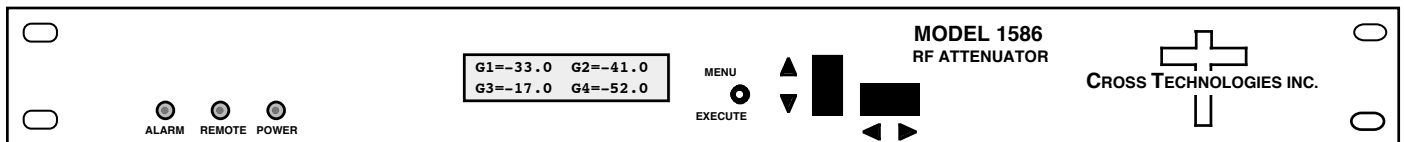# Instruction Manual

Model 1586-04-0431
RF Attenuator

April 2021,   Rev 0

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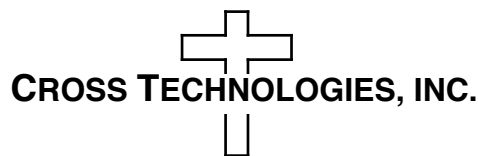Alpharetta, Georgia 30005

(770) 886-8005
FAX (770) 886-7964
Toll Free 888-900-5588

WEB www.crosstechnologies.com
E-MAIL info@crosstechnologies.com

INSTRUCTION MANUAL

MODEL 1586-06 RF Attenuator

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6170 Shiloh Road
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FAX (770) 886-7964
Toll Free 888-900-5588

WEB www.crosstechnologies.com
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MODEL 1586-04-0431 RF Attenuator

1.0 General

1.1 Equipment Description - The 1586-04-0431 Programmable Attenuator contains two 0.5 to 4 GHz and two 25 to 31 GHz Digital PIN Attenuators and Local/Remote control circuitry to independently adjust each attenuator. Multi-function push button switches select the attenuation locally. The attenuator values are stored in nonvolatile memory so these values remain when power is cycled off and on. Front panel LEDs provide indication of DC power (green), Alarm (red), and Remote (yellow). Each Attenuator provides an attenuation range of 60 dB from **10 to 70 dB** attenuation. Remote operation also controls each attenuator, provides status monitoring of attenuator settings, power supply, and summary alarms. Attenuator settings appear on the LCD display. **An "Offset" command allows adding an external attenuator to shift the attenuation range by the amount of the attenuator with the total attenuation shown on the display and via the M&C.** Connectors are SMA, female (CH1, CH2) or 2.92 mm (CH3, CH4) for inputs and outputs and DB9 female for the RS422 remote control **(Ethernet Optional)**. It is powered by a 100-240 ±10% VAC power supply **(Option -R for redundant supplies),** and in a 1 3/4" X 19 " X 16" rack mount chassis.
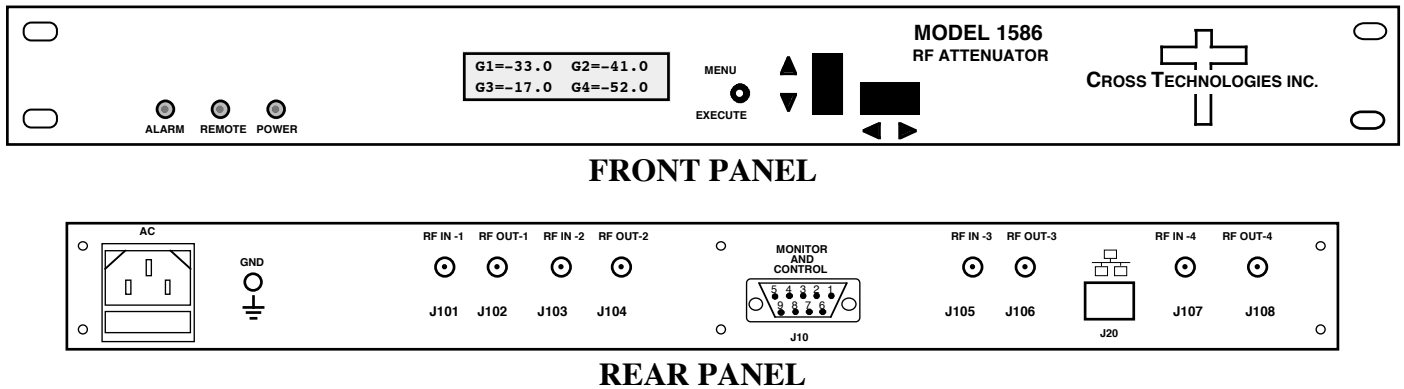

FIGURE 1.1 Model 1586-04-0431 RF Attenuator Front and Rear Panels
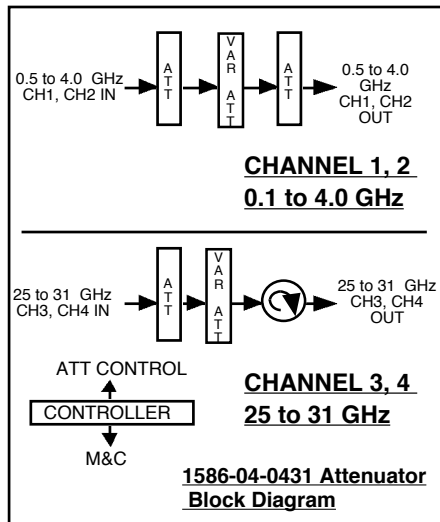

FIGURE 1.2 Model 1586-04-0431 RF Attenuator Block Diagrams

1.2 Technical Characteristics

TABLE 1.1 Model 1586-04-0431 RF Attenuator Technical Characteristics

EQUIPMENT SPECIFICATIONS*		
Input Characteristics	**CH 1,2**	**CH 3,4**
Impedance/Return Loss	50Ω/14 dB	50Ω/14 dB
Frequency	0.5-4.0 GHz	25.0-31.0 GHz
Input No Damage	+20 dBm	+20 dBm
Input Level range	**0 to -20 dBm**	**0 to -20 dBm**
Input 1 dB comp, min att	+10 dBm	+10 dBm
Output Characteristics		
Impedance/Return Loss	50 Ω /14 dB	50 Ω /14 dB
Frequency (GHz)	0.5-4.0 GHz	25.0-31.0 GHz
Output Level Range	-20 to -80 dBm	-20 to -80 dBm
Channel Characteristics		
Attenuation, min. at Fc	**10 ±1 dB**	**10 ±1 dB**
Att. range, 0.5±0.5 dB steps	**10 to 70 dB**	**10 to 70 dB**
Freq. Resp. @att range		
10 to 30 dB	±1.5 dB	±1.5 dB
31 to 50 dB	±2.0 dB	±2.0 dB
51 to 70 dB	±2.5 dB	±2.5 dB
Att Accuracy @att range, Fc		
10 to 30 dB	±1.0 dB	±1.0 dB
31 to 50 dB	±1.0 dB	±1.0 dB
51 to 70 dB	±1.5 dB	±1.5 dB

Other
Temp Coefficient	±0.025 dB/Degree C, max.

Controls, Indicators
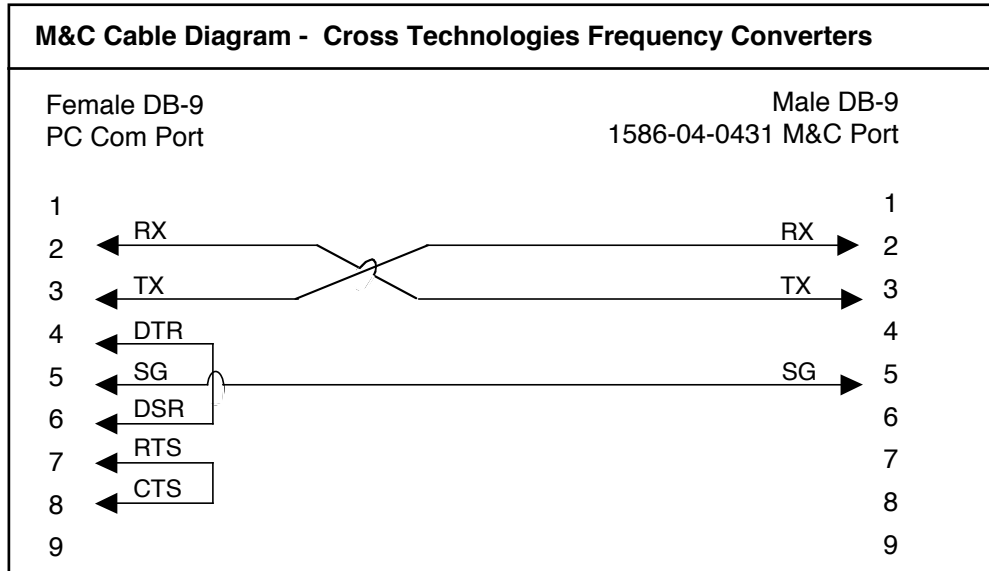|	
Gain	Direct readout LCD; pushbutton switches or remote
Offset	**Shifts attenuation range by the amount of ext attenuator**
Power; Alarm; Remote	Green LED; Red LED; Yellow LED
Remote	RS232C/RS485/422, 9600 baud (Ethernet Optional)

Other
CH 1,2; CH 3,4 Con.	SMA (female); 2.92 mm (female), 50Ω
Alarm Connector	DB9 - NO or NC contact closure on Alarm
Size	19 inch standard chassis 1.75" high X **19"** deep
Power	100-240 ± 10% VAC, 47 - 63 Hz, **25** watts maximum

---

*+10 to +40 degrees C; Specifications subject to change without notice

1.3 Monitor and Control Interface

A) Remote serial interface

Protocol: RS-232C, 9600 baud rate, no parity, 8 data bits, 1 start bit, and 1 stop bit.
(RS-232C, RS-422, or RS-485)

```
┌──────────────────────────────────────────────────────────────────────┐
│  M&C Cable Diagram -  Cross Technologies Frequency Converters          │
├──────────────────────────────────────────────────────────────────────┤
│   Female DB-9                                      Male DB-9           │
│   PC Com Port                              1586-04-0431 M&C Port       │
│                                                                        │
│   1                                                        1           │
│         RX                                      RX                      │
│   2  ◄──────────────┐          ┌──────────────────►  2                 │
│         TX           └────  ────┘    TX                                 │
│   3  ◄──────────────────  ──────────────────────►  3                   │
│   4     DTR                                                4           │
│      ◄────┐                                                             │
│   5     SG │                                    SG                      │
│      ◄────┼──────────────────────────────────►  5                      │
│   6     DSR│                                               6           │
│      ◄────┘                                                             │
│   7     RTS                                                7           │
│      ◄────┐                                                             │
│   8     CTS│                                               8           │
│      ◄────┘                                                             │
│   9                                                        9           │
└──────────────────────────────────────────────────────────────────────┘
```

Connector: Rear panel, DB-9 male

J10 Pinouts (RS-232C/422/485)	
Pin	**Function**
1	Rx-
2	Rx+ (RS-232C)
3	Tx+ (RS-232C)
4	Tx-
5	GND
6	Alarm Relay: Common
7	Alarm Relay: Normally Open
8	Not Used
9	Alarm Relay: Normally Closed

B) Status Requests -

Table 1.1 lists the M&C commands for the 1586-04-0431 and briefly describes them.

* PLEASE NOTE: The two character {aa}(00-31) prefix, in the table below, should be used ONLY when RS-485 is selected.

TABLE 1.1 1586-04-0431 Commands		
Command	**Syntax ***	**Description**
Set Channel 1 Gain	{aaCAyyyy}	where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		A = command code (case sensitive, capital A)
		yyyy = Channel gain in dB.
		Range: channel 1 offset -10.0 to channel 1 offset -70.0 in 0.5 dB steps; the decimal point is optional.
		example: {CA-455}
		Will set channel 1 total gain (including offset) to -45.5 dB.
		The unit will reply with the '>' character if the command is sucessfully processed.
Set Channel 1 Offset	{aaCayy}	where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		a = command code (case sensitive, lower case a)
		yy = Channel offset in dB. This value reflects any external attenuation added to the system.
		Range: 00 to 60 dB.
		example: {Ca40}
		Will set channel 1 external attenuation offset to 40 dB.
		The unit will reply with the '>' character if the command is sucessfully processed.
Set Channel 2 Gain	{aaCByyyy}	where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		B = command code (case sensitive, capital B)
		yyyy = Channel gain in dB.
		Range: channel 2 offset -10.0 to channel 2 offset -70.0 in 0.5 dB steps; the decimal point is optional.
		example: {CB455}
		Will set channel 2 total gain (including offset) to -45.5 dB.
		The unit will reply with the '>' character if the command is sucessfully processed.
Set Channel 2 Offset	{aaCbyy}	where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		b = command code (case sensitive, lower case b)
		yy = Channel offset in dB. This value reflects any external attenuation added to the system.
		Range: 00 to 60 dB.
		example: {Cb40}
		Will set channel 2 external attenuation offset to 40 dB.
		The unit will reply with the '>' character if the command is sucessfully processed.

Command	Syntax *	Description
TABLE 1.1 Continued: 1586-04-0431 Commands		
Set Channel 3 Gain	{aaCCyyyy}	where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		C = command code (case sensitive, capital C)
		yyyy = Channel gain in dB.
		Range: channel 3 offset -10.0 to channel 3 offset -70.0 in 0.5 dB steps; the decimal
		point is optional.
		example: {CC-455}
		Will set channel 1 total gain (including offset) to -45.5 dB.
		The unit will reply with the '>' character if the command is sucessfully processed.
Set Channel 3 Offset	{aaCcyy}	where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		c = command code (case sensitive, lower case c)
		yy = Channel offset in dB. This value reflects any external attenuation added to
		the system.
		Range: 00 to 60 dB.
		example: {Cc40}
		Will set channel 3 external attenuation offset to 40 dB.
		The unit will reply with the '>' character if the command is sucessfully processed.
Set Channel 4 Gain	{aaCDyyyy}	where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		D = command code (case sensitive, capital D)
		yyyy = Channel gain in dB.
		Range: channel 4 offset -10.0 to channel 4 offset -70.0 in 0.5 dB steps; the decimal
		point is optional.
		example: {CD455}
		Will set channel 4 total gain (including offset) to -45.5 dB.
		The unit will reply with the '>' character if the command is sucessfully processed.
Set Channel 4 Offset	{aaCdyy}	where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		d = command code (case sensitive, lower case d)
		yy = Channel offset in dB. This value reflects any external attenuation added to
		the system.
		Range: 00 to 60 dB.

B) Status Requests -

Table 1.2 lists the status requests for the 1586-04-0431 and briefly describes them.

* PLEASE NOTE: The two character {aa}(00-31) prefix, in the table below, should be used ONLY when RS-485, (OPTION-Q), is selected.

TABLE 1.2 1586-0400431 Status Requests		
Command	Syntax *	Description
Get Channel 1 Gain	{aaSA}	returns {aaSAyyy.y}
		where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		A = command code (case sensitive, capital A)
		yyy.y = Channel gain in dB.
		The unit will reply with the '>' character if the command is sucessfully processed.
Get Channel 1 Offset	{aaSa}	returns {aaSayy}
		where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		a = command code (case sensitive, lower case a)
		yy = Channel offset in dB.
		The unit will reply with the '>' character if the command is sucessfully processed.
Get Channel 2 Gain	{aaSB}	returns {aaSByyy.y}
		where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		B = command code (case sensitive, capital B)
		yyy.y = Channel gain in dB.
		The unit will reply with the '>' character if the command is sucessfully processed.
Get Channel 2 Offset	{aaSb}	returns {aaSbyy}
		where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		b = command code (case sensitive, lower case b)
		yy = Channel offset in dB.
		The unit will reply with the '>' character if the command is sucessfully processed.
Get Channel 3 Gain	{aaSC}	returns {aaSCyyy.y}
		where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		C = command code (case sensitive, capital C)
		yyy.y = Channel gain in dB.
		The unit will reply with the '>' character if the command is sucessfully processed.

TABLE 1.2 Continued: 1586-0400431 Status Requests

Command	Syntax *	Description
Get Channel 3 Offset	{aaSc}	returns {aaScyy}
		where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		c = command code (case sensitive, lower case c)
		yy = Channel offset in dB.
		The unit will reply with the '>' character if the command is sucessfully processed.
Get Channel 4 Gain	{aaSD}	returns {aaSDyyy.y}
		where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		D = command code (case sensitive, capital D)
		yyy.y = Channel gain in dB.
		The unit will reply with the '>' character if the command is sucessfully processed.
Get Channel 4 Offset	{aaSd}	returns {aaSdyy}
		where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		d = command code (case sensitive, lower case d)
		yy = Channel offset in dB.
		The unit will reply with the '>' character if the command is sucessfully processed.
Get Unit Alarm Status	{aaSL}	returns {aaSLx}
		where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		L = command code
		x = 0 for alarm off, 1 for alarm on.
		The unit will append the '>' character if the command is sucessfully processed.
Get Product Info	{aaSV}	returns {aaSV1586-04-0431rev.5xx}
		where:
		aa = unit address, range = 00 to 31, only used if interface is RS485, otherwise omit
		V = command code
		The unit will append the '>' character if the command is sucessfully processed.
		returns {aaSixxx.xxx.xxx.xxx}

2.0 Installation

2.1 Mechanical - The 1586-04-0431 consists of one Controller PCB assembly, two General Microwave Model 346C 10 Bit Digital PIN Attenuators and two General Microwave Model 3499 11 Bit Digital PIN attenuators housed in a 1 RU (1 3/4 inch high by 19 inch deep) chassis. One 100-240 VAC, 25W power supply provides redundant power for the assemblies. The 1586-04-0431 can be secured to a rack using the 4 holes on the front panel. Figure 2.0 shows how the 1586-04-0431 is assembled.
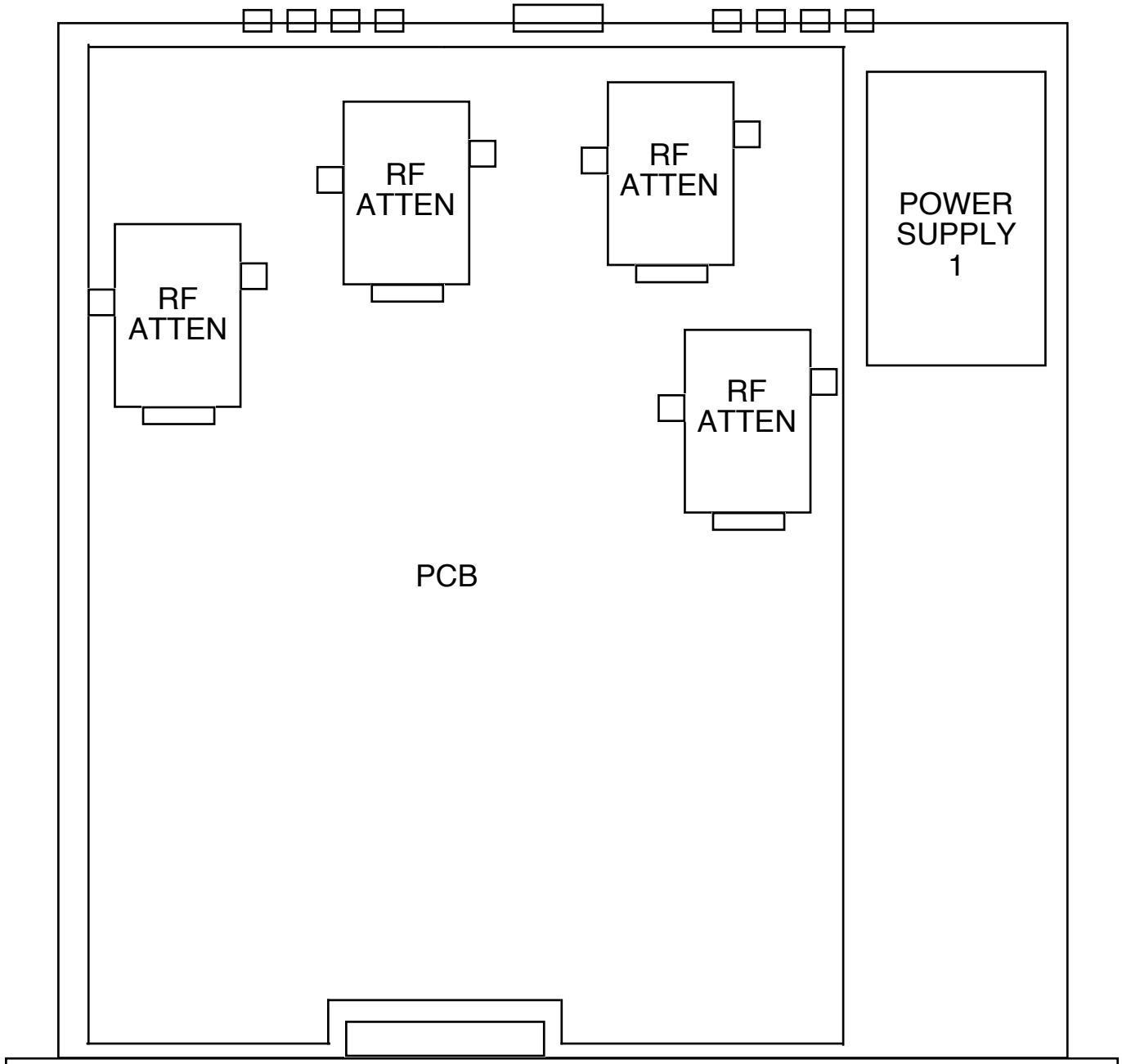
Model 1586 -04-0431 RF Attenuator Assembly Layout

FIGURE 2.0 1586-04-0431 Mechanical Assembly

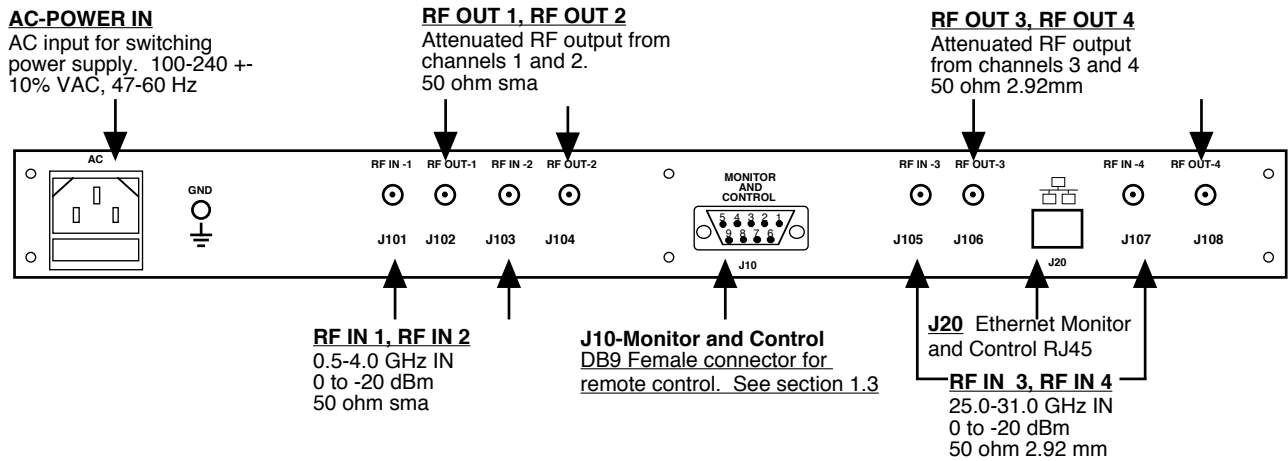## 2.2 Rear Panel Input/Output Signals - Figure 2.1 shows the input and output connectors on the rear panel.

AC-POWER IN
AC input for switching power supply. 100-240 +- 10% VAC, 47-60 Hz

RF OUT 1, RF OUT 2
Attenuated RF output from channels 1 and 2.
50 ohm sma

RF OUT 3, RF OUT 4
Attenuated RF output from channels 3 and 4
50 ohm 2.92mm

RF IN 1, RF IN 2
0.5-4.0 GHz IN
0 to -20 dBm
50 ohm sma

J10-Monitor and Control
DB9 Female connector for remote control. See section 1.3

J20 Ethernet Monitor and Control RJ45

RF IN 3, RF IN 4
25.0-31.0 GHz IN
0 to -20 dBm
50 ohm 2.92 mm

FIGURE 2.1 1586-04-0431 Rear Panel I/O's

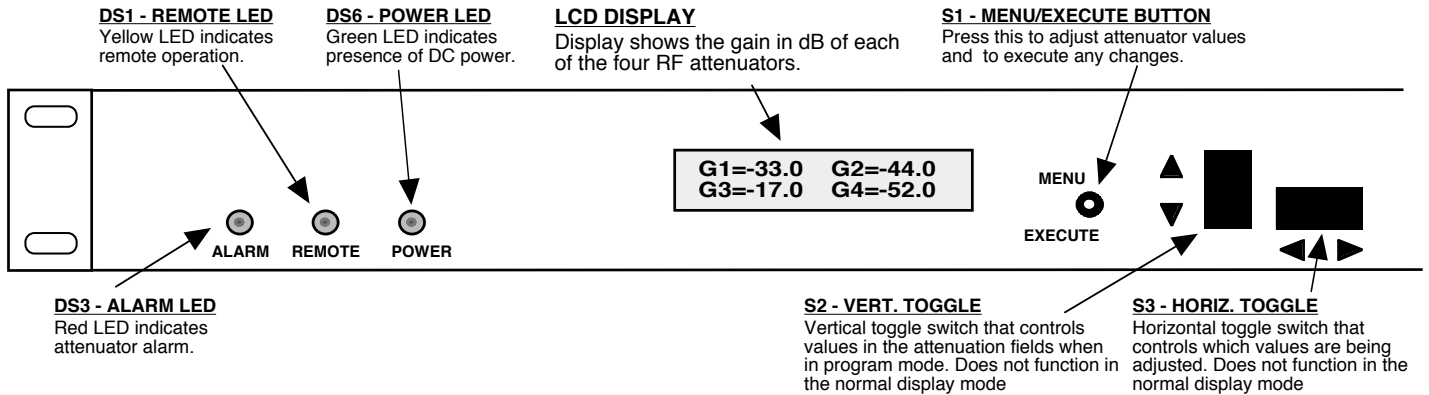## 2.3 Front Panel Controls and Indicators - The following are the front panel controls and indicators.

DS1 - REMOTE LED
Yellow LED indicates remote operation.

DS6 - POWER LED
Green LED indicates presence of DC power.

LCD DISPLAY
Display shows the gain in dB of each of the four RF attenuators.

S1 - MENU/EXECUTE BUTTON
Press this to adjust attenuator values and to execute any changes.

```
G1=-33.0   G2=-44.0
G3=-17.0   G4=-52.0
```

DS3 - ALARM LED
Red LED indicates attenuator alarm.

S2 - VERT. TOGGLE
Vertical toggle switch that controls values in the attenuation fields when in program mode. Does not function in the normal display mode

S3 - HORIZ. TOGGLE
Horizontal toggle switch that controls which values are being adjusted. Does not function in the normal display mode

FIGURE 2.2 1586-04-0431 Front Panel Controls and Indicators

2.4 Installation / Operation

2.4.1 Installing and Operating the 1586-04-0431 RF Attenuator

1.) Connect 0 to -20 dBm signal(s) to any or all of the four RF Attenuator Inputs (Figure 2.1).

2.) Connect the desired RF Attenuator Outputs to the external equipment (Figure 2.1).

3.) Connect 100-240 ±10% VAC, 47 - 63 Hz to AC1 and/or AC2 on the back panel.

4.) Set the desired gain and attenuation offset for each attenuator (See Section 2.5 Menu Settings).

5.) Be sure DS1 (DC Power) is green (Figure 2.2).

6.) **AC Fuses -** The fuses are 5 mm X 20 mm, 2 amp slow blow (Type T) and are inserted in the far slot in the drawer below the AC inputs as shown in Figure 2.3. There is a spare fuse in the near slot. If a fuse continues to open, the power supply is most likely defective.
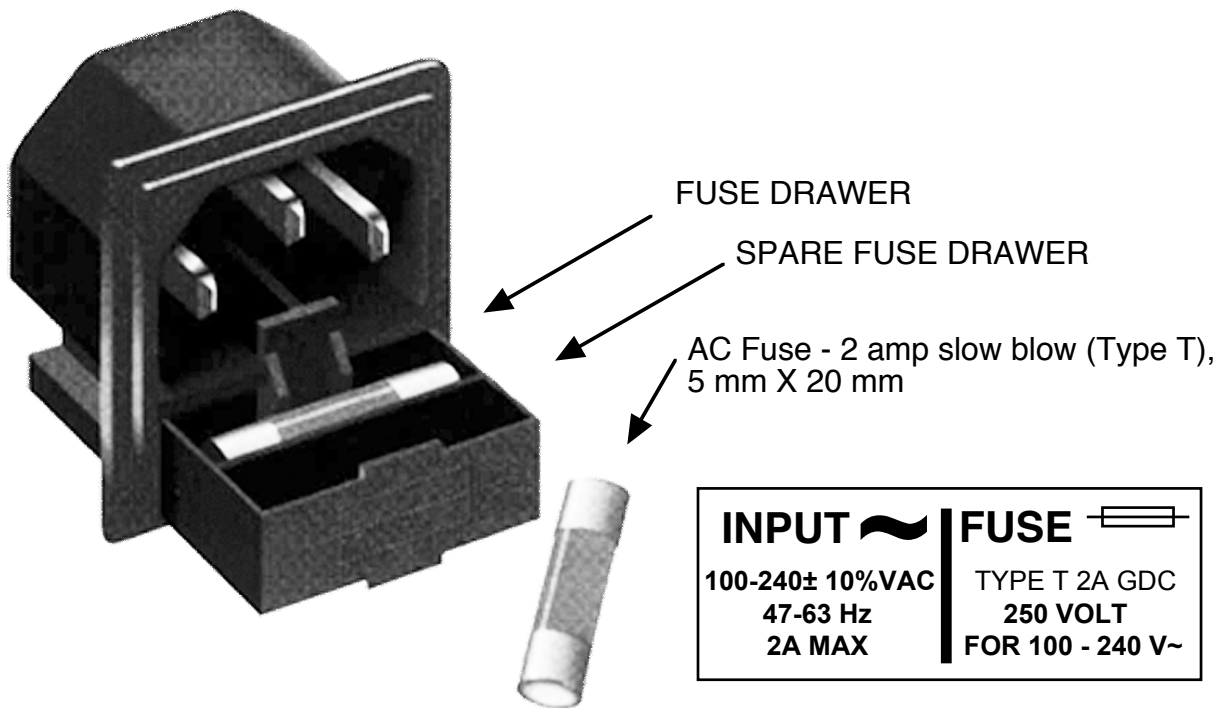
FUSE DRAWER

SPARE FUSE DRAWER

AC Fuse - 2 amp slow blow (Type T), 5 mm X 20 mm

INPUT ~	FUSE
100-240± 10%VAC	TYPE T 2A GDC
47-63 Hz	250 VOLT
2A MAX	FOR 100 - 240 V~

FIGURE 2.3 Fuse Location and Spare Fuse

2.5 Menu Settings

2.5.1 Functions

This section describes operation of the front panel controls. There are three ope rator switches, the LCD display and alarm indicator LEDs. All functions for the equipment are controlled by these components. The functions are (see Figure 2.5):

Power Up
Normal Display

Menu 1	CH 1 GAIN, OFFSET
Menu 2	CH 2 GAIN, OFFSET
Menu 3	CH 3 GAIN, OFFSET
Menu 4	CH 4 GAIN, OFFSET
Menu 5	Set REMOTE
Menu 6	Set Interface
Menu 7	Set RS485 address
Menu 8	Reset Ethernet Settings

Save Menu   When "R" is selected in any above menu or the next menu item after Menu 8

Alarm indications appear on the LEDs (see figure 2.2).

All program changes must start with the operation of the Menu/Execute switch and must also end with the operation of the Menu/Execute switch verified by the "Save Settings?" Menu. If this sequence is not followed, none of the changes will take effect. If programming is initiated and no operator action takes place for approximately 12 seconds (before the final press of the Menu/Execute switch) the display will revert to its previous status and you will need to start over.

2.5.2. Power On Settings

NOTE: The last status of a unit is retained even when power is removed. When power is restored, the unit will return to it's previous settings.

When power is first applied, the LCD display goes through three steps.

      1. The LCD goes black to show all segments are functioning.

      2. The software version will be displayed.

```
REV 5.20
```

      3. The present gain of each attenuator is shown.

```
G1=-33.0    G2=-41.0
G3=-17.0    G4=-52.0
```

The unit is now operational and ready for any changes the operator may desire.

2.5.3 Control Switches

1. <u>Menu/Execute</u> - Any change to the programming of the unit must be initiated by pressing the Menu/Execute switch and completed by pressing the Menu/Execute switch.
2. <u>Horizontal Switch</u> - This switch is mounted so its movement is horizontal and moves the cursor left or right.
3. <u>Vertical Switch</u> - This switch is mounted so its movement is vertical and has two functions:
       A. During frequency, gain changes, the vertical movement will raise or lower the selected number in the direction of the arrows.
       B. For other functions, the vertical switch will alternately turn the function on or off regardless of the direction operated.

2.5.4 Gain and Offset Changes

The nominal gain through each channel is adjustable from -10.0 dB to -70.0 dB. Each channel has an offset value that allows you to add external attenuation that will automatically be reflected in the gain value displayed for that channel. The offset value is adjustable from 0 to 60 in 1 dB steps.

The gain and offset changes will be made as you make them but if you do not wish to save the changes you have made, scroll to **"R"** and push the menu/Execute switch and select **"NO"** in the **"SAVE SETTINGS?"** window or **do not press the Menu/Execute switch**; simply do nothing for approximately 30 seconds, and the system will return to the normal operating mode.

To change the GAIN or OFFSET, first push the Menu/Execute switch to get to the desired channel's gain/offset menu setting:

> Operate the Menu/Execute switch until you get to the menu item you want to change (see Figure 2.5 for the sequence of menu options). The following display is for changing the gain and offset for channel 1:

```
CH1 GAIN=-33.0
CH1 OFFSET=+20    R
```

NOTE: CHANGES TAKE PLACE ON GAIN AND OFFSET IMMEDIATELY BUT DO NOT GET SAVED UNTIL YOU GO TO THE SAVE MENU AND INDICATE YOU WANT TO SAVE THE CHANGES.

> Press the Up/Down switch to change the gain in 0.5 dB steps. Use the left/right switch to navigate from gain to offset. Press the Up/Down switch to adjust the external attenuation offset value. The gain value will be adjusted to reflect the new offset value at the time that the changes are made.

NOTE: THE GAIN AND OFFSET WILL BE CHANGED AS YOU ADJUST THE NUMBERS. HOWEVER, THE VALUE WILL NOT BE STORED UNTIL YOU INDICATE YES IN THE SAVE SETTINGS WINDOW.

> When the display indicates the value desired you can push the Menu/Execute switch to the next item OR you can scroll to "R", push the Menu/Execute switch to get to:

```
SAVE SETTINGS? Y N
```

Selecting **Y** will save the new settings. Selecting **N** will revert to the previous settings.

Pushing the Menu/Execute switch then takes you to:

```
G1=-33.0    G2=-41.0
G3=-17.0    G4=-52.0
```

Figure 2.5 gives the menu items and how to make changes

2.5.5 Alarm Indications

An alarm condition for will occur if the l+12 VDC or -12VDC power supplies (to the internal attenuators) are out of range.

	ON POWER UP	
Power Up	`1586-04-0431W8W28` `5.20`	

	NORMAL DISPLAY	
Normal Display	`G1=-33.0 G2=-41.0` `G3=-17.0 G4=-52.0`	PUSH BUTTON

PUSHING MENU/EXECUTE SEQUENCE

Menu 1 CH 1 GAIN, OFFSET	`CH1 GAIN=-33.0` `CH1 OFFSET=+20    R`	SCROLL <> SCROLL ⬍ PUSH BUTTON
Menu 2 CH 2 GAIN, OFFSET	`CH2 GAIN=-41.0` `CH2 OFFSET=+10    R`	SCROLL <> SCROLL ⬍ PUSH BUTTON
Menu 3 CH 3 GAIN, OFFSET	`CH3 GAIN=-17.0` `CH3 OFFSET=+00    R`	SCROLL <> SCROLL ⬍ PUSH BUTTON
Menu 4 CH 4 GAIN, OFFSET	`CH4 GAIN=-52.0` `CH4 OFFSET=+30    R`	SCROLL <> SCROLL ⬍ PUSH BUTTON
Menu 5 Set REMOTE	`REMOTE    ON       R`	SCROLL <> SCROLL ⬍ PUSH BUTTON
Menu 6 Set Interface	`INTERFACE        R` `RS232`	SCROLL <> SCROLL ⬍ PUSH BUTTON
Menu 7 Set RS485 address	`RS485    ADDR  01   R`	SCROLL <> SCROLL ⬍ PUSH BUTTON
Menu 8 Reset Ethernet Settings	`RESET ETHERNET    R` `SETTINGS        NO`	SCROLL <> SCROLL ⬍ PUSH BUTTON
Menu 9 Save Settings When "R" is selected from any menu above, or at the end	`SAVE SETTINGS? YN`	SCROLL <> PUSH BUTTON

FIGURE 2.5   Menu Display and Sequence

1.4 Environmental Use Information

A. **Rack-Mounting** - To mount this equipment in a rack, please refer to the installation instructions located in the user manual furnished by the manufacturer of your equipment rack.

B. **Mechanical Loading** - Mounting of equipment in a rack should be such that a hazardous condition does not exist due to uneven weight distribution.

C. **Elevated Operating Ambient Temperature** - If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack may be greater than room ambient temperature. Therefore, consideration should be given to Tmra.

D. **Reduced Air Flow** - Installation of the equipment in a rack should be such that the amount of air flow required for safe operation of the equipment is not compromised. Additional space between units may be required.

E. **Circuit Overloading** - Consideration should be given to the connection of the equipment to the supply circuit and the effect that overloading of circuits could have on over current protection and supply wiring. Appropriate consideration of equipment name plate rating should be used, when addressing this concern.

F. **Reliable Earthing** - Reliable earthing of rack-mounted equipment should be maintained. Particular attention should be given to supply connections other than direct connection to the Branch (use of power strips).

G. **Top Cover** - There are no serviceable parts inside the product so, the Top Cover should not be removed. If the Top Cover is removed the ground strap and associated screw MUST BE REINSTALLED prior to Top Cover screw replacement. FAILURE TO DO this may cause INGRESS and/or EGRESS emission problems.

CROSS TECHNOLOGIES, INC.

6170 Shiloh Road
Alpharetta, Georgia 30005

(770) 886-8005
FAX (770) 886-7964
Toll Free 888-900-5588

WEB www.crosstechnologies.com
E-MAIL info@crosstechnologies.com

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