DOUG FLEENOR DESIGN
(805) 481-9599

DMX Terminators

model: TERM, T2
technical data sheet

The DMX Terminator plugs into the feed-through connector of the final DMX device on a control cable. Using the DMX Terminator improves signal reliability by preventing reflections and reducing ringing. The DMX Terminator features a "happy" LED that illuminates when a strong DMX512 signal is present. The Terminator also incorporates three *Tranzorb* transient absorbing diodes to suppress spikes that can appear on the control cable during electrical storms. Radio frequency interference (RFI) is bypassed to chassis ground via the .001uF capacitance of the *Tranzorb* diode. An economy version (T2) is also available that does not have the indicator, transient absorbers, or RFI suppression.

SPECIFICATIONS: models: TERM-3 & TERM-5

Connector:	3 pin or 5 pin male XLR, gold plated contacts
Indicator:	Low current red light emitting diode (LED) illuminates on signal strength of 2 volts or greater.
Indicator circuit:	2K series resistor limits the LED's effect on termination performance. 1N4004 diode across LED protects against reverse voltage.
Termination resistance:	120 ohms +/- 10% between pins 2 & 3
Termination power capacity:	2 watts
Transient absorbing capacity:	500 watts
Transient clamp time:	Less than 5nS (0.000000005 seconds)
Transient clamp voltage:	Approximately 7 volts
Transient absorber locations:	Pins 2 and 3 clamped to pin 1. Pin 1 clamped to shell.
Capacitance:	Between pins 1 & 2: .001 uF Between pins 1 & 3: .001 uF Between pin 1 and shell: .001 uF
Size and weight:	1.9" long, 0.8" maximum diameter, 1 ounce

SPECIFICATIONS: models: T2-3, T2-4 & T2-5

Connector:	3 pin, 4 pin or 5 pin male XLR, gold plated contacts
Termination resistance:	120 ohms +/- 10% between pins 2 & 3
Termination power capacity:	2 watts
Size and weight:	1.9" long, 0.8" maximum diameter, 1 ounce

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Why Terminate?

Doug Fleenor, aka Dr. DMX

Why is it necessary to terminate the end of a DMX512 control run? In *Recommended Practice for DMX512* by Adam Bennette, Mr. Bennette states "Incorrect or missing termination is probably the single most common reason for faulty DMX512 systems." In a talk I gave at the 1995 USITT conference I showed that termination has a profound effect on DMX signal integrity. Without getting into the math or technical terms, I will try to shed some light on what termination does.

Reflections. DMX512 signals have electrical components in the Radio Frequency (RF) range. Cables carrying radio frequencies are called Transmission Lines and have a special set of rules and formulas that describe their behavior. One of these rules describes what happens to a signal traveling down the cable (at over half the speed of light) when it hits the end of the cable. No, the cable doesn't bulge or explode. Instead a percentage of the signal is "reflected" back up the cable. The way to prevent this reflected energy is to absorb it. To absorb the maximum amount of energy, a resistor which matches the "characteristic impedance" of the cable is placed across the data line. The DMX512 specification states the cable should have a characteristic impedance of 120 ohms (although most DMX512 *techies* agree a value between 100 and 120 ohms is satisfactory). A value of 120 ohms is usually specified for proper DMX512 termination.

Why are reflections a problem? The signals travel down the cable at roughly 60% of the speed of light. Although fast, this is not instantaneous. The DMX512 data is digital. Each digit is placed on the line for only 4 millionths of a second (abbreviated 4uS). The receiving device looks at the value of the digit in the center of the 4uS. That is 2uS after the digit is placed on the line. In 2uS a signal can travel down and back about 590 feet of cable. If a device is sitting on a cable such that it receives the reflected signal as well as the initial signal, it sees two numbers at once. It gets confused!

People have told me they have seen DMX512 problems, which were corrected by termination, on cables much shorter than 590 feet. Although I can easily replicate DMX512 problems with cable lengths over 500 feet, I have not been able to duplicate these problems with short cable lengths. The following are some possible explanations:

1) The cable they were using was "slow" with the signals traveling at much less than 60% of the speed of light.

2) Reflections can occur at both ends of the cable. Perhaps the delayed signal had been reflected up and down the line several times causing a 2uS delay on shorter cables. A weak signal from the console may aggravate this problem.

3) The problem was not caused by reflections, but by noise or signal distortion. The low resistance of the terminator helps to clean up the signal (see below).

Cable Capacitance and Inductance. In looking at DMX512 signals on the oscilloscope I've noticed signal distortion on relatively short lines. Some distortion is caused by the fact that all cables have capacitance and inductance. This causes "ringing" (oscillation at the beginning or end of a digit) and rounding of the edges of the digit. Although any low value resistor across the end of the line will lower the effect of cable capacitance and inductance, using the proper termination resistance is recommended.

Noise. Low impedance cabling systems pick up less electrical noise than high impedance systems. By adding the proper termination, the susceptibility of the system to noise is reduced.

Conclusion. Terminate those DMX lines! It will improve your system and make you feel good.