

INSTRUCTION MANUAL

MODEL 2779 SUBCARRIER MODULATOR

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MODEL 2779 SUBCARRIER MODULATOR

SECTION 1 GENERAL

1.1 Equipment Description- The Model 2779 Subcarrier modulator provides an FM modulated signal in the 5 to 8.5 MHz subcarrier band at a frequency set at the factory and specified by the customer. The 2779 provides 75 microseconds emphasis, and 50 to 150 kHz peak deviation (see model chart in section 1.2) at a 0 to +18 dBm peak program level input into a balanced 600 ohm input impedance. The output provides 50 to 250 mV p-p out into 75 ohms. Audio connectors are barrier strip and the subcarrier output connector is BNC female. The unit is mounted on a standard 19", 1 3/4 " high rack mount panel and DC power is supplied by a wall mount power supply.



Model 2779-XX Transmitter and Model 2710-XX Receiver - Dual



Model 2779-XX Transmitter and Model 2710-XX Receiver - Single

FIGURE 1.0 Model 2779 Subcarrier Modulator

1.2 Technical Characteristics

TABLE 1.0 2779 MODULATOR SPECIFICATIONS

<u>Characteristics</u>	<u>Specifications*</u>
Audio Input Characteristics	
Impedance	600 ohms, balanced
Frequency	50 Hz or 15 kHz
Input Level	0 to +18 dBm at PPL (adjustable)
SC Output Characteristics	
Impedance	> 1.5K ohms (bridging)
Frequency range	4.5 - 8.5 MHz, factory set
Level	50 - 250 mVp-p into 75
Channel Characteristics	
Deviation	(see model chart below)
Pre-emphasis	75 usec
Frequency Response	±1.0 dB, 50 Hz - 15 kHz
Distortion	1 %, 1 kHz
Controls	
Output level adjust	10 turn pot adjusts the subcarrier output over 50 - 250 mV p-p
Input level adjust	10 turn pot adjusts the audio deviation
Indicators	
PLL/ALC Alarm	Red LED (with open collector out)
Peak Deviation	Yellow Led, lights at PPL audio level
Other	
DC Power, max.	+15VDC, 125 ma; -15VDC, 50ma; via wall power supply
RF, IF Connectors	BNC, female

MODELS							
<u>TX SINGLE</u>	<u>TX DUAL</u>	<u>RX SINGLE</u>	<u>RX DUAL</u>	<u>TX + RX</u>	<u>Peak Deviation</u>	<u>CH. Spacing</u>	<u>Threshold-C/No</u>
2779-01	2779-21	2710-01	2710-21	2751-21	150 kHz	400 kHz	67
2779-02	2779-22	2710-02	2710-22	2751-22	75 kHz	250 kHz	64
2779-03	2779-23	2710-03	2710-23	2751-23	50 kHz	180 kHz	62

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

2.0 Installation

2.1 Mechanical - The 2779 Modulator PCB is packaged in an aluminum extrusion. The 2779 is mounted on a 1 3/4" X 19" panel that can be mounted to a rack using the 4 holes at the ends. The unit derives $\pm 15V$ from the wall power supply. See Figure 2.1.

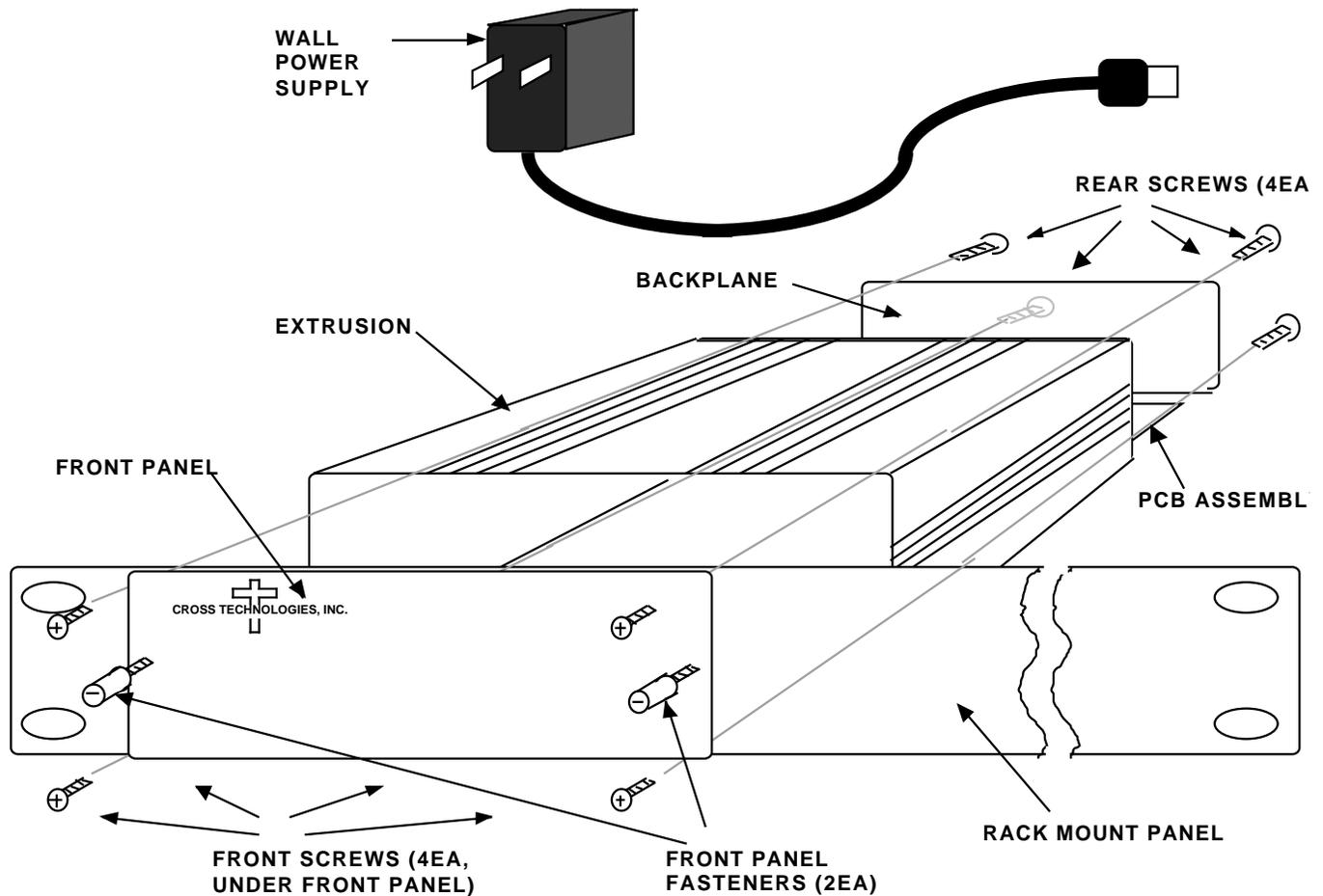


FIGURE 2.1 SERIES 2700 ASSEMBLY DRAWING

2.2 Controls and Indicators - Figure 2.2 shows front panel controls and indicators.

2.3 Input / Output Signals - Figure 2.3 shows the input and output signals to the 2779.

2.4 Removing the Printed Circuit Board (PCB) From the Extrusion - There are no on-card jumpers or other on-card controls. To remove the printed circuit board (PCB) from the extrusion:

- 1.) Remove four (4) **rear panel screws** (see Figure 2.1).
- 2.) **Gently** pull the backplane and PCB assembly completely out of the extrusion.
- 3.) **Always remove power** when removing or installing the PCB in to the extrusion. Make sure the shield goes in the lower channel and the PCB in the next channel above that in the extrusion.
- 4.) **Gently** push the backplane and PCB assembly completely in to the extrusion.
- 5.) Install four (4) **rear panel screws**.

2.5 Installation / Operation -

2.5.1 Operation -

- 1.) Connect the wall power supply to the 2779 and the wall power supply to 115 VAC, 60 Hz (Figure 2.1)
- 2) **AUDIO INPUT** - Pins 16 and 17 of J4 (terminal strip on the back panel, see Figure 2.3 and Table 2.1) are the balanced audio inputs. Pin 18 is ground.
- 3) **SUBCARRIER OUTPUT** - The subcarrier output is available on J1, the BNC connector on the back panel (Figure 2.3). JP1 may be placed in the "TERM" position for a 75 ohm termination. If video is being looped through, this jumper it should be placed in "non-term" (JP1 pins 2 -3) position. Use a BNC "T" to add the subcarrier output to the video if using the high impedance loop through. Be sure a 75 termination is provided at some point in the loop, preferably at the end.
- 4.) The output level is adjustable from 50 to 250 mV p-p into a 75 ohm load with R65 (Figure 2.2).
Remove the front panel by unscrewing the 2 front panel knurled head screws.
- 5.) The alarm indicator CR1 (Figure 2.2) will illuminate if the output level is adjusted beyond the ALC range of the module. It will also illuminate if the PLL comes out of lock.
- 6.) The peak deviation indicator, CR8 (Figure 2.2) flashes when the modulator exceeds 150 kHz /peak deviation. With R10 (Figure 2.2) adjust the input level so that the peak deviation indicator flashes occasionally on modulation peaks

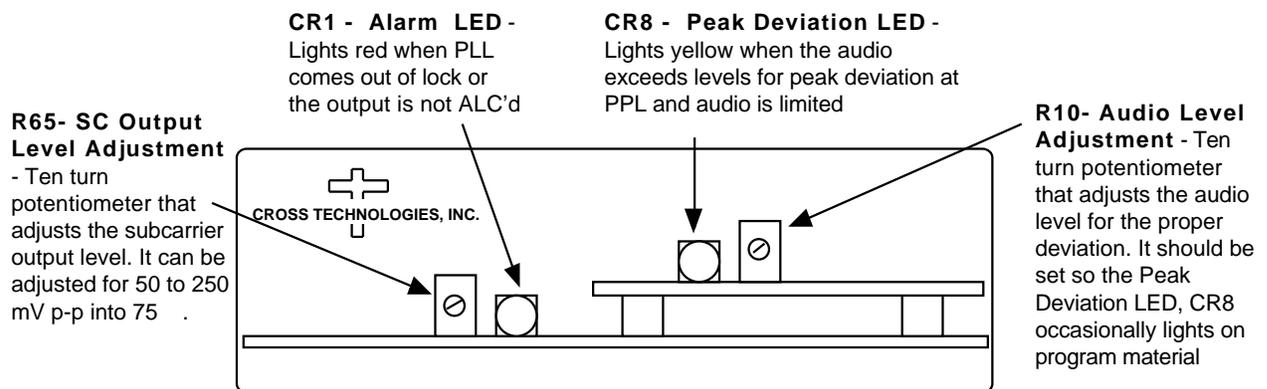
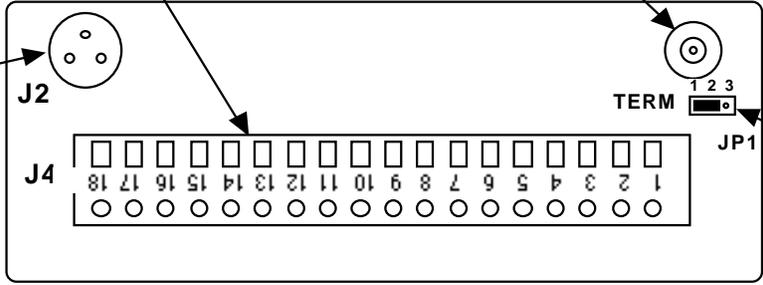
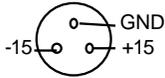


FIGURE 2.2 2779 Front Panel Controls and Indicators

J4 - I/O BARRIER STRIP - Provides connections for audio, data, alarm signals, etc. Pin numbers are as shown upside down on the connector. See Table 3.2

J1 - BNC IN/OUT - Signal from pin 2 or 3 (as set by strap beside J1) of PCB which is for subcarrier, video, IF and RF signals.

J2 - DC IN - The +15 VDC AND -15 VDC regulated DC voltage from the wall power supply



JP1 - J1 OUTPUT TERMINATION
 TERM = 75 TERMINATION
 2-3 = NO 75 TERMINATION

FIGURE 2.3 2779 Inputs and Outputs

TABLE 2.1 INPUT AND OUTPUT SIGNALS			
CONNECTOR	GENERAL FUNCTION	2779 FUNCTION	COMMENTS
J1	BNC IN/OUT	SUBCARRIER OUTPUT	50 TO 250 MV P-P
J2	DC IN	DC IN	± 15 VDC, 3PIN MINI-DIN
J3	PCB EDGE CONNECTOR	PCB EDGE CONNECTOR	INTERNAL USE
J4 - PIN			
1	GROUND	GROUND	
2	BB IN/OUT	NOT USED	
3	RF/IF OUT/IN.	NOT USED	
4	+AUDIO - L; +CLK	NOT USED	
5	-AUDIO - L; -CLK; RS232	NOT USED	
6	MISC; AGC; CC; BCD-0	NOT USED	
7	UNBAL AUDIO - L.	NOT USED	
8	MISC; CC; BCD-1	NOT USED	
9	+15 VOLTS.	+15 VOLTS.	
10	MISC; CC; BCD-2	NOT USED	
11	-15 VOLTS	-15 VOLTS	
12	MISC; CC; BCD-3	NOT USED	
13	UNBAL AUDIO - R.	NOT USED	
14	MISC; CC;	NOT USED	
15	ALARM; CC.	ALARM OPEN COLLECTOR	(+30 VDC, 30ma MAX).
16	+AUDIO - R; +DATA.	+AUDIO IN	0 to +18 dBm PPL, 600 balanced
17	-AUDIO - R; -DATA; RS232.	-AUDIO	0 to +18 dBm PPL, 600 balanced
18	GROUND	GROUND	

2.6 MODEL 27XX DUAL SYSTEMS

2.6.1 Equipment Description- The Model 2779 Subcarrier modulator and 2710 Subcarrier demodulator provides modulation and demodulation of an FM modulated signal in the 5 to 8.5 MHz subcarrier band at a frequency set at the factory and specified by the customer. The unit is mounted on a standard 19", 1 3/4 " high rack mount panel and DC power is supplied by a wall mount power supply. As the table of Figure 2.5 shows these are available as two units per standard 19", 1 3/4 " high rack mount panel. For the 2751-XX Series with one modulator and and demodulator the modulator is usually on the left as you face the front.



Model 2779-XX Transmitter and Model 2710-XX Receiver - Dual

FIGURE 2.4 Model 2779 Subcarrier Modulator

2.6.2 MODEL NUMBERS

DUAL MODEL CONFIGURATIONS						
	MODULES MAKING THIS					
MODEL	2710-01	2710-02	2710-03	2779-01	2779-02	2779-03
DUAL RX						
2710-21	2	-	-	-	-	-
2710-22	-	2	-	-	-	-
2710-23	-	-	2	-	-	-
DUAL TX						
2779-21	-	-	-	2	-	-
2779-22	-	-	-	-	2	-
2779-23	-	-	-	-	-	2
RX + TX						
2751-21	1	-	-	1	-	-
2751-22	-	1	-	-	1	-
2751-23	-	-	1	-	-	1

FIGURE 2.5 Model 27XX Model Numbers

2.6.3 DC POWER - Generally the 27XX series will have one wall power supply that can be connected to J2 of either module and have pins 9 (+15 Volts DC), pins 11 (-15 Volts DC) and pins 1 (ground) connected together as shown in Figure 2.6 below. You can power the modules from individual power supplies by ordering another one from Cross Technologies, Inc. and disconnecting the jumpers that connect these pins.

2.6.4 OPERATING INFORMATION - Refer to the individual module manuals for detailed operating instructions

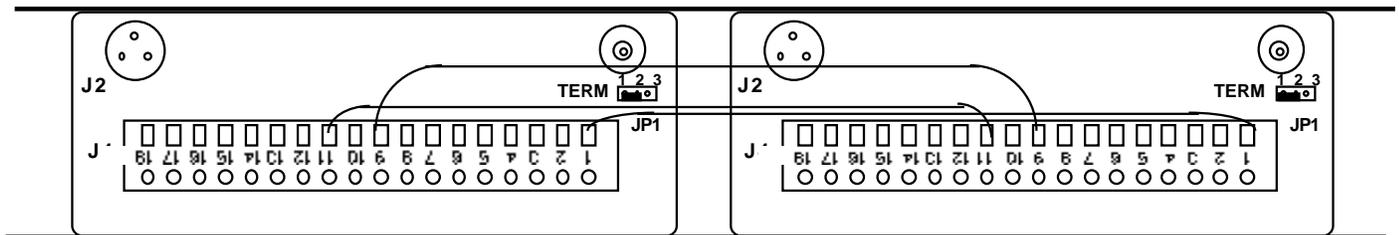


FIGURE 2.6 Model 27XX Rear Panels Showing DC wired together for Use With One Wall Power Supply

3.0 Circuit Description

3.1 Block Diagram Description - 2779 (Figure 3.1) -

The subcarrier modulator generates a frequency modulated carrier in the 4.5 to 8.5 MHz range for use in a subcarrier transmission system. Its output power is variable, permitting various injection levels. Refer to Figure 3.1 and the following detailed description.

The FM oscillator is a varactor tuned, modified Colpitts oscillator whose frequency is stabilized by a phase locked-loop (PLL) to a crystal reference. The output from the FM oscillator is amplified in the ALC amplifier to a sufficient level for use in the transmission system. The bandpass filter is a three pole LC filter with a bandwidth sufficient to pass the FM carrier and its significant sidebands. An emitter follower isolates the output from external conditions. The output impedance is relatively high (nominally 2 k ohms), permitting bridging onto a low impedance baseband with minimal loading. A portion of the output is sampled for control of the alarm and mute circuit. Should the unloaded carrier level decrease below 40 mV p-p either by failure, loading, or external mute, the ALC and muting circuit biases the ALC amplifier off and activates the alarm circuitry. The alarm circuit consists of several logic gates which monitor the PLL performance and status of the ALC bias. Should the PLL break lock, U4 detects the PLL state and:

- a. Biases Q3 on for external alarm indications.
- b. Illuminates CR1 to provide a visual indication of alarm
- c. Biases U5B positive which, in turn, shuts off the ALC amplifier.

The external mute (available in some models) forces a similar condition and causes alarm conditions

The PLL system maintains frequency stability of the FM oscillator. A portion of the FM oscillator output is sampled in U3; the crystal standard oscillator is sampled in U1. The resulting square waves OUT of U1 and U3 respectively are processed in the PLL, U2. The PLL attempts to maintain phase lock between U3 and U1 outputs by providing a DC bias which is filtered in the PLL filter, and applied to the varactor diode in the FM oscillator. The summing junction, U6B, sums the modulating frequency with the DC bias, then applies the composite baseband to the varactor diode, CR7. The center frequency of the FM oscillator is dependent on the DC component of composite baseband provided by Vref, which stabilizes the capacitance of CR7. The PLL filter has a very slow time constant which prevents excessive frequency shift of the FM oscillator due to modulation.

The audio processor on the subcarrier modulator provides pre-emphasis, filtering, and precision clipping of the program should program level exceed deviation specifications. The pre-emphasis circuit, U1B, provides standard 75 microsecond pre-emphasis. The LPF, U2, is a 4 pole Sallen and Key synthesis of the Chebychev function for low pass filtering, whose response is +1 dB 50 Hz to 15 kHz. The precision clipper is set such that any signal whose level after pre-emphasis exceeds 100% deviation will be clipped to prevent over deviation. The peak detector illuminates CR8 upon clipping.

