

SD 125V3 DATA RADIO

maxon[®]

User Guide



THEORY OF OPERATION

The SD 125V3 radio is comprised of two PCB's (an RF PCB and a digital PCB). These boards are connected with an 18 pin female and male connector. The digital board is interfaced with external data equipment through the 9 pin d-sub male connector, which controls the radio and data receiving and sending.

DIGITAL CIRCUIT

The digital circuit is charged to be control for all of the signal path and set the frequencies to be set and selecting the desired channel.

TX-Signal circuit

The TX data signal comes from Pin 2 of Con 401, and goes through U404D. The TX-signal is amplified by U406C. The TX-signal is filtered by U405A & B which is a 4'th order low pass filter, therefore, the filtered signal supply to the RF board for TX modulation.

RX-Signal Circuit

The RX- data signal comes from the RF board, which is connected with pin 10 of Con 403. The RX-signal is switched by U404A and adjusted by RV403 and amplified by U407. The amplified signal goes to pin10 of Con 401.

RSSI Detector

From the RF board, the RSSI (Received Signal Strength Indicator) signal comes to U403A & B through R461. The pulse is injected from pin 5 of U403B every 1 ms and C451 is discharged. After then, it begins to be charged by R464. Simultaneously, RSSI signal is input to pin 7 of U403A and those signals are compared. The compared signal is output from U403A. Pin 1 and the CPU detects the pulse width. The pulse width is varied by RSSI DC voltage. Therefore, the CPU determines the carrier detection .

EEPROM

RX, TX channel and RSSI detection level as well as other data from the programmer are stored in the EEPROM. The data stored is retained without power supplied. This is a non-volatile memory . The EEPROM may have information re-programmed or erased. U402 is an EEPROM with 2048 capacity and data is written and read serially.

Channel Selector

One of 16 channels may be selected using the clip switch named SW401 . SW401 encodes the channel number, selected into 4-bit binary code. The binary code plus one equals the channel number. The binary code is decoded by the CPU enabling the appropriate RX or TX frequency and associated data to be selected from the EEPROM. In the binary bit of SW401, the lower 2 bits are connected to Con402. It causes the low 4 channels to be selected from the external equipment's.

DC to DC Converter

The main DC power is injected to the DC to DC converter . The DC to DC converter regulates the various input power supply voltage and outputs a constant voltage of 7.5 Volts. It is a source for all of the RF and digital circuits.

The DC to DC converter is formed by U801, Q801, Q802, L801 and R804. U801 is a switch mode DC to DC Converter IC. Input DC various appears as a voltage various through R804. U801 detects the voltage and controls the switching pulse. As the switching pulses, Q801and Q802 switches the input DC of various supply voltages and generates the constant DC of supply voltage.

RF CIRCUITS

TRANSMITTER

The transmitter is comprised of:

1. Buffer
2. P.A Module
3. Low Pass Filter
4. Antenna Switch
5. A.P.C Circuits

Buffer

VCO output level is -6dBm and amplified to, +6dBm. The buffer consists of Q16 and Q17 for isolation and gain.

P. A. Module

The P.A Module contains Q501, Q502, and Q503. Three stage amplifier Q501 amplifies the TX signal from +10 dBm to 100 mW. Q502 is amplified to 0.5W. Q503 amplifies to 3W and then matched to 50 OHMs using the L.C. network, thereby reducing the harmonics by -30 dB.

Low Pass Filter

L7, L8, L11, C72, C73, C74 and C75 are the 7th order Chebyshev low pass filter. Unwanted harmonics are reduced by -70 dBc.

Antenna Switch

When transmitting, the diodes D5 and D6 are forward biased enabling the RF signal passage to the antenna. D6 is shorted to ground inhibiting the RF signal to front end. In receive the diodes D5 and D6 are reversed biased passing the signal from the antenna through L13 and C83 to the front end without signal loss.

Automatic Current Control (ACC) Circuits

The ACC circuit consists of R109, variable resistor RV1, IC3(B) and transistors Q21 and Q22. The supply current is monitored by the difference voltage on R109 (0.1 Ohm). If the current varies by RF power output or other reasons, it produces some bias voltage by IC3A and Q19. The differential signal at the output of IC3 is passed to Q21 and Q22 that produces a constant power output to the antenna. RV1 is used to adjust the RF power level.

RF CIRCUITS PLL SYNTHESIZER

12.8 MHz TCXO

The TCXO contains the 3-stage thermistor network compensation and crystal oscillator and modulation ports. Compensation is +/-5 PPM or less from -30c to +60c.

PLL IC Dual Modules Prescaler

Input frequency of 12.8 MHz to IC2 MC14519 pin 20 is divided to 6.25 KHz or 5 KHz by the reference counter, and then supplied to the comparator. RF signal input from VCO is divided to 1/64 at the prescaler in IC2, divided by A and N counter in IC2 to determine frequency steps, and then supplied to the comparator. PLL comparison frequency is 6.25/5KHz so that minimum programmable frequency step is 5/6.25 KHz. The A and N counter is programmed to obtain the desired frequency by serial data in the CPU. In the comparator, the phase difference between reference and VCO signal is compared. When the phase of the reference frequency is leading, Fv is the output, but when VCO frequency is leading, Fr is the output. When Fv=Fr, phase detector out is a very small pulse. 64/65 modulus prescaler is comprised in IC2, and has two output ports:

Port A pin 16: TX enable 2

Port B pin 15: prescaler power save control in PLL IC Pin 13 labeled test2 allows the technician to see the output of the dual modulus prescaler for trouble shooting purposes, no connection should be made to this pin.

Level Shifter & Charge Pump

The charge pump is used for changing output signals Fr, Fv at PLL IC from 0-5v to 0-12v necessary for controlling the VCO.

Reference Frequency LPF

The Loop Filter contains R12, C21 and C22. LPF settling time is 12mS with 1 KHz frequency. This also reduces the residual side-band noise for the best signal-to-noise ratio.

DC to DC Converter

The DC to DC converter convert the 5v to 14-16v to supply the necessary voltage for wide range frequency in the VCO.

VCO

The VCO consist of an RX VCO and a TX VCO. It is switched TX/RX by the power source. It is configured as a colpits oscillator and connected to the buffer as a cascade bias in order to save power. The varicap diode D201/D301 are low-resistance elements and produce a change in frequency with a change in reverse bias voltage (2-11v). L203/L303 are resonant coils, which changes the control voltage by the tuning core. D202 modulation diode, modulates the audio signal. C204 compensates for the non-linearity of the VCO due to modulation diode, and maintains a constant modulation regardless of frequency .

RECEIVER

Front End

The receive signal is routed backward through the low pass filter, then onward to Pin 1 of the Hybrid Receiver Front End Module to a bandpass filter consisting of C622 through C608, L607 through L604 is coupled to the base of Q601 which serves as an RF amplifier. Diode D601 serves as protection from static RF overload from nearby transmitters. The output of Q601 is then coupled to a second bandpass filter consisting of C607 through C623 and L604 through L607. The output of Pin 6 is then coupled to the doubly balanced mixer D9. The receiver front end module is factory pre-tuned and requires no adjustment. Repair is effected by replacement of the entire module of the proper banded module. The receiver front end module signal pins are as follows:

1. RF Input
2. Input Ground
3. N/A
4. Receive +5V
5. Ground
6. Output

First Mixer

D9, T2 and T3 are double balanced mixers which provide the 45.1 MHz intermediate frequency output. The filtered frequency from the front end module is coupled to T2 . The 45.1 MHz IF output is matched to the input of the 2-pole monolithic filter by L14, L31, C69 and C97. The crystal filter provides a bandwidth of +/-7.2 KHz from the operating frequency providing a high degree of spurious and intermodulation protection. Additionally, a 90 MHz trap (XF1) is also placed at the filter output to provide additional attenuation of the second order IMD. The output of the filter is impedance matched by C97 and C69 to the base of the post of filter IF amplifier Q25.

Second Oscillator Mixer Limiter And FM Detector

The output of the post filter amplifier, Q25, is coupled via C98 to the input of IC5 (MC3371). IC5 is a monolithic single conversion FM transceiver, containing a mixer, the second local oscillator, limiter and quadrature detector. Crystal X1 44.645 MHz is

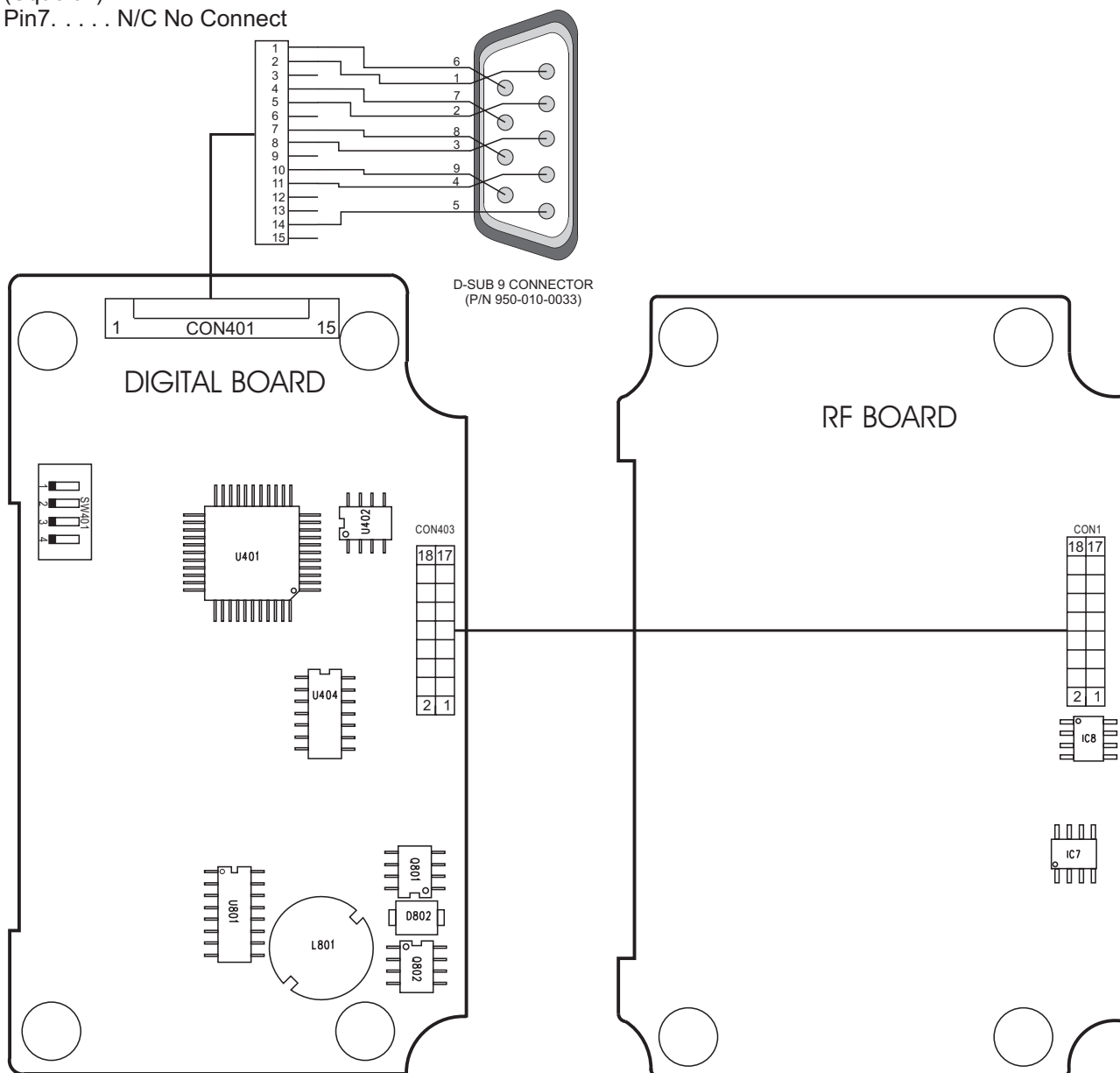
used to provide resultant 455KHz signal from the output of the second mixer. The mixer output is then routed to CF1 (455F). These ceramic filters provide the adjacent channel selectivity of 25 KHz bandwidth .

RSSI (Receiver Signal Strength Indicator)

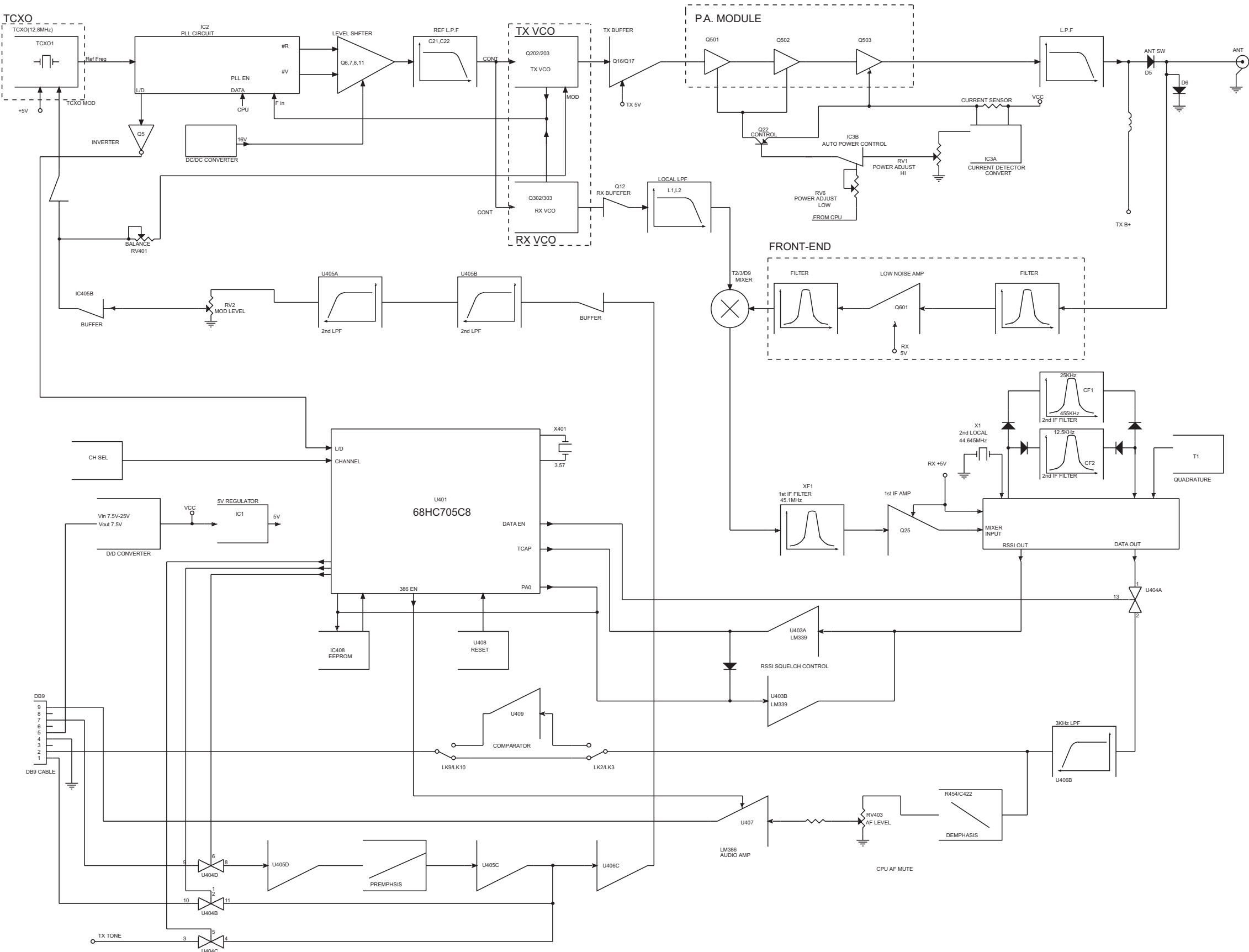
The RSSI signal is output from IC5 on pin 13. As the receiver signals the output, DC voltage is varied as much as receiver signal strength. Also, the DC signal is temperature compensated with a thermistor (THI).

WIRING DIAGRAM

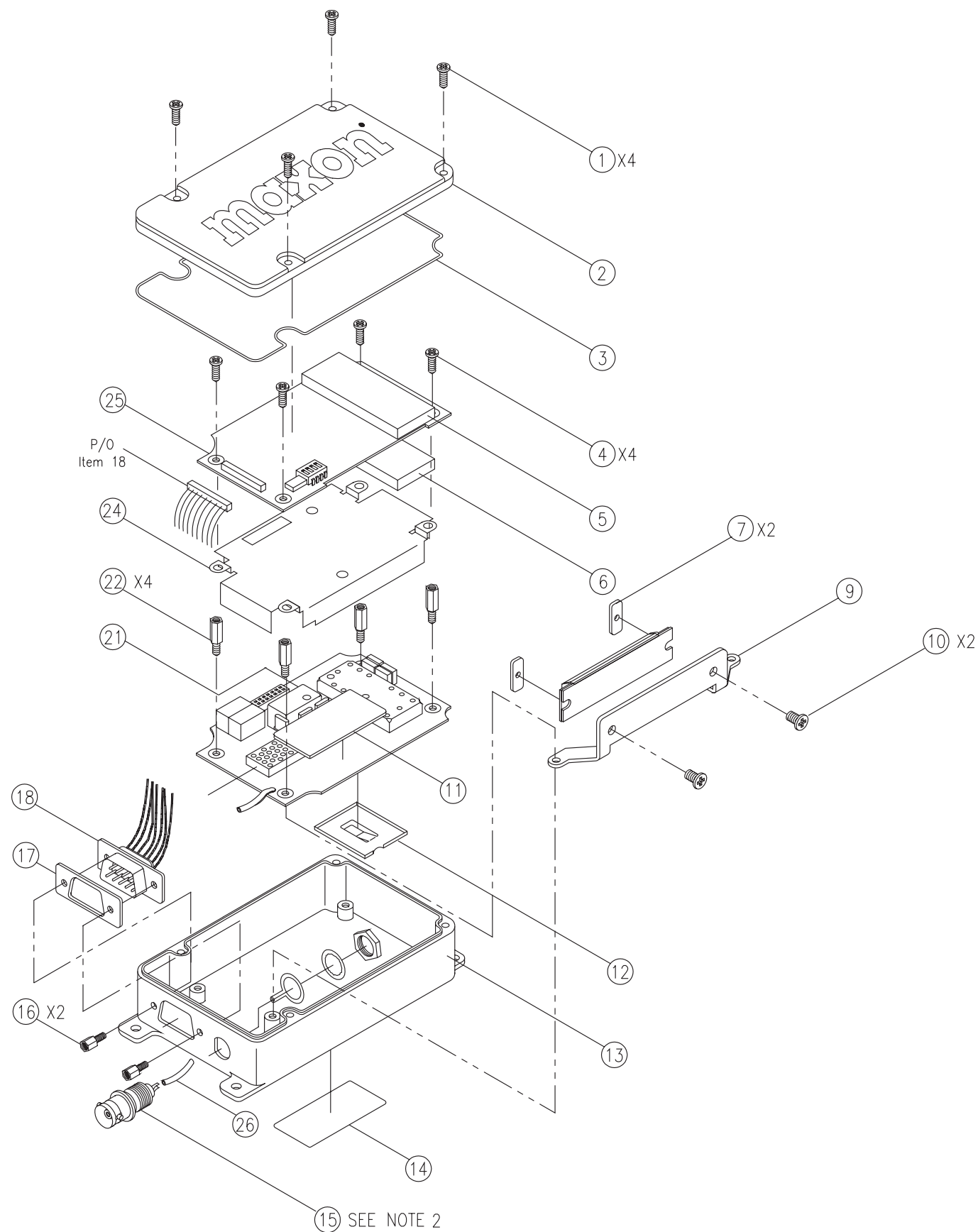
- Pin1. Audio In (Data RX)
 Pin2. Audio Out (Data TX)
 Pin3. PTT
 Pin4. GND (Ground)
 Pin5. B+ (8-18 Volts DC)
 Pin6. Carrier Detect
 (Squelch)
 Pin7. N/C No Connect



WIRING DIAGRAM



EXPLODED VIEW



REPAIRABLE/REPLACEABLE PARTS LIST			
ITEM #	QUANTITY	PART NUMBER	DESCRIPTION
1	4	330-110-0082	SCREW, M3X8
2	1	560-080-0053	UPPER COVER
3	1	330-220-0038	GASKET
4	4	330-110-0047	SCREW, M2X6
5	1	NOT AVAILABLE	SHIELD CAN
6	1	NOT AVAILABLE	SHIELD CAN
7	2	NOT AVAILABLE	BRACKET
9	1	NOT AVAILABLE	HEAT SINK
10	2	330-110-0042	SCREW, M2.5x10,
11	1	NOT AVAILABLE	SHIELD
12	1	NOT AVAILABLE	SHIELD
13	1	560-080-0054	BOTTOM COVER
14	1	NOT AVAILABLE	FCC COMPLIANCE LABEL
15	1	140-080-0016	BNC CONNECTOR, 50 OHM
16	2	330-115-0001	JACK SCREW
17	1	330-220-0039	GASKET
18	1	950-010-0033	D-SUB 9 CONNECTOR
21	1	650-100-0002	TCXO MODULE
22	4	330-270-0018	STANDOFF, HEX, M/F, 1.1.8x4xM2.6
24	1	NOT AVAILABLE	SHIELD PLATE
25	1	NOT AVAILABLE	DIGITAL PCB ASSY.
26	1	920-060-0005	COAX CABLE
AVAILABLE BOARD LEVEL COMPONENTS FOR DIGITAL BOARD			
SW401	1	830-130-0004	DIP SWITCH, 4 POSITION
L801	1	355-010-0120	INDUCTOR, CHIP, 12uH
L802	1	355-010-0335	INDUCTOR, CHIP, 3.3uH
X401	1	310-020-0004	CERAMIC RESONATOR, 3.58MHz
RV403	1	901-120-0223	VARIABLE RESISTOR, 22K
AVAILABLE BOARD LEVEL COMPONENTS FOR RF BOARDS			
T1	1	353-012-0001	COIL, VAR, 455kHz QUAD, IFT
RV1, RV6	2	901-120-0103	VARIABLE RESISTOR, 10K
RV2	1	901-120-0104	VARIABLE RESISTOR, 100K
RV3	1	901-120-0473	VARIABLE RESISTOR, 47K
CON1	1	140-020-0056	CONNECTOR, SKT, 18P/DIP
CF1	1	310-101-0010	CERAMIC FILTER, LT-455FW, 455kHz
CF2	1	310-010-0013	CERAMIC FILTER, ALCFM455E, 455kHz
X1	1	168-044-6450	CRYSTAL, 44.645MHz
XF1 / XF2	1(PAIR)	310-030-0015	CRYSTAL FILTER, PAIR, 45.1MHz

NOTES:

1. THE SD-125 SERIES EXTENDER BOARD (P/N: 650-060-0016) IS REQUIRED FOR TROUBLESHOOTING.

2. BNC CONNECTOR (ITEM 15) INCLUDES ALL NECESSARY HARDWARE TO MOUNT CONNECTOR.

EXPLODED VIEW