

# TEAC

## INTEGRATED RECORDER

# GX-1

## Instruction Manual

Please read this manual before using the product, and keep this manual handy.

Introduction

Installation

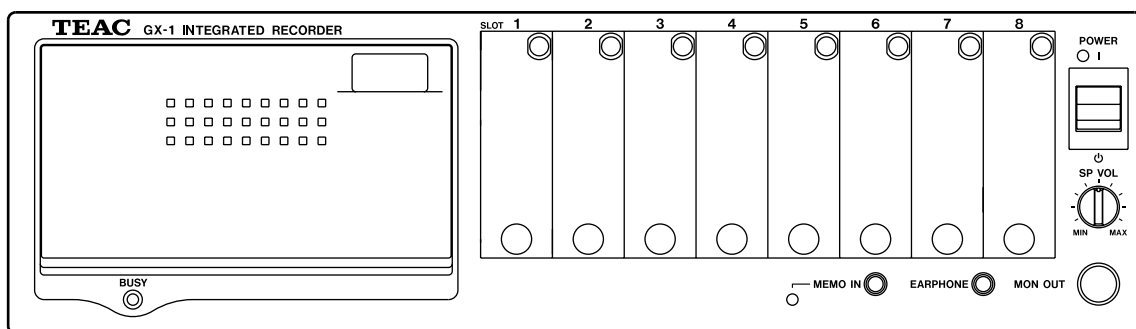
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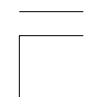
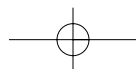
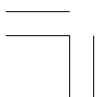
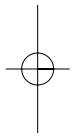
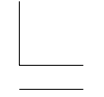
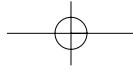
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TEAC Corporation

May 2002 D00458510C



# SAFETY INSTRUCTIONS

**CAUTION:**

- **Read all of these Instructions.**
- **Save these Instructions for later use.**
- **Follow all Warnings and Instructions marked on the product.**

- 1) Read instructions** — All the safety and operating instructions should be read before the product is operated.
- 2) Retain instructions** — The safety and operating instructions should be retained for future reference.
- 3) Heed Warnings** — All warnings on the product and in the operating instructions should be adhered to.
- 4) Follow instructions** — All operating and use instructions should be followed.
- 5) Cleaning** — Unplug this product from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.
- 6) Attachments** — Do not use attachments not recommended by the product manufacturer as they may cause hazards.
- 7) Water and Moisture** — Do not use this product near water — for example, near a bath tub, wash bowl, kitchen sink, or laundry tub; in a wet basement; or near a swimming pool; and the like.
- 8) Accessories** — Do not place this product on an unstable cart, stand, tripod, bracket, or table. The product may fall, causing serious injury to a child or adult, and serious damage to the product.
- 9) Ventilation** — Slots and openings in the cabinet are provided for ventilation and to ensure reliable operation of the product and to protect it from overheating, and these openings must not be blocked or covered. The openings should never be blocked by placing the product on a bed, sofa, rug, or other similar surface. This product should not be placed in a built-in installation such as a bookcase or rack unless proper ventilation is provided or the manufacturer's instructions have been adhered to.
- 10) Power Sources** — This product should be operated only from the type of power source indicated on the marking label. If you are not sure of the type of power supply to your home, consult your product dealer or local power company. For products intended to operate from battery power, or other sources, refer to the operating instructions.
- 11) Grounding or Polarization** — This product may be equipped with a polarized alternating-current line plug (a plug having one blade wider than the other). This plug will fit into the power outlet only one way. This is a safety feature. If you are unable to insert the plug fully into the outlet, try reversing the plug. If the plug should still fail to fit, contact your electrician to replace your obsolete outlet. Do not defeat the safety purpose of the polarized plug.

**12) Power-Cord Protection** — Power-supply cords should be routed so that they are not likely to be walked on or pinched by items placed upon or against them, paying particular attention to cords at plugs, convenience receptacles, and the point where they exit from the product.

**13) Lightning** — For added protection for this product during a lightning storm, or when it is left unattended and unused for long periods of time, unplug it from the wall outlet. This will prevent damage to the product due to lightning and power-line surges.

**14) Overloading** — Do not overload wall outlets, extension cords, or integral convenience receptacles as this can result in risk of fire or electric shock.

**15) Object and Liquid Entry** — Never push objects of any kind into this product through openings as they may touch dangerous voltage points or short-out parts that could result in a fire or electric shock. Never spill liquid of any kind on the product.

**16) Servicing** — Do not attempt to service this product yourself as opening or removing covers may expose you to dangerous voltage or other hazards. Refer all servicing to qualified service personnel.

**17) Damage Requiring Service** — Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:

- a) when the power-supply cord or plug is damaged.
- b) if liquid has been spilled, or objects have fallen into the product.
- c) if the product has been exposed to rain or water.
- d) if the product does not operate normally by following the operating instructions. Adjust only those controls that are covered by the operating instructions as an improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the product to its normal operation.
- e) if the product has been dropped or damaged in any way.
- f) when the product exhibits a distinct change in performance — this indicates a need for service.

**18) Replacement Parts** — When replacement parts are required, be sure the service technician has used replacement parts specified by the manufacturer or have the same characteristics as the original part. Unauthorized substitutions may result in fire, electric shock, or other hazards.

**19) Safety Check** — Upon completion of any service or repairs to this product, ask the service technician to perform safety checks to determine that the product is in proper operating condition.

**20) Heat** — The product should be situated away from heat sources such as radiators, heat registers, stoves, or other products (including amplifiers) that produce heat.

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

#### TO THE USER

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

#### CAUTION

Changes or modifications to this equipment not expressly approved by TEAC CORPORATION for compliance could void the user's authority to operate this equipment.

#### For the customers in Europe

##### WARNING

This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

#### Pour les utilisateurs en Europe

##### AVERTISSEMENT

Il s'agit d'un produit de Classe A. Dans un environnement domestique, cet appareil peut provoquer des interférences radio, dans ce cas l'utilisateur peut être amené à prendre des mesures appropriées.

#### Für Kunden in Europa

##### Warnung

Dies ist eine Einrichtung, welche die Funk-Entstörung nach Klasse A besitzt. Diese Einrichtung kann im Wohnbereich Funkstörungen verursachen ; in diesem Fall kann vom Betreiber verlangt werden, angemessene Maßnahmen durchzuführen und dafür aufzukommen.

#### Disclaimer

TEAC disclaims all warranty, either expressed or implied, with respect to this product and the accompanying written materials. In no event shall TEAC be liable for any damages whatsoever (including, without limitation, damages for loss of business profits, business interruption, loss of business information or other loss) arising out of the use of or inability to use this product.

This manual applies to the memory type, AIT type, MO type, and PC card type. Before reading the manual, make sure which type your GX-1 belongs to. AIT tapes, MO disks, and PC cards are generally termed as "removable media" when they are not distinguished.

#### Notes

- For the AIT type, the following functions to record in the memory are for future extensions. Please contact us for support.
  - Record in the memory
  - Transfer data from the memory to a PC
  - Copy data from the memory to a PC
  - Copy data from the memory to the AIT
- For the AIT type and memory type, the following functions are for future extensions. Please contact us for support.
  - Submenu "Open"
  - Multi-sampling

- This product is not an approved medical device.
- The names of products that appear in this document are registered trademarks of the respective holders.

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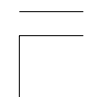
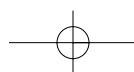
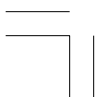
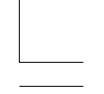
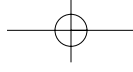
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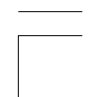
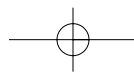
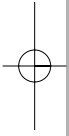
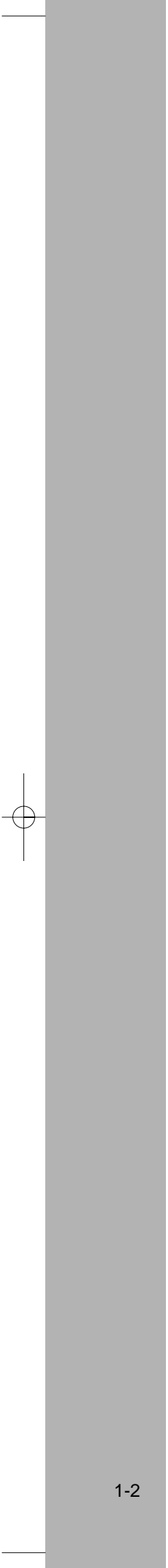
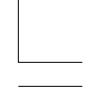
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**Overview**

The GX-1 is a customizable data acquisition system for measurement data; the GX-1 enables construction of a data collection system optimized to your needs. Recorded data can be saved to files for a PC in a TEAC unique format called **TAFFmat**, and can be opened and processed using commercially available analytical PC software.

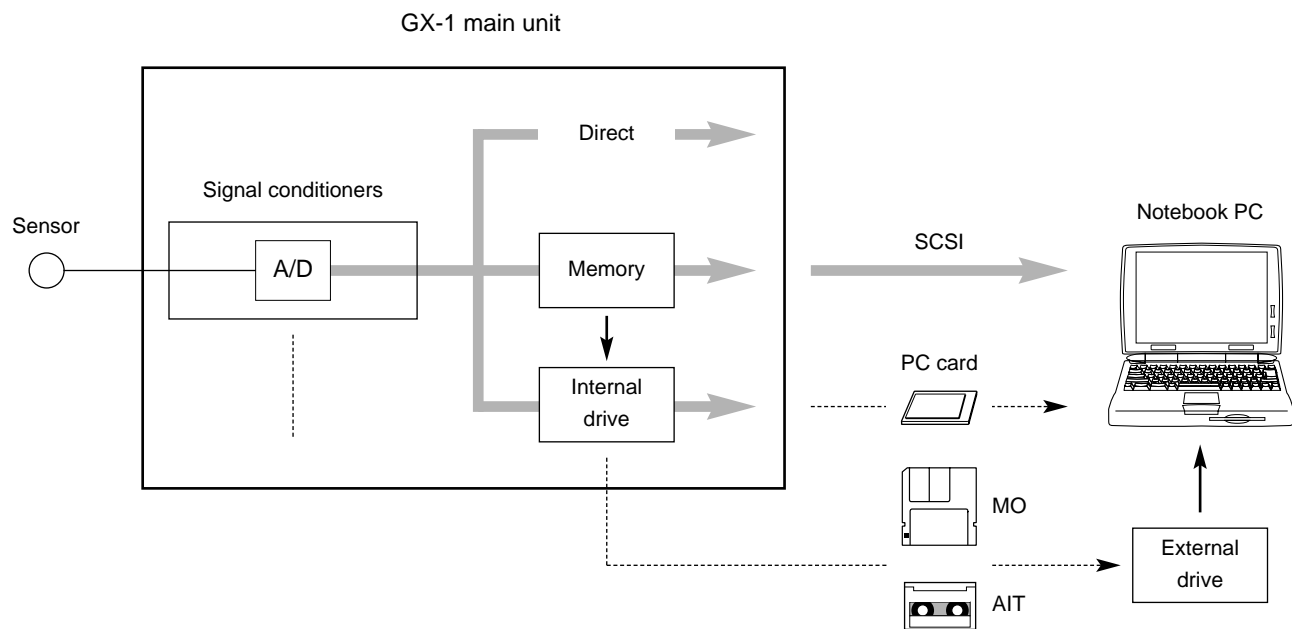
A variety of signal conditioners can be installed as input amps, so you can forget the nightmare of setting up many amps individually and connecting the power supply for them. The GX-1 main unit contains 8 slots for input amps. Each input amp card handles 2 input channels, which enables up to 16 input channels to be recorded when all 8 input card slots are used. Furthermore, you can use optional channel expansion units to expand the number of channels up to 64 input channels.

You can choose the recording medium that best suits what you want to measure: memory, AIT (Advanced Intelligent Tape), MO, or PC card. Whichever you choose, after recording you can pass on the data to a PC via SCSI as well as record data directly to a PC's hard disk. Of course, if you choose an AIT drive, after recording you can insert the AIT cartridge into a PC's external AIT drive for data processing at the PC. Also, the data recorded on an MO or a PC card can be read by a PC's external MO drive or PC card slot as TAFFmat files.

The GX-1 can be controlled either from a PC via SCSI using provided software (named "GX Navi"), or from a remote controller that has a color LCD (DK-GXLCD). If you just want to control the recording status, a hand-held remote controller (ER-GXRC) is handy.

▼ A PC cannot recognize the internal drive of a GX-1.

▼ On an AIT cartridge, the data is stored in a TEAC unique format. However, you can use the software that comes with the GX-1 to copy the data as a TAFFmat file to a PC.



System Conceptual Diagram

▼ Separate dedicated software **GX View** must be used to read data from an external AIT drive.

## Introduction

### Features

- **Selectable recording medium that best matches what you record**

A choice of recording media allows you to select the medium that best matches the application, like choosing memory when recording fast phenomena and choosing an AIT or MO drive when recording a great amount of data. (See the table below.) The measured data can also be recorded directly to a PC (e.g., to a hard disk) via SCSI. (We term this PC-direct mode **real-time transfer**. In this mode, the real-time monitoring introduced next is unavailable.)

- **Real-time monitoring**

Using the provided software “GX Navi”, you can monitor recorded data on a PC window as real-time waveforms or bar graphs, and you can also perform real-time FFT analyses. The waveforms of data recorded in memory or removable medium can later be displayed, and scrolled through, in a window. (Bar graph and FFT displays are possible for sampling frequencies of 50 kHz or less, and waveform displays are possible for 200 kHz or less.)

- **Multi-sampling**

From the internal clock frequencies, you can select a base sampling frequency and 10 times the base sampling frequency at a time. This enables you to record fast phenomena and slow phenomena at the same time besides saving storage capacity.

Available internal clock frequencies:

1, 2, 5, 10, 20, 50, 100, 200, 500 Hz, and 1, 2, 5, 10, 20, 50, 100, 200, 2.5, 12.5, and 25 kHz

**Notes:**

- The sampling frequencies are set slot by slot, not channel by channel.
- The total of [*sampling-frequency* × *number-of-channels*] must not exceed 3,200 kHz.
- Some commercially available analytical software cannot read the data files recorded by multi-sampling. Contact us for details.

- **Voice memo recording/playback**

You can record and play back voice memos.

- **External-clock sampling**

Sampling can be performed based on an external clock signal.

- **Various recording modes**

- **Manual start mode:** Recording is started manually.
- **Pre-trigger mode:** Data is continuously stored so that data from a specified time before the occurrence of the trigger can be recorded in memory.
- **Post-trigger mode:** Recording is started at a specified time after the occurrence of the trigger.
- **Level-trigger mode:** Recording is started when a specified change occurs in the signal level of a specified channel.
- **Timer mode:** Recording is started at a specified time.

- **Event marks**

You can attach event marks to desired points in data during recording. You can later search through the data to find attached event marks.

- **Analog reproducing**

Data recorded in the internal device—memory or removable medium—can be reproduced in waveform display. With the optional analog output amplifier, you can reproduce the recorded data as analog signal.

- **Clock correction by IRIG-B time code**

The internal clock can be corrected by an external IRIG-B time code signal.

## Sampling Frequency and Monitoring

(Up to 32 channels)

		Sampling frequency			
		200 kHz	100 kHz	50 kHz	≤ 20 kHz
Waveform	Manual start recording	OK	OK	OK	OK
	Level trigger recording	—	Δ	OK	OK
	Reproducing	—	OK	OK	OK
FFT	Manual start recording	—	—	OK*	OK
	Level trigger recording	—	—	Δ	OK
	Reproducing	—	—	—	—
Bar graph	Manual start recording	—	—	OK	OK
	Level trigger recording	—	—	OK	OK
	Reproducing	—	—	—	—

\* : When no expansion unit is added, up to 8 channels are displayable. When one expansion unit is added, up to 6 channels are displayable. When two or three expansion units are added, up to 4 channels are displayable. Δ : Monitoring not supported

## Sampling Frequency vs. Recording Time

(Up to 32 channels)

Media (recording capacity)	Sampling frequency x number of channels (at maximum)	Recording time (at maximum transmission rate)
Memory (256 MB)	3,200 k (e.g., 200 k x 16 channels)	Approx. 40 sec.
AIT (25 GB)	1,500 k (e.g., 50 k x 30 channels)	Approx. 138 min. max.
MO (1.3 GB)	200 k (e.g., 20 k x 10 channels)	Approx. 50 min. max.
PC card	50 k (e.g., 5 k x 10 channels)	Depends on the card capacity
Media on PC	1,500 k (e.g., 50 k x 30 channels)	Depends on the type of media

## Introduction

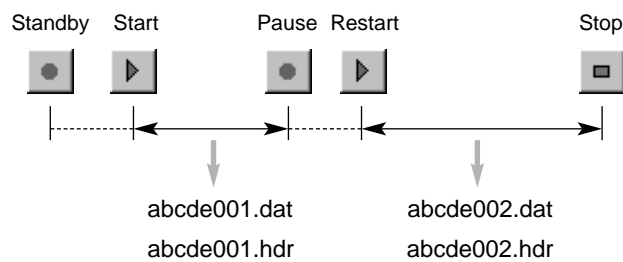
### About TAFFmat

TAFFmat is an acronym of **T**each **D**ata **A**cquisition **F**ile **F**ormat. In the TAFFmat format, data are saved in two kinds of files: data files that contain data through A/D conversion, and header files that contain recording information such as recording conditions. A collection of data recorded from the start until the end of each measurement by a GX-1 is referred to as an *ID*. Each ID is composed of one data file and one header file.

**Data File:** A binary file containing binary-format data through A/D conversion. Each data file has the filename extension of **.dat**.

**Header File:** A text file (ASCII code) containing recording information such as conditions. Each header file has the filename extension of **.hdr**.

Within the same ID, the data file and header file have the same filename, which begins with five alphanumeric characters and is followed by a three-digit ID number. The three-digit ID number is automatically set to 001 when five characters are given as a new filename. You can also specify that this number automatically increments by one whenever a recording starts.

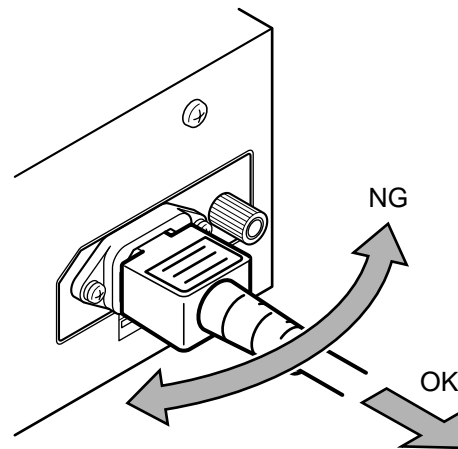


### Precautions

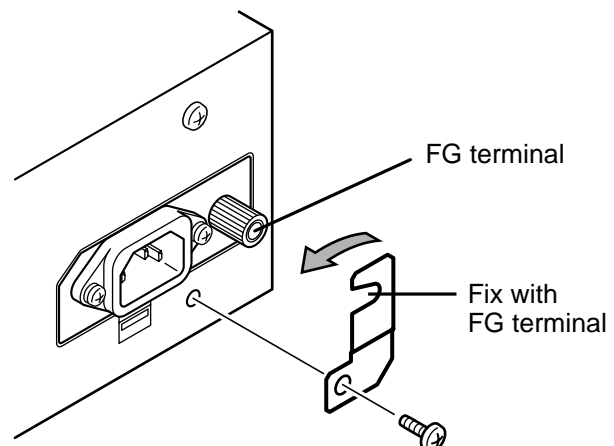
- Check whether the delivered product is exactly the one you ordered.  
Although thorough quality control is implemented at TEAC, when you receive the package, please confirm that the delivered product has exactly the same configuration as the one you ordered. If there is any deficiency or if parts are missing, please contact TEAC promptly.
- Use the specified power supply.  
Do not connect a power supply that is not specified for this product. Using a power supply that does not meet the specifications may damage the product.
- Use UPS.  
We strongly recommend that you use an uninterruptible

power supply to protect data from power failure. If power failed while an AIT or MO is in the drive, the data on the medium may become unreadable.

- To remove the plug from the AC adaptor  
To remove the AC cable from the AC adaptor, hold the AC adaptor with one hand so that the adaptor may not be pulled out from the GX-1, and pull the plug straight with the other hand. Do not pull the cord.

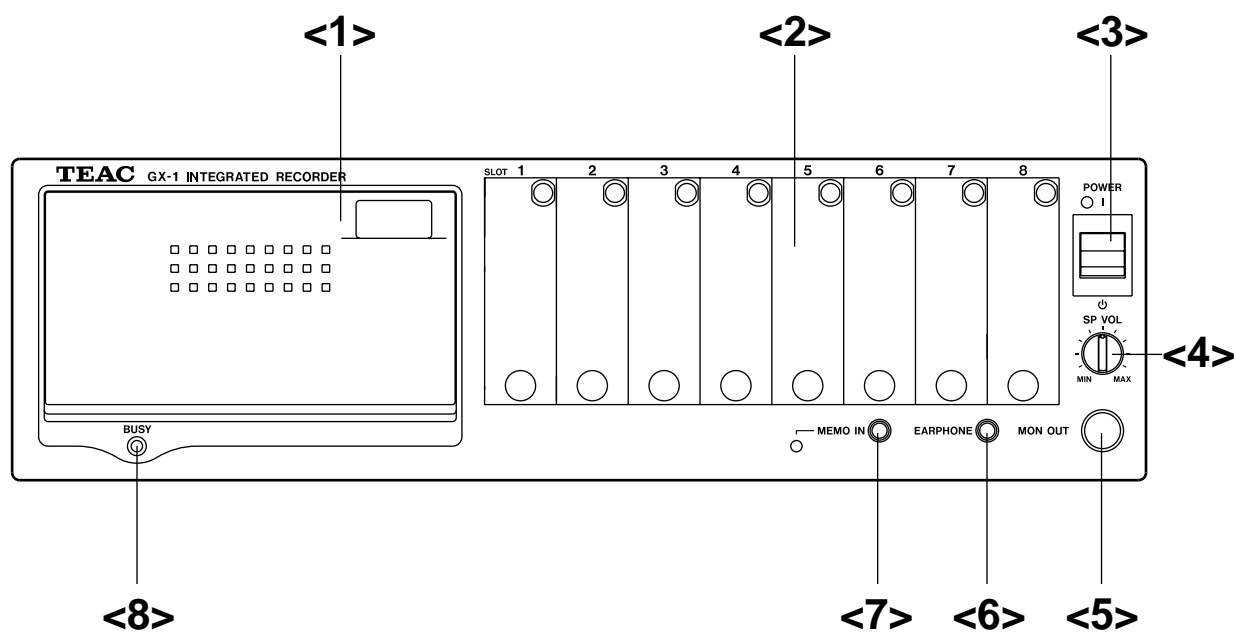


- To attach the AC adaptor stopper  
If you operate the GX-1 usually from AC power, we recommend that you attach the supplied stopper as shown below to fix the adaptor:



## Name of Each Part

## Front Panel

**<1> Recording device slot**

The slot into which an AIT drive, MO drive, or PC card slot is installed.

**<2> Signal conditioner slots**

Slots into which signal conditioners are installed.

**<3> Power switch**

A switch to turn on and off the power. Pressing the upper side of the switch (labeled with I) turns on the power, and pressing the lower side (labeled with O) turns off the power.

**<4> Volume knob**

Controls the sound level of the reproduced voice memo.

**<5> Monitor output connector**

The jack used to output the analog signal of a selected channel during recording/reproducing. The monitored channel is selected by the software. The output level is fixed to  $\pm 5$  V.

The output is filtered when the input filters of signal conditioners AR-GXDC or AR-GXPA are enabled. The cutoff frequency is the same as the signal conditioners. When the input filters of these amps are disabled, or with the other types of amplifiers, the output is a stepped signal.

**<6> Earphone jack**

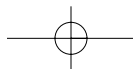
The jack for an earphone to listen to the reproduced voice memo.

**<7> Mic jack**

The jack for a microphone to record voice memo.

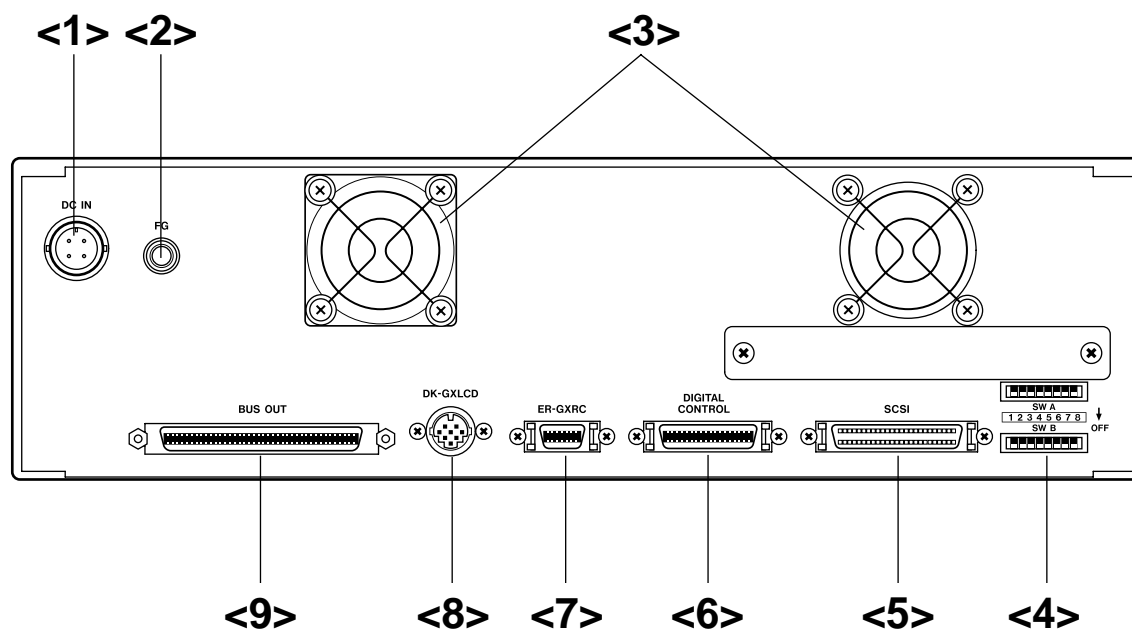
**<8> BUSY lamp**

Blinks in the Record Standby status, and lights during recording. The BUSY lamp may also blink during calibration of some signal conditioners.



## Introduction

### Rear Panel



#### <1> DC IN connector

Connect a power supply from +11 to 30 V DC when driving the product with DC power.

#### <2> Frame grounding terminal

Connect a grounding wire.

#### <3> Cooling fan

An exhaust fan for cooling the GX-1 main unit. Do not block the exhaust vent.

#### <4> SW A and B (DIP switch units)

A: Set all the digits to OFF.  
B: Set the SCSI ID.

#### <5> SCSI connector

Used to connect a PC or remote controller that has a color LCD by using a SCSI cable.

#### <6> DIGITAL CONTROL connector

Used to input a digital control signal such as an IRIG-B time code, and external sampling clock.

#### <7> ER-GXRC connector

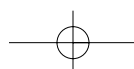
Used to connect a hand-held remote controller.

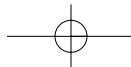
#### <8> DK-GXLCD connector

Connect the dedicated cable to the **TO GX-1** connector on the LCD controller when you record a voice memo with a microphone connected to the controller.

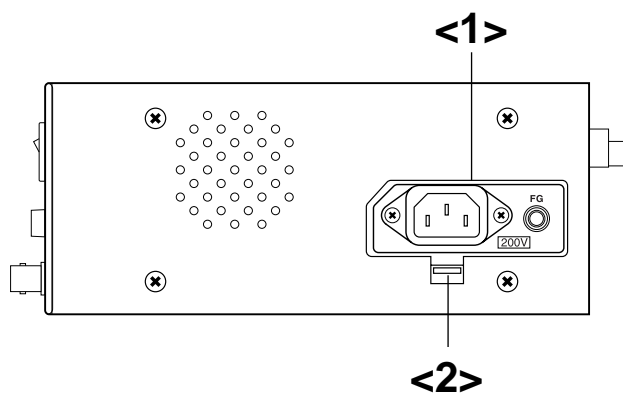
#### <9> BUS OUT connector

Used to connect a channel expansion unit when expanding the number of input channels. Do not use any cable other than the dedicated cable supplied from TEAC.





### Right Side Panel

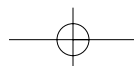
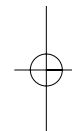
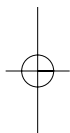


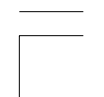
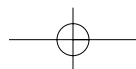
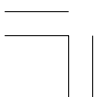
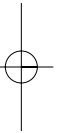
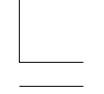
#### <1> Power supply slot

The slot into which an AC adaptor or battery pack is to be installed.

#### <2> Eject lever

Push this lever when removing an inserted AC adaptor or battery pack. The AC adaptor or battery pack pops out by the force of a built-in spring—be careful not to hurt yourself or drop it.



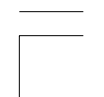
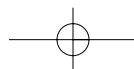
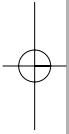
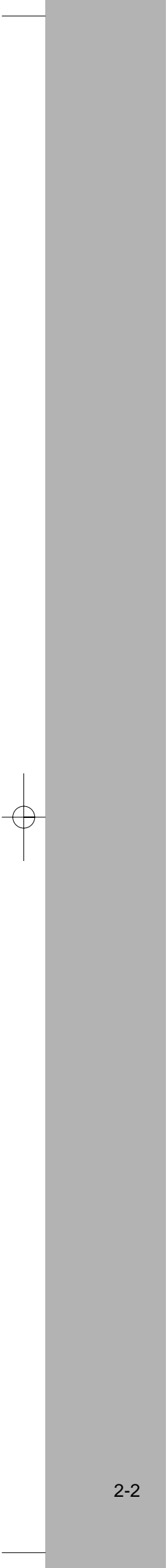
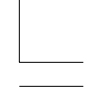
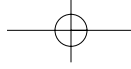




# Installation

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## Installing Amplifiers

### CAUTION

Before attempting to install or remove a signal conditioner, turn off the power at the GX-1 main unit. If you attempt installation or removal while the power is turned on, you might damage the GX-1 main unit and the signal conditioner.

### ● Channel Numbers

Slots are numbered from the left (as viewed from the front of the GX-1 main unit) in the order 1, 2, 3, etc. These correspond to channels 1 and 2, channels 3 and 4, etc. The input terminal A of each signal conditioner corresponds to the smaller number of the channel numbers, and input terminal B corresponds to the next channel. For example, A of slot 3 is channel 5.

### ■ Installation Procedure

1. Loosen the two screws at the top and bottom of the blank panel, and remove the panel.  
(You cannot remove the screws from the panel even after you loosen them.)
2. Insert the signal conditioner into the slot. Insert the lower edge of the board into the guide rail.  
Holding the signal conditioner vertically, press it in firmly.
3. Tighten the two screws at the top and bottom.

This completes the installation.

### ● Set the parameters

The parameter settings for the GX-1 main unit are reset when you add a new signal conditioner or move a signal conditioner to another slot. So choose **Setup** and then **Params** to revise the settings for all channels.

### ■ Attaching Ferrite Core

The cable connected to the input connector may emit radio noise. To reduce the radio noise, attach the supplied ferrite core on the input cable.

Open the ferrite core, turn the cable around the ferrite core, and close the core. (See fig. 1.)

**Note:** If the cable is thick, just pass the cable through the ferrite core and secure the core with the cable tie. (See fig. 2.)

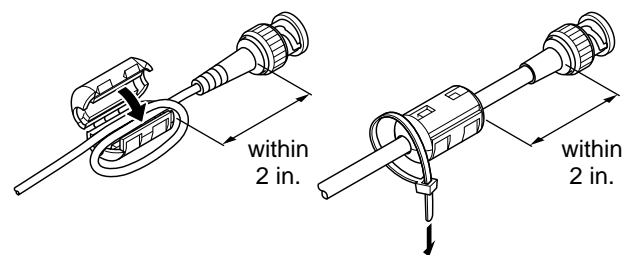
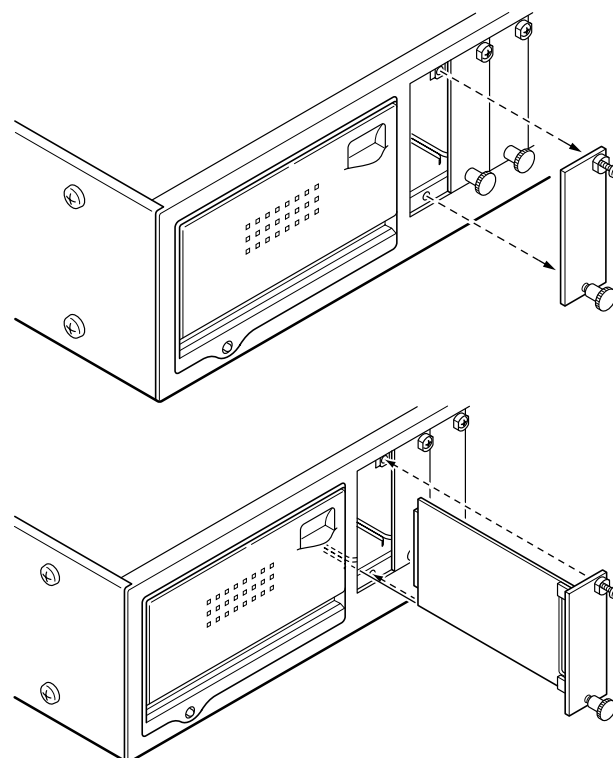


Figure. 1

Figure. 2



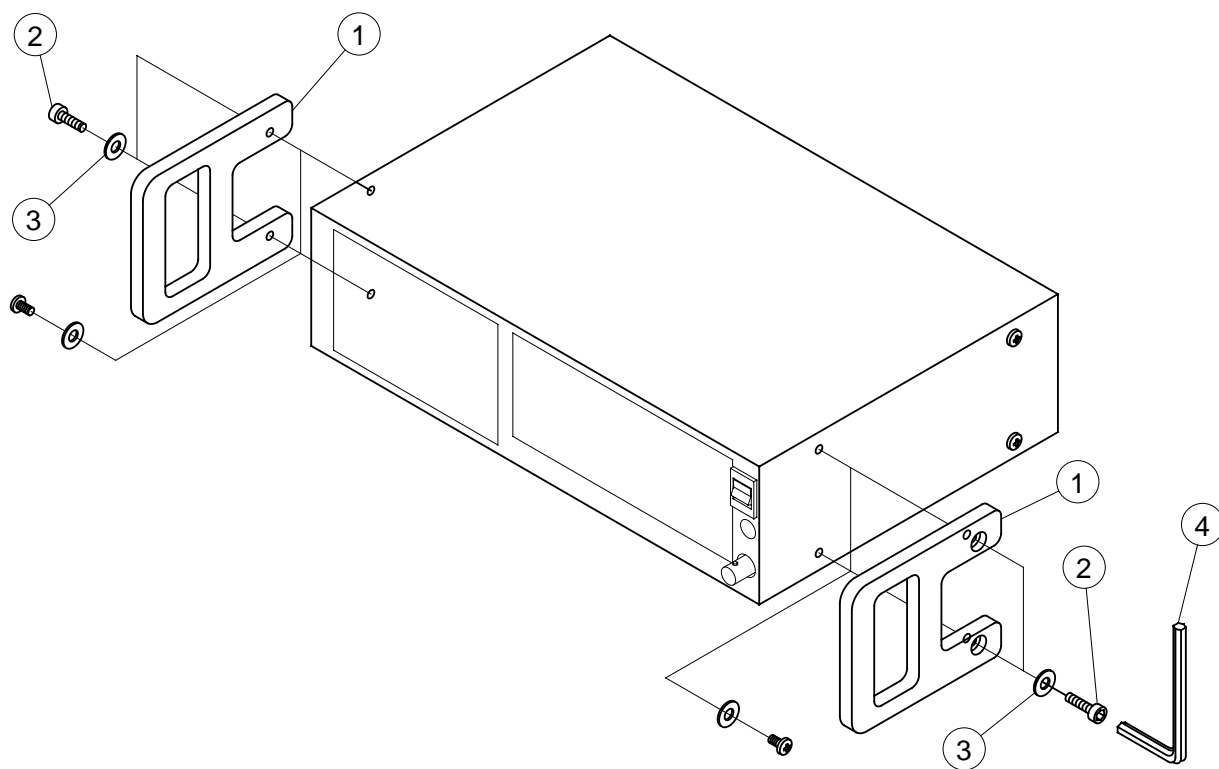
## Installation

### Attaching the Handles

1. Remove the screws and washers from both sides of the GX-1.  
1. (Two from each side)
2. Mount the handles ① with the provided screws ② and washers ③ using the hexagonal wrench ④.  
(Torque: 1.3 N•m)

#### CAUTION

Hold both handles to carry the GX-1. Do not carry it by holding one handle.

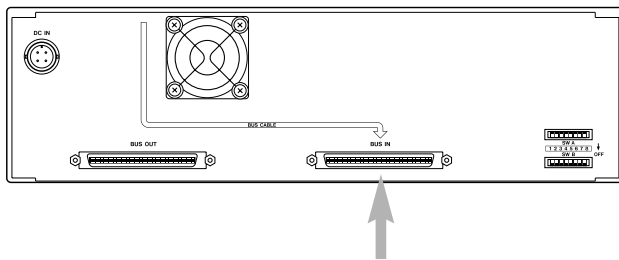


**Adding the Expansion Unit**

**■ Connecting**

**CAUTION**  
 Before connecting the expansion unit, turn off the power at the GX-1 main unit. If you attempt to connect the expansion unit while the power is turned on, you might damage the GX-1 main unit and the expansion unit.

Use the dedicated cable to connect the BUS OUT connector at the rear of the GX-1 main unit to the BUS IN connector at the rear of the expansion unit. To add more expansion units, daisy-chain them likewise.



**Note :**  
 Do not use any cable other than the dedicated cable from TEAC.

**■ Preparing the Power Supply**

In the same way as for the GX-1 main unit, prepare an AC adaptor, DC power source, or battery pack.

**Note:**  
 There is no power switch on the expansion unit. Power is supplied when the power switch on the GX-1 main unit is turned on.

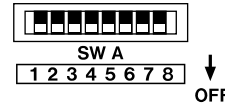
**■ Specifications**

- Signal conditioner slots :8
- Power : +11 to 30 V DC  
 Internal AC adaptor (separate adaptors for 100 V and 200 V)  
 Battery (optional)
- Power consumption: Approx. 35 W (with 8 DC input amps)
- External dimensions : Approx. 300W x 85H x 200D (mm), (excluding protruding parts)
- Mass : Approx. 5 kg (including 8 DC input amps and an AC adaptor)

**■ DIP Switch Settings**

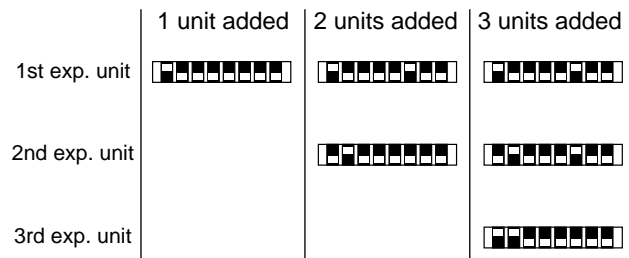
Set as shown below.

**SW A** on the GX-1 main unit



Set all the digits to OFF.

**SW A** on the expansion unit



● Set all the digits of **SW B** on the expansion units to ON.

**■ Notes when expanded to more than 32 channels**

● Maximum recording rate—sampling frequency multiplied by number of channels

- Recording in memory: Recording rate ≤ 2,500 k
- Recording in AIT: Recording rate ≤ 1,200 k
- Recording in MO: Recording rate ≤ 200 k
- Recording on PC card: Recording rate ≤ 50 k

● Waveform display in reproducing  
 Possible when the sampling frequency is 100 kHz or lower.

● Continuous reproduction from AIT  
 Possible when the recording rate is 500 kHz or lower.

## Installation

### Preparing the Power Supply

#### ■ AC Adaptor

#### WARNING

Before installing or removing the AC adaptor, disconnect the power cable from the adaptor. If the cable is left connected to the adaptor and a power outlet, the power supply voltage is applied to the output terminals of the adaptor and might cause an electric shock.

#### Note:

There are two types of AC adaptors: one for 100 V and one for 200 V. Confirm that the AC adaptor you use matches the power supply voltage of the power outlet.

To install the AC adaptor:

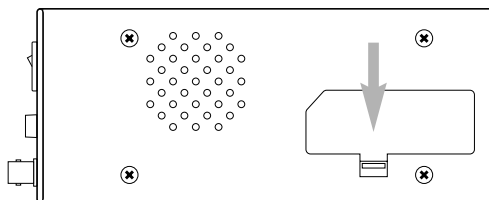
1. Confirm that the power is turned off at the GX-1 main unit: that is, the switch is toggled down to  $\text{⏻}$ .
2. Insert the AC adaptor into the power supply slot on the right side of the GX-1.
3. Plug the power cable into the AC adaptor.
4. Plug the power cable into the power outlet.

#### Note: Backup by DC power

If +11 to 16 V DC power is supplied to the DC IN connector while using the GX-1 with an AC power supply, the DC power supply backs up in case of a failure of the AC power. However, if the supplied voltage is +16 V DC or greater, the DC power supply takes priority.

#### Note: Removing the AC adaptor

To remove the AC adaptor, push the eject lever beneath the power supply slot. The AC adaptor pops out with the force of a built-in spring—be careful.



#### ■ DC Power Supply

The GX-1 can be operated on +11 to 30 V DC.

To connect the DC power supply:

1. Confirm that the power is turned off at the GX-1 main unit: that is, the switch is toggled down to  $\text{⏻}$ .
2. Plug the DC power cable into the DC IN connector at the rear of the GX-1.

Note: What happens when the DC supply voltage drops to +11 V or less?

The message **LOW BATTERY** appears on the status bar of the provided software's window. When you see this message, promptly quit recording. If data is being recorded to the GX-1's memory at this time, transfer the data from memory to a removable medium or PC. When the power supply voltage further drops to +10 V or less, the GX-1 automatically shuts down.

#### Note: Backup by battery pack

If the battery pack is installed in the power supply slot while using the GX-1 with a DC power supply, the DC power supply and battery pack are used in parallel. This way of use is recommended when the DC power supply is unstable. Also in this case, if the supply voltage drops to +10 V or less, the GX-1 automatically shuts down. However, since an idling current flows even during shutdown, turn off the power switch to prevent excessive discharge of the battery pack.

#### ■ Battery Pack

To install the battery pack:

1. Confirm that the power is turned off at the GX-1 main unit: that is, the switch is toggled down to  $\text{⏻}$ .
2. Insert the battery pack into the power supply slot on the right side of the GX-1.

#### Notes:

- What happens when the battery voltage drops to +11 V or less?  
The message **LOW BATTERY** appears on the status bar of the provided software's window. When you see this message, promptly quit recording. If data is being recorded to the GX-1's memory at this time, transfer the data from memory to a removable medium or PC. When the voltage further drops to 10 V or less, the GX-1 automatically shuts down. However, since an idling current flows even during shutdown, turn off the power switch to prevent excessive discharge of the battery pack.
- Removing the battery pack  
In the same way used to remove the AC adaptor, push the eject lever.
- With a fully charged battery pack, the GX-1 can record continuously for approximately 40 minutes (when using an AIT or an MO).
- To recharge a battery pack, follow the documentation for the battery charger.
- Nickel metal hydride batteries are susceptible to a "memory effect". Discharge the battery fully before recharging.

## Preparing a Personal Computer

### ■ System Requirements for the PC

The recommended specifications of the PC are as follows.

- **Operating system:** Windows 95 (OSR2.0 or later),  
Windows 98, or Windows NT 4.0  
(File sizes and the total number of files may be limited depending on the operation systems.)
- **CPU:** Pentium 200 MHz or better
- **Display resolution:** At least 800 x 600 pixels
- **Memory:** At least 64 MB
- **Hard disk:** At least 2 GB
- **SCSI interface:** An Adaptec SCSI interface card (board) must be used. Operations might be incorrect when using another manufacturer's SCSI board.

### ■ Connections

#### ● SCSI cable

Prepare a half-pitch 50-pin cable.

#### ● Connecting the PC to the GX-1

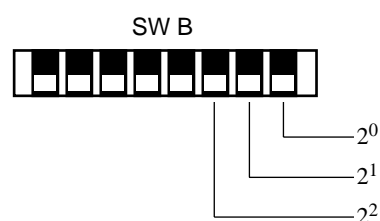
**Note:**

Turn off the power to the GX-1 and PC before starting the connection procedure. Do not turn on the power before completing the connection procedure.

1. Connect the SCSI cable to the SCSI connector at the rear of the GX-1.
2. Connect the other side of the SCSI cable to the connector of the SCSI interface card (board).

#### ● Setting the SCSI ID

Set the SCSI ID using the DIP switches on the rear panel. Three switches from the rightmost to the left in SW B correspond to  $2^0$ ,  $2^1$ , and  $2^2$ , respectively. (See the figure below.) Set a number from 0 to 6. If one or more SCSI devices are connected to the PC, make sure you set a unique ID. All the digits are set to OFF at the factory.



### ■ Installing the Software

To install the provided software "GX Navi."

1. Insert the installation disk into the drive of the PC.
2. Run Setup.exe on the installation disk. (The installer then starts.)
3. Follow the messages appearing in the setup wizard to proceed with the setup.
4. When installation has finished, restart the PC.

### ■ Running the Software

**Note:** Exit software that eats a lot of memory before you run the "GX Navi".

To run "GX Navi":

1. Turn on the power at the GX-1 main unit: that is, toggle the switch up to ( I ).

**Note:**

When the power is turned on, the signal conditioners are calibrated automatically. When the calibration finishes, a buzzer sounds. (The buzzer consists of three pairs of beeps.) The time until the buzzer sounds depends on the types of signal conditioners that are mounted, and might take up to several minutes.

The buzzer will sound three pairs of beeps.

2. Turn on the power to the PC.
3. Start "GX Navi".

**Note:**

While "GX Navi" is running, if the power to the GX-1 main unit is turned off and an attempt is then made to perform some operation with GX Navi, an error message is shown. If you then turn on the power to the GX-1 main unit again, the PC will be unable to recognize the GX-1. To enable the PC to recognize the GX-1, restart GX Navi.

#### ● If startup time is unusually long

If the time between power-on and the buzzer sound is unusually long, or if the buzzer sound is abnormal, the signal conditioners may not be recognized. If the conditioners are not recognized, turn off the power and then on again.

## Installation

### About AIT Cartridge

#### ■ Inserting an AIT Cartridge

To insert an AIT cartridge:

1. Turn on the power to the GX-1 main unit.

The buzzer will sound three pairs of beeps.

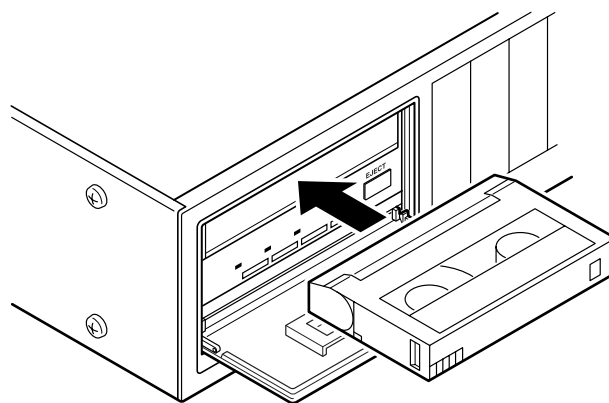
2. Open the door to the AIT drive.

3. Insert the AIT cartridge.

After the AIT cartridge is inserted part of the way, it will be set automatically.

4. Close the door to the AIT drive.

Wait until the activity display on the status toolbar shows "READY".



#### ■ Removing the AIT Cartridge


##### Eject AIT Before Power-off

Remove the AIT cartridge before turning off the power to the GX-1. The volume information will be written just before the cartridge is ejected. If you turn off the power while the AIT is still inserted, the data recorded on that AIT cartridge might become unreadable.

- Pressing the EJECT button on the AIT drive will have no effect while software is running or while the LCD controller is performing an operation.

To remove an AIT cartridge:

1. Open the door of the AIT drive.

2. Click the Eject button (  ) on the toolbar in the attached software, or use the LCD controller to perform the Eject operation.

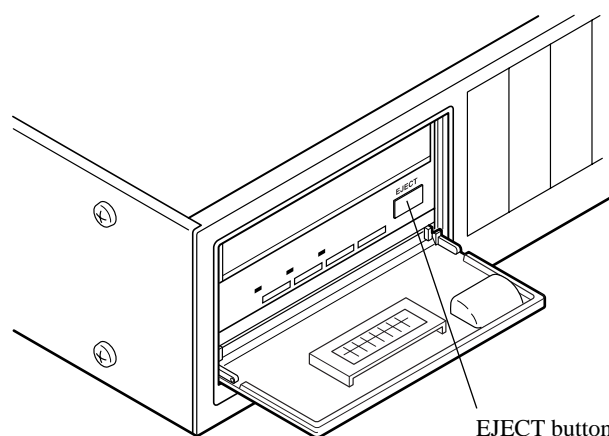
The AIT cartridge will be ejected.

3. Take the AIT cartridge out of the GX-1.

4. Close the door on the AIT drive.

Notes:

- You cannot remove an AIT cartridge during recording or reading of data. Pressing the EJECT button will have no effect.
- Quitting *GX Navi* automatically ejects the cartridge.





**■ Precautions for Use of AIT Drive****● Prevent condensation.**

Use of this product in a warm room when the product itself is cool (for example, when you switch the product on in a warm room and start using it immediately), may cause condensation on the rotary head or the tape. When the product is cool but the room is warm, turn on the power to the product before inserting a tape cartridge and leave the power on for at least 30 minutes to warm up the product. Then, after confirming that there is no condensation, insert a tape cartridge. (In general, even if the room temperature is within the specified ambient conditions, a change in temperature of 15°C per hour may cause condensation.)

**● Operate in a horizontal position.**

Place the unit in a horizontal position when you operate the AIT drive. Do not position the unit on its sides.

**● Always eject the tape cartridge before turning off the power.**

If a tape cartridge is left inserted for a long time after the power is turned off, the tape may adhere to the rotary head. If the power is turned on after this, the tape may jam on the rotary head and damage the head and tape.

**● Periodically clean the head.**

The head will gradually get dirty. Writing and reading cannot be performed correctly with a dirty head. As a guideline, use the specified cleaning tape (SONY SDX1-CL) to clean the head once every fifty hours of operation.

To clean the head, turn on the power to the GX-1 and insert the cleaning tape into the drive. The drive will automatically perform cleaning and eject the tape after the cleaning is completed.

For details on how to use a cleaning tape, see the documentation for the cleaning tape.

**● Use specified tape cartridges only.**

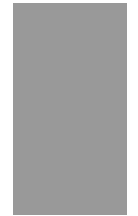
Use SONY SDX1-25C tape cartridges. Writing and reading cannot be guaranteed if any other tape is used.

**● Be careful about the write-protection lug position to avoid deleting critical data.**

To prevent important data from being deleted from a tape cartridge, make sure you slide the write-protection lug of the cartridge to the SAFE side.

**● Follow the notes and precautions for the cartridge.**

For details on handling of tape cartridges, read through the documentation that comes with the tape and follow the notes and precautions written.



## Installation

### About MO Disk

#### ■ Inserting an MO Disk

To insert an MO disk:

1. Turn on the power to the GX-1 main unit.

The buzzer will sound three pairs of beeps.


2. Open the door to the MO drive.
3. Insert the MO disk with its label side faced up.
4. Close the door to the MO drive.  
Wait until the activity display on the status toolbar shows "READY".

#### ■ Removing the MO Disk

##### Eject MO Before Power-off

Remove the MO disk before turning off the power to the GX-1. If you turn off the power while the drive is writing, the data recorded on that MO disk might become unreadable. Also, moving the GX-1 with a disk in the drive may cause damage to the GX-1 or the disk.

To remove an MO disk:

1. Open the door of the MO drive.
2. Click the Eject button () on the toolbar in the attached software, or use the LCD controller to perform the Eject operation.  
The MO disk will be ejected.
3. Take the MO disk out of the GX-1.
4. Close the door on the MO drive.

Notes:

- Pressing the EJECT button on the MO drive will have no effect while software is running or while the LCD controller is performing an operation.
- You cannot remove an MO disk during recording or reading of data. Pressing the EJECT button will have no effect.
- Quitting *GX Navi* automatically ejects the disk.

#### ■ Use Specified MO Disk

Use 1.3 GB 3.5-inch MO disks manufactured by Fujitsu Limited. Writing and reading cannot be guaranteed if any other MO is used.

- The specified MO disks are not formatted. On inserting an unused MO to the internal MO drive, a message will appear on the PC to prompt you to format it.

#### ■ Data in MO Disk

To record data to an MO, first create a folder in the MO, and then record data into that folder. The data recorded on an MO can be read by a PC's external MO drive as TAFFormat files and can be processed using commercially available analytical software.

#### ■ Write-protect MO Disk

Write-protect an MO disk in which data is recorded before you insert it into a PC's external MO drive. If not protected, and if you delete, move, or rename files or folders in it, the link between the data file and the header file will be lost, and as a result, the data become unreadable by PC or GX-1.

#### ■ Cleaning the disk and lens

After a long period of use, the surfaces of the disk and the optical lens might collect dust: this can cause malfunctioning. To prevent this problem, clean the disk and the lens with the recommended cleaning kit (optional). Although the required cleaning depends on the usage environment, we recommend that you clean once every 3 months.

- To clean the disk, use the optional cleaning kit: TZ-381.
- To clean the lens, use the optional lens cleaner: 0240470.
- For details on how to clean, see the documentation that accompanies the cleaning kit.

## About PC Card

### ■ Inserting a PC Card

To insert a PC card:

1. Turn on the power to the GX-1 main unit.

The buzzer will sound three pairs of beeps.

2. Open the door to the PC card slots.
3. Insert the PC card with its label side faced up in the direction of the arrow written on the label. Push the card firmly into the slot.
4. Close the door to the PC card slots.  
(The status toolbar still shows "NO MEDIA".)

### ■ Removing the PC Card

#### Note

Do not insert or eject the PC card unless the unit is in the recording STOP mode or the power is turned off. Otherwise, the data recorded on that PC card might become unreadable.

To remove a PC card:

1. Open the door to the PC card slots.
2. Push the button on the left of the slot and remove the PC card.
3. Close the door to the PC card slots.

### ■ Use Specified PC Card

Use PCMCIA TYPE II flash ATA cards manufactured by HITACHI. Writing and reading cannot be guaranteed if any other PC card is used.

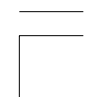
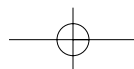
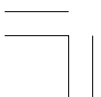
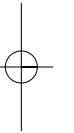
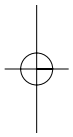
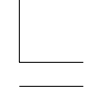
- When you use an unused PC card, format the card by choosing **File** and then **Format** to enter a volume label.

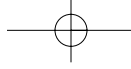
### ■ Data in PC Card

To record data to a PC card, first create a folder in the PC card, and then record data into that folder. The data recorded on a PC card can be read by a PC's PC card slot as TAFFmat files and can be processed using commercially available analytical software.

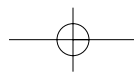
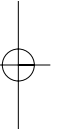
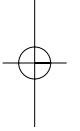
### ■ When inserting PC card into PC's slot

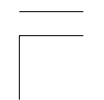
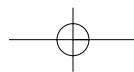
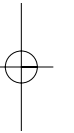
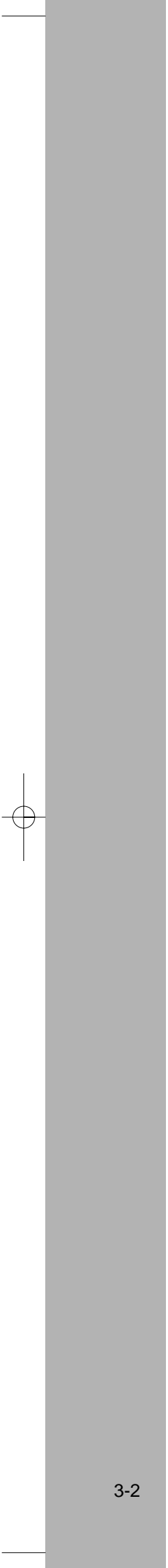
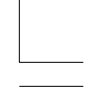
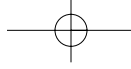
Do not delete, move, or rename files or folders in a PC card. If you delete, move, or rename files or folders in a PC card, the link between the data file and the header file will be lost, and as a result, the data become unreadable by PC or GX-1.

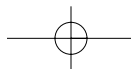




# ***GX Navi***

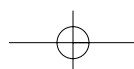
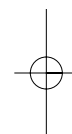
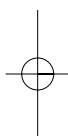






# Basic Operations

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## Basic Operations

### The Initial Window

When the attached software “GX Navi” starts, the following window is displayed.

▼Exit software that eats a lot of memory before you run the “GX Navi”.

**Main toolbar:** Contains buttons for file operations and settings.

**Control toolbar:** Contains buttons for recording/reproducing operations.

**Window toolbar:** Contains buttons for switching the display.

**Monitor area:** Displays waveforms, FFT, and bar graphs. Waveforms and FFT can be from a maximum of 16 channels.

**Control Panel:** Enables you to control recording/reproducing and to monitor activities.

**Channel Select Palette:** Enables you to select which channel is displayed in waveform or FFT.

**Status toolbar**

Elapsed recording time    Activity    Message    Selects the monitored channel

000'04    1998/01/02 05:32:12    STOP    NORMAL    001-000    None

Current time (In reproducing, this area displays the date and time when the recording was made.)

Number of IDs: Displays the number of IDs from the start of recording. The number after the hyphen is the number of event marks in one ID. In reproducing, the number of IDs is not displayed.

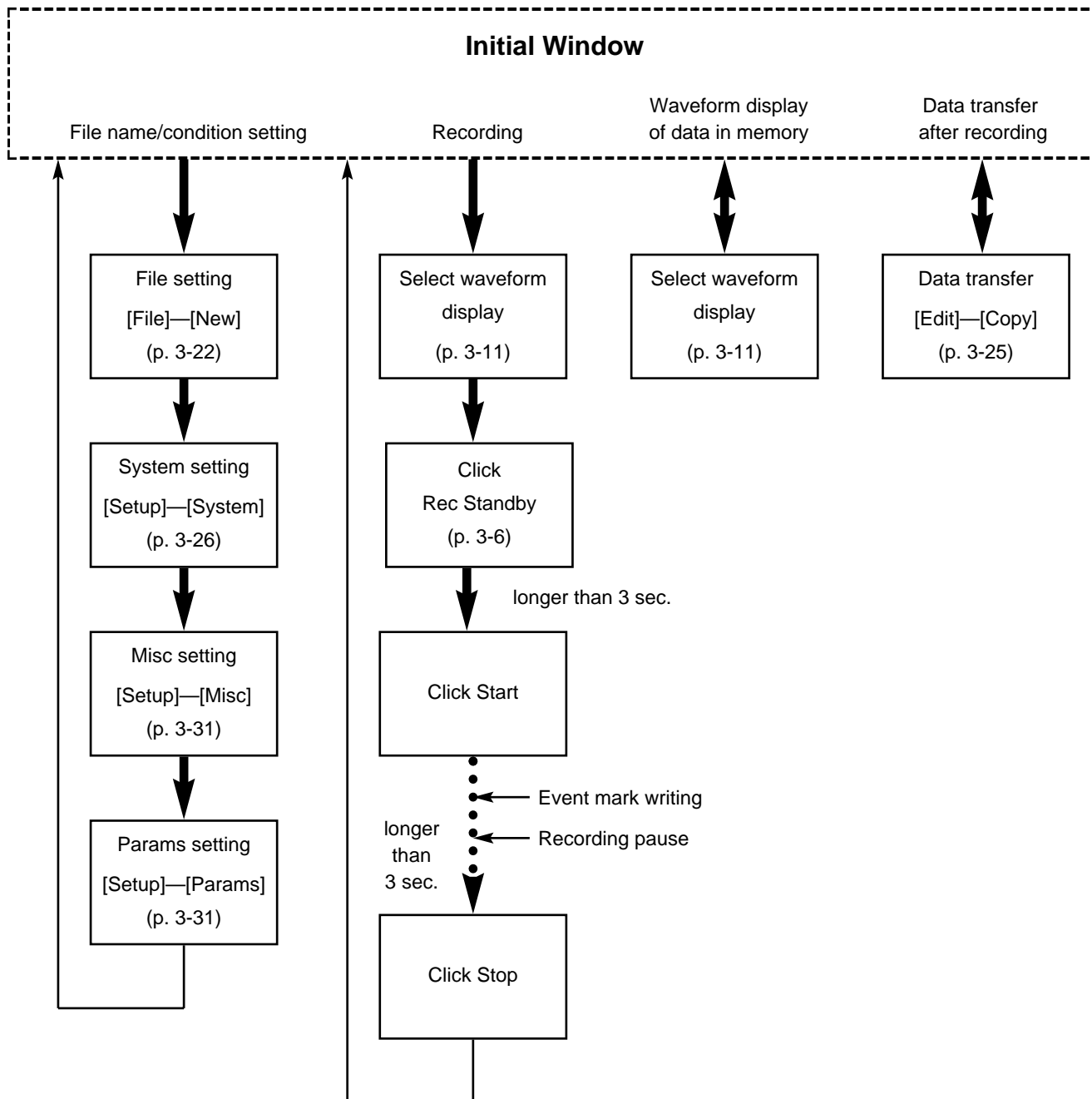
▼If the characters extend off the boxes, choose Windows' **Control Panel, Display, Settings** tab, and then select **Small Fonts** for **Font size**.



**Basic Operations**

**Operation Flow**

From the initial window, follow the flow below.  
Other procedures may cause malfunction.



**Note:**

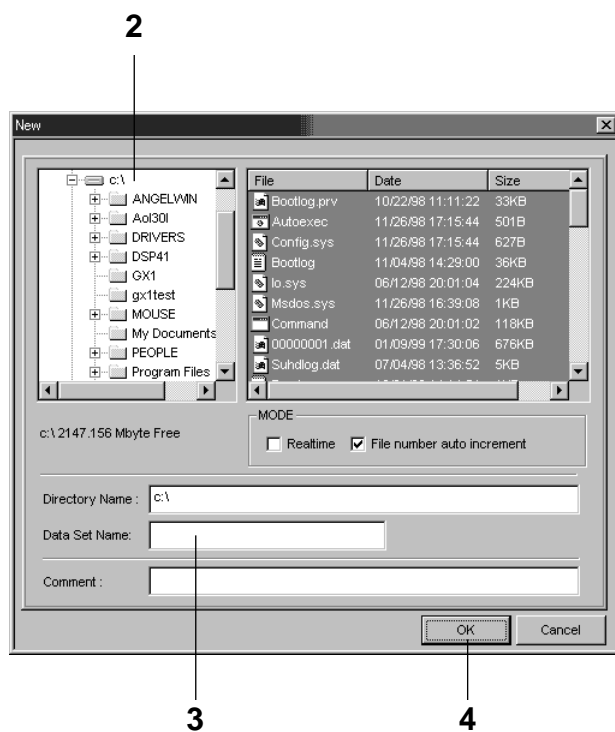
Click **OK** on each setting submenu following the steps above even if you want to change only one setting item. For example, if you enter a new file name, do not start recording at once but open submenus from the **Setup** menu and click **OK** at each submenu.

## Basic Operations

### Recording to Memory, Then Transferring to PC

The following procedure illustrates how to record two IDs in memory and to transfer the data to a PC after recording stops. The procedure also illustrates how to attach an event mark to a desired location in the data.


1. From the **File** menu, choose **New**. The following window appears.



2. Select the folder in the PC's hard drive to which data will be transferred after recording.


3. In **Data Set Name**, enter the filename using up to five characters.

4. Click **OK**.

5. Click the  button on the toolbar to select the waveform display.

6. Click the Rec Standby button ().

The Activity area of the **Status** toolbar displays **REC STANDBY**, and the Monitor area displays the input waveform.

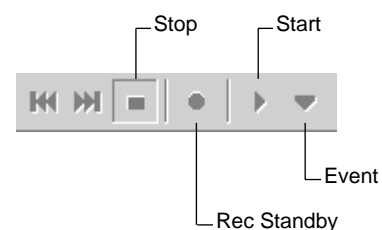
7. Wait three seconds and click the Start button ().

Recording starts, and the Number of IDs area in the **Status** toolbar will display the number of IDs (**001-000**).

▼ Before actual recording, set the recording conditions following the steps illustrated in the previous page.

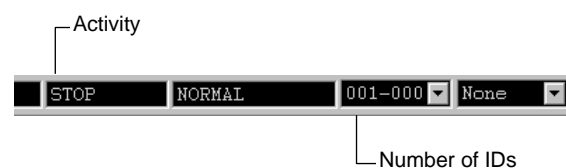
▼ The data in the memory is cleared when the unit enters **Rec Standby** state after recording is stopped. To save the data, after **Stop**, transfer the data to the PC.

▼ Select waveform display before starting recording. After starting recording, you can change to FFT or bar graph display.



▼ You can also use the function keys on the keyboard:

- Stop: F5 key
- Rec Standby: F6 key
- Start: F7 key
- Event: F8 key



**Basic Operations**

**8.** Click the Event button (  ).

The Number of IDs area displays **001-001**.

**9.** Click the Rec Standby button (  ).

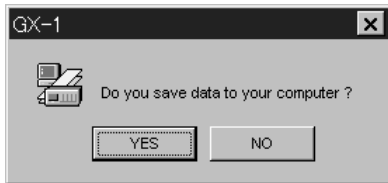
Recording of the first ID stops, and the system enters a pause status. The Activity area displays **REC PAUSE**.

**10.** Click the Start button (  ).

Recording of the second ID starts, and the Number of IDs area displays **002-000**.

**11.** Click the Stop button (  ).

Recording stops, and the following message is displayed.

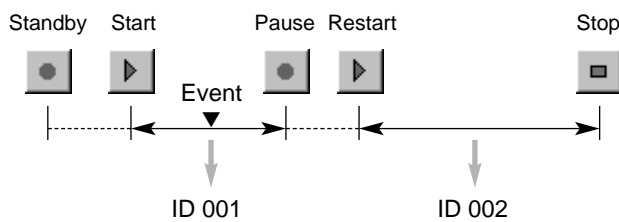


**12.** Click **Yes**.

The two IDs of data are transferred to the PC.

**Note:**

Even if you click **No**, you can still transfer data to a PC or removable medium by choosing **Edit** and then **Copy**.



**NOTE**

Do not do the following operations during recording (during REC STANDBY, RECORDING, or REC PAUSE) as they may cause system instability:

- change monitored channel
- change displayed channels
- click Event button at shorter intervals than two seconds

Leave longer than two seconds period between key/mouse operations.

▼ The number of scans at this moment is recorded in the header file.

▼ There must be at least two seconds between event marks. No event mark is attached if the time is less than two seconds.

▼ When FFT display is selected, the event mark writing is delayed. Select waveform display to prevent this delay.

▼ There must be at least three seconds between Start and Stop.

▼ This message is displayed each time recording stops because when the power to the main unit is turned off, data in memory is lost.

▼ When you use the optional remote controller, you can choose “Yes” by pressing the **START** button, or “No” by pressing the **EVENT** button.

▼ Clicking the Cancel button cancels the transfer of the next file, not the file currently being transferred.

▼ The following four files are created in the specified directory.

**xxxxx001.dat**  
**xxxxx001.hdr**  
**xxxxx002.dat**  
**xxxxx002.hdr**

where **xxxxx** is the entered filename.

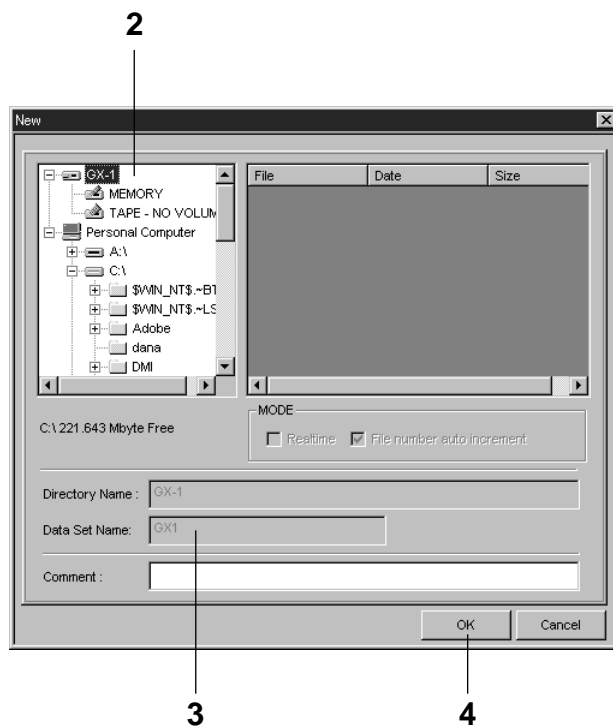
▼ If the PC’s drive becomes full during transfer, the message “Not enough drive space” will appear. In this case, the data is not transferred to the PC, but remains in the GX-1’s memory. You can transfer the data to the PC’s another drive by choosing **Edit** and then **Copy**.

## Basic Operations

### Recording to Removable Medium

The following procedure illustrates how to record two IDs to AIT/MO/PC card. The procedure also illustrates how to attach an event mark to a desired location in the data.

1. From the **File** menu, choose **New**. The following window appears:



2. From the directory tree, select **TAPE** or a folder in the MO or PC card. (In the case of PC cards, the status display changes from NO MEDIA to DRIVE READY at this point of time.) If the MO or PC card contains no folder, enter an folder name in **Directory Name**.

3. In **Data Set Name**, enter the filename using up to five characters.

4. Click **OK**.

5. Click the Rec Standby button (  ).

The Activity area of the Status toolbar displays **REC STANDBY**, and the Monitor area displays the input waveform.

6. Click the Start button (  ).

Recording starts, and the Number of IDs area in the Status toolbar displays the number of the ID (**001-000**).

▼ Before actual recording, set the recording conditions following the steps illustrated in the page 3-5.

#### NOTE

The files are closed just before the ejection. The files are not closed if the power failed with the AIT inserted. Therefore, it is recommended that you eject the AIT after every important recording for an unexpected accident.

#### ▼ Waveform time axis during AIT recording

When the recording rate—sampling frequency multiplied by number of channels—is 800 k data/s or higher, the time axis is fixed to one second.

#### ▼ Mouse response during recording to a removable medium

The mouse pointer response is delayed when using the provided software. Press the function keys instead.

- F5: Stop
- F6: Rec Standby
- F7: Start
- F8: Event

▼ You cannot record by overwriting data on a removable medium. If a medium becomes full (and you do not need the recorded data), reformat the medium.

**Basic Operations**

7. Click the Event button (  ).

The Number of IDs area displays **001-001**.

8. Click the Rec Standby button (  ).

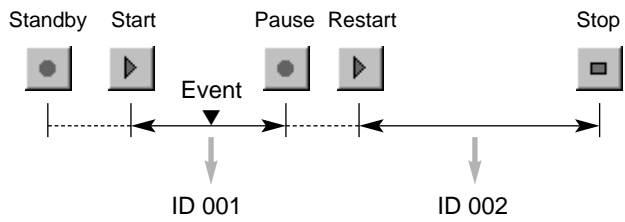
Recording of the first ID stops, and the system enters a pause status. The Activity area displays **REC PAUSE**.

9. Click the Start button (  ).

Recording of the second ID starts, and the Number of IDs area displays **002-000**.

10. Click the Stop button (  ).

Recording stops, and the recorded data file is made on the medium.



**NOTE**

Do not do the following operations during recording (during REC STANDBY, RECORDING, or REC PAUSE) as they may cause system instability:

- change monitored channel
- change displayed channels
- click Event button at shorter intervals than two seconds

Leave longer than two seconds period between key/mouse operations.

▼ The number of scans at this moment is recorded in the header file.

▼ There must be at least two seconds between event marks. No event mark is attached if the time is less than two seconds.

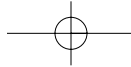
▼ When FFT display is selected, the event mark writing is delayed. Select waveform display to prevent this delay.

▼ There must be at least three seconds between Start and Stop.

▼ The following four files are created in the specified directory.

xxxxx001.dat  
 xxxxx001.hdr  
 xxxxx002.dat  
 xxxxx002.hdr

where xxxxx is the entered filename.



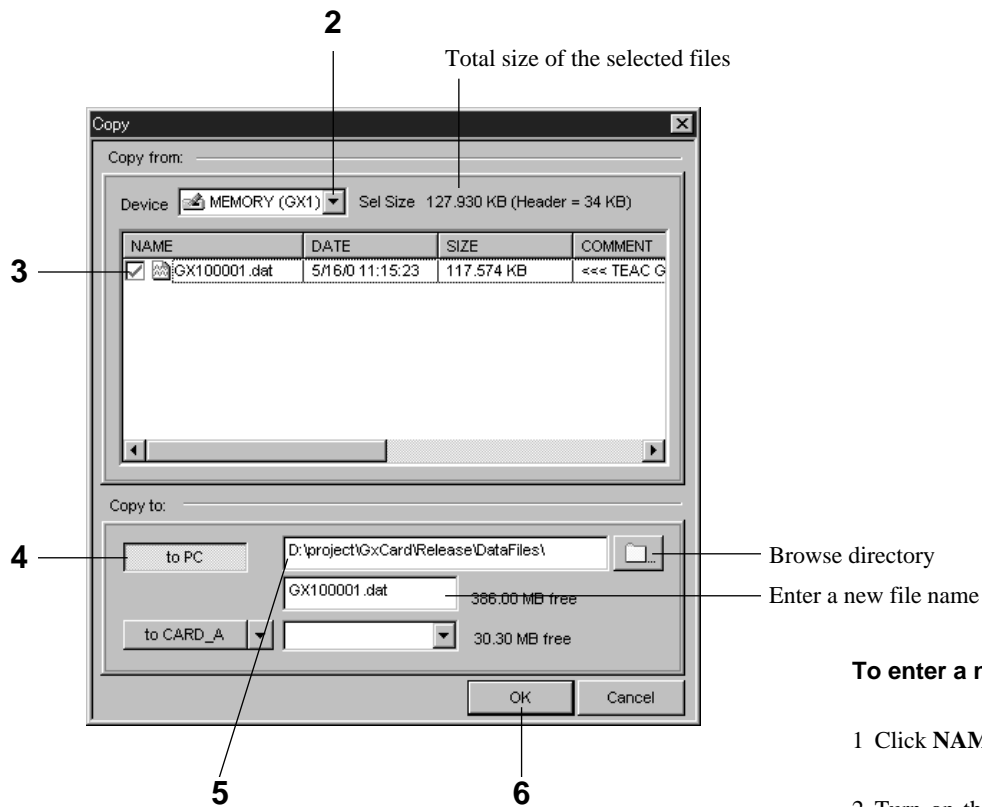
## Basic Operations

### Copying from Removable Medium to a PC

To copy the data recorded on AIT/MO/PC card to a PC, proceed as follows:

1. From the **Edit** menu, choose **Copy**. The following window appears:

▼ Do not eject a removable medium during copying even if it is not the source or destination.



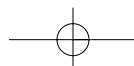
2. From **Device**, select **TAPE** or a folder in the MO or PC card.
3. Select the data files to be copied (ensure a check mark is displayed).
4. Click **to PC**.
5. Specify the directory that is the copy destination.
6. Click **OK**.

The selected data files are transferred to the PC.

#### To enter a new file name:

- 1 Click **NAME** to turn off the check boxes.
- 2 Turn on the check box to select a source file.
- 3 Click the source file name, and it will be highlighted.
- 4 Type a new file name in the file name box.
- 5 Repeat from step 2 to rename more than one file.


▼ When the data file is copied, the paired header file is also copied at the same time.

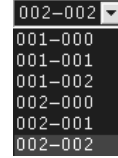


### The Waveform Display Window

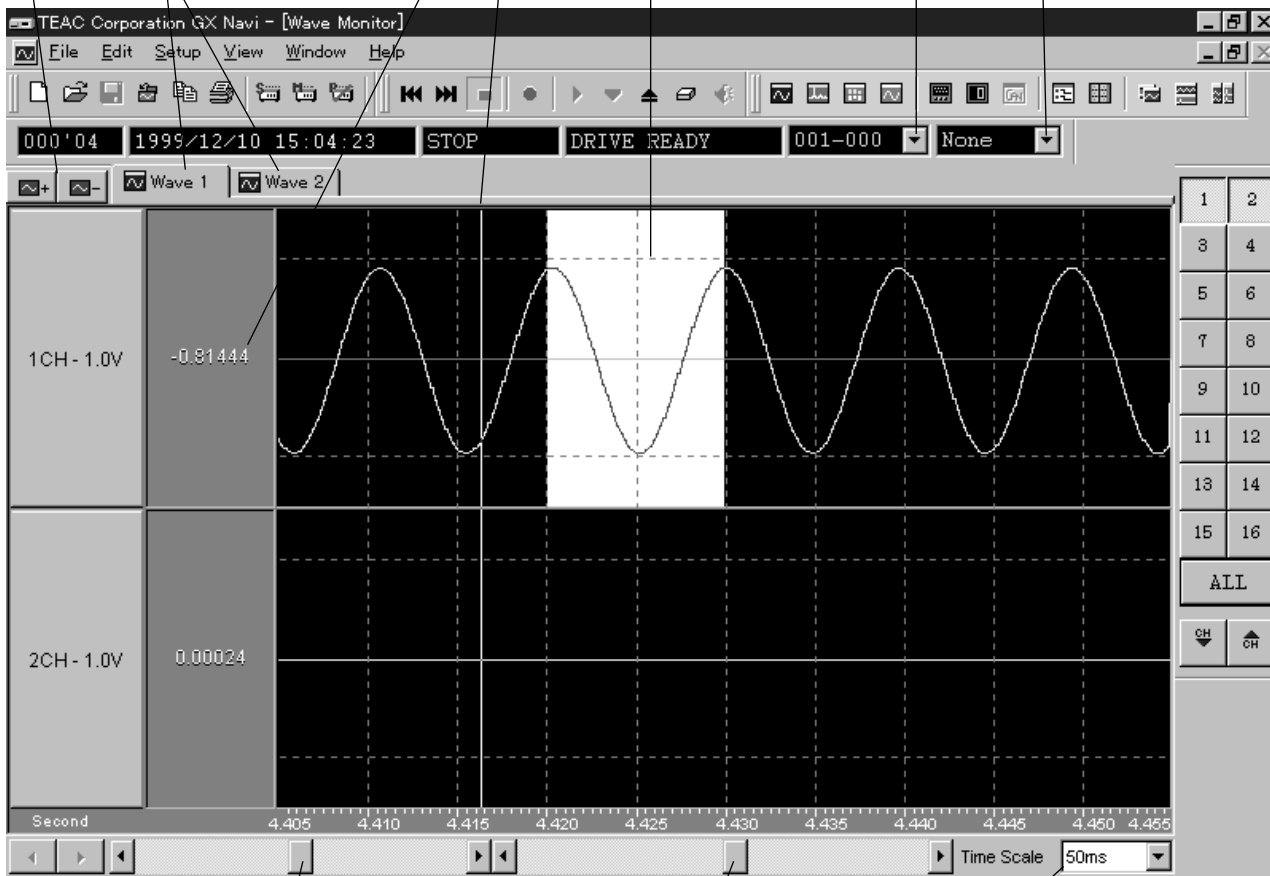
The Waveform Display window is composed of the components described below. After data is recorded in memory, this window displays the data in memory. You can use the cursor to read values, enlarge parts of a waveform, and scroll through the display.

- ▼ It may be some time before the waveform appears after recording stop.
- ▼ Decimated data is displayed when the sampling frequency is 200 kHz.

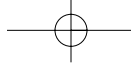
To switch from the FFT window or the Bar Graph window to the Waveform Display window, from the **View** menu choose **Wave Monitor**, or click the  button.



- Click here to add or cut a page.
- Click here to turn to another page. Channels can be selected for each page. Fleeting noise may appear on turning the pages.
- Dragging the cursor displays the values of that position in the left of the graph.
- After using the mouse to specify the area, from the **Edit** menu choose **Zoom** to enlarge the area. (Effective when **Time Scale** is 50 ms to 1 s.)
- Clicking an event number in the list displays the data of that position in the far left of the window.
- Selects a channel to output from the MON OUT connector. Do not change during recording.



- Dragging the rectangle scrolls through the display. (In reproducing, only when stopped) The range is all the data. The left and right arrow buttons scroll through one second units.
- Dragging the rectangle scrolls through the display. (In reproducing, only when stopped) The range is one second. The left and right arrow buttons scroll through 1/10 of the units in **Time Scale**.
- Selects the scale of the time axis. The possible time scale settings depend on the sampling frequencies. (See the next page.)



## Basic Operations

### ■ Time Axis for the Waveform Display, and Sampling Frequency

Sampling frequency	Time axis settings											
	50 mS	100 ms	200 ms	500 ms	1 s	2 s	5 s	10 s	20 s	50 s	100 s	Note
1 Hz	— *1	— *1	— *1	— *1	OK	OK	OK	OK	OK	OK	OK	*5
2 Hz	— *1	— *1	— *1	— *1	OK	OK	OK	OK	OK	OK	OK	*5
5 Hz	— *1	— *1	— *1	— *1	OK	OK	OK	OK	OK	OK	OK	*5
10 Hz	— *1	— *1	— *1	— *1	OK	OK	OK	OK	OK	OK	OK	*5
20 Hz	— *1	— *1	— *1	— *1	OK	OK	OK	OK	OK	OK	OK	*5
50 Hz	— *1	— *1	— *1	— *1	OK	OK	OK	OK	OK	OK	OK	*5
100 Hz	— *1	— *1	— *1	— *1	OK	OK	OK	OK	OK	OK	OK	*5
200 Hz	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	*5
500 Hz	OK	OK	OK	OK	OK	Δ *2	Δ *2	Δ *2	Δ *2	Δ *2	Δ *2	*5
1 kHz	OK	OK	OK	OK	OK	Δ *2	Δ *2	Δ *2	Δ *2	Δ *2	Δ *2	*5
2 kHz	OK	OK	OK	OK	OK	Δ *2	Δ *2	Δ *2	Δ *2	Δ *2	Δ *2	*5
5 kHz	OK	OK	OK	OK	OK	—	—	—	—	—	—	
10 kHz	OK	OK	OK	OK	OK	—	—	—	—	—	—	
20 kHz	Δ *3	Δ *3	Δ *3	Δ *3	OK	—	—	—	—	—	—	
50 kHz	Δ *3	Δ *3	Δ *3	Δ *3	OK	—	—	—	—	—	—	
100 kHz	Δ *3	Δ *3	Δ *3	Δ *3	OK	—	—	—	—	—	—	
200 kHz	Δ *3	Δ *3	Δ *3	Δ *3	OK	—	—	—	—	—	—	*6
2.5 kHz	OK	OK	OK	OK	OK	—	—	—	—	—	—	
12.5 kHz	Δ *3	Δ *3	Δ *3	Δ *3	OK	—	—	—	—	—	—	
25 kHz	Δ *3	Δ *3	Δ *3	Δ *3	OK	—	—	—	—	—	—	
External	— *1	— *1	— *1	— *1	OK	OK *4	OK *4	OK *4	OK *4	OK *4	OK *4	

\*1 These choices are displayed in the Time Scale drop-down list, but they are not selectable.

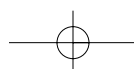
\*2 When the multi-sampling settings are in effect, these are not selectable.

\*3 When the medium is AIT and the recording rate is 800 k or more, these are not selectable. (Fixed to 1 second.)

\*4 When the frequency of an external clock is high, the waveform might be disordered.

\*5 A time scale from 2 s to 100 s is selectable only when the maximum sampling frequency is 2 kHz or lower. It takes about 3 seconds to display a waveform. (At a base sampling frequency of 10 Hz or lower, it takes about 6 seconds.) From 2 s to 100 s, 2 or fewer channels cannot be displayed. (Recording is possible.)

\*6 Waveforms cannot be displayed during reproduction at a sampling frequency of 200 kHz.






**Basic Operations**

**The FFT Window**

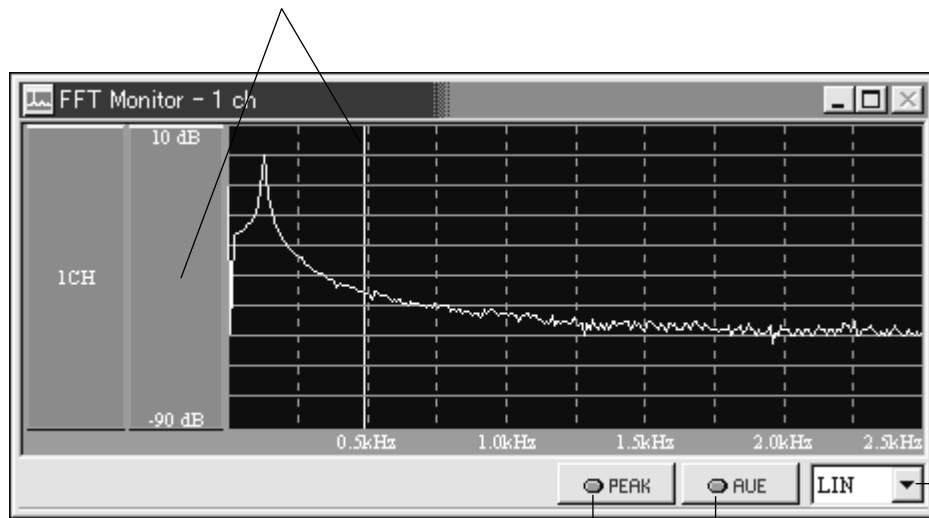
The FFT window has the functions described below.

To switch from the Waveform Display window or the Bar Graph window to the FFT window, from the **View** menu choose **FFT Monitor**, or click the  button.

▼ FFT display is possible when the sampling frequency is 50 kHz or lower.

▼ The number of FFT points is 256.

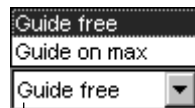
- The value at the cursor location is displayed on the left of the graph.



- Holds the maximum value of the data since this button is clicked.

- Displays the average of [the newest data] and [the previous average value].

- Select the horizontal axis units from **LIN** (linear) or **LOG** (logarithmic).



- Selecting **Guide on max** automatically moves the cursor to the maximum value. Selecting **Guide free** enables the cursor to be dragged to any location.




- Select the FFT analysis window function in the far right of the status bar.

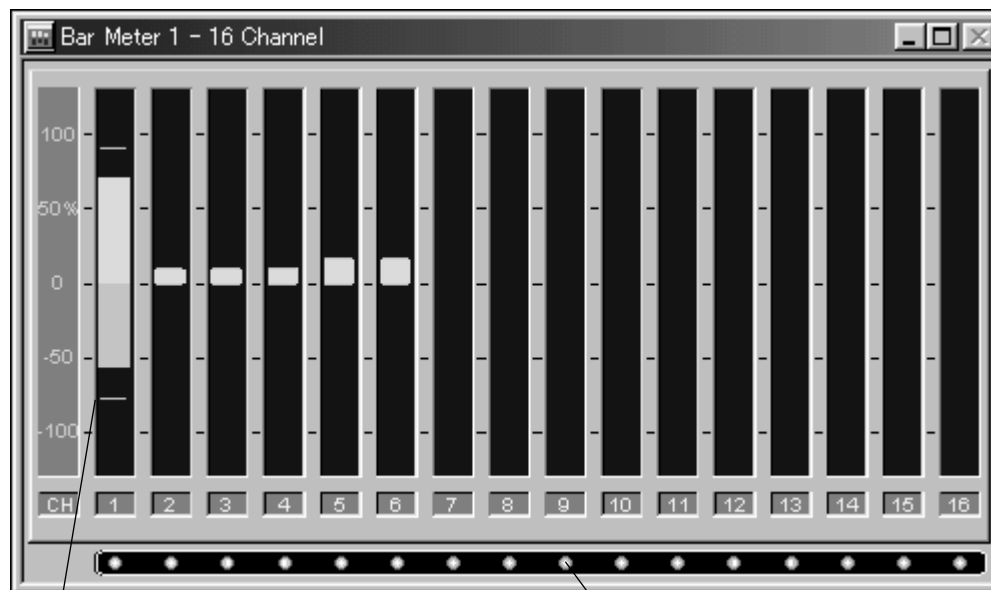
## Basic Operations

### The Bar Graph Window


The Bar Graph window has the functions described below.

To switch from the Waveform Display window or the FFT window to the Bar Graph window, from the **View** menu choose **Bar Graph**, or click the  button.

▼ Bar graph display is possible when the sampling frequency is 50 kHz or lower.



● Holds the peak values on the plus side and the minus side.

To clear, press the  button.

● The indicator for the valid channel is green.

**Basic Operations**

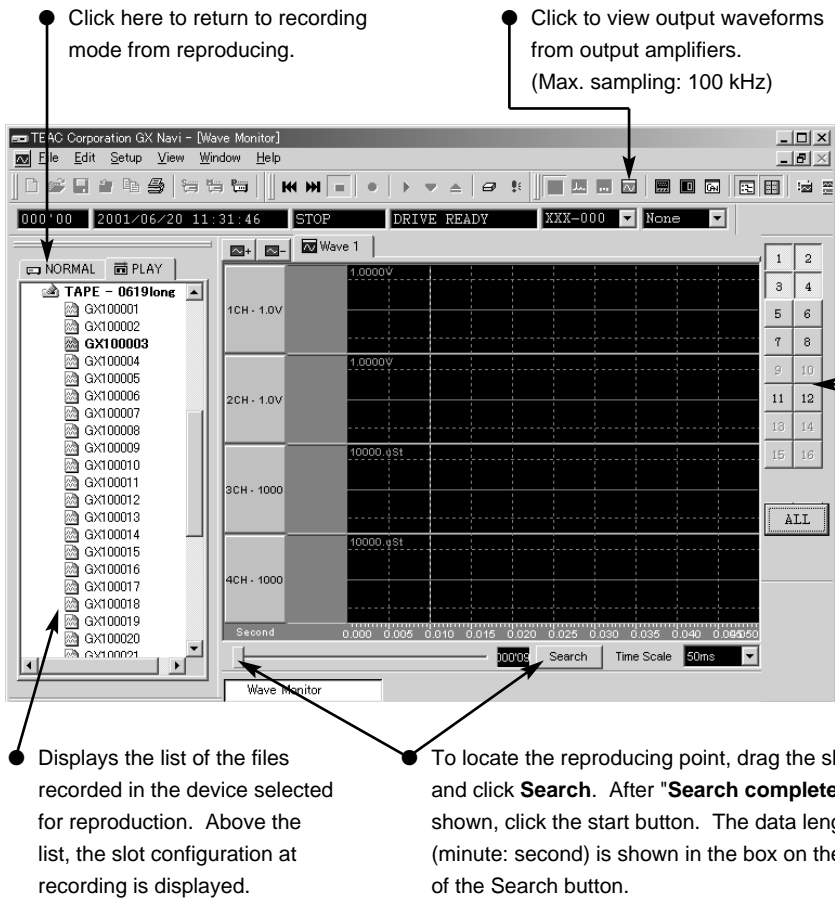
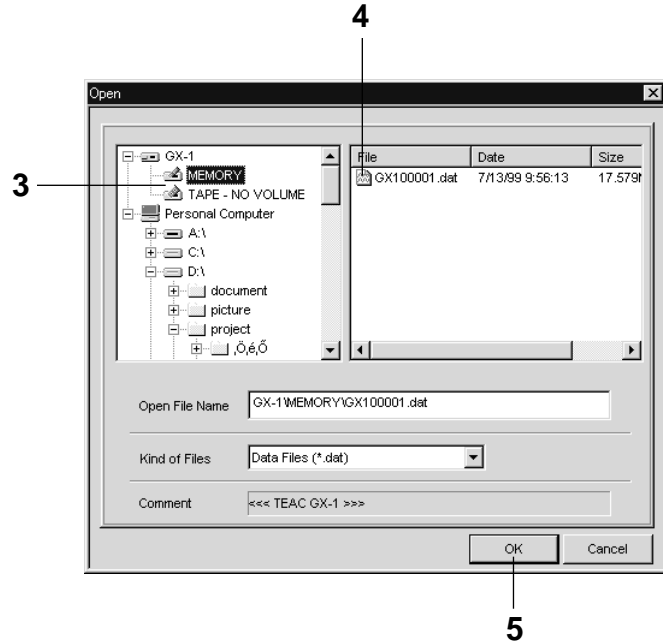
**Reproducing**

Data recorded in the internal device—memory or removable medium—can be reproduced in waveform display.

▼ The data recorded in a medium on the PC cannot be reproduced.

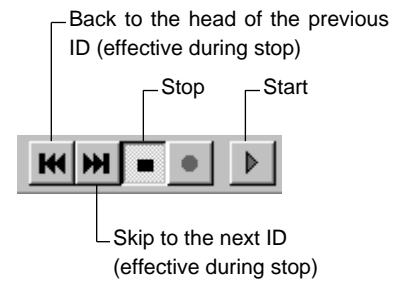
▼ With the optional analog output amplifier, you can reproduce the recorded data as analog signal.

1. If the **PLAY** tab on the left of the monitor area is active, click the **NORMAL** tab.
2. From the **File** menu, choose **Open**.
3. In the dialog that appears, select a device or a folder containing the data file you want to reproduce.
4. Select the data file (.dat file) you want to reproduce.
5. Click **OK**.  
The **PLAY** tab is activated and the window below appears.




- ▼ When data in a removable medium is selected, it takes some time until the display changes.
- ▼ Operations at this display can be done in the same way as recording monitor. The IDs are not displayed.
- ▼ Do not change the channels to display during reproduction. Do not switch from waveform to bar graph during reproduction.

**Use of toolbar for reproducing**



## Basic Operations

6. Click the Start button (  ) to start reproducing.

7. Click the Stop button (  ) to make reproducing pause.

Reproducing pauses at the current point of the data. Clicking the Stop button twice stops reproducing and locates the the beginning of the data.

Click the Start button to restart reproducing.


8. To reproduce another file in the same device (or folder), double-click on the desired file on the **PLAY** tab and click the Start button.

### ■ Setting Analog output Amp

To set the analog output amplifiers, choose **Params** from the **Setup** menu in the same way as for signal conditioners. To change the settings after you open a file to reproduce, proceed as follows:

1. Click  button on the toolbar.

The output monitor screen is displayed.

2. Click  button on the toolbar.

3. In the dialog that appears, select desired channels, output range, offset, and filter cutoff frequency.

4. Click **OK**.

▼ When reproducing data recorded at a low sampling frequency, it may take some time until the waveform appears. Please note that, if the recording time is short, the reproduction may be finished before the waveform appears.

▼ Reproducing frequency is same as the sampling frequency.

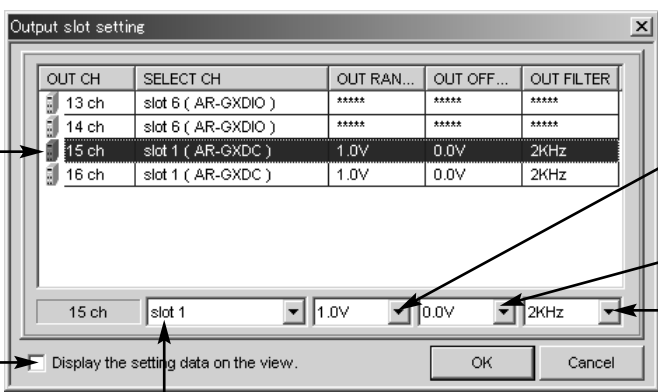
#### ▼ Reproduction of data recorded in AIT

Data cannot be reproduced continuously when the recording rate—sampling frequency multiplied by number of recording channels—is 800 k data/s or higher. Reproduction pauses when the buffer becomes empty. When reproduction pauses, click the Start button to resume reproduction.

#### ▼ Waveform time axis in AIT reproducing

When the recording rate is 800 k data/s or higher, the time axis is fixed to one second.

▼ Setting changes explained here are not reflected in the settings done by Setup/Params.



Click the channel you want to set.

Set output range. The output ranges and the units cannot be matched with the input settings depending on the type of amplifiers.

Set offset.

Select cutoff frequency of output filter.

Turn on to display the settings on this dialog on the Output Monitor screen.

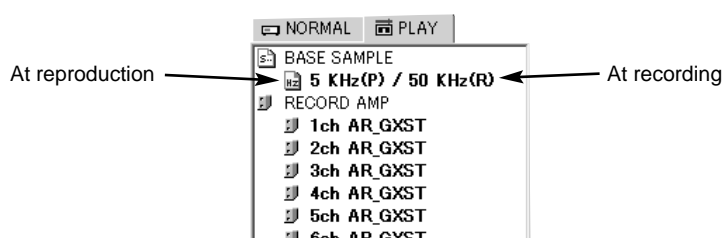
Select the slot of the channels you want to reproduce. The slot numbers in the expansion unit are added eight. If you remove the expansion unit when you reproduce the data recorded with the expansion unit installed, you cannot select the slots in the expansion unit.

OUT CH	SELECT CH	OUT RAN...	OUT OFF...	OUT FILTER
13 ch	slot 6 ( AR-GXDIO )	*****	*****	*****
14 ch	slot 6 ( AR-GXDIO )	*****	*****	*****
15 ch	slot 1 ( AR-GXDC )	1.0V	0.0V	2KHz
16 ch	slot 1 ( AR-GXDC )	1.0V	0.0V	2KHz

## ■ Reproduction at a Speed Different from the Recording Speed

You can select a sampling frequency at reproduction that is different from the sampling frequency at recording. After selecting the file to be reproduced, from the **Setup** menu choose **Params**, and then change the **Base Sample** setting.

When you select a sampling frequency different from the sampling frequency at recording, the 2 base sampling frequencies (at reproduction and at recording) are displayed on the **PLAY** tab in the left side of the monitor area.



- When reproducing a file recorded by multi-sampling, you cannot select a sampling frequency of 2.5 kHz, 12.5 kHz, 25 kHz, 50 kHz, 100 kHz, or 200 kHz.
- When the data was recorded by internal sampling, you cannot reproduce it by external sampling. Also vice versa: if data was recorded by external sampling, you cannot reproduce it by internal sampling.
- When a voice memo was recorded in MIX mode, reproduction at a selected reproduction speed is possible, and the voice is reproduced using the same timings as the measured data. However, reproduction quality deteriorates.
- When a voice was recorded in AFTER mode, you cannot change the reproduction speed of the voice. So the timing of the reproduced voice will not match the measured data. When you increase the reproduction speed, the voice will be slower than the data reproduction. When you decrease the reproduction speed, the voice will be faster than the data reproduction.
- The elapsed time displayed in the Status toolbar is the elapsed time at recording.
- The time displayed on the left of the **Search** button displays the temporal position at recording.
- At reproduction time, as at recording time, you cannot reproduce data at a rate that exceeds the maximum transfer rate of the internal drive. (See page 1-5.)
- During reproduction, the time axis on the Waveform Display window displays the actual time at reproduction.

## Basic Operations

### Using the Remote Controller

You can use the easy-to-use remote controller ER-GXRC to start and stop recording/reproducing, and to attach event marks to data. The remote controller can be used in conjunction with operations from the PC.

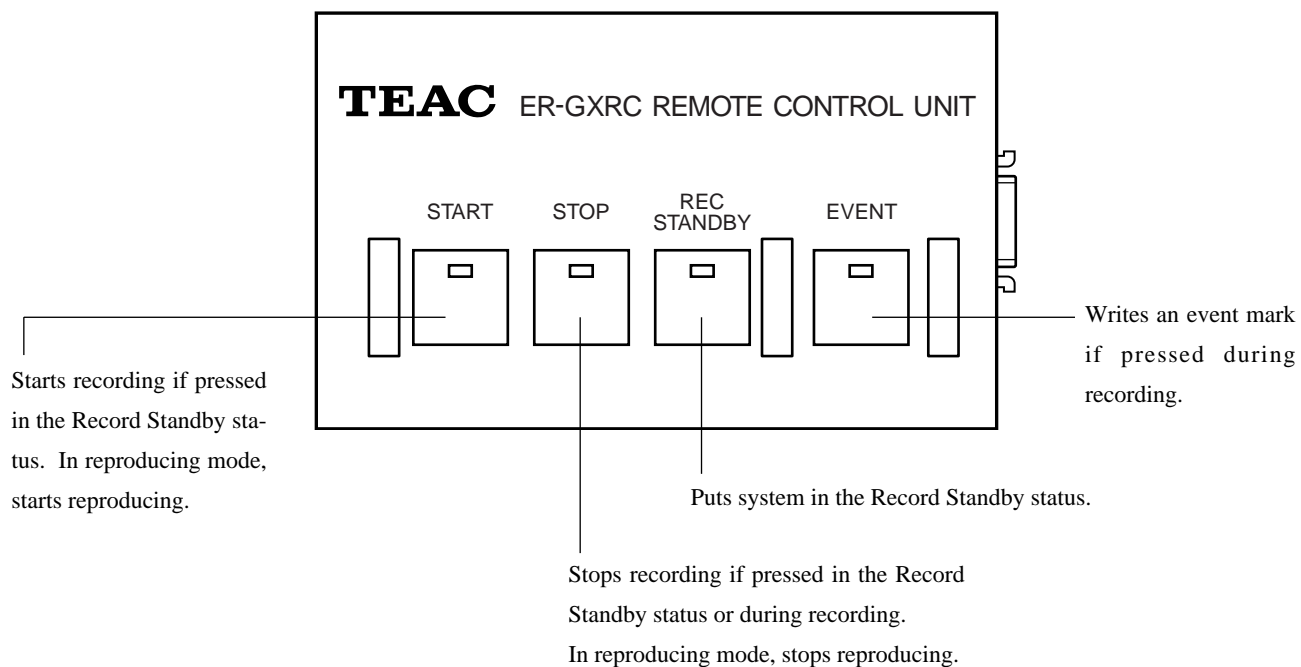
#### ■ Connecting

Use the dedicated cable to connect the remote controller to the ER-GXRC connector at the rear of the GX-1.

#### Note:

It does not matter whether the power to the GX-1 is turned on before or after you connect the remote controller.

#### ■ Functions of Each Button

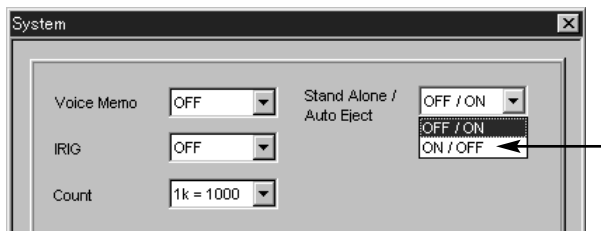


External dimensions : Approx. 90W x 30H x 55D (mm) (excluding protruding parts)

Mass : Approx. 160 g (excluding the cable that is approx. 90 g)

### ■ Recording Without a PC

You can record to recording media (such as AIT or an MO disk) using the handy remote controller ER-GXRC only, without connecting to a PC. In the upper right of the GX Navi **System** window, select **ON/OFF** in **Stand Alone / Auto Eject**.



#### When ON/OFF is Selected

In this mode, you can control GX-1 recording by using the ER-GXRC only (Stand Alone is ON). Control is also possible from GX Navi; though, in such a case, the media is not ejected when GX Navi terminates (Auto Eject is OFF).

- Before recording, you must use GX Navi to select the recording media and set the various parameters.
- When using the ER-GXRC (without using GX Navi) to eject the media, in the STOP mode press the eject button on the drive. Make sure that the BUSY lamp on the drive is extinguished when you do this. When using GX Navi to control operations, use GX Navi to eject the media.
- When AIT recording is stopped or paused, catalog information is recorded. This is information about all the files on the AIT tape, so writing this information takes about 1 minute. Therefore, if the next recording starts quickly, the recording data is buffered in internal memory. In this mode, if you repeatedly stop and then start recording, the internal buffer will continue to be consumed and the internal buffer might become full during recording. In such a case, recording will stop automatically.
- Even if you forget to eject the AIT and turn off the power after a new AIT recording, catalog information is already recorded.
- Before calibrating the microphone input amp AR-GXMC or zero-balancing the strain input amp AR-GXST, you must first turn on the power. If you are recording without a PC in

a system that uses a microphone input amp or a strain input amp, start recording as follows. First connect the PC and use GX Navi to perform calibration or zero balancing. Next, terminate GX Navi, disconnect the PC (with the power left on) from GX-1, and then start recording.

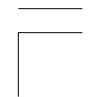
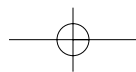
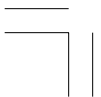
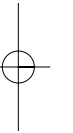
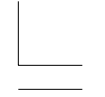
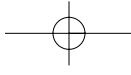
#### When OFF/ON is Selected

In this mode, you cannot control GX-1 recording by using the ER-GXRC only (Stand Alone is OFF). You must connect a PC and use GX Navi. When GX Navi terminates, the medium is ejected automatically (Auto Eject is ON).

- Ejection of the media is controlled from GX Navi, and the eject button on the drive is unusable.
- The catalog information for AIT recording is recorded in a batch at ejection.
- If you forget to eject the AIT and turn off the power after a new AIT recording, catalog information is not recorded. There is, however, a restoration function for catalog information. Restoration might take a long time: perhaps more than 20 or 30 minutes.

#### ■ When Recording to a PC Card

When you record to a PC card, ejection requires manual operation. So whether you select ON/OFF or OFF/ON, the operation is the same. Also, when you record using the handy remote controller without connecting a PC, the GX-1 selects the card slot for recording regardless of the GX Navi setting. When two cards are inserted, data is recorded to the card in the upper slot. When one card is inserted, data is recorded to that card.





# Explanations of Menus

File			
New	Ctrl+N	.....	3-22
Open...	Ctrl+O	.....	3-23
Format		.....	3-23
Print...	Ctrl+P	.....	3-23
Print Preview		.....	3-23
Print Setup...		.....	3-23
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Save as Bitmap		.....	3-24
Reset Setting Data		.....	3-24
Exit		.....	3-25

Edit			
Zoom		.....	3-25
Save		.....	3-25
Copy		.....	3-25
Sort		.....	3-26

Setup			
System		.....	3-26
Misc		.....	3-31
Params		.....	3-31
Save Setting		.....	3-34
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View			
Toolbar		.....	3-35
Status Bar		.....	3-36
Wave Monitor		.....	3-36
EFT Monitor		.....	3-36
Bar Graph		.....	3-36
Output Monitor		.....	3-36
Control Panel		.....	3-36
Wave Panel		.....	3-37
Can ID Panel		.....	3-37
Further Info		.....	3-37
Channel Select		.....	3-38

Window			
Cascade		.....	3-38
Tile Horizontal		.....	3-38
Tile Vertical		.....	3-38

## Explanations of Menus

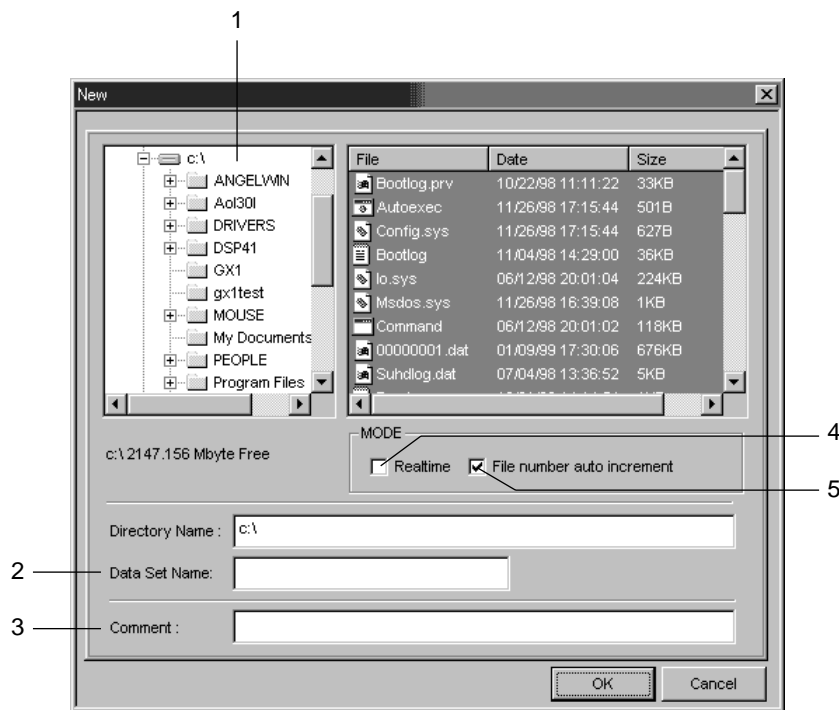
This chapter explains how to use the attached software “GX Navi” by explaining each of the menu commands.

### The File Menu

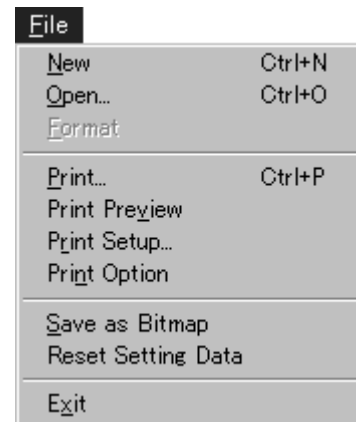
#### ■ New



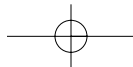
The **New** command enables you to select the destination to which new data is recorded, and to enter the name of the data file.



1. Specify the media or the folder into which data is to be recorded. If the MO or PC card contains no folder, enter a folder name in **Directory Name**. When specifying a PC, you can also enter a directory in **Directory Name**.
2. Enter the filename. You can enter up to 5 alphanumeric characters. A 3-digit ID number beginning from **001** is appended to these 5 characters, giving a total of 8 characters.
3. Enter a comment using up to 80 alphanumeric characters. This is written to the header file.
4. When **Realtime** is selected, the recorded data is transferred directly to the PC media without going through the GX-1 internal memory—**real-time transfer**. In real-time transfer, however, following functions are disabled:
  - to monitor waveform displays, etc., on the PC
  - to monitor elapsed time
  - to attach an event mark
  - to establish recording-standby status
  - to operate with the remote controller ER-GXRC.



- ▼ If you select GX-1's **MEMORY** for the recording media, transfer the data in the memory to the PC after recording stop by choosing **Edit** and then **Copy**. When **REC STANDBY** is established again after **STOP**, the data in the memory will be cleared.
- ▼ When 4 or fewer characters are entered, zeros (0) are embedded between the filename and the 3-digit number to give a total of 8 characters.
- ▼ No extension is needed. The **.dat** extension will be attached to data files automatically, and the **.hdr** extension will be appended to header files.
- ▼ Real-time transfer is possible when the the recording rate—sampling frequency multiplied by number of channels—is 1500 k data/s or lower.
- ▼ In real-time transfer, stop recording before the PC's hard disk space is less than 150 MB.
- ▼ When PC memory is small and cannot keep up with the GX-1 transfer speed, recording stops when the GX-1 memory becomes full. Data up to that point is transferred.



## Explanations of Menus

5. When **File number auto increment** is selected, the 3-digit ID number appended to the filename is automatically incremented whenever recording is restarted after a STOP (or after a pause). If not selected when recording into the PC, the ID number begins from "001" every time you start recording after a STOP. If, then, the data file of the same name already exists, it is overwritten. If the data file of the same name already exists when recording on the removable medium, the data files are automatically numbered consecutively through the medium regardless of selecting or not. When a new filename is given, the ID number automatically begins from "001".

### ■ **Open**

Opens and reproduces a data file (.dat file) recorded in the memory or removable medium. For details, see *Basic Operations*.

### ■ **Format**

Formats a removable medium. While formatting an MO or a PC card finishes soon, formatting an AIT takes about 3 minutes. You can enter a volume label using up to 8 characters.

### ■ **Print**

Prints the contents of a Waveform Display window or FFT window. When multiple windows are displayed, first make active the window that you want to print and then choose the **Print** command. You can print a waveform that was enlarged by choosing **Edit** and then **Zoom**.

### ■ **Print Preview**

Displays an image of how the Waveform Display window or FFT window will print.

### ■ **Print Setup**

Specifies the printer settings.

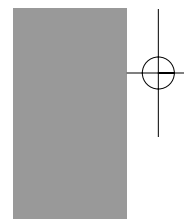
▼ Even if the **File number auto increment** option is not selected, the ID number will be automatically incremented whenever the following sequence is repeated:  
Recording start → Recording pause

▼ If the last digit of the filename is numeral, that digit becomes a part of the ID number.  
ex) If the filename is "GX1", the ID number is incremented as follows:

GX100001 → GX100002 → GX100003

Then, if you enter "GX" for a new filename and record a data file in the same folder, the filename will be incremented beginning from "GX100004".

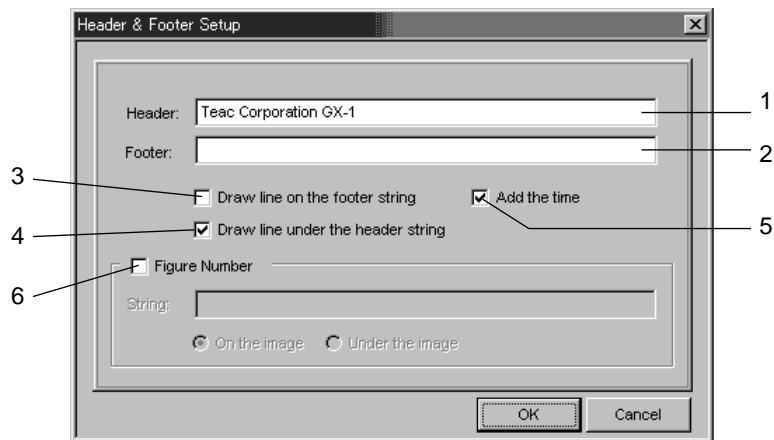
▼ The active window is the window whose title bar is displayed in blue. To make a window active, click in it.



## Explanations of Menus

### ■ Print Option

Adds elements such as headers to printed documents.



1. In **Header**, use alphanumeric characters to enter the header to be printed at the top of the graph.
2. In **Footer**, use alphanumeric characters to enter the footer to be printed at the bottom of the graph.
3. When the option **Draw line on the footer string** is selected, a line is drawn above the footer.
4. When the option **Draw line under the header string** is selected, a line is drawn under the header.
5. When the option **Add the time** is selected, the current time of the PC is printed.
6. When the option **Figure Number** is selected, you can print a figure name other than the header and footer. In **String**, enter the characters to be printed. Select **On the image** to print the characters above the image, or select **Under the image** to print the characters under the image.

### ■ Save as Bitmap

Saves the print image of the Waveform Display window or FFT window into a bitmap (BMP) file. This file can be opened in Paint that comes with Windows.

### ■ Reset Setting Data

Resets the **Setup** menu's **System**, **Misc**, or **Params** settings. Also resets the settings stored in the memory of the GX-1 main unit. To start recording just after resetting, click **ALL** on the channel select palette.

## Explanations of Menus

### ■ Exit

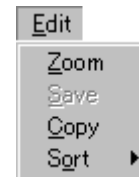
Terminates the application.

### The Edit Menu

#### ■ Zoom



Enlarges part of a displayed waveform after data is recorded. While pressing the left button, drag the mouse pointer through the area that you want to enlarge; the area will be highlighted. Next, choose the **Zoom** command to enlarge the display of that part. You can also print the enlarged portion by choosing **File** and then **Print**. To close the window showing the enlarged part, click the button.



#### ■ Copy



Copies data files.

▼ When a data file is copied, the paired header file is copied at the same time.

▼ In the case PC card slots are installed together with an MO drive, copying between an MO and a PC card is impossible.

▼ Do not eject a removable medium during copying even if it is not the source or destination.

Total size of the selected files

The screenshot shows a 'Copy' dialog box with the following elements:

- 1**: Points to the 'Device' dropdown menu, currently set to 'MEMORY (GX1)'. The 'Sel Size' is 127.930 KB (Header = 34 KB).
- 2**: Points to a table of files to be copied.
- 3**: Points to the 'Copy to:' section, specifically the 'to PC' radio button and the directory path 'D:\project\GxCARD\Release\DataFiles\'. A 'Browse directory' button is also visible.
- 4**: Points to the 'to CARD\_A' radio button and the available space '30.30 MB free'.

NAME	DATE	SIZE	COMMENT
<input checked="" type="checkbox"/> GX100001.dat	5/16/0 11:15:23	117.574 KB	<<< TEAC G

Additional labels in the image:

- 'Browse directory' points to the folder selection button.
- 'Enter a new file name (p. 3-10)' points to the file name input field.

1. In **Device**, select the media or the folder at the copy source.
2. Select the data files to be copied (ensure that a check mark is displayed).
3. To copy to a PC, click **to PC** and then specify the directory.
4. To copy to a removable medium, select a device.  
To copy to MO or PC card, select a folder from the box on its right.

## Explanations of Menus

### Sort

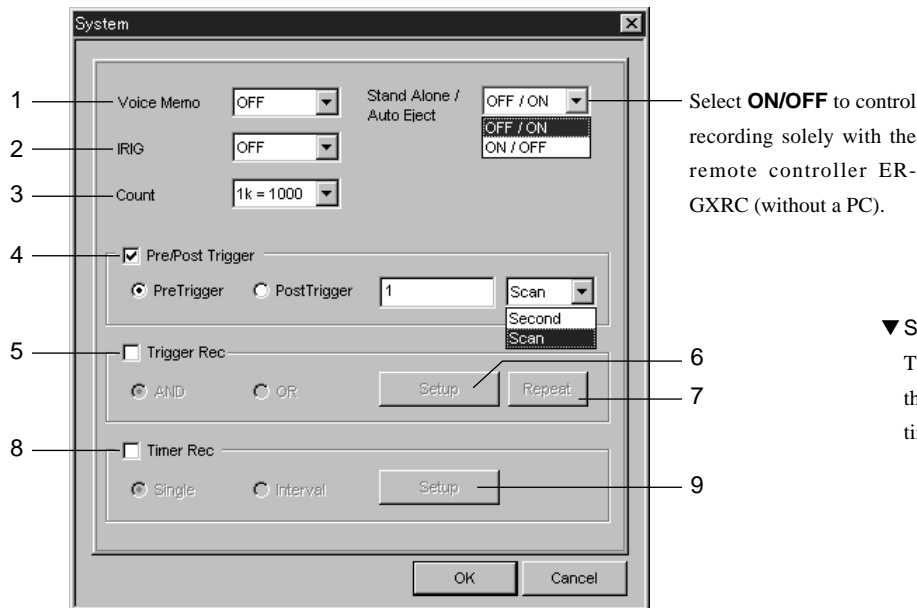
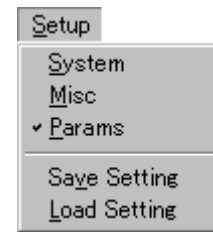
When the Waveform Display window is displayed and the displayed channel is changed by the Channel Select Palette, the order of graphs in the windows might get out of order. In such a case, the **Sort** command orders the graphs in the order of the channels. Select **Ascending** to sort so that the lowest channel numbers are at the top. Select **Descending** to sort so that the highest channel numbers are at the top.



## The Setup Menu

### System

Modifies the settings for recording activity.



#### ▼ Saving the settings

The settings in the **Setup** menu are stored in the memory of the GX-1 main unit. These settings are read to a PC when the GX Navi starts.

#### 1. Voice Memo

From **Voice Memo**, select **MIX**, **BEFORE**, or **AFTER**, to record voice memo. Details of each mode are explained on the next page.

#### 2. IRIG

When **IRIG** displays **ON**, at the start of recording the GX-1 internal clock is corrected by an IRIG-B time code input through the DIGITAL CONTROL connector. Be sure to supply the IRIG-B time code signal when selecting **ON**. If not supplied, the unit will not enter Rec Standby status.

#### 3. Count

In **Count**, select the units for k (kilo) of the sampling frequency: either 1,000 or 1,024.

▼ When you select 1,024 for **Count**, the sampling frequencies that do not make up a full **k** are converted as follows: 500 to 512, 200 to 204.8, 100 to 102.4, and so on. However, note that the display in the **PARAMS** menu will not change. Also note that the value  $[sampling-frequency \times number-of-channels \times 1.024]$  cannot exceed 3,200 kHz.

▼ The **Count** must be **1k = 1000** at 200 kHz sampling.

## Explanations of Menus

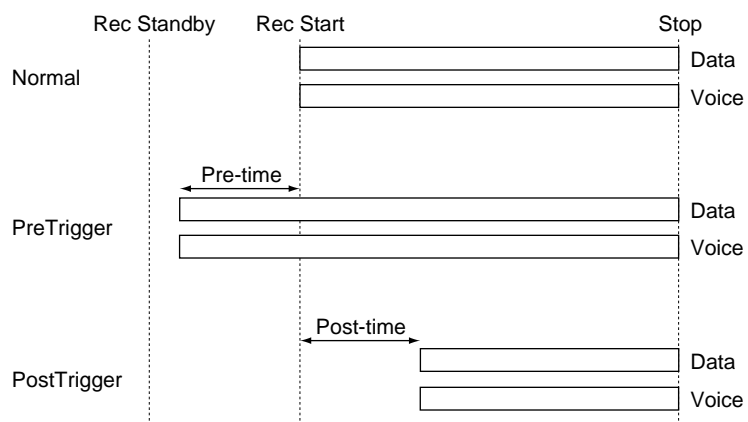
### ● About voice memo recording/playback

There are three types of modes for recording voice memo:

#### MIX:

Voices are sampled at the same sampling frequency as data. Set the sampling frequency to higher than 5 kHz to listen to the voice. The voice data is appended to the last channel data in the data file and is counted as one data channel. Therefore, make sure that the value [sampling frequency multiplied by (number of channels + 1)] does not exceed 3,200 k data/s. This voice data can be converted into WAVE files with commercially available software.

To play back the voice, select **MIX**.

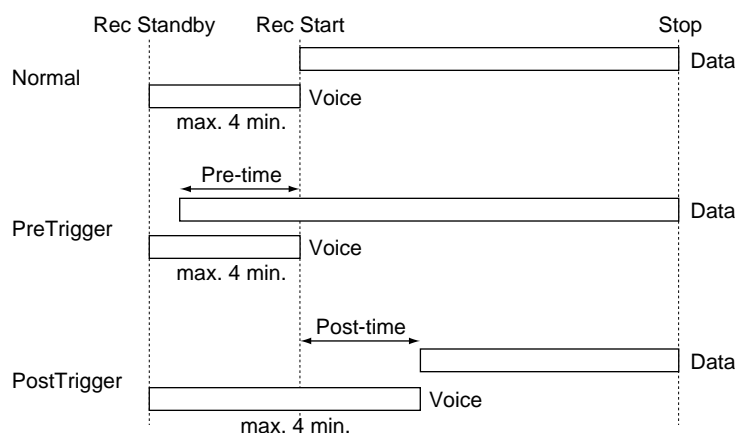


#### BEFORE:

Voices are recorded before the start of recording and cannot be recorded after that.

Voices are recorded from Rec Standby to Rec Start for maximum of approximately four minutes. You can start playing back voices by choosing **File** and then **Open**. However, voice playback is stopped when the Start button is clicked.

The voice data is recorded in a WAVE file created in addition to a data file and a header file. When a data file is copied, this WAVE file is also copied. The WAVE files can be opened in Windows Media Player.

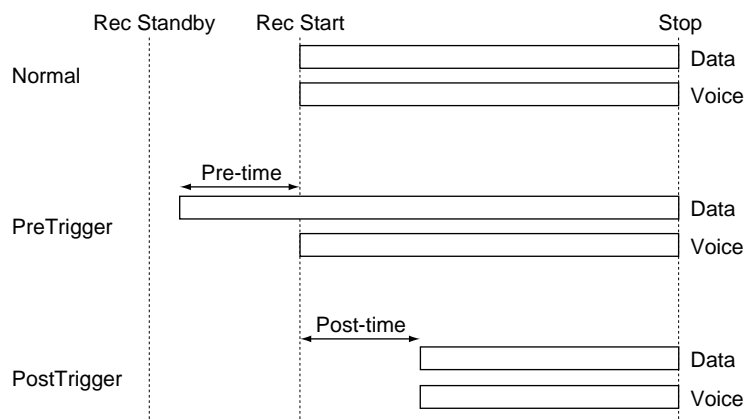


#### AFTER:

Voices are recorded after the start of recording. In Pre/PostTrigger recording, however, the timing is different, and the voices cannot be played back by choosing **File** and then **Open**.

You cannot select this mode when recording to AIT.

The voice data is recorded in a WAVE file in the same way as in the BEFORE mode.



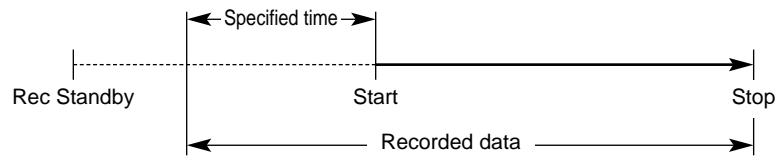
## Explanations of Menus

### 4. Pre/Post Trigger

When the option **Pre/Post Trigger** is selected, the Pre-trigger or Post-trigger recording mode can be selected. Select either the **PreTrigger** or **PostTrigger** option, and select **Second** or **Scan** in the rightmost box to determine whether you specify the time in terms of seconds or scans.\* Then, enter the number of seconds ( $\leq 10000$ ) or scans ( $\leq 2147483647$ ) in the left box. \* See *File Formats* for “scan.”

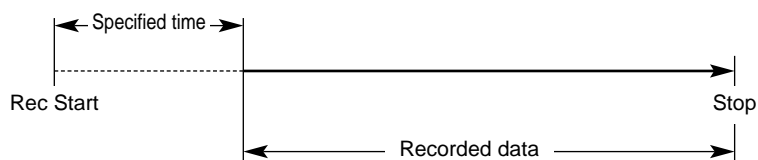
#### ● Activity in the Pre-trigger mode

In the Pre-trigger mode, data is read before the recording START. In the Record Standby status, data begins to be stored in a buffer. This buffer stores the most recent data for the specified period. At the recording START, the data for the specified time before START becomes recorded data.



#### ● Activity in the Post-trigger mode

In the Post-trigger mode, data is read from a specified time after START.



▼ **Pre/Post Trigger** can be used in conjunction with **Trigger Rec**, which is explained next.

▼ The possible pre-trigger time depends on the amount of memory, the sampling frequency, and the number of channels. Specify a value that does not exceed the time possible using available free memory.

▼ You cannot specify the time in seconds for external sampling.

▼ The period between Rec Standby and Start must be longer than the specified pre-time plus one second.

**Example:** If 5 seconds is specified for the post-trigger, data is recorded from 5 seconds after the time of START. However, when STOP occurs within 5 seconds after START, data cannot be recorded.

▼ During the specified post-time, the activity display shows “REC POST”, and the Rec Standby button is disabled. Do not click the Stop button during the post-time.



## Explanations of Menus

### 5. Trigger Rec

When the option **Trigger Rec** is selected, recording starts when the specified channel signal level changes to the trigger level. When the system enters the Record Standby status, the level begins to be monitored and recording starts when the trigger condition is reached.

### 6. Setup

Clicking the **Setup** button enables you to specify the channel and level. To specify multiple channels, select the option **AND** if you want recording to start when all channels reach the trigger condition, or select the option **OR** if you want recording to start when any of the channels reaches the trigger condition.

### 7. Repeat

To automatically repeat recording based on a level trigger, click the **Repeat** button and specify the number of repetitions and the recording time.

▼ The **Trigger Rec** settings can be used in conjunction with the previously described **Pre/Post Trigger** settings.

▼ You can set the time from the start to the end of recording by clicking the **Repeat** button and specifying the time in the **Rec Time** page.

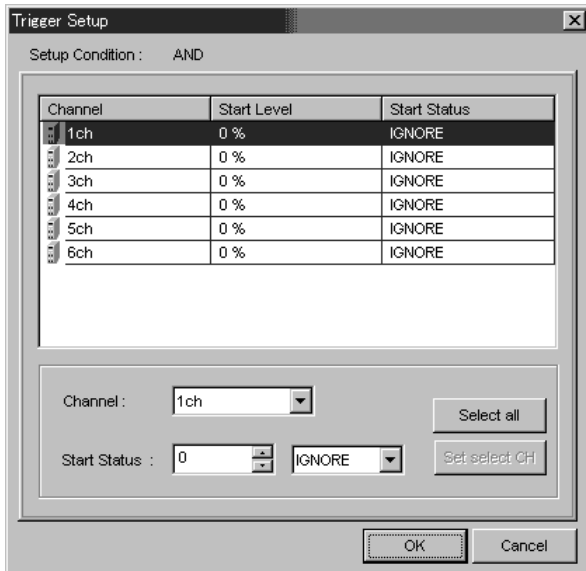
▼ When the level trigger is set and the sampling frequency is 100 kHz or higher, the elapsed recording time display on the toolbar and control panel stops during recording or recording standby.

▼ When the level trigger is set and the sampling frequency is 50 kHz, do not select the trigger-monitored channel for FFT display.

▼ IDs corresponding to the number of repetitions are recorded.

▼ **Repeat** is disabled in real-time transfer.

## Trigger Rec Settings



**Channel:** Select the channel whose settings you want to specify.

**Start Status:** Sets the trigger level as a % of the full scale. Use the right box to select UP or DOWN.

**UP:** Recording starts when input reaches a level higher than the trigger level. Recording starts immediately if the signal level is already higher than the trigger level at the time START.

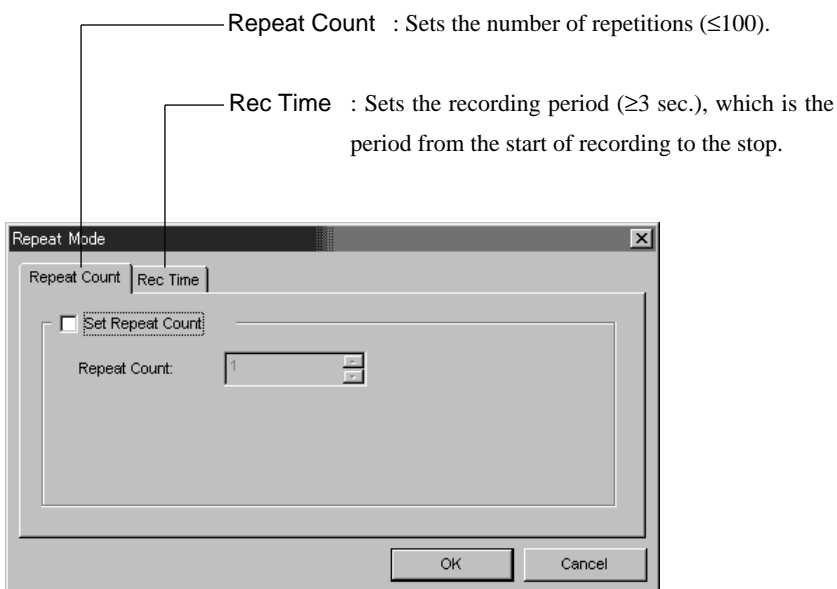
**DOWN:** Recording starts when input reaches a level lower than the trigger level. Recording starts immediately if the signal level is already lower than the trigger level at the time START.

**IGNORE:** Does not become a channel whose level is monitored.

**Select all:** Selects all channels.

**Set select CH:** Sets multiple selected channels at the same time.

## Repeat Settings



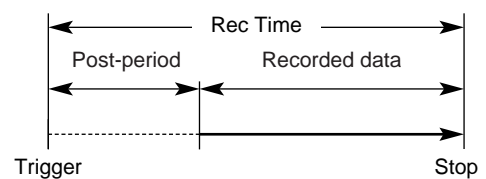
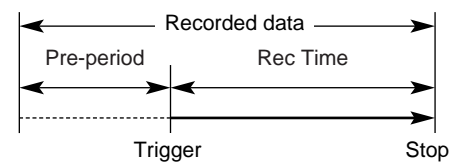
**Repeat Count :** Sets the number of repetitions ( $\leq 100$ ).

**Rec Time :** Sets the recording period ( $\geq 3$  sec.), which is the period from the start of recording to the stop.

▼ Select waveform display during **Repeat** operation.

In three seconds after stop, prevent the next trigger.

▼ When **Trigger Rec** is used in conjunction with **Pre/Post Trigger**, Rec Time is defined as shown below:



## Explanations of Menus

### 8. Timer Rec

When the option **Timer Rec** is selected, the GX-1 internal clock is set to timer activity. If **Single** is selected, the starting or stopping of recording at the specified time is performed only once. If **Interval** is selected, the starting or stopping of recording at the specified time is repeated the specified number of times. To set details, click the **Setup** button (9). After specifying settings for the timer activity, put the system in the Record Standby status.

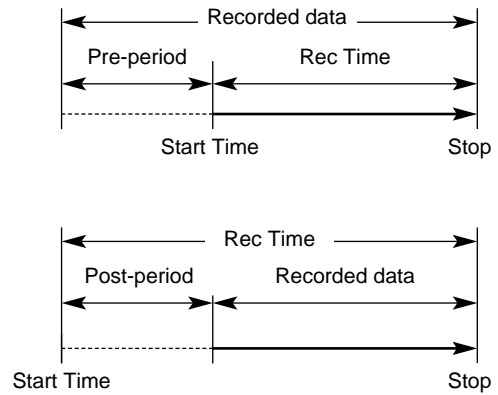
- ▼ **Timer Rec** can be used in conjunction with the previously described **Pre/Post Trigger** settings.
- ▼ IDs corresponding to the number of repetitions are recorded.
- ▼ **Interval** is disabled in real-time transfer.

#### Single Settings

Start Time : Sets the date and time for the start of recording.

Rec Time : Sets the recording period.

- ▼ When **Timer Rec** is used in conjunction with **Pre/Post Trigger**, Rec Time is defined as shown below:



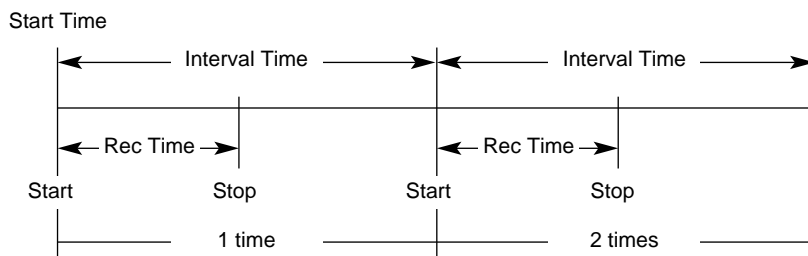
#### Interval Settings

Start Time : Sets the date and time for the start of recording.

Interval Time : Sets the period from the start of the first recording until the start of the next recording ( $\geq 6$  sec.). In **times**, specify the number of repetitions ( $\leq 100$ ).

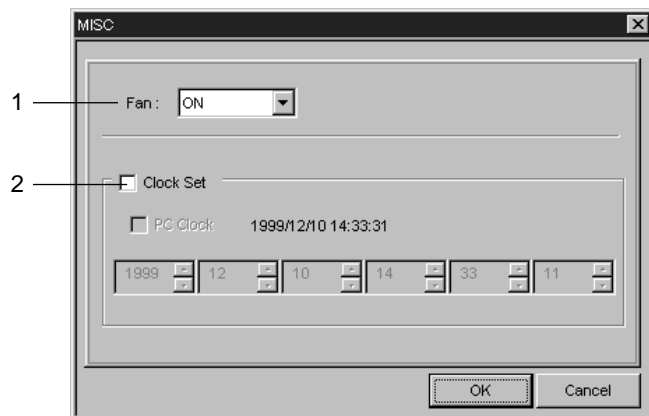
Rec Time : Sets the recording period ( $\geq 3$  sec.).

- ▼ Select waveform display during **Interval** operation.
- ▼ When **Interval** operation is enabled with AIT, **Interval Time** minus **Rec Time** must be longer than 15 seconds.



## Explanations of Menus

### Misc

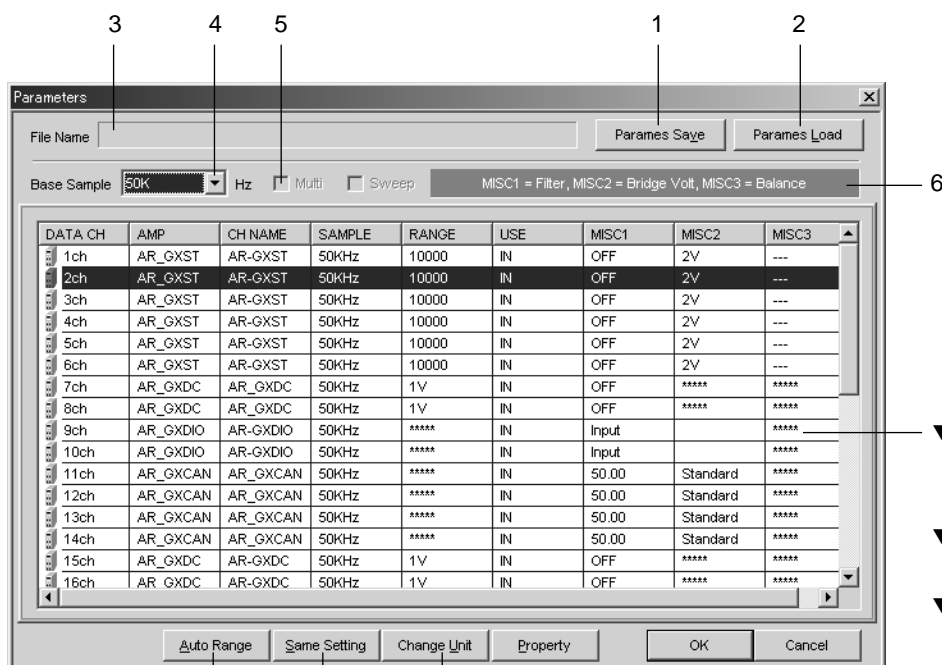


1. The **Fan** setting can stop the GX-1 cooling fan for five minutes from the start of recording. This is convenient when taking sound measurements. The fan does not stop during REC STANDBY. When **Fan** displays **ON**, the fan does not stop.
2. The **Clock Set** option is used to adjust the GX-1 internal clock. When you enter the date and time and click **OK**, the internal clock begins working from that time. If you select the option **PC Clock** and then click **OK**, the GX-1 internal clock is matched to the PC clock.

- ▼ Use this function only when the GX-1 operates on DC. **Do not** stop the fan when the GX-1 is powered from the AC adaptor or the battery pack.
- ▼ Once you perform recording with the fan stopped, wait five minutes before you resume recording.
- ▼ **Do not** stop the fan in Post Trigger mode, Level Trigger mode, or Interval mode of Timer recording.

### Params

Sets the recording parameters for each channel.



See page 3-39.

7

8

- ▼ The slot in which a signal conditioner is not installed
- ▼ The **AMP** column displays the types of signal conditioners.
- ▼ You can enter a channel name in the **CH NAME** column. You can enter up to 16 alphanumeric characters.

## Explanations of Menus

To set the parameters, first click on the line for the channel whose parameters you want to set. The line will be highlighted. Next, click on an item in the line to display a list of selectable options. Choose the desired item from that list.

Double-clicking on the line of the channel to be set displays a dialog box. This dialog box contains settings additional to those in the **Parameters** window: for example, you can perform zero balancing or calibration for some signal conditioners. For details, see *Amplifiers*.

### Notes on RANGE selection

The A-to-D converted value can range from -131% to +131% of the selected input range, but the input margin is about  $\pm 120\%$ . Select a range so that the input will not exceed  $\pm 120\%$ .

### 1. Parames Save

The **Parames Save** button saves the parameter settings as a **.prm** file or **.txt** file.

### 2. Parames Load

The **Parames Load** button reads a **.prm** file. Before reading, insert the same medium that was used when the prm file was saved into the same slot. When read, the filename is displayed in the **File** box (3). If you then click **OK** in the **Parameters** window, the contents of the file will be set in the GX-1 main unit.

### 4. Base Sample Freq

The **Base Sample Freq** entry determines the sampling frequency common to all channels. When you select the option **Multi Sampling**, you can also set a 10 times the Base Sample Freq for each slot. Select **External** for external sampling.

#### Notes on external sampling

- The value [*sampling-frequency* x *number-of-channels*] must be 3,200 kHz or lower.
- Bar graph display is possible when the external sampling frequency is lower than 50 kHz. FFT display is disabled in external sampling. In waveform display, select both channels of slots. The time axis of waveform is fixed to one second.
- When level trigger is used in conjunction with external sampling, the sampling frequency must be 100 kHz or lower.
- When the external sampling frequency is low, do not click **Start** button before the waveform is displayed. If you start recording before the waveform is displayed, the data may become "0".

▼ Enable both channels of a slot.

▼ Filter cutoff frequency is set slot by slot, not channel by channel.

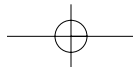
▼ This dialog box can be also displayed by highlighting a line of a channel and then clicking on the **Property** button.

▼ A **.txt** file cannot be loaded by the **Parames Load** explained below.

▼ An error occurs if the **.prm** file contents conflict with the currently installed signal conditioners.

▼ The unit for k (kilo) in this box is determined by the **Count** setting (from the **Setup** menu, choose **System**). The unit can be 1,000 or 1,024.

▼ The value [*sampling-frequency* x *number-of-channels*] cannot exceed 3,200 kHz. When recording to an AIT or in real-time transfer, it cannot exceed 1,500 kHz. To an MO, it cannot exceed 200 kHz, and to a PC card 50 kHz.



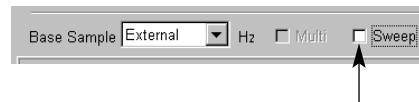
## Explanations of Menus

### To sweep external sampling clock

When you choose **External** from **Base Sample Freq**, **Sweep** check box will appear. Check the box to sweep the external sampling clock. If not checked, the input frequency must be constant.

Note the following when sweeping the sampling clock.

- The swept frequency must be 20 kHz or lower. The external sampling frequency must be constant if it is higher than 20 kHz.
- Sweep the clock continuously. Stepwise change may cause recording impossible.
- When the external sampling frequency is low, it takes some time for the waveform to be displayed after pressing the **Rec Standby** button. (ex. 2 minutes and 30 seconds at 1 kHz)
- Bar graph display is disabled in sweep mode.



### 5. Multi Sampling

Turn on the **Multi Sampling** check box to perform multi-frequency sampling, which enables you to set a 10 times the **Base Sample Freq** for each signal conditioner (that is, for each 2 channels). When the sampling frequency of one channel is changed, the sampling frequency for the other channel of the slot also changes.

#### Notes on Multi-sampling

- The **Base Sample Freq** must be 20 kHz or lower.
- Multi-sampling is not possible when using external sampling.
- A data file recorded by multi-sampling cannot be read by commercially available analytical software.
- The voice memo is sampled at the **Base Sample Freq** when it is recorded in the **MIX** mode.
- Phase differences among channels do not occur in recorded data. However, in reproduced waveforms, phase differences occur.
- When the **Base Sample Freq** is 5 Hz or lower, reproduced waveforms may be distorted.

### 6. MISC

Unique settings for each signal conditioner can be set in **MISC1**, **MISC2**, and **MISC3** for each channel. This area (6) displays the **MISC** contents. The example shows that **MISC1** of the DC amp for the channel 1 is the cutoff frequency.

### 7. Same Setting

After highlighting a line for a channel by clicking on it, if you then click the **Same Setting** button, the same settings will be set for all channels of the same type of signal conditioner.

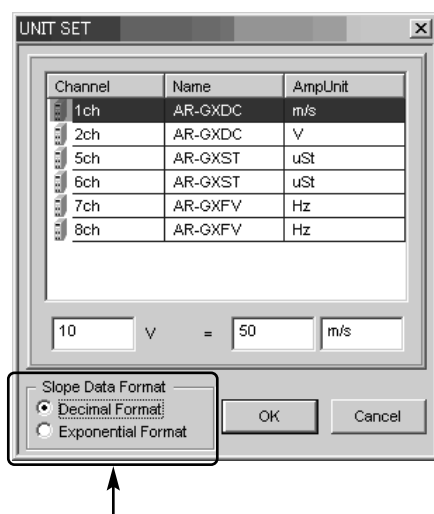
## Explanations of Menus

### 8. Change Unit

You can use engineering units instead of the physical units to be written in the VERT\_UNITS line of the header file. The coefficient (SLOPE value) is accordingly converted and written in the header file. To specify a different unit, click **Change Unit**, choose a desired channel from the list in the dialog box that appears, and enter values and the unit to complete the equation at the bottom of the box.

#### Example:

If you record a signal from an anemometer that outputs 10 V at a wind velocity of 50 m/sec (0 V at 0 m/sec) and you choose 10 V for the input range, the unit name in VERT\_UNITS will be "V", and the SLOPE value will be  $10 / 25000 = 0.0004$ . Then, if you enter as shown below in the Change Unit dialog box, the unit name in VERT\_UNITS will be "m/s", and the SLOPE value will be 0.002.



You can select a format for the coefficient values to be written in the SLOPE line of the header file.

**Decimal Format:** Written in a decimal number Ex) 12.3456789

**Exponential Format:** Written in an exponential number Ex) 1.2345E+01

### ■ Save Setting

Saves the settings from **System**, **Misc**, and **Params** in the **Setup** menu. The settings are saved in a **.gxs** file. It is recommended that you save the settings for an unexpected accident.

### ■ Load Setting

Loads the **.gxs** file. Before loading, insert the same medium that was used when the gxs file was saved into the same slot. The settings in this file are set in the GX-1 main unit when the file is read.

- ▼ The unit names must be within four characters.
- ▼ The units displayed on the left of the waveform graphs will be also changed to the units specified by this setting.
- ▼ This setting is not saved.
- ▼ You cannot change the units for the microphone input amps and thermocouple input amps.

- ▼ This **.gxs** file is different from a **.prm** file. The **.prm** file stores the parameter settings only.

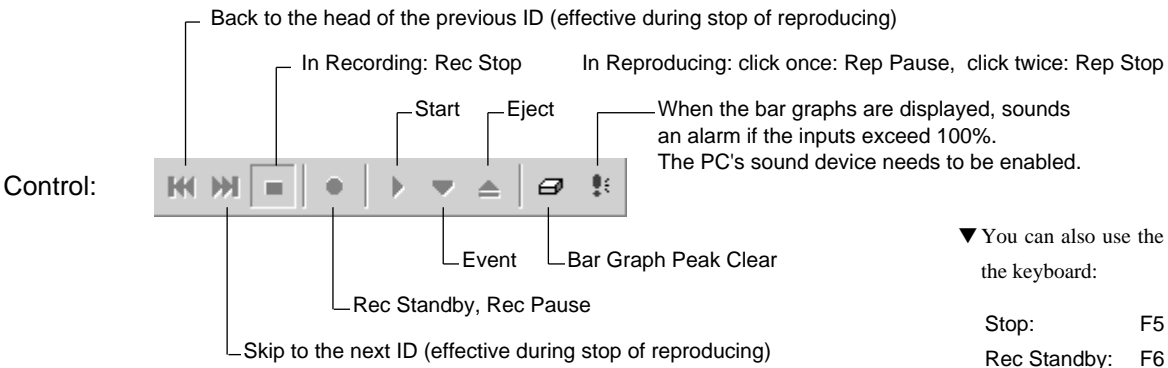
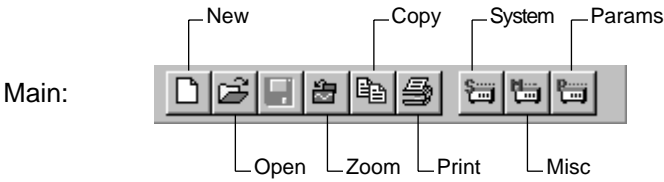
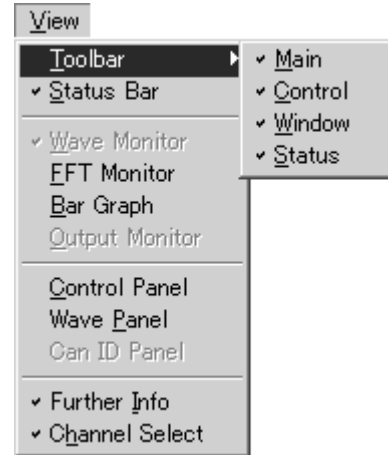
- ▼ Loading may take some time depending on the contents of the file to be loaded.

**Explanations of Menus**

**The View Menu**

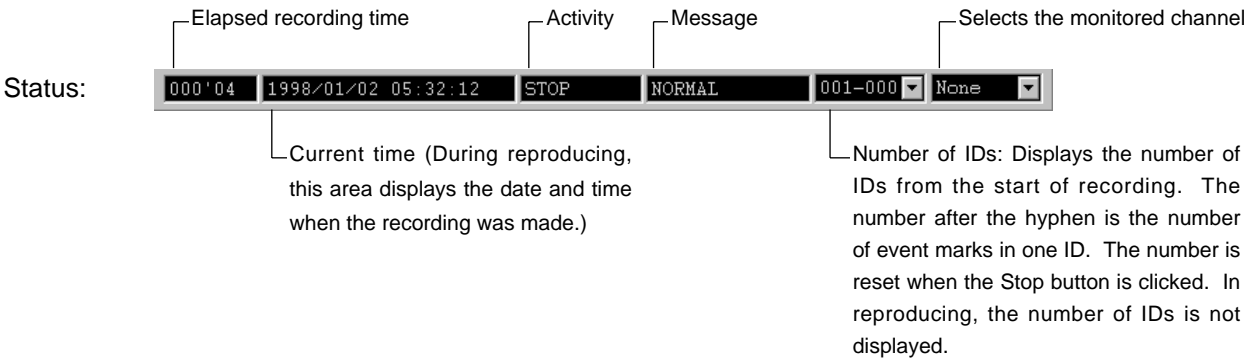
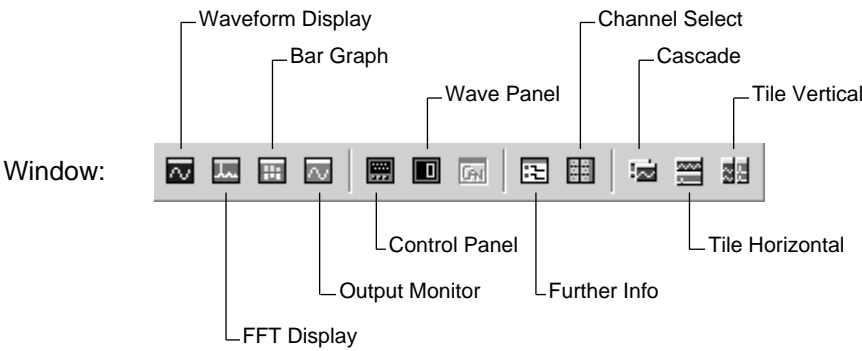
**■ Toolbar**

Selects the toolbar to be displayed. Selecting the name of a toolbar adds a check mark in front of the name.



▼ You can also use the function keys on the keyboard:

- Stop: F5 key
- Rec Standby: F6 key
- Start: F7 key
- Event: F8 key




## Explanations of Menus

### ■ Status Bar

Displays or hides the status bar at the bottom of the window.

■ **Wave Monitor**  : Switches the display to the Waveform Display window.

■ **FFT Monitor**  : Switches the display to the FFT window.


■ **Bar Graph**  : Switches the display to the Bar Graph window.

■ **Output Monitor** 

Displays the waveforms of reproduced output from the output amplifiers: AR-GXDIO or AR-GXAO. Selectable only in the reproduction mode: when the **PLAY** tab is active. The maximum sampling frequency is 100 kHz.

■ **Control Panel** 

Displays the Control Panel. The Control Panel enables you to control recording/reproducing and to monitor activities.



Number of ID      Event number      Monitored channel

001 - 003      001ch

1998/1/2      04:07:26      001'06

Activity display: Blinks during Rec Standby. A lighted segment rotates during recording, reproducing, and pause of reproducing.

Elapsed recording time

Current time  
During reproducing, the date and time when the recording was made.

Stop      Rec Standby      Start      Event

Skip to the next ID (effective during stop of reproducing)

Back to the head of the previous ID (effective during stop of reproducing)

▼ Rec Standby button:  
Rec Standby, Rec Pause

▼ Stop button:  
In recording:      Rec Stop  
In reproducing: click once: Rep Pause  
                         click twice: Rep Stop

▼ You can also use the function keys on the keyboard:

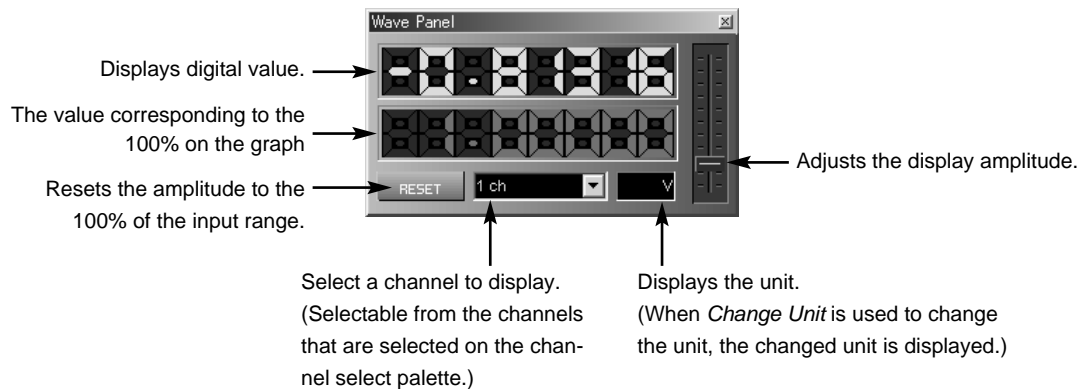
Stop:              F5 key  
Rec Standby:      F6 key  
Start:              F7 key  
Event:              F8 key



## Explanations of Menus

### ■ Wave Panel

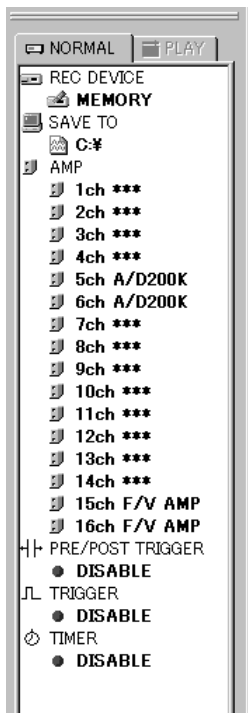
Displays the panel to show the digital value of the waveform. Selectable only when the waveform display is selected. The value at the left end—not at the cursor—of the waveform of the specified channel is displayed.



### ■ Further Info

Displays, in the left of the window, the information shown below.

#### Recording mode

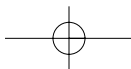


The **NORMAL** tab becomes active in the recording mode. Information such as the recording media, data transfer destination, signal conditioner status, trigger settings is displayed.

#### Reproduction mode



The **PLAY** tab becomes active in the reproduction mode. The files recorded in the device specified for reproducing are listed. The currently opened file is shown in boldface type. Above the list, the signal conditioner status at recording is displayed.



## Explanations of Menus

### Channel Select



Displays the Channel Select Palette.



Selects the channel to be displayed.  
The CAN input amps are selected slot by slot.

Displays all channels.

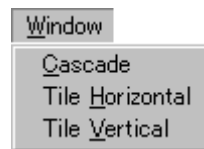
Switches between each set of 16 channels  
when using expanded channels.

## The Window Menu

### Cascade



When multiple windows are open, this menu command displays the windows in a partly overlapping format.



### Tile Horizontal



When multiple windows are open, this menu command displays the windows in a tiled format in which the windows are placed above and below each other.

### Tile Vertical



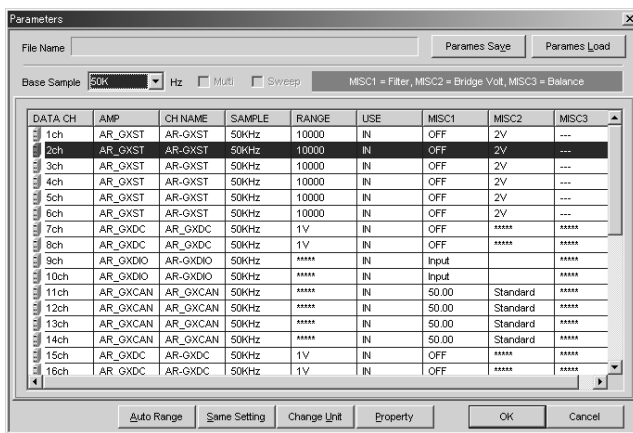
When multiple windows are open, this menu command displays the windows in a tiled format in which the windows are placed to the left and right of each other.

### ■ About Auto Range

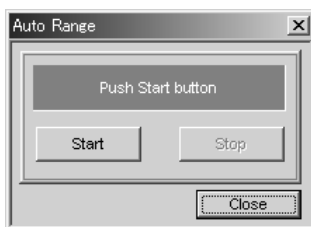
You can automatically optimize the input ranges for analog type amplifiers. The input ranges of all channels of the analog type amplifiers are optimized at a time.

- You cannot use this function when the sampling frequency (the higher frequency in multi-sampling) is higher than 50 kHz or when you sweep the external sampling clock.

1. From the **Setup** menu, choose **Params** and click **Auto Range**.

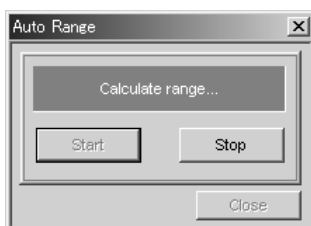


The box below appears.



2. Click **Start**.

The message in the box changes to "Calculate range..."

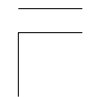
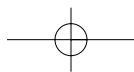
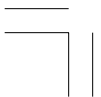
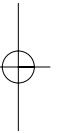
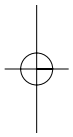
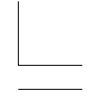
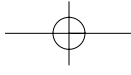


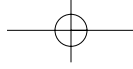
3. Input the actual signals.

4. After the signals are finished, click **Stop**.

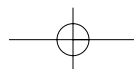
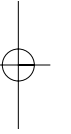
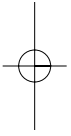
5. Click **Close**.

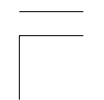
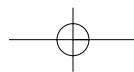
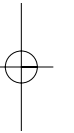
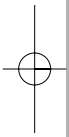
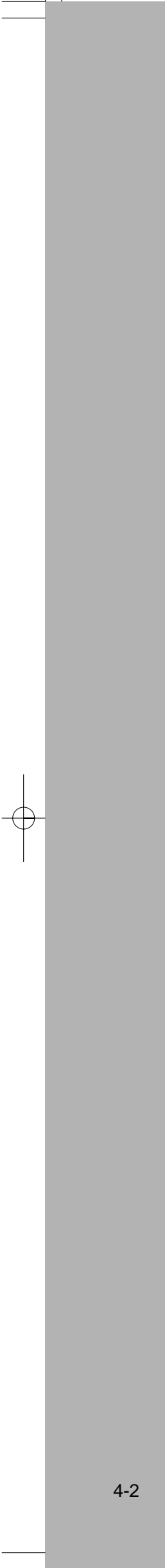
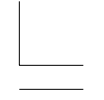
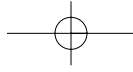
The input ranges changed by this function are displayed in red in the Parameters window.

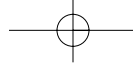




# Technical Information

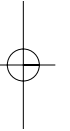
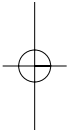






# Specifications

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File Formats . . . . .	4-6
Connector Specifications . . . . .	4-11
External Dimensions . . . . .	4-12



## Specifications

### Specifications for the GX-1 Main Unit

Signal conditioner slots :	8
Recording device slot :	1 (for AIT drive)
Memory :	DIMM 32—256 MB
Interface :	SCSI (connector 50-pin half size x 1, built-in terminator)
Contact-point control :	START, STOP, EVENT, REC STANDBY
Expansion bus connector :	1 (common)
DIGITAL CONTROL connector :	1 (time code, external sampling clock input)
Monitor channel analog output :	1 (no filter, output level fixed to $\pm 5$ V)
Microphone jack :	1
Speaker/earphone jack :	1 each
Sampling frequencies:	
Internal clock :	1, 2, 5, 10, 20, 50, 100, 200, 500 Hz 1, 2, 5, 10, 20, 50, 100, 200, 2.5, 12.5, 25 kHz
Multi-sampling :	From the internal clock frequencies, you can select a base sampling frequency and 10 times the base sampling frequency slot by slot at a time.
External clock :	Up to the maximum sampling frequency of each signal conditioner Note: The total of [sampling-frequency x number-of-channels] must not exceed 3,200 kHz.
Power :	+11 to 30 V DC Built-in AC adaptor: for 100 V: 90 to 130 V, 50 to 400 Hz for 200 V: 180 to 260 V, 50 to 400 Hz Battery (option)
Power consumption :	Approx. 45 W (DC power supply, w/ 8 DC input amps, w/o drive) Approx. 75 W (Using AC adaptor, w/ 8 DC input amps, w/o drive)
Operating temperature :	0 to 40°C (32 to 104°F)
Storage temperature :	-20 to 60°C (-4 to 140°F)
Operating humidity :	20 to 80% RH (non-condensing)
Vibration :	MIL-STD-810D Figure 514.3-1, 2, 3
External dimensions :	Approx. 300W x 85H x 200D (mm) (excluding protruding parts)
Mass:	Approx. 5 kg (including 8 DC input amps and an AC adaptor)

#### ■ Specifications when AIT drive installed

Power consumption :	Approx. 58 W (w/ DC input amp for all channels)
Operating temperature :	5 to 35°C (41 to 95°F)
Storage temperature :	-20 to 60°C (-4 to 140°F)
Vibration :	MIL-STD-810C Figure 514.2-6 V Curve (1.5G, vertical)
Mass:	Approx. 5.75 kg (including 8 DC input amps and an AC adaptor)

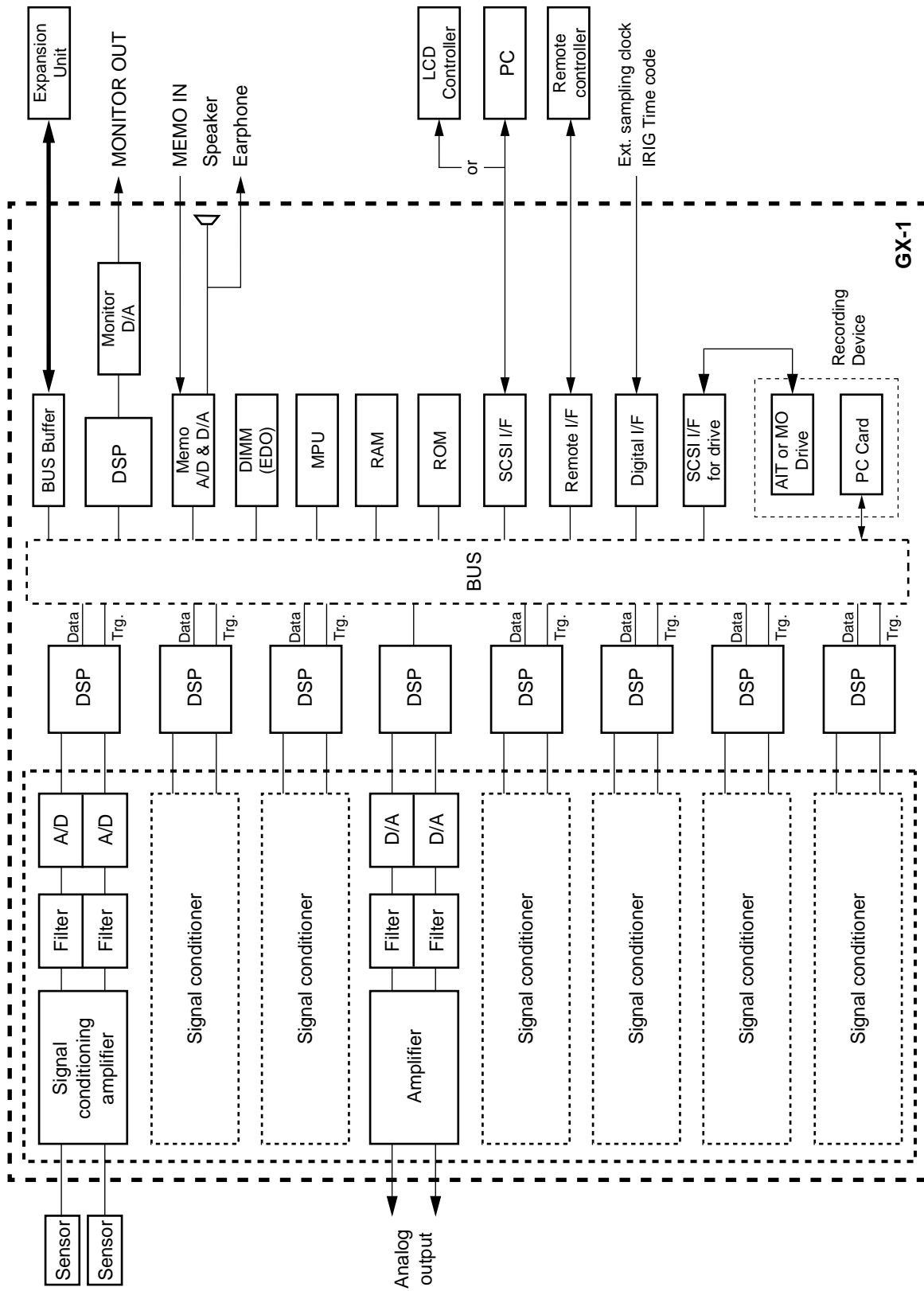
#### ■ Specifications when MO/PC card drive installed

Power consumption :	Approx. 52 W (w/ DC input amp for all channels)
Operating temperature :	5 to 35°C (41 to 95°F)
Storage temperature :	-20 to 60°C (-4 to 140°F)
Mass:	Approx. 5.5 kg (including 8 DC input amps and an AC adaptor)

Specifications are subject to change without notice.



Block Diagram



## Specifications

### File Formats

#### ■ File type

The GX-1 creates one binary-format data file and one ASCII-format header file each time recording pauses or stops.

**Data File:** A binary file containing binary-format data through A/D conversion. Each data file has the filename extension of **.dat**.

**Header File:** A text file (ASCII code) containing recording information such as conditions. Each header file has the filename extension of **.hdr**.

- The data is stored in the DOS format on an MO, PC card, or medium on a PC. On an AIT cartridge, however, the data is stored in a TEAC unique format. To utilize the data on an AIT, you can use *GX Navi* to copy the data as a TAFFM file to a PC, or use separate software *GX View* to read data from a PC's external AIT drive.
- When voice memo is recorded in the **BEFORE** or **AFTER** mode, a WAVE file is created in addition to a header and a data file. The WAVE files can be opened in Windows Media Player.

#### ■ Filename

Within the same ID, the data file and header file have the same filename, which begins with five alphanumeric characters and is followed by a three-digit number.

The first five characters are entered in the **Data Set Name** field in the **New** dialog box. You cannot use the \ / \* ? < > | " : and ; characters. When 4 or fewer characters are entered, zeros (0) are embedded between the filename and the 3-digit number to give a total of 8 characters.

The three-digit number is the ID number beginning from **001**. When **File number auto increment** is selected in the **New** dialog box, the ID number is automatically incremented whenever recording is restarted after a STOP (or after a pause). If not selected when recording into the PC, the number begins from **001** every time you start recording after a STOP. If, then, the data file of the same name already exists, it is overwritten. If the data file of the same name already exists when recording on the removable medium, the data files are automatically numbered consecutively through the medium regardless of selecting or not. When a new filename is given, the number automatically begins from **001**.

#### ■ Data file

A-to-D converted data is stored as an two-byte integer ranging from  $-32768$  to  $+32767$ . Negative values are represented by two's-complement numbers.

The order of bytes is so called "Intel format": the lower byte first, and the upper last.<sup>\*1</sup>

The order of data is **INTERLACED** format<sup>\*2</sup>: the first channel of the first sampling, the second channel of the first sampling, . . . , the last channel of the first sampling, the first channel of the second sampling, the second channel of the the second sampling, and so on.

When voice memo is recorded in the **MIX** mode, the voice data is appended to the last channel data of each sampling.

\*1: The format in which the upper byte comes first and the lower last is called "Motorola format," and is adopted for workstations and FFT analyzers with Motorola CPUs.

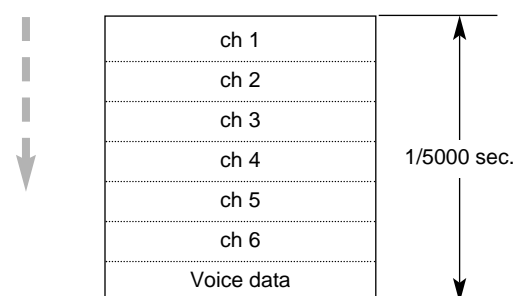
\*2: In the **SEQUENTIAL** format, data is arranged in a different order: the first channel of the first sampling, the first channel of the second sampling, . . . , the first channel of the last sampling, the second channel of the first sampling, the second channel of the second sampling, and so on.

The following example shows how the data files are organized. A block of data shown in the example is referred to as a *scan*. A data file consists of repetitions of scans.

#### Example 1

The illustration below shows a scan of data recorded at a sampling frequency of 5 kHz for channels 1 to 6 together with voice data recorded in MIX mode.

Order of data in data file



**Specifications**

**Example 2**

The illustration below shows a scan of data recorded at a sampling frequency of:

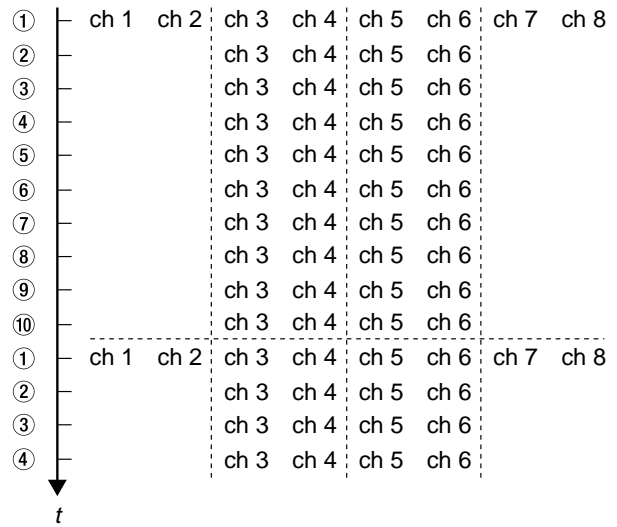
- 1 kHz for channels 1 and 2
- 10 kHz for channels 3 and 4
- 10 kHz for channels 5 and 6
- 1 kHz for channels 7 and 8

The illustration below shows the sample timing for this example:

Order of data in data file

Channel	Timing
ch 1	①
ch 2	①
ch 3	①
ch 4	①
ch 3	②
ch 4	②
ch 3	③
ch 4	③
ch 3	④
ch 4	④
ch 3	⑤
ch 4	⑤
ch 3	⑥
ch 4	⑥
ch 3	⑦
ch 4	⑦
ch 3	⑧
ch 4	⑧
ch 3	⑨
ch 4	⑨
ch 3	⑩
ch 4	⑩
ch 5	①
ch 6	①
ch 5	②
ch 6	②
ch 5	③
ch 6	③
ch 5	④
ch 6	④
ch 5	⑤
ch 6	⑤
ch 5	⑥
ch 6	⑥
ch 5	⑦
ch 6	⑦
ch 5	⑧
ch 6	⑧
ch 5	⑨
ch 6	⑨
ch 5	⑩
ch 6	⑩
ch 7	①
ch 8	①

Timing



1 / 1000 sec.



## ■ Header File

A header file is an ASCII text file in which information such as recording conditions is written. The header file format conforms to DADiSP format for waveform analytical software. Like all ASCII text files, header files can be read by text editors such as the Windows Notepad.

Each line of a header file contains information of each recording condition. The parameters are separated by commas. The following code is an example of a header file created when voice memo is recorded in the MIX mode, and is followed by an explanation.

### ● Example of Header File

```

DATASET GX100001
VERSION 1
SERIES CH3_AR-GXDC, CH4_AR-GXDC, CH9_AR-GXDC, CH10_AR-GXDC, MEMO
DATE 02-02-2000
TIME 15:52:17.00
RATE 5000
VERT_UNITS V , V , V , V , V
HORZ_UNITS Sec
COMMENT <<< TEAC GX-1 >>>
NUM_SERIES 5
STORAGE_MODE INTERLACED
FILE_TYPE INTEGER
SLOPE 0.00004000, 0.00004000, 0.00004000, 0.00004000, 0.00004000
X_OFFSET 0
Y_OFFSET 0.0, 0.0, 0.0, 0.0, 0.0
NUM_SAMPS 20720
DATA
DEVICE GX-1
CH1_3 AR-GXDC,RANGE=1V,FILTER=400Hz
CH2_4 AR-GXDC,RANGE=1V,FILTER=400Hz
CH3_9 AR-GXDC,RANGE=1V,FILTER=OFF
CH4_10 AR-GXDC,RANGE=1V,FILTER=OFF
CH5_11 MEMO,RANGE=1V,FILTER=OFF
CH_SLOT 2, 2, 1
CLOCK INTERNAL
RATE_MULTI 5000, 50000, 5000
MARK 9335
GX-1_VOICE_MEMO ADDED TO THE END OF EACH SCANNING DATA
GX-1_VERSION 13, 0C, 1.24, 1.09, 1.61
GX-1_OPTION 0001
GX-1_SYS

```

## Specifications

### ● Explanation of Header File

DATASET :	The file name.
VERSION :	Data version number (Fixed at 1).
SERIES :	Number of channel used for recording. Channel names follow the under bars. "MEMO" is appended when voice memo is recorded in the MIX mode.
DATE :	Date when recording started. (mm-dd-yyyy)
TIME :	Time when recording started. (hh:mm:ss)
RATE :	Sampling frequency (Unit: Hz). This is 1 for external sampling.
VERT_UNITS :	Units for each channel. "V" is appended when voice memo is recorded in the MIX mode.
HORZ_UNITS :	Units for time axis (Fixed at Sec).
COMMENT :	Comment entered in the <b>New</b> submenu.
NUM_SERIES :	Number of recording channels. One channel is added when voice memo is recorded in the MIX mode.
STORAGE_MODE :	Order of stored data. Fixed at INTERLACED because data is stored in the order of sampling.
FILE_TYPE :	Fixed at INTEGER because data is a two-byte integer.
SLOPE :	Coefficient for physical-value conversion. "0.00004000" is appended when voice memo is recorded in the MIX mode.
X_OFFSET :	Position of the first data on the time axis. Normally 0. In trigger recording, the specified time is written here in unit of second even when it is specified in terms of "scans". (Decimals are omitted.) A minus sign precedes the value in pretrigger mode, and a plus sign in posttrigger mode.
Y_OFFSET :	Offset for physical-value conversion. "0.0" is appended when voice memo is recorded in the MIX mode.
NUM_SAMPS :	Number of sampled data per channel.
DATA :	Indicates that the following information is unique to this device and is different from the DADiSP format.
DEVICE :	Fixed at GX-1.
CH1_ :	Channel number, type of amplifier, range setting, and filter setting follow the under bar.
CH_SLOT :	Number of channels per each slot. "1" is appended when voice memo is recorded in the MIX mode.
CLOCK :	Source of sampling clock
RATE_MULTI :	This item is written when multi-sampling is performed. The values indicates the sampling frequencies of each slot. The example on the previous page shows the sampling frequencies for ch 3/4, ch 9/10, and voice memo.
MARK :	Number of scans at the moment an event mark is attached.
GX-1_VOICE_MEMO :	Indicates the recording mode for voice memo. This is an example of MIX mode. In BEFORE mode, "WAV_FORM 16BITS 8KHZ BEFORE TRIGGER" is written here, and in AFTER mode, "WAV_FORM 16BITS 8KHZ AFTER TRIGGER."

### ■ Converting Data to Physical Value

An A-to-D converted value is an integer ranging from -32768 to +32767 and is  $\pm 25000$  when the input is  $\pm 100\%$  of the selected input range. The input physical value is figured out by the following formula:

The value in the data file  $\times$  The value of SLOPE in the header file + The value of Y\_OFFSET in the header file

- The Y\_OFFSET values are zero except when the thermocouple input amplifiers AR-GXTCK/J are used.

Specifications

Connector Specifications

■ **SCSI Connector**

Connector on GX-1 main unit : NHS050-022-BS2 from Yamaichi Electronics Co., Ltd.

Pin number	Signal name	Pin number	Signal name
1—11	GND	36	GND
12		37	
13		38	TP
14		39	
15—25	GND	40	GND
26	D0	41	ATN
27	D1	42	GND
28	D2	43	BSY
29	D3	44	ACK
30	D4	45	RST
31	D5	46	MSG
32	D6	47	SEL
33	D7	48	C/D
34	DP	49	REQ
35	GND	50	I/O

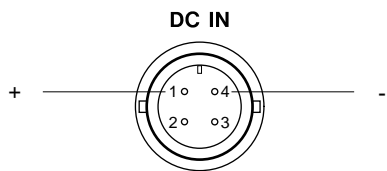
■ **ER-GXRC Connector**

Connector on GX-1  
 Main unit : DX10G1M-14SE from Hirose Electric Co., Ltd.  
 Mating plug : DX30AM-14P from Hirose Electric Co., Ltd.  
 Case cover : DX30M-14-CV from Hirose Electric Co., Ltd.

Pin number	Signal name	I/O	Pin number	Signal name	I/O
1	START	I	8	START LED	O
2	STOP	I	9	STOP LED	O
3	EVENT	I	10	EVENT LED	O
4	REC	I	11	REC LED	O
5			12		
6			13		
7	GND		14	GND	

Input: TTL, pulled-up by 4.7 kΩ  
 Output: CMOS, current limited by 1 kΩ

■ **DC IN Connector**



■ **DIGITAL CONTROL Connector**

Connector on GX-1 main unit : DX10G1M-36 from Hirose Electric Co., Ltd.

Mating plug : DX40M-36P(03) from Hirose Electric Co., Ltd.

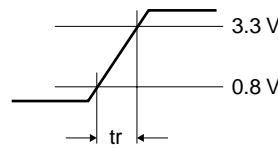
Case cover : DX30M-36-CV from Hirose Electric Co., Ltd.

Pin number	Signal name	Signal type	Level	I/O
1	IRIG	IRIG input	IRIG	I
2—17	Not used			
18	EXCLK	External sampling clock	TTL	I
19—33	Not used			
34—36	GND			

Note: TTL input: pulled-up by 4.7 kΩ

● **External sampling clock specifications**

High level: 3.3 to 5.0 V  
 Low level: 0 to 0.8 V  
 Rise time (tr): 500 ns or less



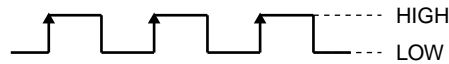
No overshoot/undershoot

No chattering

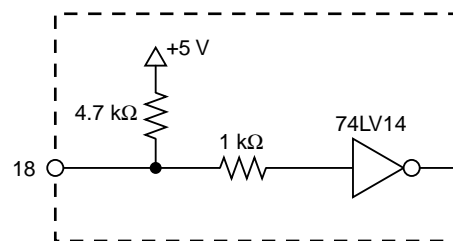
Duty: 50%±10%

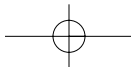
Frequency: Fixed: 200 kHz or lower  
 Sweep mode: 20 kHz or lower

Sampling timing: At rising edge



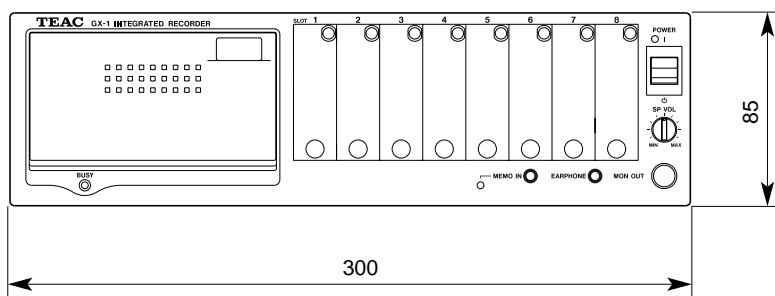
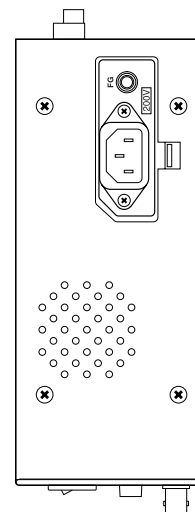
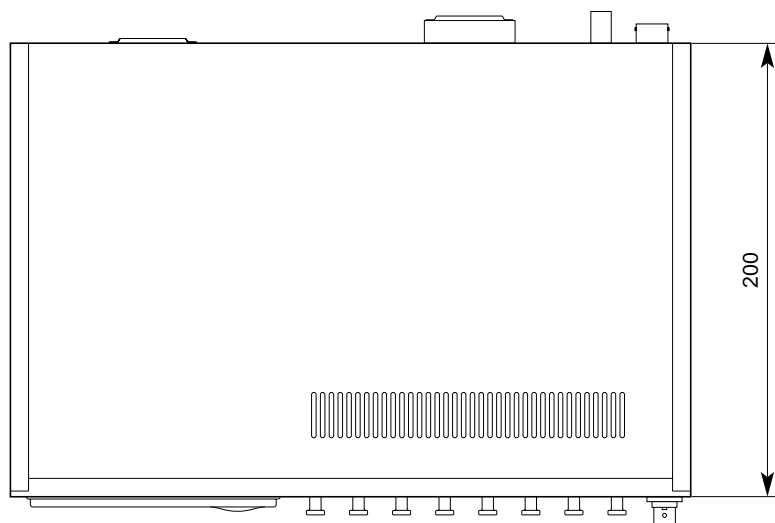
Input circuit



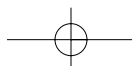


### Specifications

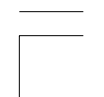
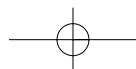
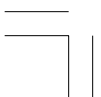
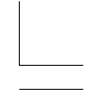
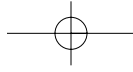
#### External Dimensions

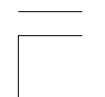
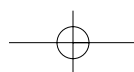
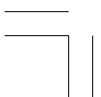
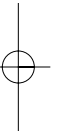
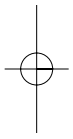
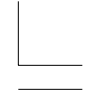
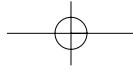


Unit: mm



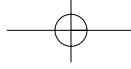






# Amplifiers

DC Input Amp (AR-GXDC) . . . . .	4-16
Microphone Input Amp (AR-GXMC) . . . . .	4-18
Dynamic Strain Input Amp (AR-GXST) . . . . .	4-22
Thermocouple Input Amp (AR-GXTCK/J) . . . . .	4-26
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Analog Output Amp (AR-GXAO) . . . . .	4-41



## Amplifiers

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### DC Input Amp (AR-GXDC)

The AR-GXDC is an amp for inputting signals converted to voltages.

#### ■ Filters

##### Analog Filter

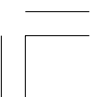
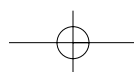
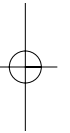
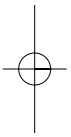
The analog filter is an 8th order Butterworth low-pass filter (–48 dB/oct). The cutoff frequency can be selected independently of the sampling frequency. To prevent aliasing, the cutoff frequency must be set to 50% or less of the sampling frequency.

##### Digital Filter

The digital filter using a DSP can attenuate from 40% of the set sampling frequency. The digital filter is not functional at sampling frequencies of 200 kHz, 100 kHz, and 50 kHz.

#### ■ Calibration

Zero and gain self-calibration using a DSP is performed whenever power is turned on, and whenever the input range or the sampling frequency is changed. The signal used for calibration is built into the amp.

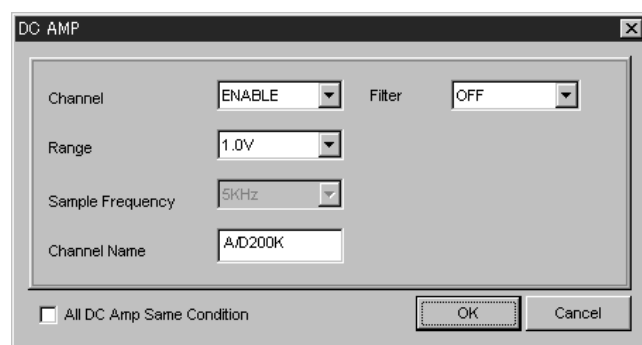


## ■ Specifications

Number of channels :	2
Input format :	Unbalanced
Input coupling :	DC
Input impedance :	100 k $\Omega$
Input range :	$\pm 0.5, 1, 2, 5, 10, 20$ Vp
Range accuracy:	$\pm 1\%$ or better
Frequency response :	DC to 80 kHz ( $\pm 1.5$ dB)
Low pass filter :	2, 4, 8, 20, 40, 80, 200, 400, 800 Hz, 2 k, 4 k, 8 k, 20 k, 40 k, 80 kHz $\pm 1.5$ dB at the cutoff frequency Attenuation: $-48$ dB/oct
Linearity:	$\pm 0.1\%$ or better
S/N ratio:	71 dB (typical), 65 dB or better (sampling frequency: 50 kHz; input range: 1 V; LPF: 20 kHz)
A/D converter :	16-bit
Sampling frequency :	1 Hz to 200 kHz
Power consumption :	Approx. 2.16 W
Input connector :	BNC

## ■ Settings

The following dialog box appears when you choose **Setup** and **Params**, and then double-click the channel that you want to set.



**Channel :** Select **ENABLE** to record with this channel, or select **DISABLE** not to record with this channel.

**Range :** Select the input range.

**Sample Frequency :** You can select 10 times the **Base Sample Freq** when you turn on **Multi Sampling** check box.

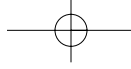
**Channel Name :** You can name the channel. Use up to 16 alphanumeric characters.

**Filter :** Select the filter cutoff frequency.

**All DC Amp Same Condition :** When this option is selected, the same parameters are set for all signal conditioners of the same type.

▼ Enable both channels of a slot.

▼ Filter cutoff frequency is set slot by slot, not channel by channel.



## Amplifiers

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### Microphone Input Amp (AR-GXMC)

The AR-GXMC is an amp for connecting a microphone used for measurements.

#### ■ Filters

##### Weighting Filter

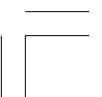
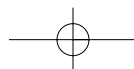
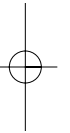
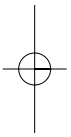
This is an analog weighting filter (A, C) that conforms to IEC TYPE1 class.

##### Analog Low-Pass Filter

Has an analog low-pass filter to prevent aliasing, with that cutoff frequency automatically determined when the sampling frequency is selected. The filter is an 8th order Butterworth filter with an attenuation ratio of 48 dB/oct. The low-pass filter is not functional at sampling frequencies of 200 Hz or lower.

##### Digital Filter

The digital filter using a DSP can attenuate from 40% of the set sampling frequency. The digital filter is not functional at sampling frequencies of 200 kHz, 100 kHz, and 50 kHz.

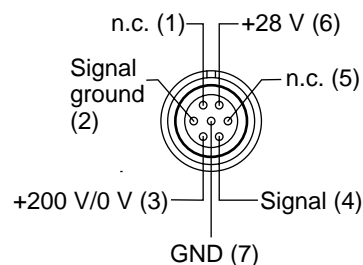


■ Specifications

Number of channels :	2
Input format :	Unbalanced
Input coupling :	AC
Input impedance :	11 kΩ
Applicable microphone :	B&K (only for 50 mV/Pa type)
Input range :	80, 90, 100, 110, 120, 130 dB
Weighting filter :	A type, C type, flat (analog filter)
Frequency response :	20 Hz to 20 kHz (-3 dB)
Power output for microphone :	200 V DC for bias, 28 V DC for preamp
A/D converter :	16-bit
Sampling frequency :	1 Hz to 200 kHz
Power consumption :	Approx. 3.18 W
Input connector :	LEMO FGG-1B-307-CLAD62

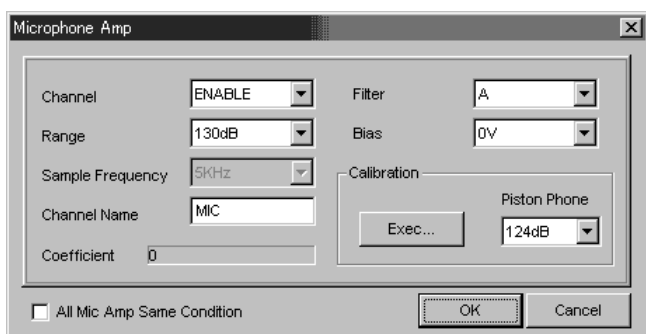
**WARNING**

Do not insert objects, such as metallic pins, in the input connector of the microphone input amp. A high voltage is output so electric shock might result.



■ Settings

The following dialog box appears when you choose **Setup** and **Params**, and then double-click the channel that you want to set.



- Channel : Select **ENABLE** to record with this channel, or select **DISABLE** not to record with this channel.
- Range : Select the input range.
- Sample Frequency : You can select 10 times the **Base Sample Freq** when you turn on **Multi Sampling** check box.
- Channel Name : You can name the channel. Use up to 16 alphanumeric characters.
- Filter : Select the weighting filter.
- Bias : Select the polarization voltage of the microphone.
- All Mic Amp Same Condition : When this option is selected, the same parameters (excluding **Piston Phone** and **Coefficient**) are set for all signal conditioners of the same type.

▼ The value displayed by the monitoring function of the **GX Navi** is the sound pressure over time. This is not the same as the sound level.

▼ Enable both channels of a slot.



## Amplifiers

### ■ Recommended Microphones

Microphones with a sensitivity of 50 mV/Pa (B&K 4189, 4190) are recommended. The GX-1 is based on a microphone with a sensitivity of 50 mV/Pa, and corrects the actual sensitivity of the input system including amp and cable. The limiting of the sensitivity to 50 mV/Pa was due to such considerations as the S/N (signal-to-noise) ratio in recorded data and calibration precision. When a low-sensitivity microphone is used, the S/N ratio becomes a disadvantage, and piston phone calibration might fail.

### ■ How to Calibrate

Calibrate each channel whenever the GX-1 is powered on.

- At piston phone calibration, a special recording method (different from the usual recording method) is adopted. The calibration is not affected by the current settings for Range, Sample Frequency, or Filter in the Params window. So there is no effect on the calibration even if the range is set to a value below the sound pressure issued by the piston phone, and even if the sampling frequency is set to a value below the discriminable frequency of the piston phone sound, and even if the filter is set.
- There are various types of piston phones, but piston phone calibration of the GX-1 is limited to the following: 250 Hz to 1 kHz, and 94, 114, and 124 dB SPL.
- The GX-1 piston phone calibration is performed at a sampling frequency of 20 kHz, so calibration is not possible with a frequency for which a peak cannot be detected at 20 kHz sampling.
- Calibrate with the post trigger turned off.

To calibrate, attach the piston phone to the microphone, and turn on the piston phone switch. In **Piston Phone**, select the piston phone output, and then click **Exec**. When calibration finishes, the correction value is displayed in **Coefficient** and the calibrated sound-pressure waveform is displayed. If calibration fails, an error message is displayed indicating that a peak-detection failure occurred.

- The default value 1.0 for **Coefficient** is the value when the microphone sensitivity was set to 50 mV/Pa. After calibration, the display shows the value that is inversely proportion-

al to the actual sensitivity of the microphone that includes the amp and cable.

- When using a high-sensitivity microphone higher than 50 mV/Pa (including the amp and the drop across the cable), the correction value becomes less than 1.0; and when using a low-sensitivity microphone lower than 50 mV/Pa (including the amp and the drop across the cable), the correction value becomes more than 1.0. Therefore, you can determine whether piston phone calibration was performed correctly.
- If you note down the correction value, as an alternative to performing piston phone calibration, you can later type this value into **Coefficient** and click **OK**. However, you cannot expect precision with this method because the microphone sensitivity changes depending on such factors as temperature, humidity, and barometric pressure.
- If no piston phone is available to you, as an alternative to performing calibration, you can obtain (by dividing 50 mV/Pa by the actual sensitivity) the correction value from the test sheet data attached to the microphone, and type this value into **Coefficient**. However, you cannot expect precision with this method because this value will differ from the calibration of the entire input system including the amp amplification factor and the drop across the cable. In this case, consider the value to be just an estimate.
- The correction value is a temporary numeric value used at calibration, and has no relation to the SLOPE value of the header file.

### ■ Input Range

You can select the input range from 80, 90, 100, 110, 120, and 130 dB. A value of  $\pm 100\%$  of the instantaneous value (peak-to-peak) for the selected range is set as  $\pm 100\%$  of the rating (by using the AD conversion value,  $\pm 25000$ ). When the measured sound pressure is high, select a large range. When the measured sound pressure is low, select a small range. When a small range is selected, the S/N ratio becomes poor.

- For the AD conversion value, you can obtain a range of  $\pm 131\%$  (by using the AD conversion value,  $-32768$  to  $+32767$ ); however, the input margin is about  $\pm 120\%$  considering the amp amplification factor, the sensitivity correction, and the DSP calculation.



### ■ Analog Playback

In reproduction using the analog output amp AR-GXAO, the instantaneous value input is output as the instantaneous value without change.  $\pm 100\%$  of the input for the selected input range is output by the voltage selected in Output Range.

#### Example

When you set 1.0 V in Output Range of the analog output amp,  $\pm 100\%$  of the input, using instantaneous values, for the selected input range (by using the AD conversion value,  $\pm 25000$ ) is generated by  $\pm 1$  V.

### ■ Waveform Display Window

In the waveform display window, the instantaneous value (peak-to-peak) is displayed. The upper and lower two grids correspond to  $\pm 100\%$  of the input, using instantaneous values, for the selected input range. The display range is  $\pm 131\%$ .

### ■ FFT Window

With 0 dB as the scale of the Y axis on the FFT window,  $\pm 100\%$  of the input, using instantaneous values, for the selected input range is displayed.

### ■ To Convert Data to RMS Values

Sound is a compressional wave, and microphone output is a plus value in a dense location, and a minus value in a sparse location. Data recorded to GX-1 is unchanged instantaneous values.

A recorded AD conversion value is an integer from  $-32768$  to  $+32767$ .  $\pm 100\%$  of the input, using instantaneous values (peak-to-peak), for the selected input range is converted to an AD value of  $\pm 25000$ . To convert this AD conversion value to a physical quantity, you multiply the AD conversion value by the SLOPE value of the header file.

To convert an AD value to the instantaneous sound pressure value in Pa units, use the following formula:

$$\begin{aligned} & \text{Instantaneous sound pressure (Pa)} \\ & = \text{AD conversion value} \times \text{SLOPE} \end{aligned}$$

To express this instantaneous sound pressure as an absolute value in dB units:

From  $20 \mu\text{Pa} = 0 \text{ dB}$ ,

$$\begin{aligned} & \text{Sound pressure (dB absolute value)} \\ & = 20 \log ( | \text{instantaneous sound pressure value (Pa)} | \\ & \quad / 0.00002) \end{aligned}$$

To convert the instantaneous sound pressure to rms (root-mean-square) values in dB units, use the following formula:

$$\begin{aligned} & \text{Sound pressure (dB rms value)} \\ & = 20 \log [(\text{square root of the one-cycle average of squared} \\ & \quad \text{individual instantaneous sound pressures}) / 0.00002] \end{aligned}$$

While treating the waveform of one cycle as a sine wave, to perform a quick conversion of instantaneous sound pressure to an rms value in dB units, use the following formula:

$$\begin{aligned} & \text{Sound pressure (dB rms value)} \\ & = 20 \log ( | \text{instantaneous sound pressure value (Pa)} | \\ & \quad \times 0.707 / 0.00002) \end{aligned}$$

#### Example

For this example in which recording used an input range of 120 dB, we want to calculate the number of dBs for the rms value for  $\pm 100\%$  of the input, using instantaneous values, for the range. When the input range is set to 120 dB, the SLOPE value of the header file becomes 0.0008.  $\pm 100\%$  of the input is converted to an AD value of 25000.

The instantaneous sound pressure value (Pa) is the AD value multiplied by the SLOPE, so the result is:

$$| \pm 25000 | \times 0.0008 = 20 \text{ (Pa)}$$

If you express the above as an absolute value in dB units, the result is:

$$20 \log (20 / 0.00002) = 120 \text{ (dB)}$$

If you perform a quick conversion of the instantaneous sound pressure to an rms value in dB units, the result is:

$$20 \log (20 \times 0.707 / 0.00002) = 117 \text{ (dB)}$$

## Amplifiers

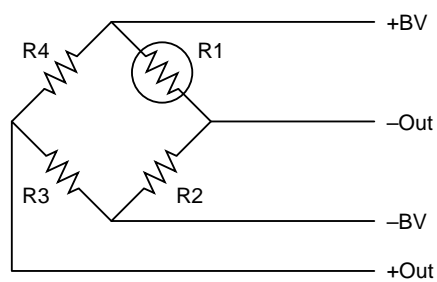
### Dynamic Strain Input Amp (AR-GXST)

The AR-GXST provides an excitation voltage to a sensor that uses a strain gauge, and extracts a signal. Input is balanced input, and the amp has a balance adjustment function that corrects unbalances in the strain gauge, and enables zero balancing up to  $\pm 700\%$  of the rated value. The adjustment range for a  $\pm 200 \mu\text{ST}$  range becomes approximately  $\pm 1400 \mu\text{ST}$ .

When a sensor and the GX-1 are separated by a long distance, the lowered excitation voltages can affect measurements. The AR-GXST has a remote sense function for controlling this voltage.

#### ■ When Using a Strain Gauge Directly

The strain gauge usually uses a general bridge box, and is used with an internal Wheatstone bridge (see the diagram below).



R1 is the strain gauge and is usually  $120 \Omega$  to  $1000 \Omega$ . (Merging of direct currents might lead to higher resistance values.) Taking  $120 \Omega$  as an example, and using a resistance of  $120 \Omega$  for R2, R3, and R4, the voltage change  $\Delta e$  by a strain is:

$$\Delta e = \frac{E}{4} K \epsilon$$

Where E is the excitation voltage, K is the gauge factor, and  $\epsilon$  is the strain.

For the excitation voltage E, in the AR-GXST you can add 2 V or 5 V.

The gauge factor K means the proportion of the rate of change ( $\Delta R/R$ ) of the resistance value against the rate of change (strain  $\epsilon$ ) in the length direction. In the AR-GXST, this is assumed to be 2.0. A gauge factor of 2 is thus a change of 2 times the resistance value against the change (strain) in the length direction.

The strain  $\epsilon$  is the comparative ratio ( $\Delta l/l$ ) of the changed part  $\Delta l$  of the length against the original length l.

When the excitation voltage is 2 V and the gauge factor is 2, then the voltage change  $\Delta e$  by a strain becomes

$$\Delta e = \epsilon$$

So because the strain quantity and output voltage are numerically the same (making the situation easy to understand), an excitation voltage of 2 V is often used. For example, when  $\epsilon = 1000 \mu\text{ST}$  ( $\mu\text{ST}$ : micro strain. A strain of  $10^{-6}$  in the length of the original. The value of  $1000 \mu\text{ST}$  means a change in the length direction of  $1000 \times 10^{-6}$ , which is  $1/1000$ .), then there is a change of  $1/1000$  V (that is, 1 mV).

However,  $K = 2$  is an ideal value, and the actually used gauge factor of a gauge is usually a little larger than 2. You can use **Change Unit** in GX Navi to correct the difference in this gauge factor. For example, when the gauge factor is 2.13, specify  $2.13 \mu\text{ST} = 2.00 \mu\text{ST}$ .

#### ■ When Using a Strain Gauge Type Transducer

The situation is as described above when using a direct strain gauge for measurements, but in the case of a transducer that used a strain gauge, the output values are output not as strain quantities but rather as voltage signals. (Usually mV/V is indicated.)

For example, when the excitation voltage is 2 V in a load cell with a rated output of 2 mV/V ( $\pm 1\%$ ) and a rated capacity of 20 kN, a signal of 4 mV for the 20 kN can be obtained. When the excitation voltage is 2 V as described above, 1 mV corresponds to  $1000 \mu\text{ST}$  so 20 kN corresponds to  $4000 \mu\text{ST}$ .

However, there is variation (in this case,  $\pm 1\%$ ) in the rated output of individual transducers. You can use **Change Unit** in GX Navi to correct this variation. For example, when the rated output is 1.98 mV/V, set the input range to  $5000 \mu\text{ST}$ , and use Change Unit to specify  $3960 \mu\text{ST} = 20 \text{ kN}$ .

#### For Reference

A strain gauge is usually called a sensor, but a strain gauge that is packaged with a bridge configuration is not usually called a sensor; rather it is called a transducer. Usually 4 (not just 1) gauges are used internally. (All 4 resistances of a bridge are used for the strain gauge.)

## ■ Filters

### Analog Filter

The analog filter is an 8th order Butterworth low-pass filter (-48 dB/oct). The cutoff frequency can be selected independently of the sampling frequency. To prevent aliasing, the cutoff frequency must be set to 50% or less of the sampling frequency.

### Digital Filter

The digital filter using a DSP can attenuate from 40% of the set sampling frequency. The digital filter is not functional at sampling frequencies of 200 kHz, 100 kHz, and 50 kHz.

## ■ Calibration

Gain self-calibration using a DSP is performed whenever power is turned on, and whenever the input range or the sampling frequency is changed. The signal used for calibration is built into the amp.

### Zero Balancing

Perform zero balancing each time you turn on power to the GX-1. To perform zero balancing, in the parameter settings dialog box click the **Exec** button. When you select **All Strain Amp** and click **Exec**, zero balancing will be simultaneously performed on all channels in the dynamic strain input amp.

(For zero balancing, set the post trigger to OFF.)

## Amplifiers

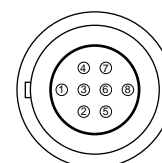
### ■ Specifications

Number of channels :	2
Input format :	Balanced difference input
Input coupling :	DC
Input resistance :	1 M $\Omega$
Gage ratio :	2.0
Excitation voltage :	2 V DC, within 5 V $\pm$ 0.2%. Has remote sensing.
Range :	$\pm$ 200, 500, 1000, 2000, 5000, 10000 $\mu$ ST
Range accuracy* :	$\pm$ 2% ( $\pm$ 200 to 1000 $\mu$ ST) $\pm$ 1% ( $\pm$ 2000 to 10000 $\mu$ ST) The accuracy above is guaranteed when the sensors are connected before turning on the power of the GX-1.
Temperature characteristics :	1%/10 $^{\circ}$ C
Balance adjustment method :	Electronic (accuracy: $\pm$ 1.2%)
Balance adjustment range :	$\pm$ 700% (each input range)
Frequency response :	DC to 30 kHz ( $-3$ dB)
S/N ratio* :	65 dB (typical), 60 dB or better (range: 2000 $\mu$ ST; sampling: 5 kHz; LPF: 2.5 kHz)
Low pass filter :	25, 50, 250, 500, 2.5 k, 5 k, 24 kHz, $-3$ dB at the cutoff frequencies ( $-5$ dB at 24 kHz) Attenuation: $-48$ dB/oct, Butterworth
A/D converter :	16-bit
Sampling frequency :	1 Hz to 200 kHz
Power consumption :	Approx. 3.4 W
Input connector :	HR25-7P-8P from Hirose Electric Co., Ltd.

\*At temperatures of  $+23^{\circ}\text{C}\pm 5^{\circ}\text{C}$

▼ Connect the cables from the sensors to the input connectors before turning on the power of the GX-1. Otherwise, the precision may be lowered.

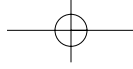
### ● Pin assignment for input connector



Pin number	Signal name
1	+BV Excitation voltage
2	-IN Signal input
3	-BV Excitation voltage
4	+IN Signal input
5	GND
6	+S
7	-S
	Remote sensing signal of excitation voltage

### Notes:

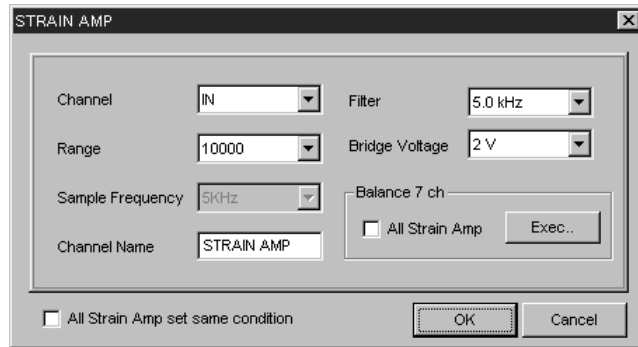
- Connect +S to +BV, and -S to -BV at the sensor when remote sensing is performed, or at the input connector when not performed. Otherwise, a correct excitation voltage cannot be obtained.
- Be sure to connect the shield of the sensor connector and the cable shield.



## Amplifiers

### ■ Settings

The following dialog box appears when you choose **Setup** and **Params**, and then double-click the channel that you want to set.



**Channel :** Select **IN** to record with this channel, or select **DISABLE** not to record with this channel.

**Range :** Select the input range.

**Sample Frequency :** You can select 10 times the **Base Sample Freq** when you turn on **Multi Sampling** check box.

**Channel Name :** You can name the channel. Use up to 16 alphanumeric characters.

**Filter :** Select the filter cutoff frequency.

**Bridge Voltage :** Select **2 V** or **5 V** for the excitation voltage.

**All Strain Amp set same condition :** When this option is selected, the same parameters are set for all signal conditioners of the same type.

#### ● Zero Balancing

Click **Exec** to perform zero balancing whenever the GX-1 is powered on.

After selecting the option **All Strain Amp** and clicking **Exec**, zero balancing is performed simultaneously on all channels on the installed dynamic strain input amps.

▼ Disable post trigger before zero balancing.

▼ Enable both channels of a slot.

▼ Filter cutoff frequency is set slot by slot, not channel by channel.

## Amplifiers

### Thermocouple Input Amp (AR-GXTCK/J)

When two different types of metal are connected to make a circuit and there is a temperature difference between both ends of the joined part, an electric current flows. A thermocouple uses this phenomenon. You can connect a K type thermocouple (CA: Chromel Alumel) to the AR-GXTCK, and a J type thermocouple (IC: Iron Constantan) to the AR-GXTCJ. A K type thermocouple generates a large electromotive force, and you can measure to a comparatively high temperature (up to 1200°C with the AR-GXTCK). A J type thermocouple generates a similarly large electromotive force, and you can measure to a comparatively low temperature. With the GX-1, the lower temperature range of both is down to -50°C.

Both the AR-GXTCK and the AR-GXTCJ use special dedicated connectors (GIM-K1 and GIM-J1), and you connect a thermocouple by matching the plus and minus connectors. In the K type, Chromel is plus; in the J type, Iron is plus.

Calibration is not necessary. In each range, however, the rated value (in AD values: -25000) on the minus side is -50°C. So to obtain the temperature °C you do not just multiply the SLOPE value by the AD value; you also add the Y\_OFFSET value.

For example, if you use the AR-GXTCK to measure in a range of 1200°C, the AD value is made to -21950. To convert this to a temperature, multiply by the SLOPE value 0.025, and add the Y\_OFFSET value of 575. This calculation obtains a temperature of 26.25°C.

The SLOPE value 0.025 is determined as follows:

The rated values (for an AD value: ±25000) are each +1200 and -50, so:

$$\frac{1200 - (-50)}{25000 - (-25000)} = 0.025$$

The Y\_OFFSET becomes a temperature of 575°C when the AD value is 0.

### Filters

#### Analog Filter

The analog filter is a 2nd order Butterworth low-pass filter (-12 dB/oct). The cutoff frequency can be selected independently of the sampling frequency. To prevent aliasing, the cutoff frequency must be set to 50% or less of the sampling frequency.

#### Digital Filter

The digital filter using a DSP can attenuate from 40% of the set sampling frequency. The digital filter is not functional at sampling frequencies of 200 kHz, 100 kHz, and 50 kHz.

### Calibration

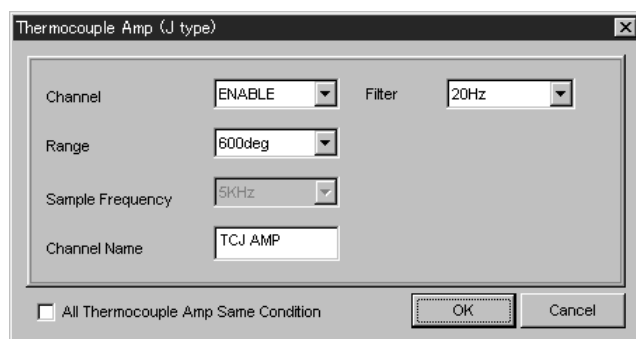
Zero and gain self-calibration using a DSP is performed whenever power is turned on, and whenever the input range or the sampling frequency is changed. The signal used for calibration is built into the amp.

## ■ Specifications

Number of channels :	2
Applicable thermocouple :	K (AR-GXTCK), J (AR-GXTCJ)
Zero point compensation :	Electronic
Range :	AR-GXTCK : -50 to 300, -50 to 600, -50 to 1200°C AR-GXTCJ : -50 to 150, -50 to 300, -50 to 600°C
Range accuracy :	1%FS±3°C (-50 to 150°C, -50 to 300°C) 0.5%FS±3°C (-50 to 600°C, -50 to 1200°C) FS represents the highest of each range. Accuracy guaranteed at temperatures of +23±5°C
Low pass filter :	5, 10, 20 Hz, PASS (-3 dB at the cutoff frequency; attenuation: -12 dB/oct)
A/D converter :	16-bit
Sampling frequency :	1 Hz to 200 kHz
Power consumption :	Approx. 1.2 W
Input connector :	GIM-K1 (AR-GXTCK) from Omega GIM-J1 (AR-GXTCJ) from Omega

## ■ Settings

The following dialog box appears when you choose **Setup** and **Params**, and then double-click the channel that you want to set. (Example is for J type.)



**Channel :** Select **ENABLE** to record with this channel, or select **DISABLE** not to record with this channel.

▼ Enable both channels of a slot.

**Range :** Select the input range.

**Sample Frequency :** You can select 10 times the **Base Sample Freq** when you turn on **Multi Sampling** check box.

**Channel Name :** You can name the channel. Use up to 16 alphanumeric characters.

**Filter :** Select the filter cutoff frequency.

**All Thermocouple Amp Same Condition :** When this option is selected, the same parameters are set for all signal conditioners of the same type.

## Amplifiers

### F/V Input Amp (AR-GXFV)

When analyzing the behavior of revolving bodies, such as in engines or turbines, you sometimes need to record signals corresponding to the number of revolutions. The AR-GXFV converts into voltages the frequency of the pulses issued according to the revolutions, and records the resulting values.

The AR-GXFV has a function for dividing the input signal so that the AR-GXFV can handle a wide range of frequencies. You can use **Pulse Counts Per Rotate** in GX Navi to set this function. This value is reflected in SLOPE, and you can obtain the frequency by multiplying the AD conversion value by the SLOPE value.

Units of rpm (revolutions per minute) are usually used. To convert the frequency Hz to rpm, if you use **Change Unit** to set 1 Hz = 60 rpm, processing will be in rpm units. For example, when 4 pulses are obtained for one revolution, set the frequency division ratio to 4, and use **Change Unit** to set 1 Hz = 60 rpm. Processing will then be done in rpm units. In such a case, if the frequency division ratio is recorded as an unchanged 1, use **Change Unit** to set 4 Hz = 60 rpm, or 1 Hz = 15 rpm.

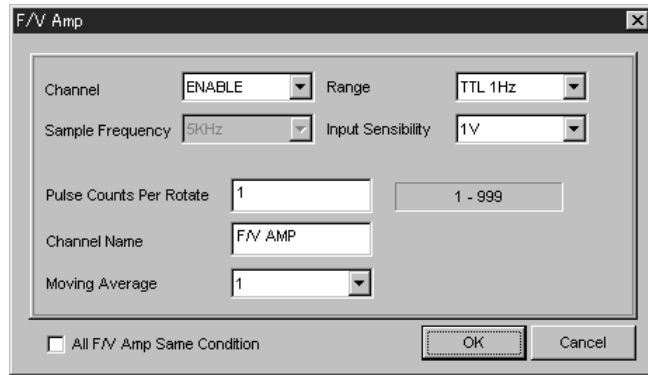
### ■ Specifications

Number of channels :	2
Input :	TTL (pulse width $\geq$ 500 ns) or AC switching
Input impedance :	10 k $\Omega$
Sensitivity (at AC input) :	$\pm$ 50 mV, $\pm$ 100 mV, $\pm$ 500 mV, $\pm$ 1 V
Frequency range :	TTL mode : 1, 100, 1 k, 10 k, 100 k, 500 kHz (Maximum input frequency: 575 kHz) AC mode : 10 to 200, 10 to 500, 10 to 1 k, 10 to 10 k, 10 to 20 kHz (Maximum input frequency: 230 kHz, Maximum permissible input voltage: $\pm$ 10 V)
Response time :	10 msec
Pulse count :	TTL mode : 1 to 255 ( <i>pulses/rotate</i> $\times$ <i>frequency-range</i> $\leq$ 500 kHz) AC mode : 1 to 255 ( <i>pulses/rotate</i> $\times$ <i>frequency-range</i> $\leq$ 200 kHz)
Setting for moving average :	1 to 16 (sampling cycle: 1 ms)
Transformation precision :	$\pm$ [( <i>input-frequency</i> $\div$ 1000) + ( <i>set-frequency-range</i> $\div$ 3125)] Hz
Sampling frequency :	1 Hz to 200 kHz
Power consumption :	Approx. 1.44 W
Input connector :	BNC



## ■ Settings

The following dialog box appears when you choose **Setup** and **Params**, and then double-click the channel that you want to set.



**Channel :** Select **ENABLE** to record with this channel, or select **DISABLE** not to record with this channel. Enable both channels of a slot.

**Sample Frequency :** You can select 10 times the **Base Sample Freq** when you turn on **Multi Sampling** check box.

**Range :** Select the input mode (TTL/AC) and the frequency range.

**Input Sensibility :** Select the input sensitivity in the AC input mode. Only signals of the set voltage, or higher, will be detected.

**Pulse Counts Per Rotate :** Enter the number of pulses in the range 1 to 255. This setting will be reflected to SLOPE in the header file.

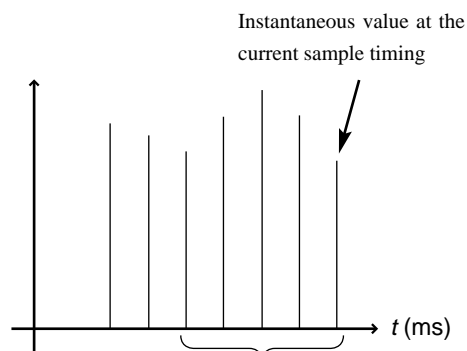
**Channel Name :** You can name the channel. Use up to 16 alphanumeric characters.

**Moving Average :** Select the number of samples for the moving average. (1 to 16)

**All F/V Amp Same Condition :** When this option is selected, the same parameters are set for all signal conditioners of the same type.

### Notes on Moving Average:

The sampling cycle for the moving average is 1 ms independently of the sampling frequency setting. For example, when **Moving Average** is set to "5", the average of five values—the values of 4 ms before, 3 ms before, 2 ms before, 1 ms before, and the current instantaneous value—is recorded as the data at the moment.



When **Moving Average** is "5", the average of these five values is recorded as the data at the moment.

## Amplifiers

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### Charge Amp (AR-GXCH)

When pressure is applied to certain crystals, electrical polarization occurs. This phenomenon is called a piezoelectric effect. From among the acceleration transducers that use this piezoelectric effect, the electrical-charge output type transducers are connected to the AR-GXCH.

In the SI system of units, the unit of acceleration is  $m/s^2$ . However, former measurements of acceleration using the gravity acceleration unit G (9.80665  $m/s^2$ , shortened to 9.81 in the descriptions below) are common, so the units for the AR-GXCH range are G with the units of sensitivity being  $pC/G$ . The recorded data is also in G units. If you want to record in  $m/s^2$  units, use **Change Unit** in GX Navi to specify 1 G = 9.81  $m/s^2$ .

### ■ Filters

#### Analog Filter

The analog filter is an 8th order Butterworth low-pass filter (−48 dB/oct). The cutoff frequency can be selected independently of the sampling frequency. To prevent aliasing, the cutoff frequency must be set to 50% or less of the sampling frequency.

#### Digital Filter

The digital filter using a DSP can attenuate from 40% of the set sampling frequency. The digital filter is not functional at sampling frequencies of 200 kHz, 100 kHz, and 50 kHz.

### ■ Calibration

Gain self-calibration using a DSP is performed whenever power is turned on. The startup period when the power is turned on is longer than for other types of amps. The signal used for calibration is built into the amp.

■ Specifications

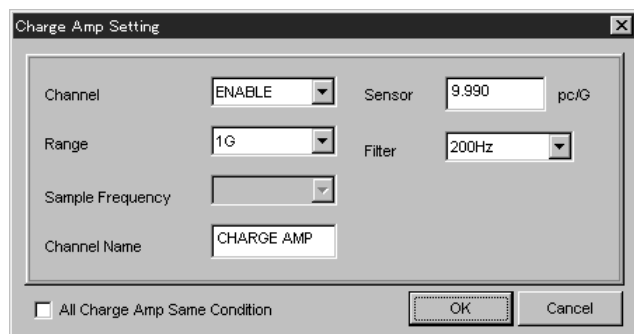
Number of channels : 2  
 Electric charge sensitivity : 0.1 to 999 pC/G  
 Range : 1, 5, 10, 50, 100, 500 G  
 (100 G and the 500 G range cannot be used when the electric charge sensitivity is 100 pC/G or higher)  
 (1 G and the 5 G range cannot be used when the electric charge sensitivity is lower than 1 pC/G)  
 Range accuracy\* : 3%  
 S/N ratio\* : 62 dB (typical), 60 dB or better (10 pC/G; sampling: 50 kHz; input range: 10 G; LPF: 10 kHz)  
 Frequency response : 1 Hz to 30 kHz (-3 dB)  
 Low pass filter : 100, 200, 500, 1 k, 2 k, 5 k, 10 kHz  
 (-3 dB at the cutoff; attenuation: -48 dB/oct)  
 A/D converter : 16-bit  
 Sampling frequency : 1 Hz to 200 kHz  
 Power consumption : Approx. 2.16 W  
 Input connector : MICRO DOT 10-32UNF

1 G = 9.81 m/s<sup>2</sup>

\*At temperatures of +23°C±5°C

■ Settings

The following dialog box appears when you choose **Setup** and **Params**, and then double-click the channel that you want to set.



Channel : Select **ENABLE** to record with this channel, or select **DISABLE** not to record with this channel.

Range : Select the range.

Sample Frequency : You can select 10 times the **Base Sample Freq** when you turn on **Multi Sampling** check box.

Channel Name : You can name the channel. Use up to 16 alphanumeric characters.

Sensor : Enter the sensor sensitivity.

Filter : Select the filter cutoff frequency.

All Charge Amp Same Condition : When this option is selected, the same parameters are set for all signal conditioners of the same type.

▼ Enable both channels of a slot.

▼ Filter cutoff frequency is set slot by slot, not channel by channel.

## Amplifiers

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### Pulse Input Amp (AR-GXPC)

Like the AR-GXFV, the AR-GXPC inputs pulse signals from sources such as a revolving body; however, the AR-GXFV converts pulses to voltages whereas the AR-GXPC counts pulses directly. Available modes include the Total Mode in which the total number of pulses is recorded, and the Gate Mode in which the number of pulses in a specified gate period are counted. You use **Count Type** to specify the gate period in the Gate Mode as a multiple whole integer (1 to 255) of the sampling period.

Also like the AR-GXFV, the AR-GXPC has a division function for counting a large number of items. You use **Divide Rate** to specify this function.

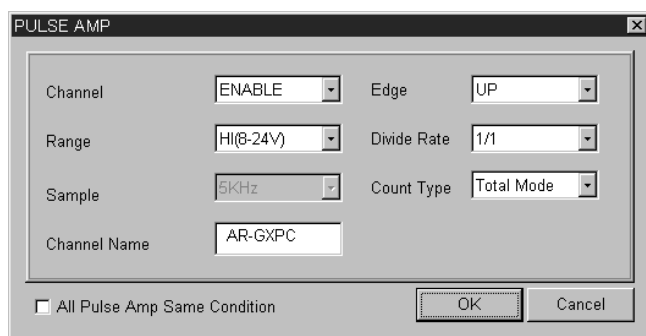
Like the AR-GXFV, use **Change Unit** when you want to process in rpm. In this situation, keep in mind the values specified with Divide Rate and Count Type. For example, when 1 revolution is 360 pulses (pulse angle is 1° for each pulse) and there are 100 revolutions per second (6000 rpm), record this with a sampling frequency of 100 Hz. If Divide Rate is set to 1/90 (conversion to 4 pulses per revolution) and Count Type is set to 100 (effectively resulting in the number of pulses per second), then the pulses counted per second will be 400; so in Change Unit, specify 400 cnt = 6000 rpm, and any later processing will be in rpm.

## ■ Specifications

Number of channels :	2
Input format :	Insulated by photocoupler
Input voltage range :	4—10 V/8—24 V (8 mA or more input current required)
Responsive frequency :	2 MHz max.
Sampling frequency :	1 Hz to 200 kHz
Counting method :	Division rate: 1/1 to 1/255 Count: 0 to 32767 (16 bits with a sign)
	Gate mode: repeats counting pulses within each gate period. Gate period is specified by the sampling period multiplied by 1 to 255. The output keeps the same count until the next gate. The count keeps 32767 when overflows.
	Total mode: counts total number of pulses from recording start to stop. Outputs the current total number of pulses during measuring. Restarts from 0 when overflows.
Counting accuracy:	Gate mode: $\pm 5$ counts Total mode: $\pm 1$ count
Input connector :	Insulated BNC

## ■ Settings

The following dialog box appears when you choose **Setup** and **Params**, and then double-click the channel that you want to set.



**Channel :** Select **ENABLE** to record with this channel, or select **DISABLE** not to record with this channel.

**Range :** Select the range.

**Sample:** You can select 10 times the **Base Sample Freq** when you turn on **Multi Sampling** check box.

**Channel Name :** You can name the channel. Use up to 16 alphanumeric characters.

**Edge :** Select whether the count is incremented at rising (UP) or falling (DOWN) edges of pulses.

**Divide Rate :** Select the division rate from 1/1 to 1/255. This setting will be reflected to SLOPE in the header file.

**Count Type :** Select gate mode or total mode. If gate mode, specify the gate period by selecting a multiplier.

**All Pulse Amp Same Condition :** When this option is selected, the same parameters are set for all signal conditioners of the same type.

▼ Enable both channels of a slot.

▼ Gate period setting example

When "10" is selected at the sampling frequency of 1000 Hz, the gate period is:

$$1 \text{ ms} \times 10 = 10 \text{ ms}$$

## Amplifiers

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### DC/ICP Input Amp (AR-GXPA)

Like the charge amp AR-GXCH, the AR-GXPA connects to an acceleration transducer that uses the piezoelectric effect; however, the AR-GXPA connects to a transducer that has a built-in preamp to convert the charge to voltage and lower the circuit resistance. The AR-GXPA provides a constant current source (0.5 mA, 3 mA, and 5 mA) to this preamp. If this constant current source is not provided, functionality is the same as the DC input amp AR-GXDC.

The units for the input range are not G nor  $m/s^2$ ; rather they are volts. For example, when using a sensor that outputs 10.10 mV/G and measuring up to 100 G, select 1 V for the range. In this situation, to record in G units, use **Change Unit** to specify 0.0101 V = 1 G; and to record in  $m/s^2$  units, use Change Unit to specify 0.0101 V = 9.81  $m/s^2$ .

#### ■ Filters

##### Analog Filter

The analog filter is an 8th order Butterworth low-pass filter (-48 dB/oct). The cutoff frequency can be selected independently of the sampling frequency. To prevent aliasing, the cutoff frequency must be set to 50% or less of the sampling frequency.

##### Digital Filter

The digital filter using a DSP can attenuate from 40% of the set sampling frequency. The digital filter is not functional at sampling frequencies of 200 kHz, 100 kHz, and 50 kHz.

#### ■ Calibration

Zero and gain self-calibration using a DSP is performed whenever power is turned on, and whenever the input range or the sampling frequency is changed. The signal used for calibration is built into the amp.

## ■ Specifications

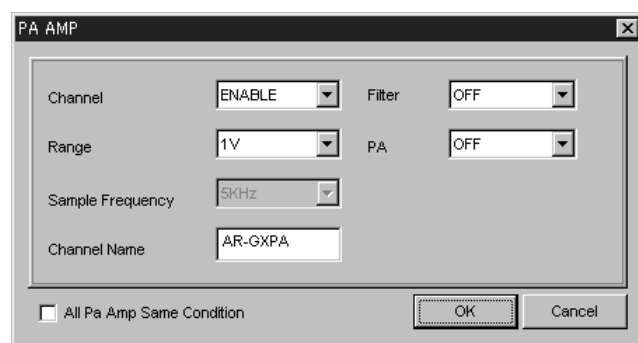
Number of channels :	2
Input format :	Unbalanced
Input coupling :	DC (DC mode)/AC (PA mode)
Input impedance :	100 k $\Omega$
Input range :	$\pm 0.5, 1, 2, 5, 10, 20$ Vp (DC mode) $\pm 0.1, 0.2, 0.5, 1, 2, 5, 10, 20$ Vp (PA mode)
Range accuracy:	$\pm 1\%$ or better
Frequency response :	DC to 80 kHz ( $\pm 1.5$ dB, DC mode) 0.1 Hz to 80 kHz ( $\pm 1.5$ dB, PA mode)
Linearity:	$\pm 0.1\%$ or better
S/N ratio:	71 dB (typical), 65 dB or better (sampling frequency: 50 kHz; input range: 1 V; LPF: 20 kHz)
Low pass filter :	2, 4, 8, 20, 40, 80, 200, 400, 800 Hz, 2 k, 4 k, 8 k, 20 k, 40 k, 80 kHz $\pm 3$ dB at the cutoff frequency Attenuation: $-48$ dB/oct
Sensor power supply :	18 V DC/0.5, 3, 5 mA (PA mode)
A/D converter :	16-bit
Sampling frequency :	1 Hz to 200 kHz
Input connector :	BNC

▼ DC mode: Not supply power to the sensors.  
PA mode: supplies power to the sensors.

▼ When you record in the PA mode for the first time after power-on, or when you switch from the DC mode to the PA mode, leave the unit in the **Rec Standby** mode for about one minute before **Rec Start** to stabilize the amplifier.

## ■ Settings

The following dialog box appears when you choose **Setup** and **Params**, and then double-click the channel that you want to set.



Channel : Select **ENABLE** to record with this channel, or select **DISABLE** not to record with this channel.

Range : Select the input range.

Sample Frequency : You can select 10 times the **Base Sample Freq** when you turn on **Multi Sampling** check box.

Channel Name : You can name the channel. Use up to 16 alphanumeric characters.

Filter : Select the filter cutoff frequency.

PA : Select the sensor power supply. Set to **OFF** in DC mode.

All Pa Amp Same Condition : When this option is selected, the same parameters are set for all signal conditioners of the same type.

▼ Enable both channels of a slot.

▼ Filter cutoff frequency is set slot by slot, not channel by channel.

## Amplifiers

### Digital Input/Output Amp (AR-GXDIO)

The AR-GXDIO amp is for recording and playback of 16-bit digital signals. When used as an output amp, analog signals input into another channel can be output as a digital signal.

When used as an input amp, engineering implications can be added to recorded data. For example, when the upper 8 bits are all made 0, and the AR-GXDIO connects to the output of an AD converter with a resolution of 1 mV for the lower 8 bits, you can record in mV units by using **Change Unit** to specify 1.0 = 1.0 mV.

However, for conversion to an engineering quantity when digital signals such as BCD (Binary Coded Decimal) were input, just processing of SLOPE and Y\_OFFSET is not possible. When using 16 bits to input data in which the uppermost bit in the uppermost digit of a 4-digit BCD value is 0, such as a tide value of 1234 cm; if the data is read as binary data, it becomes the decimal 4660. To return this decimal value  $p$  to the original value  $x$ , perform the following calculation:

$$x = \text{int}\left(\frac{p}{16^3}\right) \times 1000 + \text{int}\left(\frac{p \bmod(16^3)}{16^2}\right) \times 100 + \text{int}\left(\frac{p \bmod(16^2)}{16}\right) \times 10 + p \bmod(16)$$

Where  $\text{int}(k)$  is the integer part of  $k$ , and  $p \bmod(k)$  is the remainder when integer  $p$  is divided by the integer  $k$ . If  $p = 4660$ , 1234 is obtained when  $x$  is calculated.

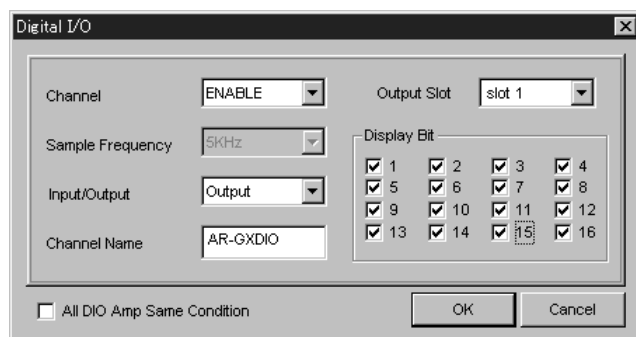


## ■ Specifications

Number of channels :	2
Input format :	CMOS level, 16 bits each channel
Output format :	Open drain, 16 bits each channel
Input/Output switching:	Slot by slot
Sampling frequency :	1 Hz to 200 kHz
Trigger:	AND/OR selectable for specified bits
Input/Output connector :	JAE TX20A-36R-D2LT1-A1LH (amp side) A connector and a cable attached (one end stripped)

## ■ Settings

The following dialog box appears when you choose **Setup** and **Params**, and then double-click the channel that you want to set.



**Channel :** Select **ENABLE** to enable this channel, or select **DISABLE** to disable this channel.

**Sample Frequency :** You can select 10 times the **Base Sample Freq** when you turn on **Multi Sampling** check box.

**Input/Output :** Select whether to use this amp as an input (recording) amp or output (reproducing) amp.

**Channel Name :** You can name the channel. Use up to 16 alphanumeric characters.

**Output Slot :** When you use this amp as an output (reproducing) amp, select the slot of the channel you want to reproduce.

**Display Bit :** Select the bits you want to display in the graphs.

**All DIO Amp Same Condition :** When this option is selected, the same parameters are set for all signal conditioners of the same type.

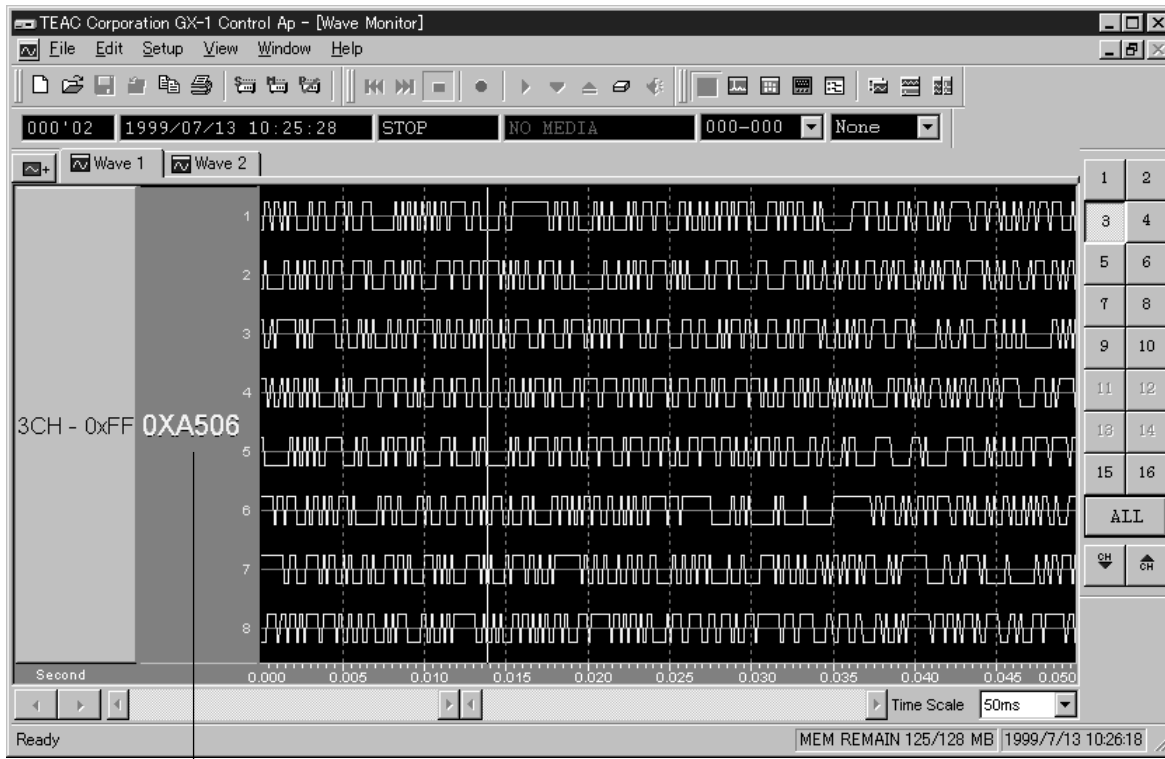
▼ Enable both channels of a slot.

▼ When Output is selected, digital monitor output of the recording signal of another channel is possible.

## Amplifiers

### Digital Monitor

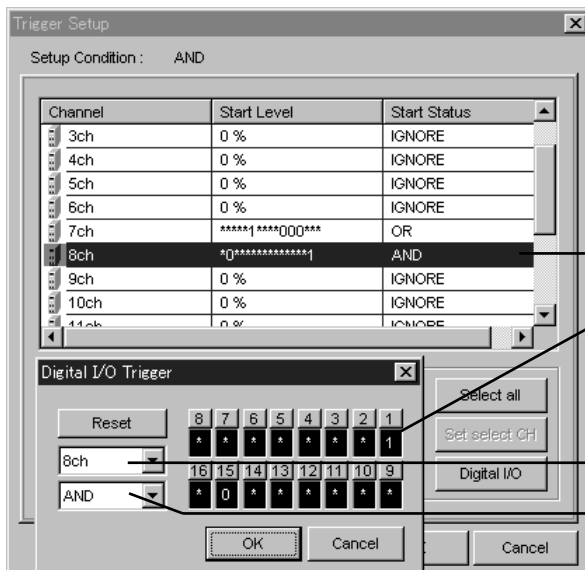
The waveform display for the digital input/output amp shows High/Low of each bit as shown below:



● The value is displayed in hexadecimal.

### Digital Input Trigger Setting

High/Low change of specified bits of digital input channel can trigger recording. To set trigger conditions, click the channel of digital input/output amp on **Trigger Rec** box and then click **Digital I/O**.



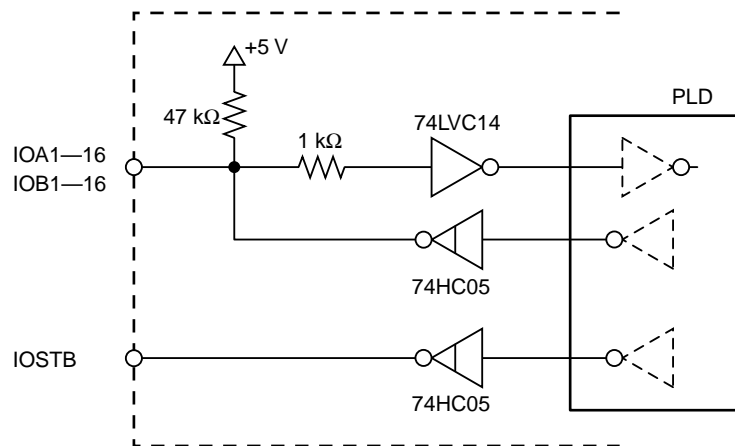
Shows the current setting.

Select "1" when recording is triggered by High, or "0" by Low. If \* is selected, the bit is ignored.

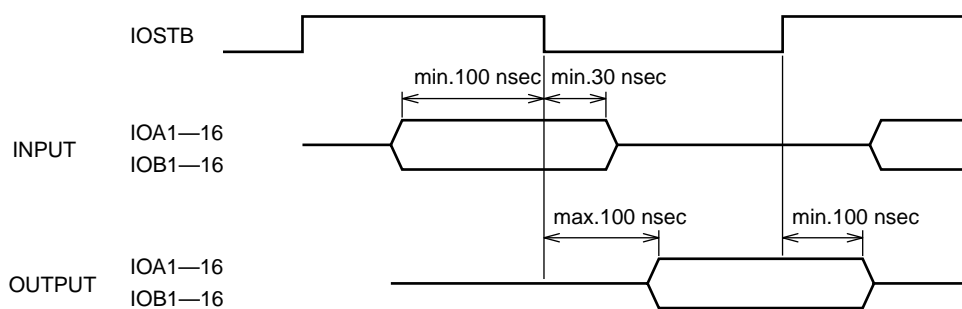
Select the channel that you want to set.

When multiple bits are set, select whether to AND or OR them.

■ **Input/Output Circuit**



■ **Input/Output Timing (at connector)**



Note: IOSTB should be pulled-up externally.

● **Relation between sampling frequency and IOSTB**

Sampling frequency	IOSTB
1 to 50	1 k
100	2 k
200	2 k
500	5 k
1 k	10 k
2 k	20 k
5 k	10 k
10 k	20 k
20 k	100 k
50 k	100 k
100 k	100 k
200 k	200 k

(Unit: Hz)

## Amplifiers

### ■ Pin Assignment and Wire Color of Attached Cable

Pin	Signal name	Function	Wire color	Pin	Signal name	Function	Wire color
1	IOA1	A channel IO1	Orange (1 black dot)	19	IOB1	B channel IO1	Orange (1 red dot)
2	IOA2	A channel IO2	Gray (1 black dot)	20	IOB2	B channel IO2	Gray (1 red dot)
3	IOA3	A channel IO3	White (1 black dot)	21	IOB3	B channel IO3	White (1 red dot)
4	IOA4	A channel IO4	Yellow (1 black dot)	22	IOB4	B channel IO4	Yellow (1 red dot)
5	IOA5	A channel IO5	Pink (1 black dot)	23	IOB5	B channel IO5	Pink (1 red dot)
6	IOA6	A channel IO6	Orange (2 black dots)	24	IOB6	B channel IO6	Orange (2 red dots)
7	IOA7	A channel IO7	Gray (2 black dots)	25	IOB7	B channel IO7	Gray (2 red dots)
8	IOA8	A channel IO8	White (2 black dots)	26	IOB8	B channel IO8	White (2 red dots)
9	IOA9	A channel IO9	Yellow (2 black dots)	27	IOB9	B channel IO9	Yellow (2 red dots)
10	IOA10	A channel IO10	Pink (2 black dots)	28	IOB10	B channel IO10	Pink (2 red dots)
11	IOA11	A channel IO11	Orange (3 black dots)	29	IOB11	B channel IO11	Orange (3 red dots)
12	IOA12	A channel IO12	Gray (3 black dots)	30	IOB12	B channel IO12	Gray (3 red dots)
13	IOA13	A channel IO13	White (3 black dots)	31	IOB13	B channel IO13	White (3 red dots)
14	IOA14	A channel IO14	Yellow (3 black dots)	32	IOB14	B channel IO14	Yellow (3 red dots)
15	IOA15	A channel IO15	Pink (3 black dots)	33	IOB15	B channel IO15	Pink (3 red dots)
16	IOA16	A channel IO16	Orange (4 black dots)	34	IOB16	B channel IO16	Orange (4 red dots)
17	IOSTB	strobe	Gray (4 black dots)	35	IOSTB	strobe	Gray (4 red dots)
18	GND		White (4 black dots)	36	GND		White (4 red dots)

## Analog Output Amp (AR-GXAO)

### ■ Specifications

Number of channels :	2
Output format :	Unbalanced
Output coupling :	DC
Output range :	$\pm 1$ to 5 Vp (variable in 0.1 V steps)
Zero shift :	0 to $\pm 5$ V (in 0.1 V steps)
Output current:	Approx. 10 mA
Frequency response :	DC to 80 kHz
Low pass filter :	2, 4, 8, 20, 40, 80, 200, 400, 800 Hz, 2 k, 4 k, 8 k, 20 k, 40 k, 80 kHz -1.5 dB at the cutoff frequency (This value is derived only from the AR-GXAO unit; The frequency response of the coupled signal conditioner is added to this value.) Attenuation: -48 dB/oct
Range accuracy:	2% (at temperatures of $+23^{\circ}\text{C} \pm 5^{\circ}\text{C}$ )
S/N ratio:	65 dB (output range: 5 V)
D/A converter :	16-bit
Output connector :	BNC

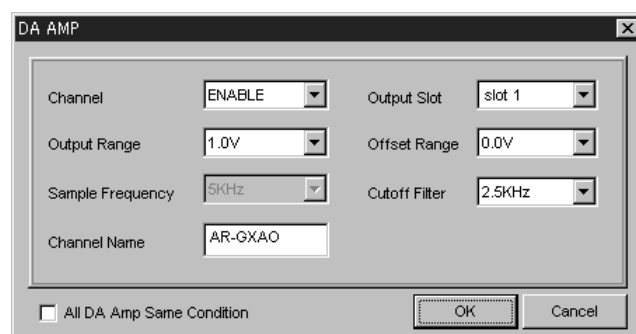
▼ Analog output amplifiers must be installed in the slots following the slots in which input amplifiers are installed.

▼ The maximum output voltage is approx.  $\pm 6$  Vp.

▼ Monitor output for recording signals can be also output.

### ■ Settings

The following dialog box appears when you choose **Setup** and **Params**, and then double-click the channel that you want to set.



Output Range : Select the output range.

Sample Frequency : Determined by **Base Sample Freq** in Params menu.

Channel Name : You can name the channel. Use up to 16 alphanumeric characters.

Output Slot : Select the slot of the channel you want to reproduce.

Offset Range : Set the offset.

Cutoff Filter : Select the output filter cutoff frequency.

**Note:** The output signals are filtered, but the displayed graphs are not filtered.

All DA Amp Same Condition : When this option is selected, the same parameters are set for all analog output amps.

▼ The output ranges and the units cannot be matched with the input settings depending on the type of amplifiers.

## Amplifiers

### CAN Input Amp (AR-GXCAN)

The CAN input amp is an amp card for recording data frames on a CAN (Controller Area Network) bus while recording other analog signals. The recorded data is divided in units of labels included in each ID, and analog signals and time-series displays are possible. The label information corresponds to CANdb from Vector Inc. When you specify a CANdb file at recording time, the CANdb information can be recorded in the header information file, together with the data file. This card can be used with GX Navi only, and cannot be used with the LCD remote controller DK-GXLCD.

#### ■ Specifications

Supported CAN protocols:	CAN 2.0A (Standard ID 11 bits) CAN 2.0B (Extended ID 29 bits)
Recording Baud rate:	1 Mbps to 5 Kbps
Number of recording bus ports:	1 port/card
Supported CAN bus standards:	Supported standards include the following CAN protocols and bus specifications based on CAN: ISO11898 (Transceiver: 251 Type) ISO11519 (Transceiver: 1053 Type) SAE J1939 (Transceiver: 251 Type) SAE J2284 (Transceiver: 251 Type) SAE J2411 (Transceiver: 5790 Type) NMEA-2000 (Transceiver: 251 Type) Device Net (Transceiver: 251 Type) CANopen (Transceiver: 2515 Type) Note, however, that some conversions of physical quantities might not be supported using GX AFC CAN (described later).
Recorded data:	Records data frames on a CAN bus only.
CAN at Recording Time	
Data monitor:	Hexadecimal display of the data length and data in ID units at recording time. The display formats can be a fixed ID display of a specified ID only, or a scrollable display of all IDs.
Reproduction function:	None. (Post-processing as a recorded-data file.)

#### ▼ Slots for the CAN Card:

Install the CAN card in a slot before other analog input amps: for example, install in SLOT1 or SLOT2. If you are using an expansion unit, do not install the CAN card in the expansion unit.

#### ▼ Cable Connections to the CAN Bus:

If you connect the GX-1 CAN card's transceiver cable while the CAN bus line is active, an error frame might be issued.

▼ Connection is possible while both a standard ID and an extended ID exist on the bus. For recording, however, select either a standard ID or an extended ID and then record.

▼ The Baud rate can be selected from within the range calculated by the expression described later. (Page 4-46)

▼ The GX-1 recognizes the CAN input amp as an A/B 2-channel amp. You can install a maximum of 2 CAN input amps.

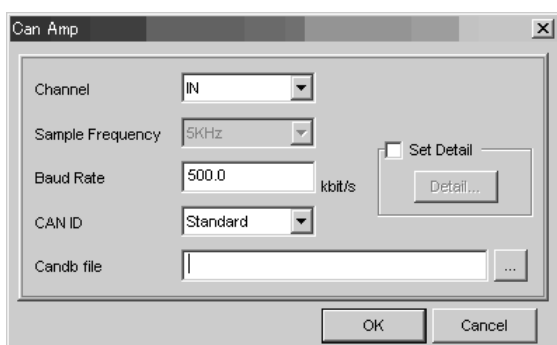
▼ Differences in physical layers are supported by changing the optional transceiver inserted between the bus and the amp.

▼ As recording media, the CAN input amp supports real-time recording to memory, AIT, and PCs; but does not support MO disks or PC cards.

▼ With GX Navi, a CAN card can output waveform data; however, this data is packet data replaced by waveforms, and there is no analysis display function per label.

■ **Settings**

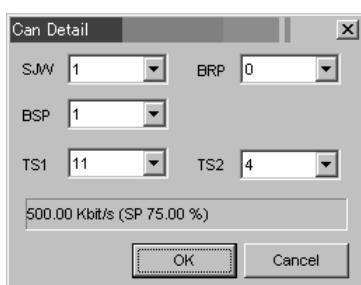
The following dialog box appears when you choose **Setup** and **Params**, and then double-click the channel that you want to set.



▼ This amp does not support the listen-only mode. So care is required because, if the Baud rate setting differs from the Baud rate of the connected bus, an error frame might be issued and the bus for the sending node might be set to off (released from the bus).

- Channel:** Select IN to use this channel, or select DISABLE not to use this channel.
- Sample Frequency:** For multi-sampling, for each slot you can set a frequency that is 10 times the Base Sample Freq.
- Baud Rate:** Set the bit rate for the CAN bus line. To set detailed parameters for the bus line, select the **Set Detail** check box and click the **Detail** button. (See below.)
- CAN ID:** For the ID of the CAN data to be recorded, select **Standard** or **Extended**.
- Candb file:** When there is a CANDb file, specify the file.

**Can Detail dialog box**




- SJW: Maximum bit cycle width
- BRP: Baud rate pre-scaler
- BSP: Sampling point
- TS1: Time segment 1
- TS2: Time segment 2

For details, see "Parameters on the CAN Detail Dialog Box".

## Amplifiers

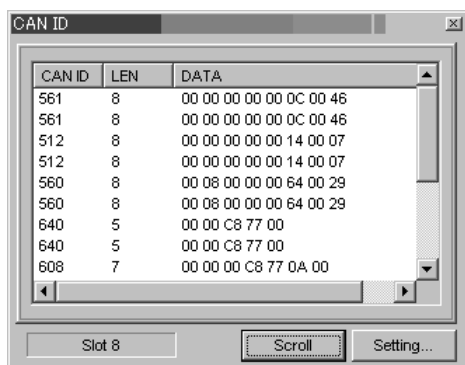
### ■ CAN Data Monitor

During recording, the CAN data monitor can monitor and display the ID, data length and data (hexadecimal). In the channel selection palette, you specify that the CAN board data is to be displayed, and click the CAN monitor button  in the toolbar. If you do not do this and thereby do not select the data to be displayed, the following monitor functions have no effect.

In the CAN data monitor, there is a scroll mode that traces and displays issued packets, and a normal mode that displays data of a specified ID. To switch modes, you click the **Normal** or **Scroll** button. The label on this button displays the current display mode.

#### The CAN ID Dialog Box in Scroll Mode

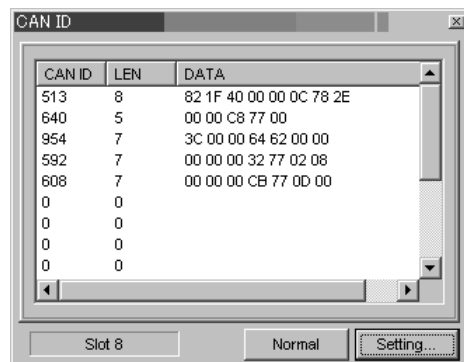
The dialog box displays the issued packets in sequence.



- Some data might be dropped depending on the timing at which the display is refreshed. If you set an appropriate sampling frequency, however, recorded data will not be dropped.
- If a value of 2 seconds or more is set for the Time Scale of the waveform display, the display will not be refreshed. So set a value of 1 second or less.

#### The CAN ID Dialog Box in Normal Mode

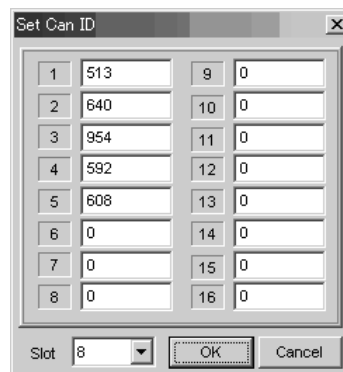
The dialog box displays the data for a specified ID.



- There is no function for extracting (and displaying) each label's data from the CAN data.

#### Specifying an ID to Display

To specify an ID to be displayed, click the **Setting** button. You specify an ID in the dialog box that appears. You can specify up to 16 IDs to be displayed, which is the maximum number of recording IDs. Use decimal numbers to specify the IDs, as shown below. In **Slot** in the lower left of the dialog box, you specify the slot in which the CAN board is installed.



When you use the Waveform Display window or the Bar Meter window, for an analog measurement channel the data being recorded is displayed by waveforms or a bar graph. In such a case, the waveform or bar graph of a channel that corresponds to the CAN board displays the input packet data as unchanged digital data, and does not display the data by data labels. So, the data cannot be displayed as label signals.



### ■ Relationship of the CAN Bus Baud Rate and the Sampling Frequency Set for GX-1

To record without dropping CAN bus data frames, you must use the formula below to determine the GX-1 lowest sampling frequency, and set that value (or as illustrated below, an approximation of that value). If the GX-1 data transmission (1 frame for 4 samplings) is faster than the time for one transmission by a CAN bus data frame, frames will not be dropped.

#### Conditions for Determining the Sampling Frequency

Time per bit = 1 / Baud-rate

Minimum frame time = data-frame-length x time-per-bit

Data frame length for a standard ID = 44 bits (fixed part)

Data frame length for an extended ID = 62 bits (fixed part)

ITM time = time-per-bit x 3 bits

(When the ITM time is shorter than 25 microseconds, make the ITM time 25 microseconds. 25 microseconds is the delay time output from the CAN controller.)

Sampling frequency  $\geq 1 / [(smallest-frame-time + ITM-time) / 4]$

#### Example

When the CAN bus Baud rate is 500 Kbps for a standard ID:

Time per bit = 1 / 500 K = 2  $\mu$  sec/bit

Minimum frame time = 44  $\times$  2  $\mu$  sec = 88  $\mu$  sec

ITM time = 2  $\mu$  sec  $\times$  3 bit = 6  $\mu$  sec

( $\therefore$  6  $\mu$  < 25  $\mu$  so set the ITM time to 25  $\mu$  sec.)

Sampling frequency  $\geq 1 / [(88 \mu \text{ sec} + 25 \mu \text{ sec}) / 4] = 38.835 \text{ kHz}$

(The lowest sampling frequency of the GX-1 becomes the approximation of 50 kHz, a near approximation higher than the above 38.835 kHz.)

#### Examples of CAN bus Baud rates and sampling frequencies:

CAN bus Baud rate	GX-1 sampling frequency (standard ID)	GX-1 sampling frequency (extended ID)
50 Kbps	5 kHz	5 kHz
100 Kbps	10 kHz	10 kHz
250 Kbps	20 kHz	20 kHz
500 Kbps	50 kHz	50 kHz
1 Mbps	100 kHz	50 kHz

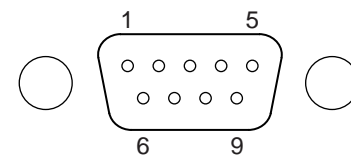
Using the multi-sampling function, the Base Sample setting for other analog channels can be set to 1/10 of the above sampling frequencies.

## Amplifiers

### Arrangement of Transceiver Cable Pins

Recommended transceiver cables are from KVASER Inc.

Pin No.	DRVcan 251/1053 TYPE	DRVcan S
1	Not connected.	Not connected
2	CAN_L (low level @ dominant)	Not connected
3	GND	GND
4	Not connected.	Not connected
5	Shield	Shield
6	Not connected.	Not connected
7	CAN_H (high level @ dominant)	CAN_H (high level @ dominant)
8	Not connected.	Not connected
9	Not connected.	Power Supply (12 V)



D-sub connector on the transceiver

### Parameters on the CAN Detail Dialog Box

The parameters on the CAN Detail dialog box have the meanings shown below:

Parameter	Selectable value	Default setting	Meaning
SJW	0		Max. bit cycle width 1 TQ
	1	Default	Max. bit cycle width 2 TQ
	2		Max. bit cycle width 3 TQ
	3		Max. bit cycle width 4 TQ
BSP	1	Default	1 sampling point
	3		3 sampling point
BRP	0 to 63	7	Baud rate pre-scaler
TS1	4 to 16	14	Time segment 1
TS2	2 to 8	5	Time segment 2

50 kbps

Use the following formula to determine the Baud rate.

$$\text{Baud rate (kbps)} = \frac{16 \text{ MHz}}{2 \times (\text{BRP} + 1) \times (1 + \text{TS1} + \text{TS2})}$$

Adjust SJW and BSP when data cannot be obtained because of the CAN bus line status.

**Restrictions on TS1 and TS2 Parameter Settings**

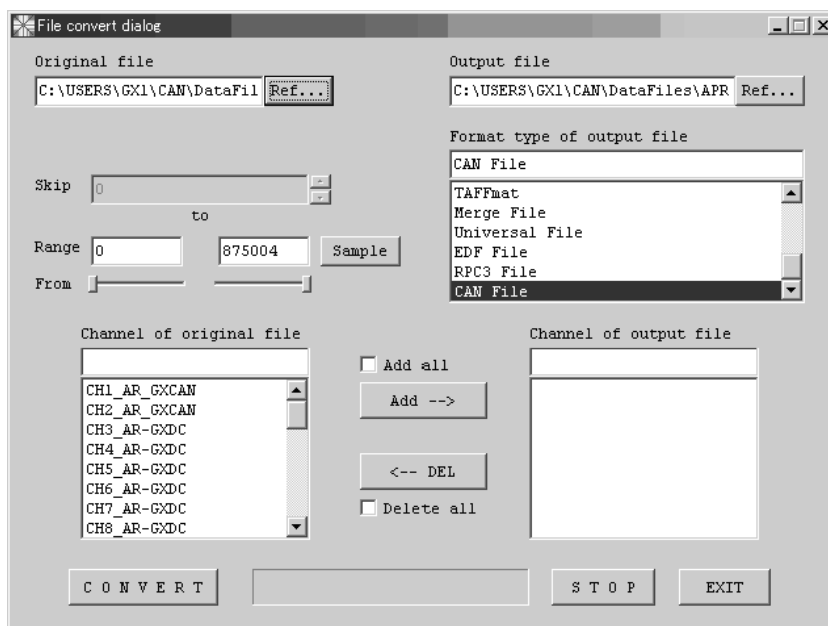
	TQ value	TS2							
		2	3	4	5	6	7	8	9
TS1	4	NG	OK	NG	NG	NG	NG	NG	NG
	5		OK	OK	NG	NG	NG	NG	NG
	6		OK	OK	OK	NG	NG	NG	NG
	7		OK	OK	OK	OK	NG	NG	NG
	8		OK	OK	OK	OK	OK	NG	NG
	9		OK	OK	OK	OK	OK	OK	NG
	10		OK	OK	OK	OK	OK	OK	OK
	11		OK	OK	OK	OK	OK	OK	OK
	12		OK	OK	OK	OK	OK	OK	OK
	13		OK	OK	OK	OK	OK	OK	OK
	14		OK	OK	OK	OK	OK	OK	OK
	15		OK	OK	OK	OK	OK	OK	OK
	16		OK	OK	OK	OK	OK	OK	OK

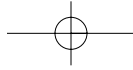
NG: Do not set for this value.

Δ: Do not set when the BRP value is 0.

**■ Converting Files Using GX AFC CAN**

GX AFC (Advanced File Converter) CAN is provided as a tool for reorganizing CAN data from a data file in a PC. The tool extracts required data from the packet data, and expands it to the same time-series data as the analog channel. In the dialog box shown below, in **Original file** you specify the source file to be converted (the file with the status read from GX-1), and in **Output file** you specify the output file. In **Format type of output file**, you specify CAN File.

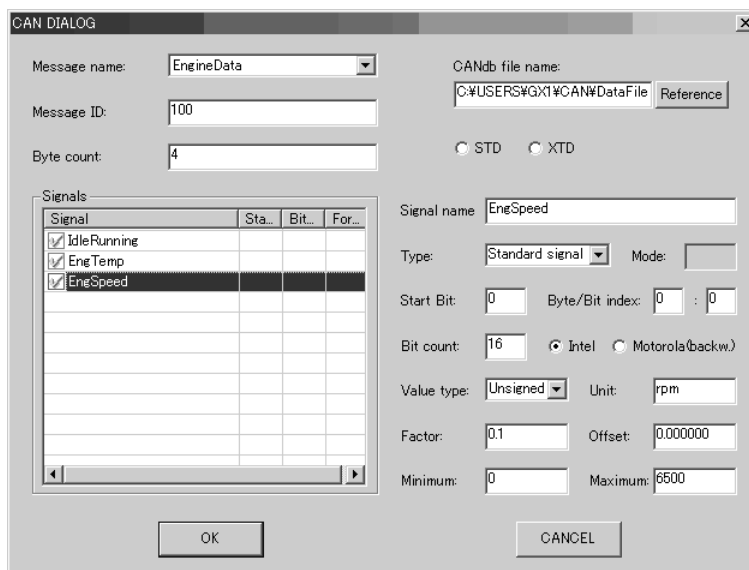




## Amplifiers

To specify the output data, in **Channel of original file** select the data that you want to output, and click the **Add** button. The method for selecting the CAN data label is described below.

The **Channel of original file** area displays the CAN channel (CH1\_AR\_GXCAN in the example on the previous page), so double-click that channel. A dialog box similar to the following CANdb Editor dialog box will appear, so in this dialog box select the label for the output file.



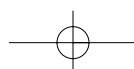
Select the label to be output (so that a check mark is displayed), and then click **OK** to return to the original dialog box.

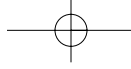
- When CANdb file is specified and recording is based on GX Navi, items in **Message name**, etc., are usually displayed. If not specified, however, in **CANdb file name** specify the same CANdb as the recorded CAN data.

The information will be added to the list of specified analog channels, and the selected CAN data label information will be displayed. If you now click the **Add** button, the name of the signal that is output is displayed in the **Channel of original file** list. The maximum number of selectable channels is 128. (When recording via 30 analog channels, the maximum number of CAN labels is 98.)

After you have finished selecting the data, click the **Convert** button to perform the conversion. (The conversion process might take a long time, depending on the amount of recorded data.)

- When you specify **CAN+DADISP** in **Format type of output file**, you can perform up-sampling of data recorded by multi-sampling, and can output the data as a file with the same sampling. For details, see the “GX AVC Instruction Manual”.
- For conversion of physical amounts, when there is data that exceeds 16 bits in one signal, the data is rounded to 16 bits. CAN data to be recorded becomes one item of effective CAN data at 4 samplings, so the rounding might cause the first and last part of the recorded data to become ineffective as CAN data. In such a case, physical quantities might not convert correctly.

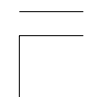
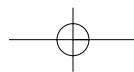
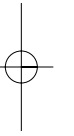
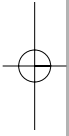
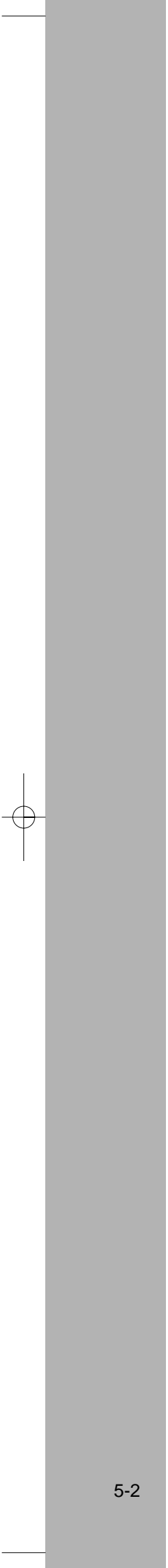
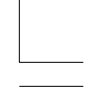
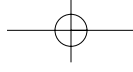




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### In Case of Trouble

#### ■ If the system hangs up

To reset the GX-1 if it hangs up, proceed as follows:

1. Quit the attached software “GX Navi” and turn off the power of the GX-1.
2. Remove one of the signal conditioners from the GX-1 and turn on the power of the GX-1.
3. After the buzzer sounds three pairs of beeps, turn off the power of the GX-1 again.
4. Mount the signal conditioner removed in step 2 back to the slot, and turn on the power of the GX-1.
5. After the buzzer sounds three pairs of beeps, start the GX Navi.

**Note:** The settings memorized in the GX-1 are reset. You must set them again.

#### ■ If system hangs with AIT inside

If the system hangs up with the AIT in the drive, reset the GX-1 following the steps below:

**Note:** The last data file may not be recovered.

1. Wait for more than five minutes. Do not attempt to eject the AIT.
2. Quit the attached software and turn off the power of the GX-1.
3. Remove one of the signal conditioners from the GX-1 and turn on the power of the GX-1.
4. After the buzzer sounds three pairs of beeps, start the attached software.
5. When the message “One data file in this tape is not closed” appears, click **YES**.  
File closing begins. If the data is large, it takes some hours to close the file.
6. After the file is closed, quit the attached software and turn off the power of the GX-1.
7. Mount the signal conditioner removed in step 3 back to the slot, and turn on the power of the GX-1.
8. After the buzzer sounds three pairs of beeps, start the attached software.

#### ■ How to eject AIT if GX Navi hangs

1. Quit GX Navi forcefully.
2. Turn off the power of the GX-1.
3. Turn on the power of the GX-1 and (without booting GX Navi,) press the eject button on the AIT drive.

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Supplied Accessories	Separately Purchasable Options
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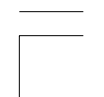
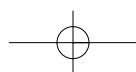
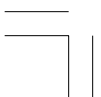
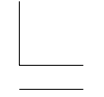
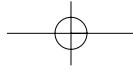
<b>■ GX-1</b>		AIT cartridges (SONY SDX1-25C)	
AC power cable	1	AIT cleaning tape	(SONY SDX1-CL)
3P-2P adaptor*	1	PC adaptor board	(TZ-GXPAB)
DC power cable	1	ST input cable type 1	(CL-GXST1)
AC adaptor	1	Sync. cable type 1	(CL-GXSYC1)
Earphone	1	Cable for ER-GXRC connector	(CL-GXRC)
Microphone	1		
Ferrite core & cable tie	1 each		
Ferrite core	1		
Installation disk	1		
Handle	2		
Screws & washers for handle	4 each		
Hexagonal wrench	1		
AIT cassette (AIT type only)	1		
Cleaning tape (AIT type only)	1		
MO disk (MO type only)	1		
Instruction manual (this manual)	1		

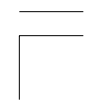
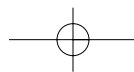
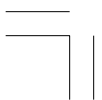
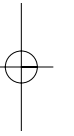
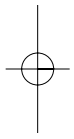
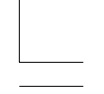
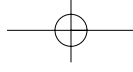
\* Not supplied for Europe.

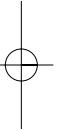
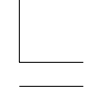
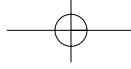
Amplifiers (per unit)	Connector	Ferrite core
AR-GXDC	0	2
AR-GXMC	0	2
AR-GXST	2	2
AR-GXTCK/J	2	2
AR-GXFV	0	2
AR-GXCH	0	2
AR-GXPC	0	2
AR-GXPA	0	2
AR-GXAO	0	2
AR-GXDIO	1	1

<b>■ Expansion Unit (AU-GXEPIO)</b>	
AC power cable	1
3P-2P adaptor*	1
DC power cable	1
AC adaptor	1
Joint plate	2
Screws & washers	8 each
Handle plate	2
Expansion cable	1
Illustration for mounting	1

\* Not supplied for Europe.







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