DigiCart/E®

Ethernet Audio Recorder

Contents

Advancing an Industry Standard

360 Systems' new DigiCart/E Ethernet Audio recorder builds on a decade of experience gained delivering DigiCart II recorders to television broadcasters. DigiCart/E is more than an improvement on the digital cart machine concept – it's the foundation of the new, high-performance, Ethernet Audio system for television broadcasters. DigiCart/E is 100% compatible with earlier DigiCart recorders, can play files produced on them, and uses similar front panel commands. A key feature of the 360 Systems' Ethernet Audio™ network is the link to Mac® and PC-based audio workstations. Audio programs produced on DAWs can be easily accessed for playback on DigiCart/E.

Networked Audio without the Computer

No computer and no mouse – just the hands-on efficiency of real buttons for all operations. DigiCart/E is designed from the ground up for broadcast professionals. It's fast, straightforward, and easy to use.

DigiCart/E Works the Same Way as DigiCart II

Everyone who knows how to use DigiCart II will know how to use DigiCart/E. It brings better displays,

better screen messages, and new networking features, with the same familiar buttons.

Complete File Compatibility with DigiCart II

All earlier DigiCart files can be played – whether Dolby AC-2, 16-bit linear, 44.1 or 48K – so valuable program content and archives can be carried forward. DigiCart/E can also create new files for use in DigiCart II, so earlier hardware investments remain a valid part of any new facility.

Make Digital Transfers to the New DigiCart/E

- The standard 100MB Zip disks for DigiCart II still move files back and forth to DigiCart/E. DigiCart/E's newer 250MB Zip drive also writes 100MB disks.

- The original D-NET file transfer protocol using AES ports has been maintained, making it easy to move valuable files into the new DigiCart/E.

- AES/EBU ports perform digital machine-to-machine transfers. DigiCart's 75-ohm AES ports on BNC connectors can transfer files as far as 1,000 feet.

New Editing Tools

DigiCart/E provides a faster way to edit audio. The weighted front-panel jog wheel moves rapidly back and forth, making it easy to place marks or set time points. DigiCart/E offers these non-destructive editing features:

- Head trims
- Tail trims
- Fade-ins
- Fade-outs
- Pre-roll times
- Gain change

Edits can always be undone, and trim points can be easily changed for a future re-edit of the cut. DigiCart/E provides clear indications of edit points and the present location within a cut.

File Interchange with Digital Audio Workstations

The new DigiCart/E employs wave files (.WAV) as a new native format, and supports broadcast wave (.BWF) extensions. It is compatible with most popular workstations, including Pro Tools®. Using Ethernet as the file-exchange medium, DAW files can be exported in .WAV format to the 360 Systems' Ethernet Audio server, where they are immediately available from any DigiCart/E terminal.

Local Audio Storage Plus Network Storage

DigiCart/E provides an important extra level of reliability by storing important audio files on its own local hard drive, separate from the file server. For example, by optionally copying files to a DigiCart/E, playback is virtually guaranteed, regardless of the status of the audio network. Redundancy is a key part of the system design. For example,

should a file commonly used by Master Control be lost on the file server, it could be played from the local hard drive on Master Control's DigiCart/E.

New Audio Standards for Television Production and Broadcast

24-Bit Audio Quality

DigiCart/E's 24-bit audio circuit design approaches 120 dB of dynamic range from the analog inputs. Our Bit-for-Bit™ digital design also maintains 24-bit integrity through AES ports, assuring error-free reproduction not only of standard PCM files, but also of Dolby AC-3 or Dolby-E recordings.

Sample Rate Compatibility

Although most users will work at a 48 kHz sample rate, DigiCart/E is equally adept at 44.1, 88.2 and 96k. The high-quality sample rate converter can be positioned at either machine input or output, permitting conversion of any sample rate to 48K, or any other rate. Now 44.1, 88.2, and 96k music masters received from compact disks or an audio workstation can be changed to standard 48K broadcast files.

Word-Length Compatibility

DigiCart/E plays files of any word length – 16, 20, or 24-bit. In addition to recording new material at 24-bits, it can also deliver 16-bit digital audio for compatibility with DAT machines or earlier DigiCart recorders.

Mixed File Types Allowed

DigiCart/E can store audio in many different formats, and play them consecutively without changing machine setup. Any desired output format, such as 48K – 16-bit, can be selected, regardless of how the original file was recorded.
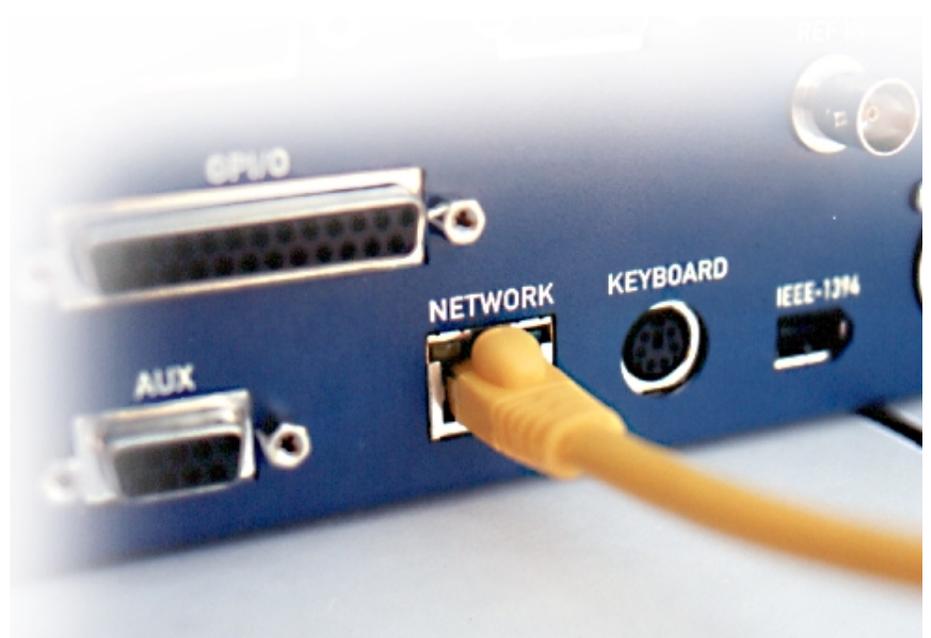
DigiCart/E®

High-Speed Transfers Through Ethernet Audio

When it's time to actually move a file to or from the server, the Ethernet Audio network can move files many times faster than real-time.

Serial and GPI Control

A variety of serial and parallel ports adapt DigiCart/E to most facilities:

• An RS-422 serial port operates with standard ES-Bus protocols; it is compatible with most automation systems, with DigiCart II, and with our new RC-Series remote controls. It also supports Peripheral Bus "E-Mem" commands, giving DigiCart/E direct control by popular video switchers.

• Five optically isolated GPI inputs provide control of play, stop, record, pause, and loop. These conform to the DigiCart II connector for easy upgrades.

DigiCart/E Uses a Time-Proven User Interface

DigiCart recorders are hands-on machines. Its physical buttons, knobs and display make it a good choice for fast-paced operations, with direct access to frequently used functions. The new DigiCart/E continues an eleven-year industry operating standard. Most users will never open the Operations Manual to make full use of DigiCart/E.

Features & Benefits

- Instant access and playout of audio from anywhere in a broadcast facility
- Same familiar operations as DigiCart II Plus
- File interchange with DigiCart II via Zip disk, D-Net, AES/EBU or linear transfer
- Utilizes popular .WAV files as a native format
- Record and playback to local drives, or to the network file server
- Hot Keys for instant-playback of audio clips, local or network
- Over 19 hours of 48K stereo storage on the internal hard drive
- 100Mb/s Ethernet interface to the network file server for fast audio transfers
- 250 MB Zip drive for import/export
- LCD displays 7 lines of text, 40 characters in length
- 24-bit A/D, D/A converters
- Read/write Dolby AC-2 data format (use is optional)
- Sample rates: 44.1K, 48K, 88.2K, 96K
- Sample Rate Converter can generate any output sample rate from stored files
- AES/EBU Digital I/O on XLR-3 connectors
- IEC-958 Type II digital I/O on BNC connectors (consumer)
- Line level analog input and output on XLR connectors
- Output level trims on rear panel
- 14-segment LED level meters with clip indication
- Threshold record trigger
- Headphone jack with level control
- Sync sources include internal crystals, AES-3, S/P DIF, AES-11 (black)
- Alphanumeric keyboard connector
- Cordless infrared alphanumeric keyboard (optional)
- RS-422/485 remote port on DB-9 connector
- Supports DigiCart/II ES-Bus serial protocols
- Supports Peripheral Bus (E-Mem) serial commands
- Supports RC-230 remote control
- Five GPI inputs with tally output, DB-25 connector
- Internal 20 GB hard drive
- Playlisting, local or network
- Software updates via Zip disk or network transfer
- Operation from 115 or 230 volts
- Compact 2U high x 19" wide for rack or table top use

Audio

Audio Channels	2
Quantization	16 or 24-bit, linear PCM
Native File Formats	WAV, DigiCart II Linear and Dolby AC-2
Data Reduction	Optional; Dolby AC-2, 48K stereo
Bandwidth	10Hz to 21 kHz ±0.2 dB @ 48K sample rate
Sampling Frequencies	44.1K, 48K, 88.2K, 96K stereo pairs
Dynamic Range	116 dB typical
Signal-to-Noise	116 dB typical
Distortion (THD+N)	<0.002%
Inter-Channel Phase Deviation	<0.1 degree at 15kHz
Inter-Channel Crosstalk	>90 dB at any frequency
Input Circuit	Electronically balanced, Z=20k ohms, XLR-3 female
Common Mode Rejection	Better than 60 dB @ 120 Hz
Maximum Input Level	+20 dBu
Level Adjustment	Rear panel trim, output level
Level Metering	Quasi-peak, 14-segment LED display with clip indication
Nominal Operating Level	+4 dBu (provides 16 dB headroom)
Sample Rate Converter	24-bit, 3:1 ratio; input or output
Output Circuit	Balanced, Z=100 ohms, XLR-3 male
Maximum Output Level	+20 dBu
Headphones	Front panel 1/4" (6.35mm) jack with level adjustment
Digital Audio Inputs	1. AES/EBU, XLR-3, 110Ω
	2. AES3-ID, BNC, 75Ω
	3. IEC-958 type II, BNC (w/ RCA adapter)
Digital Audio Outputs	1. AES/EBU, XLR-3 female, 110Ω
	2. AES3-ID, BNC, 75Ω
	3. IEC-958 type II, BNC (w/ RCA adapter)
Output Word Size Conversion	24-bit to 16-bit by TPD or noise-shaping
Digital Audio Sync Reference	Internal crystal, AES-3, or AES-11 (BNC)

General Specifications

Removable Cartridge	100 or 250 MB Zip™ magnetic disk
Internal Hard Disk	20 GB standard ATA interface
Audio Start/Restart Time	Instantaneous
Display	64 x 240 pixel graphic LCD with backlight
Network Connection	Ethernet, 100 Base-T
File Transfer to/from DigiCart II	D-NET, 100 MB Zip disk
GPI Remote Control	Remote contacts with lamp drive; 25-pin"D" connector
9-pin Serial Remote Control	RS-422/485; ES-Bus or peripheral-bus interface (E-Mem)
Cue Output (secondary marker)	Open collector output
Cue Erase/Relocate	Cue marker may be individually erased or relocated

Hard Drive Characteristics

|	
Hard Disk Reliability	MTBF >625,000 hours (6,240 POH/year @ 35°C)
Component Life	5 years
Disk Interface	Ultra-ATA/100
Error Correction	288-bit Reed-Solomon ECC
Seek Errors	<1 error in 10^6 seeks
Non-Recoverable Errors	<10 errors in 10^{13} bits
Drive or Disk Temperature	5° to 55°C (41° to 131°F)
Relative Humidity, Noncondensing	10 to 85% RH
Temperature Gradient	24°C/hr Max (75°F/hr)
Altitude	To 3,000 m (10,000 ft)
Shock	10 Gs 1/2 sine wave for 11 ms duration (write)
Vibration	1 G P-P at 5-300 Hz; Sinewave,1/2-octave/min sweep

250 MB Zip® Drive & Cartridge Characteristics

Cartridge Drive Reliability	MTBF >100,000 hours
Drive Insertion/Removal Cycles	10,000 min
Disk Insertion/Removal Cycles	2,000 min
Non-Recoverable Errors	<10 errors in 10^{13} bits
Recoverable Errors	<10 errors in 10^9 bits
Seek Errors	<1 error in 10^6 seeks
Drive or Disk Temperature	10° to 32°C (50° to 89.6°F)
Relative Humidity, Noncondensing	10 to 80%
Maximum Temperature Gradient	12°C/hr (22°F/hr)
Shock	7g 1/2 sine wave for 11 msec
Vibration	0.7g P-P at 5-17 Hz; 0.25g P-P at 17-500 Hz

Physical/Miscellaneous

Form Factor	Standard 2U 19" rack; built-in rack flanges
Dimensions (H-W-D)	3.48" x 17.00" x 12.00" (88mm x 433mm x 305mm)
Power	115/230 volts AC, 50-60 Hz, 25 watts
Cooling	Fan
Net Weight	18.25 lb. (8.3 Kg)
Agency Approvals	UL, C-UL, CE, FCC
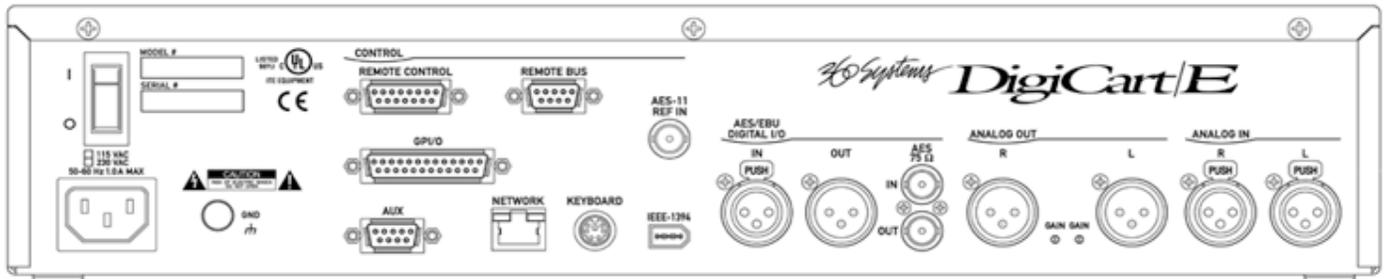
- AC Power, 115/230 volts, detachable cord with IEC connector
- Power Switch
- Ground Lug with thumb nut (frame)
- Ethernet Port (100 Mbps)
- Alphanumeric keyboard port, PS/Z
- GPI Control, 25-pin D-connector
- Serial Port, RS-422/485, 9-pin
- Remote Control Port, 15-pin (360 Systems remote control)
- Remote Bus, RS-422, 9-pin (360 Systems remote control)
- AES-11 Sync Input, 75-ohm BNC
- AES/EBU Digital Audio Input, XLR-3
- AES/EBU Digital Audio Output, XLR-3
- AES-3-ID digital input, BNC; also IEC 958 type 2
- AES-3-ID digital output, BNC; also IEC 958 type 2
- Analog Audio Outputs, Balanced, +4 dBu, XLR-3
- Output Level Trims (2)
- Analog Audio Inputs, Balanced, +4 dBu, XLR-3

Why should I consider DigiCart/E over other networked audio systems?

- More DigiCart recorders are in use in television broadcast than any other brand of hard disk audio recorder. It has an 11-year track record.
- DigiCart/E is 100% compatible with your present investment in recorded audio, disk libraries, system wiring, and operating methods.
- DigiCart recorders are one of the most reliable pieces of broadcast equipment ever made. Tens of thousands of people already know how to use DigiCart recorders.
- People like hardware-based solutions. It's faster and easier to use than a PC. 360 Systems' audio network makes economic sense for small and mid-size stations. It can be expanded to almost any size without sacrificing the original investment.
- 360 Systems' audio network is conservative, based entirely on proven technology, and can be maintained by available network professionals.

In what ways is DigiCart/E compatible with my investment in earlier DigiCarts?

- Operating controls are very similar. People familiar with DigiCart II can immediately use DigiCart/E.
- Files created on DigiCart II can be played on DigiCart/E. Your entire library of recorded audio is directly playable. Transfer methods include Zip® disk and D-NET.

- Files for use on DigiCart II may be created on DigiCart/E, and exported on 100 MB Zip disks or by D-NET. Export file types include Dolby® AC-2 and 16-bit linear files.
- Serial control via 9-pin RS-422 is identical.
- GPI control by contract-closure is identical.
- File-naming conventions and ID numbering schemes are compatible.
- All DigiCart recorders employ professional XLR-3 connectors for analog and AES/EBU digital audio, plus 75-ohm BNC connectors for AES-3-ID and IEC-958 Type II (consumer) digital audio.

What does DigiCart/E do better than its predecessors?

- Network access to centrally stored audio from any location in the building.
- Native wave (WAV and BWF) file formats for workstation compatibility
- Compatible with all sample rates from 44.1 through 96K
- Compatible with audio word lengths from 16-bit to 24-bit.
- Converts any input sample rate or word length to any other, for storage.
- Converts any stored file to any sample rate or word length for playback (real-time).
- Records, plays and edits in standard wave (WAV) file format.
- Front-panel Hot Keys for instant playback of cuts.
- Easier navigation with buttons for Drive, Directory and File.
- Much larger LCD permits easy browsing, displays five titles at once with continuous scrolling.
- Easy-to-ready interactive menu items. Includes headphone jack with adjustable level.
- Integral rack mounting; only 2U (3 1/2") high.

How much delay occurs when playing a cut from the file server?

Because a cut is immediately buffered in local DigiCart memory when selected (as are all Hot Keys), playback starts instantly.

What are the audio inputs and outputs?

- AES/EBU interfaces appear as XLR ports with transformer isolation and also as 75-ohm BNC ports (AES-3id-2000).
- Analog inputs are balanced on a XLR-3 connector with pin 2 hot, Z=20K/leg, +4 operating level, 16 dB of headroom to full-scale.
- Analog outputs are balanced, Z = 50-ohms/leg, +4 operating level, full scale output = +20 dBu. Outputs have a rear panel level trim. Audio connectors have gold plated pins for low noise.

Is there a separate AES/EBU reference input?

A separate AES-11 sync input is provided on the rear panel.

What sample rates does DigiCart/E operate at?

DigiCart/E can record and play at standard sample rates of 44.1K, 48K, 88.2K and 96K. DigiCart/E permits different sample rates to co-exist on its hard drives. It is equally adept at playing different rates, even when back-to-back within a play list

What digital audio word widths does DigiCart/E operate at?

Files may be created in either 16-bit or 24-bit word widths. The internal A/D converter is 24-bits, but can also produce high-quality 16-bit files. Digital audio inputs of any word length are acceptable, and can be converted to 16 or 24-bit lengths before being recorded. All conversions take place in real-time.

Does DigiCart/E contain a sample rate converter?

A 24-bit sample rate converter (SRC) is available on AES/EBU digital inputs and outputs. It may be used to convert any input sample rate to a preferred recording standard. For example, a compact disc (always a 44.1K audio stream) can be easily converted to 48K and recorded as a 48K file within DigiCart/E.

The sample rate converter can also be used to provide an AES/EBU digital output at a rate different than that used to record the file. For example, a music master may exist on hard disk as a 24/96 file, but can still be played

out (in real time) as a 48K, 16-bit audio stream – or any other sample rate.

DigiCart/E's file flexibility permits audio to be stored at its "native" sample rate and word size, and then converted to a new standard on a project-by-project basis.

Can digital audio word lengths be changed?

24-bit recordings may be dithered to 16-bit for output, and 16-bit input data streams may be recorded as either 16 or 24-bit words.

Is the Dolby AC-2 data format from earlier model DigiCarts available?

Dolby AC-2 processing is carried forward from the earlier DigiCart II to maintain file compatibility. It is possible (though by no means required) to record new files in that format, and also to import and play DigiCart II files in Dolby AC-2 format.

What audio file formats does DigiCart/E record and play?

- Linear PCM in 16-bit or 24-bit WAV (or BWF) format
- Linear PCM in 16-bit DigiCart II format
- Dolby AC-2 as in DigiCart II

Can DigiCart/E accept a feed from program distribution for recording?

Each DigiCart/E recorder includes both stereo line-level analog inputs and an AES/EBU digital input. Either may receive a feed from a control room output. Long-term logging is possible if desired, as the maximum file length is in excess of 32 hours.

Can a DigiCart/E record directly to the file server?

All DigiCart/E recorders can record directly to the network file server, or to their internal hard drive.

What editing operations are available?

Editing tools include head-trim, tail-trim, and pre-roll time. Edit points may be rapidly located with the weighted jog wheel, or by typing a desired location. Edits are pointers (for use within the DigiCart product family) and are non-destructive. Other DSP-based editing features are fade-in, fade-out, and gain-adjustment.

Can cuts be looped?

Accurate editing tools make it easy to create virtually seamless loops.

What about working with watermarked material?

DigiCart recorders employ 360 Systems Bit-for-Bit technology in digital recording. Input data received digitally will be replicated exactly at the output, provided such data has not been edited, sample rate converted, re-dithered to another word size, or subjected to some other DSP process such as fade-outs, etc. Standard digital recording is always Bit-for-Bit.

How does DigiCart/E handle data-compressed bitstreams such as Dolby AC-3, Dolby-E, MPEG-2?

360 Systems' Bit-for-Bit digital architecture guarantees that encoded data will not be corrupted by internal machine processes. Dolby Laboratories markets stand-alone encoders for their proprietary formats. These may be connected to 360 Systems' DigiCart/E, which will then act as an "audio data" recorder for Dolby-encoded multi-channel audio.

Can stored cuts be locked or password-protected after editing?

Operators may invest a great deal of time cutting a piece of music to fit one of their shows. DigiCart/E can lock files to prevent modification by other parties.

Are real buttons used for firing audio playback?

DigiCart/E has real illuminated buttons on its front panel and on its optional remote control. "Hot Keys" also exist on both.

Is there a playback stack or "jukebox" (user-based memories) for each DigiCart?

As many as 1,000 customizable "playlists" may be created and stored

on each drive. Each playlist may contain an unlimited number of cuts, and each can be given its own unique name, representing a show, a user, or any other identifying characteristic. Playlists can be nested, looped, and single-stepped.

Can pre-built playlists be accessed from any location?

When playlists and audio cuts are stored on the network file server, they can be accessed from any location on the network. A sequence of cuts may be developed in an edit area, and then accessed for production on a stage.

Can files be transferred between DigiCart/E and the network file server?

Files recorded to DigiCart/E's local drive can be transferred to the file server, or vice-versa. Note that original recordings can be made to a local drive, or to the server; there is no requirement to move files except as a user convenience.

How can saved cuts be imported and exported to an external medium?

DigiCart/E includes a 250 MB Zip® disk, large enough to archive a majority of file sizes used in broadcast. The drive can also use 100-MB disks to exchange material with DigiCart II recorders.

Can DigiCart/E handle "peripheral bus" or E-Mem serial commands?

Yes. A menu determines what format is accepted by the 9-pin serial port.

Can DigiCart/E accept the same automation commands as earlier models?

Yes. Major automation systems such as Harris/Louth will directly control DigiCart/E.

What about GPI control?

Five GPI inputs are provided on a 25-pin D connector: PLAY, STOP, RECORD, LOOP, PAUSE and SECONDARY. All include an open-collector output for operating an LED or lamp.

Can I play audio if the file server goes down?

DigiCart/E contains its own internal hard drive. Mission-critical locations such as Master Control can keep "local" copies of important cuts so they can always go to air. DigiCart/E does not have to be connected to a network, and also operates as a stand-alone recorder/editor/player.

Model RC-320 Desktop Remote Control

Features

Presets	16 Hot Keys for rapid playback of pre-assigned Cuts or Stacks
Find	Locates Cuts by entering the ID number
10-Button Keypad	Enters Cut ID numbers
Stack Directory	Direct access to the Stack directory
Enter	Enters/confirms new selections
Assign Presets	Selected Cuts or Stacks are mapped to any of sixteen presets
View Playlist	Visual preview of a Playlist
Make Playlist	Assembles Cuts into a list
Play-Stop-Record	Transport functions
Loop	Plays a Cut or Stack continuously
Pause	Places machine on "hold" in both Play and Record
Menu Keys	Edit, Setup, Utility
Display	2-line x 20 character VFD display
Key Switches	Double-shot molded legends, color-coded
Dimensions (HxWxD)	1.875" x 11.5" x 7" (47.6mm x 292mm x 178mm)

DigiCart/E®

Model RC-235 Infrared Keyboard

- Compact size / Cordless / Easy to store
- Enter Cut Titles and Numbers
- Controls Ten Primary DigiCart/E Functions
- Keys can be mapped to Hot Keys or Playlists

The RC-235 wireless keyboard is designed for remote control of the DigiCart/E recorder from a distance of 25 feet. The absence of a connecting cord makes it convenient to set the RC-235 aside when not needed.

The infrared receiver plugs into the keyboard jack, and may be positioned to facilitate pickup from the keyboard. Fifteen different channel settings are available for each keyboard/receiver pair, so multiple units can be operated in the same room without interference.

The 88-key layout includes embedded numeric keys, plus 10 function keys mapped to operate primary DigiCart features. These include: utility menu, setup menu, edit menu, view list, find, pause, loop, record, stop, play, and cancel.

Models & Accessories

MODEL	DESCRIPTION
E-3000E-115	DigiCart/E with 20GB hard drive, 115 volt
E-3000E-230	DigiCart/E with 20GB hard drive, 230 volt
RC-320	Full function wired remote control
RC-235	Infrared keyboard remote control
BOOK-2000E	Operations manual
BOOK-320	Operations manual for RC-320 Remote Control
D-SERIAL-320	Spare Serial Cable for RC-320, 25 ft. (7.5m)

DigiCart/E®

Sales Contacts

Authorized Network System Representatives

360 Systems will appoint qualified organizations to represent DigiCart/E
and other network products throughout the U.S. and for export.
Be certain to obtain the names of authorized sales representatives from the
factory before placing an order.

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