

**PLUG-N-PLAY 150
150 WATT DIGITAL
FM TRANSMITTER**

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IM No. 597-0150

INSTRUCTION MANUAL

MARTI ELECTRONICS

PNP 150 FM TRANSMITTER

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INTRODUCTION.

The MARTI Electronics PLUG-N-PLAY 150 (PNP 150) is a 150 watt digital solid-state FM transmitter designed for continuous operation in the 87.5 MHz to 108 MHz broadcast band (refer to Figure 1). The PNP 150 is equipped with: 1) a digital exciter, 2) a two stage up-converter system, 3) a broadband 150 watt power amplifier module, 4) two modular dc power supply units, and 5) a front panel circuit board containing display and power control circuitry. The unit operates from a 110V/220V 50/60 Hz ac power supply. All the components are housed in a 19 inch chassis requiring 7 inches of rack space (refer to Figure 2).



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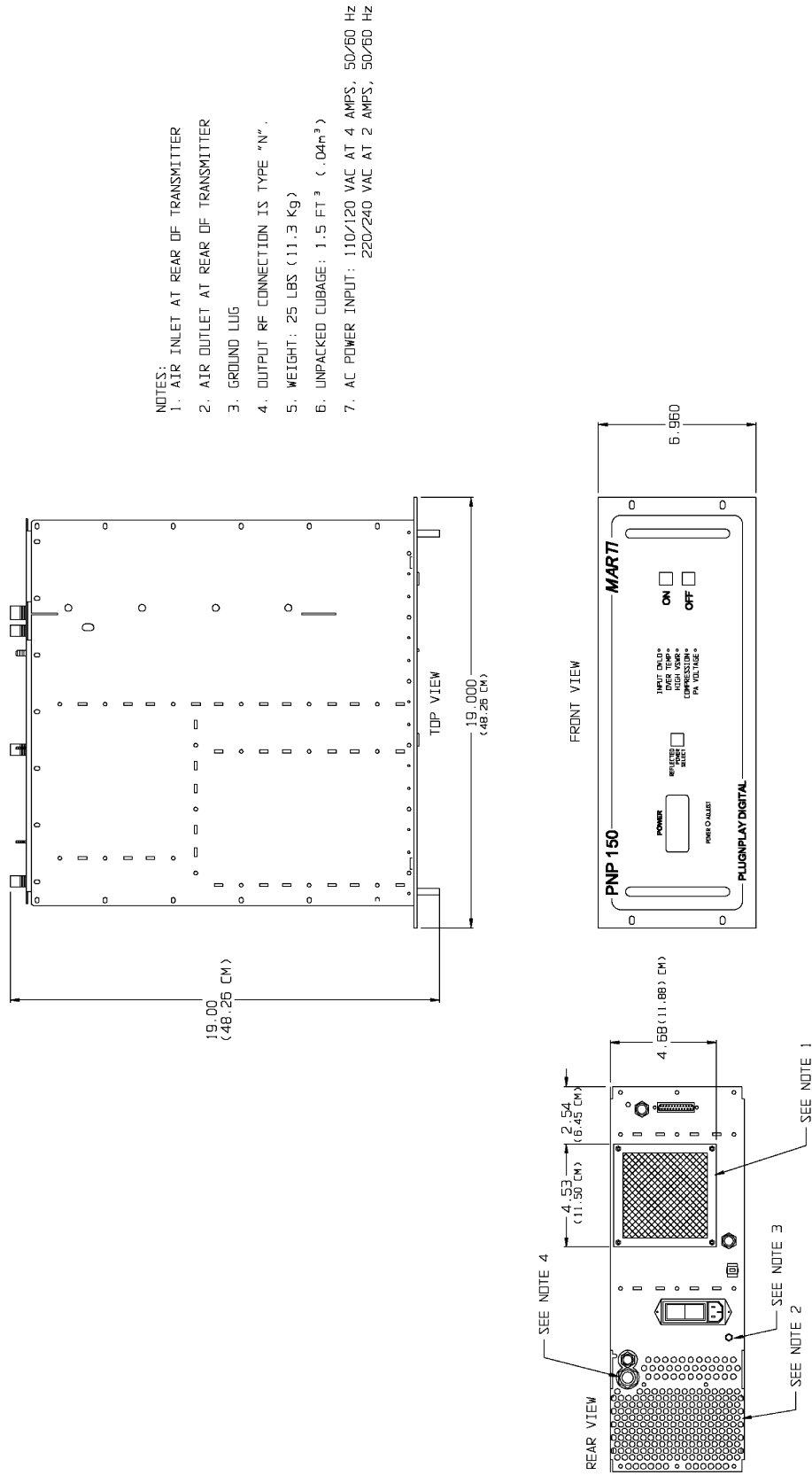
FIGURE 1. PLUG-N-PLAY 150

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- **Digital Exciter** - The PNP 150 is equipped with a digital exciter. The exciter provides outstanding audio performance and reliability. The exciter is designed with a wide variety of audio inputs to meet almost any audio input configuration: 1) analog left and right channel, 2) digital AES/EBU wire, 3) digital AES/EBU optical, 4) digital S/PDIF, and 5) composite. Additional features include an SCA audio input, 50/75 uS preemphasis, and built-in audio compression.

The exciter is designed using the latest digital technology. Two DSP integrated circuits and a large programmable PLD integrated circuit provide the processing power for the circuitry. A high performance analog circuit provides the analog interface to the digital circuitry for analog left and right channel audio.

- **SCA Audio Input** - The exciter is equipped with a built-in 67 kHz SCA encoder. The circuit allows the direct input of SCA audio without the use of a separate encoder. The circuit also allows the selection of 5 or 7.5 kHz deviation.
- **Built-In Audio Compression** - The digital circuitry in the exciter is equipped with built-in audio compression. The compression circuitry is built into the DSP circuitry and allows audio to be applied at a maximum level without clipping. A front-panel indicator illuminates when the compression circuitry is engaged. This is approximately 2 dB above the nominal audio level.
- **2-Stage Up-Converter System** - The output of the digital exciter is converted to the output frequency using a 2-stage up-converter system. The system uses crystal circuitry and two high performance RF mixers to generate the 87.5 MHz to 108 MHz RF signal. The up-converter system also contains a gain stage to provide the required level for the final power amplifier module.



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FIGURE 2. PNP 150 INSTALLATION DIAGRAM

- **RF Amplifier Module** - The RF amplifier module is a broadband device designed to output 15 to 150 watts of RF power. The amplifier module is equipped with a driver circuit board, an RF amplifier circuit board, and a low-pass filter/directional coupler circuit board. DC power for the amplifier is provided by a modular +48 V dc switching power supply.

Control of the RF amplifier module is provided a power control circuit on the front panel circuit board. Samples such as PA voltage, forward power, reflected power, and temperature are routed to the power control circuit. The circuit automatically adjusts the output power level in response to high reflected power and temperature conditions.
- **Remote Control Operation** - The PNP 150 is designed for remote control operation. Control functions include on/off and failsafe. Status functions include: 1) on/off status, 2) VSWR, and 3) temperature fault. Sample functions include: 1) forward and reflected power and 2) PA voltage.
- **Power Supply Operation** - The PNP 150 can be operated from a wide variety of ac input voltages. The unit can be operated from a 110/220V ac 50/60 Hz ac power source. The power supply circuitry automatically switches between 110V and 220V 50/60 ac operation.
- **Mounting** - The PNP 150 components are contained in a single chassis. The unit requires 7 inches (17.8 cm) of a 19 inch (48.3 cm) rack cabinet.

ORDERING INFORMATION.

The PNP 150 can be ordered in a single configuration. Refer to the following text for the PNP 150 ordering information.

MODEL NO.	DESCRIPTION	PART NO.
PNP 150	PNP 150 Solid State FM Transmitter For Operation In The 87.5 MHz to 108 MHz FM Broadcast Band, 15 to 150 Watts, 120V/240V AC 50/60 Hz Power Supply Operation.	909-0150-205

SPECIFICATIONS.

TABLE 1. PNP 150 ELECTRICAL, PHYSICAL, AND ENVIRONMENTAL SPECIFICATIONS
(Sheet 1 of 4)

PARAMETER	SPECIFICATION
ELECTRICAL	
RF POWER OUTPUT	15 to 165 watts.
FREQUENCY RANGE	87.5 MHz to 108 MHz. Jumper selectable to a specific operating frequency. Programmable in 50 kHz steps.
OUTPUT IMPEDANCE	50 Ohms nominal.
OUTPUT CONNECTOR	Type-N female.
VSWR	Rated power into a 1.5 : 1 VSWR maximum. Open and short circuit protected at all phase angles.
FREQUENCY STABILITY	±300 Hz, -10 Degrees C to +40 Degrees C (+14 to +104 Degrees F).
MODULATION TYPE	Digital.

TABLE 1. PNP 150 ELECTRICAL, PHYSICAL, AND ENVIRONMENTAL SPECIFICATIONS
(Sheet 2 of 4)

PARAMETER	SPECIFICATION
<i>ELECTRICAL (con't)</i>	
MODULATION CAPABILITY	Greater than 150 kHz. 350 kHz maximum.
ASYNCHRONOUS AM SIGNAL-TO-NOISE RATIO	55dB below rated power reference carrier with 100% AM modulation at 400Hz and 75 uS de-emphasis. No modulation present.
SYNCHRONOUS AM SIGNAL-TO-NOISE RATIO	50dB below rated power reference carrier with 100% AM modulation at 400Hz and 75 uS de-emphasis. FM modulation equal to ± 75 kHz at 400Hz.
RF HARMONIC AND SPURIOUS SUPPRESSION	70 dB or greater.
AC POWER REQUIREMENTS	90V to 264V ac, 50/60 Hz, single phase.
POWER FACTOR	To Be Determined.
SAFETY	Meets IEC 215 Specifications.
SURGE PROTECTION	Tested with IEEE C62.41-1991 recommended waveforms for location category B3 and IEC 801-4 standard waveforms for severity level 4.
<i>LEFT/RIGHT ANALOG AUDIO INPUT</i>	
CONNECTOR	D-Type, 25-Pin, female.
INPUT LEVEL	Jumper selectable -10, 0, +4, and +8 dBm for 100% modulation @ 400 Hz.
IMPEDANCE	Balanced 600 Ohms or 10 k Ohms, resistive, jumper selectable.
FREQUENCY RESPONSE	± 0.5 dB, 30 Hz to 15 kHz, flat, 50 uS preemphasis, or 75 uS preemphasis.
TOTAL HARMONIC DISTORTION	0.05% or less, 30 Hz to 15 kHz.
FM SIGNAL-TO NOISE	73 db below 100% modulation at 1kHz measured in a 22Hz to 22kHz bandwidth with CCIR weighted filter.
CCIF INTERMODULATION DISTORTION	To be determined.
CHANNEL SEPARATION	50 dB or greater; 30Hz to 15kHz, left into right or right into left.

TABLE 1. PNP 150 ELECTRICAL, PHYSICAL, AND ENVIRONMENTAL SPECIFICATIONS
(Sheet 3 of 4)

PARAMETER	SPECIFICATION
<i>COMPOSITE INPUT</i>	
CONNECTOR	BNC.
INPUT LEVEL	1.25V peak-to-peak for 100% modulation @ 400 Hz.
IMPEDANCE	50 Ohms or 10 k Ohms, resistive, jumper selectable.
FREQUENCY RESPONSE	±0.5dB, 30 Hz to 15 kHz.
TOTAL HARMONIC DISTORTION	0.06% or less at 1 kHz.
FM SIGNAL-TO NOISE	73 db below 100% modulation at 1kHz measured in a 22Hz to 22kHz bandwidth with CCIR weighted filter.
CCIF INTERMODULATION DISTORTION	To be determined.
CHANNEL SEPARATION	40 dB or greater; 30Hz to 15kHz, left into right or right into left.
<i>DIGITAL INPUT</i>	
CONNECTOR	
AES/EBU	D-Type 25 Pin or Toshiba TORX173 optical connector.
S/PDIF	RCA Phono, female.
FREQUENCY RESPONSE	±0.5dB, 30 Hz to 15 kHz, flat.
TOTAL HARMONIC DISTORTION	0.05% or less, 30 Hz to 15 kHz.
FM SIGNAL-TO NOISE	76 db below 100% modulation at 1kHz measured in a 22Hz to 22kHz bandwidth with CCIR weighted filter.
CHANNEL SEPARATION	50 dB or greater; 30Hz to 15kHz, left into right or right into left.
AUDIO OVERSHOOT	2 dB maximum.
LINEAR CROSSTALK	40 dB minimum below 100% modulation. Main to Sub/ Sub to Main due to distortion products.
57 kHz, 76 kHz, and 95 kHz SUPPRESSION	80 dB below 100% modulation.
<i>SCA INPUT (INTERNALLY GENERATED)</i>	
CONNECTOR	D-Type, 25-Pin, female.
INPUT LEVEL	+8 dBm.
IMPEDANCE	600 Ohms or 10 k Ohms, resistive, jumper selectable.
FREQUENCY	67 kHz.
DEVIATION	5 kHz or 7.5 kHz.
FM SIGNAL-TO NOISE	60 db or greater.

TABLE 1. PNP 150 ELECTRICAL, PHYSICAL, AND ENVIRONMENTAL SPECIFICATIONS
(Sheet 4 of 4)

PARAMETER	SPECIFICATION
<i>ENVIRONMENTAL</i>	
TEMPERATURE RANGE	+14 Degrees F to +104 Degrees F (-10 Degrees C to +40 Degrees C).
HUMIDITY	95% maximum, non-condensing.
ALTITUDE	
50 Hz	7500 feet (2286 m).
60 Hz	10,000 feet (3048 m).
<i>PHYSICAL</i>	
HEIGHT	7 inches (17.8cm).
WIDTH	19.0 inches (48.3 cm).
DEPTH	19.0 inches (48.3 cm).
WEIGHT (unpacked)	25 pounds (11.3 kg).
NOTE	The PNP 150 system performance is specified using the model FMSA-1 Precision Digital FM stereo modulation analyzer and Audio Precision APWin software version 1.4. Measured at 100% modulation where applicable.

UNPACKING AND INSPECTING.

The equipment becomes the property of the customer when the equipment is delivered to the carrier. Carefully unpack the equipment. Perform a visual inspection to determine that no apparent damage has been incurred during shipment. All shipping materials should be retained until it is determined that the unit has not been damaged. Claims for damaged equipment must be promptly filed with the carrier or the carrier may not accept the claim.

The contents of the shipment should be as indicated on the packing list. If the contents are incomplete, or if the unit is damaged electrically or mechanically, notify both the carrier and MARTI Electronics immediately.

SAFETY/OPERATING CONSIDERATIONS.



WARNING

NEVER OPERATE THE TRANSMITTER WITH THE TOP-COVER REMOVED.

WARNING



WARNING

ENSURE ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED BEFORE REMOVING THE TOP-COVER.

WARNING



CAUTION

TO PREVENT DAMAGE TO THE TRANSMITTER FROM IMPROPER COOLING, DO NOT OPERATE THE TRANSMITTER WITH THE TOP-COVER REMOVED.

CAUTION

The PNP 150 transmitter meets the IEC 215 safety standard. However, good judgement, care, and common sense must be practiced to prevent accidents. Procedures contained in this manual should be performed only by experienced and trained maintenance personnel.

The transmitter contains hazardous voltages when the top-cover is removed. Therefore, never operate the transmitter with the top-cover removed.

Operation of the transmitter with the top-cover removed results in inadequate cooling of the PA module and power supplies. Therefore, do not operate the transmitter with the top-cover removed.

PNP 150 - QUICK INSTALL.

The PNP 150 transmitter is assembled, operated, tested, and inspected at the factory prior to shipment and is ready for installation when received. Prior to installation, this publication should be studied to obtain an understanding of the operation, circuitry, nomenclature, and installation requirements.

The following text presents a quick installation procedure. The procedure presents a brief description of the steps required to install the transmitter. The steps are explained in further detail following the procedure.

STEP 1 - PRE-INSTALLATION.



WARNING

ENSURE NO PRIMARY POWER IS CONNECTED TO THE TRANSMITTER BEFORE PROCEEDING.

WARNING

Place the transmitter on a work surface. Ensure no primary power is connected to the transmitter and remove the top-cover. Retain all screws for replacement at a later time.

STEP 2 - PREEMPHASIS PROGRAMMING.

The transmitter is programmed from the factory for 75 uS preemphasis. If a flat response or 50 uS preemphasis is required, refer to Figure 3 - Sheet 3 of 3 and program headers J9 and J11 as required.

STEP 3 - AUDIO INPUT.

The transmitter is equipped with the following audio inputs: 1) analog left channel and right channel, 2) AES/EBU wire, 3) AES/EBU optical, 4) S/PDIF, and 5) composite. The following text presents the procedure to connect and program the unit for the desired type of audio input.

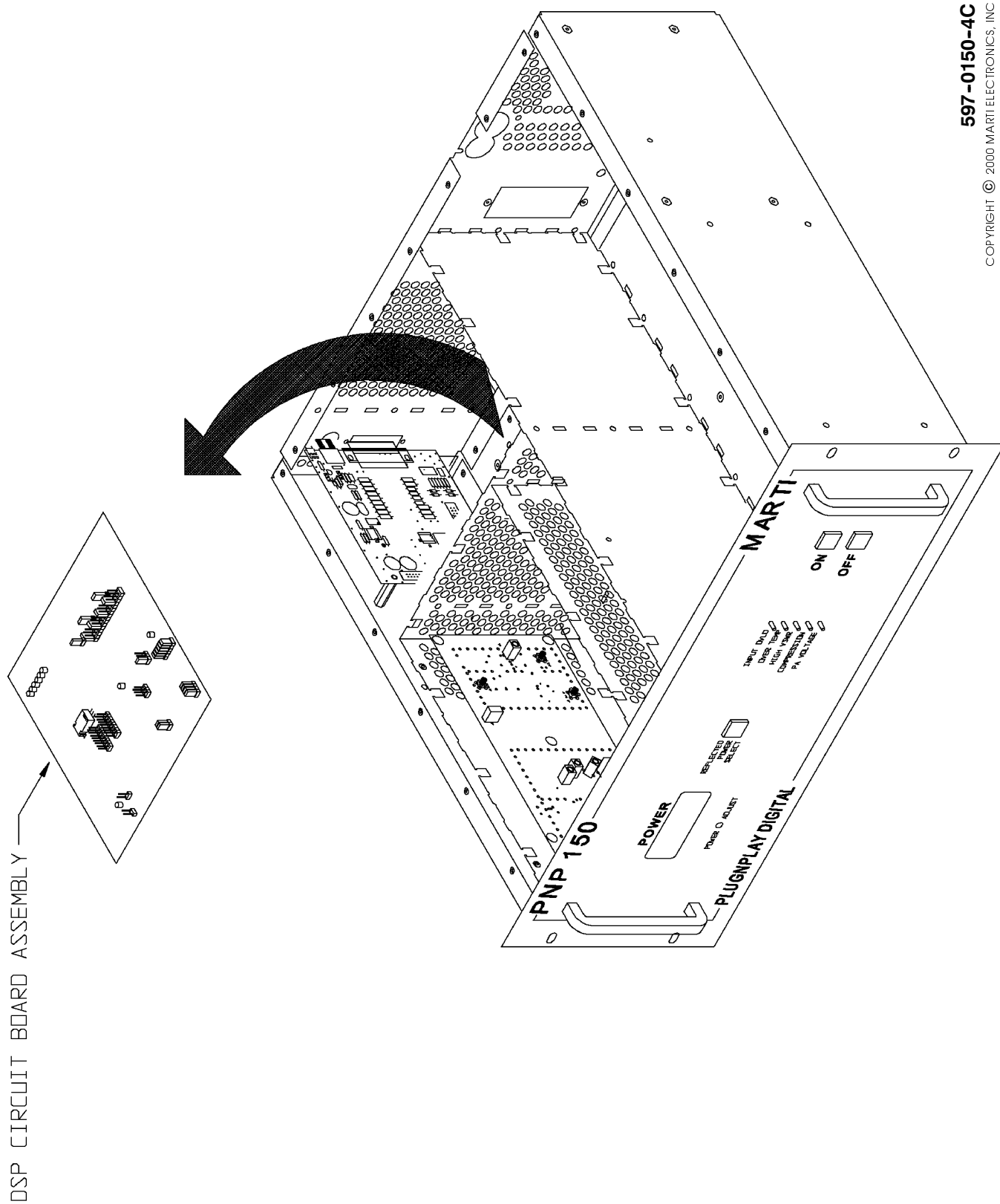


FIGURE 3. DSP CIRCUIT BOARD PROGRAMMING (SHEET 1 OF 3)

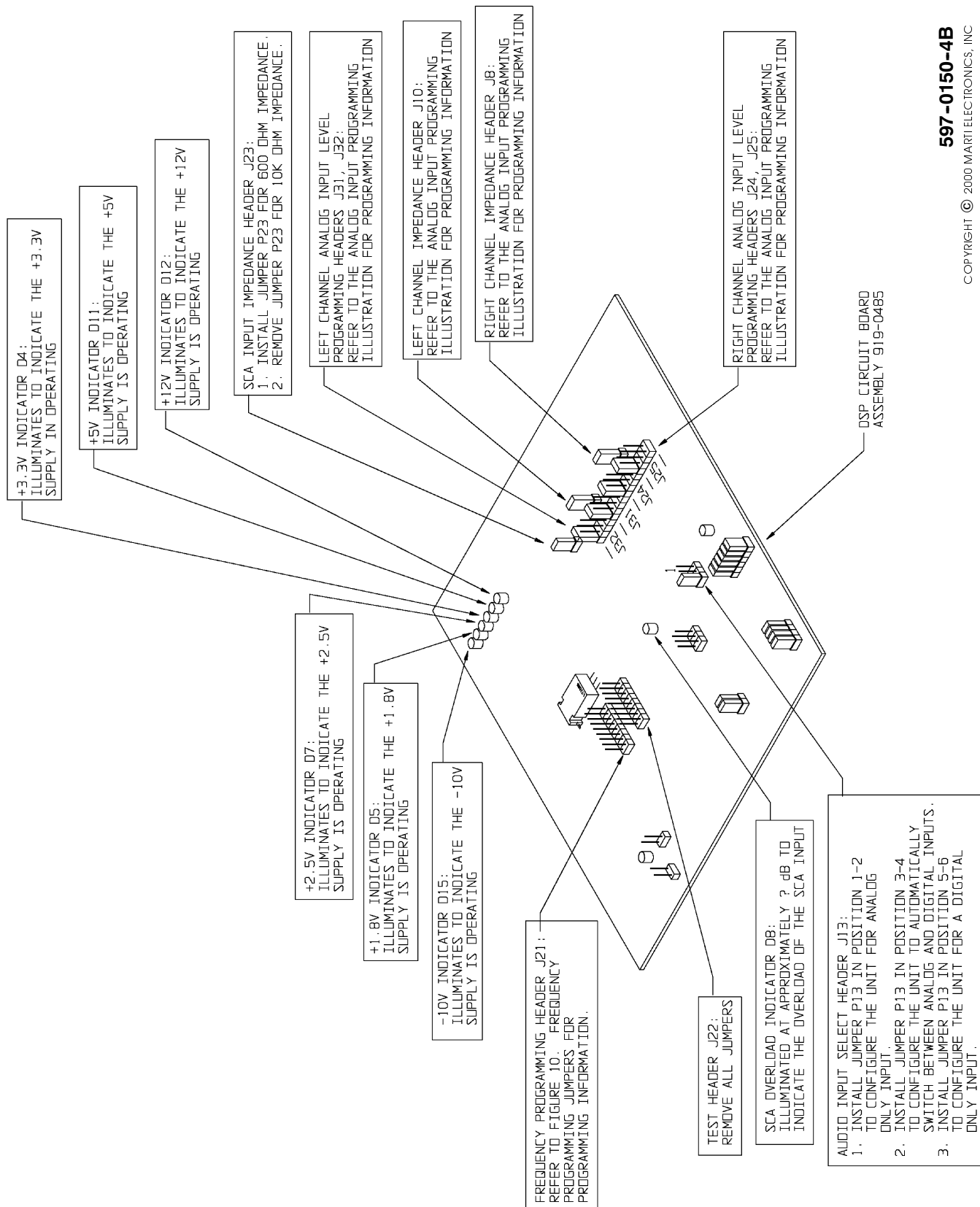
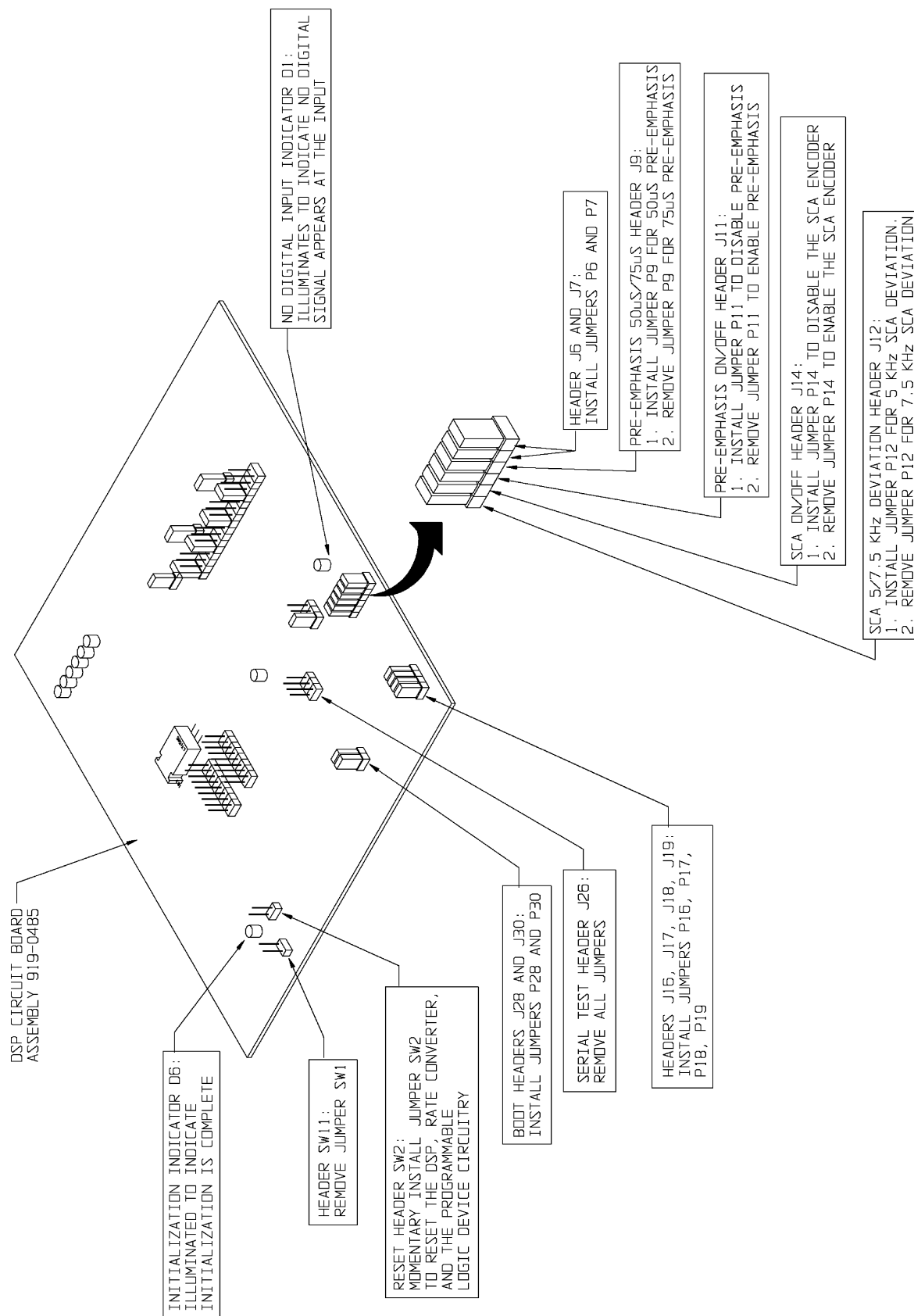


FIGURE 3. DSP CIRCUIT BOARD PROGRAMMING (SHEET 2 OF 3)



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FIGURE 3. DSP CIRCUIT BOARD PROGRAMMING (SHEET 3 OF 3)

ANALOG LEFT AND RIGHT CHANNEL -

1. Left and right channel audio is interfaced to the PNP 150 at remote interface connector J1 (refer to Figure 4). Refer to Figure 4 and connect the audio to J1 as follows:

AUDIO SIGNAL	J1
Left Channel +	J1-20
Left Channel -	J1-21
Left Channel Shield	J1-22
Right Channel +	J1-9
Right Channel -	J1-10
Left Channel Shield	J1-11

2. The analog input can be programmed for a 600 Ohm or 10 k Ohm impedance. The unit is shipped from the factory configured for a 600 Ohm audio impedance. Refer to Figure 5 and program headers J8 and J10 as desired.
3. The analog input must be programmed for the audio input level to be used. The input can be programmed for an input of -10 dBm, 0 dBm, +4 dBm, or +8 dBm. The unit is shipped from the factory configured for a 0 dBm audio input level. Refer to Figure 5 and program headers J24/J25/J31/J32 on the DSP circuit board as required.

AES/EBU WIRE -

1. An AES/EBU wire input is interfaced to the PNP 150 at remote interface connector J1 (refer to Figure 4). Refer to Figure 4 and connect the AES/EBU signal to J1-12 and J1-13. The AES/EBU signal is polarity independent. Therefore, the signal cables can be connected to J1-12 and J1-13 in any combination.

AES/EBU OPTICAL -

1. An AES/EBU optical input is interfaced to the PNP 150 at DIGITAL IN OPTICAL connector U1 (refer to Figure 4). Refer to Figure 4 and connect the AES/EBU signal to DIGITAL IN OPTICAL connector U1.

S/PDIF -

1. An S/PDIF input is interfaced to the PNP 150 at DIGITAL IN S/PDIF connector J2 (refer to Figure 4). A BNC-to-RCA phono adapter is provided in the accessory kit. Refer to Figure 4 to install the adapter and connect the S/PDIF cable to DIGITAL IN S/PDIF connector J2.

COMPOSITE -

1. An composite input is interfaced to the PNP 150 at COMPOSITE IN connector J4 (refer to Figure 4). Refer to Figure 4 and connect the composite signal to COMPOSITE IN connector J4.
2. The composite input can be programmed for a 50 Ohm or 10 k Ohm impedance. The unit is shipped from the factory configured for a 10 k Ohm input impedance. Refer to Figure 6 and program header J6 as desired.
3. The PNP 150 is designed to automatically detect and select the composite input when a pilot is present. If no pilot is detected, the analog left/right channel input will be selected. However, the unit can be programmed to select: 1) only the composite input or 2) only the analog left/right channel input. The unit is shipped from the factory for automatic switching between the composite input and the analog left/right channel input. If the unit is to be configured for composite only or left/right channel only operation, refer to Figure 6 and program header J5 as desired.

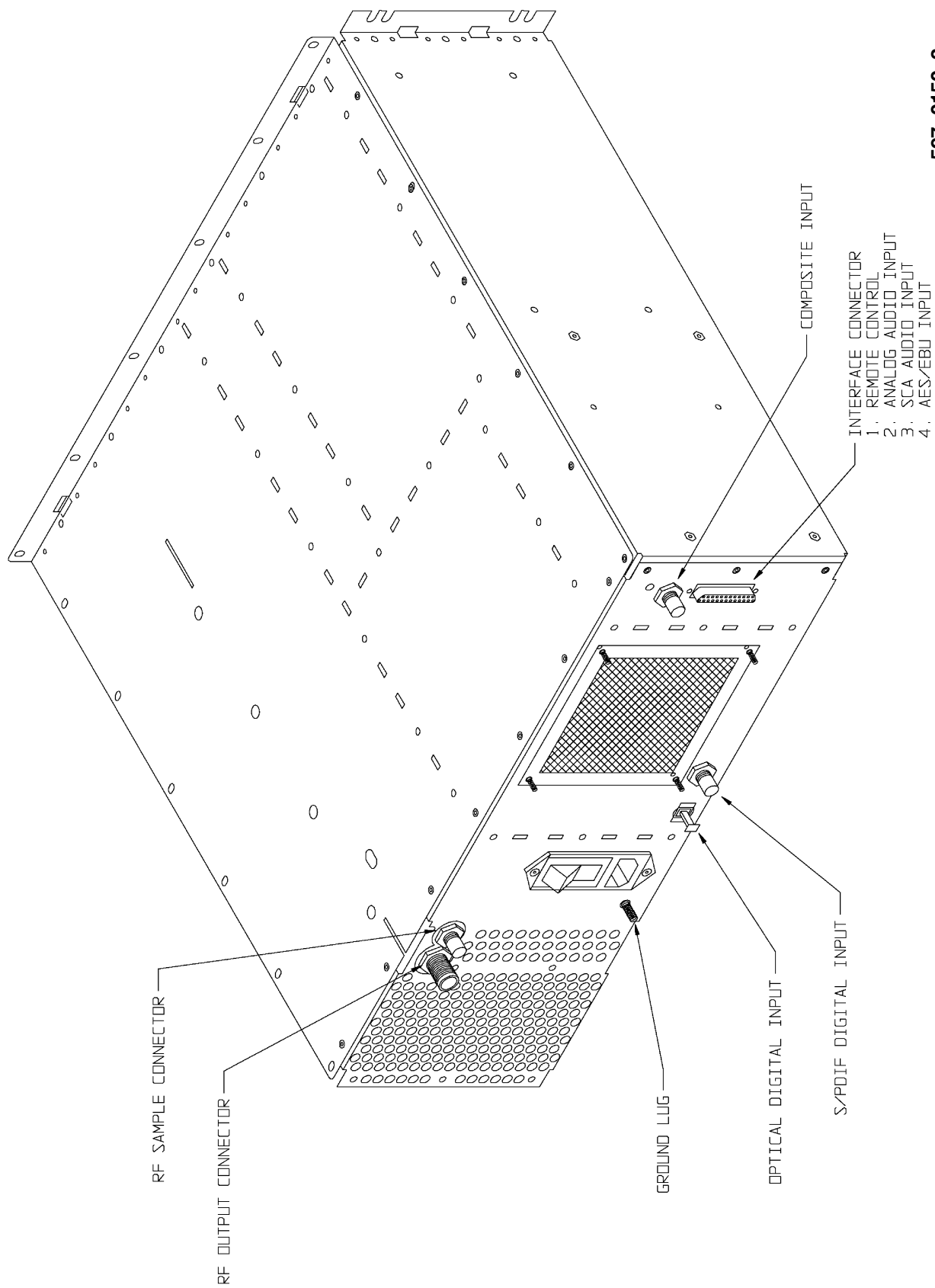
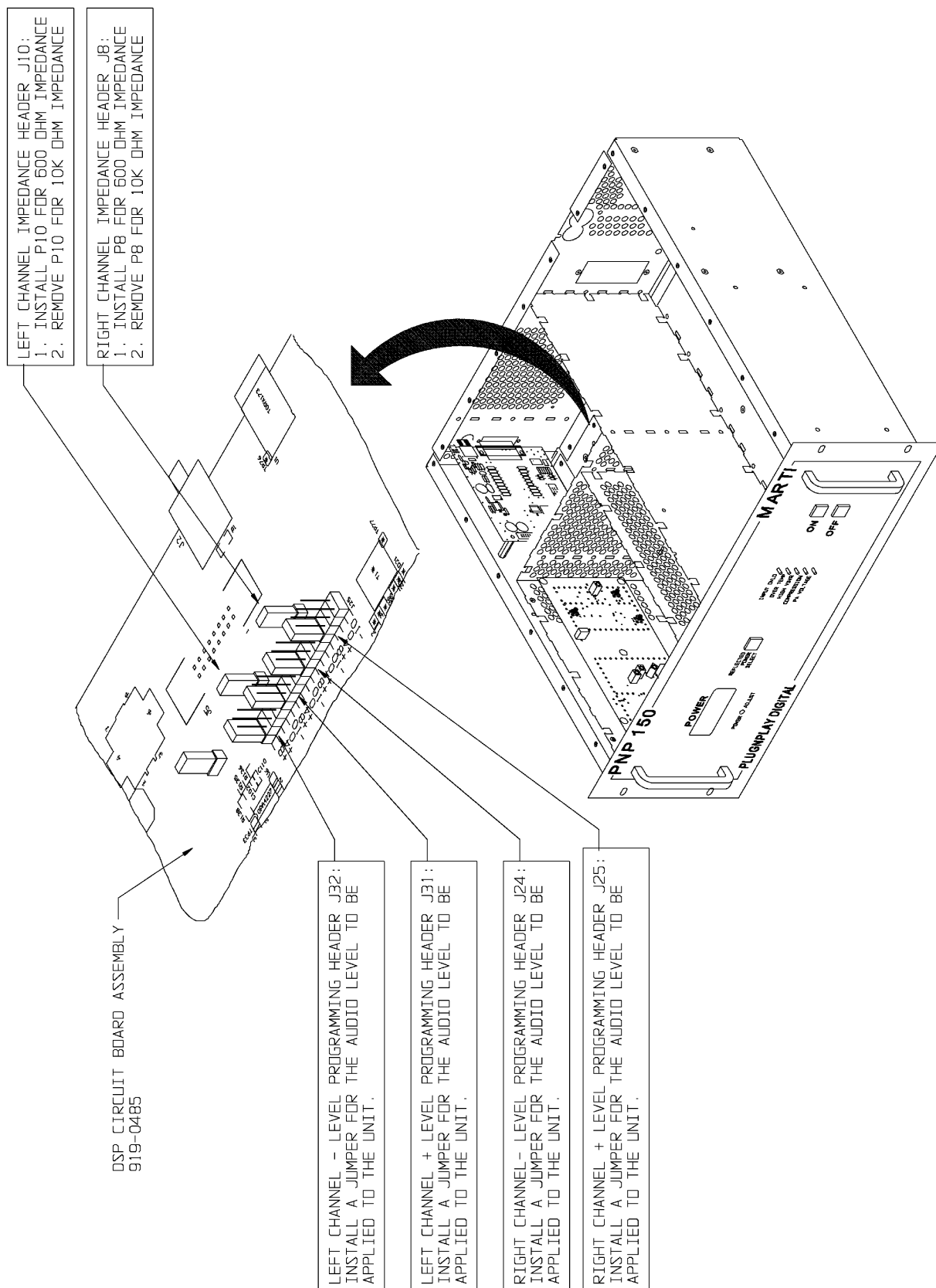


FIGURE 4. PNP 150 REAR-PANEL CONNECTORS

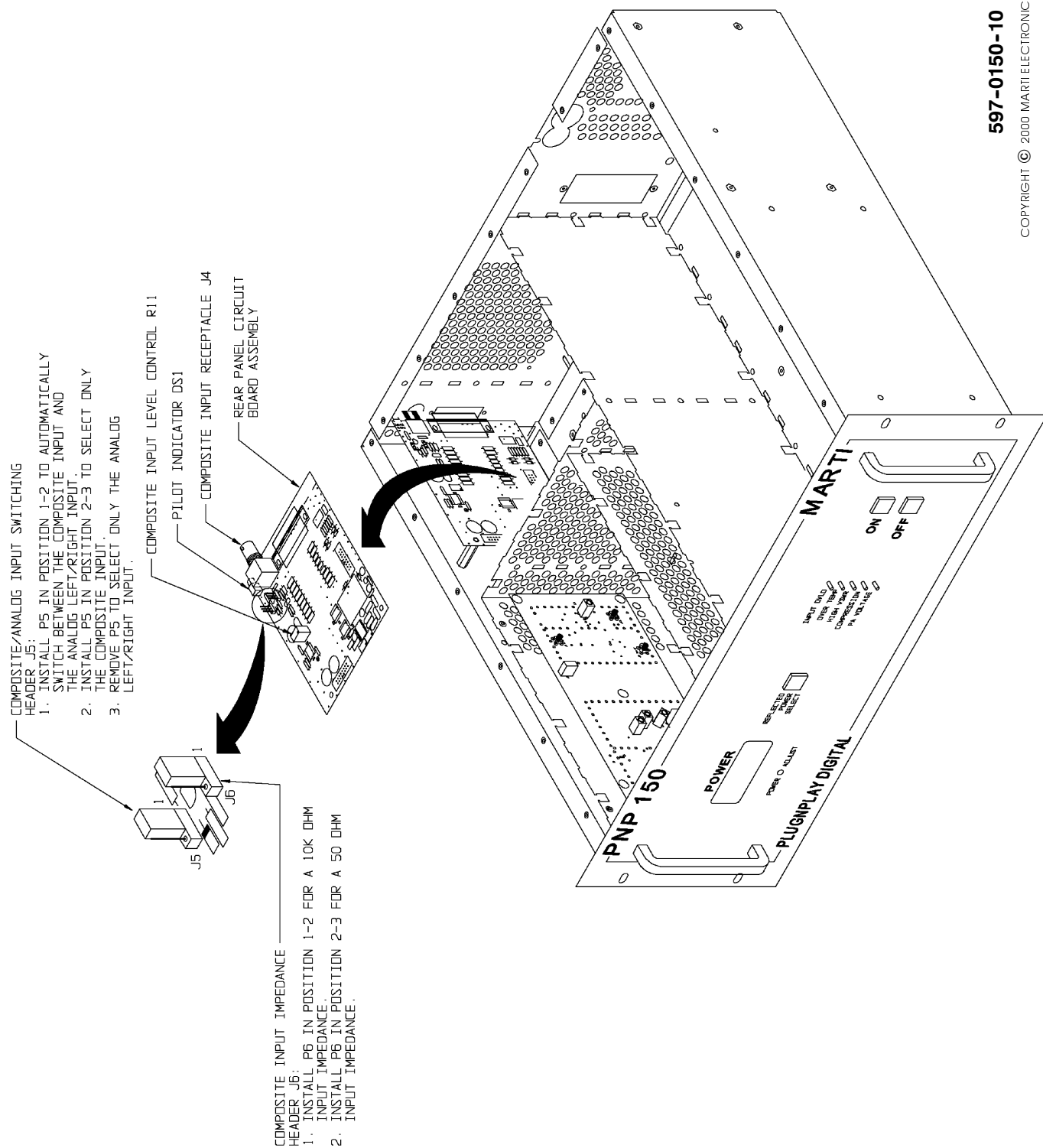
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FIGURE 5. ANALOG LEVEL PROGRAMMING



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FIGURE 6. REAR PANEL CIRCUIT BOARD CONTROLS AND INDICATORS

STEP 4 - FAILSAFE INPUT.



NOTE

NOTE

ENSURE A FAILSAFE JUMPER OR CONTROL DEVICE IS CONNECTED TO FAILSAFE INPUT J1-17. THE UNIT IS EQUIPPED WITH A PRE-WIRED INTERFACE CONNECTOR TO PERMIT IMMEDIATE ON-AIR OPERATION.

The transmitter is equipped with a failsafe input. This input is designed for the connection of a control device such as a remote control unit failsafe connection. The polarity of the input is controlled by POS/NEG switch S2 on the transmitter front panel circuit board (refer to Figure 7 - Sheet 3). If a failsafe connection is not required, a jumper must be connected at J1-17. To permit immediate on-air operation, the unit is equipped with a pre-wired 25-Pin D-Type interface connector. The connector is located in the accessory kit and contains a failsafe input jumper. To permit immediate operation, install the connector on J1. For a different jumper configuration, refer to Figure 7 and: 1) operate switch S2 to the desired polarity and 2) connect a jumper to J1-17 as determined by polarity switch S2. The unit will not operate unless a jumper or control device is connected to J1-17.

STEP 5 - MODULATION MONITOR CONNECTION.

The PNP 150 is equipped with an **RF SAMPLE** receptacle (refer to Figure 4). The sample port is for the connection of a modulation monitor or test equipment. The receptacle will provide 1.5V RMS at 150 watts. Connect the desired equipment to the **RF SAMPLE** receptacle as required.

STEP 6 - ANTENNA CONNECTION.

A Type-N RF output receptacle is provided for the connection of the antenna to the transmitter. Refer to Figure 4 and connect the antenna to the RF output receptacle.

STEP 7 - AC POWER AND GROUND.



WARNING

WARNING

ENSURE THE TRANSMITTER IS CONNECTED TO A 100 TO 240 VOLT 50/60 HZ GROUNDED AC RECEPTACLE.

The transmitter requires connection to a 100 to 240 volt 50/60 Hz ac power supply. The unit requires 4 amperes at 120 volts or 2 amperes at 220V. The power supply circuitry automatically switches between 110 volt and 220 volt operation.

The transmitter must be connected to a grounded and circuit breaker/fused protected ac receptacle. Connect the ac power cord to an appropriate 110 volt or 220 volt ac receptacle.

The transmitter is also equipped with a rear-panel ground lug. Refer to Figure 4 and connect an earth ground to the ground lug using a 2 inch wide (5.05 cm) copper strap or equivalent.

STEP 8 - AUDIO INPUT LEVEL ADJUSTMENT.

The transmitter audio input level must be properly adjusted to provide the desired modulation level and prevent over-driving/clipping of the audio circuitry. Refer to AUDIO INPUT LEVEL ADJUSTMENTS in the following text and perform the procedures to adjust the audio input level.

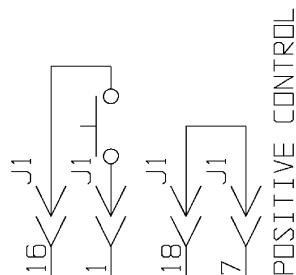
REMOTE INTERFACING

①

ON COMMAND

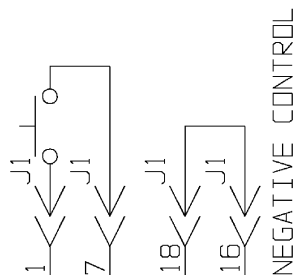
POSITIVE CONTROL

MOMENTARY OR SUSTAINED CONTACT TO +5V TO +12V REQUIRED TO OPERATE THE TRANSMITTER TO ON.



NEGATIVE CONTROL

MOMENTARY OR SUSTAINED CONTACT TO GROUND REQUIRED TO OPERATE THE TRANSMITTER TO ON.

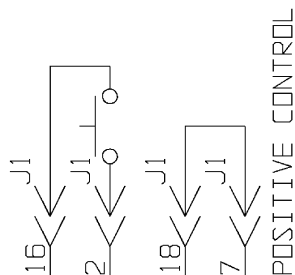


②

OFF COMMAND

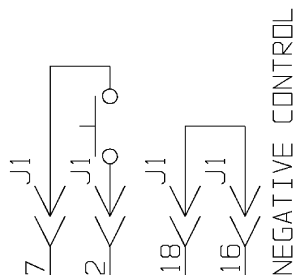
POSITIVE CONTROL

MOMENTARY OR SUSTAINED CONTACT TO +5V TO +12V REQUIRED TO OPERATE THE TRANSMITTER TO OFF.



NEGATIVE CONTROL

MOMENTARY OR SUSTAINED CONTACT TO GROUND REQUIRED TO OPERATE THE TRANSMITTER TO OFF.



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FIGURE 7. REMOTE CONTROL/SCA AUDIO/ANALOG AUDIO/AES/EBU WIRE INTERFACING (SHEET 1 OF 4)

J1 PIN DESCRIPTIONS

③ ON STATUS	TRANSMITTER ON INDICATION LOW (ON DC) WHEN ACTIVE, CURRENT LIMITING RESISTOR REQUIRED	
④ OFF STATUS	TRANSMITTER OFF INDICATION LOW (ON DC) WHEN ACTIVE, CURRENT LIMITING RESISTOR REQUIRED	
⑤ FWD PWR	FORWARD POWER METER OUTPUT +2VDC = 150W	
⑥ RFL PWR	REFLECTED POWER METER OUTPUT +2VDC = 6W	
⑦ CIRCUIT GND	CIRCUIT GROUND	
⑧ CHASSIS GND	CHASSIS GROUND	
⑨ RIGHT +	ANALOG RIGHT CHANNEL + INPUT 600 OR 10K OHM IMPEDANCE P8 DSP PCB - 600 OHM = P8 ON P8 DSP PCB - 10 K OHM = P8 OFF LEVEL PROGRAMMING - P25 ON DSP PCB	
⑩ RIGHT -	ANALOG RIGHT CHANNEL - INPUT 600 OR 10K OHM IMPEDANCE P8 DSP PCB - 600 OHM = P8 ON P8 DSP PCB - 10 K OHM = P8 OFF LEVEL PROGRAMMING - P24 ON DSP PCB	
⑪ RIGHT GND	ANALOG RIGHT CHANNEL GROUND	
⑫ AES/EBU +	DIGITAL AES/EBU + INPUT	
⑬ AES/EBU -	DIGITAL AES/EBU - INPUT	
⑭ VSWR	VSWR FAULT INDICATION. HIGH (+12 VDC) WHEN A 1.5:1 VSWR CONDITION OCCURS, 100 MA MAX.	
⑮ TEMP FAULT	TEMPERATURE OVERLOAD INDICATION. HIGH (+12 VDC) WHEN THE AMPLIFIER HEATSINK TEMPERATURE EXCEEDS 80 DEGREES C, 100 MA MAX.	

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FIGURE 7. REMOTE CONTROL/SCA AUDIO/ANALOG AUDIO/AES/EBU WIRE INTERFACING (SHEET 2 OF 4)

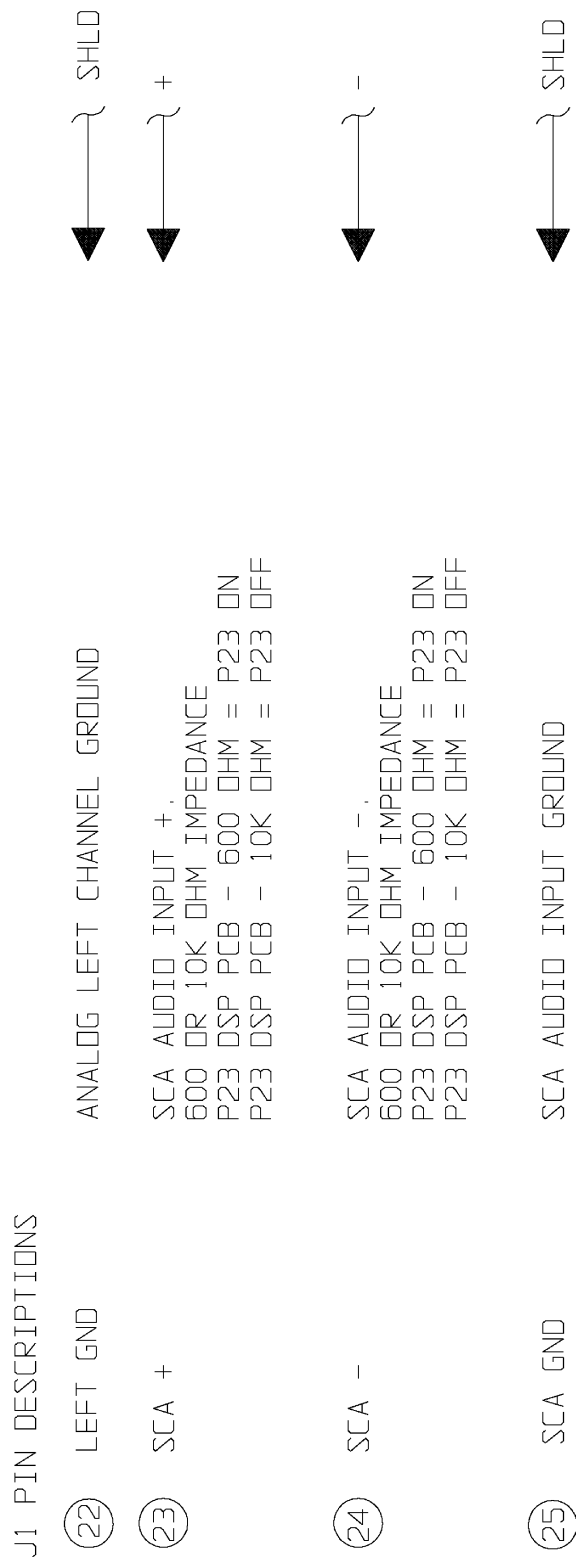
J1 PIN DESCRIPTIONS

16	+12V	+12V DC	
17	FAILSAFE	MUTES/UNMUTES THE RF OUTPUT POSITIVE CONTROL - REQUIRES: 1. +12V DC AT J1-17 2. S2 ON FRONT PANEL PCB IN THE POS POSITION	
18	R.C. IN COMMON	Negative control - requires 1. GROUND AT J1-17 2. S2 ON FRONT PANEL PCB IN THE NEG POSITION	
19	PAV SAMPLE	REMOTE CONTROL IN COMMON. USED FOR REMOTE CONTROL CONNECTIONS	
20	LEFT +	PA VOLTAGE SAMPLE 10% OF PA VOLTAGE. WHEN PA VOLTAGE = 48V SAMPLE = 4.8V ANALOG LEFT CHANNEL + INPUT. 600 OR 10K OHM IMPEDANCE P10 DSP PCB - 600 OHM = P10 ON P10 DSP PCB - 10K OHM = P10 OFF LEVEL PROGRAMMING - P31 ON DSP PCB	
21	LEFT -	ANALOG LEFT CHANNEL - INPUT. 600 OR 10K OHM IMPEDANCE P10 DSP PCB - 600 OHM = P10 ON P10 DSP PCB - 10K OHM = P10 OFF LEVEL PROGRAMMING - P32 ON DSP PCB	
22	LEFT GND	ANALOG LEFT CHANNEL GROUND	

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FIGURE 7. REMOTE CONTROL/SCA AUDIO/ANALOG AUDIO/AES/EBU WIRE INTERFACING (SHEET 3 OF 4)



597-0150-3D

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FIGURE 7. REMOTE CONTROL/SCA AUDIO/ANALOG AUDIO/AES/EBU WIRE INTERFACING (SHEET 4 OF 4)

STEP 9 - RF OUTPUT LEVEL ADJUSTMENT.

Replace the transmitter top-cover. The PNP 150 transmitter RF output is adjusted for a 150 watt output at the factory. To re-adjust the RF output, proceed as follows:

1. Operate the front-panel **REFLECTED POWER SELECT** switch/indicator to extinguish the switch/indicator.

*The front-panel **POWER** LCD display will be configured to display forward power.*

2. Using a tuning tool, adjust front-panel **POWER ADJUST** control clockwise to increase power or counterclockwise to decrease power.

STEP 10 - MOUNTING.

The unit requires 7 inches (17.78 cm) of a 19 inch (48.3 cm) rack cabinet (refer to Figure 2). Do not mount the transmitter directly above or below heat generating equipment. Once a rack location is determined, mount the chassis in the rack using 4 screws.

END OF QUICK INSTALL.

The transmitter is ready for on-air operation.

OPERATION/FEATURE PROGRAMMING.

The PNP 150 allows the user to select many types of different operating parameters and features. Many of the operating parameters and features are programmed on the DSP and front-panel circuit boards. Refer to the following text to program the transmitter for the desired operating characteristics.

OPERATING PARAMETERS/FEATURES/INDICATORS - DSP CIRCUIT BOARD.

Many of the operating parameters and features are programmed on the DSP circuit board (refer to Figure 3). Refer to Figure 3 and the following text to program the transmitter for the desired operating characteristics.

SCA OPERATION -

SCA operation is controlled by several jumpers on the DSP circuit board. SCA operation is controlled by header J14. The SCA audio impedance is selected by header J23. Indicator D8 presents the SCA audio input overload status. The SCA input can be configured for 5 kHz or 7.5 kHz deviation. Refer to AUDIO INPUT CONNECTIONS/PROGRAMMING and the SCA procedure for information associated with the SCA input.

FREQUENCY PROGRAMMING -

The PNP 150 carrier frequency is programmed by header J21 on the DSP circuit board and a group of headers on the 2nd up-converter circuit board. Refer to FREQUENCY PROGRAMMING for information associated with programming the transmitter carrier frequency.

TEST HEADER -

Ensure all jumpers are removed from header J22.

INITIALIZATION INDICATOR -

Indicator D6 presents the status of the DSP initialization. D6 will illuminate to indicate when the initialization process has finished.

HEADER SW1 -

Ensure the jumper is removed from header SW1.

RESET HEADER SW2 -

Header SW2 is used to reset the DSP, rate converter, and programmable logic device circuitry. To reset the circuitry, momentarily install jumper SW2.

BOOT HEADERS -

Headers J28 and J30 control the boot process. Ensure jumpers P28 and P30 are installed.

SERIAL TEST HEADER -

Ensure all jumpers are removed from serial test header J26.

AUDIO INPUT SELECT HEADER -

Header J13 controls the selection of the audio input signal. The unit can be configured for: 1) an analog only input, 2) a digital only input, or 3) auto mode. The auto mode automatically switches between the analog and digital inputs. The unit is shipped from the factory configured for auto mode. Program J13 for the desired mode of operation.

HEADERS J16/J17/J18/J19 -

Ensure jumpers P16, P17, P18, and P19 are installed.

DIGITAL INPUT STATUS -

Indicator D1 presents the status of the digital input. The indicator will illuminate when the digital input is missing.

PREEMPHASIS -

The transmitter can be configured for flat, 50 uS preemphasis, or 75 uS preemphasis. The unit is programmed from the factory for 75 uS preemphasis. Header J9 configures the unit for 50 uS or 75 uS preemphasis. Header J11 enables or disables preemphasis operation. Program headers J9 and J11 for the desired preemphasis operation.

HEADER J6/J7 -

Ensure jumpers P6 and P7 are installed.

ANALOG INPUT -

Header J8 controls the right channel audio impedance. Headers J24/J25 program the right channel audio input level. Header J10 controls the left channel audio impedance. Headers J31/J32 program the left channel audio input level. Refer to AUDIO INPUT CONNECTIONS/PROGRAMMING and the ANALOG INPUT procedures for information associated with the analog input.

POWER SUPPLY INDICATORS -

The DSP circuit board is equipped several power supply status indicators. Indicator D15 illuminates when the -10V dc supply is operational. Indicator D5 illuminates when the +1.8V dc supply is operational. Indicator D7 illuminates when the +2.5V dc supply is operational. Indicator D4 illuminates when the +3.3V dc supply is operational. Indicator D11 illuminates when the +5V dc supply is operational. Indicator D12 illuminates when the +12V dc supply is operational.

OPERATING PARAMETERS/FEATURES - FRONT-PANEL CIRCUIT BOARD.

Some of the operating parameters and features are programmed on the front-panel circuit board (refer to Figure 8). Refer to Figure 8 and the following text to program the transmitter for the desired operating characteristics.

OPERATE/TEST HEADER -

Ensure jumper P7 is installed in position 1-2.

EXTERNAL FORWARD POWER HEADER -

Ensure jumper P5 is installed in position 1-2.

EXTERNAL REFLECTED POWER HEADER -

Ensure jumper P6 is installed in position 1-2.

REFLECTED POWER METER/TEMPERATURE SELECT -

The front-panel LCD display can be programmed to display reflected power or the RF amplifier heatsink temperature when the front-panel REFLECTED POWER SELECT switch/indicator is illuminated. The unit is shipped from the factory configured for reflected power display. Program J8 for the desired mode of operation.

POS/NEG FAILSAFE CONTROL SWITCH -

The failsafe input is used to mute and unmute the transmitter RF output. This input is designed for the connection of a control device such as a remote control unit failsafe connection. The polarity of the input is controlled by POS/NEG switch S2. Operate S2 for the desired control polarity.

AUDIO INPUT CONNECTIONS/PROGRAMMING.

The PNP 150 is equipped with several audio inputs: 1) analog left channel and right channel, 2) AES/EBU wire, 3) AES/EBU optical, 4) S/PDIF, and 5) composite. The following text presents the procedure connect and program the unit for the desired audio input.

ANALOG INPUT.

CONNECTIONS -

Analog left and right channel audio is interfaced to the PNP 150 at connector J1 (refer to Figure 7). Refer to Figure 7 and connect the analog left and right channel audio to J1 as follows:

AUDIO SIGNAL	J1
Left Channel +	J1-20
Left Channel -	J1-21
Left Channel Shield	J1-22
Right Channel +	J1-9
Right Channel -	J1-10
Left Channel Shield	J1-11

IMPEDANCE PROGRAMMING -

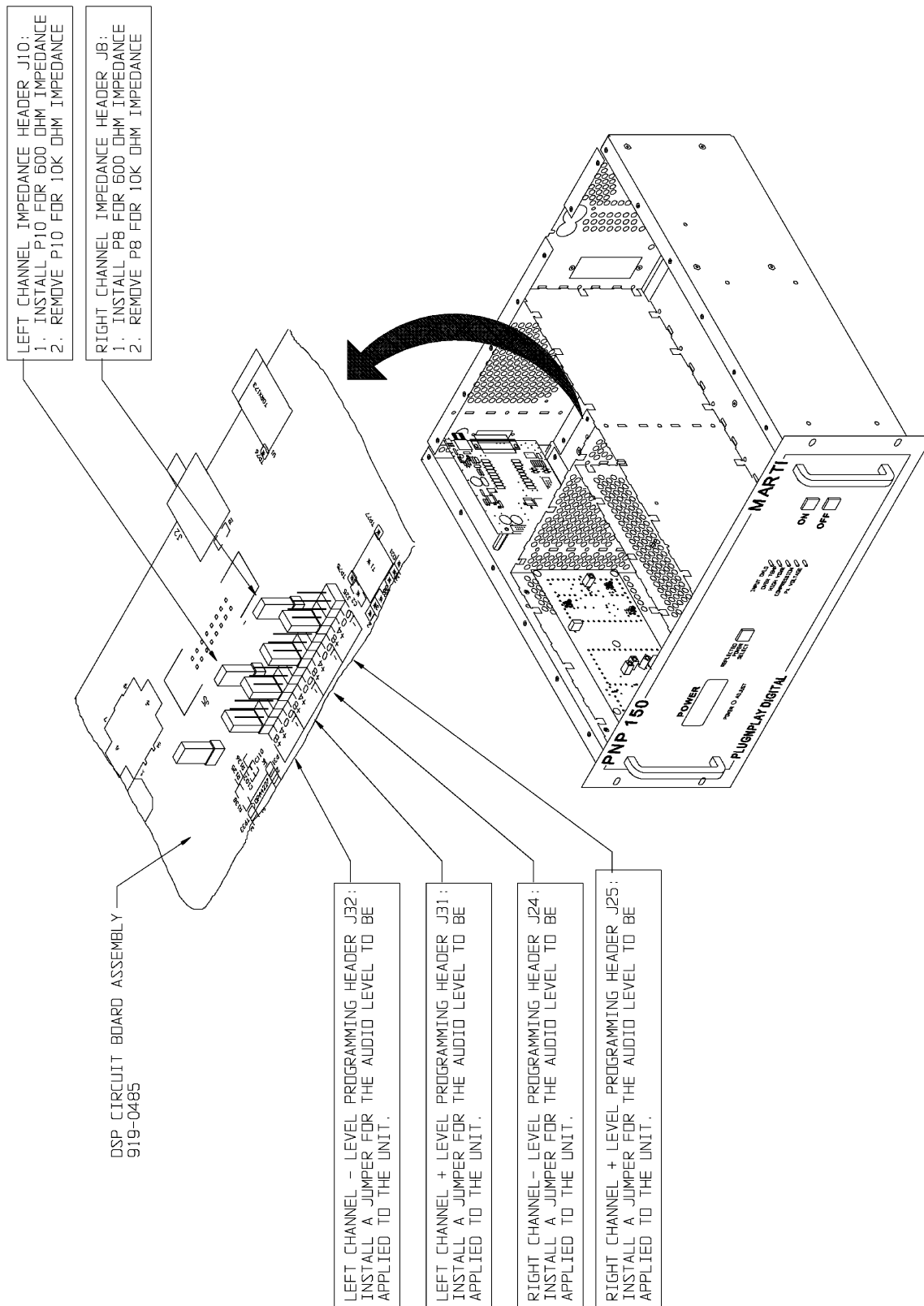
The analog left and right channel audio impedance is controlled by headers J8 and J10 on the DSP circuit board. The unit can be programmed for a 600 Ohm or 10 k Ohm audio impedance. The unit is shipped from the factory configured for a 600 Ohm audio impedance. Refer to Figure 9 and program the unit for the desired audio impedance.

LEVEL PROGRAMMING -

The analog left and right channel audio level is controlled by headers J24/J25/J31/J32 on the DSP circuit board. The unit can be programmed for a -10 dBm, 0 dBm, +4 dBm, or a +8 dBm audio input level. The unit is shipped from the factory configured for a 0 dBm Ohm audio input level. Refer to Figure 9 and program the unit for the desired audio level.

AES/EBU WIRE.

An AES/EBU wire input is interfaced to the PNP 150 at remote interface connector J1 (refer to Figure 4). Refer to Figure 4 and connect the AES/EBU signal to J1-12 and J1-13. The AES/EBU signal is polarity independent. Therefore, the signal cables can be connected to J1-12 and J1-13 in any combination.



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FIGURE 9. ANALOG INPUT LEVEL/IMPEDANCE PROGRAMMING

AES/EBU OPTICAL.

An AES/EBU optical input is interfaced to the PNP 150 at DIGITAL IN OPTICAL connector U1 (refer to Figure 4). Refer to Figure 4 and connect the AES/EBU signal to DIGITAL IN OPTICAL connector U1.

S/PDIF.

An S/PDIF input is interfaced to the PNP 150 at DIGITAL IN S/PDIF connector J2 (refer to Figure 4). A BNC-to-RCA phono adapter is provided in the accessory kit. Refer to Figure 4 to install the adapter and connect the S/PDIF cable to DIGITAL IN S/PDIF connector J2.

COMPOSITE.

CONNECTIONS -

A composite input is interfaced to the PNP 150 at COMPOSITE IN connector J4 (refer to Figure 4). Refer to Figure 4 and connect the composite signal to COMPOSITE IN connector J4.

IMPEDANCE PROGRAMMING -

The composite input can be programmed for a 50 Ohm or 10 k Ohm impedance. The unit is shipped from the factory configured for a 10 k Ohm input impedance. Refer to Figure 6 and program header J6 as desired.

AUTOMATIC SWITCHING BETWEEN COMPOSITE AND ANALOG LEFT/RIGHT CHANNEL PROGRAMMING -

The PNP 150 is designed to automatically detect and select the composite input when a pilot is present. If no pilot is detected, the analog left/right channel input will be selected. However, the unit can be programmed to select: 1) only the composite input or 2) only the analog left/right channel input. The unit is shipped from the factory for automatic switching between the composite input and the analog left/right channel input. If the unit is to be configured for composite only or left/right channel only operation, refer to Figure 6 and program header J5 as desired.

SCA.

The transmitter is equipped with a built-in 67 kHz SCA encoder. The encoder is controlled by several jumpers on the DSP circuit board.

CONNECTIONS -

SCA audio is interfaced to the PNP 150 at connector J1 (refer to Figure 7). Refer to Figure 7 and connect: 1) SCA + to J1-23, 2) SCA - to J1-24, and 3) SCA shield to J1-25.

IMPEDANCE PROGRAMMING -

The SCA audio impedance is controlled by header J23 on the DSP circuit board. The unit can be programmed for a 600 Ohm or 10 k Ohm audio impedance. The unit is shipped from the factory configured for a 600 Ohm audio impedance. Refer to Figure 3 - Sheet 2 of 3 and program the unit for the desired audio impedance.

ON/OFF CONTROL -

SCA operation is controlled by header J14 on the DSP circuit board. The unit is shipped from the factory with the SCA operation disabled. Refer to Figure 3 - Sheet 3 of 3 and remove P14 to enable SCA operation.

5 kHz/7.5 kHz DEVIATION -

5 kHz or 7.5 kHz deviation is controlled by header J12 on the DSP circuit board. The unit is shipped from the factory with the unit configured for 7.5 kHz deviation. Refer to Figure 3 - Sheet 3 of 3 and program P12 for the desired deviation.

REMOTE CONTROL AND INDICATIONS.

The PNP 150 is designed for remote control/indication operation (refer to Figure 7). The transmitter will interface with almost any remote control unit or panel. The following text presents a description of the remote control and indicator functions.

TRANSMITTER ON COMMAND -

The transmitter on command is located at J1-1. The command allows the transmitter to be enabled from a remote location. The command can be activated using positive or negative control. Positive control requires: 1) the use of a momentary or sustained contact to a +5 volt to +12 volt dc signal to enable transmitter operation. Negative control requires: 1) the use of a momentary or sustained contact to ground to enable transmitter operation.

TRANSMITTER OFF COMMAND -

The transmitter off command is located at J1-2. The command allows the transmitter to be disabled from a remote location. The command can be activated using positive or negative control. Positive control requires: 1) the use of a momentary or sustained contact to a +5 volt to +12 volt dc signal to disable transmitter operation. Negative control requires: 1) the use of a momentary or sustained contact to ground to disable transmitter operation.

TRANSMITTER ON INDICATOR -

The transmitter on indicator presents the transmitter on status. The indicator will go LOW (0 volts dc) when the transmitter is enabled. The transmitter on indicator is located at J1-3. Current limiting resistors required.

TRANSMITTER OFF INDICATOR -

The transmitter off indicator presents the transmitter off status. The indicator will go LOW (0 volts dc) when the transmitter is disabled. The transmitter off indicator is located at J1-4.

FORWARD POWER METER OUTPUT -

The remote forward power meter output is located at J1-5. The forward power meter will output +2 volts dc when the transmitter output is 150 watts. Circuit ground is recommended for remote metering connections.

REFLECTED POWER METER OUTPUT -

The remote reflected power meter output is located at J1-6. The reflected power meter will output +2 volts dc when the reflected power is 6 watts. Circuit ground is recommended for remote metering connections.

CIRCUIT GROUND -

Circuit ground is located at J1-7. The ground is recommended for remote control, indicator, and metering connections.

CHASSIS GROUND -

Chassis ground is located at J1-8. The ground can be used for remote control, indicator, and metering connections if a problem is encountered with circuit ground.

ANALOG RIGHT CHANNEL INPUT -

The analog right channel input + is located at J1-9. The analog right channel input - is located at J1-10. The analog right channel input ground is located at J1-11. The input impedance can be configured for 600 Ohms or 10 k Ohms. The input level can be configured for -10 dBm, 0 dBm, +4 dBm, or +8 dBm.

AES/EBU INPUT -

The AES/EBU input + is located at J1-12. The AES/EBU input - is located at J1-13. The AES/EBU signal is polarity independent. Therefore, the signal cables can be connected to J1-12 and J1-13 in any combination.

VSWR FAULT INDICATOR -

The VSWR fault indicator provides a status signal when a 1.5 : 1 or greater VSWR condition is present at the PNP 150 RF output. The indicator will go HIGH (+12 volts dc) when a 1.5 : 1 VSWR condition occurs. The VSWR fault indicator is located at J1-14.

TEMP FAULT INDICATOR -

The temperature fault indicator provides a status signal when the RF amplifier heatsink temperature exceeds approximately 80 degrees C. The indicator will go HIGH (+12 volts dc) when the over-temperature condition occurs. The temperature fault indicator is located at J1-15.

+12V DC -

+12 volts dc is located at J1-16. The supply is used for remote control and indicator connections.



NOTE

NOTE

ENSURE A FAILSAFE JUMPER OR CONTROL DEVICE IS CONNECTED TO FAILSAFE INPUT J1-17. THE UNIT IS EQUIPPED WITH A PRE-WIRED INTERFACE CONNECTOR TO PERMIT IMMEDIATE ON-AIR OPERATION.

FAILSAFE INPUT -

The transmitter failsafe input is located at J1-17. The failsafe input is used to mute and unmute the transmitter RF output. This input is designed for the connection of a control device such as a remote control unit failsafe connection. The polarity of the input is controlled by POS/NEG switch S2 on the transmitter front panel circuit board. S2 is shipped from the factory in the positive position. To permit immediate on-air operation, the unit is equipped with a pre-wired 25-Pin D-Type interface connector. The connector is located in the accessory kit and contains a failsafe input jumper. To permit immediate operation, install the connector on J1. For a different jumper configuration when a failsafe connection is not required, refer to Figures 7 and 8 to: 1) operate switch S2 to the desired polarity and 2) connect a jumper to J1-17 as determined by polarity switch S2.

R.C. IN COMMON -

The R.C. in common input is located at J1-18. The remote control common input determines the polarity of remote control operation. For negative control operation, connect a jumper between J1-17 and J1-16. For positive control operation, connect a jumper between J1-17 and J1-7.

PAV SAMPLE -

A PAV (power amplifier voltage) sample is provided at J1-19. The sample will output 10% of the PAV. For example, if the PAV is +48 volts, the sample voltage will equal 4.8 volts dc. The PAV sample maximum is 4.8 volts dc.

ANALOG LEFT CHANNEL INPUT -

The analog left channel input + is located at J1-20. The analog left channel input - is located at J1-21. The analog left channel input ground is located at J1-22. The input impedance can be configured for 600 Ohms or 10 k Ohms. The input level can be configured for -10 dBm, 0 dBm, +4 dBm, or +8 dBm.

SCA AUDIO INPUT -

The SCA audio input + is located at J1-23. The SCA audio input - is located at J1-24. The SCA audio input ground is located at J1-25. The input impedance can be configured for 600 Ohms or 10 k Ohms.

MODULATION MONITOR CONNECTION.

The PNP 150 is equipped with an **RF SAMPLE** receptacle (refer to Figure 4). The sample port is for the connection of a modulation monitor or test equipment. The receptacle will provide 1.5V RMS at 150 watts. Connect the desired equipment to the **RF SAMPLE** receptacle as required.

ANTENNA CONNECTION.

A Type-N RF output receptacle is provided for the connection of the antenna to the transmitter. Refer to Figure 4 and connect the antenna to the RF output receptacle.

GROUND CONNECTION.



WARNING

WARNING

ENSURE THE TRANSMITTER AC LINE CORD IS CONNECTED TO A GROUNDED AC RECEPTACLE AND AN EARTH GROUND IS CONNECTED TO THE CHASSIS GROUND LUG.

The transmitter must be connected to a grounded and circuit breaker/fused protected ac receptacle. Ensure the transmitter is connected to a grounded ac receptacle.

The transmitter is also equipped with a rear-panel ground lug. Refer to Figure 4 and connect an earth ground to the ground lug using a 2 inch wide (5.05 cm) copper strap or equivalent.

AC POWER.



WARNING

WARNING

ENSURE THE TRANSMITTER IS CONNECTED TO A 100 TO 240 VOLT 50/60 HZ GROUNDED AC RECEPTACLE.

The transmitter requires connection to a 100 to 240 volt 50/60 Hz ac power supply. The unit requires 4 amperes at 120 volts or 2 amperes at 220V. The power supply circuitry automatically switches between 110 volt and 220 volt operation.

The transmitter must be connected to a grounded and circuit breaker/fused protected ac receptacle. Connect the ac power cord to an appropriate 110 volt or 220 volt ac receptacle.

RF OUTPUT LEVEL ADJUSTMENT.

The PNP 150 transmitter RF output is adjusted for a 150 watt output at the factory. To re-adjust the RF output, proceed as follows:

1. Operate the front-panel **REFLECTED POWER SELECT** switch/indicator to extinguish the switch/indicator.

*The front-panel **POWER LCD** display will be configured to display forward power.*

2. Using a tuning tool, adjust front-panel **POWER ADJUST** control clockwise to increase power or counter clockwise to decrease power.

AUDIO INPUT LEVEL ADJUSTMENTS.

The transmitter audio input level must be properly adjusted to provide the desired modulation level and prevent over-driving/clipping of the audio circuitry. It is strongly recommended a modulation monitor be used to adjust the audio level. This ensures the transmitter will provide maximum modulation without over-modulation. If a modulation monitor is not available, the level can be adjusted using the PNP 150 front panel **COMPRESSION** indicator. However, the adjust will not ensure a 100% modulation level from the transmitter.

ANALOG INPUT - AES/EBU WIRE - AES/EBU OPTICAL - S/PDIF.

The analog input, AES/EBU wire, AES/EBU optical, and S/PDIF audio level is adjusted by using the output level control on the audio source. For the analog input, the level is coarse adjusted by the analog audio input level headers on the DSP circuit board. To fine adjust the level to obtain the desired modulation, proceed as follows:

ADJUSTMENT WITH MODULATION MONITOR -

1. Refer to Figure 4 and connect the modulation monitor to the **RF SAMPLE** receptacle.
2. Operate the rear-panel ON/OFF switch to ON.
3. Depress the front-panel ON switch/indicator to illuminate the switch/indicator.
4. Operate the audio source to output a 400 Hz tone at: 1) -2 dBfs for digital sources or 2) the selected nominal level for analog sources.
5. Adjust the audio source output level for 100% modulation on the modulation monitor.

ADJUSTMENT WITHOUT MODULATION MONITOR -



NOTE

WITHOUT A MODULATION MONITOR, THE FOLLOWING ADJUSTMENT WILL NOT ENSURE A 100% MODULATION LEVEL FROM THE TRANSMITTER.

NOTE

1. Operate the rear-panel ON/OFF switch to ON.
2. Depress the front-panel ON switch/indicator to illuminate the switch/indicator.
3. Operate the audio source with normal program music audio such as a CD.
4. Adjust the audio source output level until the front-panel COMPRESSION indicator blinks at a rate of approximately once per second. This will provide a modulation level of less than 100%. However, the audio input will be adjusted to a level ensuring audio input overload and clipping will not occur.

COMPOSITE.

The composite input level is adjusted at the factory for 100% modulation with a 1.25 volt peak-to-peak input level. The input level is adjusted by composite input level control R11 on the rear-panel circuit board (refer to Figure 6). If re-adjustment of the input level is required, proceed as follows:

ADJUSTMENT WITH MODULATION MONITOR -

1. Refer to Figure 4 and connect the modulation monitor to the **RF SAMPLE** receptacle.
2. Operate the rear-panel ON/OFF switch to ON.
3. Depress the front-panel ON switch/indicator to illuminate the switch/indicator.
4. Operate the audio source to output a 400 Hz tone at the nominal level.
5. Ensure pilot indicator DS1 is illuminated (refer to Figure 6). If the indicator is not illuminated, the composite signal is not present at the transmitter.
6. Adjust the composite source output level control for 100% modulation on the modulation monitor. If the composite source does not contain an output level control, refer to Figure 6 and adjust composite input level control R11 for 100% modulation on the modulation monitor. Ensure the level does not exceed 1.4 volts peak-to-peak.

ADJUSTMENT WITHOUT MODULATION MONITOR -



NOTE

NOTE

WITHOUT A MODULATION MONITOR, THE FOLLOWING ADJUSTMENT WILL NOT ENSURE A 100% MODULATION LEVEL FROM THE TRANSMITTER.

1. Operate the rear-panel ON/OFF switch to ON.
2. Depress the front-panel ON switch/indicator to illuminate the switch/indicator.
3. Operate the audio source with normal program music.
4. Ensure pilot indicator DS1 is illuminated (refer to Figure 6). If the indicator is not illuminated, the composite signal is not present at the transmitter.
5. Adjust the composite source output level control until the front-panel **COMPRESSION** indicator blinks at a rate of approximately once per second. This will provide a modulation level of less than 100%. However, the audio input will be adjusted to a level preventing audio input overload and clipping. If the composite source does not contain an output level control, refer to Figure 6 and adjust composite input level control R11. Ensure the level does not exceed 1.4 volts peak-to-peak.

SCA.

The SCA input audio level is adjusted by using the output level control on the audio source. To adjust the level to obtain the desired modulation, proceed as follows:

1. Connect an SCA decoder to the modulation monitor.
2. Operate the rear-panel ON/OFF switch to ON.
3. Depress the front-panel ON switch/indicator to illuminate the switch/indicator.
4. Operate the audio source to output a 400 Hz tone.
5. Adjust the audio source output level for approximately 15% modulation on the SCA decoder. Indicator D8 on the DSP circuit board (refer to Figure 3 - Sheet 2 of 3) illuminates to indicate the overload of the SCA input. If D8 illuminates decrease the audio level until D8 extinguishes.

MOUNTING.

The PNP 150 transmitter requires 7 inches (17.78 cm) of a 19 inch (48.3 cm) rack cabinet. Do not mount the transmitter directly above or below heat generating equipment. Once a rack location is determined, mount the chassis in the rack using 4 screws.

FREQUENCY PROGRAMMING.

The transmitter is programmed for the desired carrier frequency from the factory. The carrier frequency is determined by: 1) header J21 on the DSP circuit board and 2) header J19 on the 2nd up converter (refer to Figure 10).

Figure 10 and Table 2 text presents the information required to re-program the transmitter frequency. Some of the carrier frequencies can be programmed using 2 different oscillator circuits. For those frequencies, use the oscillator circuit which provides optimum performance from the transmitter. Use the information only when the transmitter carrier frequency must be changed.

TABLE 2. FREQUENCY PROGRAMMING														
	OSCILLATOR 2ND UP CONVERTER					MSB - A DSP CIRCUIT BOARD					LSB - B DSP CIRCUIT BOARD			
FREQUENCY	150	155	160	165		8	4	2	1		8	4	2	1
87.0	OFF	ON	ON	ON		ON	ON	ON	ON		ON	ON	ON	ON
87.05	OFF	ON	ON	ON		ON	ON	ON	ON		ON	ON	ON	OFF
87.1	OFF	ON	ON	ON		ON	ON	ON	ON		ON	ON	OFF	ON
87.15	OFF	ON	ON	ON		ON	ON	ON	ON		ON	ON	OFF	OFF
87.2	OFF	ON	ON	ON		ON	ON	ON	ON		ON	OFF	ON	ON
87.25	OFF	ON	ON	ON		ON	ON	ON	ON		ON	OFF	ON	OFF
87.3	OFF	ON	ON	ON		ON	ON	ON	ON		ON	OFF	OFF	ON
87.35	OFF	ON	ON	ON		ON	ON	ON	ON		ON	OFF	OFF	OFF
87.4	OFF	ON	ON	ON		ON	ON	ON	ON		OFF	ON	ON	ON
87.45	OFF	ON	ON	ON		ON	ON	ON	ON		OFF	ON	ON	OFF
87.5	OFF	ON	ON	ON		ON	ON	ON	ON		OFF	ON	OFF	ON
87.55	OFF	ON	ON	ON		ON	ON	ON	ON		OFF	ON	OFF	OFF
87.6	OFF	ON	ON	ON		ON	ON	ON	ON		OFF	OFF	ON	ON
87.65	OFF	ON	ON	ON		ON	ON	ON	ON		OFF	OFF	ON	OFF
87.7	OFF	ON	ON	ON		ON	ON	ON	ON		OFF	OFF	OFF	ON
87.75	OFF	ON	ON	ON		ON	ON	ON	ON		OFF	OFF	OFF	OFF
87.8	OFF	ON	ON	ON		ON	ON	ON	OFF		ON	ON	ON	ON
87.85	OFF	ON	ON	ON		ON	ON	ON	OFF		ON	ON	ON	OFF
87.9	OFF	ON	ON	ON		ON	ON	ON	OFF		ON	ON	OFF	ON
87.95	OFF	ON	ON	ON		ON	ON	ON	OFF		ON	ON	OFF	OFF
88.0	OFF	ON	ON	ON		ON	ON	ON	OFF		ON	OFF	ON	ON
88.05	OFF	ON	ON	ON		ON	ON	ON	OFF		ON	OFF	ON	OFF
88.1	OFF	ON	ON	ON		ON	ON	ON	OFF		ON	OFF	OFF	ON
88.15	OFF	ON	ON	ON		ON	ON	ON	OFF		ON	OFF	OFF	OFF
88.2	OFF	ON	ON	ON		ON	ON	ON	OFF		OFF	ON	ON	ON
88.25	OFF	ON	ON	ON		ON	ON	ON	OFF		OFF	ON	ON	OFF
88.3	OFF	ON	ON	ON		ON	ON	ON	OFF		OFF	ON	OFF	ON
88.35	OFF	ON	ON	ON		ON	ON	ON	OFF		OFF	ON	OFF	OFF
88.4	OFF	ON	ON	ON		ON	ON	ON	OFF		OFF	OFF	ON	ON
88.45	OFF	ON	ON	ON		ON	ON	ON	OFF		OFF	OFF	ON	OFF

TABLE 2. FREQUENCY PROGRAMMING														
	OSCILLATOR 2ND UP CONVERTER					MSB - A DSP CIRCUIT BOARD					LSB - B DSP CIRCUIT BOARD			
FREQUENCY	150	155	160	165		8	4	2	1		8	4	2	1
88.5	OFF	ON	ON	ON		ON	ON	ON	OFF		OFF	OFF	OFF	ON
88.55	OFF	ON	ON	ON		ON	ON	ON	OFF		OFF	OFF	OFF	OFF
88.6	OFF	ON	ON	ON		ON	ON	OFF	ON		ON	ON	ON	ON
88.65	OFF	ON	ON	ON		ON	ON	OFF	ON		ON	ON	ON	OFF
88.7	OFF	ON	ON	ON		ON	ON	OFF	ON		ON	ON	OFF	ON
88.75	OFF	ON	ON	ON		ON	ON	OFF	ON		ON	ON	OFF	OFF
88.8	OFF	ON	ON	ON		ON	ON	OFF	ON		ON	OFF	ON	ON
88.85	OFF	ON	ON	ON		ON	ON	OFF	ON		ON	OFF	ON	OFF
88.9	OFF	ON	ON	ON		ON	ON	OFF	ON		ON	OFF	OFF	ON
88.95	OFF	ON	ON	ON		ON	ON	OFF	ON		ON	OFF	OFF	OFF
89	OFF	ON	ON	ON		ON	ON	OFF	ON		OFF	ON	ON	ON
89.05	OFF	ON	ON	ON		ON	ON	OFF	ON		OFF	ON	ON	OFF
89.1	OFF	ON	ON	ON		ON	ON	OFF	ON		OFF	ON	OFF	ON
89.15	OFF	ON	ON	ON		ON	ON	OFF	ON		OFF	ON	OFF	OFF
89.2	OFF	ON	ON	ON		ON	ON	OFF	ON		OFF	OFF	ON	ON
89.25	OFF	ON	ON	ON		ON	ON	OFF	ON		OFF	OFF	ON	OFF
89.3	OFF	ON	ON	ON		ON	ON	OFF	ON		ON	ON	ON	OFF
89.35	OFF	ON	ON	ON		ON	ON	OFF	ON		OFF	OFF	OFF	OFF
89.4	OFF	ON	ON	ON		ON	ON	OFF	OFF		ON	ON	ON	ON
89.45	OFF	ON	ON	ON		ON	ON	OFF	OFF		ON	ON	ON	OFF
89.5	OFF	ON	ON	ON		ON	ON	OFF	OFF		ON	ON	OFF	ON
89.55	OFF	ON	ON	ON		ON	ON	OFF	OFF		ON	ON	OFF	OFF
89.6	OFF	ON	ON	ON		ON	ON	OFF	OFF		ON	OFF	ON	ON
89.65	OFF	ON	ON	ON		ON	ON	OFF	OFF		ON	OFF	ON	OFF
89.7	OFF	ON	ON	ON		ON	ON	OFF	OFF		ON	OFF	OFF	ON
89.75	OFF	ON	ON	ON		ON	ON	OFF	OFF		ON	OFF	OFF	OFF
89.8	OFF	ON	ON	ON		ON	ON	OFF	OFF		OFF	ON	ON	ON
89.85	OFF	ON	ON	ON		ON	ON	OFF	OFF		OFF	ON	ON	OFF
89.9	OFF	ON	ON	ON		ON	ON	OFF	OFF		OFF	ON	OFF	ON
89.95	OFF	ON	ON	ON		ON	ON	OFF	OFF		OFF	ON	OFF	OFF
90.0	OFF	ON	ON	ON		ON	ON	OFF	OFF		OFF	OFF	ON	ON
90.05	OFF	ON	ON	ON		ON	ON	OFF	OFF		OFF	OFF	ON	OFF
90.1	OFF	ON	ON	ON		ON	ON	OFF	OFF		OFF	OFF	OFF	ON
90.15	OFF	ON	ON	ON		ON	ON	OFF	OFF		OFF	OFF	OFF	OFF
90.2	OFF	ON	ON	ON		ON	OFF	ON	ON		ON	ON	ON	ON
90.25	OFF	ON	ON	ON		ON	OFF	ON	ON		ON	ON	ON	OFF
90.3	OFF	ON	ON	ON		ON	OFF	ON	ON		ON	ON	OFF	ON
90.35	OFF	ON	ON	ON		ON	OFF	ON	ON		ON	ON	OFF	OFF

	OSCILLATOR 2ND UP CONVERTER					MSB - A DSP CIRCUIT BOARD					LSB - B DSP CIRCUIT BOARD			
FREQUENCY	150	155	160	165		8	4	2	1		8	4	2	1
90.4	OFF	ON	ON	ON		ON	OFF	ON	ON		ON	OFF	ON	ON
90.45	OFF	ON	ON	ON		ON	OFF	ON	ON		ON	OFF	ON	OFF
90.5	OFF	ON	ON	ON		ON	OFF	ON	ON		ON	OFF	OFF	ON
90.55	OFF	ON	ON	ON		ON	OFF	ON	ON		ON	OFF	OFF	OFF
90.6	OFF	ON	ON	ON		ON	OFF	ON	ON		OFF	ON	ON	ON
90.65	OFF	ON	ON	ON		ON	OFF	ON	ON		OFF	ON	ON	OFF
90.7	OFF	ON	ON	ON		ON	OFF	ON	ON		OFF	ON	OFF	ON
90.75	OFF	ON	ON	ON		ON	OFF	ON	ON		OFF	ON	OFF	OFF
90.8	OFF	ON	ON	ON		ON	OFF	ON	ON		OFF	OFF	ON	ON
90.85	OFF	ON	ON	ON		ON	OFF	ON	ON		OFF	OFF	ON	OFF
90.9	OFF	ON	ON	ON		ON	OFF	ON	ON		OFF	OFF	OFF	ON
90.95	OFF	ON	ON	ON		ON	OFF	ON	ON		OFF	OFF	OFF	OFF
91	OFF	ON	ON	ON		ON	OFF	ON	OFF		ON	ON	ON	ON
91.05	OFF	ON	ON	ON		ON	OFF	ON	OFF		ON	ON	ON	OFF
91.1	OFF	ON	ON	ON		ON	OFF	ON	OFF		ON	ON	OFF	ON
91.15	OFF	ON	ON	ON		ON	OFF	ON	OFF		ON	ON	OFF	OFF
91.2	OFF	ON	ON	ON		ON	OFF	ON	OFF		ON	OFF	ON	ON
91.25	OFF	ON	ON	ON		ON	OFF	ON	OFF		ON	OFF	ON	OFF
91.3	OFF	ON	ON	ON		ON	OFF	ON	OFF		ON	OFF	OFF	ON
91.35	OFF	ON	ON	ON		ON	OFF	ON	OFF		ON	OFF	OFF	OFF
91.4	OFF	ON	ON	ON		ON	OFF	ON	OFF		OFF	ON	ON	ON
91.45	OFF	ON	ON	ON		ON	OFF	ON	OFF		OFF	ON	ON	OFF
91.5	OFF	ON	ON	ON		ON	OFF	ON	OFF		OFF	ON	OFF	ON
91.55	OFF	ON	ON	ON		ON	OFF	ON	OFF		OFF	ON	OFF	OFF
91.6	OFF	ON	ON	ON		ON	OFF	ON	OFF		OFF	OFF	ON	ON
91.65	OFF	ON	ON	ON		ON	OFF	ON	OFF		OFF	OFF	ON	OFF
91.7	OFF	ON	ON	ON		ON	OFF	ON	OFF		OFF	OFF	OFF	ON
91.75	OFF	ON	ON	ON		ON	OFF	ON	OFF		OFF	OFF	OFF	OFF
91.8	OFF	ON	ON	ON		ON	OFF	OFF	ON		ON	ON	ON	ON
91.85	OFF	ON	ON	ON		ON	OFF	OFF	ON		ON	ON	ON	OFF
91.9	OFF	ON	ON	ON		ON	OFF	OFF	ON		ON	ON	OFF	ON
91.95	OFF	ON	ON	ON		ON	OFF	OFF	ON		ON	ON	OFF	OFF
92.0	OFF	ON	ON	ON		ON	OFF	OFF	ON		ON	OFF	ON	ON
92.0	ON	OFF	ON	ON		ON	ON	ON	ON		ON	ON	ON	ON
92.05	OFF	ON	ON	ON		ON	OFF	OFF	ON		ON	OFF	ON	OFF
92.05	ON	OFF	ON	ON		ON	ON	ON	ON		ON	ON	ON	OFF

TABLE 2. FREQUENCY PROGRAMMING														
	OSCILLATOR 2ND UP CONVERTER					MSB - A DSP CIRCUIT BOARD					LSB - B DSP CIRCUIT BOARD			
FREQUENCY	150	155	160	165		8	4	2	1		8	4	2	1
92.1	OFF	ON	ON	ON		ON	OFF	OFF	ON		ON	OFF	OFF	ON
92.1	ON	OFF	ON	ON		ON	ON	ON	ON		ON	ON	OFF	ON
92.15	OFF	ON	ON	ON		ON	OFF	OFF	ON		ON	OFF	OFF	OFF
92.15	ON	OFF	ON	ON		ON	ON	ON	ON		ON	ON	OFF	OFF
92.2	OFF	ON	ON	ON		ON	OFF	OFF	ON		OFF	ON	ON	ON
92.2	ON	OFF	ON	ON		ON	ON	ON	ON		ON	OFF	ON	ON
92.25	OFF	ON	ON	ON		ON	OFF	OFF	ON		OFF	ON	ON	OFF
92.25	ON	OFF	ON	ON		ON	ON	ON	ON		ON	OFF	ON	OFF
92.3	OFF	ON	ON	ON		ON	OFF	OFF	ON		OFF	ON	OFF	ON
92.3	ON	OFF	ON	ON		ON	ON	ON	ON		ON	OFF	OFF	ON
92.35	OFF	ON	ON	ON		ON	OFF	OFF	ON		OFF	ON	OFF	OFF
92.35	ON	OFF	ON	ON		ON	ON	ON	ON		ON	OFF	OFF	OFF
92.4	OFF	ON	ON	ON		ON	OFF	OFF	ON		OFF	OFF	ON	ON
92.4	ON	OFF	ON	ON		ON	ON	ON	ON		OFF	ON	ON	ON
92.45	OFF	ON	ON	ON		ON	OFF	OFF	ON		OFF	OFF	ON	OFF
92.45	ON	OFF	ON	ON		ON	ON	ON	ON		OFF	ON	ON	OFF
92.5	OFF	ON	ON	ON		ON	OFF	OFF	ON		OFF	OFF	OFF	ON
92.5	ON	OFF	ON	ON		ON	ON	ON	ON		OFF	ON	OFF	ON
92.55	OFF	ON	ON	ON		ON	OFF	OFF	ON		OFF	OFF	OFF	OFF
92.55	ON	OFF	ON	ON		ON	ON	ON	ON		OFF	ON	OFF	OFF
92.6	OFF	ON	ON	ON		ON	OFF	OFF	OFF		ON	ON	ON	ON
92.6	ON	OFF	ON	ON		ON	ON	ON	ON		OFF	OFF	ON	ON
92.65	OFF	ON	ON	ON		ON	OFF	OFF	OFF		ON	ON	ON	OFF
92.65	ON	OFF	ON	ON		ON	ON	ON	ON		OFF	OFF	ON	OFF
92.7	OFF	ON	ON	ON		ON	OFF	OFF	OFF		ON	ON	OFF	ON

	OSCILLATOR 2ND UP CONVERTER					MSB - A DSP CIRCUIT BOARD					LSB - B DSP CIRCUIT BOARD			
FREQUENCY	150	155	160	165		8	4	2	1		8	4	2	1
92.7	ON	OFF	ON	ON		ON	ON	ON	ON		OFF	OFF	OFF	ON
92.75	OFF	ON	ON	ON		ON	OFF	OFF	OFF		ON	ON	OFF	OFF
92.75	ON	OFF	ON	ON		ON	ON	ON	ON		OFF	OFF	OFF	OFF
92.8	OFF	ON	ON	ON		ON	OFF	OFF	OFF		ON	OFF	ON	ON
92.8	ON	OFF	ON	ON		ON	ON	ON	OFF		ON	ON	ON	ON
92.85	OFF	ON	ON	ON		ON	OFF	OFF	OFF		ON	OFF	ON	OFF
92.85	ON	OFF	ON	ON		ON	ON	ON	OFF		ON	ON	ON	OFF
92.9	OFF	ON	ON	ON		ON	OFF	OFF	OFF		ON	OFF	OFF	ON
92.9	ON	OFF	ON	ON		ON	ON	ON	OFF		ON	ON	OFF	ON
92.95	OFF	ON	ON	ON		ON	OFF	OFF	OFF		ON	OFF	OFF	OFF
92.95	ON	OFF	ON	ON		ON	ON	ON	OFF		ON	ON	OFF	OFF
93.0	OFF	ON	ON	ON		ON	OFF	OFF	OFF		OFF	ON	ON	ON
93.0	ON	OFF	ON	ON		ON	ON	ON	OFF		ON	OFF	ON	ON
93.05	OFF	ON	ON	ON		ON	OFF	OFF	OFF		OFF	ON	ON	OFF
93.05	ON	OFF	ON	ON		ON	ON	ON	OFF		ON	OFF	ON	OFF
93.1	OFF	ON	ON	ON		ON	OFF	OFF	OFF		OFF	ON	OFF	ON
93.1	ON	OFF	ON	ON		ON	ON	ON	OFF		ON	OFF	OFF	ON
93.15	OFF	ON	ON	ON		ON	OFF	OFF	OFF		OFF	ON	OFF	OFF
93.15	ON	OFF	ON	ON		ON	ON	ON	OFF		ON	OFF	OFF	OFF
93.2	OFF	ON	ON	ON		ON	OFF	OFF	OFF		OFF	OFF	ON	ON
93.2	ON	OFF	ON	ON		ON	ON	ON	OFF		OFF	ON	ON	ON
93.25	OFF	ON	ON	ON		ON	OFF	OFF	OFF		OFF	OFF	ON	OFF
93.25	ON	OFF	ON	ON		ON	ON	ON	OFF		OFF	ON	ON	OFF
93.3	OFF	ON	ON	ON		ON	OFF	OFF	OFF		OFF	OFF	OFF	ON
93.3	ON	OFF	ON	ON		ON	ON	ON	OFF		OFF	ON	OFF	ON

TABLE 2. FREQUENCY PROGRAMMING														
	OSCILLATOR 2ND UP CONVERTER					MSB - A DSP CIRCUIT BOARD					LSB - B DSP CIRCUIT BOARD			
FREQUENCY	150	155	160	165		8	4	2	1		8	4	2	1
93.35	OFF	ON	ON	ON		ON	OFF	OFF	OFF		OFF	OFF	OFF	OFF
93.35	ON	OFF	ON	ON		ON	ON	ON	OFF		OFF	ON	OFF	OFF
93.4	ON	OFF	ON	ON		ON	ON	ON	OFF		OFF	OFF	ON	ON
93.45	ON	OFF	ON	ON		ON	ON	ON	OFF		OFF	OFF	ON	OFF
93.5	ON	OFF	ON	ON		ON	ON	ON	OFF		OFF	OFF	OFF	ON
93.55	ON	OFF	ON	ON		ON	ON	ON	OFF		OFF	OFF	OFF	OFF
93.6	ON	OFF	ON	ON		ON	ON	OFF	ON		ON	ON	ON	ON
93.65	ON	OFF	ON	ON		ON	ON	OFF	ON		ON	ON	ON	OFF
93.7	ON	OFF	ON	ON		ON	ON	OFF	ON		ON	ON	OFF	ON
93.75	ON	OFF	ON	ON		ON	ON	OFF	ON		ON	ON	OFF	OFF
93.8	ON	OFF	ON	ON		ON	ON	OFF	ON		ON	OFF	ON	ON
93.85	ON	OFF	ON	ON		ON	ON	OFF	ON		ON	OFF	ON	OFF
93.9	ON	OFF	ON	ON		ON	ON	OFF	ON		ON	OFF	OFF	ON
93.95	ON	OFF	ON	ON		ON	ON	OFF	ON		ON	OFF	OFF	OFF
94	ON	OFF	ON	ON		ON	ON	OFF	ON		OFF	ON	ON	ON
94.05	ON	OFF	ON	ON		ON	ON	OFF	ON		OFF	ON	ON	OFF
94.1	ON	OFF	ON	ON		ON	ON	OFF	ON		OFF	ON	OFF	ON
94.15	ON	OFF	ON	ON		ON	ON	OFF	ON		OFF	ON	OFF	OFF
94.2	ON	OFF	ON	ON		ON	ON	OFF	ON		OFF	OFF	ON	ON
94.25	ON	OFF	ON	ON		ON	ON	OFF	ON		OFF	OFF	ON	OFF
94.3	ON	OFF	ON	ON		ON	ON	OFF	ON		ON	ON	ON	OFF
94.35	ON	OFF	ON	ON		ON	ON	OFF	ON		OFF	OFF	OFF	OFF
94.4	ON	OFF	ON	ON		ON	ON	OFF	OFF		ON	ON	ON	ON
94.45	ON	OFF	ON	ON		ON	ON	OFF	OFF		ON	ON	ON	OFF
94.5	ON	OFF	ON	ON		ON	ON	OFF	OFF		ON	ON	OFF	ON
94.55	ON	OFF	ON	ON		ON	ON	OFF	OFF		ON	ON	OFF	OFF
94.6	ON	OFF	ON	ON		ON	ON	OFF	OFF		ON	OFF	ON	ON
94.65	ON	OFF	ON	ON		ON	ON	OFF	OFF		ON	OFF	ON	OFF
94.7	ON	OFF	ON	ON		ON	ON	OFF	OFF		ON	OFF	OFF	ON
94.75	ON	OFF	ON	ON		ON	ON	OFF	OFF		ON	OFF	OFF	OFF
94.8	ON	OFF	ON	ON		ON	ON	OFF	OFF		OFF	ON	ON	ON
94.85	ON	OFF	ON	ON		ON	ON	OFF	OFF		OFF	ON	ON	OFF
94.9	ON	OFF	ON	ON		ON	ON	OFF	OFF		OFF	ON	OFF	ON
94.95	ON	OFF	ON	ON		ON	ON	OFF	OFF		OFF	ON	OFF	OFF
95.0	ON	OFF	ON	ON		ON	ON	OFF	OFF		OFF	OFF	ON	ON
95.05	ON	OFF	ON	ON		ON	ON	OFF	OFF		OFF	OFF	ON	OFF
95.1	ON	OFF	ON	ON		ON	ON	OFF	OFF		OFF	OFF	OFF	ON

TABLE 2. FREQUENCY PROGRAMMING														
	OSCILLATOR 2ND UP CONVERTER					MSB - A DSP CIRCUIT BOARD					LSB - B DSP CIRCUIT BOARD			
FREQUENCY	150	155	160	165		8	4	2	1		8	4	2	1
95.15	ON	OFF	ON	ON		ON	ON	OFF	OFF		OFF	OFF	OFF	OFF
95.2	ON	OFF	ON	ON		ON	OFF	ON	ON		ON	ON	ON	ON
95.25	ON	OFF	ON	ON		ON	OFF	ON	ON		ON	ON	ON	OFF
95.3	ON	OFF	ON	ON		ON	OFF	ON	ON		ON	ON	OFF	ON
95.35	ON	OFF	ON	ON		ON	OFF	ON	ON		ON	ON	OFF	OFF
95.4	ON	OFF	ON	ON		ON	OFF	ON	ON		ON	OFF	ON	ON
95.45	ON	OFF	ON	ON		ON	OFF	ON	ON		ON	OFF	ON	OFF
95.5	ON	OFF	ON	ON		ON	OFF	ON	ON		ON	OFF	OFF	ON
95.55	ON	OFF	ON	ON		ON	OFF	ON	ON		ON	OFF	OFF	OFF
95.6	ON	OFF	ON	ON		ON	OFF	ON	ON		OFF	ON	ON	ON
95.65	ON	OFF	ON	ON		ON	OFF	ON	ON		OFF	ON	ON	OFF
95.7	ON	OFF	ON	ON		ON	OFF	ON	ON		OFF	ON	OFF	ON
95.75	ON	OFF	ON	ON		ON	OFF	ON	ON		OFF	ON	OFF	OFF
95.8	ON	OFF	ON	ON		ON	OFF	ON	ON		OFF	OFF	ON	ON
95.85	ON	OFF	ON	ON		ON	OFF	ON	ON		OFF	OFF	ON	OFF
95.9	ON	OFF	ON	ON		ON	OFF	ON	ON		OFF	OFF	OFF	ON
95.95	ON	OFF	ON	ON		ON	OFF	ON	ON		OFF	OFF	OFF	OFF
96	ON	OFF	ON	ON		ON	OFF	ON	OFF		ON	ON	ON	ON
96.05	ON	OFF	ON	ON		ON	OFF	ON	OFF		ON	ON	ON	OFF
96.1	ON	OFF	ON	ON		ON	OFF	ON	OFF		ON	ON	OFF	ON
96.15	ON	OFF	ON	ON		ON	OFF	ON	OFF		ON	ON	OFF	OFF
96.2	ON	OFF	ON	ON		ON	OFF	ON	OFF		ON	OFF	ON	ON
96.25	ON	OFF	ON	ON		ON	OFF	ON	OFF		ON	OFF	ON	OFF
96.3	ON	OFF	ON	ON		ON	OFF	ON	OFF		ON	OFF	OFF	ON
96.35	ON	OFF	ON	ON		ON	OFF	ON	OFF		ON	OFF	OFF	OFF
96.4	ON	OFF	ON	ON		ON	OFF	ON	OFF		OFF	ON	ON	ON
96.45	ON	OFF	ON	ON		ON	OFF	ON	OFF		OFF	ON	ON	OFF
96.5	ON	OFF	ON	ON		ON	OFF	ON	OFF		OFF	ON	OFF	ON
96.55	ON	OFF	ON	ON		ON	OFF	ON	OFF		OFF	ON	OFF	OFF
96.6	ON	OFF	ON	ON		ON	OFF	ON	OFF		OFF	OFF	ON	ON
96.65	ON	OFF	ON	ON		ON	OFF	ON	OFF		OFF	OFF	ON	OFF
96.7	ON	OFF	ON	ON		ON	OFF	ON	OFF		OFF	OFF	OFF	ON
96.75	ON	OFF	ON	ON		ON	OFF	ON	OFF		OFF	OFF	OFF	OFF
96.8	ON	OFF	ON	ON		ON	OFF	OFF	ON		ON	ON	ON	ON
96.85	ON	OFF	ON	ON		ON	OFF	OFF	ON		ON	ON	ON	OFF
96.9	ON	OFF	ON	ON		ON	OFF	OFF	ON		ON	ON	OFF	ON
96.95	ON	OFF	ON	ON		ON	OFF	OFF	ON		ON	ON	OFF	OFF

TABLE 2. FREQUENCY PROGRAMMING														
	OSCILLATOR 2ND UP CONVERTER					MSB - A DSP CIRCUIT BOARD					LSB - B DSP CIRCUIT BOARD			
FREQUENCY	150	155	160	165		8	4	2	1		8	4	2	1
97.0	ON	OFF	ON	ON		ON	OFF	OFF	ON		ON	OFF	ON	ON
97.0	ON	ON	OFF	ON		ON	ON	ON	ON		ON	ON	ON	ON
97.05	ON	OFF	ON	ON		ON	OFF	OFF	ON		ON	OFF	ON	OFF
92.05	ON	ON	OFF	ON		ON	ON	ON	ON		ON	ON	ON	OFF
97.1	ON	OFF	ON	ON		ON	OFF	OFF	ON		ON	OFF	OFF	ON
97.1	ON	ON	OFF	ON		ON	ON	ON	ON		ON	ON	OFF	ON
97.15	ON	OFF	ON	ON		ON	OFF	OFF	ON		ON	OFF	OFF	OFF
97.15	ON	ON	OFF	ON		ON	ON	ON	ON		ON	ON	OFF	OFF
97.2	ON	OFF	ON	ON		ON	OFF	OFF	ON		OFF	ON	ON	ON
97.2	ON	ON	OFF	ON		ON	ON	ON	ON		ON	OFF	ON	ON
97.25	ON	OFF	ON	ON		ON	OFF	OFF	ON		OFF	ON	ON	OFF
97.25	ON	ON	OFF	ON		ON	ON	ON	ON		ON	OFF	ON	OFF
97.3	ON	OFF	ON	ON		ON	OFF	OFF	ON		OFF	ON	OFF	ON
97.3	ON	ON	OFF	ON		ON	ON	ON	ON		ON	OFF	OFF	ON
97.35	ON	OFF	ON	ON		ON	OFF	OFF	ON		OFF	ON	OFF	OFF
97.35	ON	ON	OFF	ON		ON	ON	ON	ON		ON	OFF	OFF	OFF
97.4	ON	OFF	ON	ON		ON	OFF	OFF	ON		OFF	OFF	ON	ON
97.4	ON	ON	OFF	ON		ON	ON	ON	ON		OFF	ON	ON	ON
97.45	ON	OFF	ON	ON		ON	OFF	OFF	ON		OFF	OFF	ON	OFF
97.45	ON	ON	OFF	ON		ON	ON	ON	ON		OFF	ON	ON	OFF
97.5	ON	OFF	ON	ON		ON	OFF	OFF	ON		OFF	OFF	OFF	ON
97.5	ON	ON	OFF	ON		ON	ON	ON	ON		OFF	ON	OFF	ON
97.55	ON	OFF	ON	ON		ON	OFF	OFF	ON		OFF	OFF	OFF	OFF
97.55	ON	ON	OFF	ON		ON	ON	ON	ON		OFF	ON	OFF	OFF
97.6	ON	OFF	ON	ON		ON	OFF	OFF	OFF		ON	ON	ON	ON
97.6	ON	ON	OFF	ON		ON	ON	ON	ON		OFF	OFF	ON	ON

TABLE 2. FREQUENCY PROGRAMMING														
	OSCILLATOR 2ND UP CONVERTER					MSB - A DSP CIRCUIT BOARD					LSB - B DSP CIRCUIT BOARD			
FREQUENCY	150	155	160	165		8	4	2	1		8	4	2	1
97.65	ON	OFF	ON	ON		ON	OFF	OFF	OFF		ON	ON	ON	OFF
97.65	ON	ON	OFF	ON		ON	ON	ON	ON		OFF	OFF	ON	OFF
97.7	ON	OFF	ON	ON		ON	OFF	OFF	OFF		ON	ON	OFF	ON
97.7	ON	ON	OFF	ON		ON	ON	ON	ON		OFF	OFF	OFF	ON
97.75	ON	OFF	ON	ON		ON	OFF	OFF	OFF		ON	ON	OFF	OFF
97.75	ON	ON	OFF	ON		ON	ON	ON	ON		OFF	OFF	OFF	OFF
97.8	ON	OFF	ON	ON		ON	OFF	OFF	OFF		ON	OFF	ON	ON
97.8	ON	ON	OFF	ON		ON	ON	ON	OFF		ON	ON	ON	ON
97.85	ON	OFF	ON	ON		ON	OFF	OFF	OFF		ON	OFF	ON	OFF
97.85	ON	ON	OFF	ON		ON	ON	ON	OFF		ON	ON	ON	OFF
97.9	ON	OFF	ON	ON		ON	OFF	OFF	OFF		ON	OFF	OFF	ON
97.9	ON	ON	OFF	ON		ON	ON	ON	OFF		ON	ON	OFF	ON
97.95	ON	OFF	ON	ON		ON	OFF	OFF	OFF		ON	OFF	OFF	OFF
97.95	ON	ON	OFF	ON		ON	ON	ON	OFF		ON	ON	OFF	OFF
98.0	ON	OFF	ON	ON		ON	OFF	OFF	OFF		OFF	ON	ON	ON
98.0	ON	ON	OFF	ON		ON	ON	ON	OFF		ON	OFF	ON	ON
98.05	ON	OFF	ON	ON		ON	OFF	OFF	OFF		OFF	ON	ON	OFF
98.05	ON	ON	OFF	ON		ON	ON	ON	OFF		ON	OFF	ON	OFF
98.1	ON	OFF	ON	ON		ON	OFF	OFF	OFF		OFF	ON	OFF	ON
98.1	ON	ON	OFF	ON		ON	ON	ON	OFF		ON	OFF	OFF	ON
98.15	ON	OFF	ON	ON		ON	OFF	OFF	OFF		OFF	ON	OFF	OFF
98.15	ON	ON	OFF	ON		ON	ON	ON	OFF		ON	OFF	OFF	OFF
98.2	ON	OFF	ON	ON		ON	OFF	OFF	OFF		OFF	OFF	ON	ON
98.2	ON	ON	OFF	ON		ON	ON	ON	OFF		OFF	ON	ON	ON
98.25	ON	OFF	ON	ON		ON	OFF	OFF	OFF		OFF	OFF	ON	OFF

TABLE 2. FREQUENCY PROGRAMMING														
	OSCILLATOR 2ND UP CONVERTER					MSB - A DSP CIRCUIT BOARD					LSB - B DSP CIRCUIT BOARD			
FREQUENCY	150	155	160	165		8	4	2	1		8	4	2	1
98.25	ON	ON	OFF	ON		ON	ON	ON	OFF		OFF	ON	ON	OFF
98.3	ON	OFF	ON	ON		ON	OFF	OFF	OFF		OFF	OFF	OFF	ON
98.3	ON	ON	OFF	ON		ON	ON	ON	OFF		OFF	ON	OFF	ON
98.35	ON	OFF	ON	ON		ON	OFF	OFF	OFF		OFF	OFF	OFF	OFF
98.35	ON	ON	OFF	ON		ON	ON	ON	OFF		OFF	ON	OFF	OFF
98.4	ON	ON	OFF	ON		ON	ON	ON	OFF		OFF	OFF	ON	ON
98.45	ON	ON	OFF	ON		ON	ON	ON	OFF		OFF	OFF	ON	OFF
98.5	ON	ON	OFF	ON		ON	ON	ON	OFF		OFF	OFF	OFF	ON
98.55	ON	ON	OFF	ON		ON	ON	ON	OFF		OFF	OFF	OFF	OFF
98.6	ON	ON	OFF	ON		ON	ON	OFF	ON		ON	ON	ON	ON
98.65	ON	ON	OFF	ON		ON	ON	OFF	ON		ON	ON	ON	OFF
98.7	ON	ON	OFF	ON		ON	ON	OFF	ON		ON	ON	OFF	ON
98.75	ON	ON	OFF	ON		ON	ON	OFF	ON		ON	ON	OFF	OFF
98.8	ON	ON	OFF	ON		ON	ON	OFF	ON		ON	OFF	ON	ON
98.85	ON	ON	OFF	ON		ON	ON	OFF	ON		ON	OFF	ON	OFF
98.9	ON	ON	OFF	ON		ON	ON	OFF	ON		ON	OFF	OFF	ON
98.95	ON	ON	OFF	ON		ON	ON	OFF	ON		ON	OFF	OFF	OFF
99	ON	ON	OFF	ON		ON	ON	OFF	ON		OFF	ON	ON	ON
99.05	ON	ON	OFF	ON		ON	ON	OFF	ON		OFF	ON	ON	OFF
99.1	ON	ON	OFF	ON		ON	ON	OFF	ON		OFF	ON	OFF	ON
99.15	ON	ON	OFF	ON		ON	ON	OFF	ON		OFF	ON	OFF	OFF
99.2	ON	ON	OFF	ON		ON	ON	OFF	ON		OFF	OFF	ON	ON
99.25	ON	ON	OFF	ON		ON	ON	OFF	ON		OFF	OFF	ON	OFF
99.3	ON	ON	OFF	ON		ON	ON	OFF	ON		ON	ON	ON	OFF
99.35	ON	ON	OFF	ON		ON	ON	OFF	ON		OFF	OFF	OFF	OFF
99.4	ON	ON	OFF	ON		ON	ON	OFF	OFF		ON	ON	ON	ON
99.45	ON	ON	OFF	ON		ON	ON	OFF	OFF		ON	ON	ON	OFF
99.5	ON	ON	OFF	ON		ON	ON	OFF	OFF		ON	ON	OFF	ON
99.55	ON	ON	OFF	ON		ON	ON	OFF	OFF		ON	ON	OFF	OFF
99.6	ON	ON	OFF	ON		ON	ON	OFF	OFF		ON	OFF	ON	ON
99.65	ON	ON	OFF	ON		ON	ON	OFF	OFF		ON	OFF	ON	OFF
99.7	ON	ON	OFF	ON		ON	ON	OFF	OFF		ON	OFF	OFF	ON
99.75	ON	ON	OFF	ON		ON	ON	OFF	OFF		ON	OFF	OFF	OFF
99.8	ON	ON	OFF	ON		ON	ON	OFF	OFF		OFF	ON	ON	ON
99.85	ON	ON	OFF	ON		ON	ON	OFF	OFF		OFF	ON	ON	OFF

TABLE 2. FREQUENCY PROGRAMMING														
	OSCILLATOR 2ND UP CONVERTER					MSB - A DSP CIRCUIT BOARD					LSB - B DSP CIRCUIT BOARD			
FREQUENCY	150	155	160	165		8	4	2	1		8	4	2	1
99.9	ON	ON	OFF	ON		ON	ON	OFF	OFF		OFF	ON	OFF	ON
99.95	ON	ON	OFF	ON		ON	ON	OFF	OFF		OFF	ON	OFF	OFF
100.0	ON	ON	OFF	ON		ON	ON	OFF	OFF		OFF	OFF	ON	ON
100.05	ON	ON	OFF	ON		ON	ON	OFF	OFF		OFF	OFF	ON	OFF
100.1	ON	ON	OFF	ON		ON	ON	OFF	OFF		OFF	OFF	OFF	ON
100.15	ON	ON	OFF	ON		ON	ON	OFF	OFF		OFF	OFF	OFF	OFF
100.2	ON	ON	OFF	ON		ON	OFF	ON	ON		ON	ON	ON	ON
100.25	ON	ON	OFF	ON		ON	OFF	ON	ON		ON	ON	ON	OFF
100.3	ON	ON	OFF	ON		ON	OFF	ON	ON		ON	ON	OFF	ON
100.35	ON	ON	OFF	ON		ON	OFF	ON	ON		ON	ON	OFF	OFF
100.4	ON	ON	OFF	ON		ON	OFF	ON	ON		ON	OFF	ON	ON
100.45	ON	ON	OFF	ON		ON	OFF	ON	ON		ON	OFF	ON	OFF
100.5	ON	ON	OFF	ON		ON	OFF	ON	ON		ON	OFF	OFF	ON
100.55	ON	ON	OFF	ON		ON	OFF	ON	ON		ON	OFF	OFF	OFF
100.6	ON	ON	OFF	ON		ON	OFF	ON	ON		OFF	ON	ON	ON
100.65	ON	ON	OFF	ON		ON	OFF	ON	ON		OFF	ON	ON	OFF
100.7	ON	ON	OFF	ON		ON	OFF	ON	ON		OFF	ON	OFF	ON
100.75	ON	ON	OFF	ON		ON	OFF	ON	ON		OFF	ON	OFF	OFF
100.8	ON	ON	OFF	ON		ON	OFF	ON	ON		OFF	OFF	ON	ON
100.85	ON	ON	OFF	ON		ON	OFF	ON	ON		OFF	OFF	ON	OFF
100.9	ON	ON	OFF	ON		ON	OFF	ON	ON		OFF	OFF	OFF	ON
100.95	ON	ON	OFF	ON		ON	OFF	ON	ON		OFF	OFF	OFF	OFF
101	ON	ON	OFF	ON		ON	OFF	ON	OFF		ON	ON	ON	ON
101.05	ON	ON	OFF	ON		ON	OFF	ON	OFF		ON	ON	ON	OFF
101.1	ON	ON	OFF	ON		ON	OFF	ON	OFF		ON	ON	OFF	ON
101.15	ON	ON	OFF	ON		ON	OFF	ON	OFF		ON	ON	OFF	OFF
101.2	ON	ON	OFF	ON		ON	OFF	ON	OFF		ON	OFF	ON	ON
101.25	ON	ON	OFF	ON		ON	OFF	ON	OFF		ON	OFF	ON	OFF
101.3	ON	ON	OFF	ON		ON	OFF	ON	OFF		ON	OFF	OFF	ON
101.35	ON	ON	OFF	ON		ON	OFF	ON	OFF		ON	OFF	OFF	OFF
101.4	ON	ON	OFF	ON		ON	OFF	ON	OFF		OFF	ON	ON	ON
101.45	ON	ON	OFF	ON		ON	OFF	ON	OFF		OFF	ON	ON	OFF
101.5	ON	ON	OFF	ON		ON	OFF	ON	OFF		OFF	ON	OFF	ON
101.55	ON	ON	OFF	ON		ON	OFF	ON	OFF		OFF	ON	OFF	OFF
101.6	ON	ON	OFF	ON		ON	OFF	ON	OFF		OFF	OFF	ON	ON
101.65	ON	ON	OFF	ON		ON	OFF	ON	OFF		OFF	OFF	ON	OFF
101.7	ON	ON	OFF	ON		ON	OFF	ON	OFF		OFF	OFF	OFF	ON
101.75	ON	ON	OFF	ON		ON	OFF	ON	OFF		OFF	OFF	OFF	OFF

TABLE 2. FREQUENCY PROGRAMMING														
	OSCILLATOR 2ND UP CONVERTER					MSB - A DSP CIRCUIT BOARD					LSB - B DSP CIRCUIT BOARD			
FREQUENCY	150	155	160	165		8	4	2	1		8	4	2	1
101.8	ON	ON	OFF	ON		ON	OFF	OFF	ON		ON	ON	ON	ON
101.85	ON	ON	OFF	ON		ON	OFF	OFF	ON		ON	ON	ON	OFF
101.9	ON	ON	OFF	ON		ON	OFF	OFF	ON		ON	ON	OFF	ON
101.95	ON	ON	OFF	ON		ON	OFF	OFF	ON		ON	ON	OFF	OFF
102.0	ON	ON	OFF	ON		ON	OFF	OFF	ON		ON	OFF	ON	ON
102.0	ON	ON	ON	OFF		ON	ON	ON	ON		ON	ON	ON	ON
102.05	ON	ON	OFF	ON		ON	OFF	OFF	ON		ON	OFF	ON	OFF
102.05	ON	ON	ON	OFF		ON	ON	ON	ON		ON	ON	ON	OFF
102.1	ON	ON	OFF	ON		ON	OFF	OFF	ON		ON	OFF	OFF	ON
102.1	ON	ON	ON	OFF		ON	ON	ON	ON		ON	ON	OFF	ON
102.15	ON	ON	OFF	ON		ON	OFF	OFF	ON		ON	OFF	OFF	OFF
102.15	ON	ON	ON	OFF		ON	ON	ON	ON		ON	ON	OFF	OFF
102.2	ON	ON	OFF	ON		ON	OFF	OFF	ON		OFF	ON	ON	ON
102.2	ON	ON	ON	OFF		ON	ON	ON	ON		ON	OFF	ON	ON
102.25	ON	ON	OFF	ON		ON	OFF	OFF	ON		OFF	ON	ON	OFF
102.25	ON	ON	ON	OFF		ON	ON	ON	ON		ON	OFF	ON	OFF
102.3	ON	ON	OFF	ON		ON	OFF	OFF	ON		OFF	ON	OFF	ON
102.3	ON	ON	ON	OFF		ON	ON	ON	ON		ON	OFF	OFF	ON
102.35	ON	ON	OFF	ON		ON	OFF	OFF	ON		OFF	ON	OFF	OFF
102.35	ON	ON	ON	OFF		ON	ON	ON	ON		ON	OFF	OFF	OFF
102.4	ON	ON	OFF	ON		ON	OFF	OFF	ON		OFF	OFF	ON	ON
102.4	ON	ON	ON	OFF		ON	ON	ON	ON		OFF	ON	ON	ON
102.45	ON	ON	OFF	ON		ON	OFF	OFF	ON		OFF	OFF	ON	OFF
102.45	ON	ON	ON	OFF		ON	ON	ON	ON		OFF	ON	ON	OFF
102.5	ON	ON	OFF	ON		ON	OFF	OFF	ON		OFF	OFF	OFF	ON
102.5	ON	ON	ON	OFF		ON	ON	ON	ON		OFF	ON	OFF	ON

TABLE 2. FREQUENCY PROGRAMMING														
	OSCILLATOR 2ND UP CONVERTER					MSB - A DSP CIRCUIT BOARD					LSB - B DSP CIRCUIT BOARD			
FREQUENCY	150	155	160	165		8	4	2	1		8	4	2	1
102.55	ON	ON	OFF	ON		ON	OFF	OFF	ON		OFF	OFF	OFF	OFF
102.55	ON	ON	ON	OFF		ON	ON	ON	ON		OFF	ON	OFF	OFF
102.6	ON	ON	OFF	ON		ON	OFF	OFF	OFF		ON	ON	ON	ON
102.6	ON	ON	ON	OFF		ON	ON	ON	ON		OFF	OFF	ON	ON
102.65	ON	ON	OFF	ON		ON	OFF	OFF	OFF		ON	ON	ON	OFF
102.65	ON	ON	ON	OFF		ON	ON	ON	ON		OFF	OFF	ON	OFF
102.7	ON	ON	OFF	ON		ON	OFF	OFF	OFF		ON	ON	OFF	ON
102.7	ON	ON	ON	OFF		ON	ON	ON	ON		OFF	OFF	OFF	ON
102.75	ON	ON	OFF	ON		ON	OFF	OFF	OFF		ON	ON	OFF	OFF
102.75	ON	ON	ON	OFF		ON	ON	ON	ON		OFF	OFF	OFF	OFF
102.8	ON	ON	OFF	ON		ON	OFF	OFF	OFF		ON	OFF	ON	ON
102.8	ON	ON	ON	OFF		ON	ON	ON	OFF		ON	ON	ON	ON
102.85	ON	ON	OFF	ON		ON	OFF	OFF	OFF		ON	OFF	ON	OFF
102.85	ON	ON	ON	OFF		ON	ON	ON	OFF		ON	ON	ON	OFF
102.9	ON	ON	OFF	ON		ON	OFF	OFF	OFF		ON	OFF	OFF	ON
102.9	ON	ON	ON	OFF		ON	ON	ON	OFF		ON	ON	OFF	ON
102.95	ON	ON	OFF	ON		ON	OFF	OFF	OFF		ON	OFF	OFF	OFF
102.95	ON	ON	ON	OFF		ON	ON	ON	OFF		ON	ON	OFF	OFF
103.0	ON	ON	OFF	ON		ON	OFF	OFF	OFF		OFF	ON	ON	ON
103.0	ON	ON	ON	OFF		ON	ON	ON	OFF		ON	OFF	ON	ON
103.05	ON	ON	OFF	ON		ON	OFF	OFF	OFF		OFF	ON	ON	OFF
103.05	ON	ON	ON	OFF		ON	ON	ON	OFF		ON	OFF	ON	OFF
103.1	ON	ON	OFF	ON		ON	OFF	OFF	OFF		OFF	ON	OFF	ON
103.1	ON	ON	ON	OFF		ON	ON	ON	OFF		ON	OFF	OFF	ON
103.15	ON	ON	OFF	ON		ON	OFF	OFF	OFF		OFF	ON	OFF	OFF
103.15	ON	ON	ON	OFF		ON	ON	ON	OFF		ON	OFF	OFF	OFF

TABLE 2. FREQUENCY PROGRAMMING														
	OSCILLATOR 2ND UP CONVERTER					MSB - A DSP CIRCUIT BOARD					LSB - B DSP CIRCUIT BOARD			
FREQUENCY	150	155	160	165		8	4	2	1		8	4	2	1
103.2	ON	ON	OFF	ON		ON	OFF	OFF	OFF		OFF	OFF	ON	ON
103.2	ON	ON	ON	OFF		ON	ON	ON	OFF		OFF	ON	ON	ON
103.25	ON	ON	OFF	ON		ON	OFF	OFF	OFF		OFF	OFF	ON	OFF
103.25	ON	ON	ON	OFF		ON	ON	ON	OFF		OFF	ON	ON	OFF
103.3	ON	ON	OFF	ON		ON	OFF	OFF	OFF		OFF	OFF	OFF	ON
103.3	ON	ON	ON	OFF		ON	ON	ON	OFF		OFF	ON	OFF	ON
103.35	ON	ON	OFF	ON		ON	OFF	OFF	OFF		OFF	OFF	OFF	OFF
103.35	ON	ON	ON	OFF		ON	ON	ON	OFF		OFF	ON	OFF	OFF
103.4	ON	ON	ON	OFF		ON	ON	ON	OFF		OFF	OFF	ON	ON
103.45	ON	ON	ON	OFF		ON	ON	ON	OFF		OFF	OFF	ON	OFF
103.5	ON	ON	ON	OFF		ON	ON	ON	OFF		OFF	OFF	OFF	ON
103.55	ON	ON	ON	OFF		ON	ON	ON	OFF		OFF	OFF	OFF	OFF
103.6	ON	ON	ON	OFF		ON	ON	OFF	ON		ON	ON	ON	ON
103.65	ON	ON	ON	OFF		ON	ON	OFF	ON		ON	ON	ON	OFF
103.7	ON	ON	ON	OFF		ON	ON	OFF	ON		ON	ON	OFF	ON
103.75	ON	ON	ON	OFF		ON	ON	OFF	ON		ON	ON	OFF	OFF
103.8	ON	ON	ON	OFF		ON	ON	OFF	ON		ON	OFF	ON	ON
103.85	ON	ON	ON	OFF		ON	ON	OFF	ON		ON	OFF	ON	OFF
103.9	ON	ON	ON	OFF		ON	ON	OFF	ON		ON	OFF	OFF	ON
103.95	ON	ON	ON	OFF		ON	ON	OFF	ON		ON	OFF	OFF	OFF
104	ON	ON	ON	OFF		ON	ON	OFF	ON		OFF	ON	ON	ON
104.05	ON	ON	ON	OFF		ON	ON	OFF	ON		OFF	ON	ON	OFF
104.1	ON	ON	ON	OFF		ON	ON	OFF	ON		OFF	ON	OFF	ON
104.15	ON	ON	ON	OFF		ON	ON	OFF	ON		OFF	ON	OFF	OFF
104.2	ON	ON	ON	OFF		ON	ON	OFF	ON		OFF	OFF	ON	ON
104.25	ON	ON	ON	OFF		ON	ON	OFF	ON		OFF	OFF	ON	OFF
104.3	ON	ON	ON	OFF		ON	ON	OFF	ON		ON	ON	ON	OFF
104.35	ON	ON	ON	OFF		ON	ON	OFF	ON		OFF	OFF	OFF	OFF
104.4	ON	ON	ON	OFF		ON	ON	OFF	OFF		ON	ON	ON	ON
104.45	ON	ON	ON	OFF		ON	ON	OFF	OFF		ON	ON	ON	OFF
104.5	ON	ON	ON	OFF		ON	ON	OFF	OFF		ON	ON	OFF	ON
104.55	ON	ON	ON	OFF		ON	ON	OFF	OFF		ON	ON	OFF	OFF
104.6	ON	ON	ON	OFF		ON	ON	OFF	OFF		ON	OFF	ON	ON

TABLE 2. FREQUENCY PROGRAMMING														
	OSCILLATOR 2ND UP CONVERTER					MSB - A DSP CIRCUIT BOARD					LSB - B DSP CIRCUIT BOARD			
FREQUENCY	150	155	160	165		8	4	2	1		8	4	2	1
104.65	ON	ON	ON	OFF		ON	ON	OFF	OFF		ON	OFF	ON	OFF
104.7	ON	ON	ON	OFF		ON	ON	OFF	OFF		ON	OFF	OFF	ON
104.75	ON	ON	ON	OFF		ON	ON	OFF	OFF		ON	OFF	OFF	OFF
104.8	ON	ON	ON	OFF		ON	ON	OFF	OFF		OFF	ON	ON	ON
104.85	ON	ON	ON	OFF		ON	ON	OFF	OFF		OFF	ON	ON	OFF
104.9	ON	ON	ON	OFF		ON	ON	OFF	OFF		OFF	ON	OFF	ON
104.95	ON	ON	ON	OFF		ON	ON	OFF	OFF		OFF	ON	OFF	OFF
105.0	ON	ON	ON	OFF		ON	ON	OFF	OFF		OFF	OFF	ON	ON
105.05	ON	ON	ON	OFF		ON	ON	OFF	OFF		OFF	OFF	ON	OFF
105.1	ON	ON	ON	OFF		ON	ON	OFF	OFF		OFF	OFF	OFF	ON
105.15	ON	ON	ON	OFF		ON	ON	OFF	OFF		OFF	OFF	OFF	OFF
105.2	ON	ON	ON	OFF		ON	OFF	ON	ON		ON	ON	ON	ON
105.25	ON	ON	ON	OFF		ON	OFF	ON	ON		ON	ON	ON	OFF
105.3	ON	ON	ON	OFF		ON	OFF	ON	ON		ON	ON	OFF	ON
105.35	ON	ON	ON	OFF		ON	OFF	ON	ON		ON	ON	OFF	OFF
105.4	ON	ON	ON	OFF		ON	OFF	ON	ON		ON	OFF	ON	ON
105.45	ON	ON	ON	OFF		ON	OFF	ON	ON		ON	OFF	ON	OFF
105.5	ON	ON	ON	OFF		ON	OFF	ON	ON		ON	OFF	OFF	ON
105.55	ON	ON	ON	OFF		ON	OFF	ON	ON		ON	OFF	OFF	OFF
105.6	ON	ON	ON	OFF		ON	OFF	ON	ON		OFF	ON	ON	ON
105.65	ON	ON	ON	OFF		ON	OFF	ON	ON		OFF	ON	ON	OFF
105.7	ON	ON	ON	OFF		ON	OFF	ON	ON		OFF	ON	OFF	ON
105.75	ON	ON	ON	OFF		ON	OFF	ON	ON		OFF	ON	OFF	OFF
105.8	ON	ON	ON	OFF		ON	OFF	ON	ON		OFF	OFF	ON	ON
105.85	ON	ON	ON	OFF		ON	OFF	ON	ON		OFF	OFF	ON	OFF
105.9	ON	ON	ON	OFF		ON	OFF	ON	ON		OFF	OFF	OFF	ON
105.95	ON	ON	ON	OFF		ON	OFF	ON	ON		OFF	OFF	OFF	OFF
106	ON	ON	ON	OFF		ON	OFF	ON	OFF		ON	ON	ON	ON
106.05	ON	ON	ON	OFF		ON	OFF	ON	OFF		ON	ON	ON	OFF
106.1	ON	ON	ON	OFF		ON	OFF	ON	OFF		ON	ON	OFF	ON
106.15	ON	ON	ON	OFF		ON	OFF	ON	OFF		ON	ON	OFF	OFF
106.2	ON	ON	ON	OFF		ON	OFF	ON	OFF		ON	OFF	ON	ON
106.25	ON	ON	ON	OFF		ON	OFF	ON	OFF		ON	OFF	ON	OFF
106.3	ON	ON	ON	OFF		ON	OFF	ON	OFF		ON	OFF	OFF	ON
106.35	ON	ON	ON	OFF		ON	OFF	ON	OFF		ON	OFF	OFF	OFF
106.4	ON	ON	ON	OFF		ON	OFF	ON	OFF		OFF	ON	ON	ON
106.45	ON	ON	ON	OFF		ON	OFF	ON	OFF		OFF	ON	ON	OFF
106.5	ON	ON	ON	OFF		ON	OFF	ON	OFF		OFF	ON	OFF	ON

TABLE 2. FREQUENCY PROGRAMMING														
	OSCILLATOR 2ND UP CONVERTER					MSB - A DSP CIRCUIT BOARD					LSB - B DSP CIRCUIT BOARD			
FREQUENCY	150	155	160	165		8	4	2	1		8	4	2	1
106.55	ON	ON	ON	OFF		ON	OFF	ON	OFF		OFF	ON	OFF	OFF
106.6	ON	ON	ON	OFF		ON	OFF	ON	OFF		OFF	OFF	ON	ON
106.65	ON	ON	ON	OFF		ON	OFF	ON	OFF		OFF	OFF	ON	OFF
106.7	ON	ON	ON	OFF		ON	OFF	ON	OFF		OFF	OFF	OFF	ON
106.75	ON	ON	ON	OFF		ON	OFF	ON	OFF		OFF	OFF	OFF	OFF
106.8	ON	ON	ON	OFF		ON	OFF	OFF	ON		ON	ON	ON	ON
106.85	ON	ON	ON	OFF		ON	OFF	OFF	ON		ON	ON	ON	OFF
106.9	ON	ON	ON	OFF		ON	OFF	OFF	ON		ON	ON	OFF	ON
106.95	ON	ON	ON	OFF		ON	OFF	OFF	ON		ON	ON	OFF	OFF
107.0	ON	ON	ON	OFF		ON	OFF	OFF	ON		ON	OFF	ON	ON
107.05	ON	ON	ON	OFF		ON	OFF	OFF	ON		ON	OFF	ON	OFF
107.1	ON	ON	ON	OFF		ON	OFF	OFF	ON		ON	OFF	OFF	ON
107.15	ON	ON	ON	OFF		ON	OFF	OFF	ON		ON	OFF	OFF	OFF
107.2	ON	ON	ON	OFF		ON	OFF	OFF	ON		OFF	ON	ON	ON
107.25	ON	ON	ON	OFF		ON	OFF	OFF	ON		OFF	ON	ON	OFF
107.3	ON	ON	ON	OFF		ON	OFF	OFF	ON		OFF	ON	OFF	ON
107.35	ON	ON	ON	OFF		ON	OFF	OFF	ON		OFF	ON	OFF	OFF
107.4	ON	ON	ON	OFF		ON	OFF	OFF	ON		OFF	OFF	ON	ON
107.45	ON	ON	ON	OFF		ON	OFF	OFF	ON		OFF	OFF	ON	OFF
107.5	ON	ON	ON	OFF		ON	OFF	OFF	ON		OFF	OFF	OFF	ON
107.55	ON	ON	ON	OFF		ON	OFF	OFF	ON		OFF	OFF	OFF	OFF
107.6	ON	ON	ON	OFF		ON	OFF	OFF	OFF		ON	ON	ON	ON
107.65	ON	ON	ON	OFF		ON	OFF	OFF	OFF		ON	ON	ON	OFF
107.7	ON	ON	ON	OFF		ON	OFF	OFF	OFF		ON	ON	OFF	ON
107.75	ON	ON	ON	OFF		ON	OFF	OFF	OFF		ON	ON	OFF	OFF
107.8	ON	ON	ON	OFF		ON	OFF	OFF	OFF		ON	OFF	ON	ON
107.85	ON	ON	ON	OFF		ON	OFF	OFF	OFF		ON	OFF	ON	OFF
107.9	ON	ON	ON	OFF		ON	OFF	OFF	OFF		ON	OFF	OFF	ON
107.95	ON	ON	ON	OFF		ON	OFF	OFF	OFF		ON	OFF	OFF	OFF
108.0	ON	ON	ON	OFF		ON	OFF	OFF	OFF		OFF	ON	ON	ON
108.05	ON	ON	ON	OFF		ON	OFF	OFF	OFF		OFF	ON	ON	OFF
108.1	ON	ON	ON	OFF		ON	OFF	OFF	OFF		OFF	ON	OFF	ON
108.15	ON	ON	ON	OFF		ON	OFF	OFF	OFF		OFF	ON	OFF	OFF
108.2	ON	ON	ON	OFF		ON	OFF	OFF	OFF		OFF	OFF	ON	ON
108.25	ON	ON	ON	OFF		ON	OFF	OFF	OFF		OFF	OFF	ON	OFF
108.3	ON	ON	ON	OFF		ON	OFF	OFF	OFF		OFF	OFF	OFF	ON
108.35	ON	ON	ON	OFF		ON	OFF	OFF	OFF		OFF	OFF	OFF	OFF

FACTORY DEFAULTS.

The transmitter is equipped with many operating parameters and features. The following text presents the factory programming for the operating parameters/features.

OPERATING PARAMETER/ FEATURE	COMPONENT - LOCATION	FACTORY DEFAULT	JUMPER POSITION
PREEMPHASIS	J11/J9 - DSP PCB	ENABLED - 75 uS	P11 - REMOVED P9 - REMOVED
ANALOG LEFT CHANNEL LEVEL	J31/J32 - DSP PCB	0 dBm	P31/P32 - INSTALLED IN 0 dB POSITION
ANALOG RIGHT CHANNEL LEVEL	J24/J25 - DSP PCB	0 dBm	P24/P25 - INSTALLED IN 0 dB POSITION
ANALOG LEFT CHANNEL IMPEDANCE	J10 - DSP PCB	600 OHMS	P10 - INSTALLED
ANALOG RIGHT CHANNEL IMPEDANCE	J8 - DSP PCB	600 OHMS	P8 - INSTALLED
SCA	J14 - DSP PCB	OFF	P14 - INSTALLED
SCA IMPEDANCE	J23 - DSP PCB	600 OHMS	P23 - INSTALLED
SCA DEVIATION	J12 - DSP PCB	7.5 kHz	P12 - REMOVED
RF OUTPUT POWER	R67 - FRONT PANEL PCB	150 WATTS	----
AUDIO INPUT	J13 - DSP PCB	AUTO	P13 - INSTALLED IN POSITION 3-4
REFLECTED POWER/HEAT- SINK TEMPERATURE	J8 - FRONT PANEL PCB	REFLECTED POWER	P8 - INSTALLED IN POSITION 1-2
CARRIER FREQUENCY	J21 - DSP PCB	STATION FREQUENCY	----
COMPOSITE INPUT LEVEL	----	1.25 VOLTS PEAK-TO- PEAK EQUALS 100% MODULATION	----
DIGITAL INPUT LEVEL	----	-2 dBfs	----
FAILSAFE INPUT POLARITY	S2 - FRONT PANEL PCB	POSITIVE	----
COMPOSITE INPUT IMPEDANCE	J6 - REAR PANEL PCB	10 k Ohms	P6 - INSTALLED IN POSITION 1-2
COMPOSITE INPUT AUTO SWITCH	J5 - REAR PANEL PCB	AUTOMATIC SWITCHING	P5 - INSTALLED IN POSITION 1-2

CONTROLS AND INDICATORS.

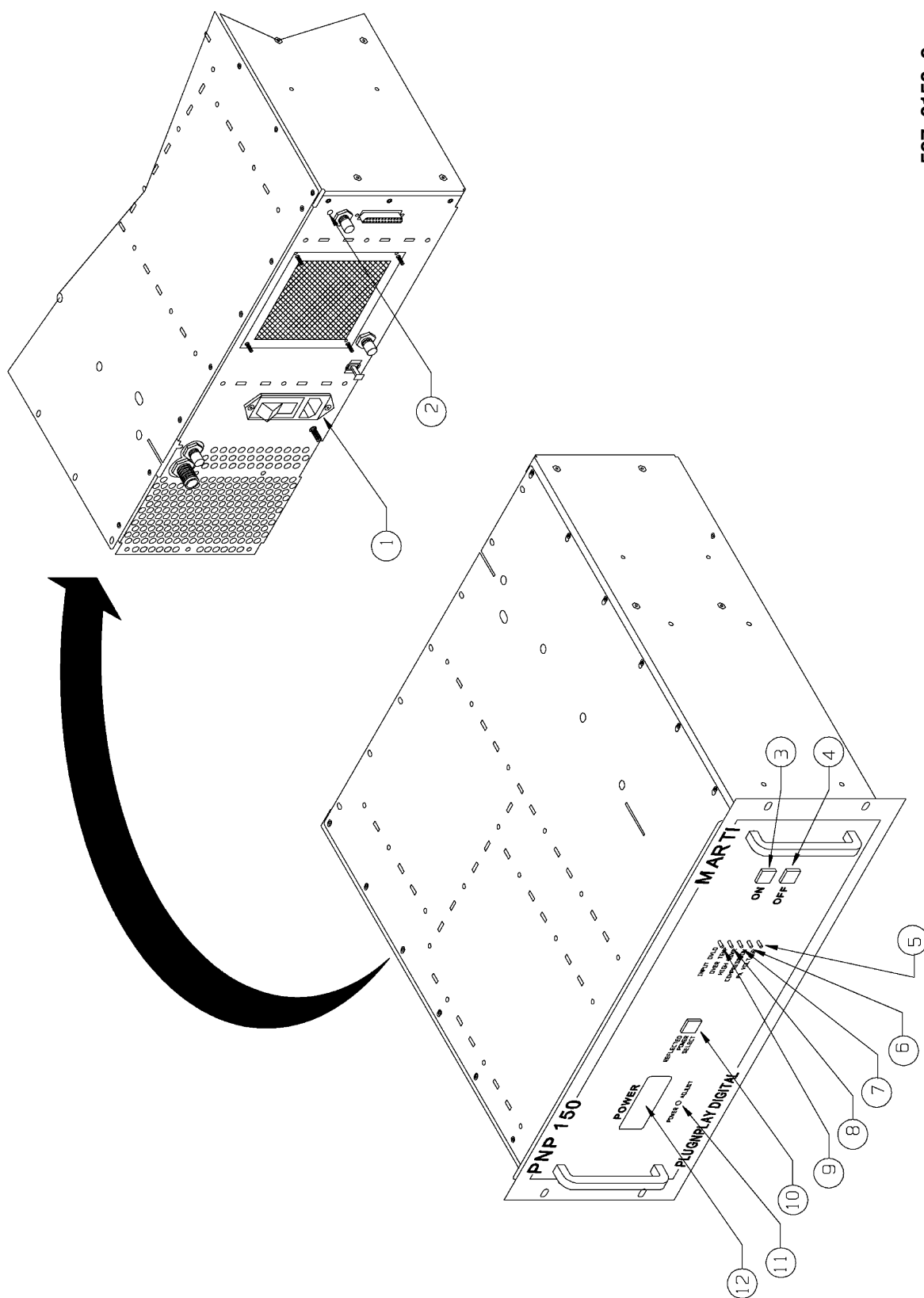
Refer to Figure 11 and the following text for a description of the PNP 150 controls and indicators.

1 - AC POWER ON/OFF SWITCH.

Provides primary ac power control for the transmitter.

2 - COMPOSITE PILOT INDICATOR.

Illuminates to indicate the composite pilot signal is present at the transmitter.



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FIGURE 11. PNP 150 CONTROLS AND INDICATORS

3 - ON SWITCH/INDICATOR.

SWITCH - Enables the transmitter RF output by unmuting the power amplifier module.

INDICATOR - Illuminates to indicate the transmitter RF output is enabled.

4 - OFF SWITCH/INDICATOR.

SWITCH - Disables the transmitter RF output by muting the power amplifier module.

INDICATOR - Illuminates to indicate the transmitter RF output is disabled.

5 - PA VOLTAGE INDICATOR.

Illuminates to indicate the +48 volt dc power amplifier module power supply is operational.

6 - COMPRESSION INDICATOR.

Illuminates to indicate the automatic-gain-control circuit on the DSP circuit board is engaged. This will occur when the audio input level is approximately 2 dB above nominal. The circuit is designed to compress higher than nominal levels to prevent clipping at the digital-to-analog converter.

7 - HIGH VSWR INDICATOR.

Illuminates to indicate the presence of a 1.5 : 1 or greater VSWR condition at the transmitter output. At this point, the transmitter automatic power control circuitry will begin to foldback the output power.

8 - OVERTEMP INDICATOR.

Illuminates to indicate the power amplifier heatsink temperature is approximately 80 degrees C or greater. At this point, the transmitter automatic power control circuitry will begin to foldback the output power.

9 - INPUT OVLD.

Illuminates to indicate the audio input level is approximately 4 dB above nominal. This level may cause clipping at the digital-to-analog converter and result in high audio distortion.

10 - REFLECTED POWER SELECT SWITCH/INDICATOR.

SWITCH - Selects reflected power or heatsink temperature for display on the front-panel **POWER** LCD display. Header J8 on the front-panel circuit board allows the selection of reflected power or heatsink temperature.

INDICATOR - Illuminates to indicate reflected power or heatsink temperature is selected for display on the **POWER** LCD display. The indicator is extinguished when transmitter forward power is displayed on the **POWER** LCD display.

11 - POWER ADJUST CONTROL.

Adjusts the transmitter RF output power from 15 watts to 150 watts.

12 - POWER LCD DISPLAY.

An LCD display used to present forward power, reflected power, or heatsink temperature information. When the **REFLECTED POWER SELECT** switch/indicator is illuminated, the display will present reflected power in watts or heatsink temperature in degrees Celsius as selected by header J8 on the front-panel circuit board. When the **REFLECTED POWER SELECT** switch/indicator is extinguished, the display will present forward power in watts.

TURN ON.

Refer to the following text to operate the transmitter to on.

1. Operate the rear-panel ac power on/off switch to on.

*The **OFF** switch/indicator will illuminate.*

2. Depress the **ON** switch/indicator to illuminate the switch/indicator.

*The **PA VOLTAGE** indicator will illuminate.*

*The **POWER LCD** display will indicate forward power if the **REFLECTED POWER SELECT** switch/indicator is extinguished.*

TURN OFF.

Refer to the following text to operate the transmitter to off.

1. Depress the **OFF** switch/indicator to illuminate the switch/indicator.

*The **PA VOLTAGE** indicator will extinguish.*

*The **POWER LCD** display will indicate 0 watts forward power if the **REFLECTED POWER SELECT** switch/indicator is extinguished.*

POWER LCD DISPLAY.

The **POWER LCD** display presents forward power, reflected power, or power amplifier module heatsink temperature. To operate the display, proceed as follows:

FORWARD POWER - To display forward power, depress the **REFLECTED POWER SELECT** switch/indicator to extinguish the switch/indicator. The transmitter forward power will be displayed in watts.

REFLECTED POWER/HEATSINK TEMPERATURE - The **POWER LCD** display will display reflected power or heatsink temperature as determined by the programming of header J8 on the front-panel circuit board. To display reflected power/heatsink temperature, depress the **REFLECTED POWER SELECT** switch/indicator to illuminate the switch/indicator. The transmitter reflected power will be displayed in watts or the power amplifier heatsink temperature will be displayed in degrees Celsius.

POWER ADJUST.

The transmitter output power is adjusted by the **POWER ADJUST** control. To adjust the transmitter output power, use a tuning tool to adjust the control clockwise to increase the output power or counterclockwise to decrease the output power.

INPUT OVLD INDICATOR.

The transmitter is equipped with an audio input overload indicator. The **INPUT OVLD** indicator will illuminate to indicate the audio input level is approximately 4 dB above nominal. This level may cause clipping at the digital-to-analog converter and result in high audio distortion.

OVER TEMP INDICATOR.

High power amplifier module heatsink temperatures are displayed by the **OVER TEMP** indicator. The **OVER TEMP** indicator illuminates when the power amplifier heatsink temperature is approximately 80 degrees Celsius or greater. At this point, the transmitter automatic power control circuitry will begin to foldback the output power.

HIGH VSWR INDICATOR.

High VSWR conditions are displayed by the **HIGH VSWR** indicator. The **HIGH VSWR** indicator illuminates to indicate the presence of a 1.5 : 1 or greater VSWR condition at the transmitter output. At this point, the transmitter automatic power control circuitry will begin to foldback the output power.

COMPRESSION INDICATOR.

Higher than nominal audio input level conditions are displayed by the **COMPRESSION** indicator. The **COMPRESSION** illuminates to indicate automatic-gain-control circuit on the DSP circuit board is engaged. This will occur when the audio input level is approximately 2 dB above nominal. The circuit is designed to compress higher than nominal levels to prevent clipping at the digital-to-analog converter.

PA VOLTAGE INDICATOR.

The operating status of the power amplifier +48 volt PA supply is presented by the **PA VOLTAGE** indicator. The indicator will illuminate to indicate the +48 supply is operational.

PILOT INDICATOR.

The status of composite input pilot is presented by the **PILOT** indicator on the transmitter rear-panel. The indicator will illuminate to indicate the presence of the composite signal at the transmitter.

CUSTOMER SERVICE.



WARNING

WARNING

NEVER OPERATE THE TRANSMITTER WITH THE TOP-COVER REMOVED.

Due to complexity and critical nature of the PNP 150 circuitry, the transmitter is not considered to be customer repairable in the field. Never operate the transmitter with the top-panel removed. Technical assistance and repair service for the transmitter is provided by MARTI Electronics. The service department can be reached by telephone, e-mail, fax, or letter. Equipment requiring repair or exchange should be sent by common carrier, prepaid, insured, and well protected. Do not mail the equipment. MARTI Electronics can assume no liability for inbound damage and necessary repairs become the obligation of the shipper. Prior arrangement is necessary. Contact the service department for a Return Authorization.

TECHNICAL ASSISTANCE -

- Telephone - (817)-645-9163 8:00 AM To 5:00 PM Central Time
- E-Mail - support@martielectronics.com
- Fax - 817-641-3869