

# TC-550 BART (BASIC ANIMATION/REAL TIME) CONTROLLER DESCRIPTION AND OPERATIONS GUIDE

Ver. 2.0 02/20/97

## TABLE OF CONTENTS

1.0	BART Functional Description
2.0	Connectors
3.0	Programming
4.0	Digital Output Applications
5.0	Input
6.0	Terminal Operations
7.0	Setup and Configuration
8.0	Diagnostics System
9.0	Events Menu
10.0	Program Menu
11.0	Pin and Port Assignments
12.0	TC-556 BART Daughter Board

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## SECTION 1.0 FUNCTIONAL DESCRIPTION

The TC-550 "BART" Controller is designed to integrate a number of common control functions onto a single, reliable PCB to solve many typical control applications, either as a stand-alone, dedicated control system, or as part of a much larger system or network.

The basic board provides for serial communications for up to 4 full duplex ports, 16 digital inputs, and 16 digital outputs. An expansion slot allows for additional serial ports, or the addition of analog control outputs. Digital inputs and outputs may be expanded using external decoder/driver cards, or by "daughter boards" that dock on top of the basic TC-550 card. Tally LED indicators on the front of the board display the status of all inputs, outputs, and serial ports.

An IR (infrared) receiver is available on the front of the board for use in decoding or "learning" IR commands from a hand-held remote controller.

A two line by 16 character, back-lit LCD display is available, with up/down/enter buttons for menu-driven commands, prompting, and configuration.

32K bytes of program ROM, 32K of battery-backed RAM, and up to 4 meg (512 Kbytes) of "FLASH" or EPROM space are available on-board, for both events and real-time (animation data) program storage, or custom applications. Using Triad's Synthesis data compression, this allows for an extremely complex or long show playback. A fast, efficient 4 MHz. processor provides plenty of power for interrupt driven, real-time process control.

DMX (USITT DMX-512) control for up to 64 lighting channels is available using the "Ser C" comm port. Cues may be created directly in the Events system, or programmed as lighting cues or real-time animation cues using the Synthesis software on a host PC. Cues may then be performed based on SMPTE time code or in response to real-time trigger inputs or a combination of both.

After revision 96.12, the BART Controller can generate SMPTE time code.

Inputs and outputs can be used to control the selection or "real world" aspects from external inputs, which makes the BART ideal for monitoring applications, intelligent operator controls, or interactive displays.

An optional battery-backed real-time clock (RTC) may be added for time-of-day scheduling or logging applications.

The board can either be mounted in a Hoffman-style enclosure, or is available in a two RU (3.5"), rack mounted enclosure, with or without the front panel LCD display and controls.

All connectors for external equipment are on the back side of the board for easy termination and installation.

## SECTION 2.0 CONNECTORS

The available connectors and basic I/O capacity are as follows:

<u>SYNC</u>	BNC style connector for composite video, video sync, 60 hertz pilot tone (other frequencies upon request), or industry-standard longitudinal SMPTE time code. (An internal crystal clock source may also be used.)
<u>SER A</u>	Modular telco style six pin connector for RS-232 terminal operation, normally used for setup and configuration, uploading, and communication to a larger show control system, also available for general purpose serial control.
<u>SER B</u>	Modular telco style six pin connector for RS-232 serial interface for general purpose control applications.
<u>SER C</u>	DB9F connector for RS-232 or RS-422/485 applications. Data rates up to 250K baud are available on this port, which can also be used for network, DMX and TRX (Triad format serial) data applications.
<u>SER D</u>	DB9F connector for RS-232 or RS-422/485 applications. As with SER C, can be used for a wide variety of applications, with the addition of an optically-isolated differential line receiver for remote data or network applications.
<u>DX 1/3</u>	DB9M connector with serial data for digital out channels 1 and 3. Each channel can control up to 32 subchannels using external Triad decoder/driver cards (TC-316, TC-3161, and TC-124).
<u>DX 2/4</u>	DB9M connector with serial data for digital out channels 2 and 4. Each channel can control up to 32 subchannels using external Triad decoder/driver cards (TC-316, TC-3161, and TC-124).
<u>Digital In</u>	DB37M connector for termination of sixteen external digital inputs. The inputs can be contact closures using plus and common voltage available on the connector, or any DC voltage between 5 and 32 volts. All inputs are optically isolated, and the tip/ring (plus and minus) inputs are independent for each input.
<u>Digital Out</u>	DB37F connector for termination of sixteen, optically isolated digital outputs. Each output can be configured for current sink to common ("contact closure"), or for current sourcing applications. Plus and common voltage is available for operating relays, valves, small lamps, etc., or an external voltage of 5 to 32VDC may be used.
<u>Power</u>	Five pin, 180 degree DIN style connector for +5VDC (at less than 500MA.), and +/- 12-15VDC if analog channels are required, or 12-24VDC available on both the digital input and output connectors.
<u>Remote</u>	Not currently implemented.

## SECTION 3.0 PROGRAMMING

The TC-550/BART Controller is designed to run Triad's LDC/SCU firmware, which is a compatible subset of the Synthesis Show Control system designed for IBM/compatible computer systems. Animation/real time programs and scripted events files are created on a PC, then uploaded to BART using one of the serial ports. Custom modifications, extensions, or even applications can be created from Triad's library of routines and experience.

### APPLICATIONS

- Board Room/Meeting Room Control - Access tape decks, laser players, VCRs, control screens, curtains, etc.
- Laser Disc Control
- Animation (Analog and Digital)
- Special Effects
- Projection Control
- Video Wall Control
- Lighting (digital, analog 0-10, or DMX-512 control)
- Interactive displays and exhibits
- Logging and monitoring applications
- SMPTE decoding/synchronized applications
- Stand-alone show control
- Expanded I/O for networked show control
- "PLC" like applications, with additional benefits of serial control and more extensive programming
- Touch-screen controller
- Many IR (Infrared) remote control possibilities

### DMX OPERATION

07/06/96 SCUDMX.TXT

There have been various installations that could use a relatively small number of DMX lighting control channels, where it would be preferable not to have a full computer and TC-560 Transmitter Card. The hardware (of both the TC-550 BART and TC-3550 control processors) was designed to be able to handle both the electrical and software data specification to meet the USITT DMX-512 specification. It is now possible to use some of the analog channels (out of a possible pool of 64) for DMX applications using REV 95.06 or later of the firmware.

The operation is very straight forward. The DMX connection is made on pins 1 (common), 3 (-), and 7 (+) of the DB9F connector labeled as "C" on the back of the BART Controller. There is currently no return data from the dimmers, so it is recommended that the jumper be set to RS-232 receive data on this port and the input pin left unconnected.

To engage DMX on a BART, use the C.ONFIG: C.omm setup through the menu, or use pokes to change the DATA port (port 2 on the setup and diagnostic menus) to E.xtrn clock (250 kbaud). This is equivalent to poking a \$EE at location \$3FC4. Also, set the parity to N.one, and the stop bits to 2. This is mapped into \$13 at location \$3FC5, and \$0F at location \$3FC6. During RUN mode, the firmware looks to see if the baud rate is set to E.xtrn, and if so, initiates a DMX transmission by sending a BREAK followed by a "0" data byte.

The DMX data starts at logical DIMMER channel 1 beginning at the end of the configured number of analog channels (normally 16 for a BART), and sends consecutive channels up to a maximum of 64 (17-64, or 48 channels if a TC-336 Analog Module is used for a BART). Note that it should be possible to set the number of analog channels (ACHAN) to 0 to use all 64 possible channels for lighting. This can be achieved using a poke of 0 to location \$00D4. (\*\*UNTESTED\*\* - THE ONLY TEST HAS BEEN USING THE "PICO".)

The soft patch DOES remain in effect for all analog channels and the patch bay is normalized to unity after a reset.

NOTE THAT THE BART MUST BE IN THE RUN MODE FOR DMX DATA TO BE OUTPUT. That is, data can either originate in a local cue EPROM, from events (AnValu, FadeRt, and FadeTo), or from TC-format data from a host computer. **Analog diagnostics will not transmit DMX data.**

NOTE THAT WHEN NOT IN "RUN" MODE, that is, at any menu or during an upload to the BART Controller, DMX data is not sent. On some dimmers, and per the USITT specification, it is legal for the dimmers to black out after 30 seconds of receiving no data. Use caution that there are other work lights in any area being controlled using DMX on a BART!

There is currently no way to change the BREAK time (as on a TC-560), although it has been set to a long enough period to wake up most known dimmer receivers (especially Colortran!).

## SECTION 4.0 DIGITAL OUTPUT APPLICATIONS

### FUNCTIONAL DESCRIPTION

REV 1.05 09/08/92 WJS

The TC-550 BART Controller has 16 discrete, optically isolated digital outputs on the basic motherboard. Considerable flexibility has been provided in configuring the uncommitted transistor outputs, including header connectors for internal squelching diodes, source current limiting resistors, etc. Outputs may be configured to source or sink 5V logic, 12VDC, or 24VDC signals at up to 100MA. Common applications include:

- Solid state audio source starts and other logic level "closures"
- Non-dim lighting control
- Audio track switching and muting functions
- Tally and status light drivers/ops panel display
- Rigging/curtain control
- Smoke and special effects control
- Exhaust/ventilation control
- Strobe and special effects projectors
- Tape deck/VCR control
- Video switching and control

Specifically, these outputs are ideal for situations where total isolation is desired (to prevent ground loops, hum, and/or other problems associated with common grounds) and where high current drive or sourcing is not required.

Individual tally LEDs are provided for each channel as a bar graph display on the front panel, wired in series with the associated optocoupler, for channel status and diagnostics. The LEDs mimic the current into the opto device and not the actual output.

Provisions have been made to add an additional 16 internal digital outputs as a daughter board that mounts as a piggy back above the TC-550 Main Logic Board.

Up to four groups of 32 digital outputs may be connected to the "DX" digital multiplex outputs available on the back panel. Cards available and compatible with these outputs are:

- TC-316 16 channel optically-isolated logic output (similar to the on-board output configuration).
- TC-3161 16 channel, fused output driver board for relay, valve, and lamps, at up to a 1/2 amp per channel. Up to two of these cards may be connected to each of the four DX output signals.
- TC-124 24 channel medium current outputs (500 ma./channel) with molex 3 pin output connectors, designed to interface with valve banks, relay strips, etc.

Further information and applications for these cards may be found in the Triad Hardware and Software Documentation manual.

## DIGITAL OUTPUT APPLICATIONS APPLICATION INFORMATION

REV 1.01 09/09/92 WJS

- All outputs are normally uncommitted, optically isolated transistor closures, rated at 100ma. for sinking applications.
- Collector and emitter busses may be strapped externally, at the DB-37F output connector, or on a breakout/distribution terminal strip.
- All outputs are intended for use with low voltage (<32 volts) DC loads only. Do NOT connect with any AC circuitry, even if transformer isolated!
- For "Contact Closure" applications, connect the emitters corresponding to channels on pins 1-16 to the common or low side of the external device input port. Connect the collectors (pins 21-35) to the high side of the control port of the other device. When the channel is active, the collector will be pulled down to the emitter, with a voltage drop of about .7 volts. This is more than adequate for most devices specified for contact closure activation, including opto-isolators, transistor inputs, solid-state relays, etc.

The emitters may be linked together for a single "common" when more than one control channel is being used with the same device. For optimal isolation and noise immunity, individual pairs-per-circuit are recommended.

- To SOURCE voltage, connect a resistor or jumper from the PLUS supply voltage (available internally on pins 36 and 37) to the collector pins of the appropriate channels (pins 21-35). The output will appear as an active HIGH signal on the emitter pins (1-16). A common/ground reference is available on pins 17-19.

An external + voltage reference may be used if preferred.

In this case, remove the two diode headers at locations "RP2" and "RP4", located immediately behind the output connector J16.

- To SINK current from the internal + reference, connect the emitter pins (1-16) to common, which is available on pins 17-19. Connect the load (such as a lamp or relay) between the + voltage (on pins 36 and 37) and the collector outputs on pins 21-35.

The headers with diodes should be installed at locations "RP2" and "RP4". This is the normal configuration used for relay, valve and lamp drivers.

Note: If a relay or other inductive load is located at a fairly long distance from the BART Controller (over 20'), we recommend the installation of a squelching diode directly across the coil.

Other configurations are possible; contact Triad Productions for application assistance.

## **SECTION 5.0 INPUT SECTION FUNCTIONAL DESCRIPTION**

REV 1.02 09/10/92 WJS

The TC-550 Digital Input section is designed to monitor up to sixteen optically isolated digital inputs. Typical applications include operator control consoles, push button selection stations, and any type of proximity or infrared sensors for externally triggered show operation.

Each of sixteen digital inputs appears as a plus and minus input on a DB-37 male connector. The inputs may be wired individually or connected to a common buss either at the DB-37 connector or at breakout terminal strips. Each input controls a 4N33 opto isolator through a current limiting resistor on the card. A tally LED bar graph display is provided on the front panel to monitor each of the inputs as received by the opto-isolator.

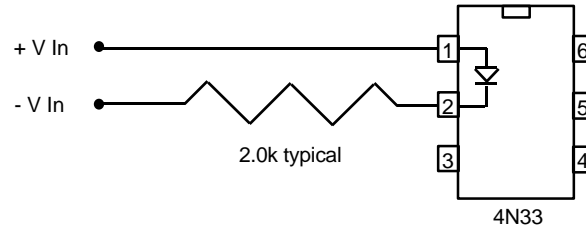
The TC-550 "BART" Controller has been designed to allow expansion of 16 additional inputs, using a header connector to attach a piggy-back daughter above the motherboard.

## INPUT SECTION

### APPLICATION INFORMATION

REV 1.02 09/10/92 WJS

- All inputs are normally isolated, opto-isolator diodes, with a series limiting resistor designed to sense 12-24 volt DC inputs. The series resistor is on the LOW side of the diode.



- The resistors are soldered onto a removable header, such that other values may be used if higher or lower voltages need to be monitored. Each channel can therefore be "programmed" for the appropriate input voltage.
- For active low or SINKING inputs, strap + V IN pins (1-16) to the positive supply, available on pins 36 and 37 of the digital input connector. Provide (contact or opto-isolators) closures to ground to the - V IN pins (21-35). A common reference is provided on pins 17-19 of the input connector. This is the most common and compatible method of interface!
- For active high or SOURCING inputs, strap - V IN pins (21-35) together and connect to negative supply common, and provide voltage + V IN on pins 1-16. An internal plus voltage is available on pins 36 and 37 of the input connector.

This method of interface is most commonly used when interfacing to sensors or PLC (Programmable Logic Controller) devices that only provide sourcing outputs.

- Different companies and different products use the terms "sinking" and "sourcing" in exactly opposite and non-standardized terms. If our description is not clear or consistent with your application, please contact Triad for specific application information.
- Each input is fully isolated, so that if care is taken in observing the isolation and polarity of signals, any combination of sinking or sourcing inputs is possible, using internal or external voltages/commons.
- The inputs are designed for DC signals only; do not connect AC voltages to the input port!
- There is no inductive load presented, and the current requirements are quite low, so squelching diodes are not required when connecting to the input port.
- All inputs should be stable for at least 34 ms. for proper sensing.
- The software allows both EDGES of the input signal to be monitored, thus an action can be programmed on the active edge, inactive edge, or BOTH. Thus, using either normally open or normally closed contacts is generally not a problem, and can be used effectively in many situations. For example, an E-STOP loop should be made up of all normally closed switches, wired in series to the input, which will then be active (ON) when the loop is "safe".

## SECTION 6.0 TERMINAL OPERATION

A "dumb" terminal or terminal emulator (i.e. within the Synthesis system) may be connected to the upper modular port of the TC-3550 to access diagnostics, configuration, and other options directly. Please refer to the reference section for information on the TechTerm terminal.

Configuration parameters, initial defaults, and other operating parameters are stored in battery-backed RAM memory when the interface is not powered up. The communications parameters for the terminal are as follows:

9600 baud, No parity, 8 data bits, 1 stop bit  
(2 stop bits may be required for upload/download procedures)

There is normally a "sign-on" message displayed whenever the BART is reset; otherwise, the display will normally show a status line including the current time, sync mode, and last executed event.

*If the BART is being used as a time code reference to a host system, an ASCII stream representation of the time code will be continuously output, which will appear as garbage on a normal display.*

To get the computer's attention, press the ESC (Escape) key on the terminal. The BART should respond with a menu roughly as follows:

```
SCU:  Cfig  Diag  Evnt  Prog  Run  Time                               Version 95.06
```

Options are normally selected by pressing the letter key corresponding to the desired operation, i.e. "S" for setup, "D" for diagnostics, etc.

No events, triggers, animation programs, or scheduled events can occur while any of the editing or menu modes are being used. Therefore, it is essential that the BART be placed into the "R"un mode (or reset) when all terminal operations are complete.

The **Escape** key is generally used to terminate any operation, and to return to the next higher selection or menu level. Pressing ESC from the (main) menu will also cause the system to restart similar to R.un. If ESC is pressed three (3) times within one second at the Main menu, the system will drop into the Triad/65 monitor and debugger, and all functions will cease. The only (known) exception is when it is necessary to 'exit' the terminal mode. In this case CTRL-A is used to exit terminal operation and return to the Diagnostic menu. To restart the system from the monitor, either do a hardware reset, or type in the following command:

```
C000G (that's zero, not "o!")
```

In an emergency, it is possible to reset all RAM parameters to the EPROM defaults by entering the following command at the debugger:

```
002E:00 <enter> C000G (or a hardware reset)
```

Proper operation may be disrupted by changing **any** parameters stored in the RAM memory using debugger commands, and this should only be attempted if directed by Triad!

Refer to the section "TechTerm" operation for more information regarding the hand held terminal used for diagnostics, maintenance, and focus operations.

## SECTION 7.0 SETUP AND CONFIGURATION

### CONFIGURATION MENU

Configuration (Cfig) is used to define operational modes and options for the BART system.

Cfig: A.na C.om ACHAN=xx DCHAN=xx FPS=xx SWTCH=xx Version 95.06  
ROMS=xx xx

A.na Analog Configuration Menu to set up analog outputs for either <OFF>, 8 Bit Monopolar, 8 Bit Bipolar, or 12 bit Bipolar operation. The prompt looks like this:

Amode: 01 @ 8 MON

C.om Communication port setup menu. Allows all ports available to the BART to have Baud rate, Parity, Data and Stop Bits configured. The default for all Triad equipment is 9600, N, 8, 1. The prompt looks like this:

TERM: 9600,N,8,1  
DATA: 9600,N,8,1  
COM3: 9600,N,8,1  
COM4: 9600,N,8,1  
TC11: 9600,N,8,1  
TC12: 9600,N,8,1  
TC13: 9600,N,8,1  
TC14: 9600,N,8,1  
TC15: 9600,N,8,1  
TC16: 9600,N,8,1  
TC17: 9600,N,8,1  
TC18: 9600,N,8,1  
PORT: 1-4, 11-18:

After a port is selected you get this series of prompts:

1.200 2.400 4.800 9.600 N9.2K T8.4K E.xtn:  
PARITY: N,E,O,M,S  
STOP: 1,2

Note: N is for 19.2k and T is for 38.4k baud.

The entire communications configuration is then redisplayed and the process can continue until all ports are properly set. Use caution when changing the baud rate of the terminal port, as you can lose control! If this happens, it is always possible to recover the system by pressing "Escape" immediately after a hardware reset. This will get you into the MARVIN monitor/debugger at 9600,N,8,1. From there, a "cold" restart can be performed.

Achan Currently a fixed configuration, but should normally be set to the maximum number of channels that can exist within the system (16 for BART, 64 for LDC).

Dchan Digital channel select is set to match the Triad decoder card(s) used in the system. Possible values are 16, 24, and 32 based on the number of subchannels on the output card. The normal value is 16.

FPS= Allows you to set the frame rate of the BART's clock. Valid choices are 15 or 30.

Swth This is a soft-switch which duplicates the functions of the 8 position dip switch used on TC-3500 BART systems. The value is entered in HEX and is based on the following bit settings:

SWITCH	HEX	APPLICATION
1	01	Switches 1 to 4 from an interval time in minutes, from off (00) to 15 (0F). An automatic show start will occur after the time interval has elapsed.
2	02	
3	04	
4	08	
5	10	On = show real time status line, off = squelch status
6	20	
7	40	On = output time code (overrides 5), off = no time code
8	80	

Typical values for this switch are 00 for run "quiet", 10 for displaying ASCII time code, and 40 for sending binary time code.

ROMS Allows you to set the size of the ROMS in a 3505 Memory expansion card.

ROMS= 20 20 20 20 20 20 20 20

ESC.ape may be used to return to the main menu.

## SECTION 8.0 DIAGNOSTICS SYSTEM

### DIAG MENU

D.iag is the Diagnostics menu, and is used to exercise analog and digital channels, test serial communications, etc.

DIAG: [Ana-Clr-Init] [Dig-Res-Prst] Que Stat Trm Version 95.06

Ana Selects an analog channel to exercise, and allows setting or ramping the current level. The prompts look like this:

Analog: 01  
Level: 000

Clr Clears all analog channels to the preset value (0).

Init Creates an analog preset using current analog values. Prompts with an "Are you Sure?" (must be answered with a capital "Y").

Dig Allows selection of an output channel and subchannel on the card and shows the current status (on/off). Pressing the ENTER key will toggle the status of the channel on->off->on. The prompts look like this:

Channel: 01  
Subchan: 01+

Res Restores all digital channels to an UNBLINDED condition, and sets the values to the default preset value (OFF).

Prst Creates a digital preset using current digital values. Prompts with an "Are you Sure?" (must be answered with a capital "Y").

Q.ue Will show a list of cue macro locations, executing macros, armed triggers, delays, locks, and the trigger queue. This is for debugging only. The information displayed is:

```
QU BK=HILO BK:HILO:FM SBR/TR SBR/SEC SBR/FRM SBR/LK TRIG X
01
02...
64
```

This display may be paused or resumed by pressing any key on the terminal. It is primarily provided for debugging and testing purposes. Contact TRIAD for further details.

Stat Displays the current status of all of the analog and digital channels configured in the card frame. Note that this display will overload the focus/remote terminal, and will only be meaningful on a larger display screen. If a "B" is displayed, it indicates that the channel is currently blinded. The status display looks like this:

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

1 000 000 000 000 000 000 000 000  
2 000 000 000 000 000 000 000 000  
3 000 000 000 000 000 000 000 000  
4 000 000 000 000 000 000 000 000  
5 000 000 000 000 000 000 000 000  
6 000 000 000 000 000 000 000 000  
7 000 000 000 000 000 000 000 000  
8 000 000 000 000 000 000 000 000

Trm Allows communication between the terminal port and devices connected to one of the auxiliary comm ports (1-8) on the BART card frame. No buffering of data is performed in this mode, so the maximum communications speed is limited to the SLOWEST of the device baud rates. You are prompted for a port:

PORT (1-4,11-18):

When one is selected, you are reminded of the ^A key exiting the terminal.

^A = EXIT

ESC.ape may be used to return to the main menu.

## SECTION 9.0 EVENTS MENU

E.vnt is the Events menu, and is used to view, modify and zap (clear) events programs in the BART's memory.

EVENT: Edit Macro On: Subr Zap ESC

Version 95.06

Edit - Enters the timed events editor and allows editing and viewing of the timed events.

55:55.55 55 255 255 <2000

Macro Enters the ASCII macro editor and allows editing and viewing of all 56 ASCII macros.

..... <01 E.dit < >

On: Enters the "On" events editor and allows editing and viewing of the "On" events.

55:55.55 55 255 255 <3600

Subr Enters the subroutine events editor and allows editing and viewing of subroutine events.

S255:255 55 255 255 <2000

Zap Clears all events and ASCII macros from memory. Prompts with an "Are you Sure?" which must be answered by a capital "Y".

## SECTION 10.0 PROGRAMMING MENU

Prog: Dnld Upld Bnk EvRm Marv Xmem Version 95.06

Dnld Starts a memory dump of the events file (in hex).

Upld Waits for an upload of an events file (in hex).

Bnk Not implemented in BART firmware.

EvRm Not implemented in BART firmware.

Marv Goes directly into the Marvin monitor/debugger.

Xmem Goes directly into the Xmem Extended Memory Manager.

## SECTION 11.0 REAL TIME SCHEDULER

The Real Time Scheduler system allows scheduled execution of subroutines based on real time. Use of this option requires use of an optional real time clock module.

TIME: Edit Set Clear Zap ?Hlp

Version 95.06

E.dit Enters the Schedule Editor which displays smtwfs.00:00-000 <00.

S.et Allows the date and time to be set. The prompts look like this:

00/00/00  
0 00:00.00

C.lr Clears all of the execution flags. Prompts with an "Are you Sure?" which must be answered by a capital "Y".

Z.ap Clears the schedule table. Prompts with an "Are you Sure?" which must be answered by a capital "Y".

?Hlp Displays help for this menu

**SECTION 12.0 PIN AND PORT ASSIGNMENTS**

**J1 Power Connector  
5 Pin 180 Female Din  
Using Elpac Pin Assignments**

PIN	SIGNAL
1	+5V
2	+12V
3	NC
4	-12
5	GND

**J16 Digital Output Connector  
DB-37 Female Connector**

Emitter 1	1	20	Collector 1
Emitter 2	2	21	Collector 2
Emitter 3	3	22	Collector 3
Emitter 4	4	23	Collector 4
Emitter 5	5	24	Collector 5
Emitter 6	6	25	Collector 6
Emitter 7	7	26	Collector 7
Emitter 8	8	27	Collector 8
Emitter 9	9	28	Collector 9
Emitter 10	10	29	Collector 10
Emitter 11	11	30	Collector 11
Emitter 12	12	31	Collector 12
Emitter 13	13	32	Collector 13
Emitter 14	14	33	Collector 14
Emitter 15	15	34	Collector 15
Emitter 16	16	35	Collector 16
Digital Common	17	36	+12V
Digital Common	18	37	+12V
Digital Common	19		

**P9 Digital Input Connector  
DB-37 Female Connector**

Input 1+	1	20	Input 1-
Input 2+	2	21	Input 2-
Input 3+	3	22	Input 3-
Input 4+	4	23	Input 4-
Input 5+	5	24	Input 5-
Input 6+	6	25	Input 6-
Input 7+	7	26	Input 7-
Input 8+	8	27	Input 8-
Input 9+	9	28	Input 9-
Input 10+	10	29	Input 10-
Input 11+	11	30	Input 11-
Input 12+	12	31	Input 12-
Input 13+	13	32	Input 13-
Input 14+	14	33	Input 14-
Input 15+	15	34	Input 15-
Input 16+	16	35	Input 16-
GND	17	36	+12V
GND	18	37	+12V
GND	19		

**P7 DX Digital Outputs 1 and 3  
DB-9 Male Connector**

PIN	SIGNAL
1	+5V
2	NC
3	GND
4	
5	Data 1
6	Strobe 1
7	Data 3
8	GND
9	Strobe 3

**P8 DX Digital Outputs 2 and 4  
DB-9 Male Connector**

PIN	SIGNAL
1	+5V
2	NC
3	GND
4	
5	Data 2
6	Strobe 2
7	Data 4
8	GND
9	Strobe 4

**J11 Remote  
DB-15 Female Connector**

PIN	SIGNAL
1	Output 1 - Stop
2	Input 1
3	Output 2 - Play
4	Input 2
5	Output 3 - Rewind
6	Input 3
7	Output 4 - Fast Forward
8	GND
9	+12V
10	External Reset
11	NC
12	Input 4
13	NC
14	NC
15	NC

**J12 Serial Connector A - (Event 11, Com2:)  
Diag/Config - Serial Port 1  
6 Pin Telco Connector**

This pin assignment matches the TC-3550, TC-560 and SMPTE Reader

PIN	SIGNAL
1	+5V
2	GND
3	TXD RS232
4	RXD RS232
5	GND
6	NC/Reset-

**J13 Serial Connector B - (Event 13, Com3:)  
Diag/Config - Serial Port 3  
6 Pin Telco Connector**

This pin assignment matches the TC-3550, TC-560 and SMPTE Reader

PIN	SIGNAL
1	+5V
2	GND
3	TXD RS232
4	RXD RS232
5	GND
6	NC

**J14 Serial Connector C - (Event 10, Com1:)  
 Diag/Config - Serial Port 2  
 DB-9 Female Connector**

PIN	SIGNAL
1	GND
2	RXD- RS485
3	TXD+ RS485
4	TXD RS232
5	GND
6	RXD- RS485
7	TXD- RS485
8	RXD RS232
9	NC

**J15 Serial Connector D - (Event 14, Com4:)  
 Diag/Config - Serial Port 4  
 DB-9 Female Connector**

PIN	SIGNAL
1	GND
2	RXD- RS422 Optically isolated
3	TXD+ RS485
4	TXD RS232
5	GND
6	RXD- RS422 Optically isolated
7	TXD- RS485
8	RXD RS232
9	NC

**J3 Video/SMPTE  
 BNC Connector**

Tip	Video/Audio
Barrel	GND

**EXAR 68C684 QUART Port Assignments  
Serial Ports**

Port A	Serial Port 1, Event 11, Com2:
Port B	Serial Port 2, Event 10, Com1:
Port C	Serial Port 3, Event 13, Com3:
Port D	Serial Port 4, Event 14, Com4:

**EXAR 68C684 QUART Port Assignments  
Output Port Assignments**

OP 0	LCD Enable
OP 1	LCD R/W
OP 2	LCD Register Select
OP 3	IR/Speaker on Front Panel
OP 4	Front Panel LED
OP 5	Digital Output Strobe
OP 6	Digital Output Latch
OP 7	Read Enable Serial 3
OP 8	Digital Input Clock
OP 9	Digital Input Shift/Load
OP 10	Remote Output 4
OP 11	Remote Output 3
OP 12	Remote Output 2
OP 13	Remote Output 1
OP 14	Read Enable Serial 4
OP 15	EPROM Output Enable

**EXAR 68C684 QUART Port Assignments  
Input Port Assignments**

IP 0	SMPTE
IP 1	Pilot
IP 2	IRIN
IP 3	Digital Input Data In
IP 4	LCD Busy Bit
IP 5	UCLK
IP 6	UCLK
IP 7	Remote Input 1
IP 8	Front Panel Up Switch
IP 9	Front Panel Down Switch
IP 10	Front Panel Enter Switch
IP 11	Remote Input 2
IP 12	Remote Input 3
IP 13	UCLK
IP 14	UCLK
IP 15	Remote Input 4

**EXAR 68C684 QUART Port Assignments  
Internal Device Base Addressing**

EXAR Select	\$8000
LCD Data Select	\$8100
Memory Select	\$8200
Internal Expansion Card Select	\$8300
Expansion Header Select	\$8400
Spare	\$8500
Spare	\$8600
Spare	\$8700

## TC-556 BART DAUGHTER BOARD FUNCTIONAL DESCRIPTION

06/22/94

The TC-556 BART Daughter Board is designed to increase the digital I/O capabilities of the TC-550 BART Controller by adding sixteen digital inputs, sixteen normal digital outputs and sixteen relay type digital outputs, all within the same two rack unit chassis which houses a standard BART Controller.

### CONNECTORS

- Digital In DB-37M connector for termination of sixteen external digital inputs. The inputs can be contact closures using plus and common voltage available on the connector, or any DC voltage between 5 and 32 volts. All inputs are optically isolated, and the tip/ring (plus and minus) inputs are independent for each input.
- Digital Out DB-37F connector for termination of sixteen optically isolated digital outputs. Each output can be configured for current sink to common ("contact closure"), or for current sourcing applications. Plus and common voltage is available for operating relays, valves, small lamps, etc., or an external voltage of 5 to 32VDC may be used.
- Relay Out 1-8 DB-25M connector for termination of eight relay digital outputs in either normally open or normally closed (depending on the pins used for the connection).
- DX 2/4 As above, for subchannel 9-16.

## PIN AND PORT ASSIGNMENTS

### J1 Digital Output Connector DB-37 Female Connector

Emitter 1	1	20	Collector 1
Emitter 2	2	21	Collector 2
Emitter 3	3	22	Collector 3
Emitter 4	4	23	Collector 4
Emitter 5	5	24	Collector 5
Emitter 6	6	25	Collector 6
Emitter 7	7	26	Collector 7
Emitter 8	8	27	Collector 8
Emitter 9	9	28	Collector 9
Emitter 10	10	29	Collector 10
Emitter 11	11	30	Collector 11
Emitter 12	12	31	Collector 12
Emitter 13	13	32	Collector 13
Emitter 14	14	33	Collector 14
Emitter 15	15	34	Collector 15
Emitter 16	16	35	Collector 16
Digital Common	17	36	+12V
Digital Common	18	37	+12V
Digital Common	19		

### P3 Digital Input Connector DB-37 Female Connector

Input 1+	1	20	Input 1-
Input 2+	2	21	Input 2-
Input 3+	3	22	Input 3-
Input 4+	4	23	Input 4-
Input 5+	5	24	Input 5-
Input 6+	6	25	Input 6-
Input 7+	7	26	Input 7-
Input 8+	8	27	Input 8-
Input 9+	9	28	Input 9-
Input 10+	10	29	Input 10-
Input 11+	11	30	Input 11-
Input 12+	12	31	Input 12-
Input 13+	13	32	Input 13-
Input 14+	14	33	Input 14-
Input 15+	15	34	Input 15-
Input 16+	16	35	Input 16-
GND	17	36	+12V
GND	18	37	+12V
GND	19		

**P1 Relay Digital Output Connector  
DB-25 Male Connector**

RELAY	COMMON	NORMALLY CLOSED	NORMALLY OPEN
1	1	2	3
2	4	5	6
3	7	8	9
4	10	11	12
5	14	15	16
6	17	18	19
7	20	21	22
8	23	24	25

**P2 Relay Digital Output Connector  
DB-25 Male Connector**

RELAY	COMMON	NORMALLY CLOSED	NORMALLY OPEN
9	1	2	3
10	4	5	6
11	7	8	9
12	10	11	12
13	14	15	16
14	17	18	19
15	20	21	22
16	23	24	25

**NOTES**