



**Model 2352S Series
Millimeter Wave
CW-Pulse
Radio Link**

**Installation and Operation
Manual**

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SECTION I

TECHNICAL DESCRIPTION

The 2352S CW-Pulse radio link operates in a simplex mode, transmitting a 10 MHz CW and TTL pulse signals. The radio link consists of 4 separate units; 1 each Transmit and Receive indoor control units and 1 each Transmit and Receive outdoor RF Heads. They are set up to transmit and receive on frequencies within 1 of 4 bands within the 21.2 to 23.6 GHz frequency band.

The 2352S are available in two configurations: (1) with RF Heads that include integral 12 inch parabolic antennas, and (2) with the RF Heads housed in a separate box for use with larger external antennas. In the integral antennas configuration, no separate antennas or flexible wave-guide sections are required. In the external antenna configuration, the customer must furnish the separate antennas and the sections of WR42 flexible wave-guide to interconnect the RF Head wave-guide interface and the antenna feed mechanism.

The Control Unit is a standard 19" 2RU configuration with an AC (optional DC) power supply, signal interface and processing unit, with a base band interface or demodulator for transit or receive operation.

Two (customer furnished) 50 Ohm Type N Male to Type N Male coaxial cables are required (one at each end of the link) for installation and operation of the radio link. The cable should be 100% shielded and of the highest quality, such as Belden 9913 (or equivalent). The cable runs between the Indoor Control Unit and the outdoor RF Head and carries the Tx baseband signal to the Head from the Control Unit, the AGC voltage and the 70 MHz IF signal from the RF Head to the Control Unit, and all of the alarm, diagnostic, and control information. Each Control Unit provides the following diagnostic indicators:

Power On	Green LED
CW Present (TX) or CW Lock (RX)	Green LED
Pulse Present	Green LED
Link Continuity, Head to Control Unit	Green LED
FSE Alarm (Frequency Select Error)	Red LED
AGC Alarm (Operational on RX unit Only)	Red LED
Rx Alarm (Operational on RX unit Only)	Red LED
Tx Alarm (Operational on TX unit Only)	Red LED
AGC Voltage (RX unit only)	Meter (0-10 Volts)

System Interface to Radio

CW IN Interface (TX unit):

Input for 10 MHz signal

PULSE IN Interface (TX unit):

Input for TTL pulse signal

CW OUT Interface (RX unit):

Output for 10 MHz signal

PULSE OUT Interface (RX unit):

Output for TTL pulse signal

Power

The radio link requires 93-265 VAC via attached 6-foot long power cord. (DC power is an extra cost option)

SECTION II

UNPACKING AND INSPECTION

Your Sierra Digital Series Millimeter Wave Link has been carefully inspected and packed at the factory. Each end of the Link is shipped in a single box. Please check the packing list carefully to ensure that all pieces have been received undamaged. If anything is missing, contact Telenetics.

TRANSIT DAMAGE

Although the factory has carefully packed the units, check for possible transit damage. If any damage has occurred in shipping, leave the entire units and packing carton intact and contact your carrier. Telenetics is not responsible for transit damage.

RETURN AUTHORIZATION NUMBER

If necessary to return the equipment, first obtain a return authorization number (RMA number) from Telenetics. Please contact the Telenetics Customer Service organization at (916) 624-7313 to obtain a RMA number. When contacting Customer Service, you will need your Model number, Serial number, a responsible technical contact, and a description of the problem. Please have all of this available when you make your call.

SECTION III

PATH REQUIREMENTS

The microwave path must be clear “line of sight”. That is, it must have no obstructions of any kind between the two antennas. Ensure that the path is not obstructed by buildings, trees (allow for growth), billboards, telephone poles, light poles, and/ or any other objects either man-made or natural. A strobe light is often used to verify “line of sight”.

The microwave “beam” does not travel along the path in a parallel fashion, it actually spreads out in the middle of the path and it is possible that a portion of this “spread-out” beam may hit an obstruction. In some cases this may cause multi-path interference.

After the path has been checked, and the antenna height verified, attention should be given to the mounting structures for the RF head units. Sierra Digital Communications Millimeter wave radios are designed for easy installation. They will mount to pipes varying in diameter from 2.5 to 4.5 inches. This will accommodate almost all mounting structures available. The structure must be relatively rigid to prevent antenna movement when it is windy. The structure must not vibrate, twist, or sway. If necessary, guy wires may be used to stabilize the structure. The rigidity required is a function of the antenna size, which determines the RF signal beam width. The larger the antenna, the narrower the beam width, and the tighter the control over vibration, twist, and sway must be.

SECTION IV

SPECIFICATIONS

General Description: This radio configuration supports simplex transmission of the 10 MHz reference 10 MHz CW signal plus the trigger pulse. The unit will operate in the 21.2-23.6 GHz band and have both an outdoor RF head and an indoor interface unit. The RF head will have an integrated 12" parabolic antenna. Optional external antenna configurations are available.

General Specifications:

Modulation:	FM
Channel Bandwidth:	50 MHz
Frequency Source:	Synthesized
System Gain:	97 dB
MTBF:	> 80,000 hours

Transmitter Characteristics:

RF Source:	Synthesized
Power Output:	+17 dBm (minimum)
Frequency Stability:	+/- 0.001%
Tuning Range:	21.2 – 23.6 GHz (with 2 sets of RF modules)
Tuning Steps:	5 MHz

Receiver Characteristics:

Type:	Dual Conversion Superhetrodyne (2500 & 70 MHz)
Noise Figure:	5.5 dB (typical)
Sensitivity:	-80 dBm
Maximum Receiver Input:	-15 dBm

Environmental Characteristics:

	<u>Outdoor Unit</u>	<u>Indoor Unit</u>
Operating Temperature:	-30° to +70°C	0° to +50°C
Storage Temperature:	-40° to +80°C	-40° to +60°C
Humidity: (non-condensing)	up to 100%	up to 95% at +50°C

Input Power Requirements:

Voltage Input:	93 – 265 VAC (Brown out at 90 VAC)
Line Frequency:	50/60 Hz
Power Consumption:	50 Watts each end (RF Head plus Interface Unit)

Size and Weight:

	<u>Height</u>	<u>Depth</u>	<u>Width</u>	<u>Weight</u>
Outdoor RF Unit:	15"	12"	15"	15 lbs.
Indoor Interface Unit:	3.5" (2RU)	14"	19"	10 lbs.

12" Antenna Characteristics:

Type/Size:	Parabolic, 12"
Polarization:	Linear (H or V determined by mounting orientation)
Gain/Beam width (22.4 GHz):	35 dB / 3.2°
Front to Back Ratio:	42 dB

Interconnect Cables & Connectors:

RF head to Interface Unit: 50 Ω , N-Type connector, 0-1000 Ft., Belden 9913 or better
RF head RF Output: Waveguide Flange UG 595/U (For external antenna configuration only)
Power: IEC 320 connector

Payload 10 MHz Signal Specifications:

Input Connector: BNC
Input Impedance: 50 Ω
Input Level: 0.2 – 2.0Vpp
Input Waveform: Sine wave, 10.0MHz \pm 80Hz, Phase noise < -75dBc/Hz @ 10 Hz

Output Frequency: Phase locked to input signal
Output waveform: Sine wave
Output Stability: Phase locked to input signal
Output Phase Noise: -75 dBc/Hz @ 10Hz from carrier
Output Harmonics: -50 dBc
Output Level: 2.0 \pm 0.1 Vpp when terminated in 50 Ω
Output Connector: BNC
Output Impedance: 50 Ω

Payload Trigger Pulse Signal Specifications:

Input Connector: BNC
Input Impedance: 75 Ω
Input Level: TTL level (Assume ~0-5V into 75 Ω)
Input Shape: TTL level positive pulses, width of 250, 500, 750 or 1000 nS and with a PRR of 1 Hz to 1 MHz. Nominal PRR's in Hz are 80.4, 160.9, 320.17, 640.35, 1280.69 & 2561.38. Maximum rise and fall times are 10 nS. Minimum pulse width is 220nS; Duty Factor < 20%

Output Connector: BNC connector
Output Impedance: 50 Ω
Output Level: High Level 3.0V min to 5.5V max (terminated into 50 Ω)
Low Level 0.0V min to 0.4V max (terminated into 50 Ω)
Output Pulse Width: \pm 2.5% or \pm 10nS, whichever is greater
Output Rise/Fall Time: 10 nS nominal
Delay: < 2.6 uS (not including propagation delay)
Jitter: < \pm 10nS from input

SECTION V

THEORY OF OPERATION

General

The following information is intended to provide a more in depth understanding of the design of the 2352S microwave radio system. It is not necessary to read or understand this information to install and align the system. It may be helpful in explaining why certain controls and indicators behave the way they do. You may proceed to section VI and come back to this section later if desired.

The basic function of this model microwave radio system is to transmit a 10 MHz CW signal and TTL pulse signal in a single direction, i.e. simplex mode. Since the CW signal is limited to a very exact frequency range and the TTL pulse signals are limited in pulse widths, repetition rates and duty cycles it is possible to multiplex them in the frequency domain on the transmit side and then de-multiplex them on the receive side. With proper processing the accuracy of the signals can be maintained.

Block Diagrams

The block diagram shown in figure 5-1 is for the top system level only. It provides an overview of the primary signals as they relate to the Indoor Control Units and RF Heads. The basic simplex operation is indicated by the CW reference signal and Trigger Pulse signal going in one direction only. The signals on the cable between the RF Heads and the Interface units are comprised of primary signals, telemetry signals and DC power.

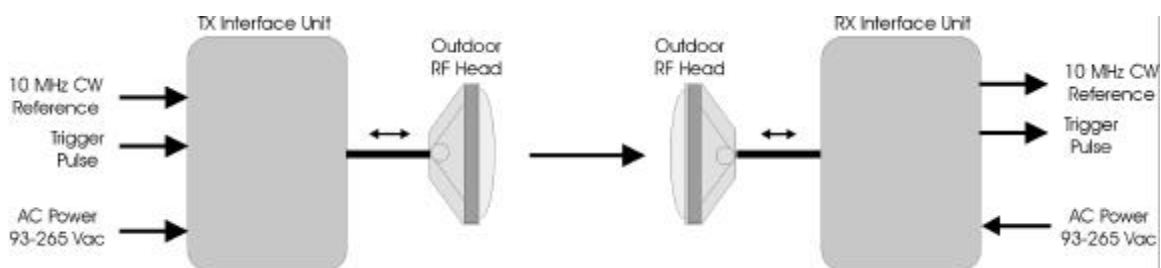


Figure 5-1

The block diagrams shown in Figures 5-2 and 5-3 are for the TX and RX Interface units. They provide a more detailed indication of the signals that are connected to the various sub modules within the radio interface. If you take the top cover off the interface unit you will be able to associate the various blocks in these diagrams with the modules inside. The Interface board provides the modulation and demodulation circuits.

SECTION V

THEORY OF OPERATION (Continued)

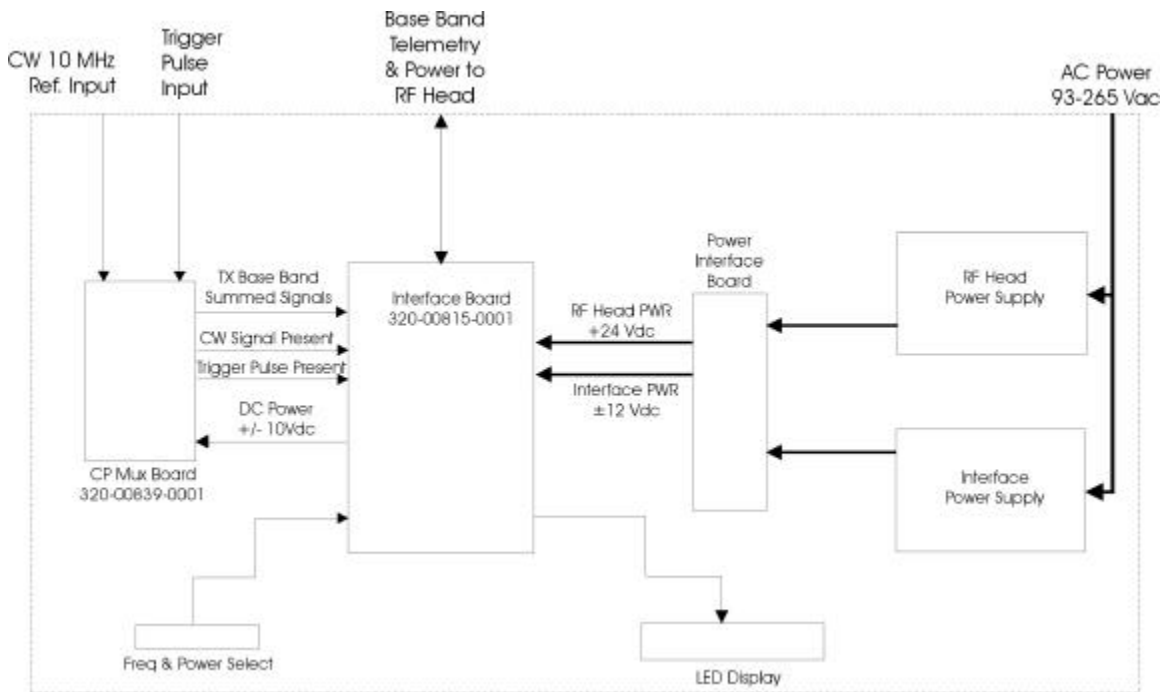


Figure 5-2
TX Interface Block Diagram

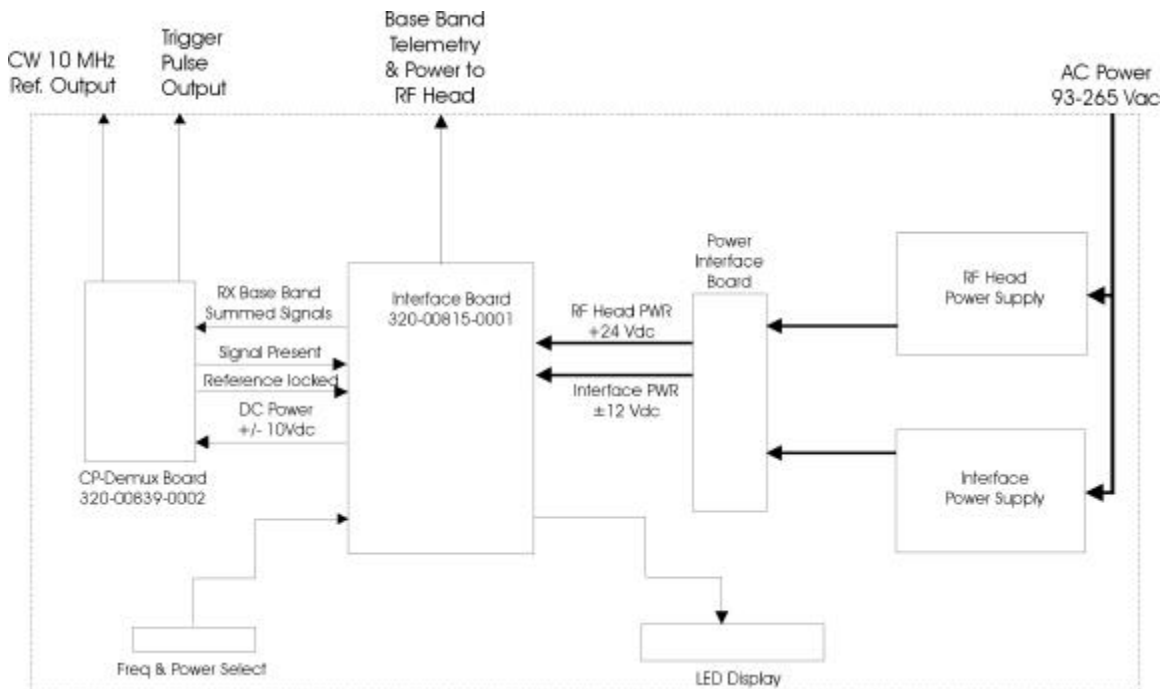


Figure 5-3
RX Interface Block Diagram

SECTION V

THEORY OF OPERATION (Continued)

Figure 5-4 provides a more detailed indication of the CP-Mux and CP-Demux design. Only the primary circuits are represented in the various blocks. As such there are other adjustments on the board that are not represented in this diagram. These adjustable components should only be adjusted in the factory.

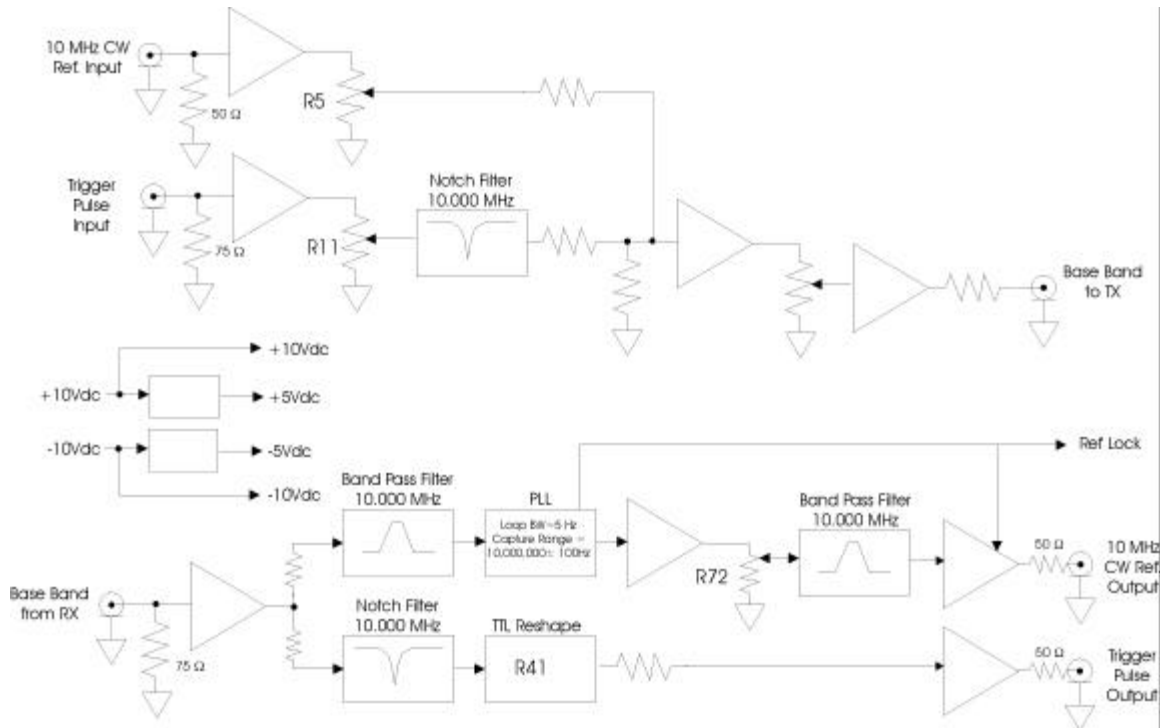


Figure 5-4
CP Mux-Demux Block diagram

Since the pulse and the CW signals are summed together in the CP Mux board (upper block diagram section) it is imperative that any energy in the pulse around 10 MHz be subtracted. This allows the separation of the 2 signals on the CP-Demux board (lower block diagram section). The signal out of the CP-Mux section is conditioned for modulation on another board.

When the signal enters the CP-Demux board it is separated into the 2 different original signals. The pulse signal is reshaped and sent to the Pulse Out connector. The CW signal is sent to a low phase noise PLL circuit to meet the phase noise specifications required. It takes approximately 2 seconds to lock (or unlock) when a valid 10MHz signal is present (10.0MHz + 90Hz). A band pass filter is used to suppress any remaining harmonics of 10 MHz. A squelch circuit will turn off the CW output if the PLL is not locked.

SECTION VI

PRELIMINARY INSTALLATION CONSIDERATIONS

Prior to receiving the radio equipment, there are a number of preliminary tasks, which should be completed. Proper site preparation will significantly expedite the final installation process.

1. Determine the exact sites where the radio equipment will be located.
2. Ensure that the tower or mounting structure is adequate to support the RF head unit (and the external antenna if that configuration is used), and that line of sight exists between the antenna points, please refer to Section III, Path Requirements. Note that the mounting point must be stiff enough to hold the pointing within +/- 3.2 degrees when utilizing the integral 12 Inch parabolic antennas and correspondingly tighter tolerances when using larger antennas.
3. Perform the path survey. Identify any potential interference objects such as buildings, vegetation, elevated roads or bridges, or nearby highly reflective surfaces such as lakes, rivers or other wet areas.
4. Obtain the necessary ancillary equipment (interconnect cable, connectors, etc.), and determine any special installation requirements.
5. Ensure that appropriate power is available.
6. Install the interconnect cable runs between the Outdoor RF Heads and the Indoor Control Units. Provide/install the coax cables that will be used to connect the signal interface equipment to the radio indoor control units.

SECTION VII

INSTALLATION INSTRUCTIONS

The Sierra Digital Series 2352S microwave radio link includes two terminals, each consisting of two units ...the Outdoor RF Head and the Indoor Control Unit. The 2352S RF Head is pole mounted and consists of the microwave transmitter or receiver, and, in the integral antenna version, the 12-inch parabolic antenna. In the configuration for use with external antennas, the transmitter and receiver is housed in a small box with a waveguide connection to the external antenna via a short flexible waveguide section. The Control Unit is mounted in an indoor enclosure and contains the signal interface circuitry and power supplies, which power both the Control Unit and the RF Head. Input power to the link is 96-265 VAC applied at the Control Unit or, as options 24 or 48 VDC.

The RF Head is connected to the Control Unit by a single 50-Ohm coaxial cable, which may be up to 1000 feet long with Type N connectors at each end. The CW and Pulse input and output connections to the radio are BNC type.

- Installation Steps:
1. Install Indoor Units
 2. Install RF Heads
 3. Align RF heads
 4. Verify-adjust Pulse signal
 5. Verify-adjust CW signal

Tools/Test Equipment Required:

- 2 ea 3/4" wrench to adjust antenna elevation angle
- 2 ea Wrench sized for customer supplied U-clamp
- 1 ea Tool to install cable connectors
- 1 ea Screwdriver, Philips, #1 size (Indoor Unit top cover)
- 1 ea Screwdriver, Philips, #2 size (Indoor Unit rack mount ears if used)
- 1 ea Screwdriver, Flat blade, #1 size (electronic adjustments if needed)
- 2 ea Fluke 73 series II multimeter or equivalent
- 1 ea 100 MHz Oscilloscope, desirable but normally not required.
- 2 ea Hand held high intensity strobe lights to facilitate antenna pointing, (Optional)

Customer furnished items required:

- 4 ea U-Clamps (2.5" to 4.5" diameter) for pole mount
(2 for each RF Head with matching saddle clamps)
- As required 50-Ohm Interconnect cable and Type N connectors
- As required Cable ties

Telenetics furnished items:

- 1 ea "A" RF Head Unit (Transmitter)
- 1 ea "B" RF Head Unit (Receiver)
- 1 ea Indoor Control Unit (Transmit side)
- 1 ea Indoor Control Unit (Receive side)
- 2 ea AC Power Cord for indoor control units
- 4 ea Rack mount ears, 2 ea for each indoor control unit
- 2 ea Mounting brackets (p/n 380-00062-0001) (For integral antenna config.)
- 4 ea Mounting screws, 2 ea. for each RF head Bracket

SECTION VII

INSTALLATION INSTRUCTIONS (continued)

Indoor Control Unit Installation

1. The indoor control units should be installed in an equipment room environment. Rubber feet and rack mount ears are provided for either desktop or 19" equipment rack installation.
2. Care should be taken to ensure proper ventilation is available for the indoor units. (Ventilation holes on the top and bottom of the chassis should not be covered or blocked)
3. Adjustments may be required inside the indoor unit. Initial placement should allow for removal of the top covers (9 screws) and access to adjustments on the circuit boards.
4. Power receptacle should be checked for correct wiring. Power cords, provided, are standard IEC 60320 C13 type for US Standard NEMA 5-15P.
5. Install 50 Ω coaxial cables, with Male Type N connectors attached, between the RF Head locations and the Control Unit locations.
6. With power off to the interface units set the frequency and line build out switches under the cover located on the lower left of the front panel. Switch descriptions are located in section VIII, Controls and Indicators, of this document.

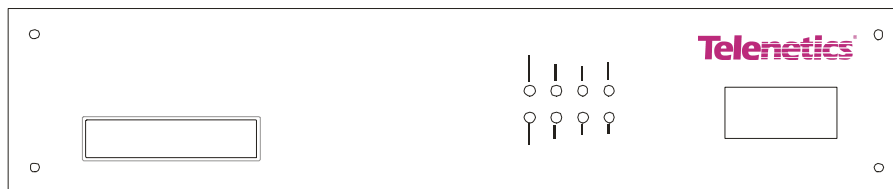


Figure 1
Indoor Control Unit Front Panel

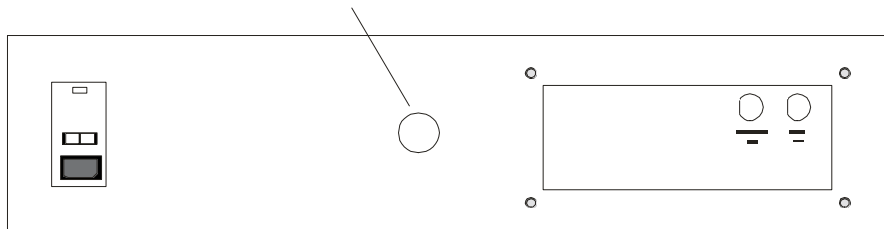


Figure 2
Indoor Control Unit Rear Panel (TX and RX)

SECTION VII

INSTALLATION INSTRUCTIONS (continued)

RF Head Installation

1. If using the external antenna configuration the RF head **must** be mounted with the heat sink fins running vertically. Also, the screws **must** be removed from the downward-facing water drain holes. **If this is not done the unit may fill with water, and the warranty will be voided.**

If using the integral antenna configuration, determine the desired 2352S RF head orientation for correct antenna polarization at both ends of the link.

Polarization is parallel to the imaginary line that connects the 2 large mounting holes on either side of the RF Head unit with the integrated 12" antenna. Therefore Horizontal polarization would exist if the mounting bolts were on the sides. Vertical polarization would exist if the mounting bolts were on top and bottom.

Always be sure to mount the unit so the appropriate drain holes are on the bottom. There are only two sets of drain holes so there are only two (2) correct orientations of the possible four (4). Be sure to remove the drain hole screws from the holes located on the bottom after installation.

Make sure the feed polarization is the same at both ends. In the external antenna configuration, mount the antenna separately to provide the proper antenna polarization.

2. In the integral antenna configuration, mount RF heads so both horizontal and vertical-mounting angles can be easily adjusted during the antenna alignment process. In the external antenna configuration, make sure the antenna mounting brackets allow sufficient azimuth and elevation movement.
3. Connect interconnect cables to the RF Head Unit at each end of link.
4. Continue to RF head Alignment

SECTION VII

INSTALLATION INSTRUCTIONS (continued)

RF Head Alignment

1. Antenna alignment requires a person with a communication device (Cellular Phone, Walkie Talkie, etc.) at each end of the link. The first step is to visually align antennas at each other. On short distances this can be done without any visual aids. In longer distances the opposite end may be difficult to locate. The use of a strobe light and/or binoculars may help.
2. After visual alignment the next step is to align using the AGC voltage. This requires that power be applied to the radio system. This is possibly the first time power is applied so some initial checks need to be done.

Turn power on to the indoor control unit with the power switch located on the rear of the unit. This will also apply power to the RF head if the coax cable is connected.

There should be two LED's on the front panels that illuminate. The power LED, green, should come on immediately upon power on.

The Link LED, green, should also come on if the coax cable is connected between the control unit and RF head. It indicates that the telemetry between the control unit and the RF head is working properly. See the table below for the LED status

LED	TX	RX	LED	TX	RX
PWR	ON	ON	FSE	OFF	OFF
LINK	ON	ON	AGC	OFF	*ON
PULSE	OFF	OFF	RX	OFF	OFF
CW	OFF	OFF	TX	OFF	OFF

The AGC LED on the Receiver may be On or Off. It is unlikely it will be Off unless the RF units happened to be aligned already.

3. Use a multi-meter in DC voltage mode and place the ground lead of the multi-meter into the black tip jack and the red lead of the multi-meter into the red tip jack on the RF head on the receive side.

Open the RF head unit. LED indicators should be on. If no LED's are on, check the connections for AC (or DC) power.

The radios were shipped from the factory so the Receiver frequency matched the Transmitter. Check the frequency select switches to verify.

SECTION VII

INSTALLATION INSTRUCTIONS (continued)

4. Hold one antenna still, such as the Transmit Unit, and monitor the AGC voltage at the far end (RX end) and move the near end antenna very very slowly from side to side to find the maximum AGC voltage. There may be more than one peak, (but only one large one) so make sure the arc is large enough to ensure that the maximum voltage is achieved. If no voltage is detected it may be necessary to try for a better visual alignment of the Transmitter unit.

Once a good maximum is detected. Move the antenna slowly up and down for maximum AGC, just as you did for the horizontal alignment.

After an AGC of +4 volts or more is established; adjust each antennas very slightly left to right and up to down to find the maximum AGC voltage at both ends.

5. Once RF alignment is complete the connection proceed to Pulse verification and adjustment procedure.

SECTION VII

INSTALLATION INSTRUCTIONS (continued)

Pulse Verification and Adjustment

1. Connect a TTL pulse to the Pulse In connector of the Transmitter Indoor control Unit. The pulse level should be between 3.0 and 5.5 Volts when connected to the input. The Pulse LED should illuminate on both the TX and RX indoor control units.

The system was set up in the factory for a TTL pulse input level of 4.5V. If the level is less than 4.0V a minor adjustment may be necessary. If an adjustment is necessary connect a scope probe to TP11 on the CP Mux board 320-00838-0001 inside TX control unit. Adjust R11 for 800mVpp signal using a pulse width of 500nS or greater with a duty factor less than 20%. A CW signal should not be connected to the CW input.

2. The output on the RX control interface unit Pulse Out connector should have a pulse of the same width and repetition rate as that put into the Pulse In connector on the TX control interface unit.

For short pulses of less than 500nS the output pulse width may require a minor adjustment. If the pulse width is more than 10nS different it can be compensated for by a slight adjustment of R41 on the CP Demux board.

CW Verification and Adjustment

1. Connect a 10 MHz sine wave to the CW Input of the TX indoor control unit. The CW LED on both front panels should illuminate. The LED on the RX unit should take approximately 2 seconds after the signal is connected to the input on the RX unit.

The Factory was set up for a sine wave input of approximately 1.0Vpp. If the input is less than 500mVpp or Greater than 1.5Vpp an adjustment should be made on the CP Mux board in the TX indoor control unit. With the 10 MHz sine signal connected to the CW input adjust R5 for a 400mVpp signal at TP11 on the same board. The Pulse In signal should not be connected.

4. The installation is complete and the radio link may be put into service.

SECTION VIII

CONTROLS AND INDICATORS

Frequency Select Switch Settings for Various Operating Frequencies

LOWER HALF OF THE FULL 23 GHZ BAND

		“B” Head		“A” Head	
		Higher Frequency of Pair		Lower Frequency of Pair	
Frequency Pair	Frequency Start at 22.405 GHz	Switch Setting 500s - 50s - 5s	Frequency Start at 21.205 GHz	Switch setting 500s - 50s - 5s	
H	22.425	0 - 0 - 4	21.225	0 - 0 - 4	
I	22.475	0 - 1 - 4	21.275	0 - 1 - 4	
J	22.525	0 - 2 - 4	21.325	0 - 2 - 4	
K	22.575	0 - 3 - 4	21.375	0 - 3 - 4	
L	22.625	0 - 4 - 4	21.425	0 - 4 - 4	
M	22.675	0 - 5 - 4	21.475	0 - 5 - 4	
N	22.725	0 - 6 - 4	21.525	0 - 6 - 4	
O	22.775	0 - 7 - 4	21.575	0 - 7 - 4	
P	22.825	0 - 8 - 4	21.625	0 - 8 - 4	
Q	22.875	0 - 9 - 4	21.675	0 - 9 - 4	
R	22.925	1 - 0 - 4	21.725	1 - 0 - 4	
S	22.975	1 - 1 - 4	21.775	1 - 1 - 4	

UPPER HALF OF THE FULL 23 GHZ BAND

		“B” Head		“A” Head	
		Higher Frequency of Pair		Lower Frequency of Pair	
Frequency Pair	Frequency Start at 23.005 GHz	Switch Setting 500s - 50s - 5s	Frequency Start at 21.805 GHz	Switch setting 500s - 50s - 5s	
D	23.025	0 - 0 - 4	21.825	0 - 0 - 4	
T	23.075	0 - 1 - 4	21.875	0 - 1 - 4	
G	23.125	0 - 2 - 4	21.925	0 - 2 - 4	
E	23.175	0 - 3 - 4	21.975	0 - 3 - 4	
C	23.225	0 - 4 - 4	22.025	0 - 4 - 4	
U	23.275	0 - 5 - 4	22.075	0 - 5 - 4	
V	23.325	0 - 6 - 4	22.125	0 - 6 - 4	
B	23.375	0 - 7 - 4	22.175	0 - 7 - 4	
X	23.425	0 - 8 - 4	22.225	0 - 8 - 4	
Y	23.475	0 - 9 - 4	22.275	0 - 9 - 4	
F	23.525	1 - 0 - 4	22.325	1 - 0 - 4	
A	23.575	1 - 1 - 4	22.375	1 - 1 - 4	

IMPORTANT NOTE: Switch Settings at both ends of the link must be exactly the same . . . for example: the link shipped with “B” Head set to 0-7-4 and “A” Head set to 0-7-4 (approximately the center of the authorized band). This ensures that the Transmitter at one end and the Receiver at the other end are tuned to the same frequency.

SECTION VIII

CONTROLS AND INDICATORS

Line Build-Out Switch Settings for Various RF Head to Control Unit Separations

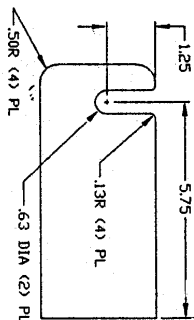
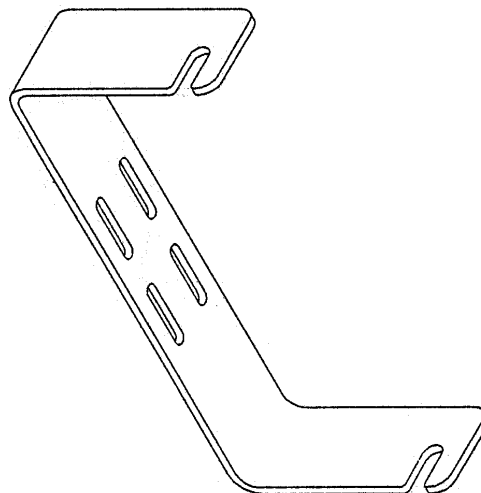
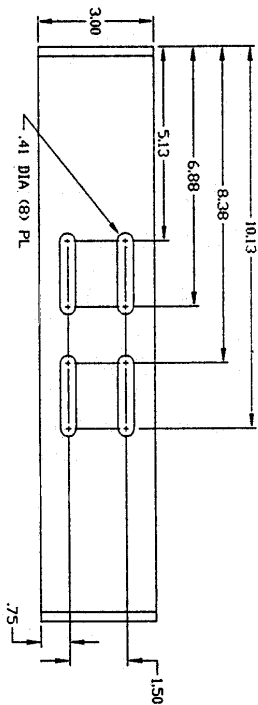
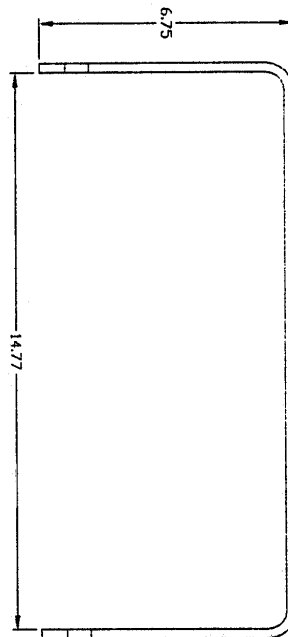
Head to Control Unit Separation	Switch # 1	Switch # 2
0 to 250 Feet	OFF	OFF
250 to 500 Feet	ON	OFF
500 to 750 Feet	OFF	ON
750 to 1,000 Feet	ON	ON

Transmit Power Control Switch Settings for Various RF Radiated Power Settings (If Option Installed)

Three-gang switch located between the
Frequency Select Switches and the Line Build Out Switch

Transmit Power (Steps are approx. 3 db)	Switch # 1 (On left) (Four steps)	Switch # 2 (In center) (Two steps)	Switch # 3 (On right) (One step)
Maximum Power	On – Up	On – Up	On – Up
Max less 3 db	On – Up	On – Up	Off – Down
Max less 6 db	On – Up	Off – Down	On – Up
Max less 9 db	On – Up	Off – Down	Off – Down
Max less 12 db	Off – Down	On – Up	On – Up
Max less 15 db	Off – Down	On – Up	Off – Down
Max less 18 db	Off – Down	Off – Down	On – Up
Minimum Power	Off – Down	Off – Down	Off – Down

REVISIONS				
LTR	ECO	DESCRIPTION	APPR'D	DATE
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E	00293	CHG THK		

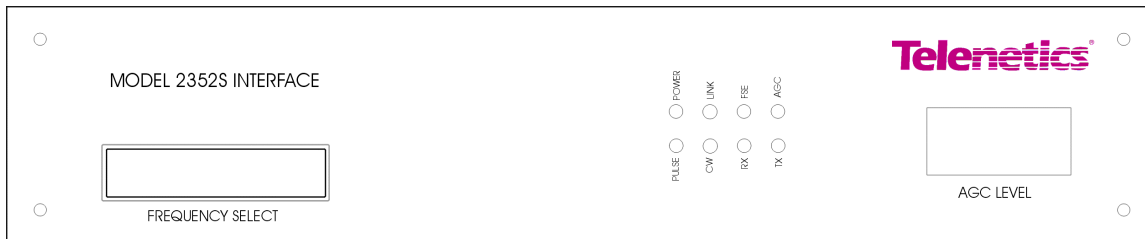


- NOTES (UNLESS OTHERWISE SPECIFIED)
1. MATERIAL - AL 5052-H32, .25 THK
 2. ALL DIMENSIONS IN INCHES
 3. TOLERANCE - XX.4.02
 4. MINIMUM BEND RADIUS: BREAK ALL SHARP EDGES
 5. FINISH - CHEMICAL FILM PER MIL-C-5541 TYPE I, GRADE C, CLASS 5, CLEAR

PROPRIETARY NOTICE		SIERRA DIGITAL COMMUNICATIONS	
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		APPROVED BY: [Signature]	6-6-93
		DESIGNED BY: [Signature]	6-10-93
		DWG NO: 380-00062-0001	SCALE: 1/2
		REV: E	FILE: 00062E.DWG
			SHEET 1

SECTION VIII

CONTROLS AND INDICATORS



TX ICU LED EXPLANATION

Power	Green	---	Indoor Unit AC Power Present
Link	Green	---	Indoor and outdoor units are communicating
CW	Green	---	On when 10 MHz signal present
PULSE	Green	---	On when TTL pulse signal present
FSE	Red	---	Improper Frequency selected. Check Freq. Settings
AGC	Red	---	Signal level below -75 db
RX Alarm	Red	---	RX Synthesizer/ Receiver Fault
TX Alarm	Red	---	TX Synthesizer/ Transmitter Fault

RX ICU LED EXPLANATION

Power	Green	---	Indoor Unit AC Power Present
Link	Green	---	Indoor and outdoor units are communicating
CW	Green	---	On when PLL is locked to a 10 MHz signal present
PULSE	Green	---	On when TTL pulse signal is received
FSE	Red	---	Improper Frequency selected. Check Freq. Settings
AGC	Red	---	Signal level below -75 db
RX Alarm	Red	---	RX Synthesizer/ Receiver Fault
TX Alarm	Red	---	TX Synthesizer/ Transmitter Fault

SECTION IX

LIMITED WARRANTY

Seller warrants to the Buyer that all Seller goods (equipment and component parts) when sold are free from defects in materials and workmanship under normal use and service for a period of one year from the date of shipment, as evidenced by Seller's or its agent's packing list or transportation receipt. Seller's obligation under this warranty shall be limited to the repair or replacement of goods. No person, including any dealer, agent or representative of Seller, is authorized to assume for Seller any other liability on its behalf.

Seller has no obligation or responsibility for goods, which have been repaired or altered by other than Sellers employees.

This warranty is the only warranty made by seller and is expressly in lieu of all other warranties express or implied, and warranties of merchantability and fitness for any particular purpose are specifically excluded.

WARRANTY CLAIM PROCEDURES

Defective goods must be returned, transportation charges prepaid, to seller for correction. Seller will pay return transportation charges for warranty repair. Upon redelivery of goods corrected under this warranty, the repaired or replaced portions shall be subject to this warranty for a period of 90 days or until expiration of the original warranty, whichever is later. All claims of failed or defective goods must be in writing and received by Seller within the specified warranty period. Seller will provide Buyer a return authorization number as authority to return the goods and for use in monitoring repair status.

Repair or replacement of defective goods will be at Seller's discretion and for the Buyer's account when the cause of failure is determined by Seller's examination to be misuse, mishandling or abnormal conditions of operation. In such event a firm price quotation for correction of the goods may be submitted to the Buyer. No repair or replacement work will be initiated prior to receipt of the Buyer's written authorization to proceed and approval of price, except as may be necessary to complete Seller's examination of the goods. If returned goods are determined not to be defective or if the Buyer elects not to authorize correction at its expense of goods not covered by its warranty, the Seller may charge a reasonable amount for such evaluation. Any amounts due Seller under these conditions will be subject to the same payment terms as the original sale. The Buyer will not recover from Seller by offset, deduction or otherwise, the price of any goods returned to Seller under this warranty.

REPAIR AND RETURN PROCEDURE

A return authorization number must be obtained from Telenetics before any items will be accepted for repair or return. Please contact the Telenetics Customer Service organization at (916) 624-7313 to obtain this authorization number. When contacting Customer Service, you will need your Model number, Serial number, a Purchase Order number (if out of warranty), a responsible technical contact, and a description of the problem. Please have this information available prior to calling.

SECTION X

GLOSSARY OF MICROWAVE RADIO TERMS

This glossary of microwave radio terms is offered in the belief that it will aid in the understanding of the application of Telenetics microwave radios.

A.G.C.

Automatic Gain Control voltage, which indicates the relative signal strength of the microwave carrier, used to align the RF head during installation; also useful in determining the status of the microwave link.

ALARM

An indication of an error condition.

AUXILIARY SUBCARRIER

An extra carrier for a specialized circuit.

BANDWIDTH

The portion of the frequency spectrum, expressed in Hertz, required for the transmission of one or more signals.

BASEBAND (BB)

The band of frequencies occupied by the signal before it modulates the carrier (or sub-carrier) frequency.

BIT ERROR RATE (BER)

The ration of erroneous bits to total bits received in a specified measurement interval; Equivalently, the bit errors per second divided by the data rate in bits per second.

CARRIER

A high frequency signal, which may be varied from a known reference by modulation.

C.C.I.R. (International Radio Consultative Committee)

International Standards Committee covering the radio transmission of information; a committee of the International Telecommunications Union (ITU) Geneva Switzerland.

CHANNEL

The pair of frequencies used by the two RF heads within a link to transmit data between them.

CW

Continuous wave. Typically a sine wave of a given frequency.

GUNN DIODE

The high frequency device that generates the signal in an SDC radio.

INTERFACE UNIT

The ground level equipment used interface between the users equipment and the RF head; contains a power supply and interface board(s).

LED

Light Emitting Diode; a solid-state lamp used to indicate status.

MODEM

A contraction of modulator-demodulator

SECTION X

GLOSSARY OF MICROWAVE RADIO TERMS (Continued)

MULTIPLEXING

The subdivision of a transmission facility into two or more channels.

PATH

The physical airspace between the two antennas.

PRR

Pulse Repetition Rate. The rate at which pulses occur, expressed in frequency such as 100 Hz

PULSE

In context of this product a TTL level signal of varying pulse width and repetition rate.

PULSE CODE MODULATION (PCM)

An encoding rather than a modulation technique in which quantized samples of analog information are buffered and retimed. Digital data are transmitted in the form of binary words, each consisting of a fixed number of bits. These PCM data words are arranged in a single serial bit stream by the data source and fed to the communications channel in continuous uniformly timed fashion. Normally word identification bits and synchronization bits are mixed with the data words in a regular and predetermined pattern.

R.F. HEAD (HEAD)

In the case of the 31 GHz unit, a pole mounted transmitter/ receiver/ antenna assembly. In the case of the 23 GHz and 18 GHz units, the antenna is not supplied.

SUMMARY ALARM

A single alarm that indicates that one of several alarms has occurred may be tied to a common office alarm.