

# *DMX Pathfinder MR*

## **USERS GUIDE**

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## INTRODUCTION

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### **WELCOME TO THE WORLD OF *DMXPATHFINDER!***

This Installation Guide is intended to walk you through a typical installation. In preparing the User Guide, it has been assumed that you are reasonably familiar with the DMX512 and the various wiring methods associated with RS422/485 based protocols.

*DMXPathfinder MR* is a DMX512 distribution tool, providing a method for distributing up to eight DMX sources (such as dimming or moving light controls) to a number of DMX devices or outlets. All inputs and outputs are opto-isolated and repeated, in conformance with the USITT/ESTA specifications for DMX512 signal distribution.

The Installer's Guide is divided into 2 chapters:

- **DMXPathfinder Installation** leads you through all the steps necessary for a "clean" installation of your hardware.
- **Maintenance and Testing** offers troubleshooting tips and procedures to keep everything running smoothly.

## Chapter 1: Installation and Assembly

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### SUMMARY

This section describes how to correctly assemble the *DMXPathfinder MR* hardware into an equipment rack and connect permanently installed external wiring.

To ensure a trouble-free installation, you should follow this sequence:

1. Install the equipment rack
2. Run conduit and pull cable
3. Install auxiliary rack equipment and power bars
4. Mount termination boards (if applicable)
5. Dress cable in the rack and terminate (if possible)
6. Unpack the *DMXPathfinder MR* I/O Modules and prepare
7. Install the I/O Modules in the rack
8. Connect cabling to the I/O Modules
9. Power up and test

### BEFORE STARTING

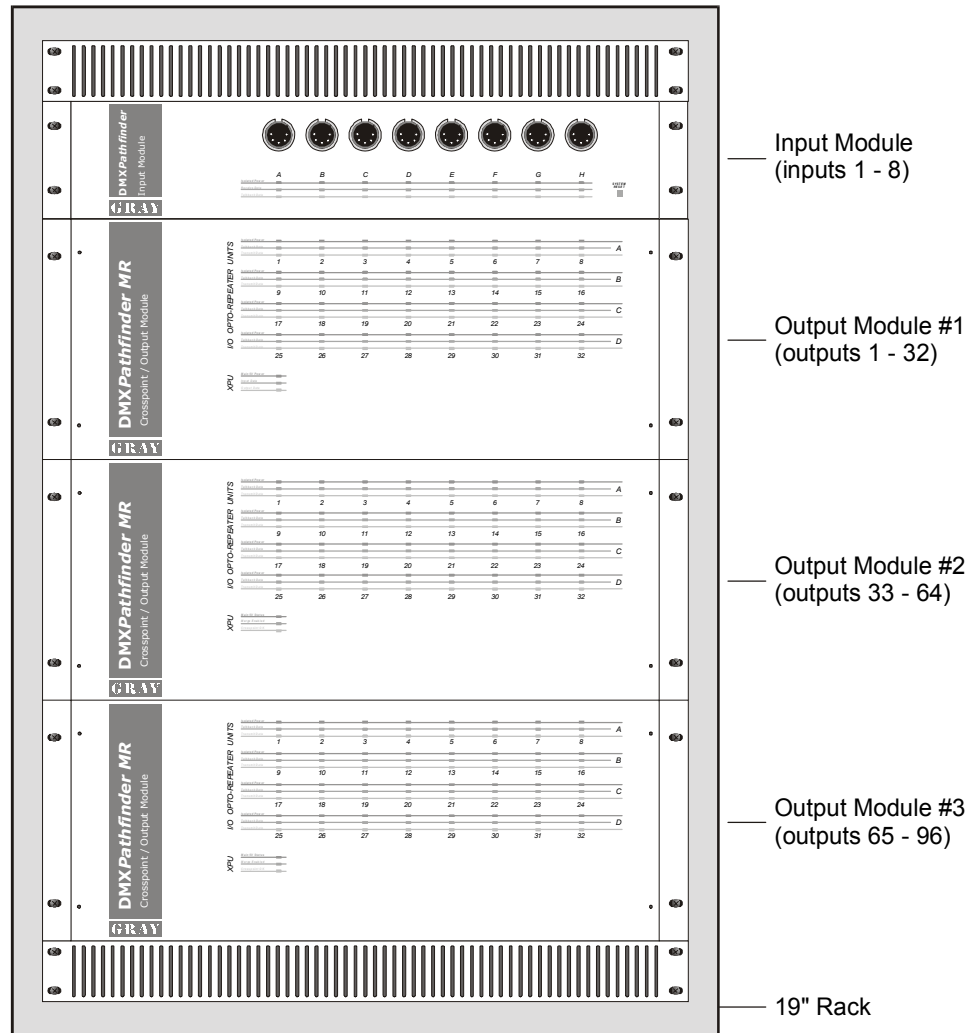
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Before installing the *DMXPathfinder MR* equipment rack, you should carefully consider the environment in which the equipment is to be installed, the proximity to power sources, and the required conduit and/or cable runs.

**Environmental Considerations** -- To maximize equipment life and minimize the possibility of unreliable operation or failures, the following conditions should be adhered to:

- Ambient temperature extremes: -10 to 50 degrees C
- Recommended operating temperature: +10 to +40 degrees C
- Relative humidity: 10-95% non-condensing
- General conditions: clean, dust-free environment

**Fan Cooling** -- Each of the *DMXPathfinder MR* Output Modules is provided with an internal cooling fan. These fans draw air in on the right hand side and exhaust air on the left. To ensure adequate air circulation, do not block the modules at either side. If more than two or three Output Modules are



installed in the same rack, allow for at least a 1U ventilation panel at the top and bottom of the rack.

**Power Requirements** -- A single-phase power source (50 or 60Hz, 100-240VAC, at 0.2A per Input Module and 0.5A per Output Module) must be provided to the *DMXPathfinder MR* equipment rack. It is recommended that no more than ten I/O modules be connected to one power circuit due to the startup current requirements of their switch-mode power supplies.

## RACK SIZING AND PLACEMENT

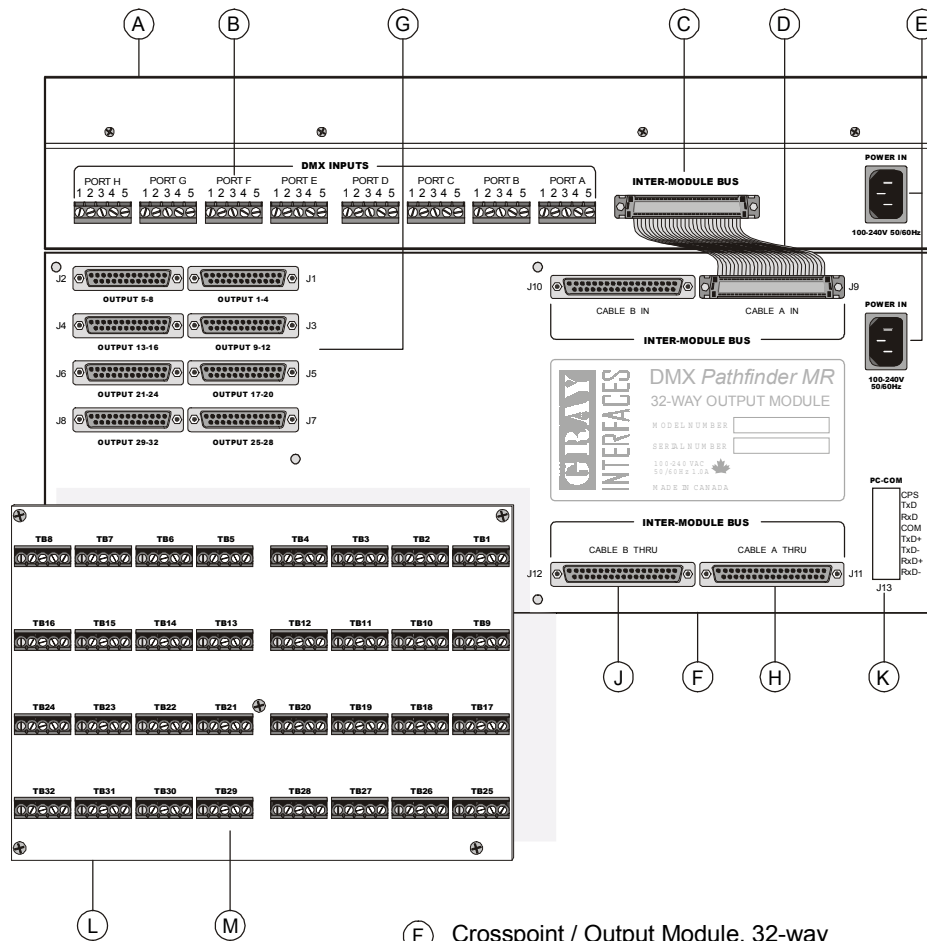
The system installer normally supplies the *DMXPathfinder MR* equipment rack. Use only a standard E.I.A. 19" rack, at least 18" deep (24" is

recommended). To calculate minimum height, add up the number of 2U Input Modules and 4U Output Modules to be installed, then add at least 2U for vent panels and allowance for power bars, connector panels or other accessories if required. Louvered, locking front and rear doors are recommended.

Locate the rack such that at least 3 feet of clearance is allowed at the front, 2 feet at the back, and sufficient clearance at one side (preferably the left) to permit service access to the internal cable connections.

### MOUNTING TERMINATION BOARDS

One of two types of cable termination boards are normally supplied with the system to provide the physical interface between the DMXPathfinder MR Output Modules and external station cabling.



- (A) Input Module, 8-way
- (B) DMX Input Terminal Blocks
- (C) Inter-Module Bus Connection
- (D) Linking Cable, 37 conductor
- (E) Mains Power Supply Input
- (F) Crosspoint / Output Module, 32-way
- (G) DMX Output Connectors, 4-way (DB25F)
- (H) Inter-Module Bus Connector, 1-8 Inputs (DB37F)
- (J) Inter-Module Bus Connector (unused)
- (K) PC Communications Connection (unused)
- (L) Output Terminal Adapter Board, 32-way
- (M) DMX Output Terminal Blocks, 2 piece

Model P2020 32-way terminal block transition boards are the most commonly used method of connecting the DMX output station cabling. These boards mount directly to the rear of each output module using five 6-32 standoffs and screws. They electrically connect to each Output Module with eight 25-pin D-style connectors, therefore a certain amount of force is required to mate the two parts. Ensure that all 8 connectors are fully mated and that the board is resting on the standoffs before installing the five screws.

If the *DMXPathfinder MR* is to be installed in a swing-out (hinged) type of equipment rack, a different type of termination board is usually supplied, the DMS-16LT type. These are 16-way boards, intended for mounting in the rear of the equipment rack, on the rear service panel or on 4U rack panels supplied by the installer or the factory, depending on project requirements. 25-conductor twisted pair ribbon cables, 1-meter long, interconnect these boards with the rear of the *DMXPathfinder MR* Output Modules. Two termination boards should be installed side-by-side on each panel. We recommend the use of 3/8"-1/2" 6-32 threaded standoffs and 1/4" screws to attach the boards to the mounting panels. Insulated hardware is not necessary.

Using DMS-16LT termination boards, mounting and external station cabling may be completed well in advance of installation of the rest of the *DMXPathfinder MR* hardware.

## I/O CABLE INSTALLATION

Input and Output cabling may enter the equipment rack through the top or bottom. Bundle cables at either side of the rack, just in front of the termination boards. Cabling installed to the rear of the rack from the panels will obscure access to terminal blocks at the extreme edges of the termination boards.

Cables are then dressed into place for connection at the input/output terminal blocks. Note the order of the terminal blocks. On 32-way boards they are labeled TB1 to TB32 and are arranged right to left, top to bottom. On 16-way boards they are labeled TB1 to TB16 and are arranged top to bottom, left to right.

## MODULE PREPARATION

Unpack all of the *DMXPathfinder MR* system modules and accessories and arrange on a flat surface. First, locate the package of screws supplied with each module, and use 8-32 screws to attach the rack mount ears to the sides of each Input and Output Module.

If P2020 type termination boards are to be used, mate them to each Output Module and fasten with 5 x 6-32 screws.

Using one power cord, power up each Input and Output Module one at a time and verify that the main power LEDs illuminate.

Remove the four adhesive rubber feet from the bottom of each module.

## MODULE INSTALLATION

Starting with the last (bottom) Output Module, install the modules into the equipment rack. Normally the Input Module is located above the Output Modules, but it can be placed at the bottom, if desired. In any case the Input Module may not be placed between Output Modules.

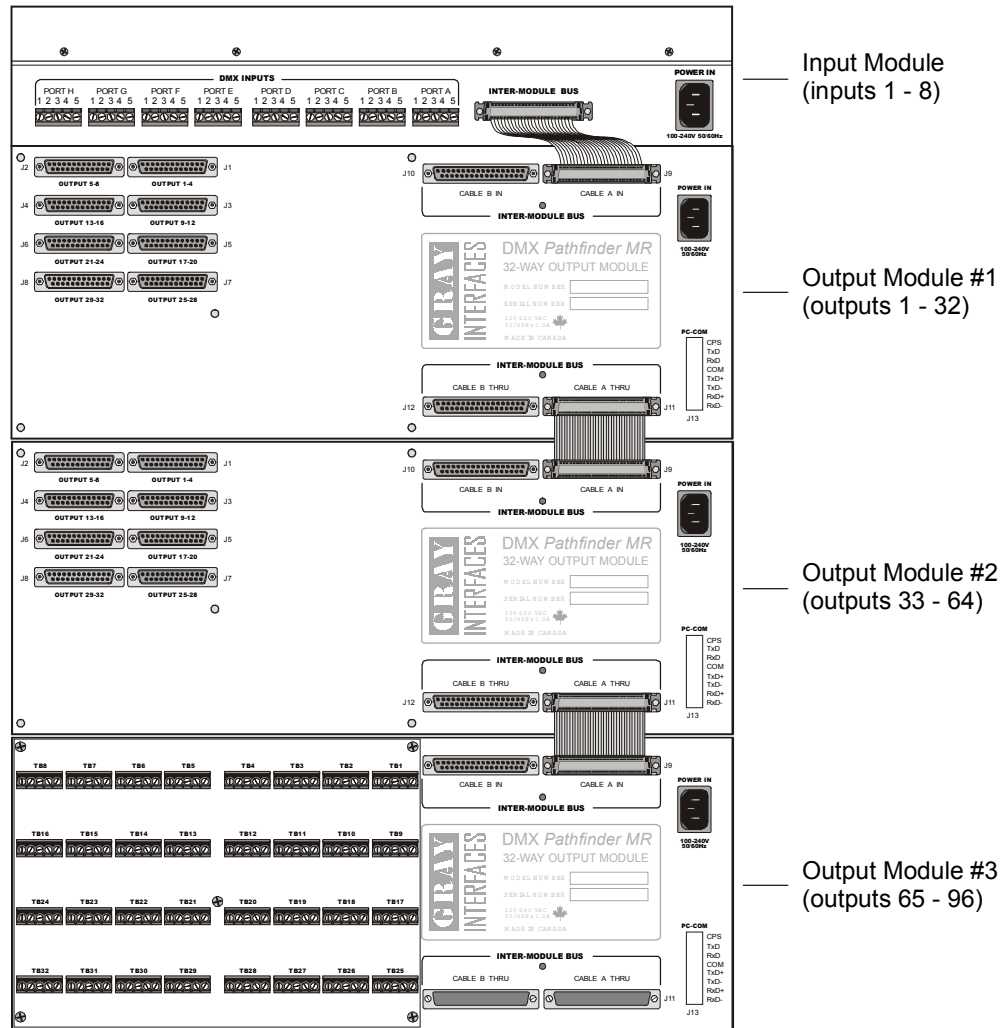
Locate the 37-conductor ribbon cable jumpers and 37-pin bus terminator(s). There should be one 8" long cable for the Input Module and one 4" short cable per Output Module.

Attach the long jumper cable from the Input Module to the top Inter-Module Bus connector marked "CABLE A IN". Install the short ribbon cable jumpers between Output Modules. The bottom connector marked CABLE A THRU on one module connects to the top (IN) connector on the next lower module in all cases.

Install the 37-pin bus terminator plug at the bottom or last unconnected CABLE A THRU jacks in the system.

It is unnecessary to connect anything to the CABLE B jacks on the Output Modules, however if additional jumper cables have been supplied it's a good idea to install them there for possible future upgrades.





## I/O CABLE CONNECTION

Strip back about 3 inches (8cm) of cable jacket and braid shield from each input or output cable. Apply a 2.5" (6.5cm) piece of 1/16" heat shrink to the drain wire and a 1" (2.5cm) piece of 3/8" heat shrink over the exposed braid ends where each cable was stripped. These precautions are to ensure that cable shields cannot contact each other or equipment ground.

Strip about 1/2" of insulation from the four signal wires in each cable. Bend over 1/4" of the exposed conductors on all five wires and connect them to the terminal block. Note that each five-position terminal block is numbered 1 thru 5 on the termination board. This corresponds to the pin numbering on XLR 5-pin connectors, that is:

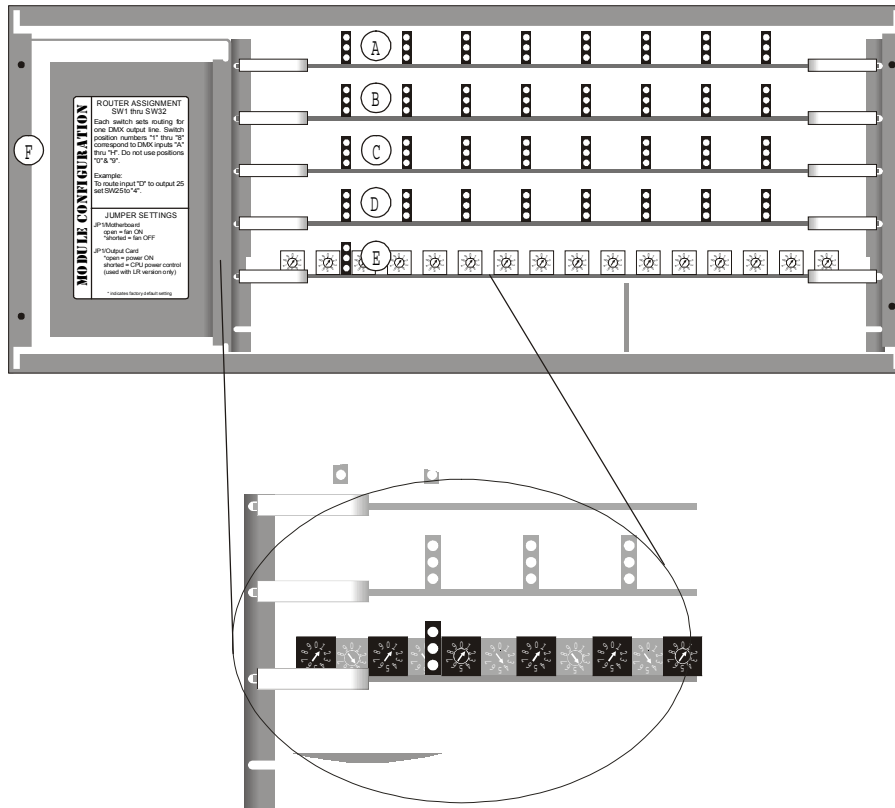
- Pin 1 -- Signal Common (shield)
- Pin 2 – DMX Data (-)
- Pin 3 – DMX Data (+)
- Pin 4 – Talkback Data (-)
- Pin 5 – Talkback Data (+)

Be sure to use one twisted pair for the DMX data and the other for Talkback data. It is also good practice to label each station cable and corresponding terminal block header position with the cable number.

Input Modules are provided with both 5-position rear-mounted terminal blocks and parallel 5-pin XLR male faceplate jacks. In some installations, the hardwired cable terminates at female jacks mounted on an auxiliary panel provided by the system supplier. In this case, no connection is made to the Input Module's rear terminal blocks; instead short XLR patch cables are used to interconnect the auxiliary panel female jacks with the Input Module's male faceplate jacks.

## Patching

To assign outputs to inputs, first remove the front cover to access the Crosspoint Card (E).



Each of the 32 rotary selector switches on the Crosspoint Card corresponds to an output in this Output Module. The switch is set to the input number from one to eight that you wish to feed this output from. Position one corresponds to input "A" and position eight to input "H". Positions zero and nine are unused.

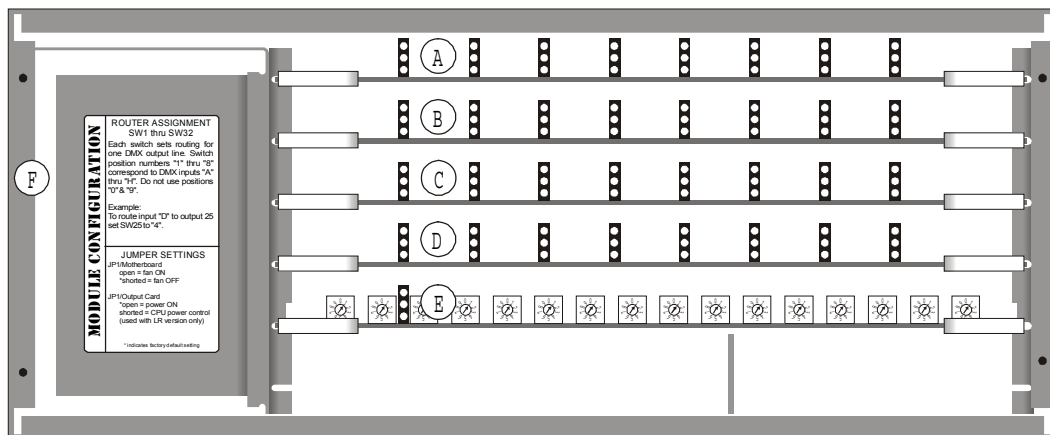
## Chapter 2: Maintenance & Testing

### TESTING THE INSTALLATION

Once all connections are made and inspected for possible errors, you can power up the *DMXPathfinder MR* modules in the equipment rack. With no DMX source signals or talkback signals present, all eight red *Isolated Power* LEDs on the face of the Input Module should be illuminated. On each Output Module, all eight red *Isolated Power* LEDs on each installed output card and the *Main 5V Power* LED on the crosspoint card (XPU) should be illuminated. If any green or amber LEDs are on, there may be a wiring problem with the external DMX cabling. Try disconnecting the corresponding input or output temporarily to see whether this is the case.

### CARD REPLACEMENT

Should a defective component be found in an Output Module or other module during troubleshooting, it is best to replace the suspected defective circuit card with a spare unit and re-test. Powering down the entire *DMXPathfinder*, or at least the specific module, is recommended before removing or inserting cards.



- |  |  |
|--|--|
| (A) Output card #1 (CH. 1-8) part # 2108   | (D) Output card #4 (CH. 25-32) part # 2108 |
| (B) Output card #2 (CH. 9-16) part # 2108  | (E) Crosspoint card part # 2320            |
| (C) Output card #3 (CH. 17-24) part # 2108 | (F) Output module (MR) part # 2300         |

To replace an Output Module card, first remove the four front-panel Phillips screws and the cover panel, then grasp the card stiffener bracket (or ejector handles), and pull the card straight out of the module chassis. Carefully align the replacement circuit board into the chassis' left and right card guides and slide the unit in until it protrudes about 5mm, then push the module firmly into its mating backplane receptacles. The card is not fully seated unless its front edge is flush with the front of the metal chassis.

If the Crosspoint Card was replaced, check that the rotary switches have been set the same as the replaced card. Test the system to ensure that the fault has been corrected.

## TEST PROCEDURES

System testing by maintenance personnel will usually be carried out in response to a fault that has developed somewhere in the system. Powerful diagnostic instruments are available to assist maintenance technicians with this task: the Fluke Model 650 LAN Cable Meter, and Goddard Design Li'l DMX'ter, amongst others. These will be described in more detail below. In general, though, the troubleshooting instructions in this chapter are likely to help solve the vast majority of problems encountered, especially where any system downtime cannot be tolerated.

Tests using instrumentation will be performed where anomalies have developed in the system that cannot be isolated with standard troubleshooting procedures. Additionally, testing can establish minimum network performance where non-DMX512 control equipment is to be connected to the system.

**Fluke 650 Cable Meter** -- Please refer to the manufacturer's user's manual for detailed instructions and theory before attempting to use this instrument. It's not obvious to the first time user! The Fluke 650 is provided with a battery-powered remote plug-in unit, a set of 2 adapter cables (RJ45 to 5-pin XLR) and an AC adapter. The unit may be powered by a 9-volt alkaline battery, but battery life tends to be rather short with the 650 so use of the AC adapter is recommended.

When the remote unit is connected to the other end of any DMX cable run, the 650 will verify wiring continuity on all pins except ground (pin 1). Cable length can also be measured with the instrument, and any anomalies, e.g. changes in line impedance will be detected. The 650 measures performance of the cable installation at up to 10 million bits per second.

The Fluke 650's signalling is not compatible with the *DMXPathfinder MR* electronics or any other DMX generating or receiving equipment. Thus its usage should be confined to the cable installation only.

***Goddard Design Li'l DMX'ter*** -- This useful instrument can test most aspects of the DMX Distribution System, from wiring continuity to signal propagation through the *DMXPathfinder* electronics. Since the DMX'ter can both generate and receive DMX512, it is 100% compatible with all aspects of the distribution system, including any control system or receiving device. The DMX'ter will directly control any receiving unit, and will verify the output of a controller by displaying the data on an LCD readout. In addition, the instrument will test cable continuity on all five XLR pins. Please refer to the *Li'l DMX'ter Operating Manual* for more information.

***Other Test Equipment*** -- The maintenance technician will find the following additional test equipment useful:

.1 Oscilloscope -- for viewing data in conjunction with the DMX'ter and its scope trigger module; for checking that both differential signals are present on a given data line; for evaluating the performance of crosspoint matrix and opto-repeater circuitry at higher operating speeds (greater than 250 Kbits per second).

.2 Frequency Generator -- for testing crosspoint matrix and opto-repeater high-speed performance. Useful for evaluating whether other systems with higher data rates can be used in the network.

.3 Digital Volt/Ohm Meter -- a general purpose tool for checking continuity, termination resistor values and power supplies.

## **ADVANCED TROUBLESHOOTING**

As described earlier, basic troubleshooting usually involves isolating a troublesome or defective opto-repeater circuit, card or module and replacing it with a known good one. It may also include checking for obvious things such as incorrect addressing or DMX protocol incompatibility with DMX receiving devices, absence of a line terminator, defective DMX patch cables, or even incorrect control console configuration.

Once all basic troubleshooting checks have been completed, without the desired resolution of the problem, more sophisticated faultfinding may be carried out. Try swapping input or output cable connections on the back of

the *DMXPathfinder* modules with adjacent ones to use a different receiver and transmitter circuits. Next, a DMX tester should be used to either transmit DMX in place of the control console, or receive DMX in place of the receiving device(s). Check the receiving device by connecting the DMX tester directly to it in transmit mode. Then set the tester to receive mode and monitor the data coming to the *DMXPathfinder* from the console, by plugging into the Input Module faceplate XLR with a female-female cable. If this test does not point to the data source or the receiving device as being the cause of the problem, there may be a slight incompatibility between them as far as DMX512 is concerned. However, if the two units had previously worked together, these tests will point to a problem in the DMX cable installation or in one of the *DMXPathfinder* modules.

At this point, the suspect Output Module's output card or should be withdrawn from its chassis and the spare unit inserted in its place (remember to power down before withdrawing or inserting any cards). If this proves that the original unit is defective, inspect the card for signs of damage or any other obvious cause. Return the defective card to the factory for repair unless you have the facilities to carry out your own service. For more serious defects, such as power supply or fan failure, disconnect the entire module and take it to the test bench for repair, or return it to the factory. *DMXPathfinder MR* modules are not difficult to service with basic tools and test equipment. If the suspect module proves to be good, test the DMX cable installation for open or shorted lines using a loopback test connector. You can easily make one of these from a 5-pin male XLR plug by shorting together pins 2&4 and 3&5. Insert the plug into the female DMX-out receptacle at the far end of the cable and apply a DMX signal to the desired *DMXPathfinder* input. Switch-select that input at the crosspoint card. If the wiring installation is good, the green & amber LEDs on the Input Module, crosspoint card and output card will all be illuminated. Note that this test is possible only in systems where all five XLR pins are wired.

If the above tests yield passing results and the problem persists, it may be necessary to use the Fluke LAN Cable Meter to do a high-frequency analysis of the suspect cable runs. This test will quickly indicate any anomalies having to do with cable impedance and capacitance that would result in excessive signal distortion or attenuation. This test will help to locate less-obvious problems such as pinched or over-heated cabling that cannot be found with simple continuity checks.

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