Component Engineering

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DX-10^{tm}
Digital Interface
User's Guide

GPIO Communications

Revision B

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Forward

The advent of digital cinema presents new challenges and opportunities to theatre owners and operators. Digital cinema provides an unprecedented movie-going experience while offering new revenue opportunities and potential for reduced operating expenses.

The migration to digital cinema requires the installation of new equipment. For some screens, a digital projector and cinema server are added to an existing film projector and automation, establishing dual film/digital or hybrid capability. For other screens, film projectors are removed and replaced with digital projectors and cinema servers. For new screens, installation options now include digital only, hybrid, or film only configurations.

During digital presentations, the automated control of house functions can no longer be performed using traditional film-based cueing systems. Instead, cinema automations are controlled using digital communications including serial, General Purpose Input/Output (GPIO), and Ethernet protocols.

The DX-10 Digital Interface provides digital communications between the Component Engineering TA-10 Theatre Automation and digital cinema servers.

Introduction

What's in the Box

Item	Description
DX-10 Circuit Board	Installs into TA-10 Theatre Automations
User's Guide – GPIO	Installation and operation manual for digital cinema

What it Does

The DX-10 Digital Interface allows a digital cinema server with GPIO to control theatre house functions wired into a Component Engineering TA-10 Theatre Automation.

The DX-10 fires cue relays, event lines, and auxiliary relays in response to commands issued by a cinema server.

The DX-10 allows an operator to resume and stop digital presentations with the TA-10's Start and Stop buttons.

The DX-10 allows Panic Stop or Fire Alarm to control the digital system.

The DX-10 allows for the control and monitoring of multiple digital systems through a remote control box. The DX-10 responds to remote control start and stop buttons and manages remote control box status LED indicators during both digital and film presentations.

The DX-10 allows a single TA-10 to control house functions for both a film projector and a digital system supporting film and digital on a single screen in a hybrid configuration.

The DX-10 can be used to upgrade a TA-10 Theatre Automation that is currently installed in the field without re-wiring. The DX-10 can also be ordered pre-installed in a new TA-10.

Whether ordered as part of a new TA-10 or installed later as a field upgrade, the combination of a TA-10 Theatre Automation and a DX-10 Digital Interface is called a TA-10 Digital Theatre Automation System.

How It Works

The DX-10 acts as a communications interface between the digital cinema server and a TA-10 Theatre Automation. The general purpose output (GPO) ports of the cinema server are connected by cable to general purpose input (GPI) terminals on the DX-10. The cable that connects the cinema server to the DX-10 is supplied with the server and consists of a Digital Video Interface (DVI) or DB37 style connector on one end and individual wires on the other end. When the DX-10 receives a GPIO signal from the server, the DX-10 fires a Macro Cue that instructs the TA-10 Theatre Automation to perform a series of actions. These actions include pulsing cue relays, pulsing event lines, turning the alarm on or off, controlling the auxiliary relay, and turning the Show Run, remote control box, and front panel LEDs on or off.

As noted above, a Macro Cue is a group of actions performed together in response to a GPIO trigger from the server (or some other trigger). Macro Cues are programmed into the DX-10 using Cue Manager[tm] software. A trigger causes a Macro Cue to fire. When a Macro Cue is fired, the associated actions are performed.

Available Triggers	*Available Actions*
Serial Command	Show Run On
GPIO Command	Show Run Off
Automation and Remote Start Buttons	Pulse Cue 1 Relay
Automation and Remote Stop Buttons	Pulse Cue 2 Relay
Panic Stop	Pulse Cue 3 Relay
Film Run-Out	Pulse Cue 4 Relay
	Pulse Cue 5 Relay
	Pulse Cue 6 Relay
	Pulse Cue 7 Relay
	Pulse Event 1 Relay
	Pulse Event 2 Relay
	Pulse Event 3 Relay
	Pulse Event 4 Relay
	Pulse Event 5 Relay
	Motor Off Pulse
	Automation Alarm On
	Automation Alarm Off
	Pulse TTL Output 1
	Pulse TTL Output 2

Major Features

• Performs all TA-10 legacy and film functions

• General Purpose Input/Output (GPIO) ports for connection to a digital cinema server

• On-Board Macro Cue storage

• Dedicated Digital Sound Select feature for use in a hybrid environment

• Dedicated Pulse On Panic Stop relay

• Programmable TTL outputs

Setup

Installation Strategy

We recommend installing the DX-10 Digital Interface for use with a digital cinema server with GPIO as follows:

1. Install the DX-10 circuit board into the TA-10 Theatre Automation.
2. Set the automation address DIP switches if applicable.
3. Set the intermission delay time DIP switches if applicable (hybrid installations only).
4. Set the interlock zone jumper if applicable (hybrid installations only).
5. Wire the cinema server's GPIO interface into the DX-10.
6. Program the DX-10 with Macro Cues using Cue Manager software.
7. Use the server's macro editor to create corresponding automation macro cues containing GPO actions.
8. Use the server's playlist editor (e.g. Doremi CineLister) to place automation macro cues into the digital playlist timeline.

System Requirements

Component Engineering TA-10 Theatre Automation System
Component Engineering DX-10 Digital Interface
Component Engineering Cue Manager Macro Cue Programming Software
PC-Compatible Computer with serial port (or USB-to-serial-port converter)
Programming Serial Cable (supplied by Component Engineering with Cue Manager Software)
Server GPIO Cable (supplied with the cinema server)
Digital Cinema Server with GPIO

Installing the Circuit Board

1. Disconnect the TA-10 Theatre Automation from power.
2. Open the chassis of the TA-10.
3. Locate the legacy MCU circuit board. This board is mounted vertically in two brackets on the TA-10 motherboard and has two sets of DIP switches.
4. Remove the legacy MCU circuit board by pulling it firmly straight up. Set the legacy MCU circuit board aside. Do not change the Address or Timer DIP switches or Interlock Zone jumper settings. These settings will be referenced later when configuring the DX-10.
5. Remove chip U6 from its socket on the TA-10 motherboard. Place it into the foam supplied on the end of the ribbon connector and store it with the legacy MCU circuit board.
6. Install the DX-10 board into the two vertical brackets, pressing down firmly until the board is fully seated.

Installing the Ribbon Cable

Insert the male end of the ribbon cable into the empty U6 socket on the motherboard. It is important that the orientation of the ribbon cable is correct. The red wire must be installed in pin 1 of the socket. Pin 1 is close to U7, near the notch in the socket. Make sure all pins are properly seated into their corresponding socket holes.
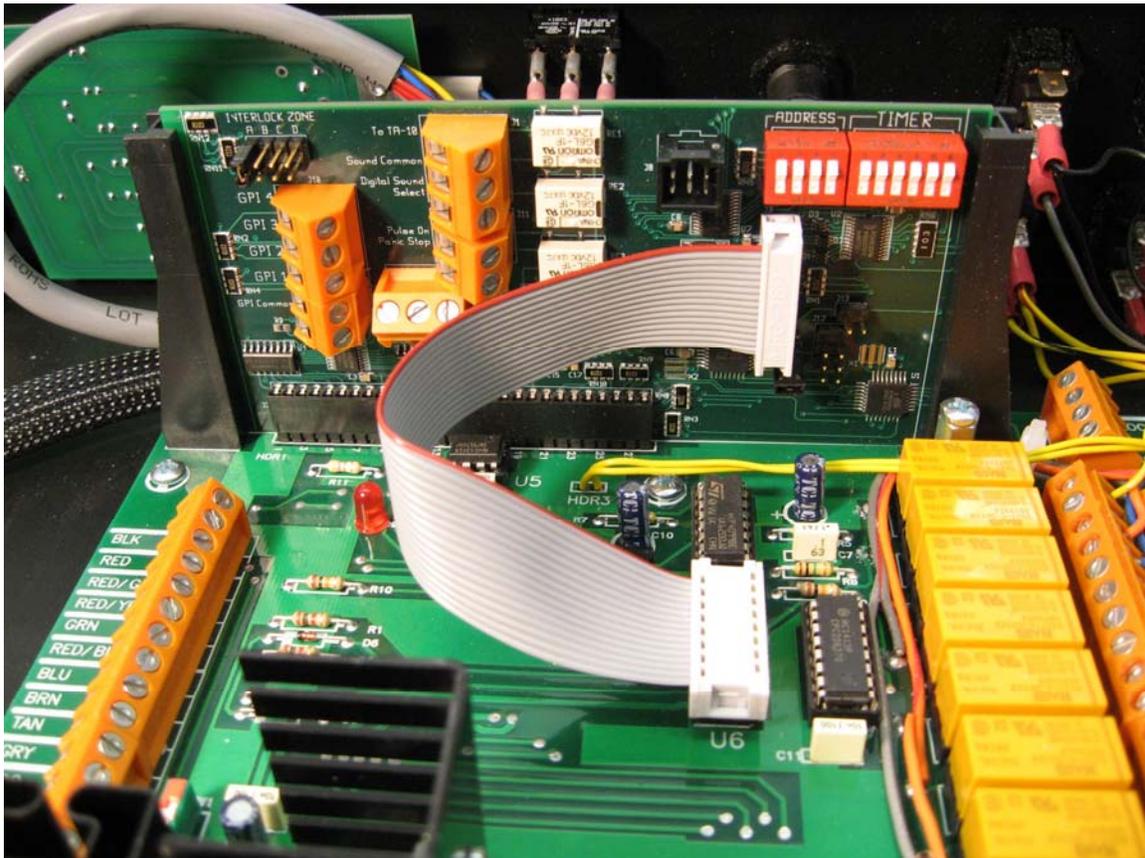
DX-10 properly installed in the TA-10 Theatre Automation

Setting the Automation Address

If installing the DX-10 into an existing TA-10 installation, set the DX-10's four-position Address DIP rocker switches so that they match the settings of the legacy MCU board. If you are establishing automation addresses for the first time, set the DIP rocker switches according to the table below. For a detailed description of automation addressing, refer to the TA-10 Theatre Automation Operator's Manual.

Automation *Address*	*Switch Positions*			
	1	*2*	*3*	*4*
1	Open	Open	Open	Open
2	Open	Open	Open	Closed
3	Open	Open	Closed	Open
4	Open	Open	Closed	Closed
5	Open	Closed	Open	Open
6	Open	Closed	Open	Closed
7	Open	Closed	Closed	Open
8	Open	Closed	Closed	Closed
9	Closed	Open	Open	Open
10	Closed	Open	Open	Closed
11	Closed	Open	Closed	Open
12	Closed	Open	Closed	Closed
13	Closed	Closed	Open	Open
14	Closed	Closed	Open	Closed
15	Closed	Closed	Closed	Open
16	Closed	Closed	Closed	Closed

Setting the Intermission Delay Time

The Intermission Delay Timer DIP switches on the DX-10 perform the same function as those on the legacy MCU board. Accordingly, set the DX-10's six-position Delay Time DIP switches so that they match the settings of the legacy MCU board. The Intermission Delay Timer is in effect only during film presentations and does not affect digital presentations. For a detailed description of how to set the intermission delay time, refer to the TA-10 Theatre Automation Operator's Manual.

Setting the Interlock Zone

The Interlock Zone jumper on the DX-10 performs the same function as the jumper on the legacy MCU board. Accordingly, set the DX-10's Interlock Zone jumper to the same position as the jumper on the legacy MCU board. The Interlock Zone setting is in effect only during film presentations and does not affect digital presentations. For a detailed description of how to set the interlock zone, refer to the TA-10 Theatre Automation Operator's Manual.

If your TA-10 is equipped with an interlock zone switch installed into its front panel, the switch must be disconnected from the interlock zone connector on the legacy MCU board and re-connected to the DX-10's interlock zone connector.
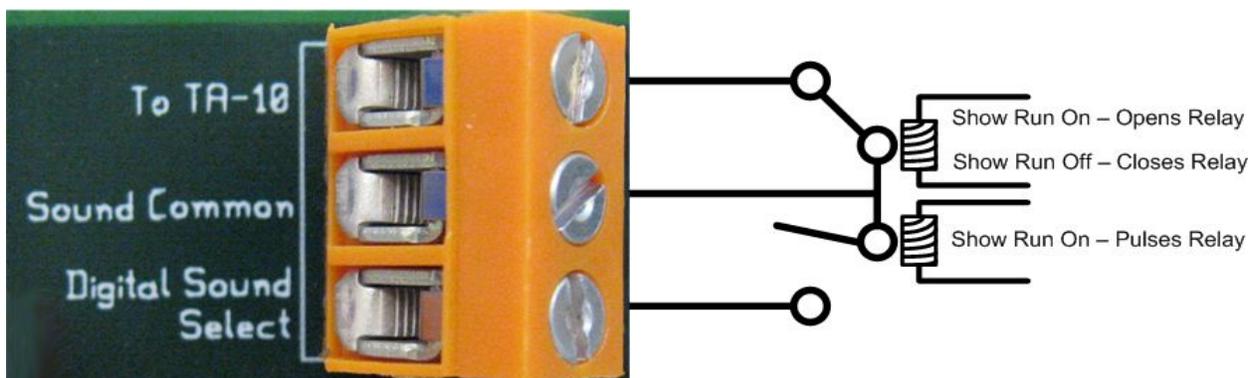

Digital Sound Selection for a Hybrid Theatre

<u>Description</u>

The DX-10 includes an auxiliary Digital Sound Select feature. This feature is used when the installation is for a hybrid configuration containing both film and digital projectors tied to a single TA-10. Do not use this feature if your installation is either film-only or digital-only.

The auxiliary digital sound select is activated with the Show Run On automation action. The Show Run On automation action is programmed into the DX-10 using Cue Manager software. Reference the Cue Manager User's Guide for programming instructions. When the auxiliary Digital Sound Select is activated, digital server sound input is selected on the sound processor and all other TA-10 sound select connections are disabled. This allows for switching house functions connected to any sound select line without changing the sound format during the digital presentation. The Show Run Off automation action re-enables all TA-10 sound select connections.

This feature is comprised of two relays, the first of which pulses closed for 500 milliseconds connecting the Digital Sound Select line to Sound Common whenever the Show Run On automation action is processed. The second relay latches open disconnecting the TA-10 sound common and thus disabling the selection of other sound inputs whenever the Show Run On automation action is processed. Whenever the Show Run Off automation action is processed, the second relay latches closed reconnecting the TA-10 sound common and re-enabling the selection of other sound inputs.

DX-10 On-Board Digital Sound Select Relays

1. Disconnect the TA-10 Theatre Automation from power.
2. Disconnect the sound processor from power.
3. Open the chassis of the TA-10.
4. Move the sound processor's common line from the TA-10 motherboard to the DX-10.
   a. Disconnect the sound processor's common line from the common side of the TA-10 sound select relays.
   b. Connect the sound processor's common line to the "Sound Common" terminal on the DX-10.
5. Install a new wire lead from the common side of the TA-10 sound select relays to the DX-10 terminal that is labeled "To TA-10".
6. Install a new wire lead from the DX-10 "Digital Sound Select" terminal to the sound processor's Digital Server Input Select terminal or pin.
7. Reference the following wiring diagram.
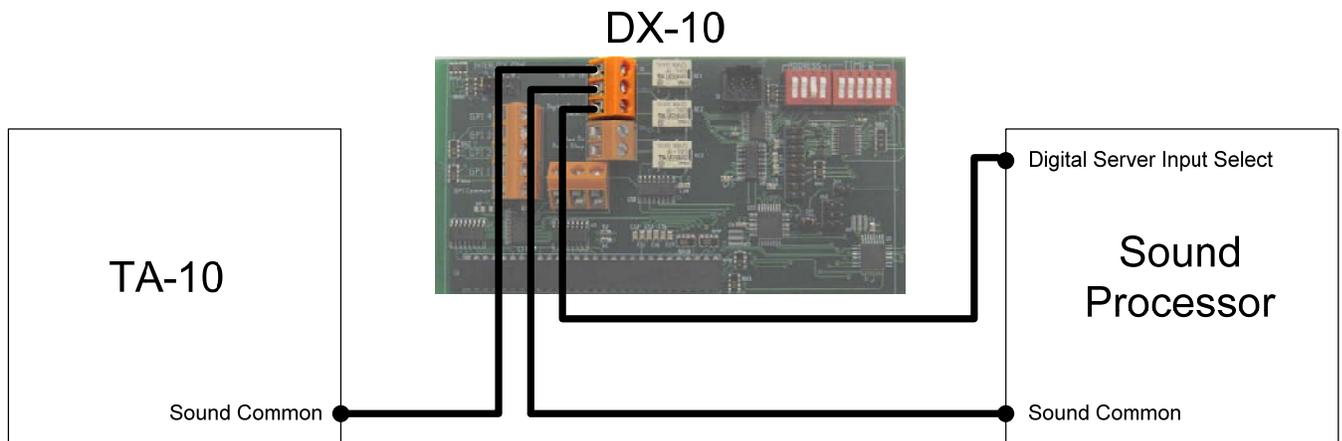
*Wiring the Auxiliary Digital Sound Select for a Hybrid Theatre*

Pulse On Panic Stop Relay

Description

When the DX-10 receives a panic stop signal over the automation bus, the DX-10's Pulse On Panic Stop relay automatically pulses closed for 500 milliseconds. This relay may be connected to any external device that can utilize a low voltage relay contact closure input.

Wiring

The DX-10 Pulse On Panic Stop relay may be connected to any external device that can process a low voltage relay contact closure. For example, you could wire an external alarm into this relay. Typically one side of the relay is wired to the external device control line and the other side is wired to the device common. See the figure that follows.
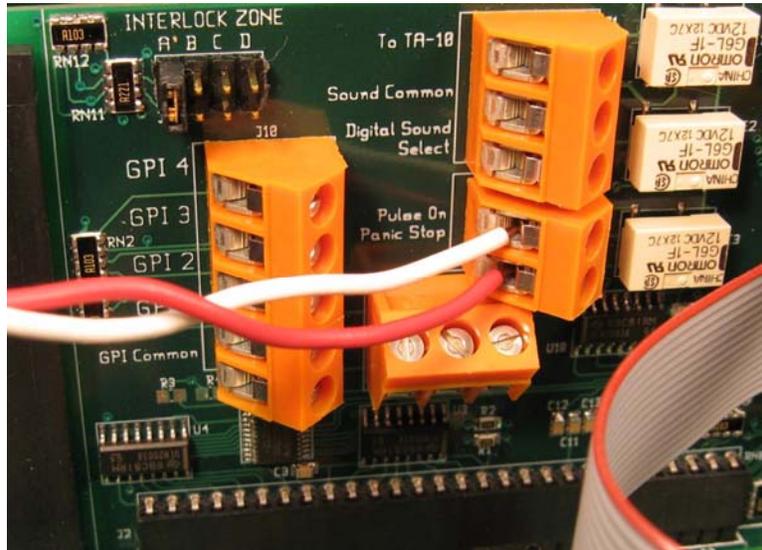
External device properly wired into the DX-10 Pulse On Panic Stop Relay

Connecting to a Computer for Programming

Description

A PC-compatible computer and Component Engineering Cue Manager^{tm} software are used to create, name, and test Macro Cues and to store the Macro Cues into the TA-10 Digital Theatre Automation. A Macro Cue is a group of actions performed in response to a trigger from a digital cinema server.

Wiring

In order to program Macro Cues into the DX-10, you will need a computer with a serial port, Cue Manager software installed on the computer, and a programming cable. The programming cable is included with the Cue Manager software. The programming cable is 10 feet in length and is terminated by a female DB-9 connector and a 6-position female plug. Connect the 6-position female plug to the 6-pin header J8 on the DX-10 board. Connect the DB-9 connector to a serial port on the computer. Note: If your computer does not have a serial port you must first install a USB-to-serial-port converter on your computer which will provide the necessary serial port.
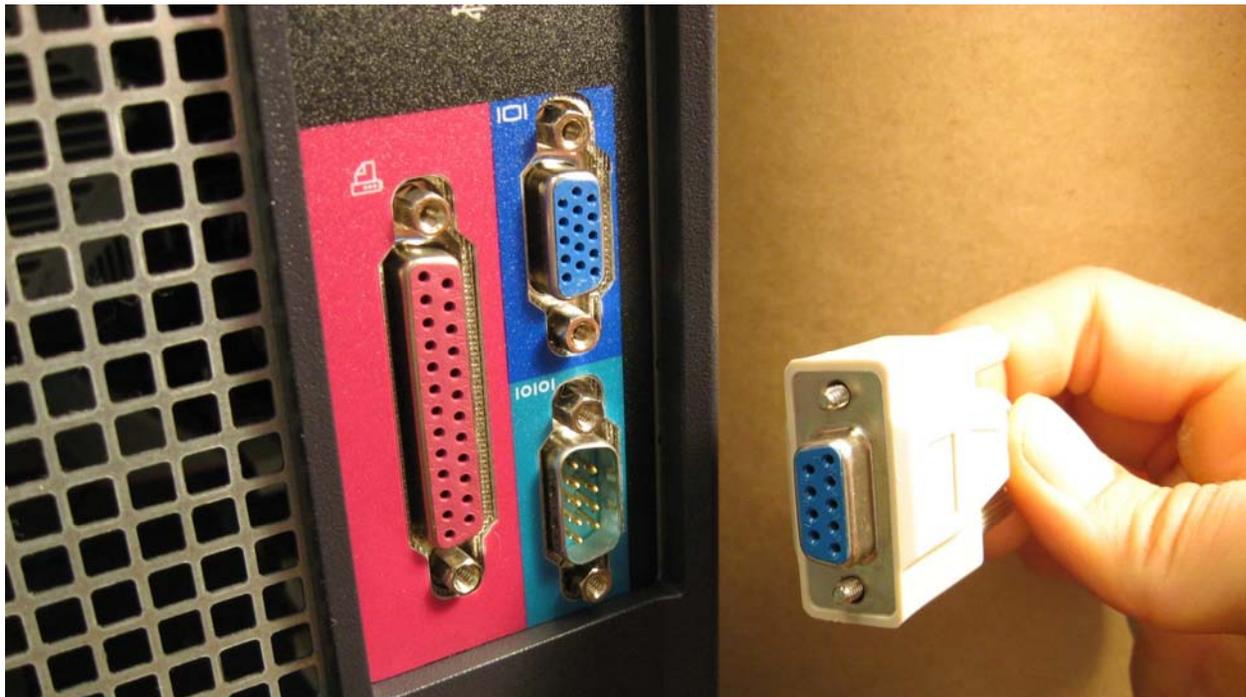
Serial Port Configuration

Confirm that the serial port parameters are configured as follows:

Data Rate: 9600
Data Bits: 8
Parity: Even
Stop Bits: 1
Flow Control: Hardware Flow Control
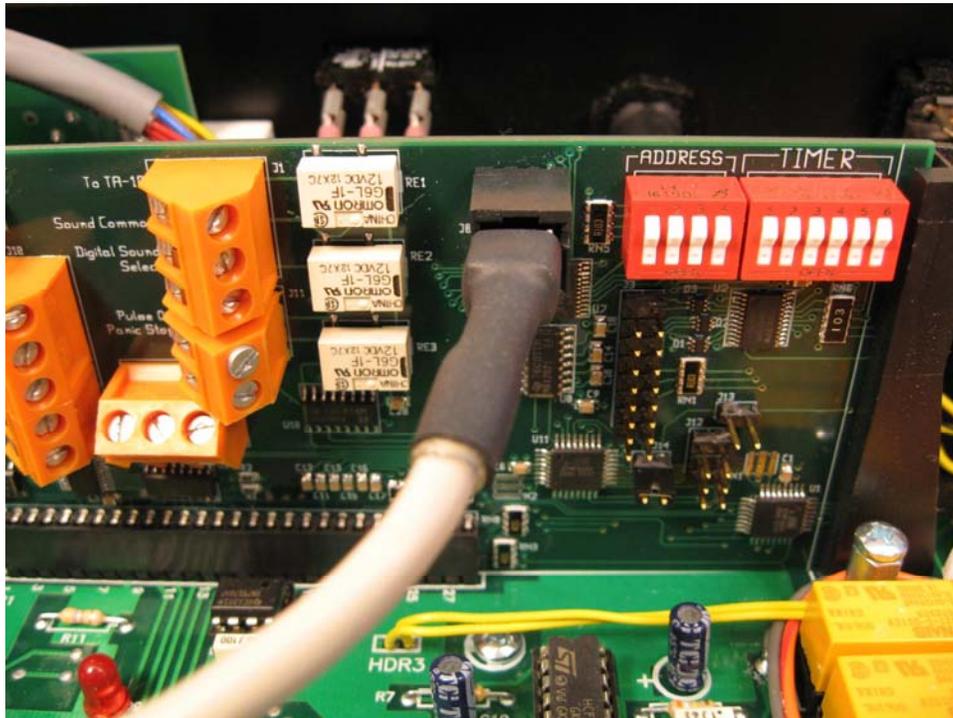
Programming cable properly connected to the DX-10 at connector J8

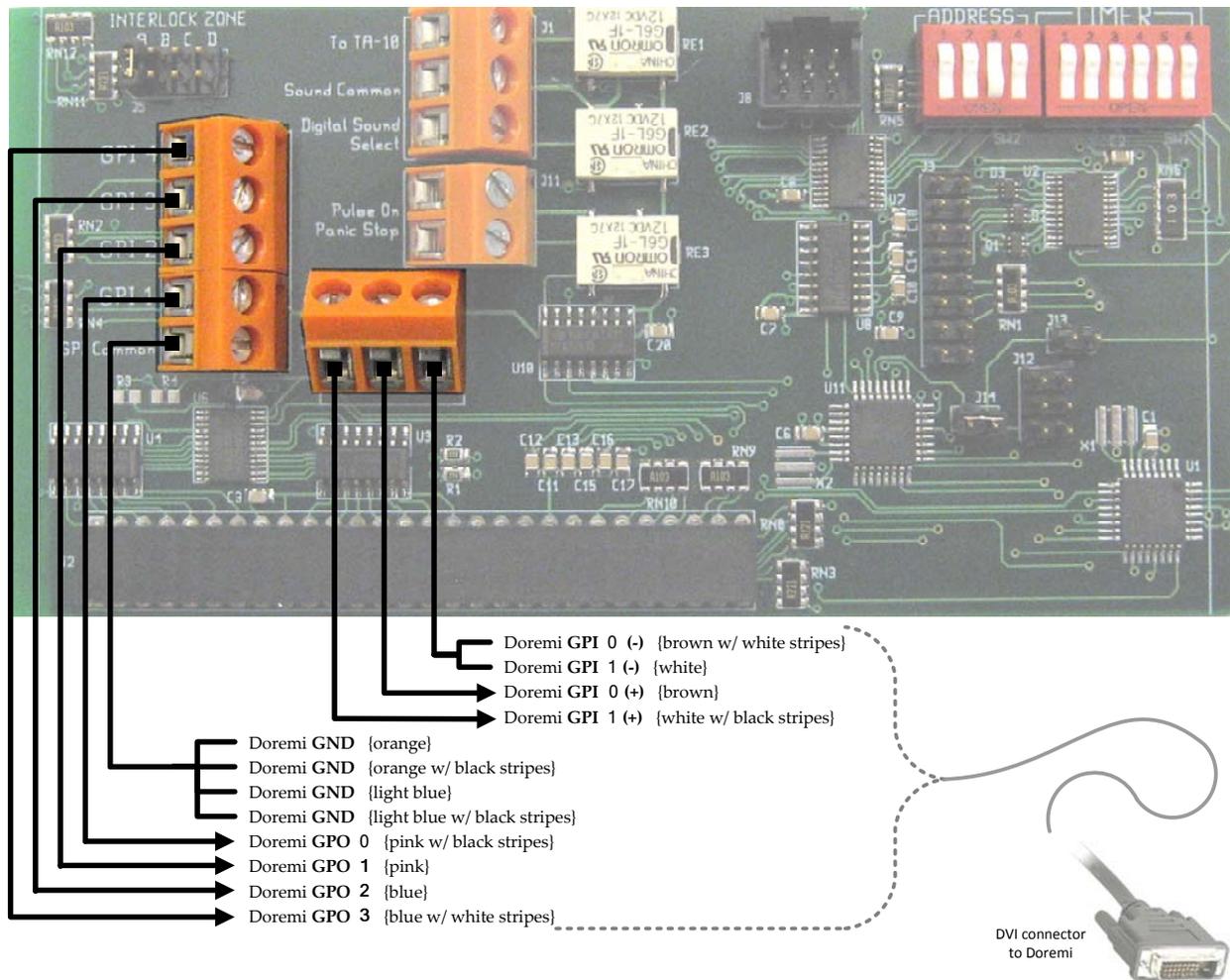*Connecting the programming cable to the PC serial port*

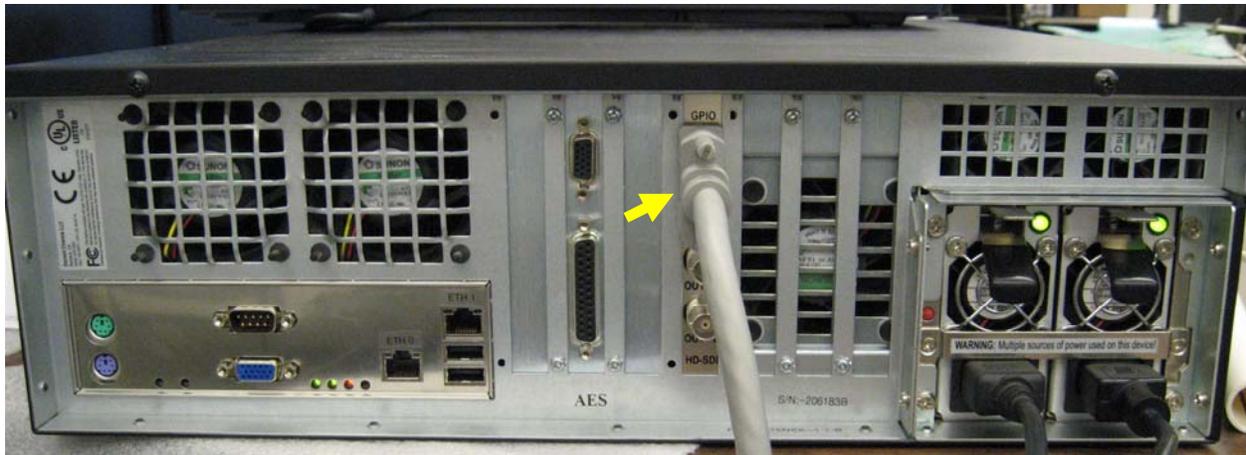## Connecting to a Digital Cinema Server for Running a Show

Description

A show running on the cinema server is managed through a playlist. The playlist consists of film clips and cinema server automation macro cues. DX-10 Macro Cues corresponding to the server automation macro cues are programmed into the TA-10 Digital Automation. When the show is running and a server automation macro cue is encountered in the playlist timeline, the server issues a command through its GPIO interface instructing the TA-10 Digital Automation to fire the corresponding Macro Cue.

Wiring

In order to run a digital show you will need a cinema server with GPIO, a DX-10 installed in a TA-10 Theatre Automation, and a GPIO cable. The GPIO cable is supplied with the cinema server and is terminated on one end by a male DVI or DB37 connector and on the other end by individual stripped wires. Insulate and tie back any unused GPIO wires. An example of a wiring configuration for the Doremi Digital Cinema Server is shown in the diagram below.

Doremi **GPI** 0 (-) {brown w/ white stripes}
Doremi **GPI** 1 (-) {white}
Doremi **GPI** 0 (+) {brown}
Doremi **GPI** 1 (+) {white w/ black stripes}

Doremi **GND** {orange}
Doremi **GND** {orange w/ black stripes}
Doremi **GND** {light blue}
Doremi **GND** {light blue w/ black stripes}
Doremi **GPO** 0 {pink w/ black stripes}
Doremi **GPO** 1 {pink}
Doremi **GPO** 2 {blue}
Doremi **GPO** 3 {blue w/ white stripes}

DVI connector to Doremi

Server GPIO cable properly connected to the DX-10 terminal blocks

GPIO cable properly connected to a Doremi Digital Cinema Server

Operation

TA-10 Legacy Functions

When installed into a TA-10 Theatre Automation, the DX-10 performs all legacy TA-10 MCU functions and includes support for the following:

Legacy Functions
FM-35 cue monitoring system
Film cues
Event lines
Start and Stop buttons
Panic stop
Motor, lamp, douser, and auxiliary relays
Show run and other front panel LEDs
Remote control
Film interlock mode
Intermission delay timer
Automation address selection
Interlock zone selection
Fault alarms

During a film presentation, a TA-10 with a DX-10 board installed operates exactly as it did with a legacy MCU board installed.

Programming the DX-10

To program the DX-10 to respond to commands from a cinema server, connect the programming cable between your computer and the DX-10. Install Cue Manager software on your computer using the Cue Manager CD. Follow the programming instructions in the Cue Manager User's Guide. With Cue Manager, you will create Macro Cues which include triggers and automation actions.

Configuring the Digital Cinema Server

The digital cinema server communicates with the DX-10 through GPIO lines. The GPO lines from the server connect to the DX-10 GPI inputs as described in the *Connecting to a Cinema Server for Running a Show* section of this manual. The server GPO lines act as triggers for Macro Cues programmed into the DX-10 using Cue Manager software.

After you have created, named, programmed, tested, and saved cues in the DX-10 using Cue Manager software, create a list of corresponding cues in the cinema server using the server's macro editor taking care to ensure that the names of the server cues *exactly* match the "Macro Cue Name" in Cue Manager. The corresponding server cues are programmed to generate GPO signals that trigger the automation cues stored in the DX-10.

For example, to create a cue for a Doremi Digital Cinema Server using GPO line 0 to trigger a DX-10 Macro Cue using Discrete logic:

1. Select the Menu button on the opening screen of the server then select the Doremi Labs, Inc. option and choose the item Macro Editor (refer to Doremi Macro Editor Manual).
2. Add a cue to the screen by selecting the "+" button.
3. Type the name of the cue. It is recommended to use the same name as the corresponding macro cue created in Cue Manager. Press OK.
4. Highlight the name of the cue that you just created on the left side of the screen.
5. Select the "+ Insert a new Action" button on the lower right side of the screen.
6. In the "Action Window", press the "General Purpose Output" button.
7. Select the GPO line number 0 and press OK.
8. Save the macro cue.
9. Create a show by organizing clips and cues into the show playlist timeline using the Doremi CineLister program.

Running a Digital Show

When a digital show is running, clips and features are played in the order they appear in the playlist timeline. When the presentation encounters a cue in the playlist timeline, the server issues a GPIO signal through its GPIO interface. The DX-10 receives this GPIO signal and fires the Macro Cue performing all the Macro Cue's automation actions.

Troubleshooting

Digital Cinema Server and DX-10 are Not Communicating

Confirm that the cinema server and the TA-10 Digital Automation are powered on. Confirm that the GPIO cable is properly connected between the DX-10 and the server.

Programmed Cues are Not Firing

Use Cue Manager software to confirm that the Macro Cues that the cinema server is to control are actually stored in the automation and programmed correctly. Use Cue Manager software to test individual relays with the "Test Relays" command. Test Macro Cues with Cue Manager "Test Macro Cues" command.

Use the digital cinema server's show management software to confirm that automation macro cues and trigger cues are actually programmed correctly into the server's playlist timeline.

In addition, confirm that the automation macro cue GPO actions programmed into the server match the Cue Manager Macro Cue triggers programmed into the DX-10.