wow and flutter, throw the switch to the DC-200Hz position. The signal of the TO RECORDER terminal actually is the output of a frequency discriminator and this signal is constantly supplied irrespective of settings of the panel switches. The signal varies in the negative polarity as the tape speed drifts into a faster speed. The signal of the TO SCOPE terminal corresponds to setting of the MODE selector and WOW & FLUTTER (%) selector switches.

3.3.9 For zero adjustment of the TAPE SPEED indicating meter by self calibration, depress the PUSH CAL switch and turn the TAPE SPEED ZERO ADJ using a screwdriver so that the meter indicates the zero scale point. In this adjustment, the TAPE SPEED (%) selector must be set in the "1" state. Note that wow/flutter measuring function is idle during the PUSH CAL switch is kept depressed, although the SET LEVEL lamp is kept lighted. To resume the wow/flutter measurement, the PUSH CAL switch must be released (set to the OFF state) by pushing it again.

3.4 MEASURING EXAMPLES

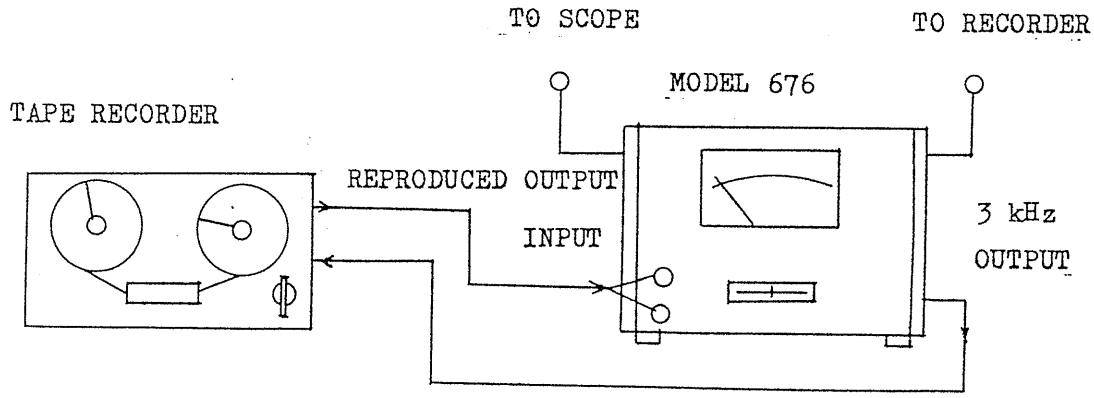


Fig. 3-3 A measuring setup for wow and flutter of a tape recorder

3.4.1 Measuring Methods

(1) Simultaneous record/playback measurement: Measurement is made while recording and playback operations are being simultaneously perform recording and playback)

(2) Separate record/playback measurement: At first, recording is made and the recorded tape is rewound. Then, measurement is made playing back the recorded tape.

(3) Different recorder measurement: Measurement is made by playing back the tape which has been recorded with another tape recorder.

Measurement can be made with the measuring setup as shown in Fig. 3-3, for all of the above three methods.

3.4.2 Excerpt of JIS C 5551 "Test Method for Magnetic Sound Recording and Reproducing Equipment"

Reproduce the signal from the wow/flutter test tape wound on a reel of the maximum size usable on the tape recorder to be tested. Measure the reproduced signal using a wow/flutter meter which has a weighted circuit (hearing sense compensation circuit) of characteristics as shown in Fig. 3-4 and which measures the wow/flutter components in rms value and indicates the measured result in percentage.

Measurements shall be made for three times at different portions of each of the starting, center, ending sections of the tape wound on the reel. The largest one of the three shall be determined as the wow/flutter characteristics of the tested tape recorder. Measurement for each section must be made for a period not less than 10 seconds.

3.5 PRECAUTIONS

3.5.1 Note that, in wow and flutter measurement, the indication largely varies according to the applied standards. Also note that the indication largely varies according to JIS, NAB, and CCIR Standards, and by whether a weighted circuit is employed or not.

3.5.2 For the separate measurement of WOW or FLUTTER, there are no standards or provisions to be based upon.

3.5.3 The reproduced output which is applied to the INPUT terminal must have a sufficient level to light the SET LEVEL lamp. This lamp will light so far as the input signal has a sufficient level, even if the signal frequency is not within 3 kHz ±10%. Ensure that the TAPE SPEED indicating meter indicates that the frequency is within the tolerance of ±10%.

3.5.4 Do not apply a signal from the circuit where a DC or other signal is superimposed, to the INPUT, 3 kHz OUTPUT, TO SCOPE, or TO RECORDER terminal.

3.5.5 Do not simultaneously depress a plural number of buttons of each of selectors for MODE, INDICATION, WOW & FLUTTER, and TAPE SPEED (%). If this precaution is ignored, measurement will be unsuccessful.

3.5.6 When the reproduced signal level is sufficiently high (more than 50 mV), measurement should be made without depressing the SENSITIVITY PUSH 5 mV button. Under this state, the wow/flutter indicating meter is less subjected to overscale deflection and stable measurement can be made being less affected by noise.

3.5.7 Zero adjustment of the TAPE SPEED indicating meter is rarely required. However, after the WOW & FLUTTER meter has been used for a long period of time, it must be checked by means of its internal calibration provision. Note that, when the PUSH CAL switch is depressed, the input impedance of the INPUT terminal becomes approximately 10 kΩ.

3.5.8 If the pointer of the indicating meter is not pointing the zero scale position under the state the power is turned off, adjust the pointer to the zero position by inserting a screwdriver through the adjusting hole drilled on the panel.

4. OPERATING PRINCIPLE

The operating principle of the Model 676 Wow & Flutter Meter is illustrated in the block diagram of Fig. 4-1.

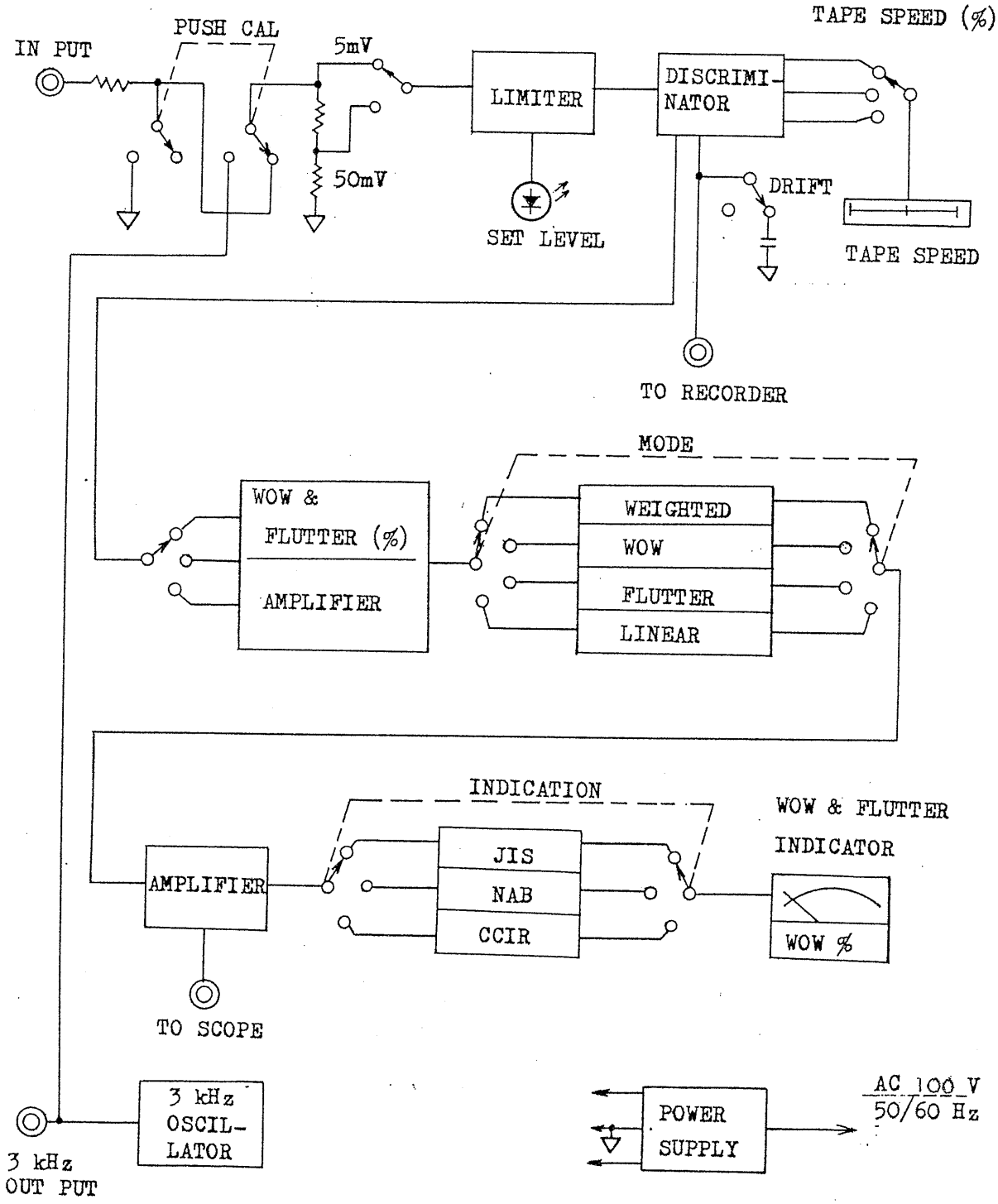


Fig. 4-1 Block diagram of Model 676 Wow & Flutter Meter

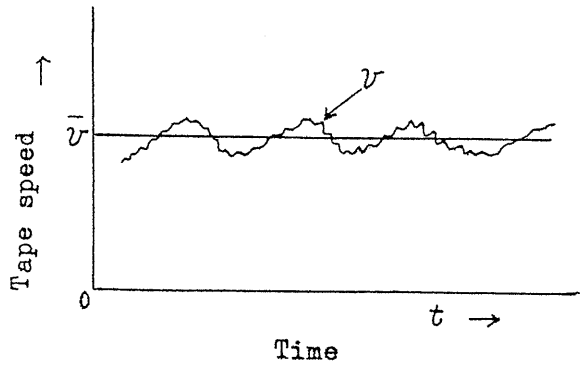


Fig. 4-2 Definition of wow and flutter

The ordinate of Fig. 4-2 represents the tape speed; and the abscissa the time. Denoting the average tape speed by $\bar{v}$, the wow/flutter is given as follows:

$$\text{Wow/flutter} = \frac{v - \bar{v}}{\bar{v}} \times 100\ (\%)$$

When the tape on which a signal has been recorded with an ideal tape recorder having almost no wow/flutter is reproduced by the tape recorder to be tested, the wow/flutter is given by the below equation since the instantaneous frequency of the reproduced signal is proportional to the tape speed.

$$\text{Wow/flutter} = \frac{f - f_o}{f_o} \times 100\ (\%)$$

where, f_o: Center frequency (constant frequency of test tape)

f: Instantaneous value of reproduced frequency

Wow/flutter actually is measured employing the latter equation. In fact, the signal reproduced by the tested tape recorder is frequency-modulated by wow and flutter with respect to the center frequency (f_o). The wow/flutter factor actually is measured as a depth of frequency modulation. Thus, the basic operating principle of the wow/flutter meter is identical with that of a demodulator of an FM wave receiver.

Wow and flutter are results of departures of the actual tape speed from the absolutely uniform ideal velocity. Slower variations are called wow, and the faster variations flutter. Very slow variations are called drift and are excluded from wow/flutter.

Referring to Fig. 4-1, the output signal (frequency-modulated signal) of the tape recorder to be tested is fed through the INPUT terminal to the limiter. The limiter eliminates the amplitude-modulated component of the signal lest it should affect the wow/flutter measurement.

The constant-amplitude output of the limiter is fed to the frequency discriminator. This frequency discriminator is of a PULSE COUNT TYPE and provides an extraordinarily excellent linearity. The frequency-demodulated output signal (wow/flutter signal) of the discriminator is fed through the tape speed range selector to the tape speed indicating meter.

The wow/flutter signal also is fed through the range selector to the mode selector which has filters of the required characteristics. The WEIGHTED filter is for hearing sense compensation as per JIS, NAB, and CCIR Standards. The WOW filter and FLUTTER filter, having responses as illustrated in Fig. 4-3, are used to separate the wow component from the flutter component, with 6 Hz as the separating frequency. The LINEAR filter passes all wow and flutter components.

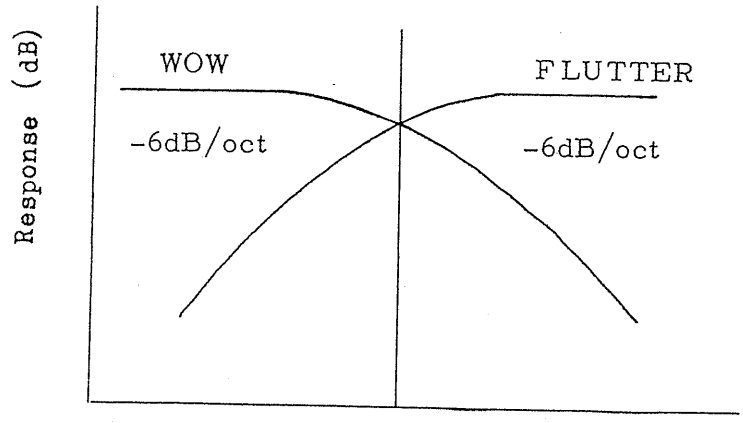


Fig. 4-3

The wow/flutter signal which has passed the required filter is amplified and drives the wow/flutter indicating meter in the selected indication mode (JIS, NAB, or CCIR).

The TO SCOPE terminal provides the wow/flutter signal to be displayed on an oscilloscope for waveform observation. The TO RECORDER terminal provides the wow/flutter and drift (tape speed) signal to be recorded with an external recorder (an oscillograph). The signal voltage varies in the negative polarity as the tape speed increases.

When a test tape (standard tape) on which the standard signal has been correctly recorded is available, wow/flutter measurement can be readily made by playing back this tape with the tape recorder to be tested. However, when no such test tape is available, the signal must at first be recorded on a tape and, then, the recorded tape must be replayed. To provie a reference signal for this purpose, a reference oscillator is incorporated in this Wow/Flutter Meter. This oscillator is a tuning-fork type, provides an excellent frequency accuracy and stability, and its operation is independent from all the other circuits of the Wow/Flutter Meter.

5. MAINTENANCE

5.1 ACCESS TO INTERNAL COMPONENTS

To gain access to the internal components of the Wow & Flutter Meter, remove the four clamping-screws shown in Fig. 5-1 and slowly pull backwards both side panels, top panel, and bottom panel.

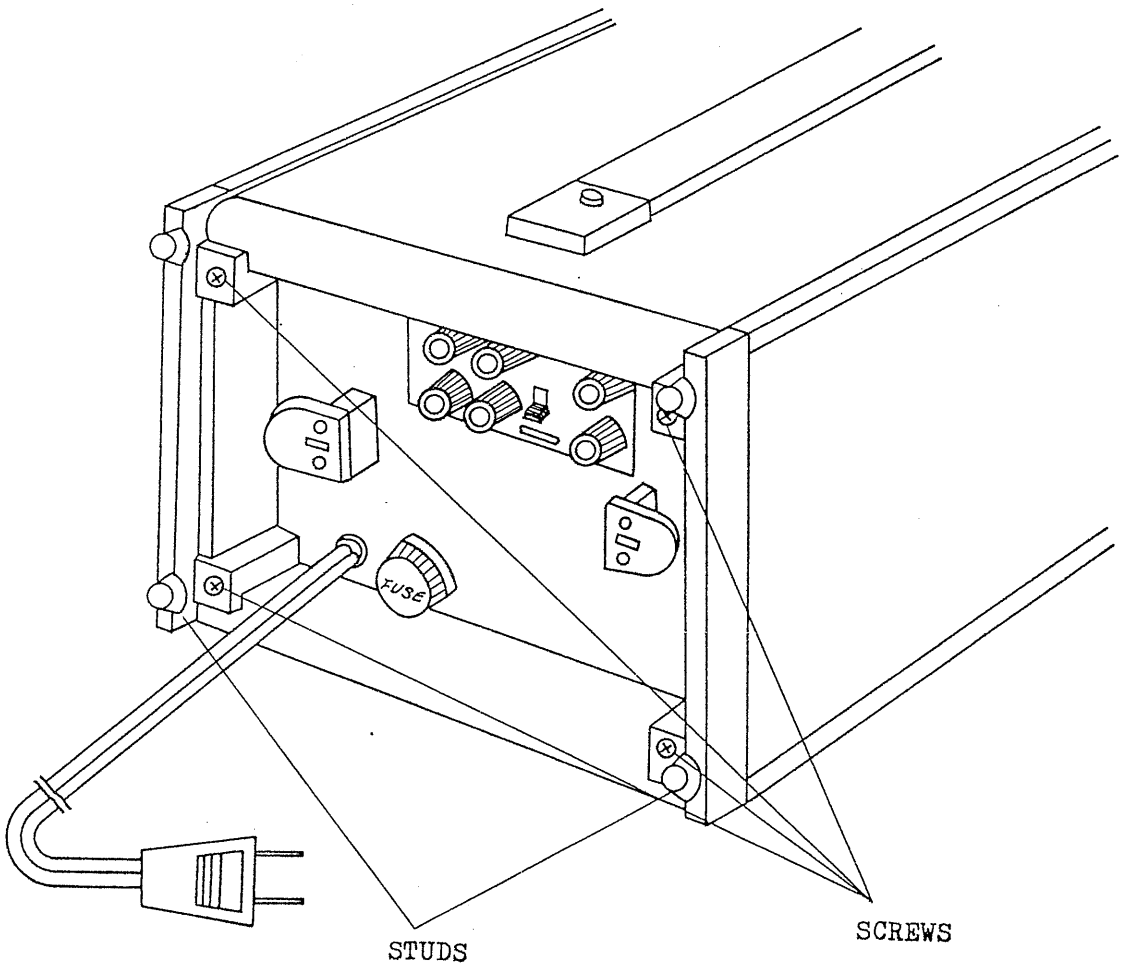
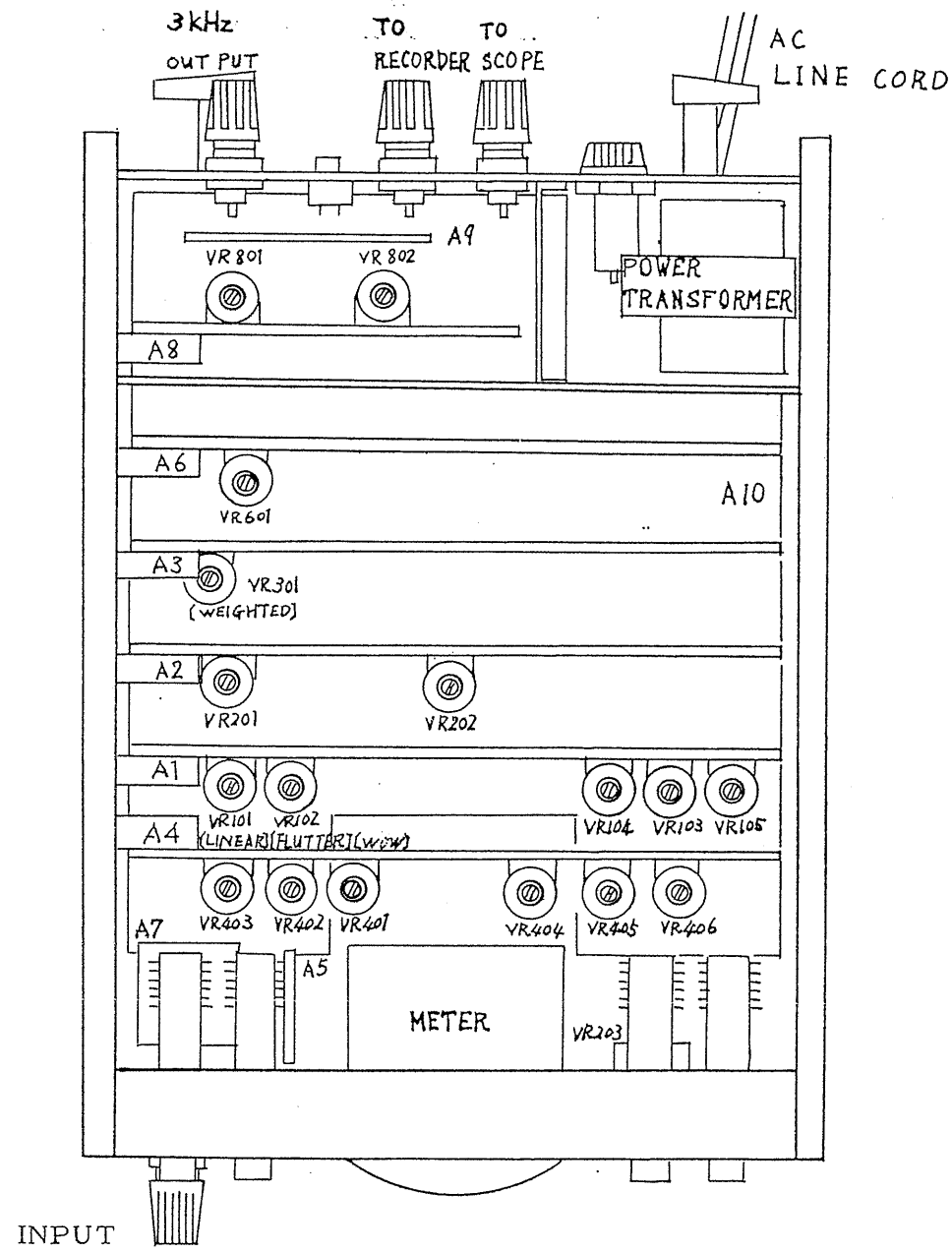


Fig. 5-1

Note: If the front panel is inclined by holding the handle under the state that the studs of the rear panel are removed, the top panel will come off. Do not incline the panel under such state.



A1; LIMITER A2; DISCRIMINATOR A3; WOW AMP.

A4; MODE FILTER, METER CIRCUIT A5;INDICATION

A6; 3kHz OSC. A7; INPUT A8; POWER SUPPLY

A9;DRIFT A10; MOTHER BOARD

Fig. 5-2 Layout of components (top view)

5.2 ADJUSTMENT AND CALIBRATION

The Model 676 Wow & Flutter Meter has been properly adjusted and accurately calibrated at the factory prior to shipment and, therefore, does not require adjustment or calibration by the user. However, adjustment and calibration will be necessary periodically or when a certain defective component has been removed. Such adjustment and calibration procedures will be described in this section.

5.2.1 Precautions for Adjustment and Calibration

(a) Allow more than 5 minutes of warm-up period after turning on the power of the Model 676 Wow & Flutter Meter.

(b) Allow sufficient stabilization periods for calibrating instruments.

(c) Refer to Fig. 5-2 and the schematic diagram.

5.2.2 Instruments Required for Adjustment and Calibration

Instruments	Performance	Remarks
Wow/flutter calibrator	Center frequency: 3 kHz Wow/flutter: 0 - 1% Wow/flutter frequency: 0.2 - 200 Hz	KIKUSUI MODEL 601
Audio signal generator	20 - 100 kHz	KIKUSUI MODEL 417A
AC voltmeter	0.1 mV - 300 V	KIKUSUI MODEL 164D
Frequency counter	0.1 Hz - 1 MHz	
DC voltmeter	0 - 100 V	KIKUSUI MODEL 155A

5.2.3 Adjustment of Regulated Voltage Circuit

Connect a DC voltmeter to each of between test point TP801 of printed board A8 and chassis and between test point TP802 and chassis, and adjust VR801 and VR802 so that the voltages are made +15V and -15V, respectively.

5.2.4 Adjustment of 3 kHz Oscillator

The oscillation frequency does not appreciably vary by aging and, therefore, no frequency adjustment is required. For output voltage adjustment, connect an AC voltmeter to the 3 kHz OUTPUT terminal (on the rear panel) and adjust VR601 (on printed board A6) so that the voltage is made 1.5 V rms.

5.2.5 Adjustment of TAPE SPEED Indicating Meter

(1) Set the panel switches as follows:

TAPE SPEED (%):	1
PUSH CAL:	Unpushed state
WOW & FLUTTER (%):	0.1
POWER:	ON

The other push-button switches may be set in arbitary positions.

(2) If the pointer of the indicating meter is not pointing the zero point without any signal being fed to the INPUT terminal, adjust the pointer to the zero point by turning VR202 on printed board A2.

(3) Connect the audio signal generator output (voltage approximately 1 V, frequency 3,000 Hz) to the INPUT terminal.

(4) Adjust VR201 (coarse adjustment) and VR203 (fine adjustment) so that the meter indicates zero.

(5) To check the full scale deflection of the meter, vary the audio signal generator output frequency by ±1% (±30 Hz) from 3,000 Hz. If the full scale point is incorrect, adjust it with VR105 on printed board A1.

(6) In a similar manner as above, vary the frequency by ±3% (±90 Hz) and ±10% (±300 Hz) for the "3" and "10" push-button switches, respectively, of the TAPE SPEED (%) selector, and adjust the span with VR104 and VR103.

5.2.6 Adjustment and Calibration of Wow/Flutter Indicating Meter

(1) Set the panel switches as follows:

MODE:	WEIGHTED
INDICATION:	JIS
SENSITIVITY PUSH 5 mV:	Unpushed
WOW & FLUTTER (%):	0.1
TAPE SPEED (%):	1
PUSH CAL:	Unpushed
POWER:	ON

(2) To the INPUT terminal, connect a wow/flutter calibrator which has been set as follows:

(a) Output approx. 1 V; center frequency 3,000 Hz

(b) Wow/flutter: 0.1% rms, sine wave

(c) Wow/flutter frequency: 4 Hz

(3) If the meter pointer is not correctly deflected to the full scale point, make adjustment with VR301 of printed board A3.

(4) Set the MODE selector alone among the front panel selectors as follows:

MODE: LINEAR

(5) Adjust VR403 (on printed board A4) so that the meter indicates the full scale position.

(6) Depress the WOW button of the MODE selector.

(7) Set the wow/flutter frequency of the calibrator alone at 2 Hz.

(8) Adjust VR401 so that the meter indicates the full scale position.

(9) Depress the FLUTTER button of the MODE selector.

(10) Set the wow/flutter frequency of the calibrator alone at 40 Hz.

(11) Adjust VR402 so that the meter indicates the full scale position.

(12) Depress the WEIGHTED button of the MODE selector and the NAB button of the INDICATION selector.

(13) Set the wow/flutter frequency of the calibrator alone at 4 Hz.

(14) Adjust VR406 so that the meter indicates the full scale position.

(15) Set the calibrator as below:

(a) Output approx. 1 V; center frequency 3,000 Hz

(b) Wow/flutter: 0.1% peak, sine wave

(c) Wow/flutter frequency: 4 Hz

(16) Set the INDICATION selector alone among the panel selectors as below:

INDICATION: CCIR

(17) Adjust VR405 so that the meter indicates the full scale position.

5.2.7 Adjustment of Dynamic Characteristics of Wow & Flutter Indicating Meter

No adjustment is required for the JIS and NAB Standards since the dynamic characteristics do not vary appreciably. For adjustment for the CCIR Standards, proceed as below.

(1) Set the panel selectors as follows:

MODE:	WEIGHTED
INDICATION:	CCIR
SENSITIVITY PUSH 5 mV:	Unpushed state
WOW & FLUTTER (%):	0.1
TAPE SPEED (%):	1
PUSH CAL:	Unpushed state
POWER:	ON

(2) To the INPUT terminal, connect the wow/flutter calibrator which has been set as follows:

(a) Output approx. 1 V; center frequency 3,000 Hz

(b) Wow/flutter: 3% rms

(c) Function: Pulse

(d) Wow/flutter frequency range: 1 Hz (irrespective of dial)

(e) Pulse width: 100 msec.

(3) Turn clockwise the MODULATION control of the calibrator so that the maximum deflection conforms with the full scale position of the meter.

(4) Check that the minimum deflection (center indication between a full scale and another full scale) is (40 ±10)% or within a range of .3 to .5 of the scale.

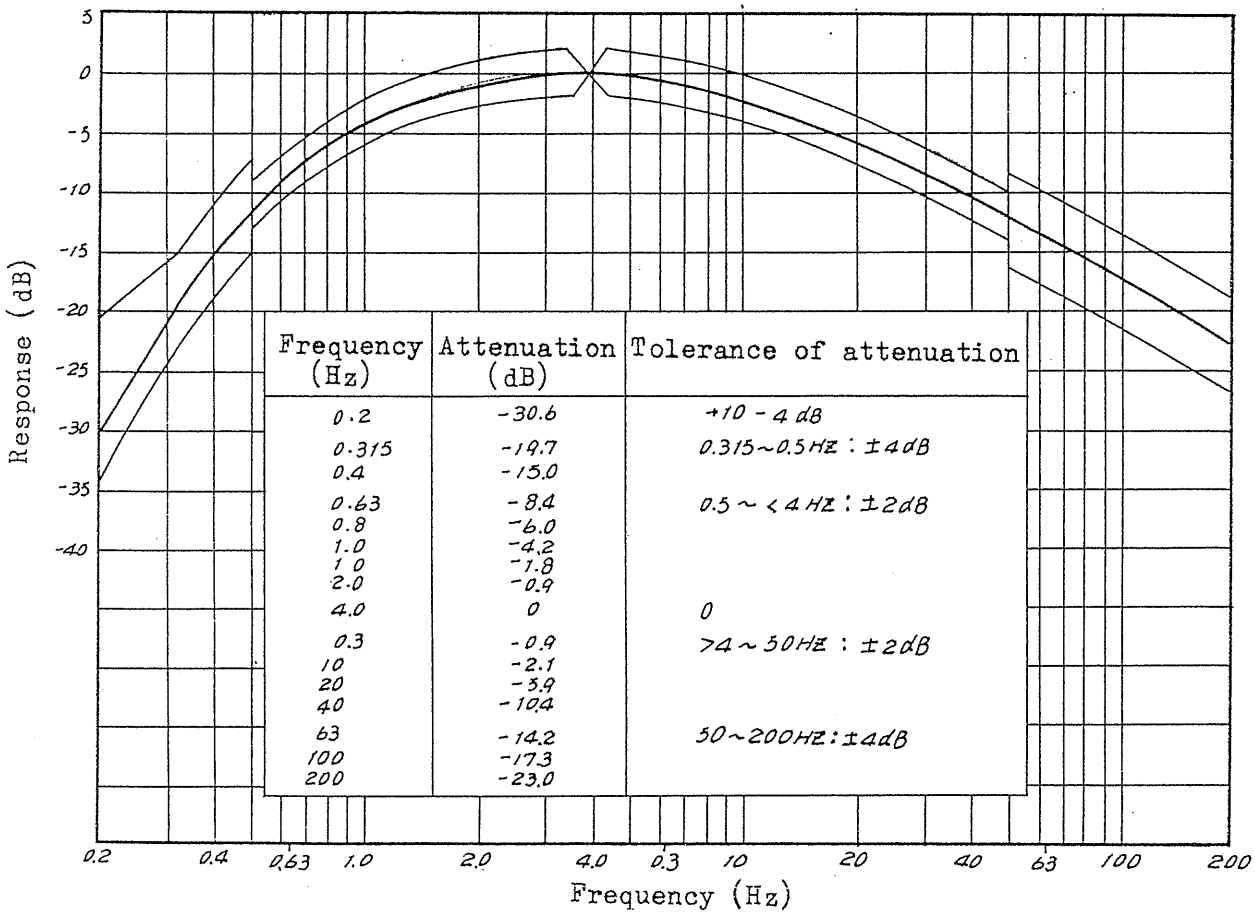
(5) Change the pulse width of the calibrator to 60 msec., 30 msec. and 10 msec., and ensure that the maximum indications are within the following tolerances:

60 msec.:	.84 - .96
30 msec.:	.56 - .68
10 msec.:	.18 - .24

(6) If the indication is not within the above tolerances, adjust VR404 on printed board A4.

(7) When the above adjustment has been made, the full scale will be slightly affected. So, return to the procedure of Item 5.2.6 (15). Repeat the procedures (5.2.6 (15) - 5.2.7 (7)) for a few times.

5.3 WEIGHTED CURVES (JIS, NAB, AND CCIR), AND DYNAMIC CHARACTERISTICS RECOMMENDED BY CCIR



Frequency (Hz)	Attenuation (dB)	Tolerance of attenuation
0.2	-30.6	+10 - 4 dB
0.315	-19.7	0.315~0.5 Hz : ±4dB
0.4	-15.0	
0.63	-8.4	0.5 ~ < 4 Hz : ±2dB
0.8	-6.0	
1.0	-4.2	
1.0	-1.8	
2.0	-0.9	
4.0	0	0
0.3	-0.9	>4 ~ 50 Hz : ±2dB
10	-2.1	
20	-3.9	
40	-10.4	
63	-14.2	50~200 Hz : ±4dB
100	-17.3	
200	-23.0	

Fig. 3-4 Weighted compensation curves for wow/flutter measurement

Dynamic Characteristics of Indicator as per CCIR Recommendation

The meter shall be calibrated for its full scale with a frequency-modulated signal (center frequency 3 kHz and peak-to-peak modulated with a sine wave of 4 Hz). Next, apply another frequency-modulated signal (modulated with the rectangular pulses of the unidirectional polarity, pulse repetition frequency 1 Hz, and pulse width 100 msec.) and adjust the pulse heights so that the same full scale is obtained. When the pulse width (A) is applied, the meter indication must be B% as mentioned in the below table.

A (msec.)	10	30	60	100
B (%)	21±3	62±6	90±6	100±4

The return time must be such that, when a pulse signal of repetition frequency 1 Hz and pulse width 100 msec. is applied, the meter indicates (40±10)% between two adjoining pulses.

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