

DTU - DATA TERMINAL UNIT
RTU - REMOTE TERMINAL UNIT
DESCRIPTION AND OPERATIONS GUIDE
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SECTION 1.0 DTU/RTU FUNCTIONAL DESCRIPTION

The Data Terminal Unit (DTU) and Remote Terminal Unit (RTU) receive TRX high-speed serial data consisting of analog and digital channel information. Each drives up to four local TC-336 16 Channel Analog Output Modules for up to 64 analog channels, and/or up to eight local or remote digital output channels. A digital output channel can have up to 32 subchannels. There is a physical limit of eight local TC-3161 16 Channel Digital Output/Driver cards and eight remote TC-3161 cards for a maximum total of 256 digital outputs.

Various configurations are possible, and may be specified by the model number. A "standard" DTU configuration consists of 64 analog and 64 digital outputs terminated in DB or ELCO style I/O connectors mounted to a hinged back panel. DTU's are normally mounted in an 19" equipment rack in the Show Control equipment room.

A version with no back panel connectors designed for remote mounting is called an RTU (Remote Terminal Unit) and normally terminates in Phoenix style screw terminals. The RTU is normally mounted in a Hoffman-style enclosure and has its own local power supplies. The RTU is normally mounted near the animation or equipment to be controlled and eliminates long runs of multi-conductor cables.

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

The DTU/RTU frame is controlled by a TC-3550 Processor/Receiver card, which handles bi-directional communication with a CTU (Central Terminal Unit) or directly with a TC-560 Data Transmitter card for smaller applications or during show programming.

A TC-3505 Memory Expansion card may optionally be used for stand-alone show playback from sequences programmed on a Synthesis Show Programming system.

NOTE: The slots within a DTU or RTU card frame are dependent on the card type. Please reference the installation section of this manual for slot applications.

External power supplies are required for the DTU or RTU system. A typical configuration requires +5 VDC @ 1.5A, +/- 15 VDC @ 1.2A, and +24 VDC at a current rating appropriate for the intended worst case load on the digital outputs.

SECTION 2.0 INSTALLATION

The DTU is designed as a card frame that will accept cards of different system functionality.

As always, make sure that the power to the DTU is **OFF** when inserting and removing cards in the DTU card frame or when working on I/O terminations.

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

When installing a DTU follow the below chart for proper card placement. Slots are referenced left to right and 1 through 10 when facing the front of the DTU card frame. When facing the front of a DTU card frame, 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 Processor Card | Left-most Card |
| 2 | TC-3505 | Up to 2 MEG RAM/ROM Card | Optional |
| 3 | TC-336 | 16 Channel D/A Module | Analog Outputs 1-16 |
| 4 | TC-336 | 16 Channel D/A Module | Analog Outputs 17-32 |
| 5 | TC-336 | 16 Channel D/A Module | Analog Outputs 33-48 |
| 6 | TC-336 | 16 Channel D/A Module | Analog Outputs 49-64 |
| N/A | TC-613A | TC-3161 Digital Output Backplane | |
| | | | 16 CHANNEL 32 CHANNEL |
| 7 | TC-3161 | 16 Channel Digital Output Card | Dig Out Ch 1 1-16 Dig Out Ch 1 1-16 |
| 8 | TC-3161 | 16 Channel Digital Output Card | Dig Out Ch 2 1-16 Dig Out Ch 1 17-32 |
| N/A | TC-613A | TC-3161 Digital Output Backplane | |
| 9 | TC-3161 | 16 Channel Digital Output Card | Dig Out Ch 3 1-16 Dig Out Ch 2 1-16 |
| 10 | TC-3161 | 16 Channel Digital Output Card | Dig Out Ch 4 1-16 Dig Out Ch 2 17-32 |
| | | | Repeats for additional digital output cards |
| | | | Right most card |

IMPORTANT:

VERIFY ALL POWER CONNECTIONS AND VOLTAGES PRIOR TO POWERING UP THE CARD FRAME.

ALWAYS VERIFY SAFETY CLEARANCE PRIOR TO POWERING UP HYDRAULICS OR PNEUMATICS!

SECTION 4.0 SETUP AND CONFIGURATION

Cfig, short for configure, is used to setup many of the one-time parameters for the current card frame, as well as where it "lives" within the total system I/O space.

Once configured, further changes should be avoided to prevent conflicts with other frames in the system. Further changes should also be avoided to be sure that the channels are properly configured for the type of analog and digital outputs being used for the controlled device. The configuration profile may be displayed, printed or uploaded for future recovery in the event of a system failure or replacement.

The terminal will display a line similar to the following:

```
CONFIG:D.ip L.oc P.rt S.et U.pdn Xmem Z.ap          Version 93.09E
```

D.ip A soft-switch used to emulate the 8 position hardware dip switch used on older Triad cards, and is used to set variables or options. Most of these are being phased into menu options. The value is entered in HEX and should be set to 10.

L.oc Used to select the analog and digital channels that will be decoded **locally** within this DTU frame.

NAME:

Allows entry of a 32 character name for each frame.

FRAME:

The local card frame ID, from \$F1 to \$F8. This will be used in the future to setup bi-directional communications between the CTU and DTU, RTU, and STU (Servo Terminal Unit) card frames in the system. For now, use a value of \$F1 (although it is not used).

FORMT:

Choose between CTU or STU data formats (C or S). You must make a decision.

ABANK1:

ABANK2:

Up to two (2) banks of 32 analog channels may be selected, for a total of 64 analog outputs. If 32 or fewer channels are required, use 00 for bank 2. Analog banks are designated as A0 through AF:

| | | | |
|------------|-------------|-------------|-------------|
| A0: 1-32 | A4: 129-160 | A8: 257-288 | AC: 385-416 |
| A1: 33-64 | A5: 161-192 | A9: 289-320 | AD: 417-448 |
| A2: 65-96 | A6: 193-224 | AA: 321-352 | AE: 449-480 |
| A3: 97-128 | A7: 225-256 | AB: 353-384 | AF: 481-512 |

AOFST1:

Shifts first logical channel of analogs, e.g. an offset of 16 would make physical channel 1, logical channel 17. Valid values range from 00 to 19.

DBANK1:

For digitals, there are two banks, D0 or D1 that select which **group** of 256 digitals will be used by local digital cards in the DTU.

D0: 1-256

D1: 257-512

DiCHAN:

Selects the number of strobe pulses to generate for local digital I/O card subchannels, and should be set to 16 or 32 based on the cards and configuration being used.

DiSHFT:

It is possible to offset the logical digital card numbers without rewiring the data/strobe signals to the decoder/driver card using the DSHFT parameter. A DSHFT of 0 maps logical card 1 to physical card #1, 2 to 2, etc. By using a DSHFT of 1, physical card 1 will receive data from logical card 2, 2 from 3, etc. The maximum DSHFT is 7.

P.rt Will print (display) the software revision and configuration settings. A communications program (such as ProComm) may be used to capture this information for future reference. (We also suggest that the analog and digital presets be logged.)

S.et Used to set additional operating modes of the STU.

SET: P.ot* S.wt

P.ot Used to assign an external analog input or pot to one of the analog output channels. Four inputs are available (along with 10 V reference and ground) on the 6 pin modular connector on the first TC-346 Analog Input Module in the DTU frame. If one or more pots are assigned, data for that channel follows the input, not show control.

This is currently supported only on STU (Servo Terminal Unit) systems.

S.wt Used to assign an external digital input to a digital output channel OR to an animation macro program stored in EPROM. Up to eight switch inputs are allowed. The signals are active low, TTL level, and are input on the TC-3550 Processor PB0-PB7 pins. By assigning an external switch to a move, "live" operation or interaction is possible.

U.pdn Will request for the associated configuration information from a DTU to be uploaded or downloaded from an external computer.

Xmem Will enter the Extended Memory Manager.

Z.ap Resets ALL parameters, configurations, etc. to the defaults. Use this as a LAST RESORT!!

Do NOT Z.ap all parameters unless you are very sure of what you are about to do, as ALL information as to the "personality" of this processor will be IMMEDIATELY AND PERMANENTLY DESTROYED (unless backed up or printed!).

Application: The configuration should be performed only by qualified personnel, using the parameters defined during initial system design, installation, and calibration. All settings are normally stored in non-volatile memory, and should only require alteration if a processor card (TC-3550) or other components are changed.

Once all parameters and defaults have been configured, the values should be Uploaded to the show control system, or P.rinted to a hard-copy device for backup.

SECTION 5.0 DIAGNOSTICS SYSTEM

DIAG MENU

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

**** IMPORTANT ****

When any digital or analog channel is selected in the D.iagnostics system, it is automatically "blinded" from receiving any data from a higher source, such as the CTU or Show Control Unit (SCU). Otherwise, data from the other device would "wipe out" any local settings. The channel WILL REMAIN BLINDED until explicitly reset by using the R.estore command (independent for the analog and digital submenus).

DIAG: Ana Dig Stat Term Esc Version 93.09E

ANA: Chan Mode Name Pre* Rest Stat Trim

Chan (Channel) - Selects an analog channel to exercise, and allows setting or ramping the current level. A channel that is actually changed here is automatically blinded from higher data sources (SCU, CTU) until R.stored (see below).

Mode Used to set the span and range of each of the analog channels. The default/most common operating mode is "8UN", which stands for 8 bit, unipolar (0 to 10 VDC) operation. To set the mode of a channel, select Mode, then using the "<" and ">" keys, select the channel to set. Press enter, and use the "<" and ">" keys to roll through the various options, which include:

| | |
|-----|--|
| OFF | This channel will not be updated and its output value is undetermined. |
| 8UN | 8 bit resolution, unipolar operation (0 to 10 VDC) |
| 8BI | 8 bit resolution, bipolar operation (-10 to +10 VDC) |
| 12B | 12 bit resolution, bipolar operation (requires 2 analog "channels"). |

Name Allows entry and editing of a 16 character name for the analog function.

* Not implemented yet. Pre* (Preset) Makes the current analog settings the default preset for when the transmitter card is reset or restarted. If the value for analog channel is P.reset to 255, then when the system is Reset, the analog channel will remain at the last value set (from 0 to 255) and will not be cleared or set to a default value.

Analog channels configured for servo operation get their preset from the S.ervo configuration.

Rest (Restore) Resets all analog values to the preset (as defined above) and un-blinds all local analog channels. Data from the Show Control Unit will be used for all analog outputs.

Stat (Status) Status display for the analog channel levels.

Trim Used to set the fine trim for 8 bit analog output channels OTHER than servo channels. The number is from 0-255, but only the 4 MSB's have an effect.

DIG: Chan Name Pres Rest Stat Zap

These are the digital diagnostics options, used to set/clear any or all of the digital channels in the local (or downstream remote) card frame(s).

- Chan (Channel) Allows selection of an output card 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, and blind the output from show control.
- Name Allows entry and editing of a 16 character name for the digital function.
- Pres (Preset) Makes the current digital settings the default preset for when the transmitter card is reset or restarted.
- Rest (Restore) Restores all digital channels to an UNBLINDED condition and sets the values to the default (preset) value.
- Stat (Status) Displays the current status of all the digital channels being received by the card frame. Note that this display will overload the focus/remote terminal and will only be useful on a 24x80 display screen.
- Zap Resets all digital channels to clear or off. Unless this is also made a P.reset (see above), the channels will revert to their preset values when the channels are R.eset or the system is restarted. A prompt of "Are You Sure?" is presented; respond with "Y" to confirm clearing of all channels.
- Stat (Status) Displays the current status of all the analog and digital channels being received by the card frame.
- Term (Terminal) Allows communication between the terminal port and devices connected to one of the auxiliary comm ports on the CTU/DTU 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.

SECTION 6.0 DTU ERROR MESSAGES

STU/DTU

89.10.01 If an error is detected in the incoming data, a character will be displayed on a connected terminal. The errors are:

- # The frame is not recognized, properly framed, or consistent with the configuration of the receiver <OR> the transmitter. (If the transmitter is configured to talk to a CTU, a STU or DTU cannot parse the data!)
- A The analog frame data was corrupt, or not the correct ID for this frame. Use the C.onfig F.ormat command in the transmitter if you are connected directly to a STU, DTU, or RTU to match the analog bank(s) to the installation/programming channels. The analog offsets work in banks of 32, such that:

- A0 = 1-32
- A1 = 33-64
- A2 = 65-96
- A3 = 97-128
- A4 =
- (etc.)

A DTU may process 64 analog channels, so set the ABANK1 and ABANK2 variables to match the offsets as configured in the CTU (Central Terminal Unit).

- D The digital frame data was corrupt, or not the correct group for this frame. There are two digital groups, D1 for channels 1-256, and D2 for channels 257-512.

* There is also a "shift" variable, which allows the physical data output connectors to offset to other digital cards without having to reconfigure the hardware. Using a shift of 0 causes the digital cards in the frame to respond to the normal hardware mapping.

SECTION 7.0 HARDWARE

Cards that are associated with a Data Terminal Unit (DTU) or Remote Terminal Unit are:

TC-3550 (CPU/Data Receiver card) that communicates/controls other cards within a DTU card frame along with an external CTU.

TC-3505 (2 MEG Memory Card) Battery backed-up random access read/write memory (RAM) or non volatile random access read only memory (ROM). The TC-3505 is an optional card.

TC-336 (16 Channel Analog Output) A maximum of four TC-336 Analog Output Modules may be configured per DTU card frame for 64 analog channels.

TC-3161 (16 Channel Digital Output) A maximum of eight TC-3161 High-Current Digital Output cards per DTU or 128 digital channels.

TC-636 (Active Card Frame Backplane) This is the backplane in which are plugged the TC-3550 and the TC-3505. There is one TC-636 per DTU frame even if no analog output modules are used.

TC-613A (Passive Card Frame Backplane) This is the backplane in which are plugged up to two TC-3161 Digital Output cards. Up to four TC-613's may be fitted per DTU card frame.

Power required is +5 VDC for all digital and processor logic, +/-15 for analog output modules, and normally +24 VDC for digital output channels.

Refer to the specific hardware manuals and documentation for each of these boards.

