OPERATION MANUAL

AUTOMATIC MODULATION METER (FILTER FOR FREQUENCY SHIFT KEYING (FSK))

KDM 6380

Third Edition

KIKUSUI ELECTRONICS CORPORATION

(KIKUSUI PART NO. Z1-212-320)

M-94112

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.

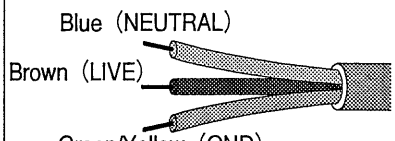
☐ AC power cable

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.

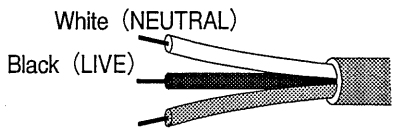
WARNING

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

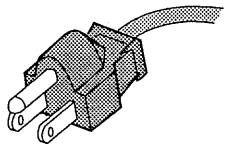
☐ Without a power plug



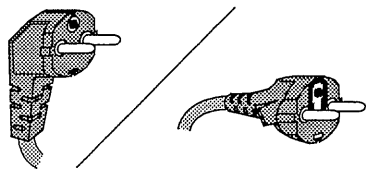
☐ Without a power plug



☐ 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

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1. INTRODUCTION

1.1 General Description

The KDM6380 is a modulation meter used in the production of communication devices that covers a frequency range of 1.5MHz to 2GHz. It is suitable for the adjustment and inspection of the modulation and distortion factor of the transmission units of cordless telephones, personal radios, MCA, car telephones and many other devices used in communications applications.

This instrument is able to perform a series of modulation analyses, including measurement of modulation factor in FM and AM modes, S/N, distortion and AF level, that cannot be found in any other similar products. In addition, the high-speed automatic tuning function allows the target signal to be found accurately and rapidly, while automatic ranging allows accurate values to be obtained easily. Moreover, the internal digital data communications filter allows the performing of accurate demodulation in filter shift keying (FSK) modulation and other applications.

Considerations have also been given to strengthening of the human interface with respect to full automation of measurement of input signals and digitization accompanying the use of a liquid crystal panel display, a high-speed bar graph display with the feel of an analog display which especially makes adjustment work easier, a target function for target value management resulting in improved work efficiency, and adjustment and inspection screens that provide the display of the minimum necessary information using bar graphs and display of measured values.

1.2 Features

1) The wide frequency range of 1.5MHz to 2GHz allows testing of various types of communication devices and radios, etc.
2) Various types of analysis of the modulation signal can be performed with a single instrument.
3) Extremely easy operation:
   a) High-speed automatic tuning and auto-ranging allows data to be obtained easily.
   b) The combination of a digital display and bar graph display is optimum for adjustment work.
   c) The target function allows rapid and accurate adjustment of modulation factor, S/N, distortion and so on resulting in uniform quality.
   d) The store and recall functions allow the recalling of 100 sets of panel settings.
4) A logic output port which enables on/off control from the panel can be used for switching of external circuits.
5) The instrument is also equipped with a filter optimum for demodulation of digital signals (FSK modulation) such as the control and data signals of cordless telephones, personal radios and MCA. This filter optimizes the waveform distortion of the overshoot, etc. of control and data signals.
6) The providing of GP-IB control as standard equipment allows the overall evaluation and testing of communication devices and personal radios, etc. to be automated by upgrading the system.
7) An internal weighting filter is also available by special ordering at the time of factory shipment.

2. SPECIFICATIONS

○ Frequency Input

Frequency Range	1.5MHz-2GHz
Input Sensitivity	−27 to +13dBm 10mV to 1Vrms
Max. Allowed Input	+27dBm (0.5W, 5Vrms)
Input Impedance	50Ω nominal, BNC connector
Tuning	High-speed, automatic tuning

○ Measured Items

FM Mode	Deviation, distortion, S/N, SINAD
AM Mode	Modulation factor, distortion, S/N, SINAD
AF Mode	AF level, distortion, S/N, SINAD

○ Frequency Modulation (FM)

Display	3-digit digital display, bar graph display and target value
Max. Deviation	100kHz
Range	Automatic ranging, 1kHz, 10kHz, 100kHz
Resolution	10Hz, 100Hz, 1kHz
Frequency Range	1kHz reference: 50Hz-25kHz ±1dB ≦700MHz 50Hz-25kHz ±1.5dB ≦1GHz 50Hz-25kHz ±3dB ≦2GHz
Accuracy	At modulation frequency of 1kHz: ±3% of Range F.S. + residual FM
Distortion	At modulation frequency of 1kHz and deviation of 50kHz: ≦1%
Residual FM (S/N)	At demodulation band of 300Hz-3kHz: ≦7.5Hz rms ≦100MHz ≧50dB at deviation of 3.5kHz ≧77dB at deviation of 75kHz ≧100MHz, increases in increments of 7.5Hz for each 100MHz
De-emphasis	50μS,75μS,750μS±1dB

○ Amplitude Modulation (AM)

Display	3-digit digital display, bar graph display and target value
Max. Modulation Factor	100%
Range	Automatic ranging, 1%, 10%, 100%
Resolution	0.01%, 0.1%, 1%
Frequency Range	50Hz-25kHz ±1dB, 1kHz reference
Accuracy	At modulation frequency of 1kHz and 5%＜modulation factor＜95%: ±3% of Range F.S. + residual AM
Distortion	≦1% at modulation frequency of 1kHz and modulation of ≦80%
Residual AM (S/N)	At modulation band of 50Hz-3kHz: ≦0.5%rms ≧36dB at modulation factor of 30% ≧42dB at modulation factor of 60%

○ AF Level Meter

Display	1) Digital display having resolution of 0.01V 2) Bar graph display having target value
Max. Input Level	3V rms
Range	Automatic ranging, 0.03V, 0.3V, 3V
Frequency Range	50Hz-25kHz ±1dB, 1kHz reference
Accuracy	At frequency of 1kHz: ±3% of Range F.S.
Input Impedance	Approx. 100kΩ, switchable to 600Ω

○ Target Value Range	1) FM(kHz), AM(%), Ratio(%) 1, 2, 4, 10, 20, 40, 100, 200, 400 2) AF(V) 0.01, 0.02, 0.04, 0.1, 0.2, 0.4, 1, 2, 4 3) Ratio(dB) ±0.5, ±1, ±2, ±5, ±10, ±20, ±100, ±200
Setting Range	1) FM deviation: 0-100kHz 2) AM modulation factor: 0-95% 3) AF input level: 0-3V
Distortion Setting Range	0-30%, no lower limit value setting
SINAD Setting Range	0-40dB, no upper limit value setting

- Detection Mode: +P, (P−P)/2=(±P/2), −P peak value display, RMS value, AVG value, DISTN (distortion), SINAD

- Filter:
  1) HPF : 50Hz, 300Hz cutoff frequency
  2) LPF : 3kHz, 15kHz cutoff frequency
  3) Frequency shift keying filter :
     B9kHz (9th order, B=Bessel filter)
     −3dB frequency approx. 30kHz

- AF Oscillator Output

Frequency	1kHz
Accuracy	±3%
Level	1mV to 999mV: 1mV steps −60dBV to 0dBV: 0.1dB steps −63.8dBm to−3.8dBm: 0.1dB steps
Level Accuracy	±5%
Distortion	≦0.3% at level of 999mV
S/N	≧50dB at level of 100mV
Impedance	Approx. 600Ω

- Distortion Factor Meter

Input Frequency	1kHz ±5%
Input Level	100mV-3Vrms
Distortion	1%-30%, 3-digit numeric display

- IF Signal Output

Frequency	420kHz ±40%
Impedance	Approx. 50Ω
Level	Approx. 100mVrms

- Demodulation Output

Impedance	Approx. 600Ω
Level	Approx. 2Vp-p at range F.S.

- Setting Functions: Using function keys, cursor keys, and rotary knob on LCD display screen
  1) Switching between FM, AM and AF modes

2) Setting of detector, distortion, SINAD, filter, de-emphasis, memory addresses, AF oscillator output and others
3) Setting of LOG and LIN display
4) Range selection of numeric display (range hold)
5) Setting of bar graph maximum values, target value, lower limit, and upper limit values
6) Setting of logic output

- Memory Function: The memory can be used in blocks of 10-points or as a continuous spaace of 100-points.

- Logic Output: On/Off control from the panel can be used for swithing of external swithes. Voltage of 5V and current of 50mA when on

- Remote Control: Recall of settings stored in memory using cursor, rotary knob, function key F1-F5.

- GP-IB Interface: SH1, AH1, T2, L2, SR1, RL1, PP0, DC1, DT0, C0

- Backup Battery is provided.

- Environmental Conditions (Temperature and humidity)

Range to satisfy specifications	5-35℃(41 to 95°F): 85% or less
Allowable Range for operation	0-40℃(32 to 104°F): 90%

- Power Source

Working Voltage Range	AC100V, 120V, 220V, 240V ±10% (selected by card)
Frequency	50Hz/60Hz
Power dissipation	Approx. 36VA

- Size and Weight

Dimensions	300(W) × 99(H) × 350(D) mm (rack)
	315(W) × 119(H) × 405(D) mm (max.)
Weight	Approx. 7kg

○ Accessories	Input Cable	1
	Power Cord	1
	Operating Manual	1
	Fuses 1.0A	1
	0.5A	1

○ Special Order Factory Shipped Accessories (please consult with us at the time of ordering)	1) Weighting Filter a) CCIR rec 468-2 b) CCIR/ARM

3. PRECAUTIONS PRIOR TO USE

3.1 Request for Unpacking Inspection Upon Arrival

This instrument has been completely tested and inspected both electrically and mechanically prior to shipment from the factory, and has been checked and guaranteed to operate properly.

As soon as the instrument is delivered, please confirm that the instrument has not suffered any damage during transport. If the instrument is found to havesuffered some form of damage, please contact the retailer where the instrument was purchased immediately.

3.2 Confirmation of Line Voltage

This instrument can be used within the operating voltage ranges indicated in the table below according to the voltage selection PC board on the rear panel. Before plugging in the power cord, please check the line voltage and the setting of the voltage selection PC board.

Furthermore, when selecting the set voltage range, also replace the fuse inaccordance with the table below. Use of the instrument at a voltage outside of the set voltage range may result in erroneous operation or damage to the instrument.

Displayed Voltage	Range of Line Voltage to be Used	Fuse Used
100V	90-110V	1.0A
120V	108-132V	
220V	198-242V	0.5A
240V	216-264V	

Refer to section 7 for details regarding selection of line voltage.

3.3 Ambient Temperature and Humidity, Warm-Up Time and Installation Site

The ambient temperature at which this instrument will operate properly is 0-40°C. Prolonged use or standing in environments of high temperatures and high humidity will result in malfunctions and shorten the service life of the instrument.

A warm-up period of 30 minutes is required. In addition, it is not desirable to operate the instrument in locations where there are powerful magnetic fields or radiation of electromagnetic waves.

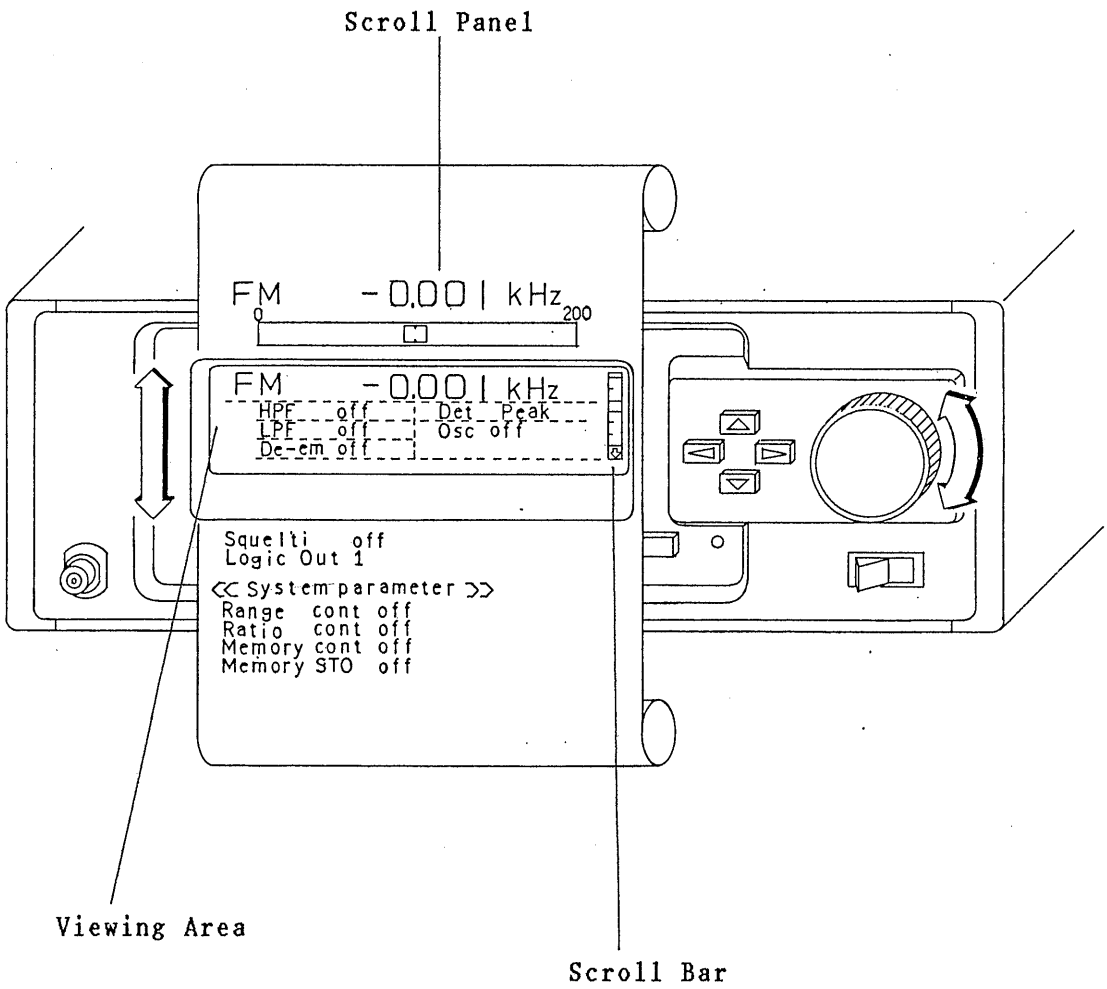
4. METHOD OF USE

4.1 Scroll Panel System

A portion of the scroll panel is displayed in the viewing area. A better understanding of this system will be obtained if the following is read while referring to sections 4.8.7 through 4.8.8. A portion of the display is shown in the figure below.

Operation of the scroll panel system involves scrolling the necessary function so that it is within the viewing area, aligning the pointing cursor with that display function, and then modifying the corresponding setting function with rotary knob ⑥.

When the setting function is changed, the hardware will also be changed on a real-time basis allowing rapid measurement.



4.2 Front Panel Explanation

Please refer to the figures on pages 13 and 14 which contain diagrams of the front and rear panels. As the diagrams contain the numbers ① through ⑳, the following provides an explanation of the front and rear panels based on those numbers.

① [INPUT Z=50Ω] 0.5W MAX

This is a 50Ω BNC connector that serves as the high frequency input terminal. Measurement signals over a frequency range of 1.5MHz-2GHz are connected to this terminal. The maximum input power is 0.5W.

② [LCD] Display

This is used to display memory addresses, FM, AM, AF and detector modes, range, measured values, error messages, bar graph, bar graph minimum and maximum values, width of target value, target value, lower and upper limits of target value, along with function keys ③.
Setting of each display item can be done with cursor keys ⑤ and rotary knob ⑥. Refer to sections 4.6 through 4.8 for further details.

③ [Function Keys F1-F5]

These are used to display memory address recall, range hold and ratio functions on the bottom of the [LCD] display ②. This is also used to perform step-up ▲ and step-down ▼ of memory recall, switch range hold on and off, and switch ratio on and off. When these are switched on, the respective items are inversely displayed with dark characters on a light background.

④ [Yellow Key] Software Key

When the yellow key is pressed, an asterisk "*" will be displayed in the lower right corner of the [LCD] display screen ②. Each of the functions will then be executed by pressing the altered function keys.

⑤ △,▽,◁,▷ Cursor Keys

These are used to move the cursor on the [LCD] display screen ②.

⑥ Rotary Knob

This is used to modify the location of the cursor.

⑦ [CTRS]

This knob is used to adjust the contrast of the [LCD] display screen ②. Adjust this to a level that allows easy viewing of the display.

⑧ [POWER] ON/OFF

When the power switch is put in the ON position, the power is turned on, and when it is put in the OFF position, the power is turned off. When the power is turned on, the 1st viewing area will be displayed on the [LCD] display screen ②.

The status of each of the functions immediately prior to the power being turned off will then be recalled.

4.3 Rear Panel Explanation

⑨ [IF OUTPUT]

This is used to produce an IF signal having an output frequency of 420kHz and an output level of 100mV.

This is a BNC connector having an output impedance of 50Ω.

⑩ [AF INPUT]

This is an input terminal for measuring external AF signals.

It is a BNC connector having an input impedance that can be switched between either 100kΩ or 600Ω.

⑪ [1kHz OUTPUT]

This is the output terminal of an internal 1kHz AF oscillator.

It is a BNC connector having an output impedance of 600Ω.

⑫ [REMOTE]

This is a connector which allows remote control of panel functions.

⑬ ⑭ These are optional connector installation holes.

⑮ [LOGIC OUTPUT]

A voltage of 5V and a current of 50mA is obtained when this is at "1".

This is an output terminal for switching of external switches, etc.

⑯ ⑰ These are also optional connector installation holes.

⑱ [DEMOD OUTPUT]

This is an output terminal for monitoring AF demodulation signals. An output of roughly 2Vp-p at full scale is obtained.
It is a BNC connector having an output impedance of 600Ω.

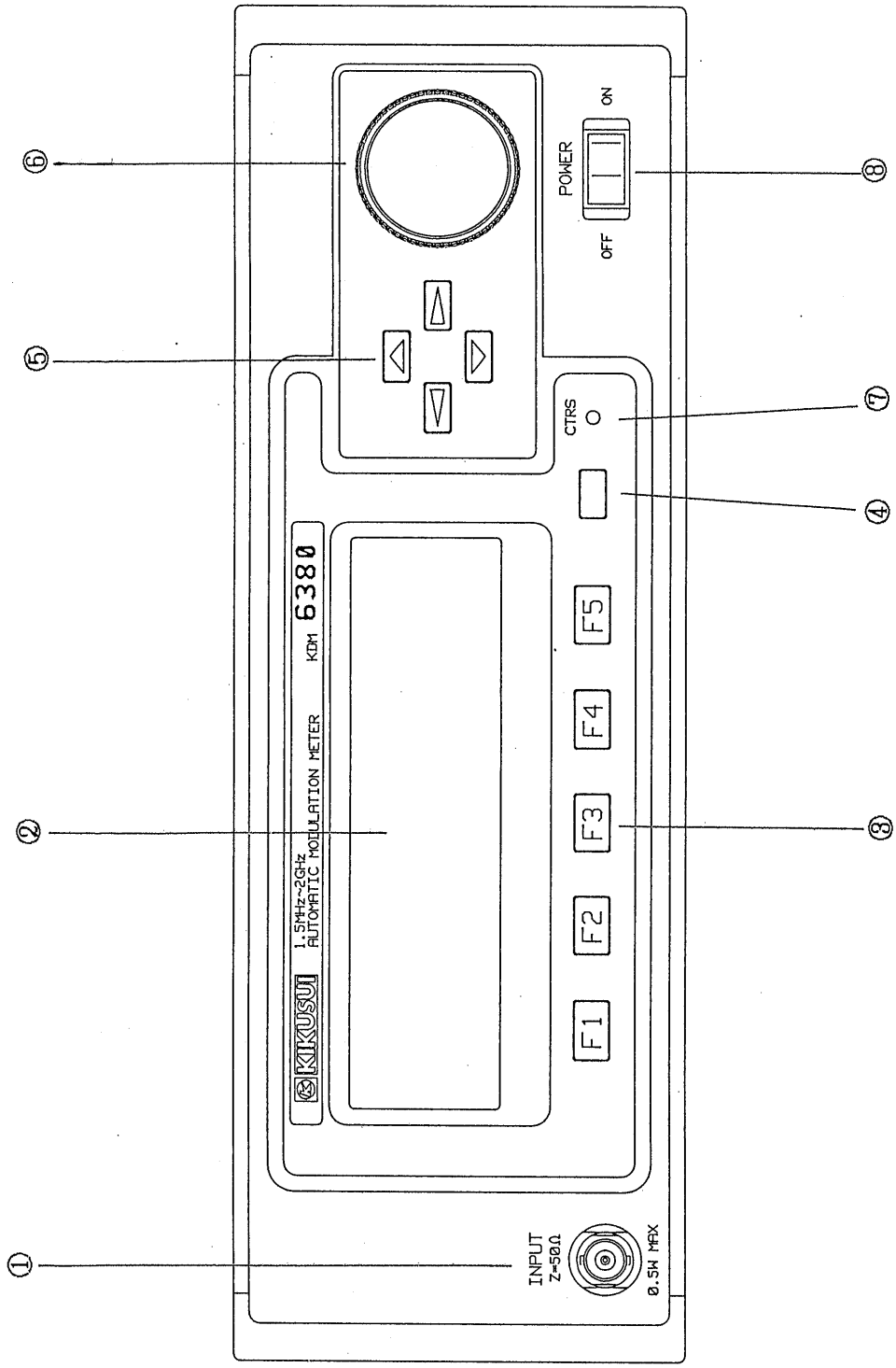
⑲ [GP-IB]

This connector is for controlling the instrument using a GP-IB interface.

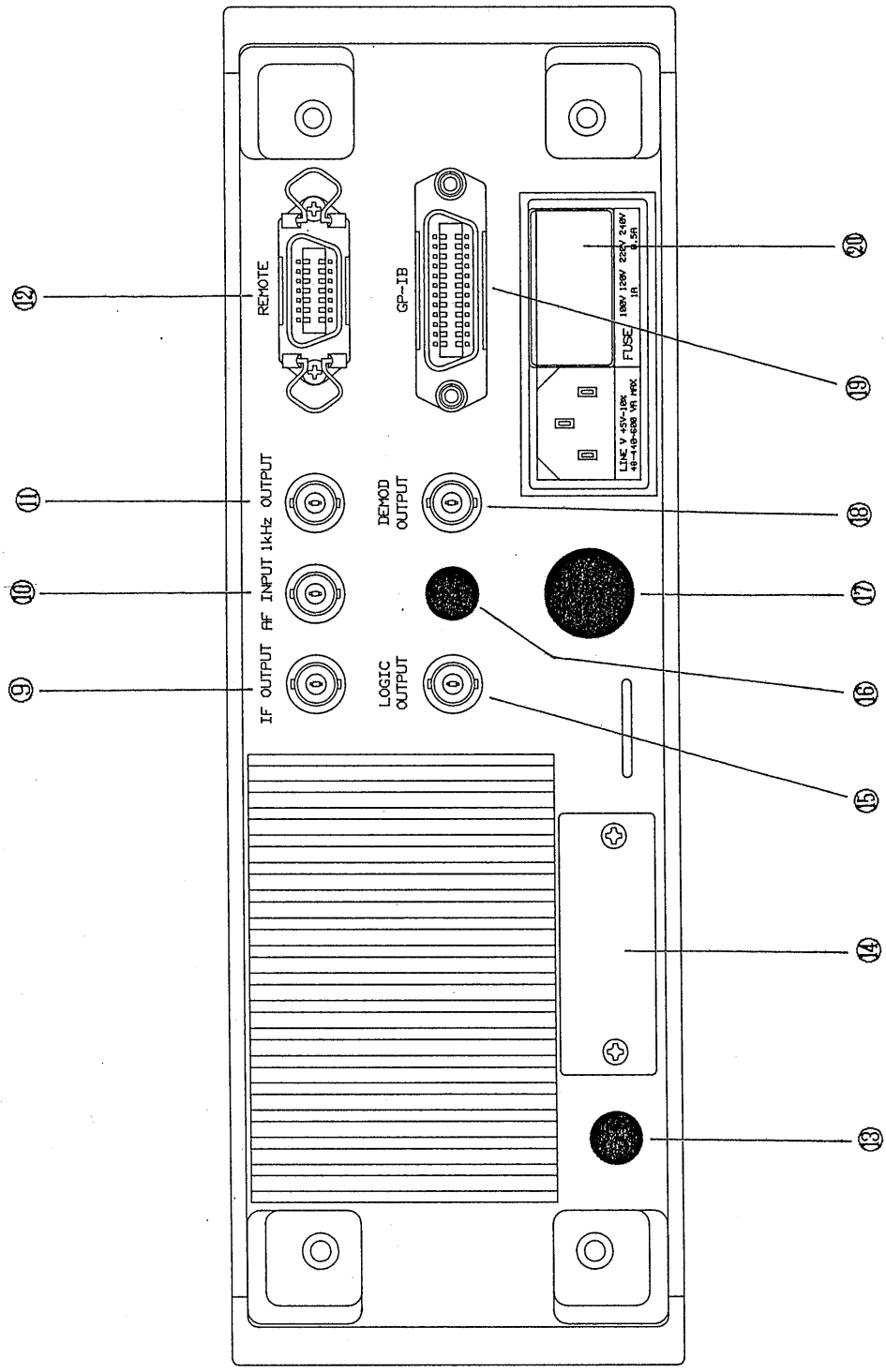
⑳ [Voltage Selector/3P Connector with Fuse]

This a voltage selector in which the AC line fuse and plug have been combined into a single unit.
A fuse is used that matches the AC line voltage.

4.4 Front Panel Diagram



4.5 Rear Panel Diagram



4.6 Scrolling Method

The 1st scroll panel is divided into viewing areas 1-6 and the 2nd scroll panel is divided into viewing areas 7-13.
Refer to sections 4.8.7 and 4.8.8.
In order to scroll the display screen, the cursor keys ⑤ △,▽,▷ are used to leave each of the viewing areas. In other words, pressing of the up, down and right cursor keys moves the cursor to the scroll bar. However, the cursor will not move to the top of the 1st viewing area.

The method of operating the viewing area consists of two modes:

1) Scroll Mode (the state in which the scroll bar is being displayed on the screen allowing scrolling).
2) Operation Mode (the state in which the cursor is displayed inversely with dark characters on a light background within the viewing area).

During the Scroll Mode:
Scrolling can be performed smoothly using rotary knob ⑥.
However, the cursor is moved between the viewing areas of the 1st and 2nd scroll panels with the △,▽ cursor keys ⑤.
In addition, the △,▽ cursor keys ⑤ can also be used to make selections (move) in each of the viewing areas.
At this time, function keys ③ are not displayed at the bottom of the viewing area.

4.6.1 Scroll Panel Displays

The 1st scroll panel is divided into six viewing areas and consists of viewing areas 1-6 as indicated in section 4.8.7.
Viewing area 1 is the screen for adjustment work. Measured values, bar graphs and target function, etc. are displayed.

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See p. 26

Viewing area 2 is the measuring screen. All conditions and measured values are displayed.

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See p. 26

Viewing area 3 is used to select the items for the << Storage Conditions >>.
Viewing area 4 does not contain any settings.

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See p. 26

Viewing area 5 is used to perform setting of memory addresses.

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See p. 26

Viewing area 6 is used to control the displays of viewing areas 1 and 2.

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See p. 26

The 2nd scroll panel is divided into 7 viewing areas as indicated in section 4.8.8 and consists of guides to GP-IB program codes in viewing areas 7-13.

4.7 Operating Procedure

Pressing the ◁ cursor key ⑤ switches the instrument from the scroll mode into the operating mode.

The basic operating procedure in the operating mode consists of moving the cursor to the item desired to be changed with the △,▽,◁,▷ cursor keys ⑤, and changing the contents of those items with rotary knob ⑥.

Upper and lower settings are inversely displayed with dark characters on a light background with the △,▽ cursor keys ⑤ and left and right settings are inversely displayed in the same manner with the ◁,▷ cursor keys ⑤ followed by setting using rotary knob ⑥.

Figs. 4-1 and 4-2 indicate the names of each of the screen display items.

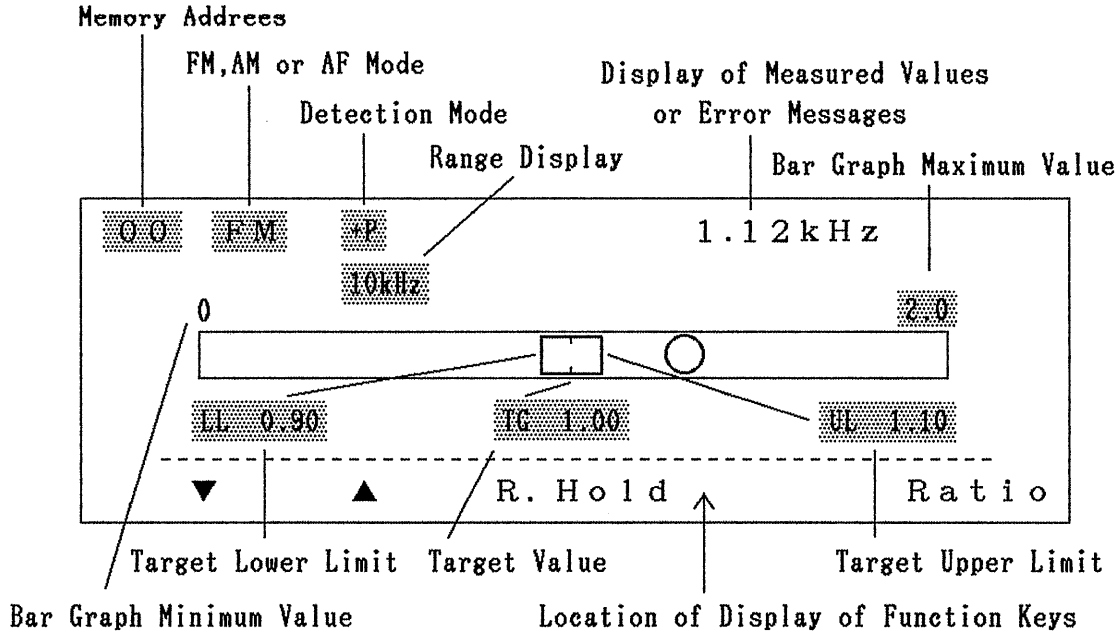


Fig. 4-1

Note:

Movement to the location of the range display can be done by pressing the R.Hold function key ⑦ (F3) to inversely display the range since range is normally set by the automatic ranging function.

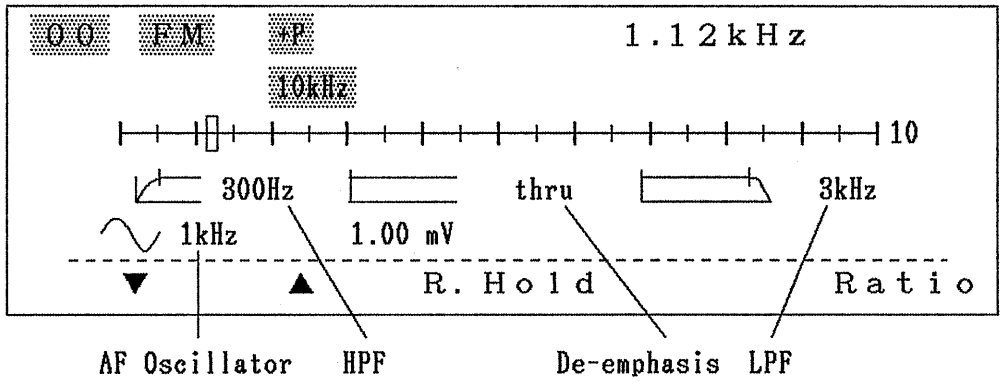


Fig. 4-2

The function keys are as described below.
However, ▼, ▲, Exe, STO ▲, R.Hold, and Ratio can be displayed in viewing area 6 when a ○ has been set.

1) Normal State

▼	▲	R.Hold		Ratio
F1	F2	F3	F4	F5

▼ (F1): ····· Moves one step down in memory.

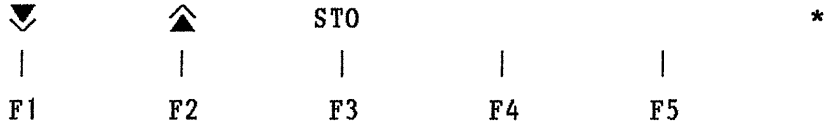
▲ (F2): ····· Moves one step up in memory.

R.Hold (F3): ·· This is used to switch between automatic and manual ranging for the range of the FM, AM and AF modes. When R.Hold is pressed, this will be inversely displayed and an "H" will be displayed at the location of the range display. The range will then be held at that value.
However, during DISTN and SINAD, an "H" will not be displayed. Reset R.Hold when changing FM deviation, AM modulation factor and AF level.

Ratio (F5): ···· When Ratio is pressed in setting of the ratio of the measured values, this will be inversely displayed and "REL" will be displayed at the location of the measured value display. When LOG is set and when dB REL and LIN are set, the units will change to % REL. However, this cannot be set during DISTN and SINAD.

2) When Yellow Key ④ has been pressed:

An asterisk (*) will be displayed when the yellow key has been pressed.

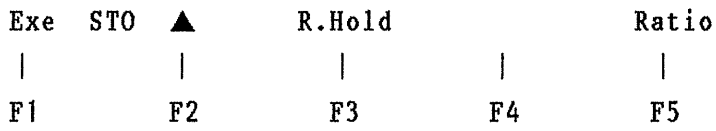


⏬ (F1): ····· Moves down in 10-step increments to the memory block.

⏫ (F2): ····· Moves up in 10-step increments to the memory block.

STO (F3): ····· This is set when storing data in memory.
The display switches to that shown in 3) below.

3) When STO has been pressed in 2) above:



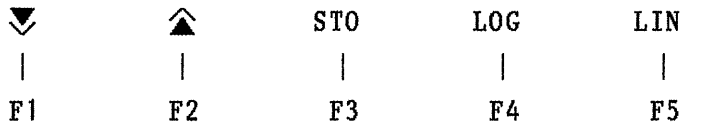
Exe (F1): ····· Data is stored in the memory address displayed and the display returns to he recall state (Exe is the abbreviation for "Execute"). When the Yellow Key ④ is pressed after STO has been pressed, STO will be inversely displayed indicating that the instrument is in the store mode.

STO ▲(F2): ···· Data is stored in the next memory address displayed and the display returns to the recall state.

The F3 and F5 keys are the same as that described in 1) above.

4) When Ratio has been pressed in 1) above:

"Ratio" is inversely displayed. When the Yellow Key ④ is pressed after this, the display will change to that indicated below.



At this time, the items for which LOG and LIN are set will be inversely displayed. The functions of the F1,F2 and F3 keys are the same as that described in 2).

LOG (F4): ····· FM, AM and AF modes set to LOG (dB)

LIN (F5): ····· FM, AM and AF modes set to LIN (%)

Ratio can be canceled by pressing Ratio again.

4.8 Explanation of Screen Displays

4.8.1 1st Scroll Panel - Viewing Area 1: Setting of Screen Display for Adjustment Work

When the function keys for <<System Manage>> of Viewing Area 6 are defined, the detection mode, range display, scale, target, ratio display, range hold and memory storage and recall can be controlled.

1) Settings can be made for the measurement items of FM deviation, AM modulation factor and the AF mode.
   Input for the AF mode is made using the [AF INPUT] input terminal ⑩ on the rear panel with a audio frequency voltmeter.
2) The detection mode is equipped with 5 detection systems and 2 functions.
   These can be set as indicated below.
   +P, (P−P)/2 = (±P/2), −P, RMS, AVG, DISTN, SINAD
   +P, (P−P)/2 and −P indicate the peak values. RMS indicates the rms value and AVG indicates the average value.
   For DISTN (distortion) and SINAD, the rms values are detected.
3) Each range is equipped with range hold off (automatic ranging) and range hold on (manual ranging). Each of these consist of three ranges as indicated in the table below for the measurement items.
   R.Hold (F3) of the function keys ③ is pressed causing it to be inversely displayed. This turns range hold on which allows the three ranges to be selected with the rotary knob ⑥ as indicated below.

Mode	Range		
FM	1kHz	10kHz	100kHz
AM	1%	10%	100%
AF	0.03V	0.3V	3V

4) There are nine ranges when the bar graph is at full scale for the FM and AM modes. These can be set to ranges consisting of 1, 2, 4, 10, 20, 40, 100, 200, 400kHz or %.
   There are also nine ranges for the AF mode consisting of 0.01, 0.02, 0.04, 0.1, 0.2, 0.4, 1, 2, and 4V.
5) The target value (TG) is set as shown in Fig. 4-3 in a location that is easily legible in the center of the bar graph.

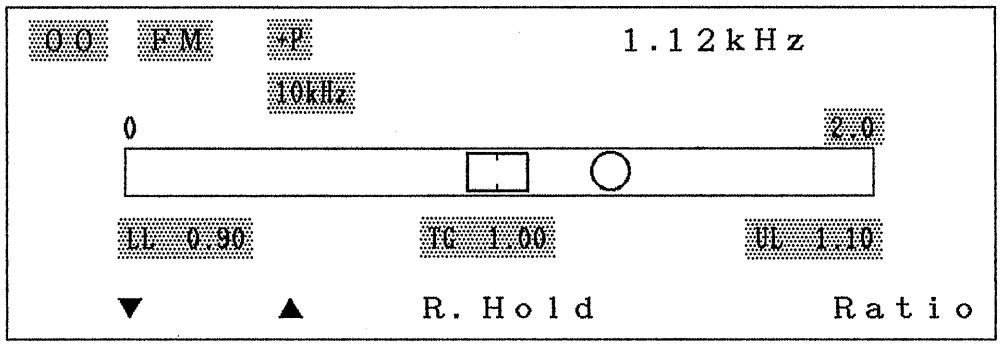


Fig. 4-3

6) The target value upper limit (UL) is set at +10% of the target value.
7) The target value lower limit (LL) is set at −10% of the target value.
However, only the upper limit of the target value can be set during adjustment of DISTN, and only the lower limit of the target value can be set during adjustment of SINAD.

4.8.2 1st Scroll Panel - Viewing Area 2: Setting of Screen Display for Measurement

The items indicated below can be set as shown in Fig. 4-4.

1) FM, AM and AF modes.
2) Detection mode, +P, ±P/2, −P, RMS, AVG and DISTN and SINAD functions.
3) Three ranges can be selected for each mode using rotary knob ⑥ as indicated in the table below when range hold is on (manual ranging).

Mode	Range		
FM	1kHz	10kHz	100kHz
AM	1%	10%	100%
AF	0.03V	0.3V	3V

4) The high pass filter (HPF) can be switched between settings of thru, 50Hz and 300Hz (thru means that the filter is off).
The low pass filter (LPF) can be switched between settings of 3kHz, 15kHz and B9kHz (Bessel filter) and thru.
5) De-emphasis can be set when in the FM mode.
Settings of 750μS, 75μS, 50μS and thru can be selected using rotary knob ⑥.

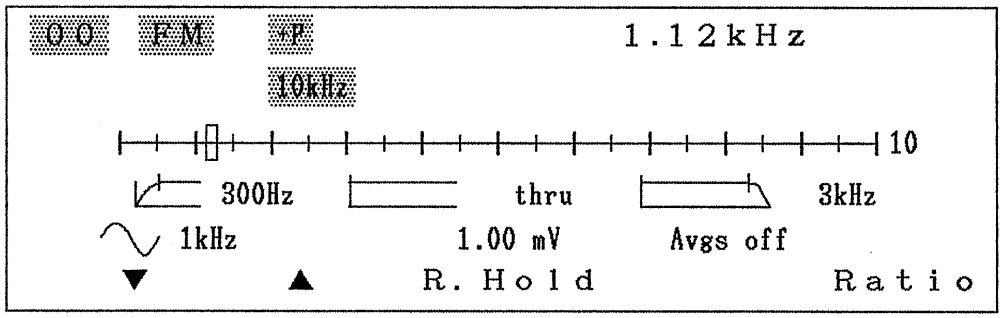


Fig. 4-4

6) The AF oscillator can be set to 1kHz or off as well as to a variable output level.
The output from the AF oscillator is obtained from the [1kHz OUTPUT] ⑪ on the rear panel.
The output level can be varied over a range of 1.00mV to 999mV, −60.0 to 0dBV or −63.8 to −3.8dBm.
Setting of each of the digits is performed with the ◁,▷ cursor keys ⑤ by moving the cursor to the particular unit digit and the setting the unit using the rotary knob ⑥.

7) Any drift in the display data or bar graph can be reduced by manipulating averaging.
The number of averagings (Avgs) can be set to either off, 2, 4, 8 or 16 averagings.
Averaging takes place for when the detection mode described in 2) is operating for +P, ±P, −P, RMS and AVG.

Note:
The displays of those measurement items that are common to both viewing are as 1 and 2 will change when the cursor is moved to that viewing area.

4.8.3 1st Scroll Panel - Viewing Areas 3 and 4: Setting of << Storage Conditions >> and << Non-Storage Conditions >>

1) Viewing Area 3

Setting of <<Storage Conditions>>

Those items that can be stored in memory are:

a) Logic control output is "0"., "1".

Either 0 or 1 can be set for each memory step for the setting of logic output ⑮ on the rear panel.

This can be switched automatically using a coaxial switch, etc. for moving up and moving down in memory.

When set to "1", a relay, etc. onthe order of a voltage of 5V and a power supply of 50mA can be driven.

Setting of <<Non-Storage Conditions>>

Those items that cannot be stored in memory are:

a) AF INPUT impedance is 600 ohm., 100 kohm.

The input impedance ⑩ of the audio frequency voltmeter on the rear panel is switched between settings of 600Ω and 100kΩ.

2) Viewing Area 4

There are no measurement settings in this viewing area.

4.8.4 1st Scroll Panel - Viewing Area 5: Setting of <<Memory Manage>>

The size of the memory blocks can be set as desired from 1 to 99. Please refer to section 4.10 on Use of Memory for further details.

4.8.5 1st Scroll Panel - Viewing Area 6: Setting of <<System Manage>>

1) Setting is performed as to whether or not to display the detection mode, range, bar graph full scale, target value as well as upper and lower limits of target value that are displayed in viewing areas 1 and 2.

a) Det. display ○, ×

This defines whether detection mode functions are to be displayed or not. An ○ displays the functions and an × does not.

b) Rng. display ○, ×

This defines whether or not range is displayed.

c) Scale lock ○, ×

This locks the setting of full scale of the bar graph. An × allows setting to be performed in the viewing area while an ○ does not.

d) Trg. display ○, ×

This defines whether or not to display the target value, upper limit of target value and lower limit of target value.

2) Setting is performed as to whether or not function keys ③ are to be displayed in viewing areas 1 and 2.
However, the function keys ③ are not displayed when the scroll bar is being displayed irrespective of this setting.

a) Ratio ○, ×

This defines whether or not ratio is to be displayed for F5 function key ③. When displayed, ratio can be manipulated.
In addition, when ratio is being displayed, either a LOG display (dB) or LIN display (%) can be selected using function keys F4 and F5.

b) R.Hold ○, ×

This defines whether or not range hold is to be displayed for F3 function key ③. When displayed, range hold can be manipulated.

c) ▼ ▲ ○, ×

This defines whether or not memory recall is to be displayed for F1 and F2 function keys ③.

Note:

When recall is not displayed by setting "×", store will also not be displayed.

d) Exe STO ▲ ○, ×

This defines whether or not memory storage is to be displayed for F1 and F2 function keys ③.
When displayed, memory storage can be manipulated.

4.8.6 List of Error Messages

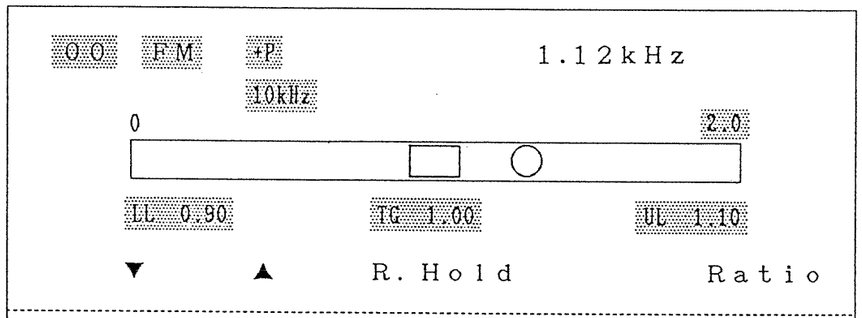
Error messages are displayed for the measured values of viewing areas 1 and 2 of the 1st scroll panel.

In the case of unsuitable input signals or when the range setting is inappropriate, the following error messages will be output to notify the operator.

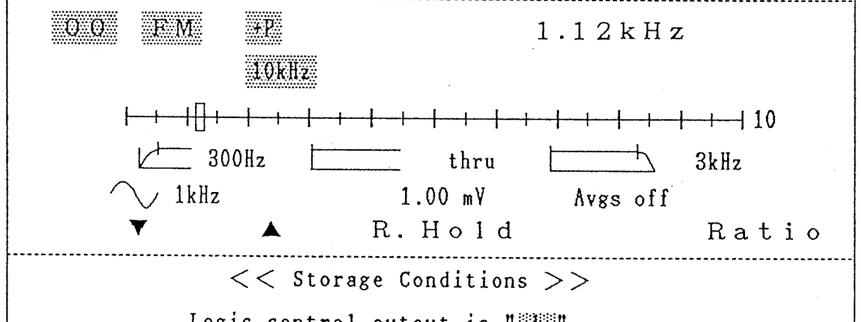
Display	Error Description
RF+	The input level is too high (Input level too high). The maximum input level is +13dBm.
RF−	The input level is too low (Input level too low). An error message will be displayed for an input level from −30 to −40dBm. If the level is lower than this, the following unlock error will be displayed.
−−	This is displayed when the internal circuit has become unlocked due to an excessively low input level (Unlock error), or when the input frequency is 1.5MHz or less.
AF+	The input of the AF circuit is excessive (AF circuit over drive), or the AF circuit level is too high. Either change the range or switch to automatic ranging. When performing FM and AM measurement, lower the modulation level. In addition, during AF measurement, lower the input level.

4.8.7 1st Scroll Panel Displays

Viewing Area 1



Viewing Area 2



Viewing Area 3

<< Storage Conditions >>

Logic control outout is "[ ]".

<< Non Storage Conditions >>

AF INPUT impedance is 600 ohm.

Viewing Area 4

Viewing Area 5

<< Memory Manage >>

00 – 09 10 – 19 20 – 29 30 – 39

40 – 49 50 – 59 60 – 69 70 – 79

80 – 89 90 – 99 (begin – end)

Viewing Area 6

<< System Manage >>

Det display	○	Ratio	○
Rng display	○	R.Hold	○
Scale lock	×	▼ ▲	○
Trg display	○	Exe STO ▲	○

4.8.8 2nd Scroll Panel Displays

	<< GP−IB >>				
				Address	13
Viewing	< Measurement >				
Area 7	AM		M1	FM	M2
	AF		M3		
	< Detector >				
	+Peak		D1	−Peak	D2
	Average		D4	1kHz Distn	D5
	RMS		D8	(P−P.)/2	D9
Viewing	SINAD		DS		
Area 8	< Filers >				
	High Pass			Low Pass	
		thru	H0	thru	L0
	50Hz	on	H1	3kHz on	L1
	300Hz	on	H2	15kHz on	L2
				B9kHz on	L3
Viewing	< FM De-emphasis >				
Area 9		De-emphasis thru			P0
	50μS	De-emphasis on			P3
	75μS	De-emphasis on			P4
	750μS	De-emphasis on			P5
	< Other Condition >				
	Averages				AVGSn
Viewing	< Display >				
Area 10	Display Result		LOG/LIN		LG/LN
	Ratio	on/off			R1/R0
	< Range >				
	Auto Range		G0	Range Hold	G1
	Range low		RG0	Range mid	RG1
Viewing	Range high		RG2		
Area 11	< Trigger >				
	trigger	off	T0	Hold	T1
	Trig immed		T2		
	< 1kHz Oscillator >				
	Oscillator	on/off			OSON/OSOF
	Amplitude				AP
	mV units				MV
Viewing	dBm units				DM
Area 12	dBV units				DV
	< Special Function >				
	Logical control		0/1		LC0/LC1
	AF input impd		600/100k		ZL/ZH
	< Memory management >				
Viewing	Recall		RC		
Area 13	Store		ST		

4.9 Use of the KDM6380

4.9.1 Adjustment of FM Deviation

1. Make connections as shown in Fig. 4-5.

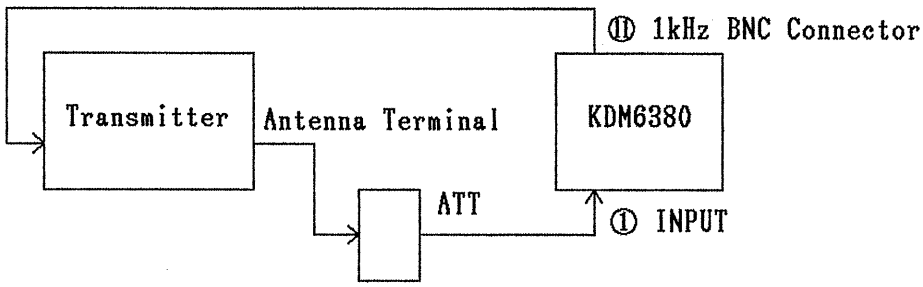


Fig. 4-5

Note:
The optimum input level of Z=50Ω INPUT ① is −27 to +13dBm. When this optimum level is exceeded, an attenuator (ATT) is required.

2. The measurement items are set to the FM mode in viewing area 2 as shown in Fig. 4-6.

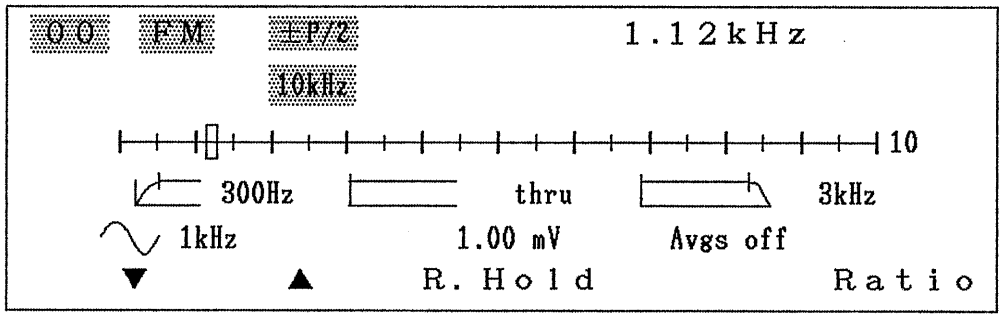


Fig. 4-6

3. The detection mode is set to ±P/2.
4. The HPF and LPF filters are set to the required bands.
5. De-emphasis is set to the "thru" setting.
6. The AF oscillator output ⑪ is set to the modulation level of the transmitter, for example, 100mV.
7. The number of averagings is set in consideration of drift of the display and response time to a value, for example, of "4".
8. Next, the display is scrolled to the viewing area 1 and adjustments are made so that the FM deviation of the transmitter is at the specified target value.

9. For example, in the case of a target value (TG) deviation of 1kHz, when attempting to adjust to within a deviation of ±10% from the target value, adjustment is made within the zone in which the target value lower limit (LL) is a deviation of 0.9kHz and the target zone upper limit (UL) is a deviation of 1.1kHz.

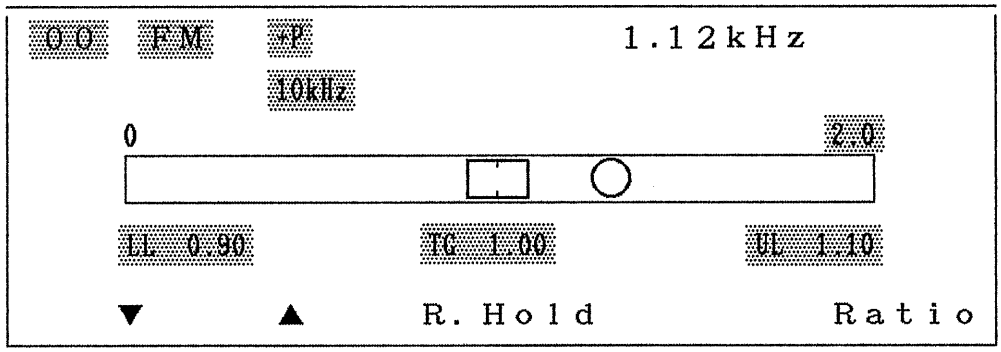


Fig. 4-7

Use of the function keys ⑧ allows display of memory recall and storage, range hold and ratio.

4.9.2 Measurement of FM Transmission SINAD (Distortion)

1. Make connections as shown in Fig. 4-8.

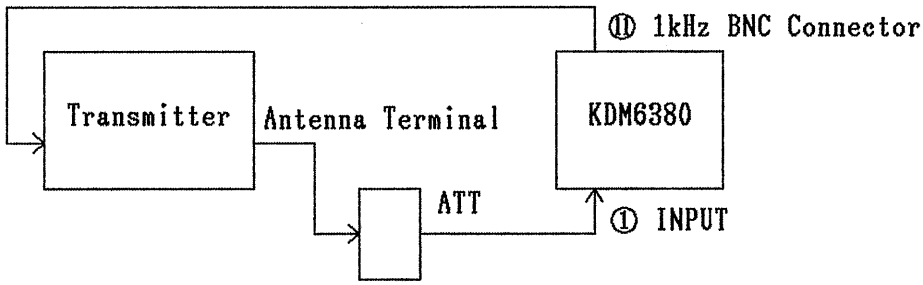


Fig. 4-8

Note:
The optimum input level of the Z=50Ω INPUT ⑪ is −27 to +13dBm. When this optimum input level is exceeded, an attenuator (ATT) is required.

2. The measurement items are set to the FM mode.
3. The detection mode is set to SINAD.
4. The HPF and LPF filters are set to the required bands.
5. De-emphasis is set to the "thru" setting.

6. The AF oscillator output ⑪ is set to obtain the specified deviation. This completes setting for measurement of FM transmission SINAD.
   FM transmission SINAD can then be read directly from viewing area 2 as shown in Fig. 4-9.
   In addition, a rough estimate of the level can also be read from the bar graph.
7. In the case of connecting an oscilloscope to DEMOD OUTPUT ⑱ and observing the distortion waveform, etc., turn R.Hold (F3) on.
8. When changing the settings for FM deviation, AM modulation factor and AF level, turn R.Hold off and reset it.

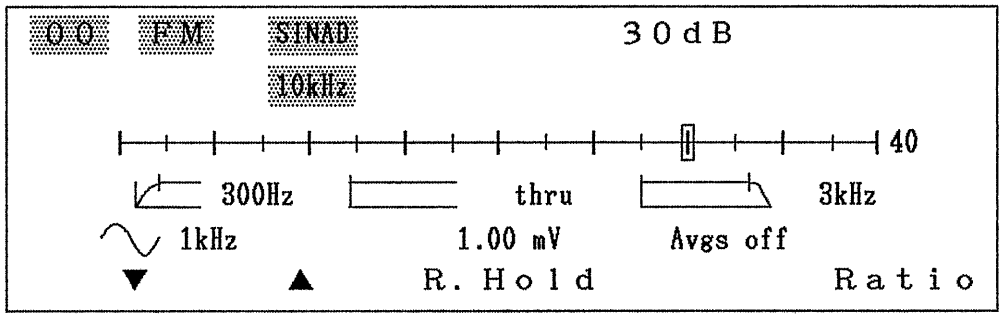


Fig. 4-9

Use of the function keys ③ allows memory recall and storage.

Reference:
The display is automatically set to LOG display (dB) during measurement of SINAD.
If the detection mode is set to DISTN, the display will change to LIN display (%) allowing measurement in % units.
The relationship between SINAD and DISTN is as indicated below.

SINAD display (dB) = $20 \times \log_{10}$(DISTN display/100)

Normally, DISTN is used for measurement of distortion and SINAD is used for measuring the portion containing noise in addition to distortion.
The SINAD and DISTN modes can also be used switching the display between LOG and LIN display.

4.9.3 Measurement of FM S/N

1. Make connections as shown in Fig. 4-10.

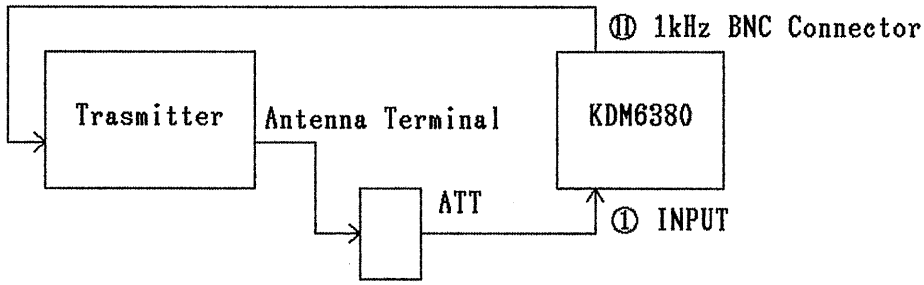


Fig. 4-10

Note:
The optimum input level of the Z=50Ω INPUT ⑪ is −27 to +13dBm. When this optimum input level is exceeded, an attenuator (ATT) is required.

2. The measurement items are set to the FM mode.
3. The detection mode is set to RMS in the case of S/N measurement.
4. The HPF and LPF filters are set to the required bands.
5. De-emphasis is set to 75μs, etc. to match the characteristics of the transmitter.
6. The AF oscillator output ⑪ is set to obtain the specified deviation.
7. The F5 Ratio function key ⑧ is then pressed to inversely display ratio in dark characters on a light background.
   Note:
   When the Ratio function key ⑧ is not being displayed, define the function keys with <<System Manage>> in viewing area 6.

8. Turn off the AF oscillator. Items 6.-8. are repeated allowing FM S/N to read directly from viewing area 2 as shown in Fig. 4-11.
   The display on the right side of the bar graph scale is such that the left side of the scale indicates −20dB, the right side +20dB and the center 0dB.
   Therefore, in the example of Fig. 4-11, the display of −45dB REL is displayed on the left side. Changing of the ratio display between LOG and LIN displays is done by pressing the F4 and F5 key after pressing the yellow key ④.

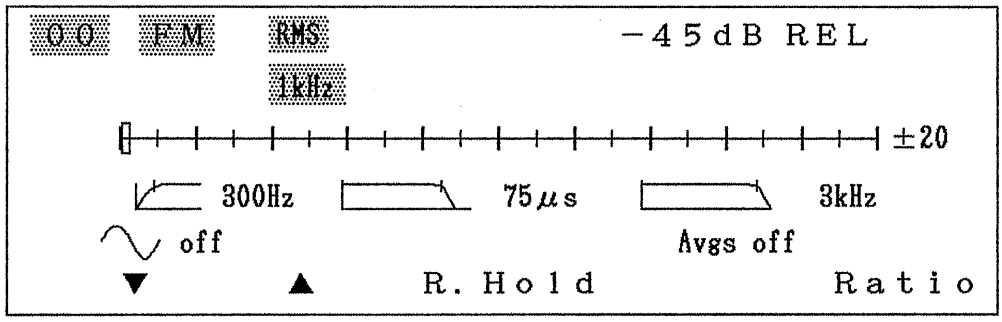


Fig. 4-11

In addition to ratio display, use of the function keys ⑧ allows memory recall and storage.

4.9.4 Measurement of Frequency Characteristics of Receiver Audio Output

1. Make connections as shown in Fig. 4-12.

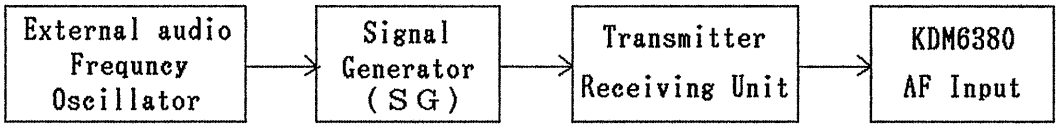


Fig. 4-12

2. The signal generator (SG) is set to the external modulation mode and the frequency, output level and modulation factor are set.
3. The external audio frequency oscillator is set to the required output level for external modulation of the signal generator.
4. Measurement items are set to the AF mode, the detection mode is set to RMS and the HPF and LPF filters are set to "thru".
5. The frequency of the external audio frequency oscillator is set to 1kHz and the F5 Ratio function key ⑧ is pressed to inversely display it in dark characters on a light background.
6. All settings are now completed. The frequency characteristics for the frequency of the external audio frequency oscillator can be read directly from viewing area 2 as shown in Fig. 4-13. In addition, a rough idea of deviation can be determined from the bar graph.
7. Either LOG display (dB) or LIN display (%) can be selected for display of frequency characteristics.
   Switching between these two is performed by pressing the F4 and F5 keys after pressing the Yellow key ④.

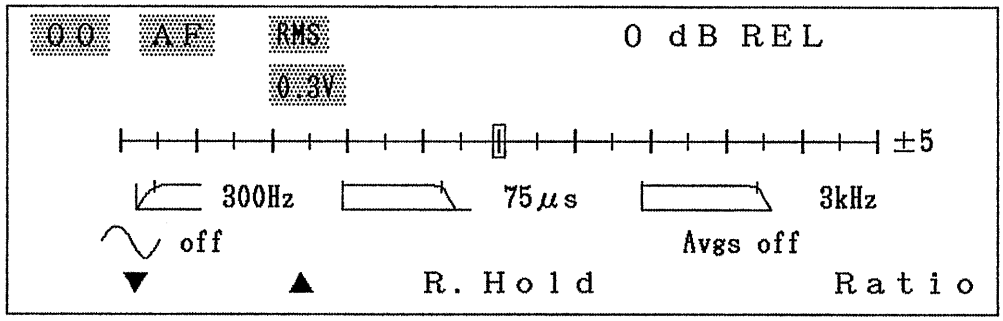


Fig. 4-13

Note:

Although the resolution of the digital display unit of the AF voltmeter that is used here is 0.01V, if the Ration function is used (LOG display), measuring can be performed at a resolution of 60dB or more (0.001V or more) with respect to 1V.

4.9.5 Use of IF OUTPUT

When a signal having a frequency of 1.5MHz-2GHz and an input level of −27dBm to +13dBm is connected to INPUT ①, an output in which the frequency has been converted to yield an intermediate frequency of roughly 420kHz and an output level of approximately 100mV is output at the IF OUTPUT terminal ⑨.

This can be used for monitoring of radio frequency signals with and oscilloscope, spectrum analyzer and so on.

4.9.6 Use of DEMOD OUTPUT (with R.Hold on)

Detected FM and AM waveforms can be observed by connecting an oscilloscope to the DEMOD OUTPUT ⑱. Since the level of this signal changes depending on the range, lock the range as necessary by using with R.Hold on (inversely displayed). Range can be set by moving the cursor to the range setting with R.Hold on.

In the case of measurement of DISTN and SINAD, distortion waveforms can be observed using the DEMOD OUTPUT ⑱ with R.Hold on.

4.10 Use of Memory

The memory of this instrument is arranged in the form of a matrix. In other words, there are a total of 100 points arranged in memory in the form of 10 lines moving vertically and 10 columns moving horizontally.

The following diagram indicates the layout of memory in this instrument.

Memory Addresses - 2-Digit Display

00	01	02	03	04	05	06	07	08	09
10									·
20									·
30									·
40									·
50									·
60									·
70									·
80									·
90	·	·	·	·	·	·	·	·	99

4.10.1 Memory Recall

When performing memory recall, define the display of the function keys ⑧ with <<System Manage>> in viewing area 6.

Case of Performing Memory Recall:

<<System Manage>>

▼ ▲ ⑧

Memory recall can be performed by pressing the ▼ (F1) or ▲ (F2) keys for moving up and down in memory using the function keys ⑧ in viewing areas 1 and 2, or by pressing the Yellow key ④ and then pressing ⏬ (F1) or ⏫ (F)2 keys for moving up and down in memory (in 10-step increments).

4.10.2 Partial Memory Recall

Normally, those memory blocks that can be recalled consist of blocks of 10 steps.

The size of memory blocks can be set as desired from 0 to 99 using <<Memory Manage>> in viewing area 5.

1) Example: When desiring to change the memory address from [10]→[11]→[12]→[13]→[10]→[11]:

Move the cursor with the cursor keys ◁,▷ ⑤ to 10-19 as shown in Fig. 4-14 in viewing area 5, and turn the rotary knob ⑥ to set to 13.

Note:

Note that setting to 10-10 results in no movement in memory.

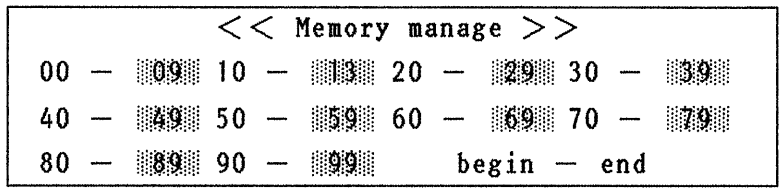
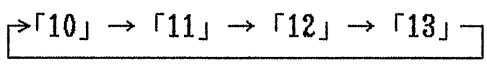


Fig. 4-14

Recall is then set to memory address [10] by pressing the Yellow key ④ and then using the ▲ (F2) key in viewing areas 1 and 2.

When the ▲ (F2) function key ③ is pressed, the following operation is repeated.



4.10.3 Continuous Use of Recalled Memory in 10 Steps or More

1) Example: Case of allowing continuous recall of memory addresses [20]-[39]:

Move the cursor with the cursor keys ◁,▷ ⑤ to 20-29 as shown in Fig. 4-15 in viewing area 5, and turn the rotary knob ⑥ in the clockwise direction. Address [29] and address [30] to the right will disappear from the screen.

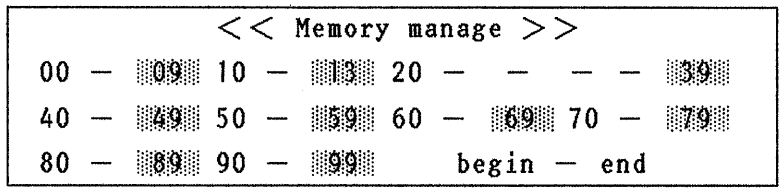
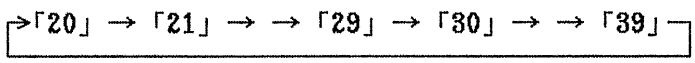


Fig. 4-15

Recall is then set to memory address [10] by repeating the procedure of pressing the Yellow key ④ and then using the ▲ (F2) key in viewing areas 1 and 2 twice.
When the ▲ (F2) function key ③ is pressed, the following operation is repeated.



4.10.4 Memory Storage

As was indicated in section 4.10, memory addresses are arranged in the form of a matrix and the functions set in viewing areas 1 and 2 are able to be stored in memory. When storing these functions in memory, the display of the function keys ③ are defined with <<System Manage>> in viewing area 6.

Case of Performing Memory Storage:

<<System Manage>>

▼ ▲ ○

Exe STO ▲ ○

As is indicated above, when defining the store keys, defining of the recall keys is also set to ○.

Memory Storage Operation:

Memory storage operation is performed in viewing areas 1 and 2.

1. Press the Yellow key ④.
2. Press the STO (F3) key of the function keys ③ to set the instrument in the store mode.
3. When Exe STO (F1) of the function keys ③ is pressed, the function will be stored in the memory address that is being displayed.
4. When STO ▲ (F2) key of the function keys ③ is pressed, the function will be stored in the next address after the address that is being displayed with the memory address display increasing by 1.
5. In order to store in 10-step blocks or larger, store is performed after setting at that address with recall.

4.10.5 Memory Storage Example

The size of the memory block can be set as desired from 0-99 using <<Memory manage>> in viewing area 5.

1) Example: Operation for storing memory address in [10]→[11]:

a) When storing FM mode, detection mode of +P, range of 10kHz, bar graph maximum value of 20, target value lower limit of 9kHz, target value of 10kHz, target value upper limit of 11kHz, HPF of 300Hz, LPF of 3kHz, de-emphasis of 75μs and logic control = 1 in memory address [10]:

1. Switch the display to viewing area 1 with cursor keys ⑤.
2. Set the memory address to [10] by pressing Yellow key ④ and then pressing recall keys ▼ (F1) and ▲ (F2).
3. Move the cursor to the FM mode with cursor keys ⑤ and set to FM using rotary knob ⑥.
4. Move the cursor to the detection mode and set the detection mode to +P.
5. When R.Hold (F3) is pressed, R.Hold is inversely displayed. Move the cursor to "range" with cursor keys ⑤ and then set to 10kHz with rotary knob ⑥.
6. Move the cursor to the bar graph range with cursor keys ⑤ and then set to a maximum value of 20 with rotary knob ⑥.
7. Move the cursor to the lower limit of the target value with cursor keys ⑤ and then set to 9kHz with rotary knob ⑥.
8. Move the cursor to the target value with cursor keys ⑤ and then set to 10kHz with rotary knob ⑥.
9. Move the cursor to the upper limit of the target value with cursor keys ⑤ and then set to 11kHz with rotary knob ⑥.
10. Move the cursor to the scroll bar to switch the display to viewing area 2 and set the HPF to 300Hz with rotary knob ⑥ at the HPF position.
11. Set the LPF to 3kHz with rotary knob ⑥.
12. Set the de-emphasis to 75μs with rotary knob ⑥.
13. Move the cursor to the scroll bar to switch the display to viewing area 3 and set to the logic control output to "1" at the logic control output position in viewing area 3.
14. Move the cursor to the scroll bar to switch the display to viewing area 1.
    Push the Yellow key ④ and then push STO (F3) followed by Exe (F1).
    The above settings will then be stored in memory address [10].

b) When storing AM mode, detection mode of RMS, range of 100%, bar graph maximum value of 100%, target value lower limit of 45%, target value of 50%, target value upper limit of 55%, HPF of thru, LPF of thru, de-emphasis of thru and logic control = 0 in memory address [11]:

1. Switch the display to viewing area 1 with the cursor keys ⑤.
2. Set the memory address to [10] by pressing Yellow key ④ and then pressing recall keys ⩛ (F1) and ⩓ (F2).
3. Move the cursor to the AM mode with cursor keys ⑤ and set to AM using rotary knob ⑥.
4. Move the cursor to the detection mode and set the detection mode to RMS.
5. When R.Hold (F3) is pressed, R.Hold is inversely displayed. Move the cursor to "range" with cursor keys ⑤ and then set to 100% with rotary knob ⑥.
6. Move the cursor to the bar graph range with cursor keys ⑤ and then set to a maximum value of 100% with rotary knob ⑥.
7. Move the cursor to the lower limit of the target value with cursor keys ⑤ and then set to 45% with rotary knob ⑥.
8. Move the cursor to the target value with cursor keys ⑤ and then set to 50% with rotary knob ⑥.
9. Move the cursor to the upper limit of the target value with cursor keys ⑤ and then set to 55% with rotary knob ⑥.
10. Move the cursor to the scroll bar to switch the display to viewing area 2 and set the HPF to "thru" with rotary knob ⑥ at the HPF position.
11. Set the LPF to "thru" with rotary knob ⑥.
12. Move the cursor to the scroll bar to switch the display to viewing area 3 and set to the logic control output to "0" at the logic control output position in viewing area 3.
13. Move the cursor to the scroll bar to switch the display to viewing area 1. Push the Yellow key ④ and then push STO (F3) followed by STO ▲ (F2).
    The above settings will then be stored in memory address [11].

The contents of a) and b) above can then be recalled by pressing recall keys ▼ (F1) and ▲ (F2).
In addition, block output will switch each time memory addresses [10] and [11] are recalled.

4.10.6 Memory Copy to Same Model Instrument

1) The 100-point memory containing stored settings and so on can be copied from one instrument functioning as the master to another instrument of the same model.
2) Copying of memory is performed according to the procedure indicated below.
   a) Turn on the power of the respective instruments.
   b) Connect the [REMOTE] terminals ⑫ of each of the instruments with one functioning as the master and the other as the slave with the DUMP cable.
   c) Set the display of the master to <<Memory manage>> of viewing area 5 using the cursor keys ⑤ and rotary knob ⑥.
   d) When the DUMP key (F1) of the function keys ③ of the master is pressed, "Transfer memory data" will be displayed in viewing area 5 indicating that copying of memory to the slave instrument has begun. If the DUMP cable has not been connected, <<Time out in dump>> will be displayed.
   e) When copying of memory has begun, "Receive memory data" will be displayed in the viewing area of the slave. When DUMP is being performed from another model, <Receive other memory data> will be displayed in the viewing area of the slave.
   f) When copying of memory is completed, "** Remove cable & Power off **" will be displayed in the viewing area of the slave.
   g) Disconnect the DUMP cable and turn off and then on again the power of the slave KDM6380.

Note:
An amphenol-type, 14-pin connector is used for the DUMP cable. Although pins 8-10 of those 14 pins are not connected, all other pins are connected.
DUMP cable model SA510 is sold separately.

5. REMOTE CONTROL

5.1 Introduction

5.1.1 General Description

This instrument is equipped with a remote connector so as to allow key operation using a remote box or similar device from the outside in the same manner as key operation from the front panel.
The timing chart for key reading in this case is indicated in Fig. 5-1.

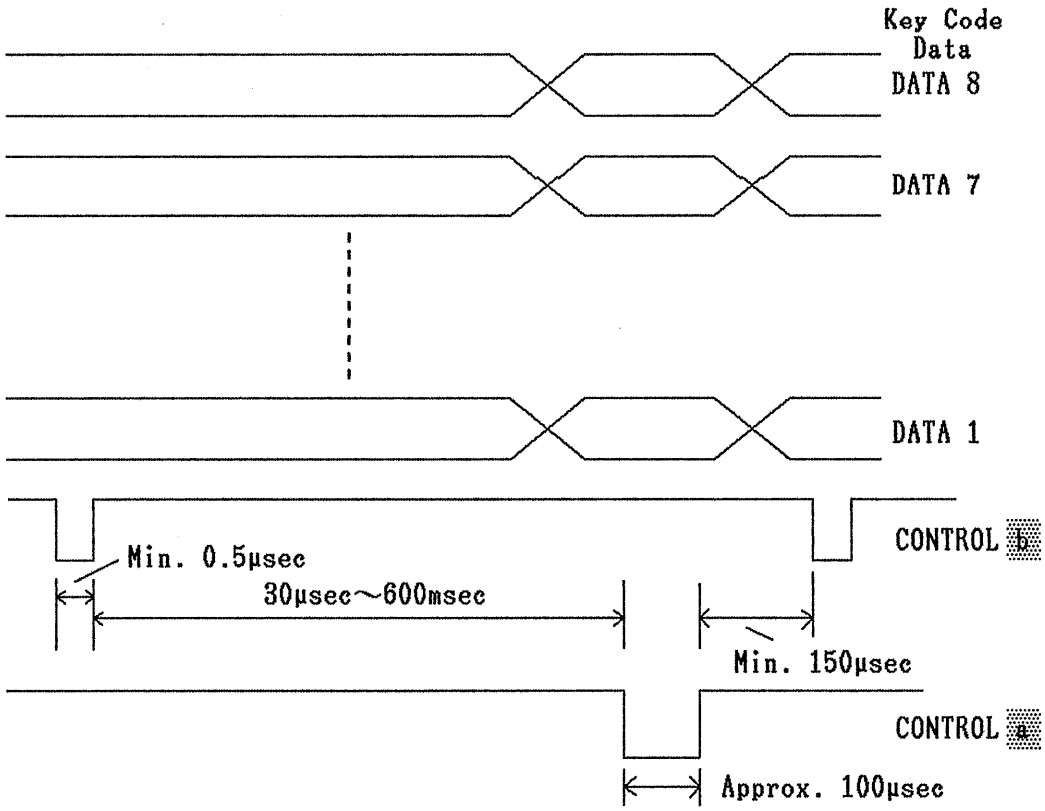


Fig. 5-1

In the explanation below, the values of "1" and "0" refer to the high level and low level, respectively, of the TTL level.

Control b : ····· This is a signal which requests reading of data, and is at "0" for a period of 0.5µsec or more.

Control a : ····· This signal is output at "0" for approximately 100µsec 30-600msec after control signal b is received. Data is read during that time. Control signal b is not accepted for a period of 150µsec after the signal level has returned to "1".

DATA 1-8 : ····· It is necessary to hold key code data during the time control signal a is at "0".

5.2 Method of Use

5.2.1 Remote Connector Explanation

The pin connections of this connector as viewed from the rear panel are as shown in Fig. 5-2.

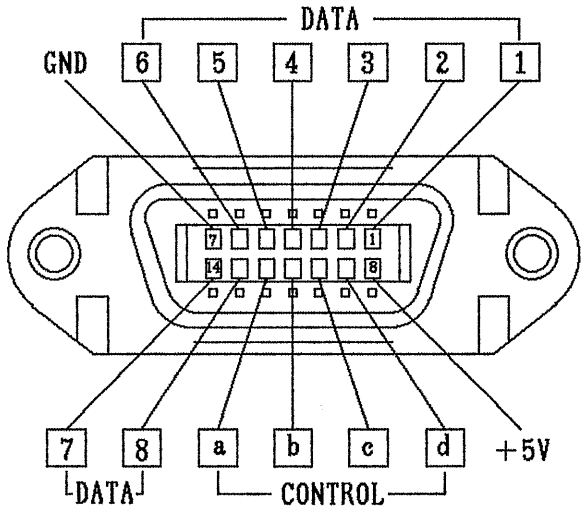


Fig. 5-2

Explanation of Terminals:

1) DATA Terminals 1-8 ..... Pins 1-6,13,14

Data terminals are connected to the bus of the main panel which is in the form of a bi-directional bus that can be used for both input and output.

Note:

Since data terminals are bi-directional, if data at level "0" or "1" is directly applied to data lines 1-8, the main unit will not operate.

2) CONTROL Terminals ..... Pins 11,12

a: DATA STROBE Output Terminal ..... Pin 12

This is normally at "1" and goes to "0" during reading of data.

b: REQUEST TO READ Input Terminal ..... Pin 11

This is normally at "1" and requests reading of data when at "0".

3) CONTROL Terminals ..... Pins 9,10

c, d: Display control output terminals.

When either c or d is at "1", this indicates that processing relating to data is in progress.

4) +5V Terminal ..... Pin 8

This is used as the remote control power source, and has a maximum power level of 100mA. It is also equipped with a 2-digit LED.

5) GND Terminal ..... Pin 7

5.2.2 Table of Panel Key Codes

All panel keys are encoded. By setting the key code data indicated in Table 5-1 and putting control signal ···b··· at "0", this will be equivalent to pressing the keys on the panel.

		Data Input Pin Numder							
		13	14	6	5	4	3	2	1
Key Name		MSB		←	Key Code		→		LSB
Function	F1	1	0	0	0	1	0	0	0
〃	F2	1	0	0	0	1	0	0	1
〃	F3	1	0	0	1	0	0	0	0
〃	F4	1	0	0	1	0	0	0	1
〃	F5	1	0	1	0	0	0	0	0
Cursor	△	1	0	0	0	1	1	0	0
〃	▽	1	0	0	1	0	1	0	0
〃	◁	1	0	0	0	1	0	1	0
〃	▷	1	0	0	1	0	0	1	0
Rotary Knob	UP	1	0	0	0	0	0	0	0
〃	down	1	0	0	0	0	0	0	1
Yellow	(YE)	1	0	1	0	0	0	0	1

Table 5-1

5.2.3 Setting Example of Remote Control Memory Storage

The display is set to viewing area 1.

Example of setting function key F2:

1) Set function key F2 code, "10001001", by referring to the panel key code table (Table 5-1).
2) Set control b to "0".
3) Data will then be read during the time control signal a is at "0".

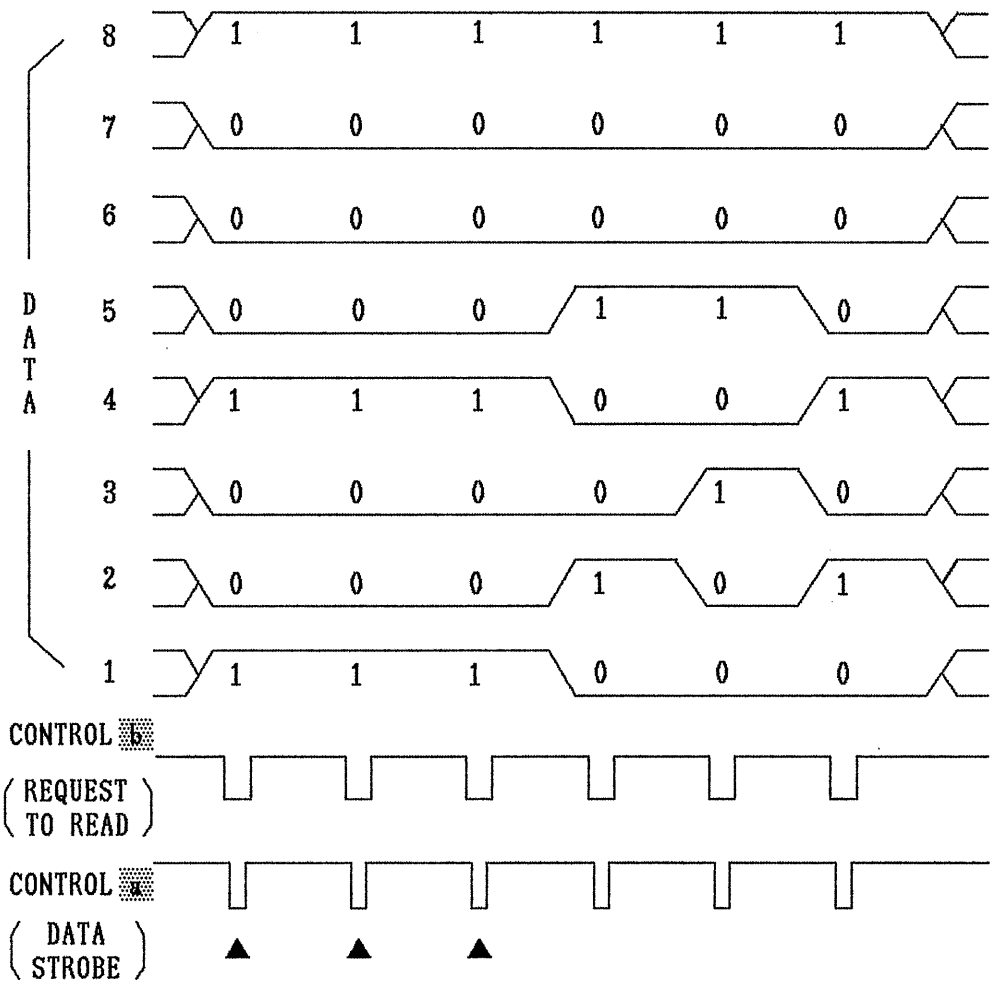


Fig. 5-3

4) After this point, processing for memory storage inside the main unit will begin from the point data "10001001" of function F2 and control signal b are sent and control signal a goes to "0" as indicated in Fig. 5-3.

5.2.4 Example of Remote Control Circuit Diagram and Explanation of Operation

We recommend that a circuit like that indicated in Fig. 5-4 be used for the connector data lines for remote control operation when controlling from the outside since the bus that is used is a bi-directional bus as indicated previously.

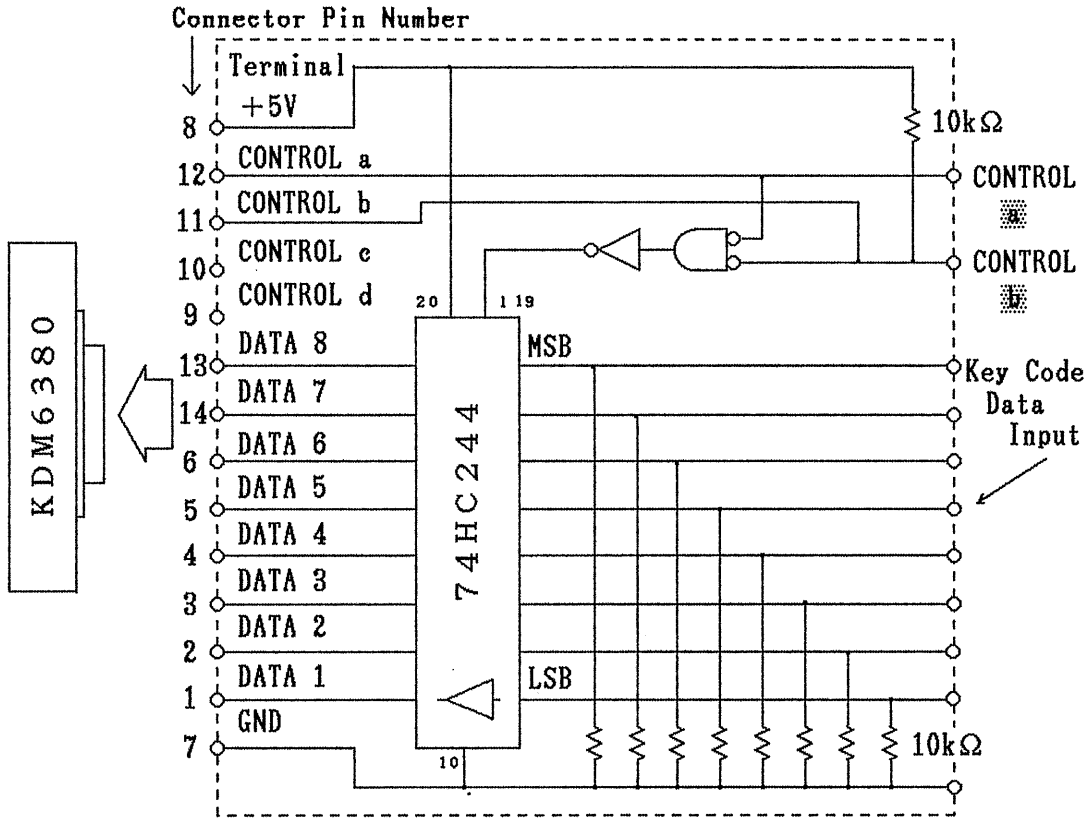


Fig. 5-4

Fig. 5-4 indicates a circuit which performs remote control from the outside. When control signal b is at "1", key code data 1-8 of key code table 5-1 is set for the key code data input, and finally control signal b goes to "0" after allowing an amount of time of at least 10&Lsec after the set data has become stable.

Since control signal a goes to "0" for a period of time of 30μsec to 600msec (see following note), during the approximately in which time 100μsec Enable A and B (pins 1 and 19) of the 74HC244 is lowered to "0" and control signal a is at "0", processing is performed in which the set key code data is loaded into the main unit. Once processing is completed, control signal a goes to "1". The next key code data is set after it has been confirmed that this signal has risen to "1".

As a result of the above procedure being repeated, it is possible to successively input key code data.

Note:
In the case of continuous input of key code data, if control signal [illegible] goes to "0" when processing of the previous key code data has not been completed, a maximum of approximately 600msec (processing time of key code data of memory recall) is required until output of control signal [illegible].
The timing of the input data circuit example is indicated in Fig. 5-5.

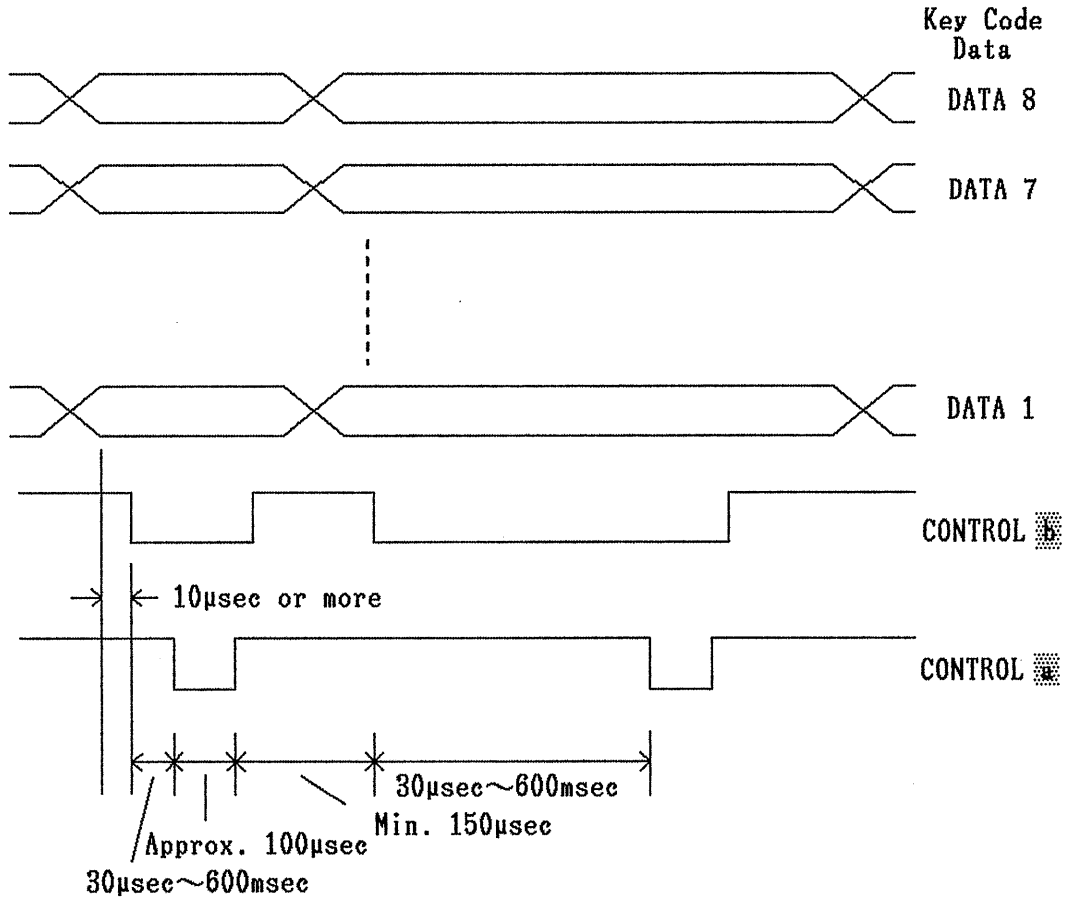


Fig. 5-5

6. GP-IB INTERFACE

6.1 Introduction

6.1.1 General Description

This instrument is equipped with a GP-IB interface function that is controlled by an IEEE 488 standard interface bus.

6.1.2 Features

1) Allows control of the instrument by an IEEE 488 standard interface bus.
2) The displaying of "Remote, Press YE-Key to LOCAL" on the LCD display ② allows confirmation of operation in the remote mode.
3) The instrument can be set in the remote mode at any time simply by pressing the Yellow key ④ thereby allowing manual operation from the panel.
   When the instrument is in the local lockout state, "Remote and Local Lockout" is displayed and manual operation is no longer possible.
4) The device address set in the instrument can be verified in viewing area 7 on the LCD display ②.

6.2 Performance

6.2.1 Electrical Specifications Relating to the Interface System

Electrical specifications conform to IEEE Std 488-1975.

6.3 Method of Use

6.3.1 Preparations Before Use

Turn on the power switch and confirm the GP-IB device address.

1) The GP-IB device address is displayed in the area indicated by <<GP-IB>> in viewing area 7 of the 2nd scroll panel.
2) When desiring to change the device address, set the new address in accordance with the address setting procedure described in section 6.3.2.
3) "13" is displayed when hard reset and soft reset of the CPU is performed.
4) Connect the GP-IB cable with the power off.

6.3.2 Address Setting

1) Software Setting

Scroll the viewing area on the LCD display ② to display the <<GP-IB>> display of viewing area 7 of the 2nd scroll panel. The address can be changed by pressing ◁ cursor keys ⑤ and using rotary knob ⑥.

2) Hardware Setting

The address of this instrument is set to "13" at the time of shipment. The address switch is mounted on the CPU board inside the instrument. When setting the address, remove the upper cover of the instrument and set the address to the desired address using address switch S1 (Fig. 6-1) located on board 90-SIG-90044 mounted on the aluminum sash case on the rear panel. The upper cover can be removed by removing the two screws on the top of the right side of the instrument and the two screws on the top of the left side of the instrument that are also holding in place the rubber feet. The top cover is then removed by lifting up.

The aluminum sash case can be removed by removing the one screw holding the case located on the top of the right side of the case, and the two screws on the top of the left side of the case. The aluminum sash case is then removed by lifting up on the right side of the case and unhooking the catches on the lower left side of the case. While doing this, the case is then pulled to the back while holding down the board mounting plate.

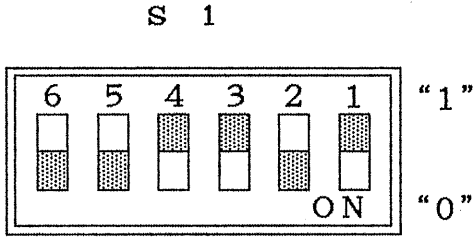
After address setting has been completed, the aluminum sash case and top cover are returned to their original positions.

At this time, perform either soft or hard reset (see section 8.2).

a) The relationship between the DIP switches and the address set values is indicated in Table 6-1.

b) When the DIP switches are put in the ON position, this means they are at the "0" level.

c) In the diagram below, the address is set to "13".



Device Address Setting Example

$2^0+2^2+2^3=13$
(1) (4) (8)

Fig. 6-1

Table 6-1

Listener/Talker Address Device Number	Address Switch Number 1 2 3 4 5 6	
0 0	0 0 0 0 0 0	
0 1	1 0 0 0 0 0	
0 2	0 1 0 0 0 0	
0 3	1 1 0 0 0 0	
0 4	0 0 1 0 0 0	
0 5	1 0 1 0 0 0	
0 6	0 1 1 0 0 0	
0 7	1 1 1 0 0 0	
0 8	0 0 0 1 0 0	
0 9	1 0 0 1 0 0	
1 0	0 1 0 1 0 0	
1 1	1 1 0 1 0 0	
1 2	0 0 1 1 0 0	
1 3	1 0 1 1 0 0	Setting at the time of Shipment
1 4	0 1 1 1 0 0	
1 5	1 1 1 1 0 0	
1 6	0 0 0 0 1 0	
1 7	1 0 0 0 1 0	
1 8	0 1 0 0 1 0	
1 9	1 1 0 0 1 0	
2 0	0 0 1 0 1 0	
2 1	1 0 1 0 1 0	
2 2	0 1 1 0 1 0	
2 3	1 1 1 0 1 0	
2 4	0 0 0 1 1 0	
2 5	1 0 0 1 1 0	
2 6	0 1 0 1 1 0	
2 7	1 1 0 1 1 0	
2 8	0 0 1 1 1 0	
2 9	1 0 1 1 1 0	
3 0	0 1 1 1 1 0	

DIP SW

1 : OFF Position

0 : ON Position

Note:

This instrument can not operate in Listen Only and Talk Only mode. Do not set this instrument to those mode. If you have set, turn off the POWER switch first. And turn on the POWER switch while pressing the Yellow key.

6.3.3 List of Valid Control and Bus Line Commands

Table 6-2

Control and Bus Line Commands: Case of Using the HP 9816	Description
REMOTE 713	When the listener address is specified, "Remote, Press YE-Key to LOCAL" is displayed in viewing areas 1 and 2 indicating that preparations for accepting data are completed. When the Yellow key is then pressed in this state, the display disappears from the screen, the instrument returns to the local mode allowing manual operation from the panel.
LOCAL LOCKOUT 7	This is a universal command such that when LOCAL LOCKOUT is sent to all devices on the GP-IB bus, all manual operation from the panel is prohibited. At this time, "Remote and Local Lockout" is displayed in viewing areas 1 and 2.
LOCAL 713	The display of "Remote, Press YE-Key to LOCAL" disappears from viewing areas 1 and 2 and the instrument returns to the local mode thereby allowing manual operation from the panel.
CLEAR 713	This is equivalent to the state when the power is turned off or on.
SPOLL (713)	This allows confirming of data ready by a serial poll.

Note:

1. *As control and bus line commands vary depending on the computer that is used, please refer to those respective operating manuals.*
2. *When device clear is performed using CLEAR 713, send the next command after waiting roughly 5 seconds.*
3. *Refer to the program example shown in section 6.3.8 for further details regarding SPOLL (713).*

6.3.4 Table of Program Codes

The program codes of this instrument are set according to the functions listed in Table 6-3. In addition, for the sequence of setting of program codes when creating a control program, commands are sent in the same sequence as the order of panel operations.

Table 6-3 GP-IB Program Codes (For Listener/Talker) According to Individual Functions

Function	Listener Code	Talker Code	Returned Data
< Measurement >			
AM	M1	M?	M1
FM	M2		M2
AF	M3		M3
< Detector >			
+Peak (+P)	D1	D?	D1
−Peak (−P)	D2		D2
Average (AVG)	D4		D4
1kHz Distn (DISTN)	D5		D5
RMS	D8		D8
(p-p)/2、(=±P/2)	D9		D9
SINAD	DS		DS
< Filters >			
High Pass thru	H0	H?	H0
50Hz on	H1		H1
300Hz on	H2		H2
Low Pass thru	L0	L?	L0
3kHz on	L1		L1
15kHz on	L2		L2
B9kHz on	L3		L3
< FM De-emphasis >			
thru	P0	P?	P0
50μS on	P3		P3
75μS on	P4		P4
750μS on	P5		P5
< Other Condition >			
Averages (Avgs)	AVGSn	AVGS?	AVGSn

Function	Listener Code	Talker Code	Returned Data
< Display >			
Display Result LOG	LG	R?	LG(during R1)
LIN	LN		LN(during R1)
Ratio on	R1		LG or LN
off	R0		R0
< Range >			
Auto Range	G0	G?	G0
Range Hold	G1		G1
Range low	RG0	RG?	RG0
Range mid	RG1		RG1
Range high	RG2		RG2
< Trigger>			
Trigger off	T0		
Trigger Hold	T1		
Trigger Immed	T2		
< 1kHz Oscillator >			
Oscillator on	OSON	OS?	OSON
off	OSOF		OSOF
Amplitude	AP	AP?	
mV unit	AP(number)MV		AP1.00～999MV
dBm units	AP(number)DM		AP-63.8～-3.8DM
dBV units	AP(number)DV		AP-60.0～0.0DV
< Special Function >			
Logical control			
" 0 "	LC0	LC?	LC0
" 1 "	LC1		LC1
AF input impedance			
600Ω	ZL	Z?	ZL
100kΩ	ZH		ZH
< Memory management >			
Recall	RC(number)	RC?	0～99 (C,R)
Store	ST(number)		

Note:

1. n is 0, 2, 4, 8 or 16.

2. Data is in the form of integers or real numbers and E format cannot be used.

3. The delimiters are carriage return and line feed.

4. Confirmation of settings when setting has been performed using GP-IB program codes can be done by switching from the scroll mode to the operating mode in the viewing area containing those settings.

5. FM de-emphasis can only be set when in the FM mode.

6. Averages and Ratio On cannot be set when in the DISTN and SINAD modes of the detector.

7. The display of LOG and LIN can be changed when Ratio is on.

6.3.5 Explanation of GP-IB Commands

1) G? and RG? Range Commands

a) G0: Range hold is turned off (automatic ranging).

b) G1: Range hold is turned on (manual ranging).

c) RG0: Range is set to 1kHz for FM, 1% for AM and 0.03V for AF.

d) RG1: Range is set to 10kHz for FM, 10% for AM and 0.3V for AF.

e) RG2: Range is set to 100kHz for FM, 100% for AM and 3V for AF.

2) T0-2 Trigger Command

There are two modes that are used as the methods for performing data sampling. They are the free run mode and the trigger mode. The free run mode performs sampling at fixed intervals with writing of data changing to new data when sampling is completed. In the trigger mode, sampling is started by the trigger command (T2) with writing of data changing to new data when sampling is completed. Setting to the trigger mode is done with the T1 command and canceling of the trigger mode is done with the T0 command.

There are three trigger commands consisting of T0, T1 and T2.

a) T0: Turning the trigger off cancels the trigger mode. In other words, free run sampling is performed on the data and when sampling is completed, writing of data switches to new data.

b) T1: Trigger hold is used to set the trigger hold mode and hold the display. Although reading of data cannot be performed, panel settings can be confirmed by setting the talker code.

c) T2: This sets immediate trigger in the trigger hold mode. Sampling of data is started with this trigger and when sampling is completed, writing of data switches to new data. (Sampling completion can be determined according to the serial poll status described in 3) to follow.)

3) Serial Poll Mask

Serial Poll Status Table

	Bit	Weight	Condition
LSB	d1	1	Data Ready
	d2	2	Not used
	d3	4	Not used
	d4	8	Not used
	d5	16	Not used
	d6	32	Not used
	d7	64	SRQ MASK set
MSB	d8	128	Not used

When data sampling is completed, the serial poll is masked when desiring to perform reading of data.
If the SRQ MASK set is set to "1", SRQ can be generated as a result of completion of sampling.
If Data Ready is set to "1", the status can be set to "1" as a result of completion of sampling.
The serial poll mask sends the weight indicated in the table above after the header "SPM".

Example 1: SPM1
This set so that Data Ready is output as the status.

Example 2: SPM65
This generates SRQ following completion of data sampling as a result of the T2 command.

4) Serial Poll Status

In the case the serial poll mask SPM65 has been set, status bits d7 and d1 are at "0" during the time sampling is being performed, and then change to "1" when sampling is completed.
Bit d7 then returns to "0" when the status is read, and bit d1 returns to "0" when the data is read. As a result, The status value goes from "0" to "65" and then returns to "0".

Note:
After using the T1 and T2 commands with the GP-IB interface, the display of data will remain in the hold state even if operation is returned to the local mode by pressing the Yellow key. In order to cancel hold, either send the T0 command with the GP-IB interface or turn off and then turn back on the power.

5) RC? Memory Management Command

The memory addresses that are currently set in memory can be checked by using the RC? memory management command. In addition, in the case returned data is either dC or ddC, this command indicates that there are consecutive series of addresses consisting of 10 addresses or more, and in the case the returned data is dR or ddR, this command indicates that the addresses are divided into memory blocks (d refers to a single number from 0 to 9).

6.3.6 GP-IB Error Codes

In the case of input signals being inappropriate or when range settings are not suitable, the returned data obtained with the GP-IB interface becomes 90dd. The characters dd refer to the weight from 1-15 indicated in the table below.

For example, at the time of an error code of 15, the number 9015 will be returned (refer to section 4.8.6 on error messages).

Description of Error	Weight
AF circuit over drive	1
Input level too low	2
Unlock error	4
Input level too high	8
Not used	16
Not used	32
Not used	64
Not used	128

For example, when the error code is 6, this means that both the input level is too low and an unlock error has occurred.

6.3.7 Basic Data Programming Method

The programming example indicated below is for the HP9816.
The settings used are FM measurement, +Peak detection, automatic ranging, LPF of 3kHz, HPF of 300Hz, de-emphasis of thru, 1kHz oscillator on, output of 100mV and ratio off.

Example 1: OUTPUT 713;"M2,D1,G0,L1,H2,P0,OSON,AP100MV,RO"
Example 2: As an alternative to the above, each piece of data can be sent separately.

OUTPUT 713;"M2"	FM measurement
OUTPUT 713;"D1"	+Peak detection
OUTPUT 713;"G0"	Automatic ranging
OUTPUT 713;"L1"	LPF set at 3kHz
OUTPUT 713;"H2"	HPF set to 300Hz
OUTPUT 713;"P0"	De-emphasis set to thru
OUTPUT 713;"OSON"	1kHz oscillator on
OUTPUT 713;"AP100MV"	Output set to 100mV
OUTPUT 713;"RO"	Ratio off

The following lists several examples of each function.
Example 3: When setting to AM measurement: "M1"
Example 4: When setting to SINAD measurement: "DS"
Example 5: When setting to range hold: "G1"
Example 6: When setting the LPF to 15kHz: "L2"
Example 7: When setting the HPF to 50kHz: "H1"
Example 8: When setting the de-emphasis to 50μs in the FM range: "M2,P3"
Example 9: When setting the 1kHz oscillator to off: "OSOF"
Example 10: When setting the output level to −17.8dBm: "AP-17.8DM"
Example 11: When setting to a LOG display with ratio on: "R1,LG"
Example 12: Memory recall - Recalling of memory address "36": "RC36"
Example 13: Memory storage - Storing of memory address "36": "ST36"

6.3.8 Reference (Program Example)

For reference purposes, the following indicates an example of a program which reads measurement data using the HP9816. This program is not the best program that can be used. Since the methods of description vary according to the controlling system, we recommend that control be performed using a method that is optimum for the particular system being used (the results obtained by deleting line numbers 40 and 70 are the same as those when line numbers 40 and 70 are not deleted).

Example 1: When reading data:

```
10 DIM A$[256]                  This secures a data area from the
                                KDM6380.
20 OUTPUT 713;"SPM1"            This sets the Data Ready mask of
                                serial poll status.
30 WHILE 1>0                    This is an infinite loop that
                                continues until line 70.
40   IF SPOLL(713) AND 1 THEN   This confirms Data Ready with a serial
                                poll.
50     ENTER 713;A$             Data is then read from the KDM6380.
60     PRINT A$                 Data is displayed on the screen.
70   END IF                     The program returns to line 40.
80 END WHILE
90 END
```

Example 2: When investigating as to what range has been set:

When the program is run, "RG2", for example, will be displayed on the screen.

```
10 OUTPUT 713;"RG?"
20 ENTER 713;A$
30 PRINT A$
40 END
```

Example 3: When checking the setting of the output level of the 1kHz oscillator:

When the program is run, "AP1.00MV", for example, will be displayed on the screen.

```
10 OUTPUT 713;"AP?"
20 ENTER 713;A$
30 PRINT A$
40 END
```

7. LINE VOLTAGE SWITCHING METHOD

Pull out the power cord and open the cover by moving to the left. Remove the fuse by pulling out the portion marked FUSE PULL and turning to the left.

Pull out the PC board inside and insert in the direction in which the voltage display is normally read from the left when viewed from the rear panel. Insert the proper fuse that corresponds to the voltage being used and closethe cover. In this manner, the line voltage can be switched to each of the voltages.

8. BACK-UP BATTERY AND RESETTING THE CPU

8.1 Back-Up Battery

As this instrument uses a back-up battery to back-up memory storage, when not using the instrument for an extended period of time, the back-up battery mayspontaneously discharge.

As the instrument is equipped with a charging circuit, turn on the power ofthe instrument and sufficiently charge the battery.

In addition, the memory back-up battery is greatly affected by ambient temperature, ambient humidity, storage conditions and so on. When used for a period of 5 years, the discharge capacity is roughly 90%. Although the instrument can still be used when the battery is in this state, when the batteryhas become defective, replace with the type GB 50H-3X battery made by the Nippon Battery Co., Ltd.

[Battery Installation Position and Replacement Method]

When the top cover of the instrument is removed, the CPU printed circuit board can be seen inside the aluminum sash case located on the side of the rear panel. The battery is installed on the top of this board. Refer to section 6.3.2 for details regarding removal of the top cover and aluminum sash case.

When replacing with a new battery, remove the single screw on the upper right side and the two screws on the left side that are holding the aluminum sash case. Remove the aluminum sash case, pull out the printed circuit board and replace the battery.

Furthermore, when replacement of the battery has been completed, cover the printed circuit board with the aluminum sash case, insert the screws, tighten, and then perform CPU hardware reset.

8.2 Resetting the CPU

When performing reset, turn off and then turn back on the power.

8.2.1 Hard Reset

Turn on the power and push the initial set push button switch S1 with an insulated screwdriver in the direction of the rear panel through the hole on the upper surface of the aluminum sash case (on rear panel side) on which the CPU is mounted. This will perform initial setting of the CPU. At this time, the values, setting values and GP-IB addresses stored in memory will be reset to theinitial hardware values.

8.2.2 Soft Reset

Turning the power switch ON while pressing the Yellow key ④ on the panel performs reset of the CPU. At this time, setting values stored in memory will not be cleared.

However, GP-IB addresses will be reset to the initial hardware values.