

Chapter 11

Digital I/O Module

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Intelligent Digital Module

This optional hardware and software feature can be added to any Audicity. It lets you connect digitally to CD and DAT recorders, effects devices, and audio networks without complicated adjustments. Special features include automatic adaptation to virtually any digital signal (including marginal ones), instant sample rate and format conversion for input and outputs, and synchronization with word clock or video signals. The module also includes high-quality analog input converters at 32 kHz and 44.1 kHz.

This chapter describes how to use it. We call the module “intelligent” because it’s self-adjusting, and matches itself to any signal or sample rate. You don’t have to understand digital audio, because the module does.

- If you’re in a hurry to get into digital production, just glance at the first two pages for some pointers.

The Digital Module also includes advanced features, including diagnostics for out-of-spec signals, that can make it the heart of a digitally-equipped studio.

- If you want to get the most out of your Audicity system, read the rest of the chapter.

Input Selection

Recording with the Intelligent Digital Module is no different from using Audicity’s Analog module, except you have a choice of inputs:

Analog: These are the familiar “XLR” audio connectors, and they’re probably connected to conventional equipment in your studio (like the console or mic preamps). Their specifications and adjustments are covered in Chapter 14 of this manual.

AES/EBU¹: This is the most trouble-free kind of digital connection. In your studio it might be connected to a DAT machine, networking system, or switcher.

SPDIF²: These are the phono-jack (sometimes called “coaxial” or “RCA”) digital connectors on consumer equipment, CD players, and some portable recorders.

¹Stands for Audio Engineering Society/European Broadcast Union: the professional digital serial transmission standard used around the world. It also uses XLR connectors.

²Acronym for Sony / Phillips Digital Input Format. It’s actually now the IEC958 standard, but was originally created by the hi-fi manufacturers to avoid another bloody “VHS-Beta” war.

The S/PDIF signal often carries a copy protection signal, to prevent subsequent recording in a consumer environment. Since Audicy is professional gear, it ignores copy protection.

Selecting An Input

You can have signals plugged into each jack, and select which one Audicy uses as an input. It'll let you hear or record that signal only, and ignore the others.

There are three different ways to select which input Audicy uses. Each method has exactly the same effect; use the one that's most convenient.

- Press the *Input* button, or
- Use Input selection from a menu: Use the arrow buttons to highlight I/O Setup in the Patchbay menu. Then *Enter* one of the submenu input choices on its left.

			PATCH BAY
		AUTO A/B	RECORD MODE
	PHASE INVERT	EFX MUTE	EFX PATCH
SPDIF IN	AES/EBU IN	ANALOG IN	IO SETUP
		CHASE MODE	SMPTE
		MAP TRACKS	NAME TRACKS
READ DEFAULT	SAVE DEFAULT	SAVE PATCH	READ PATCH

Figure 11-1: Patchbay Menu

- Use Input selection within a form: Open I/O Setup form (by holding *Shift* while you press *Input* or by selecting the Studio:I/O Setup menu choice and pressing *Enter*) and you'll see a form. Use the arrow buttons to move to the Audio Source field and then select an input type. When satisfied, press *Shift+Enter*.

When you change input type, both the left and right channel change simultaneously. A text window on the left side of the Status Bar tells you which input is selected. Everything else is automatic.

If you've chosen Analog, the incoming signal will be sampled at the rate you've chosen for the current production, either 32 kHz or 44.1 kHz.

If you've chosen AES/EBU or S/PDIF, the Module will scan the incoming signal and adjust to its digital sample rate and format.

- You can record signals at any rate, no matter what rate you've chosen for the production. Signals are converted instantly, and the sound quality isn't affected.

For example, you can start a production at memory-saving 32 kHz...

add sound from a 44.1 kHz compact disk...

add more sound from a 48 kHz DAT...

and even more from a varispeed DAT...

output at 48 kHz...

and never leave the digital domain!

Input Status Displays

If you've selected a digital input and the chosen signal is missing, because a cable is disconnected or the source isn't turned on, the input status window on the Status Bar will appear in red letters and have a line through it.

In this case, Audicy will record silence. When the signal is restored, its name will return to normal.

The second window of the Status Bar displays the chosen external sync source for Audicy timing and digital outputs. If the chosen external sync signal is missing or out-of-spec, Audicy reverts to its on high-precision crystal and draws a line through the sync source's name.

While you'll probably switch input sources many times during a production, you don't have to worry about Sync: It can be set once as a default for your studio (see below) and applied automatically to all new productions.

Setup

The Intelligent Digital Module lets you select output and synchronization standards.

- You don't have to do this with each production. Set things up once for your studio and save it as your default. You can leave the settings alone after that.
- If you don't care to bother with digital stuff, just leave the factory defaults in place. Audicy will take care of most of the decisions for you.
- If you want, you can use the Setup function to diagnose incoming signals and make sure other equipment is performing to spec.

If you press *Enter* on I/O Setup in the Patchbay menu, you'll open Audicy's Input/Output Setup form. As a shortcut, hold *Shift* while you press *Input*.

Use the *up* and *down* arrows to jump from one selection field to the next, and the *left* and *right* arrows to cycle through your choices for each field.

For instance, you can use *up* and *down* to make sure the Audio Source field is highlighted. Then, by pressing *left* or *right*, you can change the source.

The changes you make in this form won't affect the audio until you confirm them with one of the Accept choices.

You can press *Esc* at any time to leave the form without making additional changes.

ANALOG/DIGITAL I/O SETUP						
Input		Digital Input Status				
Audio source	s/pdif	Preemphasis	50 us	Input rate	44.1 kHz	
Sync source	Internal	SCMS status	cons cons	Tolerance	<400 ppm	
Sync rate	32 kHz	Input format	cons	Last Error	no audio	
Main out		Aux. Out	Hardware Status			
Sample rate	48 kHz	48 kHz	PLL status	okay	Sync rate	32 kHz
Format	Pro	Pro	I/O Hardware	okay		
Defaults?	Ignore	Accept Yes and stay in screen				

Figure 11-2: I/O Setup Form

Audio Source

Use this field to change which input Audicy uses. It works the same as pressing the *Input* button when the form is closed.

By the way, all three sets of Audicy outputs are active simultaneously; no selection is necessary. The main outputs appear on the two main analog output connectors, on the AES/EBU output XLR, and on the S/PDIF phono jacks. The same is true for the Auxiliary outputs.

Audicy's digital inputs don't require synchronization. The system automatically matches any input signal, and resyncs it to the standard you've selected.

Sync Source

Use this to select an external signal to control Audicy's internal timing and synchronize the digital outputs.

- If a sync source disappears, Audicy will warn you by drawing a line through the sync Status Window, and automatically switch to internal sync.

Select from AES/EBU, S/PDIF, Word Clk, Video and Internal.

The first two choices match Audicy's timing to the signal on one of the digital input jacks. This can be helpful if you're connected to a digital network.

The Word Clk and Video choices match Audicy's internal clock and the edge of each output word to the selected signal on the Digital Module's BNC connectors. This is useful in all-digital or video sweetening studios.

Internal uses Audicy's own high-precision crystal. Note that when internal sync is selected, the sync Status Window is empty.

Sync Rate

If you've chosen Internal sync, Audicy's crystal is set to the current production sample rate — either 32.0 or 44.1 kHz — and that rate is displayed here.

If you're syncing to an external digital audio or word clock source, select Auto, 32.0 kHz, 44.1 kHz, or 48.0 kHz. Choose Auto if you're not sure: It scans the incoming signal and locks to the closest standard rate. Audicy then phase-locks its internal crystal to it, so the sync rate doesn't have to match the production's sample rate.

If you're syncing to Video, select NTSC or PAL to match your local broadcast standard. Audicy will accept full video or sync-only signals on the video-input BNC jack.

If an external sync signal is very slightly off-speed, Audicy will still lock to it. Large speed errors — more than .02% — can affect the sound. In this case Audicy will revert to its internal crystal, and the sync source window will change color as a warning.

Sample Rate

This sets the frequency for all four digital outputs (Main and Aux). Choose one of the standard sample rates: 32, 44.1 or 48 kHz.

- The output rate does not have to match Audicy's internal sample rate. You can create broadcast productions at memory-saving 32 kHz (with full 15 kHz bandwidth), and still dub to a 48 kHz DAT or 44.1 kHz CD-R. If you've selected 48 kHz and are syncing to an external video signal, the output will be fully compatible with digital videotape equipment.
- You can change the output rate at any time, even during a production.
- Note that the Aux Output sample rate is tied to the Main Output rate, and cannot be set independently.
- Audicy's outputs remain locked to the chosen sample rate, even during scrub and Vari-speed play.

Format

Choose Pro for professional, or Cons for consumer. You can set the main and Aux outputs separately, to match effects boxes or consumer DAT recorders.

Some home and semi-pro DAT recorders won't record certain combinations of rate and format³. If you're having trouble dubbing a finished production to one of these units, try setting Audicy's output to 48.0 kHz and Cons.

Diagnostics

The right side of the I/O Setup Form displays information about the input signal, sync signal, and how well Audicy is tracking the sync source⁴.

Preemphasis

In the early days of digital audio (long before Audicy) some devices added a high-frequency boost to compensate for less-than-perfect recording methods. A digital code would be added to the signal, to switch a corresponding deemphasis filter on playback.

This field reads the digital code and reports either No emphasis, 50/15 (the time constant usually used, in μ seconds), or CCIT (a European preemphasis standard).

Preemphasis is now obsolete, but you might encounter a very old tape that used it. If a digital signal sounds too bright, check this display. Audicy doesn't have automatic deemphasis, but you can compensate very closely with an equalizer set to -10 dB shelf at 6 kHz.

Input Rate

The Intelligent Digital Module scans the incoming signal and shows the closest standard rate — 32.0 kHz, 44.1 kHz, or 48 kHz — here. If you've chosen an analog signal, it shows: No Input.

SCMS Status

The Serial Copy Management System is added to consumer-format digital signals to protect against home CD copying⁵. Since this makes CDs useless as a production source, we ignore it. A lot of DAT recorders don't, and this display may help you diagnose recording problems.

The first field displays the source status, either Original or Copy. The second field shows the permission level, either Prot (for protected) or OK. If the input isn't a consumer-format signal, both fields show na, for not applicable.

³Particularly 44.1 kHz Consumer, the output of most CD players. This disables the record circuits of some DAT decks, to guard against nasty CD pirates.

⁴Note that this is the *sample rate* sync source. If you have the optional SMPTE hardware and software, there are other screens to control and display how well Audicy is tracking a timecode source.

⁵The record companies insisted.

Audicy's consumer-format output is automatically set to Orig (for original) or OK, for unlimited copying. If you're having trouble dubbing from a CD player to a semi-pro DAT deck, try routing the signal through Audicy.

Tolerance

This shows how close the input signal is to the nearest standard sample rate. It displays ± 400 ppm in green, $\pm 4\%$ in yellow, and No Lock in red. Again, this is a warning about problems with the source, not necessarily an indication that Audicy won't record.

Input Format

This field displays Pro or Cons according to the digital input signal, or na for analog.

Last Error

Digital audio includes built-in error indicators to check for transmission and equipment problems. The indicators check each sample separately, so a problem might exist for only a brief period of time. Many problems are automatically corrected by Audicy and don't affect your recording.

This field captures and displays any error Audicy detects, whether or not it disrupts the audio. Depending on what it shows, you may want to fix your source equipment, change your studio wiring, or do nothing at all. If no errors are detected, the field displays OK.

Error Codes

- No Audio indicates there's a digital signal coming in, but it isn't a digital audio signal. You might see this if you accidentally play computer data.
- CRC indicates a possible failure of the Cyclic Redundancy Check, because of a problem with the source or cables. But it might not: Some sources (including one of the most widely sold professional DAT decks made) don't send a CRC signal, so you might see this warning even though there's nothing wrong with the audio.
- Parity and Biphase indicate problems with the signal stream: Data is there, but it's corrupted. Marginal warns you when signal voltages are dangerously low. No Lock indicates the voltages are too low to read at all, or the signal is completely missing. These four errors are usually caused by noise or interference in the cables.

Digital signals depend on very fast rise times, and have to be handled more like RF than like audio. If you see Parity or Biphase and the audio is corrupted, try replacing the digital interconnect cable with a much

shorter one, as recommended in Chapter 14. If this doesn't fix the problem, check your source equipment.

- Slipped indicates the source and Audicy have somehow gotten out of sync with each other. If you see this message consistently, contact Orban technical support.

PLL Status And Sync Rate

These two fields are valuable when you're locking Audicy's internal clock to other equipment (see "Sync Source," discussed above.)

Sync Rate displays the standard sample rate that's closest to the sync source. If you've chosen an audio or word clock signal for syncing, it'll show 32.0 kHz, 44.1 kHz, or 48.0 kHz. If you've chosen a video sync source, it shows NTSC or PAL. If you're using internal sync, it displays the current production sample rate.

PLL Status indicates the condition of Audicy's three Phase Locked Loops, to check the condition of external sync signals. Okay indicates the signal is fine and Audicy's timing is locked to it. No Input indicates a missing video or word clock signal. No Lock means there's a signal, but its level or frequency is unusable. B unlock, 11 unlock, and 12 unlock indicate problems at different PLL frequencies.

IO Hardware

This checks the condition of the Intelligent Digital Module itself. If you see Failure there's a hardware problem; call Orban technical support.

Defaults

Choose Ignore, Apply my defaults, or Save my defaults. Once you've saved defaults, they'll be automatically applied to all new productions. If you have never saved defaults, Audicy will apply generic settings.

Change Settings?

Choose Yes and stay in screen, or Yes and exit screen, to keep new settings. Choose Undo all changes to restore the screen's previous settings or choose Escape with no changes to close form without making any new changes.

Shortcut

You can set your choices any time by pressing *Shift+Enter*. You can leave the setup screen any time without making further changes, by pressing *Esc*.

Starting and Restarting the I/O Module

When you first turn Audicy on, the Intelligent Digital Module is in an idle mode and not generating any digital signals. When you begin working on a production, it automatically starts up using the settings for that production; if this is a new production then it starts up using your defaults or factory generic settings.

After you Quit a production, the I/O Module continues generating digital silence and word clock signals using the settings from that production. These output settings change only if you manually change them from a production, or if you load an old production which has settings which differ from the last used ones. Normally, most studios will set the sync settings up once for their studio, save these as the default, and rarely, if ever change them.

Since Audicy generates sync signals from the digital module, so long as you start a production at least once after a power up, you can use Audicy as the master sync source for your studio.