



**INSTRUCTION MANUAL**

**DAM-2000**

**AUDIO & DATA  
FIBER OPTIC MULTIPLEXER  
TRANSPORT SYSTEM**

**MULTIDYNE Electronics, Inc.**

*Innovations in Television Testing & distribution*

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This product was designed and manufactured in the  
UNITED STATES of AMERICA

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## INTRODUCTION

The DVM-2000 12 Bit Video and 24 Bit Audio Fiber Optic Transport offers state-of-the-art performance exceeding RS250C Short-haul and Broadcast Specifications with a Signal to Noise ration exceeding 75 dBs. The system will support one video, up to 6 audio and up to 3 data channels per optical wavelength. The user can (WDM) Wave Division Multiplex, permitting multiple optical sources to share a single fiber, doubling the capacity of fiber optic cables. Applications include links from studio to transmitter, studio to studio, studio to CATV head-end, distance learning and backhaul feeds from special events. The transmit and receive units are available in portable and rack-mount packages making the system ideal for both field and studio applications. The transmit unit includes a 1000 feet post-equalizer for 8281 type cable.

## FEATURES and OPERATION

### **!!!!!! DANGER !!!!!**

#### **INVISIBLE LASER RADIATION**

#### **AVOID DIRECT EXPOSURE TO BEAM**

**OUTPUT POWER MAX: 2 mW. WAVELENGTH: 1300/1550 NM. CLASS III b LASER**

**The optical laser transmitter may harm the human eye. Proper eye protection should be used at all times when working with laser. Please read the entire manual before operating the Fiber Optic devices.**

### **WARNING**

#### **HIGH VOLTAGES INSIDE**

**The unit should be only serviced or opened by qualified personnel.  
There are no user serviceable parts or adjustments inside.**

## VIDEO CHANNEL

The video performance of the fiber optic system exceeds RS-250C Short-haul specifications. The system uses state-of-the-art technology to offer a true 12 bit Video Analog to digital conversion and a 24 bit Audio A to D conversion. By using 12 bits we are able to achieve a Signal to Noise ration of over 75 dBs. The system is ultra linear and distortion free giving differential gain and phase of less than 0.3 % and 0.3 degrees, respectively. The video input and output signals are back-porch clamped.

The system has a video bandwidth of 8 MHz. The transmission of NTSC, PAL, SECAM and video with diplexed audio carriers at 4.5 MHz, 5.8 MHz and 6.4 MHz are fully compatible with the fiber optic system.

## TRANSMITTER, DVM-2000-FTX

The transmitter unit, designated by model number DVM-2000-FTX, includes a **VIDEO IN** BNC connector in the rear and a front panel equalizer monitoring BNC, labeled **CLAMPED VIDEO**. The gain and equalizing flatness of the input video can be adjusted from the front panel and monitored from the **CLAMPED VIDEO** output. The **VIDEO GAIN** and **VIDEO EQ** controls can be found on the transmitter front panel. For optimal system performance the **VIDEO GAIN** and **VIDEO EQ** adjustments should be set for 100 IRE units and a flat frequency response, respectively. The transmitter front panel includes a **VIDEO PRESENT** LED to indicate the delivery of video to the A to D. The **LASER FAIL**. LED indicates a laser failure when RED. The **AUDIO LEVELS OVERF**. LEDs indicate an audio level overflow in the audio A to D when RED. This typically occurs when the input level exceeds +18 dBm. The **POWER** LED indicates that power is ON.

## RECEIVER, DVM-2000-FRX

The receiver unit, designated by model number DVM-2000-FRX, includes a **VIDEO OUT** BNC connector on the rear panel. The front panel control **VIDEO GAIN** is used to set the video output level. The receiver front panel includes a **VIDEO PRESENT** LED to indicate the delivery of video to the A to D. The **LASER FAIL**. LED indicates a laser failure on the transmitter or loss of received optical signal when RED. The **POWER** LED indicates that power is ON.

## AUDIO CHANNELS

The fiber optic system includes 6 channels of high quality CD grade audio encoded in 24 bits. The balanced audio inputs are configurable for 600 Ohm or High impedance terminations. The termination can be found on the audio adapter board included with the unit. The factory setting is 600 Ohms. The 600 Ohm termination may be removed for high impedance operation. The balanced audio outputs have a source termination of 50 Ohms. The system is able to accommodate a maximum input and output level of +18 dBm with a 600-Ohm termination. The input level to the transmitter should not exceed +18 dBm. The **AUDIO OUTPUT LEVELS** on the receiver have a +/- 6 dBm gain adjustment for setting system audio levels, labeled **CH1** through **CH6**. The audio I/Os are labeled **A1+**, **A1-** through **A6+**, **A6-** respectively. The terminal labeled **GND** is the audio ground connection.

## DATA CHANNELS

The fiber optic system can accommodate up to 3 simplex RS-232 data channels. The 3 RS-232C data channel connections are labeled as **D0**, **D1** and **ALARM2**. The terminal labeled **GND** is the data ground connection. The third data channel can be configured as a local video presence alarm on the transmitter side and as a remote alarm on the receiver side.

## OPTICAL OPTIONS

The DVM-2000 Fiber Optic system is available in several different optical configurations. There are multi-mode systems available with 1310 nm wavelengths. The multi-mode systems are available with ST connectors. The singlemode laser systems are available in 1310 nm and

1550 nm wavelengths with ST, SC or FC connectors. The 1310 nm single-mode laser system is available with -8 dBm, -3 dBm, 0 dBm and +3 dBm optical powers. The 1550 nm single-mode laser system is available in an optical power of +3 dBm. Please read the section **INSTALLATION and HANDLING** for further information.

## SYSTEM ALARMS

The Laser Failure provides a dry contact switched to GND in the event of laser failure. The alarm signal is labeled **ALARM1**. The **ALARM2** connection provides a third data channels or a video presence alarm. The **ALARM2** signal is an open collector that that is pulled low in the event of video loss. The third data channel can be configured as a local video presence alarm on the transmitter side and as a remote alarm on the receiver side. Internal jumpers may be set to provide a third data channel. The factory default setup is for a video presence alarm.

## INSTALLATION

Extreme caution should be used when handling Laser equipment. Appropriate eye protection should be worn at all times. Direct exposure to the eyes and skin can be harmful. The video, audio, data and optical connections can be found in the sections above. There are no user serviceable parts or adjustments inside the system. The only user controls and interfaces are present on the front and rear panels. If service or calibration adjustments are necessary please return the system to the factory.

When installing a 1310 or 1550 nm Singlemode Laser system the launched optical power can vary from -8 dBm to +3 dBm depending on the model purchased. The receiver will compensate for variations in optical attenuation. The receiver unit will operate with an optical signal from -32 to +3 dBm with out over-load.

The DVM-2000-FRX Fiber Optic Receiver for Singlemode applications all has an optical window from the wavelength of 1100 to 1600 nm. If a Singlemode system is to be Wave Division Multiplexed with other optical wavelengths in the 1100 to 1600 nm range, the appropriate optical filters and wave division multiplexers should be used. The user may contact MULTIDYNE to purchase such devices.

## CIRCUIT DESCRIPTION

The Multidyne DVM200 is a highly linear low noise, low distortion fiber optic link. The circuitry in the transmitter processes and digitizes seven analogue and 3 digital signals and, through high speed time division multiplexing, serializes them into a single, self clocking bit stream that modulates the output of an LED or a laser. At the receiving end a high speed demultiplexer extracts the imbedded clock and then the data in a parallel format to be presented to seven digital to analogue converter that reconstruct the 7 analogue signals.

## DVM-2000-FTX TRANSMITTER DESCRIPTION

U22 is an AD8052 dual wide band operational amplifier. The first half is the input video buffer. It interfaces video to the anti-aliasing low pass filter after some processing. Diodes D10 to D13 suppress transients that could be harmful to the buffer. R60 adjusts the common mode rejection of the buffer. Capacitors C89 to C92 together with resistors R65 to R68 form a 4 pole variable cable equalizer that restores the phase and amplitudes of certain video frequency components. LPF1 is an elliptical 11 pole low pass filter. It attenuates out of band signals that would produce aliasing products at the output of U23, the video analogue to digital converter. The second half of U22 is the video post amplifier that overcomes the filter losses and, through the adjustment of C68 trims the high frequency response of the input video channel. R48 is adjusted to 1VPP terminated in  $75\omega$ . Q1 is the video sync separator. Composite sync is present at Q1's collector. Q2 is a "box car" pulse former that generates a positive going pulse beginning with the second edge of horizontal sync and ending approximately with the end of color burst. The positive pulse is AC coupled to the gate of Q3 a junction NFET that abruptly conducts during burst time and dumps the average DC value plus any low frequency component into C57. U29, a very high gain amplifier, applies the DC error in phase opposition to the input buffer thus canceling its effects and clamping the video's back porch to the level set by R7. U20 is a high precision push-pull video driver. The analogue to digital converter wants to see video 4 volts (2 volts on each side) of push pull video centered on its +2V reference, U20 does just that. The video channel is adjusted using full level modulated stair step as follows. Adjust the video front panel controls for a well-equalized 1VPP at J9 then while monitoring video at the receiver's output adjust R70 for maximum gain and R7 to center the DC bias for not clipping of the chroma or sync. It is very helpful to monitor U23 pin 14 for no pulses during this adjustment. U23 makes a 12 bit measurement of the video at every tick of the clock supplied by a monolithic crystal oscillator Y1. U24 is the high-speed monolithic serializer. It accepts 16 bits plus system clock and serializes them into a single differential PECL bit stream that drives the laser or LED module.

The audio section interfaces a well balanced audio signal to the audio analogue to digital converters. U1, U5 and U9 are dual audio buffers. They convert balanced audio to single ended. U2, U3, U6, U7, U10 and U11 convert single ended audio to accurately balanced audio ready to be digitized by U4, U8 and U12 stereo analogue to digital converters. U4 is the master that supplies drive signals to U8 and U11. LEDs 1, 2 and 3 indicate overflow. U18 strobes the registers where this overflow signals are being stored. They glow when the input audio goes over +19dB. All measurements are performed at input level of +18dBm. U15 is a quadruple digital multiplexer. It inserts external asynchronous data into the digital audio user bit location. Normally only 2 channels are used for external data while the third one carries video presence indication from the transmitter to the receiver. Alarms are provided at the transmitter end for laser failure and for video loss. At the receiver end there are alarms for remote video loss and loss of optical input. The optical failure alarms on both sides are dry relay contacts grounding the external connection, the video loss failure are on both sides open collectors sinking 40mA positive DC to ground. U20 is an automatic reset generator.

## DVM-2000-FRX RECEIVER SECTION

The data modulated light beam is transformed into a balanced PECL bit stream and presented to U15, a monolithic high-speed deserializer. The internal state machine of U1 driven asynchronously by Y1 a monolithic crystal oscillator, recombines the data into a 16 bit parallel bit stream. Internal phase lock loops regenerate the sending end sampling clock with an edge stability of a few pico-seconds. The first 12 bits of the reconstituted data are presented to U16, the video analogue to digital converter that reconstitutes the original video signal. R16, a front panel control varies the converter's DC reference thus adjusting the output gain. LPF1 is the reconstitution low pass filter that removes the clock components from the video. U17 provides gain and flatness adjustments while interfacing the video to the outside world. The audio portion transforms the three audio bit stream again into audio. The associated operational amplifiers are 2 pole low pass filters and output drivers. U1 edge detects the audio channel pulse and triggers monostable multivibrator U3 that produces a strobe pulse occurring at the center of the digital audio's user bit location. The positive edge of U3's output strobes that location recovering external data and remote video presence indication. The whole audio system calibration relies just on 6, one per channel, output gains.

## SPECIFICATIONS

### Video Performance:

**Exceeds the RS-250C Short-haul specification.**

Signal to noise .....	> 75 dB
Differential gain .....	< +/- 0.3 %
Differential phase .....	< +/- 0.3 °
Chrominance to luminance gain .....	< +/- 1 %
Chrominance to luminance delay .....	< +/- 10 nsec.
Frequency response to 8 MHz.....	< +/- 0.1 dB
3 dB Bandwidth .....	8 MHz
Luminance non-linearity.....	< 1 %
Ringing .....	< +/- 0.5 %
Tilt.....	< +/- 0.2 %
Video output & input impedance.....	75 Ohms

### Audio Performance:

Signal to noise .....	> 90 dB
Frequency response to <b>20 Hz to 20 KHz</b> .....	< +/- 0.1 dB
Distortion .....	< 0.05 %
Audio output level, adjustable.....	Unity, +/- 6 dBm
Maximum input & output level, 600 Ohm termination .....	+18 dBm
Audio output impedance, balanced .....	50 Ohms
Audio input impedance, balanced (selectable) .....	600 Ohms or High
Data channels .....	RS-232C, RS-422, CMOS
Power dissipation .....	< 15 Watts, per unit
AC operation.....	110 or 220 VAC (optional 48VDC)
Operating temperature .....	0 to +50 °C
Portable and Wall-mount:.....	7" L x 5 3/4" W x 1 3/4" H
Triple Rack-mount Kit for 3 modules (Part number -RMT):.....	7" L x 19" W x 1 3/4" H

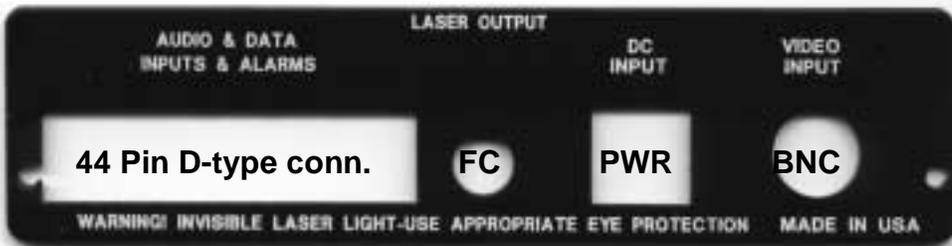
Specifications subject to change without notice.

## DRAWINGS

### DVM-2000 Front and Rear Panel Drawings



Front Panel Transmitter



Rear Panel Transmitter

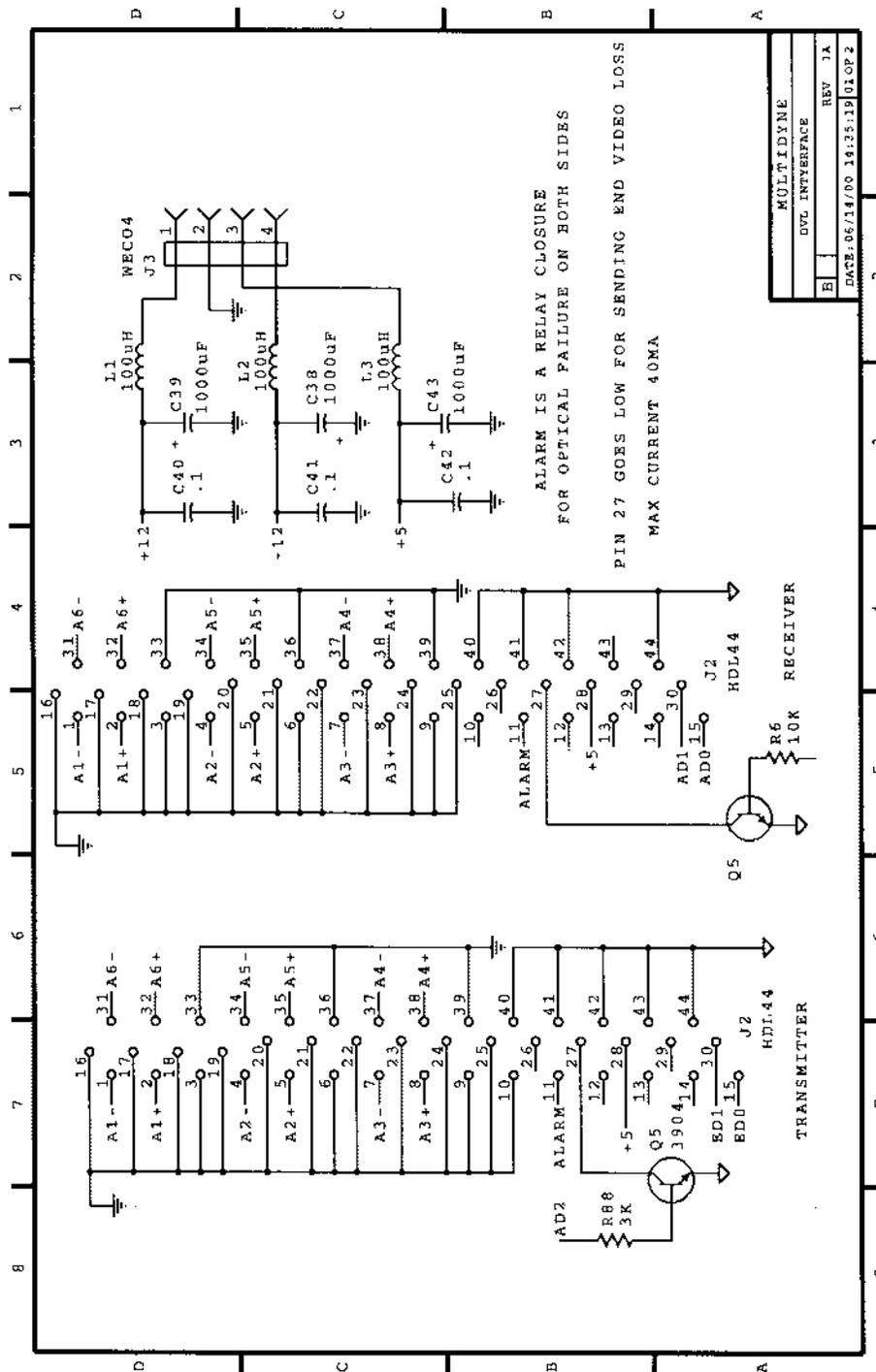


Front Panel Receiver



Rear Panel Receiver

DVM-2000 D-type Connector Wiring Diagram



The 44 pin D-type connector interfaces with a screw terminal break-out board included with the standard unit.

**DVM-2000-FTX Transmitter Mechanical Drawing**

**DVM-2000-FRX Receiver Mechanical Drawing**