# Operation Manual

## RIPPLE NOISE METER

# RM-104

## KEISOKU GIKEN CO., LTD.

# Quality Assurance Provision

This product passed our strict inspection. When it did not satisfy an early purpose, specifications by trouble after the delivery in a year, we repair it gratis in the case of the responsibility in our production. Please report to agency or us. We repair it in our factory. About measurement precision, I guarantee it for six months after the delivery. But I will repair it under mentioned for payment.

1. In the case of trouble / the damage that occurred by the handling against usage mentioned in the manual of this product and instructions.
2. When you remodeled it without our approval
3. In the case of trouble / the damage that occurred because the handling was not reasonable such as the bad transportation by the visitor, a fall at the time of the movement, a shock.
4. In the case of trouble / the damage by the natural accidents such as a fire / an earthquake / the flood.
5. In the case of trouble / the damage that occurred by the abnormal input voltage.
6. When we dispatched an engineer.
7. When the VOID seal is peeled off.

*This warranty is valid only in Japan.

## Copyrights

According to relevant laws, all the copyright of these manual contents belongs to KG (Keisoku Giken Co., Ltd.). Copy of any part or a whole of this manual is prohibited without prior written consent by KG.

## Read this manual before start using this product

Please read this manual carefully before using this product.
This manual should be kept in an accessible place.
Attach this manual to this product when you relocate them.

This manual is written based on the functions of this product when shipped from KG.
The specifications are subject to change without any notice.

## Registered trademark

Microsoft Windows, Microsoft Excel, ActiveX, Visual Basic, Visual C ++ are registered trademarks of Microsoft Corporation in USA and other countries

# READ FIRST

Please Read this "For your Safety Usage" carefully to avoid misunderstanding or wrong operation of RM-104.

## Chapter structure

The contents and chapters are as follow.
When using it for the first time, read from "Chapter 1 GENERAL".

**Contents**

# For your Safety Usage

For your safety reasons, you are requested to read this manual thoroughly first. Keisoku Giken shall not be responsible for any accidents which resulted from your improper use or something like that.

## Danger Warning Label

This symbol indicates warnings, dangers, or cautions. If this symbol is displayed on this product, refer to the relevant section of this manual.



This symbol means Careful for Handling.
It is suggested to read manual to know how to protect operator and product itself against risk of damages.

**⚠ Danger**

This term indicates the possibility of causing fatal damage to an operator.

**⚠ Warning**

This term indicates the possibility of causing serious damages to an operator.

**⚠ Caution**

This term indicates the possibility of causing low-level damages to an operator.

**■ Note**

This term indicates what you want to know of product performance or operation method.



This term indicates a prohibited act.



This symbol indicates that this product meets the requirements of the applicable EU Directive.

## For using safely

This is a precaution to use this product safely. Please understand the contents and be sure to observe it.
Keisoku Giken is not responsible for accidents caused by inappropriate methods of use by the customer.

### ■ User



This product should be used only by a person who has enough knowledge of electronics.
In case the operator does not have enough electronic knowledge, use it only under supervision of knowledgeable person.

### ■ Input voltage



Be sure to use the input power supply voltage of this product within the rated range.
Use Power Cable which is suitable for your own country's safety standard.

### ■ Disassembly



Inside this product, there are parts that risk danger to the body such as high voltage. Do not remove covers or panels.

■ **Gas**

Do not use in environments where explosive and corrosive gases are in the surroundings.

■ **Noise**

Avoid using it in strong electromagnetic environment. Under a strong electromagnetic field environment, the noise induced in the input cable is measured as an input signal due to the characteristics of the instrument, so the measured value may be affected.

■ **High temperature, high humidity**

Avoid locations that are hot or in direct sunlight. Use under the specified ambient conditions. In case of condensation, please do not use this product until completely dry. Avoid places with high humidity.

■ **Dust**

Please do not use in a dusty place. Please do not use in a place with bad ventilation.

■ **Placement, inclination, vibration**
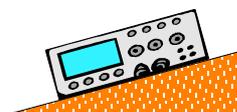
Be sure to level it. Please do not use it in a place with inclination and vibration.

■ **Connection / removal**
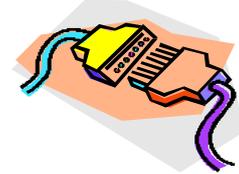
Before connecting cables and devices, be sure to turn off the power switch of each device.

■ **Move**

Turn off the power switch and remove all wiring cables. Attach the instruction manual when moving this product.
When transporting this product, be sure to use exclusive packing materials. When there is no exclusive packing material, please pack it after sufficiently protecting with cushioning material.

■ **Maintenance and inspection**

Always unplug the power cord to prevent electric shock accidents when performing maintenance and inspection.
Periodic maintenance, inspection and cleaning are recommended to maintain the safety of this product. Periodic calibration is recommended to maintain the performance of this product.

■ **Overload**

Do not apply voltages outside the specification range on the connector and input terminals of this product. Do not use the connector and input terminal of this product for purposes other than those described in this manual.

■ **Calibration and repair**

If calibration or repair is necessary, contact us or your dealer. Calibration and repair of this product is done by us.

# Check when you unpack

After you unpack, please check if the product suffers any damages and all the accessories are duly provided.
Should you find any damages and missing accessories, please contact dealer you purchased from or KG directly?
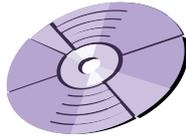
SUPPORT CD
(Instruction manual, USB Driver, etc)
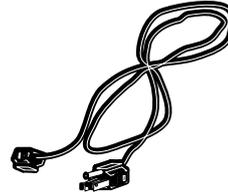
AC power cord (3P, 2 m)

Signal Cable (BM-58U-150KO)
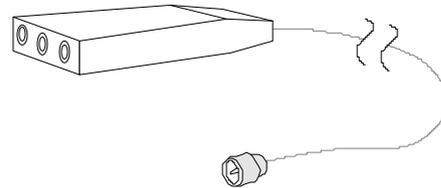
Differential probe (DP-100)
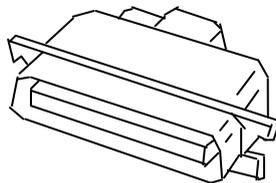
Connector for OUT PORT
(57-30140)
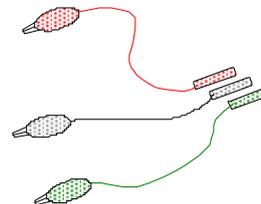
Probe for DP-100(RED, BLACK, GREEN)
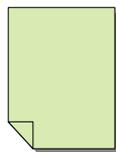
Safety precautions

■**Note**   When you unpack, check the product and all the accessories.

◆   Check if the product suffers any damages.
◆   Check if all the accessories are duly provided.

# Precautions when moving

Observe the following precautions when moving the product.

| ⚠️ **Warning** | **Risk of electric shock.** |
|---|---|

◆ For your safety, be sure to turn off the power switch when moving.
Even if the power is turned off, the voltage may remain in the device.
Make sure that the voltage has dropped before starting work.

| ⚠️ **Caution** | It may damage the equipment. |
|---|---|

◆ When transporting this device, use the dedicated packing material (packing material at the time of delivery).
◆ If you do not have a dedicated packing material, be sure to use the same or better packing material.

# Contents

# Chapter 1.   GENERAL

RM-104 can measure following parameters such as "PARD" of output of Switching Power Supply and judge them PASS or FAIL by setting Upper/Lower Tolerance.

- a) DC Output Voltage
- b) P-P Ripple Voltage
- c) P-P Noise Voltage (PARD)

Also by selecting Filters of RM-104, you can measure AC Ripple and Switching Ripple separately and can sum up both of them.
The following measurements can be made using the various mode buttons.

- d) DC Output Voltage + (Noise Voltage) /2
- e) DC Output Voltage + (Ripple Voltage) /2

Please read this manual carefully to avoid misunderstanding or misoperation of this unit.
In addition, recognize this measurement contains high frequency components.
Note the followings for better measurement result.

1. Cable Locations
   Because the Noise and Ripple contains High Frequency Component, they can radiate and be induced among circuit lines. So Measured Noise and Ripple Data may differ due to the cabling.

2. Termination
   As RM-104 contains 50Ω input terminator, it is not required to use 50Ω external terminator.

3. The Max, Input Voltage of RM-104 is ± 500 V.
   If you apply more than ± 500 V, it may damage RM-104.

4. Measured data may change due to cabling conditions.
   We recommend to use attached Differential Cable, DP-100 as the input cable as DP-100 can reduce Common Mode Noise as much as 40 dB up to 100 MHz. Otherwise 50 Ω Coaxial Cable (One cable is attached to RM-104) should be used as input cable since signal loss is minimal.

5. Measured Ripple Data usually changes due to PIPPLE RATIO Setup.
   Refer to "Chapter 12 HOW TO SEPARATE p-p RIPPLE FORM p-p NOISE

# Chapter 2.   FEATURES

1. In addition to DC Output Voltage, following Items can be measured as the Digital Data.

   Test Items
   1) Ripple & Noise voltage (A)
   2) Ripple voltage (B)
   3) Noise voltage (C)
   4) Switching Ripple voltage (D)
   5) AC Ripple voltage (E)
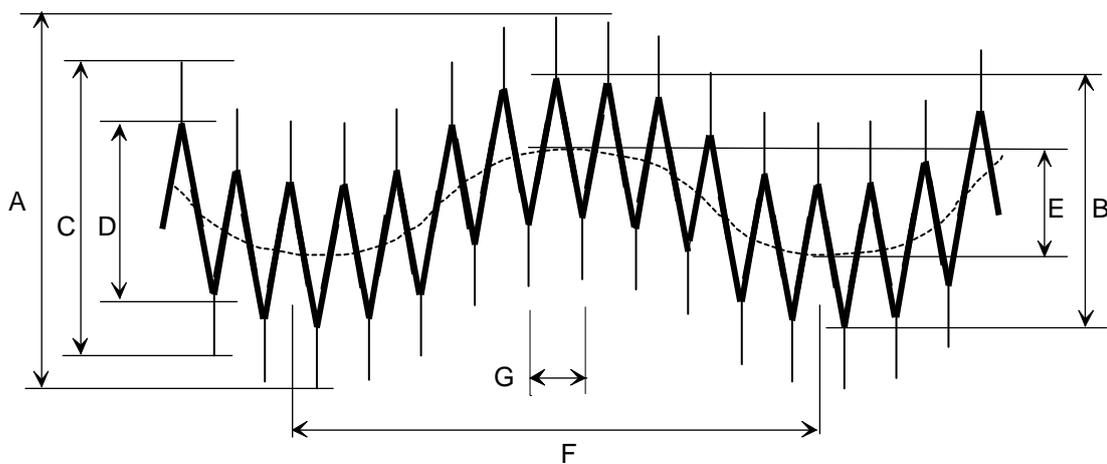


**Typical sample of output waveform for switching power supplies**

   A : Ripple & Noise voltage (LF + HF, NOISE)
   B : Ripple voltage (LF + HF, RIPPLE)
   C : Noise voltage (HF, NOISE)
   D : Switching Ripple voltage (HF, RIPPLE)
   E : AC Ripple voltage (LF,RIPPLE)
   F : Input voltage period
   G : Switching cycle period

   * The parentheses ( ) indicate the setups of FILTER and MODE.

2. Ripple Ratio Setup Capability.
   With this feature, you can measure Ripple voltage, AC Ripple voltage or Switching Ripple voltage accurately and speedy manner. Compared with the Measurement with Oscilloscope, there are following benefits:

   <Benefits>
   1) Reduction of human error
      Because of there is no Human judgment factor when you measure Noise voltage and/or Ripple voltage by RM-104. It is common to measure with an oscilloscope, but reading error cannot be avoided.

   2) All Measured data are Digital
      So you can read back measured data, judge and/or save them by GP-IB Control, which means that Automatic Test can be done without an Operator who should read measured data in the production line etc.

3. Judge Function
RM-104 can judge the measured data by setting upper/lower limits. After the data judgment, you can easily recognize the result by just checking the display on Front Panel as follows;

LOW: Lit when measured data is less than Lower limit (FAIL)
MID: Lit when measured data is between Lower and Higher limits (PASS)
HIGH: Lit when measured data is higher than Upper limit (FAIL)

This is especially effective for Off Line operation on the production Line.

4. Input terminal expansion function
By connecting the SC-83 (option), you can add up to 16 input BNC terminals for measuring voltage and ripple noise voltage. (For details, refer to the SC-83 User Manual.)
From the OUTPORT terminal of the RM-104, it is possible to control the upper and lower limit determination of voltage, measurement result output, terminal switching, etc. by the GP-IB with the added BNC terminal.

Connection example for adding up to 16ch



(1) BNC-BNC cable (accessory of SC-83)
(2) RMSC-10 (option) Connection cable connecting RM-104 and SC-83
(3) SCSC-05 (option) Connection cable connecting SC-83 and SC-83

With these cables, you can select channel by either Manual or GP-IB control to RM-104.

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■**Note**    When measuring 8CH or more input channels.

◆    Connect two SC-83s in cascade.

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■**Note**    Compatibility of SC-83

◆    SC-83 is the successor to SC-82 and is compatible.

# Chapter 3.　Preparation for use

## Cautions on Usage

(1) Remove a Cover
Because of High Voltage applied inside, do not remove the cover of RM-104.

(2) Gas Environment
For the safety reason, do not use RM-104 in such Environments as more explosive or corrosive gas exists than it does contain in normal circumstances.

(3) Overload Voltage
Do not apply over voltage beyond specification to all connectors and input terminals of RM-104.

(4) Usage under strong Electric Magnetic Filed
Usage under strong Electric Magnetic Filed would affect the measurement result. Because noise induces by such field may be added to input signal or RM-104.

(5) Installation
No other goods are allowed to stack on RM-104. Do not place any cups or cans filled with liquid near RM-104.

(6) Connection with Peripheral Equipment
Never fail to power off RM-104 and peripheral equipment before you connect between or among them.

(7) BNC connector
Handle the BNC connector carefully as it is easily damaged.

## Power Line

1. Check Input Power Line if it should meet specification of RM-104, AC 85 V to AC 264 V 50/60 Hz, and Consumption Power is 30 VA.

2. Use three line type Power Cable which is suitable for your own country's safety standard. And connect power cable to 3 pin type outlet without fail, because RM-104 is designed that one of three lines is reserved as ground line to provide grounding via by using three line type Power Cable to avoid electrification. Even In case 2pin-3pin conversion plug is used with a Power Cable, make sure to connect the ground line to ground. No heavy goods on the cable is allowed and No Stamping the cable.
Install this product to be able to easily remove the AC power cord set from the inlet.

⚠ **Warning**　**Risk of electric shock.**

◆　Use a power cable that conforms to the safety standards of your country.
◆　Before connecting the power cable, turn off the POWER switch.
◆　Use a 3-pin plug connector to prevent the risk of electric leakage.
◆　Be sure to use an outlet with a ground terminal.
◆　Make sure that the power supply wiring and ground are connected correctly.

# Input Cable

As Input Cable of RM-104, use attached Differential Probe (DP-100) or 50 Ω Coaxial Cable.

1. Do not touch BNC Connector portion or connect/disconnect (attached)
   Differential Cable while the Differential Cable is connected with Power Supply to avoid risk of Electrification which would be very dangerous.

2. When using coaxial cables other than accessories, the metal part of the BNC connector may be exposed. Do not touch the connector or do not connect or disconnect the connector while connected to the DUT. There is a risk of electric shock and it is very dangerous.

| ⚠️ Warning | Risk of electric shock. |
|---|---|

   ◆ Before connecting the power cable, turn off the POWER switch.
   ◆ Use a 3-pin plug connector to prevent the risk of electric leakage.
   ◆ Be sure to use an outlet with a ground terminal.
   ◆ Make sure that the power supply wiring and ground are connected correctly.

# Chapter 4. FRONT & REAR PANEL

## Front Panel
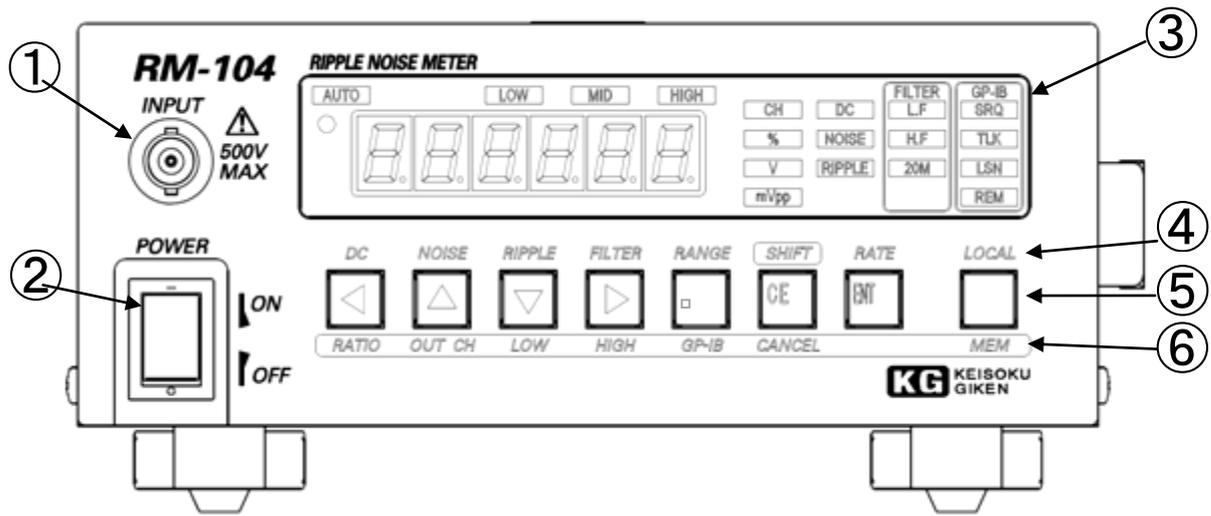


### ① INPUT CONNECTOR

This is an Input Connector for Signal Measurement from D.U.T. Use attached DP-100, Differential Probe, to connect this input connector. Otherwise, 50 Ω coaxial cable should be used. You don't have to connect 50 Ω terminator before this connector, because the line is already terminated inside RM-104 for High Frequency Range.

| ■Note | BNC connector mounting position for input |
| --- | --- |

◆ You can select another Input Connector located on REAR Panel as the signal Input, but this should be advised us in purchasing. (Factory Option)

| ⚠ **Warning** | **Risk of electric shock.** |
| --- | --- |

◆ Do not apply any Voltage more than max, rated ±500 V to INPUT Terminal.
◆ Because it would cause damage equipment and/or electric shock etc.
When you, however, use attached Differential Probe, DP-100, the max input Voltage is ±200 V. So do not apply more than ±200 V them.
◆ Do not touch a portion of BNC Connector or attach/detach the Connector while the probe is connected with U.U.T.
Because it would be very dangerous for electric shock.
◆ Handle the BNC connector carefully as it is fragile.

## ② POWER SWITCH

This is the Power Switch to Power ON/OFF RM-104.

## ③ INDICATION
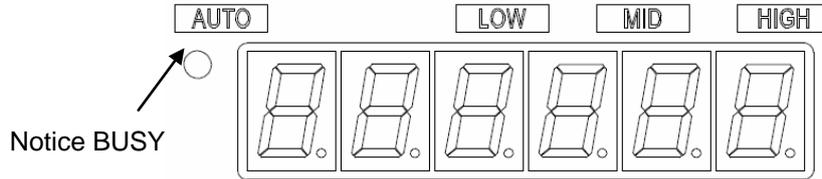


### AUTO

This "AUTO" Indicator is turned on when auto range is selected.

### BUSY

The indicator blinks when continuing measurement.
When in SLOW mode, it blinks slowly. (Factory setting is FAST measurement)

### LOW/MID/HIGH

Test Result can be judged (PASS or FAIL) as follows:

| | |
|---|---|
| LOW | : This indicator is ON when the Measured data is less than Lower Limit. (Lower FAIL) |
| MID | : This indicator is ON when the Measured data is between Lower and Upper Limits. (PASS) |
| HIGH | : This indicator is ON when the Measured data is more than Higher Limit. (Higher FAIL) |
| Note | 1: To utilize these indicators, you have to setup Upper and/or Lower Limit(s) of the corresponding Measurement mode before measuring data. (Ex. You have to setup Lower and/or Upper Limit(s) of Noise Measurement before executing judgment of Noise Measurement.)<br><br>2: Upper and Lower Limits can be setup independently for following there (3) testing items.<br>a) DC Output Voltage Measurement(*1,*2)<br>b) Noise Voltage Measurement(*1,*2)<br>c) Ripple Voltage Measurement(*1,*2)<br>* 1: It doesn't matter which Filters are selected Filters.<br>* 2: To execute judgment, you have to setup these Limits in advance. |

### SEGMENT of the LED (Seven Segment LED)

Measured data or Setup Parameters are displayed on these LED's.
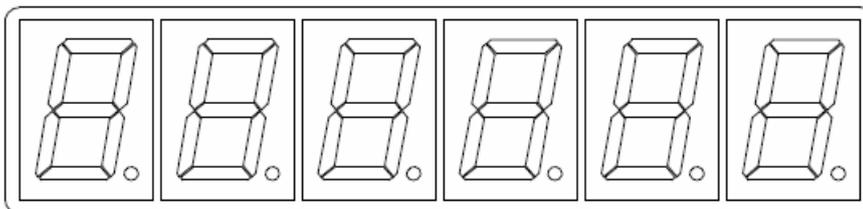
## UNIT DISPLAY

The Unit which corresponds to the measurement items are displayed.

CH : This indicator is ON when the channel is selected through the Output Port of RM-104.
% : This indicator is ON when Ripple Ratio is being setup.
V : This indicator is ON when DC Voltage is being setup.
mVpp : This indicator ON when Ripple or Noise is being measured.
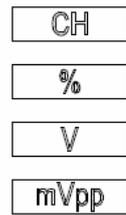
## MEASUREMENT MODE DISPLAY

The indicator of MEASUREMENT MODE is ON as follows:

DC : This indicator lit when in DC Voltage Measurement.
NOISE : This indicator lit when in Noise Measurement.
RIPPLE : This indicator lit when in Ripple Measurement.

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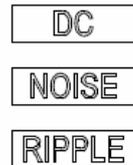
■Note    Press and hold the mode button to enter measurement mode.

◆ By holding down one of the measurement mode buttons, the RM-104 goes into measurement mode, addition computation 1/2 of the ripple noise voltage measurement results to the DC measurement results. In this case, DC indication and NOISE or RIPPLE indication are simultaneously displayed, and the unit is "V".

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## FILTER

The indicator of selected filter(s) is ON when Noise or
Ripple measurement is being selected or executed as follows:

L.F : Low Pass Filter 50 kHz~2 kHz
H.F : High Pass Filter 2 kHz~100 MHz
20 MHz : 20 MHz of Low Pass Filter

## GP-IB

The status of GP-IB is Displayed.

SRQ : Turns ON when SRQ mode
TLK : Turns ON when Data is sending
LSN : Turns ON when Data is Receiving
REM : Turns ON when keep on pushing mode

#### ④ KEY LAVEL 1 (Measurement Mode)

These Labels are effective when corresponding SELECT KEY is pushed. (except " SHIFT" and "Local" Key)
* Details are described in "Chapter 5. FUNCTION of PANEL KEYS".

| DC | NOISE | RIPPLE | FILTER | RANGE | SHIFT | RATE | LOCAL |
|----|-------|--------|--------|-------|-------|------|-------|
| ◁ | △ | ▽ | ▷ | □ | CE | ENT | |

#### ⑤ SELECTION KEYS

These KEYS are for changing Parameters.
The functions written on the KEYS are effective when Parameters or Input mode are entered.

* Details are described in "Chapter 5. FUNCTION of PANEL KEYS".

| ◁ | △ | ▽ | ▷ | □ | CE | ENT | |
|----|----|----|----|----|----|-----|--|
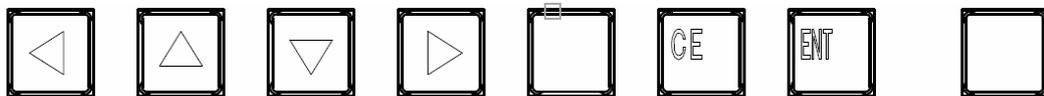
#### ⑥ KEY LABEL 2 (SHIFT MODE)

These Labels are effective when SHIFT KEY is pushing first then corresponding SELECT KEY is pushed.
* Details are described in "Chapter 5. FUNCTION of PANEL KEYS".

| ◁ | △ | ▽ | ▷ | □ | CE | ENT | |
|----|----|----|----|----|----|-----|--|
| RATIO | OUT CH | LOW | HIGH | GP-IB | CANCEL | | MEM |

# Rear Panel View



MAC address (LAN option)

⑦ INPUT 500V MAX

LAN
MAC Address 00-80-A3-CF-ED-A9

OUT PORT

~LINE 100-240V 50/60Hz 30VA MAX

USB

検査合格証 CERTIFICATE KG KEISOKU GIKEN

GP-IB

RM-104  バーコード S/N: 00000000

MADE IN JAPAN

CE

Inspection certified

Serial number
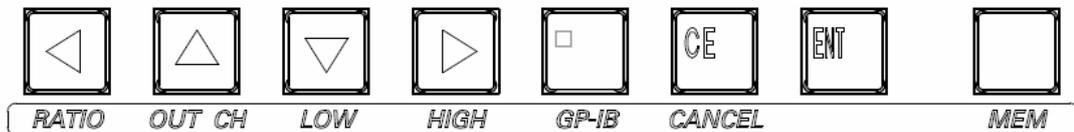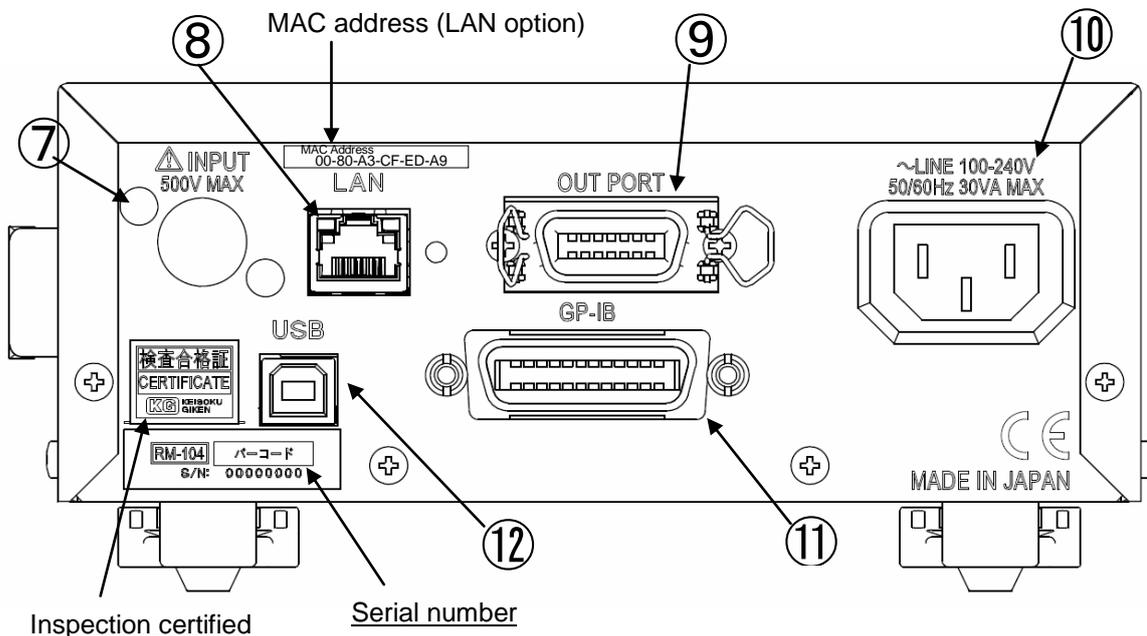
## ⑦ INPUT CONNECTOR (Factory Option)

The input connector on the front panel can be relocated to rear panel on order at the time of ordering. (Factory option only)

## ⑧ LAN (Factory Option)

The LAN terminal is a factory option.
* Refer to "Chapter 11. Ethernet (LAN) Interface".

## ⑨ OUT PORT

This Output Port has Photo Coupler type Inputs and Outputs which are for controlling external equipment(s) such as SC-83, our Eight (8) Channel Scanner, by which as many as Eight (8) or Sixteen (16) channel,(*1) of inputs for DCV, p-p Noise or p-p Ripple Measurement can be switched from RM-104 by GP-IB. Besides, there are "HIGH", "MID" and "LOW" judgments Output of Measurement, "BUSY" output which outputs when a command is executing, and "START" Trigger Input.
(*1)It requires two sets of SC-83 to select from more than Eight (8) up to Sixteen (16) Channel, of Inputs.
* Refer to "Chapter 8. OUT PORT Connector" for Pin Location and actual Circuit Diagram of this Output Port.

## ⑩ AC100 ~ 240V

This is AC inlet. The Input Voltage Range is from AC 85 V to AC 264 V.

## ⑪ GP-IB

GP-IB interface is standard equipment. GP-IB allows you to set various measurement functions, set measurement parameters, and read measurement data.
* Refer to "Chapter 7. GP-IB OPERATION".

## ⑫ USB

The USB interface is standard equipment.
* Refer to "Chapter 10. USB Interface".

# Chapter 5.   FUNCTION of PANEL KEYS

Each Key on the front Panel of RM-104 has different Function which is depending upon the following Modes.

## Type of MODES

### 1) Meas Mode (Measurement Mode)
After Power ON RM-104, it is automatically in Meas Mode.
If the some figures are displayed, without blinking, it is in Meas Mode.

**<How to change to other Modes>**
From Shift Mode →Push [SHIFT/CE/CANCEL] key
From Setup Mode →Push [SHIFT/CE/CANCEL] key
From keep on Pushing Mode of [RATE/ENT] key → Push [RATE/ENT] key to hear a
beep.
From keep on Pushing Mode of [NOISE] or [RIPPLE] key → Push [NOISE] key etc

### 2) Shift Mode

**<How do you know?>**
If the Five small zeros are displayed as 00000, it is in Shift Mode.

**<How to change from other Modes>**
From Meas Mode → Push [SHIFT/CE/CANCEL] key
From Setup Mode → Push [SHIFT/CE/CANCEL] key twice
From keep on Pushing Mode of [RATE/ENT] key → Push [RATE/ENT] key to hear a
beep and push [SHIFT/CE/CANCEL] key.
From keep on Pushing Mode of [NOISE] or [RIPPLE] key → Push [NOISE] key etc and
push [SHIFT/CE/CANCEL] key.

### 3) Setup Mode

**<How do you know?>**
If the one figure is turning On and Off, it is in Setup Mode.

**<How to change from other Modes>**
From Meas Mode → Push [SHIFT/CE/CANCEL] key and push [DC/←/RATIO] key etc
From Shift Mode → Push [DC/←/RATIO] key etc
From keep on Pushing Mode of [RATE/ENT] key → Push [RATE/ENT] key to hear a
beep and push [SHIFT/CE/CANCEL] key
then push [DC/←/RATIO] key etc
From keep on Pushing Mode of [NOISE] or [RIPPLE] key → Push [NOISE] key etc and
push [SHIFT/CE/CANCEL] key then push
[DC/←/RATIO] key etc.

### 4) Keep on Pushing Mode

**<How do you know?>**
There three (3) types of Keep on Pushing Modes available.

**<How to change>**
When you are in Meas Mode then push [NOISE], [RIPPLE] or [RATE] key for about one second till you hear a beep.

# Function of Each key

## [DC/◀/RATIO]

| DC ◀ RATIO | Meas Mode | When this "DC" key is pushed in Meas Mode, you can measure DC Voltage in Auto Range. |
|---|---|---|
| | Shift Mode | When this "RATIO" key is pushed in Shift mode, it is ready to setup "Ripple Ratio". |
| | Setup Mode | When this "←" key is pushed in Setup Mode, you can shift to the Left the digit to edit. |

## [NOISE/▲/OUT CH]

| NOISE ▲ OUT CH | Meas Mode | When this "NOISE" key is push in Meas Mode, you can measure Noise in Auto Range. |
|---|---|---|
| | Shift Mode | When this "OUT CH" key is pushed in Shift Mode, it is ready to select Output Channel when you use SC-83, 8 ch Input Scanner. |
| | Setup Mode | When this "↑" key is pushed in setup Mode, you can increase the number to setup. |
| | Keep on Pushing Mode | When this "NOISE" key is pushed till you hear a beep, you can measure the data of {DC Volt. + (Noise Volt.)/2}. |

## [RIPPLE/▼/LOW]

| RIPPLE ▼ LOW | Meas Mode | When this "RIPPLE" key is pushed in Meas Mode, you can measure Ripple in Auto Range. |
|---|---|---|
| | Shift Mode | When this "LOW" key is pushed in Shift Mode, it is ready to input Low Limit for GO/NG Judgment. |
| | Setup Mode | When this "↓" key is pushed in setup Mode, you can decrease the number to setup. |
| | Keep on Pushing Mode | When this "RIPPLE" key this pushed till you hear a beep, you can measure the data of {DC Volt. + (Ripple Volt.)/2}. |

## [FILTER/▶/HIGH]

| | | |
|---|---|---|
| FILTER<br>▶<br>HIGH | Meas Mode | When this "FILTER" key is pushed in Meas Mode, you can Select the Combination of Filters, L.P.F., H.P.F., and 20MHz Filter all of which are inside RM-104 as follows.<br>THRU → 20MHz → HPF → HPF + 20MHz → LPF → LPF + HPF → LPF + HPF + 20MHz → THRU.<br><br><br>Filter characteristics |
| | Shift Mode | When this "HIGH" key is pushed in Shift Mode, it is ready to input HIGH Limit for GO/NG Judgment. |
| | Setup Mode | When this "→" key is pushed in setup Mode, you can shift to the Right the digit to edit. |
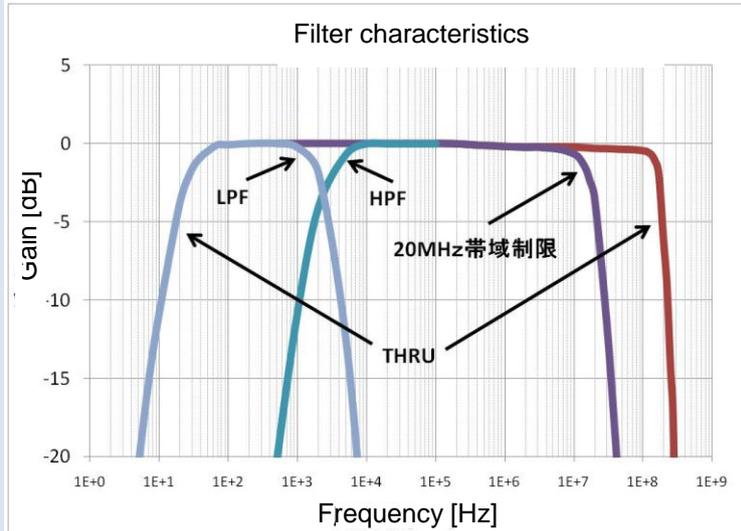
## [RANGE/./GP-IB]

| | | |
|---|---|---|
| RANGE<br>■<br>GP-IB | Meas Mode | When this "RANGE" key is pushed in Meas Mode, you can change the Measurement Range for DC Volt., Ripple, Ripple Noise Measurement. |
| | Shift Mode | When this "GP-IB" key is pushed in Shift Mode, it is ready to setup both GP-IB Address and its Delimiter. |
| | Setup Mode | When this " . " key pushed in setup Mode, you can shift the Decimal Point to the digit which may be selected by "→" or "←" key, if it is available.<br>GP-IB Address (0~30)<br>Delimiter 0 : CR + LF<br>1 : CR<br>2 : LF<br>3 : EOI<br>Push "SHIFT" key and followed by "GP-IB" key, then you can input GP-IB Address. At that time, displayed is "GP00.0", where GP-IB Address is displayed in upper two (2) digit, while figure of under decimal indicates type of delimiter. Enter GP-IB address by using arrow keys and press [ENT]to fix.<br>To save the setting, push [MEM] after pushing [SHIFT] then push [ENTER] key.<br><br>It will beep when completed to same in the memory. |

## [SHIFT/CE/CANCEL]

| | | |
|---|---|---|
| SHIFT<br><br>**CE**<br><br>CANCEL | Meas Mode | When this "SHIFT" key is pushed in Meas Mode, you can change into Shift Mode. |
| | Shift Mode | When this "CANCEL" key is pushed in Shift Mode, you can exit Shift Mode and back to Meas Mode. |
| | Setup Mode | When this "CANCEL" key is pushed in setup Mode, you can Cancel the Setup you have made before. To setup, you have to push "ENT" key. |
| | Keep on Pushing Mode | When this "ENT" key is pushed till you hear a beep, you can select AC Input Frequency either 50Hz or 60Hz. This setup to AC Input Frequency would increase the accuracy of the Measurement of RM-104. |

## [RATE/ENT]

| | | |
|---|---|---|
| RATE<br><br>**ENT** | Meas Mode | When this "ENT" key is pushed in Meas Mode, the measurement speed will be switched.<br>(During DC voltage measurement) |
| | Shift Mode | When this "ENT" key is pushed in Shift Mode, you can exit Shift Mode and back to Meas Mode. |
| | Setup Mode | When this "ENT" key is pushed in Setup Mode, you can Setup Conditions you have input before. |
| | Keep on Pushing Mode | When this "ENT" key is pushed till you hear a beep, you can measure DC Volt, with Trigger Input which should be input to OUT PORT of RM-104 or you push the one of the following keys.<br>[DC/←/RATIO], [NOISE/↑/OUT CH], [RIPPLE/↓/LOW]<br>To Exit, push [RATE/ENT] key again. |

## [LOCAL/MEM]

| | | |
|---|---|---|
| LOCAL<br><br><br><br>MEM | Meas Mode | When this "LOCAL" key is pushed during in GP-IB Remote Condition, you can Exit GP-IB Remote and change into Local Mode. |
| | Shift Mode | When this "MEM" key is pushed in Shift Mode, you can Store all the setup Meas, Function and Parameters into the Back up Memory inside RM-104.<br>When the save is confirmed by pressing the [ENT] key, a beep sounds. |
| | Default mode | When this "MEM" key is pushed twice in Shift mode, "DEF?" is displayed and preparations are made to return to the factory shipment state. When the "ENT" key is pushed, it turns to defaults (factory) setting. |
| | Default mode Cancel | When this "MEM" key is pushed twice in Shift mode, "DEF?" is displayed and preparations are made to return to the factory shipment state. When the "CE" key is pushed, it defaults mode is canceled. |

# Chapter 6.    Basic OPERATION

Operation bases on the Function are described here.

## Power ON and Initialization

When you Power on, RM-104 starts Initialization, reads setting parameters from the Backup Memory, and displays the following status.

    (1) Frequency Setup of AC Input        e.g. 50H (Hz)
    (2) Setup of OUT PORT CH             e.g. 00 (CH.)
    (3) GP-IB Address and Delimiter Type  e.g. GP01.0
    (4) Ripple Ratio                    e.g. 02.0 (%)

Then RM-104 can start measuring according to the contents of backup Memory.

---

■**Note**      Register the setting parameters in memory.

---

◆ To register setting parameters in memory, push [SHIFT / CE / CANCEL] key and then push [LOCAL / MEM] key from measurement mode.
◆ If the settings are saved in memory, the memory contents will not be erased even if the power is turned "OFF".

## Over Range Display

- In the fixed range mode, if an Input Signal is out of Measurement Range, RM-104 displays "Over".

- In auto range mode, it does not display unless the maximum measurement voltage in each measurement range mode is exceeded.

# Shift Mode

In Shift Mode, you can select one of the following Items to go to Setup Mode and then you can setup each of the condition From Shift Mode. (displays "oooooo")

Keys to set Conditions

| | |
|---|---|
| [DC/←/RATIO] | Ripple Ratio |
| [NOISE/↑/OUT CH] | OUTPUT PORT channel setting |
| [RIPPLE/↓/LOW] | LOWER LIMIT (*) of GO/NG judgment |
| [FILTER/→/HIGH] | HIGHER LIMIT (*) of GO/NG judgment |
| [RANGE/./GP-IB] | GP-IB Address and Delimiter |
| [LOCAL/MEM] | Register in the backup memory |

■**Note**     GO / NG judgment function setting (*)

◆ LOWER (*) and HIGHER LIMITS (*) can be setup for DC Volt., Ripple and Noise measurements independently.

### <How to setup>

1. Select the Digit to be Edited
   After any of the above key is pushed, you will find a Digit which turns ON and OFF. It is exact a Digit you can change figure by [DC/←/RATIO] or [FILTER/→/HIGH] key.
   To Shift the digit to be Edited, Push [DC/←/RATIO] or [FILTER/→/HIGH] key.
   If you would like to Shift the Decimal Point, Move the Digit which turns ON and OFF by pushing [DC/←/RATIO] or [FILTER/→/HIGH] key, then push and [RANGE/./GP-IB] key to shift the point.

2. Setup the Parameter
   To Change/Parameter, Push [NOISE/↑/OUT CH] or [RIPPLE/↓/LOW] key to setup.
   Then, push [RATE/ENT] key to activate the setup condition.
   If you would like to Cancel the Setup, push [SHIFT/CE/CANCEL] key.

3. Save the Setup information into Backup Memory
   Setup Conditions are eliminated when you power OFF RM-104 unless you saved the Setup conditions.
   Push [SHIFT/CE/CANCEL] and then push [LOCAL/MEM] key. If you hear a beep at this time, the settings are saved. Once the Setup Conditions is saved, it won't be eliminated if you power OFF the RM-104.

# Long-Press Mode

When you push following keys till you hear a beep, you are in the Long-Press Mode.
In Long-Press Mode, RM-104 can measure and display following;

1. Push [NOISE/↑/OUT CH] till you hear a beep, then RM-104 measures {DC Volt. + (Noise Volt.)/2}. Switching sound of the relay is heard from inside the equipment.
   * Both "DC" and "NOISE" LUNPS are turns ON. To Exit push [NOISE/↑/OUT CH] key again.

2. Push [RIPPLE/↓/LOW] till you hear a beep, then RM-104 measures {DC Volt. + (Ripple Volt.)/2}. Switching sound of the relay is heard from inside the equipment.
   * Both "DC" and "NOISE" LUNPS are turns ON. To Exit push [RIPPLE/↓/LOW] key again.

3. Push [SHIFT/CE/CANCEL] to Select AC Input Frequency to select 50 or 60Hz, push [NOISE/↑/OUT CH] or [RIPPLE/↓/LOW] key.
   To activate this Setup, push [RATE/ENT] key to cancel this setup, push [SHIFT/CE/CANCEL] key.

4. Push [RATE/ENT] to Set Trigger Condition.
   After this key is pushed, then you push following key to select measurement item.

   | Key to push: | Measurement Item: |
   |---|---|
   | [DC/←/RATIO] | DC Volt. |
   | [NOISE/↑/OUT CH] | Noise |
   | [RIPPLE/ ↓/LOW] | Ripple |

   To go back Meas Mode, push [RATE/ENT] key again.

# DC Volt. Measurement

**\<How to start Measurement\>**
To start DC Volt. Measurement, from Meas Mode, push [DC/←/RATIO] key.

**\<How to select Range\>**
RM-104 has three (3) Ranges for DC Volt. Measurement.
When you push [DC/←/RATIO] key, then RM-104 Measures in AUTO Range.
If you would like to Change/Select Ranges, push [RANGE/./GP-IB] key to change.

■**Note**    In case of Over Range

◆    In case of Over Range, "OVER" will be displayed.

### <How to Change Measurement Speed>

RM-104 has two Measurement Speeds available. You can select either of them to suit your DUT. To select, just push [RATE/ENT] key in a sort period.

A "FAST" and "SLOW" mode comes up alternately.

■**Note**     When you long-Press till you hear a beep.

◆     If you Long-Press it till you hear a beep, you are in Wait to Trigger condition. To go back push [RATE/ENT] till you hear a beep again.

### <How to set WAIT TRIGGER Condition>

To set Wait Trigger, long-press [RATE/ENT] till you hear a beep.

To Trigger, just push [RATE/ENT] key in a sort period or input Start Trigger Signal into OUT PORT. (*)

To exit to Meas Mode, long-press [RATE/ENT] again till you hear a beep.

■**Note**     Confirm the Pin Location of OUT POR and the timing chart.

◆     (*) Pin Location of OUT PORT and Required Waveform are described in "Chapter 8 OUT PORT Connector".

### <What is LOW/HIGH LIMITS?>

RM-104 has a Capability to judge the Measurement Result by LOW and HIGH LIMITS and display the Result by turning ON the one of the following Indicators on the RM-104 and also output Signal from the OUT PORT(*) of RM-104.

| Lit Indicator: | Result: |
|---|---|
| LOW (in Red) | Measured Data < LOWER LIMIT |
| MID (in Green) | L.L=< Measured Data =< H.L |
| HIGH (in Red) | HIGHER LIMIT < Measured Data |

■**Note**     Confirm the Pin Location of OUT POR and the timing chart.

◆     (*) Pin Location of OUT PORT and Required Waveform are described in "Chapter 8 OUT PORT Connector".

### <How to Setup LOW/HIGH LIMITS>

To setup, from Meas Mode of DC Volt., push [SHIFT/CE/CANCEL] key and then push following keys.

| Key to select: | Applied Limit: |
|---|---|
| [RIPPLE/ ↓ /LOW] | LOW LIMIT |
| [FILTER/→/HIGH] | HIGH LIMIT |

Then you can setup by pushing following keys.

| Key to select: | Functions: |
|---|---|
| [DC/←/RATIO] | Shift the Digit to be edited to the Left. |
| [NOISE/↑/OUT CH] | Increase the Figure. |
| [RIPPLE/ ↓/LOW] | Decrease the Figure. |
| [FILTER/→/HIGH] | Shift the Digit to be edited to the Right. |
| [RANGE/./GP-IB] | Shift the Decimal Point to Confirm, push [RATE/ENT] key. |
| [SHIFT/CE/CANCEL] | Cancel the setting |

# Noise Voltage Measurement

### <How to start Measurement>

To start Noise Measurement, from Meas Mode, push [NOISE/↑/OUT CH] key.

### <How to select Ranges>

RM-104 has Two (2) Range for Noise Measurement.
When you push [NOISE/↑/OUT CH] key, then RM-104 Measures in AUTO Range. If you would like to Change /Select Ranges push [RANGE/./GP-IB] key to change.

---

■**Note**    In case of Over Range

---

◆    When in Over Range, "OVER" will be displayed.

---

### <How to set WAIT TRIGGER Condition>

To set Wait Trigger, push [RATE/ENT] till you hear a beep.
To Trigger, just push [RATE/ENT] key in a start period or input Start Trigger Signal into OUT PORT. (*)
To exit to Meas Mode, push [RATE/ENT] again till you hear a beep.

---

■**Note**    To check the Pin Location of OUT POR and the timing chart.

---

◆    (*) Pin Location of OUT PORT and Required Waveform are described in "Chapter 8 OUT PORT Connector".

### <What is LOW/HIGH LIMITS?>

RM-104 has a Capability to judge the Measurement Result with LOW and HIGH LIMITS and its Result by turning ON the one of the following Indicators on the RM-104 and also output Signal from the OUT PORT(*) of RM-104.

Lit Indicator:          Result:
LOW (in Red)            Measured Data < LOWER LIMIT
MID (in Green)          L.L =< Measured Data =< H.L
HIGH (in Red)           HIGHER LIMIT < Measured Data

■**Note**     To check the Pin Location of OUT POR and the timing chart.

◆ (*) Pin Location of OUT PORT and Required Waveform are described in "Chapter 8 OUT PORT Connector".

### <How to Setup LOW/HIGH LIMITS>

To setup, from Meas Mode of Noise, push [SHIFT/CE/CANCEL] key and then push following keys.

Key to select:          Applied Limit:
[RIPPLE/↓/LOW]          LOW LIMIT
[FILTER/→/HIGH]         HIGH LIMIT

Then you can setup by pushing following keys.

Key to select:          Functions:
[DC/←/RATIO]            Shift the Digit to be edited to the Left.
[NOISE/↑/OUT CH]        Increase the Figure.
[RIPPLE/↓/LOW]          Decrease the Figure.
[FILTER/→/HIGH]         Shift the Digit to be edited to the Right.
[RANGE/./GP-IB]         Press [RATE/ENT] key to fix the decimal point.
[SHIFT/CE/CANCEL]       Cancel the setting

### <How to Measure {DC Volt. +(NOISE)/2}>

From Meas Mode, push [NOISE/↑/OUT CH] key till you hear a beep.
To Exit, just push [NOISE/↑/OUT CH] key in a start period.

### <How to select Filters inside RM-104>

Push [FILTER/→/HIGH] key to select Filters.
Applied Filters are indicated on the Front Panel of RM-104.

# Ripple Measurement

### <About RIPPLE RATIO>
* What is RIPPLE RATIO?
  See "Chapter 12 HOW TO SEPARATE p-p RIPPLE FORM p-p NOISE".

* What would be the best RIPPLE RATIO?
  In General, You would like to select Ripple Ratio so that the measured Ripple Data of RM-104 is almost the same as that of an Oscilloscope you use. One of the ways to Select Ripple Ratio is to measure Ripple Data as you change the Ripple Ratio and find the one Ripple Ratio by which you can get the almost same Ripple Value as you measure by an Oscilloscope which should be 100MHz Band Width.
  The other way is that again you Measure the Ripple Data as you change the Ripple Ratio.
  According to the Method of Ripple Measurement of RM-104, you can get the suitable Ripple Ratio. (see "<How to setup RIPPLE RATIO>" in more Detailed) By this Second Method, You can get the suitable Ripple Ratio without an Oscilloscope.

### <How to setup RIPPLE RATIO>
From Meas. mode, push [SHIFT/CE/CANCEL] key and then push [DC/←/RATIO] key. Then you can setup by pushing following keys.

| Keys to select: | Functions: |
|---|---|
| [DC/←/RATIO] | Shift the Digit to be edited to the Left. |
| [NOISE/↑/OUT CH] | Increase the Figure. |
| [RIPPLE/↓/LOW] | Decrease the Figure. |
| [FILTER/→/HIGH] | Shift the Digit to be edited to the Right. |
| [RANGE/./GP-IB] | Press [RATE/ENT] key to fix the decimal point. |
| [SHIFT/CE/CANCEL] | Cancel the setting. |

You can be set in 0.0 % and 50.0 %. (0.5 % Resolution)

■**Note** Ripple voltage measurement when 0.0 % is set

◆ If you set 0.0 %, the Ripple Data would be same as Noise Data.

■**Note** When measurement is not possible due to the test object or other conditions.

◆ There are some possibilities that RM-104 can't select Ripple Ratio by this method due to the D.U.T. and/or some other conditions. In such cases, "Error" is displayed on RM-104.

### <How to start Measurement>

To start Ripple Measurement, from Meas Mode, push [RIPPLE/↓/LOW] key.
When you push [RIPPLE/↓/LOW] key, then RM-104 Measures in AUTO Range.
If you would like to Change/Select Range, push [RANGE/./GP-IB] key to change.

---

■**Note**     In case of Over Range

◆     When in Over Range, "OVER" will be displayed.

---

### <How to set WAIT TRIGGER Condition>

To set Wait Trigger, push [RATE/ENT] key till you hear a beep.
To Trigger, just push [RATE/ENT] key in a sort period or input Start Trigger Signal into OUT PORT. (*)
To exit to Meas Mode, push [RATE/ENT] key again till you hear a beep.

---

■**Note**     To check the Pin Location of OUT POR and the timing chart.

◆     (*) Pin Location of OUT PORT and Required Waveform are described in "Chapter 8 OUT PORT Connector".

---

### <What is LOW/HIGH LIMITS>

RM-104 has a capability to judge the Measurement Result by LOW and HIGH LIMITS and display the Result by turning ON the one of the following Indicators on the RM-104 and also output Signal from the OUT PORT(*) of RM-104.

| Lit Indicator: | Result: |
|---|---|
| LOW (in Red) | Measured Data < LOWER LIMIT |
| MID (in Green) | L.L. =< Measured Data =< H.L |
| HIGH (in Red) | HIGHER LIMIT < Measured Data |

---

■**Note**     Confirm the Pin Location of OUT POR and the timing chart.

◆     (*) Pin Location of OUT PORT and Required Waveform are described in "Chapter 8 OUT PORT Connector".

## \<How to Setup LOW/HIGH LIMIT\>

To set up, from Meas Mode of RIPPLE, push [SHIFT/CE/CANCEL] key and then push following keys.

| Key to select: | Applied Limit: |
|---|---|
| [RIPPLE/↓/LOW] | LOW LIMIT |
| [FILTER/→/HIGH] | HIGH LIMIT |

Then you can setup by pushing following keys.

| Key to select: | Functions: |
|---|---|
| [DC/←/RATIO] | Shift the Digit to be edited to the Left. |
| [NOISE/↑/OUT CH] | Increase the Figure. |
| [RIPPLE/↓/LOW] | Decrease the Figure. |
| [FILTER/→/HIGH] | Shift the Digit to be edited to the Right. |
| [RANGE/./GP-IB] | Shift the Decimal Point to Confirm, push [RATE/ENT] key. |
| [SHIFT/CE/CANCEL] | Cancel the setting |

## \<How to Measure {DC Volt. + (Ripple Volt.)/2}\>

From Meas Mode, push [RIPPLE/↓/LOW] key till you hear a beep.
To Exit, just push [RIPPLE/↓/LOW] key in a sort period.

## \<How to select Filters inside RM-104\>

Push [FILTER/→/HIGH] key to select Filters.
Applied Filters are indicated on the Front Panel of RM-104.
See "3. Feature" for your proper Filter Selection in RM-104.

### Judgment Function

RM-104 can judge the Measure Data and Compare it with both LOW and HIGH LIMIT which you can setup for DC Volt., Noise and Ripple independently.

(Default of LOW LIMIT is zero (0) For Detailed, see "DC Volt. Measurement (P-26)", "Noise Voltage Measurement (P-28)" and "Ripple Measurement (P-30)".)

# Chapter 7.  GP-IB OPERATION

For your Remote Control for RM-104, following GP-IB Commands are supported.

## RM-104 GP-IB Commands

### RM-104  GP-IB Commands

| Command | MEMO | | Function |
|---------|------|--|----------|
| MD0 | Set AUTO Range | | Range Setup and DC Volt, Measurement |
| MD1 | Set 6 V Range | | |
| MD2 | Set 60 V Range | | |
| MD3 | Set 500 V Range | | |
| MN0 | Set AUTO Range | | Range Setup and Noise Measurement |
| MN1 | Set 0.3 V Range | | |
| MN2 | Set 3 V Range | | |
| MR0 | Set AUTO Range | | Range Setup and Ripple Measurement |
| MR1 | Set 0.3 V Range | | |
| MR2 | Set 3 V Range | | |
| @ | Combined Commands | | MD?@MN? { DCV + ( Noise ) / 2 } |
| | | | MD?@MR? { DCV + ( Ripple ) / 2 } |
| MF0 | Free RUN Mode | | Measurement Rate of DC Volt, |
| MF1 | Hold Mode | | |
| MS0 | FAST (One Meas,) | | 50 Hz |
| MS1 | SLOW (Ave. of 3 Meas,) | | 60 Hz |
| HZ0 | 50 Hz | | Sampling Rate of DC Volt, ( Select AC Input Freq, ) |
| HZ1 | 60 Hz | | |
| FL1 | **No Filters** | **LPF/HPF is not used** | Filters setting |
| FL2 | H.P.F | 2 kHz - setting | |
| FL3 | L.P.F | 50 Hz - 2 kHz setting | |
| FL4 | LPF + HPF | (50 Hz - 2 kHz) + (2 kHz -) setting | |
| FH1 | Up to -100 MHz **(20 MHz setting not used)** | | Select Freq, Range |
| FH2 | Up to -20 MHz | | |
| RF0 - RF50 | Fixed Ratio Setup | | 0.5 – 50 % ( 0 %: equivalent to Noise Meas, ) |
| LDxxxx | For DC Volt, Meas, | | Setup LOW LIMIT |
| LNxxxx | For Noise Meas, | | |
| LRxxxx | For Ripple Meas, | | |
| HDxxxx | For DC Volt, Meas, | | Setup HIGH LIMIT |
| HNxxxx | For Noise Meas, | | |
| HRxxxx | For Ripple Meas, | | |
| ON1 - ON4 | 1 bit Set | | Control of Ext, Output |
| OF1 - OF4 | 1 bit Reset | | |
| OB0 - OB15 | 4 bit Se | | |
| T0 | Comma, Space | | ( Response Data of T0 is Space ) Make to Divide Response Data |
| T1 | Comma | | |
| T2 | Space | | |
| S0 | N/A | | Trigger Condition for issuing SRQ |
| S1 | On Finish Measurement | | |
| S2 | On Out of Range | | |
| V | RM-104 Ver X.X | | Respond Version |

# RM-100, RM-101 Compatible Commands

### RM-100, RM-101 Compatible Commands

| Command | MEMO | Function |
|---|---|---|
| M1, D | DC Volt, ( SLOW Mode ) | Select Meas Mode |
| M2 | DC Volt, ( FAST Mode ) | |
| M3, M5 | Ripple Volt, | |
| M4, M6, N | Noise Volt, | |
| R | Ripple ( at 2 % Ripple Ratio ) | |
| X1 | 0.3 V Range | Select Range of Ripple / Noise Meas, |
| X2 | 3.0 V Range | |
| X3 | 60 V Range | Select Range of DC Volt Meas, |
| X4 | 500 V Range | |
| Y0 | Set Auto Range | Setup Meas, Range |
| Y1 | Set Fixed Range | |
| F0 | 50 Hz – 100 MHz setting (THRU) | Select Filters |
| F1 | (LF)+(HF) setting | |
| F2 | 2 kHZ – 100 MHz setting (HF) | |
| F3 | 50 Hz – 2 kHz setting (LF) | |
| R0 - R15 | Set Fixed Ratio | Set at 0 %:noise V, 0-15 %: separation ratio |
| V0, V1 | N/A | Change Version |

■**Note** If you specify old version commands to RM-104

◆ If you specify old version commands to RM-104, RM-104 will be set up automatically the nearest conditions. Commands are compatible.

# RM-104 Multi Line Message

### RM-104 Multi Line Message

| Command | MEMO | Function |
|---|---|---|
| DCL, SDC | Device Clear | Set as the conditions of Power ON, |
| GET | Trigger | Measure in the set mode |
| GTL | GO TO LOCAL | Enable Key Operation |

# RM-104 Status Register

**RM-104 Status Register**

| BIT | Name | Contents |
|-----|------|----------|
| 80 | OVER | Out of Range |
| 40 | SRQ | Service Request |
| 20 | ERR | Command Error |
| 10 | BUSY | Under Command Execution |
| 08 | | |
| 04 | | |
| 02 | | |
| 01 | | |

# CAUTIONS of GP-IB Commands

1) Transmission Buffer of RM-104 is initialized each time a new Command is received.
So when you need the Transmission Data, you have to receive it before you issue the Command.
Once the Data is sent from RM-104, RM-104 initializes the Buffer.

2) If you send/receive of more than 100 Byte, Command Error may occur.
* Please check if a command transaction is finished by BUSY Flag of Status Register.
* Please divide commands so as not to exceed 100 Byte of Transmission Data.

# Chapter 8.    OUT PORT Connector

## Pin Assignment

Suitable Connector : 57-30140 ( DDK )
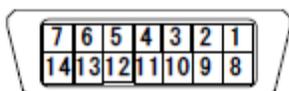
| No | Name | No | Name |
|----|------|----|------|
| 1 | OUT-1H | 8 | OUT-1L |
| 2 | OUT-2H | 9 | OUT-2L |
| 3 | OUT-3H | 10 | OUT-3L |
| 4 | OUT-4H | 11 | OUT-4L |
| 5 | LOW | 12 | START_TRIG ( Input ) |
| 6 | MID | 13 | BUSY |
| 7 | HIGH | 14 | COM |

OUT1~4
Photo Coupler Output

Remote Control

1kΩ

Output Rated : 24V 10mA MAX
Input Rated : 12V 12mA
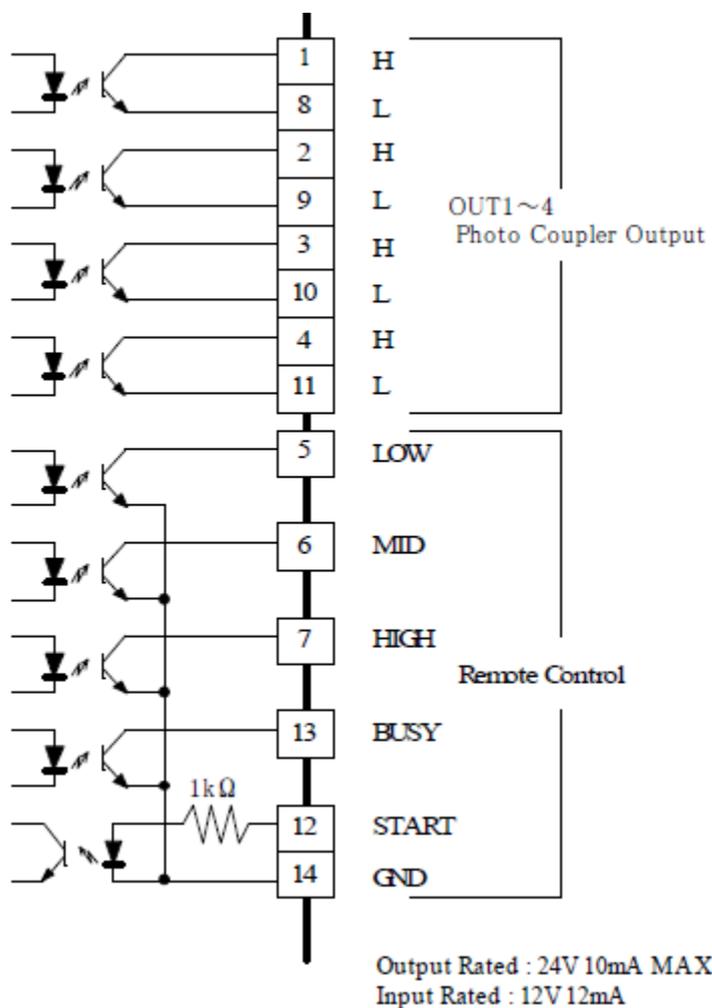
**RM-104 OUT PORT**

# 10.1 Input / Output Waveform

e.x) Following is an example of the sequence which starts from "LOW" (NG) level of Judge Result and through getting "Start Trigger" and then reaches to "MID" (GO) of the Result.

---

■**Note**     About START Pulse

---

◆     START Pulse can start from HIGH to LOW at Input pin of "START TRIG". START Pulse requires more than 10ms for both HIGH and LOW conditions. If you input START pulse during measurement, it can't be accepted.



*1 appro. 5ms
*2 appro. 2ms
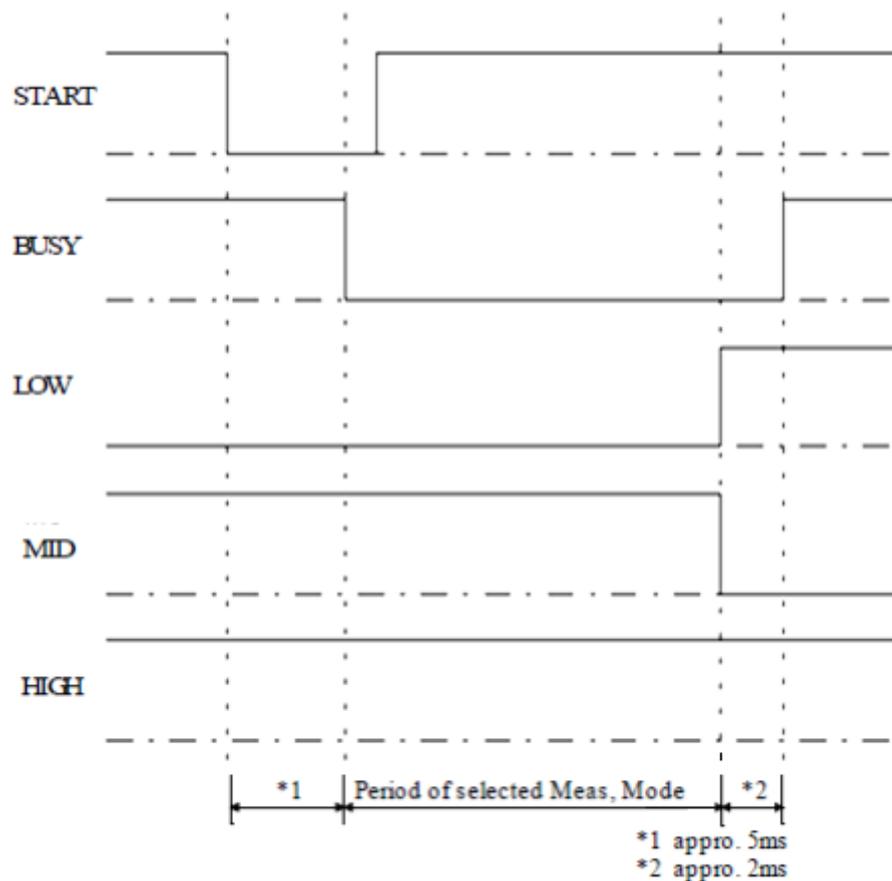
**RM-104 OUT PORT Input and Output sequence**

# Chapter 9.   Controlling SC-83 from RM-104

## GP-IB Commands to Control SC-83 from RM-104

**GP-IB Commands to Control SC-83**

| Select | Command ( 1Biti Set ) | Command ( 4Bit Set ) |
|--------|----------------------|----------------------|
| CH1 | OF1,OF2,OF3,OF4 | OB0 |
| CH2 | ON1,OF2,OF3,OF4 | OB1 |
| CH3 | OF1,ON2,OF3,OF4 | OB2 |
| CH4 | ON1,ON2,OF3,OF4 | OB3 |
| CH5 | OF1,OF2,ON3,OF4 | OB4 |
| CH6 | ON1,OF2,ON3,OF4 | OB5 |
| CH7 | OF1,ON2,ON3,OF4 | OB6 |
| CH8 | ON1,ON2,ON3,OF4 | OB7 |

**■Note**        When controlling with GP-IB command

◆    Set SELECT SW "R2" position when you controlling with the GP-IB Commands.

# Operation of SC-83

(1) Set SELECT SW of SC-83 at "R" position.
(2) Connect (short) B/C Signal on "CONT IN" Connector of SC-83 (See the next section) with Low.

**External Signal Input to Control SC-83**

| Select CH | CONT1(OUT1) | CONT2(OUT2) | CONT3(OUT3) | M/S(OUT4) |
|---|---|---|---|---|
| 1 | High (OFF) | High (OFF) | High (OFF) | High (OFF) |
| 2 | Low (ON) | High (OFF) | High (OFF) | High (OFF) |
| 3 | High (OFF) | Low (ON) | High (OFF) | High (OFF) |
| 4 | Low (ON) | Low (ON) | High (OFF) | High (OFF) |
| 5 | High (OFF) | High (OFF) | Low (ON) | High (OFF) |
| 6 | Low (ON) | High (OFF) | Low (ON) | High (OFF) |
| 7 | High (OFF) | Low (ON) | Low (ON) | High (OFF) |
| 8 | Low (ON) | Low (ON) | Low (ON) | High (OFF) |

■**Note**     For operation of SC-83

◆   For more detailed, see "SC-83 Ripple Noise Scanner" manual.

■**Note**     Compatibility of SC-83

◆   SC-83 is the successor to SC-82 and is compatible.

# Connection Diagram Between RM-104 and SC-83
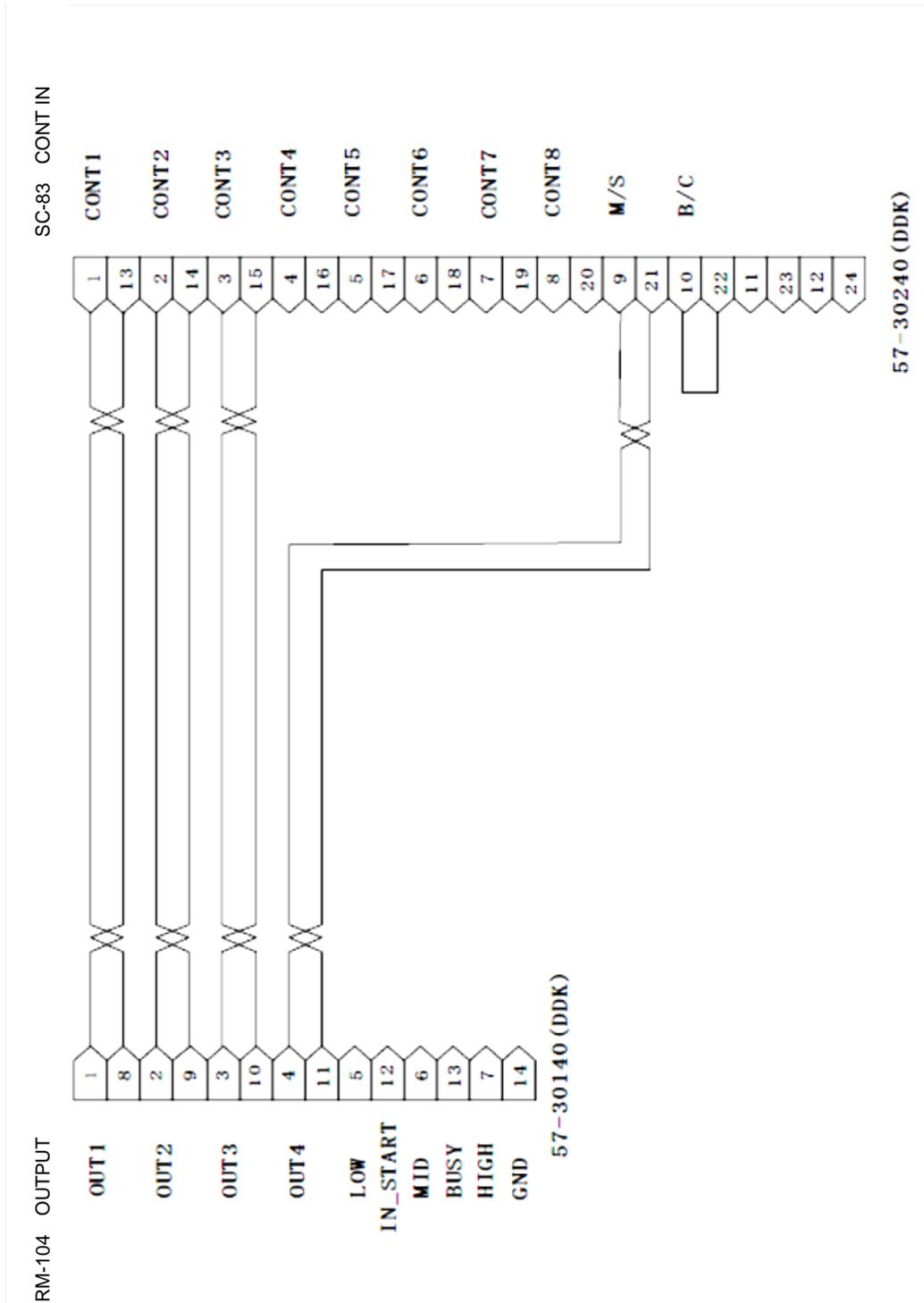


**Connection Diagram Between RM-104 and SC-83**

# Chapter 10. USB Interface

Control this unit using ActiveX from VBA such as Visual Basic, Excel etc. only by connecting with PC with USB interface with USB cable. The command system is similar to the GP-IB interface.

Operating environment
Supported OS: Microsoft Windows 7/ 8 / 8.1 / 10 Japanese 32 Bit / 64 Bit
PC main body: IBM PC / AT compatible machine with USB running the above OS
*   CPU clock 2 GHz or more, memory 4 GB or more recommended
*   Only available for Intel chipset

## USB driver installation procedure

**1.**
Double-click "dpinst.exe" on the attached CD.
　　32 Bit  →　　　　"¥Driver¥KG¥32Bit"
　　64 Bit  →　　　　"¥Driver¥KG¥64Bit"

**2.**
Click "next"

**3.**
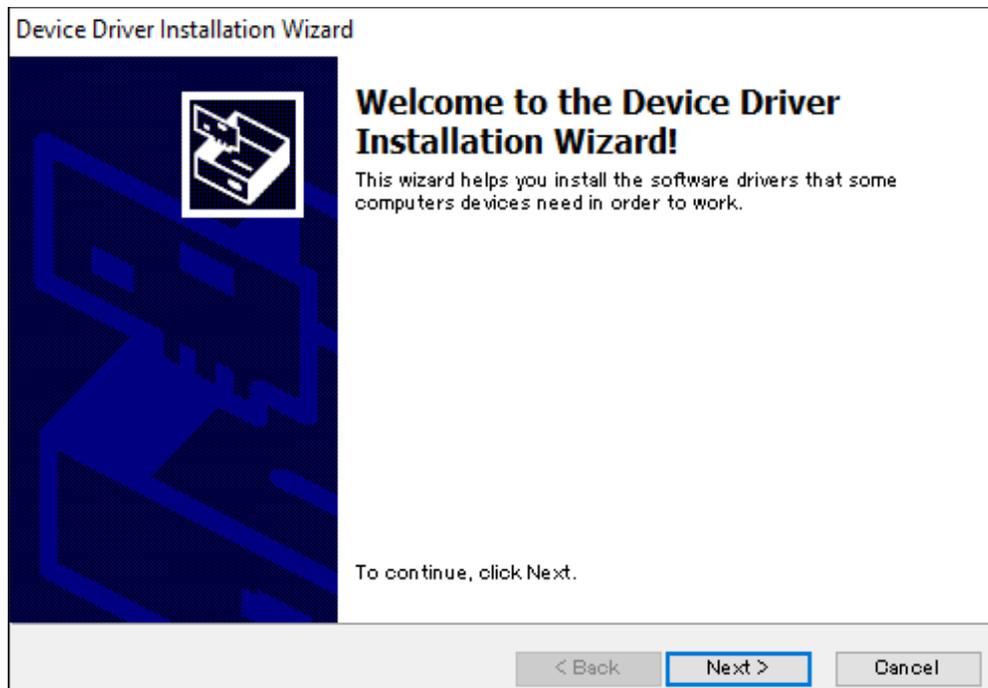
When the following message is displayed, check "Always trust software from "KEISOKU GIKEN CO., LTD."" and click Install".



**4.**

Click "Finish"



**5.**
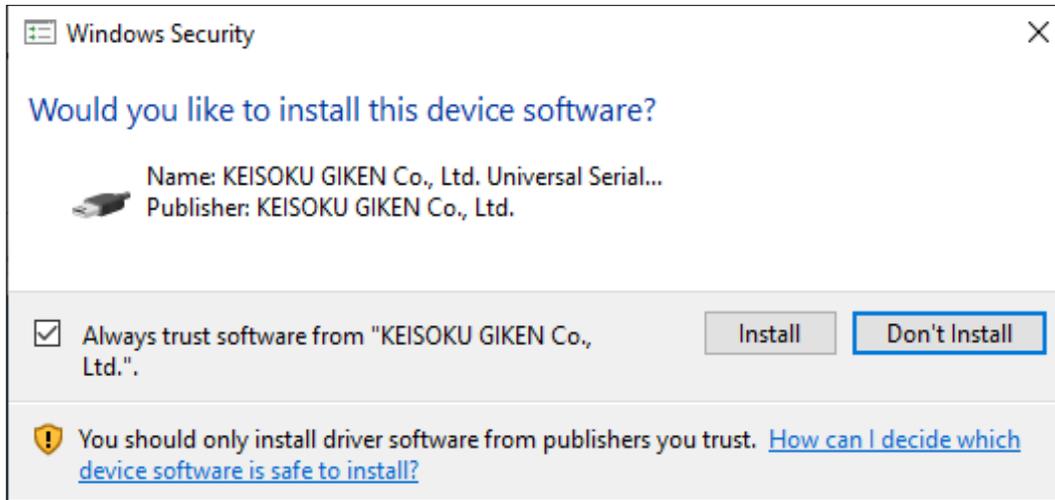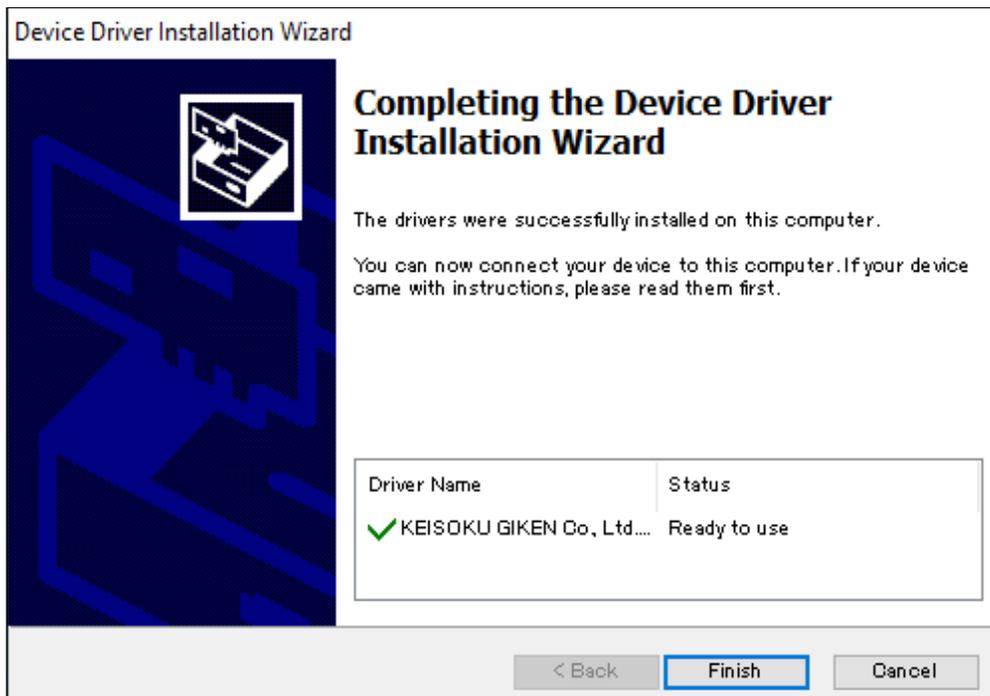
After connecting this product and the PC with the USB cable, installation is completed if it is displayed in the device manager as follows.
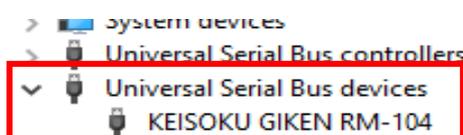
# Install software ActiveX

**1.**

Double-click "RM-104Setup.msi" in ¥Tool on the attached CD to start the setup program.
\*   Installation warning will be displayed from user account control during installation, but please click "Yes" to continue installation.

**2.**

When the following screen is displayed, click "Next>".



**3.**

Select the destination folder. After determining the folder, click "Next>".
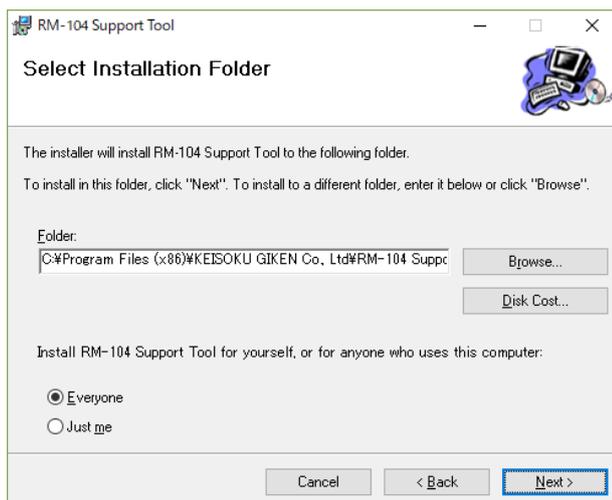
**4.**

The final confirmation screen of installation appears. Click "Next>".
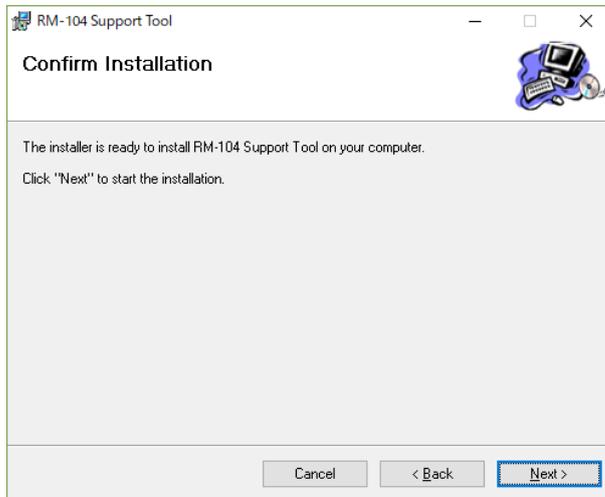


**5.**

When the installation completion screen is displayed, click "Close" to finish.
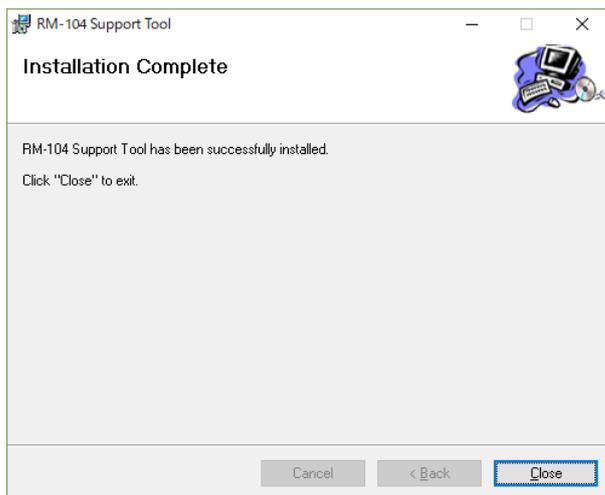
# ActiveX control function reference

As with GP-IB control, you can communicate with USB by using ActiveX control.
Available functions are as follows.

```
Cmdsend (devNo As Long. sndstr As String) As Long
CmdRcv (devNo As Long. rcvstr As String) As long


• CmdSend (devNo As Long. sndstr As String) As Long
Send character string

Argument:
devNo   Specify the device number of one or more devices recognized from
Windows.
sndstr  String to send

Return value:
0:error, 1:success
example):CmdSend  1, "V"        ˙Send V command to device 1


• CmdRcv(devNo As Long. rcvstr As String) As long
Receive character string

Argument:
devNo   Specify the device number of one or more devices recognized from
Windows
rcvstr  The received character string is stored

Return value:
0:error, 1:success

example):Dim ret As String
CmdRcv  1, ret 'ret' stores the received character string
```

# How to use ActiveX control from Excel

This chapter explains how to select ActiveX program for Excel using Visual Basic. Here is the screen with Excel 2013.

**1.**
Start Excel, click the design mode on the Developer tab, and click Insert> Select Control.
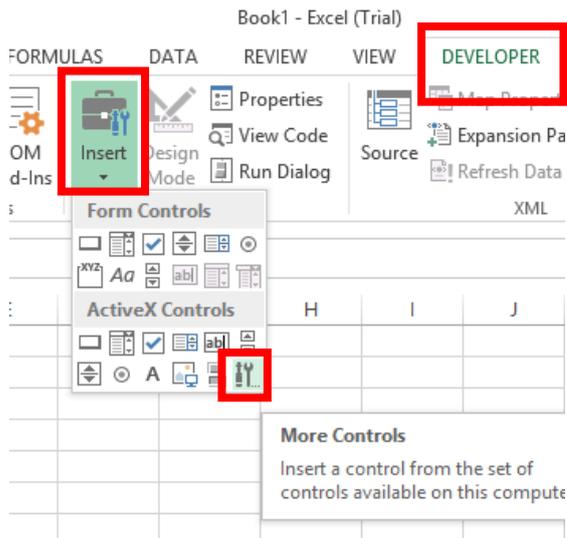


**2.**
Select "KEISOKU RM-104 Control" from the More Controls.

**3.**
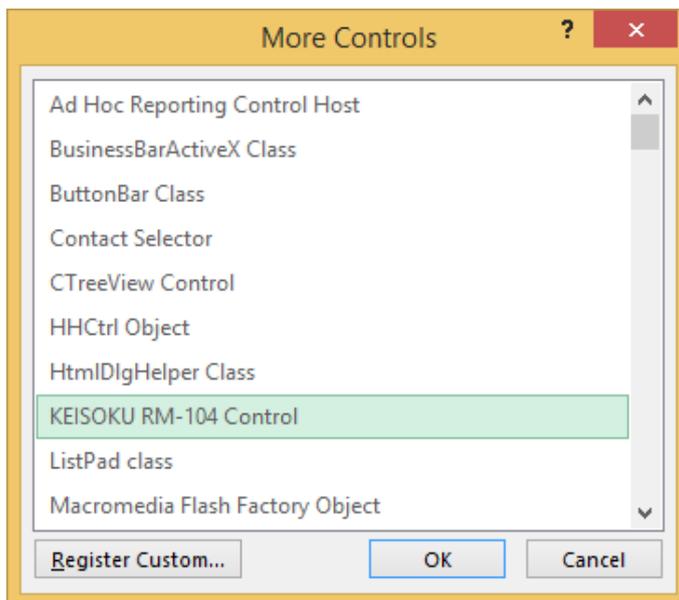
Click at the appropriate place in the cell and paste the control.



# USB sample program

I will explain a program example using Excel's Visual Basic. For Visual Basic, please refer to the specialty book etc. This sample is the contents to inquire about the version of RM-104 and display it by message.
Here is the screen with Excel 2013.

**1.**

Paste the ActiveX control of RM-104 by referring to all the items.

**2.**

Paste the control button to the appropriate place in the cell in the same way as the capacity to attach the ActiveX control.
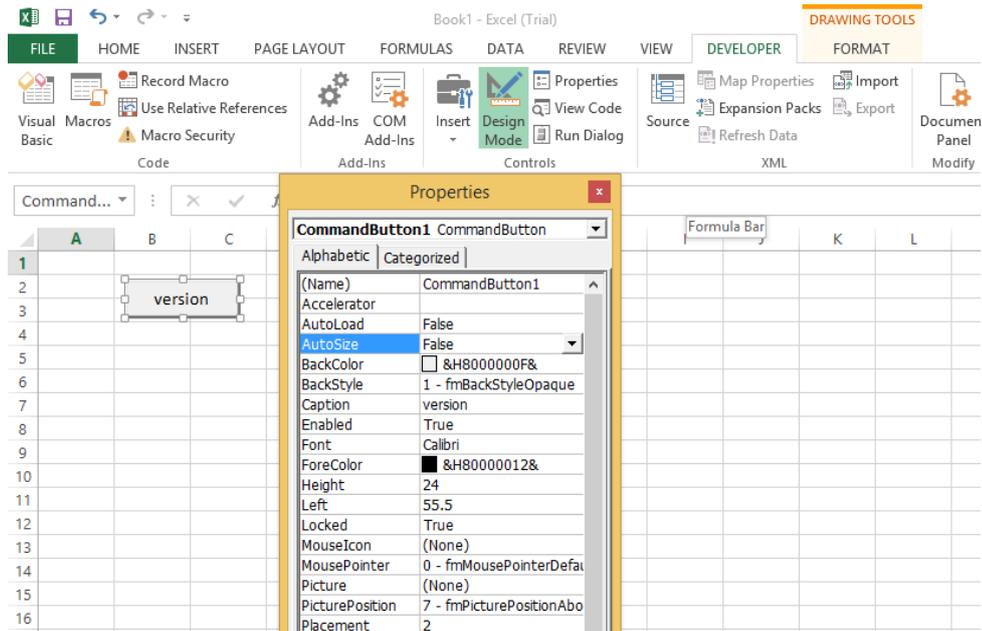
**3.**

Double clicking the pasted button control will display the Visual Basic Editor, so enter the code as shown below.
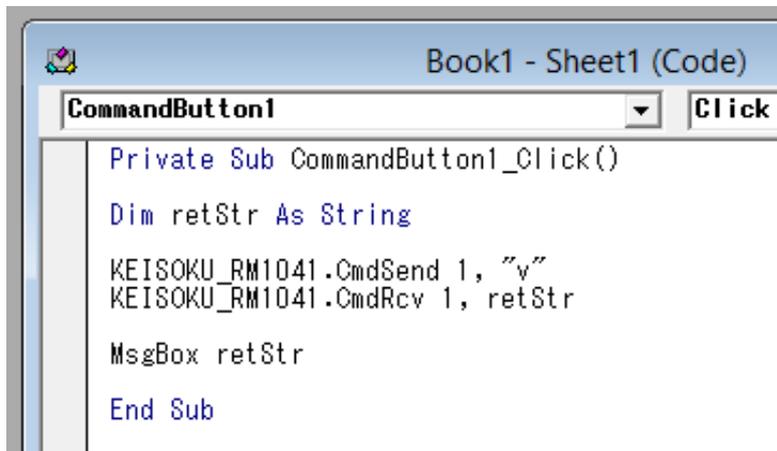


**Excel Visual Basic Editor**

```
Private Sub CommandButton1_Click( )

Dim retStr As String    'Return value storage variable

KEISOKU_RM1041.CmdSend  1, "v"       'Send version read command to
                                      device number 1
KEISOKU_RM1041.CmdRcv 1, retStr      'Receive character string
MsgBox retStr                        'Display received character
                                      string in message box

End Sub
```

## 12.5.4

Click the design mode on the Development tab and click the pasted button control.

When it is executed normally, a message box will be displayed as shown below.
*   The displayed version information is at development time and it is different from the actual product.
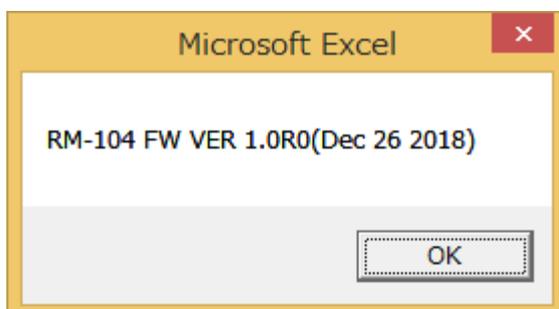


**Worksheet after Executing Sample Program**

# Chapter 11. Ethernet (LAN) Interface

## Ethernet (LAN) specification

RM-104 can communicate using the TCP / IP protocol.

### LAN I/F specification

| | |
|---|---|
| **Specification** | IEEE 802.3 |
| **LAN I/F connector** | RJ45 |
| **Data rate** | 10Base-T<br>100Base-TX |

Status of the RM-104 can be known by the LED of the LAN I / F connector.
The appearance of the LAN I / F connector and the meaning of the LED are as follows.

**LAN active LED**
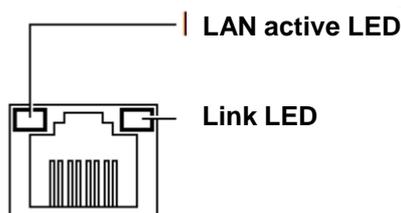
**Link LED**

**LAN I / F Connector Appearance**

### LAN I / F Connector LED Definition

| LED | LED State | Definition |
|---|---|---|
| LAN active LED | Lit green | Link is established correctly |
| | Lights off | Link not established |
| Link LED | Lights off | No communication data |
| | Blinking orange | connecting |

IP address default.

### RM-104 Default IP Address and Port Number

| Communication protocol | RM-104 Default IP address | port number |
|---|---|---|
| TCP/IP | 172.29.130.40 | 10001 |

RM-104 only supports one - to - one multicast communication. It is not compatible with one-to-many broadcast communication.

# Confirmation of

## Ethernet (LAN) connection of RM-104

By using telnet, you can easily check the operation of LAN I / F. telnet is the name of the general purpose communication protocol used mainly in IP network. In general the name of the terminal software that can run this protocol is also called telnet.

Since the telnet command is not enabled by default on Windows 7 or later OS, it must be enabled by OS setting.

# Enable Telnet command

**1.**
Click on Control Panel -> Programs



**2.**
Programs and Functions  →  Click to Turn Windows features on or off.

**3.**

Check "Telnet Client" and click OK.
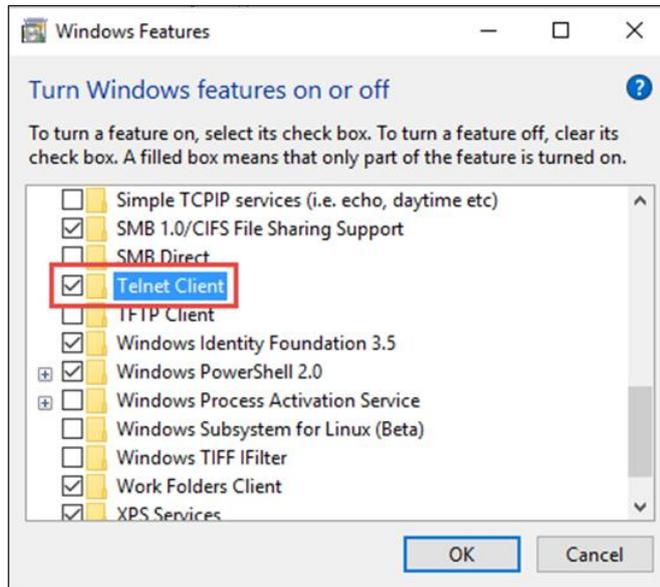


Telnet is now enabled.

Next is a description of how to communicate with the RM-104 using the Telnet command.

# Communication confirmation by Telnet command

**1.**

Start command prompt with administrator privileges.

**2.**

Enter the command as follows from the command prompt.

```
telnet "IP address of RM-104" 10001
```



\* In the above example, it is when the IP address of RM-104 is set to 169.254.186.174.

When entering the command and pushing the enter key, the screen where all characters are deleted is displayed.

**3.**
Enter the command of RM-104.
Execute version information acquisition command as an example. With nothing displayed, type "V" and push the return key. You can get version information of RM-104 as shown below.
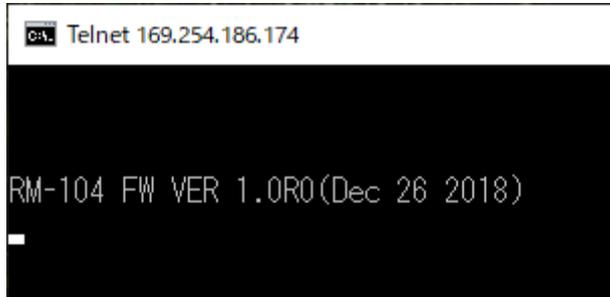


It was confirmed that the LAN I / F is working normally.

# IP address change method of RM-104 (DHCP)

**1.**
Start the Internet browser and enter the IP Address of RM-104 in the address field.



\*   The above is the case when IP of RM-104 is 169.254.90.249.

**2.**
Since the login screen comes out, enter them accordingly.
"User name: admin"
"Password: (None)"
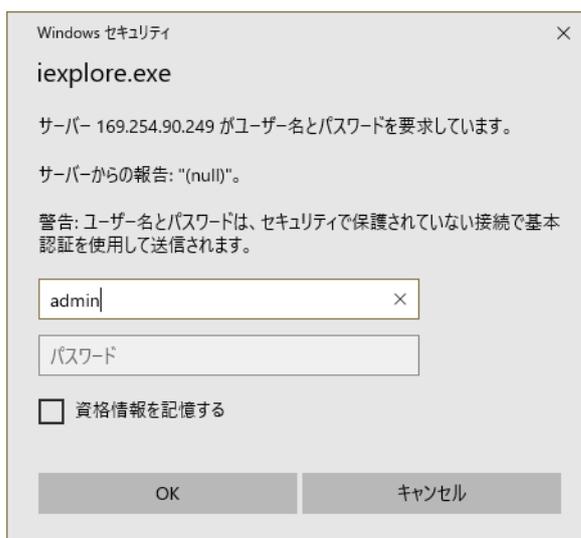
**3.**

When the setting screen opens, click [Network] in the menu on the left side of the screen.



**4.**

When the IP address setting screen opens, select the [Obtain IP address automatically] button.



**5.**
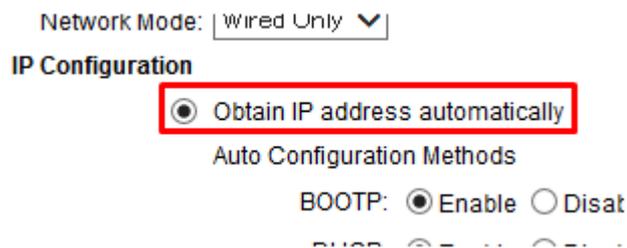
Setting Click the OK button at the bottom of the screen.



**6.**

Click Apply Settings in the menu on the left side of the screen.



**7.**
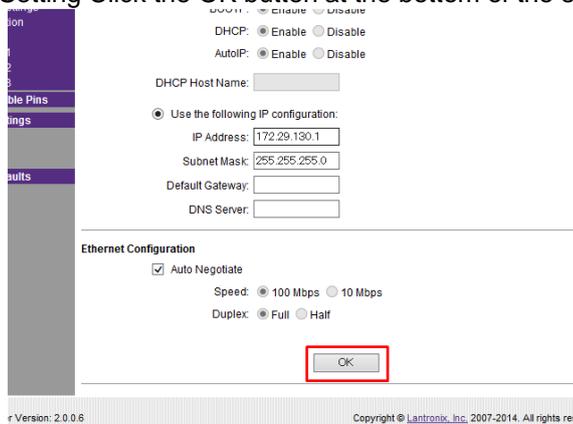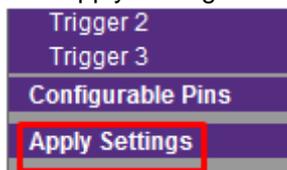
Close Internet browser and restart RM-104.

**8.**

Confirm whether connection is possible by Telnet command or the like.

# How to change the IP address of RM-104 (fixed setting)

**1.**

Start the Internet browser and enter the IP address of RM-104 in the address field.



*   The above is the case when IP of RM-104 is 169.254.90.249.

**2.**

Since the login screen comes up as follow, enter them accordingly.
"User name: admin"
"Password: (None)"
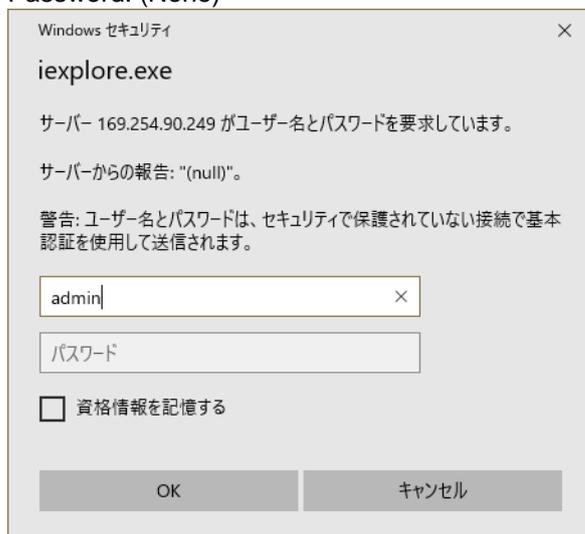


**3.**

When the setting screen opens, click [Network] in the menu on the left side of the screen.

**4.**

When the IP address setting screen opens, select the "Use the following configuration" button.



**5.**

Enter the IP address and subnet mask you want to set.

**6.**

Click the OK button at the bottom of the screen.



**7.**

Click Apply Settings in the menu on the left side of the screen.



**8.**

Close the Internet browser and restart RM-104.

**9.**

Confirm that you can connect with Telnet command etc.

# Chapter 12.  HOW TO SEPARATE p-p RIPPLE FORM p-p NOISE

## General Switching Ripple Noise Waveform
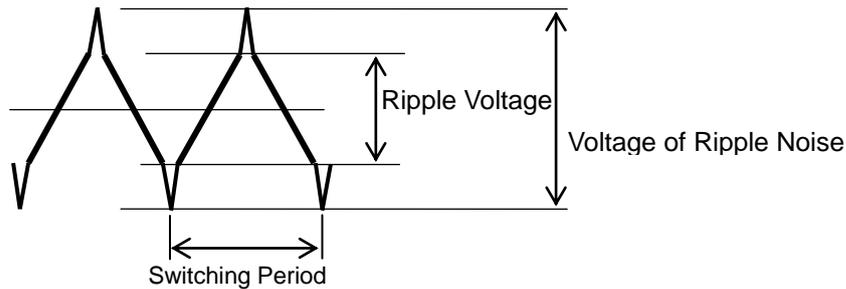


**Switching Ripple Waveform**

The General Output Waveform of Switching Power Supply is shown below, when you can see the p-p Voltage of Ripple Noise and Ripple, and Switching Period.

In the Switching Power Supply, as you know, because there is switching On and Off every switching period by the semiconductor switching device, generated is triangle-shaped Waveform of Ripple volt, which has been integrated by smoothing capacitors and filters. And also added is the large Spike Noise which is generated when Switching is actually made and appears on the higher and lower summit of Ripple volt. From the Waveform above, many efforts had been made to separate only p-p Ripple Component. The easiest way is that you can cut off the High Frequency Range of Spike Noise component by a Low Pass Filter. In such a case, however, you cannot eliminate only the Spike Noise component without deforming the waveform of the Ripple. This means you cannot measure Ripple Waveform accurately. When you measure the Power Supply which varies Switching Frequency or which Spike Noise is relatively wide, it is more difficult to separate and measure Ripple Waveform accurately.

# Ripple Separation Method by Duty Ratio of Pulse Width

RM-104 and other Keisoku Giken's products adopt unique method to separate only Ripple component accurately. Which is made possible by setup "Ripple Ratio"; Duty Ratio of Pulse Width of Spike Noise.
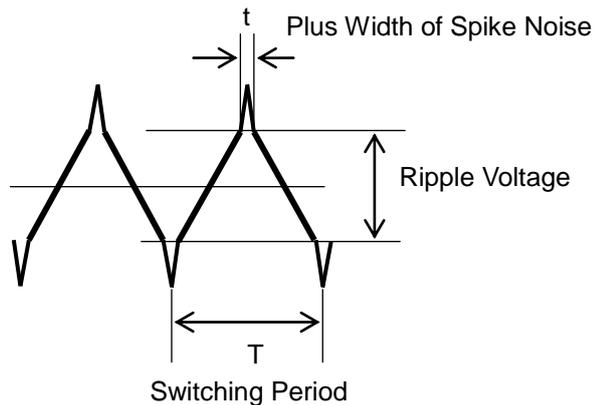


**Separation method with pulse width duty ratio**

In Fig. 8-2, "T" is the Switching Period, while "t" is the Pulse Width of Spike Noise which should be eliminated.

Where (t/T)×100 (%) is defined as "Ripple Ratio", and you can setup this Ripple Ratio by 0.0 % through 50.0 % in digital on the RM-104. In this method, RM-104 can measure p-p Ripple by detecting the Peak Level where the Ratio of Pulse Width of Spike Noise (t) and Switching Period (T) is equal to the "Ripple Ratio" which you have setup.

The Feature of this Separation Method is that you can separate Ripple without deforming the Waveform, so the Measured Ripple Data would be almost same as you can measure it by in Oscilloscope.

# How to select "Ripple Ratio"

(A) Wave form of Ripple and Ripple Noise
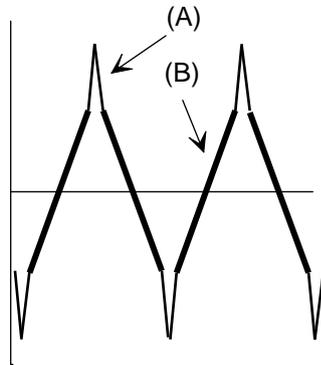
(B) Measurement of Ripple Voltage

**A 1**

**B 1**

**A 2**

**B 2**

**A 3**

**B 3**
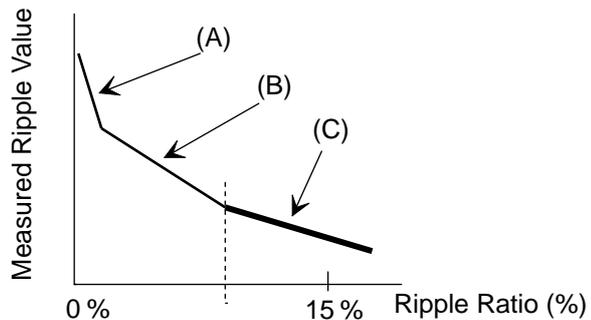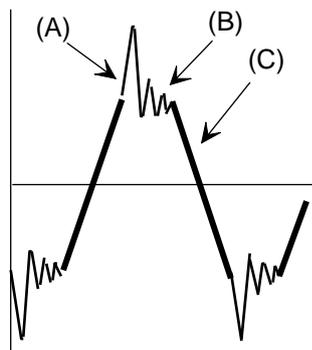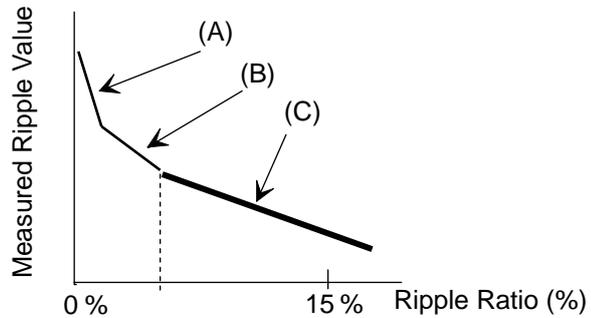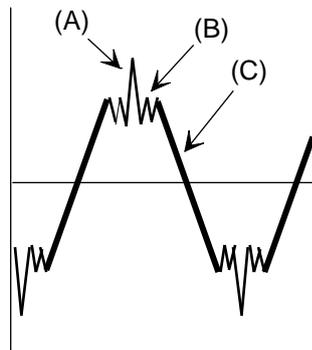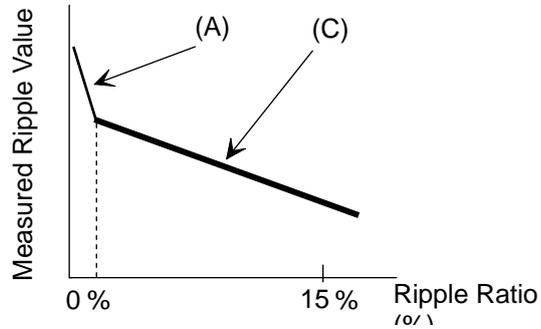
**Explain how to Ripple Ratio**

(A): Section (A)
(B): Section (B)
(C): Section (C)

When you would like to measure p-p Ripple by RM-104, you may have to select Ripple Ratio so that the Measured Ripple Data is almost the same as the Ripple Data which is measured by an Oscilloscope.
When you measure Switching Power Supply by RM-104, as you change the Ripple Ratio, the Measured Ripple Data also changes.
This means that the Measured Ripple Data is the Function of the Ripple Ratio.
The reason of this attributes to the Function of RM-104 which is described in Fig 8-3.
Following are the Explanation how to select a Ripple Ratio so as the measured Ripple data would be close to the data of an Oscilloscope.

First, a typical output Waveform is shown in A1, the right side B1 shows the Graph when you change the Ripple Ratio from Zero (0) to Fifteen (15) %.

When you setup Zero (0) of Ripple Ratio, the Ripple Data shows the Largest Value which is exactly the Ripple Noise Data. As you increase the Ripple Ratio and Plot the Ripple Data on the Graph, you'll find the two ranges in which the angle of inclination is different from that of the other one; in the first range the Slope of the line in the graph is so steep (section-A), and it is followed by Section-C where the Slope is most gentle.

If the Output Waveform is something like A2 or A3 in Fig.8-3, it may appear the new Section-B which slope is not so steep as in Section-C.

In the Fig.8-3, you may recognize on an Oscilloscope that Waveform written in bold would be a waveform to measure Ripple (see A1, A2 and A3)

If so, you can select the nearest Ripple Ratio which is the Left Edge of the Section-C in B1, B2 or B3.

You don't have to change the Ripple Ratio during the Test of the same type of Power Supply.

# Ripple Data when both AC and Switching Ripple are Combined
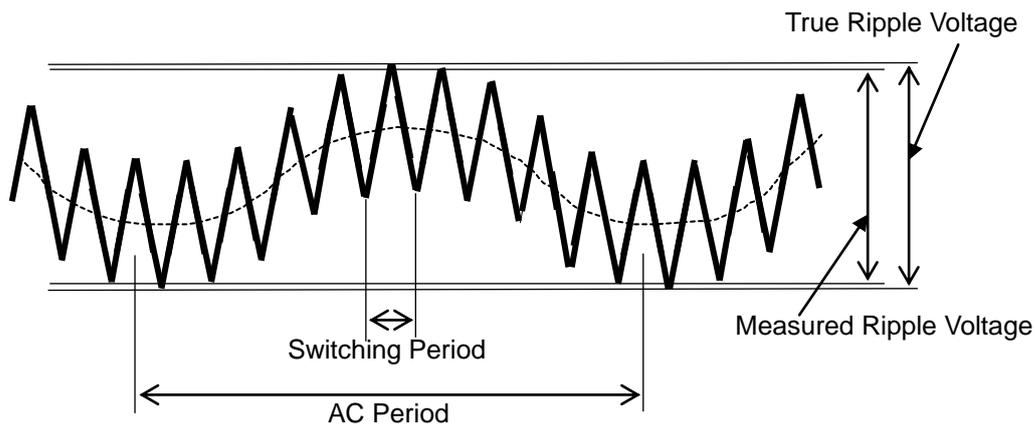


**Waveform of AC ripple and switching ripple are overlapped**

With the ripple separation method based on the Pulse Width Duty Ratio (ripple separation ratio), the measured ripple value will be lower if the filter method is not used for signals with a fundamental frequency of 2 frequencies.

Therefore, without setting the switching fundamental wave as one cycle, the longest cycle (AC component, etc.) is set as one cycle, and measure the voltage level of where the total average duty ratio of the spike voltage in that cycle becomes the ripple separation ratio setting value..

In this method, in order to compensate for the interrupted spike component in the valley portion of the AC component, the level is lowered so as to penetrate into the switching fundamental wave component in the mountain region.

Thus, for measurements with two fundamental frequencies, the correct result is obtained with a 2 k to 5 k filter.

(However, the measurement time is more than twice.)

# Chapter 13. Specification

| Model | RM-104 | | |
|---|---|---|---|
| **DC Voltage measurement** | | | |
| Range | ±6.0000 V | ±60.000 V | ±500.00 V |
| Resolution | 0.1 mV | 1.0 mV | 10.0 mV |
| Measurement AUTO range | -6.0000 V ~ 6.0000 V | -60.000 V ~ -5.600 V<br>5.600 V ~ 60.000 V | -500.00 V ~ -56.00 V<br>56.00 V ~ 500.00 V |
| Accuracy    (*1) | ±0.025 % of rdg. ±0.025 % of f.s. | | |
| Max. input voltage | ±500 V | | |
| Measurement time    (*2) | less than 90 ms (Fast Mode) / less than 250 ms (Slow Mode) | | |
| **Ripple & Noise measurement** | | | |
| Range | 300.0 mV p-p | | 3000 mV p-p |
| Resolution | 0.1 mV | | 1.0 mV |
| Accuracy    (*1, 3, 4) | ±2 % of rdg. ±1 % of f.s. | | |
| Filter — THRU (no filter) | 50 Hz ~ 100 MHz | | |
| Filter — LPF | 50 Hz ~ 2 kHz | | |
| Filter — HPF | 2 kHz ~ 100 MHz | | |
| Filter — 20 MHz bandwidth limit | 50 Hz ~ 20 MHz | | |
| Ripple separation ratio (*5) | 0.0 % ~ 50.0 % (0.5 % increment) | | |
| Measurement time (*2, 5) | Approx.170 ms | | |
| **Interface** | | | |
| GP-IB | IEEE488.1 | | |
| LAN (*6) | IEEE 802.3 | | |
| USB | USB 2.0 (Full-Speed) | | |
| OUT PORT: PASS, FAIL | Photo Coupler Output Common Connected (14 Pins)    (*7) | | |
| OUT PORT: Start Trigger | Photo Coupler Input Common Connected (14 Pins)    (*8) | | |
| OUT PORT: 4 Channel Output | Photo Coupler Output (for SC-83 Control)    (*7) | | |
| **Input terminals, Cables** | | | |
| Impedance | DC 1 MΩ, HF 50 Ω | | |
| Cables used | DP-100 or 50 Ω Coax cable, 1.5 m | | |
| **General** | | | |
| Power | AC 85-264 V, 50/60 Hz (47-63) | | |
| Consumption Power | less than 30 VA | | |
| Withstanding voltage | Between Input-Output 3 kVac (1 min)<br>Between Input-GND 1.5 kVac (1 min) | | |
| Isolation resistance | Between Input-GND 500 Vdc, 30 MΩ or more | | |
| Installation environment | Indoor, horizontal installation | | |
| Operating environment | No freezing, condensation or corrosive gas | | |
| Altitude | Up to 2000 m | | |
| Cooling method | Natural air cooling | | |
| Operating Environment | 0-40 °C, 20-85 % RH (no dew condensation) | | |
| Storage Environment | -20-60 °C, 20-85 % RH (no dew condensation) | | |
| Dimension (*9) | 180 (W) x 85 (H) x 300 (D)    mm | | |
| Weight | Approx.1.8 kg | | |

*1 Guaranteed for 6 months under environmental temperature of 23 °C ± 5 °C, 70 % RH.

*2 At same measurement range and mode.

*3 Within ripple separation range of 0 % ~ 10 %.

*4 Within 10 kHz ~ 10 MHz range.

*5 Within 10 kHz ~ 100 MHz range.
*6 Factory option.
*7 Photo Coupler output     Power Rating: 24 V 10 mA MAX.
*8 Photo Coupler input      Input Rating: 12 V 12 mA (input resistance 1 kΩ)
*9 External dimensions do not include protrusions of the interface. For details, please refer to
"Dimension"
・Calibration date and time are displayed at startup.
・Compatible with the previous model RM-103.

# Dimension
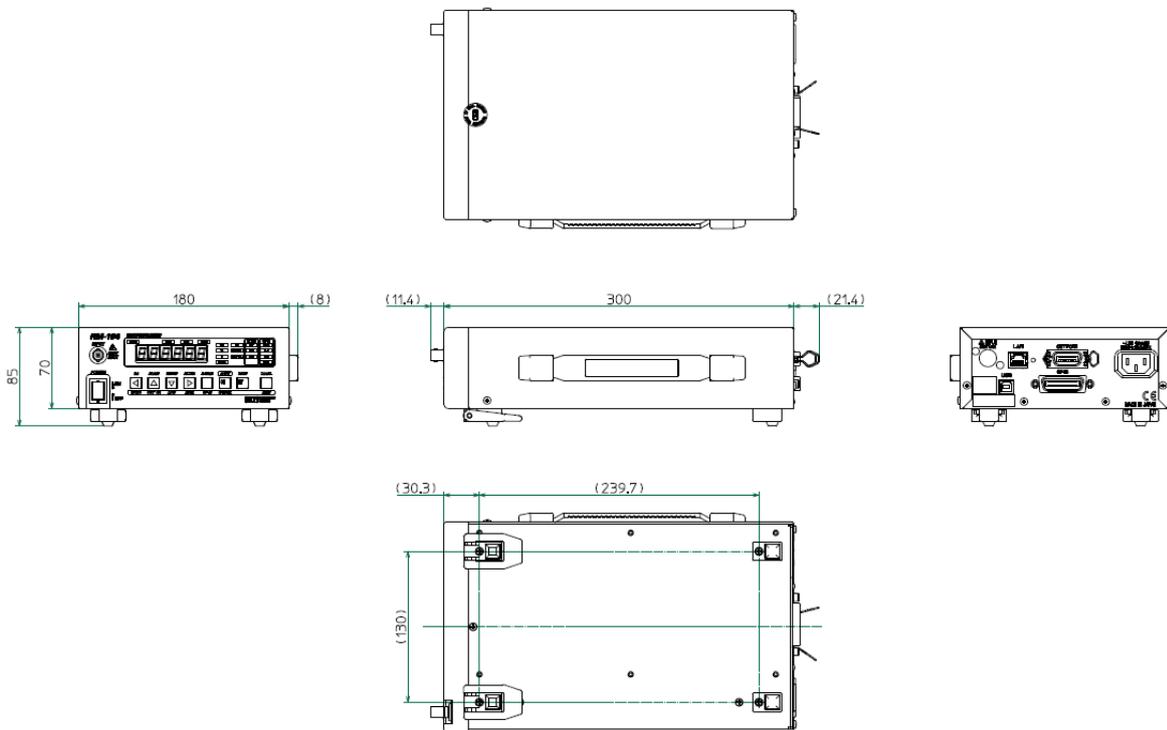


180 (W) x 85 (H) x 300 (D) mm
*    The protruding part is not included

# Chapter 14. Maintenance

## Cleaning

To clean up, wipe it with soft or lightly dump cloth.

| ⚠ **Caution** | It may damage the equipment. |
|---|---|

- ◆ Be sure to turn off the power switch and unplug the power cord before cleaning.
- ◆ Refrain from using Benzene, Acetone or any other Organic Solvents which would transmute a sort of plastics. And also be careful not to infiltrate any fluid such Solvents into RM-104.

## Input power cord

Check and inspect for damage to the coating, looseness of the plug, and cracks.

| ⚠ **Warning** | **Risk of electric shock.** |
|---|---|

- ◆ Stop using it immediately. If the coating is damaged, there is a risk of electric shock.

To purchase accessories, please contact the distributor from which you purchased the product or us.

## Calibrations

For calibration of this product, contact the distributor from which you purchased the product or us.

## Preservation

If you don't use RM-104 for a long time, it is suggested to wrap or cover RM-104 with vinyl or put it in a box and preserve it dry area to keep it away from dust and direct sunshine:

**Ripple Noise Meter**

**RM-104**

**OPERATION MANUAL**


**M-2493-02**

**Rev1.3**


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Ripple Noise Meter Operation Manual
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Ripple Noise Meter
**RM-104**