SOUND DEVICES

702 / 702T (time code)

High Resolution Digital Audio Recorders
User Guide and Technical Information
firmware rev. 1.67

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TIME CODE

FireWire

backside - front cover

Table of Contents

Note About This Guide
Quick Start Guide 3
Powering the Unit
Menu Navigation Basics
Connecting Audio Sources
Routing Inputs to Tracks
Selecting Recording Parameters and File Destination
Time Code Setup (702T only)
Recording
Playback
FireWire File Transfer
Front Panel Descriptions 6
Panel Button Lock
LCD Main Display Descriptions 9
Left Panel Connectors and Controls 11
Right Panel Connectors and Controls 12
Back Panel Descriptions 13
Input Setup and Control 14
Input Source Selection
Analog Inputs
Input Linking (Stereo or MS Decoding)
Signal Presence and Peak Indicator
Digital Input – AES3
Digital Input – AES3id (S/PDIF)
Input Delay
Input-to-Track Routing 17
Routing
Selective Input Muting
Sampling Rate and Bit Depth 18
Sampling Rate
Bit Depths
Word Clock 19
Clock Slave
C. Link – Multi-Unit Linking
Outputs – Analog and Digital 21
Analog Output Bus
Digital Output Bus
Headphone Output 22
Selecting Headphone Sources
Setting Headphone Source Options
MS Stereo Monitoring
Rotary Switch Behavior
Headphone Favorite Selection
Headphone Playback Mode
Warning Tones
Metering and Display 24
Output Meter
Meter Ballistics
Peak LEDs
Tone Oscillator
LCD Contrast & Backlight, LED Brightness
Record Indication
Time Code (702T only) 26
Frame Rate
48048-F Sampling Rate Mode
Time Code Modes
Jam Menu
User Bits
NTSC Standard Definition (SD) Video Production
Audio File Formats 31
WAV / BWF
MP3 Files
Recording 32
Recording
Pre-Record Buffer
Failure During Recording
Display Options
Playback 33
AutoPlay
File Naming / Numbering 34
Scene Name/Number
Take Numbers
Mono Track Name Designators
Duplicate File Names
File Management 36
File Finder Navigation
File Viewer Screen
Folder Actions
File Time and Date
File Size Maximum
File Deletion
File Transfer – FireWire
Compact Flash Recording Media 40
Formatting
Speed Testing
Media Repair Utility
Qualified CF Cards
Powering 42
Lithium Ion Rechargeable Battery
External Powering and Battery Charging
Time Code Clock Battery
Auto Functions with External Powering
Firmware Upgrades 44
Version Information
Upgrading Firmware
Specifications 46
Connector Pin Assignments 48
Power Consumption Variables 49
Recording Time Calculation 49
Uncompressed Recording Time in Track-Hours
MP3 Compressed Record Time in Hours
Accessories 51
Front Panel Button Shortcuts 52
Setup Menu Shortcuts
Warranty and Technical Support 53
CE Declaration of Conformity 54
Software License 55
702 Setup Menu 56
702 Setup Presets 60
Built-In Presets
User Setup Data File
702T Setup Menu 63
702T Setup Presets 68
Built-In Presets
User Setup Data File

Welcome

Thank you for purchasing the 702 / 702T digital recorder. The super-compact 702 records and plays back audio to and from Compact Flash, making field recording simple and fast. It writes and reads uncompressed PCM audio at 16 or 24 bits with sampling rates between 32 kHz and 192 kHz. Compressed (MP3) audio playback is also supported. The time code implementation on the 702T extends its usefulness in audio-for-picture applications—from over-the-shoulder to cart-based production.

The 702 implements a no-compromise audio path that includes Sound Devices' high-resolution, discrete microphone preamplifiers. Designed specifically for high bandwidth, high bit rate digital recording, these preamps set a new standard for frequency response linearity, low distortion performance, and low noise.

With documentary and ENG sound engineers in mind, the 702 is very small, while still being feature-rich. No other recorder on the market matches its size and feature set. In addition, its learning curve is quite short—powerful does not mean complicated. While the 702 is a very capable recorder by itself, it truly excels when used in conjunction with an outboard audio mixer such as Sound Devices' own 442 or 302.

Sound Devices took advantage of the best in professional and consumer electronics technologies to bring incredible feature depth with ease of use. Compact Flash media is highly reliable, industry standard, and easily obtainable. The removable, rechargeable battery is a standard Sony-compatible Li-ion camcorder cell. The 702 interconnects with Windows and Mac OS computers via FireWire for convenient data transfer and backup.

Note About This Guide

Throughout this guide the 702 model variation will be referenced, describing features of both the 702 and 702T models. Features exclusive to the 702T will be identified throughout.

Copyright Notice and Release

Quick Start Guide

The 702 is an extremely powerful and flexible portable audio recorder. Before recording, please familiarize yourself with the product. Several settings should be verified or set based on individual recording needs.

Powering the Unit

1. Apply power to the unit by attaching the (included) removable, rechargeable Li-ion (lithium ion) battery to the back panel battery mount. The metal tabs on the mount line up with the electrical contacts on the battery. From the factory, the battery may not have a charge, so external DC may be needed for initial operation and charging. Connect the included AC-to-DC power adapter to the DC input plug to power and charge the battery.
2. Press and hold the power button to turn on the unit. Press and hold the power button to turn off the unit.

If this is the first time the recorder has been powered, or if it has been without a battery for an extended period, the date and time may need to be set.

Charge the included Li-ion battery for 6 hours prior to initial use.

Menu Navigation Basics

The Setup Menu provides options for recording, routing, and control. The single layer menu structure allows for very quick navigation and function selection. To enter the Setup Menu press the front panel menu (MENU) button. Once in the Setup Menu, the following conventions are shared for navigating among selections and to select specific parameters.

- (MENU) - enters Setup Menu
- ›ITEM‹ - highlighted menu item
- ✔ - selects highlighted item or parameter
- ↑ - moves up in menu and between menu parameters
- ↓ - moves down in menu and between menu parameters
- ✘ - exits the selected function or Setup Menu altogether
- The (■) stop button will exit from any menu and cancel any changes. Use it to escape out of the Setup Menu.

The right panel Rotary Switch (labeled “Select”) is a convenient control to quickly navigate among menu items and item options. Its push-to-select function duplicates the check mark in most menus.

Connecting Audio Sources

1. Connect audio sources, either analog or digital, to the appropriate input connector.
2. Set the appropriate input level—mic, line, or digital (input 1)—with the adjacent slide switch.
3. If mic-level inputs are used make certain that phantom power, input limiters, and high-pass filters are activated as required.

Routing Inputs to Tracks

Before recording, inputs **must** be assigned to tracks. Each 702 input (1 and 2) can be assigned to the two recorded tracks (A and B). These 16 possible routing combinations are shown on the front panel with 4 blue LEDs. Illuminated LEDs indicate input-to-track assignment.

1. Press and hold the ■ STOP button then press the INPUT button to cycle through factory routing presets. The 702 has several often-used presets for quick setup of input-to-track routing combinations. Note the routing combinations on the blue LEDs with each successive press.
2. If none of the preset routing combinations are suitable, assign a custom routing. Sequential presses of the INPUT button will eventually cycle to the custom routing option (see *Input to Track Routing, pg. 18*). From the custom input routing menu any input can be assigned to any track, including multiple inputs assigned to a single track.
3. Press **EXIT** to leave input routing mode.

If no input is assigned to a track the 702 will not record.

Selecting Recording Parameters and File Destination

For most productions, the general recording parameters of bit depth, sampling rate, and file format are infrequently changed. Enter the Setup Menu to verify recording settings. Bit depth and sampling rate are displayed on the LCD panel.

1. Select the bit depth as needed.
2. Set the sampling rate as needed.
3. Select the file type, WAV, BWF or MP3, for recorded files.

Time Code Setup (702T only)

When using a time code workflow, proper time code setup is essential for accuract sync of picture and sound. Skip this section if time code is not being used.

1. Select a time code frame rate appropriate for your project. For film production, typical the time code rates are 30 fps non-drop (NTSC) or 25 fps (PAL). For standard definition video projects, use either 29.97 or 29.97 non-drop. For high-definition projects, use either 23.98 or 29.97, depending on what post workflow or format is used.
2. Select the time code run mode: free run, record run, 24 hr. run, or one of the external run modes.
3. Typically, the 702T is used as the master clock source and all other cameras and slates are jammed to it. This will assure that every device is using the same time reference. (See *Time Code* for additional information on time code setup).

Recording

With file parameters set, the 702 is ready to record. The 702 is a record-priority device—pressing the record button cancels all functions, except file-based operations, and immediately begins recording a new sound file. When record is pressed, the red record LED illuminates to confirm that the unit is recording. The file name on the LCD display shows the currently recorded sound file. Press and hold the ■ STOP button to end recording.

Playback

When recording is stopped, the most recently recorded file is immediately available for playback. Press the ► button to start file playback from the beginning of the file.

To select files for playback:

1. Press and hold the HDD button to enter the File Viewer and navigate among sound files and folders for playback. The folder of where the most recent file was recorded is opened when the HDD button is pressed.
2. Use either the Rotary Switch or the arrow soft-buttons, to navigate through file folders.

3. Once a file is highlighted, press the ▶ play button to begin playback.

When playback has finished, the filename will flash on the LCD display. Use the » fast-forward button or « rewind button to step through files in the folder, or press the ■ stop button to exit playback mode.

FireWire File Transfer

Sound Devices strongly recommends shutting down equipment before connecting to or from any FireWire device with a connection that carries power (6-pin). Reports have come to our attention of isolated problems when hot-plugging IEEE 1394 (FireWire) devices. (Hot-plugging refers to making the connections when one or more of the devices—including the computer—is on.) When hot-plugging, there are rare occurrences where either the FireWire device or the FireWire port on the host computer is rendered permanently inoperable. From our experience, any FireWire connection which carries power is susceptible to this type of damage.

When connected via FireWire (IEEE-1394a) to a Mac OS or Windows OS computer (*see Specifications for computer requirements*), the Compact Flash card mounts onto a computer as "letter" accessible, removable storage media. This effectively makes the 702 a card reader for Compact Flash cards. Use the appropriate FireWire cable (6-pin to 4-pin or 6-pin to 6-pin) for interconnection. From the computer files on the 702 CF card can be treated as if they are local files, including renaming files, copying, deleting and playing directly through the 702.

In general, it is good practice to transfer sound files from the 702 to a computer before any processing is performed on the files.

To connect the 702 for FireWire transfer:

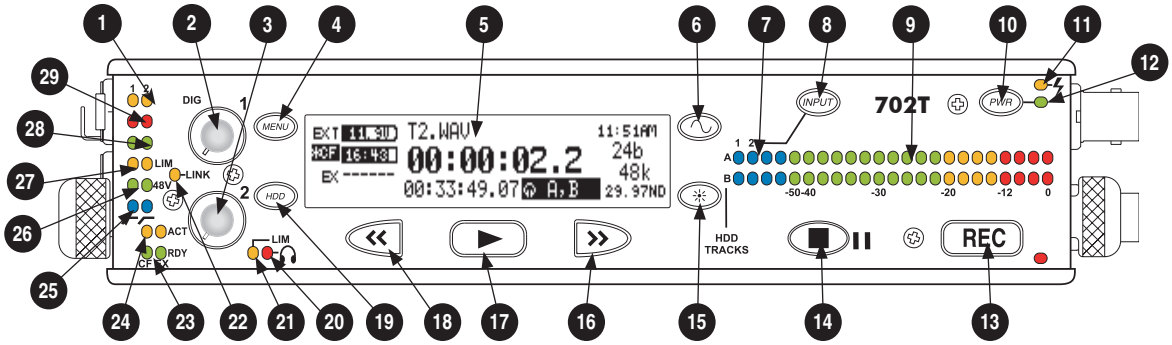
1. Stop all playback and recording, then shut down the recorder
2. Make certain the 702 battery is fully charged, or that the unit is connected to external DC.
3. Connect the 702 to the host computer with a FireWire cable.
4. Power the 702.
4. The 702 will enter FireWire mode, indicated by **COMPUTER CONNECTION** on the LCD display. All functions of the 702 are stopped while the 702 is connected to a computer through FireWire.
5. Navigate to the attached drive from the computer and copy all needed sound files to local storage on the computer.

To avoid possible corruption of data on the Compact Flash card, do not interrupt the connection process and always properly dismount (eject) the drives from the operating system. On Mac OS platforms, drag the drive icons to the trash. On Windows platforms, right-click the 702 volume and choose eject.

Dismount the 702 after file transfer by "ejecting" the volume from the computer. In Mac OS, drag the disk icon from the desktop to the trash or hit ⌘-e. In Windows OS, highlight the disk icon, right-click, and select "eject". It is best practice to "eject" the 702 volume from the computer to maintain file integrity (*see FireWire File Transfer*).

Front Panel Descriptions

All 702 settings can be accessed and monitored through the front panel LCD and navigation buttons. This allows the unit to be placed in a production bag along with field mixers, wireless transmitters, and wireless receivers.



1) **Digital Input LEDs**
Indicates the presence of AES or SPDIF-digital signal on the respective input. When flashing, indicates that digital input is selected but no valid digital word clock signal is present.

2) **Input 1 Gain**
Controls the analog gain (input trim) of the channel 1 input. Normal mic input range is from 25 dB to 70 dB, low gain mic range is from 10 dB to 55 dB, line input range is from –6 dB to 18 dB. For line-level inputs, this control can be defeated for setup-menu-controlled gain. If the LCD display shows "locked" when the control is rotated, gain control of the line-level input is menu-controlled. When inputs are linked as a stereo pair, Input 1 Gain controls the gain of both inputs.

3) **Input 2 Gain**
Controls input 2 gain, as in #2 above. When inputs are linked as a stereo pair, Input 2 Gain adjusts left-to-right balance.

4) **MENU Button**
Used to access all 702 Setup Menu selections. When in menu mode, used to move up through the menu selections. Pressing the HDD and MENU buttons simultaneously brings up the time code jam menu (702T).

5) **LCD Display**
Primary display of the 702. The LCD is backlit using the LCD backlight control (#15).

6) **Tone Oscillator**
Press and hold to activate the tone oscillator. Tone frequency, tone level, and routing are controlled in the Setup Menu. Tone must be pressed before entering recording to lay tone to the head of a sound file. Tone level and frequency are menu-controlled.

7) **Input-to-Track Matrix LEDs**
Blue LEDs indicate inputs (1 and 2) enabled for recording to tracks (A and B). A solid blue LED indicates an input is routed to a track. A flashing LED during "custom" routing mode shows the selected input/track combination.

8) **INPUT Select Button**
Pressing the INPUT button brings up the input muting and routing menu. Hold down the INPUT button and press one of the indicated soft buttons to mute inputs. Pressing the STOP button and the INPUT select button cycles through the four factory preset input-to-track routing combinations plus the custom routing menu. In the custom routing menu any input can be routed to any track. See *Input-to-Track Routing, page 18*.

9) **Level Meter LEDs**
Two 19-segment track level-meters indicate level in dBFS. Metering ballistics are selected in the Setup Menu.

10) **Power Button**
Press and hold to power up the 702. Press and hold to power down.

11) **Charge LED**
Indicates the charge status of the on-board battery charger. LED flashes when external power is connected and the removable battery is charging; illuminates solid when battery is fully charged.

12) **Power LED**
Indicates the 702 is powered and available for operation. LED flashes when the removable battery or external DC is in a low-voltage condition.

13) **Record Button**
Press to record. The 702 is a record-priority device; pressing this button starts recording and discontinues all other functions, except file operations. Pressing button during recording can set a cue marker or start a new file, as selected in the Setup Menu.

14) **Stop/Pause Button**
Press and hold to stop recording. In playback mode, a single press pauses playback (play-pause), allowing audio scrubbing with the FF and REW buttons. Another press of the button enters play-stop mode where the FF and REW buttons select files for playback from the current folder. One more press of the button exits playback mode altogether. In the Setup Menu the stop button is also used to exit from any selection, returning to the main display.

15) **LCD Backlight Button**
Press to toggle LCD and buttonboard backlighting. Hold the button and turn the Rotary Switch to adjust the brightness of LEDs. In menu mode, functions as the soft-button to cancel a selection.

16) **Fast-Forward Button**
Performs fast-forward (FF) scrubbing through a playing sound file when pressed in playback and play-pause mode. Play-pause indicated by flashing A-time on LCD. Fast forward rate increases the longer the button is held. In play-stop mode (indicated by flashing filename on LCD) selects the next file in the record folder (either daily folder or main folder).

17) **Play Button**
Plays the sound file displayed in the LCD. If pressed immediately after recording is stopped, the most recently recorded file is begins playback.

18) **Rewind Button**
Performs reverse (REW) scrubbing through a playing sound file when pressed in playback and play-pause mode. Play-pause indicated by flashing A-time on LCD. Reverse playback rate increases the longer the button is held. In play-stop mode (indicated by flashing filename on LCD) selects the previous file in the record folder (either daily folder or main folder).

19) **HDD (File Viewer) Button**
Press to enter the File Viewer. Pressing simultaneously with the MENU button opens the time code jam menu.

20) **Headphone Output Peak LED**
Indicates overload of the headphone amplifier. When lit, the headphone circuit is overloading. Reduce headphone level.

21) **LIM LED**
Indicates that the microphone input limiters are on. This LED does **not** show input limiting activity (*see descriptor #27, Microphone Input Limiter LEDs*).

22) **Link LED**
Indicates that channels 1 and 2 are linked as a stereo pair. In link mode input 1 potentiometer controls gain, input 2 potentiometer controls left-to-right balance. Inputs can be linked as either a stereo L/R pair or as a a Mid-Side (MS) pair.

23) **Media Ready LEDs**
Indicates storage media is present and available to record; CF (Compact Flash), EX (external Firewire device) [*EX not available in firmware version 1.xx*]. Flashing indicates media problem.

24) **Media Activity LEDs**
Indicates storage media read/write activity. CF (Compact Flash), EX (external Firewire device) [*EX not available in firmware version 1.xx*]. Do not remove power until all media activity LED's are off.

25) **High-Pass Filter LEDs**
Indicates that the high-pass (low-cut) filter is active for the input. High-pass only operates when the input is set to microphone level.

26) **Phantom Power LEDs**
Indicates that phantom power (48 volts) is active for the individual input. Phantom can be applied to microphone or line-level signals (menu-selected).

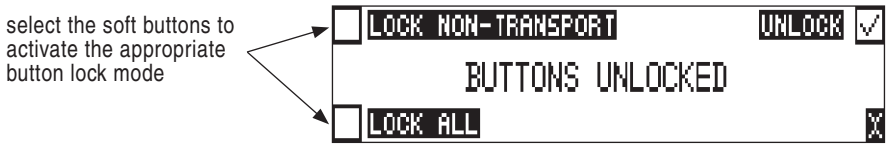
27) **Microphone Input Limiter LEDs**
Illuminates orange when limiting is occurring on the microphone input. If constantly lit, the microphone input is being hit with too "hot" of a signal. Reduce the input sensitivity until limiting occurs infrequently.

28) **Input Signal Presence LEDs**
Indicates presence of analog or digital signal and its relative level on each of the four inputs.

29) **Input Peak (Overload) LED**
Indicates analog signal is approaching clipping (–3 dBFS) on each of the inputs. Additionally, flashes to indicate that an input is muted.

Panel Button Lock

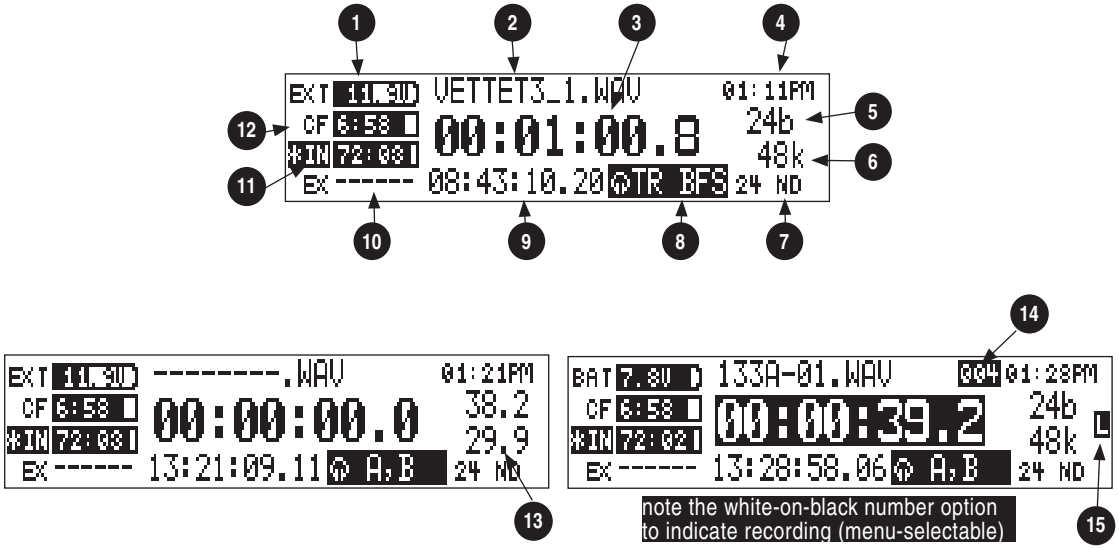
Press and hold the backlight button then the tone button to bring up the Button Lock screen. Button Lock prevents accidental changes to settings or record status. The 702 displays any button lock options enabled.



There are three modes:

- **Unlocked** – all buttons are accessible and operate normally.
- **Non-Transport Lock** – All front panel controls are locked except the Record, Stop, Play, Rewind and Fast Forward.
- **Lock All** – All front panel buttons are locked except the Record button. The Record button is kept active so the user can initiate recording after entering this mode and enter cue markers. To stop recording in this mode, you must disengage the panel lock and hit the stop button.

LCD Main Display Descriptions



1) **Battery Level Indicator**
Shows the voltage level of either the removable Li-ion battery or external power sources. External power overrides battery power when present. Graphical bar for relative level and numeric indicator for precise voltage measurement.

2) **File Name Display**
Shows the file name actively being recorded or played back. In playback-stop mode, a flashing file name indicates that the fast-forward and rewind buttons can be used to step through files in the current playback folder.

3) **Absolute Time (A-time) Display**
Shows the elapsed time of the file being recorded or played back in hours, minutes, seconds, and tenths. The A-time and the time code display can be exchanged if a large time code display is needed. This display can be set to reverse or flash during recording. Flashes in playback-pause mode.

4) **Time & Date Display**
Alternating display between the set date and time of the 702. This information is written as the creation and modification date for recorded sound files.

5) **Bit Depth Indicator**
Shows the set record bit depth. In playback, shows the file bit depth.

6) **Sampling Rate Indicator**
Shows the set record sampling rate. In playback shows the file sampling rate.

7) **Time Code Rate (702T only)**
Shows the set time code frame rate. If a sound file has time code information, the playback frame rate is shown. If external time code is connected and the external rate differs from the rate set internally, the time code rate will flash.

8) **Headphone Source Display**
Indicates the source for headphone output. Sources and selection order are user selectable in the Setup Menu.

9) **Time Code Display (702T only)**
In stop and record, shows the time code generated or received by the 702T. In play mode, the display shows the played file's time code information (if available). If non-time code files are playing, the display shows dashes. The time code display can be exchanged with the A-time display from a Setup Menu selection.

10) **External Media Space Status (space remaining/record ready)**
Not available on version 1.xx firmware. Bar graph indicates amount of record time remaining on external FireWire media. Numbers show time in hours and minutes based on the presently selected number of record tracks, sample frequency, bit rate, and file type.

11) **Compact Flash Status (space remaining/record ready)**
Bar graph indicates amount of record time remaining on the inserted Compact Flash card. Time remaining is shown in hours and minutes based on the presently selected number of record tracks, sampling rate, bit depth, and file type.

For both media types, an asterisk in front of the media indicates that it is selected for recording. Highlighted volume indicates media selected for record monitoring, playback or file folder display.

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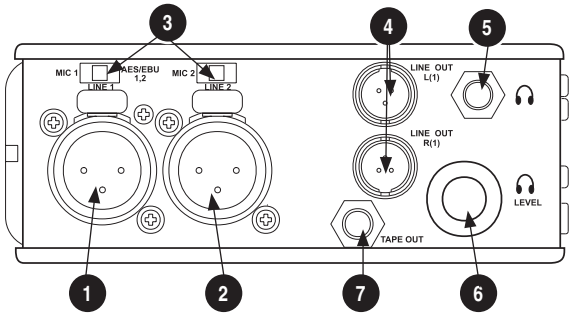
13) **Input 1/2 Level**
When input 1 or 2 gain is turned this indicates the gain level in dB for inputs 1 and 2. Normal mic input gain range is from 26 dB to 70 dB, low gain mic range is from 10 dB to 50 dB, line input range is from –6 dB to 18 dB. "Locked" will be displayed on the LCD when the gain is turned with digital inputs selected or with line inputs set for menu control.

14) **Cue Marker Display**
In record mode, indicates when cue markers are set. Markers are set by pressing the record button (this option must be selected in Setup Menu). In playback mode, displays cue points numerically as they are reached in a file.

15) **External Digital Clock Indicator**
Indicates that the 702 is locked to a valid external AES or word clock source.

Left Panel Connectors and Controls



1) **XLR Input 1/AES3 Input 1&2**
Dual function input connection. Input type set with switch above. Active-balanced analog microphone- or line-level input for input 1. Transformer-balanced two-channel AES3 input (1 and 2).

2) **XLR Input 2**
Active-balanced analog microphone- or line-level input for input 2.

3) **Mic-Line Input Switch**
Selects the input level and mode of the associated XLR input connector. Input 1 also can be selected for AES3 input.

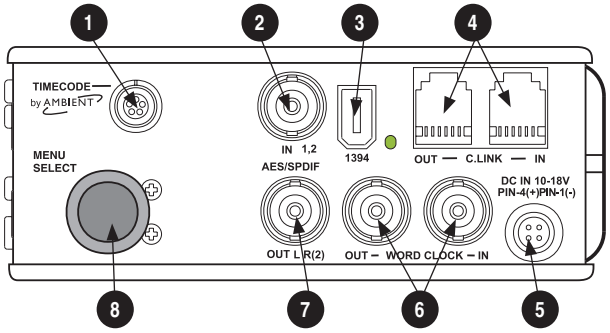
4) **TA3 Master (L/R) Analog Outputs**
Active-balanced, line-level analog L/R outputs for the Master Output Bus. Program source and attenuation level are user selectable. Pin-1 ground, pin-2 (+), pin-3 (–).

5) **Headphone Output**
3.5 mm TRS stereo headphone connector. Can drive headphones from 8 to 1000 ohm impedances to very high levels. Tip-left, ring-right, sleeve-ground.

6) **Headphone Level**
Adjusts the headphone output level. NOTE: the 702 is capable of producing ear-damaging levels in headphones.

7) **Tape Output**
Unbalanced tape (–10 dBv nominal) output on 3.5 mm TRS stereo connector. Signal source is identical to the Master Output Bus. Tip-left, ring-right, sleeve-ground.

Right Panel Connectors and Controls



1) **Time Code Multi-Pin (702T only)**
Time code input and output on 5-pin LEMO® connector.

2) **AES3id Input 1/2**
Unbalanced digital input accepts two channel AES3id (or S/PDIF) on BNC connectors. Supports sample rates up to 200 kHz.

3) **FireWire (IEEE-1394) Port**
Connection to a computer to access the Compact Flash card as a mass storage device. Direct connection to Mac OS (10.2+) and Windows (XP- and 2000-only) computers.

4) **C. Link In/Out**
RS-232 protocol interface on 6-pin modular ("RJ-12") connector for linking multiple 7-Series. Word clock, machine transport, and time code are carried on the C. Link connector. Additionally, C. Link accessories connect through this connector.

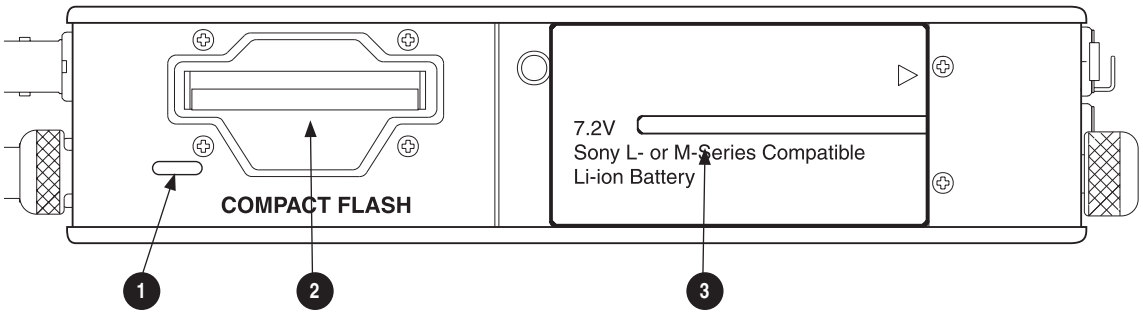
5) **External DC In**
Accepts power sources of 10–18 volts DC for unit powering and removable Li-ion battery charging. The Hirose 4-pin connector is wired pin-1 negative (–), pin-4 positive (+). Pin-2 (–) and pin-3 (+) are used to charge the removable Li-ion battery. DC ground at both pins-2 and 3 is at the same potential as chassis and signal ground.

6) **Word Clock Input and Out**
Provides clock input and output for the 702. Word input accepts sampling rates from 32 kHz to 192 kHz. Word clock output is the rate that box is running. There is no sample rate conversion onboard the 702.

7) **AES3id Master Output Bus**
Unbalanced digital output, two-channel, for the Master Output Bus. Signal source is menu-selected and is identical to the Analog Master Output Bus signal.

8) **Rotary Switch**
In record and playback modes, selects the headphone monitor source; push action is user selectable. When in the Setup Menu, the Rotary Switch moves between menu selections; push to select or enter data.

Back Panel Descriptions



1) **Security Slot**
Compatible with the Kensington® Security Slot specification. Useful for securing the recorder to a fixed object with a compatible computer lock.

2) **Compact Flash Slot**
Accepts Compact Flash cards with the label-side up. Compatible with Type I, Type II, and MicroDrives.

3) **Battery Mount**
Accepts Sony® InfoLithium L- or M-Series removable batteries. Also accepts batteries conforming to this mount. Various capacities, from 1500 mAh to 7000 mAh are available.

Input Setup and Control

The 702 has two inputs and two record tracks. Inputs are selectable between analog or digital sources. Analog inputs are connected with the balanced XLR connectors; digital inputs can be connected to either XLR Input 1 (AES3) or the BNC input (AES3id).

Input Source Selection

Input types are selected in pairs. Each input pair accepts analog or digital audio. The XLR input signal is selected with slide switch above the connector.

Manually selecting the audio source is used to force the inputs to analog while using an AES3 or AES3id input to lock the 702 to an external sample rate.

Digital sources connected to AES3id BNC inputs override analog signals on the corresponding XLR input. The BNC input signal type is set in the menu settings **INPUT 1,2: SOURCE**. For most situations the appropriate setting is auto select—the 702 will choose the input type based on signal present.

The 702 is capable of off-speed sample rates when clocked from either external digital inputs or the word clock input.

Input sources can be set to "disabled (power save)". This option shuts down all circuitry associated with the inputs to reduce power draw and extend battery runtime during playback. When an input pair is disabled, the digital input LEDs associated with the pair will flash.

Analog Inputs

Analog inputs on XLR connectors, are the primary connection into the recorder. These inputs accept balanced or unbalanced mic- or line-level signals. Gain control for mic inputs 1 and 2 is adjusted solely by the front panel pop-up potentiometers. Gain for the line-level inputs can be controlled by the front panel potentiometers or via menu settings. Line input gain is controlled in 0.1 dB steps.

A digital input present on the BNC inputs will override an analog signal present on the XLR inputs unless the input source is set to analog in the Setup Menu.

In the Setup Menu, the following functions can be controlled for analog inputs 1 and 2:

Phantom Power

Phantom power (48 volts) can be activated for analog inputs. When active, phantom is indicated by the illuminated front panel LEDs (48V).

Phantom power can be applied to both mic- and line-level inputs. Using the line-level input setting with microphones is useful in extreme SPL environments such as concert recording. Make certain to turn off phantom power with line level output devices susceptible to damage from DC.

Shortcut: To toggle phantom power without entering the menus, press and hold the Tone button then press the MENU button (MENU) for channel 1. Channel 2 phantom can be toggled by pressing the tone button then pressing the HDD button (HDD). If the inputs are in line level mode, phantom power will not activate using button combination shortcut. and must be activated from the menus.

Input Limiters (mic-level only)

Microphone inputs 1 and 2 each have a limiter circuit designed to prevent input overload. In normal operation, with proper gain settings, the limiters should rarely engage. When activated, these limiters will prevent unusually high input signal levels from clipping the analog input stage of the pre-

amp. The front panel LIM LED () shows that the limiter is engaged. Limiter activity is indicated by additional front panel LEDs, one for each input channel (). The input limiters activate only with mic-level inputs. The limiters are engaged by (factory) default.

When limiters are engaged, audio on channels 1 and 2 is limited to –6 dBFS.

Microphone-Level Control

Microphone gain is controlled by the front panel pop-up potentiometers. The gain control adjusts an analog gain stage and is identical to the input trim on a mixing console or stand-alone microphone preamplifier.

Even with the gain controls fully counter-clockwise, there is gain, and consequently audio passing through the recorder. The front panel gain controls do not function as faders.

Gain Range (microphone-level only)

The microphone inputs operate in two gain ranges, normal and low. The normal range is from 25 dB to 70 dB of gain. The low range is from 10 dB to 55 dB. The low range is useful for high SPL recording environments.

High-Pass Filters (microphone-level only)

The high-pass filters on the microphone inputs use both analog and digital filters to reduce sensitivity to low frequency signals. When the high-pass is engaged on an input, its blue front-panel LED illuminates to indicate it is engaged (). The first pole of the high-pass is an analog filter at 40 Hz, 6 dB per octave. This filter is part of the microphone preamplifier circuit. Additional poles of high-pass filtering are done in DSP.

Several frequency and slope combinations are available, including corner frequencies of 40, 80, 160, or 240 Hz, and filter slopes of 12 dB, 18 dB, or 24 dB per octave. The high-pass is selected for each input independently.

Shortcut: The filters can be toggled with a two-button combination. Press and hold the LCD backlight button  and press the MENU button  for channel 1 high-pass. Press and hold the LCD backlight button  and press the HDD button  to toggle channel 2 high-pass.

Line-Level Gain Control

When in line-level position, the gain for inputs 1 and 2 is controlled by the front panel recessed potentiometers or by a menu sensitivity setting. When set for front panel control in the user menu, **`LINE INPUT 1: GAIN`** and **`LINE INPUT 2: GAIN`** controls in the user menu are lined out and not accessible.

Input Linking (Stereo or MS Decoding)

Analog inputs 1 and 2 can be linked as a stereo pair. When linked, the channel 1 front panel potentiometer controls the signal level of both inputs, and the channel 2 pot controls the left-to-right balance of the pair. When the inputs are linked, their peak limiters are linked, as well.

When set to link as an MS pair, the inputs are decoded as MS stereo, where the gain and balance for the pair work the same as stereo linking above. Input 1 is for Mid signal, input 2 for Side signal.

If MS stereo linking is selected for inputs, program sent to tracks and headphones will be L/R stereo program. To record discrete M and S signals, do not link for MS, but monitor the MS signal in headphones.

Signal Presence and Peak Indicator

 The signal presence and peak indicators show audio activity before input-to-track routing. Input signal presence LED's illuminate when a –50 dBFS or greater signal is present. Input signal peak LEDs illuminate when signal levels reach –3 dBFS or greater.

Digital Input – AES3

The 702 accepts AES3 (AES/EBU) balanced digital at the input 1 XLR connector. Digital input is two-channel—AES3 signals on XLR-1 appear at inputs 1 and 2. To use the AES3 input, the input mode-select switch must be set to AES/EBU. There is no level control for AES inputs.

 The front panel digital input LEDs illuminate when digital signal is selected as input. If the LED is flashing, digital input is selected but a no valid digital clock is being received.

Digital Input – AES3id (S/PDIF)

The 702 accepts AES3id and S/PDIF unbalanced digital signals on the BNC connector. The 702 will auto detect the type of digital signal and adjust accordingly. Like AES3 signals, this is two channel input. There is no level control for AES3id inputs.

AES3id inputs override analog signals present at the XLR inputs. To use analog sources while using the AES3id signal as a digital clock source, select analog in the input source menu selection.

When a digital signal is present, the 702 locks its sample rate to its source frequency. This lock is indicated by a highlighted block L on the main LCD display to the right of the bit depth and sample rate indicators. Recording bit depth is independent of the external digital source.

When locking the 702 to an external digital signal, be certain the source is stable. Loss of digital signal will cause the 702 to revert to its internally set sample rate, even while recording. The portion of the file recorded after the loss of signal may not play back properly. Once recording has begun, unused digital inputs are muted, digital signals that appear on them after the record button has been pressed will not be recorded or affect the sample rate of the 702.

The 702 clocks itself to the first digital signal presented to it. If the 702 detects a digital signal on the BNC inputs and locks to that signal, a digital signal applied to the XLR input will be ignored until the first digital signal is removed.

Input Delay

A digital delay is selectable on each channel of the 702 in one microsecond (µS) steps. 1,000 microseconds equals 1 millisecond (ms). The Rotary Switch and menu arrows are accelerated. The more you press or spin, the faster the delay setting will increment or decrement. Delay is not set until enter is pressed. The amount of delay available is dependent on the sampling frequency in use.

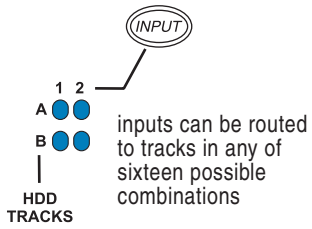
Sample Frequency	Maximum Amount of Delay Available (per input)
32, 44.1, 48, 48.048 kHz	30,000 µS
88.2, 96, 96.096 kHz	15,000 µS
176.4, 192 kHz	7,500 µS

Input delay can be useful for time-aligning input signals from differing sources. For example, digital wireless mics that have a processing delay in their outputs. In addition, all digital conversion stages have delay.

Input-to-Track Routing

The 702 uses a flexible routing scheme to assign inputs and tracks for recording. The input matrix allows any input to be routed to any recording track. Multiple inputs can be routed to a single track to create mono-mixed recordings.

The 2-by-2 blue LED matrix makes it easy to view the set routing. A solid blue LED indicates an input is assigned to a record track.

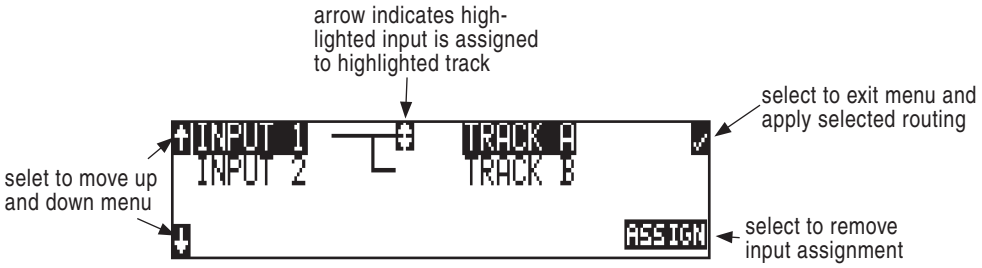


Routing

Hold down the STOP button then press the INPUT button (INPUT) to cycle through the four preset input-to-track routing combinations. These presets are factory set and cannot be changed. The last preset selection brings up the **CUSTOM ROUTE** option. Press the **EDIT** soft button to enter the custom routing menu. Custom routing allows any input to be assigned to any record track. In the menu, highlighted input and track combination are displayed in white text. The two inputs are shown on the left; the two record tracks are shown on the right.

To assign custom input routing:

1. Press and hold the Stop button, then press the INPUT button (INPUT) successively until **INPUT ROUTING** is displayed in the LCD display.
2. Use either the soft buttons for up and down or the Rotary switch to select **CUSTOM ROUTING.** Press the **EDIT** soft button (✳).

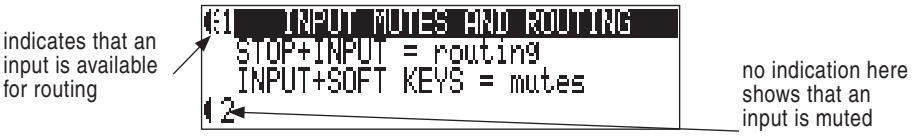


3. Using either the Rotary Switch or the up and down arrows, navigate to desired input-to-track combinations.
4. When a chosen pairing is highlighted press either the **ASSIGN** soft button or the Rotary Switch to assign the combination. Assigned tracks are noted on the screen by the addition of an arrow pointing to the record track. The LED routing matrix will also show a flashing blue LED for the currently selected input-to-track combination.
5. Once a track is assigned move to the next input-to-track combination desired.
6. To remove an input-to-track combination assignment, navigate that combination and press the **UNASSIGN** soft button.
7. Exit and complete the assignment by pressing the check mark soft button.

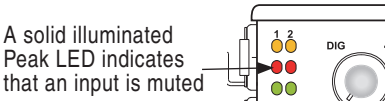
The input routing menu will always exit to the main screen whether entered from the INPUT button or the Setup Menu.

Selective Input Muting

When the INPUT button is pressed, individual input muting is available. This feature can be used to quickly mute microphones while maintaining their respective track assignments.



A solidly lit input Peak LED indicates that an input is muted.



Mono- and polyphonic files behave differently when selective muting is applied. When monophonic files are selected, files from tracks A and B are named with the suffix "_1 and _2" respectively. If, for instance, track A is muted but trackB is still selected, the resulting file will be named with the suffix "_2" and track A will not be recorded, saving storage space.

When polyphonic file type is selected in the same scenario as above with track A muted, the resulting data file will be a two-track file with track A being a blank track. Blank tracks in polyphonic files take up the same amout of storage space as tracks that are assigned.

Sampling Rate and Bit Depth

When recording to WAV (with .WAV or .BWF extension) the 702 generates uncompressed, PCM sound files at the user-selected sampling rate and bit depth. The 702 LCD calculates available recording time based on the sampling rate, bit depth, number of tracks armed for recording and the storage media's available capacity. See the *Calculating Recording Time* later in this guide to estimate record time.

Sampling Rate

When a sampling rate is selected for recording, all tracks are recorded at the selected sampling rate. Sampling rates are selected among common rates from 32 kHz to 192 kHz. Additionally, non-standard sampling rates can be applied when the 702 is word clocked from an external source (clock sources between 32 kHz and 192 kHz). When recording off-speed sampling rates files will be stamped with the rate closest to an internally generated frequency.

Sampling Frequency = Available Audio Bandwidth

The sampling frequency is expressed in samples per second (in hertz) and defines the number of times in a second that the analog audio signal has been measured. Sampling frequency determines the audio bandwidth, or frequency response, that can be represented by the digital signal. A quick estimate of the maximum bandwidth capable of being represented at a given sampling rate is

maximum analog frequency = sampling frequency/2. Higher sampling frequencies allow for greater audio bandwidth.

The 702 generates the following sampling rates:

- 32 kHz
- 44.1 kHz
- 48 kHz
- 48.048 kHz
- 48.048F -file stamped at 48 kHz
- 88.2 kHz
- 96 kHz
- 96.096 kHz
- 96.096F - file stamped at 96 kHz
- 176.4 kHz
- 192 kHz

Bit Depths

The 702 records at bit depths of either 16 or 24 bit. 24 bit recording provides greater dynamic range and addition headroom for signal peaks relative to 16 bit recordings. 24 bit recording (versus 16 bit) is a significant benefit for field production audio tracks.

Bit Depth = Available Dynamic Range

Bit depth defines the digital "word length" used to represent a given sample. Bit depth correlates to the maximum dynamic range that can be represented by the digital signal. Larger bit depths accomodate more dynamic range. A quick estimate of maximum dynamic range capable of being represented by a given word length is dynamic range ~= no. of bits x 6 dB. Bit depth is an exponential measure (exponent of 2), so as bit depth increases, the amount of data it represents increases exponentially. The majority of field recording is done with 16-bit audio, therefore, each sample is represented by a digital word of 2^16 (65,536) possible values. 24-bit audio has a word length of 2^24 (16.7 million) possible values per sample.

The 702 has 24 bit analog-to-digital converters. To obtain 16 bit recording the 702 can be set to dither the 24 bit digital signals output from the analog-to-digital converter to 16 bit. The 702 uses a proprietary pseudo-random dither routine for accurate bit rate reduction. Dither can be defeated in the user menu. Without dither, 24 bit audio is truncated to 16 bit, meaning the least significant 8 bits are discarded.

Once a file is recorded its sampling rate and bit depth can not be changed in the recorder. The 702 does not perform sample rate conversion or bit depth changes. File conversion must be done in another environment, such as an audio workstation. Alternatively, a real-time analog transfer is often performed instead of sample rate conversion.

Word Clock

Stable word clock is fundamental to a high quality digital audio signal. The 702 uses a highly-stable crystal to generate its internal word clock. The 702 can clock external devices from its word clock and accept external clock sources for recording.

The 702 ingnores external clock, both AES and word clock, during playback.

Clock Master

When sending digital audio to several devices, one unit is designated as the word clock master and the others as slaves. Generally, the device with the analog-to-digital converter is designated as the word clock master.

The 702 can function as an analog-to-digital converter and can be used as a master word clock source. Slaved devices will derive their word clock timing from either their digital audio inputs, S/PDIF or AES/EBU, or through their word clock input connection. As a word clock master the 702 generates word clock whether or not audio is sent.

Clock Slave

When using an external digital preamplifier connected to the 702 inputs, the recorder can derive its clock signal from the AES (S/PDIF) stream (it will slave to the external device), or the external device can be slaved from the 702 (if the external device has word clock input or accepts clock from the 702's digital output).For example, if you are using a wireless receiver with a digital output, it may not have an external word clock input, and must be the word clock master.

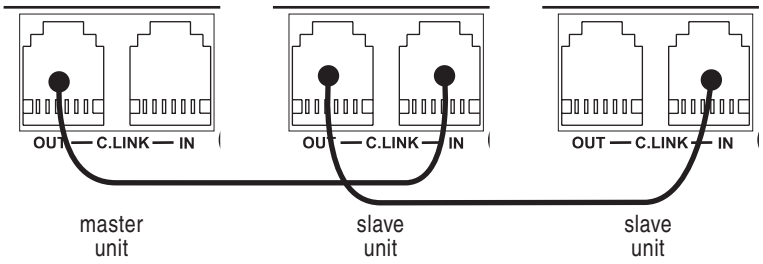
If digital audio is connected to the 702 from more than one digital device, you must word clock the sources to the same clock, otherwise variations between the sources will render their signals unusable.

If the 702 is slaved to external word clock, be certain that the source is stable. Loss of the word clock signal during recording can cause the 702 to revert back to its internally set sampling frequency. If this occurs, the portion of the file recorded after the loss of word clock may not play back at the proper speed. For reliability, set the 702 to the same sample frequency as the word clock source. Loss of the word clock signal in this case will likely cause a glitch in the file, but the file may still be usable.

C. Link – Multi-Unit Linking

The proprietary C. Link (control link) connection allows multiple 702, 702T, 722, and 744T recorders to be connected and clocked together. When linked, recorders have a master/slave relationship. When the master recorder enters record, the slave unit will roll, as well. Multiple units can be daisy-chained together to record many tracks. The C. Link protocol links carries the following data:

- word clock
- time code information (702T and 744T only)
- RS-232 machine transport data



To link units:

1. Connect multiple units as shown in the illustration.
2. Set all linked recorders to the same sample rate, bit depth, file format, and time code frame rate (for 702T and 744T units used). This will ensure that all files generated are compatible.
3. Set scene and take numbers on all linked recorders to the same starting file name. There is no file name synchronization with multiple unit linking.

When linked, record start and stop on slave units will not affect units "above" it in the linked chain. This makes it possible for units to get out of synchronization if a unit other than the master is set to record or stop. Using the master unit will assure that all machines begin and end recording together.

The C. Link jack is a proprietary RS-232 port. Under no circumstances should analog or digital telephone lines be connected to either jack. Serious damage may result.

Outputs – Analog and Digital

The 702 has two independent output buses, the Analog Output Bus (Bus 1) and the Digital Output Bus (Bus 2). Each side (left and right) of the two-channel buses are assigned audio sources independently, allowing the 702 to feed multiple audio devices with unique program content.

The chart below shows the audio sources available for the analog and digital output buses. The audio source for each output is selected in the Setup Menu.

Available Output Sources	Description
Input **1** Input **2**	Inputs are assignable for each channel of the output bus. *When inputs are selected as the source for the outputs, the state of recording or playback activity has no effect on the output signal. This allow uninterrupted input audio at the output.*
Track **A** Track **B**	Track assignments and playback audio.
Input **1,2**	Multiple inputs are summed with these selections.
Track **A,B**	Multiple track assignments are summed with these selections.

Analog Output Bus

Audio signals routed to the Analog Output Bus (Bus 1) are sent to three output connections:

- analog line out, TA3 x 2, two-channel
- analog tape out, 3.5 mm TRS, two-channel

Analog Line Out L, R

The analog line outputs are active-balanced line-level signals on Switchcraft TA3M locking connectors. The output level is a nominally 0 dBu at –20 dBFS. The output level can be attenuated from the Setup Menu by up to 40 dB in 1 dB increments. Both left and right outputs are attenuated equally.

Analog Tape Output

The tape output connection is stereo, unbalanced consumer output level (–10 dBV) on a TRS 3.5 mm connector. Output attenuation affects this output level.

Digital Output Bus

Just as with the Analog Output Bus, the Digital Output Bus (Bus 2) can be assigned signal sources from inputs or tracks. Sources assigned to the Digital Output Bus are exclusive and do not affect the assignments to the Analog Output Bus or headphone assignments. The same signal sources available for the Analog Output Bus are available for Digital Output Bus (see chart above).

The Digital Output Bus appears solely on the AES3id BNC output connector. The unbalanced AES3id output is directly compatible with most S/PDIF inputs.

The format for the AES3id output is selectable between professional AES and SPDIF. In either case the SCMS bit is not set.

The maximum output level is 0 dBFS and can be attenuated in the Setup Menu in 1 dB increments by 40 dB.

Headphone Output

The 702 headphone output is a flexible tool for monitoring audio in the field. The 702 allows the user to monitor inputs, tracks, and post-record tracks in a number of combinations. MS stereo monitoring is also available in headphones.

The headphone output is independent of the Master Output Bus and the Output Bus 2—audio sources can be routed to headphones independent of routing assignments to output buses.

The 702 is capable of driving headphones to extremely high sound pressure levels. Hearing experts advise against exposure to high sound pressure levels for extended periods.

Selecting Headphone Sources

The headphone source display on the main LCD screen (A,B) shows the audio sources sent to headphones. The 702 comes from the factory with several preset headphone audio source selections available on the Rotary Switch. These selections include inputs, tracks and track monitors. Turn the Rotary Switch to select among the available headphone monitoring sources.

Track Monitoring While Recording (Confidence Monitoring)

The 702 can monitor actual recorded audio written to the Compact Flash card during recording. This is commonly referred to as "confidence monitoring". To monitor recorded tracks, during recording select one of the track monitor modes. Because of the record buffering topology of the 702, a delay of up to 12 seconds can be expected before recorded audio appears at the output. The 702 will play back recorded audio from the media highlighted on the LCD panel (see *File Management and Copying* for more information on selecting and highlighting storage medium).

Setting Headphone Source Options

In addition to the 5 preset headphone routings, a total of 20 available "slots" can be filled in a user defined order. Headphone monitoring sources are selected from combinations of inputs, tracks, and post-record tracks, including stereo and MS decoding. The order of headphone selections is user-selectable. Available sources for headphone monitoring include:

HP Sources	Description
Inputs **1,2**	Stereo monitoring of input pairs. Input 1 is assigned to left headphone output; input 2 is assigned to right headphone output.
Tracks **A,B**	Stereo monitoring of track pairs. Track 1 is assigned to left headphone output; track 2 is assigned to right headphone output. Upon playback, will play as track monitor.
Monitor **A,B**	Stereo monitoring of playback (post-record) track pairs. Track 1 is assigned to left headphone output; track 2 is assigned to right headphone output. *When using the recorded track monitor selection, there is a sample rate dependent delay in the signal. At 48 kHz sampling, the delay is approximately 12 seconds. This delay is due to the record buffering topology. Audio can not be monitored until it has left the record buffer and written to the recording media.*
Input **1, 1** Input **2, 2**	Solo monitoring of selected input. This signal is sent to both sides of the headphones.
Track **A, A** Track **B, B**	Solo monitoring of selected track. This signal is sent to both sides of the headphones. Upon playback, will play as track monitor.

HP Sources	Description
Monitor **A, A** Monitor **B, B**	Solo monitoring of playback (post-record) track. Highlighted media is source of monitor program. This signal is sent to both sides of the headphones. When not in playback, headphones have no program.
Inputs **1, 2 (MS)**	Stereo monitoring of discrete M (mid) and S (side) input pairs. Highlighted media is source of monitor program.
Tracks **A, B (MS)**	Stereo monitoring of discrete M (mid) and S (side) track pairs. Highlighted media is source of monitor program. Upon playback will function as MS track monitor.
Monitor **A,B (MS)**	Stereo monitoring of playback (post-record) discrete M (mid) and S (side) track pairs. Highlighted media is source of monitor program. When not in playback, headphones have no program.
Inputs **1+2, 1+2**	Summed inputs appear in each ear for summed mono monitoring of both inputs.
Tracks **A+B, A+B**	Summed tracks appear in each ear forsummed mono monitoring of both tracks.

When tracks (A or B) are monitored in headphones, audio assigned to the tracks is heard in headphones during recording. During playback the recorded track audio is heard in headphones.

To set the available headphone source options for headphone monitoring enter **HP:MONITOR** from the Setup Menu. In the Monitor Modes menu you will immediately be in slot-1. Turn the Rotary Switch to select the source you wish to appear first in your Headphone monitor list. Once the chosen source appears, press the Rotary Switch or the soft button **ENTER** (tone) button to move to the next slot. Continue down the list to select the source for each slot in the list. Once all sources have been chosen, press (done). This will exit the headphone monitor mode setup. You can exit the selection process by pressing the stop or cancel (backlight) button at any time.

If **DONE** *is pressed in the first headphone slot, the 702 will select a single option (Tracks A, B) for headphone monitoring. The 10 factory presets will be erased.*

MS Stereo Monitoring

The MS stereo mode decodes discrete Mid-Side stereo signals to a left/right stereo signal for monitoring purposes. This allows for a proper stereo signal to be monitored in the field while discrete M and S signals are recorded for later post production. For the MS decoder to operate properly, the Mid signal is connected to input 1 and the Side signal is connected to input 2. The amount of stereo "spread" is fixed to a 50/50 percentage from Mid to Side signal.

If MS is selected for input linking, do not use MS stereo monitoring. This would result in two MS decoders being inserted in the signal path. The resulting audio in the headphones would be the discrete M and S signals!

Rotary Switch Behavior

The action of the Rotary Switch during recording and playback is set from among the three available options:

- **Disabled**: pushing the Rotary Switch has no effect.
- **Selects Favorite Mode**: places the headphone source into the mode selected in the HP Favorite menu.

Headphone Favorite Selection

If "**SELECTS FAVORITE MODE**" is selected from the choices above, pushing the Rotary Switch selects the assigned "Headphone Favorite" source. This feature is helpful to quickly return to a selected headphone monitoring selection while recording or playing. One of the available headphone selection can be selected as the headphone favorite.

Headphone Playback Mode

The user may select a headphone source for automatic selection upon playback. All headphone source selections are available for Headphone Playback Mode, as well as "No Change", which leaves the headphone source set to the currently selected mode. Headphone Playback Mode is controlled in the Setup Menu.

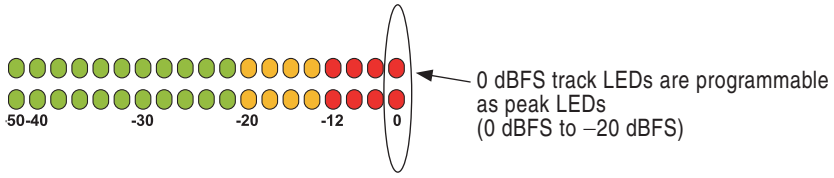
Warning Tones

The 702 can generate an audible beep, or warning "bell", in the headphones when an error has occurred. The specific error will be reported on the LCD. The output level of the warning bell is menu-selectable from off to –12 dBFS in the Setup Menu.

Metering and Display

The 702 features a 38-segment LED (2 x 19) signal level meter. The DSP-controlled meter provides a selection of ballistics and lighting intensities. In addition, peak indicators on input channels show overload activity.

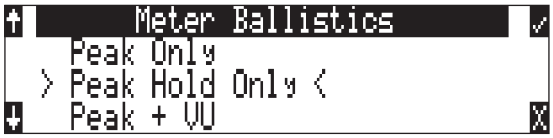
Output Meter



The meter uses energy efficient LEDs viewable in full sunlight. The 702 output meter is unaffected by shock or extremes in temperature and humidity. Meter ballistics are Setup Menu selectable among VU, Peak, Peak-Hold, VU + Peak and VU + PeakHold.

The meter uses a compound metering scale which increases meter resolution in the most important part of the scale. From –50 to –40 dBFS, each LED segment equals approximately 10 dB. From –40 to –12 dBFS, each segment equals 2 dB. From –12 to 0 dBFS each segment equals 4 dB.

Meter Ballistics



The output meter can be set to display any of five types of meter ballistics: VU, Peak, Peak-hold, a combination of VU and Peak, and a combination of VU with Peak-hold. The meter ballistics are selected in the Setup Menu.

VU - (Volume Units)

Ballistics correspond closely to how the human ear perceives loudness and provides a good visual indication of how loud a signal will be. In VU mode, the attack and decay of the meter signal is 300 mS. While giving a very good visual indication of perceived loudness, VU meters gives poor information on actual signal peaks and are virtually useless for tracking to the 702. In VU mode, the front panel meter labeling is in volume units.

Peak

Peak-reading ballistics correspond to actual signal maximums, but don't necessarily correspond to perceived signal loudness. A peak meter has a near-instantaneous attack to display maximum signal amplitude and a slow decay to allow the user to see them. Peak metering is essential for digital recording, since signal overload can cause immediate distortion. The peak meters front panel markings are calibrated in dBFS, decibels relative to full-scale digital signal.

Peak Hold

Essentially the same as Peak metering where the peak level indication will hold for the peak level indication for several seconds. Peak-hold indicators are useful for metering in applications when an overload condition is unacceptable.

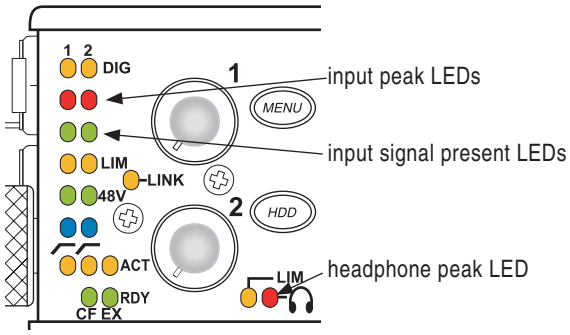
Peak/VU

The meter can simultaneously display VU and Peak level information. In this mode the perceived loudness (VU) is displayed on a bar graph, and the Peak signal on a dot above the VU. With this combination the user gets the best of both VU and Peak metering by seeing both the "loudness" of the signal and the peaks at the same time. Peak/VU is the factory default.

Peak Hold/VU

Similar to VU/Peak mode, this mode holds the peak level indication for several seconds before releasing. Peak Hold indicators are useful for metering in applications when an overload condition is unacceptable.

Peak LEDs



In addition to the main LED output meter, peak LEDs show input peaks, track peaks, and headphone peaks.

Input Peak

The 702 has a peak LED associated with each input. These LEDs illuminate when input signal reaches –3 dBFS. There is no user-adjustment to the Input Peak LEDs. These LED's also function as indicators of input mute activity (*see Input-to-Track Routing*).

Track Peak

The 0 dBFS LED on each track can also function as a track peak indicator. The user can select a signal threshold above which the 0 dB LED will flash.

Headphone Peak

Like the channel peak LEDs, the headphone circuit has an indicator for peak overload. This LED is useful, since headphones can often overload before the recorder overloads. Monitoring without a visual indication of headphone clipping may mislead the operator into thinking that the output or return tracks are distorting.

Tone Oscillator

The tone oscillator level and frequency are user selectable. Tone level is adjustable over a range of –40 to 0 dBFS. Tone frequency is adjustable from 100 to 10,000 Hz. Standard tone levels vary according to the practices and needs of production and post-production, but are generally in the –20 to –12 dBFS range.

The tone oscillator is activated by pressing the front panel button. Tone will active only while the tone button is pressed. Tone is routed where specified in the Setup Menu. Routing choices include: outputs, outputs and tracks, tracks only, or no tone routing (disabled). Tone can only be recorded to the head of a sound file. To record tone, press the tone button and continue to hold it down while starting to record. Subsequent presses of the tone button are locked out to prevent tone from inadvertently being recorded.

LCD Contrast & Backlight, LED Brightness

LCD contrast is Setup Menu controlled. From the factory the contrast is set to 50%, suitable for most viewing conditions. Contrast can be increased or decreased.

The front panel button toggles the LCD and button backlight. Backlighting is suitable in low or no ambient light situations.

LED brightness is continuously adjustable from low to high. Hold down the button, then turn the
Rotary Controller to change brightness levels. The brightness of all LED's is adjusted. In stealth mode (Setup Menu selected) the LEDs are toggled on and off with the LCD backlight button.

Record Indication

The position of the A-time numbers and time code numbers can be exchanged in the Setup Menu. When **BIG TIME CODE** is selected in the menu the time code is displayed in the main numeric display. If time code is turned off A-time is shown as large numbers, even with **BIG TIME CODE** set.

To provide for additional visual indication that recording is in process the big numerals can be set to reverse contrast or to flash during record. This is menu-selected.

702 display shown

reversed numbers indicating that recording is active

Time Code (702T only)

The 702T uses time code circuitry developed by Ambient Recording GmbH, a leading developer of stable, portable time code products (visit Ambient on the web at www.ambient.de). Clock stability and continuity are critical aspects of the 702T time code implementation. Its temperature-compen-

sated crystal oscillator ensures rock solid TC stability and accuracy (< 0.2 ppm when tuned with an Ambient Master Controller).

Depending on the stability of other time code devices used with the 702T, time code can be accurate throughout an entire production day. Tyically, a jam sync is performed after each time the camera is power cycled. In the absence of power, the 702T holds accurate time code for up 2 hours between battery changes using its internal, rechargeable AA NiMH time code cell. After two hours without power, the 702T reverts to a less precise time-of-day crystal to maintain the date/time of the unit. The time code/time-of-day battery is charged from internal or external power whenever the 702T is powered up.

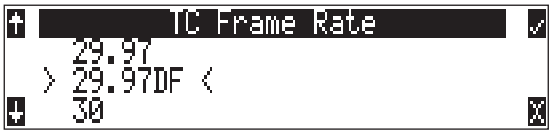
If the time-of-day clock is reset during the production day or if the time code mode is changed from 24 hour run to another mode and back, the time code value will change. You must re-jam all time code devices to ensure proper synchronization.

File-based recorders place a single time code stamp in the data header of an AES31 (Broadcast WAV) file. The 702T generates SMPTE time code from this number and extrapolates it based on the time code frame rate for playback.

All files generated by the 702T have time code numbers begin on the :00 frame (or 02 in DF modes). If necessary, pre-roll is dynamically applied to accomplish this. This simplifies synchronization in post-production.

Frame Rate

A single time code frame rate is selected in the **TIMECODE:FRAMERATE** menu.



The 702T supports all of the common production time code rates, including:

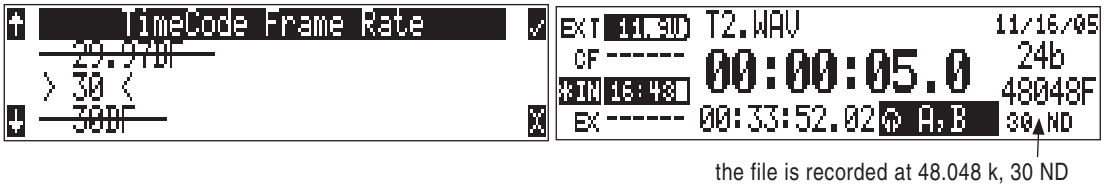
- **23.976** – used with Sony high definition video cameras
- **24** – to sync audio to film where no transfer to NTSC video is expected
- **25** – to sync sound to PAL video
- **29.97** – to sync sound to NTSC SD video shot in non-drop frame mode and Panasonic high definition cameras
- **29.97DF** - to sync sound to NTSC video shot in drop frame mode
- **30** – to sync sound to film where transfer to NTSC SD downconvert is expected
- **30DF** – to sync sound to film for transfer to NTSC video in drop-frame mode 29.97 fps

48048-F Sampling Rate Mode

The 48.048-F mode (F stands for fake, faux, Fostex—take your pick) is a specific compatibility mode for use with the Fostex DV40 software (1.74 and previous), Avid, Final Cut Pro, and other post-production environments. The 48048F mode can aid in obtaining an NTSC 0.1% speed pulldown without sample rate conversion. In this mode files are recorded at a 48.048 kHz sampling rate but are stamped at 48 kHz. When played at 48 kHz, they will play back 0.1% slower than real time.

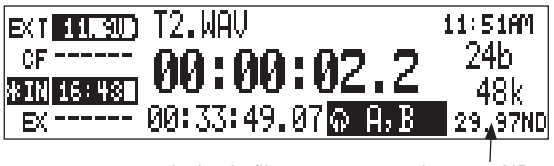
One use for the 48048-F mode is to force a 0.1% speed reduction (pull down) of audio to match MOS-telecined film (24 fps-to-NTSC SD) in non-linear edit systems, such as Avid or Final Cut Pro. Since the file is stamped as a 48 kHz file, the edit system will play it back at 48 kHz and not at 48.048 kHz. This “audio pull down” will match the transfered picture without the need for an intermediate step through other software or though an analog conversion to create the pull down.

The time code frame rate (actual recording rate) is forced to 30 ND in 48.048-F mode. The front panel of the unit will show 30 ND during recording. No other frame rate is available in 48.048-F mode.



the file is recorded at 48.048 k, 30 ND

The sound file, however, is stamped with a 29.97 ND frame rate, along the 48 kHz sampling rate. It will appear as if the file was originally recorded at a 48 kHz sampling rate at a TC rate of 29.97 ND.



on playback, file appears at 48 k, 29.97 ND

Fostex DV40

When using files recorded in the 48.048-F mode in an older software versioned DV40, set the DV40 time code frame rate to 29.97ND. Time code stamps will properly match the original time code start times.

It is very important to know what file type is required and expected in telecine and transfer. Make certain to contact the person performing the transfer to make certain your files will be readable.

Time Code Modes

The 702T includes the following time code modes:

Off

The time code generator is disabled. The front panel time code display is blank.

Free Run:

The internal time code generator runs continuously without regard to the record mode. Any time code value can be used as the start value by "jamming value" in the jam menu.

Record Run

The time code generator runs only when the 702T is recording. Time code in this mode defaults to 00:00:00:00 at power-up. When switching to record run from another mode, the internal generator will stop at the last number generated. A user-defined value can be jammed into the internal generator from the jam menu.

Free Run Jam Once

The on-board time code generator will re-jam from external time code whenever a valid, running time code signal is connected to the TC input. Similar to free run mode, the generator runs continuously without regard to record mode. For a jam to occur, the time code signal must be disconnected and re-connected to the time code input. Free run Jam Once is useful when using the recorder as a slave, although one of the External TC modes may be more appropriate for slaved operation.

24 Hour Run

Identical to free run with the exception that the generator will automatically jam itself from the time-of-day clock on power-up. The generator will also re-jam if the time-of-day clock is reset. Once jammed, the generator will run continuously from the time code clock, not the time-of-day clock.

Ext TC

The internal time code generator follows an external time code signal appearing at the time code input.

Ext TC/cont

The internal time code generator follows an external time code signal appearing at the time code input. If the external time code is removed the internal generator continues to run to preserve continuous time code. Useful for time code transmission over RF where RF "hits" may interrupt time code.

Ext TC-Auto Record

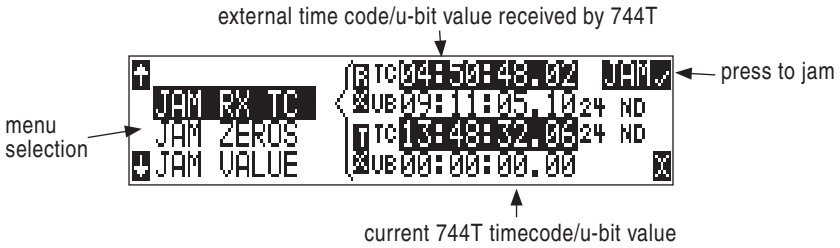
The internal time code generator follows the external time code signal appearing at the time code input. When external code advances, the 702T enters record mode automatically. When the external code is stopped, the 702T generator pauses and recording is stopped. This is appropriate when dual-system sound is used with video cameras set for Rec Run time code. The video camera will function as master time code and the recorder "transport" will follow the video camera transport.

Ext TC/cont-Auto Record

The internal time code generator follows the external time code signal appearing at the time code input. When external code advances, the 702T enters record mode automatically. When the external code is stopped, the 702T generator pauses and recording is stopped. If the external time code is removed the internal generator continues to run to preserve continuous time code. Useful for time code transmission over RF where RF "hits" may interrupt time code. This is appropriate when dual-system sound is used with video cameras set for Rec Run time code. The video camera will function as master time code and the recorder will follow.

In Free Run Jam Once and all four external time code modes, time code is recalculated, "back stamped," when external static time code advances after the 702T begins recording. If external time code does not advance, the file will be stamped with the stopped time code number. Back stamping the file allows the audio time code to properly correspond to picture time code if sound rolls before picture in a video Rec Run environment.

Jam Menu



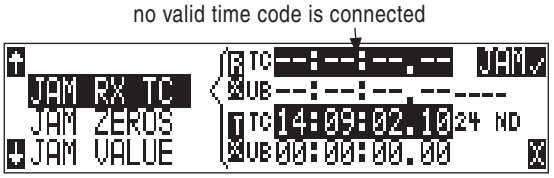
Time code setup is done from the jam menu selection, **TIMECODE JAMMENU**. Pressing and holding the HDD drive button then the MENU menu button enters the jam menu. In this menu, the top of the display shows the value of signal present on the time code input and the bottom of the display shows the currently set time code value. In addition, the 702T displays the frame rate of the incoming time code and the current frame rate setting of the 702T.

The 702T time code generator can be set in three ways.

Jam RX TC

When the JAM RX TC menu item is highlighted in the jam menu, the external time code, user bits, and frame rate are shown at the top of the LCD screen; the 702T internal generator, user bits, and frame rate are shown at the bottom of the screen. To jam the 702T from an external value, press soft button next to the jam button or the Rotary Switch button. The screen will display **JAMMING**. Once

the 702T is jammed to the external time code, the external and internal numbers will match and run in sync.

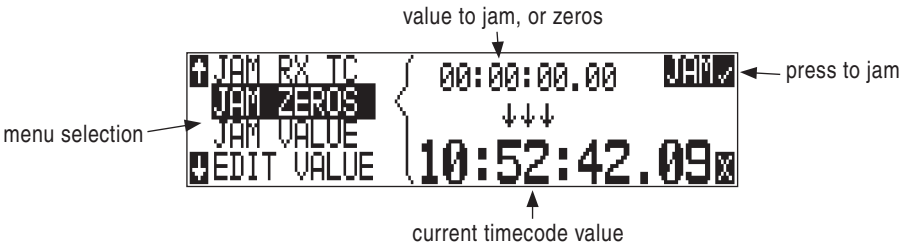


Make certain that the external time code source appears in the time code jam menu. If the 702T does not receive valid time code from the sending source the jam menu displays lines in place of numbers.

Identical to the Ambient Recording series of time code products, the 702T time code generator can "cross jam" select frame rates. The 702T will cross jam time code at the top of the second for phase-accurate (the 00 frames will match) time code at the set frame rate.

Jam Zeros

This menu selection resets the internal generator to zero.



Jam Value

Press the soft button **JAM** (tone button) or the Rotary Switch button to jam the user-entered time code start value into the internal generator.

Edit Value

This menu allows the user to set any valid time code value (**00:00:00:00–23:59:59:29**) for entry with the jam value selection above. The initial screen of this menu shows the currently set value as well as the current time code setting of the 702T. Press the soft button labeled **EDIT** or the Rotary Switch to select a specific time code value. Time code numbers are changed in pairs (hours, minutes, seconds and frames). Once **(DONE)** is selected the value can be "jammed" into the internal generator.

A value is not jammed into the 702T time code generator until **JAM VALUE** *is selected.*

User Bits

The 702T has seven user-selectable user bit modes. Time code user bits are a portion of the time code data which can be allocated several different ways. Commonly, user bits carry information such as the date, take, sound roll, or the camera roll number.

Highlight **EDIT U-BIT** in the jam menu and select the soft key **EDIT** to make change to user-adjustable user bits. Highlight Press the soft enter (tone button) or the Rotary Switch to enter user bit edit mode. The screen will show the format and setting of the user bits. Using the Rotary Switch or the soft-button up and down arrows, user bit digits can be edited (in pairs). Once **DONE** is selected, the user bits are set. If editing is not available in the selected user bit mode "**NO USER EDITS**" will appear in the screen.

NTSC Standard Definition (SD) Video Production

Audio Chasing Video

With many video productions, the video camera operates in a Rec Run time code mode. This eases logging of video information and helps eliminate duplicate time code numbers in editorial. One of the 702T's external time code modes can be used to write the picture's time code value to the audio file.

Drop Frame

NTSC video uses a frame rate of 29.97 frames per second. Unfortunately, that leaves 108 frames per hour unaccounted. To keep 29.97 time code in sync with "clock" time, the concept of "drop frame" was devised. Two frames are dropped at the top of each minute not divisible by 10. 54 drops per hour x 2 frames = 108 frames per hour.

To sync the 702T to a video camera, first determine if the camera is in drop frame or non-drop frame mode. If you, the DP or the producer are unsure about what setting to use, check with post-production, if possible.

As a rough guideline, video production for NTSC news segments is often drop-frame. Whether at drop or non-drop rates, make certain all time code devices are at the same rate.

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1. Set the 702T to either 29.97DF or 29.97 respectively.
2. Jam the camera from the 702T using a LEMO-5 to BNC adapter cable connected to the time code input on the video camera.
3. Switch the camera to free run time code. The 702T time code should appear in the time code display on the camera.
4. Disconnect the time code cable.

The camera and recorder time code should now be running in sync. Check it after roughly 5 minutes to be certain synchronization is maintained.

Video cameras are notorious for time code instability when switched off. If the video camera must be shut down, re-jam it when it is powered back up.

Audio File Formats

The 702 records audio to the industry-standard Broadcast Wave file format, either monophonic or polyphonic. Files can be named with either a .WAV or a .BWF extension.

WAV / BWF

The 702 and 702T write AES-31 BWF-formatted files. The filename extension is user-selectable between .WAV or .BWF. Users wishing to record "standard" wave files should select the .WAV extension.

There is no difference between files generated with WAV or BWF extensions except for the extension name.

The sound files created by the 702 and 702T place additional information in the file header, called the Broadcast Audio Extension data chunk. Software that does not recognize this additional broadcast wave data chunk will simply ignore this added information. Among the values recorded are:

- time code stamp (702T only, when time code is on)
- time code frame rate (702T only)
- date and time of the original recording
- bit depth
- sampling rate
- originating machine serial number

If time code is turned off, broadcast wave metadata will still be written, although the time code will not. Files will only be written with a .WAV extension.

MP3 Files

The 702 can play back MPEG-1 Layer III (MP3) sound files. The 702 has a high-quality MP3 decoder that can play back both fixed-rate and variable bit rate MP3 files with 44.1 or 48 kHz sampling rates. Additionally, the 702 can play back MPEG-1 Layer II sound files with an .MP2 extension. The Absolute Time (A-Time) of the file will appear in the file viewer and during playback on the front panel. MP3 playback is very useful on-set to play a personal MP3 audio library during downtime.

Recording

The user interface of the 702 has been designed to be very similar to a "tape recorder". Recording and playback functions are quite similar to that of tape-based machines.

Recording

The largest, most easily accessed control on the 702 is its record button. Recording takes priority over all activity except for disk formatting, disk speed tests, and file transfers. The 702 will immediately begin recording audio whenever the record button is pressed. When recording, the adjacent red LED will illuminate to indicate that the unit is in record mode.

If no inputs are routed to tracks, the unit can not record. Make certain that at least one record track is assigned for recording.

While recording, the power, Fast Forward, Rewind, Input, Tone, and HDD File Viewer buttons are disabled. Stop recording by pressing and holding the STOP button. The STOP button must be held for 150 ms or greater to end recording. Although you can enter the Setup Menu during recording, menu items that affect recording are lined out in the menu list.

During recording, subsequent presses of the Record button can perform one of three setup-menu-selected actions:

- no action,
- new cue - cue markers are set within the file being written,
- new file - a new file is started with each press of the record button, the take counter is increased by one.

When removing the Compact Flash card after recording, always observe the amber CF activity LED. If it is lit, wait until it goes out before removing the card. If you remove the CF while the LED is lit, the file will be corrupted and there is a possibility of FAT corruption as well.

Pre-Record Buffer

To prevent missing record cues or up-cutting takes, the 702 has pre-record (or pre-roll) buffering available. When active, pre-record begins recording at a set number of seconds PRECEEDING the record button being pressed. The amount of pre-record is sample-rate-dependent. At 48 kHz, ten seconds of buffered audio is available. At a 96 kHz sampling rate five seconds is available. At very high rates (192 kHz) two seconds of pre-record buffer is available.

Record buffering is disabled with the time code mode is set to record run or to one of the external time code mode. This is to prevent possible overlapping time code numbers between adjacent files.

Failure During Recording

In the event of a recording media failure the error will be indicated on the front panel and by a tone in headphones. Possible causes of media failure include a full Compact Flash card or a card not capable of keeping up with the record data.

Front Panel Lockout

See *Panel Lock* on page 8 to engage panel lock to prevent changes while recording.

Display Options

The position of the A-time numbers and time code numbers can be exchanged with a Setup Menu selection. When **BIG TIME CODE** is selected in the menu the time code is displayed in the main numeric display. If time code is turned off A-time is shown as large numbers, even with **BIG TIME CODE** set (702T only).

For additional visual indication that recording is in process the large display can be step to show-white numbers on black number (reversed) or the display can be set to flash during recording. This is Setup Menu controlled.

reversed numbers indicating that recording is in process

Playback

The 702 has high-resolution playback circuitry and is appropriate for any reference audio application. Any file recorded by the 702 can be played back, as well as MP2 and MP3 files. Whether files were recorded from the 702 or from copied to a Compact Flash card using a card reader, the 702 will recognize valid audio files. In addition, files copied to CF from a computer can be played back in the recorder. This is useful when using the 702 as a high-resolution playback device.

When play is pressed, the 702 defaults to playing the most recently recorded (or played) sound file, unless another sound file is selected. There are two ways to select sound files for playback.

- Press either the FastForward or Reverse button to put the 702 in to play-stop mode. The file name display will flash and the FastForward and Reverse buttons can be used to step through sound files in the currently selected file folder.
- To select files in other folders, press the HDD button to enter the File Viewer. Navigate to the appropriate file folder by scrolling up and down the file list. Highlight the sound file for playback and press play.

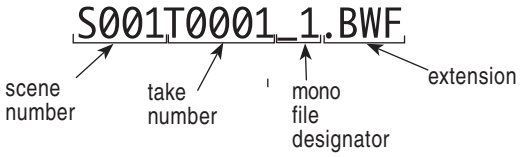
AutoPlay

The 702 can be set to play back all valid sound files in a folder. Files will play back in their order they were placed in the folder. Autoplay can be set with the following options:

- **Disabled** – auto playback is off
- **Play all** – all files in the folder will play, then stop when all files have been played
- **Repeat one** – the selected file will play back continuously until stopped by the user
- **Repeat all** – all files in the folder will play in succession, then repeat until stopped by the user

File Naming / Numbering

Files generated by the 702 are named using a syntax made up of four parts: scene number, take number, mono track designator (if mono file is selected), and extension.



Scene Name/Number

Scene names are made with alphanumeric characters, including " _" and "-" and can be any length between zero (0) and nine (9) characters in length. Scene numbers are helpful to match audio with the corresponding scene in a production. Scene names can also be used to identify other items, including recording date, artist name, or any other descriptor as required.

Scene names are user-selected in the Setup Menu and do not change until changed by the user.

To change scene numbers:

1. Enter the user menu and navigate to the Scene Name/Number option.
2. Use the REW (<<) and FF (>>) soft buttons to move among characters. Use the PLAY button to delete characters. Characters are entered from left to right and deleted from right to left.
3. Use the Rotary Switch or the soft button arrows on the left to choose characters. Press the Rotary Switch or press the fast-forward button to save the character and move to the next position.
4. To save the scene name, press the soft button labeled check or the Rotary Switch without selecting a character. After the ninth character is entered, the scene name is automatically saved.

If all characters are removed, no scene name will be written to files, only a take number. If Scene Folder is selected for file management, all takes will be placed in the Compact Flash card root folder.

Take Numbers

Take numbers are integers between **1** and **32000**, with or without preceding zeros, which increase by one each time a new file is recorded. Take numbers can be set with or without a take separator, such as the character "**–**" or "**T**". Take numbers can be overridden and a new take number can be set in the Setup Menu. If the 702 detects a file with a duplicate name in the destination folder, a letter suffix, starting with "**A**" is added to the file name, before the extension. Note that take number handling can be selected to reset if set in the Setup Menu (see *File Management and Copying*).

To change take numbers:

1. Enter the user menu and navigate to the Take Name/Number option.
2. Use the REW (**<**) and FF (**>**) soft buttons to move among decimal places and to jump to the single alphanumeric take spacer character. Use the PLAY button to reset the take number to 1. Characters are entered from left to right and deleted from right to left.
3. Turning the Rotary Switch or pressing the soft buttons for up and down choose characters/numbers. Push in the Rotary Switch or hit the soft button labeled check to save the character and move to the next position.

From the user menu the action for take resetting is controlled from the following options:

- **Never** – take numbers do not reset
- **When scene is changed** – take resets when scene name is changed
- **When daily folder is changed** – takes reset on new day
- **Either scene or daily**– takes reset on either change

Mono Track Name Designators

When recording monophonic Broadcast Wave files each track is recorded in a separate data file. To identify each track, each file is identified by an underscore and track number suffix. The file of the first track recorded has "_1" appended to it. The file name suffix, _1 and _2 always correspond to tracks A and B, respectively. For instance, if track B is the only track recorded, it's file name suffix will be _2.

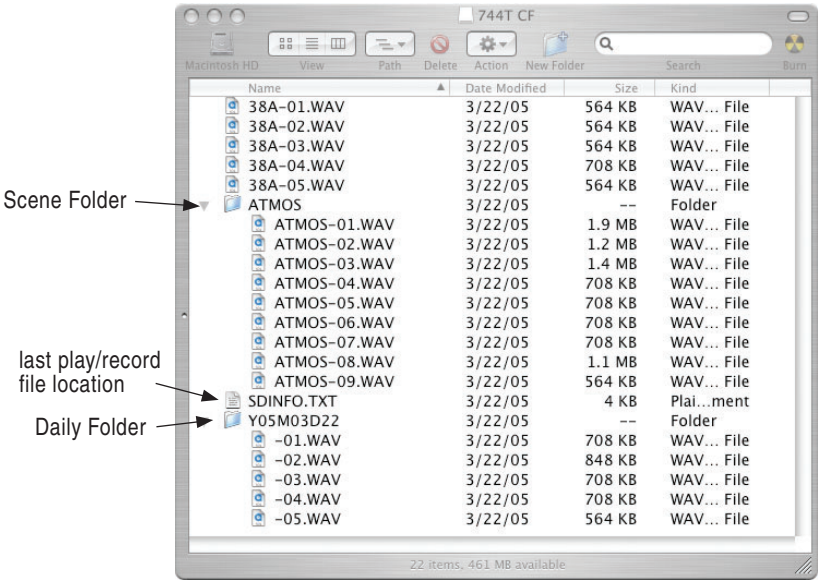
Duplicate File Names

When the 702 detects that a duplicate file name is going to be generated in a specific folder, the 702 changes the file name by adding of a letter suffix before the extension. For instance, if take numbers are reset but files are recorded to the same folder as previous files, a suffix "A" is added to the file. If additional duplicate files are generated the letter suffix increments, to B, C, etc.

File Management

The 702, like a computer, writes its sound files to a file system. The 7-Series recorders use a FAT32 file system. The 702 formats Compact Flash cards as single volume named "**702 CF**". The 702 writes files to the card does not write files to the root level of the card. Files recorded by the 702 are placed in one of three places, the root of the Compact Flash card, a Daily Folder on level down from root, or a Scene Folder one level down from root.

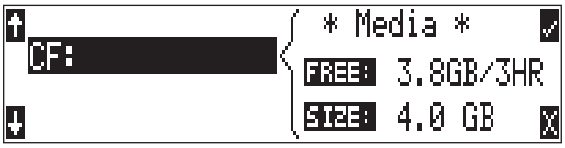
An example hierarchical view of files recorded by the 702 and viewed in Mac OS X is below. Notice the volume name (744T CF shown), files, Daily folder, Scene folder, and the files contained within the folders.



File Finder Navigation

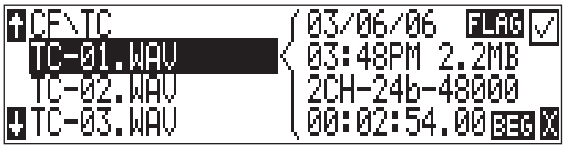
Moving from file to file on the recorder is similar to navigating among files on a computer.

1. Enter the File Viewer by either selecting **FILE:VIEW FILES** file in the Setup Menu or by pressing the front panel HDD button. By default the folder with the last recorded or played audio file will be opened. The 702 knows this file name by reading a text file, named SDINFO.TXT, which is written to each time the unit records or plays.
2. To move up the hierarchy scroll up to the top of the menu to "**\..**" .
3. Press enter or push the Rotary Switch to go up one menu level.
4. From the root menu, selecting **\..** opens the media select screen.
5. Continuing up the file hierarchy the media menu is viewable. The top-most view in the heirarchy shows the inserted card's size and available free space.



Large audio files take longer to show details than smaller files; this is normal.

File Viewer Screen



The File Viewer screen contains information about each individual audio file. The left side of the display shows files and folders. The top line displays the path in the form of **MEDIA\FOLDER NAME**. File names are listed in the order they were recorded.

File types not recognized do not show up in the File Viewer, although all folders are viewable.

File details are shown on the right side of the display. The center divider points to the file selected for information viewing. Information shown includes:

- file creation date, file flag (archive) bit status, checked means the file archive bit is set, clear means the file archive bit is cleared
- file creation time, file size
- number of tracks, bit depth, sampling rate
- beginning (**BEG**) time code stamp of the file for BWF files or the length (**LEN**) of MP3 files
- There is additional information available for BWF files. Pushing the Rotary Switch will cycle through the beginning time code stamp (BEG), file length (LEN) and user bits (USR).

The File Viewer always exits to the main screen whether entered from the Setup Menu or from the HDD button.

Folder Actions

Files generated by the 702 are placed in either the card's root, a "daily" sub-folder within the root, or a Scene sub-folder within root. Options are chosen in the Setup Menu from the following:

- **Single folder** - all files are placed in a root of the card. This is appropriate for non-sync files such as wild sounds, effects, etc. Note that if a great many files are generated, this filing action can become cumbersome to manage and navigate.
- **Daily folder** - a new sub-folder is generated in card root each calendar day. All files recorded on that day are placed within it. The daily folder is made based on the onboard clock and used the syntax of "YxxMxxDxx, where Y is year, M is month, and D is day. Make certain that the 702 time-of-day clock and date are properly set, otherwised files will be placed in meaningless date folders.
- **Scene folders** - a new sub-folder is generated in card's root each time the scene name changes. All files with a specific scene name will be place in its corresponding scene folder.

File Time and Date

Similar to a computer file system, all files recorded by the 702 are stamped with the time and date of file generation. To ensure that accurate time-ofsoundd-day and file generation dates are written for each file, make certain that the time-of-day clock and calendar are accurately set.

File time and date and time code are unrelated.

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1. Enter the **TIME/DATE: SET** menu.
2. Set the present time and date using the navigation tools below.

Once set, the time and date clock will be kept while the removable rechargeable battery is attached. If it is removed the internal AA NiMH time code battery maintains the time-of-day and date for 20 days, or more.

File Size Maximum

The Compact Flash card is formatted as a FAT32 volume. This structure allows for the CF cards to directly mount on common computer platforms, either using the units FireWire or from a card reader. Using the FireWire connection the Compact Flash card in the 702 appears as an external FAT32 removable storage volume.

Windows XP has a limitation on FAT32 drive formatting; XP can format a FAT32 volume to a maximum of 32 GB, however it can read FAT32 volumes as large as 2 TB.

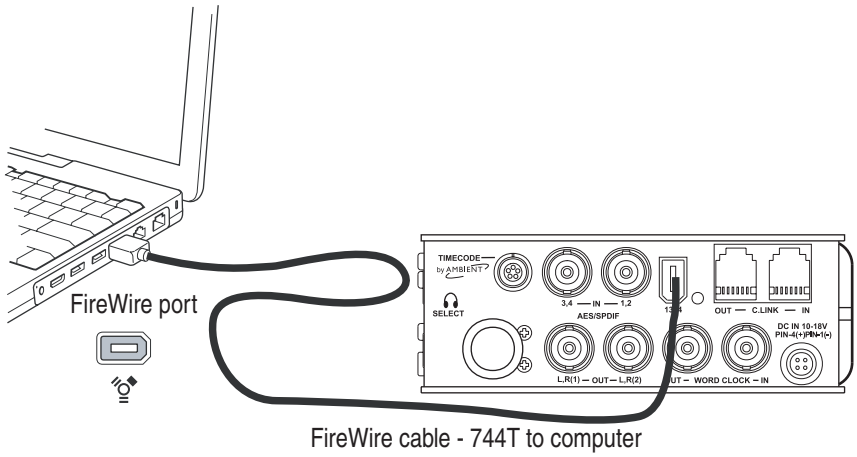
FAT32 has a maximum individual file size limitation of 4 GB. While it is possible to have thousands of files on the 702 CF card, the largest any single file may be is 4 GB. The 702 automatically splits audio file before the 4 GB size is reached and begins recording to a new file. When joined in an editing program, these files match seamlessly with no samples lost. The 702 has a menu-selectable file size maximums of 650 MB, 1 GB, 2 GB, and 4 GB. The 650 MB size makes long form recordings easy to split up into CD-R sized files for backup to inexpensive CD-R medium. There are numerous file size breaking points sizes to ensure that files recorded will fit onto specific media.

File Deletion

There is presently no provision for deleting individual files directly from the 702. Selective file deletion is under consideration for future revisions of firmware.

Presently, selective file deletion requires connection to a computer via FireWire. The 702 records audio files in continuous sectors. Data is written to the card with each file being written immediately after the the preceding file with no gaps. Selective file deletion can badly fragment storage media and reduce its read and write throughput, possibly bringing it below the threshold to record high bit rate audio reliably. Any newly recorded audio will be written in the gaps that are generated by selective deletion. Sound Devices recommends periodic re-formatting of media to keep media throughput at its maximum.

File Transfer – FireWire



Software revision 1.xx does not support drive mirroring to external FireWire volumes.

The 702's FireWire (IEEE-1394) port makes transfer of recorded files to a computer quick and easy. When connected, the Compact Flash card of the 702 will mount to a Mac OS X or Windows computer as a local, removable mass storage devices. Using Mac Finder, Windows Explorer, or any other file utility, files can be copied, read, and deleted directly to and from the 702 Compact Flash card.

It is best practice to copy original sound files to the computer before editing.

To mount the 702 to a computer via FireWire:

1. Stop all playback and recording activity.
2. Interconnect the 702 to a FireWire-enabled computer using an appropriate FireWire cable. No drivers are required if the computer meets the requirements listed in Specifications.
3. The 702 will now show the screen below when successfully connected via FireWire. When connected, all audio functionality of the 702 is defeated.

4. Navigate the drives on the computer and copy all needed audio to local storage.

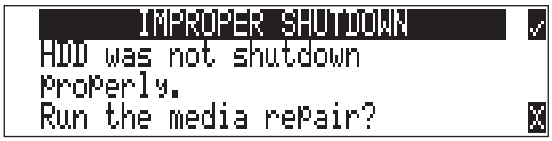
To avoid possible corruption of Compact Flash medium, always properly dismount the 702 from the operating system. On Mac platforms, drag the drive icons to the trash. On Windows platforms, use the "Disconnect External Media" icon in the system tray.

To disconnect the 702 from FireWire:

1. Make certain that any software applications referencing the 702 are closed and that all file copy functions to and from the 702 have been completed.
2. In Mac OS X highlight the drive icon on the desktop and select ⌘-e to eject the volume. Alternatively, drag the drive icon to the trash in the dock.
2. In Windows, right-click the drive icon and select "eject."
3. The cable between the computer and 702 can now be disconnected. If a future connection is going to be made the cable can be left connected.

If the 702 is disconnected from the computer via an eject command and the FireWire cable is still physically connected between the computer and recorder, the data connection can be made by entering the Setup Menu select **FIREWIRE: CONNECTION**. Alternatively, press the STOP button and HDD button together to begin a FireWire connection.

Different than when dismounting the 702 in Windows, with Mac OS, if a 702 is disconnected from FireWire by pulling the FireWire cable without first dismounting the drive the following error will appear.



While it is typically safe to disregard this message and hit the soft button X, it is best practice to properly remove the 702 from a Macintosh by dragging the volume to the trash or by using the front panel shortcut ⌘-e.

Do not remove the Compact Flash card while **CONNECTED TO COMPUTER** *appears in the LCD.*

Compact Flash Recording Media

Compact Flash (CF) is an excellent portable storage medium for audio recording. Its speed and capacity continue to increase as its price continues to come down. The 702 records to and plays from CF cards as its primary storage medium.

The key benefits of Compact Flash include:

- wider temperature range capability than hard disk drives
- greatly increased shock immunity versus hard disk drives
- convenient, portable, removable media
- ubiquitous card readers and transfer tools

Formatting

Upon insertion of an unformatted (or non-FAT32 formatted) CF card, the 702 will indicate that the card is not formatted and request the user to format the card. If the card was previously formatted as a FAT32 volume, either from the 702, a computer, or another audio recorder, the card will be ready for recording. To format the CF card, perform the following:

1. Ensure that all files on the card have been copied or are no longer needed.
2. Enter the Setup Menu and use the Rotary Switch to scroll to **INHDD: (ERASE)**.
3. Press the Rotary Switch button to begin formatting.
4. Press the Rotary Switch once more to confirm the operation.

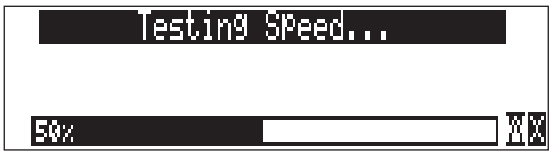
Formatting the 702 Compact Flash card can take up to 20 seconds. When formatting is complete, the 702 will generate a fresh menu hierarchy, including the daily folder, if selected.

The 702 can format and use Compact Flash cards with a minimum capacity of 64 MB. There is no practical limit to the maximum Compact Flash card capacity (2 TB).

Formatting the CF rebuilds the FAT (file allocation table) and erases all audio and data files present on the card. While some PC and Mac utilities can recover files immediately after formatting a CF card, consider that the files have been permanently erased. FAT32 volumes may not be compatible with some consumer electronic devices, including entry-level digital cameras (these may only support FAT/FAT16 volumes).

After recording to CF has stopped, it may take several seconds for the 702 to finish "housekeeping" on the card. Before removing the card, always observe the amber CF activity LED. If it is lit, wait until it is off before removing the card. If the CF is removed while the LED is lit, at the very least the file will be corrupted and there is a possibility of FAT corruption as well.

Speed Testing



CF cards vary widely in their read and write throughput. Later generation "24x" and greater CF cards can reliably read and write multi-track, high sample rate audio. The 702 includes a drive speed test to measure the throughput speed of CF medium.

The speed test reports the throughput of the card by generating a test file, then reading it. The speed test can vary from test to test depending on the amount of free space on the drive, the amount of fragmentation, and other factors. Use the speed test as a general, relative measurement from one card type to another.

Few CF cards can sustain write speeds for reliable 192 kHz recording. Sound Devices strongly recommends using only the fastest cards to record at sampling rates above 96 kHz.

Media Repair Utility

Included in the 702 Setup Menu is a basic media repair utility. This utility is similar to Windows "scandisk" with added capabilities specific to audio files. This utility can be run after improper media removal, or in the event of a file write error during recording. When selected from the Setup Menu, the repair utility will scan the inserted card, report the number of errors, and correct any errors found. Recovered files are placed in a new folder named **RECOVERED**. The **RECOVERED** folder is located in the card's root. Specific operations include:

1. **Boot Record Check** – the card's boot record is checked for proper information. Any out-of-range values are forced to the nearest valid value.
2. **FAT Chain Scan** – each file on the card is allocated space by linking together data clusters into a "chain" of clusters. Each chain is specified in the card's file allocation table (FAT). In this stage of media repair, each and every FAT chain is scanned and checked for validity. Broken chains, lost chains, cross-linked chains, and chains with no end, are fixed or truncated.
3. **Lost Chain Recovery** – FAT chains that are not tied to a file are considered "lost." These chains represent used space on the drive, and may have been separated from their file due to a card error or improper shut-down. These chains are converted to files and placed in the "RECOVERED" folder.

4. **RIFF (WAV/BWF) file check** – All RIFF files are checked for proper format. RIFF files are composed of "chunks" of data, where each chunk has a type and a size. If the size does not match the actual amount of data for the particular chunk (which might be the case if the file was not closed properly), the size is adjusted.

At the end of the repair operation, the number of errors found and fixed is displayed. In some cases, errors can not be fixed automatically.

It is possible that a Compact Flash card can become corrupted in such a way the media repair utility is unable to recover audio. In this case the operation will abort and the user is prompted to check the hardware and try again.

Qualified CF Cards

Sound Devices does not specifically "qualify" CompactFlash cards for use in the recorder. From our tests of numerous cards—including medium from Lexar Media, SanDisk, and Kingston Technology—cards in capacities ranging from 128 MB to 4 GB will successfully operate in the 702. Small capacity cards may not format as FAT32 and may not be useable. Use the CF transfer speed test to verify that an installed card can support the needed read/write speed.

Powering

The 702 is powered from either removable, Li-ion rechargeable batteries or external DC power. The included, removable 7.2 V Li-ion cell can be used as a primary or backup power source. The 702 automatically chooses the power source based on the voltage level of the external power supply. If it falls below a factory-set threshold, the unit will transition to Li-ion power. The transition between external and removable battery powering is seamless and has no affect on recording or playback operation.

During typical operation the 702 will run for approximately four hours from the included 4800 mAh Li-ion battery.

Lithium Ion Rechargeable Battery

The 702 is compatible with Sony-mount L- or M-type Li-ion rechargeable batteries. Numerous power capacities are available in these battery types, ranging from 1000 mAh to 7000 mAh. The 702's mount accommodates unlimited battery depth. Larger amp-hour cells provide more run time.

When powered by the removable Li-ion battery the LCD displays the battery voltage. The nominal operating voltage for Li-ion batteries is 7.2 V, with operating voltages ranging between 6.5–8.5 V. When the battery drops to 6.5 V, the LCD voltage display and the power LED begin flashing to warn that the battery is nearly depleted. When the voltage reaches 6.3 volts the 702 will power down—any recordings in-process will automatically be closed (stopped).

External Powering and Battery Charging

The 702 can be powered externally from 10–18 VDC (2 amp minimum). External DC fully powers the unit and charges an attached Li-ion battery simultaneously using the 702's onboard Li-ion charger. The charger circuit operates whenever the unit is powered on and optionally when the unit is off, depending on the external power wiring (*see below*).

DC input uses a 4-pin Hirose connector (Part # HR10-7P4P). There are two connection options available:

External DC Input Wiring	Operation
pin-2 to negative (–) pin-3 to positive (+)	operates the on-board Li-ion charger when the unit is both turned on and off. Use when plugged into AC power
pin-1 to negative (–) pin-4 to positive (+)	operates the on-board Li-ion charger only when the unit is turned on—there is no external current draw when powered off. Use when connecting to an external battery pack
Regardless of whether pins-1 and -4 or pins-2 and -3 are used, the unit will always charge the Li-ion battery when the unit is powered on.	

Pin-1 and pin-2 of the external DC input are at the same ground potential as chassis and signal ground.

The voltage level of the source powering the unit is shows on the LCD (EXT 12.0V). When the 702 senses a low voltage condition from an external DC source the power LED and battery voltage display flashes, to alert the user. When the external DC reaches 9 volts, the 702 will automatically switch over to the removable battery. If no battery is installed the unit will shut down.

The included AC-to-DC "wall-wart" power supply operates the unit and charges the removable batteries simultaneously. Pins-3 and -4 are wired to (+) and pins-1 and -2 are wired to (–).

When power is applied, the charging circuit evaluates the battery condition and supplies charging current, if necessary. When charging, the amber charge LED will flash. Once the battery is fully charged, the charger will turn off and the amber charge LED will light solid, indicating a full charge. Large capacity cells increase the charge time.

Charge LED Activity	Description of Activity
Off	Charger disabled
On	Completed charge / battery fully charged
1 blink	Charger enabled / battery is charging
2 blinks	No Li-ion battery attached
3 blinks	High/low internal temperature state
4 blinks	Battery level error code (>15 min. in slow mode)
5 blinks	Error - charger has been operating for over 8 hours without full charge

If the charge LED shows anything but a successful charge, the Li-ion battery may require replacement.

Time Code Clock Battery

The 702 has an internal NiMH LR6 (AA) battery to power to the time code generator circuitry and time-of-day clock. This battery is charged simultaneously with the Li-ion battery. Additionally, the AA is charged from the Li-ion battery when the unit is powered on.

With a fully charged AA battery, accurate time code is held for two hours after power down. The 702 can be powered down and the removeable battery can be removed and replaced without worry of time code jumps or inaccuracy. When the NiMH battery reaches a factory-set voltage, the time code generator will shut off and the time-of-day clock will take over — holding time and date for up to 60 days.

702 maintains accurate time code for 2 hours after power-down with a fully charged NiMH battery time code AA battery, even with the Li-ion and external DC power sources removed.

Auto Functions with External Powering

The 702 can perform several functions when DC power is applied to and removed from the recorder. Options available include:

- **Power on unit** – unit will turn on and be ready for operation.
- **Power on and begin recording** – unit will power on and begin recording with the settings used when previously powered down.
- **Power on, power off unit** – external DC functions as the on/off switch.
- **Power on and begin recording, power off** – unit will power and begin recording, then turn off when power is removed.

These functions are useful when the unit is part of a production kit powered by a single power source. A single power switch can be used to power on the whole kit.

In addition to the internal record timer, the auto functions (power on/begin record/power off) can be used for more extensive unattended recording control. Using an outboard timer attached to a DC supply the 702 can be placed and activated to record events including SFX or nature, and for surveillance applications.

Firmware Upgrades

The 702 uses upgradable EEPROM (electrically erasable programmable read-only memory) to hold the unit's operating system software, or firmware. Firmware is the source code which controls all aspects of the device, including: menu options, signal routing, signal processing, LED's, button and switches, and data ports.

Version Information

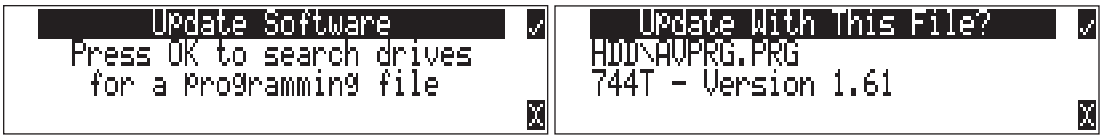
During manufacturing the unit's hardware revision number and serial number are burned into a protected area of the EEPROM and are not changeable. These numbers can be viewed from the **INFO:VERSION** selection of the Setup Menu. **INFO:VERSION** also shows the firmware version of the recorder.

The 702 firmware version and unit serial numbers are written to the data chunk of every WAV and BWF sound file generated by the 702.

Upgrading Firmware

From time to time Sound Devices may issue revisions (new versions) of firmware for the 702. Firmware is user-upgradeable. To upgrade firmware follow the steps below.

1. Download the firmware file from the Sound Devices web site or obtain it on disk.
2. Transfer the firmware file (it will be named **VERSION _ NUMBER.PRG**) to a Compact Flash card in the 702 via FireWire. If there are multiple firmware files on the media, the 702 will indicate the firmware file listed to apply. To prevent confusion, ensure that there is only one firmware file available on either 702 media.
3. Enter the firmware upgrade menu. You will be prompted to search for the firmware file. If a valid firmware file is present on the CF card the recorder will prompt if the path is the proper file to use. Press the Rotary Switch or the tone button to say yes. The 702 will begin firmware upgrade and validation. Progress is indicated with a bar graph.



4. When the upgrade and verify process is complete, power cycle the 702. On power-up the LCD will turn solid black and the green LED next to the FireWire port will blink 20 times. When the update sequence is complete, the 702 will reboot once again.
5. Verify the firmware version using the **INFO:SOFTWARE** menu.
6. Reset the time-of-day clock, time code generator, and verify any recording parameters.
7. It is best practice to download the latest user guide from the Sound Devices web site, since the changes to functionality are documented.

Firmware upgrades usually preserve all user menu settings. However, save a snapshot of the settings to a setup file on the CF. Once a firmware upgrade is complete, restore settings from this file, if necessary. Some firmware updates may make changes to user setups; verify all user setups after an upgrade.

Specifications

System

Sampling Frequency	internal: 32, 44.1, 48, 48.048, 88.2, 96, 96.096, 176.4, 192 kHz external clocking: 32–192 kHz via word clock input
Internal Data Path and Processing	32 bit, 192 dB dynamic range
A/D, D/A Converters	24 bit, 192 kHz sampling rate maximum. A/D converters on socketed, field-upgradeable daughter board
A/D Dynamic Range	114 dB, A-weighted bandwidth 110 dB, 20 Hz–22 kHz bandwidth
D/A Dynamic Range	112 dB, A-weighted bandwidth 108 dB, 20 Hz–22 kHz bandwidth
Metering	76-segment (4 x 19), sunlight-viewable selectable peak, VU, or peak (with or without peak hold) with VU ballistics, variable brightness

Analog Input

(all measurements at Fs 96 kHz, 24 bit unless noted)

Frequency Response	Mic or Line: 10 Hz–40 kHz, +0.1, –0.5 dB (gain controls centered)
Equivalent Input Noise	Mic: –133 dBu max (–135 dBV), 50 ohm source, A-weighted filter Mic: –131 dBu max (–133 dBV), 50 ohm source, 20 Hz–20 kHz BW flat filter, gain fully up Mic: –130 dBu max (–132 dBV), 150 ohm source, A-weighted filter Mic: –128 dBu max (–130 dBV), 150 ohm source, 20 Hz–20 kHz BW flat filter, gain fully up
THD + Noise	Mic: 0.004% max (1 kHz, 22 Hz–22 kHz BW, gain control down, –15 dBu input) Line: 0.004% max (1 kHz, 22 Hz–22 kHz BW, gain control down, +16 dBu input)
Gain (input dBu to –20 dBFS)	Mic (normal gain mode): 25–70 dB Mic (low gain mode): 10–55 dB Line: –6–18 dB, 0.1 dB increments
Input Impedance	Mic (XLR): 7.5k ohm Line (XLR and TA3): 20k ohm
Input Clipping Level	Mic input: –5 dBu minimum (normal gain mode, gain control fully down) Mic input: +10 dBu minimum (low gain mode, gain control fully down) Line input: +26 dBu minimum (gain control fully down)
Input Topology	Mic and Line: fully electronically balanced, RF, ESD, short, and overload protected; pin-2 hot, pin-3 cold
Gain Matching	Line inputs: ±0.1 dB, channel-to-channel
Common Mode Rejection Ratio	Mic: 40 dB minimum at 80 Hz
High-Pass Filters	40, 80, 160, 240 Hz @ 12/18/24 dB/oct (all menu selectable)
Mic Powering (each XLR selectable)	48 V phantom through 6.8k resistors, 10 mA per mic available, menu-selected per channel in mic or line level positions
Mic Input Limiters	analog (pre-A/D converter), dual-stage optocoupler and FET, –4 dBFS threshold, 20:1 limiting ratio, 5 mS attack time, 200 mS release time

Output Analog

Line Output Clipping Level	+20 dBu minimum, 10k ohm load
Attenuation & Resolution	0–40 dB, 1 dB increments
Output Topology	Line: fully electronically-balanced, RF, ESD, short, and overload protected; pin-2 driven hot, pin-3 driven cold; let pin-3 float for unbalanced connections.

Inputs/Outputs – Digital

AES3-id	75 ohm, 1.0 V p-p, S/PDIF compatible with RCA adapter

Digital Storage

Compact Flash	CF type I, II, and + (microdrive) compatible, FAT32 formatted, up to 2 TB addressable
File Types	WAV or BWF (AES-31 format), mono or polyphonic, at supported Fs, 24-bit or 16-bit MP3 @ 64, 96, 128, 240, or 320 kb/s stereo
Utilities	format, speed test, and repair utility for CF media

Data Transfer / Control

FireWire	drive-mode, IEEE-1394a compliant, 6-pin FireWire, Windows 2000, XP, Mac OS X only
C. Link	6-wire modular input and output, RS-232 machine control, word clock, time code transfer

Time Code

Modes Supported	free run, record run, 24 hour run, external time code receive
Frame Rates	23.976, 24, 25, 29.97DF, 29.97ND, 30DF, 30ND
Accuracy	<0.2 ppm, when tuned with Ambient Master Controller, holds TC clock for 8 hours after main battery removal (AA time code battery installed); after 8 hours, retains time of day
Input / Output	20k ohm impedance, 0.3V p-p (–8 dBu) minimum / 1k ohm impedance, 3.0V p-p (+12 dBu)

Powering

Internal Voltages	±16 VDC regulated audio rails 5 VDC data 3.3 VDC data 1.5 VDC DSP core 48 VDC phantom power
Power supply (batteries)	operating cell, removable 7.2 V (nominal) Sony M- or L-type Li-ion, operational from 6–8 V, time code battery, 1.2 V AA nickel metal-hydride
Power supply (external)	10–18 V, 1000 mA minimum, via locking 4-pin Hirose connector, use Hirose #HR10-7P-4P (DigiKey# HR100-ND) for locking mating DC connector; pin-1 (–), pin-2 (–), pin-3 (+), pin-4 (+). See *Powering* section for additional details

Environmental

Operation and Storage	ambient temperature 5–55° C, relative humidity (non-condensing) <80%

Other

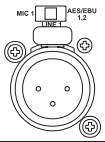
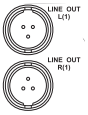
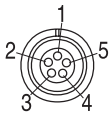
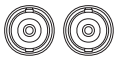
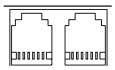
LCD Display	202 x 32 pixels, extended temperature, backlit display
Tone Oscillator	100 Hz–10 kHz, variable output, assigned to tracks or outputs (menu-selectable)
Quick Setups	four factory presets, one user setup stored to CF or HD as data file

Dimensions and Weight

Size	45 mm x 209 mm x 125 mm (H x W x D) 1.8" x 8.2" x 4.9"
Mass	unpackaged: 970 grams, (2.14 lbs) without battery

Connector Pin Assignments

Each connector type, electrical characteristics, and pin assignment is shown below.

Connector		Pin Assignments	Notes
XLR (Analog Inputs)		1 – ground 2 – signal (+) 3 – signal (-)	7.5k ohm input impedance, mic level 20k ohm input impedance, line level active-balanced
XLR (AES Inputs)		1 – ground 2 – signal (+) 3 – signal (-)	transformer-balanced, for use 110 ohm twisted-pair cabling, AES3 specification
TA3M Master Output Bus		1 – ground 2 – signal (+) 3 – signal (-)	120 ohm output impedance, active balanced. For unbalanced connection, pin-1 ground, pin-2 hot, pin-3 not connected. Mates with Switchcraft TA3F-type connector.
3.5 mm Master Output Bus		tip – signal L ring – signal R sleeve – signal ground	Master Output Bus signal in an unbalanced, consumer-electronic level.
3.5 mm Headphone		tip – signal L ring – signal R sleeve – signal ground	mates with 3.5 mm TRS jack.
5-pin LEMO Time code (702T only)		1 – ground 2 – SMPTE TC In 3 – ASCII in/out 4 – tuning out 5 – SMPTE TC out	LEMO B-series connector, pin assignments as viewed on panel-mounted connector
AES3id (S/PDIF) Input		center pin – signal sleeve – ground	BNC female, unbalanced, coaxial connection, 75 ohm connectors recommended
AES3id (S/PDIF) Output		center pin – signal sleeve – ground	BNC female, unbalanced, coaxial connection, 75 ohm connectors recommended
Word Clock Input and Output		center pin – signal sleeve – ground	BNC female, unbalanced, coaxial connection, 75 ohm connectors recommended
FireWire (-1394)		center pin – signal sleeve – ground	6-pin male FireWire cable
C. Link In / Out		1 – +3.3 V 2 – Tx (output) 3 – ground 4 – Rx (input) 5 – WC in 6 – TC in	Not a telephone jack!
Hirose 4-pin DC Input		1 – ground 2 – ground, same as pin-1 3 – DC (+) 4 – DC (+)	DC applied to pin-3 will operate and charge the unit when on and off DC applied to pin-4 will operate and charge the unit when on

Power Consumption Variables

The 702 draws power from either its on-board Li-ion battery or from external DC sources. Two factors need to be considered to calculate battery runtime—battery/power supply capacity and unit power consumption. The best determination of your run time is to experiment with a given recording setup.

The 702 power consumption varies over a range between 4 W to 20 W (12 volts), depending on active functions. The following functions have the most significant affect on power consumption:

Inputs	Active analog inputs increase power consumption. If recording from digital sources, disable analog inputs, or inputs altogether to reduce power consumption. If recording solely to inputs 1 and 2, disable inputs 3 and 4 to reduce power consumption. Analog inputs and the microphone preamps draw current whether they are idle or active. Active inputs draw 1.5 W compared to deactivated inputs.
Microphone Powering	Phantom powered microphones draw power for operation. Up to 1 W can be drawn from the phantom supply.
Battery Chargers	Depending on the charge state of the on-board Li-ion and the internal AA time code battery, the charging circuit can draw ~10 W from external DC.
Sampling Rate	The 702 draws more power at higher sampling rates. Each doubling of the sampling rate adds ~1 W of power consumption.

Recording Time Calculation

The calculation of available 702 recording time involves three factors:

- **track count** - how many concurrent audio tracks are selected for recording.
- **data rate** - calculated from the sampling rate and bit depth for non-compressed audio and by bit rate for data compressed audio. Data rate determines how big the data "container" is for the audio signal (see the calculation below for determining PCM audio).
- **storage capacity** - typically expressed in GB

Uncompressed Recording Time in Track-Hours

Data Rate (bit depth/sampling rate), one track

Storage in GB (1000 MB = 1 GB)	**16/44.1** (5.05 MB/min)	**16/48** (5.49 MB/min)	**24/48** (8.24 MB/min)	**24/96** (16.5 MB/min)	**24/192** (33.0 MB/min)
1	3.30	3.03	2.02	1.01	0.51
2	6.60	6.07	4.05	2.02	1.01
4	13.2	12.1	8.09	4.05	2.02
8	26.4	24.3	16.2	8.09	4.05
15	49.5	45.5	30.3	15.2	7.59
40	132	121	80.9	40.5	20.2
60	198	182	121	60.7	30.3
100	330	303	202	101	50.6

The chart above shows recording time available with the 702. Time is expressed in hours per track (track-hours) at the specified data rate supported by the 702. If recording two tracks, divide the track hours figure by two. Similarly for four-track recording, divide track-hours by four. Note that the 702 supports additional sampling rate / bit depth combinations, however, only the most common are included below.

Record Time

The chart shows that when recording 24-bit/48 kHz audio to a 40 GB hard drive the maximum amount of recording time available roughly 80 track-hours. If recording a stereo two-track file, this yields 40 stereo hours of record time.

Note that most storage media now quote capacity in GB using SI units, where 1000 megabytes equals one gigabyte.

PCM Audio

Uncompressed digital audio is expressed numerically by two measurements, bit depth and sampling frequency, such as 16-bit/48 kHz. These two numbers are used to compute the data rate of uncompressed audio.

Audio Data Rate = Bit Depth x Sampling Frequency

In the example below the data rate of a single 16-bit/48 kHz audio stream is computed in megabytes per minute. Division by 1,048,576 converts from bits to megabits. Division by 8 converts from megabits to megabytes; multiply by 60 converts seconds to minutes.

(((16 x 48000) / 1,048,576) / 8) x 60 = 5.49 MB/min

MP3 Compressed Record Time in Hours

MP3 Data Rate (bit depth/sampling rate), stereo track

Storage in GB (1000 MB = 1 GB)	64 kb/s (0.47 MB/min)	96 kb/s (0.70 MB/min)	128 kb/s (0.94 MB/min)	160 kb/s (1.17 MB/min)	192 kb/s (1.40 MB/min)	256 kb/s (1.86 MB/min)	320 kb/s (2.34 MB/min)
1	35	23	17	14	11	8	7
2	71	47	35	28	23	17	14
4	142	94	71	56	47	35	28
8	284	189	142	113	94	71	56
15	533	355	266	213	177	133	106
40	1422	948	711	568	474	355	284
60	2133	1422	1066	853	711	533	426
100	3555	2370	1777	1422	1185	888	711

The chart above shows recording time available with the 702 when recording to an MP3 file. Time is expressed in hours at the specified MP3 supported by the 702. Note that all recordings are two-channel recordings.

Compressed Audio

When digital audio is compressed using some form of lossy, perceptual process such as MPEG2-Layer3 (MP3 audio), Windows Media encoding (WMA), ATRAC encoding (used in MiniDisc), AAC (MPEG-4 audio), or others - it can have a significant reduction in its data rate. Compressed audio has enabled the practical distribution of audio over low speed data networks.

Accessories

Included Accessories

The accessories below are included with the 702:

- Worldwide mains power supply, 100–240 VAC input, 12 VDC, 24 W output (XL-WPH)
- Li-ion removable rechargeable battery, 4800 mAh (XL-B2)
- 3.5 mm to 1/4-inch jack for headphone output extension (XL-14)
- C. Link cable for unit-to-unit linking (XL-RJ)
- Padded man-bag (XL-MAN)

Optional Accessories

The above accessories are just the start of building a flexible recording kit that can accommodate multiple types of connections. Available accessories from Sound Devices include:

- **XL-WPH**
  power adapter included with unit; 100–240 VAC input, 12 VDC output; it's good to have a spare
- **XL-B2**
  removable, rechargeable, Li-ion battery; 4800 mAh battery; it's good to have several spares
- **CS-3**
  Production bag with shoulder strap, holds 702 and is compatible with PortaBrace RM accessories; mounts onto CS-442, CS-302, and CS4W mixer bags
- **XL-1A (sold as pair)**
  TA3F to TA3F cable, used to connect the direct outputs of the a Sound Devices 442 mixer to the channel 3/4 analog line-level inputs
- **XL-2 (sold as pair)**
  TA3F to XLR-M cable, used for output connection from the master analog output
- **XL-2F (sold as pair)**
  XLR-F to TA3F cable, used for input connection to line inputs 3 and 4 from balanced, XLR outputs.
- **XL-BNC**
  BNC to BNC cable, to connect word clock from external sources to the 702 for synchronizing the 702; also used to sync external devices from the word clock of the 702.
- **XL-LB2**
  5-pin LEMO to two (2) BNC, used to jam to and from video cameras.
- **XL-LL**
  5-pin LEMO to 5-pin LEMO, used to connect the 702 time code circuit to Ambient time code sync boxes, slates, and controllers or to jam one 702 to another 702; additionally used to jam Aaton cameras from the 702
- **XL-LX**
  5-pin LEMO to XLR-M and XLR-F, used to connect the time code output to SMTPE time code inputs and outputs

Front Panel Button Shortcuts

To speed navigation the 702 has numerous navigation “shortcuts”.

acts as an escape button and exits from most menus and functions immediately

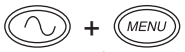
drops all functions except file copy and begins recording

press simultaneously to enter the time code jam menu

press backlight then tone to lock all front panel buttons except for Record, Stop and Play. FF and Rev are available in playback mode. Use backlight and tone again to unlock the panel.

hold down and press soft buttons to mute inputs

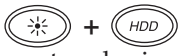
hold down STOP and press INPUT to cycle through input routing presets. Last preset will open the input routing menu to the custom route selection



toggles input 1 phantom power

toggles input 2 phantom power

toggles input 1 high-pass



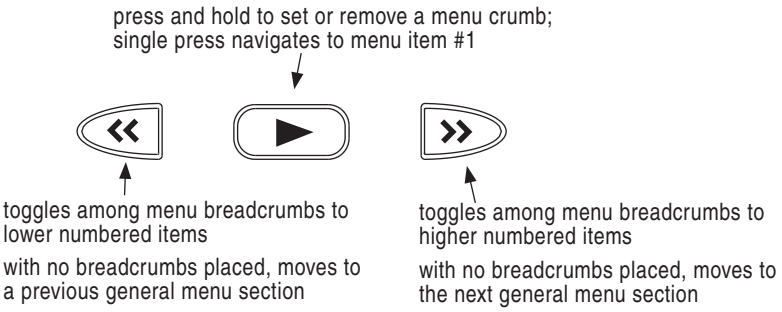
toggles input 2 high-pass

initiates FireWire connection if previously disconnected via an “eject” command

with the power off, hold down these buttons while powering the unit to enter Flashlight mode. This illuminates all LEDs except for three. Press power again to exit.

Setup Menu Shortcuts

The Setup Menu can be quickly navigated using the Rotary Switch to move up and down through the menu. Additionally, shortcuts, or “breadcrumbs” can be placed on often-used menu items. A breadcrumb is set by holding the play button when at a selected menu item. A small dot is shown to the left of the setup number. Any number of breadcrumbs can be set, but their utility is reduced with too many applied.



Warranty and Technical Support

Warranty & Service

Sound Devices, LLC warrants the 702 and 702T Portable Audio Recorders against defects in materials and workmanship for a period of ONE (1) year from date of original retail purchase. This is a non-transferable warranty that extends only to the original purchaser. Sound Devices, LLC will repair or replace the product at its discretion at no charge. Warranty claims due to severe service conditions will be addressed on an individual basis. THE WARRANTY AND REMEDIES SET FORTH ABOVE ARE EXCLUSIVE. SOUND DEVICES, LLC DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. SOUND DEVICES, LLC IS NOT RESPONSIBLE FOR SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES ARISING FROM ANY BREACH OF WARRANTY OR UNDER ANY OTHER LEGAL THEORY. Because some jurisdictions do not permit the exclusion or limitations set forth above, they may not apply in all cases.

For all service, including warranty repair, please **contact Sound Devices for an RMA** (return merchandise authorization) before sending your unit in for repair. Product returned without an RMA number may experience delays in repair. When sending a unit for repair, *please do not include accessories, including CF cards, batteries, power supplies, carry cases, cables, or adapters unless instructed by Sound Devices*.

Sound Devices, LLC
Service Repair RMA #XXXXX
300 Wengel Drive
Reedsburg, WI 53959 USA
telephone: (608) 524-0625

Technical Support / Bug Reports

For technical support and bug reporting on all Sound Devices products contact:

Sound Devices, LLC
E-mail: support@sounddevices.com
web: www.sounddevices.com/contact_support.htm
Telephone: +1 (608) 524-0625 / Toll-Free in the U.S.A.: (800) 505-0625
Fax: +1 (608) 524-0655

Sound Devices hosts a support forum for 7-Series recorders. The URL is:

www.sounddevicessupport.com

Sound Devices cannot guarantee that a given computer, software, or operating system configuration can be used satisfactorily with the 702 based exclusively on the fact that it meets our minimum system requirements.

Please check with your software editing application to make certain that it is compatible with the file type selected.

CE Declaration of Conformity

According to ISO/IEC Guide 22

Sound Devices, LLC
300 Wengel Drive
Reedsburg, WI 53959 USA

declares that the product, 702 and 702T Professional Digital Audio Recorders are in conformity with and passes:

EN55103-1, 1997	EMC-product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use. Part 1: Emissions
EN55103-2, 1997	EMC-product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use. Part 2: Immunity
EN55103-1 Phenomena 2, 3, 1997	Magnetic emissions at 1 meter 50 Hz – 50 kHz
EN55103-2 Phenomena 3, 1997	Magnetic immunity 50 Hz to 10 kHz
CISPR 22 (EN55022) 2003	Radiated and conducted emissions, Class B
EN61000-4-2 (2001)/ IEC61000-4-2 (2001)	ESD, ±4 kV contact, ±8 kV air discharge
EN61000-4-3 (2001)/ IEC1000-4-3 (2001)	Radiated RF immunity, 10 V/m, 80% 1 kHz amplitude modulation
EN61000-4-4 (2001)/ IEC61000-4-4 (2001)	AC power ports: EFT Burst, I/O lines, ±0.25 kV to ±1.0 kV, power line ±0.5 kB – ±1 kV
EN61000-4-4 (2001)/ IEC61000-4-4 (2001)	EFT Burst, I/O lines, ±0.25 kV to ±1.0 kV, power line ±0.5 kB – ±1 kV
EN61000-4-5 (2001)/ IEC61000-4-5 (2001)	Surge ±1 kV differential mode (line-to-line), ±2 kV common mode (line-to-ground)
EN61000-4-6 (2001)/ IEC61000-4-6 (2001)	Conducted RF immunity, 3 V, 80% @1 kHz amplitude modulation
EN61000-4-11 (2002)/ IEC61000-4-11(2001)	Voltage dips and short interruptions at test voltage level: 0% V unominal @ 70% V unominal @ 25 period

Tested by L. S. Compliance, Inc. Cedarburg, Wisconsin
March 15, 2006

Matthew Anderson
Director of Engineering
Sound Devices, LLC

Software License

End-user license agreement for Sound Devices 7-Series Embedded Software / Firmware

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Governing Law

This agreement and limited warranty are governed by the laws of the state of Wisconsin.

702 Setup Menu (rev. 1.67)

The chart below describes the available setting for the 702. This chart is for the 702 only. The 702T setup chart is later in this guide.

#	702 Setup Name	Setup Description	Setup Options
1	**Quick Setup**	Allows the user to quickly apply default menu setups and save/retrieve user setups to disk or CF.	• Load Factory Settings - restores the factory default settings • Load Film Settings - applies typical setups for film production • Load Reporter Settings - applies typical setups for voice recording • Load Music Settings - applies typical setups for music recording • Load User from CF - applies settings saved by user to CF • Save User to CF - saves present state to file on CF
2	**Rec: Sample Rate**	Sets the audio sampling rate of 702 recordings.	• 32 kHz • 44.1 kHz • 48 kHz • 48.048 kHz • 48.048k F • 88.2 kHz • 96 kHz • 96.096 kHz • 96.096 k F • 174.4 kHz • 192 kHz
3	**Rec: Bit Depth**	Sets the bit depth of the 702 recordings.	• 16 bit, • 24 bit
4	**Rec: File Type**	Selects the file format (type) recorded to the selected medium. WAV and BWF files are identical, the only difference is the file extension.	• .WAV poly • .WAV mono • .BWF poly • .BWF mono
5	**Rec: Scene Name/Number**	User-defined, alpha-numeric file scene name.	<up to 9 alpha-numeric characters can be entered for the scene name> Scene name can also be left blank
6	**Rec: Take Name/Number**	Numeric, auto-incrementing number used for take identification.	<selectable alpha character + integers up to 32000, with or without preceding 0's>
7	**Rec: Take Reset Mode**	Defines when take numbers are reset. Reset brings take number to <1>.	• Never - take numbers do not reset • When scene is changed - take resets when scene name is changed • When daily folder is changed - takes reset on new day • Either scene or daily - takes reset on either change
8	**Rec: Pre-Roll Time**	Selects the amount of pre-roll time the 702 will add to the beginning of each file.	0–10 sec. @ 48 kHz 0–5 sec. @ 88.2–96.096 kHz 0–2 sec. @ >96.096–192 kHz
9	**Rec: Dither**	Selects whether to dither is added to 24 bit digital signals while recording 16 bit files.	• Off • On (16 bit only)
10	**Rec: Timer Start**	Sets a specific start time/date for unattended recording. Unit must be powered.	<enter time, date>

#	702 Setup Name	Setup Description	Setup Options
11	**Rec: Timer Stop**	Set a specific time/date to stop recording. May be used with or without the Rec: Timer Start. May be set before the Timer Start time to temporarily stop recording and then resume recording with Timer Start.	<enter time, date>
12	**Rec: Error Handler**	Sets the behavior when a Compact Flash write error occurs.	• Stop recording • Keep Recording to New File
13	**Rec: Record Indicator**	Sets how the large display looks when the unit enters record.	• Normal Numbers • Reverse Numbers • Flash Numbers
14	**Input: Routing**	Allows the user to setup their routing matrix among all available inputs and tracks. There are four preset routings and one custom routing available. Pressing the input select button repeatedly will cycle through all preset routings. *Primarily accessible from the Input Select Button.*	• 1 → A / 2 → B • 1 → A / 1 → B • 1 → A,B / 2 → A,B • Custom Route
15 16	**Input 1: 48V Phantom** **Input 2: 48V Phantom**	Enables or disables 48 V phantom power on inputs 1 and 2.	• Off • On - Mic • On - Mic and Line
17	**Mic Inputs: Limiter**	Enables or disables the analog input limiter on input 1 and 2 mic preamps.	• Disabled • Enabled
18 19	**Mic Input 1: Low Cut** **Mic Input 2: Low Cut**	Enables the high-pass (low cut) filter to reduce sensitivity to low frequencies.	• Disabled • Enabled
20 21	**Mic Input 1: Low Cut Freq** **Mic Input 2: Low Cut Freq**	Selection of twelve high-pass filter frequency and slope combinations for microphone inputs.	• 40, • 80, • 160, • 240 Hz @ 12 dB/oct • 40, • 80, • 160, • 240 Hz @ 18 dB/oct • 40, • 80, • 160, • 240 Hz @ 24 dB/oct
22 23	**Mic Input 1: Gain Range** **Mic Input 2: Gain Range**	Selects the sensitivity of the microphone input. Low sensitivity is used for very loud and/or very hot microphones.	• Normal • Low
24	**Input 1, 2: Source**	Forces the inputs to analog or digital mode. Default is auto-select.	• Auto-select • Analog • Digital (S/PDIF/AES) • Disabled (Power Save)
25	**Input 1,2: Linking, MS**	Selects whether the input 1 & 2 levels are controlled independently or grouped as a pair with or without mid-side decoding.	• Unlinked Inputs 1 and 2 operate independently • Linked 1/2 Inputs are linked, channel 1 pot controls level, channel 2 pot controls pan • Linked 1/2 and MS Inputs are linked, channel. 1 pot controls level, channel. 2 pot controls pan and are decoded for MS stereo.
26	**Line Input 1,2: Gain Control**	When inputs 1 and 2 are in LINE input mode, selects whether the gain setting is controlled by the front panel knobs or by the menu sensitivity settings below.	• Use front panel knobs • Use sensitivity settings
27 28	**Line Input 1: Gain** **Line Input 2: Gain**	Adjusts the input sensitivity in 0.1 dB steps –6 dB and +18 dB.	Meters show a pre-fader level of the input signal of all four inputs on their respective meters to aid in the adjustment.
29 30	**Input 1: Delay** **Input 2: Delay**	Sets a digital delay for each input. Can be used to compensate for delay in various digital wireless microphone units or digital processors.	0 µsec to 30,000 µsec up to 48.048 kHz Fs 0 µsec to 15,000 µsec up to 96.096 kHz Fs 0 µsec to 7,500 µsec up to 192 kHz Fs

#	702 Setup Name	Setup Description	Setup Options
31	**File: Marker Mode**	Enables the user to set cue points on the fly while recording by pressing the record button.	• Markers disabled No cue marks are set. • New Cue Cue markers will be set within one contiguous file. • New File A new file is started with each press of the record button, the take counter is increased by one.
32	**File: Max Size**	Selects the file size where the 702 will close, then start a new file. The 702 will not record a file larger than the selected size. *The largest file permissible with the 702's FAT32 file system is 4 GiB*	• OFF (4 GiB) 3.6 GB • 4 GB 1.8 GB • 2 GB 950 MB • 1 GB 450 MB • 640 MB
33	**File: Folder Options**	Selects whether files are placed in the main card root, or a new folder for each production day or unique scene.	• Single folder • Daily folder • Scene Folder
34	**File: View Files**	Enters the File Viewer to navigate to sound files and folders.	Highlight media descriptor to navigate the menu
35 36	**Output 1 Left: Source** **Output 1 Right: Source**	Selects the signal source for the Master Output Bus (TA3 outputs, tape outputs, and digital 1 outputs.	• Input 1 • Input 2 • Track A • Track B • Input 1+2 • Track A+B
37	**Output 1 L,R: Attenuation**	Selects the attenuation level of signal sent to the Master Output Bus.	selectable from 0 to –40 dBFS
38 39	**Output 2 Left: Source** **Output 2 Right: Source**	Selects the signal source for each side of output bus 2 (digital).	• Input 1 • Input 2 • Track A • Track B • Input 1+2 • Track A+B
40	**Output 2 L,R: Attenuation**	Selects the attenuation level of the signal output to bus 2.	selectable from 0 to –40 dBFS
41	**Digital Output: Mode**	Selects whether or not the consumer SPDIF bit is applied or not in the AES3id output.	• Consumer • Professional
42	**Play: AutoPlay Mode**	Allows user to play file(s) consecutively from selected folder, one time through or continuously. *Great for playing an MP3 collection during down time!*	• Disabled • Play all • Repeat one • Repeat all
43	**Time/Date: 12/24 Hr**	Selects between 12 hour and 24 hour time.	• 12 hr • 24 hr
44	**Time/Date: Date Format**	Selects the date syntax of the recorder.	• mm/dd/yy • dd/mm/yy
45	**Time/Date: Set**	Sets the internal date and time of the 702. *Resetting the time re-jams the internal time code generator to the set time. Setting the internal clock during a production day will require time code devices to be re-jammed.*	<time, date> *Clock is not set until <done> is selected*

#	702 Setup Name	Setup Description	Setup Options
46	**LCD: Contrast**	Adjusts the contrast level of the LCD display.	0–100%
47	**Meter: Ballistics**	Selects among five different meter ballistics settings	• VU only • Peak only • Peak-hold only • Peak+VU • Peak-hold + VU
48	**Meter: Peak Threshold**	User-set level in dBFS where track peak LED's illuminate. 0 LED doubles as track peak indicator.	0 to –20 dBFS (1 dB increments)
49	**Meter: Stealth Mode**	Enables LEDs to toggle on and off with the LCD backlight button.	• Off • On
50	**HP: Rotary Switch Function**	Selects the functionality of the Rotary Switch's button when in record and playback.	• Disabled: push makes no change to the headphone matrix. • Selects Favorite Mode: in record and playback modes, push will change the headphone source immediately to the favorite selected in HP: Favorite Mode. • Playback/Monitor Drive Select Selects the media source for file playback and record monitoring
51	**HP: Monitor Modes**	Select the sequence of the modes that appear in the Headphone Source Display on the LCD.	Up to 20 source selections can be entered in any order. See headphone monitor section in guide for adjustment and Favorite Mode below for list of headphone selections.
52	**HP: Favorite Mode**	Selects the audio source monitored when the Rotary Switch is pressed during recording or playback.	• Inputs 1, 2 • Tracks A, B • Monitor A, B • Input 1, 1 • Input 2, 2 • Track A, A • Track B, B • Monitor A, A • Monitor B, B • Inputs 1,2 (MS) • Tracks 1,2 (MS) • Monitor 1,2 (MS) • Input 1+2, 1+2 • Tracks A+B, A+B
53	**HP: Playback Mode**	Selects the audio source sent to headphones upon playback.	• No change • Same as options listed above
54	**HP: Warning Bell Level**	Set the output level of the multi-function warning bell.	off, –60 to –12 dBFS in 1 dB steps
55	**Tone: Level**	Set the output level of the reference tone	–40 to 0 dBFS in 1 dB steps
56	**Tone: Frequency**	Allows the user to set the frequency of the reference tone oscillator	100–10,000 Hz in 100 Hz steps
57	**Tone: Mode**	Select the destination of the reference tone or to disables it completely	• disabled • to record tracks only • to outputs only • to record tracks and outputs
58	**CF: Test**	Performs a speed test on the Compact Flash media installed. Data transfer speed is measured in KB/s.	*Caution: Drive test will disable processing and mute outputs for duration of test. Outputs will not return until test is exited.*
59	**CF: Space**	Shows the drive file system, total size, and space remaining on connected Compact Flash medium.	
60	**CF: (Erase)**	Formats installed Compact Flash medium *Caution, while various PC utilities are able to recover files from re-formatted drives, once formatted, old audio data is not accessible by the 702.*	

#	702 Setup Name	Setup Description	Setup Options
61	**CF: Repair**	Runs a utility that will repair minor errors in the directory structure of the Compact Flash.	
62	**Balance Cal**	Calibrates the center position of the input 2 pot when used as the balance control for MS recording.	Place balance control to center and press to select.
63	**Power: Ext Low Batt Volt**	Sets the warning voltage of the low battery alert with an external power source. Internal battery warning threshold is factory set.	10.0–18.0 VDC, 0.1 V steps
64	**Power: Ext Power Function**	Controls the behavior of the unit when power is applied to the external DC jack.	• Do Nothing • Power On Unit • Power On and Start Record • Power On/Off unit • Power On/Off unit and Record
65	**FireWire: Connection**	Activates FireWire drive mode.	• Press OK to connect.
66	**Info: Version**	Shows the current hardware revision, serial number, and firmware version.	
67	**Update Software**	Upgrade tool used to apply new firmware. It will search all connected storage for the firmware file and prompt to update.	

702 Setup Presets

Presets are useful shortcuts to speed setting the numerous parameters available in the Setup Menu. The 702 has four built-in presets and unlimited user presets.

Built-In Presets

The 702 is shipped from the factory with the factory preset applied. Its settings are listed below. Three additional presets, film, reporter, and music presets allow for quick setup of typical parameters for the defined application. Presets are applied by entering the Setup Menu and selecting the preset. All previous settings are lost when a preset is applied.

702 Setting	Factory Preset	Film Preset	Reporter Preset	Music Preset
Sampling rate	48 kHz	48 kHz	44.1 kHz	44.1 kHz
Bit Depth	24 bits	24 bits	16 bits	16 bits
Input 1/2 Gain Controls	Unlinked	Unlinked	Unlinked	Linked
Record Dither	Off	Off	On	On
Pre-Roll Recording Buffer Time	2	2	2	2
Input 1 Delay	0	0	0	0
Input 2 Delay	0	0	0	0
LED Brightness	10	10	10	10
LCD Backlight	On	On	On	On
LED Backlight Mode	Normal	Normal	Normal	Normal
LCD Contrast	50%	50%	50%	50%
Meter Ballistics	Peak-hold+VU	Peak-hold+VU	Peak-hold+VU	Peak-hold+VU

702 Setting	Factory Preset	Film Preset	Reporter Preset	Music Preset
Input #1 Low Cut Filter	40 Hz, 12 dB/Oct	40 Hz, 12 dB/Oct	80 Hz, 18 dB/Oct	40 Hz, 12 dB/Oct
Input #2 Low Cut Filter	40 Hz, 12 dB/Oct	40 Hz, 12 dB/Oct	80 Hz, 18 dB/Oct	40 Hz, 12 dB/Oct
Input #1 Low Cut	Off	Off	On	On
Input #2 Low Cut	Off	Off	On	On
Limiters Enable	On	On	On	On
Transport Error Mode	Continue	Continue	Continue	Continue
Track Peak Threshold	0 dBFS	0 dBFS	0 dBFS	0 dBFS
Date Format	MM/DD/YY	MM/DD/YY	MM/DD/YY	MM/DD/YY
Record File Format	WAV poly	WAV mono	WAV poly	WAV poly
Marker Mode	Off	New file	New file	New file
Marker Pre-Roll	Off	Off	Off	Off
Auto File Split Size	2 GB	2 GB	2 GB	2 GB
Output Bus 1 Source	Tracks A/B	Tracks A/B	Tracks A/B	Tracks A/B
Output Bus 1 Attenuation	0 dBFS	0 dBFS	0 dBFS	0 dBFS
Output Bus 2 Source	Tracks C/D	Tracks C/D	Tracks C/D	Tracks C/D
Output Bus 2 Attenuation	0 dBFS	0 dBFS	0 dBFS	0 dBFS
HPMon1	Inputs 1/2	Inputs 1/2	TracksA/B	Inputs 1/2
HPMon2	Inputs 3/4	Inputs 3/4	End-of-list	Inputs 3/4
HPMon3	Tracks A/B	Tracks A/B		Tracks A/B
HPMon4	Tracks C/D	Tracks C/D		Tracks C/D
HPMon5	Input 1	Input 1		Input 1
HPMon6	Input 2	Input 2		Input 2
HPMon7	Input 3	Input 3		Input 3
HPMon8	Input 4	Input 4		Input 4
HPMon9	Mon A/B	Mon A/B		Mon A/B
HPMon10	Mon C/D	Mon C/D		Mon C/D
HPMon11	End-of-list	End-of-list		End-of-list
Number of HP Monitor Modes	10	10	1	10
Headphone current mode	Tracks A/B	Tracks A/B	Tracks A/B	Tracks A/B
Headphone favorite mode	Tracks A/B	Tracks A/B	Tracks A/B	Tracks A/B
Rotary Switch Function	Favorite Mode	Favorite Mode	Favorite Mode	Favorite Mode
Custom Route Value				
Input Routing	4 Track	4 Track	Dual Mono	Stereo
Record Folder Options	None	None	None	None
Tone Level	–20 dBFS	–20 dBFS	–12 dBFS	–12 dBFS
Tone Frequency	1 kHz	1 kHz	1 kHz	1 kHz
Tone Mode	Trks & Outs	Trks & Outs	Trks & Outs	Trks & Outs
Ch #1 Phantom	Off	On - Mic Only	On - Mic Only	On - Mic Only
Ch #2 Phantom	Off	On - Mic Only	On - Mic Only	On - Mic Only
Input #1/2 Source	Auto Select	Auto Select	Auto Select	Auto Select

702 Setting	Factory Preset	Film Preset	Reporter Preset	Music Preset
Input #1/2 Control	Knobs	Knobs	Knobs	Knobs
Line Input #1 Gain	0 dB	0 dB	0 dB	0 dB
Line Input #2 Gain	0 dB	0 dB	0 dB	0 dB
External Voltage Threshold	11.0 V	11.0 V	11.0 V	11.0 V
Autoplay mode	Play All	Play All	Play All	Play All
HP Monitor Playback Mode	Tracks A,B	Tracks A,B	Tracks A,B	Tracks A,B
Warning Bell Level	–30 dBFS	–30 dBFS	–30 dBFS	–30 dBFS
Mic Input #1 Gain Range	Normal	Normal	Normal	Normal
Mic Input #2 Gain Range	Normal	Normal	Normal	Normal
Take Counter Clear Mode	Never	On new daily folder	Never	Never

User Setup Data File

All of the set parameters in the table above can be saved to a date file on the Compact Flash card. By entering the Get/Save Setup Menu, the user can save or restore parameters to and from this data file. This binary file is named **`702.SUP`** and is saved in the root on the Compact Flash card

702T Setup Menu (rev. 1.67)

The chart below describes the available setting for the 702T. This chart is for the 702T only. The 702 (non-time code) setup chart is earlier in this guide.

#	702T Setup Name	Setup Description	Setup Options
1	**Quick Setup**	Allows the user to quickly apply default menu setups and save/retrieve user setups to disk or CF.	• Load Factory Settings - restores the factory default settings • Load Film Settings - applies typical setups for film production • Load Reporter Settings - applies typical setups for voice recording • Load Music Settings - applies typical setups for music recording • Load User from CF - applies settings saved by user to CF • Save User to CF - saves present state to file on CF
2	**Rec: Sample Rate**	Sets the audio sampling rate of 702 recordings.	• 32 kHz • 44.1 kHz • 48 kHz • 48.048 kHz • 48.048k F • 88.2 kHz • 96 kHz • 96.096 kHz • 96.096 k F • 174.4 kHz • 192 kHz
3	**Rec: Bit Depth**	Sets the bit depth of the 702 recordings.	• 16 bit, • 24 bit
4	**Rec: File Type**	Selects the file format (type) recorded to the selected medium. WAV and BWF files are identical, the only difference is the file extension.	• .WAV poly • .WAV mono • .BWF poly • .BWF mono
5	**Rec: Scene Name/Number**	User-defined, alpha-numeric file scene name.	<up to 9 alpha-numeric characters can be entered for the scene name> Scene name can also be left blank
6	**Rec: Take Name/Number**	Numeric, auto-incrementing number used for take identification.	<selectable alpha character + integers up to 32000, with or without preceding 0's>
7	**Rec: Take Reset Mode**	Defines when take numbers are reset. Reset brings take number to <1>.	• Never - take numbers do not reset • When scene is changed - take resets when scene name is changed • When daily folder is changed - takes reset on new day • Either scene or daily - takes reset on either change
8	**Rec: Pre-Roll Time**	Selects the amount of pre-roll time the 702 will add to the beginning of each file.	0–10 sec. @ 48 kHz 0–5 sec. @ 88.2–96.096 kHz 0–2 sec. @ >96.096–192 kHz
9	**Rec: Dither**	Selects whether to dither is added to 24 bit digital signals while recording 16 bit files.	• Off • On (16 bit only)
10	**Rec: Timer Start**	Sets a specific start time/date for unattended recording. Unit must be powered.	<enter time, date>
11	**Rec: Timer Stop**	Set a specific time/date to stop recording. May be used with or without the Rec: Timer Start. May be set before the Timer Start time to temporarily stop recording and then resume recording with Timer Start.	<enter time, date>

#	702T Setup Name	Setup Description	Setup Options
12	**Rec: Error Handler**	Sets the behavior when a Compact Flash write error occurs.	• Stop recording • Keep Recording to New File
13	**Rec: Record Indicator**	Sets how the large display looks when the unit enters record.	• Normal Numbers • Reverse Numbers • Flash Numbers
14	**Input: Routing**	Allows the user to setup their routing matrix among all available inputs and tracks. There are four preset routings and one custom routing available. Pressing the input select button repeatedly will cycle through all preset routings. *Primarily accessible from the Input Select Button.*	• 1 → A / 2 → B • 1 → A / 1 → B • 1 → A,B / 2 → A,B • Custom Route
15 16	**Input 1: 48V Phantom** **Input 2: 48V Phantom**	Enables or disables 48 V phantom power on inputs 1 and 2.	• Off • On - Mic • On - Mic and Line
17	**Mic Inputs: Limiter**	Enables or disables the analog input limiter on input 1 and 2 mic preamps.	• Disabled • Enabled
18 19	**Mic Input 1: Low Cut** **Mic Input 2: Low Cut**	Enables the high-pass (low cut) filter to reduce sensitivity to low frequencies.	• Disabled • Enabled
20 21	**Mic Input 1: Low Cut Freq** **Mic Input 2: Low Cut Freq**	Selection of twelve high-pass filter frequency and slope combinations for microphone inputs.	• 40, • 80, • 160, • 240 Hz @ 12 dB/oct • 40, • 80, • 160, • 240 Hz @ 18 dB/oct • 40, • 80, • 160, • 240 Hz @ 24 dB/oct
22 23	**Mic Input 1: Gain Range** **Mic Input 2: Gain Range**	Selects the sensitivity of the microphone input. Low sensitivity is used for very loud and/or very hot microphones.	• Normal • Low
24	**Input 1, 2: Source**	Forces the inputs to analog or digital mode. Default is auto-select.	• Auto-select • Analog • Digital (S/PDIF/AES) • Disabled (Power Save)
25	**Input 1,2: Linking, MS**	Selects whether the input 1 & 2 levels are controlled independently or grouped as a pair with or without mid-side decoding.	• Unlinked Inputs 1 and 2 operate independently • Linked 1/2 Inputs are linked, channel 1 pot controls level, channel 2 pot controls pan • Linked 1/2 and MS Inputs are linked, channel. 1 pot controls level, channel. 2 pot controls pan and are decoded for MS stereo.
26	**Line Input 1,2: Gain Control**	When inputs 1 and 2 are in LINE input mode, selects whether the gain setting is controlled by the front panel knobs or by the menu sensitivity settings below.	• Use front panel knobs • Use sensitivity settings
27 28	**Line Input 1: Gain** **Line Input 2: Gain**	Adjusts the input sensitivity in 0.1 dB steps –6 dB and +18 dB.	Meters show a pre-fader level of the input signal of all four inputs on their respective meters to aid in the adjustment.
29 30	**Input 1: Delay** **Input 2: Delay**	Sets a digital delay for each input. Can be used to compensate for delay in various digital wireless microphone units or digital processors.	0 µsec to 30,000 µsec up to 48.048 kHz Fs 0 µsec to 15,000 µsec up to 96.096 kHz Fs 0 µsec to 7,500 µsec up to 192 kHz Fs

#	702T Setup Name	Setup Description	Setup Options
31	**File: Marker Mode**	Enables the user to set cue points on the fly while recording by pressing the record button.	• Markers disabled No cue marks are set. • New Cue Cue markers will be set within one contiguous file. • New File A new file is started with each press of the record button, the take counter is increased by one.
32	**File: Max Size**	Selects the file size where the 702 will close, then start a new file. The 702 will not record a file larger than the selected size. *The largest file permissible with the 702's FAT32 file system is 4 GiB*	• OFF (4 GiB) 3.6 GB • 4 GB 1.8 GB • 2 GB 950 MB • 1 GB 450 MB • 640 MB
33	**File: Folder Options**	Selects whether files are placed in the root, or a new folder for each production day or unique scene.	• Single folder • Daily folder • Scene Folder
34	**File: View Files**	Enters the File Viewer to navigate to sound files and folders.	Highlight media descriptor to navigate the menu
35	**Time Code: Frame Rate**	Sets the time code frame rate. All common time code frame rates are available.	• 23.976 – used with high definition video cameras • 24 – to sync audio to film where no transfer to NTSC video is expected • 25 – to sync sound to PAL video • 29.97 – to sync sound to NTSC video shot in non-drop frame mode • 29.97DF - to sync sound to NTSC video shot in drop frame mode • 30 – to sync sound to film where transfer to NTSC video is expected • 30DF – to sync sound to film for transfer to NTSC video in drop-frame mode
36	**Time Code: Mode**	Sets the mode for the time code generator	• Off – time code not active, recorded or output • Free Run – time code runs continuously regardless of record mode • Free Run Jam Once – time code is initialized from an external source and updates itself to the external source when reconnected • Record Run – time code generator only runs during recording for continuous time code from file to file. • 24 Hr Run – time code is initialized from the system clock on startup and enters free run mode. • Ext TC – writes external TC to the file. • Ext TC/cont – writes external time code to the recorder; internal generator continues to run if TC signal is lost. • Ext TC-Auto Record – writes external time code to the recorder. Unit enters Record when TC runs; stops when TC stops. • Ext TC/cont-Auto Record – writes external time code to the file; internal generator continues to run if time code signal is lost. Unit enters Record when time code runs and stops when time code stops.

#	702T Setup Name	Setup Description	Setup Options
37	**Time Code: User Bits**	Sets the time code user bits generated by the 702. mm – month dd – day of week yy – year tt – take number uu – user-defined	• Not Used – user bits are not set or output • mm:dd:yy.tt • dd:mm:yy.tt • uu:uu:tt:tt – user bits are set to 4 user definable digits with 4 take digits • uu:uu:uu:uu • tt:tt:tt.tt – user bits are set to the take counter for all 8 digits • mm:dd:yy:uu • dd:mm:yy:uu
38	**Time Code: Jam Menu**	Allows the user to jam or edit the internal time code generator and user bits. (Also accessible by pressing HDD and Menu buttons simultaneously).	• Jam RX TC – jams the internal generator to received external code • Jam Zeros – resets the internal generator to zero • Jam Value – sets the internal generator to the value set in edit value • Edit Value – allows to user to enter a free-form number to initialize the time code • Edit U-Bit – allows the user to edit allowed user bit numbers
39	**Time Code: Display Mode**	Sets the numbers of the large numerical display.	• Big A-time • Big time code
40 41	**Output 1 Left: Source** **Output 1 Right: Source**	Selects the signal source for the Master Output Bus (TA3 outputs, tape outputs, and digital 1 outputs.	• Input 1 • Input 2 • Track A • Track B • Input 1+2 • Track A+B
42	**Output 1 L,R: Attenuation**	Selects the attenuation level of signal sent to the Master Output Bus.	selectable from 0 to –40 dBFS
43 44	**Output 2 Left: Source** **Output 2 Right: Source**	Selects the signal source for each side of output bus 2 (digital).	• Input 1 • Input 2 • Track A • Track B • Input 1+2 • Track A+B
45	**Output 2 L,R: Attenuation**	Selects the attenuation level of the signal output to bus 2.	selectable from 0 to –40 dBFS
46	**Digital Output: Mode**	Selects whether or not the consumer SPDIF bit is applied or not in the AES3id output.	• Consumer • Professional
47	**Play: AutoPlay Mode**	Allows user to play file(s) consecutively from selected folder, one time through or continuously. *Great for playing an MP3 collection during down time!*	• Disabled • Play all • Repeat one • Repeat all
48	**Time/Date: 12/24 Hr**	Selects between 12 hour and 24 hour time.	• 12 hr • 24 hr
49	**Time/Date: Date Format**	Selects the date syntax of the recorder.	• mm/dd/yy • dd/mm/yy

#	702T Setup Name	Setup Description	Setup Options
50	**Time/Date: Set**	Sets the internal date and time of the 702. *Resetting the time re-jams the internal time code generator to the set time. Setting the internal clock during a production day will require time code devices to be re-jammed.*	<time, date> *Clock is not set until <done> is selected*
51	**LCD: Contrast**	Adjusts the contrast level of the LCD display.	0–100%
52	**Meter: Ballistics**	Selects among five different meter ballistics settings	• VU only • Peak only • Peak-hold only • Peak+VU • Peak-hold + VU
53	**Meter: Peak Threshold**	User-set level in dBFS where track peak LED's illuminate. 0 LED doubles as track peak indicator.	0 to –20 dBFS (1 dB increments)
54	**Meter: Stealth Mode**	Enables LEDs to toggle on and off with the LCD backlight button.	• Off • On
55	**HP: Rotary Switch Function**	Selects the functionality of the Rotary Switch's button when in record and playback.	• Disabled: push makes no change to the headphone matrix. • Selects Favorite Mode: in record and playback modes, push will change the headphone source immediately to the favorite selected in HP: Favorite Mode. • Playback/Monitor Drive Select Selects the media source for file playback and record monitoring
56	**HP: Monitor Modes**	Select the sequence of the modes that appear in the Headphone Source Display on the LCD.	Up to 20 source selections can be entered in any order. See headphone monitor section in guide for adjustment and Favorite Mode below for list of headphone selections.
57	**HP: Favorite Mode**	Selects the audio source monitored when the Rotary Switch is pressed during recording or playback.	• Inputs 1, 2 • Tracks A, B • Monitor A, B • Input 1, 1 • Input 2, 2 • Track A, A • Track B, B • Monitor A, A • Monitor B, B • Inputs 1,2 (MS) • Tracks 1,2 (MS) • Monitor 1,2 (MS) • Input 1+2, 1+2 • Tracks A+B, A+B
58	**HP: Playback Mode**	Selects the audio source sent to headphones upon playback.	• No change • Same as options listed above
59	**HP: Warning Bell Level**	Set the output level of the multi-function warning bell.	off, –60 to –12 dBFS in 1 dB steps
60	**Tone: Level**	Set the output level of the reference tone	–40 to 0 dBFS in 1 dB steps
61	**Tone: Frequency**	Allows the user to set the frequency of the reference tone oscillator	100–10,000 Hz in 100 Hz steps
62	**Tone: Mode**	Select the destination of the reference tone or to disables it completely	• disabled • to record tracks only • to outputs only • to record tracks and outputs
63	**CF: Test**	Performs a speed test on the Compact Flash media installed. Data transfer speed is measured in KB/s.	*Caution: Drive test will disable processing and mute outputs for duration of test. Outputs will not return until test is exited.*
64	**CF: Space**	Shows the drive file system, total size, and space remaining on connected Compact Flash medium.	

#	702T Setup Name	Setup Description	Setup Options
65	**CF: (Erase)**	Formats installed Compact Flash medium *Caution, while various PC utilities are able to recover files from re-formatted drives, once formatted, old audio data is not accessible by the 702.*	
66	**CF: Repair**	Runs a utility that will repair minor errors in the directory structure of the Compact Flash.	
67	**Balance Cal**	Calibrates the center position of the input 2 pot when used as the balance control for MS recording.	Place balance control to center and press to select.
68	**Power: Ext Low Batt Volt**	Sets the warning voltage of the low battery alert with an external power source. Internal battery warning threshold is factory set.	10.0–18.0 VDC, 0.1 V steps
69	**Power: Ext Power Function**	Controls the behavior of the unit when power is applied to the external DC jack.	• Do Nothing • Power On Unit • Power On and Start Record • Power On/Off unit • Power On/Off unit and Record
70	**FireWire: Connection**	Activates FireWire drive mode.	• Press OK to connect.
71	**Info: Version**	Shows the current hardware revision, serial number, and firmware version.	
72	**Update Software**	Upgrade tool used to apply new firmware. It will search all connected storage for the firmware file and prompt to update.	

702T Setup Presets

Presets are useful shortcuts to speed setting the numerous parameters available in the Setup Menu. The 702 has four built-in presets and unlimited user presets.

Built-In Presets

The 702T is shipped from the factory with the factory preset applied. Its settings are listed below. Three additional presets, film, reporter, and music presets allow for quick setup of typical parameters for the defined application. Presets are applied by entering the Setup Menu and selecting the preset. All previous settings are lost when a preset is applied.

702T Default Setting	Factory Preset	Film Preset	Reporter Preset	Music Preset
Sampling rate	48 kHz	48 kHz	44.1 kHz	44.1 kHz
Bit Depth	24 bits	24 bits	16 bits	16 bits
Input 1/2 Gain Controls	Unlinked	Unlinked	Unlinked	Linked
Record Dither	Off	Off	On	On
Pre-Roll Recording Buffer Time	2	2	2	2
Input 1 Delay	0	0	0	0
Input 2 Delay	0	0	0	0
LED Brightness	10	10	10	10

702T Default Setting	Factory Preset	Film Preset	Reporter Preset	Music Preset
LCD Backlight	On	On	On	On
LED Backlight Mode	Normal	Normal	Normal	Normal
LCD Contrast	50%	50%	50%	50%
Meter Ballistics	Peak-hold+VU	Peak-hold+VU	Peak-hold+VU	Peak-hold+VU
Input #1 Low Cut Filter	40 Hz, 12 dB/Oct	40 Hz, 12 dB/Oct	80 Hz, 18 dB/Oct	40 Hz, 12 dB/Oct
Input #2 Low Cut Filter	40 Hz, 12 dB/Oct	40 Hz, 12 dB/Oct	80 Hz, 18 dB/Oct	40 Hz, 12 dB/Oct
Input #1 Low Cut	Off	Off	On	On
Input #2 Low Cut	Off	Off	On	On
Limiters Enable	On	On	On	On
Transport Error Mode	Continue	Continue	Continue	Continue
Track Peak Threshold	0 dBFS	0 dBFS	0 dBFS	0 dBFS
Time Code Frame Rate	30 ND	30 ND	30 ND	30 ND
Time Code Mode	Free run	Free run	Off	Off
Time Code User Bits Mode	mm:dd:yy:tt	mm:dd:yy:tt	Not Used	Not Used
Time Format	12 Hour	12 Hour	12 Hour	12 Hour
Date Format	MM/DD/YY	MM/DD/YY	MM/DD/YY	MM/DD/YY
Record File Format	WAV poly	WAV mono	WAV poly	WAV poly
Marker Mode	Off	New file	New file	New file
Marker Pre-Roll	Off	Off	Off	Off
Auto File Split Size	4 GB	4 GB	4 GB	4 GB
Output Bus 1 Source	Tracks A/B	Tracks A/B	Tracks A/B	Tracks A/B
Output Bus 1 Attenuation	0 dBFS	0 dBFS	0 dBFS	0 dBFS
Output Bus 2 Source	Tracks C/D	Tracks C/D	Tracks C/D	Tracks C/D
Output Bus 2 Attenuation	0 dBFS	0 dBFS	0 dBFS	0 dBFS
HPMon1	Inputs 1/2	Inputs 1/2	TracksA/B	Inputs 1/2
HPMon2	Inputs 3/4	Inputs 3/4	End-of-list	Inputs 3/4
HPMon3	Tracks A/B	Tracks A/B		Tracks A/B
HPMon4	Tracks C/D	Tracks C/D		Tracks C/D
HPMon5	Input 1	Input 1		Input 1
HPMon6	Input 2	Input 2		Input 2
HPMon7	Input 3	Input 3		Input 3
HPMon8	Input 4	Input 4		Input 4
HPMon9	Mon A/B	Mon A/B		Mon A/B
HPMon10	Mon C/D	Mon C/D		Mon C/D
HPMon11	End-of-list	End-of-list		End-of-list
Number of HP Monitor Modes	10	10	1	10
Headphone current mode	Tracks A/B	Tracks A/B	Tracks A/B	Tracks A/B
Headphone favorite mode	Tracks A/B	Tracks A/B	Tracks A/B	Tracks A/B
Rotary Switch Function	Favorite Mode	Favorite Mode	Favorite Mode	Favorite Mode
Custom Route Value				

702T Default Setting	Factory Preset	Film Preset	Reporter Preset	Music Preset
Input Routing	4 Track	4 Track	Dual Mono	Stereo
Timecode Userbits U-value (Low Word)				
Record Folder Options	None	None	None	None
Tone Level	–20 dBFS	–20 dBFS	–12 dBFS	–12 dBFS
Tone Frequency	1 kHz	1 kHz	1 kHz	1 kHz
Tone Mode	Trks & Outs	Trks & Outs	Trks & Outs	Trks & Outs
Ch #1 Phantom	Off	On - Mic Only	On - Mic Only	On - Mic Only
Ch #2 Phantom	Off	On - Mic Only	On - Mic Only	On - Mic Only
Input #1/2 Source	Auto Select	Auto Select	Auto Select	Auto Select
Input #1/2 Control	Knobs	Knobs	Knobs	Knobs
Line Input #1 Gain	0 dB	0 dB	0 dB	0 dB
Line Input #2 Gain	0 dB	0 dB	0 dB	0 dB
External Voltage Threshold	11.0 V	11.0 V	11.0 V	11.0 V
Clear Source Flag Bit After Copy	Enabled	Enabled	Enabled	Enabled
Autoplay mode	Play All	Play All	Play All	Play All
HP Monitor Playback Mode	Tracks A,B	Tracks A,B	Tracks A,B	Tracks A,B
Warning Bell Level	–30 dBFS	–30 dBFS	–30 dBFS	–30 dBFS
Mic Input #1 Gain Range	Normal	Normal	Normal	Normal
Mic Input #2 Gain Range	Normal	Normal	Normal	Normal
Take Counter Clear Mode	Never	On new daily folder	Never	Never

User Setup Data File

All of the set parameters in the table above can be saved to a date file on the Compact Flash card. By entering the Get/Save Setup Menu, the user can save or restore parameters to and from this data file. This binary file is named **`702.SUP`** and is saved in the **`SOUNDDEV`** folder on the Compact Flash card

Notes

SOUND DEVICES

702/702T rev. 1.67 - Printed in U.S.A.