

PRO TOOLS | SYNC X Guide

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Guide Part Number 9329-66128-00 REV A 03/21

Safety Instructions
Read and Keep these Instructions

Model Name: SYNC X **Regulatory Model #: 9100-74080**

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

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

The garbage bin with a cross is intended to alert the user that the product may not be disposed of by regular garbage, but as electronic equipment.

Product Safety Warning



Important Safety Instructions

1. Read these instructions.
2. Keep these instructions.
3. Heed all warnings.
4. Follow all instructions.
5. Do not use this equipment near water.
6. Clean only with dry cloth.
7. Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
8. Do not install near any heat sources such as radiators, heat registers, stoves, or other equipment (including amplifiers) that produce heat.
9. Protect power cords from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the equipment.
10. Only use attachments/accessories specified by the manufacturer.
11. For products that are not rack-mountable: Use only with a cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with the equipment. When a cart is used, use caution when moving the cart/equipment combination to avoid injury from tip-over.
12. Unplug this equipment during lightning storms or when unused for long periods of time.
13. Refer all servicing to qualified service personnel. Servicing is required when the equipment has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the equipment, the equipment has been exposed to rain or moisture, does not operate normally, or has been dropped.
14. For products that are a Mains powered device:

The equipment shall not be exposed to dripping or splashing and no objects filled with liquids (such as vases) shall be placed on the equipment.

WARNING! To reduce the risk of fire or electric shock, do not expose this equipment to rain or moisture.

AVERTISSEMENT! Pour réduire le risque d'incendie ou de choc électrique, n'exposez pas cet équipement à la pluie ou à l'humidité.

Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong are provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.

15 For products containing a lithium battery:

CAUTION! Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type.

ATTENTION! Danger d'explosion si la batterie est mal remplacée. Remplacer uniquement par le même type ou le même type.

16 For products with a power switch: It should remain accessible after installation.

17 The equipment shall be used at a maximum ambient temperature of 40° C.

18 This unit is provided with a power supply cord set suitable for 120V AC input only (for U.S.A. and Canada). For other than U.S.A. and Canada, a qualified person must provide for use with this unit, an appropriate, approved power supply cord set which is in compliance with the end use country requirements and has a minimum cross-sectional area of 1.0mm2.

19 For products with more than one power cord:

CAUTION: This unit has more than one power supply cord. Disconnect two power supply cords before servicing to avoid electrical shock.

ATTENTION: Cet appareil comporte plus d'un cordon d'alimentation. Afin de prévenir les chocs électriques, débrancher les deux cordons d'alimentation avant de faire le dépannage.

20 For products with an operator-accessible fuse:

CAUTION: For continued protection against risk of fire, replace only with same type and rating of fuse.

ATTENTION: Pour ne pas compromettre la protection contre les risques d'incendie, remplacer par un fusible de même type et de même caractéristiques nominales.

Rack-Mount Safety Instructions

1 Elevated Operating Ambient—If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment might be greater than room ambient. Therefore, consider installing the equipment in an environment compatible with the maximum ambient temperature (Tma) specified by the manufacturer.

2 Reduced Air Flow—Installation of the equipment in a rack should be such that the amount of air flow required for safe operation of the equipment is not compromised. Make allowances for cooling air to be available to the front panel surface and no restrictions at the rear.

3 Mechanical Loading—Mounting of the equipment in the rack should be such that a hazardous condition is not achieved due to uneven mechanical loading.

4 Circuit Overloading—Consideration should be given to the connection of the equipment to the supply circuit and the effect that overloading of the circuits might have on over-current protection and supply wiring. Appropriate consideration of equipment nameplate ratings should be used when addressing this concern.

5 Reliable Earthing—Reliable Earthing of rack-mounted equipment should be maintained. Particular attention should be given to supply connections other than direct connections to the branch circuit (for example, use of power strips).

LED Safety Notices

Avid hardware might contain LED or Laser devices for communication use. These devices are compliant with the requirements for Class 1 LED and Laser Products and are safe in the intended use. In normal operation the output of these laser devices does not exceed the exposure limit of the eye and cannot cause harm.

Environmental Compliance

Proposition 65 Warning

Warning This product can expose you to chemicals including Pb and Pb compounds, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

Perchlorate Notice

This product may contain a lithium coin battery. The State of California requires the following disclosure statement: “Perchlorate Material—special handling may apply, see www.dtsc.ca.gov/hazardous waste/perchlorate.”

Recycling Notice



Disposal of Waste Equipment by Users in the European Union



This symbol on the product or its packaging indicates that this product must not be disposed of with other waste. Instead, it is your responsibility to dispose of your waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local city recycling office or the dealer from whom you purchased the product.

EMC (Electromagnetic Compliance)

Avid declares that this product complies with the following standards:

- FCC Part 15 Class A (USA EMI)
- ICES-003 Class A (Canada EMI)
- EN 55032 Class A (EU EMI)
- AS/NZS CISPR 32 Class A (Australia/New Zealand EMI)
- CISPR32 Class A (international EMI)
- RRA NO 2017 19, Dec 28,2017 (Korea EMI & EMS)
- RRA NO 2018-99, Oct 12, 2018 (Korea EMI & EMS)
- EN 61000-3-2 (EU EMI)
- EN 61000-3-3 (EU EMI)
- EN 55035 (EU EMS)
- EN 55103-2, Environment E2, E3, E4 (EU EMS)

FCC Notice: Class A Equipment

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at personal expense.

Cables

Connections to Avid hardware must be made with shielded cables with metallic RFI/EMI connector hoods in order to maintain compliance with FCC Rules and Regulations.

Any modifications to the unit, unless expressly approved by Avid, could void the user's authority to operate the equipment.

Canadian ICES-003 Class A Notice

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Australian Compliance



Korean EMC Compliance

이 기기는 업무용 (A 급) 전자파적합기기로서 판매자 또는 사
용자는 이 점을 주의하시기 바라며 , 가정외의 지역에서 사용하
는 것을 목적으로 합니다 .

Safety Compliance

This equipment has been tested to comply with USA, Canadian, EU and International safety certification standards: UL 60065:2015, CAN/CSA C22.2 No. 60065:16, IEC/EN 60065:2014 (8th Edition) (International/EU), UL 62368-1:2014, CAN/CSA 62368-1-14, and IEC/EN 62368-1:2014 (2nd Edition) (International/EU).

Avid Technology Inc., has been authorized to apply the appropriate NRTL mark on its compliant equipment.

This equipment has been tested to comply with EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011 +A2:2013

Power Safety Input Rating

Regulatory Model Number (RMN) 9100-74080: AC~100-240V, 50-60Hz, 0.5A

CE Compliance

(EMC, Safety and RoHS)



Avid is authorized to apply the CE (Conformite Europenne) mark on this compliant equipment thereby declaring conformity to EMC Directive 2014/30/EU, Low Voltage Directive 2014/35/EU and RoHS Recast Directive 2011/65/EC.

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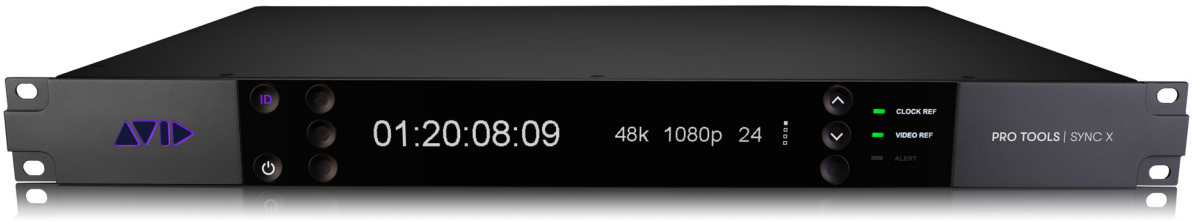
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Chapter 1: Introduction

Pro Tools | Sync X



Pro Tools | Sync X

Pro Tools | Sync X from Avid® is a versatile master synchronization and clock peripheral for use with Pro Tools | Ultimate™ software on Pro Tools | HD™ Native and Pro Tools | HDX™ systems.

Pro Tools | Sync X Features

Pro Tools | Sync X supports sample rates of 44.1, 48, 88.2, 96, 176.4, and 192 kHz.

Pro Tools | Sync X provides the following:

- Clock Reference Sources:
  - Internal
  - Video Reference
  - Word Clock
  - Loop Sync
  - 10 MHz
  - AES3
  - AES3-id
  - LTC (Linear Time Code)
  - Bi-phase/Tach
  - Pilot Tone
- Video Reference Sources:
  - Internal
  - External
- Positional Reference Sources:
  - LTC (Linear Time Code)
  - Serial Time Code
  - Bi-phase/Tach
  - Internal Time Code Generator

- Output and Generation:
  - Video Reference Generator (four outputs)
  - Video Reference Out (two outputs)
  - Loop Sync (base rate of 44.1 kHz or 48 kHz)
  - Word Clock (six outputs)
  - AES3
  - AES3id
  - LTC (Linear Time Code)
  - MTC (MIDI Time Code)
  - 9-Pin MachineControl™
- Other Features:
  - Large front panel OLED displays for timecode, device settings, and reference status
  - Integrated control of Sync X from Pro Tools
  - 9-pin Sony P-2 protocol port, for Deck Control with MachineControl-enabled systems
  - GPIO for play, stop, record, and fader start commands

System Requirements and Compatibility Information

Avid can only assure compatibility and provide support for hardware and software it has tested and approved.

For complete system requirements and a list of qualified computers, operating systems, storage solutions, peripherals, and third-party devices, visit www.avid.com/compatibility.

For Pro Tools | Sync X–specific system requirements, FAQ, and video, visit avid.com/syncx-support.

Pro Tools | Sync X with Pro Tools | Ultimate

To use Pro Tools | Sync X with Pro Tools | Ultimate, the following is required:

- An Avid-qualified Pro Tools | HDX or HD Native system
- An 8-pin to 8-pin serial cable (included) to connect the Sync X Host serial port to the primary HDX card or HD Native device serial port

Conventions Used in Pro Tools Documentation

Pro Tools documentation uses the following conventions to indicate menu choices, keyboard commands, and mouse commands:

Convention	Action
File > Save	Choose Save from the File menu
Control+N	Hold down the Control key and press the N key
Control-click	Hold down the Control key and click the mouse button
Right-click	Click with the right mouse button

The names of Commands, Options, and Settings that appear on-screen are in a different font.

The names of physical switches on Pro Tools | Carbon are in displayed **in bold text**.

The following symbols are used to highlight important information:

 *User Tips are helpful hints for getting the most from your Pro Tools system.*

 *Important Notices include information that could affect your Pro Tools session data or the performance of your Pro Tools system.*

 *Shortcuts show you useful keyboard or mouse shortcuts.*

 *Cross References point to related sections in this guide and other Avid documentation.*

Resources

The Avid website (www.avid.com) is your best online source for information to help you get the most out of your Avid system.

Account Activation and Product Registration

Activate your product to access downloads in your Avid account (or quickly create an account if you do not have one). Register your purchase online, download software, updates, documentation, and other resources.

www.avid.com/account

Support and Downloads

Contact Avid Customer Success (technical support), download software updates and the latest online manuals, browse the Compatibility documents for system requirements, search the online Knowledge Base or join the worldwide Avid user community on the User Conference.

www.avid.com/support

Training and Education

Study on your own using courses available online, find out how you can learn in a classroom setting at an Avid-certified training center, or view video tutorials and webinars.

www.avid.com/education

Video Tutorials

The *Get Started Fast with Pro Tools* series of online videos provide tutorials to help if you are new to Pro Tools. They also provide videos for the experienced user that introduce new features found in the latest versions of Pro Tools.

www.avidblogs.com/get-started-fast-with-pro-tools/

Products and Developers

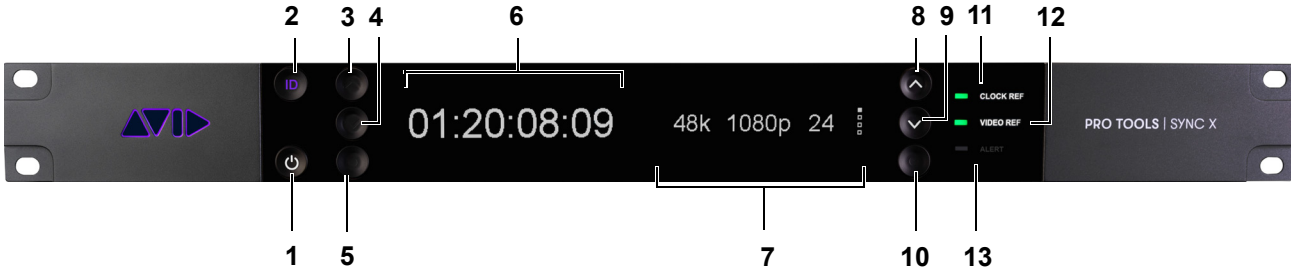
Learn about Avid products, download demo software, or learn about our Development Partners and their plug-ins, applications, and hardware.

www.avid.com/products

Chapter 2: Pro Tools | Sync X Front Panel

Pro Tools | Sync X is controlled by Pro Tools | Ultimate software on your computer. The front panel of the unit provides displays, indicators, and controls.

Pro Tools | Sync X Front Panel Features



Pro Tools | Sync X front panel

1 Power button: Press the Power button to power on the unit. Press and hold the Power button for two seconds to power off the unit.

2 **ID** button: Press the **ID** button to flash the **ID** button and ID LED on back panel. This lets you easily identify the unit from the back when it is installed in a rack. This button can also be used to reset the unit to its original firmware and factory settings (see Factory Reset).

3 No functionality at this time.

4 No functionality at this time.

5 No functionality at this time.

6 Timecode display: The current positional reference (internal or external), is displayed in hours:minutes:seconds:frames. Non-Drop Frame Timecode is indicated by a colon between seconds and frames. Drop Frame Timecode is indicated by a semi-colon between seconds and frames. The Timecode Display only shows running timecode when generating timecode (GEN LTC engaged) or when chasing running timecode from an external source.

7 Settings display: Provides four separate page views that show the current settings of Sync X, see Settings Display.

8 Settings Down button: When illuminated, press to display the next page in the Settings display. When not illuminated, the last page (4) is shown in the Settings display.

9 Settings Up button: When illuminated, press to display the previous page in the Settings display. When not illuminated, the first page (1) is shown in the Settings display.

10 Settings Select button: Can be used to reset Sync X to the default hardware settings, see Hardware Settings Reset.

11 CLOCK REF LED: Indicates the status of the Clock Reference source. Mirrors the Clock Ref Status indicator in the Pro Tools Session Setup window, and also in Synchronization view in the Transport window and the Edit Window toolbar.

Clock Ref LED indications

Sync X Clock Ref LED	Session Setup/Front Panel	Clock Reference
Solid Green	Locked/Generating	0.0%–0.025% faster/slower than the expected rate*
Flashing Fast Yellow	Locked	>0.025%–4% faster than the expected rate*
Flashing Slow Yellow	Locked	>0.025%–4% slower than the expected rate*
Flashing Fast Orange	Locked	>4%-8% faster than the expected rate*
Flashing Slow Orange	Locked	>4%-8% slower than the expected rate*
Flashing Fast Red	Locked	>8% faster than the expected rate*
Flashing Slow Red	Locked	>8% slower than the expected rate*
Unlit	Not Locked	not locked or signal missing

** expected rate = session sample rate +/– any pull up/down factor*

12 VIDEO REF LED: Indicates the status of the Video Reference source. Mirrors the Video Ref Status indicator in the Pro Tools Session Setup window, and also in Synchronization view in the Transport window and the Edit Window toolbar.

Video Ref LED indications

Sync X Video Ref LED	Session Setup/Front Panel	Video Reference
Solid Green	Locked/Generating	Video Reference signal is present and matches
Flashing Fast Red	Not Locked	Video Reference signal is present, but does not match
Unlit	Not Present	Video Reference signal is missing

13 No functionality at this time.

Settings Display

The Settings Display provides four separate page views that show the current settings of Sync X. These pages are navigated by the Settings Up and Down buttons to the right of the display. When either button is lit, it indicates that it can be pressed to move to the next or previous page respectively. On the right of the display are four boxes, one for each page (1–4 from top to bottom).

Settings Display Page 1

Session Sample Rate Displays the Session Sample Rate.

Video Reference Format Displays the selected Video Reference Format.

Up Arrow Shown above the Sample Rate display when there is an active Pull Up.

Down Arrow Shown below the Sample Rate display when there is an active Pull Down.

VSO “Shown below the Sample Rate display when VSO is enabled.

Settings Display Page 2

Session Sample Rate Displays the Session Sample Rate.

Clock Reference Source Displays the current Clock Reference Source.

Output Sample Rate Displays the precise sample rate distributed to all clock outputs. This mirrors the Output Sample Rate display in the Session Setup window.

VSO If VSO is enabled, displays the VSO setting in semitones and cents (0.00).

Settings Display Page 3

Video Reference Source Displays the current Video Reference Source.

Format Displays the current Video Reference Format.

Detected Input Format Displays the Detected Input Format of the incoming video reference signal (if any).

Settings Display Page 4

Positional Reference Displays the Positional Reference Format.

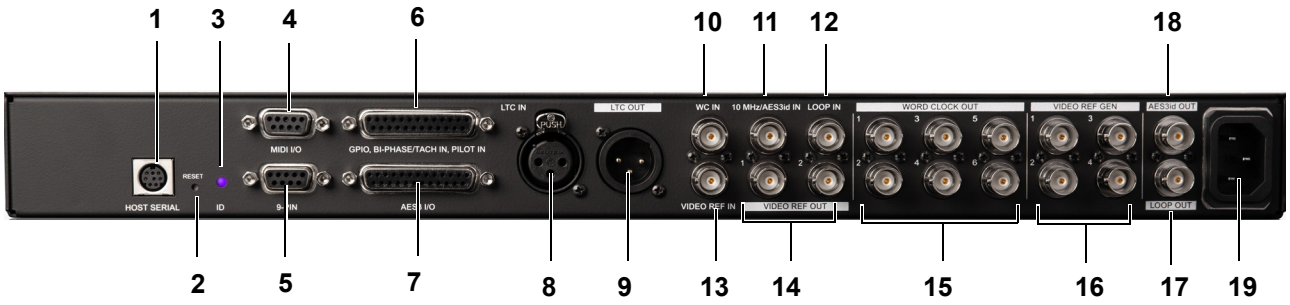
Audio Rate Pull Displays the Audio Rate Pull Up/Down setting (if any).

Firmware Displays the version of the Firmware on the unit.

Factory Reset Indicates how to Reset the unit to its factory firmware and default settings: Hold ID on power up (see Factory Reset).

Chapter 3: Pro Tools | Sync X Back Panel

Pro Tools | Sync X Back Panel Connectors



Pro Tools | Sync X back panel

1 **HOST SERIAL**: The Host Serial port is a bidirectional (in/out) port to connect Sync X to the Serial Port on HD Native or on the primary HDX card in your system.

2 **RESET** button (see Factory Reset).

3 **ID** LED: Flashes when the ID button is engaged on the front panel. This lets you easily identify the unit when it is installed in a rack.

4 **MIDI I/O**: The MIDI I/O port is a 9-pin connection for the included MIDI I/O breakout cable. Sync X outputs MTC (MIDI Time Code), only. No other MIDI data appears at this output. MTC output is regenerated while Sync X is locked to any supported positional reference and clock reference, or internally generated in Generate mode, in which case MTC output follows generator run/stop. This port is intended to supply MTC from Sync X to external sequencers or other MIDI devices. Sync X does not respond to incoming MTC at this time.

5 **9-PIN**: For Machine Control-enabled systems, this port connects directly to external 9-pin transports. Use a Colin Broad 422 USB serial adapter to connect to a USB port computer.

For more information, see the Machine Control chapter of the Pro Tools Reference Guide.

6 **GPIO, BI-PHASE/TACH IN, PILOT IN**: This DB-25 port is an accessory port for Bi-Phase, Tach, and Pilot signals (specific cables are required for different applications). This connector is also used for GPI input, output (including Fader Start), and thru signals.

For wiring information and other specifications for this port, see Wiring Diagrams and Pin Assignments.

7 **AES3 I/O**: This DB-25 port provides AES3 clock reference input and outputs. The AES3 audio signal is silent (all bits OFF) and its sample rate exactly matches the Sync X sample clock.

8 **LTC IN**: This XLR port receives a LTC (Linear Time Code) source, balanced or unbalanced analog, for positional and/or clock reference. This port is often used to receive LTC from an audio track on an external deck or the address track of a VTR.

9 **LTC OUT**: This XLR port outputs LTC (Linear Time Code), in balanced or unbalanced analog audio format. LTC output level is adjustable using the Synchronization page of the Peripherals dialog in Pro Tools.

For wiring details, see Wiring Diagrams and Pin Assignments.

10 **WC IN**: This BNC port receives Word Clock, for clock reference purposes only. Word Clock is often used with external master clocks, digital consoles, and audio interfaces (such as Pro Tools | MTRX™).

11 **10 MHz/AES3id IN**: This BNC port receives either 10 MHz or AES3id signal depending on which is selected as the Clock Reference Source in the Session Setup window.

12 **LOOP IN**: This BNC port receives Loop Sync from any HD audio interface or MTRX Studio.

13 **VIDEO REF IN**: This BNC port receives tri-level or black burst video reference signal, which can be used for frame edge alignment and/or clock reference. This connector is internally terminated at 75 ohms.

14 **VIDEO REF OUT 1** and **2**: These BNC ports output a buffered copy of the signal at the **VIDEO REF IN** port.

15 **WORD CLOCK OUT 1–6**: These BNC ports output Word Clock.

16 **VIDEO REF GEN 1–4**: These BNC ports output Video Reference signal generated by Sync X. This signal is muted when Video Ref Source is set to External in the Session Setup window (see Video Ref (Frame Edge Lock)). Note that the **VIDEO REF GEN** ports are not aligned with (genlocked to) the **VIDEO REF IN** port.

17 **LOOP OUT**: This BNC port outputs Loop Sync. This port connects to the Loop In port of the primary Pro Tools audio interface.

18 **AES3id OUT**: This BNC port outputs AES3id clock signal.

19 IEC Power connector.

Chapter 4: Installing Pro Tools | Sync X

Installing and setting up Pro Tools | Sync X involves the following:

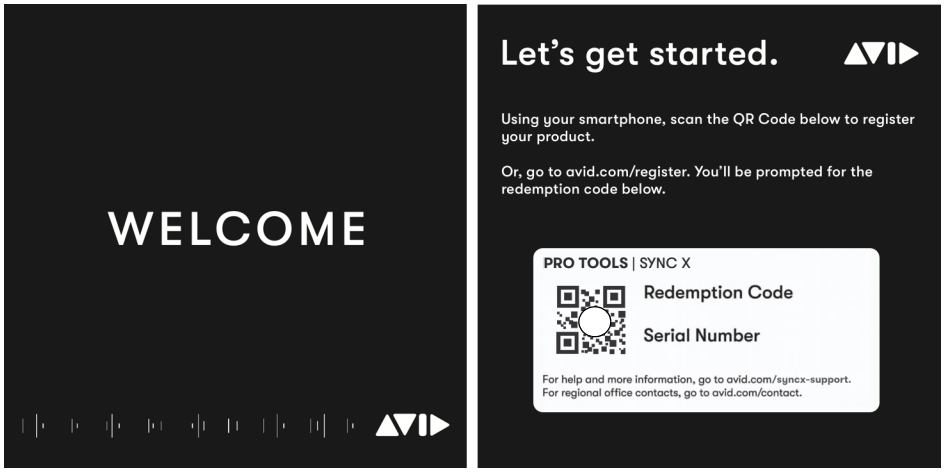
1. Unpacking Pro Tools | Sync X from the box.
2. Registering Pro Tools | Sync X.
3. Rack mounting Pro Tools | Sync X (optional).
4. Connecting cables.
5. Launching Pro Tools and enabling Pro Tools | Sync X.

Unpacking Pro Tools | Sync X

Before you get started installing Pro Tools | Sync X, unpack the box, which contains the following:

- Pro Tools | Sync X
- Power cable
- Serial cable
- BNC cable (x2)
- MIDI I/O Breakout cable
- Rack mount and desktop accessory kit
- Registration card with redemption code, QR code, and serial number
- Warranty Claims Information card
- Avid Health and Safety Guide
- Safety and Regulatory Information Sheet

Keep the Registration card on hand to register Pro Tools | Sync X and access documentation downloads. Set the cables aside until you are ready to start making cable connections. Remove Pro Tools | Sync X from the box and packaging, and place it on a hard, dry surface.



Registration card: front and back

Register Pro Tools | Sync X

Pro Tools | Sync X includes a Registration card with a redemption code and a QR code that lets you register the unit. Registering your Sync X lets you put it under Hardware Contract, access support, and access PDF documentation through your online Avid Master Account.

To register your Pro Tools | Sync X unit and access related downloads through your Avid Master Account:

1. Locate the Registration card.
2. Do one of the following:
   - With your mobile device, scan the QR code on the Registration card. Follow the on-screen instructions and then continue with the next step.
   - Visit https://www.avid.com/register and continue with the next step.
3. Log in to your Avid Master Account. If you do not already have an Avid Master Account, create a new one and log in.
4. Enter the redemption code on the Registration card and click Register. If you scanned the QR code, your redemption code is entered automatically.
5. Follow the on-screen instructions.

You are directed to the My Products page for your Avid Master Account.

Download and Review PDF Documentation

Download and review PDF documentation for Pro Tools | Sync X and Pro Tools software from your Avid Master Account. Be sure to consult any Read Me documentation for the latest known issues.

Rack Mounting Pro Tools | Sync X

If you install Pro Tools | Sync X into a 19-inch rack, use the included rack mount screws and washers. Pro Tools | Sync X, as with all Avid peripherals, needs room at the front and back of the unit to maintain proper air flow for cooling. Do not block the front or back of the unit. If the unit is rack mounted in a case, remove the case lids or doors before operating the system. Failure to do so can result in the unit overheating, which can permanently damage sensitive components.

If you decide to not install Pro Tools | Sync X in a rack, you can affix the included adhesive rubber pads to the bottom of the unit to protect whatever surface you decide to set it on (for example, if you decide to use it as a desktop unit).

Connecting Cables

Once you have installed Pro Tools | Sync X in a rack (optional), you are ready to start connecting cables.

In order to meet EMC requirements and in order to obtain the highest performance of Pro Tools | Sync X, use high-quality, properly shielded cables for all external connections.

To familiarize yourself with Pro Tools | Sync X front panel displays and controls, see Pro Tools | Sync X Front Panel. For information about back panel connections, see Pro Tools | Sync X Back Panel.

The following are the primary hardware connections on Pro Tools | Sync X:

- AC Power (power cable included)
- Sync X Host Serial port to the serial port on the Pro Tools system's HD Native device or primary HDX card (serial cable included)
- Clock to Pro Tools audio interfaces using Loop Sync and/or Word Clock (2 BNC cables included)
- 9-pin to an external machine for MachineControl (cable not included)
- Synchronization, including positional and clock references to and from remote machines using various connection formats (cables not included)

AC Power

The Pro Tools | Sync X AC connector accepts a standard AC Power Cable (included). Sync X is auto power-selecting (100V to 240V) and will automatically work with a standard modular cable to connect to AC power receptacles in any country.

Host Serial Connection

Serial Cable Connection to the HD Native Device or Primary HDX Card

Both Pro Tools | HD Native (PCIe card or Thunderbolt) and Pro Tools | HDX support Pro Tools | Sync X. Pro Tools systems require a serial cable connection between Pro Tools | Sync X and the HD Native device or the primary HDX card in your system.

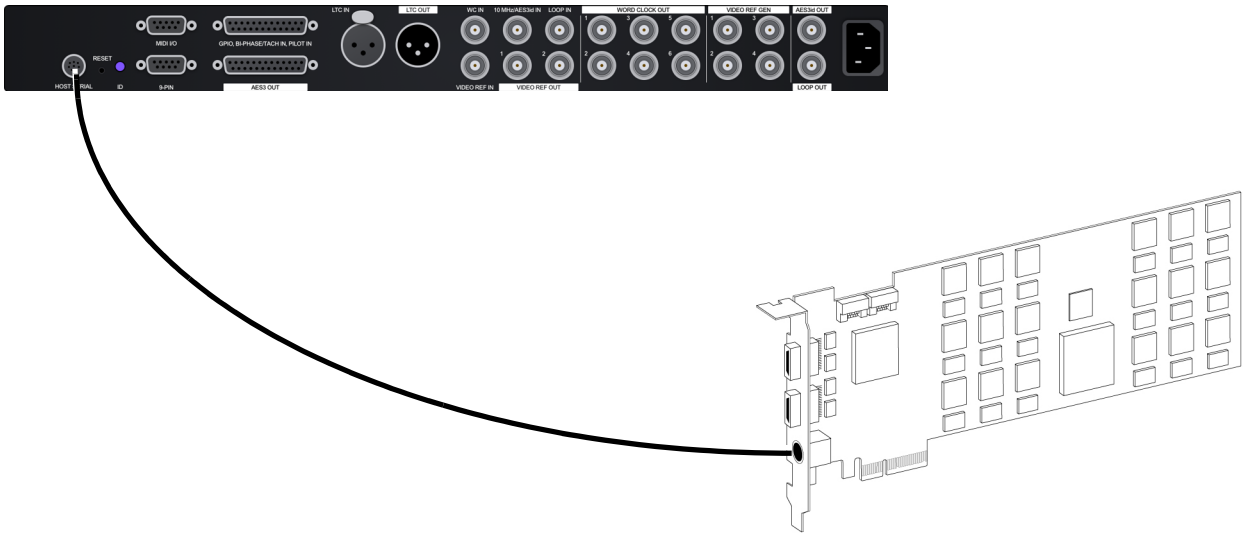
⚠ *Do not substitute a standard off-the-shelf miniDIN8 cable. It will not work. Use the included serial cable, or build a custom cable wired according to the pin-out information provided in Appendix C, "Wiring Diagrams and Pin Assignments."*

To make the serial connection between Sync X and HD Native or HDX:

1 Make sure all equipment is powered off.

2 Connect one end of the included serial cable to the Pro Tools | Sync X **HOST SERIAL** port.

3 Connect the other end to the serial port on HD Native or the primary HDX card.



Making serial connections (HDX card shown)

Clock for Pro Tools Audio Interfaces

Pro Tools | Sync X must be connected to all Pro Tools audio interfaces in the Loop Sync chain using shielded BNC cables.

Connecting Loop Sync for Pro Tools Audio Interfaces

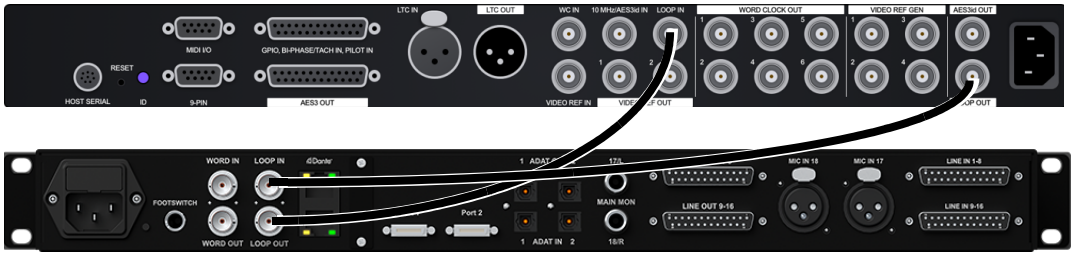
Pro Tools | Sync X supports Loop Sync and can serve as the Loop Sync Master. Loop Sync is a dedicated clock loop for synchronizing multiple Pro Tools audio interfaces. Loop Sync is used to connect multiple Pro Tools audio interfaces (such as HD I/O, HD OMNI, HD MADI, or Pro Tools | MTRX Studio™).

💡 *If Pro Tools | MTRX is also included in your system, make Loop Sync connections between Sync X and all Pro Tools audio interfaces in your system except MTRX, and make Word Clock connections between Sync X and MTRX (see Connecting Word Clock for Pro Tools | MTRX).*

To connect Loop Sync between Pro Tools | Sync X and Pro Tools audio interfaces:

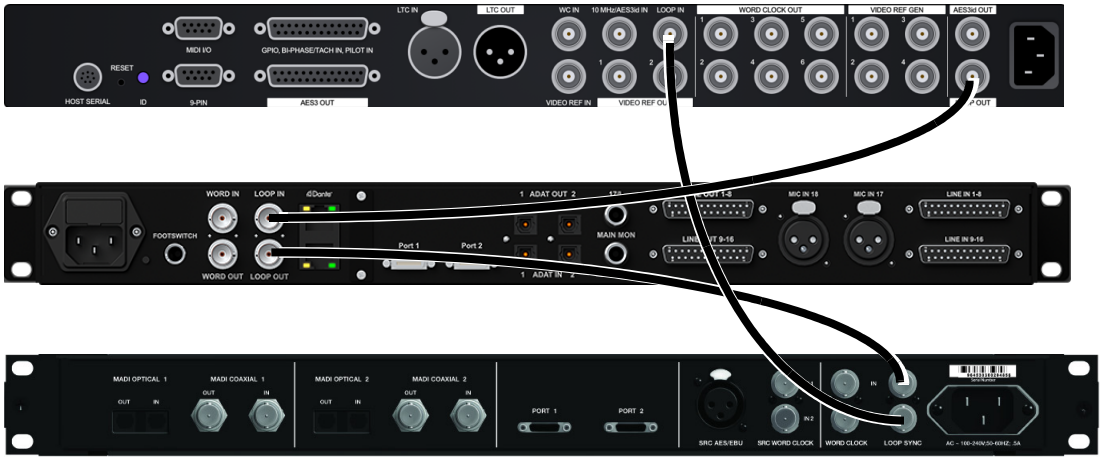
1 Using a shielded BNC cable, connect the **LOOP OUT** port of Sync X to the Loop Sync In of your Pro Tools audio interface.

2 Connect the **LOOP IN** port of Sync X to the Loop Sync Out of your Pro Tools audio interface.



Making Loop Sync connections, Sync X and MTRX Studio shown

3 When using more than one Pro Tools audio interface, make Sync X the first and last unit in the Loop Sync chain.



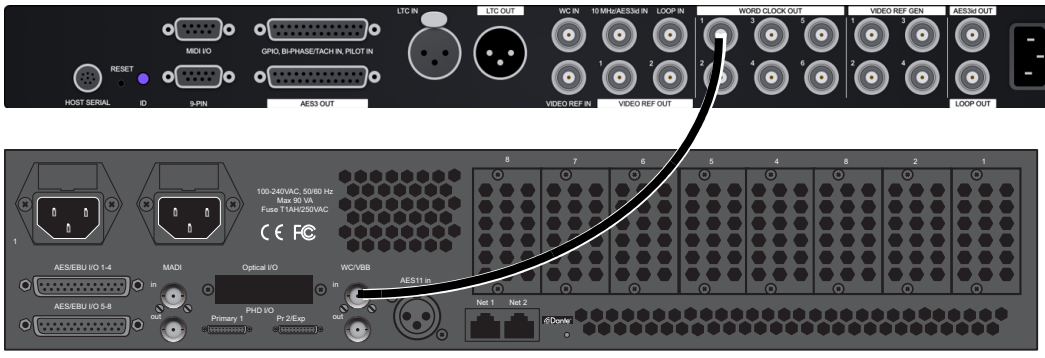
Making Loop Sync connections, Sync X, MTRX Studio, and HD MADI are shown

Connecting Word Clock for Pro Tools | MTRX

Since Pro Tools | MTRX does not support Loop Sync, use Word Clock for clock reference between Sync X and MTRX.

To connect Word Clock between Pro Tools | Sync X and Pro Tools | MTRX:.

1 Using a shielded BNC cable, connect any **WORD CLOCK OUT** port of Sync X (there are 6 separate Word Clock Out connections) to the Word Clock In of your Pro Tools | MTRX.



Making Word Clock connections, Sync X and Pro Tools | MTRX

2 In DADman software, set Word Clock as the Sync source for Pro Tools | MTRX.

When using Sync X with Pro Tools | MTRX and other Pro Tools audio interfaces (such as HD I/O), synchronize MTRX to Sync X using Word Clock and use Loop Sync for all other Pro Tools audio interfaces.

For more information on Pro Tools | MTRX, refer to the MTRX Operation Guide.pdf.

MachineControl Connections

Pro Tools | Sync X supports limited Serial Deck Control with Pro Tools | HDX or HD Native and MachineControl.

For more information on MachineControl connections and operation, refer to the MachineControl chapter of the Pro Tools Reference Guide.

Serial Deck Control Mode

For Serial Deck Control

(Non-Linear Decks Only)

Pro Tools | Sync X provides a single **9-PIN** port to control a remote deck using MachineControl.

Due to performance limitations, this configuration should be used primarily with non-linear decks.

To make connections for limited serial deck control:

- Connect a standard 9-pin cable (sold separately) from the **9-PIN** port on Sync X to the 9-pin input of the external deck.

Synchronization and Timecode Connections to Machines, Decks, and Other Devices

The following sections describe connections required for different applications.

For more information on timecode applications, see Additional Synchronization Information.

Connecting a Video Reference Source

To resolve Pro Tools | Sync X to external video reference:

- Connect the external video reference (such as Tri-Level or Black Burst) signal to the **VIDEO REF IN** port on Sync X.

Connecting LTC

Pro Tools | Sync X provides LTC input and output ports.

To input LTC to Sync X:

- Using an XLR cable, connect the LTC signal from your machine, synchronizer, or other source to the **LTC IN** port on Sync X.

To output LTC from Sync X:

- Using an XLR cable, connect the **LTC OUT** port on Sync X to your external device.

Connecting Word Clock Devices

Pro Tools | Sync X has Word Clock input and six Work Clock outputs, which can be used simultaneously. Use the **WC IN** port when you want Sync X to synchronize to Word Clock from an external master clock, such as Pro Tools | MTRX or other digital device. Use the **WORD CLOCK OUT 1–6** ports on Sync X when you want external devices (such as Pro Tools | MTRX) to synchronize to Word Clock from Sync X.

Pro Tools audio interfaces each have their own Word Clock inputs, which provide additional clock options and flexibility. Refer to the documentation of each specific audio interface for details on its Word Clock features.

Word Clock contains no positional information. If you want devices to play or record in sync, you still need to provide them with a positional reference. Sync X can generate timecode to provide positional reference to other devices (see Generating and Regenerating Timecode). If frame edge sync is required, you must use Video Reference (Internal or External) (see Video Reference).

To input Word Clock to Pro Tools | Sync X:

- Using a shielded BNC cable, connect Word Clock from the master device (such as Pro Tools | MTRX) to the **WC IN** port on Sync X.

To output Word Clock from Pro Tools | Sync X:

- Using shielded BNC cables, connect any of the six **WORD CLOCK OUT** ports on Sync X to the Word Clock input of digital devices (such as Pro Tools | MTRX) that you want to clock to Sync X.

Connecting AES Devices

To input AES clock reference to Pro Tools | Sync X:

- Connect the device's AES output to the **AES3 I/O** (XLR to DB-25) or **AES3-id IN** (BNC) port on Sync X (cable sold separately).

To output AES clock reference from Pro Tools | Sync X:

- Connect the **AES3 I/O** (DB-25 to XLR) or **AES3-id OUT** (BNC) port on Sync X to the AES reference input on the digital device (cable sold separately).

Connecting MTC Devices

Pro Tools | Sync X provides a 9-pin to two 5-pin DIN break out cable for making MTC (MIDI Time Code) connections. The MIDI Out port supplies MTC—derived from conversion from LTC or Bi-Phase—to synchronize MTC-compatible consoles, sequencers, lighting systems, and other devices. MTC output from Sync X is independent of Pro Tools MTC generation. Sync X always outputs MTC in parallel with its LTC output.

⚠ *The MIDI In port is not used since Sync X does not respond to incoming MTC at this time.*

MIDI Time Code from the MTC Out port always matches the timecode address displayed on the front panel of Sync X. To supply MTC from Sync X to another MTC-compatible device, connect the device as described below.

To connect an MTC-compatible device to receive MTC from Pro Tools | Sync X:

1. Connect the included MIDI I/O break out cable to the **MIDI I/O** port on Sync X.
2. Using a standard MIDI cable, connect the MIDI Out port on the Sync X break out cable to the appropriate MIDI input on the device.

Pro Tools and MTC

Pro Tools | Sync X does not respond to incoming MTC at this time. A separate MIDI interface is required for Pro Tools to receive MTC.

MTC is output constantly whenever Sync X is generating timecode. This output can be muted when timecode (LTC) is idle.

For more information, see Generating MTC.

Launch Pro Tools

After connecting Pro Tools | Sync X to your HDX or HD Native system, launch Pro Tools. You are notified if a firmware update is required for Sync X.

To launch Pro Tools and update Pro Tools | Sync X firmware:

1 After installing Pro Tools | Sync X, launch Pro Tools | Ultimate software:
   - On Mac, Double-click the Pro Tools icon in the Applications folder or single-click the icon in the Dock.
   - On Windows, click the Pro Tools shortcut on the Desktop or in the Windows menu.



Pro Tools application icon

2 If a a firmware update is required, you are prompted to update Sync X firmware using Avid DigiTest (for detailed information, see Updating Pro Tools | Sync X Firmware).

3 Quit Pro Tools and restart your computer.

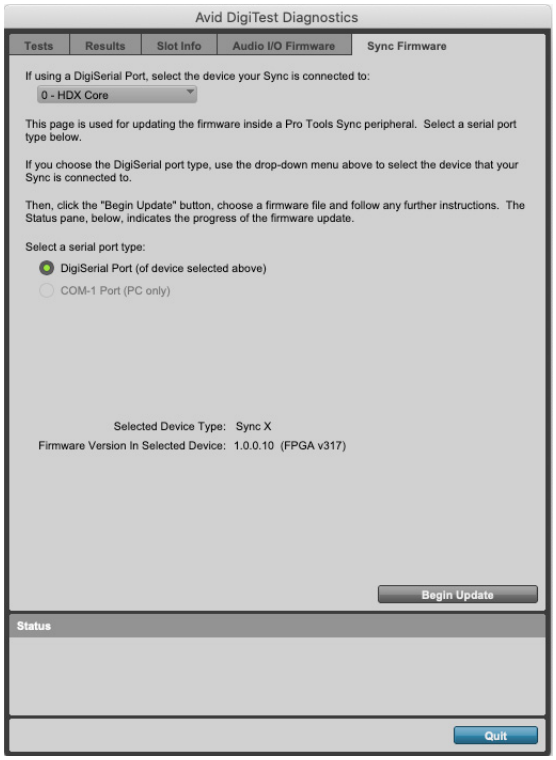
4 After you computer restarts, launch Avid DigiTest and update Sync X firmware.

5 When the firmware update is complete, quit Avid DigiTest and restart your computer.

6 After your computer restarts, launch Pro Tools and configure Sync X (see Configuring Pro Tools | Sync X).

Updating Pro Tools | Sync X Firmware

Update Pro Tools | Sync X firmware using the DigiTest application.



Updating Sync X firmware with DigiTest

To update Pro Tools | Sync X firmware:

1 Confirm that Pro Tools | Sync X is properly connected to the serial port on your primary HDX card or HD Native device.

2 Power on your computer (or restart it if it is already running).

3 Ensure that Pro Tools is not running.

4 Launch the DigiTest application from Macintosh HD/Applications/Avid/Pro Tools/Pro Tools Utilities/DigiTest (Mac) or C:\Program Files\Avid\Pro Tools\Pro Tools Utilities\DigiTest (Windows).

5 Click the Sync Firmware tab.

6 Click Begin Update.

⚠ *If Sync X is not detected with the selected HDX card, try selecting a different card in the list. Once Sync X is detected, click Begin Update again.*

7 Follow the on-screen instructions and wait for the firmware update to complete. Do not power off Sync X while the update is in progress.

8 When the update is complete, click Quit.

9 Restart your computer.

Enable Pro Tools | Sync X in Pro Tools

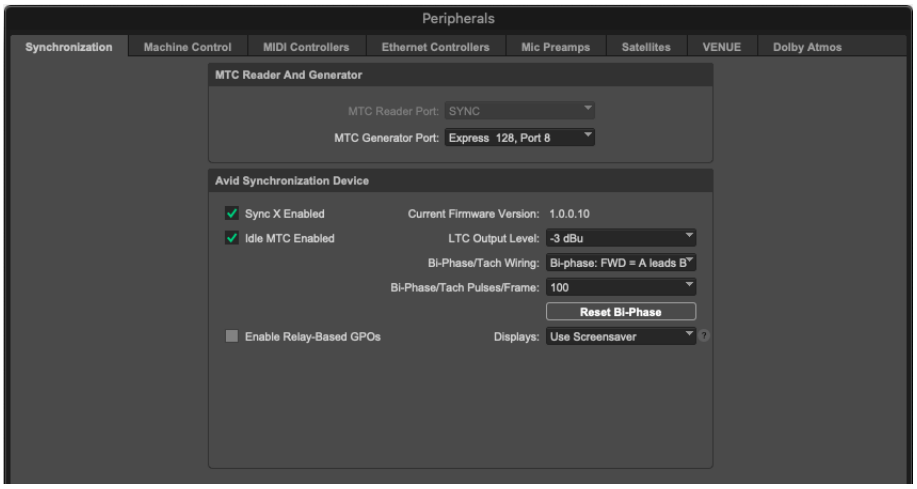
Pro Tools | Sync X is configured using Pro Tools | Ultimate software (sold separately). Pro Tools | Ultimate automatically recognizes if a Pro Tools | Sync X is connected to the serial port of the primary HDX card or the HD Native device in the system.

To check communication between Pro Tools | Sync X and Pro Tools | Ultimate:

1 After installing Pro Tools and Sync X, launch Pro Tools.

2 Choose Setup > Peripherals, and click the Synchronization tab.

3 Under Avid Synchronization Device, Sync X should be automatically enabled. If not, check Enable Sync Device.



Sync X settings in the Peripherals dialog

4 Configure the other settings as desired (see Pro Tools | Sync X Setup in the Peripherals Dialog).

5 Click OK.

If you need to update Sync X firmware, use the DigiTest application, which is installed with Pro Tools. For more information, see Updating Pro Tools | Sync X Firmware.

Chapter 5: Configuring Pro Tools | Sync X

Pro Tools | Sync X is configured and controlled using Pro Tools | Ultimate software.

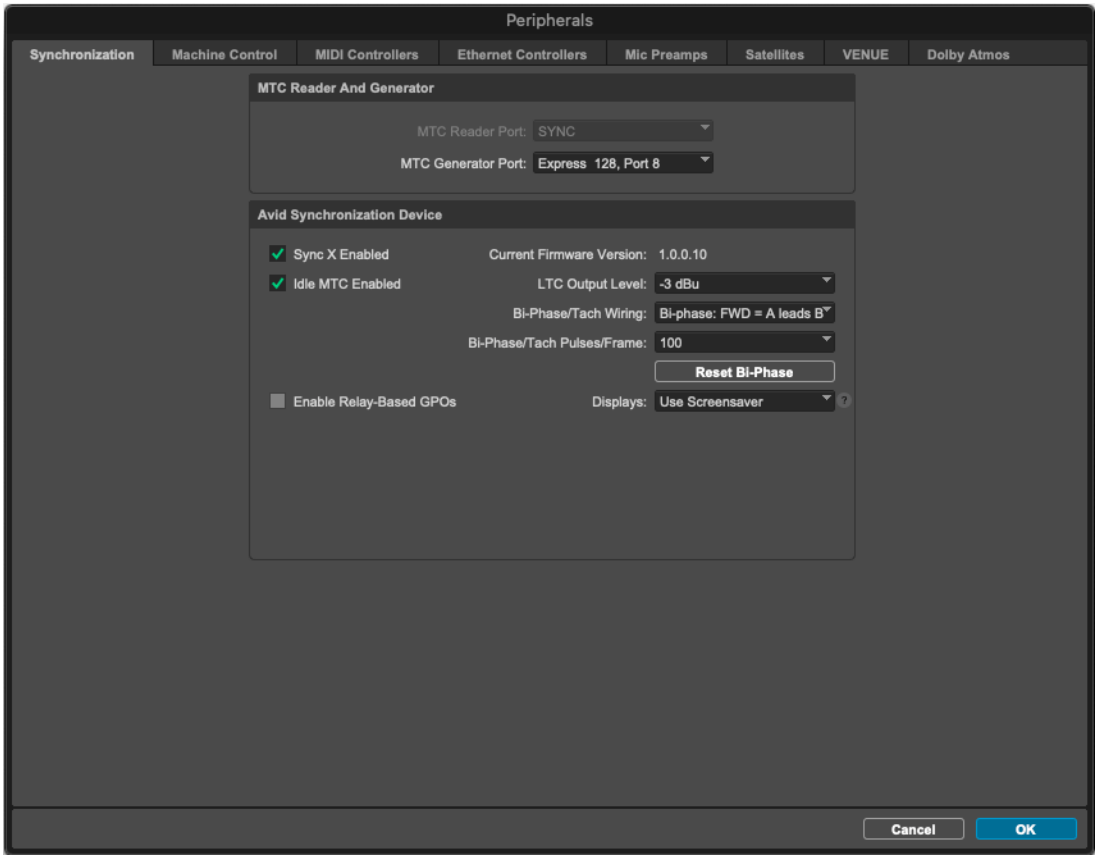
Pro Tools | Sync X Setup in the Peripherals Dialog

Enable and configure Pro Tools | Sync X in the Pro Tools Peripherals dialog (Setup > Peripherals).

Synchronization Peripherals Setup

Avid Synchronization Device

The Avid Synchronization Device settings let you configure Sync X.



Synchronization settings in the Pro Tools Peripherals dialog

Sync X Enabled

When Pro Tools | Sync X has a serial connection to the primary HDX card or HD Native device in the system and this option is enabled, the dialog provides setup options for Sync X. If you deselect this option, it updates to read Enable Sync Device and all Sync X options are hidden.

Idle MTC Enabled

When this option is disabled, MTC output is muted when playback is idle. When this option is enabled, MTC is continuously output from Sync X whether or not the transport is running.

Enable Relay-Based GPOs

When this option is enabled, GPO Output triggers 0–3 are enabled for the GPIO DB-25 port on the back panel. When disabled, there is no audible click noise from the device during playback, record, or fader start. For more information, see Wiring Diagrams and Pin Assignments.

Current Firmware Version

This displays the firmware version for the connected synchronization peripheral.

LTC Output Level

This setting lets you specify the analog audio level of the LTC output, from –24 dBu to +9 dBu in 3 dB increments.

The available output level settings for the LTC timecode generator are based upon the following measurement conditions:

- Terminating load: 600 ohms
- Voltage levels measured in dBu, RMS
- LTC generator running at 29.97 FPS (frames per second)

Bi-Phase/Tach Wiring

This setting lets you select from the following options for Bi-Phase or Tach wiring:

- Bi-Phase: FWD = A leads B
- Bi-Phase: FWD = B leads A
- Tach:FWD = B is Low
- Tach: FWD = B is High

Bi-Phase/Tach Pulses/Frame

There are several different standards for the number of pulses-per-frame output by Bi-Phase or Tach devices. Sync X can be set to operate from 2 to 250 pulses per frame. The setting should match the PPF rate of the external device's Bi-Phase/Tach encoder.

Reset Bi-Phase

This button lets you set the Bi-Phase/Tach start frame from Pro Tools. Click the button to update the Timecode Display on the synchronization peripheral to match the session timecode value.

Displays

This setting lets you specify the behavior of the front panel displays when the unit is powered on and idle for a certain amount of time.

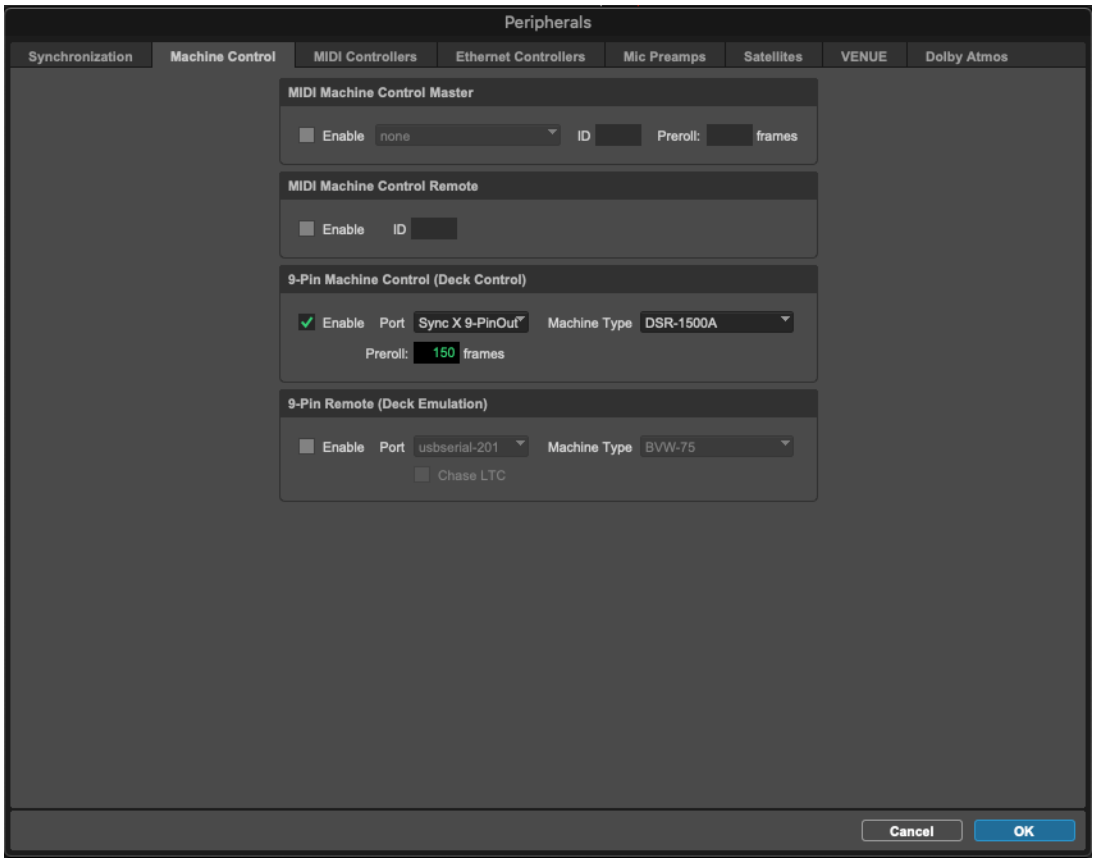
Use Screensaver After 15 minutes of inactivity the displays are dimmed. After 30 minutes the screen saver appears. After 60 minutes the displays are turned off. Pressing any front panel switch returns displays to normal on state.

Always On (Not Recommended) Displays are always on while Pro Tools is running and Sync X is enabled. Not recommended for long periods of time as this reduces display lifespan.

Off Displays are turned off, but can be turned on temporarily by pressing any front panel switch. Recommended when displays are only viewed occasionally.

Machine Control Setup

If you are using Pro Tools | MachineControl with Pro Tools | Sync X, do the following to establish basic communication.



Machine Control settings in the Pro Tools Peripherals dialog

To configure Machine Control:

1. Choose Setup > Peripherals, and click the Synchronization tab.
2. On the Synchronization page, ensure that Sync X is the current Synchronization device.
3. Click the Machine Control tab to open the Machine Control page.
4. Enable and configure options for 9-pin Serial. The 9-Pin port on Sync X is available for Deck Control only.

Pro Tools | Sync X in the Session Setup Window

With Sync X enabled in the Synchronization page of the Peripherals dialog (Setup > Peripherals), you can use the Session Setup window (Setup > Session) to configure and control Sync X. Sync X settings configured in the Session Setup window are stored in the Sync X unit.

For complete information on the Session Setup window, see the Pro Tools Reference Guide.

To select Sync X as the system Clock Master:

1. Ensure that Sync X Enabled is selected in the Synchronization page of the Peripherals dialog (Setup > Peripherals).
2. Open or create a session.
3. Open the Session Setup window (Setup > Session).
4. Select Sync X as the Clock Master.



Session Setup window

Sync X Setup & External Offsets Section

With Sync X selected as the Clock Master, the Sync X Setup & External Offsets section lets you configure the Clock Reference, Video Reference, and Positional Reference settings for Sync X.

Clock Ref (Sample Rate Lock)

Select the Clock Reference Source for Sample Rate Lock, both for Pro Tools and any connected external devices. Depending on the selected source, Sync X will either generate clock signal (such as if Internal is selected), or it will lock to the incoming clock signal from the selected external device (such as if Word Clock is selected).

Source

Select the appropriate Clock Reference Source for Sample Rate Lock from the following options:

Internal Uses the Sync X internal clock and generates clock signal at the session sample rate (or the session sample rate as modified by any specified Pull Up or Pull Down setting).

Video Reference Locks to the incoming Video Reference Input signal.

LTC Locks to the incoming LTC signal.

Bi-Phase Locks to the incoming Bi-Phase signal.

Pilot Tone Locks to the incoming Pilot signal (NTSC 60 Hz or PAL 50 Hz).

AES3 Locks to the incoming AES3 signal (DB-25).

AES3id Locks to the incoming AES3id signal (BNC).

10 MHz Locks to the incoming 10 MHz signal (BNC).

Word Clock Locks to the incoming Word Clock signal (BNC).

Loop Sync Locks to the incoming Loop Sync signal (BNC).

Output Sample Rate

This displays the precise sample rate distributed to all clock outputs. When the Clock Reference Source is set to Internal, the Output Sample Rate can be the session sample rate, the session sample rate modified by VSO (Internal clock), or by Pull Up/Down. If Sync X is following an external Clock Reference Source, the Output Sample Rate is proportional to any discrepancy between the session sample rate and the incoming reference. External devices following Sync X receive and clock to this sample rate.

Clock Ref Status Indicator

The Status indicator shows the state of the selected clock reference. Text to the right of the Status light indicates if Sync X is Generating clock reference, or if it is Locked or Not Locked to the selected Clock Source. The Clock Ref Status indicator is mirrored on the front panel of Sync X as well as in Synchronization view in the Transport window and in the Edit Window toolbar.

Clock Status

Status light	Status text	Clock Reference
Solid Green	Locked/Generating	0.0%–0.025% faster/slower than the expected rate*
Flashing Fast Yellow	Locked	>0.025%–4% faster than the expected rate*
Flashing Slow Yellow	Locked	>0.025%–4% slower than the expected rate*
Flashing Fast Orange	Locked	>4%-8% faster than the expected rate*
Flashing Slow Orange	Locked	>4%-8% slower than the expected rate*
Flashing Fast Red	Locked	>8% faster than the expected rate*
Flashing Slow Red	Locked	>8% slower than the expected rate*
Unlit	Not Locked	not locked or signal missing

** expected rate = session sample rate +/– any pull up/down factor*

VSO

Enable VSO (variable speed override) and adjust the slider to fine-tune the speed (and pitch) of Pro Tools or any device receiving its clock reference from Sync X. VSO is available at any positional reference setting, but only when Clock Ref Source is set to Internal. If timecode is being generated while using VSO, the frame rate of the generated timecode varies proportionally to the VSO changes in sample rate.

Video Ref (Frame Edge Lock)

Select the Video Reference Source and Format for video Frame Edge Lock in Pro Tools, and external devices and outputs connected to the **VIDEO REF GEN** ports.

Source

Select either Internal or External as the Video Reference Source according to the needs of your workflow.

Internal When selected, Sync X generates the Video Reference signal for Pro Tools and external devices.

External When selected, Sync X locks to the incoming (external) Video Reference signal and outputs that signal to the **VIDEO REF OUT** ports.

Format

Select the desired Video Reference Format:

- Auto-Detect Format—When selected, Sync X automatically detects and switches to the incoming video reference format.
- NTSC
- PAL
- Slow PAL - 23.976
- Slow PAL -24
- 720p - 23.976
- 720p - 24
- 720p - 25
- 720p - 29.97
- 720p - 30
- 720p - 50
- 720p - 59.94
- 720p - 60
- 1080i - 47.95/1080psf - 23.976
- 1080i - 48/1080psf - 24
- 1080i - 50/1080psf - 25
- 1080i - 59.94/1080psf - 29.97
- 1080i - 60/1080psf - 30
- 1080p - 23.976
- 1080p - 24
- 1080p - 25
- 1080p - 29.97
- 1080p - 30
- 1080p - 50 (only available when Video Ref Source is External)
- 1080p - 59.94 (only available when Video Ref Source is External)
- 1080p - 60 (only available when Video Ref Source is External)

Detected Input Format

Sync X automatically detects and displays the format of the incoming External Video Reference signal.

Video Ref Status Indicator

The Status light indicates whether or not the selected Video Reference Source is valid. Text appears to the right of the Status light indicating if Sync X is Generating video reference, or if it is Locked or Not Locked to the selected Video Reference Source. The Video Ref Status indicator is mirrored on the front panel of Sync X as well as in Synchronization view in the Transport window and in the Edit Window toolbar.

Video Ref Status

Status light	Status text	Video Reference
Solid Green	Locked/Generating	Video Reference signal is present and matches the selected format
Flashing Fast Red	Not Locked	Video Reference signal is present, but does not match the selected format
Unlit	Not Present	Video Reference signal is missing

Positional Reference

Format

Select the appropriate Format for Positional Reference.

LTC When selected, Sync X reads incoming LTC signal and outputs regenerated LTC. LTC output provides gain control (LTC Output Level in the Synchronization page of the Peripherals dialog), lets you set timecode offsets for external devices (External Offsets), and can be configured to Freewheel.

Serial Timecode When selected, Sync X can receive and generate serial timecode over the 9-pin connection. Serial timecode can be read while running or idle.

Bi-Phase When selected, Sync X requires a reference start address to synchronize Positional Reference to the incoming Bi-Phase signal (DB-25). Bi-phase is converted to LTC at the LTC output when film speed is within +/– 8% of nominal.

External Offsets

Pro Tools lets you compensate for devices that are consistently offset by a fixed number of frames (such as some color–corrected video masters), or for material that starts at a different time than the session. With Sync X there are five different types of External Offsets:

- MMC (MIDI Machine Control)
- 9-Pin (Deck Control)
- LTC
- Satellite
- LTC Sample Offset

Unique values can be defined for each of these types of offsets, or you can link the first four to adjust them in unison. Positive and negative offset values can be entered to offset the timecode display later or earlier, respectively.

LTC Sample Offset

This field lets you enter an offset in samples (+/–) to fine-tune the point at which Pro Tools synchronizes relative to incoming timecode (LTC).

Additional options for External Offsets are available when using MachineControl. For more information, see the MachineControl chapter in the Pro Tools Reference Guide.

Timecode Settings Section

This section lets you configure Freewheel settings, and Audio Rate and Video Rate Pull Up and Pull Down settings.

Freewheel

The Freewheel section lets you configure how the Pro Tools transport behaves when it is Online and chasing timecode that is interrupted or corrupted. Use these options to protect against errors that can occur if your timecode source has "drop outs" or temporarily lost signals. For example, if Pro Tools is Online and chasing external LTC, the transport continues if the incoming LTC momentarily drops out for fewer than number of Frames specified for Freewheel. If the LTC drop-out exceeds the number of Frames specified for Freewheel, the transport stops.

Sync X supports Freewheel values from 4 to 40 Frames in increments of 4. If you enter a Freewheel value lower than 4 Frames, Sync X automatically selects 4. If you enter a Freewheel value greater than 40 Frames, Sync X automatically selects 40. Freewheel settings are ignored when Sync X is generating timecode.

None

When this option is selected, freewheel is limited to 4 Frames.

Number of Frames

Enable Freewheel and enter the number of Frames (4 to 40 Frames in increments of 4) to set the maximum number of frames Sync X should continue to output timecode if synchronization is lost because incoming timecode drops out or is otherwise interrupted.

Jam Sync

Enable Jam Sync to have Sync X follow incoming timecode and continue playback or recording even if incoming timecode is completely interrupted. This can be useful if timecode is damaged, or has been accidentally erased from your source tape.

Pull Up/Down

Pro Tools provides up to 4.271% pull up and down to 4.1% pull down options. You can apply standard or non-standard pull factors to audio and video separately. This lets Pro Tools and Sync X synchronize to most supported SMPTE frame rates and formats.

Transport Window and Edit Window Toolbar Synchronization View

Synchronization view in both the Transport window and the Edit Window toolbar provides controls for generating LTC and MTC, and for putting Pro Tools Online (or Offline) to control the Transport from an external source. The GEN LTC option is only available if a synchronization peripheral is connected and configured. Additionally, if a synchronization peripheral is connected and configured, Synchronization view provides Synchronization Status indicators.

To show Synchronization view in the Transport window, do one of the following:

- Select View > Transport > Synchronization.
- In the Transport Window menu, select Synchronization.
- Right-click in the Transport window and select Synchronization.



Synchronization view in the Transport window, GEN LTC enabled

To show Synchronization view in the Edit Window toolbar, do one of the following:

- In the Edit Window menu, select Synchronization.
- Right-click in the Edit Window Toolbar menu and select Synchronization.



Synchronization view in the Edit Window toolbar, LTC enabled

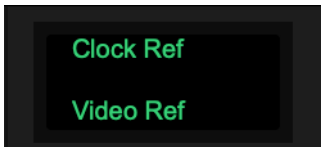
Generating LTC and MTC

With Pro Tools | Sync X connected and configured, Sync X generates both LTC and MTC when GEN LTC is enabled (see Generating and Regenerating Timecode).

GEN MTC, however, has no effect on Sync X. It is used only for generating MTC from Pro Tools using a separate MIDI interface.

Clock Ref and Video Ref Status Indicators

With Pro Tools | Sync X connected and configured, Synchronization view also provides color coded Status indicators for Clock Ref and Video Ref. These indicators mirror the indicators in the Session Setup window and on the front panel of Sync X. For more information, see Clock Ref Status Indicator and Video Ref Status Indicator.



Synchronization view, Clock Ref and Video Ref Status indicators: Locked and Generating



Synchronization view on a Satellite system, Clock Ref and Video Ref Status indicators: Locked to External sources (left), Clock Ref Locked, but Video Ref Not Locked (right)

Chapter 6: Using Pro Tools | Sync X

Clock References

The following sections explain various clock reference configurations. Active outputs from Sync X are always synchronous with the selected clock source (internal or external).

Internal Clock

Pro Tools | Sync X can use its own internal clock as the Clock Reference Source. Sync X uses a double resolution JetPLL™ Clock with extremely low jitter.

To resolve Sync X to its own internal clock:

- In the Pro Tools Session Setup window, select Internal as the Clock Reference Source.

VSO (Variable Speed Override)

To fine-tune the playback speed (and pitch) of Pro Tools and any device receiving Clock Reference from the Sync X internal clock, you can varispeed the rate of the internal clock. If generating timecode while using VSO, the frame rate of the generated LTC/MTC is varied proportionally to the sample rate and pitch change. VSO is available at any Positional Reference setting.

To varispeed the Sync X internal clock:

1. In the Pro Tools Session Setup window, select Internal as the Clock Reference Source.
2. Enable the VSO option.
3. Adjust the varispeed value using the slider. The varispeed value is displayed to the right of the slider in semitones and cents (0.00).

Sync X only outputs sample rates within the varispeed limits of the current sample rate. If a varispeed value results in an output frequency (sample rate) that is below or above the limits for the current sample rate, the Clock Ref Status indicator flashes red.

With Loop Sync I/O, Sync X supports the following VSO ranges:

At 44.1 kHz/48 kHz 40.0 kHz (Min) to 50.5 kHz (Max)

At 88.2 kHz/96 kHz 80.0 kHz (Min) to 101.0 kHz (Max)

At 176.4 kHz/192 kHz 160.0 kHz (Min) to 202.0 kHz (Max)

Video Reference

To resolve Sync X to external video reference:

1. Connect the video reference output signal to the **VIDEO REF IN** BNC port on Sync X.
2. If applicable, connect one or both of the **VIDEO REF OUT** BNC ports to the video reference input of other receiving devices.
3. In the Pro Tools Session Setup window, select Video Reference as the Clock Reference Source.

LTC (Linear Time Code)

In addition to positional reference, LTC can be used as a clock reference. However, LTC cannot be read when the reference deck is stopped, or is playing back slow or at fast wind speeds (roughly 10x playback speed). Sync X will not lock until the LTC signal is within +/– 8% of nominal play speed.

To resolve Sync X to incoming LTC:

1 Connect the output of your LTC source to the **LTC IN** XLR port on Sync X.

2 In the Pro Tools Session Setup window, select LTC as the Clock Reference Source.

For more information on LTC, see LTC Signals.

Bi-Phase/Tach

Sync X can resolve to Bi-Phase/Tach information for use as a Clock Reference.

To resolve Sync X to Bi-Phase/Tach:

1 Connect the Bi-Phase/Tach source to the **GPIO, BI-PHASE/TACH IN, PILOT IN** DB-25 port on Sync X.

2 In the Pro Tools Session Setup window, select Bi-Phase as the Clock Reference Source.

For more information on Bi-Phase/Tach signals, see Bi-Phase/Tach.

Pilot Tone

Sync X can resolve to an external Pilot Tone signal for synchronizing to (or transferring audio from) certain types of open-reel audio tape recorders. Pilot Tone is a 60 Hz (NTSC) or 50 Hz (PAL) sine wave tone. Pilot Tone is used on location film shoots to establish a common sync reference between a film or video camera with a portable 1/4-inch analog ATR. Pilot Tone contains no positional information; it provides only clock reference.

Sync X uses 60 Hz or 50 Hz as the pilot tone reference frequency according to the Video Ref Format setting. When set to PAL, the pilot tone frequency used is 50 Hz. When set to NTSC, 60 Hz is used.

The minimum recommended amplitude for Pilot Tone is 0 dBu (0.775V).

To resolve Sync X to Pilot Tone:

1 Connect the Pilot Tone reference source to the **GPIO, BI-PHASE/TACH IN, PILOT IN** DB-25 port on Sync X.

2 In the Pro Tools Session Setup window, select Pilot Tone as the Clock Reference Source.

For more information on Pilot Tone signals, see Pilot Tone.

AES3, AES3id, 10 MHz, or Word Clock

To resolve Sync X to external AES3, AES3id, 10 MHz, or Word Clock:

1 Connect the AES3, AES3id, 10 MHz, or Word Clock output of an external digital device to the corresponding **AES3 IN**, **AES3id/10 MHz IN**, or **WC IN** port on Sync X.

2 In the Pro Tools Session Setup window, select the appropriate Clock Reference Source: AES3, AES3id, 10 MHz, or Word Clock.

AES3 uses a balanced XLR connector whereas AES3id uses an unbalanced BNC connector.

The AES3 and AES3id input ports on Sync X only recognize and use the clock portion of an incoming AES3 or AES3id audio signal. All audio information is ignored and is not be passed to the Sync X AES3 or AES3id output ports.

Video Reference

Generating Video Reference

The internal Video Reference generator, if enabled, locks (resolves) to the Internal Clock source.

To generate video reference:

1. Connect the **VIDEO REF GEN** BNC output ports on the back of Sync X to external video peripherals.
2. In the Pro Tools Session Setup window, select Internal for the Video Reference Source.
3. Select the appropriate Video Reference Format.

External Video Reference

To use external video reference:

1. Connect the external video reference output signal to the **VIDEO REF IN** BNC port on the back of Sync X.
2. If applicable, connect **VIDEO REF OUT 1** and/or **2** BNC ports to the video reference input for other devices. Signal received by **VIDEO REF IN** is mirrored out the **VIDEO REF OUT** BNC ports.
3. Select External as the Video Reference Source.
4. In the Pro Tools Session Setup window, select the desired Clock Reference Source.
5. Enable enable Auto-Detect Format or select the appropriate Format.

Positional Reference

The following sections provide additional information for the available Positional Reference settings.

LTC (Linear Time Code)

LTC is used for positional reference when making ADM masters from Dolby Atmos mixes. Use Pro Tools | Sync X to generate LTC for the Dolby Atmos Renderer (RMU).

LTC is often striped onto an ATR or VTR audio track. Professional VTRs typically have an address or cue track, intended for LTC. If you are working with a standard audio tape, you will almost certainly be working with LTC. If you are working with a videotape, you may be able to work with LTC. Many digital-format VTRs output simulated LTC from data stored in a recording.

LTC is delivered to Sync X as a series of audio pulses, regardless of how it is stored or generated.

To use LTC for Positional Reference with Sync X:

- In the Session Setup window, select LTC as the Positional Reference Format.

Serial Time Code

Pro Tools | Sync X provides a 9-pin port that can be used with MachineControl-enabled systems to remotely control 9-pin transports with Serial Time Code.

For MachineControl-equipped Pro Tools systems, Serial Time Code from the 9-pin port can be used for positional reference. This option is configured from the Peripherals dialog. For details on using Serial Time Code with Sync X, see the MachineControl chapter in the *Pro Tools Reference Guide*.

Bi-Phase/Tach

Bi-Phase/Tach (tachometer) signals are Clock Reference signals that do not contain Positional Reference information of their own. However, they do contain enough information for Sync X to simulate Positional information. In order to use the Bi-Phase/Tach signal for Positional Reference, Sync X needs to know the timecode address for a particular frame of film. This positional relationship is established by parking the film device at a particular frame and setting Sync X to the equivalent timecode value using the Bi-Phase/Tach Starting Frame parameter. There are several different standards for the number of pulses-per-frame output by Bi-Phase or Tach devices. You can set Sync X to operate from a choice of several fixed values between 2 and 250 pulses per frame. The setting should match the PPF rate of the external device's Bi-Phase/Tach encoder.

To use a Bi-Phase/Tach signal for Positional Reference:

1. Connect the Bi-Phase/Tach reference source to the **GPIO, BI-PHASE/TACH IN, PILOT IN** DB-25 port on Sync X.
2. In the Pro Tools Session Setup window, select Bi-Phase as the Format for Positional Reference.
3. In the Synchronization page of the Peripherals dialog, select the appropriate Bi-Phase/Tach Wiring setting for the incoming Bi-Phase/Tach signal:
   - Bi-Phase: FWD = A leads B
   - Bi-Phase: FWD = B leads A
   - Tach: FWD = B is Low
   - Tach: FWD = B is High
4. Select the value for the Bi-Phase/Tach Pulses/Frame setting (from 2 to 250) that matches the PPF rate of the external device's Bi-Phase/Tach encoder.
5. Click OK.

Generating and Regenerating Timecode

Pro Tools | Sync X generates LTC and MTC simultaneously, and can obtain time addresses from a variety of sources.

◆ When the Format for Positional Reference is set to Generate, Sync X can generate LTC and MTC from an internal time address clock.

◆ When the Format for Positional Reference is set to LTC or Bi-Phase, Sync X generates LTC and MTC based on the time address of one of those sources.

◆ When generating LTC, Sync X also generates and outputs MTC regardless of Pro Tools generated MTC (which is configured and engaged separately).

To generate LTC and MTC from Sync X:

- In Synchronization view in the Edit or Transport window, click the GEN LTC button to enable LTC generation. The Format for Positional Reference is set to Generate automatically. Sync X generates and outputs both LTC and MTC.

Requirements for Read/Regeneration of LTC and MTC

LTC The external positional reference must be moving at normal, 1x forward speed (+/– 8%).

MTC In order for Sync X to regenerate continuous MTC, the external positional reference must be moving at normal, 1x forward speed (+/– 8%). Outside of this speed range and direction, and provided that the Idle MTC Enabled option is selected in the Synchronization page of the Peripherals dialog, short bursts of MTC will be output approximately every 200 milliseconds. This lets external devices that are clocking to MTC read Bi-Phase properly in either direction, and at speeds down to zero. Sync X begins regenerating MTC as soon as it again detects a valid Positional Reference signal.

For information about optional mute idle time MTC output, see MTC Output and Idle MTC Enabled Option.

If the Positional Reference is LTC, Sync X will regenerate timecode addresses that match the incoming timecode addresses. If the Positional Reference is a Bi-Phase/Tach signal, Sync X will generate timecode addresses starting at the Bi-Phase preset start time.

For more information, see Bi-Phase/Tach.

Generator Reference Rules

If the Clock Reference Source is set to Internal, Internal with VSO, LTC, Pilot Tone, Bi-Phase, AES3, AES3id, 10 MHz, or Word Clock, then the timecode generator locks to the selected clock reference.

If the Clock Reference Source is set to Video Reference, the timecode generator references the signal input on the VIDEO REF IN BNC port.

Frame Rate Restrictions with Video Reference

If the Clock Reference Source is set to Video Reference, Pro Tools is restricted to generating timecode at the incoming video frame rate.

In cases where the frame rate of the incoming video reference format exceeds 30 FPS, the generated timecode will be at one half the frame fate of the video format. Additionally, if the high-rate video format is interlaced (for example, 1080i/59.94), the generated timecode will be aligned with the odd field of the video reference.

Regenerating LTC

Sync X regenerates LTC whenever the external Positional Reference is moving at normal, 1x forward speed (+/– 8%).

Ensure that LTC connections are correctly made as outlined in Connecting LTC.

If you need to adjust the level of the LTC output signal from Sync X, see Adjusting LTC Output Level.

To regenerate LTC:

- In the Pro Tools Session Setup window, select the desired external Positional Reference.

Sync X regenerates LTC as soon as it receives a valid Positional Reference signal.

Generating LTC

Sync X can generate LTC using either an external or internal Clock Reference. Make sure LTC is correctly routed and that all your other gear is properly configured before you begin. If necessary, adjust the input level for the destination device.

To generate LTC using Pro Tools:

1. In the Pro Tools Session Setup window, select the desired Clock Reference Source.
2. In Synchronization view in the Edit or Transport window, enable GEN LTC.
3. Start Pro Tools recording or playback. Pro Tools commands Sync X to begin generating LTC with time addresses synchronized to the session time line.

Adjusting LTC Output Level

To adjust the LTC Output Level:

1. Choose Setup > Peripherals.
2. Click Synchronization.
3. Select the desired LTC Output Level (from –24 dBu to +9 dBu in 3 dB increments).
4. Click OK.

For more information on LTC, see LTC Signals.

Generating MTC

MTC (MIDI Time Code) is a serial digital signal. It is an inaudible type of LTC that can be used by various MIDI devices. MTC is available from the MIDI Out connector on the Sync X MIDI I/O breakout cable. Sync X always and only generates MTC when generating LTC.

To use MTC output from Sync X:

- Connect the Sync X MIDI Out connector to a MIDI In connector of a device that can recognize and use MTC. Typically, this would be a console, sequencer, synthesizer or sampler keyboard, a drum machine, or other device.

MTC Output and Idle MTC Enabled Option

MTC is normally output whenever LTC is output. Whenever LTC output stops, Sync X will continue to output MTC in bursts of one frame every 200 milliseconds. This allows any connected MIDI-reading device to be continuously updated as to the position of Bi-Phase (either of which might be operating at slow or still speeds). Thus, you can still use a connected MIDI device for Auto-Spotting from Bi-Phase. Optionally, this constant output can be set to mute when timecode (LTC) is idle.

To mute idle-time MTC output:

1. Choose Setup > Peripherals, and if necessary click Synchronization.
2. Deselect the Idle MTC Enabled option.
3. Click OK.

External Offsets and Timecode Display

The Sync X Timecode Display always shows the actual incoming timecode, regardless of any External Offset settings defined in the Session Setup window.

To apply an offset to the external timecode settings:

- In the Session Setup window, enter the desired timecode offset value in the offset field for the desired timecode format (MMC, 9-PIN, or LTC).

To apply the same external timecode offset to all devices:

- In the Session Setup window, select Link to apply the same offset value for all timecode formats.

Using Fader Start

You can apply Pro Tools | Sync X GPIO capabilities to different commands on different GPIs, such as monitoring commands, Transport, turn on Record lights, turn off AC (air conditioning), and so on. Using the **GPIO, BI-PHASE/TACH IN, PILOT IN** DB-25 port, Sync X provides six GPI outputs in total, two TTL-level and four relays. Together, this combination of outputs makes it possible for the Sync X to provide Fader Start capability.

Fader Start allows the level faders on Auxiliary Input tracks in a Pro Tools session to trigger play and stop for external devices. To implement Fader Start, Pro Tools maps the first two Auxiliary Input tracks in a session to GPI Relay outputs 0 and 1.

Utilization of Fader Start has specific wiring requirements, for additional GPI information, see GPI Relay Wiring for Fader-Start.

To configure tracks in a session for Fader Start Play and Stop:

1. Create two Auxiliary Input tracks, or if the session already has two or more Auxiliary Input tracks, use the first and second of them in the session (the two top-most in the Edit window or left-most in the Mix window).
2. When the fader on the first Auxiliary Input track in the session moves above –120 dB, GPI Relay output 3 (Fader Start #1) is enabled.
3. When the fader on the second Auxiliary Input track in the session moves above –120 dB, GPI Relay output 4 (Fader Start #2) is enabled.

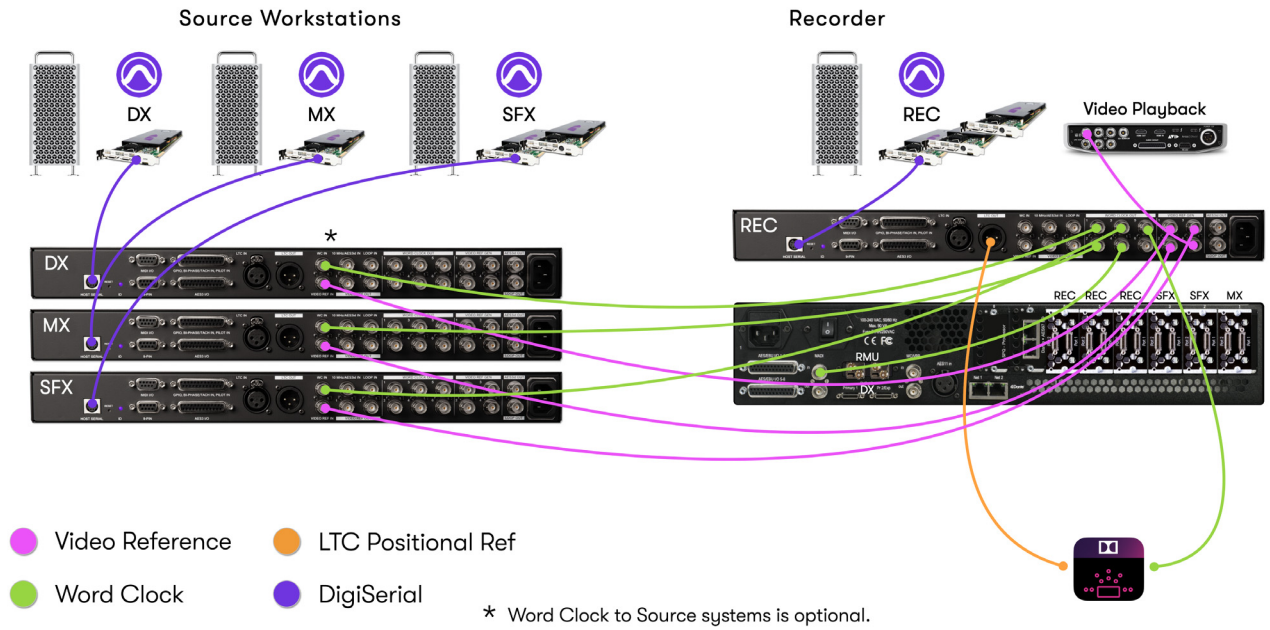
Example Fader Start Scenario

In a live television scenario, the Fader Start feature can be used to trigger bumper SFX and music before or after a commercial break. For example, coming back from commercial, move an Aux fader above –120 dB to automatically trigger Digicart SFX play-back. Similarly, bringing the fader back down automatically stops playback.

Example System Configurations

Dolby Atmos Mixing Configuration with Sync X as Video Reference Source

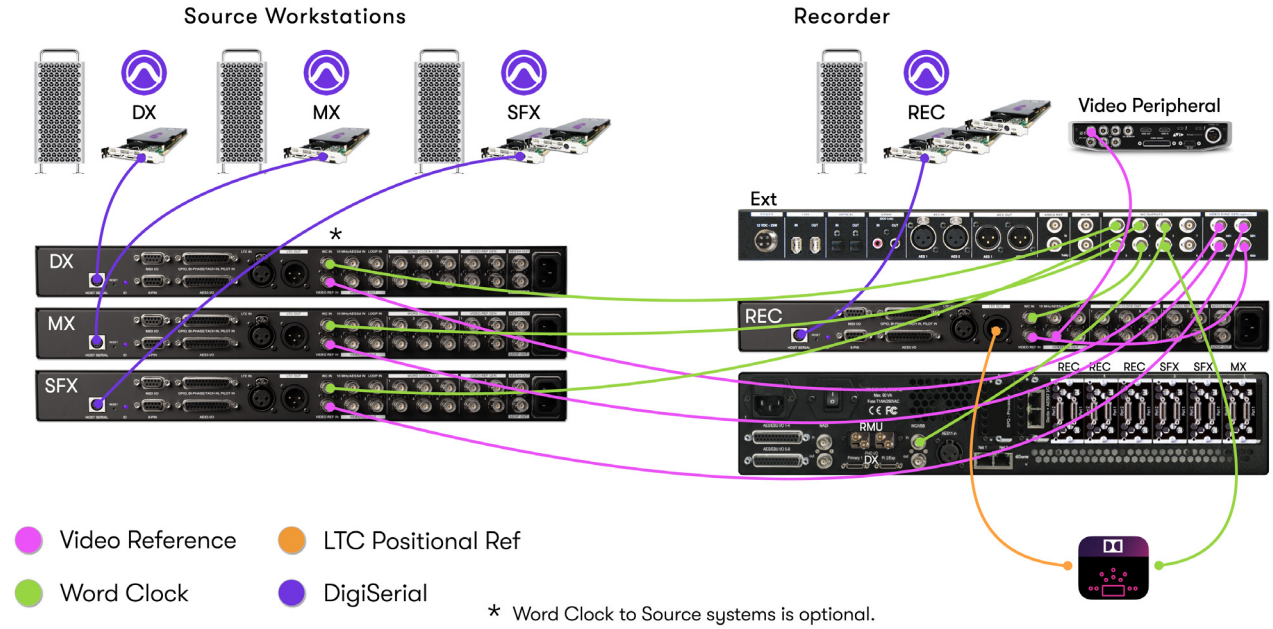
The following diagram shows an example of a Dolby Atmos mixing configuration using multiple Pro Tools Satellite systems, each with its own Sync X. In this case, the Recorder system Sync X provides Video Reference, Word Clock, and LTC Positional Reference for the other systems.



Sync X on recorder system providing clock (Internal) and video reference (Internal) to source workstation Sync X units

Dolby Atmos Mixing Configuration with External Video Reference Source

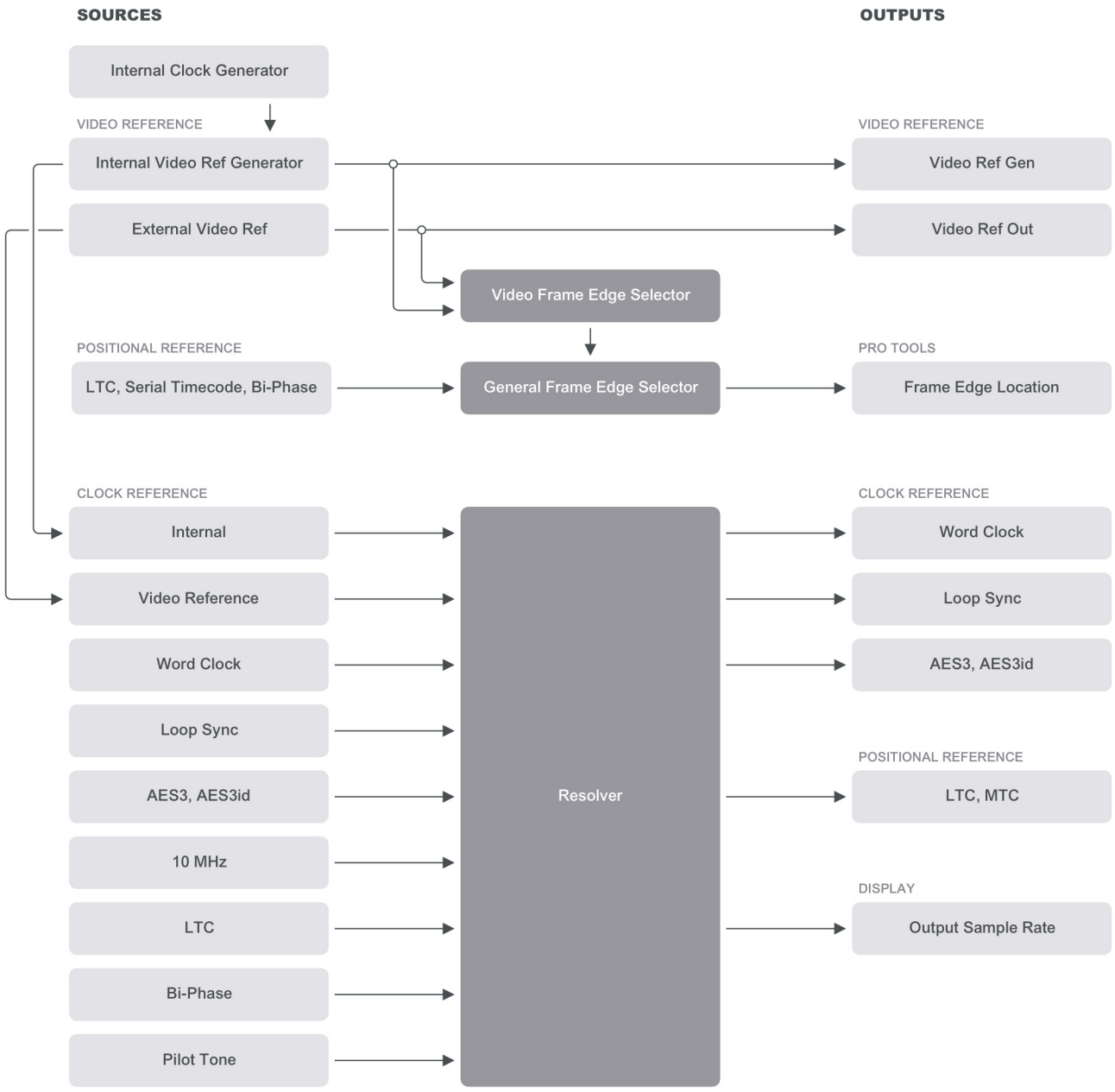
The following diagram shows another example of a Dolby Atmos mixing configuration using multiple Pro Tools Satellite systems, each with its own Sync X. In this case, each Pro Tools system is locked to external video reference and external clock source.



Sync X on recorder system and Sync X units on source workstations receiving external clock and video reference

Pro Tools | Sync X Routing

The following diagram shows signal routing for Pro Tools | Sync X with all possible sources and outputs.



Appendix A: Specifications

General

Nominal Sample Rates

Pull Up/Down	Sample Rate					
	44100	48000	88200	96000	176400	192000
+4.1667% and +0.1%	45983	50050	91967	100100	183934	200200
+4.1667%	45938	50000	91875	100000	183750	200000
+4.1667% and –0.1%	45892	49950	91783	99900	183566	199800
+0.1%	44144	48048	88288	96096	176576	192192
–0.1%	44056	47952	88112	95904	176224	191808
–4.0% and +0.1%	42378	46126	84757	92252	169513	184504
–4.0%	42336	46080	84672	92160	169344	184320
–4.0% and –0.1%	42294	46034	84587	92068	169175	184136

Frame Rates

Frame Rates:	• 30 fps • 30 fps drop-frame • 29.97 fps • 29.97 fps drop-frame • 25 fps • 24 fps • 23.976 fps

Variable Speed Override

VSO:	~40.1 kHz to ~50.4 kHz In units of 1 musical cent (1/100 semitone)

Back Panel Connectors

Connector	Specifications	
LTC IN	Format:	SMPTE/EBU 80-bit longitudinal, drop frame/non-drop frame
	Connector:	3-pin XLR female per IEC 268-12
	Speed Range:	1/10 to 30X play speed, forward or reverse
	Level:	–24 dBu to +9 dBu, differential (pin 2 hot)
	Impedance:	8K ohms
LTC OUT	Format:	SMPTE/EBU 80-bit longitudinal, drop frame/non-drop frame
	Connector:	3-pin XLR male per IEC 268-12
	Speed Range:	Generate mode: Tracks VSO Regenerate mode: Nominal Frame Rate +/–8%
	Level:	–24 dBu to +9 dBu RMS, in 3 dB steps, differential (pin 2 hot), when measured with 600-ohm load
	Level Default:	0 dBu RMS, 1.52V p-p ±10mV
	Output Impedance:	100 ohms
	Load Impedance (minimum):	600 ohms
	Rise/Fall Time:	30us ±1us measured between 10% and 90% p-p
VIDEO REF IN	Format:	NTSC 525/29.97 PAL 625/50 Slow PAL/23.98 Slow PAL/24 1280 x 720/23.98 1280 x 720/24 1280 x 720/25 1280 x 720/29.97 1280 x 720/30 1280 x 720/50 1280 x 720/59.94 1280 x 720/60 1920 x 1080/23.98/P 1920 x 1080/24/P 1920 x 1080/25/P 1920 x 1080/29.97/P 1920 x 1080/30/P 1920 x 1080/23.98/PsF 1920 x 1080/24/PsF 1920 x 1080/50/I 1920 x 1080/59.94/I 1920 x 1080/60/I 1920 x 1080/50/P 1920 x 1080/59.94/P 1920 x 1080/60/P
	Level:	1V p-p
	Termination:	75 ohms
VIDEO REF OUT	Level:	1V p-p
	Source Impedance:	75 ohms

Connector	Specifications	
VIDEO REF GEN	Format:	NTSC 525/29.97 PAL 625/50 Slow PAL/23.98 Slow PAL/24 1280 x 720/23.98 1280 x 720/24 1280 x 720/25 1280 x 720/29.97 1280 x 720/30 1280 x 720/50 1280 x 720/59.94 1280 x 720/60 1920 x 1080/23.98/P 1920 x 1080/24/P 1920 x 1080/25/P 1920 x 1080/29.97/P 1920 x 1080/30/P 1920 x 1080/23.98/PsF 1920 x 1080/24/PsF 1920 x 1080/50/I 1920 x 1080/59.94/I 1920 x 1080/60/I
	Level:	1V p-p
	Termination:	75 ohms
AES3 IN	Level:	5 V p-p at 110 ohms (pin 2 hot), transformer coupled
	Connector:	3-pin XLR female per IEC 268-12
AES3 OUT	Level:	3.3 V p-p at 110 ohms (pin 2 hot), transformer coupled
	Connector:	3-pin XLR male per IEC 268-12
Word Clock IN	Level:	1 to 5 volts PP, 50% duty cycle
	Connector:	BNC Female
	Termination:	75 ohms
Word Clock OUT (BNC 1–4)	Level:	TTL (5 V typical), 75-ohm source impedance
	Connector:	BNC Female
	Termination:	75 ohms
Word Clock OUT (BNC 5–6)	Level:	TTL (4.5 V typical)
	Connector:	BNC Female
	Termination:	75 ohms
LOOP SYNC IN	Level:	1 to 5 volts PP, 50% duty cycle
	Connector:	BNC Female
	Termination:	75 ohms
LOOP SYNC OUT	Level:	TTL (4.5 V typical)
	Connector:	BNC Female
	Termination:	75 ohms

Connector	Specifications	
AES3id IN	Level:	1 to 5 volts PP, 50% duty cycle
	Connector:	BNC Female
	Termination:	75 ohms
AES3id OUT	Level:	930 mV P-P (AC Coupled)
	Connector:	BNC Female
	Termination:	75 ohms
GPIO, BI-PHASE/TACH IN, PILOT IN	Connector:	25-pin D-Sub female (DB25)
(Bi-Phase/Tach In)	Frequency Range:	0 to 76.8 KHz
	Level:	4.5 to 12V, opto-isolated
	Current:	10 mA max
	Polarity (bi-phase):	Both inputs are software programmable
	Polarity (tach):	“Direction” polarity is software programmable
	Pulses per frame:	2, 4, 8, 10, 48, 50, 60, 96, 100, 120, 240, 250 (selectable)
(Pilot In)	Level:	100 mV to 5.5 V p-p, differential
	Frequency Range:	50 or 60 Hz nominal (selectable)
	Impedance:	8K ohms
(GPI In)	Description:	Four opto-isolator inputs/returns
	Level:	–5.0 to 5.5 V
	Current:	20 mA max
	Frequency:	Frame-rate max
	Latency:	Half frame max
(GPI Out (TTL))	Description:	Two TTL-level outputs
	Level:	TTL (3.3 V typical)
	Current:	15 mA
	Frequency:	Frame-rate max
	Latency:	Half-frame max
(GPI Out (Relay))	Description:	Four pairs of SPST contacts, normally open
	Load (while switching):	1 A max at 220 VDC, 250 VAC
	Load (continuous):	1 A max at 220 VDC, 250 VAC
	Operate/Release Time:	2 ms / 1 ms (excluding bounce)
	Switching Rate:	Frame-rate max
	Latency:	Half frame max

Connector	Specifications	
MIDI Time Code (MTC) Out	Current Rating:	15 mA current loop
	Rate:	31.25 Kilobaud
	Connector:	5-pin DIN female @ break out cable
	Cable Length:	50 feet (15 meters) max
Host Serial	Format:	RS-422A, 153.6 kbps
	Connector:	8-pin mini-DIN female (proprietary pinout)
	Max. Custom Cable Length:	100 feet (30 meters) using CAT6A cable

Clock Specifications

Average long-term jitter	72 ps	Measured at 1 ms interval as specified in AES-12id-2020. Jitter will vary slightly based on sample rate and video reference format.
Clock accuracy	+/– 1 ppm	
Drift with temperature variation	+/– 1 ppm over –20~70º C	

Power Requirements

Voltage:	85 to 264 VAC
Frequency:	47 to 63 Hz auto switching
Wattage:	9.5 W typical, 30 W maximum
Connector:	3-pin, AC and ground (IEC 950:320;3.2.4)

Mechanical Specifications

Chassis standard	19”, 1 RU
Chassis depth, without connectors mounted	34.8 cm / 13.5”
Chassis body width	44.2 cm / 17.4”
Weight	4.45 kg / 9.8 lbs.
Vibration Resistance	5 mm displacement, 10 to 55 Hz, each axis
Shock	5 G max

Environmental Specifications

Operating Temperature	39.2 to 104 degrees F (4 to 40 degrees C)
Storage Temperature	–40 to 176 degrees F (–40 to 80 degrees C)
Relative Humidity	0 to 95%, non-condensing

Appendix B: Additional Synchronization Information

Video Reference Signals

Video Reference

Black Burst

A black burst signal is essentially a “position-less” video signal. As with any “shared” video signal, you’ll want to ensure that your video feed comes from a properly buffered and distributed source, such as a video distribution amplifier, or the house video reference/black burst output of another device in the chain.

Tri-Level Sync

Tri-level sync, like black burst, is an analog video synchronization pulse primarily used for the locking of HD video signals. It is preferred in HD environments over black burst, as timing jitter is reduced since it runs at a higher frequency.

LTC Signals

Because it’s an analog audio signal, LTC can sometimes be susceptible to either tape dropouts (tape shedding), or to level mismatches between the LTC source and the LTC input. The Sync X freewheeling feature allows you to compensate for brief timecode dropouts. However, if you have serious dropouts, you may not be able to sustain accurate synchronization.

If you plan to use LTC as a clock reference (whether or not you are also using it as a positional reference), you will need to ensure that your LTC is recorded at as high a level as possible without distortion, and that there are no dropouts longer than 2 frames.

Sync X reads LTC most reliably when fed with a LTC signal of at least –12 dBu (and preferably 0 dBu to +3 dBu.)

Working with Analog Machines

It is good practice on a 24-track analog tape machine to record timecode on Track 24 at a reference level of –10 dBu (or lower), with Track 23 left blank as a “guard” track. This practice avoids crosstalk “bleed” that can occur between the timecode track and otherwise adjacent audio tracks. Timecode (which is a mid-frequency alternating pitch square wave) is very sensitive to crosstalk from adjacent tracks, and conversely you don’t want audible timecode leaking onto your audio tracks.

If your ATR is under the control of a synchronizer, you must make sure that the synchronizer and the Sync X are both locked to the same reference source (such as, typically, from a video black burst generator.)

Digital Clock Signal Types

A reference clock signal is part of any digital recording system. It is required because whenever digital audio information is mixed together or passed between devices, the playback samples must be aligned with the recording samples. Pro Tools | Sync X can resolve to AES3, AES3id, 10 MHz, and Word Clock.

AES3 and AES3id

Some professional digital audio products use AES “null clock” (which is an AES data stream that contains only clock information and no audio information) as a system clock reference source. If you are connecting Sync X to such a system, you will want to use the Sync X AES3 or AES3id input as the clock reference connection, so that all system components are referenced to the same time base.

Word Clock

Many professional digital audio products—including Pro Tools | MTRX, open-reel multitrack tape recorders, and digital mixing consoles—have Word Clock connectors.

Word Clock allows Word Clock-compatible devices to send or receive external clock information which determines the sample rate, which in turn (where applicable) controls the play and record speed.

Using just Word Clock, it is possible to create a “chain” of digital devices in your studio by picking one source as the Word Clock master, and configuring other sources to follow Word Clock.

10 MHz

A 10 MHz reference signal is most often available from an Atomic Clock or a GPS receiver or satellite communications receiver. The input for using 10 MHz is on the same BNC port as is used for the AES3id input signal.

Bi-Phase/Tach

Bi-Phase and Tach are used with mag machine,16, 35, and 70 mm projectors, flatbed editing systems and other types of motor-driven film equipment. Bi-Phase (sometimes called Quadrature Sync) and Tach information are similar, though they do differ.

Bi-Phase

A Bi-Phase signal consists of two square waves, which are generated directly by a device’s transport mechanism, and which are 90° out-of-phase with one another. As a Bi-Phase-generating device plays it outputs a steady stream of square waves that Sync X can use as its clock reference, provided that the Bi-Phase transport speed is within +/– 8% of nominal.

Sync X uses the phase relationship between the two square waves to determine the device’s direction (forward or reverse). However, this is relevant only when Sync X is using the Bi-Phase signal as a positional reference.

Tach

A Tach signal is a variation of Bi-Phase. With Tach’s two signals, one is used only as the direction indicator, while the other is used as the velocity, or rate indicator. Sync X uses this rate signal when resolving to Tach as a clock reference.

There are several different standards for the number of pulses-per-frame for Bi-Phase or Tach devices. You can set Sync X to match the PPF rate of the external device’s Bi-Phase/Tach encoder from Pro Tools.

Bi-Phase/Tach signals are clock reference signals, but do not contain positional information of their own. However, they do contain enough information for Sync X to simulate positional information.

Bi-Phase/Tach signals use two square waves to generate pulses that can function as a clock reference. The two square waves are 90° out-of-phase, in a pattern that resembles this:

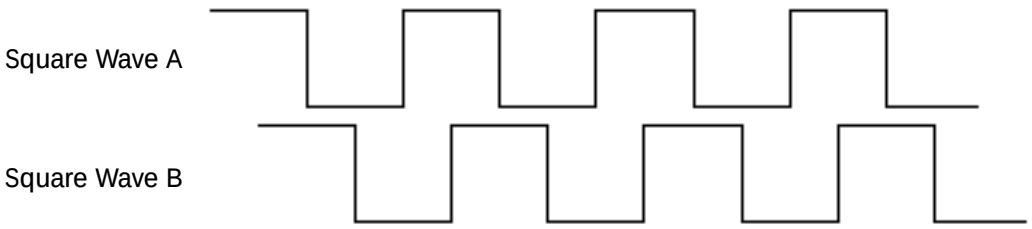


Illustration of Bi-Phase/Tach signals

With a Bi-Phase signal, Sync X can deduce the direction (forward or reverse) of the signal based upon which wave is read “high” relative to the other. For instance, with some film equipment, when the device is running forward, it will generate a Bi-Phase signal where the “A” wave leads the “B” wave—that is, where the A wave peaks before the B wave peaks. When the device is in reverse, the B wave will lead the A wave.

However, some film equipment works in the opposite manner, which is why the Sync X Bi-Phase Tach Wiring setting in the Peripherals dialog lets you make the appropriate selection (Fwd = A leads B, or Fwd = B leads A).

Calculating the direction of a Tach signal is slightly different. Tach uses two signals: the "A" signal is a square wave that provides clock information; the "B" signal is in a steady state (high or low) that indicates the direction. However, not all Tach-generating equipment uses the B signal in the same way. The Sync X Bi-Phase Tach Wiring setting in the Peripherals dialog lets you select the appropriate method (Tach: Fwd = B is Low, or Tach: Fwd = B is High).

Pilot Tone

Sync X can resolve to an external Pilot Tone signal for synchronizing to (or transferring audio from) certain types of open-reel audio tape recorders. Pilot Tone is a sine wave reference signal running at the "line frequency" or "mains frequency," meaning the same frequency transmitted by the AC line voltage from the local power utility.

Pilot Tone is used on location film shoots to establish a common synchronization reference between a film or video camera with a portable 1/4-inch analog ATR (such as those made by Nagra or Stellavox). On location, Pilot Tone is derived by clock referencing the camera to the local AC line frequency (which is 60 Hz or 50 Hz depending on the country of origin), and this same frequency is then recorded on one of the tracks of the ATR. The result is that both the camera and the ATR will maintain synchronization when played back. Some 1/4-inch machines have a center track for timecode or Pilot Tone.

Note that Pilot Tone contains no positional reference information.

MTC (MIDI Time Code)

MTC (MIDI Time Code) embeds the same timing information as standard SMPTE timecode as a series of MIDI messages every quarter-frame. MTC messages are transmitted in a sequence of eight messages, transmitting a timecode value every two frames. Sync X transmits one full sequence of MTC Quarter-Frame Messages every 200 milliseconds when MTC Idle is enabled.

Unlike standard SMPTE timecode, MTC quarter-frame and full-frame messages carry a two-bit flag value that identifies the rate of the timecode, specifying it as one of the following:

- 24 frame/s (standard rate for film work)
- 25 frame/s (standard rate for PAL video)
- 29.97 frame/s (audio and video—MIDI spec assumes drop-frame, but Sync X uses this for both drop-frame and non-drop-frame)
- 30 frame/s (audio and video—MIDI spec assumes drop-frame, but Sync X uses this for both drop-frame and non-drop-frame)

Other MIDI devices can synchronize their timecode address using the Sync X MTC output.

Appendix C: Wiring Diagrams and Pin Assignments

LTC IN and OUT XLR Ports

The Sync X LTC In and LTC Out connectors are balanced XLRs with Pin 2 wired "+" or "hot," Pin 3 wired "–" or "cold," and Pin 1 wired to ground (shield). Depending on whether you are connecting a balanced or unbalanced signal to these connectors, different wiring configurations are recommended for optimum signal integrity, especially for long cable runs.

If you are connecting a balanced signal to the Sync X LTC In or LTC Out connectors:

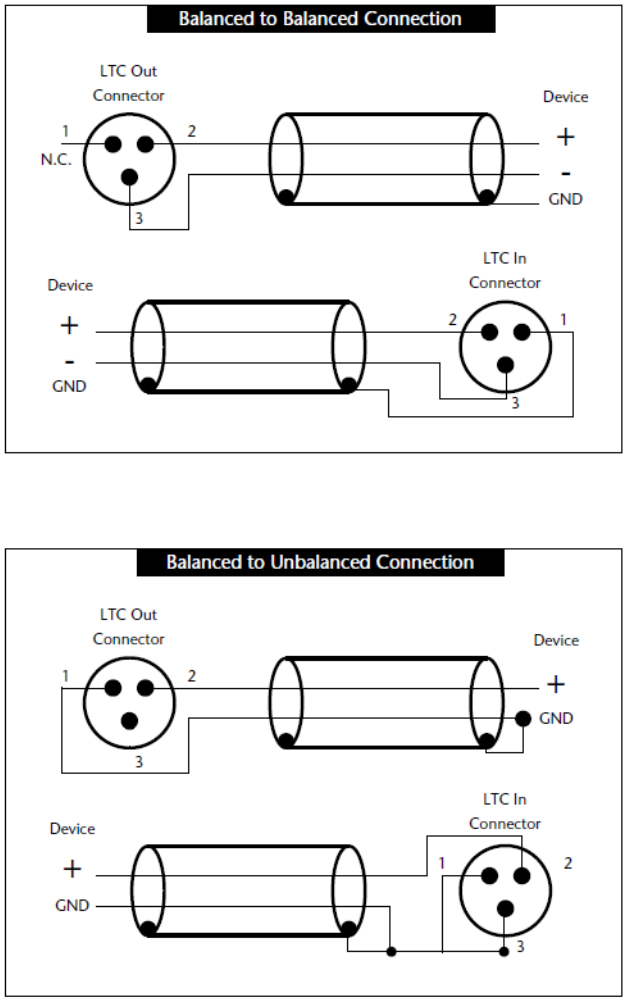
Pin 1 and ground should be connected at the input only (not at the output). This will prevent ground loops between the shield and the Pin 1 conductor.

If you are connecting an unbalanced signal to the Sync X LTC In or LTC Out connectors:

Connect only Pin 2 to the "+" signal;

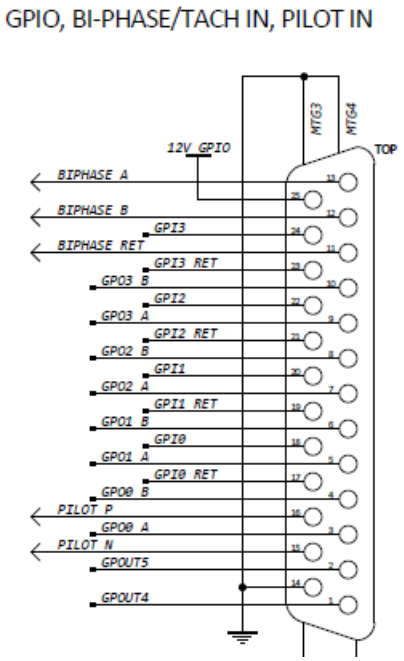
Connect Pin 1 to ground at all inputs and outputs.

Refer to the following illustration for the correct wiring diagrams.



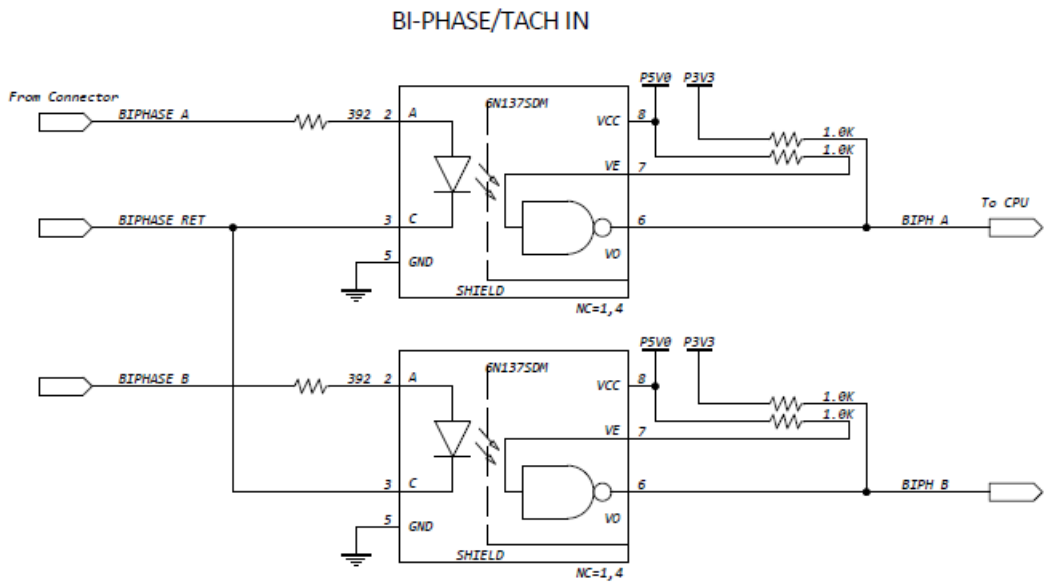
Wiring diagrams for the Sync X LTC In and LTC Out connectors

GPIO, BI-PHASE/TACH IN, PILOT IN DB-25 Port



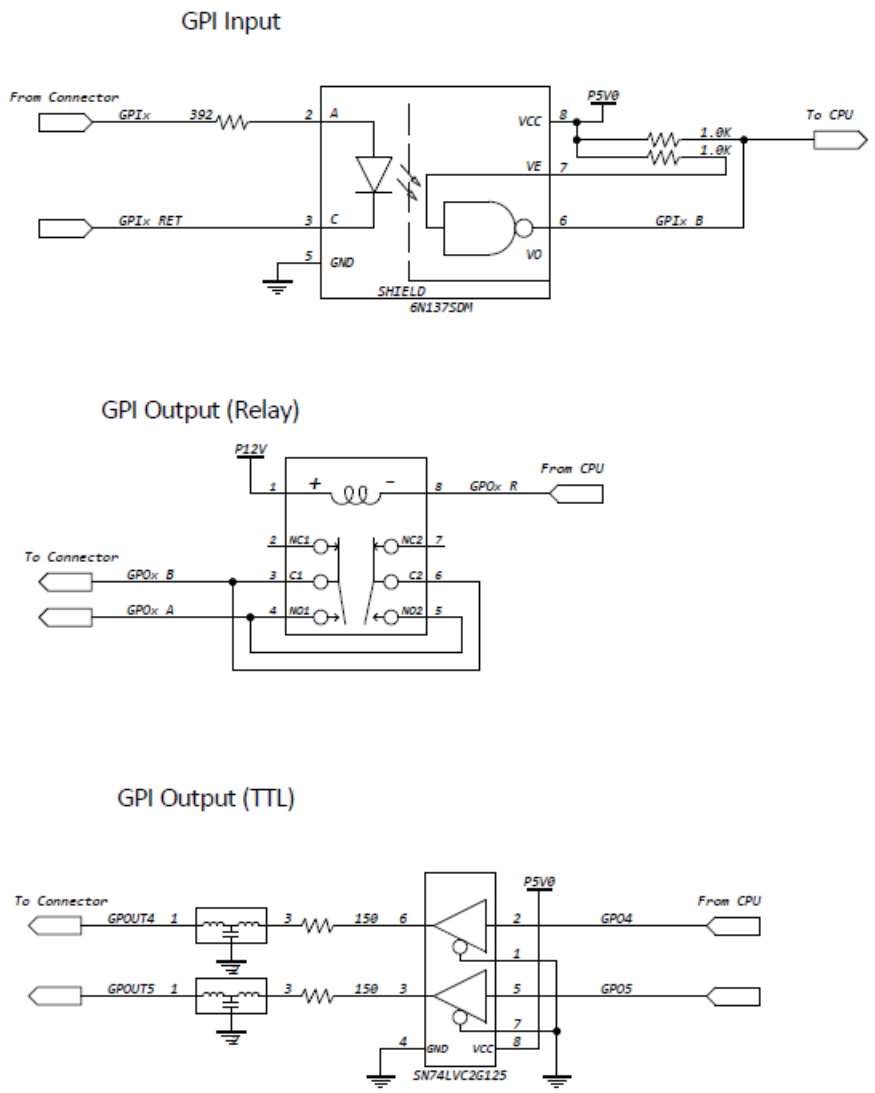
GPIO, Bi-Phase/Tach In, Pilot In DB-25 pin-out

BI-PHASE/TACH IN



Bi-Phase/Tach In

GPI Input, Output (Relay), and Output (TTL)



GPI Input, Output (Relay), and Output (TTL)

Bi-Phase/Tach/GPI/Pilot Port Interfacing Notes

◆ The six opto-isolators are 6N137 devices. The four GPI input ports pass through 390 ohm series resistors to the cathode. The two Bi-Phase/Tach inputs pass through 390 ohm series resistors to the cathode.

◆ The two TTL-level GPI outputs are driven by a 74LVC2G125. Each output passes through a 150 ohm series resistor.

◆ 12 volts is supplied at the connector for the purpose of driving the opto-isolators in film tach applications. It is regulated and can supply up to 100mA.

◆ For Tach, the “rate” input is “BIPHA_I” and the “direction” input is “BIPHB_I.” The polarity of “BIPHB_I” is software programmable and defaults to “low” for “forward.”

◆ For Bi-phase, the default polarity relationship between A and B is software programmable. The default setting for “forward” is “A leads B.” This means that the rising edge of A (0° phase) must precede the rising edge of B (90° phase).

◆ For highest signal quality, use a 25-pin cable with individually shielded conductors.

GPI Relay Wiring for Fader-Start

Sync X provides a total of four Relay-level GPI outputs on pins 3/4, 3–10 of the DB-25 connector (see the GPI Input, Output (Relay), and Output (TTL) diagram).

The GPI Relay outputs are intended to drive Relay loads only.

GPI Triggers

GPI output signals information:

0 (relay) = Play

1 (relay) = Record Ready

2 (relay) = fader start #1

3 (relay) = fader start #2

4 (TTL) = Stop

5 (TTL) = Record

Logical GPI numbers 0 through 3 are associated with GPI relay outputs 0 through 3 (pins 3 through 10). GPI numbers 4 and 5 are associated with GPI TTL outputs 0 and 1 (pins 1 and 2).

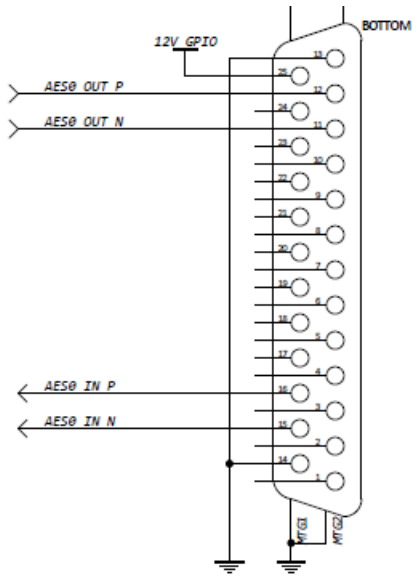
GPI TTL Wiring

The circuit can drive approximately 2 mA through a load of 1.6K and maintain a logic high level of 3.3V. In an application where the equipment being controlled has more demanding power requirements, an external buffer or relay circuit must be used. This would typically be constructed as part of a custom electrical interface.

Each GPI TTL output is fully short-circuit protected via a 150-ohm series resistor.

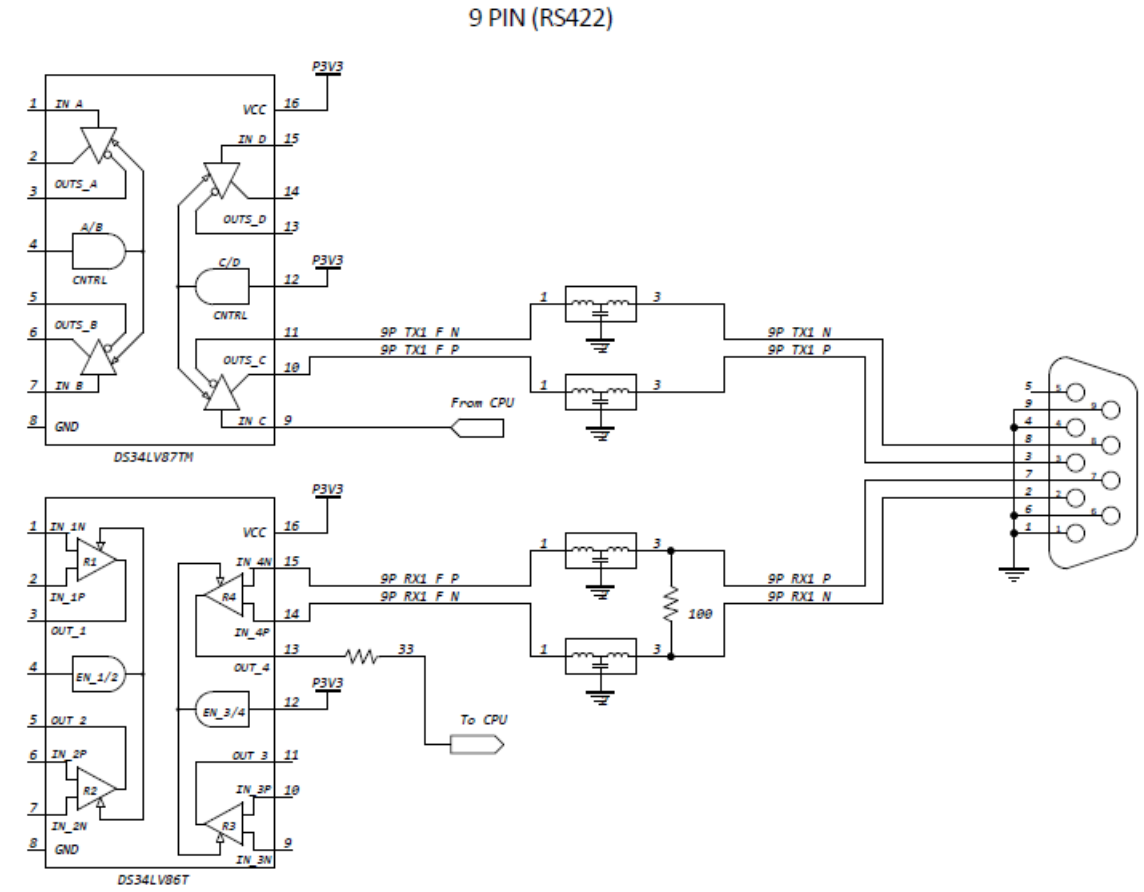
Before attempting to wire any type of custom interface, always check the electrical specifications provided by the equipment manufacturer, including voltage levels, current, loading and polarity. Incorrect wiring may damage your equipment, Sync X, or cause personal injury.

AES3 I/O DB-25 Port



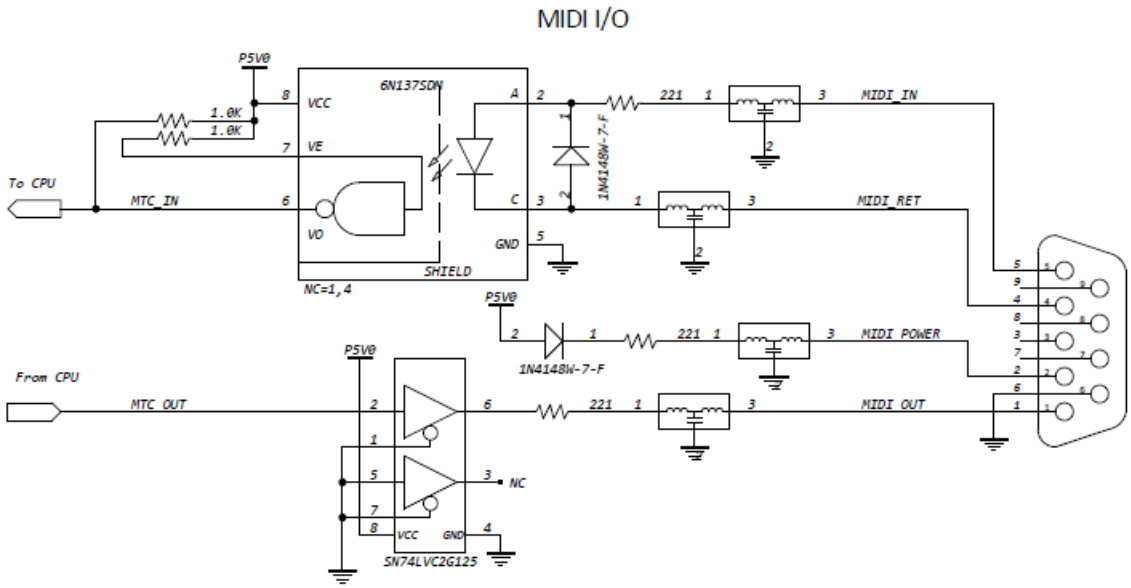
AES3 I/O DB-25 pin-out

9-Pin (RS422)



9-pin

MIDI I/O Port



MIDI I/O

Host Serial Pin Assignments

The following table shows the pin assignments for the Host serial port on the back of Sync X.

Sync X rear panel Mini DIN 8-pin connector pin assignments (Host)

Pin	Description	Direction
1	No connection	—
2	Handshake	In
3	Transmit –	Out
4	Ground	—
5	Receive –	In
6	Transmit +	Out
7	Handshake	Out
8	Receive +	In

The following table shows the wiring pin assignments for the Host Serial cable:

Mini DIN 8-pin Male to Mini DIN 8-pin Male

1	2
2	1
3	5
4	4
5	3
6	8
7	7
8	6

Appendix D: Troubleshooting

Troubleshooting

Status LEDs

The status LEDs on the Sync X front panel and in the Session Setup window may help you isolate potential problems.

Use the Incoming Time field in Pro Tools Session Setup Window as a Reference

The Incoming Time field in the Session Setup Window indicates whether or not Sync X is receiving positional reference. If this field appears to be inactive when inputting timecode to the Sync X, check your hardware device settings, the serial connection to your computer, and your software settings.

Lost Communication

If Pro Tools loses communication with Sync X, a dialog appears asking you whether you want to switch to MTC (if available) or continue trying to locate Sync X. If you see a “lost communication” dialog, first check power, serial cable, and other connections.

Lost Communication Dialog

The Lost Communication dialog provides the following options for re-establishing synchronization when communication with the Sync X stops:

Use MTC

Click this button if Sync X is unavailable, to switch to any currently connected MIDI interface for MTC synchronization. This option requires a compatible device that supports MTC conversion, and that is already connected to your CPU and enabled.

Keep SYNC X

Click this to leave the session configured for Sync X, or to continue searching for Sync X to re-establish lost communication.

Synchronization Accuracy

If you are noticing drift or lack of accurate synchronization between your devices, check the following:

- If your system locks up in the wrong place, make sure you have set the correct frame rate and format on all your devices.
- If your system locks up in the correct location, but drifts, check your clock signals and settings.

Hardware Settings Reset

If directed by Avid Customer Support, you can reset Pro Tools | Sync X to its default hardware settings without affecting the currently installed firmware.

To reset Sync X to the default hardware settings:

1 Power off the unit.

2 Press and hold Settings Select button (•) to the right of the Settings display on the front panel while you power the unit back on.

The unit is reset to the default hardware settings: 48 kHz, 1080p 24, Internal Clock Ref, Internal Video Ref, Positional Ref LTC, and no Pull Up/Pull Down.

Factory Reset

If directed by Avid Customer Support, you can reset Pro Tools | Sync X to its default factory state. This process reverts the firmware and all settings.

To reset Sync X to original firmware and settings:

1. Power off the unit.
2. Do one of the following:
   - Press and hold the **ID** button on the front panel while you power the unit back on.
   - Using the end of a paper clip, press and hold the **Reset** button on the back panel while you power the unit back on.
3. Wait for the unit to complete the reset process and reboot.

After the unit has been reset to its factory firmware and settings, update to the latest firmware as instructed by Avid Customer Support (see Updating Pro Tools | Sync X Firmware).



For Technical Support, visit
www.avid.com/support