



# ND-20

## Network Audio Distribution Unit

Operation Manual

Second Edition

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# CAUTION

**To prevent fire or shock hazard:  
Do not expose this unit to rain or moisture.  
Do not remove panels (unless instructed to do so).  
There are no user-serviceable parts inside.  
Refer servicing to qualified service personnel.**

PLEASE READ THROUGH THE SAFETY INSTRUCTIONS BELOW.



The lightning flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.



The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.



This symbol is intended to alert the user to the presence of high temperature component within the product's enclosure that may constitute a risk of heat injury to persons.

## SAFETY INSTRUCTIONS

- 1. Read Instructions:** All safety and operating instructions should be read before operation.
- 2. Retain Instructions:** The safety and operating instructions should be retained for future reference.
- 3. Heed Warnings:** All warnings on the device and in the operating instructions should be complied with.
- 4. Follow Instructions:** All operating and use instructions should be followed.
- 5. Water and Moisture:** The device should not be used near water — for example, near a bathtub, wash bowl, sink, laundry tub, in a wet basement, near a swimming pool, etc.
- 6. Carts and Stands:** The device should be used only with a cart or stand that is recommended by the manufacturer.
- 7. Ventilation:** The device should be situated so that its location or position does not interfere with its proper ventilation. For example, the device should not be situated on a bed, sofa, rug, or similar surface that may block the ventilation openings; or, placed in a built-in installation, such as a bookcase or cabinet that may impede the flow of air through the ventilation openings.
- 8. Heat:** The device should be situated away from heat sources such as a radiator, heat register, stove or other appliances (including amplifiers) that produce heat.
- 9. Power Sources:** The device should be connected to a power supply only of the type described in the operating instructions or as marked on the device.
- 10. Grounding or Polarization:** Precautions should be taken so that the grounding or polarization means of the device is not defeated.
- 11. 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 device.
- 12. Cleaning:** The device should be cleaned only as recommended by the manufacturer.
- 13. Non-Use Periods:** The power cord of the device should be unplugged from the outlet when left unused for a long period of time.
- 14. Object and Liquid Entry:** Care should be taken that objects do not enter and that liquids are not spilled into the enclosure through openings.
- 15. Damage Requiring Service:** The device should be serviced by qualified service personnel when:
  - A. The power supply cord or the plug has been damaged; or
  - B. Objects have entered, or liquid has been spilled into the appliance; or
  - C. The appliance has been exposed to rain; or
  - D. The appliance does not appear to operate normally or exhibits a marked change in performance; or
  - E. The appliance has been dropped, or the enclosure damaged.
- 16. Servicing:** The user should not attempt to service the device beyond what is described in the operating instructions. All other service should be referred to qualified personnel.

## COMMUNICATION WITH OTARI

FOR SERVICE INFORMATION AND PARTS

All Otari products are manufactured under strict quality control. Each unit is carefully inspected and tested prior to shipment.

If, however, some adjustment or technical support becomes necessary, replacement parts are required, or technical questions arise, please contact your Otari dealer or contact Otari at:

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Another part of Otari's continuing technical support program for our products is the continuous revision of manuals as the equipment is improved or modified. In order for you to receive the information and support which is applicable to your equipment, and for the technical support program to function properly, please include the following information, most of which can be obtained from the Serial number label on the machine, in all correspondence with Otari:

- Model Number:
- Serial Number:
- Date of Purchase:
- Name and address of the dealer where the machine was purchased and the power requirements (voltage and frequency) of the machine.

# 1. Introduction

The Otari ND-20 is a network audio distribution unit which provides a networking solution for audio signals. Multiple ND-20's can be connected via an IEEE 1394 based network to convert supplied audio signals into different formats or distribute audio signals within the network. Since the ND-20 supports 24-bit quantization and 96-kHz sample rate, it can be used as a high quality analog-to-digital and/or digital-to-analog converter, or a digital signal sample rate converter.

## 1.1 ND-20 Main Features

### ■ 32-Channel Audio Handling Capacity per Unit

One ND-20 unit has a maximum of 32-channel audio capacity (16 channels at 96 kHz fs)<sup>1</sup>. For the entire ND-20 network system, the maximum audio handling capacity is 96 channels (48 channels at 96 kHz fs)<sup>2</sup>.

### ■ Audio Network based on IEEE 1394

Multiple ND-20's can be connected together via the IEEE 1394 (S200) interface to transmit audio signals among them. The ND-20 is equipped with three IEEE 1394 ports. Metal cables can run as long as 4.5 meters between adjacent units. When optical fiber cables<sup>3</sup> are used, the cable run for the entire system is as long as 500 meters.

### ■ Various Modules

Mic amp (mic input), AD (analog input), DA (analog output), and AES (AES/EBU I/O) modules are available. The ND-20 can be configured in various ways to cover a wide range of applications. The audio signal interface section is designed as a 8-channel module; one ND-20 can have up to 4 modules. A module for analog signals has 8 channels of input or output and a module for digital signals (AES) has 8 channels of both input and output.

### ■ Routing Setup on Module Basis

Audio signals are routed by setting routing numbers for modules. Modules having the same routing number are connected together internally. It is possible to send signals from one input module to multiple output modules. Since the input and output sections of a digital signal module operate independently, it is possible to route audio signals within the same module (self routing function).

### ■ Format Conversion using Self Routing Function

The self routing function enables a stand alone ND-20 to operate as an A/D or D/A converter.

### ■ 96 kHz • 24 Bit

The ND-20 supports 32-kHz to 96-kHz sample rates and 24-bit quantization. The AES module has sample rate converters that can be applied to the input or output section.

### ■ Multiple Sample Rates

The ND-20's in the network system can be divided into up to 16 link groups and each group can operate at a different sample rate<sup>4</sup>.

### ■ External Synchronization Operation

The ND-20 has an external sync signal input terminal to enable external sync operation.

### ■ CB-178 Remote Control Unit (option)

By adding a CB-178 to the ND-20 network system, mic amp modules can be controlled in real time and system settings can be monitored. The CB-178 is connected to the ND-20 via an IEEE 1394 cable and a selected channel's audio signal can be monitored at the CB-178's level meter and headphone output.

### ■ Auxiliary Power Supply Unit (option)

By connecting an optional auxiliary power supply unit<sup>5</sup> to the DC power input connector, the power supply line can be duplexed.

1 When using AES modules, up to 32-In/32-Out (16-In/16-Out at 96 kHz fs).

2 Number of available channels varies based on the system configuration.

3 Multimode graded index type glass fiber.

4 If routing is done between different link groups, noise can be heard unless both link groups are operating with the same sync signal.

5 To be available.

## 1.2 Specifications

### ■ ND-20 Main Unit

**Sample Rate:** 96, 88.2, 48, 44.1, 32 kHz (switchable)

#### IEEE 1394 Interface

**Number of Ports:** 3 (metal x 3 or metal x 2 + optical x 1)

**Metal Connector:** 6-pin type, with lock mechanism

#### Optical Connector

- Multi-mode: 62.5  $\mu\text{m}$ , 50  $\mu\text{m}$
- Connector: SC type
- Transmission Distance: max. 500 meters (entire system)

#### External Synchronization

**Synchronization Signals:** word clock 96, 88.2, 48, 44.1, 32 kHz

**Format:** Sync to rising edge of square wave

**Electrical Characteristics:** TTL level

**Input Impedance:** 75  $\Omega$

**Connector:** BNC

**Operating Environment:** 5 to 40°C

**Power Supply:** 100/117/200/220/240 VAC  $\pm 10\%$  (single phase 50 / 60 Hz)

**Dimensions (W x H x D):** 482 x 88 (2U) x 380 mm

**Weight:** 9.0 kg

### ■ CB-178 Remote Control Unit

**Interface:** IEEE 1394 (metal port x 3)

**Liquid Crystal Display:** 16 characters x 2 line, backlit type

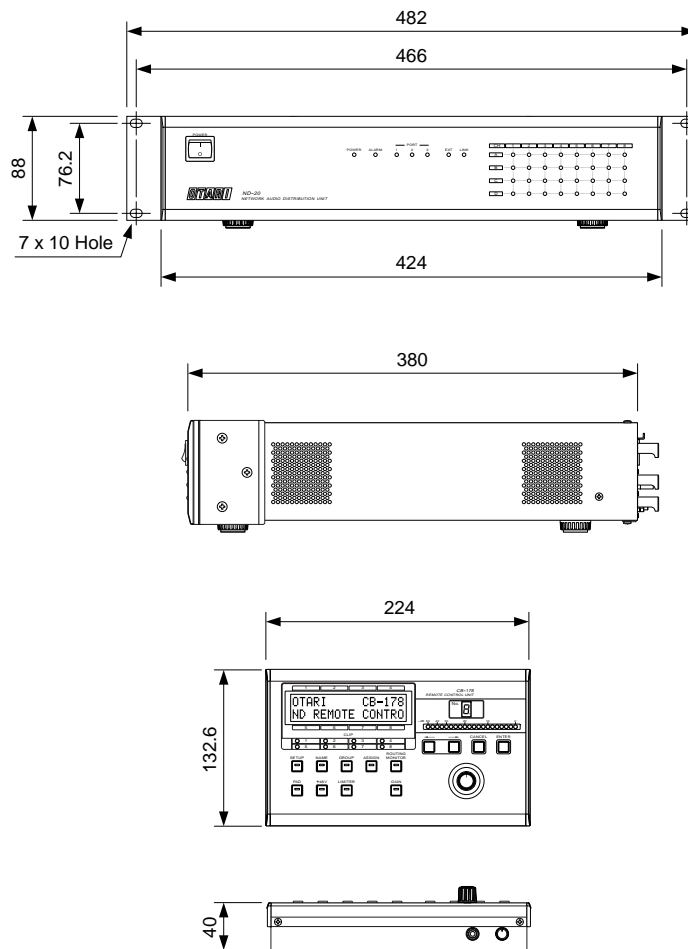
#### Headphone Output

**Impedance:** 8  $\Omega$

**Connector:**  $\phi 6.3$  mm stereo phone jack (mono output)

**Dimensions (W x H x D):** 224 x 40 x 132.6 mm

**Weight:** 9.0 kg



■ **Mic Amp Module [CB-76X]**

- **Weight:** 0.8 kg
  - **Number of Slots Required:** 2
  - **Number of Channels:** 8
  - **Connector:** XLR-3-32 (female) x 8
  - **Input Impedance:** 2 k $\Omega$ , 10 k $\Omega$  (pad on)
  - **Amplifier Gain Range (pad off):** +13 dB to +62 dB
  - **Amplifier Gain Range (pad on):** -12 dB to +37 dB
  - **Maximum Level (non-clipping):** +36 dBu
  - **Sample Rate:** Follows the unit setting.
  - **A/D Conversion:** 24 bits
  - **Frequency Response:** 20 Hz to 22 kHz +0/-1 dB
  - **Noise:** Mic input EIN -125 dB (max. gain, input 200  $\Omega$ , pad off)
  - **Distortion:** max. 0.007% (1 kHz, peak)
  - **Signal-to-Noise Ratio:** min. 102 dB (1 kHz, A-WTD)
  - **Crosstalk:** min. 100 dB (1 kHz)
- [measurement condition: 48 kHz fs, DA OUT]

■ **AD Module [CB-76Y]**

- **Weight:** 0.4 kg
  - **Number of Slots Required:** 1
  - **Number of Channels:** 8
  - **Connector:** D-sub 25-pin (female) x 1
  - **Input Impedance:** 10 k $\Omega$
  - **Maximum Level (non-clipping):** +24 dBu
  - **Sample Rate:** Follows the unit setting.
  - **A/D Conversion:** 24 bits
  - **Frequency Response:** 20 Hz to 22 kHz +0/-1 dB
  - **Distortion:** max. 0.007% (1 kHz, peak)
  - **Signal-to-Noise Ratio:** min. 108 dB (1 kHz, A-WTD)
  - **Crosstalk:** min. 100 dB (1 kHz)
- [measurement condition: 48 kHz fs, DA OUT]

■ **DA Module [CB-77A]**

- **Weight:** 0.5 kg
  - **Number of Slots Required:** 1
  - **Number of Audio Channels:** 8
  - **Connector:** D-sub 25-pin (female) x 1
  - **Output Impedance:** max. 5  $\Omega$
  - **Maximum Level (non-clipping):** +24 dBu (digital peak)
  - **Sample Rate:** Follows the unit setting.
  - **D/A Conversion:** 24 bits
  - **Frequency Response:** 20 Hz to 22 kHz +0/-1 dB
  - **Distortion:** max. 0.007% (1 kHz, peak)
  - **Signal-to-Noise Ratio:** min. 108 dB (1 kHz, A-WTD)
  - **Crosstalk:** min. 100 dB (1 kHz)
- [measurement condition: 48 kHz fs, AD IN]

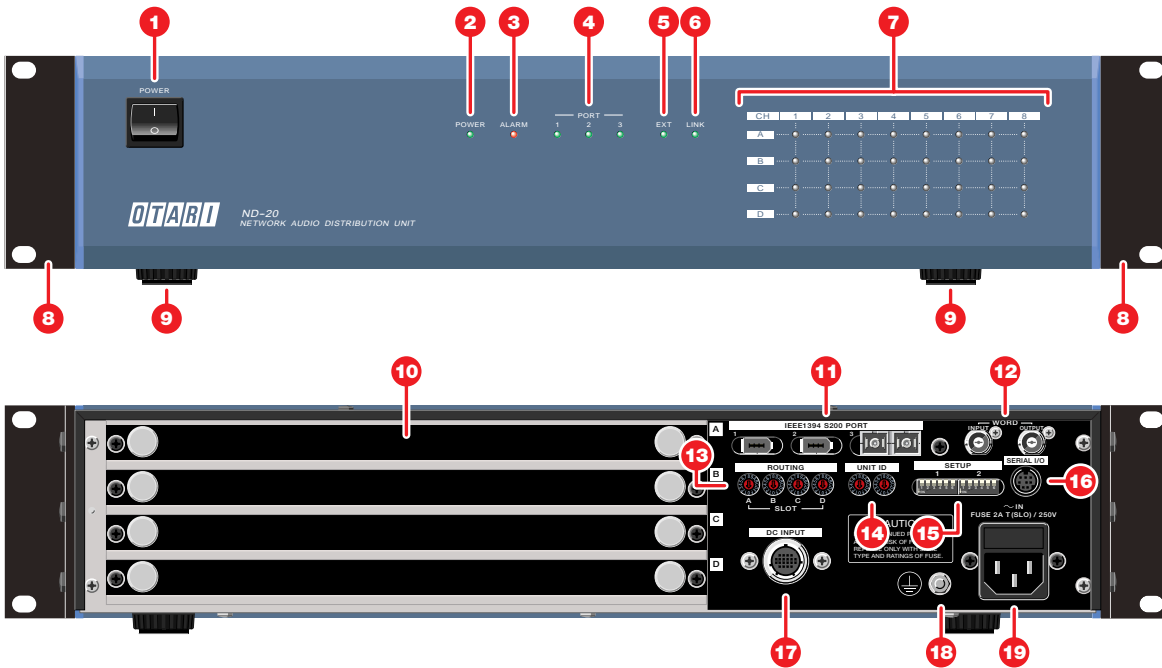
■ **AES Module [CB-77C]**

- **Weight:** 0.4 kg
- **Number of Slots Required:** 1
- **Number of Audio Channels:** Input = 8, Output = 8
- **Connectors:** Input = D-sub 25-pin (female) x 1, Output = D-sub 25-pin (female) x 1
- **Format:** IEC 958, EIAJ CP-340, AES/EBU digital audio interface (with transformer)
- **Impedance:** 110  $\Omega$
- **Sample Rate:** Follows the unit setting.
- **Sample Rate Converter:** Acceptable Frequency 10–96 kHz. (Input a word clock signal to the EXT connector (BNC type) to apply the SRC to the output signals.)

Specifications are subject to change without notice or obligation.

## 2. Controls and Indicators

### 2.1 ND-20 Main Unit



**[1] POWER switch**

Used to power up and shut down the unit. Press the “I” side to turn the unit on and press the “O” side to turn it off.

**[2] POWER indicator (green/orange)**

Illuminates in green when all of the internal power supplies are operating properly. If it lights in orange, any of them may be out of order or the number of units turned on may not be enough to activate other units’ IEEE 1394 interface sections or the CB-178.

**[3] ALARM indicator (red)**

Flashes when there is any incorrect system setup or a system failure is detected. Each time an error is detected, it flashes for several seconds, and frequency of flashing becomes higher as error frequency becomes higher. When an IEEE 1394 cable is disconnected and then reconnected, it may flash rapidly.

**[4] PORT 1-3 indicator (green/orange)**

Illuminates when the corresponding IEEE 1394 port is being used:  
**Orange:** Disconnecting a cable from this port can stop audio signal transmissions between the units which are not directly connected here also.  
**Green:** This unit or the device connected to this port is a “Leaf Node” (a node (unit) whose one port is connected only) and disconnecting a cable from this port will not stop audio signal transmissions between the units other than one connected here directly. However, if the Leaf Node device is set to operate as a master unit, audio signals may be stopped.

**[5] EXT indicator (green)**

Illuminates when the ND-20 is operating synchronized to an external signal or to an input signal to the input section of the AES module (D-I Sync mode). The indicator flashes when the ND-20 cannot synchronize to the external signal or a valid signal is not supplied (the operating clock will automatically switch to the internal clock). Activation of external synchronization is selected by the rear panel **SETUP 1-6** switch.

**[6] LINK indicator (green)**

Shows the synchronization status of the ND-20. If, as a link group master, this unit is working with its internal clock or as a link group slave, synchronizing to the sync signal fed via IEEE 1394, the **LINK** indicator illuminates. Irrespective of master or slave assignment, if there is no unit to be synchronized with, it flashes slowly. If there are multiple units being wrongly set to operate as a master in the same link group, one of such units will operate as the master and others as the slaves. In such a case, the slave units’ **LINK** indicators flash rapidly.

**[7] Channel indicator**

Shows the signal level or signal status of each channel. Usually the channel indicator shows each channel's signal level by color gradation of green to red. When clipping occurs, it turns on in red for about 0.5 seconds (when the CB-178 is used, the clip indication must be cleared manually). For mic amp modules, the slot A or C indicator shows the signal level and the slot B or D indicator shows the phantom power on/off status.

**[8] Rack mount adapter**

Used to install the ND-20 into a standard 19-inch rack. The adapters can be removed if they are not necessary.

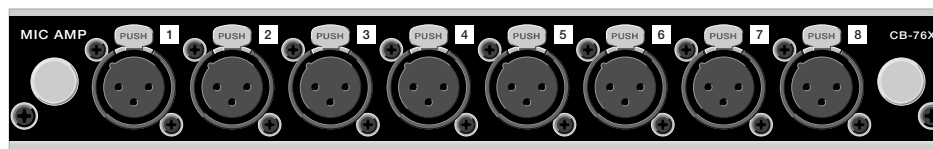
**[9] Case foot**

If the ND-20 is to be installed in a standard 19-inch rack, remove the feet.

**[10] Module slots A–D**

Slots for audio signal interface modules. There are four slots per unit, and they are labeled A–D from top to bottom. A mic amp module which occupies a 2-slot space is inserted in the slot A or C. When a sample rate higher than 48 kHz (i.e., 96 kHz, etc.) is used, the number of available channels is halved and only the slots B and D become valid (slots A and C for mic amp modules).

■ **Mic Amp Module**



The mic amp module [CB-76X--] is an input module for microphones. It converts the supplied mic level analog audio signals into digital signals and feeds them to the ND-20 main unit. One mic amp module occupies two module slots. Detailed settings of the module (gain adjustment, pad on/off, limiter on/off, phantom power on/off) can be changed from an optional CB-178 remote control unit. Microphone input connectors are XLR type (female; pin 1 = ground, pin 2 = hot, pin 3 = cold).

**NOTE:** The mic amp module's setup information is stored in the memory in the ND-20. Even if a CB-178 is not connected to the ND-20 network, by turning on the power to the unit after setting the **SETUP 2-4** switch to **ON**, the mic amp module setup is automatically restored. (However, if the ND-20 unit's module configuration has been changed, this restoring will not take place.) If the CB-178 is connected to the system, recalling of the mic amp module setup is done via the CB-178.

■ **AD Module**



The AD module [CB-76Y--] is an analog audio signal input module which converts the supplied line level analog audio signals into digital signals and feeds them to the ND-20 main unit. Analog audio signals are received at the **INPUT** connector (D-sub 25-pin, female). See §4.1 for connector pin assignment.

■ **DA Module**



The DA module [CB-77A--] is an analog audio signal module which converts the digital signals sent from the ND-20 main unit into line level analog audio signals. Analog audio signals are sent from the **OUTPUT** connector (D-sub 25-pin type, female). See §4.1 for connector pin assignment.

■ AES Module



The AES module [CB-77C--] is a digital audio interface module that receives and sends AES/EBU format audio signals. The module has 8-channel input and output sections that operate independently and 8 sample rate converters (SRC).

- **WRD IN connector (BNC):** Used to receive the word clock signal having the desired sample rate when applying the SRC to the output section. The output signals will be converted to have the same sample rate as the supplied external word clock signal's sample rate and synchronized to the external word clock signal.
- **ROUTING switch:** Used to set the routing number of the AES/EBU output. Since the input and output of the AES module operate independently, routing setup of the input section is done by the **ROUTING** switch on the ND-20, and that of the output section is done by the **ROUTING** switch on the module.  
**NOTE:** By setting the input and output to the same routing number, it is possible to route signals within the same module (self routing). However, this function is available only when the **DLY CORR** switch is set to **OFF**.
- **OUTPUT connector (D-sub 25-pin, female):** For AES/EBU format digital audio signal output. The output section is always enabled irrespective of the switch setting. For pin assignment, see §4.1.
- **Setup switches**
  - SRC-WRD/SYS:** Used to apply the SRC (sample rate converter) to the AES module's input or output section. To apply the SRC to the input section, set the switch to **SYS**. To apply to the output section, set the switch to **WRD**. If the SRC is applied to the input section, the input signal's sample rate will be converted to the unit's operating sample rate. If applied to the output section, output signals will be converted to have the sample rate of the external word clock signal fed to the **WRD IN** connector and synchronized to that signal.
  - SRC-1/2, 3/4, 5/6, 7/8:** Used to turn on/off the SRC on channel pair basis. Switches correspond to AES/EBU channel pairs 1/2, 3/4, 5/6, and 7/8.
  - IN ENBL:** Used to enable/disable the AES module's input section (the output section is always enabled). If set to **OFF**, the AES module will operate as an output module.
  - DLY CORR:** Used to activate/deactivate delay correction among channels. When set to **ON**, differences in delay amount will be corrected so that signals of the channels having the same SRC setting will be output in phase. However, if this switch is set to **ON** and the SRC setting of a channel is changed, that channel and channels that had the same setting as the SRC will be muted for an instant.
  - DI SYNC:** Used to activate/deactivate the synchronization to the word clock signal extracted from the input signal (D-I Sync function) when the AES module's input section is enabled. If the **DI SYNC** switch is set to **ON**, the unit scans the status of the AES module's inputs and operates synchronized to the valid input signal to which it can attain lock first. If this input becomes invalid, then the unit scans the inputs again. During D-I Sync operation, the front panel **EXT** indicator illuminates. This setting is also valid for the units being set to operate as slaves in the link group. However, if they are synchronizing to the external clock fed into their rear panel **WORD-INPUT** connector, that setting (external word clock) is used.
  - NOTE:** To use D-I Sync mode, the sample rate of the AES/ EBU input signal that is to be the sync source of D-I Sync must be set to the same value as the sample rate of the link group's master unit.
- **INPUT connector (D-sub 25-pin, female):** Receives AES/EBU format digital audio signals. This connector can be used only when the input section is enabled (SW6 = ON). For pin assignment, see §4.1.

[11] IEEE 1394 S200 PORT 1-3 connector

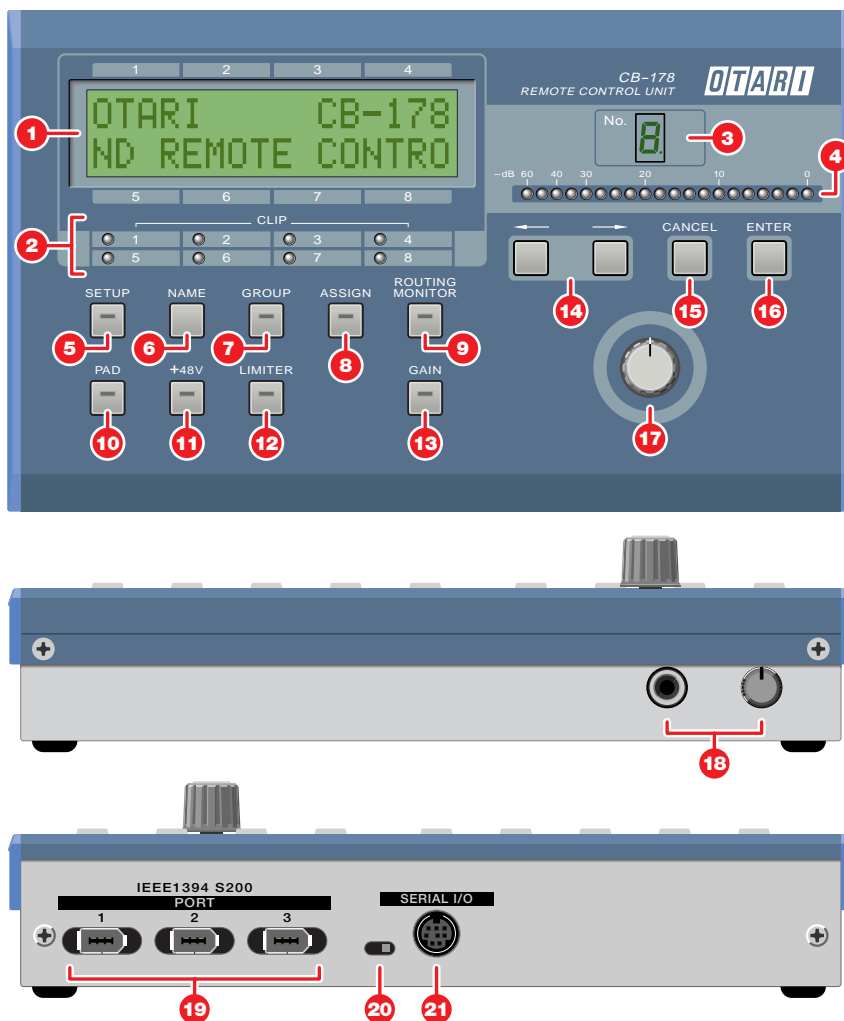
IEEE 1394 (S200) interface to connect other ND-20's or a CB-178 remote control unit. Ports 1 and 2 are for metal cables (IEEE1394-1995 based 6-core cables). The port 3 has a connector for a metal cable or two connectors for optical fiber cables (as specified by the customer).



- [12] WORD-INPUT/OUTPUT connector** Used when synchronizing this unit to an external word clock signal. In an ND-20 network system, by supplying the external signal to the link group master unit, the slave units will automatically operate synchronizing to that signal. It is also possible to feed the branched external signals to the slave units.
- [13] ROUTING A-D switch** Used to set routing numbers for modules inserted in the slots A-D. Modules set to the same number are connected together internally. It is possible to connect one input module to multiple output modules and modules in the same unit can be routed together (self routing).
- [14] UNIT ID switch** Used to set the ID number for this unit. Each unit in a system must have a unique unit ID: avoid duplicated unit ID numbers. 256 unit ID numbers (00-FF) can be set.
- NOTE:** If the same unit ID number is wrongly set in two or more units in the system, the **ALARM** indicator and channel indicator will illuminate in red. In such a case, change the unit ID and reboot the machine.
- [15] SETUP 1 and 2 switches** DIP switches used for system setup.
- **1-1 through 1-4:** Used to set the link group. **§4.6**
  - **1-5:** Used for master/slave selection in a link group. If this unit is used stand-alone, then SW1-5 setting is not necessary. **§4.6**
  - **1-6:** Used to turn on/off external synchronization. The front panel **EXT SYNC** indicator illuminates when in external sync operation. **§4.9**
  - **2-1 through 2-3:** Used to set the sample rate for this unit. **§4.7**
  - **2-4:** Used to enable/disable the restoration of the mic amp module setup when a CB-178 is not connected to the ND-20. See [10], Mic Amp Module.
  - **2-5:** Not used. Set to **OFF**.
  - **2-6:** Used to accept software updates. Usually set to **OFF**.
- [16] SERIAL I/O connector** Used when updating the ND-20's firmware. Usually leave unconnected.
- [17] DC INPUT connector** Used to connect an optional auxiliary power supply unit.
- [18] Auxiliary ground terminal** Auxiliary ground terminal for the power supply circuit. Use this terminal when the proper grounding cannot be made with the AC inlet.
- [19] AC IN connector** Used to connect the AC power supply to the unit. The fuse holder is contained in the AC inlet.

## 2.2 CB-178 Remote Control Unit (Option)

The CB-178 remote control unit is connected to a ND-20 network via the IEEE 1394 interface to control the mic amp modules in real time, to configure or manage the system, and to monitor audio signals.



**[1] Liquid crystal display (LCD)**

This 16-character x 2-line, backlit liquid crystal display is used to show various parameters and system information. When setting a mic amp module's parameters, the LCD indications will correspond to the channel numbers 1–8, displayed above and below the LCD.

**[2] CLIP indicator 1–8 (red)**

Illuminates when a clip occurs on a channel displayed on the LCD.

**[3] No. indicator**

A 7-segment LED for displaying a routing number being monitored or channel group number.

**[4] Level meter**

Shows the selected channel's signal level (display range -60 to 0 dB).

**[5] SETUP key**

Used when setting up the CB-178 and monitoring the entire setup of the system. By pressing **SETUP**, the key's LED starts flashing and the LCD shows the setup menu screen.

**[6] NAME key**

Used when naming units, slots, channels, channel groups, channel assignments, or setup files, etc. (max. 16 characters). Unit, slot, and channel names are stored in the memory in the ND-20.

- [7] GROUP key** Used to gang the mic channels to adjust the overall gain while keeping the level differences between channels. By pressing **GROUP**, its LED flashes, the **No.** indicator shows the current group number, and LCD displays the channel group setup screen. There are four channel groups (0–3) and each group can register up to 24 channels.
- [8] ASSIGN key** By using the assignment function, mic channels can be assigned to the LCD screen to centrally manage various settings. By pressing **ASSIGN**, its LED illuminates and the **No.** indicator shows the current page number (0–9). When the desired page is selected and **ENTER** is pressed, the LCD shows the channel setup screen.
- [9] ROUTING MONITOR key** Used when confirming a module's routing and monitoring each channel's audio signal. By pressing **ROUTING MONITOR**, its LED starts flashing, the **No.** indicator shows the routing number, and the LCD shows the input and output modules having that number. By pressing **ENTER** when this screen is shown, the desired channel's audio signal at the input module side can be monitored on the CB-178. Audio signals of channels that are not routed cannot be monitored.
- [10] PAD key** Used to turn on or off the pad in the mic amp module on a per channel basis.
- [11] +48V key** Used to turn on or off the phantom power output from the mic amp module on a per channel basis.
- [12] LIMITER key** Used to turn on or off the limiter in the mic amp module on a per channel basis.
- [13] GAIN key** Used to change the gain setting of the mic amp module on a per channel basis.
- [14] Arrow keys** Used to switch LCD screens or move the cursor in the screen.
- [15] CANCEL key** Used to return to a previous screen.
- [16] ENTER key** Used to execute the selected operation or to confirm the entered value.
- [17] Rotary encoder** Used to enter various parameter values and switch LCD screens.
- [18] Headphone jack & level knob** Used to listen to the selected channel's audio signal.
- [19] IEEE 1394 S200 PORT connectors 1–3** Interface for connecting the CB-178 to the ND-20 network system. All of the CB-178's three ports are connectors for metal cables.
- [20] Firmware update switch** Used when updating the CB-178's firmware. Usually set to the right position.
- [21] SERIAL I/O connector** Used when updating the CB-178's firmware. Usually left unconnected.

## 3. Installation

### 3.1 Unpacking and Inspection

#### ■ Unpacking

Each ND-20 is carefully packed and shipped to avoid damage during transportation. We recommend that you open the carton carefully and retain the packing materials at least until proper operation of the machine has been established.

#### ■ Visual Inspection

After unpacking, inspect the ND-20 visually. If there is any evidence of damage due to rough handling during shipping, you must notify the transportation carrier and submit a claim. Do not connect or use the ND-20 if damage is found.

#### ■ Checking Standard Accessories

Check that the carton contains the following standard accessories.

ITEM	OTARI P/N	Q'TY	NOTE
Case Foot	CY4176--	4	Pre-installed
Rack Mount Adapter	KZ2Z222-	2	Pre-installed
Fuse (2 A, 250V)	FH9-018-	1	Time lag type
Power Cord	PZ9D003-	1	
Operation Manual*	OS1-126-	1	This booklet

\*One copy per system

### 3.2 Installation of ND-20 Main Unit

#### ■ Location for Installation

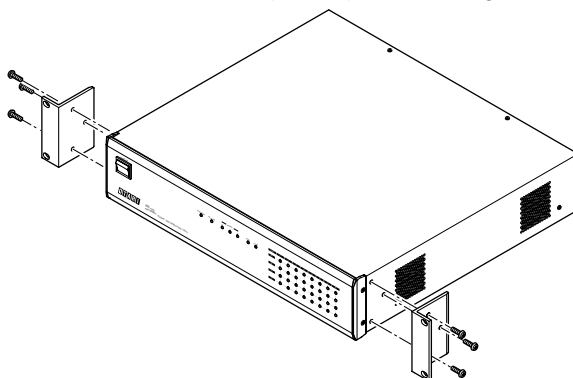
Choose a well ventilated location for installing the ND-20. Do not place the unit in a closed rack or closed boxes. Although the unit is designed to be used in various temperature environments, be sure to place it away from heat sources such as heaters, power amplifiers, etc.

#### NOTES ON OPERATING LOCATION

- Do not cover the cooling fan and ventilation slots of the unit. Be careful not to impede the air flow through the unit.
- To prevent damage or short-circuit of the internal electronic parts, do not install the rack in a place where it would be subject to rain, snow, or spills, etc.
- To prevent overheating, do not expose the unit directly to the sun.
- When installed in a rack, place the rack at a level and stable location.

#### ■ Rack/Flight Case Mounting

When mounting the unit in a rack, remove feet on the bottom panel. Then use the provided rack mount adapters [KZ2A222-] to mount the ND-20 in the rack. When securing the unit, we recommend to insert a plastic washer between the screw and the rack mount adapters to prevent scarring.



#### NOTES

- The rack mount adapters are pre-installed before shipping.
- The ND-20 occupies a 2U rack space.

## 4. Connection and Setup

The ND-20 system will automatically start audio signal transmission by just turning on the system if connections and setup have been properly done. Carefully follow the instructions below when setting up the system for the first time.

### ■ Flow of Setup Procedures

- 1. Analyze audio signal flows in the entire system and calculate the required number of the ND-20's and modules for your system (network topology). List your setup and connections, and proceed to the following steps referring to the list. §4.2**
- 2. Place the ND-20's in the desired locations and connect the power and ground cables. (§§3.2, 4.4)**
- 3. Insert the required modules into the units and connect audio signal cables. Turn off the power to the machine before connecting audio signal cables. §4.1**
- 4. To transmit audio signals between multiple units, connect the units with IEEE1394-1995 based 6-core metal cables or optical fiber cables. Avoid loop connections. §4.2**
- 5. Set a unique unit ID number for each ND-20.**  
When connecting multiple ND-20's to each other, each unit must be identified correctly by a unique ID number. §4.5
- 6. To use multiple sync signals in the system, assign the same link number to the units that will use the same sync signal. To use multiple sample rates in the system, assign the same link number to the units that will operate at the same sample rate.** (The units in the system will be divided into link groups based on the sync signals and sample rates.)  
Audio signals cannot be routed properly between different link groups. Link groups must be carefully set. §4.6
- 7. Choose a unit in each link group to be the sync source and set that unit as a master and other units as slaves.**  
Usually, the units in a link group will operate synchronized to the sync signal supplied from the master unit. §4.6
- 8. Set the sample rate for the link group on the master unit.**  
Since the slave units operate synchronized to the master unit, their sample rate setup is not used. §4.7
- 9. If necessary, change the setting of the sample rate converters on the AES module.**  
The AES module has 8 channels of sample rate converters. The sample rate converter can be applied to the input or output section. §4.7
- 10. According to the system plan, assign a routing number to each module.**  
Routing is done on a per module (8-channel) basis. Apply routing numbers correctly so that the input modules and output modules are connected. Routing between the modules in the same unit is also possible (self routing function).  
Routing cannot be done properly between different link groups. §4.8
- 11. If external sync is necessary, supply a sync signal to the WORD-INPUT connector and turn on external sync by the SETUP switch.**  
By setting the master unit in external sync mode, all of the units in that link group will be put in the same synchronization status. §4.9
- 12. To use a CB-178, connect it to the desired point in the network.**  
The power to the CB-178 is supplied from a ND-20 via an IEEE1394 metal cable. The CB-178 enables operations such as audio signal monitoring and controlling of system setup. §4.3
- 13. Check all of the connections and setup items. If everything is OK, turn on the power to each unit to start operation.**

## 4.1 Inserting and Connecting Modules

**CAUTION!** To prevent damage to the unit, do not insert or disconnect signal modules while the unit is turned on.

### ■ Inserting Modules

The modules can be inserted into any of the slots A–D in the rear panel of the unit. From the bottom slot (D) to upper ones, insert a module so that it aligns to the internal guides, and then secure the two screws on the module (the lower edge of each module panel (or blank panel) should overlap the upper edge of the lower one). When inserting a module which occupies a two-slot space, use the upper two slots A & B or lower two slots C & D (the mic amp module is recognized as inserted in the slot A or C).

**NOTE:** The number of available modules per unit differs according to the sample rate used. If the sample rate is lower than 48 kHz, then all of the four slots of the ND-20 can be used (32 channels). If the sample rate is higher than 48 kHz (i.e., 88.2/96 kHz), only two slots B and D (slots A and C for mic amp module) are available (16 channels).

**CAUTION!** Cooling fans are used for the internal ventilation. To maintain the proper ventilation, attach covers to the empty slots.

### ■ Connecting Analog Audio Signals

There are two types of input module for analog audio signals: mic amp module for microphones and AD module for line level analog signals.

**Mic Amp Module:** Uses XLR type (female) sockets. Pin assignment is pin 1 ground, pin 2 hot, and pin 3 cold. The mic amp module's parameters (gain, pad, limiter, phantom power) are set from the CB-178 remote control unit.



**CAUTION!** The mic amp module can supply +48V phantom power to microphones. Never connect or disconnect microphones while the phantom power is being supplied. Doing so may damage the microphones. Also, supplying phantom power to devices that do not require it may damage them.

**AD Module:** Uses a 25-pin D-sub connector (female) to receive analog audio signals. For connector pin assignment, see the table below.



### ■ Connecting Analog Output Signals

Analog audio signals are supplied from the 25-pin D-sub connector on the DA module. All of the analog audio signals from the DA module are at the line level. For connector pin assignment, refer to the table below.



CH	PIN		
	HOT	COLD	GND
1	24	12	25
2	10	23	11
3	21	9	22
4	7	20	8
5	18	6	19
6	4	17	5
7	15	3	16
8	1	14	2

13 : NC

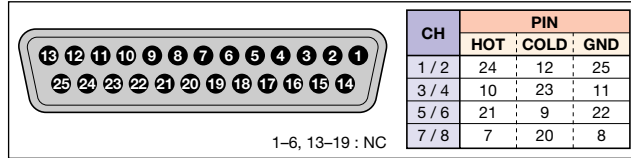
Pin Assignment of Analog Audio Connector

**■ Connection of AES/EBU Digital Signal**

The AES module has eight channels of input and output sections that operate independently and one module can handle eight channels of input and eight channels of output.



Audio signals are interfaced via 25-pin D-sub connectors (female). Connector pin assignment is as follows:



**AES/EBU Digital Signal Connector Pin Assignment**

**NOTES**

- The input section of the AES module is enabled only when its **IN ENBL** switch (SW6) is turned on.
- The input and output sections of the AES module operate independently: it is possible to route signals within the same module (self routing; however, it is disabled if the **DLY CORR** switch (SW7) is turned on).
- The AES module has 8 sample rate converters that can be applied to either of the input or output sections.

**■ Channel Indicator Behavior when AES Module is Enabled**

When the AES module's input section is enabled (SW6 = ON), the front panel channel indicator will show the input side signal if the input section is receiving audio signals. For other cases, the output side signal is indicated.

**■ Channel Status Bits of AES/EBU Signal**

**Input:** Valid bits of channel status bits of the supplied AES/EBU signal will vary according to input signal type. Only the following bits become valid and other bits and user bits become invalid.

**Bits Valid when Input is Type I (Professional)**

- ..... Byte 0: Bits 2-4 (emphasis\*), Bit 5 (lock)
- ..... Byte 1: Bits 0-3 (channel mode)
- ..... Byte 4: Bit 7 (scaling)

**Bits Valid when Input is Type II (Consumer)**

- ..... Byte 0: Bits 2-4 (emphasis\*), Bit 5 (lock)

\* Even if input signals with emphasis turned on are routed to the channels on the DA module, de-emphasis will not take place on the DA module.

**Output:** Main channel status bits of output AES/EBU signal has the following format:

Byte	Bit	Item	Notes
0	0	Type	Type I (Professional)
	1	Audio	Linear PCM sample
	2-4	Emphasis	Same as input (none, 50/15 μs, CCITT)
	5	Lock	Same as input
	6-7	Sample Rate	Same as system clock
1	0-3	Channel Mode	Same as input
2	0-2	AUX Bit	24-bit sample
4	7	Scaling	Same as input
	3-6	Sample Rate	Same as system clock

**NOTES**

- User bits on the AES/EBU interface are not supported.
- Changes in input signal's emphasis will take about 1 second to be reflected in the channel status bits of AES module's output section.

**Notes on Cabling**

- Cables carrying different level signals (mic level and line level, etc.) should be routed keeping more than 3" of space between them.
- Cables carrying different type signals (power supply cables, digital signal cables, video coaxial cables, etc.) should be routed keeping maximum space between them (this is not applicable to the ND-20's optical cables which are immune to external noise).
- When crossing cables carrying different types of signals, be sure to arrange them so that they intersect each other at right angles.

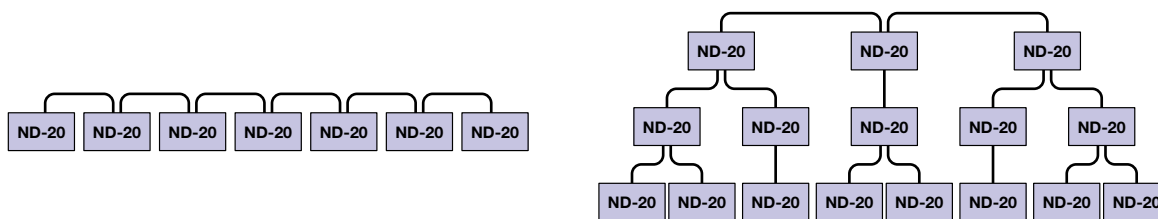
## 4.2 Networking

**CAUTION!** The ND-20's IEEE1394 interface does not support loop connections. If there is a loop connection in the network, the system will not operate correctly.

### ■ Designing Network Topology

The ND-20 has three IEEE 1394 ports as standard to construct an audio signal network by connecting multiple ND-20 units in daisy-chain or tree connection format. Before starting connection, plan your network topology (system connection) considering how the system will be used.

The maximum number of connectable IEEE1394 devices in a system is 63, including ND-20's and a CB-178. However, it is necessary to connect the devices so that the number of cables between the most remote devices in the system is less than 16 (16 hops). The maximum number of channels available in a system is 96 channels (at 48 kHz operation) but the actual number varies based on the system configuration.



Left: Daisy-Chain Connection (max. 17 units), Right: Tree Connection (max. 63 units)

### ■ Connection between ND-20 Units

According to your network topology diagram, connect the ND-20 units by using IEEE 1394 based metal cables or optical fiber cables. The ND-20's IEEE 1394 interface has three ports; the ports 1 and 2 accept metal cables, metal cables or optical cables can be connected to the port 3 as specified by the customer.



- Metal Cable Connection:** Use IEEE1394-1995 based 6-core cables. Since the connectors used support a lock mechanism, if possible, use cables with a lock mechanism to prevent troubles caused by unintentional disconnection. If metal cables with a lock mechanism cannot be obtained locally, contact Otari. IEEE1394-1995 based 6-core metal cables:
  - With lock mechanism, 4.5 meters (PZ9F070-)
  - Standard type, 4.5 meters (PZ9F069-)
- Types of Optical Fibre Cables:** For transmission longer than 4.5 meters, use optical fibre cables (SC type multimode graded index type glass fibers). The left connector (viewed from the rear) of the PORT 3 is for sending and the right connector is for receiving.

**NOTE:** The maximum cable length between adjacent units is 4.5 meters for a metal cable. When optical fiber cables are used, total length for the entire system must not exceed 500 meters. However, the operative total length of optical fiber cables varies according to system construction or application.

### ■ Disconnecting/Connecting Cables when Power is Applied

IEEE 1394 cables can be connected or disconnected when the machine is powered. However, if the system is already in operation, doing so may affect audio signal transmission.

**CAUTION!** A short beep noise may be heard when a signal source is lost by disconnecting a cable during operation.



■ **Power Supply via Metal Cable**

The IEEE1394 interface can send and receive electric power to/from connected devices via metal cables with IEEE1394-1995 based 6-core connectors. By using this feature, the ND-20 system activates the IEEE1394 interface section of a unit whose power switch is not turned on or supplies power to the CB-178 remote control unit.

- **To Receive Power via Metal Cable:** The DC voltage at the source should not exceed 40 Volts.
- **To Send Power to Other Nodes via Metal Cable:** The sum of supplied power should not exceed 15 Watts. Available voltage is 20 Volts.  
If multiple ND-20's are connected via the metal cables and if the number of turned-on units is insufficient to activate the unpowered units' IEEE1394 interface sections or the CB-178, the **POWER** indicator of the turned-on unit will illuminate in orange. In such a case, turn on the power to the other units. We recommend to turn on at least one unit for every three connected units.  
If the CB-178 is used, it is recommended to turn on the ND-20 unit to which the CB-178 is directly connected.

**NOTE:** An IEEE1394 interface section activated by the power supplied via the bus consumes max. 2 Watts. The CB-178 consumes max. 12 Watts of power.

■ **Optical Fiber Cable**

When connecting the ND-20 units with optical fiber cables, multimode graded index type glass fiber cables having 50- or 62.5-µm fiber diameter and with SC type connectors at both ends should be used.

**CAUTION!** Do not bend optical fiber cables forcibly or do not apply strong mechanical shock to them; cables may be broken.

**NOTE:** The maximum transmission distance via optical fiber cables is 500 meters for the entire system. However, the number of available hops will decrease as the transmission distance increases.

■ **If synchronization of the units connected with optical fiber cables is lost...**

And if it is impossible to transmit data correctly between the units connected with optical fiber cables, reconnect the optical fiber cables. If doing this cannot solve the problem, reboot the problematic unit. If the unit will not start up correctly, reboot other units one by one to check the operation.

**NOTE:** Characteristics of the cable can affect the performance of the system. Otari does not warranty performance when using cables that are not approved by Otari to be used with the ND-20 system.

### 4.3 Connecting CB-178

The CB-178 is connected to a ND-20 network by using a metal cable for IEEE 1394 interface. When connecting refer to your network topology diagram. Since the power to the CB-178 is supplied from the ND-20 main unit via the metal cable, no other connection is required.



**CAUTION!**

- To supply power to the CB-178, be sure to turn on the ND-20 to which the CB-178 is connected directly.
- It is impossible to connect multiple CB-178's to a network system. Confirm that only one CB-178 exists in the network.

**NOTE:** The maximum number of IEEE1394 devices that can be connected within a system is 63, including the ND-20's and a CB-178. The number of the cables between the most remote devices in the system must be less than 16 (16 hops).

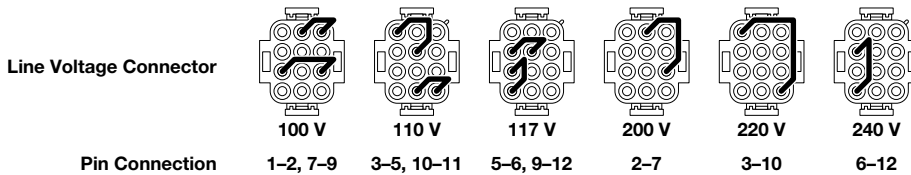
## 4.4 Connecting AC Power and Grounding

### ■ AC Power Connection

A serial number label is attached on the top cover. Confirm that voltage and frequency of your power supply are the same as those indicated in the serial number label. With the supplied power cord, connect the **AC IN** connector to an appropriate AC power outlet. If the power supply voltage setting of the ND-20 differs from the AC voltage of the facility, it is necessary to change the power voltage setting of the ND-20.

### ■ Changing AC Power Supply Voltage

If it is necessary to change the ND-20's power supply voltage setup, remove the top cover, and replace the line voltage connector attached to the power transformer with a proper one. For line voltage connectors, contact Otari. If the line voltage setting is changed, put a note near the **AC IN** connector to prevent supplying improper voltage.



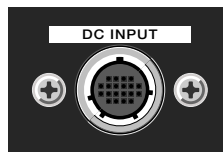
### ■ Grounding

The ND-20 has an auxiliary ground terminal for the power supply circuit. If no ground terminal exists on the AC mains, use the ground terminal for grounding. Confirm that lightning protection equipment is used in the power supply system of your facility. Also, we recommend to use a noise filter in the AC mains which is used to provide AC power to the ND-20, in order to prevent the ND-20 internal circuit from being damaged by AC line noise, high voltage spikes, surges, and "brown outs".

**CAUTION!** If the machine is not properly grounded, a high voltage may appear on the chassis if a short circuit should occur.

### ■ Operation with Auxiliary Power Supply Unit

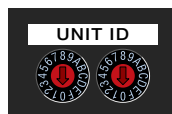
By adding the optional auxiliary power supply unit, the ND-20 operates on a dual power supply system. With the dual power supply circuits, the ND-20 can operate continuously even if one of the power supply systems fails. Use the power supply cable provided with the auxiliary power supply unit, and connect the **DC OUTPUT** connector on the auxiliary power supply unit to the **DC INPUT** connector on the ND-20. The connectors on the power supply cables are equipped with lock mechanisms. When connecting or disconnecting the cables, pull the lock ring to release the lock mechanism.



**NOTE:** The ND-20 can operate only with the DC power supply connected to the **DC INPUT** connector.

## 4.5 Setting Unit ID Number

To construct an audio signal network by connecting multiple ND-20's, each unit must have a unique unit ID number by setting the rear panel **UNIT ID** switch (00-FF, 256 ways). If there are duplicated unit ID numbers, the **ALARM** indicator and channel indicator illuminate in red. In such a case, re-set the unit ID and reboot the unit.



**NOTE:** The **UNIT ID** switch's setting is read when powering up only. If it is changed during operation, reboot the unit.

## 4.6 Configuring Link Groups

A link group is a group of ND-20's that use the same sync signal in a system. If the entire network uses the same sync signal, then there is only one link group. To use different sync signals or multiple sample rates in the network, units in the network must be divided into different link groups.

**CAUTION!** Routing should be within a link group. Input and output modules in different link groups can be connected if the routing number is the same. However noises can be heard if the link groups are not operating with the identical sync signal.

**NOTE:** By using the AES module's sample rate converter (SRC), it is possible to convert signals having different sample rates to have the sample rate used by the system, or to convert them to have another sample rate when they are output. In this case, link groups do not have to be divided.

### ■ Link Group Setting

A network can have up to 16 link groups (0-15) by setting the **SETUP 1-1-1-4** switches. Set the same number (0-15) for the units to be operated at the same sample rate.

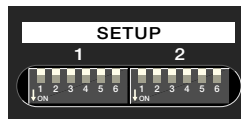
SW1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
-1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON
-2	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON
-3	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON
-4	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON

### ■ Selection of Master/Slave

After setting link groups, set the **SETUP 1-5** switch on each unit so that one of the units in each group is set to operate as the master (**SW1-5 ON**) and other units as the slaves (**SW1-5 OFF**). If the ND-20 is used alone, this setting can be neglected.

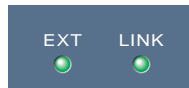
**NOTE:** If there are multiple units being set to operate as a master in a link group, one of such units will operate as the master and other units will operate as slaves. In this case, the **LINK** indicator on the units operating as slaves flashes rapidly.

To attain an external synchronization, if the unit to which the external signal is supplied is set to operate as the link group master, the slave units belonging to that link group will operate synchronized to the external sync signal supplied to the master unit (**\$4.9**).



### ■ Display of LINK Indicator

Synchronization status of a link group is shown by the **LINK** indicator on the each unit. On the units (master/slaves) that are synchronizing with other units based on the link group setup, the **LINK** indicator illuminates. At this time, the **LINK** indicator on the slave units that cannot attain synchronization will flash rapidly. On the units which have no synchronization relationship between other units, the **LINK** indicator flashes slowly. If the ND-20 is used alone (one ND-20 in the network) the **LINK** indicator goes off.



**NOTE:** During external sync operation, the synchronization status of the ND-20 is shown by the **EXT** indicator. If there is a problem in external synchronization, the ND-20 will automatically switch to the operation using the internal clock signal and flash the **EXT** indicator. However, if the master unit is in external synchronization (or D-I Sync) but the slave units are not receiving the external sync signal, the slave unit's **EXT** indicator will not illuminate, but when they attain synchronization to the clock from master unit, their **LINK** indicator will illuminate.

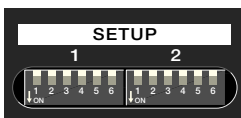
## 4.7 Setting Sample Rate

### ■ Sample Rate Setting on ND-20

Sample rate setting is done on a per unit basis. Set the **SETUP 2-1–2-3** switches to select the desired frequency as listed below.

Frequency (kHz)	48	44.1	32	96	88.2
SW2-1	OFF	ON	OFF	OFF	ON
SW2-2	OFF	OFF	ON	OFF	OFF
SW2-3	OFF	OFF	OFF	ON	ON

**NOTE:** Sample rate change within 32–48 kHz (Low Fs) or 88.2–96 kHz (High Fs) can be done while the power is supplied to the machine. However, when the setting is changed between Low Fs and High Fs, the sample rate will not be switched until the unit is rebooted.



### ■ Setups for Networking

To connect multiple ND-20 units to the network, they must belong to link groups (**\$4.6**). Every link group consists of a master and slaves; in the units being set to operate as a slave, their sample rate setting is disabled, and they automatically operate at the sample rate at which the master unit is operating. Even if slaves lose the master (for example, the master unit is turned off), their sample rate setting is not changed (i.e., the master setting is used). Sample rate is re-set when the slave unit is rebooted or the master unit resumes operation.

**NOTE:** To use multiple sample rates in a system, the units to operate at the same sample rate should be set to the same link group.

### ■ How to Use Sample Rate Converter

The AES module has eight channels of sample rate converters (SRC). The SRC's operation setup is selected by the **SRC** switch on the AES module.

- **SRC's Operation Selection:** The SRC is applied to either of the AES module's input or output section by setting the **SRC–WRD/SYS** switch.

**Applying SRC to Input:** Set the **SRC–WRD/SYS** switch to **SYS**. When the SRC is turned on, input signals are converted to have the same sample rate as that of the ND-20.

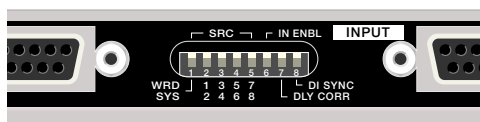
**Applying SRC to Output:** Set the **SRC–WRD/SYS** switch to **WRD** and connect the word clock signal of the frequency to be converted to the module's **WRD IN** connector. When the SRC is turned on, output signals are converted to have the same sample rate as that of the external word clock signal fed into the **WRD IN** connector and synchronized to that signal.

**CAUTION!** If the SRC is applied to the output section, the D-I Sync function cannot be used at the same time. When setting the **WRD/SYS** switch to **WRD**, turn off the D-I Sync function, or when using the D-I Sync function, set the **WRD/SYS** switch to **SYS**.

- **Turning On/Off SRC:** The SRC is turned on/off on an AES/EBU channel pair basis. To use SRC, set the switches **SRC–1/2, 3/4, 5/6, and 7/8** to **ON**.

**CAUTION!** If the SRC is set to be applied to the output section, inputs to channels (stereo pair) whose SRC is turned on cannot be used.

- **Delay Correction Setting:** If a SRC is turned on or off during operation, it is usually impossible to attain phase synchronization between channels whose SRC's have been newly set to on (off) and channels whose SRC's are already off (on). To attain phase synchronization between the channels whose SRC setting is the same, set the module's **DLY CORR** switch to **ON**. By doing this, the delay amount difference is corrected so that signals of channels having the same SRC setting will be output in phase. However, if the SRC setup of the channel whose **DLY CORR** switch is set to **ON** is changed, channels having the same SRC setup as that channel are muted for a moment.

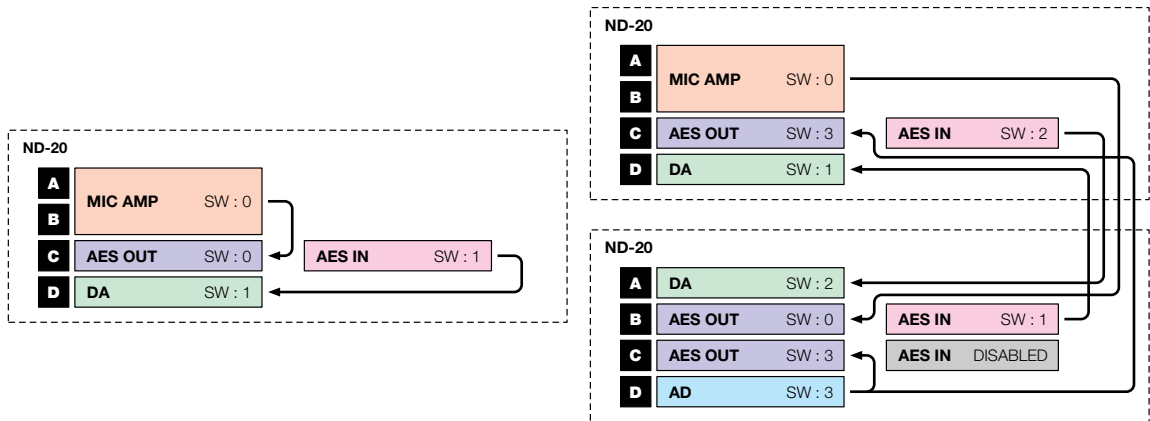


## 4.8 Signal Routing

The ND-20's modules are classified into input modules (mic amp, AD, AES (input side)) and output modules (DA, AES (output side)). Signal routing here means connecting input module's signals to output modules. Any input and output modules in the system can be connected together by assigning routing numbers to the modules by using rotary switches.

**CAUTION!** To route signals, the related units must belong to the same link group. Routing between different link groups that are operating at different sample rates can produce noise.

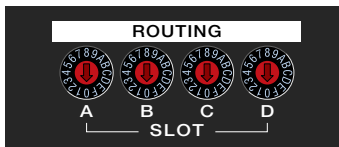
**NOTE:** Routing within one ND-20 unit is called "self routing". By using this function, the ND-20 can be used as a stand alone A/D or D/A converter. It is also possible to send input signals to other units while monitoring the signals on the unit.



Examples of Routing Setup (Left = Stand-Alone Use, Right = Network Use)

### Routing Setup

Routing is done by setting a routing number for each module. The **ROUTING A-D** switches on the rear panel correspond to the module slots A-D. Apply the same routing number to the input and output modules to be connected together. It is possible to route one input module to multiple output modules. However, do not set multiple input modules to the same routing number.



**NOTE:** The **ROUTING** switch setting can be changed during operation. The **ROUTING** switch for an empty slot can be set to any number.

**CAUTION!** If multiple input modules are wrongly set to the same routing number, the ND-20 will send only the signals of any one module to the output modules having that routing number; other modules' signals will not be output. In such a case, the channel indicators for the input modules whose signals are not output will illuminate sequentially to show that there is an error in the routing setup.

### Routing Setup on AES Module

The AES module has the input and output sections that operate independently. The input section's routing number is set by the **ROUTING** switch on the ND-20 rear panel. The output section's routing number is set by the **ROUTING** switch on the AES module.



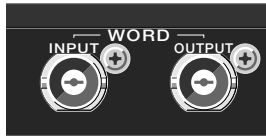
## 4.9 External Synchronization Settings

The term “external synchronization” means to operate the ND-20 synchronized to a word clock signal supplied from an external source; the ND-20’s sample rate is switched to the frequency of the external word clock signal.

**NOTE:** By synchronizing a link group’s master unit to an external signal, all of the other units belonging to that link group will synchronize to that signal. Also, since the on/off status of external synchronization has a priority over the link group’s master/slave selection, multiple units can be put in external synchronization status by supplying the same word clock signal (house sync, etc.) to all of them.

### ■ When Using External Synchronization

Connect external signal to the **WORD-INPUT** connector on the rear panel of the unit and set the **SETUP 1-6** switch to **ON**.



**NOTE:** The **OUTPUT** connector is used to output the clock signal currently used in the ND-20. Thus, it cannot be used as a “through output” connector.

### ■ Display of EXT Indicator

The ND-20’s external synchronization status (and sync status by D-I Sync function) is shown by the **EXT** indicator. When the ND-20 is synchronized to an external signal (or input signal), the **EXT** indicator illuminates steadily. The **EXT** indicator flashes when it is impossible to attain external synchronization or no valid signal is received.

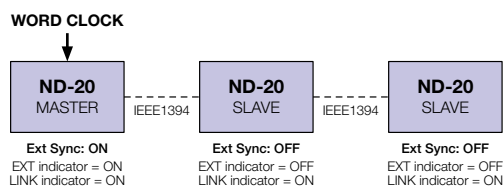


### NOTES

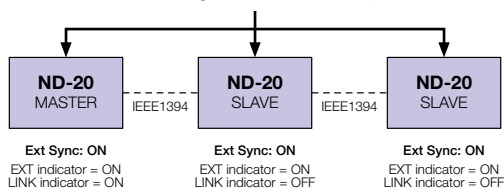
- If there is a problem in external synchronization (the **EXT** indicator is flashing), the ND-20 will automatically switch the operation to the internal clock signal.
- If the external synchronization signal is being fed to the master unit only, slave units in the link group will operate with the synchronization signal fed via the IEEE 1394 interface. In this case, on the slave unit, the **LINK** indicator illuminates.
- In D-I Sync mode, if there is no valid input signal, the **LINK** indicator illuminates.

■ Examples of External Sync Setup

- **Sync Signal Feed to Master Unit:** By feeding an external word clock to the master unit of the link group and turning on the external sync function, all of the units that belong to the same link group will synchronize with that external signal.



- **Ext Signal Feed to All Units:** It is possible to synchronize the entire system to an external word clock (house sync, etc.), by feeding it to all of the units in the link group and turning on the external sync function.



■ AES Module's D-I Sync Function

The D-I Sync function can use a word clock signal extracted from the supplied audio signal as the sync source. By setting the **DI SYNC** switch on the AES module to **ON**, the ND-20 unit scans the status of the AES module's inputs and operates synchronized to the valid input signal to which the unit can attain lock first. If this input becomes invalid, then the unit scans the inputs again.

**TIPS—To use D-I Sync mode only to the signals fed to the desired channels:** While the D-I Sync function is activated, supply AES signals only to the desired channels. After confirming that the **EXT** indicator is illuminated, then supply signals to other channels.

**CAUTION!** The D-I Sync function and applying of SRC to the output section (setting the **WRD/SYS** switch to **WRD**) cannot be used at the same time. When setting the **WRD/SYS** switch to **WRD**, turn off D-I Sync mode; when using D-I Sync mode, set the **WRD/SYS** switch to **SYS**.

**NOTES**

- The front panel **EXT** indicator illuminates during D-I Sync operation.
- If the unit's external synchronization is activated, the D-I Sync function is disabled.
- The D-I Sync function is enabled on the units being set to operate as link group slaves.

## 5. Operations on ND-20 Main Unit

### 5.1 Powering Up and Starting Operation

#### ■ Turning On/Off the Power

If connections and configurations have been properly made, the ND-20 system will start up by turning on the power by pressing the upper half of the **POWER** switch on the front panel of the ND-20. To turn off the power, press the lower half of the switch.

When the power is applied, the unit checks the setting of the whole system such as connection status, module status, switch settings, etc. (It will take several minutes per unit.) If this self diagnosis process is completed with no errors, the unit (whole system) starts signal transmission according to the setup information.

The ND-20 system can transmit signals between the units at both ends of the network even when units placed in the middle of it are not turned on. Only the IEEE1394 interface section operates by the power supplied via the metal cable. However, if there are not enough powered units in the network, it may not be operative (§4.2).

**NOTE:** Usually, mic amp module settings are done on the CB-178 (the information is stored in the ND-20's memory). If the CB-178 is not used, set the ND-20 rear panel **SETUP 2-4** switch to **ON**. This enables automatic recall of the mic amp module setup when powering up. If a CB-178 is connected, recalling of setup is done on it.

#### ■ Indications during Operation

When the system is running, the ND-20's front panel indicators work as follows:

- **POWER Indicator:** Illuminates in green when all of the internal power supplies are operating properly. It illuminates in orange when any of them is out of order or the number of units turned on may not be enough to activate the unpowered units' IEEE 1394 interface sections or the CB-178.
- **ALARM Indicator:** Flashes when there is an incorrect system setup or a system failure is detected. Each time an error is detected, it flashes for several seconds, and frequency of flashing becomes higher as error frequency becomes higher. It may flash rapidly at the time when an IEEE 1394 cable is disconnected and reconnected. When the system is working in order, the **ALARM** indicator goes off.  
**NOTE:** If the **ALARM** indicator will not stop flashing more than several minutes after powering on, there must be errors in the system. Check the setup and connection. If this indicator continues flashing rapidly, there may be an error in the IEEE1394 bus.
- **PORT Indicator:** Illuminates when the corresponding IEEE 1394 port is used.
- **EXT Indicator:** Illuminates when the unit is in external sync status or D-I Sync mode and flashes if there is a problem in sync operation. It goes off when external synchronization is not in use.
- **LINK Indicator:** Illuminates when the unit is synchronized to its internal clock or a sync signal received via the IEEE 1394 interface. If there is no unit to synchronize with, it flashes slowly; if there is only one ND-20 in the network, it goes off. Also, if there is an error in the link group setup, it flashes rapidly.
- **Channel Indicator:** Shows each channel's signal level with color gradation of green to red. When a clip occurs it illuminates in red for 0.5 s (when the CB-178 is used, clip indication must be cleared manually). For a mic amp module, indicators for slot A or C show signal level and indicators for slot B or D show on/off status of phantom power. If multiple input modules are wrongly set to the same routing number, the ND-20 will send signals of one of those modules to the destination of the routing; signals of other input module having the same routing number will not appear at output. In such a case, the channel indicators for those input modules will illuminate sequentially to show that there is an error in the routing setup.

#### ■ Signal Delay

The ND-20 digitally processes all of the audio signals supplied. So, by sending signals through the ND-20, a signal delay is developed. Note that the amount of signal delay varies according to modules used and system configuration.

- **Self Routing:** If self routing is done in a unit, the delay between the input and output signals is about several samples.
- **Networking:** Delay amount of the signal transmitted via the network will vary according to the number of units, but the IEEE 1394 standard strictly manages the input/output timing of signals, and controls the output timing from each device based on the delay between the devices which take the longest time for transmission. Therefore, even if a signal is routed to multiple destinations, transmitted signals will appear at the output of all of the modules at the same time.



## 5.2 Errors Shown on ND-20

The **ALARM** indicator flashes when there is an incorrect system setup or a system failure is detected. Each time any of the following errors is detected, it flashes for several seconds, and frequency of flashing becomes higher as error frequency becomes higher.

- **Error or Slip of AES Module's Input Signal:** Check the connection of the AES/EBU input signal cables. Also, check that the ND-20 is synchronized to the actual input signal. Use the SRC if asynchronous AES/EBU signals should be fed to the ND-20.
- **DA Converter Power Down Error:** If there is a problem in the clock signal being supplied to the DA module, the D/A converter switches to power down mode and mutes audio signals. When the clock resumes to the normal status, muting of audio signal is automatically cleared.
- **IEEE1394 Serial Bus/Port Error:** The link master unit's operation clock setting is changed or IEEE1394 cable is disconnected and then reconnected, or the IEEE1394 bus/port may become out of order temporary. For stable operation, avoid changing connection or setup during operation.
- **IEEE1394 Audio Data Error:** If a routing setup is changed or routing destination devices are lost by disconnecting an IEEE1394 cable, a part of audio data transmission may become erroneous temporary. For stable operation, avoid changing connection or setup during operation.  
**NOTE:** The **ALARM** indicator may flash rapidly when an IEEE1394 cable is disconnected and then connected again.
- **Other Errors:** If a device is damaged or out of order, the **ALARM** indicator may flash. If removing the cause of error and re-booting the system will not put the system in order, please contact Otari.  
**NOTE:** If units having the same unit ID are detected in the network, the **ALARM** indicator illuminates steadily. Also, if there is an error in the clock's synchronization setup and the synchronization is not properly attained, the **LINK** and **EXT** indicators flashes.

## 5.3 Troubleshooting

### ■ No Sound Appears at Output...

- **Are IEEE1394 cables connected correctly?** Check network connection (IEEE1394 cables).
- **Is there a loop connection in the network?** The IEEE1394 interface of the ND-20 does not support loop connections. Check the connection of the network and check if there is a loop connection.
- **Was routing done correctly?** Audio signals will not be output unless routing is properly done. Check that routing numbers are set properly.

### ■ Sound Quality Problems...

- **Is there any routing between different link groups?** It is impossible to transfer correct audio signals between link groups with different sync signals. Routing must be done within a link group.
- **Is the link slave unit's EXT indicator illuminated?** Turn off the slave unit's external sync setting and the D-I Sync function. If it is necessary to operate the slave units in external sync mode, supply the sync signal that has the same sample rate as the link master unit and enable the external synchronization.
- **Is the external synchronization activated by using a sync signal whose frequency is different from the sample rate used by the AES module?** To convert the sample rate of a digital input signal to different rate, use the SRC.

## 6. Operations on CB-178 Remote Control Unit

### ■ Mic Amp Module Related Functions

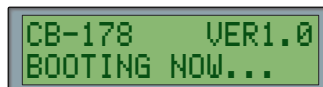
- **Module Setup:** Gain adjustment, pad on/off, limiter on/off, and phantom power on/off.
- **Central Control of Mic Channels:** Frequently used mic channels can be registered in an LCD screen for instant recalling and adjustment.
- **Grouping of Mic Channels:** Desired mic channels can be ganged to adjust the gain as a group.
- **Clip Monitoring:** The CB-178 can monitor clipping in the mic channels and notify occurrence of a clip by the LCD screen and indicator.
- **Audio Signal Monitoring:** Audio signals in all of the routed channels in the system can be monitored with the level meter and headphones.

### ■ System Setup and Monitor Functions

- **Confirmation of Routing Setup:** Routing setup in the system can be shown in the LCD and the routed audio signals can be heard on a per channel basis.
- **Confirmation of Unit Setup:** Setups of unit ID, sample rate, link group, etc. and information about module configuration can be shown in the LCD.
- **Confirmation of Link Groups:** Information about link group master and slave units and sync signal can be shown in the LCD.
- **Channel Monitoring:** Any channel' setup can be monitored by specifying the unit ID, slot, and channel number.
- **Confirmation of Reference Level of Analog I/O Modules:** Reference levels of AD, DA, and mic amp modules can be shown in the LCD.
- **Selection of Mic Channel Clip Indication**
- **Setup Protection:** The operations on the CB-178 can be locked out to prevent unauthorized changes to the system setup.
- **Storing/Recalling of Setups:** Assignment and group setups can be stored in the memory for later recalling.
- **Initialization and Recall of Setup:** Mic channel setup can be reset to the initial values or reverted to the values stored in the memory.
- **Naming Function:** Units, slots, channels, channel assignments, channel groups, and setup files can be named.

### ■ Boot-up Display

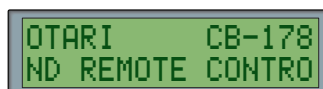
By turning on the power to an ND-20 with the CB-178 connected to the network, the CB-178 is also powered up (or by connecting the CB-178 to an operating network, the CB-178 is powered). When the power is applied, the CB-178 shows the following screen and runs a self diagnosis. When completed, it flashes all of the indicators and gathers system information via the network.



The lower line of the screen shows the following operating statuses:

Display	Status
BOOTING NOW...	Diagnosing hardware.
SCANNING PORTS...	Scanning IEEE 1394 interface.
GETTING GROUP...	Gathering system information via network.
STARTUP DONE!!	Start-up process completed.

When the system has been started up correctly, the indicators stop flashing and the LCD shows the following screen.



The lower line of the screen scrolls ND REMOTE CONTROL UNIT from right to left.

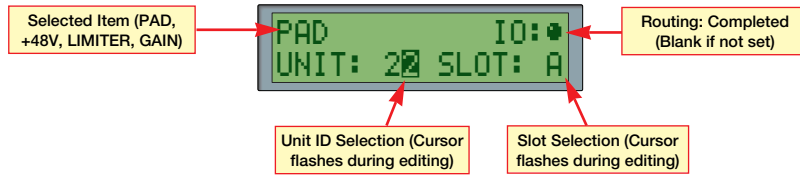
**CAUTION!** If the initial screen is not indicated and indicators do not stop flashing more than several minutes after turning on the power, check system setups and connections.

## 6.1 Setting Mic Amp Modules

The settings of the mic amp modules can be performed only from the CB-178 remote control unit.

**1. Press PAD, +48V, LIMITER, or GAIN to show the module select screen.**

The pressed key's LED starts flashing and a screen to select the mic amp module (unit/slot) is displayed.



Module Select Screen (when PAD is selected)

If a module is not selected, pressing any of the above keys will show the module select screen first. The setup item is shown on the left side of the upper line of the screen.

**2. Turn the encoder to select the desired unit and slot numbers. Then select the mic amp module to be operated from the CB-178 and press ENTER or flashing setup key.**

Selecting a unit and pressing **ENTER** will move the cursor to the slot field. Pressing **ENTER** after selecting a slot causes the LCD to show the selected item's setup screen.

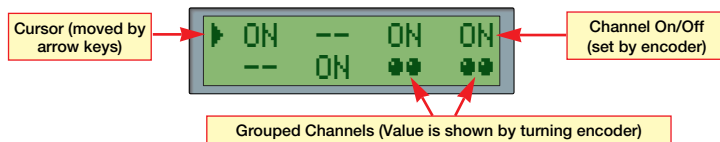
Slots without the mic amp module inserted cannot be selected.

**NOTE:** When **PAD, +48V, LIMITER, or GAIN** is pressed from the initial screen, the **No.** indicator shows the module's routing number. If the setup screen is shown from the **ASSIGN** or **GROUP** screen, the **No.** indicator shows the assignment or group number.

**3. Select a channel by pressing the left/right arrow key and set the desired parameter value by turning the encoder.**

The selected channel's audio signal appears at the level meter and headphones. Changes being made are reflected to the unit in real time.

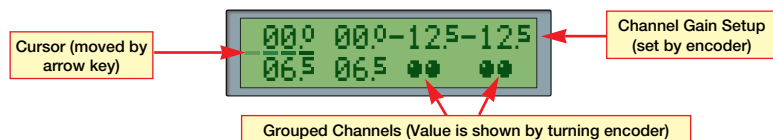
• **PAD:** Used to turn on/off the pad amplifier according to the signal level of the microphone used for the channel. When on, a -25 dB pad is inserted in the input.



• **+48V:** Used to turn on/off the phantom power on a per channel basis. This should be set correctly according to microphones used because improper setting can damage microphones. The setup screen is the same as that of PAD.

• **LIMITER:** Used to turn on/off the input limiter on a per channel basis. When on, the limiter will operate to signals that exceed the threshold. The setup screen is the same as that of PAD.

• **GAIN:** Used to adjust each channel's gain in 0.5 dB steps. Adjustable range is from 13.0 dB to 62.0 dB (from -12.0 dB to 37.0 dB when the pad is on).



Channels registered to the group are marked with "●●" and their settings cannot be changed. By turning the rotary encoder after moving the cursor to such a channel, the setup value is indicated for a while.

Pressing the illuminated setup key will revert to the previous screen.

**NOTE:** When editing an setup item, pressing any other setup key (**PAD, +48V, LIMITER, GAIN**) causes the LCD to show the selected item's setup screen. It is not necessary to select the module again.

**4. To return to the initial screen, press CANCEL.**

## 6.2 Using Channel Assignment Function

The assignment function allows assigning mic input channels to an LCD screen for central controlling. The assignment function has 10 pages (0–9) of the assignment screen and one page can register up to 8 channels.

### ■ Registering Channels to Assignment Screen

**1. Press ASSIGN.**

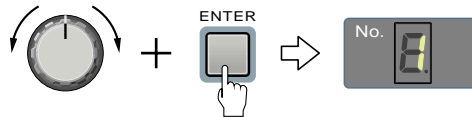
The **ASSIGN** key's LED lights and the **No.** indicator flashes the page number.



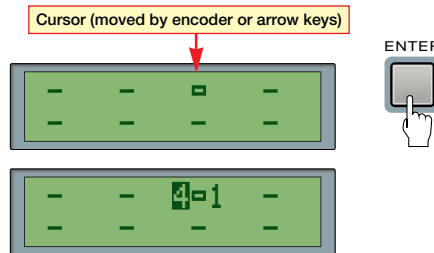
To return to the initial screen, press **ASSIGN** or **CANCEL**.

**2. Turn the rotary encoder to show the desired page number in the No. indicator and press ENTER.**

The assignment screen has 10 pages (pages 0–9).



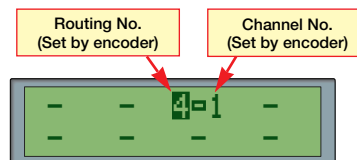
**3. By using the rotary encoder or L/R arrow keys, move the cursor to the desired position in the screen and press ENTER.**



A routing number in which the mic amp module exists is displayed on the left side of the cursor. A channel number (1 by default) is displayed on the right side of the cursor. Pressing **CANCEL** returns the CB-178 to the status for selecting page number.

**4. Select the desired routing number and channel. Press ENTER to store the setting.**

Each page can register up to 8 channels. The cursor for routing and channel numbers can be moved by the left/right arrow key. The selected channel's audio signal are fed to the level meter and headphones.



Pressing **CANCEL** will return the screen for selecting a registration position.

**5. Repeat steps 3 and 4 until all of the desired channels have been registered.**

Pressing the illuminated setup key or **CANCEL** returns the previous screen.

**CAUTION!** The same channel cannot be registered repeatedly in the same page.

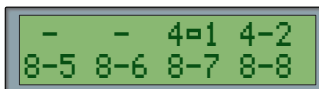
■ **Recalling an Assigned Channel:** To recall a channel from the assignment screen:

1. Press **ASSIGN**. Turn the rotary encoder to show the desired page number in the **No.** indicator and press **ENTER**.

The assignment screen has 10 pages (pages 0–9).

To return to the initial screen, press **ASSIGN** or **CANCEL**.

2. Turn the rotary encoder to select a channel to operate.

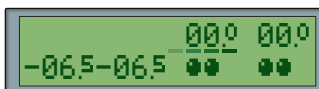


3. Press the mic channel setup keys (**PAD**, **+48V**, **LIMITER**, **GAIN**) to set the desired parameters for the channel.

The **ASSIGN** key's LED flashes and the mic channel setup keys illuminate. The LCD shows the setup screen for assigned members.



Example of Setup Screen for Pad, Phantom Power, and Limiter



Example of Setup Screen for Gain

Channels registered to the group are marked with "●●" and their settings cannot be changed. By turning the rotary encoder after moving the cursor to such a channel, the setup value is indicated for a while.

Press the illuminated setup key or **CANCEL** to return to the previous screen.

■ **Deleting Registered Channels**

To delete registered channels from a page, perform either of the following steps:

- **To delete a single channel:** Select the desired channel in the member registration screen for each page, then press **CANCEL** and **ENTER** simultaneously. A confirmation screen is displayed; press **ENTER** to execute delete or press **CANCEL** to cancel the operation.
- **To delete a whole page:** In page number selecting status (**No.** indicator is flashing), press **CANCEL** and **ENTER** simultaneously. A confirmation screen is displayed; press **ENTER** to execute delete or press **CANCEL** to cancel the operation.

## 6.3 Grouping Mic Input Channels

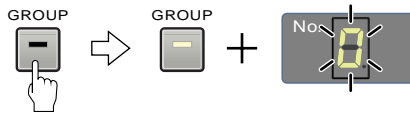
By grouping two or more mic input channels, the group's gain can be adjusted while maintaining the gain balance among the member channels. The ND-20 can have up to four channel groups and a maximum of 24 channels can be contained in each channel group.

### ■ Making a Channel Group

**CAUTION!** Each channel's gain should be set before making a channel group. Once a channel is registered to the group, the channel's gain setting cannot be changed individually, in order to maintain the gain balance within the group.

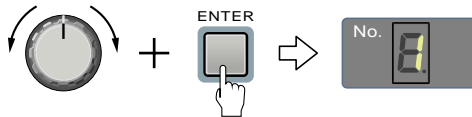
#### 1. Press GROUP.

The **GROUP** key's LED illuminates and the **No.** indicator flashes the group number. The LCD shows the members (channels) currently registered in that group.



To return to the initial screen, press **GROUP** or **CANCEL**.

#### 2. Turn the rotary encoder to indicate the desired group number in the No. indicator and press ENTER.

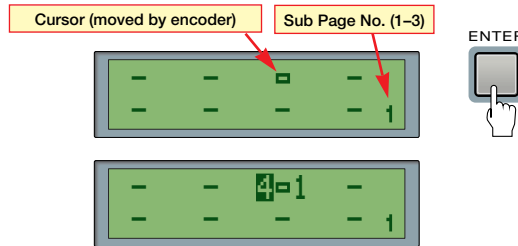


Four groups (0–3) are available. Since each group has three sub pages, one group can register up to 24 channels.

By pressing the arrow keys when the **No.** indicator is flashing, the sub pages (1–3) can be selected.

#### 3. Turn the rotary encoder to move the cursor to the desired position in the screen and press ENTER.

The cursor can also be moved by the left/right arrow key. When the cursor exceeds the page border, the screen switches to the next or previous sub page.

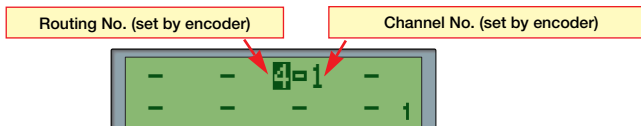


By pressing **ENTER** after placing the cursor at the desired position, a routing number in which the mic amp module exists is displayed on the left side of the cursor and a channel number (1, by default) is displayed on the right side of the cursor.

Pressing **CANCEL** returns the CB-178 to the status for selecting group number.

#### 4. Select the desired routing number and channel and press ENTER to store that channel in the group.

The cursor for routing and channel numbers can be moved by the left/right arrow key. The audio signal of the selected channel will be output to the level meter and headphones jack on the CB-178.



Pressing **CANCEL** returns the CB-178 to the status for selecting cursor position.

5. Repeat Steps 2–4 until all of the desired channels are registered in the group. One group can register up to 24 channels (8 channels x 3 sub pages).

**CAUTION!** The same channel cannot be registered repeatedly in the same page. Also, channels once registered to a group cannot be registered to another group if they are not deleted from the previous group.

#### ■ Deleting Channels from a Group

Perform either of the following steps.

- **To delete a single channel:** Select the desired channel in the group's member registration screen and press **CANCEL** and **ENTER** simultaneously. A confirmation screen is displayed; press **ENTER** to execute the delete operation or press **CANCEL** to cancel the operation.
- **To empty a sub page:** In the sub page selecting status (**No.** indicator is lit and no member is selected), press **CANCEL** and **ENTER** simultaneously. A confirmation screen is displayed; press **ENTER** to execute the delete operation or press **CANCEL** to cancel the operation.

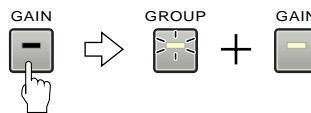
#### ■ Gain Adjustment for Group

1. Press **GROUP**. Turn the rotary encoder to indicate the desired group number in the **No.** indicator and press **ENTER**.

To return to the initial screen, press **GROUP** or **CANCEL**.

2. Press **GAIN**.

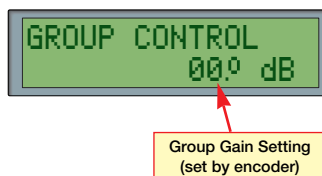
The **GROUP** key's LED flashes, the **GAIN** key's LED illuminates, and the LCD shows the **GROUP CONTROL** screen.



3. Turn the rotary encoder to adjust the group's gain.

If this is the first time to show the **GROUP CONTROL** screen after powering on, the gain value has been set to 00.0 dB.

By adjusting the gain value in this screen, gains of the channels in this group are changed simultaneously.



If the gain of a channel in the group reaches the upper or lower limit of the adjustable range, the LCD shows "OUT OF RANGE" and no further adjustment can be done.

To return to the previous screen, pressing either of the **CANCEL**, **GAIN**, or **GROUP** key.

#### ■ Gain Setting in GROUP CONTROL Screen

The gain adjusted in the **GROUP CONTROL** screen will be added to the individual gain settings of the members. After setting the group's gain, doing either of the following operations will reset the **GROUP CONTROL** screen's gain indication to zero.

- Changing members of the group
- Changing individual gain setting of registered members

**NOTE:** The ND-20's grouping function is provided to adjust gain of a group of channels while keeping the differences in each channel's gain value. This function is not the same as keeping the perceived gain balance between the channels.

■ **Changing Channel Gain in the Group**

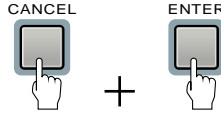
To individually adjust the gain of the channels included in a group...

1. Indicate the desired group's GROUP CONTROL screen.



2. Press **ENTER** and **CANCEL** simultaneously.

A confirmation screen is displayed.



3. To set the gain individually, press **ENTER**.

Press **CANCEL** to abort the operation.

When **ENTER** is pressed, gain settings of the group members are displayed.

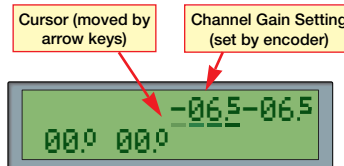


4. Move the cursor by pressing the arrow keys. To set the gain individually, press **ENTER** and **CANCEL** simultaneously.

Press **CANCEL** to abort the operation.

By pressing **ENTER**, the member's gain setting (member's existing value plus gain value for the entire group) is displayed.

The cursor is moved by pressing the arrow keys, and the gain value is changed by turning the rotary encoder.



Pressing **GAIN** or **CANCEL** after setting the gain will show the **GROUP CONTROL** screen again. At this time, if actually the member's gain has been changed individually, the entire group's gain indication will be reset to 00.0 dB (see above).

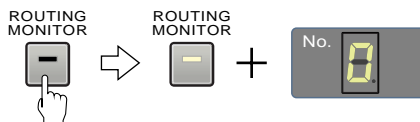


## 6.4 Confirming Routing Setup

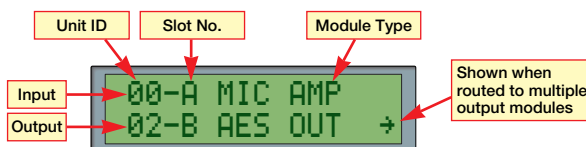
Signal routing setup in the system can be shown in the LCD on the CB-178 and all of the routed audio signals can be monitored on a per channel basis.

### 1. Press ROUTING MONITOR.

The key's LED illuminates and the **No.** indicator shows the routing number currently used.



The LCD shows the selected routing number's setting: the upper line contains information of source of routing (input side module) and the lower line contains information of destination of routing (output side module).



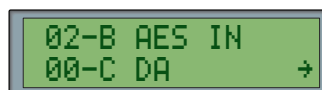
Setup of Routing No. 0

To return to the initial screen, press **ROUTING MONITOR** or **CANCEL**.

**NOTE:** For non-routed modules, a **NON ASSIGNMENT** message is displayed: If there is no output side module, it is shown in the lower line of the screen; if there is no input side module, it is shown in the upper line of the screen. Also, if there is no input side module, the **No.** indicator will not show a routing number.

### 2. Turn the rotary encoder to show the desired routing number in the **No.** indicator.

Routing numbers not being used cannot be selected.



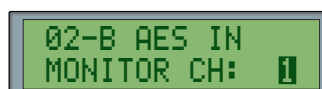
Setup of Routing No. 1

If input modules are routed to multiple output modules, an arrow is indicated at the bottom right corner of the screen. To view all of the output modules by switching the screens, press the arrow keys (use the left arrow key to return).

If a mic amp module is shown in the routing monitor screen, pressing one of the mic channel setup keys (**PAD-GAIN**) causes the LCD to show the mic channel setup screen of that mic amp module. By pressing the same key again, the previous screen is resumed.

### 3. To monitor an input signal, press **ENTER** and turn the rotary encoder to select the desired channel number.

The selected channel's audio signal is supplied to the CB-178's level meter and **PHONES** jack.



Pressing **CANCEL** or **ENTER** cancels the monitor function and returns to the routing display screen.

**NOTE:** When monitoring a mic channel, by pressing a mic channel setup keys (**PAD, +48V, LIMITER, GAIN**) causes the LCD to show the setup screen for setting the channel while the channel is kept selected.

### 4. To return to the previous screen, press **CANCEL**.

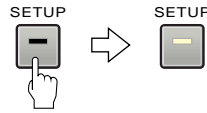
Another press will return to the initial screen.

## 6.5 System Setup Procedures

### ■ How to Use SETUP Key

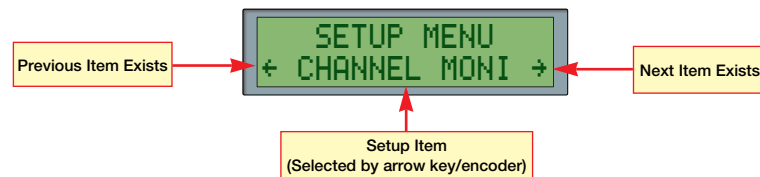
1. To monitor the setup of the entire system or to configure the CB-178 itself, press **SETUP**.

The **SETUP** key's LED illuminates and the LCD shows the **SETUP MENU** screen.



To return to the initial screen, press **SETUP** or **CANCEL**.

2. Press the left/right arrow key or turn the rotary encoder to indicate the setup item.



SETUP MENU Screen (CHANNEL MONI selected)

3. Press **ENTER**.

The setup screen for the selected item is displayed.

Pressing **SETUP** or **CANCEL** resumes the **SETUP MENU** screen.

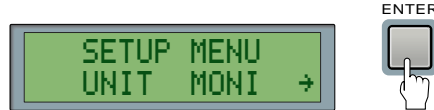
### ■ Items in SETUP MENU Screen

- **UNIT MONI:** Information about unit ID, sample rate, link group setups, and module configuration are shown in the LCD.
- **LINK MONI:** Information about link group's master unit, slave units, and sync signal are shown in the LCD.
- **CHANNEL MONI:** Any channel can be monitored by specifying the unit ID, slot, and channel number.  
**NOTE:** To monitor audio signals on the CB-178, that channel's routing must be completed.
- **REFERENCE MONI:** Reference levels of the analog I/O modules (AD, DA, mic amp) can be shown in the LCD.
- **CLIP SET:** Used to set how to indicate clipping occurred in mic channels. The ND-20 indicates clipping status according to the setup in the this screen.
- **PROTECT SET:** Used to lock out the operations on the CB-178 to prevent unauthorized changes to the setup.
- **FILE:** Used to store assignment and group setups into the memory for later recall.
- **INITIALIZE:** Used to initialize mic input channel setup or restore the setup stored in the memory.

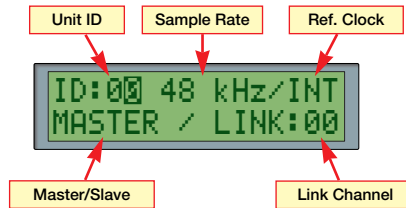
## 6.6 Confirming ND-20's Operation Setups

The ND-20's operation setups recognized by the CB-178 (for example, unit ID, sample rate, link group, link group, module configuration, etc.) can be shown in the LCD.

1. Press **SETUP**, select **UNIT MONI** in the **SETUP MENU** screen and press **ENTER**.  
To return to the initial screen, press **SETUP** or **CANCEL**.



The operating setup of this unit is shown:

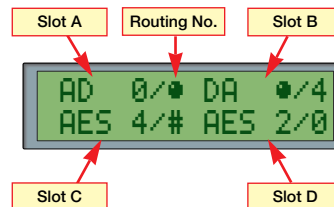


Reference clock is indicated as any one of the following four labels:

- **INT**: Internal clock (master unit only)
- **Blank**: Clock supplied from master unit (slave unit only)
- **EXT**: External word clock (external synchronization operation)
- **DI**: Digital input signal (D-I Sync function)

2. To change the unit to be displayed, change the unit ID by pressing the arrow key or turning the rotary encoder.
3. To show this unit's module configuration, press **ENTER**.

Each key press switches the screens. The upper line shows the slots A and B and the lower line shows the slots C and D.



Input/output type of the module can be identified by the routing number indication: for input modules, routing number is displayed at the left side of the slash (/) and for output modules, it is shown at the right side of the slash.

Symbols shown in the routing number field have the following meanings:

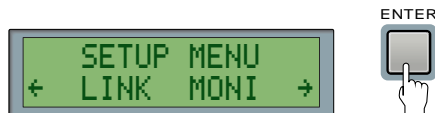
- Routing is not possible because this module is input or output only.
- ! Input or output section of I/O module is disabled by the setting: When the sample rate is set to 88.2 or 96 kHz, the slots A and C (except for mic amp) are automatically disabled.
- Routing is disabled because there are duplicated routing numbers.
- # Output module that is not routed.

Numbers (routing numbers) are shown for modules that are correctly routed.

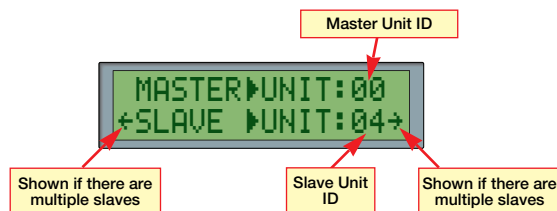
## 6.7 Confirming Link Group Setups

The link group setup (information about master unit and slave units of the link group and synchronization signal) can be shown in the LCD.

1. Press **SETUP**, select **LINK MONI** in the **SETUP MENU** screen and press **ENTER**.  
To return to the initial screen, press **SETUP** or **CANCEL**.

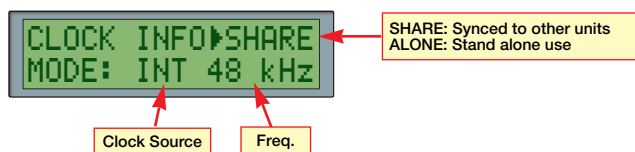


The **No.** indicator shows the link group number and the LCD displays the link group setup.



If there are multiple slave units in the link group, arrows are shown at the both ends of the lower line of the screen. By pressing the arrow keys, other slave units' unit ID numbers can be shown.

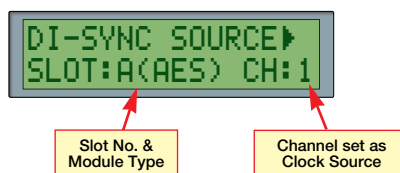
2. If necessary, turn the rotary encoder to select link group number to be displayed.
3. Press **ENTER** to view the reference clock information.  
Each **ENTER** key press switches the screens.



Clock source is indicated by either of **INT** (internal clock), **EXT** (external word clock), or **DI** (D-I Sync).

If the reference clock is set to **SHARE**, the master setup value is shown in the lower line of the screen. If set to **ALONE**, the value of the unit setup shown in the link group screen is indicated.

4. If the clock source is **DI** (D-I Sync), press **ENTER** to show the information about the sync source's input signal.  
Each **ENTER** key press switches the screens.



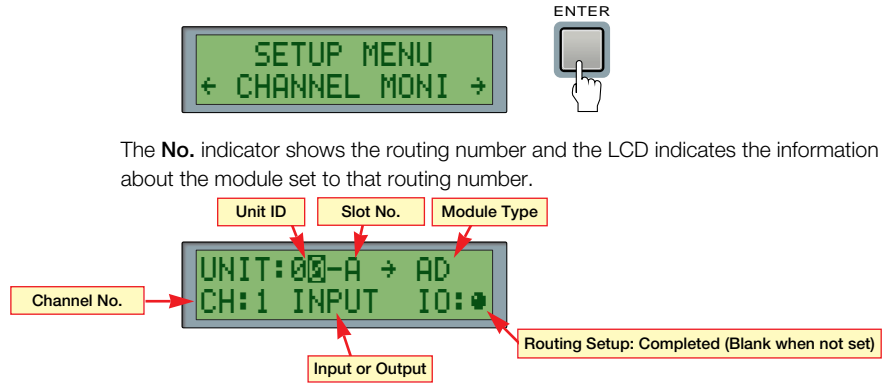
The channel shown is a member of a stereo pair.

## 6.8 Monitoring a Specified Channel

The desired channel can be monitored by specifying the unit ID, slot, and channel numbers.

**NOTE:** To monitor audio signals on the CB-178, channels must be routed correctly.

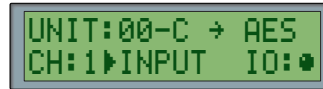
1. Press **SETUP**, select **CHANNEL MONI** in the **SETUP MENU** screen and press **ENTER**.  
To return to the initial screen, press **SETUP** or **CANCEL**.



2. Press the arrow key to move the cursor between the unit ID, slot number, and channel number, and turn the rotary encoder to change each value until the channel to be monitored is selected.

The selected channel's audio signal is fed to the level meter and headphones.

For the AES module, pressing the arrow keys moves the cursor to the **INPUT/OUTPUT** field. By turning the rotary encoder in this status, AES module's input and output sections can be switched alternately.



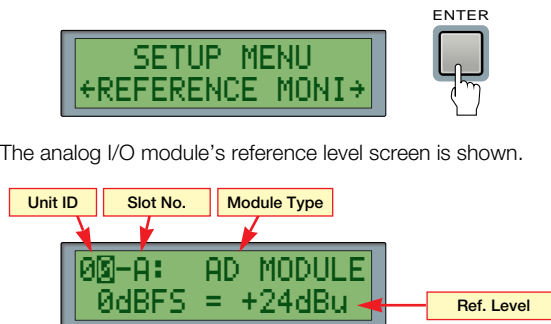
**NOTE:** When an output module's channel is selected, it is the signal of the input module routed to that output module that is actually being monitored.

## 6.9 Confirming Reference Levels of Analog I/O Modules

Audio signal reference levels of the analog I/O modules (AD, DA, mic amp) can be changed and the current setup can be shown on the CB-178.

1. Press **SETUP**, select **REFERENCE MONI** in the **SETUP MENU** screen and press **ENTER**.

To return to the initial screen, press **SETUP** or **CANCEL**.



2. Press the arrow keys to move the cursor between the unit ID and slot number, and turn the rotary encoder to change each value until the module to be monitored is selected.

The selected module's reference level setting is shown in the lower line of the screen.

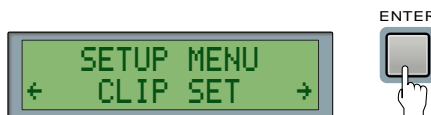
## 6.10 Clipping Monitoring

### ■ Clipping Monitoring Setup

The ND-20 always monitors occurrence of clipping in mic input channels and can show the detection of it by both the **CLIP** indicator and LCD screen. In the **CLIP SET** screen, how to indicate clipping is selected.

1. Press **SETUP**, select **CLIP SET** in the **SETUP MENU** screen and press **ENTER**.

To return to the initial screen, press **SETUP** or **CANCEL**.



The LCD shows the **CLIP SET** screen which indicates the current clipping indication mode.



2. To change the clipping indication mode, press the arrow key or turn the rotary encoder to select the desired mode and press **ENTER**.

The selected mode is marked with **< >**. The following four modes are available:

- **OFF**: Clip detection is disabled (default after power up).
- **ALL**: Clipped mic amp modules are shown in the upper line of the LCD screen and the **CLIP** indicators correspond to clipped channels illuminate.
- **ASSIGN**: Clipped channels are displayed in accordance with the assignment setup. The LCD shows the page screen to which clipped channels are registered and the **CLIP** indicators in the same positional relationship as the corresponding channels in the page will illuminate.
- **GROUP**: Clipped channels are displayed in accordance with the group setup. The LCD shows the group's page screen to which clipped channels are registered and the **CLIP** indicators in the same positional relationship as the corresponding channels in the page will illuminate.

**NOTE:** If **ASSIGN** or **GROUP** is selected, clipping monitoring works only for the channels registered in advance. Other channels are not monitored.

### ■ Returning from Clipping Monitor Indication

To revert to the usual operation from the clipping monitor indication, perform an operation for cancelling the current setup screen such as pressing **CANCEL** or illuminating key, etc. However, if there are clippings in the channels other than those indicated currently, the ND-20 will switch the indication to show those channels.

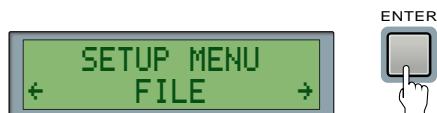
### NOTES

- To prevent misoperations, setup editing of assignment, group and naming function is inhibited during clipping monitor indication (setups can be viewed only).
- When operating in the **SETUP MENU** or when changing setup of assignment, group, or naming functions, the clipping monitor indication will not take place (it does when setup operation is completed).
- If clippings are newly detected other than those indicated currently, the indication can be switched to show them by turning the rotary encoder (when the page or routing number is selected).
- By pressing **ENTER** during clipping monitor indication, channels can be selected and monitored as usual operation. Since one of the clipped channels is automatically selected, adjust headphone volume to a proper level before starting monitoring (when the page or routing number is selected).
- By pressing a setup key for mic channel (such as **GAIN**), mic channels can be set as in usual operation. However, one of the clipped channels is automatically selected.
- When **GROUP** is selected, gain can be adjusted on group basis, as usual. At this time, by pressing **ENTER** and **CANCEL** simultaneously, individual channel setting can be edited.
- If clipping occurs when the **ASSIGN** and **ROUTING MONITOR** keys are illuminated and if that channel has been assigned to a group, a confirmation screen is displayed. By pressing **ENTER**, parameters of the grouped channels can be edited.

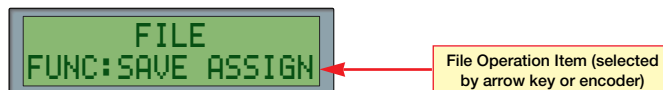
## 6.11 Saving/Recalling Setups

The ND-20 can store a group or assignment setting in the battery backup memory as a file for later recalling. Up to four setup files are available for each of group and assignment.

1. Press **SETUP**, select **FILE** in the **SETUP MENU** screen and press **ENTER**.  
To return to the initial screen, press **SETUP** or **CANCEL**.



The **FILE** screen is displayed:

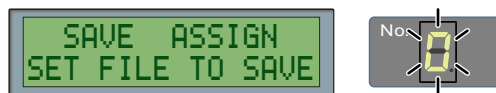


2. Use the arrow keys or rotary encoder to indicate the desired file operation and press **ENTER**.

The following operations are available:

- **SAVE ASSIGN**: Stores the current assignment setting into the assignment file.
- **LOAD ASSIGN**: Reads the setup stored in the assignment file and applies it to the current assignment setting.
- **SAVE GROUP**: Stores the current group setting into the group file.
- **LOAD GROUP**: Reads the setup stored in the group file and applies it to the current group setting.

By pressing **ENTER**, the **No.** indicator starts flashing.



3. Turn the rotary encoder to select the desired file number and press **ENTER**.

A confirmation screen is displayed.

4. To execute a store/recall of the setup file, press **ENTER**.

To cancel the operation, press **CANCEL**.

When **ENTER** is pressed, a confirmation screen telling that the operation is completed is displayed and then the **FILE** screen (operation select screen) is automatically resumed.

### ■ ACTIVE ONLY? Warning when Recalling File

When recalling a setup file, if invalid data for the current setup is detected in it (i.e., a setup member's address does not exist, addresses applied to the members are not for the current mic amp module, etc.), an **ACTIVE ONLY?** screen is displayed. Pressing **ENTER** will load the settings excluding the invalid data. Pressing **CANCEL** will load the settings as is. In both cases, the file data is kept intact.

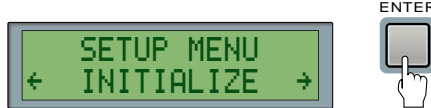
Invalid members are indicated with "\*" (asterisk) in the assignment/group screen. These members' data can be edited or deleted but the mic parameters for them cannot be adjusted.

**NOTE:** On the CB-178, the members of group and assignment refer to the unit ID, slot position, and channel numbers. Therefore, changing the unit ID of the unit to which the members belong and changing modules can make the data invalid.

## 6.12 Initializing and Recalling Setups

To initialize the mic amp module setting or recall other settings stored in the ND-20 memory,

1. Press **SETUP**, select **INITIALIZE** in the **SETUP MENU** screen and press **ENTER**.  
To return to the initial screen, press **SETUP** or **CANCEL**.



The **INITIALIZE** screen is displayed:



2. Select the desired operation (**INIT** or **RECALL**) by turning the rotary encoder.
  - **INIT**: Initializes the mic amp module setting to the status just after power-up. Pressing the arrow keys moves the cursor to the **UNIT** field. By turning the rotary encoder, the module to be initialized can be selected.



- **RECALL**: Restores all of the mic amp module settings to the status stored in the unit's memory (status at when the power was turned off last time). This is applied to all modules, not applicable to individual modules.



3. After selecting the desired operation and units to be applied, press **ENTER**.  
A confirmation screen is displayed.
4. To execute the initialization/recalling of the setup, press **ENTER**.  
To cancel the operation, press **CANCEL**.  
When **ENTER** is pressed, a confirmation screen showing that the operation is completed is displayed and then the **INITIALIZE** screen (operation select screen) is automatically resumed.

### ■ Parameters to be Initialized or Recalled

Parameter	Default Setting
Gain	±0 dB unity (pad on)
Pad	On
Phantom Power (initialize only)	Off
Limiter	On
Pad	Off
Group	All off

**CAUTION!** Phantom power settings will not be restored by the recall operation: the current setup is maintained.

### NOTES

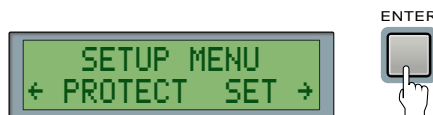
- By editing this item, the group setting done on the ND-20 is changed. If there are any differences between the group setting information contained in the CB-178 and the actual setup on the unit, the setting in the CB-178 is abandoned or changed. If necessary, store the current setting into the file before editing it.
- If an error in group setting is detected during a recall operation (the group registered more than 24 channels, a channel has been registered in multiple groups, the ND-20 unit does not respond, etc.), group settings in both the ND-20 and CB-178 are cleared.



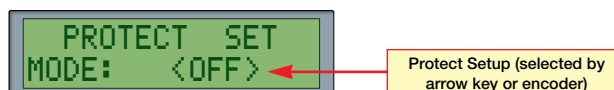
## 6.13 Protect Function

The protect function is provided to lock out the operations on the CB-178 to prevent unauthorized changes to the setup. When the protection is turned on, access to operations related to microphone parameter setting modes, clip detection setting, and file handling is inhibited.

1. Press **SETUP**, select **PROTECT SET** in the **SETUP MENU** screen and press **ENTER**.  
To return to the initial screen, press **SETUP** or **CANCEL**.



The **PROTECT SET** screen is displayed:



2. To protect the setup, select **ON**. To cancel the protection, select **OFF**. Then press **ENTER**.

The selection can be changed by the arrow key or rotary encoder.

By pressing **ENTER**, the current setup is marked with **< >**.

### NOTES

- It is possible to use the monitor function in the **SETUP** menu even when the protect function is activated. However, if an operation related to changing setups is attempted, the LCD shows **PROTECTED!**.
- When the protection is activated and a clip is detected, if a mic input channel setup is attempted to be edited, a warning screen is displayed but the protection is automatically cleared to allow correction of the mic level.

## 6.14 Naming Function

Setup items (units, slots, channels, channel groups, channel assignments, files, etc.) can be named with up to 16 characters. If the selected parameter supports the naming function, pressing **NAME** shows its name for editing.

**NOTE:** To prevent misoperations, names cannot be edited during clip indication.

1. Press **NAME** when the cursor is at either of the following items:

- Unit ID
- Slot Number
- Channel Number
- Assignment Page
- Group Page
- Assignment File
- Group File

The LCD shows the name edit screen for the selected item.

To exit from the name edit screen, press **NAME** or illuminated setup key.

2. To change the name of the selected item, press **ENTER**.  
The cursor appears at the first letter of the name.
3. Press the arrow key to move the cursor and turn the rotary encoder to select characters.  
By pressing **CANCEL** when the name edit screen is shown, the previous screen is resumed without changing the name.
4. When the desired name has been entered, press **ENTER**.  
A confirmation screen is displayed.
5. Press **ENTER** to store the entered name.  
The LCD shows the previous screen.

**NOTE:** The unit name, slot name, and channel name are stored in the ND-20 unit's memory.

## 6.15 Error Messages

The following list summarizes error messages that can be shown on the CB-178's LCD screen.

### ■ Errors during Start-up

- **REFRESH PORTS...** The IEEE1394 port has been refreshed because resetting of the IEEE1394 port failed (this may take a while). Re-connect the cables.
- **GROUP CLEARED!** The group configuration has been initialized because there was a discrepancy in the channel group setting of the connected system.
- **ERR: 1394 DEAD??** IEEE1394 interface is not working correctly. Disconnect the IEEE1394 cable immediately. An interface failure may be the cause, please contact Otari.

### ■ Error at Connection Change (Bus Resetting)

- **BUS RESET ERROR!** Bus resetting of the IEEE1394 port has not been done correctly and it is reset again.

### ■ Cable Related Errors

When any of the following error messages is indicated, check the system connection and network configuration:

- **DETECT CABLELOOP** A loop connection of an IEEE1394 cable is detected. If a loop connection exists, this system will not operate. This error may not be indicated if the CB-178 is not the starting point of the loop. When this error is indicated even though there is actually no loop connection in the system, a device which is out of order may be connected in the system.
- **CABLE POWERDOWN!** Power supply voltage via the IEEE1394 cable drops lower than the limit value.
- **FATAL:SYSTEMFAIL** The IEEE1394 interface has stopped operation because of a problem of the entire IEEE1394 bus (electrical problem) and cannot resume operation. If this error is encountered, reboot the entire system.

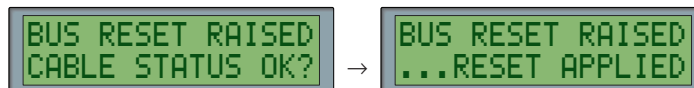
**NOTE:** An error screen **ERR: CABLE ERROR** may be shown. In such a case, recheck the system configuration.

### ■ Errors during Normal Operation

- **ERR: NO RESPONSE** No response has been received for the request to a unit, or improper response has been received.
- **ERR: MULTI REMOTE** Multiple CB-178's exist in this system. The ND-20 will not receive all of the controls until the number of connected CB-178's returns to one.
- **PROTECTED!** A setting operation has been attempted when the protection is activated.
- **SOMEUNIT NOT ACT** No response has been received for the request to a unit, or improper response has been received (during initializing, etc.).
- **OUT OF RANGE!!** A member of the channel group has reached the limit value of gain range. It is impossible to set a value higher/lower than that.
- **NO CONNECTION...** No valid module has been detected during a routing monitor operation.
- **NO MIC MODULE...** No valid mic amp module has been detected.
- **ERR: FILE LOST** The file has been initialized because a problem was detected in the memory contents when accessing to the file. This message is indicated when backup battery voltage drops lower than the limit or when using a file function after replacing batteries.

### ■ Notification of Bus Resetting Detection

If the CB-178 detects a bus reset of the IEEE 1394 interface, it instantly switches from normal operation to a mode in which it gathers system information, and shows the following LCD screens. Bus resets usually occur when a cable connection is changed or when a device is in a self recognition process after booting up and never occur during normal operation. If the following screens are shown during operation, check the connection of cables and operating status of connected devices.



Bus Resetting Detected (please wait for a while) and System Information Gathered (press any key to return to the initial screen)