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OM000001 REV01 RELEASE DATE 1/27/04
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TABLE OF CONTENTS

1.0   GENERAL INFORMATION

1.1   Scope and Organization of the Manual

This manual contains information and procedures required to install, operate, and maintain the Millitech Series MWA Motorized Waveguide Attenuator. The manual is divided into sections as follows:

    Section 1: General Information

    Section 2: Installation

    Section 3: Operation

    Section 4: Maintenance

1.2   Introduction

This section of the manual contains a general description of the Millitech Series MWA Motorized Waveguide Attenuator including functional description, list of equipment supplied, specifications, and safety precautions.

1.3   General Description

The Series MWA Motorized Waveguide Attenuator is designed to provide precise and repeatable attenuation of a waveguide path with minimum insertion loss and low VSWR mismatch across a full waveguide band. The attenuator incorporates a precision rotary vane attenuator mechanism that produces a minimum of phase shift with frequency.

1.4   Functional Description

The Series MWA Motorized Waveguide Attenuator system consists of two main subassemblies: the rotary vane type waveguide attenuator assembly or head, and the attenuator controller assembly. The rotary vane attenuator assembly can is capable of providing 0 to 50 dB of calibrated (uncalibrated up to 59.9 dB) attenuation in the waveguide when the operator selects the appropriate value on the controller assembly. These two assemblies are interconnected by a cable, terminated in standard nine pin "D" connectors. Power for the MWA is provided through an AC power cord via a standard IEC type fused rear panel connector.

1.5   Specifications

Typical performance, electrical specifications, typical applications, outline drawings, mechanical specifications, model variations and ordering information can be found in Appendix A, MWA Specification Sheet.

1.6   Instrument Identification

The model number structure of the MWA Motorized Waveguide Attenuator is detailed in the 'How To Order' section of the MWA Specification Sheet. For example, an MWA-28-1IG60 is a Ka Band 26.5-40 GHz (-28), 100-120 Vac (-1IG60), Instrumentation Model benchtop version (-1IG60) with GPIB (IEEE-488) control capability option (-1IG60), and a six-foot interconnect cable (-1IG60).

1.7   Safety Considerations

The MWA Motorized Waveguide Attenuator is a precision electro-mechanical device that should be protected from extreme environmental conditions, physical shock, excessive stresses and foreign objects entering the waveguide ports. When not in use, the waveguide ports should be kept covered to prevent inadvertent entry of foreign objects, dust or materials. Never insert anything into the interior of the waveguide as accuracy and performance of the attenuator may be affected. For applications involving repeated connections to the MWA

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waveguide flanges, Millitech suggests purchasing short straight waveguide sections for each port. This will reduce wear on the waveguide flanges that are permanently attached to the attenuator and allow easy replacement of a relatively inexpensive part. Worn waveguide flanges can cause poor performance, VSWR problems and unstable measurements. The attenuator assembly should always be properly supported to avoid stress on the waveguide flanges, either by use of a lab jack or proper mounting using the holes provided. The controller assembly contains Electrostatically Sensitive Devices (ESD) and proper precautions should be observed when operating the unit. The controller should not be disconnected from the attenuator assembly with the power on.

2.0   INSTALLATION

2.1   Introduction

This section provides instructions for installing the Millitech Series MWA Motorized Waveguide Attenuator, as well as information about initial inspection, damage claims, preparation for use, and guidance for storing, shipping, and repacking.

2.2   Unpacking and Initial Inspection

The equipment is inspected prior to shipment and packed to ensure safe delivery after shipping. In the unlikely event that damage to the shipping container is evident, immediately contact the freight carrier for instructions and, if necessary, request a representative be present when the container is opened. Unpack and verify that the contents of the container match those on the packing sheet. Retain the container and the packing material.

2.2.1   Mechanical Check

Check the equipment and all accessories for evidence of mechanical damage such as broken or bent connectors, or knobs, loose external or internal parts, or scratches or dents on all surfaces. If damage of any kind is found, retain the shipping container and packing material for inspection.

2.2.2   Electrical Check

Prepare the equipment for Electrical Check in the following sequence:

1. Section 2.3: Interconnection

2. Section 3.3: Operating Instructions

3. Section 2.4: Performance Verification Tests

A complete test data package is shipped with each attenuator assembly for reference. Complete the performance tests in Section 2.4 as soon as possible after satisfactory completion of the mechanical check. If the equipment fails the performance test and therefore does not meet the specifications, refer to section 2.2.3, Claim for Damage.

2.2.3   Claim for Damage

If physical damage is evident or if the instruments do not meet specifications when received, notify the freight carrier and Millitech to arrange for return and repair or replacement. Refer to section 2.2.4, Packaging for Shipment, and 2.2.5, Communicating with Millitech.

Millitech MUST BE CONTACTED prior to returning any items for evaluation and/or repair. A Returned Material Authorization (RMA) number must be assigned for tracking and quality control purposes.

2.2.4 Packaging for Shipment

When using the original packaging or other packing materials, make sure that all items are individually wrapped in protective wrapping before they are packed in the shipping carton. Prior to returning any item, contact Millitech for an RMA number.

1. Enclose a copy of the packing list for each item being returned. This will list the model and serial number of each item being shipped. If an item does not have a model number, (i.e.; cable assembly), list item by description.

2. To assist problem diagnosis and repair, enclose a brief description of problem or malfunction encountered.

3. Enclose equipment return-to and bill-to addresses.

4. Reference original purchase order number for repairs under warranty.

5. Clearly mark or label outside of shipping carton with RMA Number and "FRAGILE".

It is advisable to retain the original cartons and packaging materials to ensure best protection during return shipping.

If the original packaging is not available, the following general instructions should be used for packaging the instrument with commercial packing materials:

1. Use a double-walled carton made of at least 350-pound test materials.

2. Use enough shock absorbing packing materials on all sides to provide a firm cushion and to prevent the materials from sliding or shifting during transit. Protect control panel exposed parts and connectors with cardboard or similar materials.

3. Protect pre-wrapped cables and accessories with cardboard separators.

2.2.5 Communication with Millitech, Inc.

Millitech, Inc.
29 Industrial Dr. East
Northampton, MA 01060
Phone: 413-582-9620
Fax: 413-582-9622
E-mail: info@millitech.com
Web Site: www.millitech.com

Please consult the Customer Service Information packet received with your shipment for detailed instructions.

2.2.6 Storage and Shipping Environment

These instruments may be stored or shipped in environments within the following limits:

Temperature:-40°C to +75°C

Humidity: 5 to 95% relative at 0°C to +40° C

Altitude: Up to 15,240 meters (approximately 50,000 feet)

These Instruments should also be protected from temperature extremes which may cause condensation to form in the instrument.

2.3 Interconnection

The following are the installation instructions for the Millitech Motorized Waveguide Attenuator:

1. Connect the male end of the 9 pin "D" connector cable to the rear panel female "D" connector labeled "MOTOR OUTPUT" on the controller assembly.

2. Connect the female end of the 9 pin "D" connector cable to the male 9 pin "D" connector on the attenuator assembly.

3. Connect the AC cord to the rear panel IEC connector labeled "AC POWER".

4. Plug the other end of the AC cord into a wall socket with the appropriate AC voltage.

2.4 Performance Verification

Once the steps in section 2.3 are completed, perform the following procedures to verify the proper operation of the attenuator. These steps should be performed when the equipment is first received and whenever problems are suspected.

2.4.1   Local Operation

1. Turn on the switch marked **"POWER"**.

2. The LED indicator marked **"IN MOTION"** should start to flash rapidly with approximately a 50% duty cycle. This indicates that the unit is currently searching for the home or reference position. If the attenuator assembly is held up to the ear, one should hear the motor noise as it moves. If the unit is held up to the light and viewed down the waveguide barrel, one should see the central vane move. It should stop for a few seconds when it is perpendicular to the two other vanes in the barrel and then move back until it is parallel to them. During this period, the lamp may flicker as it searches for the reference position.

3. The LCD screen on the front of the controller should display the message "MWA Controller, Millitech Inc." on power-up before displaying "Local Mode".

4. When the attenuator has finished the "home" or reference search, the **"IN MOTION"** lamp should extinguish indicating the unit is at the last used attenuator value (00.0 dB default) and ready for use. Any other indication on the lamp is a malfunction.

2.4.2   Remote GPIB Operation

1. Connect an appropriate IEEE-488 connector and controller to the rear panel connector labeled **"GPIB"**.

2. Press the Mode button on the MWA controller keypad and cycle through the modes until "GPIB mode" is reached. The display will ask for a GPIB address to be entered. Valid addresses are 1 to 9. Enter the address desired using the keypad and press the Enter button.

3. The LED indicator marked **"IN MOTION"** should start to flash rapidly with approximately a

50% duty cycle. This indicates that the unit is currently searching for the home or reference position. If the attenuator assembly is held up to the ear one should hear the motor noise as it moves. If the unit is held up to the light and viewed down the waveguide barrel, one should see the central vane move. It should stop when it is perpendicular to the two other vanes in the waveguide barrel. During this period, the lamp may flicker as it searches for the reference position. The LCD screen should display "Working…" while this is going on.

4. When the attenuator has finished the "home" or reference search, the **"IN MOTION"** lamp should extinguish indicating the unit is ready for use. Any other indication on the lamp is a malfunction. The LCD screen should display "GPIB Mode/GPIB Addr. = X" where X is the GPIB address entered.

5. Send a command from the controller that sets the attenuation value to 00.0 dB (refer to the programming command list below). The **"IN MOTION"** lamp should flash for a few seconds and then stop, indicating the attenuator is in position and ready for use. Again, the motor noise may be heard if the attenuator assembly is held up to the ear and the vanes in the waveguide barrel should be parallel when the lamp is extinguished. Any other indication on the lamp is a malfunction unless the lamp flashes slowly at about a three-Hertz rate. This indicates that a value outside the OC to 59.9 dB range has been received via the bus.

Below are the IEEE-488 commands that the controller recognizes as implemented in HP Basic v 2.0 and above:

Function	HP Basic Command	Data Returned/Result
1. Set Attenuation Value	**OUTPUT 702; "12.1"** Set attenuation value at device located at GPIB address 2 to 12.1 dB	NONE Controller accepts 4 characters of the form "dd.d" (followed by a CR/LF combination) will be ignored (as long as the string is terminated somewhere by a CR/LF). The GPIB data handshake is held off on the 'LF' byte to allow the controller to process the incoming data and send it on to the attenuator hardware. When all of the required processing is completed, the handshake is completed.
2. Version/Date String Read Back Command	**OUTPUT 702; "V"** Send "V" (upper case ASCII V) to attenuator at GPIB address 2 so that next status read will produce controller's software Version and Date string.	NONE The controller will accept the letter "V", followed by a CR/LF combination. If this is received, then the next ENTER 7xx;a$ command will receive a version string including the software rev level and date.

Function	HP Basic Command	Data Returned/Result
3. Read Back Last Command and Status	**ENTER 702;a$** Return status from device at GPIB address 2.	DATA returned in string variable a$. As shown in the example above, a$ would look like "12.10" assuming no errors were returned. Controller echoes back the last valid GPIB command and status, returning exactly 4 ASCII characters ("dd.d"), followed by a CR/LF terminator combination. The returned status digit may be: '0' – all OK '1' – error in reaching position '2' – last data sent was bad '3' – failed to find home sensor when expected. '6' – in motion No EOI is sent with the last byte. As noted above, if the "V" command was sent to the attenuator, the next status readback will receive a software version data string. Please delay 100 milliseconds between an attenuator setting command and a subsequent status read. If the previous command sent was the "V" command, the Version/Date string is returned which consists of 13 ASCII bytes followed by a CR/LF combination of the form "1.20_09/17/93"
4. Status Poll Enable (SPE)	**SPOLL 702** Do serial status poll of GPIB address 2.	Controller reads and returns the status with one ASCII digit representing the status, followed by a CR/LF terminator combination. The returned status digit may be: '0' – all OK '1' – error in reaching position '2' – last data sent was bad '3' – failed to find home sensor when expected. '6' – in motion
5. Device Clear (DCL)	**CLEAR 702** Clear the device at GPIB address 2.	Controller causes the attenuator to home and then go to 59.9 dB.
6. Group Execute Trigger (GET)	**TRIGGER 702** Trigger the device at GPIB address 2.	Controller recognizes this GPIB command but takes no action.

More detailed information and a low level description of the commands is located in Section 3.3.2 Remote Operation.

2.4.3   Ethernet Operation

1. Insert an Ethernet cable into the rear Ethernet port on the MWA controller unit. Connect the other end to a jack somewhere on your network.

2. Press the "Mode" button on the keypad of the MWA controller until the LCD screen says "Ethernet Mode". It will also say that it is connecting. After a few seconds the MWA controller should pull up the current IP configuration and the LCD screen will print out what it is.

3. While using another computer on the same network as the MWA controller, one can use telnet or a similar program to connect to the MWA controller. Once connected, using the MWA controller is very similar to using local mode, only using a PC instead of the MWA keypad.

4. Send an attenuation command to the MWA controller by using *command here*. The front LED on the MWA controller should blink accordingly while the motor moves the attenuator to the correct attenuation.

insert screenshots here

3.0 Operation

3.1 Introduction

This section contains information and procedures required to operate the Millitech Model MWA-XX-XXXXX series of Motorized Waveguide Attenuators.

3.2 Operational Overview

The Millitech Model MWA-XX-XXXXX Motorized Waveguide Attenuators have been derived from Millitech's highly successful series of Manually Operated Precision Waveguide Attenuators. Each attenuator consists of a rotary vane type of precision attenuator connected mechanically to a precision stepping motor. The position of the attenuator is determined by an indexing sensor attached to the rotating body. The rotating body contains a resistive vane which, when presented at the proper angle to the propagating wave within the waveguide, will attenuate it by a value proportional to its angle. This follows the relationship:

$$\text{Attenuation ratio} \propto \frac{1}{COS^4(\Theta)}$$

Where Θ = the angle of the resistive vane in the rotating body relative to the angle of the incident wave.

The controller translates the attenuation value entered by the operator into electrical pulses. The stepping motor translates the electrical pulses from the controller into precise, mechanical steps to move the attenuator's rotating body into the predetermined position for the desired attenuation value. The allowable angles for the rotating body are 0° to 90°.

At power up the controller commands the attenuator to find the index or reference point. It then uses that reference point to determine how many pulses should be applied and in what direction to attain the desired attenuation value. This "homing" function occurs according to the following table:

1. At power up in local mode	Check "home" then to last setting
2. After GPIB address is set	Check "home" then to 59.9 dB
3. xx	xx
4. While in GPIB mode	Check home only when GPIB "CLEAR" command is issued

3.3 Operating Instructions

Three means of operating the Motorized Waveguide Attenuator are provided:

1. Local operation via the controller's front panel keypad.

2. Remote operation via the controller's rear panel "GPIB" connector.

3. Remote operation via the controller's rear panel Ethernet connector.

3.3.1   Local Operation

Local operation is the default mode on power-up to the MWA controller. After the initial start-up message, the LCD screen on the front panel of the controller should display "Local Mode" and "Enter Command". Once this message is shown the MWA controller is ready to accept local commands using the keypad.

Enter commands using the format:

<div align="center">

X   **X**   **.**   **X**
[tens]   [ones] [period] [tenths]

</div>

After entering a command of form xx.x, push the enter button to send the command.

The period[.] is necessary for a successful command. For example, entering a command of 26.0 will set the attenuation to 26.0 dB while a command of 26 will be result in an error. If a command with incorrect form is entered, an error message is displayed. Another command can then be entered.

3.3.1.1   Front Panel Error Indications

Front panel error indications are made through the **"IN MOTION"** LED and LCD screen error messages. The following table decodes indications for the **"IN MOTION"** LED:

Lamp Status	Function
OFF	Attenuator in position (no errors)
Flashing rapidly	Attenuator is in motion toward position
On continuously	Fatal error. Attenuator can't find home position sensor. Check cable between control box and attenuator and reset (cycle power)
Flashes slowly (3 HZ)	Error. Cycle to local mode and issue a new command or reset (cycle power)

3.3.2   Remote GPIB Operation

Remote GPIB operation means that the controller will accept commands through the "GPIB" connector on the rear panel of the controller. The interface conforms to IEEE-488 standards and will accept commands to set the attenuator's position or read back the last command and current status of the attenuator or the software version and date. The controller CANNOT function independently or communicate on the IEEE-488 bus without being connected to the attenuator assembly.

1. The default mode on power-up of the MWA controller is the "Local" mode. Press the "Mode" button on the keypad until the LCD screen displays "GPIB mode".

2. Connect an appropriate IEEE-488 connector and controller to the rear panel connector labeled **"GPIB"**.

3. The front panel LCD screen will ask for a GPIB address. Enter an address between 1-9. Press enter when ready. An invalid address will result in an error message.

4. The LED indicator marked **"IN MOTION"** should start to flash rapidly with approximately a

50% duty cycle. This indicates that the unit is currently searching for the home or reference position. During this period, the lamp may flicker as it searches for the reference position. The LCD screen will display the status message "Working…"

5. When the attenuator has finished the "home" or reference search, the **"IN MOTION"** lamp should extinguish indicating the unit is ready for use. The LCD screen will display the GPIB address set. Changing the address requires resetting the MWA controller (cycle power).

6. To change the GPIB address, press the period (.) key. The period key resets GPIB mode and a new address can be entered. Note that pressing the period key will remove the current address and a new address must be entered before any GPIB commands can be issued.

3.3.2.1 Remote Operation Programming Commands

The GPIB interface is designed to be easy to use and simple to program. The controller monitors the GPIB bus in remote mode and looks for a sequence of three command bytes as listed below:

UNL / UNT	The unlisten or untalk command
MTA / MLA	The bus controller's / attenuator's listen or talk address

If the MTA / MLA matches the attenuators GPIB address, then the attenuator controller will respond depending on whether it is the listener or talker. If the attenuator controller is the listener, it will expect one of two commands listed below:

1. Four ASCII characters of the form "dd.d" followed by an ASCII carriage return, line feed combination (CR/LF), where "d" are valid ASCII numeric attenuation values and "." is the ASCII character period or hexadecimal 2E. The CR/LF combination is hexadecimal 0d,0A. Therefore, a properly encoded string sent to the attenuator controller for an attenuation setting 01 29.5 dB at GPIB address 2 would look like the following string of characters (shown as 0xDD, where 0x indicates base 16 or hexadecimal and DD are any valid hexadecimal digits).

ATN= Command	ATN= Command	ATN= Command	ATN= Data	ATN= Data	ATN= Data	ATN= Data	ATN= Data	ATN= Data
0x3F	0x55	0x22	0x32	0x39	0x2E	0x35	0x0d	0x0A
UNL	MTA	MLA	"2"	"9"	"."	"5"	CR	LF

Normally, the first three characters sent in this string are handled by the bus controller software and are only shown here for clarity.

The attenuator controller does <u>not</u> look at the IEEE-488 EOI line. There is error checking performed on the ASCII digit data. Too few characters (followed by a CR/LF) will be ignored. Characters beyond the required "dd.d" will be ignored (as long as the string is terminated somewhere by a CR/LF). The GPIB handshake is held off on the LF byte to allow the software to process the incoming data and send it to the attenuator hardware. When all the required processing is completed, the handshake is completed.

2. The second command the attenuator controller recognizes is the "**VERSION"** command. When this command is received, the next valid status read (See section 3.3.2.2) will contain the software version and date of the attenuator controller. This command consists of the ASCII letter "V" (This MUST be upper case), followed by a CR/LF combination.

3.3.2.2 Remote Operation Status Read Back

Two status strings are available for readback depending on the command just prior to the read.

1. When the GPIB bus controller addresses the attenuator controller as a talker, the attenuator controller will respond with four ASCII characters of the form "dd.d", representing the last digits sent to the attenuator, followed by one more ASCII digit representing the status, followed by a CR/LF combination. The returned status digit may be:

"0"	No errors
"1"	Error in reaching position
"2"	Last data sent was bad (out of range 00.0 - 59.9 or not ASCII)
"3"	Failed to find home sensor when expected
"6"	Motor in motion

No EOI is sent with the last character.

2. The second format of readback will occur if the command just prior to the read was the "V" or VERSION command. The readback string after the "V" command will be the attenuator controller's software version/date string. This string is currently 13 characters long plus a CR/LF combination for a total of 15 characters of the form "1.20_09/17/93". This, however, is not guaranteed to be the same for different controllers since Millitech reserves the right to improve and modify the controller software when necessary.

The programmer should delay approximately 100 milliseconds between sending a command and a subsequent status read.

The attenuator controller also recognizes several other GPIB control line commands:

Serial Poll Enable (SPE)	Status character is returned to the bus controller
Device Clear (DCL)	Attenuator is homed and set to 59.9 dB
Group Execute Trigger (GET)	Attenuator recognizes the command but does nothing

3.3.2.3 Table 3 -1 IEEE -488 Command Summary Reference

The following assumes the controller address to be 20_{10} and the attenuator address to be 2_{10}.

Proper format for sending attenuation value:

ATN = Command	ATN = Command	ATN = Command	ATN = Data	ATN = Data	ATN = Data	ATN = Data	ATN = Data	ATN = Data
0x3F	0x55	0x22	0x32	0x39	0x2E	0x35	0x0d	0x0A
UNL	MTA	MLA	"2"	"9"	"."	"5"	CR	LF

Proper format for sending **VERSION** command:

ATN = Command	ATN = Command	ATN = Command	ATN = Data	ATN = Data	ATN = Data
0x3F	0x55	0x22	0x56	0x0d	0x0A
UNL	MTA	MLA	"V"	CR	LF

When combined with a subsequent Status Read, **VERSION** will return software version / date string.

Proper format for status readback:

ATN = Command	ATN = Command	ATN = Command
0x3F	0x35	0x42
UNL	MLA	MTA

Attenuator Becomes Talker	ATN = Data	ATN = Data	ATN = Data	ATN = Data	ATN = Data	ATN = Data	ATN = Data
	0x32	0x39	0x2E	0x35	0x30	0x0d	0x0A
	"2"	"9"	"."	"5"	"0"	CR	LF

Proper format for version/date string:

ATN= Command	ATN= Command	ATN= Command
0x3F	0x35	0x42
UNL	MLA	MTA

Attenuator becomes talker	ATN= Data	ATN= Data	ATN= Data	ATN= Data	ATN= Data	ATN= Data	ATN= Data	ATN= Data	ATN= Data	ATN= Data	ATN= Data	ATN= Data	ATN= Data	ATN= Data	ATN= Data
	0x31	0x2E	0x32	0x30	0x5F	0x30	0x39	0x2F	0x31	0x37	0x2F	0x39	0x33	0x0d	0x0A
	"1"	"."	"2"	"0"	"_"	"0"	"9"	"/"	"1"	"7"	"/"	"9"	"3"	CR	LF

3.3.3   Remote Ethernet Operation (optional)

Remote Ethernet Operation uses the RJ45 Ethernet jack on the back panel of the MWA controller. There are two modes available for setting an IP address to the controller: Dynamic and User-configured modes. Under either of these modes, an IP address is set to the MWA controller which is displayed on the front panel LCD screen.

3.3.3.1   Dynamic IP mode

Default mode. An IP address is automatically generated and displayed on the front panel LCD screen once Ethernet mode is ready for use. Once this IP is shown, the user can enter the IP address into telnet and operate the MWA from there. The command form is like that of Local mode:

$$X \qquad X \qquad . \qquad X$$
[tens]   [ones] [period] [tenths]

Then hit the Enter key to send the command.

3.3.3.2   User-configured IP mode

An IP address can be assigned to the MWA controller unit by connecting an Ethernet crossover cable to the RJ45 Ethernet jack on the back panel of the MWA controller to a PC. The current IP assigned to the MWA controller is displayed on the LCD screen and must be entered into the address bar of the connected PC's web browser.
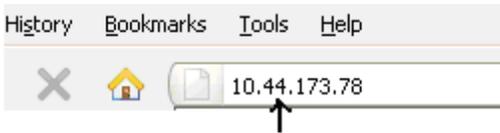
MWA IP Address (example)

Upon entering the IP address into the browser, it will ask for a username and password.
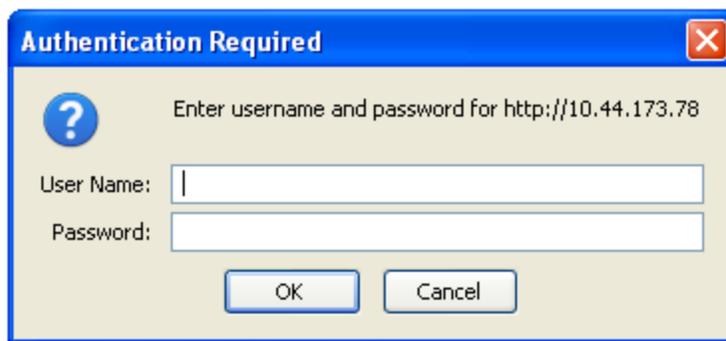
There is no username or password. Press OK without entering anything to move to the next step and the next screen displayed on the browser.

Click on "Network" on the left-side bar to get to the following screen.

Lantronix XPort Device Server

LANTRONIX®

Firmware Version: **V6.6.0.2**
MAC Address: **00-20-4A-C6-1A-F5**

Network
Server
Serial Tunnel
Hostlist
Channel 1
Serial Settings
Connection
Email
Trigger 1
Trigger 2
Trigger 3
Configurable Pins
Apply Settings
Apply Defaults

Network Settings

Network Mode: Wired Only

IP Configuration

◉ Obtain IP address automatically
Auto Configuration Methods
BOOTP: ◉ Enable ○ Disable
DHCP: ◉ Enable ○ Disable
AutoIP: ◉ Enable ○ Disable

DHCP Host Name: [   ]

○ Use the following IP configuration:
IP Address: 10.44.173.78
Subnet Mask: 0.0.0.0
Default Gateway: 0.0.0.0
DNS Server: 0.0.0.0

Ethernet Configuration

☑ Auto Negotiate
Speed: ◉ 100 Mbps ○ 10 Mbps
Duplex: ◉ Full ○ Half

[OK]

"Obtain IP address automatically" should be selected by default. To switch to a user configured IP, check the "Use the following IP configuration" option and insert an IP. Upon doing this, the user-input IP is now assigned to the MWA controller and upon cycling to Ethernet mode the LCD screen should display this new IP.

The MWA controller can then be controller remotely via the new IP.

4.0 Maintenance

4.1 Introduction

This section contains maintenance instructions for the Motorized Waveguide Attenuator and Controller. Minimum performance verification checks included in Section 2.4 should be performed whenever any doubt about the attenuator performance arises.

4.2 Operator Checks

Operator checks are procedures designed to verify that there are no initial functional problems with the attenuator. These checks can be used as an incoming inspection criteria or a. quick check prior to installation into the system.

4.2.1 Functional Checks

Make the interconnection between the attenuator assembly and the controller assembly as discussed in Section 2.0. Verify that the attenuator functions according to Section 2.4.

4.3 Troubleshooting Guide

This guide contains information for troubleshooting the attenuator assembly and the controller assembly. In the event of a malfunction, check first for obvious causes:

1. Operator error

2. Incorrect AC power or blown fuse

3. Loose cable connections

4. Obvious physical damage

If the cause of the problem(s) cannot be isolated, then contact Millitech, Inc. as discussed in Section 2.0 for repair information. The Motorized Waveguide Attenuator has no field replaceable parts.

APPENDIX

Appendix 1.0

Included are several program segments for HP Basic.

```
1   !*   THE FOLLOWING ARE THREE DIFFERENT WAYS TO SEND AND          *
2   !*   RECEIVE DATA FROM THE ATTENUATOR'S CONTROL BOX.          *
3   !*   THE ATTENUATION DATA SENT TO THE CONTROLLER IS A 6        *
4   !*   CHARACTER ASCII STRING. THE FIRST 4 CHARACTER             *
5   !*   MAKES THE ATTENUATION VALUE (THE THIRD DIGIT IS A         *
6   !*   DECIMAL POINT.) THE LAST TWO ARE THE CR LF CHARACTERS  *
7   !*   THE RECEIVED DATA IS A 5 CHARACTER STRING. THE           *
8   !*   FIRST 4 CHARACTERS ARE THE ATTENUATION VALUE LAST         *
9   !*   SENT TO THE CONTROLLER. THE LAST CHARACTER IS AN          *
10  !*   ERROR INDICATOR.          *
11  !*   0 MEANS OPERATION IS NORMAL, NO ERRORS.          *
12  !*   1 MEANS ATTENUATOR HEAD DID NOT FIND POSITION.          *
13  !*   2 MEANS "BAD" ATTENUATION VALUE WAS SENT.          *
14  !*   3 MEANS CONTROLLER CAN NOT FIND REFERENCE POINT.          *
15  !***********************************************************************
16  !
17  !    THE FOLLOWING LINES SHOW HOW TO COMMUNICATE WITH THE
18  !    CONTROLLER USING GPIB LANGUAGE. SET ADDRESS OF ATTENUATOR TO 2.
19  !    NOTE THE USE OF THE Unlisten, My Talk Address, AND
20  !    My Listen GPIB COMMANDS.
21  !
22  INPUT "INPUT ATTENUATION VALUE XX.X", P$     !P$ HOLDS ATT. VALUE.
23  SEND 7; CMD UNL MTA LISTEN 2 DATA P$, 13, 10   !VALUE SENT TO ATTENUATOR
24  SEND 7; UNL MLA TALK 2  !VALUE READ FROM ATTENUATOR
25  ENTER 7 ; D$
26  PRINT "ATTENUATOR IS AT POSITION" , D$
27  PRINT
28  !
29  !***********************************************************************
30  !
31  !THE FOLLOWING LINES DO THE SAME THING AS THE PREVIOUS PROGRAMMING
32  !LINES BY USING THE NUMERIC VALUES FOR THE GPIB COMMANDS.
33  !
34  INPUT "INPUT ATTENUATION VALUE XX.X" ,P$
35  SEND 7; CMD 63, 35, 34 DATA P$, 13, 10
36  SEND 7; CMD 63, 53, 66
37  ENTER 7 ; D$
38  PRINT "ATTENUATION IS AT POSITION" ,D$
39  PRINT
40  !
41  !***********************************************************************
42  !
43  !THE FOLLOWING LINES DO THE SAME THING AS THE PREVIOUS PROGRAMMING
44  !SEGMENTS BY USING THE HP 9816 BASIC LANGUAGE.
45  !
46  ASSIGN @Dev TO 702
47  INPUT "INPUT ATTENUATION VALUE XX.X" ,P$
```

```
48   OUTPUT @Dev ; P$
49   ENTER @Dev ; D$
50   PRINT "ATTENUATOR IS AT POSITION" ,D$
51   PRINT
52   GOTO 24
53   END
```

Appendix 2.0

(on following page)