TEAC

A New Standard in Portable Data Recording

The new LX Series data acquisition and recording system from TEAC has been designed for fast set-up, reliable recording, and versatile playback for data recording applications in the field and in the laboratory. Building upon the success and convenience of TEAC DAT recorders, the LX Series enables recording of wider bandwidths, has built-in connectivity with sensors, removable solid-state digital recording media, easy and fast PC connection, and is designed to provide cost-efficient data recording and front-end solutions.

Versatile data recording system that can interface with a wide-range of applications.

LX Series

Versatile Recording System Configurations

Choose input and output amplifiers, recording media, channel configuration, sampling frequency, and control methods to meet your data acquisition and processing requirements.
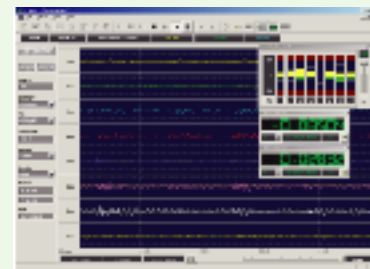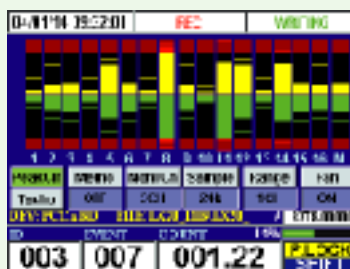
Stand-alone

With the color remote control unit

PC recording

LX-Moby
Full mobile recording system with the color remote control unit and a long-life rechargeable battery unit

Bar-meter display on the remote control unit or the wave-form and bar-meter displays on the PC provide data monitoring for recording assurance.

Application Software

TEAC LX View software is available for fast data file review, file format conversion, and analog output of recorded files saved on the PC by using the LX analog output amplifier card.

LX-10 Series

The LX-10 Series provides superior recording and playback performance with selectable recording media and input/output configurations. The remote control unit allows operation of the LX Series as a dedicated recording system suitable for mobile applications. The PC control allows operation of the LX Series as a PC front-end.

Three Types of Recording Media

Memory (from the standard 64 MB to a maximum of 576 MB) achieves maximum recording rate; a PC card (Flash memory or IBM Microdrive™, supports up to 2 GB capacity) enables data recording in harsh environments; or a 3.5 inch 1.3 GB MO disk is convenient for long-term media storage.

Recording Via a Maximum of 32 Channels, Recording Synchronization for 128 Channels

By combining channel selection and input amplifier cards, you can record via 2, 4, 8, or 16 channels, or use an expansion unit to record up to 32 data channels. Up to 4 LX units can be synchronized for recordings to maximum 128 recording channels.

(Recording synchronization is an optional function.)

Simultaneous Recording to Media and PC with a Selection of Interfaces

Either an IEEE-1394 interface or a 100BASE-TX Ethernet interface can be selected to connect to the PC. While recording to storage media, you can transfer data to a PC in real-time and display it on the PC, process the data, or record the data to hard disk drive of the PC.

(Some information, such as events stored in a header file while recording to media, are not written to the header file while recording directly to PC.)

Higher Recording Bandwidth

The LX Series can record 8 channels at 20 kHz bandwidth with 48 kHz sampling frequency per channel directly to the storage media, which is double the recording performance of DAT recorders. Using internal memory or transferring data to the PC in real-time, you can record 8 channels at 40 kHz bandwidth with 96 kHz sampling per channel via the IEEE1394 interface, or 8 channels at 20 kHz bandwidth with 48 kHz sampling via the 100BASE-TX interface.

(Using an IEEE1394 interface in the PC, as specified by TEAC. The data transfer rate to the PC varies depending on the connected PC environment.)

DC, IEPE, Strain, and AO for I/O Amp Cards in 8 Channel Units

Three types of input amplifier cards are available; including a DC input amp card with lower sampling rate (from 1 kHz to 1/60 Hz), a selectable DC / IEPE accelerometer input amp card, and a selectable DC / strain input amp card. The available output amplifier card can output the analog voltage during recording and can play back the analog voltage after recording for all types of the input amp cards.

(The output amp card does not support low sampling below 1 kHz, and can only reproduce the analog voltage within the same sampling time bases series.)

Trigger Recording

To let you record data efficiently, various types of start and stop trigger modes are provided. You can control the starting or stopping of recording by using external control, level start/stop triggers, timer recording, interval recording, timeout start, start pre-trigger, stop post-trigger recording, or repeat recordings.

(Some restrictions might apply to the triggers that can be used when using a combination of triggers.)

Voice Memo Recording and Audio Playback

You can record convenient voice memos to describe recorded data, which simplifies later extraction. These voice memos are recorded as WAV files separate from the recorded data files. Data recorded from any one channel or the voice memo can be played over the built-in speaker.

IEPE : Integrated Electronics Piezoelectric.

LX-20 Series

In addition to all recording and playback features of the LX-10 Series, the LX-20 Series provides the selection of additional sampling rate series and Tachometer pulse inputs.

Versatile Sampling Rate Series Selections for Frequency Analysis

In the LX-20 Series, 102.4 kHz, 65.536 kHz, and 100 kHz sampling rate series can be selected in addition to the 96 kHz sampling rate series of the LX-10 Series, suitable for FFT analysis data recording by using the LX-20 as a PC front-end.

Direct Rotational Signal Inputs

The LX-20 provides dedicated 1 x / 2 x tachometer pulse input(s) of 16-bit mode or 32-bit mode selectable.

(Using the tachometer pulse input channels lowers the maximum sampling rate at some of the channel settings.)

Generator Output

A waveform generating function is provided at the LX-20 monitor output terminal. You can record data while generating sine waves, white noise or pink noise.

Maximum Recording Rate

There are two types of maximum recording rates available depending on the choice of recording media or interface.

Record to the internal memory, or to the hard disk drive of the PC via IEEE1394 interface:
1.536 MB/s (Example, 40 kHz bandwidth with 96 kHz sampling rate x 8 channels)

Record to the MO/PC card, or to the hard disk drive of the PC via 100BASE-TX (Peer-to-Peer connection):
0.768 MB/s (Example, 20 kHz bandwidth with 48 kHz sampling rate x 8 channels)

Note: Recording rate to the hard disk drive of the PC may vary depending on the connection and the PC specifications.

Frequency Bandwidth vs. Recording Time

576 MB Memory
64 MB standard + 512 MB optional
(Maximum recording rate 1.536 MB/s)

Numbers of Channels	Frequency Bandwidth	Recording Time
2	40 kHz (96 kHz sampling)	1,480 seconds (Approx. 24 minutes) 1,450 seconds at Memo ON
4	40 kHz (96 kHz sampling)	740 seconds (Approx. 12 minutes) 730 seconds at Memo ON
8	40 kHz (96 kHz sampling)	370 seconds (Approx. 6 minutes) 360 seconds at Memo ON
16	20 kHz (48 kHz sampling)	370 seconds (Approx. 6 minutes) 360 seconds at Memo ON
32	10 kHz (24 kHz sampling)	370 seconds (Approx. 6 minutes) 360 seconds at Memo ON

PC Card
Calculation based on using 1.9 GB capacity of 2 GB PC card
(Maximum recording rate 0.768 MB/s)

Numbers of Channels	Frequency Bandwidth	Recording Time
2	40 kHz (96 kHz sampling)	4,940 seconds (Approx. 82 minutes) 4,840 seconds at Memo ON
4	40 kHz (96 kHz sampling)	2,460 seconds (Approx. 41 minutes) 2,440 seconds at Memo ON
8	20 kHz (48 kHz sampling)	2,460 seconds (Approx. 41 minutes) 2,440 seconds at Memo ON
16	10 kHz (24 kHz sampling)	2,460 seconds (Approx. 41 minutes) 2,440 seconds at Memo ON
32	5 kHz (12 kHz sampling)	2,460 seconds (Approx. 41 minutes) 2,440 seconds at Memo ON

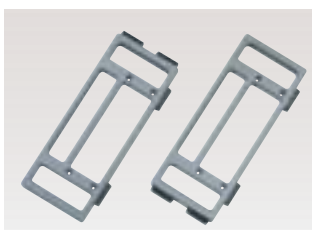**Note:** Turning ON the voice memo additionally consumes 64 kbps (8 bits x 8 kHz) data.
Turning ON the tachometer pulse input consumes 1 recording channel for 16-bit mode per a single tachometer input channel and 2 recording channels for 32-bit mode per a single tachometer input channel.

Optional Accessories

Battery Unit BU-80/ Battery Pack HR-30L

Vehicle Mount Adapters TZ-LXVM(16ch Unit)
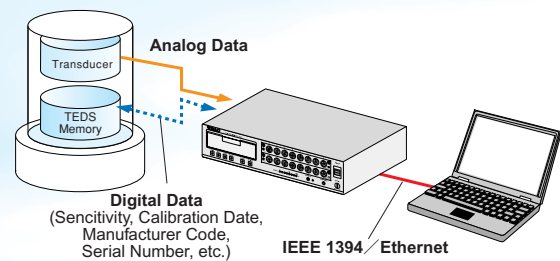
Remote Control Unit ER-LXRC2

Connecting with Applications

The LX Series provides a diverse set of connections to popular data analysis applications, which enables efficiency in all steps of the process: from experiment setup to data recording and processing.

Connecting to Sensors

Using the IEPE accelerometer input amp card, you can directly connect to ICP® accelerometers and ICP® microphones. Using the strain input amp card, you can perform either strain measurements or standard DC inputs channel by channel. This eliminates the need for traditional external amplifiers. With the IEPE accelerometer input amp card, you can read sensor information such as sensitivity and other information of connected transducers or sensors compliant with TEDS (Transducer Electronic Data Sheet) standards. These features reduce the need for additional equipment and can automate coefficient settings, thereby eliminating setup errors, and greatly reduce the time and effort required for experiment preparation and data processing.

IEEE P1451.4 Mixed-Mode Transducer

Transducer

TEDS Memory

Analog Data

Digital Data
(Sencitivity, Calibration Date, Manufacturer Code, Serial Number, etc.)

IEEE 1394 / Ethernet

Unit Connectivity for Recording Synchronization

Up to 4 sets of the LX units can be connected together for recording synchronization of maximum 128 channels. Simply connecting the recording synchronization cables among the units and assignment of a master unit and slave units by the remote control unit or the LX Navi software enables recording synchronization. The optional LX View software can merge the synchronized data files recorded by each unit independently, to a single data file.

IEEE 1394

Synchronization Cables

Connection example by using IEEE 1394
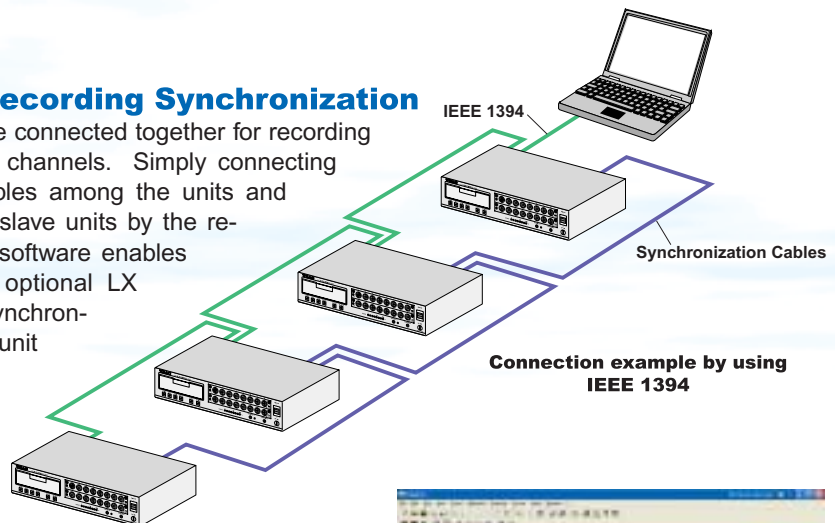
Connecting to Data Analysis Software

The format for recorded data is TAFFmat, Windows file system compatible, the file format now used by TEAC Digital Data Recorders. Data files in the TAFFmat format can be read by LX View and by other analytical software applications that support TAFFmat. Also, in a configuration in which a PC is connected and an LX Series recorder is used as the front-end, the TAFFmat format files can be used with application software to provide real-time recording and analysis functions. Popular analytical software, including ArtemiS, DASYLab, DADiSP, FlexPro, ME'scope, and MATLAB, support TAFFmat data file import or our file converter supports converting to their file formats. We provide file converter software from TAFFmat to popular data file formats, such as ASCII, UFF, ATI, MatLab, and RPC3. TEAC can provide system integrators with a Windows DLL for direct control of LX Series recorders. Contact TEAC for details.
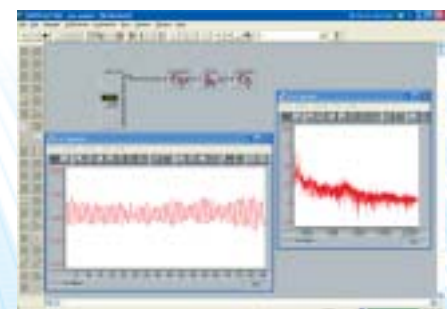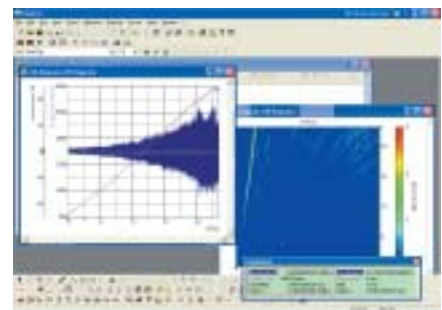
Specifications

LX-10

I/O Amp Slots	2 (Eight channels per slot)
Recording Devices	Choice of Memory only, Memory + PC card drive, or Memory + MO drive (Specify one when you order.)
Interface	Choice of IEEE 1394 or 10BASE-T/100BASE-TX Ethernet (Specify when you order.)
Front Panel Control Keys	REC, FWD, STOP, PAUSE, EVENT, P.LOCK
Digital Control Connector	Contact input; REC FWD, REC, FWD, STOP, PAUSE, event, panel lock, and ±30-second internal clock adjustment Status output; REC, FWD, STOP, PAUSE, event, and panel lock Input; L level 0.4 V or less, H level Open or 2 V or more, Pulse width 100 ms or more Output; Open drain Maximum sync current 8 mA Connector angled half pitch 36-pin (DHA-RC36-R1xxx Series)
Monitor Channel	1 (analog output)
Microphone Jack	1
Speaker and Earphone Jack	1 each
Sampling Frequencies	96, 48, 24, 12, 6, 3, 1.5 kHz (Common to each channel)
Frequency Bandwidths	DC to 40, 20, 10, 5, 2.5, 1.25, 0.625 kHz
Max. Recording Rate	With real-time transfer to memory or PC; 1.536 MB/s (by IEEE1394)/0.768MB/s (by 100BASE-TX) With an MO disk/a PC card: 0.768 MB/s
Time Precision	±1 ppm (at 25℃)
Internal Clock Correction	±30-second adjustment
Power Supply/Consumption	11 to 30 V DC, approx. 40 W for an

	8-channel I/O configuration (AR-LXPA1 and AR-LXAO) with media recording. DC power supply cable and AC adapter are supplied.
Safety Standards	CE, VCCI
Vibration	Conforms to MIL-STD-810E Figure 514.4-1,2,3 for the models with memory only, memory + PC card drive, and memory with an MO drive (only when an MO disk is not inserted.)
Shock	Conforms to MIL-STD-810E Method 516.3 20 G 11 ms Half Sine (using PC Memory Card).
External Dimensions	Approx. 300W x 65H x 200D mm /12W x 2.5H x 8 D in (excluding protruding parts)
Weight	Approx. 3.8 kg/8.5 lb (for an 8-channel I/O configuration using a PC card/an MO disk)
Temperature and Humidity	PC card model and Memory model; 0 to 45 ℃/32 to 104 ˚F at 10 to 85 % RH (operation) MO model; 5 to 35 ℃/40 to 95 ˚F at 10 to 85 % RH (operation)
Software	The LX Navi software, included as standard, provides measurement parameter set-up, data monitoring, and data transfer to PC. The following are PC system requirements: OS; Windows 98SE/Me/2000/XP CPU; Pentium III 600 MHz or faster RAM; 128 MB or more Free Hard Disk Space; 2 GB or more

LX-20

Sampling Frequencies	96, 48, 24, 12, 6, 3, 1.5 kHz / 102.4, 51.2, 25.6, 12.8, 5.12, 2.56, 1.28 kHz / 65.536, 32.768, 16.384, 8.192, 4.096, 2.048, 1.024 kHz / 100, 50, 20, 10, 5, 2, 1 kHz (Select one from 4 series, common to each channel)
Frequency Bandwidths	DC to the sampling frequency (listed above) / 2.4
Tachometer Pulse Inputs	
Num. of Input Channels	2 x 16-bit channels (ON/OFF in 2-channel units), 1 x 32-bit channel, or 2 x 32-bit channels (Use the lowest 1 bit for tachometer pulse timing bit, valid at the sampling frequencies 48kHz or below.)
Input Format	Threshold level selections: +0.5, 1, 2.5, 5, 10, and 20 V (Max. allowable input voltage is ±50 V)
Input Connector	2 x BNC
Sampling Frequency	Determined by the main-unit setting.
Frequency Division Ratio	
Setting	1 to 255
Moving Average Measurement	1 to 16 (Cannot be used simultaneously with generator output. The Highest and the 2nd highest sampling frequency settings support the moving average only at 1(one).)
Num. of Pulses Per	
Revolution	1 to 255

Measurement Modes	Pulse count mode (Count of number of pulses within the gate time; count of the total number from start to stop), Cycle count mode, Frequency measurement mode, RPM mode (Cannot be used simultaneously with generator output.)
Generator Output	
Num. of Output Channel	1 channel
Output Level	1 to 5 V (variable in 0.1 V steps, same as monitor output)
Output Connector	BNC (Monitor output)
Output Mode	Sine wave 1 to fs/2.4 (to 1 digit below the decimal point), Sweep, Sine wave, start/stop frequency, linear and log settings, Pulse, pulse width, and interval time settings (There are restrictions depending on the sampling frequency.), Pink noise, White noise
Noise Level	-70dB or less (at Sine wave mode)
Power Supply/Consumption	11 to 30 V DC, Approx. 45 W for an 8-channel I/O configuration (AR-LXPA1 and AR-LXAO) with media recording. DC power supply cable and AC adapter are supplied.
Weight	Approx. 4.1 kg/9 lb (for an 8-channel I/O configuration using an MO disk/a PC card)

* Other specifications follow the LX-10 specifications.

Battery Unit (BU-80)

Num. of Internal Battery Packs	3 (battery pack is described below)
External Dimensions	Approx. 300W x 27.5H x 200D mm / 12W x 1H x 8D in (excluding protruding parts)
Weight	Approx. 1.5 kg/3 lb (excluding the battery pack and mounting brackets)
Battery Pack	HP-30L from Paco Electronics Industry Inc.
Supplied Voltage	13.2 V
Capacity	3.3 Ah (Approx. two hours operation is possible by using three packs of the HP-30Ls at the LX main unit of 1 x AR-LXPA1 and 1 x AR-LXAO with the ER-LXRC2.)
Weight	Approx. 700 g/1.5 lb
Size	NP1 type (Estimated life is 1 year but this depends on the number of recharges and how often it is used.)
Battery Type	Ni-MH

Remote Control Unit (ER-LXRC2)

LCD	Color LCD 320 x 240 pixels
Functions	Bar meter display, main-unit control (setting, recording, reproducing) Event, Microphone input
External Dimensions	Approx. 170W x 30H x 100D mm / 6.5W x 1.2H x 4D in (excluding protruding parts)
Cable length	5 m/16 ft
Weight	Approx. 0.65 kg/1.4 lb (excluding cable)

Extension I/O Unit for DC Input Amp (AU-LXEPIO)

I/O Amp Slots	2 (Specify the combination of amp cards to be built in when you order.)
External Dimensions	Approx. 300W x 30H x 200D mm / 12W x 1.2H x 8D in (excluding protruding parts)
Weight	Approx. 1.2 kg/2.5 lb (excluding the amp card)

Extension I/O Unit for the IEPE Accelerometer Input Amp (AU-LXEPIOP)

I/O Amp Slots	2 (Specify the combination of amp cards to be built in when you order.)
Power Supply	11 to 30 V DC. DC power supply cable and AC adapter are supplied.
External Dimensions	Approx. 300W x 50H x 200D mm / 12W x 2H x 8D in (excluding protruding parts)
Weight	Approx. 2 kg/4.5 lb (excluding the amp card)

Amp Cards
DC Input Amp (AR-LXDC2)

Num. of Channels	8
Input Format	Unbalanced
Input Coupling	DC
Input Impedance	100 kohm
Input Range	±0.5, 1, 2, 5, 10, 20, 50 V (over-range ±127 %)
Absolute Max. Input Voltage	±100 V
Filter	Joint use of both a digital filter (*) and an analog filter (2nd Order Butterworth)
Frequency Characteristics	Tolerance of -0.5 dB for DC to each bandwidth of the main unit
Num. of Quantizing Bits	24 bits, MSB16 bits used for data of 24 bits
Conversion Method	Simultaneous sampling, 128-times oversampling ΔΣ (delta sigma) method; however 64-times over-sampling at 96 kHz sampling
Sampling Frequencies	See the sampling frequencies of the main unit.
Power Consumption	Approx. 5 W
Low-speed Sampling	Fixes the sampling at 2 kHz, with DSP-based down sampling in the range of 1 k, 500, 200, 100, 50, 20, 10, 5, 2, 1, 1/2, 1/5, 1/10, 1/30, and 1/60 Hz. (No filter at 1 Hz and below) Note: Analog voltage output is not supported.

IEPE Accelerometer Input Amp (AR-LXPA1)

Num. of Channels	8
Input Format	Balanced and unbalanced
Input Coupling	Balanced AC coupling, balanced DC coupling, unbalanced DC coupling
Input Impedance	100 kohm
Input Range	± 0.01, 0.0316, 0.1, 0.316, 1.0, 3.16, 10 V (over-range to ±127 %)
Absolute Max. Input Voltage	±50 V
Filter	Joint use of both a digital filter (*) and an analog filter (2nd Order Butterworth)
Frequency Characteristics	±0.5 dB. In AC mode: 1 Hz to the bandwidth of the main unit (-3 dB at 0.1 Hz). In DC mode: DC to the bandwidth of the main unit.
Num. of Quantizing Bits	24 bits, MSB16 bits used for data of 24 bits
Conversion Method	Simultaneous sampling, 128-times over sampling ΔΣ method; however 64-times over sampling at 96 kHz sampling
Sampling Frequencies	See the sampling frequencies of the main unit.
Power Supply to Sensors	28V DC, 4 mA
Power Consumption	Approx. 7 W

IEPE Accelerometer Input Amp (AR-LXPA2)

Input Range	±0.01, 0.0316, 0.1, 0.316, 1.0, 3.16, 10, 50 V (over-range to ±127 %)
Absolute Max. Input Voltage	±50 V, but ±100 V in the ±50 V range
Weighting	A, C, Flat
High Pass Filter	10 Hz, 20 Hz switchable
Power Supply to Sensors	28V DC/4 mA or 24V DC/4 mA switchable in hardware

* Other specifications follow the AR-LXPA1 specifications.

Strain Amp (AR-LXST1)

Num. of Input Channels	8
Input Impedance	1 Mohm or more
Input Mode	Strain (ST) (mV/V) mode and DC mode
Input Range	mV/V; ±0.25, 0.5, 1, 2.5, 5, 10, 25, 50 mV/V DC; ±1, 2, 5, 10 V (over range to ±127 %)
Absolute Max. Input Voltage	±25 V
Type of Input	Balanced differential input, DC coupling (DC bridge method)
Applicable Gage Resistance	120 to 2000 ohm
Gage Factor	2.0
Bridge Voltage	2 V (±1 V) / 10 V (±5V)
Bridge Connection	Full bridge
Remote Sensing	Possible
Range Accuracy	±1 % or less
Temperature Drift	0.1 % / 1 ℃ (at 10 miniute after turring on the power)
Linearity	±0.1 % or less
Balance Method	By electronic auto balance
Balance Range	±10000 microST
Zero Balance	Auto & Manual calibration by using 16 bits D/A
Frequency Response	ST mode; DC to 30 kHz (-3 dB) DC mode; DC to 40 kHz (- 3 dB)
Sampling Frequency	See the sampling frequencies of the main unit.
LPF	10, 30, 100, 300, 1 k, 3 k, 10 k, 30 kHz, Pass: - 48 dB OCT Butterworth filter (Switched Capacitor Filter = SCF) for 8 channels independent; At LPF to Pass, Joint use of both a digital filter (※) and an analog filter (2nd Order Butterworth)
Num. of Quantizing Bits	24 bits, MSB16 bits used for data of 24 bits
Input Connector	Lemo 7-pin 10 ø (ECG0 Type)
Power Consumption	Approx. 8 W

Analog Output Amp (AR-LXAO)

Num. of Channels	8
Output Format	Unbalanced
Output Coupling	DC coupling
Output Level	±1 to 5 V (variable in 0.1 V steps)
Frequency Bandwidths	DC to the frequency bandwidth of the main unit
Filter	Joint use of both a digital filter (*) and an analog filter (2nd Order Butterworth)
Num. of Quantizing Bits	24 bits, MSB16 bits used for data of 24 bits
Conversion Method	128-times over sampling ΔΣ method; however 64-times over sampling at 96 kHz sampling
Output Connector	BNC
Power Consumption	Approx. 5 W

* : Pass band and Stop band frequency depend on the sampling frequency (Fs).
At 48 kHz sampling, Pass band max. 21.768 kHz, Stop band min. 26.232 kHz, Stop band attenuation 110 dB
At 96 kHz sampling, Pass band max. 43.536 kHz, Stop band min. 52.464 kHz, Stop band attenuation 110 dB

Overall Accuracy (AR-LXPA2 and AR-LXAO)

Range accuracy	±2 % or less
Linearity	±0.1 % or less
Distortion factor	±0.05 % or less (for bandwidth of 20 kHz or more), ±0.2 % or less (for bandwidth of 10 kHz or less)
Drift	±0.1 % or less (from 10 minutes after the power has been turned on and when recording to one media)
Inter-channel phase difference	Typical 0.5˚ (in the same range and with a bandwidth of 20 kHz or less), or 3˚ or less (in the same range and with a bandwidth of 40 kHz)
Dynamic range	The typical measured dynamic range of the digitized data is 90 dB or more.

S/N (Crosstalk): measured at the Analog Output:

Input Range	At 20 kHz or less	At 40 kHz
± 0.01 V	64 dB (-64 dB)	60 dB (-60 dB)
± 0.0316 V	74 dB (-73 dB)	69 dB (-69 dB)
± 0.1 V	83 dB (-78 dB)	77 dB (-74 dB)
± 0.316 V	87 dB (-78 dB)	77 dB (-74 dB)
± 1.0 V	87 dB (-78 dB)	77 dB (-74 dB)
± 3.16 V	87 dB (-78 dB)	77 dB (-74 dB)
± 10 V	87 dB (-78 dB)	77 dB (-74 dB)
± 50 V	80 dB (-78 dB)	77 dB (-74 dB)

*Note: The overall accuracy specified here is the accuracy of the analog output when using an input amp and an analog output amp, and may differ depending on the frequency characteristics and the input range of the input amp.

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