LDC - LASER DISC CONTROLLER
DESCRIPTION AND OPERATIONS GUIDE

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SECTION 1.0 LDC AND CARD FUNCTIONAL DESCRIPTIONS

The Laser Disc Controller (LDC) card frame used to control serial RS-232 or RS-422 level source devices, such as laser video or compact disc players as well other externally controlled source/controllers requiring serial, analog or digital control. Analog control to up to four TC-336 16 Channel Analog Output Modules, and digital data for up to eight local or remote TC-316 16 Channel Isolated Digital Logic Level or TC-3161 Output/Driver or remote digital cards are available.

The LDC is controlled by a TC-3550 Processor/Receiver card, which handles bi-directional communication between the Show Control Unit (SCU) and all of the local I/O in the card frame, or as a stand-alone Show Controller.

A TC-3518 Eight Channel Serial Communications controller is used to control up to eight external serial devices, which may be at RS-232 or RS-422 interface levels. Baud rates from 110 to 38,400 are possible in any combination along with parity and stop bit selection for each port.

By using a "dumb" terminal connected to the front panel modular serial port, local setup and configuration of channel types, presets, etc. may be performed; in addition to diagnostics, program, schedule editing and other functions.

The LDC is controlled by "Events" programmed on the Synthesis Show Programming System, and is capable of stand-alone, self-contained show performance. The events program may be uploaded and run from battery-backed RAM, or from permanent EPROM memory.

Up to 32 external digital input points may be monitored as triggers to the LDC system. These inputs can be from zone sensors, ops panels, or virtually any monitor point that can provide a digital closure. Armed event sequences can respond to the inputs as programmed in the Events script.

A TC-3505 Memory Expansion card may optionally be used for stand-alone real-time/animation show data playback from sequences programmed on a Synthesis Show Programming system. Up to eight EPROMS may installed, with a total of 32 simultaneous animation macros running concurrently.

Up to two LDC systems may be operated as slaves to a Synthesis Show Control Unit to provide intelligent slave processing and allow control of multiple serial devices, up to 64 analog and 256 digital outputs, and scan and report up to 32 external digital inputs.

The LDC can synchronize show timing using an accurate internal clock, external pilot signal (such as video sync), or from a TC-750S SMPTE Time Code Reader.

Cards that are associated with a LDC/SCU are as follows:

TC-3550 (CPU/Data Receiver card) that communicates/controls other cards within an LDC card frame.

TC-3505 (Up to 2 MEG Memory Card) Battery-backed random access read/write memory (RAM) or non-volatile random access read only memory (ROM). Used for playback of up to (32) real-time animation programs. This card is optional, and used for special applications as required.

TC-3518 (8 Channel Serial card) that communicates with up to eight serial interface devices, i.e. laser disc or compact disc players, video or audio routing switchers and controllers, camera/panhead controllers, lighting controllers, laser computer systems, etc.

TC-336 (16 Channel Analog Output) A maximum of four TC-336 analog output cards can be configured per LDC. Analog outputs may be configured for 0-10, -10 to +10, or other common analog signal spans.

TC-326 (16 Channel Digital Input) A maximum of two TC-326 digital input cards can be configured per LDC. Digital inputs may be monitored for high and low transitions, and activate event or animation subroutines under program control.

TC-316 (16 Channel Logic Level Output card) A maximum of eight TC-316 isolated logic level cards may be configured within a LDC frame.

TC-3161 (16 Channel Digital Output card) A maximum of eight TC-3161 Medium-Current Digital Output cards per LDC or 128 total channels.

TC-642 (4 Channel RS-432 to TTL Level Translator card) This card is mounted on the back panel of the LDC and is used to interface to devices requiring RS-232 interface levels. A maximum of two TC-642 or TC-644 strip cards are allowed per LDC.

TC-644 (4 Channel RS-422 to TTL Level Translator card) This card is mounted on the back panel of the LDC and is used to interface to RS-422 level devices.

TC-636 (Active Card Frame Backplane) This is the backplane used for the TC-3550, TC-3505, TC-3518, and TC-336 Analog Output modules.

TC-613a (Passive Card Frame Backplane) This is the backplane adapter used for TC-3161 Digital Output cards.

Power required is +5VDC for all digital logic, +/-12VDC for RS-232 I/O, +/-15VDC for analog cards (if used) and +24VDC for digital cards.

Functional descriptions, pin assignments, and application information is available for Triad components used in the LDC/SCU frame.

SECTION 2.0 INSTALLATION

The LDC is designed as a 3 rack unit (5-1/4") by 19" rack mountable card frame that will accept various PC cards as required by the specific configuration. Input and output connectors are mounted on a hinged rear panel assembly and terminate using IDC/ribbon cable or discrete harnesses to the various backplane connectors. Power is applied through a 16 pin AMP CPC connector, while all serial, analog, and digital termination is through DB style connectors.

*ENSURE that the power to the LDC is **OFF** when inserting or removing cards in the LDC card frame.*

The slots within the LDC card frame are not keyed and it is possible to insert a card into a wrong slot in which case there could be damage to some or all of the LDC electronics.

When installing a LDC follow the below chart for proper card placement. Slots are referenced left to right and 1 through 10 when facing the front of the LDC card frame. When facing the front of a LDC, the solder side of all cards is on the right and the components are located on the left.

SLOT	ID	DESCRIPTION	NOTES
N/A	TC-636	CPU Backplane	
1	TC-3550	CPU Card	Left-most Card
2	TC-3505	Up to 2 MEG RAM/ROM Card	Optional (SCU)
	TC-3518	8 Channel Serial I/O Module	LDC
3	TC-336	16 Channel D/A Card	Optional
4	TC-336	16 Channel D/A Card	Optional
5	TC-336	16 Channel D/A Card	Optional
6	TC-336	16 Channel D/A Card	Optional
N/A	TC-616	Digital Input/Output Backplane	
7	TC-316	16 Channel Digital Logic Card	Optional
8	TC-316	16 Channel Digital Logic Card	Optional
9	TC-316/TC-326	16 Channel Digital Input Card	Optional
10	TC-316/TC-326	16 Channel Digital Input Card	Optional
N/A	TC-644	RS-422/TTL Level Translator Interface	This card is mounted on the back panel of the LDC.

Note: In some configurations, a second TC-616 backplane may be installed, for a total of eight digital output cards.

SECTION 3.0 I/O PORTS

Data termination to and from the LDC is normally accomplished through DB-style connectors located on the rear panel, with appropriate connectors installed for the specific LDC configuration or installation. The following describes the type and function of each connector. Detailed pin assignment information can be found in drawings SC-7.12 and SC-7.13. Custom configurations are available with ELCO or other style terminations.

COMPUTER This is a DB-9F connector that requires a mating DB-9M connector on the cable end. It provides full duplex RS-232 serial communication to the host or programming computer or a terminal for setup and diagnostic operations. It is normally connected to the front panel modular terminal connector on the TC-3550 Processor. In stand-alone applications, this port may be programmed for real-time serial operation, i.e. a Laser Disc Player or other serial device. The pin assignment is the same as below, except CTS and DSR are not available.

SER1-SER8 These are DB-9F serial RS-232 connectors used for serial control.

PIN	DESIGNATION	NOTES
1	Frame Ground	Use for Shield
2	RxD	Received data from external device
3	TxD	Transmit data to external device
4	CTS	Clear to Send input to LDC
6	DSR	Data Set Ready from LDC
7	COM	Signal Ground/Common

DATA This DB-9M port is designed for RS-422 communication to a host system and contains additional digital I/O points for special applications.

PIN	DESIGNATION	NOTES
1	COM	Use for Shield
2	Rx+	Received data + from external device
3	Tx+	Transmit data + to external device
4	INP1	External input 1 - Show Stop (active low)
5	INP2	External input 2 - Show Start (active low)
6	Rx-	Received data - from external device
7	Tx-	Transmit data - to external device
8	OUT1	External output 1 - active low, 100MA max.
9	COM	Signal common

AO1-AO4 These are Analog Outputs terminated at a DB-25F connector requiring a DB-25M connector on the cable end. Analog outputs appear on pins 1-16, while commons are available on pins 17-25. Some configurations do not use analog outputs, and these connectors are deleted.

DO1/DO2 These are Digital Outputs terminated at a DB-37F connector requiring a DB-37M on the cable end. Emitters (commons) are on pins 1-16, collectors on pins 20-35. For most applications, the collectors are used as the outputs, sinking to ground. +24 VDC is available on pins 36 and 37, and ground or common is on pins 17, 18, and 19. Some configurations may have additional DOx connectors. Refer to the TC-316 documentation for further information and applications.

DI1/DI2 These are Digital Inputs terminated at a DB-37M connector requiring a DB-37F on the cable end. Positive voltage inputs are on pins 1-16, negative inputs on pins 20-35. +24 VDC is available on pins 36 and 37, and ground or common is on pins 17, 18, and 19.

Some configurations may not use the DIx inputs. Refer to the TC-326 documentation for further information and applications.

POWER This is an AMP CPC-16 style connector which supplies power to the LDC/SCU I/O card frame. Triad has a standard power cable pin assignment defined, but not all voltages are required by the LDC.

PIN	DESIGNATION	NOTES	
1	Digital Ground	Isolated from other grounds	
2	+5 V	Regulated	
3	+10 V	Unregulated logic	Not Used in LDC
4	Analog Ground		
5	+12 V	Regulated	RS-232 levels
6	-12 V @	Regulated	
7	Analog Ground	Same as pin 4	
8	+15 V	Regulated	Analog Output
9	-15 V @	Regulated	
13	Control Ground	Isolated	
14	+24 VDC	Relay/tally power	
15	N/C		
16	Frame Ground	Chassis ground	

The 24VDC power is provided to operate tally lamps, small relays, or inputs to the TC-326 digital input module only. Systems requiring higher current at 24 VDC should use an external power supply.

SECTION 4.0 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-3550 and TC-550 BART 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 implementation of DMX is virtually identical to that on the BART. The DMX connection is made on pins 1 (common), 3 (+) and 7 (-) of the DB-9M "DATA" connector. Note that this is the opposite gender and reversed polarity from the BART.

To engage DMX on a LDC/SCU IO frame, 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 an $EE at location $3FC4. Also, set the parity to N.one, and the stop bits to 2. (NOTE: 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 Extrn, 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 (16, 32, or 48), and sends the remaining consecutive channels up to a maximum of 64. If you are using 64 analog outputs within the IO frame, no DMX channels are available. 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.

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 LDC 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 (AnVal, FadeRt, and FadeTo), or from TC-format data from a host computer. Analog diagnostics will not transmit DMX data as of this release.

NOTE THAT WHEN NOT IN "RUN" MODE, that is, at any menu or during an upload to the LDC 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 LDC/SCU frame!

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 (200 us) to wake up most known dimmer receivers.

Please report any results or problems to Triad as soon as possible.

SECTION 5.0 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 LDC is reset; otherwise, the display will normally show a status line including the current time, sync mode, and last executed event.

If the LDC 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 LDC/SCU should respond with a menu roughly as follows:

SCU:	Cont Diag Evnt Prog Run Set Time	Version 91.01
SCU:	Cont Diag Evnt Prog Run Time	Version 92.01
SCU:	Cfig Diag Evnt Prog Run Time	Version 95.05

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 LDC/SCU 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 two (2) 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 be 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 6.0 SETUP AND CONFIGURATION

CONFIGURATION MENU

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

SETUP:	DCHAN=xx FPS=xx SWTCH=xx	Version 91.01
SETUP:	C.om DCHAN=xx FPS=xx SWTCH=xx	Version 92.01
Cfig:	A.na C.om ACHAN=xx DCHAN=xx FPS=xx SWTCH=xx ROMS=xx xx xx xx xx xx xx xx	Version 95.05

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 LDC 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
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: 1-2, 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 (64 for LDC, 16 for BART).

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 LDC's clock. Valid choices are 15 or 30.

Swtch This is a soft-switch which duplicates the functions of the 8 position dip switch used on TC-3500 LDC 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 7.0 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 95.05

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 LDC/SCU 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 (0-8):
```

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 8.0 EVENTS MENU

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

EVENT: Edit Macro On: Subr Zap ESC Version 95.05

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 9.0 PROGRAMMING MENU

Prog: Dnld Upld Bnk EvRm Marv Xmem Version 95.05

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

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

Bnk Selects which 16k bank in a 32k Event ROM is looked at for events.

EvRm Allows the selection of up to four events programs burned into EPROM.

EVSCN:
RAM: X
B1: X
B2: X
B3: X
B4: X

Marv Goes directly into the Marvin monitor/debugger.

Xmem Goes directly into the Xmem Extended Memory Manager.

SECTION 10.0 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 95.05

E.dit Enters the Schedule Editor which displays smtwtfs.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