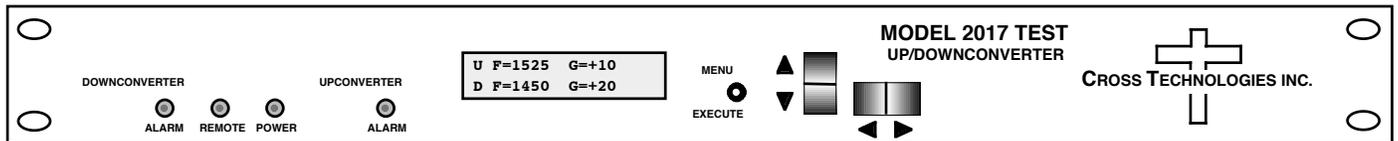


Instruction Manual

Model 2017-TD02 Up/Downconverter

December 2016 Rev. 0



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INSTRUCTION MANUAL

MODEL 2017-TD02 Up/Downconverter

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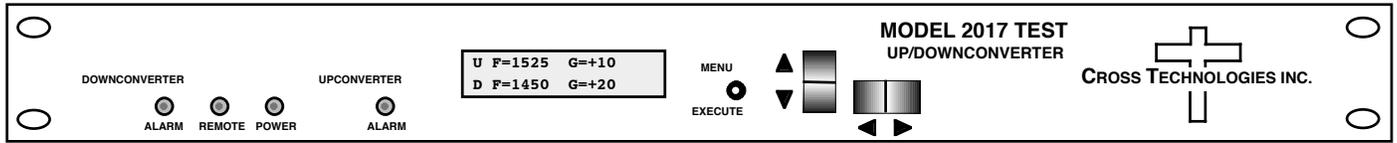
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MODEL 2017-TD02 Up/Downconverter

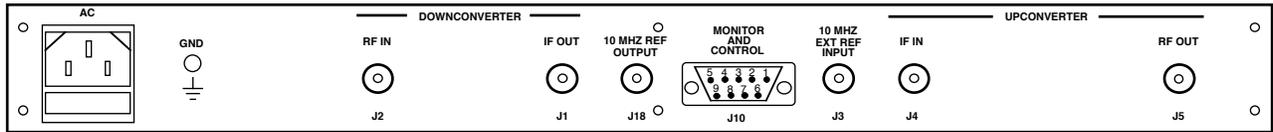
1.0 General

1.1 Equipment Description

The 2017-TD02 L-band Up/Downconverter for loop-back applications converts 70 or 140 MHz to/from 950-2150 MHz in 1 MHz steps. Multi-function push button switches select RF frequency, gain, and other parameters. The 2017-TD02 is used in applications such as connecting L-band modems to IF Up/downconverters. In this application, when converting an IF signal (70 or 140 MHz) to L-band, the modem itself contains internal filtering making it unnecessary for the 2017-TD02 to filter out all the other products (LO and other sideband). In the 2017-TD02 down conversion, because the L-band modem's transmit output is a clean signal with no image frequency, the signal can be converted to IF (70 or 140 MHz) without filtering. Front panel LEDs indicate DC power, PLL alarm, and remote operation. Remote operation allows selection of frequency and gain. Parameter selection and frequency and gain settings appear on the LCD display. Connectors are BNC female for IF and Type F female for RF. It is powered by a 100-240 \pm 10% VAC power supply and housed in a 1.75" X 19" X 16" 1RU chassis.



FRONT PANEL



REAR PANEL

Figure 1.1 Model 2017-TD02 Front and Rear Panels

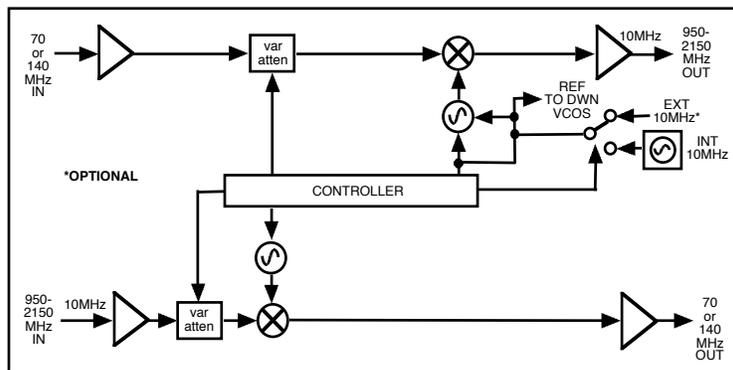


Figure 1.2 Model 2017-TD02 Up/Downconverter Block Diagram

1.2 Technical Characteristics

TABLE 1.0 2017-TD02 Up/Downconverter Specifications*

-----UPCONVERTER-----

Input Characteristics (IF)

Impedance/Return Loss 75 Ω /18 dB
 Frequency 70 \pm 18 MHz or 140 \pm 36 MHz
 Input Level -45 to -25 dBm

Output Characteristics (RF)

Impedance/Return Loss 75 Ω /12 dB
 Frequency 950 to 2150 MHz with 70 MHz in
 Frequency 1050 to 2000 MHz with 140 MHz in
 Level -45 to -25 dBm
 1dB compression -15 dBm

Channel Characteristics

Gain (adjustable) -10 to +10 dB, 1 dB steps
 Frequency Sense Non-inverting

----- -DOWNCONVERTER-----

Input Characteristics (RF)

Impedance/Return Loss 75 Ω /12 dB
 Frequency 950 to 2150 MHz with 70 MHz out
 Frequency 1050 to 2000 MHz with 140 MHz out
 Noise Figure, max. 15 dB (max. gain)
 Level -35 to -5 dBm

Output Characteristics (IF)

Impedance/Return Loss 75 Ω /18 dB
 Frequency 70 \pm 18 MHz or 140 \pm 36 MHz
 Output level -25 to -5 dBm
 1 dB compression +5 dBm

Channel Characteristics

Gain Range (adjustable) 0 to +20 dB, 1 dB steps
 Image Rejection None; no filtering
 Frequency Sense Inverting or Non-inverting (selectable)

-----UP AND DOWNCONVERTER-----

Channel Characteristics

Frequency Response \pm 1.5 dB, in band; \pm 0.5 dB, 36 MHz BW; \pm 0.75 dB, 72 MHz BW.
 Spurious Response <-50 dBC, Fo \pm 18 MHz/70MHz IF; \pm 36 MHz/140 MHz IF; LO and other sideband present for upconverter
 Group Delay, max. 0.01 ns/MHz² parabolic; 0.03 ns/MHz linear; 1 ns ripple any 36 MHz band.

Synthesizer Characteristics

Frequency Accuracy \pm 1.0 ppm internal reference (\pm 0.01 ppm, Option -H).
 Frequency Step 1 MHz.
 10 MHz In/Out Level 3 dBm \pm 3 dB, (Option -E).

| Phase Noise @ Freq | 10MHz | 1kHz | 10kHz | 100kHz | 1MHz |
|--------------------|-------|------|-------|--------|------|
| dBC/Hz | 70 | 70 | 80 | 90 | 100 |

Controls, Indicators

Frequency/Gain Selection Direct readout LCD, pushbutton switches or remote selection.
 Power; Alarm; Remote Green LED; Red LED; Yellow LED.
 Remote RS232C, 9600 baud.

Other

RF Connector Type F (female)
 IF Connector 75 Ω BNC (female).
 10 MHz Connectors BNC (female), 50 Ω /75 Ω (Option -E).
 Alarm/Remote Connector DB9 (female) - NO or NC contact closure on Alarm.
 Size 19 inch, 1RU Standard Chassis 1.75" High X 16.0" Deep.
 Power 100-240 \pm 10% VAC, 47-63 Hz, 45 watts maximum.

Available Options

-E External 10 MHz Reference
 -H High Stability (\pm 0.01ppm) internal reference
 -Q RS232C, 9600 baud

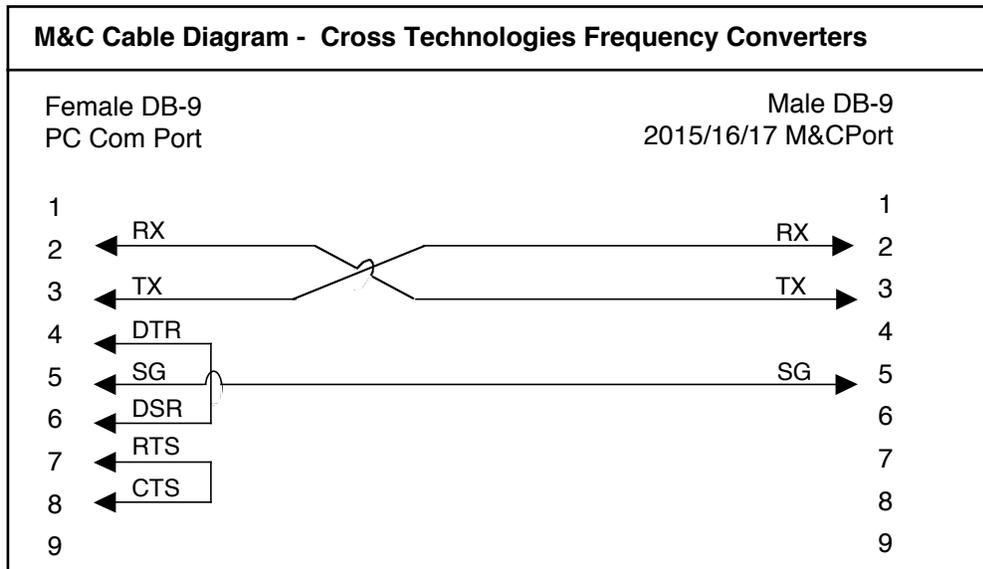
Connectors/Impedance See Table 2.2

*+10°C to +40°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 - option -Q**)



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 status requests for the 2017-TD02 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 1.1 2017-TD02 Status Requests | | |
|-------------------------------------|---------|--|
| Command | Syntax* | Description |
| Status | {aaS1} | Returns {aaS1bbbbccccdddeefGHIJ} where: |
| | | • bbbb = Tx frequency |
| | | • cccc = Rx frequency |
| | | • ddd = Tx gain |
| | | • ee = Rx gain |
| | | • F = Rx Spectrum Invert |
| | | • G = Rx Alarm |
| | | • H = Tx Alarm |
| | | • I = Summary Alarm |
| | | • J = IF Frequency: 0 = 70 MHz, 1 = 140 MHz |
| External 10MHz (option -E) | {aaS2} | Returns {aaS2bcd} where: |
| | | • b = 10 MHz Selected (0 = Internal; 1 = External) |
| | | • c = Upconverter 10 MHz insertion RF [J5] (0 = not inserted; 1 = inserted) |
| | | • d = Downconverter 10 MHz insertion RF [J2] (0 = not inserted; 1 = inserted) |
| IP Address (W8, W18, W28 only) | {aaSi} | Returns {aaSixxx.xxx.xxx.xxx} where: |
| | | • x...x is the IP address |
| Subnet mask(W8,W18,W28 only) | {aaSs} | Returns {aaSsxxx.xxx.xxx.xxx} where: |
| | | • x...x is the subnet mask |
| Unit ID | {aaSU} | Returns {aaSUx...x} where: |
| | | • x...x is the unit ID character string (max. 16 characters) |
| Product Info | {aaSV} | Returns {aaSV2017-xxxx ver y.yy} where: |
| | | 2017-xxxx is the model with options; yyy is the firmware Rev. |

C) Commands

Table 1.2 lists the commands for the 2017-TD02 and briefly describes them. After a command is sent the 2017-TD02 sends a return “>” indicating the command has been received and executed.

General Command Format - The general command format is {aaCND...}, where:

- { = start byte
- aa = address (RS-485 only **option -Q**)
- C = 1 character, either C (command) or S (status)
- N = 1 character command or status request
- D = 1 character or more of data (depends on command)
- } = stop byte

* 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 2017-TD02 Commands | | |
|------------------------------|------------|--|
| Command | Syntax* | Description |
| Set Transmitter Frequency | {aaC1xxxx} | where: <ul style="list-style-type: none"> • xxxx = 4 characters standard (7 characters -option-X) • Range: 0950-2150 MHz (0950000-2150000, option -X) |
| Set Receiver Frequency | {aaC2xxxx} | where: <ul style="list-style-type: none"> • xxxx = 4 characters standard (7 characters -option-X) • Range: 0950-2150 MHz (0950000-2150000, option -X) |
| Set Transmit Gain | {aaC3xxxx} | where: <ul style="list-style-type: none"> • xxxx = 2 or 3 characters • Range: -10 to +10 (-10 dB to 10 dB, in 1 dB steps) |
| Set Receiver Gain | {aaC4xxx} | where: <ul style="list-style-type: none"> • xx = 2 characters • Range: 00 to +20 (0 dB to 20 dB, in 1 dB steps) |
| Set IF Frequency | {aaCJx} | where x = : <ul style="list-style-type: none"> • x = 0 for IF = 70 MHz • x = 1 for IF = 140 MHz |

continued on page 8...

Table 1.2 (2017-TD02 Commands, continued from page 7...)

| Table 1.2 2017-TD02 Commands - continued from page 7 | | |
|---|-----------------------|---|
| Command | Syntax* | Description |
| Insert 10MHz on UP RF (option -E) | {aaC5x} | where: |
| (N/A option -E1) | | <ul style="list-style-type: none"> • x = 0 to disable 10 MHz upconverter insertion on RF[J5] • x = 1 to enable 10 MHz upconverter insertion on RF[J5] |
| Insert 10MHz on DOWN RF (option -E) | {aaC6x} | where: |
| (N/A option -E1) | | {0 to disable 10MHz downconverter insertion on RF (J2) {1 to enable 10MHz downconverter insertion on RF (J2) |
| Downconverter Spectrum | {aaC7x} | where: |
| | | <ul style="list-style-type: none"> • x = 0 for non-inverted • x = 1 for inverted |
| Enable Remote | # | Just # sign |
| Disable Remote | {aaCRO}* [*] | {CR and zero} |
| | | |

2.0 Installation

2.1 Mechanical

The 2017-TD02 consists of one RF/Controller PCB housed in a 1 RU (1 3/4 inch high) by 16 inch deep chassis. A switching, ± 12 , +5, +24 VDC power supply provides power for the assemblies. The 2017-TD02 can be secured to a rack using the 4 holes on the front panel. Figure 2.0 shows how the 2017-TD02 is assembled.

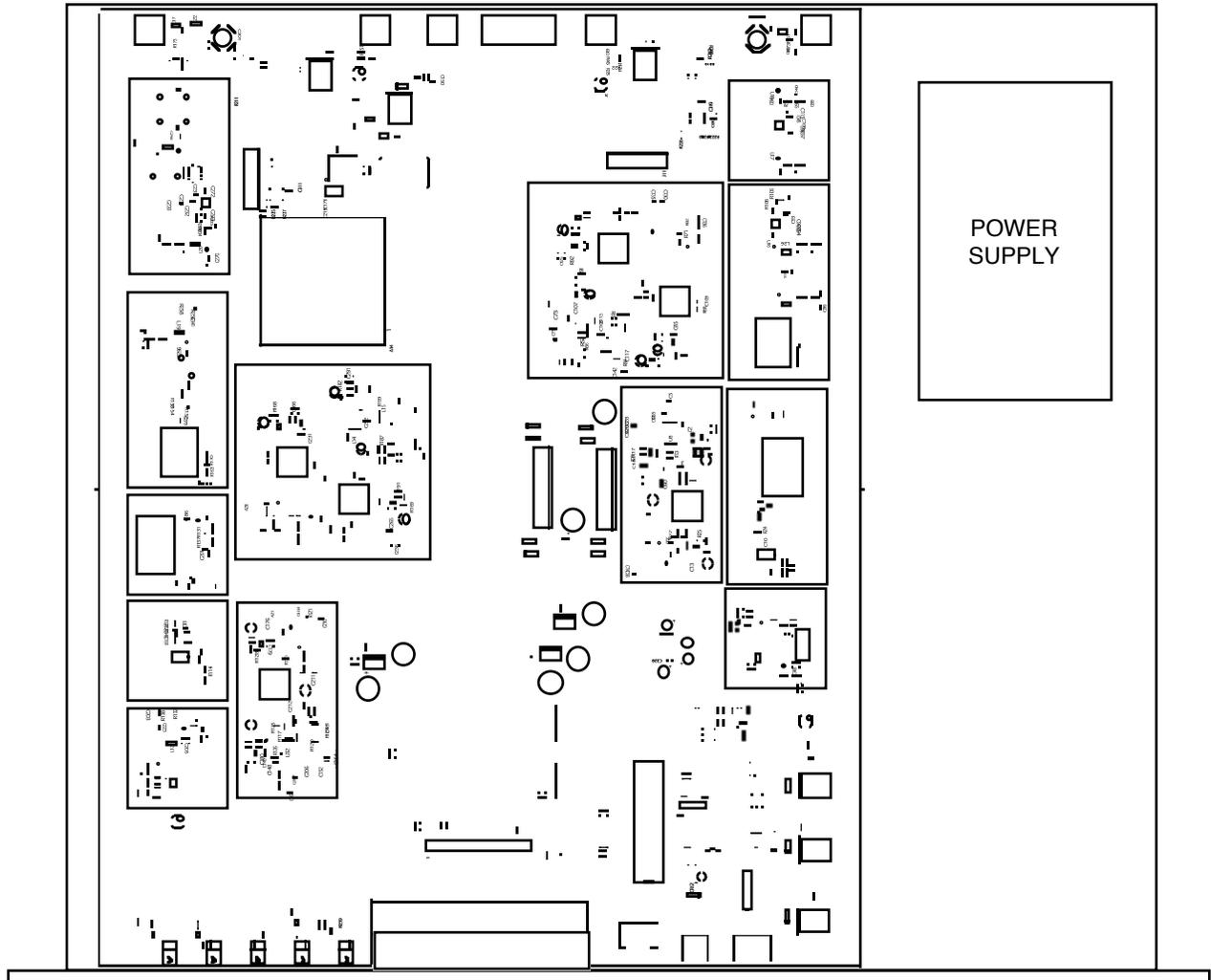


Figure 2.0 Model 2017-TD02 Mechanical Assembly

2.2 Rear Panel Input/Output Signals and Control -

Figure 2.1 shows the input and output connectors on the rear panel.

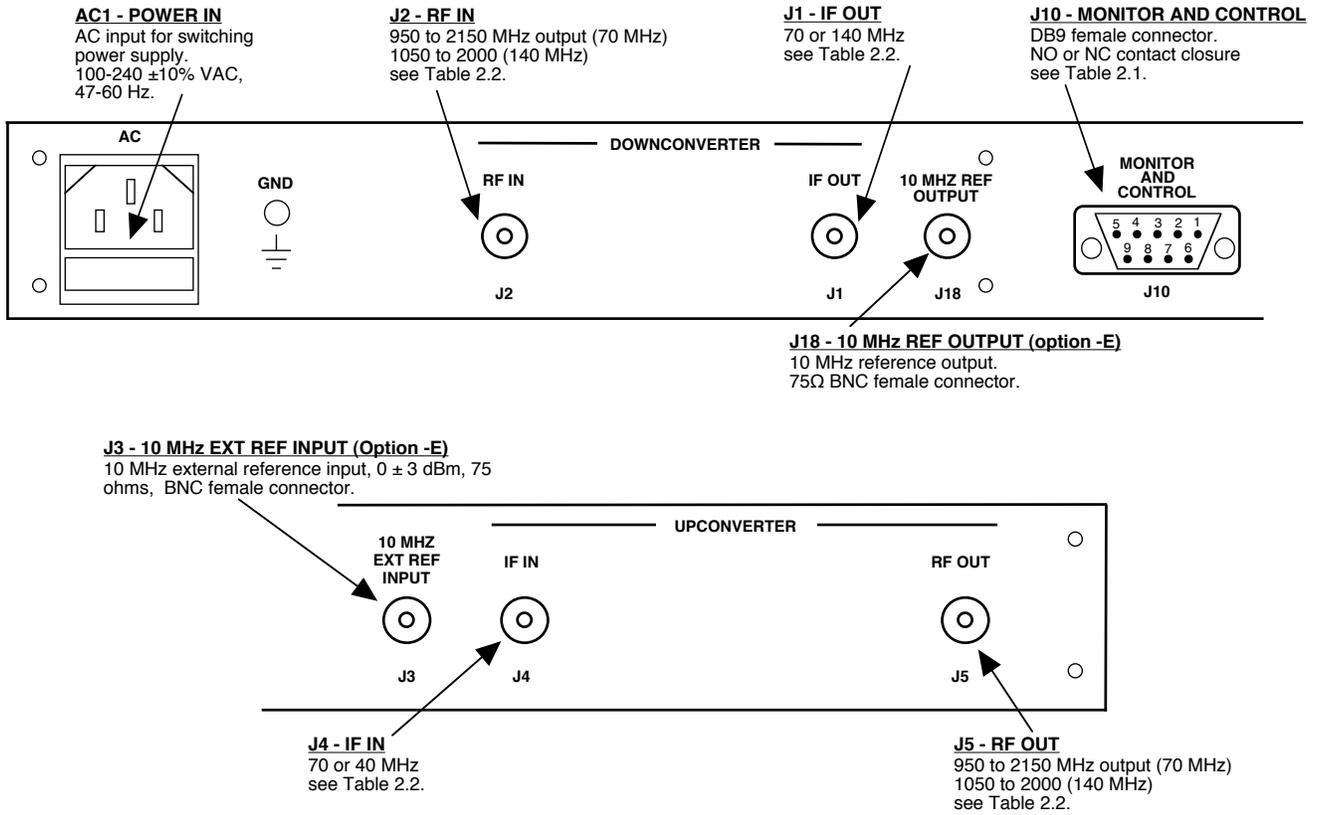


Figure 2.1 Model 2017-TD02 Rear Panel I/O's

| TABLE 2.1 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 |

***Remote Serial Interface**

Interface: DB-9 Male

Protocol: RS-232C (RS-232C/422/485 **option -Q**),

9600 baud rate, no parity, 8 data bits, 1 start bit, 1 stop bit.

| TABLE 2.2 IF/RF Connector Options | | |
|-----------------------------------|----------|-------------|
| Option | IF | RF |
| STD | BNC, 75Ω | BNC, 75Ω |
| -C | BNC, 75Ω | BNC, 50Ω |
| -D | BNC, 50Ω | BNC, 50Ω |
| -N | BNC, 75Ω | Type N, 50Ω |
| -M | BNC, 50Ω | Type N, 50Ω |

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

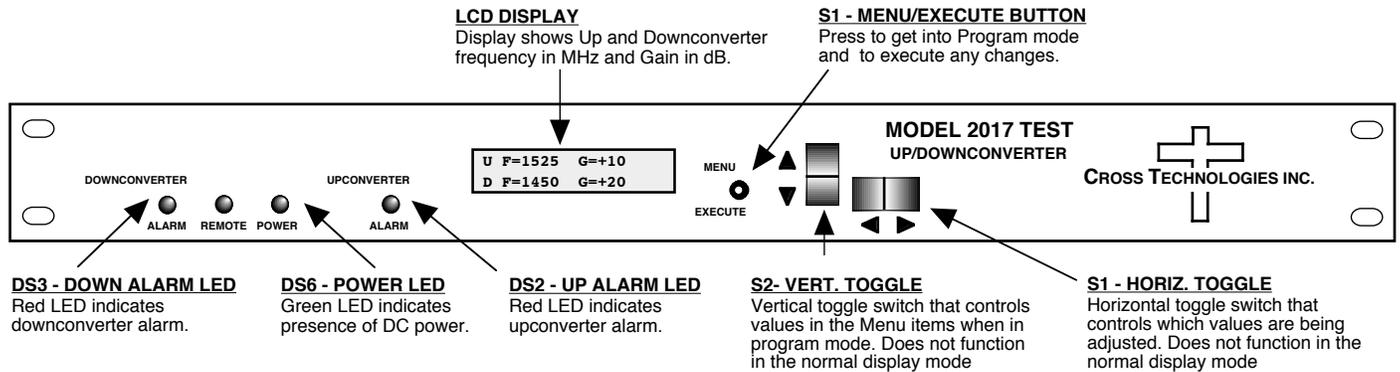


Figure 2.2 Model 2017-TD02 Front Panel Controls and Indicators

2.4 Installation / Operation

2.4.1 Installing and Operating the 2017-TD02, Upconverter Section

- 1.) Connect a -25 dBm to -45 dBm signal to IF In, J4 (Figure 2.1).
- 2.) Connect the RF OUT, J5, to the external equipment.
- 3.) Connect 100-240 \pm 10% VAC, 47 - 63 Hz to AC on the back panel.
- 4.) Be sure DS6 (Green, DC Power) is on and DS2 Upconverter Alarm and DS3 Downconverter Alarm are off (Figure 2.2).

2.4.2 Installing and Operating the 2017-TD02, Downconverter Section

- 1.) Connect a -5 dBm to -35 dBm signal to RF In, J2 (Figure 2.1).
- 2.) Connect the IF OUT, J1, to the external equipment.
- 3.) Connect 100-240 \pm 10% VAC, 47 - 63 Hz to AC on the back panel.

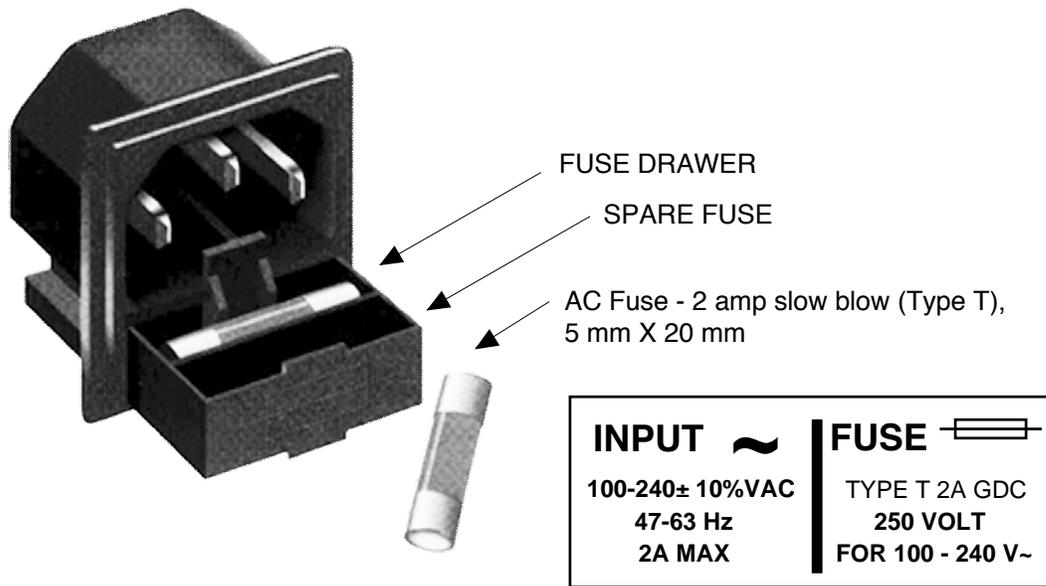


Figure 2.3 Fuse Location and Spare Fuse

2.5 Menu Settings

2.5.1 Functions - This section describes operation of the front panel controls. There are three operator switches, the LCD display and alarm indicator LEDs. All functions for the equipment are controlled by these components. The functions are (see Figure 2.2):

Power Up

Normal Display

- Menu 1** Up Frequency in MHz
- Menu 2** Up Gain (-10 to +10)
- Menu 3** Down Frequency in MHz
- Menu 4** Down Gain (0 to +20)
- Menu 5** Set Unit to Remote Operation
- Menu 6** Set Downconverter Spectrum Sense
- Menu 7** Set IF Frequency 70/140 MHz
- Menu 8** Select External 10 MHz Reference (option -E)
- Menu 9** Upconverter Reference Out (option -E)
- Menu 10** Downconverter Reference Out (option -E)

Save Menu When go to end

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 30 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 model number with options software version will be displayed.

| |
|-----------|
| 2017-TD02 |
| 1.00 |

3. The present frequency and gain of the up and downconverter is shown.

| | |
|----------|-------|
| U F=1450 | G=+10 |
| D F=1350 | G=+20 |

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

2.5.3 Control Switches

1. Menu/Execute - 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. Horizontal Switch - This switch is mounted so its movement is horizontal and moves the cursor left or right.
3. Vertical Switch - This switch is mounted so its movement is vertical and has two functions:
 - a. During frequency, gain, input level changes, the vertical movement will raise or lower the number in the direction of the arrows.
 - b. For other functions such Mute on/off, the vertical switch will alternately turn the function on or off regardless of the direction operated.

2.5.4 Frequency Changes

At any time during the modification process, if you have made a mistake and do not wish to save the changes you have made, **do not press the Menu/Execute switch**; simply do nothing for approximately 30 seconds, and the system will return to the normal operating mode or scroll to “**R**” and push the menu/Execute switch and select “**NO**” in the “**SAVE SETTINGS?**” window.

To change the FREQUENCY:

Operate the Menu/Execute switch until you get to the menu item you want to change (see Figure 2.4 for the sequence of menu options). The following display is for changing the upconverter frequency:

| | |
|----------------------|---|
| UP F = 1 <u>3</u> 50 | R |
|----------------------|---|

Pressing the Up/Down switch down will toggle the display to:

| | |
|----------------------|---|
| UP F = 1 <u>4</u> 50 | R |
|----------------------|---|

By using the horizontal rocker switch the cursor can be moved left or right.

| | |
|----------------------|---|
| UP F = 14 <u>5</u> 0 | R |
|----------------------|---|

NOTE: CHANGES DO NOT TAKE PLACE ON FREQUENCY UNTIL YOU GO TO THE SAVE MENU AND INDICATE YOU WANT TO SAVE THE CHANGES.

When the display indicates the value desired you can push the Menu/Execute switch to the next item:

| | |
|---------------------|---|
| UP G = + <u>1</u> 0 | R |
|---------------------|---|

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

OR you can scroll to “R”, push the Menu/Execute switch to get to:

| | |
|----------------|------------|
| SAVE SETTINGS? | <u>Y</u> 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 the :

| | |
|----------|-------|
| U F=1450 | G=+10 |
| D F=1250 | G=+20 |

Figure 2.4 shows all the menu items and how to make changes.

2.5.5 Gain Changes

When you get to this menu note that the gain 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.

2.5.5.1 Upconverter Gain

To set the upconverter gain, first push the Menu/Execute switch to get to the gain setting:

Operate the Menu/Execute switch until you get to the menu item you want to change. See Figure 2.4 for the sequence of menu options.

Pressing the Up/Down switch to change the level in 1 dB steps and then push the Menu/Execute switch to get to the Gain setting:

| | |
|-------------------|----------|
| UP G = +10 | R |
|-------------------|----------|

By using the horizontal rocker switch the cursor can be moved left or right .
Press the Up/Down switch until you have the desired gain.

NOTE: THE GAIN WILL CHANGE AS YOU ADJUST THE NUMBERS. HOWEVER, THE VALUE WILL NOT BE STORED UNTIL YOU INDICATE YES IN THE SAVE SETTINGS WINDOW. DO NOT SET A GAIN THAT WOULD EXCEED A 0 dBm OUTPUT LEVEL.

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? | <u>Y</u> 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 the :

| | |
|-----------------|--------------|
| U F=1450 | G=+20 |
| D F=1350 | G=+20 |

Figure 2.4 shows all the menu items and how to make changes.

2.5.5.2 Downconverter Gain

To set the downconverter gain, first push the Menu/Execute switch to get to the gain setting:

Operate the Menu/Execute switch until you get to the menu item you want to change. See Figure 2.4 for the sequence of menu options.

The following display is for changing the downconverter gain. Set the gain to provide an appropriate output level.

| | |
|------------|---|
| DN G = +20 | R |
|------------|---|

Press the Up/Down switch to change the level in 1 or 10 dB steps. By using the horizontal rocker switch the cursor can be moved left or right. Pressing the Up/Down switch down will toggle the display digit selected until you have the desired gain.

NOTE: THE GAIN WILL CHANGE 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? | <u>Y</u> 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 the :

| | |
|----------|-------|
| U F=1450 | G=+20 |
| D F=1350 | G=+20 |

Figure 2.4 shows all the menu items and how to make changes.

2.5.6 Alarm Indications

An alarm condition will occur if any local oscillator phase lock loop (PLL) comes out of lock.

| | | | | |
|--|--|---|----------------------|-------------|
| | ON POWER UP | | | |
| Power Up | 2017-TD02 1.0 | | | |
| <hr/> | | | | |
| | NORMAL DISPLAY | | | |
| Normal Display | U F = 1450 G = +10 D F = 1350 G = +20 | | | PUSH BUTTON |
| <hr/> | | | | |
| | PUSHING MENU/EXECUTE SEQUENCE | | | |
| Menu 1 Up Frequency | UP F = 1450 | R | SCROLL ⇔ SCROLL ⇅ | PUSH BUTTON |
| Menu 2 Up Gain (-10 to +30) | UP G = +10 | R | SCROLL ⇔ SCROLL ⇅ | PUSH BUTTON |
| Menu 3 Down Frequency | DN F = 1350 | R | SCROLL ⇔ SCROLL ⇅ | PUSH BUTTON |
| Menu 4 Down Gain (set 0 to +50 for -20 to 0 dBm out level) | DN G = +25 | R | SCROLL ⇔ SCROLL ⇅ | PUSH BUTTON |
| Menu 5 Set Unit to Remote Operation | REMOTE OFF | R | SCROLL ⇔ SCROLL ⇅ | PUSH BUTTON |
| Menu 6 Set Downconverter Spectrum Sense | DNSPECTRUM NON | R | SCROLL ⇔ SCROLL ⇅ | PUSH BUTTON |
| Menu 7 Set IF Frequency 70/140 MHz | IF FREQ = 70 MHZ | R | SCROLL ⇔ SCROLL ⇅ | PUSH BUTTON |
| Menu 8 Select External 10 MHz Reference (option -E) | REF MODE INT | R | SCROLL ⇔ SCROLL ⇅ | PUSH BUTTON |
| Menu 9 Select Upconverter Reference Out (option -E) | UP REF OUT OFF | R | SCROLL ⇔ SCROLL ⇅ | PUSH BUTTON |
| Menu 10 Select Downconverter Reference Out (option -E) | DN REF OUT OFF | R | SCROLL ⇔ SCROLL ⇅ | PUSH BUTTON |
| Save Settings? At the end or when "R" is selected from any of the above menus | SAVE SETTINGS? Y N | | SCROLL ⇔ SCROLL ⇅ | PUSH BUTTON |

3.0 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 unit 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.



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