OWNER'S MANUAL

MTX-DE AMX/DMX DECODER

MTX-DE Rev. 1 - 5/15/9Ø

Dove Systems
3563 Sueldo Unit E
San Luis Obispo, Ca 934Ø1
8Ø5-541-8292

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1. INTRODUCTION

The MTX-DE decodes a multiplexed control signal into a DC voltage to drive standard analog dimmers from any controller which is compatible with DMX-512, AMX-192, or C152 (Colortran) control. Each unit decodes 48 channels and the starting channel may be set to be any dimmer, 1 to 512 (1 to 192 for AMX). The MTX-DE is factory set to start on dimmer #1 and the control output voltage is Ø to +1ØV. Other settings may be made for the dimmer start channel. A condensed description of the USITT DMX-512 and AMX-192 standards is in Appendix A and B.

2. SET UP AND CONNECTION

The MTX-DE is usually located close to the dimmer packs it controls. The input and output connections should be made before the decoder is plugged into power and energized. Output connections are made on the PC terminal strip at the back of the circuit board. There are 48 positions and two common terminals. There should be a common wire for each dimmer pack. The common of the dimmer should not be tied to earth ground. The MTX-DE is factory set for Ø to +1Ø volts output and to start on channel #1. It is possible to parallel an analog controller as a backup control on the outputs, but only if it has diode protection. Higher output voltages are possible: adjust R9Ø (see page 11) clockwise for voltage ranges up to Ø to +28V.

The multiplex input can be made at either XLR connector. It is important that the proper pin designation is followed on the multiplex connector. Connector pin designations are as follows:

PIN 1 - Signal Common
PIN 2 - Dimmer Drive Complement (Clock-)
PIN 3 - Dimmer Drive True (Clock+)
PIN 4 - Analog Level (AMX Only)
PIN 5 - N/C Spare

PROTOCOL SELECTION

JUMPER	AMX	DMX	C152
JP52	1-2	2-3	2-3
JP53	N/A	1-2	2-3
JP54	2-3	1-2	1-2
JP55	2-3	1-2	1-2

JP51 ON - PARITY (Factory Set)
OFF - NO PARITY

The Start Code is changed through Switch SW1. Sum the binary values of the switches set to derive the Start Code or just follow the chart. (Note: the DMX standard requires a start code of Ø for dimmers.)

SW - 1 (X=ON, Ø=OFF)

	1	2	3	4	5	6	7	8	Start Code
Factory Set	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
	X	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1
	Ø	X	Ø	Ø	Ø	Ø	Ø	Ø	2
	X	X	Ø	Ø	Ø	Ø	Ø	Ø	3

CHANNEL SELECTION

The Starting Channel is changed through Switch SW2. Starting channels above 254 are achieved through the removal of jumper JP57.

	DMX (X=ON, Ø=OFF)										AMX									
	SW - 2								JP57		SW - 2								JP57	
	1	2	3	4	5	6	7	8		Starting Channel	1	2	3	4	5	6	7	8		Starting Channel
Factory Set	Ø	X	Ø	Ø	Ø	Ø	Ø	Ø	X	1	X	Ø	Ø	Ø	Ø	Ø	Ø	Ø	X	1
	X	X	Ø	Ø	Ø	Ø	Ø	Ø	X	2	Ø	X	Ø	Ø	Ø	Ø	Ø	Ø	X	2
	Ø	Ø	X	Ø	Ø	Ø	Ø	Ø	X	3	X	X	Ø	Ø	Ø	Ø	Ø	Ø	X	3
	X	Ø	X	Ø	Ø	Ø	Ø	Ø	X	4	Ø	Ø	X	Ø	Ø	Ø	Ø	Ø	X	4
	Ø	X	X	Ø	Ø	Ø	Ø	Ø	X	5	X	Ø	X	Ø	Ø	Ø	Ø	Ø	X	5
	X	X	X	Ø	Ø	Ø	Ø	Ø	X	6	Ø	X	X	Ø	Ø	Ø	Ø	Ø	X	6
	Ø	Ø	Ø	X	Ø	Ø	Ø	Ø	X	7	X	X	X	Ø	Ø	Ø	Ø	Ø	X	7
	X	Ø	Ø	X	Ø	Ø	Ø	Ø	X	8	Ø	Ø	Ø	X	Ø	Ø	Ø	Ø	X	8
	Ø	X	Ø	X	Ø	Ø	Ø	Ø	X	9	X	Ø	Ø	X	Ø	Ø	Ø	Ø	X	9
	X	X	Ø	X	Ø	Ø	Ø	Ø	X	1Ø	Ø	X	Ø	X	Ø	Ø	Ø	Ø	X	1Ø
	Ø	Ø	X	X	Ø	Ø	Ø	Ø	X	11	X	X	Ø	X	Ø	Ø	Ø	Ø	X	11
	X	Ø	X	X	Ø	Ø	Ø	Ø	X	12	Ø	Ø	X	X	Ø	Ø	Ø	Ø	X	12
	Ø	X	X	X	Ø	Ø	Ø	Ø	X	13	X	Ø	X	X	Ø	Ø	Ø	Ø	X	13
	X	X	X	X	Ø	Ø	Ø	Ø	X	14	Ø	X	X	X	Ø	Ø	Ø	Ø	X	14
	.										.									
	Ø	X	Ø	Ø	X	X	Ø	Ø	X	49	X	Ø	Ø	Ø	X	X	Ø	Ø	X	49
	.										.									
	Ø	X	Ø	Ø	Ø	X	X	Ø	X	97	X	Ø	Ø	Ø	Ø	X	X	Ø	X	97
	.										.									
	Ø	X	Ø	Ø	X	Ø	Ø	X	X	145	X	Ø	Ø	Ø	X	Ø	Ø	X	X	145
	.																			
	Ø	X	Ø	Ø	Ø	Ø	X	X	X	193										
	.																			
	Ø	X	Ø	Ø	X	X	X	X	X	241										
	.																			
	X	X	X	X	X	X	X	X	X	254										
	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	255										
	X	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	256										
	Ø	X	Ø	Ø	Ø	Ø	Ø	Ø	Ø	257										
	X	X	Ø	Ø	Ø	Ø	Ø	Ø	Ø	258										
	.																			
	Ø	X	Ø	Ø	Ø	X	Ø	Ø	Ø	289										
	.																			
	Ø	Ø	Ø	X	Ø	Ø	X	Ø	Ø	337										
	.																			
	Ø	X	Ø	Ø	Ø	Ø	Ø	X	Ø	385										
	.																			
	Ø	X	Ø	Ø	X	X	Ø	X	Ø	433										
	.																			
	Ø	X	Ø	Ø	Ø	X	X	X	Ø	481										
	.																			
	X	X	X	X	X	X	X	X	Ø	51Ø (LAST STARTING CHANNEL)										

Sum the binary values of the switches set to derive the starting channel for AMX and subtract one for DMX. Above Channel 254, add 255 to the sum for DMX.

When the input and output connections are made the unit may be energized by plugging into a power source which can be turned on and off with the dimmer packs. The controller may now be energized and the system tested. The LED on the front panel will glow green and red upon power-up. When a valid multiplex signal is present it will glow green only.

The MTX-DE may be modified to drive solid state relays directly. This is a factory only modification. Call the factory if you think you need this feature.

3. THEORY OF OPERATION

Multiplexing is a way of combining several control signals into one wire. This allows a savings of wire, connectors and hardware at the sending and receiving end of a communications system and is particularly convenient for computer control. The USITT DMX-512 protocol specifies that up to 512 dimmer channels may be carried on three conductors. The three conductors are: signal common; data plus; and data minus. The USITT AMX192 protocol specifies that up to 192 dimmer channels may be carried on four conductors. The four conductors are: analog level; signal common; clock plus; and clock minus.

From a DMX output the dimmer levels are sent digitally, one channel at a time in much the same way as a computer sends characters to a printer. After a reset, called a break, the first character is a zero, which indicates that the next data is for dimmers. Then one channel at a time starting with channel 1 and going up to as high as channel 512 is sent. The dimmer levels are actually numbers from Ø (for off) to 255 (on full).

From an AMX output the dimmer levels are sent on the analog level conductor with respect to the analog common, one channel at a time starting with dimmer #1 and going as high as #192. The voltage on this wire is Ø (for off) to +5 volts (for 1ØØ%). The clock line determines when the signal changes from one dimmer to the next and when to start all over with dimmer #1 (reset).

The MTX-DE decodes these signals by sampling each channel and changing them to a voltage. This voltage is amplified to the required level and fed through a diode to a terminal for each of 48 channels. The maximum current that can be source for each channel is 2Ø milliampere. This is more than enough power for most dimmers but may not be enough for driving relays or light indicators directly. Consult the factory for special applications interface.

4. IN CASE OF TROUBLE

The most common cause of trouble is a miswired connector. Be sure you have all the connections made correctly. The pin configuration for the multiplex connector is most important. The board will not work at all if any of the wires are not on the correct pin. The dimmer control common must be connected. The common of the dimmer should not be tied to earth ground. Check the diagram on page 11 to be sure of your connections.

Check the MTX-DE with a DC voltmeter. Connect the common to Test Point 3 (TD3).

If, after performing these tests, you still cannot get proper operation, you may call the factory for technical assistance at (8Ø5)541-8292. To obtain service send your unit to the factory, freight prepaid, with a note describing the specific complaint and a return shipping address.

Send To:
Service Department
Dove Systems
3563 Sueldo St. Unit E
San Luis Obispo, CA 934Ø1

LIMITED WARRANTY

The manufacturer agrees that its products shall be free from defects in material or workmanship over a period of one year from date of shipment from the factory. Said warranty will not apply if equipment is used under conditions of service for which it is not specifically intended. The manufacturer is not responsible for damage to its apparatus through improper installation, physical damage, or poor operating practice.

If any device is found unsatisfactory under the warranty, the buyer should notify the manufacturer, and after receipt of shipping advice, buyer may return it directly to Dove Systems, San Luis Obispo, CA, shipping prepaid. Such equipment will be replaced or put in proper operating condition, free of all charges except transportation. The correction of any defects by repair or replacement by the manufacturer shall constitute fulfillment of all obligations to the purchaser. Manufacturer does not assume responsibility for unauthorized repairs to its apparatus, even though defective.

Manufacturer shall not be liable for any consequential damage in case of any failure to meet the conditions of any warranty of shipping schedule, nor will claims for labor, loss of profits, repairs, or other expenses incidental to replacement be allowed.

No other representation, guarantees or warranties, expressed or implied, are made by the manufacturer in connections with the manufacture and sale of its equipment. This warranty is non-transferable and applies to the original buyer only.

APPENDIX A: DMX512/199Ø DIGITAL DATA TRANSMISSION STANDARD FOR DIMMERS AND CONTROLLERS (CONDENSED)

Data transmitted shall be in asynchronous serial format. Dimmer level data shall be transmitted sequentially, beginning with dimmer 1 and ending with the last implemented dimmer, up to a maximum of 512. Prior to the first level transmitted, a RESET signal shall be transmitted followed by a NULL START code. Valid dimmer levels shall be Ø to 255 decimal (ØØ to FF hexadecimal) representing dimmer control input levels of OFF to FULL in a linear relationship. These numeric values shall not necessarily have any relationship to actual dimmer output, which shall be determined within the dimmer itself.

The RESET signal shall consist of a BREAK lasting 88 uSeconds (two frame times) or any longer duration. A BREAK shall be defined as a high-to-low transition followed by a low of at least 88 uSeconds. All dimmers and other receiving devices shall interpret any such BREAK as a terminator for any pending transmission/data packet and its end as the start of the MARK AFTER BREAK and START code sequence at the beginning of the next packet.

The duration of the MARK that separates the RESET/BREAK and the START code shall be not less than 8 uSeconds nor greater than 1 Second. All DMX512/199Ø transmitters shall produce a MARK AFTER BREAK of not less than 8 uSeconds. All receivers shall recognize a MARK AFTER BREAK of minimum 8 uSeconds.

The NULL START code shall be defined as a properly framed NULL character (all zeros) following a RESET. The NULL START code is the data packet identifier which identifies subsequent data as sequential dimmer level information.

In order to provide for future expansion and flexibility, this Standard makes provision for 255 additional START codes (1 through 255 decimal, Ø1 through FF hexadecimal). For this reason, a dimmer receiver must not accept as 8-bit level data, any data packet with a START code other than NULL START following the RESET.

Each data link shall support up to 512 dimmers. Multiple links shall be used where larger numbers of dimmer are required.

The time between any two frames of a data packet may vary between Ø uSeconds and 1 Second. The line must remain in a "marking" state during any such idle period greater than Ø uSeconds. A receiver must be capable of accepting a data packet having no idle time (Ø uSeconds) between any of its frames.

Regardless of START code or length, every data packet transmitted on the data link must begin with a RESET, MARK AFTER BREAK, and START code sequence as defined above. The time between the second stop bit of the last data byte/frame of one data packet and the falling edge of the beginning of the RESET for the next data packet may vary between Ø uSeconds and 1 Second. The line must remain in an idle ("marking") state throughout any such period greater than Ø uSeconds. Transmitters, therefore, may not produce multiple BREAKS between data packets. Receivers must, however, be capable of recovering from multiple BREAKs produced by data link line errors.

The period between the falling edge at the start of any one BREAK shall be not less than 1196 uSeconds from the falling edge at the start of the next BREAK. The data transmission format for each level transmitted shall be as follows:

BIT POSITION	DESCRIPTION
1	Start Bit, Low or SPACE
2 though 9	Dimmer level Data Bits, Least Significant Bit to Most Significant Bit Positive Logic
1Ø, 11	Stop Bits, High or MARK
Parity	Not transmitted

The data rate and associated timing shall be as follows:

Data Rate:	25Ø Kilobits per second
Bit time:	4.Ø microseconds
Frame time:	44.Ø microseconds
	22.71 milliseconds

Maximum Update
Rate for 512 dimmers
including RESET and START 44.Ø3 times per second

Where connectors are used, the data link shall utilize 5-pin "XLR" style microphone connectors. Some manufacturers of this connector are:

Switchcraft
ITT Cannon
Neutrik

Female connectors shall be utilized on controllers or other transmitting devices and male connectors shall be utilized on dimmers and other receiving devices. In cases where an optional second data link is implemented using the spare pins of the connector for bi-directional transmission, female connectors shall still be utilized on the controller.

Connector Pin Designations shall be as follows:

PIN 1 - Signal Common (Shield)
PIN 2 - Dimmer Drive Complement (Data 1-)
PIN 3 - Dimmer Drive True (Data 1+)
PIN 4 - N/C Spare
PIN 5 - N/C Spare

Cable shall be shielded twisted pair approved for EIA-422/EIA-485 use. Examples of suitable cables are:

Belden 9841
Alpha 5271 (one pair, no spares provided)
Belden 9842
Alpha 5272 (two pairs, one as a spare)

APPENDIX B: USITT AMX192 ANALOG MULTIPLEX
DATA TRANSMISSION STANDARD FOR DIMMERS AND CONTROLLERS (CONDENSED)

Data transmission shall be via a four conductor control cable with conductors designated as follows:

ANALOG LEVEL
SIGNAL COMMON
DIFFERENTIAL CLOCK TRUE (CLOCK+)
DIFFERENTIAL CLOCK COMPLEMENT (CLOCK-)

Analog dimmer control levels shall be time multiplexed on the ANALOG line, referenced to the SIGNAL COMMON line. These levels shall vary from Ø to +5 VDC representing dimmer output levels from Ø to 1ØØ%. Synchronization of the controller (transmitting device) and the dimmer (receiving device) shall be via clock pulses on the DIFFERENTIAL CLOCK TRUE and DIFFERENTIAL CLOCK COMPLEMENT lines.

The maximum number of receivers per data link shall be 16 when using the type specified in figure 3. When using standard RS-422A receivers, the maximum number shall be four per data link.

The following parameters define the refresh cycle. Minimum refresh cycle is a function of the number of dimmer frames transmitted, up to a max of 192. There is no minimum time between the start of the last dimmer frame and the start of the next RESET frame. Dimmers must be able to accept a lapse in transmission for up to 5ØØ milliseconds.

Tc	192 dimmer refresh cycle	1Ø	5Ø	5ØØ msec
Td	Dimmer frame duration	5Ø		usec

Each data link shall support up to 192 dimmers. Multiple links shall be used where larger numbers of dimmers are required. Since a RESET pulse can occur after any valid dimmer frame, there is no minimum number of dimmers per data link.

Where connectors are used, the data link shall utilize 4-pin "XLR" style microphone connectors. Some manufacturers of this connector are:

Switchcraft
ITT Cannon
Neutrik

Optionally, when mating with existing Strand equipment, Switchcraft "Mini Connectors" (typical part numbers TY4F, TA4ML, and TA4FL) may be utilized.

Where "XLR" style connectors are utilized, male connectors shall be utilized on controllers or other transmitting devices and female connectors shall be utilized on dimmers and other receiving devices.

Where "Mini Connectors" are utilized, all equipment shall utilize female connectors and all cables shall utilize male connectors except for specific "extension" cables, which shall be male-female.

"XLR" Connector Pin Designations shall be as follows:

PIN 1- Signal Common
PIN 2- Differential Clock True (Clock +)
PIN 3- Analog Level
PIN 4- Differential Clock Complement (Clock -)

"Mini Connector" Pin designations shall be as follows:

PIN 1- Differential Clock Complement (Clock -)
PIN 2- Signal Common
PIN 3- Differential Clock True (Clock +)
PIN 4- Analog Level

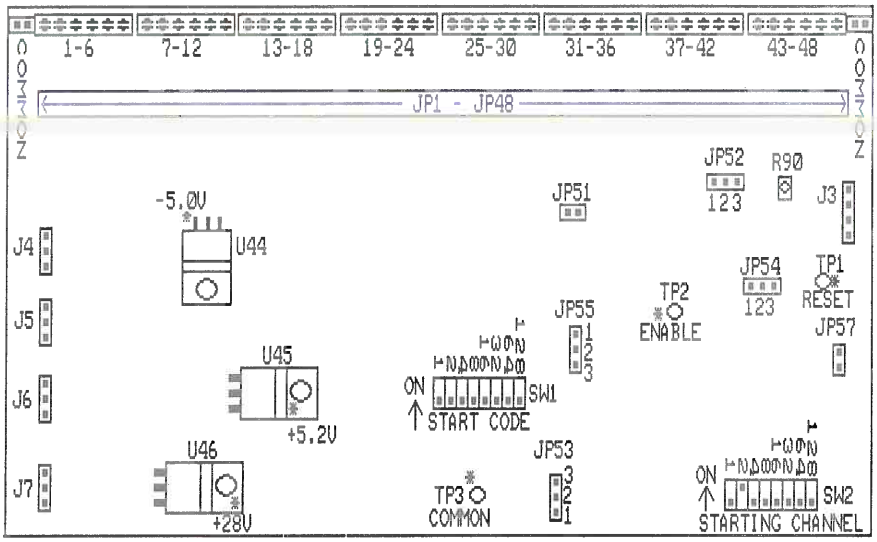
Recommended cable shall be Belden 9156 or equivalent which utilizes two unshielded 18 AWG twisted pairs.

Maximum Cable length shall be 1ØØØ feet from controller to last dimmer unit connected to the data link.

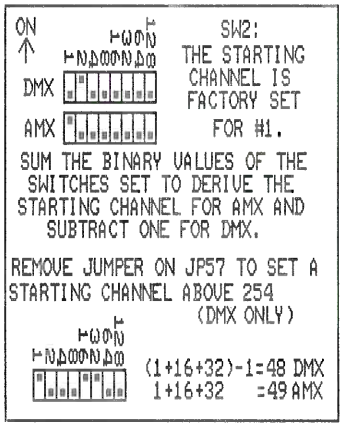
Where permanently installed, cable shall be routed through metal conduit containing no AC power conductors which might cause induced interference.

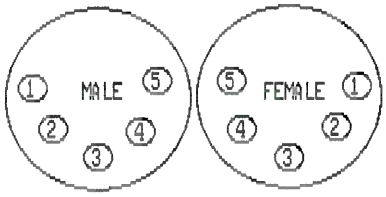
DOVE SYSTEMS
MTX–DE CONTROL INPUT
SELECTION CHART

* TEST POINTS ARE MARKED WITH ASTERIKS



JUMPER	AMX	DMX	C152
JP51	(ON FOR PARITY, OFF FOR NO PARITY)		
JP52	1-2	2-3	2-3
JP53	N/A	1-2	2-3
JP54	2-3	1-2	1-2
JP55	2-3	1-2	1-2
JP57	(ON FOR 1-254, OFF FOR 255-512)		





5 PIN XLR CONNECTORS

PIN	FUNCTION
1	COMMON
2	-CLOCK
3	+CLOCK
4	ANALOG (AMX)
5	N/A

JUMPERS JP1 - JP48
FOR DRIVING SSR's
(A FACTORY MODIFICATION)