DMX512 TO 0-10 VOLT ANALOG CONVERTER

OWNERS MANUAL

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PRODUCT DESCRIPTION

The DMX512 to Analog Converter is an interface device which allows a DMX512 control console to control 0 - 10 volt analog dimmers or other 0 - 10 volt devices.

The input to the converter is electrically isolated from the outputs. This prevents ground loops in the dimming control system as well as protecting the console from damage in the event of dimmer failure. In addition the input is protected against mis-wiring and will accept up to 120 volts on its DMX512 input without damage to the converter. The outputs are protected against positive voltages coming up the control cable. Damage to the converter may occur if high negative voltages are placed on its outputs.

The input accepts DMX512 as specified by the Untied States Institute of Theater Technology (USITT). The outputs meet the proposed ADC-10 specification.

SPECIFICATIONS

Input data rate:	250 Kilobaud
Input circuit:	EIA-485 receiver with series 100 ohm self resetting "fuses" clamped to +/- 7 volts by *Transorb* diodes
Input signal:	0.5 volts minimum, 120 volts maximum
Output circuit:	LM324 op-amp with 1N4004 series diode
Output signal:	0 to 10.1 volts into 2000 ohm load
Output linearity:	5% input to output, 1/2% between outputs
Maximum output current:	24 output: 15 mA per channel, 120 mA total all channels 96 output: 15 mA per channel, 360 mA total all channels
Input/output isolation:	greater than 500 volts
Throughput delay: output)	less than 0.004 seconds (DMX input change to analog
Power input:	100 - 120 volts 50/60 hertz, 12 watts (208 - 240 volt optional)
Dimensions & weight:	24 output: 9.0" deep, 1.6" high, 5.6" wide, 2.5 pounds 96 output: 8.0" deep, 1.7" high, 16.7" wide, 4.5 pounds (19" rack adapters are available)

SETUP AND CONNECTIONS

The DMX512 to Analog Converter is generally placed at the dimmer end of the control cable. This way the control cable needs only three conductors. In retrofitting an existing installation where the analog control cables are already in place, it may be easier to place the Converter at the console end.

The control cable to the Converter should be designed for data communication. Cables designed for this purpose may be called "RS-422" or "RS-485" cables or "Shielded Twisted Pair" or "Low Capacitance Data Cable". Microphone cable is not designed for this purpose and should not be used for control runs of over 200 feet.

TERMINATION The single most common cause of DMX512 problems is failure to terminate the end of the control run with the proper termination resistor. If the Converter is the final device on the control run its feed through connector should be terminated with a 120 ohm resistor between pins 2 and 3. You may make a termination plug by soldering a 120 ohm 1/2 watt resistor between pins 2 and 3 of a 5 pin male XLR connector or you may purchase a terminator ready made from a Doug Fleenor Design dealer. For more information on termination see Appendix A "Why Terminate", a paper presented at the 1995 Lighting Dimensions International trade show.

The cabling between the Converter and the dimmers is not as critical. Any quality wire may be used. The size or gauge of the wire is more of a mechanical consideration than an electrical one. Almost any gauge wire will work electrically but a larger wire will be less likely to break. Any size thicker than 22 gauge should provide reliable service.

The Converter uses 100 to 120 Volts, 50 or 60 Hertz, at less than 1/10 Amp (approximately 6 Watts). Plug it in to a grounded outlet for maximum safety. The Converter may have been modified to operate on 240 Volts in which case the power cord is labeled "Wired for 240 Volts".

The Converter uses the Male 5 pin "XLR" style connector specified in the DMX512 standard for its input. A Female feed-through connector is supplied to loop the incoming DMX signal on to other devices. There is no isolation between the input and output DMX connectors.

The pin outs for the 5 pin "XLR" are:

        pin 1:   DMX512 common
        pin 2:   data -
        pin 3:   data +
        pin 4 & 5:   not used (but connected to feed through connector)

There is no electrical connection between the DMX input common and the analog output common. This is accomplished by the use of a 2500 Volt optical isolator. This eliminates the possibility of ground loops and provides added protection for the console against dimmer failure and electrical storm damage.

The output of the Converter is supplied on a female DB-25 connector.

The pin outs for the DB-25 connector are:

	connector 1:	connector 2:	connector 3:	connector 4:
pins 1 - 24:	channels 1 - 24	channels 25 - 48	channels 49 - 72	channels 73 - 96
pin 25:	output common	output common	output common	output common

OPERATION

The only user adjustment required is the setting of the front panel "starting address" switch. This three digit push-wheel switch reads the number of the DMX channel which will control the first analog output. The remaining analog outputs respond to the next sequential DMX channels.

The Converter should be left plugged in for automatic operation. It may be plugged into a switched outlet if desired. If switched, there is no special sequence required in powering up the console, converter, and dimmers.

The Converter is designed to hold the last levels received from the console in the event the DMX512 signal is lost. These levels will be held until control is restored or power is removed. All levels are reset to zero upon power up.

The front panel has three indicators. The SIGNAL indicator illuminates when a valid DMX512 signal is present. The SIGNAL indicator flashes when in test mode. The OUT 1 indicator mimics the level on the first analog output (pin 1 of the first DB-25 connector). The PWR indicator illuminates whenever power is applied.

DISABLING THE HOLD FEATURE

The last level hold feature may be disabled by removing an internal jumper. When the jumper is removed the outputs will be taken to zero when the DMX signal is lost. Blackout will occur approximately one second after loss of DMX.

To remove the jumper on the 24 output model:

Disconnect the power cord.
Remove the right-most and left-most screws on the back panel (don't loose the washers).
  Do not remove the screws that hold the connectors in place.
Move the back panel down such that the cover may be slid off half way.
Slide off the cover to reveal the jumper which is on the same side as the power cord.
  The jumper is labeled "REMOVE JUMPER TO BLACK-OUT ON LOSS OF SIGNAL"
Remove the jumper.
Slide the cover back on.
Replace the back panel taking care to align the output connector.
  Be sure to re-use the lock washers.

To remove the jumper on the 96 output model:

Disconnect the power cord.

Remove the four screws that secure the top panel and remove the panel.
  The jumper is labeled "REMOVE JUMPER TO BLACK-OUT ON LOSS OF SIGNAL"
Remove the jumper.
Replace the top panel and secure with the four screws.

TEST MODE

The DMX512 to Analog Converter has a built in test mode which allows the outputs to be brought up to full without any DMX512 input. To bring up a particular channel set the starting address switch for 6XX where XX is the channel to be brought to full. For example: To bring channel 1 to full, set the switch to 601. To bring channel 24 to full set the switch to 624.

Test mode is useful for testing lamps and focusing. When in test mode, the signal LED will flash to warn the user that the unit is not using the DMX512 input to set the levels.

TECHNICAL DETAILS

For those technical types out there, here is a brief description of how the DMX to Analog Converter works.

DMX512 uses a "differential" digital signal. A differential signal is a pair of signals which are inverse from one another. That is, when one is high, the other is low. Differential signals are common in both analog processing (balanced microphone cables) and digital processing (digital communications such as EIA-485). Differential signals are used to reduce the effect of electrical noise on long cable runs. When a differential signal is processed by the receiving circuit (microphone pre-amp or EIA-485 receiver for example) the noise can be eliminated but the signal remains.

Differential signals always travel in pairs, and the wires on which they travel are usually twisted to insure any noise picked up is of equal magnitude on both wires. The noise must be of equal magnitude on each wire so that the receiving circuit can effectively subtract the noise and leave the signal. The pairs of signals are usually denoted by a plus (+) sign on the normal, or "hot", or "true" line and by a minus (-) sign on the inverted, or "return", or "complement" line. The differential signals on the combine unit are Data+ and Data-.

DMX512 is a standard for lighting control published by the United States Institute For Theater Technology. The DMX512 standard specifies that the electrical properties of the signal comply with a standard published by the Electronic Industries Association, EIA-485 (or RS-485). Many manufacturers make integrated circuits that meet the input and output specification of EIA-485. The DMX512 to 0-10 Volt Analog Converter uses the "75179" as its receiver. The "75179" was designed specifically to meet EIA-485.

The DMX512 signals from the console are applied to the input connector of the Converter. These are received by "75179" and fed to an optical isolator. The signal is passed through the isolator and on to an 80C31 micro-controller. The micro-controller receives the digital signal, selects the DMX channels required based on the setting of the starting address switch and sends these levels to a Digital to Analog converter chip

(an AD558). The micro-controller sequentially applies the levels for each output to the Digital to Analog chip (abbreviated D/A) while switching the output of the D/A to the 24 output buffers. The switching circuit (three 4051 chips) allow one D/A to service all outputs with less than 1/250 second delay between the time a DMX level changes and the analog output is updated. Capacitors hold the 0 - 10 volt level while the other outputs are being updated.

Diodes on the output allow multiple consoles to control the same dimmers by what is commonly known as Pile-On of the signal.

We cannot answer all the questions everyone might have about our products here. If you have any questions, please call. We like to talk with our customers.

ABOUT THE COMPANY

Doug Fleenor Design is a semi-custom design and manufacturing company. Our current standard products include converters for many lighting control protocols, Optical Isolation products for DMX512, AMX192, and other digital protocols, and a Digital Multiplex Combine Unit (for combining Digital Multiplex signals in a pile-on, route, or patch operation). All these standard products can be customized for particular needs.

Doug Fleenor, Principle Engineer, has been designing for the entertainment industry since 1979. He spent the years from 1984 through 1990 as Teatronics' Chief Engineer. During this time his work on advancing multiplex control consoles, dimmers and systems earned him the nick-name "Doctor Mux". Doug Fleenor Design continues to provide solutions to multiplex control problems as well as designing custom and semi-custom control and dimming systems.

WARRANTY

Products manufactured by Doug Fleenor Design carry a five year warranty. If the product breaks due to a manufacturing defect, within five years of manufacture, Doug Fleenor Design will repair it. It is the customer's responsibility to return the product to Doug Fleenor Design (at the customer's expense). Doug Fleenor Design will repair the unit and return it to the customer (at Doug Fleenor Design's expense). If a trip is necessary to the customer's site to solve a problem, the expenses of the trip must be paid by the customer.

If your unit is out of warranty, please call us anyway. We try to be fair on all repairs. If the failure was our fault, we will usually repair it at no charge regardless of the time period! We want you to be happy with your purchase.