Send Recv Test

DMXTool EXP

2nd   YES   NO

DMXTool EXP Version 1.0
USER'S GUIDE

11/2/97

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DMXTool EXP Version 1.0
USER'S GUIDE

11/2/97

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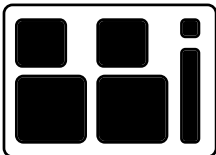
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Table of Contents

Table of Contents, continued

Table of Contents, continued

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I. General Description

The DMXTool EXP is a portable, battery operated RS-422 serial data analyzer designed especially for the DMX-512 protocol widely used in the performance lighting industry (see Section IX – What is DMX512? if you are unfamiliar with the protocol). It is a useful tool for the theatrical stage electrician, theme park technician, TV studio lighting director, or anyone else involved with dimmers, moving lights and color changers.

II. Capabilities

The functions of the DMXTool EXP can be broken into five main categories:

I. Send functions - DMXTool EXP transmits data to a dimmer or other device.

II. Receive functions - DMXTool EXP receives data from elsewhere.

III. Test functions - DMXTool EXP performs specific tests on received data, and tests both loose and installed DMX cables.

IV. Backup functions - DMXTool EXP monitors console data, and takes over if the console fails.

V. Flicker test functions – DMXTool captures a "stage picture" and compares that to the console output. Max, min and time of last deviation are logged.

III. Limitations

The DMXTool EXP does not test for hazardous voltages to ground or between conductors on the DMX cable. It is the user's responsibility to determine if such conditions exist using standard electronic test equipment before connecting the DMXTool EXP to a lighting control system.

IV. Basic Operation

The DMXTool EXP is fully menu driven, and is controlled by seven tactile feedback switches on the membrane front panel.

Power On: Press and hold the YES(on) key until the display shows "DMXTool EXP v1.0"

```
┌─────────────────────────────┐
│   Send    Recv    Test      │
│        DMXTool EXP          │
└─────────────────────────────┘
```
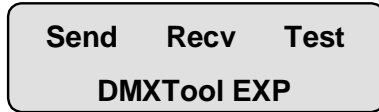
Power Off: Press and hold the NO(off) key until the display blanks (approx. 3 sec.).

Moving around:

> The arrow keys move a flashing block cursor around the display.

> Pressing YES selects the function tagged by the cursor.

> Pressing NO jumps back one menu level. Note that pressing NO four times will always return to the top menu.

V. SEND Functions

Selecting SEND from the main menu sets the DMXTool EXP to TERMINATE mode, (see Figure 3) using the <u>FEMALE</u> XLR for output, and displays the SEND menu of six choices:
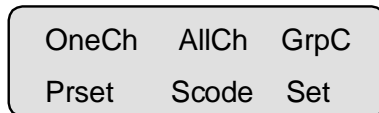
```
┌─────────────────────────────┐
│  OneCh   AllCh   GrpC       │
│  Prset      Scode   Set     │
└─────────────────────────────┘
```

The arrow keys are used to move the cursor, YES selects the function pointed to by the cursor and NO returns to the top menu.

One Channel (OneCh): Selecting One Channel starts DMX transmission out of the Female XLR connector. The display changes to:

```
T001   002  003  004
S000   000  000  000
```

In this case, T indicates Transmitting, S indicates Single channel, and **001** indicates that channel 001 is active. The Levels for channels 1 - 4 are shown on the second line after the S, and indicate all are at 0. The levels may be displayed as decimal or hex numbers or in percentage. Use 2nd + YES to toggle between the three types of displays.

```
T001   002   003   004
Sx00   x00   x00   x00
```

Hex

```
T001   002   003   004
S%00  %00  %00  %00
```

Percent

Using the UP and DOWN Arrow keys the level of the active channel may be faded up or down. The fade rate is determined by the UP and DOWN Arrow repeat time, which may be set in TEST\SETUP\VRATE(see page 34). Keying YES + UP Arrow will set the channel to FULL instantly, while YES + DOWN Arrow will set it to OFF. Pressing the UP and DOWN arrows together will set a channel to 50%.

The active channel may be changed using the Left and Right Arrow keys. The level from the previously selected channel moves into the newly selected channel. This is handy for a quick dimmer check. The rate of advance is determined by the LEFT and

RIGHT Arrow repeat time, which may be set in TEST\SETUP\VRATE(see page 34). Pressing YES + Right Arrow increments the channel number by 10, and YES + Left Arrow decrements it by 10. Using the 2nd key + Left Arrow resets the display to channel 1, while 2nd + Right Arrow set it to channels 509-512.

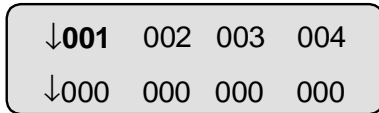The Grand Master is a proportional master fader, and operates on the level after the channel fader. Pressing 2ND + DOWN Arrow keys will fade the Grand Master down, with the display changing to:

```
┌─────────────────────────┐
│ ↓001  002  003  004      │
│ ≡000  000  000  000      │
└─────────────────────────┘
```
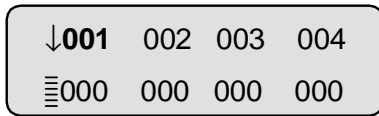
Grand Master Fading Down

Holding the 2ND + DOWN Arrow keys will fade the GM to 0, and the display will change to:

```
┌─────────────────────────┐
│ ↓001  002  003  004      │
│ ↓000  000  000  000      │
└─────────────────────────┘
```

Grand Master at 0

Pressing and holding 2ND + UP Arrow, then YES will BUMP the GM to Full, while 2ND + DOWN Arrow and YES will BUMP to 00. Intermediate GM levels are indicated by the number of lines in the block below the GM arrow. The GM is at 50% as shown here:

```
┌─────────────────────────┐
│ ↓001  002  003  004      │
│ ≡000  000  000  000      │
└─────────────────────────┘
```
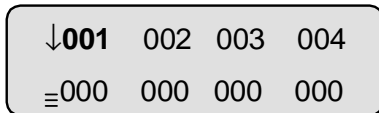
Grand Master at 50%

Note that the levels displayed are PRE Grand Master. The actual stage levels will be less than shown.

Pressing NO from the Single level display will return to the main SEND menu, and stop DMX transmission. The levels are cleared on return to the SEND menu.

All Channels (AllCh):   Selecting All channels starts DMX transmission out of the Female XLR connector.   The display changes to:

```
T001   002   003   004
A000   000   000   000
```

In this case, T indicates Transmitting, and A indicates All channels. The Levels for all channels are shown on the second line after the A, and indicate all are at 0.

Display conventions and keystrokes are similar to One Channel mode, but here the levels of all channels are set to the same value. The key combinations YES + Up Arrow and UP+DOWN Arrow are not allowed in All Channels mode, to prevent accidentally setting all channels to FULL or HALF.

Pressing NO from the All level display will return to the main SEND menu, and stop DMX transmission. The levels are cleared on return to the SEND menu.

Group of Channels (GrpC):   Selecting Group starts DMX transmission out of the Female XLR connector.   The display changes to:

```
T001   002   003   004
G000   000   000   000
```

In this case, T indicates Transmitting, G indicates a Group of channels, and **001** indicates that channel 001 is active. The Levels

for channels 1 - 4 are shown on the second line after the G, and indicate all are at 0.

Keystrokes and display conventions are the same as in One Channel mode. In group mode, however, the level of the active channel is held when a new active channel is selected. Channels are added to the group when they are made active and set to a non-zero level. The Grand Master fader may be used to proportionally modify the levels of all active channels.

Pressing NO from the Group level display will return to the main SEND menu, clear all group levels to 0 and stop DMX transmission.

Preset Mode: Selecting Preset Recall starts DMX transmission out of the Female XLR connector. The first preset transmitted is a blackout, i.e. all channels at 00. The display changes to:

```
 ┌─────────────────────────────┐
 │  Run      Edit    Time       │
 │  - - - - - - Presets - - - - - -  │
 └─────────────────────────────┘
```

Run mode allows fading between presets. **Edit** mode provides for the editing of previously created or captured presets as well as the creation of new presets. **Time** mode allows entry and recording of times on a preset-by-preset basis.

While in the Preset screens, the preset last selected will be transmitted. It is possible to move between Run, Edit and Time without any visible change on stage. Exiting Preset Mode will stop DMX transmission, and reset the active preset to 00 (Factory blackout).

Preset Run: Selecting Preset Run changes the display show:

```
InPr:000       Goto 001
YES=Go         Time: 003
```

This display indicates that Preset 000 (a factory recorded Blackout) is being transmitted. Preset 001 (a user recorded preset) is the next in the sequence, and it will fade in a time of 003 seconds.

Pressing the YES key will start the fade. The display changes to:

```
InPr:000       Goto 001
YES=Go         Time: %01
```

The Time: % display indicates the percentage completion of the fade. At the end of the fade, the display changes to:

```
InPr:001       Goto 002
YES=Go         Time: 003
```

To END a preset fade immediately, press NO. The stage levels will bump to those recorded in the GOTO preset. This is provides a way to quickly end a long fade.

Press YES repeatedly to fade through the recorded presets.

Pressing the UP or DOWN Arrow keys will increment or decrement the next (or Goto) preset. Holding the 2nd key and pressing the UP or DOWN Arrow will change the fade time. The maximum fade time is 255 seconds.

The EXP model also provides Autotimes and Links. To start a fade and enable Autotimes and Links, press 2nd + YES. The display changes to:

```
InPr:000       Goto 001
YES=Go         Time: %01
```

for the duration of the fade into preset 1, and then changes to:

```
InPr:000      Goto 002
          Link   Time: %01
```
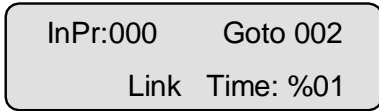
if an Autotime and Link are recorded for preset 1. The Time: % display indicates the percentage completion of the link time.

Execution of Fade times and Autotimes will continue until the end of the linked sequence, or until the NO button is pressed.

There are 56 user recordable presets and a factory recorded Blackout in preset 0. The sequence is preset to 000 on entry to the Preset Recall mode, so the output levels always start at all OFF

Preset Edit: Selecting Preset Edit changes the display to show:
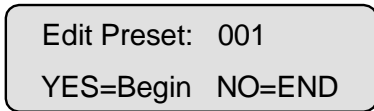
```
Edit Preset:   001
YES=Begin   NO=END
```

Use the UP and DOWN Arrow keys to select the preset to edit. 2ND + Arrows selects first or last preset. Press YES to begin editing. Press NO to return to the Preset mode. Pressing YES will first run a 2 second fade into the preset selected for editing, and then the screen will show:

```
T001   002  003   004
G000  000  000   000
```
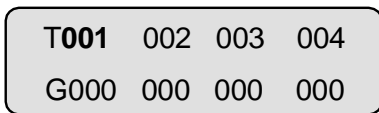
Where the levels displayed are those presently recorded in this preset and transmitted out the DMX link. All of the functions available in Group Mode(as signified by the T and G at the left side of the display) may be used to edit the preset.

The Grand Master may be used to reduce levels proportionally. Set the Grand Master to 0 and recording the preset is the fastest way to create an empty preset. Note that the levels shown on the display are the Preset levels BEFORE the Grand Master is applied. The actual levels recorded will be those ON STAGE, after the Grand Master. Editing presets "blind" is not supported.

To end the editing session, press NO. The screen will change to:

```
Record Prst:      001
Press    YES  or  NO
```

Pressing YES will write the STAGE OUTPUT LEVELS that were created in the edit session into the indicated preset.

Pressing NO will start a 2 second fade back to the PREVIOUSLY recorded levels for the indicated preset. In both cases, the screen will return to the Preset Edit screen, where the user may choose a new preset to edit, or press NO to return to the Preset main screen.

**Preset Time:** Selecting Preset Time changes the display to show:

```
Edit Time: Pr      001
YES = Begin, NO = END
```

Use the UP and DOWN Arrow keys to select the preset to edit. 2ND + Arrows selects first or last preset. Press YES to begin editing. Press NO to return to the Preset mode.

After pressing YES, the display changes to:

```
Pr: 001    Fade: 002S
Link: 002   in      003S
```

Use the UP and DOWN Arrow keys to set the Fade time, 2nd + Arrows to set the Auto time and LEFT and RIGHT Arrow keys to set the Linked preset. Press NO to end the time edit. The screen will change to:

> Record Time: 001
>
> Press   YES or NO
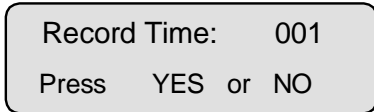
Pressing YES will record the new times. Pressing NO will revert to the previous times.

External GO: When in Preset Recall mode, the DMXTool EXP may be controlled by two external switch closures. This allows a simple switch closure to control DMX devices. Connecting pins 1(ground) and 4 on the Male XLR connector will force a fade to preset 1. Connecting pins 1 and 5 will fade to the next preset in sequence, with Autotimes ENABLED. Refer to Figure 3 for wiring details. External GO is disabled during Backup mode. (see page XX).

Start Code Select (Scode): Selecting Start Code Select allows the user to set the Start Code that will be used for both transmit and receive functions. The display changes to:
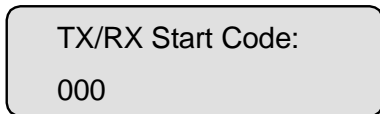
> TX/RX Start Code:
>
> 000

This display indicates that a Start Code = 000 (the standard DMX dimmer code) will be transmitted. This may be set to a different value when controlling special types of equipment.

Pressing the UP or DOWN Arrow keys increments or decrements the Start Code. Pressing 2nd + DOWN Arrow sets the Start Code to 000. Pressing 2nd + UP Arrow sets the Start Code to 255.

To **accept** the value of Start Code shown on the display and return to the SEND menu, press YES. To **revert** to the stored value and return to the SEND menu, press NO. The Start Code selected is stored in EEPROM memory and will remain the set until altered by the user.

Set: Selecting Set allows the user to set detailed timing parameters that affect the TRANSMITTED DMX frame, and offers six choices from the following display:

```
BrkLg     MAB      ICGap

IFGap     Lgth     Deflt
```

Most users will not need to change these parameters. If changed carelessly, the DMXTool EXP may not be able to transmit or receive standard DMX. For that reason, the unit may be returned to factory settings by choosing **Deflt** (Default).   The screen will change to:

```
Reset  unit  to

Fact.  settings?
```

Pressing YES will reset ALL user parameters to the factory defaults. This is a way to "bring back to life" a unit where the user settings are corrupt, or simply set to values that are not intended.

Set Break Length (BrkLg): DMX protocol uses a "line break" (see Section IX – What is DMX512?) to mark the beginning of a "frame" of data. The length of the break is sensed by DMX receiving devices, and if it is too short, the "frame is ignored.

The DMX512/1990 specification requires a break at least 88 microseconds long, with no maximum length specified.   The DMXTool EXP allows the user to select a break length from 44

microseconds to 255 microseconds. This allows for the testing of "short break" rejection by a DMX receiver.

Selecting BrkLg will change the display to:

> Transmit Break
>
> Length: 100 μS
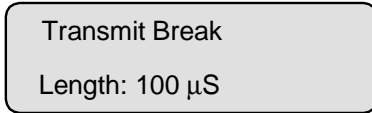
Use the UP and DOWN Arrow keys to adjust the break length. 2ND + UP Arrow will set it to 255 microseconds, while 2ND + DOWN Arrow will set it to the minimum value of 44 microseconds.   Press YES to CONFIRM the new setting. Press NO to REVERT to the old setting.

Set MAB Length (MAB): The MAB, or Mark After Break, is the length of time after a Break before the first character is sent.(see Section IX – What is DMX512?)

The original DMX512 standard specified that this delay must be greater than 4 microseconds. Due to the difficulty that some manufacturers experienced in conforming to this specification, the DMX512/1990 standard increased this to a minimum of 8 microseconds and a maximum of 1 second

The DMXTool EXP allows the user to select a MAB length from 4 microseconds to 255 microseconds. In general, this should be left set to the factory default setting of 12 microseconds, which should be accepted by all DMX equipment.

Selecting MAB will change the display to:
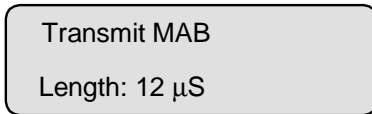
> Transmit MAB
>
> Length: 12 μS

Use the UP and DOWN Arrow keys to adjust the MAB length. 2ND + UP Arrow will set it to 255 microseconds, while 2ND + DOWN Arrow will set it to the minimum value of 4 microseconds.   Press YES to CONFIRM the new setting. Press NO to REVERT to the old setting.

Set Inter Character Gap Length (ICGap): DMX data is transmitted as characters, sent sequentially down the wire. The time between characters is very similar to the length of the MAB (see Section IX – What is DMX512?).

Some DMX equipment has difficulty receiving data sent "back to back" with no intervening time between characters. The user-selectable Inter Character Gap allows the DMXTool EXP to be used to identify such equipment, and to determine the minimum IC gap required for proper operation. This information can be useful to the manufacturer in correcting the problem, or to the user, who may have the option of "slowing down" the transmitting device

The DMX512 standard requires no delay between characters. The DMXTool EXP allows the user to select an IC Gap of 0 microseconds to 255 microseconds. In general, this should be left set to the factory default setting of 12 microseconds, which should be accepted by all DMX equipment.

Selecting ICGap will change the display to:

```
┌─────────────────────────────┐
│  Transmit Inter-            │
│                             │
│  Char Gap: 12 µS            │
└─────────────────────────────┘
```

Use the UP and DOWN Arrow keys to adjust the MAB length. 2ND + UP Arrow will set it to 255 microseconds, while 2ND + DOWN Arrow will set it to the minimum value of 4 microseconds. Press YES to CONFIRM the new setting. Press NO to REVERT to the old setting.

Set Inter Frame Gap Length (IFGap): The Inter Frame Gap is the length of time between the last character of a DMX packet and the end of the Break of the following packet.

This represents "dead time" that the receiving device may need to do something other that receiving DMX! While the DMX512 standard requires that receiving devices tolerate a 0 interframe gap, many do not. This function provides a way to identify such equipment.

The DMX512/1990 standard requires that the time between Breaks be not less than 1196 microseconds. The time between breaks is a function of the basic character time of 44µS (as determined by the 250K baud signaling rate) the number of channels transmitted, the inter-character gap and the inter-frame gap. Thus:

Time = IFGap +BrkLg + MAB + (44µS + ICGap) * Channels

Given: BrkLg = 88µS, MAB = 8µS, IFGap = 0, ICGap = 0

Then: 1196µS = 0 + 88µS + 8µS +(44µS + 0) * 25, so the minimum number of channels that may be transmitted without introducing either inter frame or inter channel gaps (or both) is 25.

Two examples:

Frame size is 24 channels. BrkLg is 88µS, MAB is 8µS, ICGap is 12µS, and IFGap is 0. Frame time is 1440µS, a legal time.

Frame size is 12 channels. BrkLg is 88µS, MAB is 8µS, ICGap is 12µS, and IFGap is 1 mS. Frame time is 1768 µS, a legal time.

Inter frame gaps ARE REQUIRED for short frames. If the factory default settings are used, these details may be safely ignored.

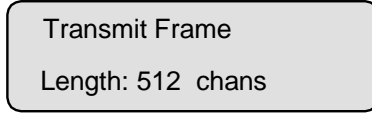Selecting IFGap will change the display to:

> Transmit Inter-
>
> Frame Gap: 10 mS
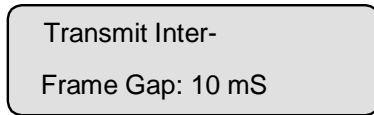
Use the UP and DOWN Arrow keys to adjust the ICGap length. 2ND + UP Arrow will set it to 255 milliseconds, while 2ND + DOWN Arrow will set it to the minimum value of 0 milliseconds. Press YES to CONFIRM the new setting. Press NO to REVERT to the old setting.

Set Frame Length (Lgth): This is a simple one, finally! Set Frame Length sets the number of channels that are transmitted.

That's all! Observe the details described in Inter Frame Gap if you want to set this to less than 25 dimmers.
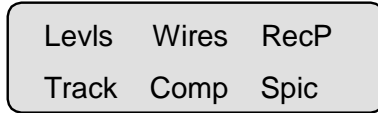
Selecting Lgth will change the display to:

```
Transmit Frame

Length: 512  chans
```

Use the UP and DOWN Arrow keys to adjust the frame length. 2ND + UP Arrow will set it to 512 channels, while 2ND + DOWN Arrow will set it to the minimum value of 1 channel. Press YES to CONFIRM the new setting. Press NO to REVERT to the old setting.
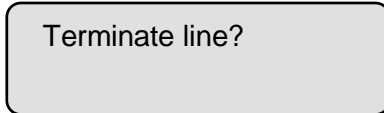
VI. Receive Functions

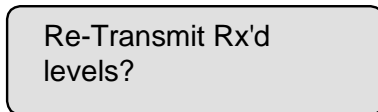Selecting Recv from the main menu displays the Receive menu of six choices:

```
┌─────────────────────────────┐
│  Levls    Wires    RecP     │
│                             │
│  Track    Comp     Spic     │
└─────────────────────────────┘
```

The arrow keys are used to move the cursor, Yes selects the function pointed to by the cursor and NO returns to the top menu.

Levels (Levls): Selecting Levels displays:

```
┌─────────────────────────────┐
│  Terminate line?            │
│                             │
│                             │
└─────────────────────────────┘
```

Pressing YES puts the DMXTool EXP in TERMINATE mode, and places a 110 ohm terminating resistor across pins 2 and 3 of the Male XLR connector. Pressing NO puts the DMXTool EXP in PASS-THRU mode and removes the terminating resistor.

In TERMINATE mode (see Figure 3), the DMXTool EXP receives data on ONLY THE MALE XLR connector. This mode should be used when the DMXTool EXP is the last device on the DMX data link, or for DMX Filter (see below). After selecting TERMINATE mode, the following screen appears:

```
┌─────────────────────────────┐
│  Re-Transmit Rx'd           │
│  levels?                    │
│                             │
└─────────────────────────────┘
```
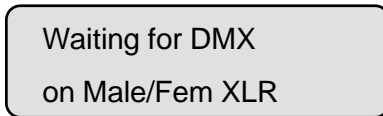
Answering YES here will place the DMXTool EXP in "**DMX Filter**" mode.

In **DMX FILTER** mode DMX levels received on the MALE XLR connector are buffered in memory, and re-transmitted out the FEMALE XLR connector, with the user's choice of DMX frame timing. This allows a "fast" DMX stream to be "slowed down" by selecting the appropriate combination of Break Length, MAB, Inter-character and Inter-frame gaps. The parameters set in the Send/Setup menu are used here for re-transmission timing. The DMXTool EXP displays the received/transmitted levels while in this mode. In order to handle the simultaneous receptin and transmission of data, the screen update rate is reduced to 2-3 updates per second. The screen update rate DOES NOT indicate the DMX level update rate!

In PASS-THRU mode (see Figure 2), the DMX transmit pair (pins 2 and 3) is passed directly through from the Male to the Female XLR connector. This allows the DMXTool EXP to be inserted between the lightboard and dimmers to monitor the line. It also allows monitoring of either a Male or Female connector.
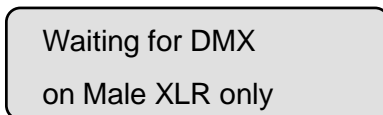
In TERMINATE mode (see Figure 3), the DMXTool EXP receives data on ONLY THE MALE XLR connector. This mode should be used when the DMXTool EXP is the last device on the DMX data link.

If no DMX data is present, the display will show:

> Waiting for DMX
>
> on Male/Fem XLR

if in PASS-THRU mode or:

> Waiting for DMX
>
> on Male XLR only

if in TERMINATE mode.

Once a valid DMX data stream is detected, the display will change to:

```
┌─────────────────────────┐
│ R001   002  003   004   │
│ L000   000  000   000   │
└─────────────────────────┘
```

Where **R** indicates Receiving, and L indicates Level. The Levels for channels 1 - 4 are shown on the second line after the L, and indicate all are at 0. The levels may be displayed as decimal or hex numbers or in percentage. Use 2nd + YES to toggle between the three types of displays.

```
┌─────────────────────────┐
│ R001  002   003   004   │
│ Lx00   x00   x00   x00  │
└─────────────────────────┘
```

<center>Hex</center>

```
┌─────────────────────────┐
│ R001  002   003   004   │
│ L%00 %00  %00  %00      │
└─────────────────────────┘
```

<center>Percent</center>

During data reception, the DMXTool EXP checks the voltage levels on the DMX receive pair (pins 2 and 3) to make sure that they are within tolerance for proper operation. It is quite possible for the negative (pin 2) wire to be broken and have some data get through. The result is a partially functional DMX link. If the DMXTool EXP detects invalid voltage levels, the **L** will change to an **X.** Further investigation may be made using the WIRES mode, or using an oscilloscope with the SCOPE TRIGGER. (see Section IX – What is DMX512? for an explanation of the broken wires problem)

It is possible that the X may be displayed intermittently when monitoring a DMX line with 0 inter character delay. If the X flashes intermittently, investigate the data line parameters using

TEST/RATE. If the maximum frame rate is above 42 for a 512 channel system, ignore the X.

The four channel display window into the 512 channel DMX data stream may be moved using the Left and Right Arrow keys. Pressing YES + Right Arrow moves the window to the right 10 channels, and YES + Left Arrow moves it to the left by 10. Using the 2nd key + Left Arrow resets the display to channel 1, while 2nd + Right Arrow sets it to the last 4 channels received.

To Find the Next channel with a level greater than a user selectable threshold, press 2nd + UP Arrow. To Find the Previous channel with such a level, press 2ND + DOWN Arrow. The Find threshold level is set in TEST/SETUP/FIND (See page 33).

The search begins after(or before) the last channel shown on the screen. (If channels 2-5 are displayed, the search starts at channel 6) If no active channels were found, the display will show the last four DMX channels received, indicating that there are no active channels from the start point to the end of the frame. Otherwise, the display will be positioned to show the first active channel. Repeatedly pressing 2nd + UP Arrow will scan the entire DMX frame.

2ND + DOWN Arrow operates similarly, but in reverse.

Note that a level of 001 in the decimal or hex displays is less than 1%. If the Find function stops before the end of the frame, and all channels show %00, change to decimal or hex mode to display the actual level received.

Pressing NO from the Level display will return to the main Receive menu and reset the DMXTool EXP PASS-THRU state. Pressing NO once again will return to the main menu.

Wires (Wires): Selecting Wires places the DMXTool EXP in a mode that samples the DMX receive pair (pins 2 and 3) and displays the electrical state of the wires. The display will show:

> Recv Data Lines:
>
> P3:OPEN   P2:OPEN

if nothing is connected. The states displayed are:

> LOW: Voltage with respect to Pin 1 (ground) is less than 1.5V.
>
> OPEN: Voltage is greater than 1.5V and less than 3V.
>
> HIGH: Voltage is greater than 3V.
>
> DATA: Voltage is changing from Low to High rapidly. Not necessarily good data, but looks something like it.

Under normal conditions, the display should indicate DATA on both pins when a valid DMX signal is connected to EITHER male or female connector.

This function can be used to help isolate the cause of an "**X**" display in the Levels mode.

Scope Trigger: When in Receive/Levels/Terminated mode, the DMXTool EXP can be used to synchronize the horizontal sweep of any triggered sweep oscilloscope to the DMX data frame. This will provide a stable display that is very useful for detailed troubleshooting of link hardware problems.
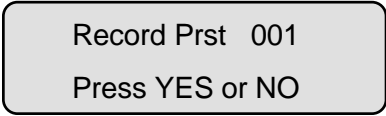
Set your scope to External Trigger, with a trigger threshold of 2V (or "logic level"), negative edge triggered. Connect a probe the External Trigger input of the scope. Connect the probe ground to pin 1 of the DMXTool EXP Female XLR, and the probe tip to pin 5 of the same connector. A test cable can be fabricated to ease this connection. Connect one vertical input channel to pin 2 of the Male XLR and one to pin 3. Ground both vertical probes to pin 1 of the Male connector. (This will require the removal of the XLR back shell on the DMX cable). The scope should then display the end of the BREAK event at the far left of the screen, followed by the start code and dimmer levels.

Record Preset (RecP): Selecting Record Preset puts the DMXTool EXP in PASS-THRU mode. If no DMX data is present, the display will show:
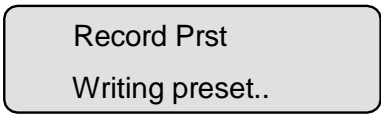
> Waiting for DMX
>
> on Male/Fem XLR

Pressing NO will return to the Receive menu. When DMX data is detected, the display will change to:

> Record Prst   001
>
> Press YES or NO

Pressing the UP or DOWN Arrow keys will increment or decrement the preset number. The DMXTool EXP provides 56 user recordable presets. Holding the keys will scroll up or down the preset number. Note that preset 000 is a factory Blackout preset and may not be re-recorded by the user.

Pressing the YES key will record a snapshot of the received DMX data into preset 001. This process may take up to 2 seconds. The DMX levels must be stable (i.e. NOT fading) during the record process. The display will show:

> Record Prst
>
> Writing preset..

while the preset is being written into EEPROM. Pressing the NO key will return to the Receive menu.

Tracking Backup(Track): Tracking Backup provides a way to guard against failure of the main console or AC power failure at the console position. By inserting the DMXTool EXP between the console and the dimmers, and recording several backup presets (either using RecP to capture them, or Edit to create them), it is

possible to continue a show WITHOUT power to the console, or with a defective console.
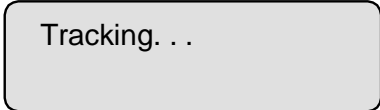
Setup:

Connect the console DMX output to the DMXTool EXP Male XLR plug.

1. Connect the DMXTool EXP Female XLR to the dimmers.

2. Connect the DMXTool EXP AC adapter to the unit and to the AC mains.

3. Turn on the DMXTool EXP and select Recv\Track. Observe that the display shows:

> Waiting for DMX
>
> on Male/Fem XLR
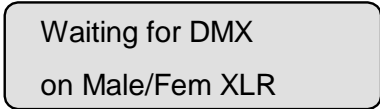
4. Turn on the console, and observe that the display changes to:

> Tracking. . .

5. The DMXTool EXP is now monitoring the DMX output of the console, and waiting for it to stop. At this time the automatic power down timer is disabled, to prevent it from timing out while running backup! To stop this monitoring, and TURN OFF the backup, press NO.

6. If the console fails to transmit valid DMX for approx. 1 second, the DMXTool EXP will disconnect the console from the DMX line (the internal relay will audibly "click") and start transmitting the "stage picture" that console sent last before quitting. The display will then change to:

```
Holding        Goto 001

YES=Go         Time: 001
```

7.   The DMXTool's behavior now depends on the setting of the Auto GO flag in TEST\SETUP\BkUp. If set to NO, the DMXTool EXP will remain in the Holding screen until the user does one of two things:

- Presses YES to fade from the "stage picture" to a preset, or

- Presses NO to restore control to the console.

8.   If set to YES, then the DMXTool EXP will immediately start a fade to preset one in the time set in the preset time screen. Control may be restored to the console by pressing NO.

9.   The user may select preset numbers and fade times using the syntax of Preset\Run mode. Control may be restored to the console by pressing NO at any time.

Compare console to Stage Picture(Comp): Compare provides a way to check the stability of the console output. Simply put, Compare allows you to find out why a dimmer channel is flickering or a color scroller is jumping about.

Compare allows you to place the blame for erratic behavior where is belongs; on the console, the DMX distribution system, or the DMX receiving device itself.

Using Compare to find unstable DMX data requires 8 steps:

1.   Connect the DMXTool EXP between the DMX source(lightboard) and the device that misbehaves (dimmer, scroller, moving light). The data line FROM the console must be connected to the DMXTool EXP Male XLR plug. The data line TO the dimmers

connects to the DMXTool Female XLR plug. If you suspect problems in the DMX distribution system and wiring, start at the output of the console using a known-good short DMX cable. If no errors are found, move the DMXTool through the system towards the dimmers until the problem is located.

2. Connect the DMXTool EXP to AC power using the AC adapter. Auto power down is disabled when operating in the Compare mode.

3. Set up the lightboard to provide a stable output. The lightboard must NOT be running fades or loops, on ANY channels.

4. Capture a Stage Picture. Select Recv\Spic. The display will change to:

> Record new stage
>
> pict. for comp?

Press YES to record, NO to exit.

5. Run Compare to look for differences. Select Recv\Comp. The display will change to:

> Comp. Threshold
>
> Is: 001   OK?

Use the UP and DOWN Arrow keys to set the minimum difference from the Stage Picture that should be logged as an error. 2ND + UP Arrow sets the threshold to the maximum of 128. 2nd + DOWN Arrow sets it to the minimum of 1. Press YES to continue, or NO to quit. The display changes to:

> Clear error mem?

If you are starting a new test, press YES. If you are continuing a previous test, press NO. To quit out of this mode, press NO. The display changes to:

> Clearing memory -
>
> Pls wait 10 sec.

After memory is initialized, the display changes to:

> EL Time: 00:00:10
>
> Er:000 F: L:

Some time later, an error occurs:

> EL Time: 00:01:14
>
> Er:003 F:004   L: 004

At this point, the compare run has started, and the DMXTool EXP is looking for differences between the Stage Picture and the console output. What does this screen show? Quite a lot.

EL TIME: 00:01:14 indicates that we are 0 hours, 1 minutes and 14 seconds into the test. If you note the local time that the test started, you will be able to determine the exact time that each failure occurred by adding elapsed time to the starting time.

Er:003 indicates that there have been 3 errors detected.

F: 004 Indicates the First channel with an error.

L: 004 Indicates the Last channel with an error.

6. Stop Compare and analyze the results.

When you are satisfied that the errors have been captured, or no errors are found, press NO to end the test. This display then changes to the error reporting screen:

```
Er:000    T00:00:00

C001:005<005<005
```
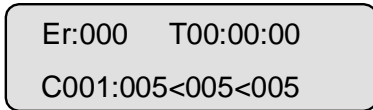
C001 indicates channel 1. The error display always starts with channel 1, even if it has no errors.

Er000 indicates that no errors were detected.

7. Search for the next error. Press UP Arrow once to advance to the next error or DOWN Arrow to go back to the previous error. The display changes to (our example has errors on channel 4):

```
Er:003    T00:01:14

C004:003<005<255
```
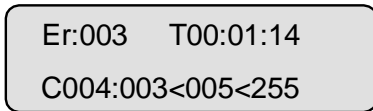
Er:003 indicates 3 errors on this channel.

T00:01:14 indicates the last error on this channel occurred 1 minute, 14 seconds into the test.

C004 indicates the channel displayed is 4.

$003 < 005 < 255$ indicates that the minimum value received on channel 4 was 003; the recorded value in the stage picture was 005 and the maximum value received was 255, or full.

8. When you are finished viewing the errors, press NO to return to the Recv menu. You may restart the test without loosing the current results by answering NO to the "Clear err mem?" screen.

VII. TEST Functions

Selecting TEST- from the main menu displays the TEST menu of six choices:
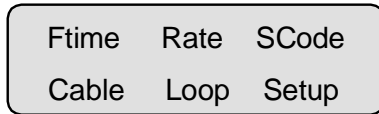
```
 Ftime    Rate   SCode
 Cable    Loop   Setup
```

The arrow keys are used to move the cursor, Yes selects the function pointed to by the cursor and NO returns to the top menu.

Frame Timing (Ftime): Selecting Frame Timing sets the DMXTool EXP to PASS-THRU mode starts DMX reception on both the Male and Female XLR connectors. The display changes to(some typical data values are shown as an example):

```
 BK:088 µ↑MAB:012µ
 FR:055m↓IF:012m
```
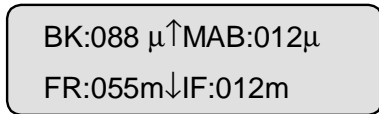
Present Link Timing

Where :

BK:088µ indicates the last Break was 88 microseconds long.

MAB:012µ indicates the last Mark After Break was 12 µS.

FR:055m indicates the last Frame was 55 ms Break – Break.

IF:012m indicates that there was 12 ms Inter Frame gap after the last channel and before the next break.

The NO key returns to the TEST menu. Use the UP and DOWN Arrow keys to select the Max and Min screens alternately.

Note that due to the very tight timing constraints in this screen, the NO key is the only key active if DMX is dropped. If

the UP and DOWN Arrow keys stop operating, DMX has been lost. Press NO to exit, and re-enter after restoring DMX.

```
BK<100 µ↑MAB<016µ
FR<065m↓IF<014m
```

Maximum Link Timing

The Maximum screen displays the LARGEST recorded values for each parameter.

```
BK>086 µ↑MAB>008µ
FR>025m↓IF>002m
```

Minimum Link Timing

Likewise, the Minimum screen displays the SMALLEST recorded values for each parameter.

Frame Rate and Length (Rate): Selecting Frame Rate and Length sets the DMXTool EXP to PASS-THRU mode starts DMX reception on both the Male and Female XLR connectors. The display changes to:

```
Frame lgth:    512
F/S:  14 < 15 < 16
```

The number of channels transmitted is 512. The lowest frame rate is 14 per second. The present rate is 15 per second. The highest rate was 16 per second.

The NO key returns to the TEST menu.

Start Code Received (Scode): Selecting Start Code Received sets the DMXTool EXP to PASS-THRU mode starts DMX reception

on both the Male and Female XLR connectors. The first four different received start codes are shown as:

```
Rx'd Start Codes:
000
```
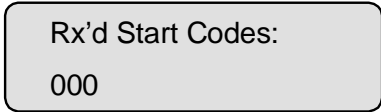
Additional start codes appear to the right on the bottom line of the display.

The NO key returns to the TEST menu.

Cable Test (Cable): This function performs a "double ended" cable test on loose DMX cables. *Do NOT select Cable Test when the DMXTool EXP is connected to any other equipment.* Doing so may result in overheating of the DMX line transceivers in all devices connected.

To test a DMX cable, connect BOTH ENDS to the DMXTool EXP. Select Cable Test. The display will show:

```
DMX: 2/3      AUX:4/5
   GOOD         GOOD
```

if both pairs are free of shorts, opens and pin reversals, and are capable of carrying DMX data.   A short or open will be shown as "BAD" and a pin reversal as "REVERSE".

Note that shield (pin 1) continuity is not tested. Shield continuity is not required (and in some cases not desired) for proper DMX transmission. If you want to check the shield continuity, a simple ohmmeter check will suffice.
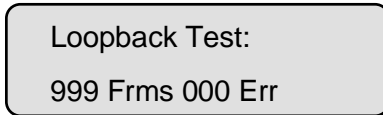
The NO key returns to the TEST menu.

Loopback Test (Loop): This function performs a "single ended" cable test on loose or permanently installed DMX cables. This test requires both the primary DMX pair (pins 2 and 3) and the AUX pair (pins 4 and 5). It will not test cables where only pins 2 and 3 are connected.

If you need to test an installed cable with only the primary pair wired, and have a known good console (or a second DMXTool), the Stage Picture/Compare test method may be used. See page 24 for detailed instructions.

The Loopback Test also requires a Loopback Plug. This is a Male XLR 5 pin connector with pin 2 connected to pin 4 and pin 3 connected to pin 5. This may be purchased from BBI or fabricated in the field.
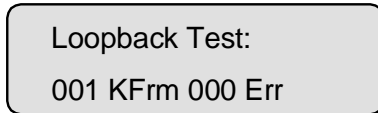
Connect the Loopback Plug to the Female DMX cable connector. Connect the Male DMX cable connector to the DMXTool EXP Female connector.

To begin the test, select LOOP and press YES. After a few seconds, The display will show:
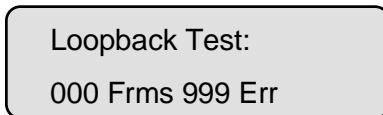
> Loopback Test:
>
> 999 Frms 000 Err

If the cable is able to pass data without errors. When the number of frames exceeds 999, the display will change to:

> Loopback Test:
>
> 001 KFrm 000 Err

where 001 KFrm indicates 1 K (1000) frames. The number of frames is equal to the Kframe count times 1000.

If the cable is unable to pass DMX data both directions the display will show(after 2-3 seconds):
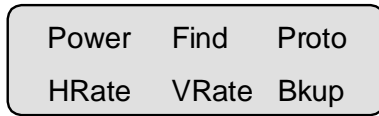
> Loopback Test:
>
> 000 Frms 999 Err

Marginal cables will show some combination of frames and errors.

The NO key returns to the TEST menu.

Misc. Setup Functions (Setup): This is not, strictly speaking, a TEST function, but it had to go someplace.

Selecting Setup from the test menu displays the Setup menu of six choices:

```
Power    Find    Proto

HRate    VRate   Bkup
```

The arrow keys are used to move the cursor, Yes selects the function pointed to by the cursor and NO returns to the top menu

Power off time(Power):

he DMXTool EXP will turn itself off after a user selectable time interval without keypad activity. The default as shipped from the factory is 5 minutes, but the user may select from 000 (never turn off) to 240 minutes (4 hours). To change the power off time, select POWER and press YES. The display will show:

```
Auto Power Down:

005 Min 0 = Never
```
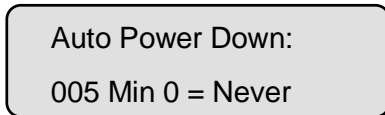
Use the UP and DOWN Arrow keys to scroll the time up and down 2nd + UP Arrow sets the time to 240 minutes. 2nd + DOWN Arrow sets the time to 000 minutes (never turn off).

To **accept** the modified time and return to the TEST menu, press YES. To **revert** to the stored value and return, press NO.

Find Channel Threshold (Find):

The Find Next Active Channel function in the Receive screens look for the next channel above a threshold level. This setup function sets that threshold. The default as shipped from the factory is a level 0f 003 decimal. This level insures that only channels that will indicate 001% or greater are found. This minimizes confusion in the Percent level displays, were channels

below 03 decimal indicate as 00%. The user may freely change this value.

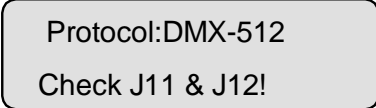To change the Find threshold, select Find and press YES. The display will show:

```
Find Channels

Above:  003
```

Use the UP and DOWN Arrow keys to scroll the time up and down 2nd + UP Arrow sets the level to 254. 2nd + DOWN Arrow sets the time to 001.

To **accept** the modified level and return to the TEST menu, press YES. To **revert** to the stored value and return, press NO.

Select Protocol (Proto):

The DMXTool EXP operates on both DMX512 and Colortran® CMX protocols. To change protocol, select Proto and press YES. The screen will change to:

```
Protocol:DMX-512

Check J11 & J12!
```

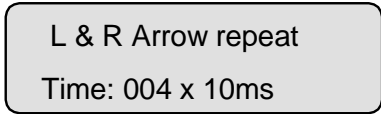Use the UP and DOWN Arrow keys to select Colortran or DMX512 protocol. Press YES to end the selection.
NOTE: The processor operating frequency determines the data rate. Jumpers J11 and J12 (inside the case) must be set to match the selected protocol.

### Horizontal and Vertical Repeat Rate (HRate and VRate):

The key repeat rate of the Horizontal (L and R) and Vertical (U and D) Arrow keys may be controlled by the user. This control is by setting the time between auto key events. For example, if the

repeat time is set to 500 milliseconds, the auto repeat time is ½ second, and the rate is 2 per second. This is useful to change the rate of advance in the Transmit\OneChannel screen, as well as to change the fade rate in all of the transmit screens.

To change the Horizontal or Vertical repeat rate, select HRate or VRate as desired and press YES. The display will show:

> L & R Arrow repeat
>
> Time: 004 x 10ms

if HRate was selected, or:

> U & D Arrow repeat
>
> Time: 004 x 10ms
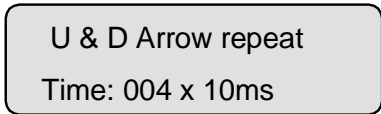
if VRate was selected.

Use the UP and DOWN Arrow keys to scroll the time up and down 2nd + UP Arrow sets the time to 255 * 10ms, or 2.55 seconds. 2nd + DOWN Arrow sets the time to 001 * 10ms, or 10 milliseconds (quite fast) The factory default is 004 * 10 ms.

To **accept** the modified time and return to the TEST menu, press YES. To **revert** to the stored value and return, press NO.

Backup Auto Go Enable(BkUp):

The Track and Hold function operates in two modes:

1. Hold last stage picture until the operator presses YES to go to a preset, or NO to return control to the console.

2. Automatically fade from the stage picture to Preset 1.

To change this mode, select BkUp and press YES. The display will show:

> Backup:Auto go
>
> To preset 1: No

if Auto GO is disabled, or:

> Backup:Auto go
>
> To preset 1: Yes

if it is enabled. In either case, you must press YES to exit and set Auto GO mode ON, or NO to exit and set Auto GO mode OFF.

VIII. Power Supply

The DMXTool EXP is powered by four AA Alkaline batteries, or optionally by a UL listed AC adapter. If used continuously, the average battery life in other than SEND mode 60 hours. In SEND mode the battery life is dependent on the number of DMX receivers connected. With 10 loads the battery life should exceed 30 hours.

Used intermittently, batteries will last much longer. The internal power supply is capable of operating off of 3 volts or greater. The 6 volt (4 cell) pack can be drained down to .8 volts/cell providing cost effective battery use.

For continuous use, the optional AC adapter is recommended. It disconnects the internal batteries and will power the unit indefinitely. The power connector is a 3.5mm mini phone plug, center pin positive at 6 volts DC, 35 milliamps maximum.

CHANGING BATTERIES:

Place the DMXTool EXP on a flat surface face down. Remove the two Phillips head screws on the back of the unit, indicated by two arrows marked "BATTERY ACCESS" on the quick reference label. Lift the bottom cover off and fold it up and away from you. Replace the batteries with four new ALKALINE AA type.

Do NOT OVERTIGHTEN the cover screws when securing the back cover!

IX. What is DMX512?

DMX512 is a standard developed by the United States Institute for Theatre Technology (USITT) for a method of digital communication between controllers and dimmers. The standard specifies the electrical characteristics, cable type, connector type, data format and protocol.

ELECTRICAL:

The USITT standard references EIA standard RS-485 for the electrical part of the specification. Briefly, RS-485 specifies a method of transmitting serial data over a differential pair of wires from one transmitter to many receivers. The number of receivers is limited by the ability of the transmitter to source current. RS-485 requires a transmitter to be able to drive 32 "unit loads", or receivers.

To circumvent this limitation, IC manufacturers have developed receivers that present a **fractional unit load** to the transmitter. The lowest load available is 1/8 unit load, allowing up to 256 receivers on a single link.

Shown below is a typical RS-485 data distribution system:
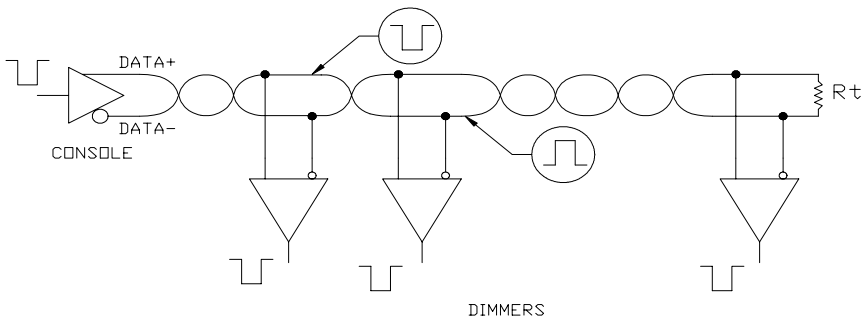
The transmitter (located in the console) takes in "single ended" data (one line referenced to ground) and emits "differential" data. The rules for differential data are:

Rules for transmitters:

INPUT	DATA +	DATA –
HIGH	HIGH	LOW
LOW	LOW	HIGH

Rules for receivers:

DATA+	DATA -	OUTPUT
HIGH	HIGH	HIGH
LOW	LOW	HIGH
HIGH	LOW	HIGH
LOW	HIGH	LOW

As you can see from the table, the DATA + and DATA – lines are always at opposite levels. There is no ground wire required between the transmitter and receivers. The RELATIVE level of the DATA+ and DATA- lines determines the output level.   If DATA+ and DATA- **are not** at opposite levels, then the output of a receiver remains in the HIGH, inactive or MARKING state.

As long as **both** the DATA+ and DATA- wires are connected, this scheme provides a channel that is much less sensitive to noise than a ground referenced system. Noise that is picked up on both wires (called "common mode noise") is rejected, since the receiver is sensitive to the **difference between** the two lines, rather than the absolute voltage above ground.

As an example of what can go wrong electrically with a RS-485 link, consider this example:

FAILURE ON MAIN LINK - TERMINATED
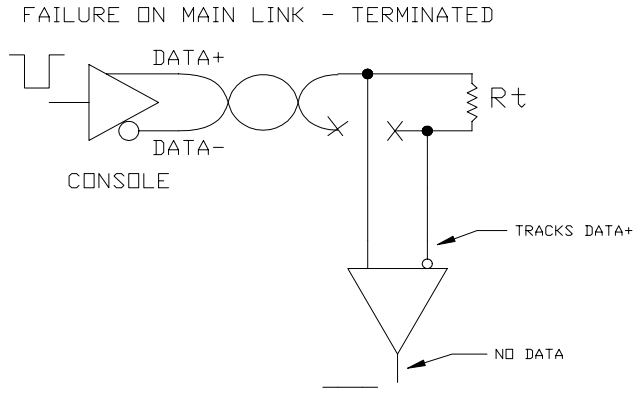
Here, there has been an open circuit failure in the link somewhere between the console output connector and the first dimmer rack. A terminating resistor is connected across the link after the last dimmer (only one dimmer is shown for space reasons). In this example, the DATA – side of the receiver is pulled to the same level as the DATA+ side by the terminating resistor. This results in an inactive, or MARKING output at the receiver, and is a valid fault. No data is received, and no noise is received. The user is alerted to the fault (the dimmers don't work) and can use the DMXTool EXP to troubleshoot the line.

To find this type of fault, connect the DMXTool EXP directly to the dimmer rack using a known good jumper cable. Connect the DMX feed cable to the DMXTool EXP Select Recv\Wires. Observe that DATA is found on both wires. The DMXTool EXP sees HIGH/LOW transitions on both pins. Now change to Recv\Levels\Unterminated. The display will show "Waiting for DMX", as no valid data is received.

If there is no terminating resistor, the same wire fault produces rather different symptoms, as in:

FAILURE ON MAIN LINK – UNTERMINATED

DATA+

DATA-

CONSOLE

FLOATS TO 2.5V

NOISY DATA
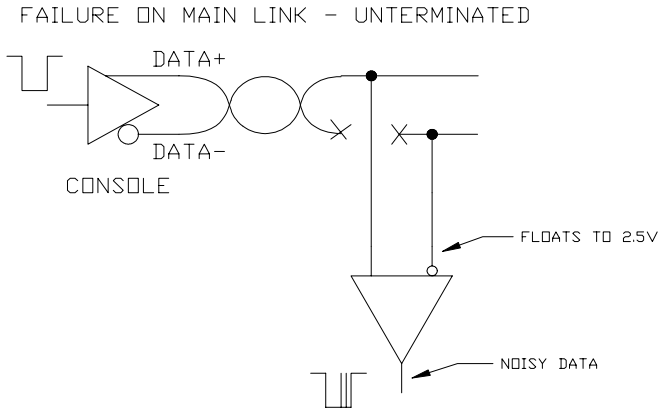
Again, the fault is between the between the console output connector and the first dimmer rack. There is NO terminating resistor. In this example, the DATA – side of the receiver will float to approximately ½ of the supply voltage, or 2.5 volts. This results in output at the receiver, which may be noisy. The user is not alerted to the fault immediately, as the dimmers may well continue to operate.

The DMXTool EXP is ideally suited to finding this type of fault. Again, connect the DMXTool EXP directly to the dimmer rack using a known good jumper cable. Connect the DMX feed cable to the DMXTool EXP Select Recv\Wires. Observe that DATA is found on DATA+ and that DATA- is OPEN.

A third type of fault involves an open in a cable drop to an individual dimmer rack:
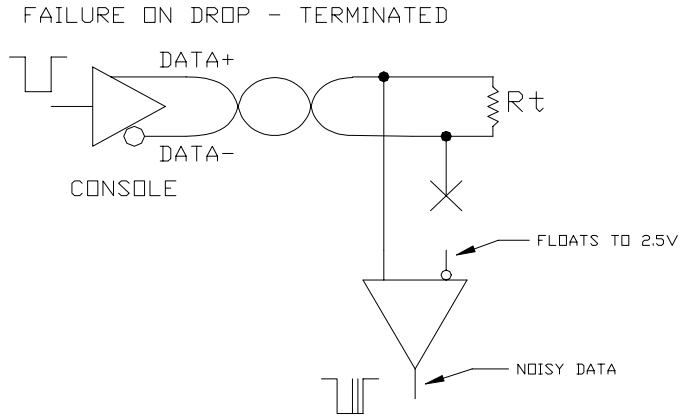
This is similar to the preceding example, and illustrates that the terminating resistor does not always provide a fault indication. Troubleshooting is performed in the same way as shown previously.

From theses examples it is obvious that the RS-485 scheme does not provide a confidence check that both wires are, in fact, connected. It will continue to pass data **without** the immunity to common mode noise provided by a differential system with **only one wire connected.**

CONNECTORS:

The standard specifies the type of connectors and wire to be used for DMX512 distribution:

Connector Type:

"XLR" 5 pin Female connectors on the console output

"XLR" 5 pin Male connectors on the dimmer input.

Cable Type:

Shielded, twisted pair data cable, suitable for RS-422/RS485 use. Examples include:

1 pair: Belden 9841

2 Pair: Belden 9842

Note that only one pair is required to operate dimmer type devices. Some manufacturers have made use of the optional second pair to return diagnostics data from dimmers, color changers and other devices.

Pinout:

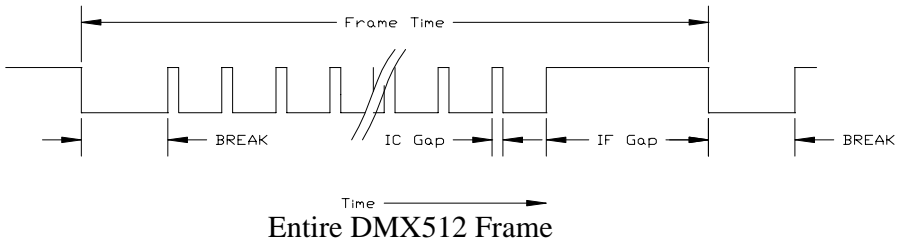| Pin 1	Shield (may omit one end)
Pin 2	Dimmer data minus
Pin 3	Dimmer data plus
Pin 4	Aux data minus
Pin 5	Aux data plus

PROTOCOL:

The DMX512/1990 standard specifies that data shall be transmitted as asynchronous, serial 250 K baud data, with one start bit, 8 data bits and 2 stop bits. At 250 K baud, one bit time is equal to 4 µSeconds. The diagram below illustrates the single 11 bit character 0x55:
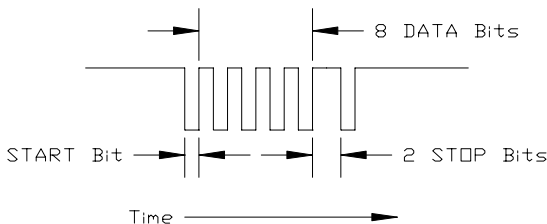
The Transmission Protocol specified is: a Line Break, followed by a MARK after the Break, followed by an 8 bit Start Code, followed by up to 512 8 bit dimmer levels. This is illustrated below:
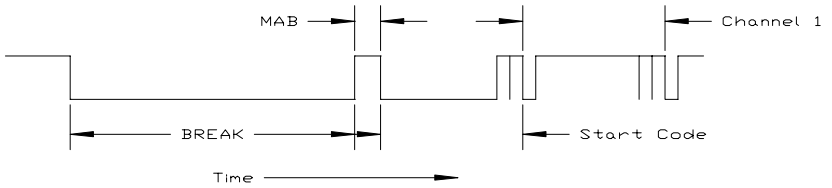
Beginning of DMX512 Frame

Entire DMX512 Frame

Description	MIN	TYP	MAX
BREAK	88 µSec.	88 µSec.	Not Spec.
MAB	8 µSec.	-	1.0 Sec.
Start Bit	3.92 µSec.	4.0 µSec.	4.08 µSec.
Data Bit	3.92 µSec.	4.0 µSec.	4.08 µSec.
Stop Bit	3.92 µSec.	4.0 µSec.	4.08 µSec.
Inter Char Gap	0	0	1.0 Sec.
Inter Frame Gap	0	0	1.0 Sec.
Frame Time	1196 µSec.	-	1.0 Sec.

DMX512/1990 Timing

The Start Code identifies the TYPE of data that follows. The standard specifies only one type of data: DIMMER LEVELS. The start code 0 identifies Dimmer Levels Follow.

Some manufacturers have made use of non-0 start codes for special signaling applications. The standard requires that dimmer-type devices be tolerant of non-0 start codes, but does not specify further what the type of data is that follows a non-0 start code.

Up to 512 dimmer levels may follow the start code. The levels are sent as 8 bit binary, with 00 being the lowest level and 0xff the highest. The level transmitted does not determine the absolute voltage output of the dimmer. Definition of the dimmer transfer function (dimmer curve) is left to the dimmer manufacturer.

No minimum number of dimmers is specified. The only restriction on "short frames" is that the time between successive Breaks shall

be greater than 1196 μSeconds. There are also no guaranteed minimum inter character or inter frame gaps, although many types of non-dimmer equipment require such gaps.

Upon loss of the DMX signal, the standard requires that dimmers hold the last level received for a minimum of one second. No maximum hold time is specified.
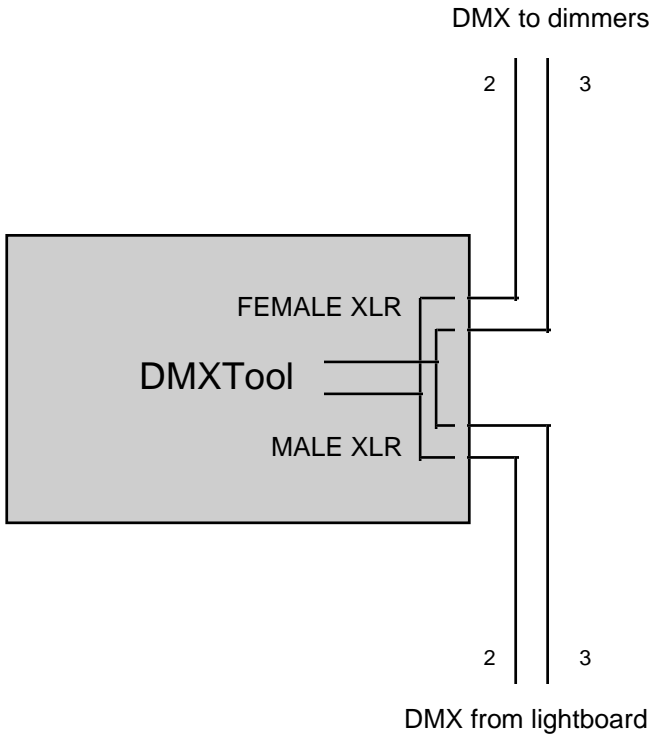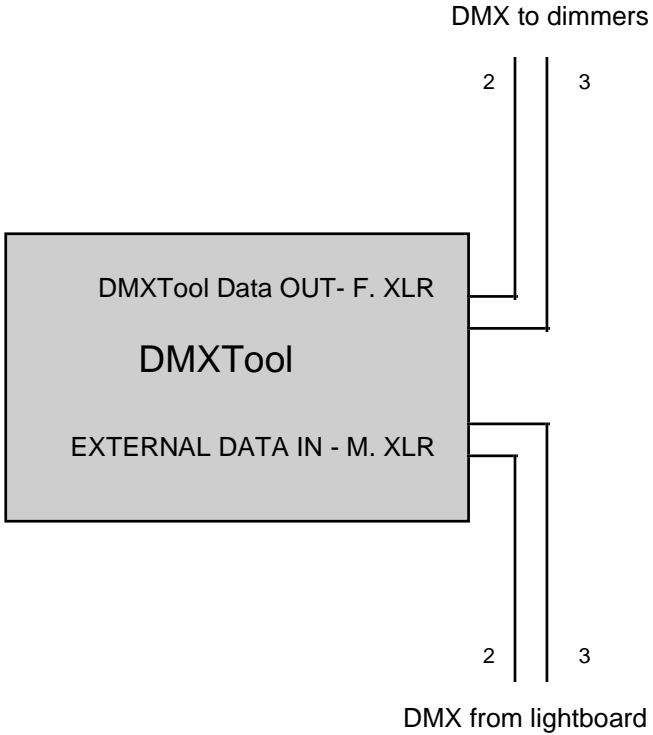
DMX to dimmers

2   3

FEMALE XLR

DMXTool

MALE XLR

2   3

DMX from lightboard

Fig. 1 - FEED-THRU MODE

DMX to dimmers

2   3

DMXTool Data OUT- F. XLR

DMXTool

EXTERNAL DATA IN - M. XLR

2   3

DMX from lightboard

Fig. 2 - TERMINATE MODE

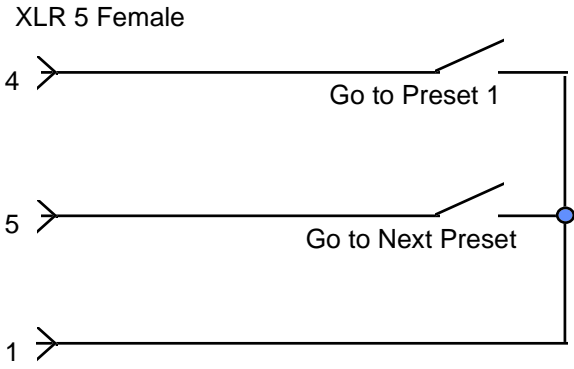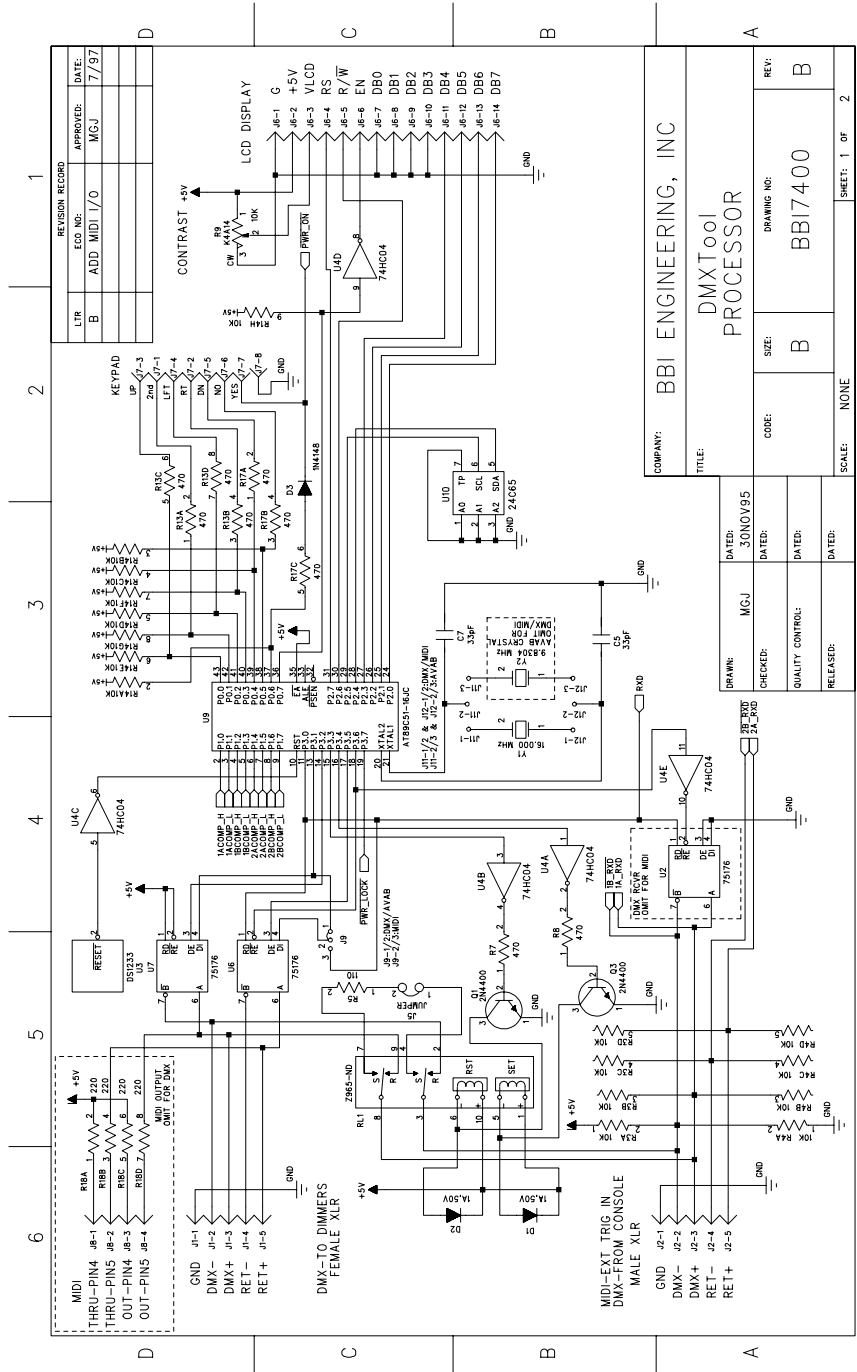XLR 5 Female

4

Go to Preset 1

5

Go to Next Preset

1

Fig. 3 - Remote GO Switch

Fig. 4 - XLR I/O Pinouts

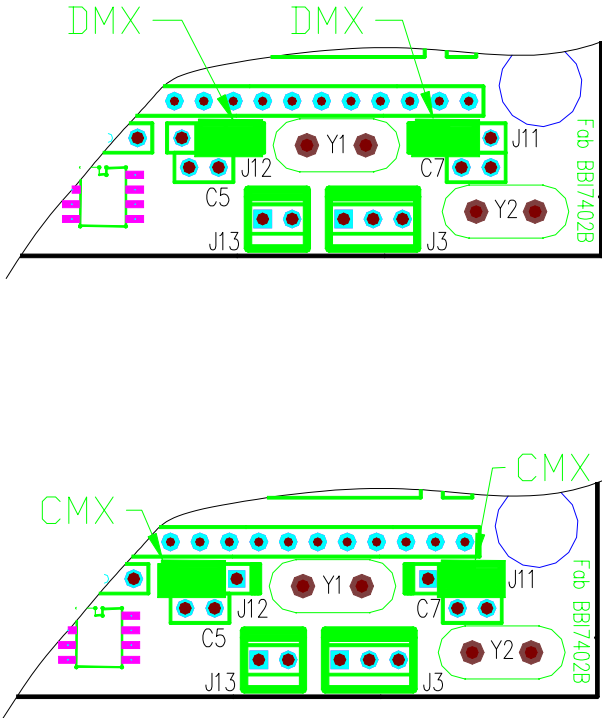| MODE	Send	Recv (PassThru y FRate / Lgth / Scode)	Recv (Terminated)	Recv (Re-Transmit)	Cable Test
PIN					
Pin 1 Fem.	Shield / Ground	Shield / Ground	Shield / Ground	Shield / Ground	Shield / Ground
Pin 2 Fem.	DMXTool DMX Data OUT -	Console Data Pass Thru -	Not used	Re-Transmitted Data OUT -	Test Pin 2 Send
Pin 3 Fem.	DMXTool DMX Data OUT +	Console Data Pass Thru +	Not used	Re-Transmitted Data OUT +	Test Pin 3 Send
Pin 4 Fem.	Not used	Not used	Scope Trigger pulse positive	Scope Trigger pulse positive	Test Pin 4 Send
Pin 5 Fem.	Not used	Not used	Scope Trigger pulse negative	Scope Trigger pulse negative	Test Pin 5 Send
Pin 1 Male	Shield / Ground	Shield / Ground	Shield / Ground	Shield / Ground	Shield / Ground
Pin 2 Male	Not used	Console Data IN -	Console Data IN -	Console Data IN -	Test Pin 2 Receive
Pin 3 Male	Not used	Console Data IN +	Console Data IN +	Console Data IN +	Test Pin 3 Receive
Pin 4 Male	Goto Preset 1	Not used	Not used	Not used	Test Pin 4 Receive
Pin 5 Male	Goto Next Preset	Not used	Not used	Not used	Test Pin 5 Receive

Fig. 6 - Protocol Jumpers

Limited Warranty Information

LIMITED WARRANTY

What is covered:

Any defect in material and workmanship.

For how long:

One year, to the original purchaser only.

What we will do:

If your DMXTool EXP is defective in any way, and is returned to us as specified below, we will repair it, or at our option replace it with a new or reconditioned one of the same or similar design.

Limitations:

We will not pay for loss of time, inconvenience, loss of use of your DMXTool EXP, or property damage caused by your DMXTool EXP or its failure to work, or any other incidental or consequential damages.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusions many not apply to you.

What we ask you to do:

To get warranty service for your DMXTool EXP, you must provide proof of purchase. (This warranty is not transferable.) Call us at 415-695-9555 to obtain product return information. You must prepay all shipping and insurance costs.

Pack the unit securely (preferably in the original packing materials) and ship according to the instructions given.

Repair or replacement at our facility is your exclusive remedy.

What this warranty does not cover:

This warranty does not cover damage while in transit to or from our facility or damage resulting from accidents, alterations, unauthorized repair, failure to follow instructions, misuse, fire, flood, and acts of God. We may, at out option, replace your DMXTool EXP with a new or reconditioned one of the same or similar design.

This warranty is the only one we give on your DMXTool EXP, and it sets forth all of our responsibilities regarding your DMXTool EXP. There are no other express warranties.

State Law Rights:

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.