

HARDWARE INSTRUCTION MANUAL

MULTI-CHANNEL SIGNAL ANALYZER

SA-02M

4-CHANNEL SIGNAL ANALYZER

SA-02A4



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<http://www.rion.co.jp/english/>

Please read this first

Thank you for selecting the multi-channel signal analyzer SA-02M/4-channel signal analyzer SA-02A4. Please read these instructions carefully in order to ensure correct operation and make full use of the advanced features of this product. You should keep the documentation at hand for future reference.

Using the documentation

The product is supplied with the following two instruction manuals.

“Hardware instruction manual” (this document)

“Software instruction manual”

For information on system setup, power-on/power-off, equipment connections etc., please refer to the hardware instruction manual.

For information on how to make parameter settings and perform measurement using the measurement analysis software, please refer to the software instruction manual.

NOTE

- Unauthorized copying of the documentation, in whole or in part, is prohibited.
- The contents of the documentation and the product specifications may be changed at any time without notice for improvements.
- Rion Corporation will not be held liable for any damages resulting from the use of this product.

Organization of this manual

This manual describes the features and operation principles of the multi-channel signal analyzer SA-02M/4-channel signal analyzer SA-02A4. For information regarding the operation of other equipment in the case of incorporating the SA-02M/SA-02A4 into a measurement system with other equipment, always make sure refer to the documentation of the other equipment. The following pages contain important information on safety. Be sure to read this part.

This manual contains the following sections.

Outline

Provides an outline of the unit.

Panel explanation

Explains the switches, indicators, connectors, and all other parts on the panels of the unit.

Preparations

Explains how to set up the system, make power connections, connect the computer, connect the copy protection key, etc.

Signal input/output

Explains how to supply signals to the BNC input connectors and how to use the AC output connectors.

External trigger signal input

Explains how to supply an external trigger signal.

Tachometer signal input

Explains how to supply a tachometer (rotary pulse) signal.

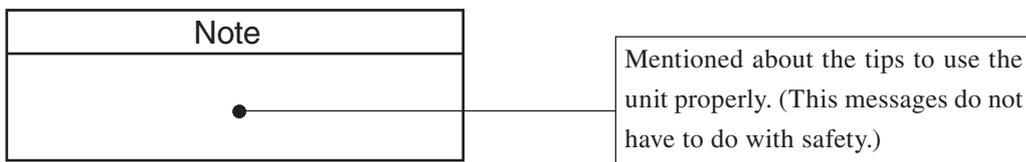
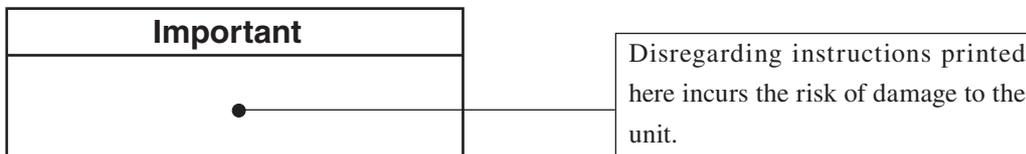
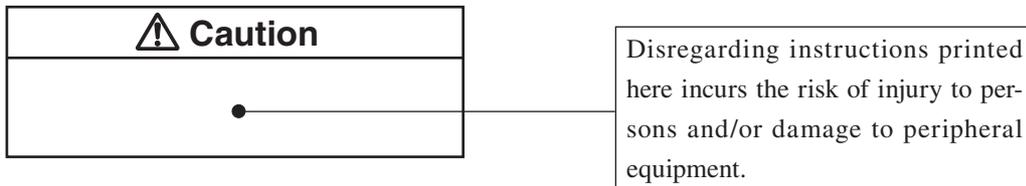
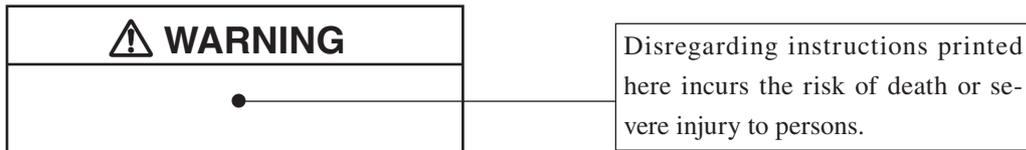
Specifications

Lists the technical specifications of the unit.

* All company names and product names mentioned in this manual are trademarks or registered trademarks of their respective owners.

FOR SAFETY

In this manual, important safety instructions are specially marked as shown below. To prevent the risk of death or injury to persons and severe damage to the unit or peripheral equipment, make sure that all instructions are fully understood and observed.



Precautions

- Operate the unit only as described in this manual.
- Install the unit on a stable, horizontal surface.
- Do not install the unit in a location where it may be directly subject to vibrations or shock.
- Do not install the unit in a location where it may be subject to splashes of water or direct sunlight.
- Do not install the unit in a location with high levels of dust.
- Do not install the unit in a location with high temperatures or humidity levels.
- Do not install the unit in a location that may be subject to air with high salt or sulphur content.
- Do not install the unit in a location that may be subject to gases or is in the vicinity of stored chemicals.
- Do not use the unit in an environment where the rated temperature and humidity range (0°C to 40°C, max. 90% RH) may be exceeded.
- Do not use the unit in an environment exposed to strong magnetic or electric fields or radiation.
- Do not place any heavy objects on the unit or the cables.
- Before use, verify that all cable connections have been correctly and safely established.
- Verify that the unit and all connected equipment operates normally.
- If a problem occurs during operation, disconnect the plug of the AC adapter from the unit, in order to fully separate the unit from the power supply.
- After use, be sure to turn the power off and disconnect the AC adapter from the AC outlet.
- When disconnecting cables, always hold the plug or connector and do not pull the cable.
- If used in a way other than specified by the manufacturer, the protection features of the unit may be defeated.
- Do not insert any wire or other metal objects or objects made of conductive plastic into any of the openings of the unit, to prevent the risk of damage.
- Do not disassemble the unit or attempt internal alterations.

- When transporting or storing the unit, be sure to use the original packaging, to protect the unit from vibrations, shock, dust etc.
- In case of malfunction, do not attempt any repairs. Note the condition of the unit clearly and contact the supplier.
- Dispose of the unit only in accordance with national and local laws and regulations.

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Outline

The SA-02M/SA-02A4 are signal analyzers that enable multi-channel FFT analysis as well as octave band analysis, 1/3 octave band analysis, and 1/12 octave band analysis. The products consist of the hardware (main unit) comprising the input section and signal processing section, and dedicated software (optional) to be installed on a generic computer. The main unit and the computer are connected via an Ethernet link.

The main unit is equipped with a DSP chip for high-speed signal processing, which allows not only FFT analysis but also multi-channel 1/N octave band analysis in real time. Simultaneous FFT analysis and 1/N octave band analysis are also possible.

Time waveform data can be stored in the memory of the computer, offering the capability to perform more detailed offline analysis later.

The dedicated software installed on the computer runs under the Windows environment and uses a sophisticated graphical interface. Data and analysis results can be handled and managed further using applications such as Microsoft Excel and Word.

The compact dimensions of the main unit allow easy portability.

In the standard configuration, the main unit has 4 input channels. The SA-02M can accommodate additional units to increase the number of input channels to a maximum of 16. A switching hub can be used to link two units, taking the maximum number of channels to 32.

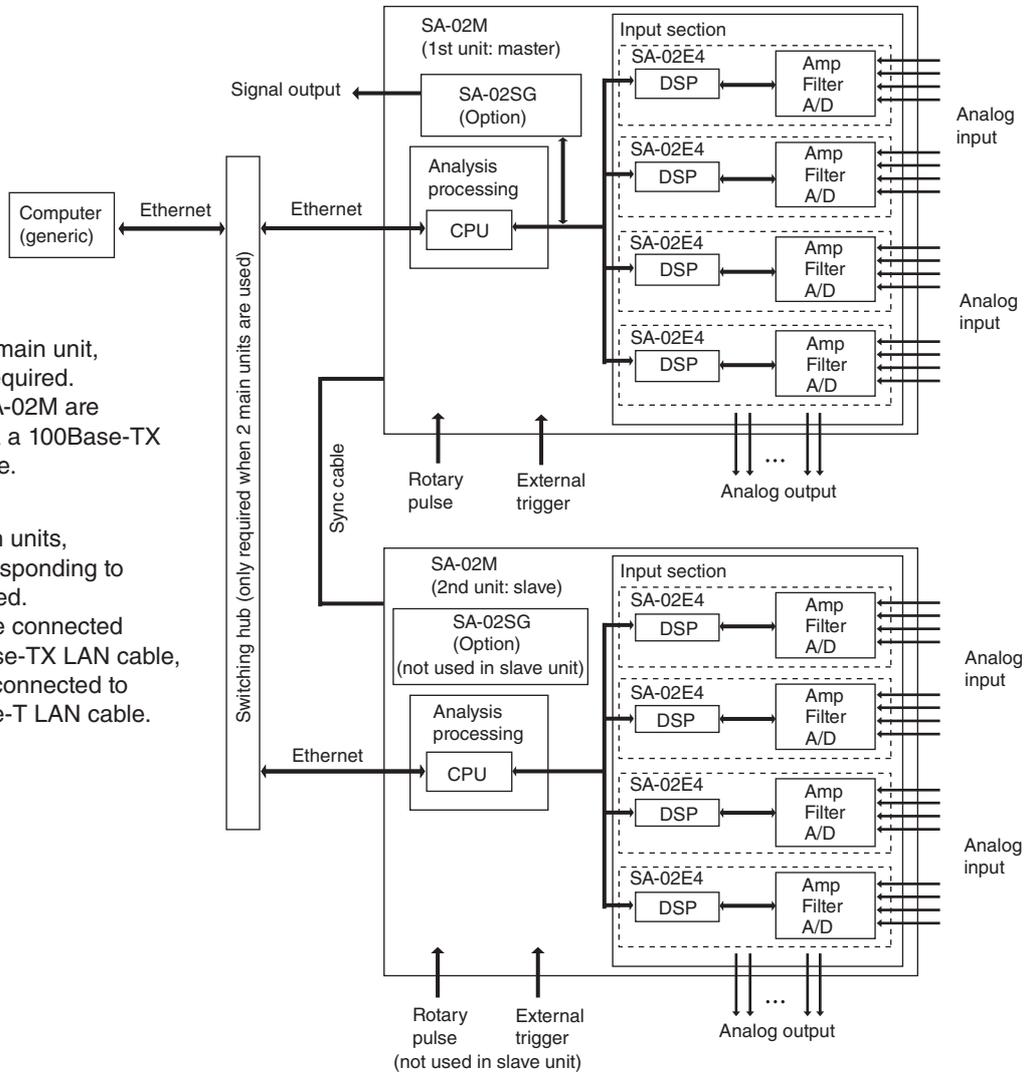
An optional signal output unit can be installed, for measurement scenarios where an output signal is required. An input for a rotary pulse signal is also available, with optional software that allows tracking analysis.

System configuration

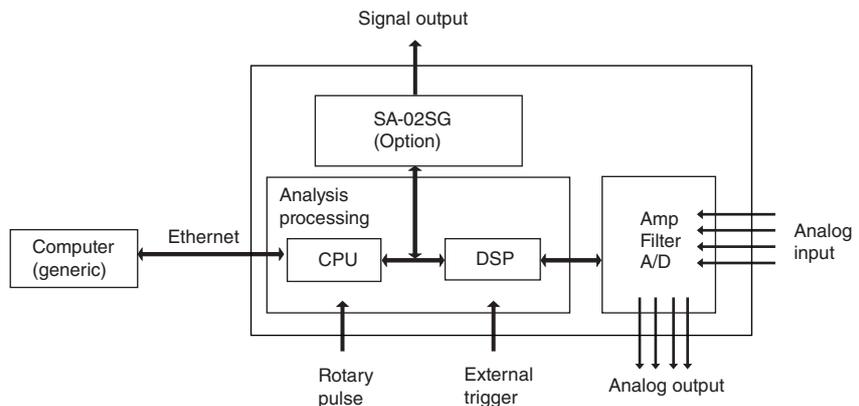
The SA-02M/SA-02A4 system consists of the processing (main) unit and a generic computer, linked via Ethernet. The main unit may have the optional signal output unit installed. The SA-02M may have one or more optional 4-channel units installed.

When using a single main unit, no switching hub is required. The computer and SA-02M are connected directly via a 100Base-TX cross-wired LAN cable.

When using two main units, a switching hub corresponding to 1000Base-T is required. The SA-02M units are connected to the hub via 100Base-TX LAN cable, and the computer is connected to the hub via 1000Base-T LAN cable.



SA-02M configuration diagram



SA-02A4 configuration diagram

Input section

- AC coupling / DC coupling selectable for each channel individually.
- CCLD sensor, TEDS sensor supported.
- Frequency weighting filter (A, C characteristics), high-pass filter, low-pass filter for each channel.
- Integrated amplifier/attenuator (-40 dB to +20 dB range, 10-dB steps) for each channel. Amplifier/attenuator and frequency weighting applied to output signal (full-scale 1 Vrms).
- A/D converter digitizes input signal and supplies data to analysis processing section.

Analysis processing section

- 32-bit floating point DSP handles input signal processing.
- Input signal processing and other processing results are sent to the computer via Ethernet link.

Computer (for dedicated software)

- Dedicated software can send commands to main unit hardware to control signal processing, setup, data retrieval, FFT analysis, analysis result processing, display, and other functions.
- Data are sent via Ethernet link.

Recommended computer specifications

CPU: Intel Core i5 / i7 1.4 GHz or higher (Core2 Duo 2.0 GHz or higher)

RAM: 2 GB or more

Display: XGA (1024 × 768 dots) or better, 65536 colors or more

Operating system:

Microsoft Windows XP Professional, Vista Business (32-bit versions)

Microsoft Windows 7 Professional 32 bit / 64 bit

LAN: 100 Base-TX (required)

1000 Base-T (when two SA-02M are connected)

CD-ROM drive (for SA-02 BASE installation)

USB port (for SA-02 BASE copy protection key)

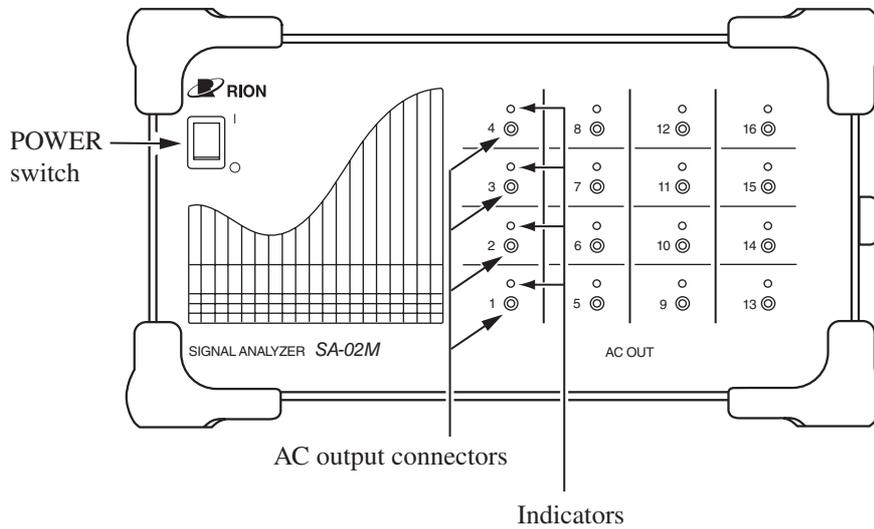
Hardware Expansion

- Option slot allows signal output unit SA-02SG installation.

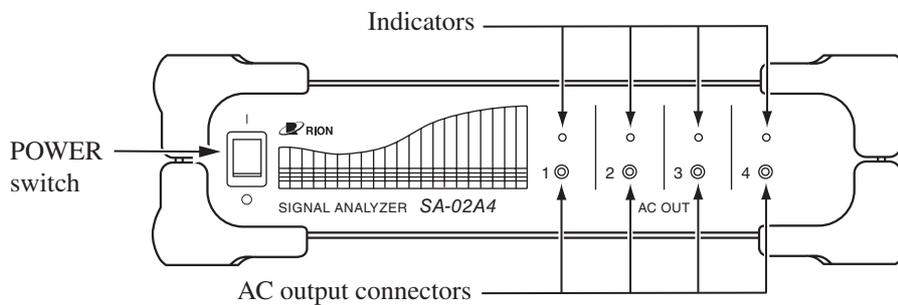
Panel explanation

Front panel

SA-02M



SA-02A4



The SA-02M has AC output connectors and indicators for 16 channels, but the output connectors and indicators for channels that are not installed are inactive.

POWER switch

Press the upper part (I) of the switch to turn the unit on, and press the lower part (O) to turn the unit off. While power is on, the switch is lit or flashing.

Flashing of the POWER switch indicates that access from the computer to the SA-02M/SA-02A4 is not possible (see “Power-on” on page 18).

AC output connectors

These are 2.5 mm mono phone jacks that carry the AC signal for the respective channel.

Indicators

These LED indicators show the status of the respective channel by their color.

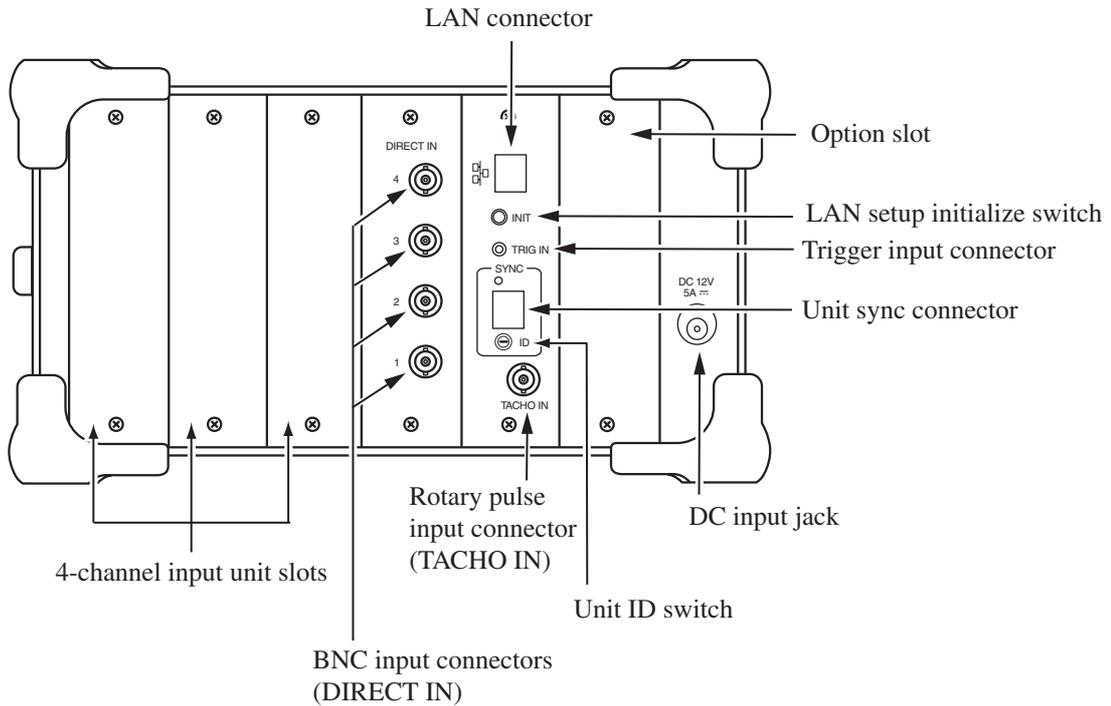
LED state	Channel status
Off	No measurement in channel
Lit green	Channel selected, measurement in progress
Lit red	Channel selected, measurement in progress, but overload has occurred

Note

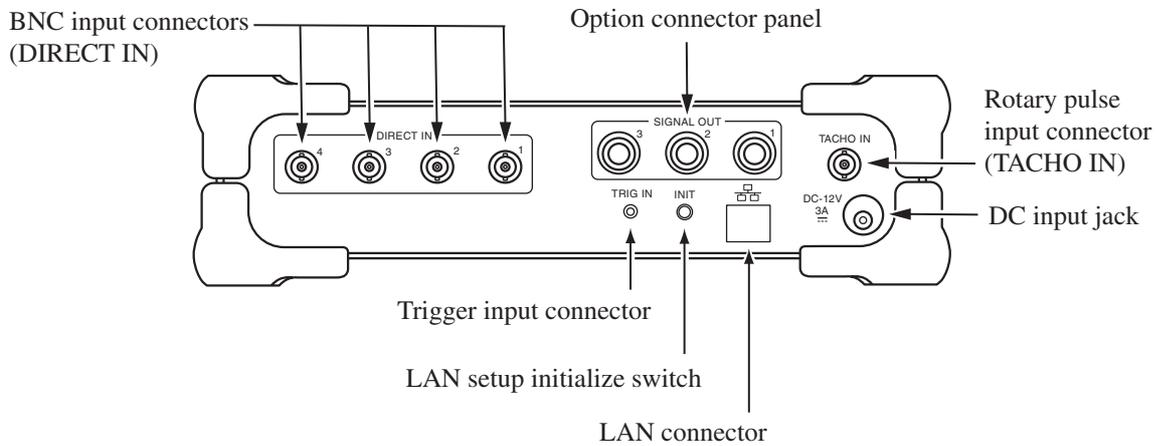
A channel can only be used after having been selected. This process is performed using the dedicated software. For details, please refer to the software instruction manual.

Rear panel

SA-02M



SA-02A4



LAN connector

RJ-45 port for connection to the computer.

Option slot (SA-02M only)

The optional signal output unit SA-02SG can be installed here.

Installation or removal of the unit is performed at the factory. Do not open the cover of this slot.

LAN setup initialize switch

Press this switch to reset the settings for communication with the computer to the default condition. (See “Hardware reset procedure” on page 22.)

Trigger input connector

2.5 mm mono phone jack for input of a trigger signal.

Unit sync connector (SA-02M only)

RJ-45 port for linking two SA-02M units.

DC input jack

The DC plug of the supplied AC adapter is to be connected here.

Unit ID switch (SA-02M only)

When two SA-02M units are used in tandem, this switch serves for setting the identification number for the first and second unit.

Rotary pulse input connector (TACHO IN)

A rotary pulse (tachometer) signal can be input here, for tracking analysis.

BNC input connector (DIRECT IN)

An AC output signal from a sound or vibration level meter or another kind of electrical signal can be input here. The connector also has a provision for supplying sensor drive power, which allows direct connection of equipment such as a piezoelectric accelerometer with integrated preamplifier.

4-channel input unit slots (SA-02M only)

The optional 4-channel input unit SA-02E can be installed here.

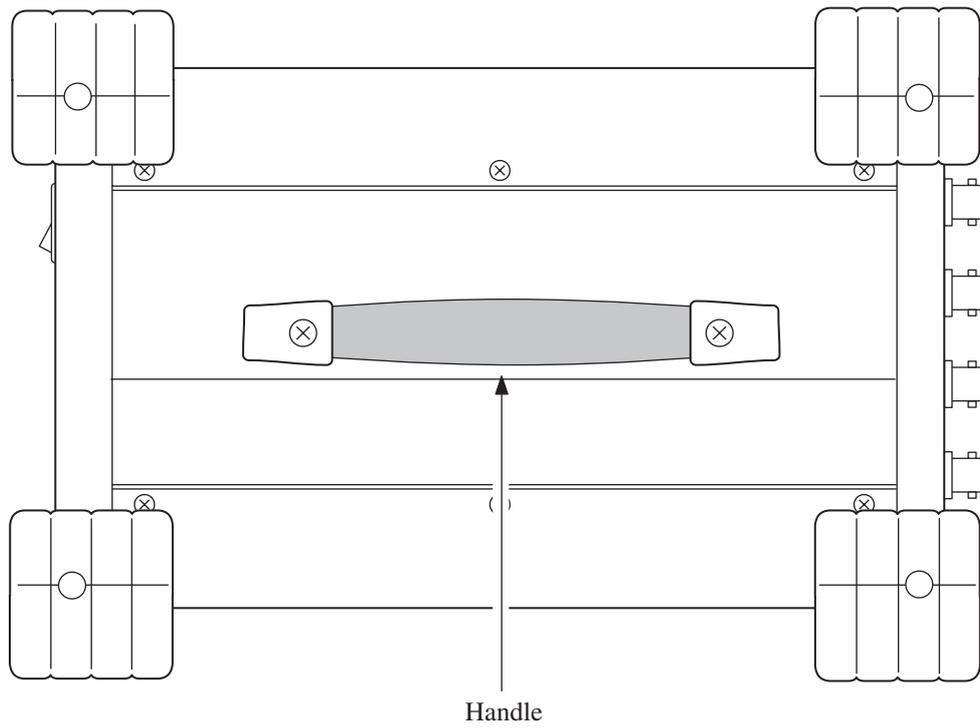
Installation or removal of the 4-channel input unit is performed at the factory. Do not open the cover of this slot.

Option connector panel (SA-02A4 only)

If the optional signal output unit SA-02SG is installed, the SIGNAL OUT connector is located here. Otherwise, the opening is covered by a grommet.

Installation or removal of the signal output unit is performed at the factory. Do not remove the grommet.

Right side panel



Handle (SA-02M only)

Serves for carrying the unit.

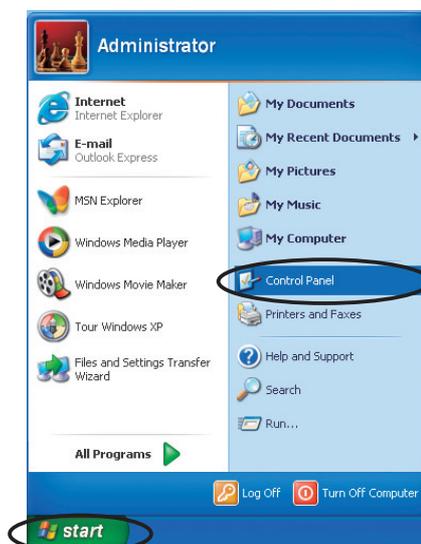
Preparations

Computer IP address setup

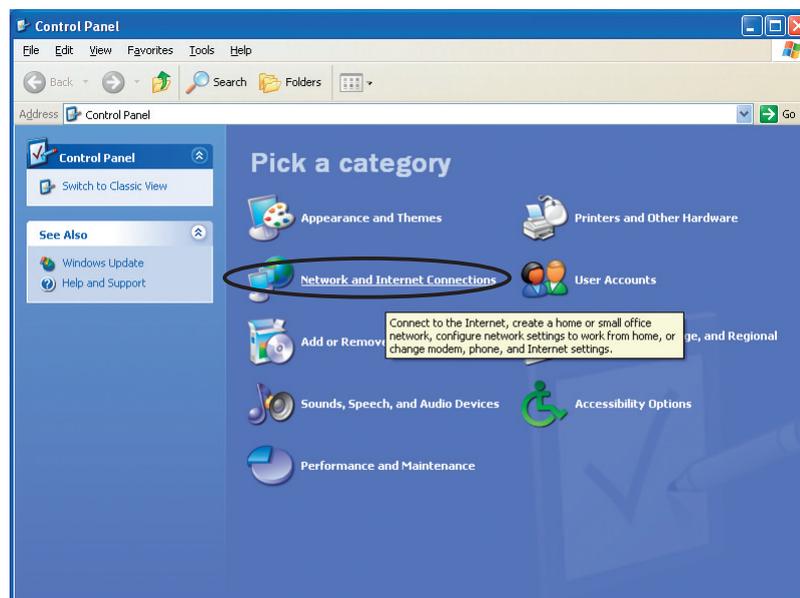
In order for the SA-02M/SA-02A4 to be able to communicate with the computer, the IP address of the computer must be set up as follows.

Setup procedure when using Windows XP

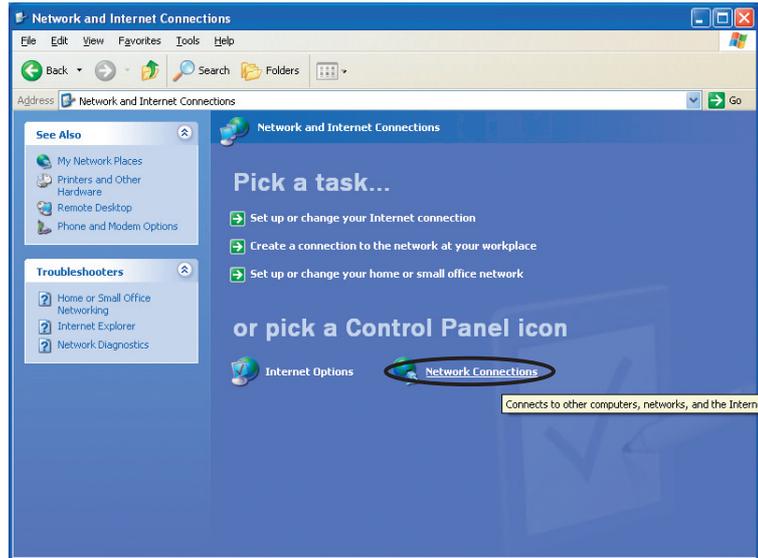
1. On the computer connected to the SA-02M/SA-02A4, click [Start] in the bottom left corner of the screen and select [Control Panel] from the start menu that appears.



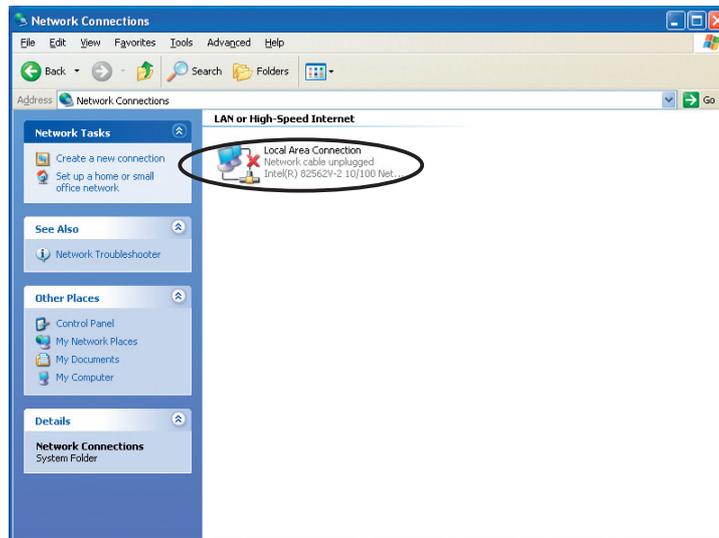
2. On the [Control Panel] screen, click [Network and Internet Connections].



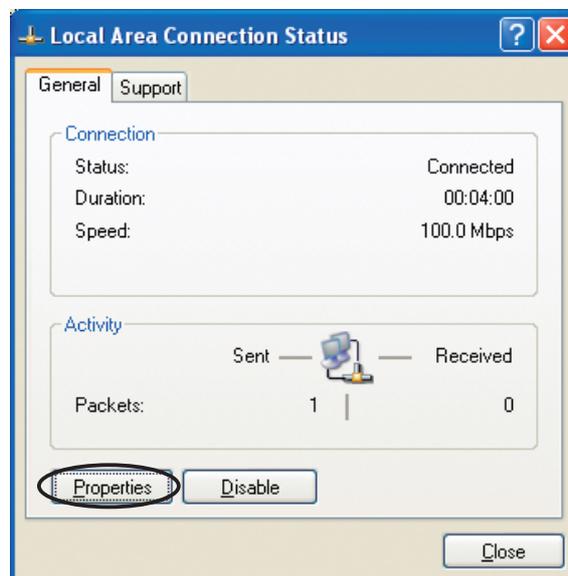
3. On the [Network and Internet Connections] screen, click [Network Connections].



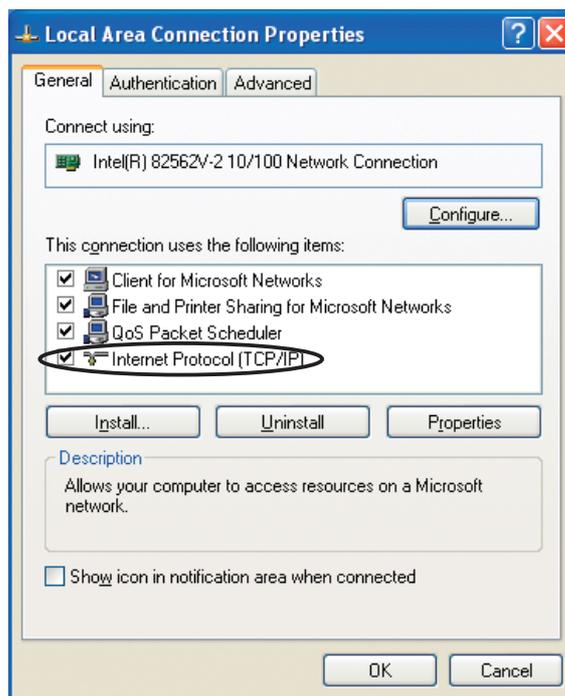
4. On the [Network Connections] screen, double-click [Local Area Connection].



5. On the [Local Area Connection Status - General] screen, click [Properties].



- On the [Local Area Connection Properties - General] screen, select the [Internet Protocol (TCP/IP)] check box and double-click.

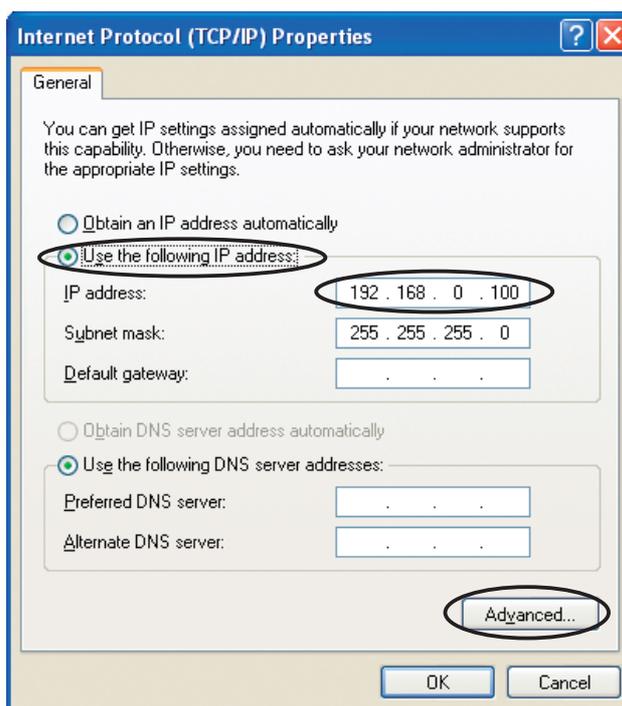


- On the [Internet Protocol (TCP/IP) Properties - General] screen, select the [Use the following IP address] check box and enter the IP address in the IP address field.

In the Subnet Mask field, enter “255 . 255 . 255 . 0”.

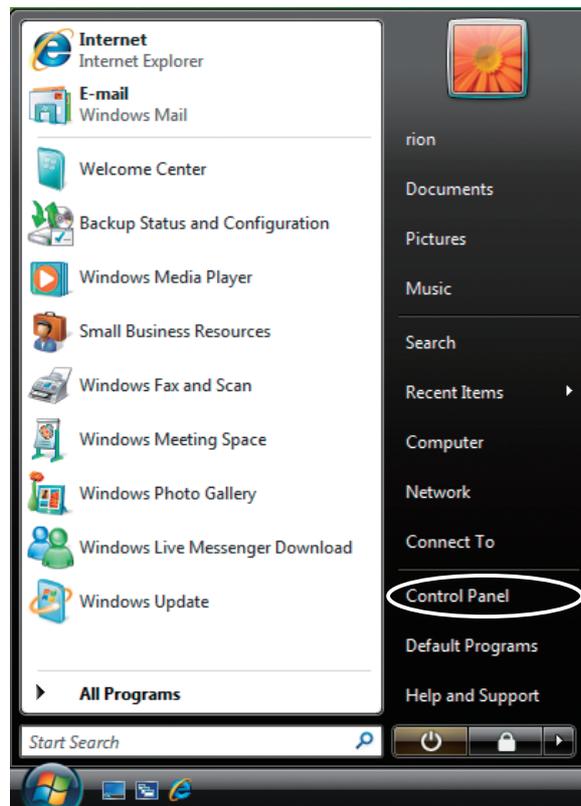
Leave the Default Gateway field blank.

When the input is complete, click [OK].

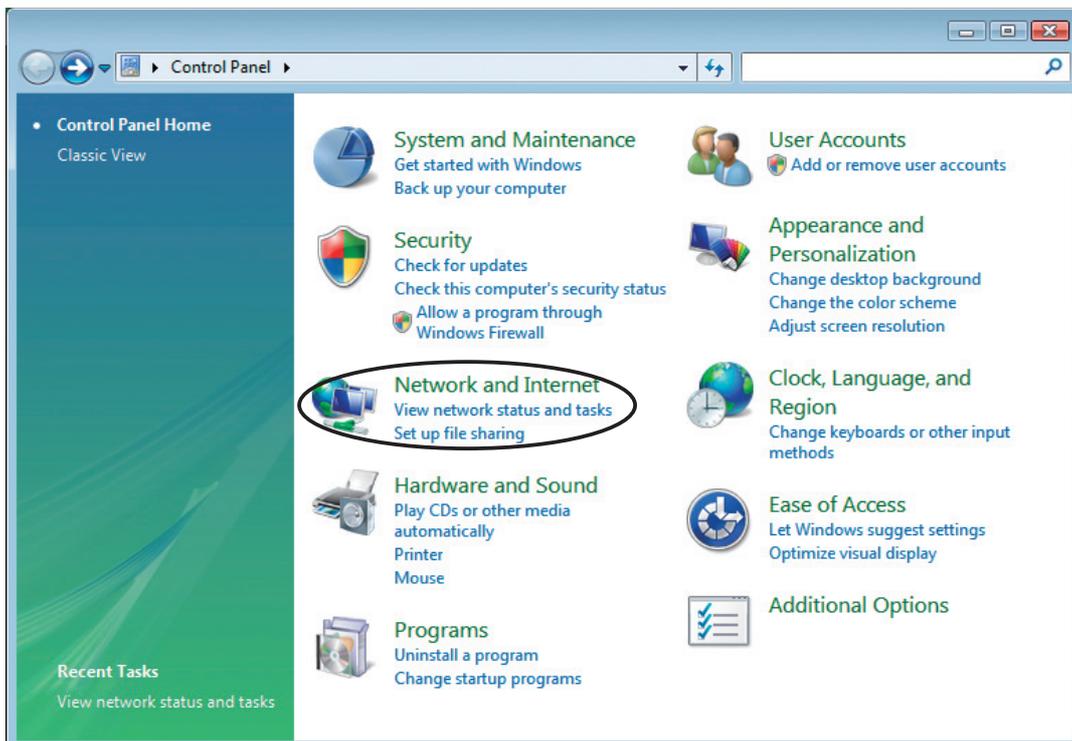


Setup procedure when using Windows Vista

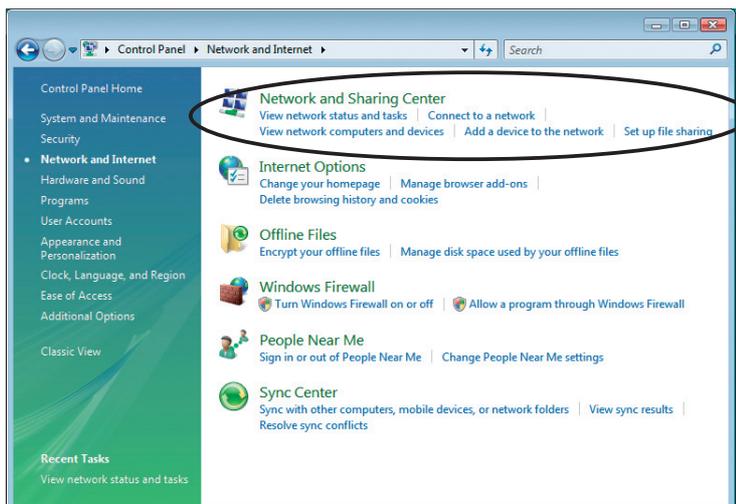
1. Click the Windows symbol in the bottom left corner of the screen and select [Control Panel] from the start menu that appears.



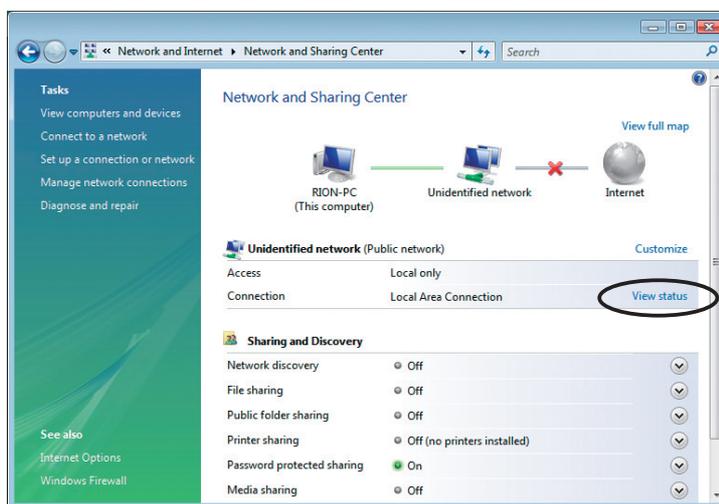
2. On the [Control Panel] screen, click [Network and Internet].



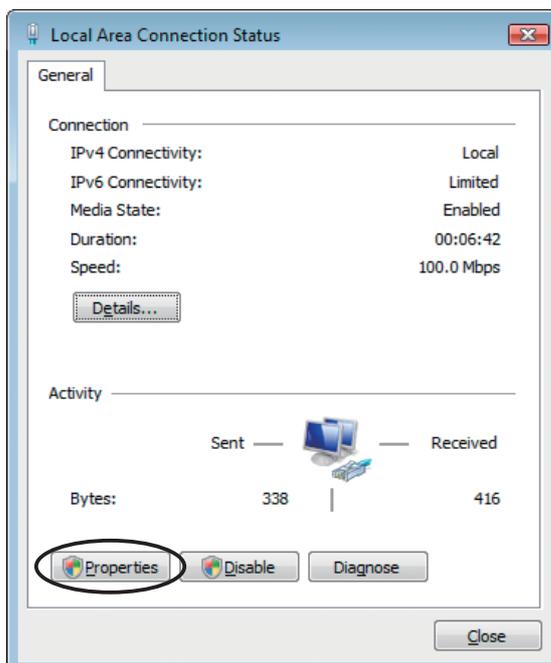
3. On the [Network and Internet] screen, click [Network and Sharing Center].



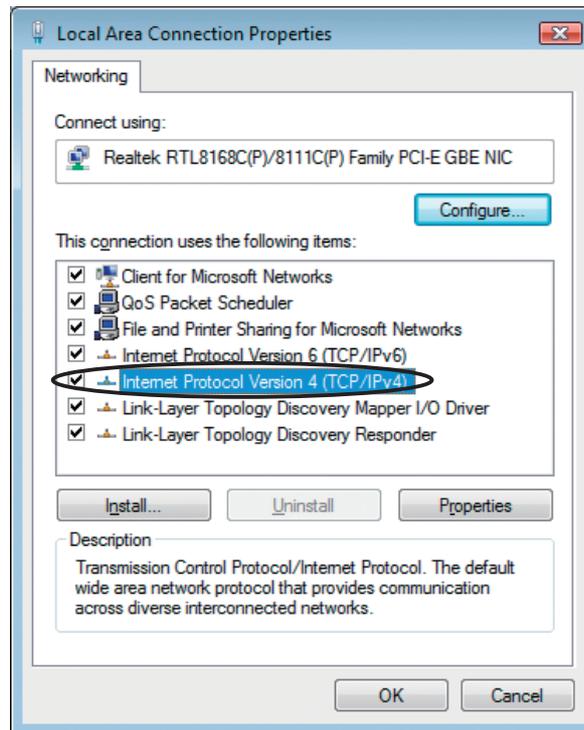
4. On the [Network and Sharing Center] screen, click [View Status] under [Local Area Connection].



5. On the [Local Area Connection Status - General] screen, click [Properties].



- On the [Local Area Connection Properties - Networking] screen, select the [Internet Protocol Version 4 (TCP/IPv4)] check box and double-click.

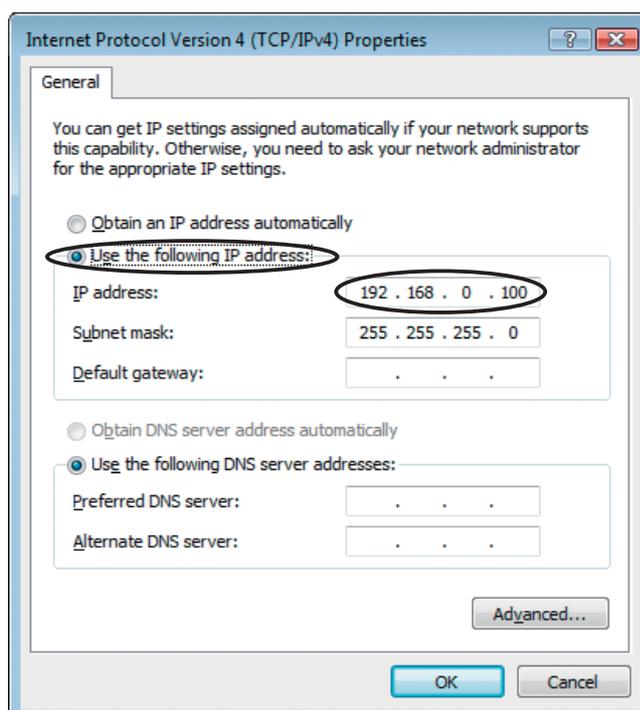


- On the [Internet Protocol Version 4 (TCP/IPv4) Properties - General] screen, select the [Use the following IP address] check box and enter the IP address in the IP address field.

In the Subnet Mask field, enter “255 . 255 . 255 . 0”.

Leave the Default Gateway field blank.

When the input is complete, click [OK].



Installation

- The SA-02A4 can be installed either horizontally or vertically.
- The SA-02M is designed to be installed horizontally only. Do not block the ventilation openings on the top by placing any objects on the unit.

Do not insert any objects between the bottom of the unit and the installation surface, so that the ventilation openings on the bottom are also unobstructed.

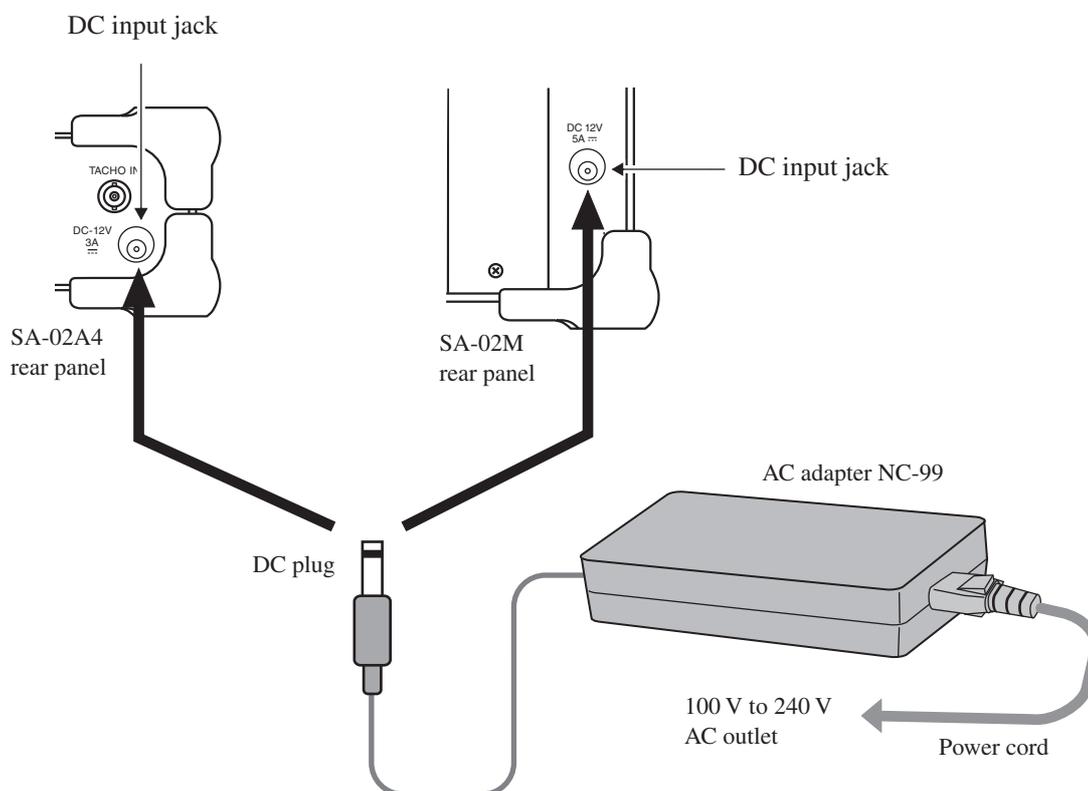
Power supply connections

The SA-02M/SA-02A4 are to be powered from the supplied AC adapter (NC-99).

Important
Do not use any AC adapter other than the supplied product. Otherwise overheating and damage may occur.

Make the connection as follows:

1. Insert the DC plug of the AC adapter into the DC input jack on the rear panel of the unit.
2. Connect the power cord to the AC adapter.
3. Plug the power cord into a 100 V to 240 V AC outlet.



⚠ WARNING

Do not insert or disconnect the power cord plug with wet hands, to prevent the risk of electric shock.

Do not plug the power cord into a power strip along with other electrical devices, to prevent the risk of overheating and fire. Always plug the power cord directly into a wall outlet (100 V to 240 V AC).

When handling the power cord plug, observe the following precautions, to prevent the risk of fire:

- Make sure that the plug is clean before inserting it.
- Always fully insert the plug and make sure that is properly seated.

Do not cover the AC adapter with paper, cloth, or other objects, to prevent heat buildup and the risk of fire.

⚠ Caution

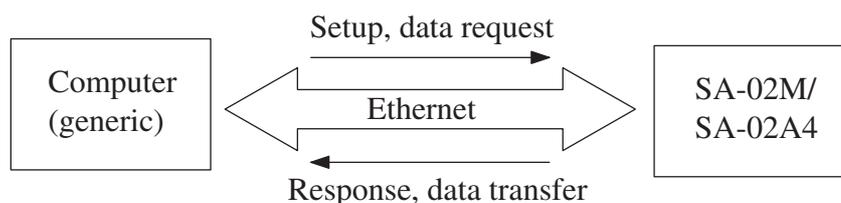
When using the AC adapter, do not coil or bunch the power cord.

Connection to the computer

All communication between the SA-02M/SA-02A4 and the computer on which the dedicated software (SA-02 BASE) is installed occurs via an Ethernet link. This includes setup commands and data request commands sent to the SA-02M/SA-02A4, and response data and measurement data sent from the SA-02M/SA-02A4.

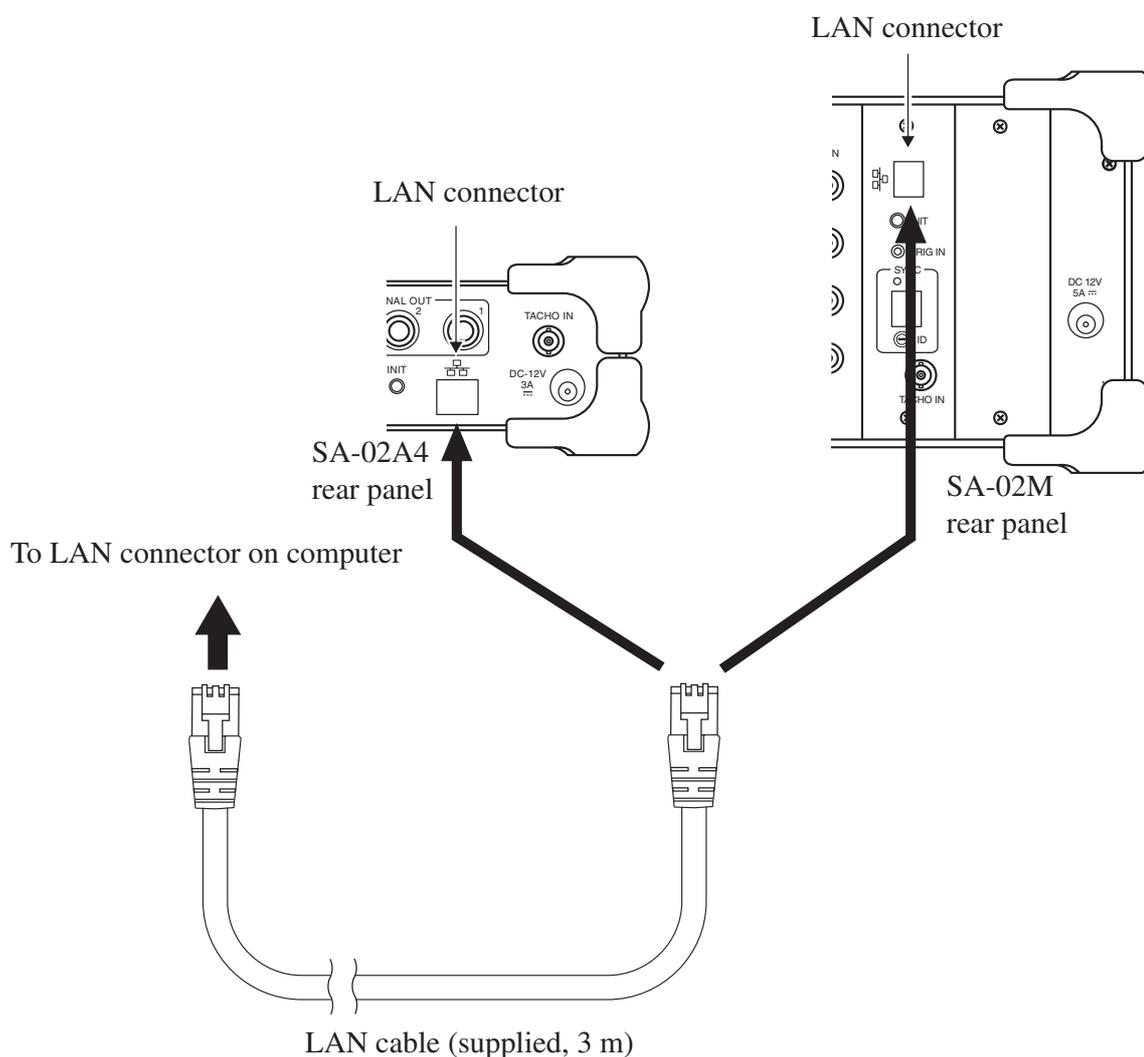
Note

For details on how to install the dedicated software on the computer, please refer to the software instruction manual.



Procedure

1. Connect the LAN connector of the SA-02M/SA-02A4 to the LAN connector of the computer, using the supplied 3 m LAN cable (cross-wired).



Important
Do not disconnect the LAN cable while the dedicated software is running.
If the LAN cable was disconnected by mistake, power to the SA-02M/SA-02A4 needs to be turned off and then on again. The dedicated software also should be shut down and restarted.
If other devices are also connected to the computer at the same time, correct operation of the SA-02M/SA-02A4 is not assured.
Note
Use the supplied LAN cable for the connection.
For information about using other LAN cables, contact the supplier.

Power-on

To turn the SA-02M/SA-02A4 on, press the upper part (|) of the POWER switch. After the power is turned on, the POWER switch lamp flashes for about 15 seconds. During this interval, the SA-02M/SA-02A4 will not be accessible from the computer, and you should not attempt to access it.

When the POWER switch stops flashing and stays constantly lit, the SA-02M/SA-02A4 can be accessed from the computer.

Important
Do not turn the SA-02M/SA-02A4 off during the POWER switch lamp flashes. Otherwise there is a risk of damage to the SA-02M/SA-02A4.
Before turning on the SA-02M, verify that the unit ID switch is set to "0". If the setting is not "0", turn the unit off, set the switch to "0", and then turn the unit on again.

Power-off

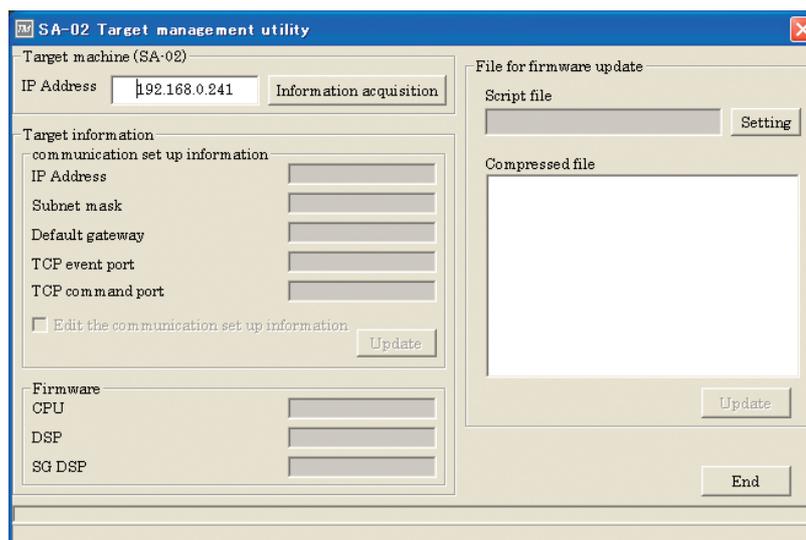
To turn the SA-02M/SA-02A4 off, press the lower part (○) of the POWER switch. The POWER switch lamp goes out.

⚠ Caution
While the unit is not being used, you should disconnect the power cord from the AC outlet for safety.

Setting the IP address of the SA-02M/SA-02A4

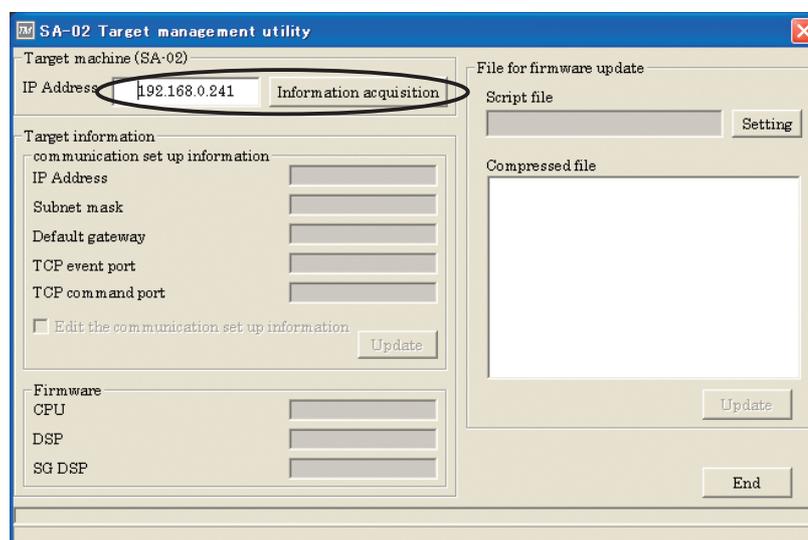
Perform the following steps to set the IP address of the SA-02M/SA-02A4. This procedure requires that the Target Management Utility software is installed on the computer connected to the SA-02M/SA-02A4 (see software instruction manual).

1. Turn power to the SA-02M/SA-02A4 on.
2. Access the Start menu on the computer connected to the SA-02M/SA-02A4, and select [RION] → [SA-02] → [SA-02 Target Management Utility]. The following window appears.

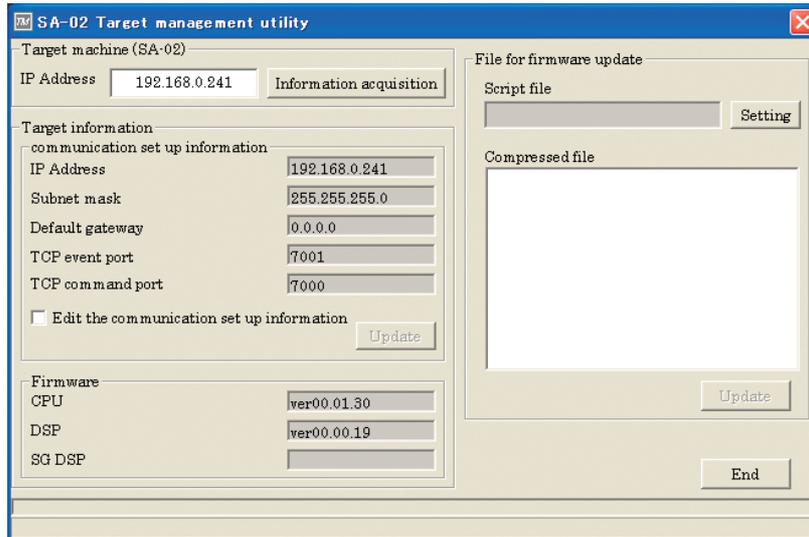


The [Target machine (SA-02)] - [IP Address] field shows the default value: “192.168.0.241”

3. If connecting to the SA-02 for the first time, click [Information acquisition]. If the IP address has been changed from the default (step 4), enter the changed IP address into the [Target machine (SA-02)] - [IP Address] field and click [Information acquisition].



When the connection to the SA-02M/SA-02A4 has been established successfully, the following screen is displayed.



If the connection failed, an error message such as shown below appears.



In this case, check the following points:

- Network settings of computer and of SA-02M/SA-02A4
- Connection of computer and SA-02M/SA-02A4
- IP address entered into [Target machine (SA-02)] - [IP Address] field and IP address of SA-02M/SA-02A4 match?

If you are not sure about the network settings of the SA-02M/SA-02A4, refer to the section “Hardware reset procedure” on page 22 and reset the network settings of the SA-02M/SA-02A4 to the default values.

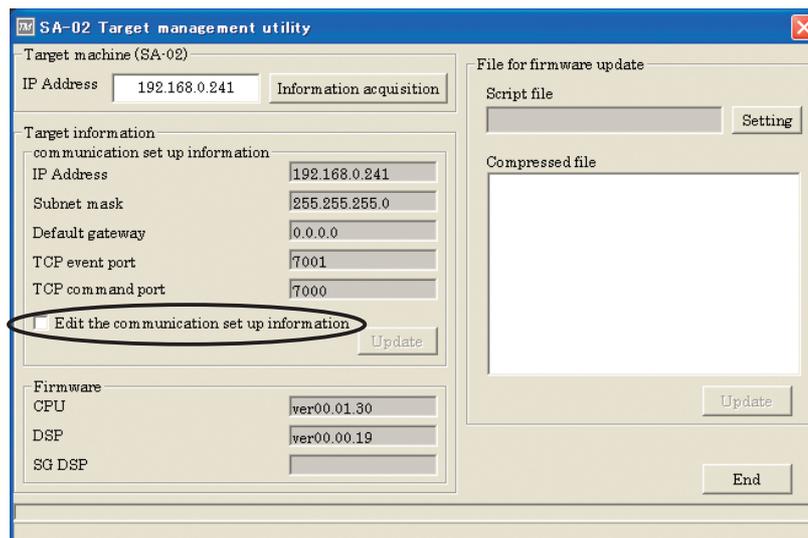
4. To change the IP address, enter the address into the [Target machine (SA-02)] - [IP Address] field and click [Information acquisition].

Important

The computer and the SA-02M/SA-02A4 must not be set to the same IP address.

5. Click [End] to terminate the SA-02 Target management utility and close the window.

Screen explanation



The [Target information] - [communication set up information] field has the following items. Some items can be modified when the [Edit the communication set up information] check box has been selected. Enter the changed value in the respective field and click [Up date].

IP Address

The IP address assigned to the SA-02M/SA-02A4 and entered into the [Target machine (SA-02)] - [IP Address] field is shown here.

Important
The computer and the SA-02M/SA-02A4 must not be set to the same IP address.

Subnet mask

The default value is “255 . 255 . 255 . 0”. A subnet mask for differentiating IP addresses between network addresses and host addresses can be set here. As a rule, the same setting as at the computer should be used. If a different value is set, the computer may no longer be able to connect to the SA-02M/SA-02A4.

Default gateway

The default value is “0.0.0.0”. Normally this should not be changed.

TCP event port / TCP command port

Indicates the port numbers used by the SA-02M/SA-02A4. This setting cannot be changed.

The [Target information] - [Firmware] field shows version information. The [File for firmware update] field is normally not used.

Hardware reset procedure

Pressing the LAN setup initialize switch returns the network settings of the SA-02M/SA-02A4 to the default condition. Perform the hardware reset as follows.

1. Verify that the POWER switch of the SA-02M/SA-02A4 is OFF.
2. Use the tip of a stylus or a similar tool to push down the LAN setup initialize switch (INT) on the rear panel of the SA-02M/SA-02A4. Do not use a sharp metallic object such as wire or a cutter knife to avoid the risk of damaging the switch.
3. While holding down the LAN setup initialize switch, turn power to the unit on. You can release the switch when the POWER switch has started to flash.
4. When the POWER switch stops flashing and stays constantly lit, the initialization is complete.

Connecting the copy protection key

To be able to use the dedicated software installed on the computer, the copy protection key supplied with the software must be connected to the computer.

Note
If the copy protection key is not connected, the software will not start up.
Keep the copy protection key in a safe location. If it is lost or has become damaged, the software cannot be used.

Procedure

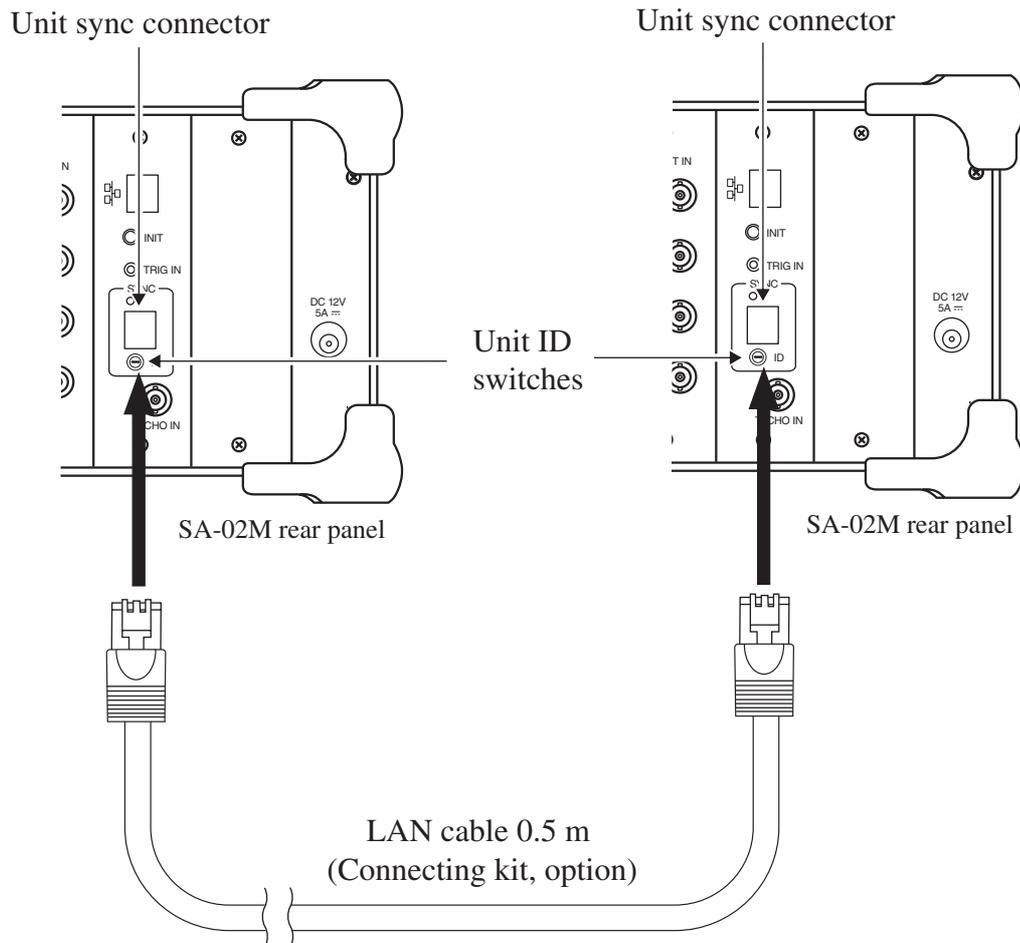
Plug the copy protection key into a USB port on the computer.

Using two SA-02M units together

To use two SA-02M units together, the units are synchronized via a LAN cable and connected to the computer via a switching hub. The Connecting kit available as an option comprises the LAN cables and hub.

Connecting the SA-02M units

Use the 0.5 m LAN cable (straight cable) supplied with the optional Connecting kit to connect the unit sync connectors on the rear panels of the two SA-02M units.



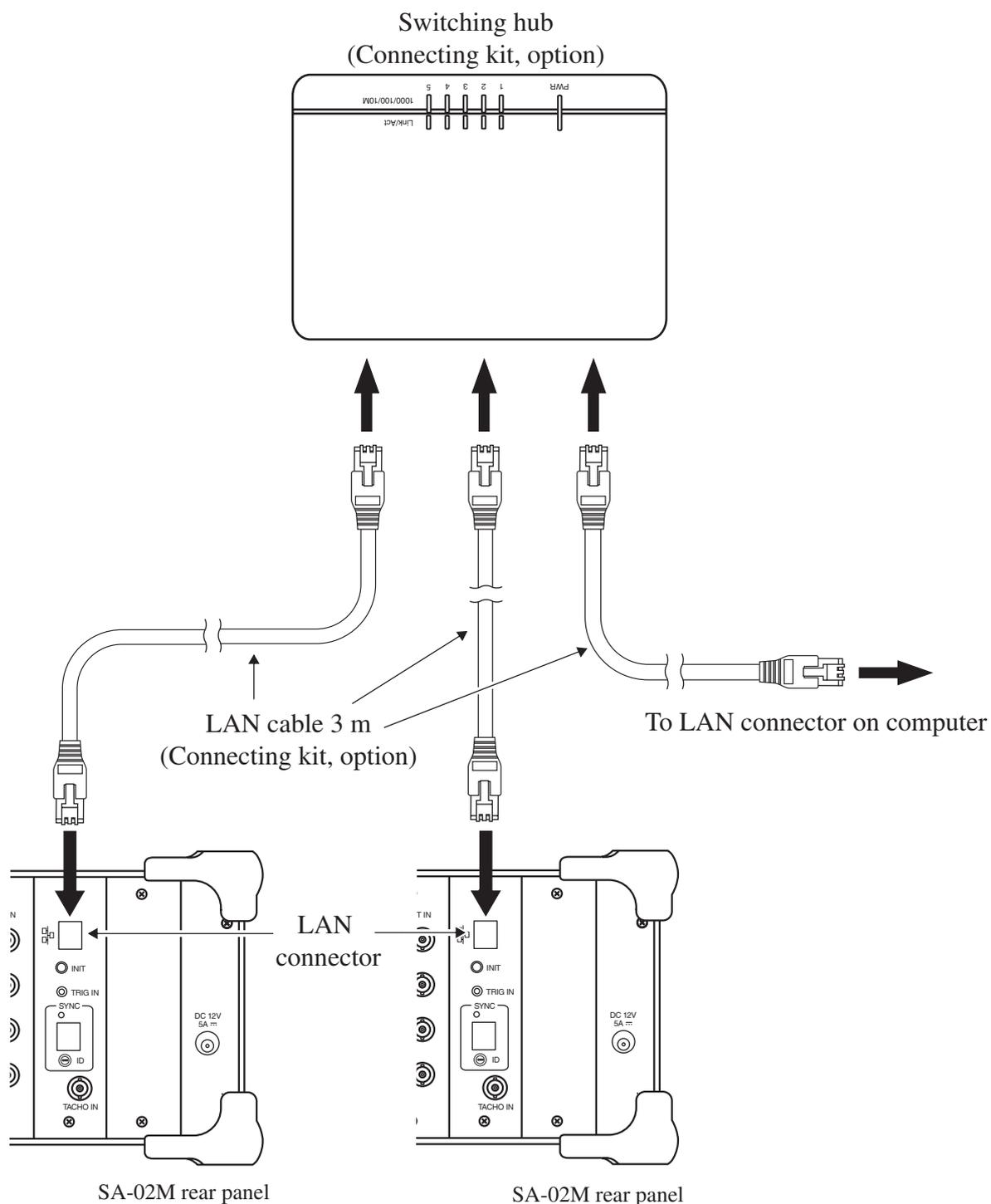
After connecting the LAN cable, set the Unit ID switches. On the unit using channels for 1 to 16, set the Unit ID switch to “1”, and set the switch to “2” on the unit using channels for 17 to 32.

Note

Use only the LAN cables supplied as part of the optional Connecting kit.

Connection to the Computer

The two SA-02M units must be connected to the computer via the switching hub supplied as part of the optional Connecting kit. Use the 3 m LAN cables (straight cables) supplied with the kit.



Note

Use only the switching hub and LAN cables supplied as part of the optional Connecting kit.

For details on using the switching hub, please refer to the supplied documentation.

Signal input/output

Signal input via BNC input connectors

The BNC input connectors accept the AC output supplied by a sound or vibration level meter, as well other kinds of electrical signals. An accelerometer with integrated preamplifier can also be connected.

WARNING

Do not touch the BNC input connectors with a wire, pin, or similar object, to prevent the risk of electric shock.

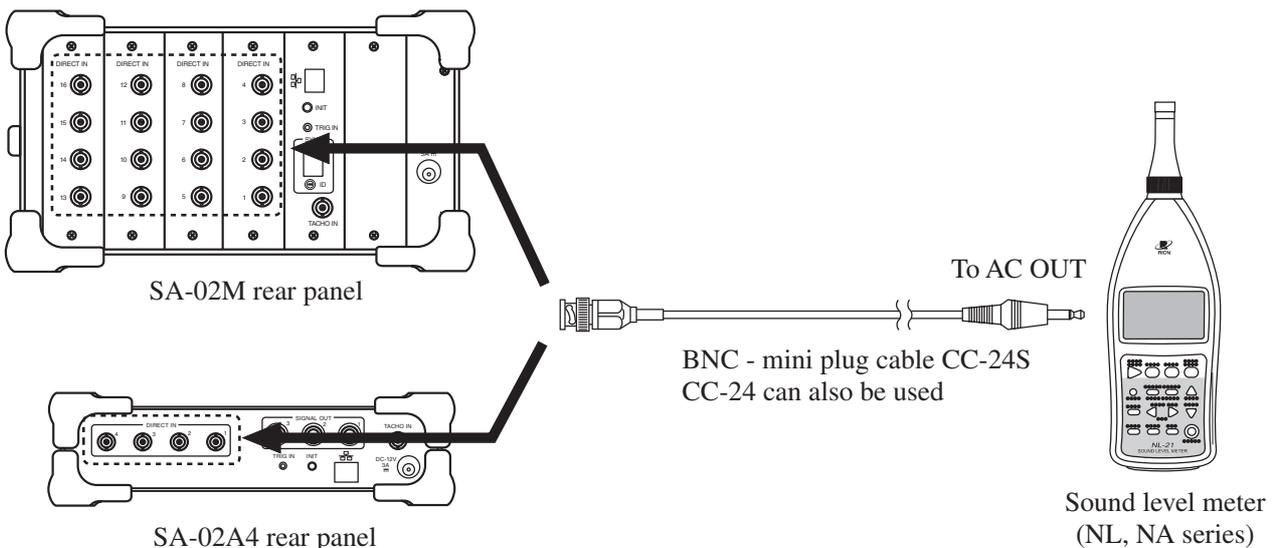
Important

Make signal input connections from a source device only while power to the SA-02M/SA-02A4 is turned off, to prevent the risk of damage.

Connection example 1

Connecting the AC output of a sound level meter

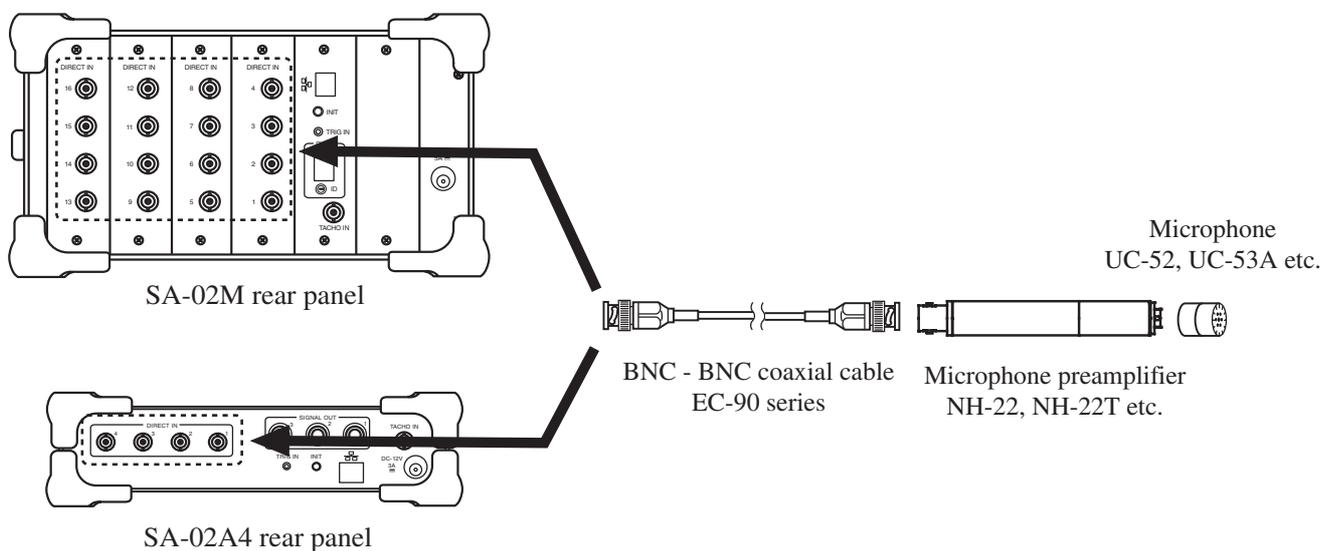
By connecting the AC output of a sound level meter (NL series, NA series or other product, option) to the BNC input connector, using the BNC - mini plug cable CC-24S (option), the signal captured by the microphone of the sound level meter can be supplied to the SA-02M/SA-02A4.



Connection example 2

Connecting a constant current drive preamplifier

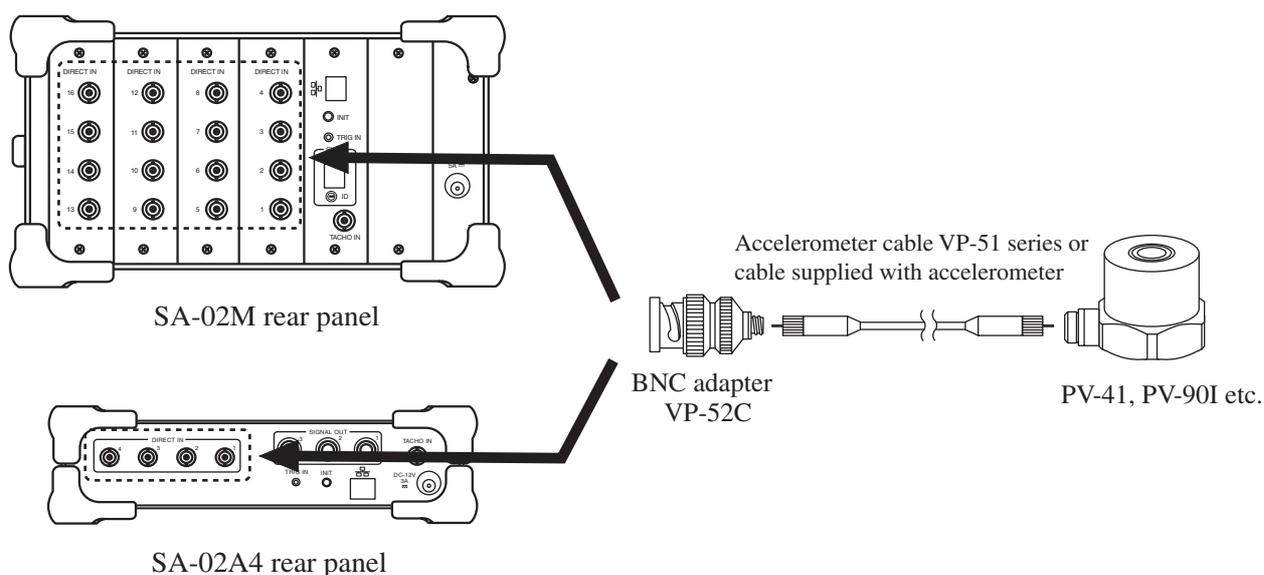
A microphone (such as the UC-52, UC-53A etc., option) mounted on a constant current drive type microphone preamplifier (such as the NH-22, NH-22T etc., option) can be connected, using a cable of the BNC - BNC coaxial cable EC-90 series (option), as shown below.



Connection example 3

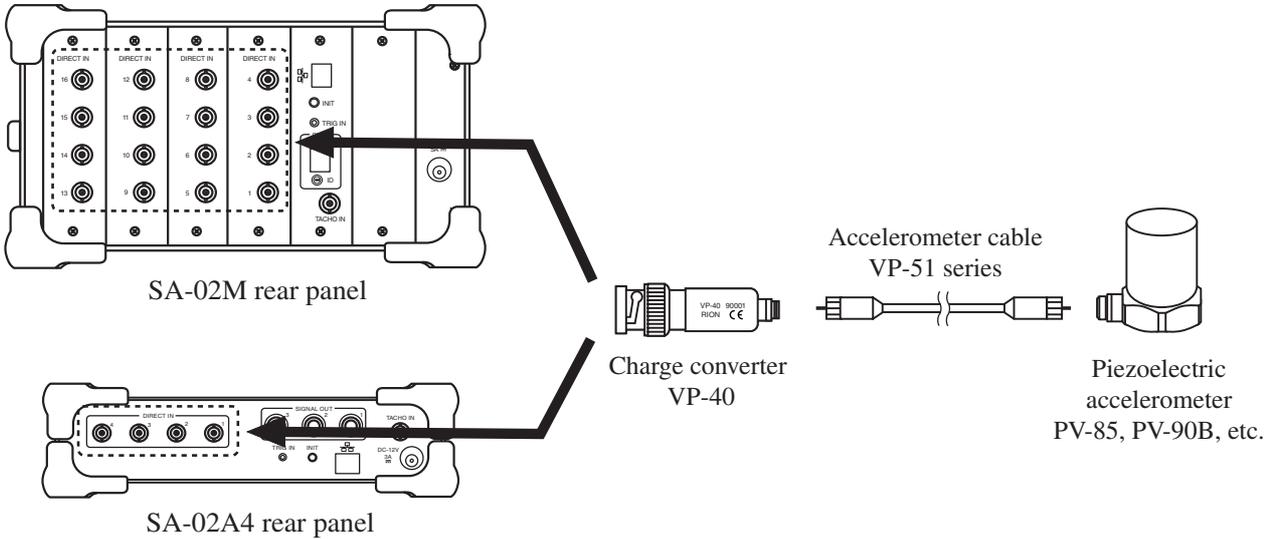
Connecting an accelerometer with integrated preamplifier

A piezoelectric accelerometer with integrated preamplifier (such as the PV-41, PV-90I etc., option) can be connected, using an accelerometer cable of the VP-51 series or the cable supplied with the accelerometer and the BNC adapter VP-52C (option), as shown below.



Connection example 4 Connecting a charge converter

A piezoelectric accelerometer (PV-85, PV-90B etc., option) used together with the charge converter VP-40 (option) can be connected, as shown below.



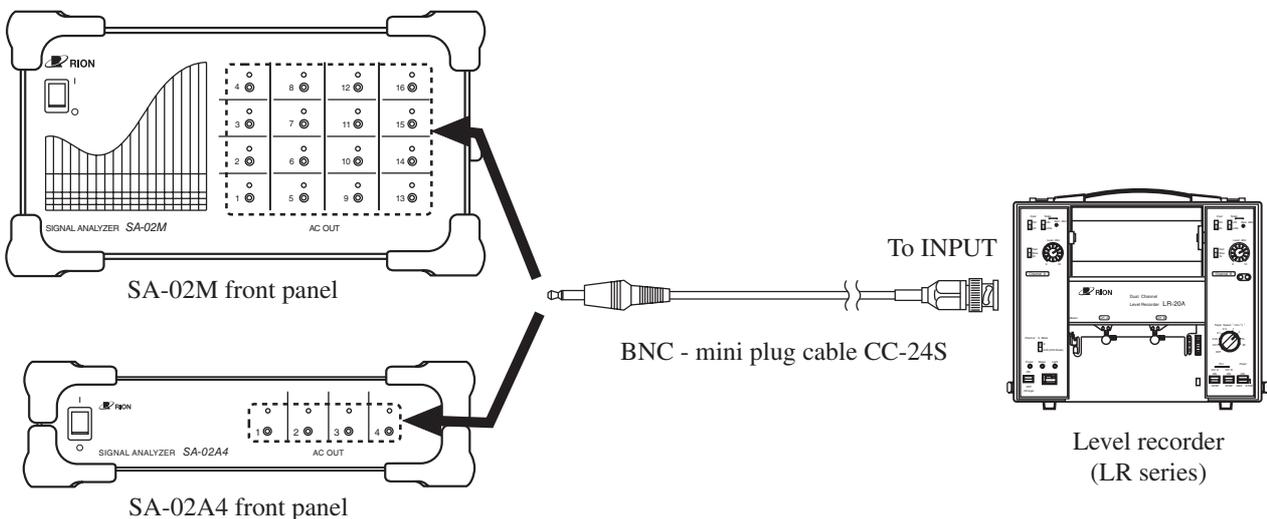
Signal output

The signal in each channel can be output as an AC signal.

Note
The signal supplied at the AC output connectors is obtained by applying frequency weighting to each channel input signal and adjusting the level so that 1 Vrms corresponds to the full-scale point in the selected level range.
The AC output connectors for slots in which no unit is installed are inactive.

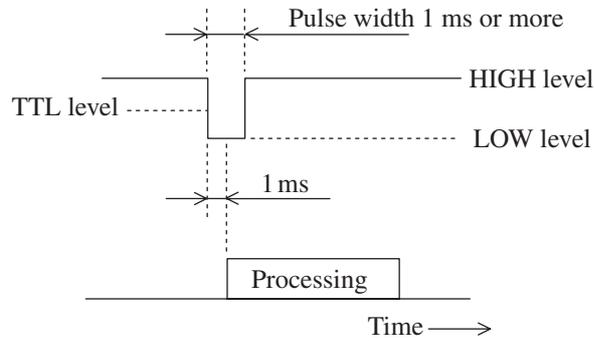
Example: Using a level recorder

The level waveform for each channel can be recorded by connecting a level recorder (LR series, option) to the unit, using the BNC - mini plug cable CC-24S (option), as shown below.



External trigger signal input

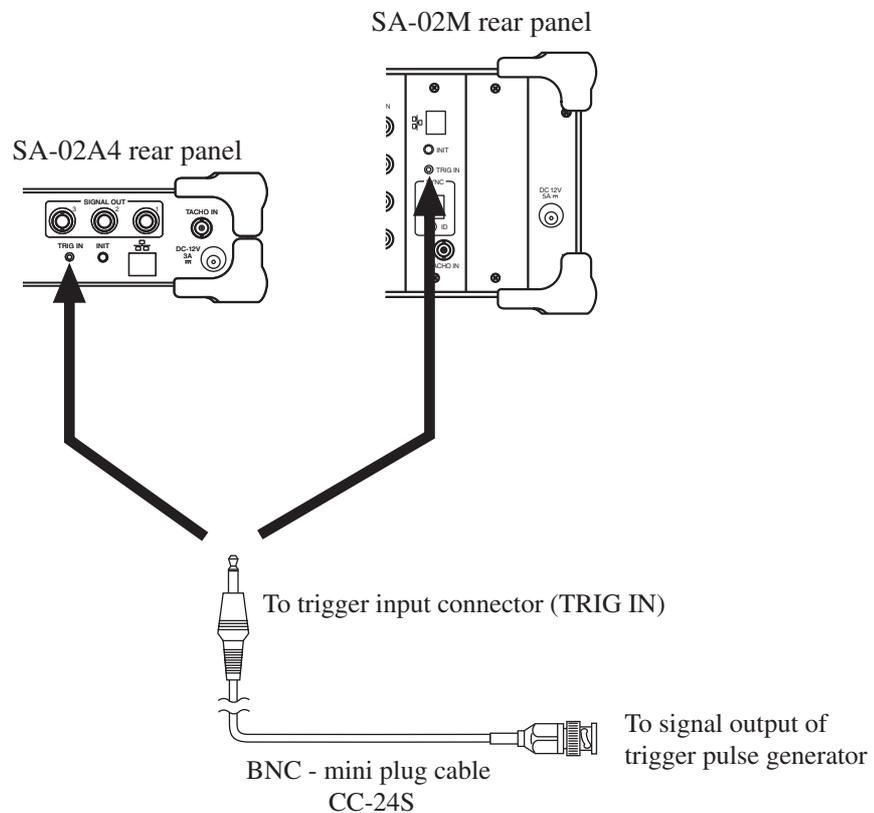
If a trigger pulse generator is connected to the trigger input connector (TRIG IN), the unit can be controlled by a trigger. As shown in the illustration below, triggering occurs when the trigger signal stays at LOW level for at least 1 ms.



Connection example

Connecting a trigger pulse generator

The BNC - mini plug cable CC-24S (option) can be used to connect a trigger pulse generator equipped with a BNC output, as shown below.



Tachometer signal input

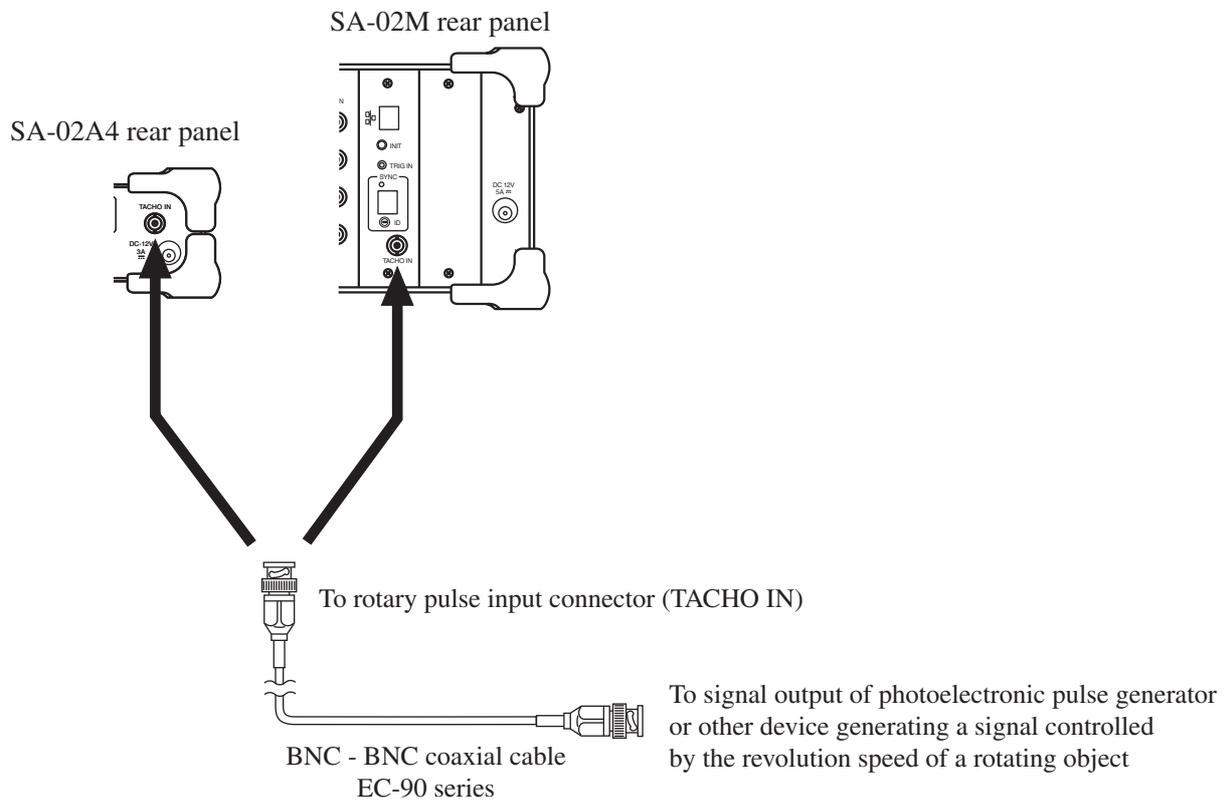
The rotary pulse input connector (TACHO IN) serves for input of a rotary pulse signal (Tacho signal). The SA-02M/SA-02A4 can perform tracking analysis of a pulse signal derived from a rotating object such as a fan or motor and changing with the revolution speed.

The rotary pulse signal can also be used for triggering.

Connection example

Connecting a rotary pulse generator

The BNC - BNC coaxial cable EC-90 series (option) can be used to connect a rotary pulse generator equipped with a BNC output, as shown below.



Specifications

Standard compliance

Octave band, 1/3 octave band, 1/12 octave band filters

JIS C 1514:2002 Class 1

IEC 61260:1995 Class 1

Legal compliance WEEE Directive

RoHS Directive

Input section

Number of channels

SA-02M 4 channels (standard)
8 channels (with 1 SA-02E4 unit installed)
12 channels (with 2 SA-02E4 unit installed)
16 channels (with 3 SA-02E4 unit installed)
Max. 32 channels (using two SA-02M units)

SA-02A4 4 channels

Connectors

Type BNC × number of channels

Max. input voltage

±20 V

Input impedance

100 kΩ

CCLD (Constant Current Line Drive)

4 mA, 24 V (separate on/off setting for each channel)

Input coupling

AC/DC (separate setting for each channel)

0.05 Hz (-3 dB, 6 dB/oct, for AC coupling)

TEDS TEDS sensor compliant

Range Separate setting for each channel

-40 dB to +20 dB, 10-dB steps (taking 1 V_{rms} as 0 dB)

Amplifier section

Frequency range DC to 40 kHz

Analog filters Separate setting for each channel

Frequency weighting filters

High-pass filter (HPF) OFF / 20 Hz (-1 dB, 18 dB/oct)

Low-pass filter (LPF) OFF / 1 kHz (-1 dB, 18 dB/oct) / 20 kHz
(-1 dB, 18 dB/oct)

Frequency weighting characteristics

FLAT / A / C (A and C available only when both HPF and LPF are OFF)

Corresponding to A and C characteristics, Class 1 of JIS C 1509-1:2005 and Class 1 of IEC 61672-1:2002

Inherent noise	-85 dB or less of range full-scale (all-pass level, 0 dB range)
	-65 dB or less of range full-scale (all-pass level, -40 dB range)
Dynamic range	105 dB or more (0 dB range)
Crosstalk	-105 dB or less (1/3 octave, 0 dB range, 1 kHz band)
Overload level	+2 dB of range full-scale

A/D converter section

A/D converter	Simultaneous sampling of all channels
	24-bit delta-sigma type converter
	Sampling frequency 102.4 kHz

Input/output section

AC output connectors

Type 2.5 dia. mono phone jack × number of channels

Output impedance

600 Ω

Output voltage

1 V_{rms} (at input range full-scale point)

Output signal Routed through analog filter before output

Trigger input connector

Type 2.5 dia. mono phone jack × 1

Input signal Open collector supported

5 V input, TTL level threshold

Rotary pulse input connector

Type BNC × 1

Input signal Rotary pulse, 0 to 10 V

Input impedance

100 kΩ

H-L threshold 1 to 4 V, changeable in 0.1-V steps

Pulse measurement method

Cycle measurement with 12.5 MHz sampling

Measurement range

30 to 600,000 pulses/minute

Data save cycle

Time waveform transfer mode:

sampling frequency of A/D converter

Octave mode: every 100 ms

LAN connector RJ-45 × 1, 100 Base-TX

Unit sync connector (SA-02M only)

RJ-45 × 1

Sync cable length: max. 50 cm

Display section

Number of windows

2 / 4 / 8 / 12 / 16

FFT analysis Functions calculated with FFT are shown (dependent on FFT analysis functions)

Octave band analysis

Octave band, 1/3 octave band, 1/12 octave band analysis results and processing results are shown

Analysis processing section

Using sampling data obtained by digitizing the input signals, the section handles calculation processing, store operations, trigger processing, and command send/receive communication with the computer

Recording section

File input/output

Test parameter file

Settings can be saved to and loaded from a file

Data file

Analysis data can be saved to and loaded from a file in CSV format

JPEG file

Graphs can be saved to a file in JPEG format

Copy function

A specified graph or the entire window can be copied to the clipboard

FFT analyzer section

Analysis frequencies (Hz)

40 k, 20 k, 10 k, 5 k, 2 k, 1 k, 500, 200, 100

Number of analysis points

64, 128, 256, 512, 1024, 2048, 4096, 8192, 16384, 32768

Throughput performance

20 kHz, 16 channels

Trigger processing

Trigger modes

Free, Single, Repeat

Trigger types

Level trigger, external trigger, signal output trigger, rotary pulse trigger

Trigger position

Settable in 1-sample steps over ± 1 frame range

Level trigger conditions

Trigger channel:	Channel used for trigger detection
Trigger amplitude:	Input signal amplitude used for trigger detection
Slope:	Amplitude change direction used for trigger detection + (Trigger amplitude down → up change) - (Trigger amplitude up → down change)

Rotary pulse trigger conditions

Trigger rotary pulse:	rpm used for trigger detection (number of pulses per minute)
Slope:	Speed change direction used for trigger detection + (Trigger rotary pulse low → high change) - (Trigger rotary pulse high → low change)

Phase difference

Corresponding to Processor Class 1 of the JIS C 1507:2006 and IEC 61043:1993 (among channels in same slot)
Within ± 1 degree at 40 kHz

Inherent noise

-105 dB or lower (40 kHz range, 0 dB range, 1024 analysis points)

Octave band analyzer section

Analysis types Octave band, 1/3 octave band, 1/12 octave band analysis

Standard compliance

JIS C 1514 (IEC 61260) Class 1

Analysis bandwidth, number of channels, analysis frequency range, number of bands

Octave band: 0.5 Hz to 16 kHz octave center frequencies and AP,
17 bands

1/3 octave band:

0.4 Hz to 20 kHz 1/3 octave center frequencies and AP, 49 bands

1/12 octave band (1 channel per board)

0.36 Hz to 22 kHz 1/12 octave center frequencies and AP, 193 bands

1/12 octave band (2 channels per board)

0.36 Hz to 11 kHz 1/12 octave center frequencies and AP, 181 bands

1/12 octave band (4 channels per board)

0.36 Hz to 5.5 kHz 1/12 octave center frequencies and AP, 169 bands

Operating channels in 1/12 mode are determined by the number of channels per board. The combination of channel number setting per board and number of operating channels is shown in the table below.

Number of channels per board	1st	2nd	3rd	4th	5th	6th	7th	8th
1	1	5	9	13	17	21	25	29
1	2	6	10	14	18	22	26	30
1	3	7	11	15	19	23	27	31
1	4	8	12	16	20	24	28	32
2	1, 3	5, 7	9, 11	13, 15	17, 19	21, 23	25, 27	29, 31
2	2, 4	6, 8	10, 12	14, 16	18, 20	22, 24	26, 28	30, 32
4	1 to 4	5 to 8	9 to 12	13 to 16	17 to 20	21 to 24	25 to 28	29 to 32

Time weighting characteristics (each channel)

1 ms, 10 ms, 35 ms, 125 ms (F), 630 ms (VL), 1 s (S), 10 s

Processing functions

Linear averaging

Processing time: 1 to 3600 s

direct calculation from filter output waveform

Maximum hold

Instantaneous value monitored and held for each sample

Maximum hold type

Band Maximum value monitored and held for each frequency band

All-pass Maximum all-pass value monitored and values held for all frequency bands

Memory functions

Store targets Instantaneous value, linear average value, or maximum value + rotary pulse

Auto store function

Data are stored in internal memory at specified store cycle and then sent to computer

Store start/stop: Manual operation or trigger

Store pause:	Processing can be paused during storing and resumed from same point
Store cycle:	Instantaneous value 1 ms to 1000 ms (1-ms steps)
Number of store data:	Min. 1, increments of 1, maximum number dependent on analysis bandwidth
	Octave band: 36,000
	1/3 octave band: 36,000
	1/12 octave band: 18,000

Trigger processing

Trigger modes

Free, Single, Repeat

Trigger types Level trigger, external trigger, signal output trigger, rotary pulse trigger

Trigger position

Settable in 1-s steps over 0 to 60 s range

Level trigger conditions

Trigger channel: Channel used for trigger detection
 Trigger level: Input signal level used for trigger detection

0 to -80 dB of full scale, 1-dB steps

Slope: Level change direction used for trigger detection

+ (Trigger level low → high change)

- (Trigger level high → low change)

Frequency band: Frequency band used for trigger detection

(For 1/12 octave band, 1/3 octave band is used; triggering occurs when one of the four 1/12 octave bands in one 1/3 octave band is exceeded.)

Rotary pulse trigger conditions

Trigger rotary pulse: rpm used for trigger detection (number of pulses per minute)

Slope: Speed change direction used for trigger detection

+ (Trigger rotary pulse low → high change)

- (Trigger rotary pulse high → low change)

Trigger controlled operation

Processing (linear average / maximum hold) start, auto store start

Inherent noise levels

At 0 dB level range

All-pass:	-85 dB of range full-scale
Octave band:	-93 dB of range full-scale
1/3 octave band:	-97 dB of range full-scale
1/12 octave band:	-102 dB of range full-scale

At -40 dB level range

All-pass:	-65 dB of range full-scale
Octave band:	-70 dB of range full-scale
1/3 octave band:	-77 dB of range full-scale
1/12 octave band:	-82 dB of range full-scale

Time waveform + octave analysis simultaneous processing

Time waveform and octave analysis results can be sent to computer simultaneously

Repeat trigger and trigger position cannot be used

Switches

POWER switch Rocker switch with LED illumination

LAN setup initialize switch

Push switch × 1

Unit ID switch Rotary switch × 1 (SA-02M only)

LEDs

Overload indication for each channel

Lit green: No overload has occurred

Lit red: Overload has occurred

LEDs for unused channels are off

Optional expansion

Channel expansion slots

SA-02A4: None

SA-02M: 3

Signal output units installed

SA-02A4: 1

SA-02M: 1

Ambient conditions for use

0°C to +40°C, max. 90% RH (no condensation)

Power supply

Source AC adapter NC-99

Power consumption (no option unit installed, NC-99 used at 100 V to 240 V AC)

SA-02A4: approx. 30 VA

SA-02M (4 channels installed): approx. 30 VA

SA-02M (8 channels installed): approx. 40 VA

SA-02M (12 channels installed): approx. 50 VA

SA-02M (16 channels installed): approx. 60 VA

Dimensions and weight

SA-02A4	58 (H) mm × 260 (W) mm × 210 (D) mm (without protruding parts and rubber feet) Approx. 2.5 kg
SA-02M	151 (H) mm × 290 (W) mm × 249 (D) mm (without protruding parts and rubber feet) Approx. 5.4 kg (4 channels installed) Approx. 5.9 kg (8 channels installed) Approx. 6.3 kg (12 channels installed) Approx. 6.8 kg (16 channels installed)

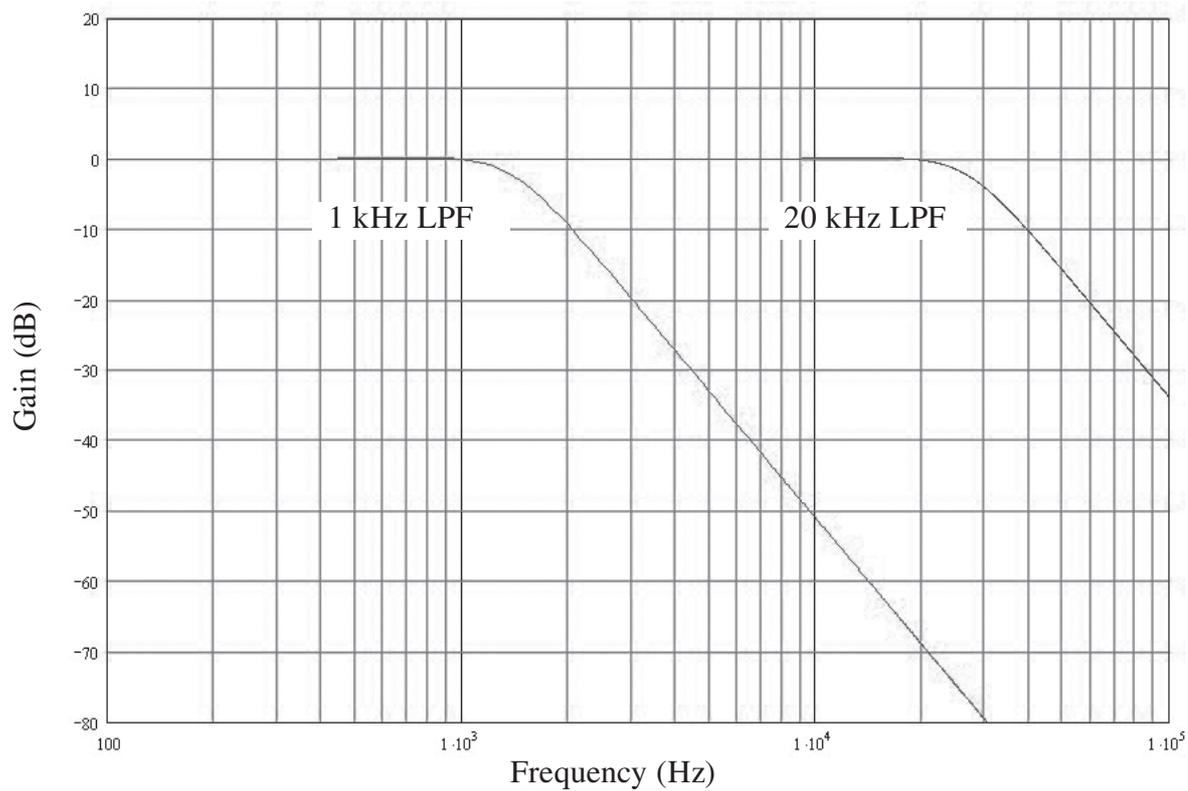
Supplied accessories

AC adapter NC-99	1
LAN cable (STP, cross-wired, 3 m)	1
Hardware instruction manual	1
Software instruction manual	1
Inspection certificate	1

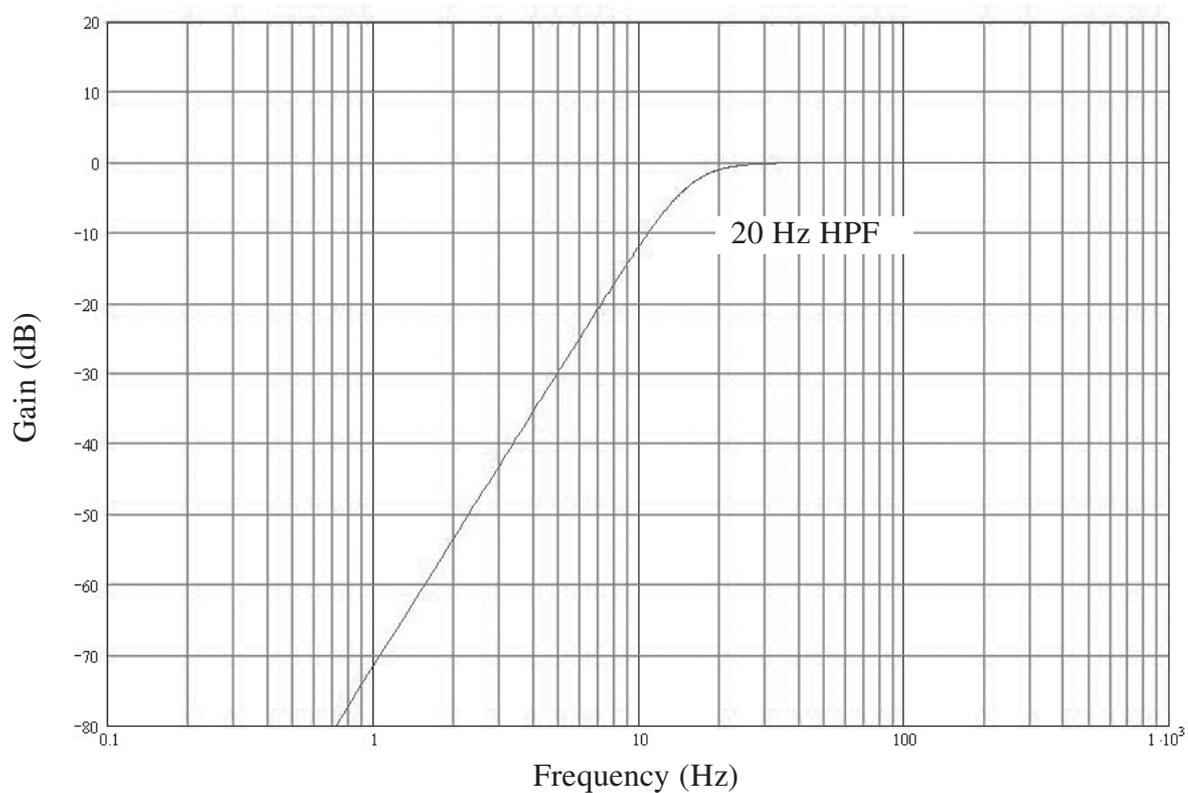
Options

4-channel input unit	SA-02E4
Signal output unit	SA-02SG
Airborne noise/floor impact noise insulation measurement software	AS-20PE5
Semi-anechoic acoustic power level measurement software	AS-30PA5
Acoustic intensity measurement software	AS-15PA5
Connecting kit	
LAN cable (STP, straight, 3 m)	3
LAN cable (STP, straight, 0.5 m, for unit sync connection)	1
Switching hub	1

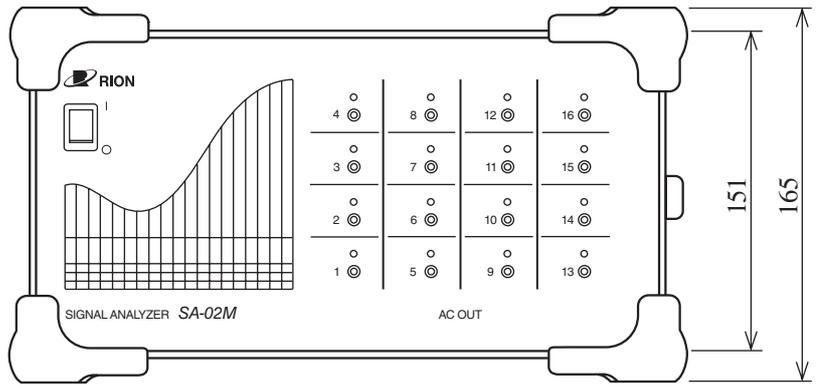
Typical characteristics of filter



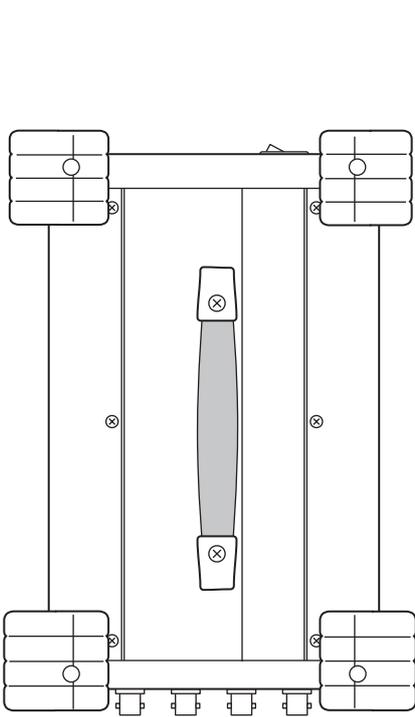
Typical characteristic of low-pass filter (LPF: 1 kHz, 20 kHz)



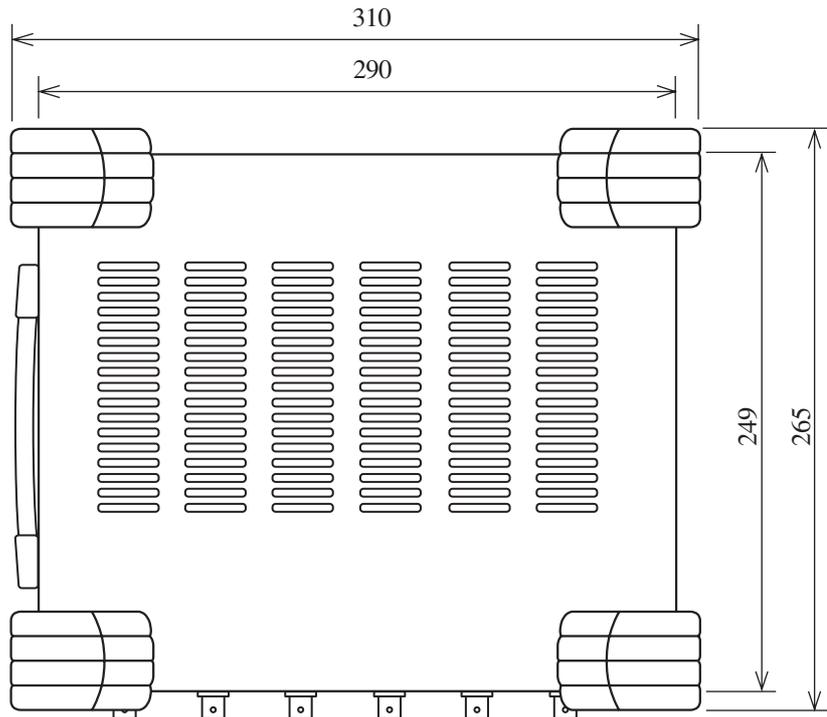
Typical characteristic of high-pass filter (HPF: 20 Hz)



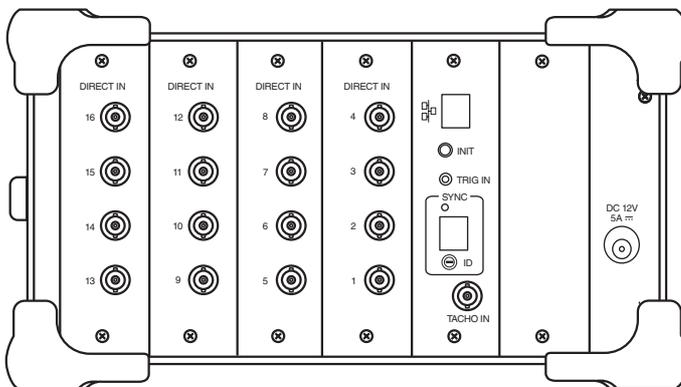
Front view



Right side view



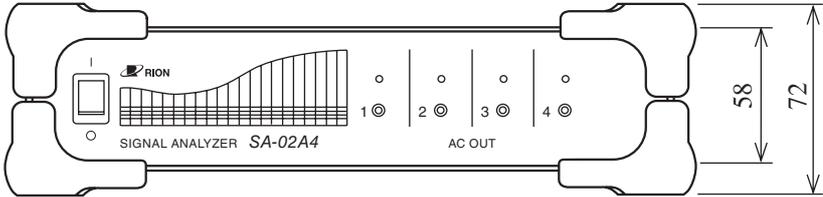
Top view



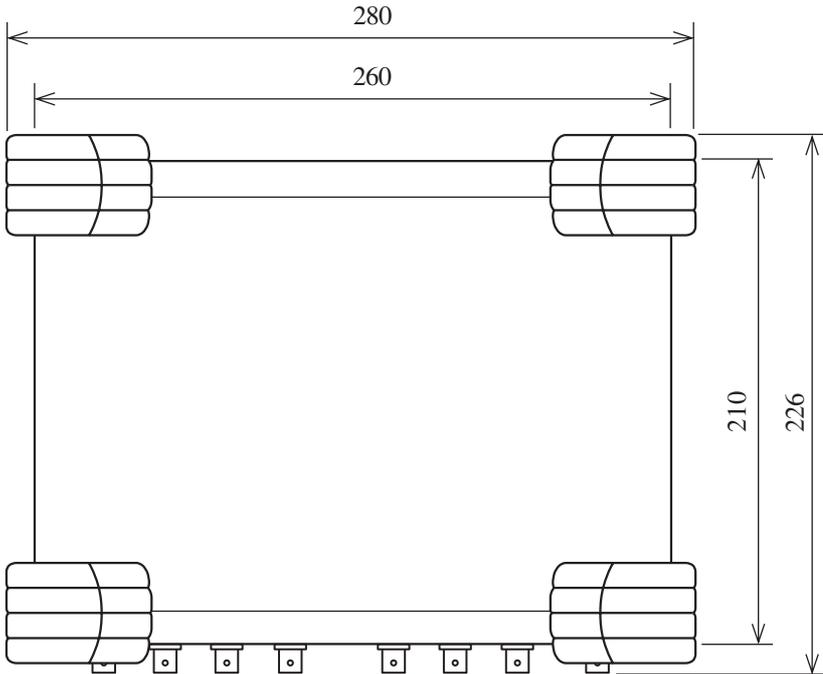
Rear view

Unit: mm

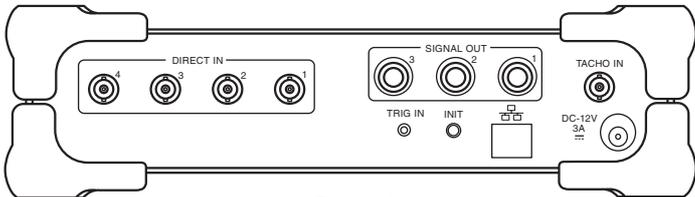
SA-02M Dimensional Drawings



Front view



Top view



Rear view

Unit: mm
SA-02A4 Dimensional Drawings

