

RECEIVER MODELS R2000/R2100/R4000

User's Manual



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**This device complies with Part 15 of the FCC Rules.
Operation is subject to the following two conditions: (1)
This device may not cause harmful interference, and (2)
This device must accept any interference received,
including interference that may cause undesired
operation.**

INTRODUCTION

Thank you for purchasing an Advanced Telemetry Systems' receiver. Our receiver is a radio frequency receiver which comes in a 2 MHz or 4 MHz version. The receiver can be programmed to scan frequencies or you can manually tune it. There are three models of our scientific receiver. Table 1 demonstrates the differences of the three.

MODEL	CHANNELS	SIGNAL DETECTION METHOD	MEMORY BANKS	COMPUTER INTERFACE
R2000	2000	AUDIO ONLY	1	NO
R2100	2000	AUDIO/TONE DECODER	1	YES
R4000	4000	AUDIO/TONE DECODER	4	YES

Table 1 - Differences in Receiver Models

As you notice, only model R2000 does not contain a tone decoder. A tone decoder is needed when the receiver is used with a data collection computer to create an automatic data collection system.

RECEIVING PROCEDURES

Operationally, the receiver works by acting as a filter to select a very narrow window in the frequency spectrum. The position of this filter in the frequency spectrum is determined by the frequency selection (tuning). The receiver rejects signals and noise outside the filter window and passes signals and noise within the window. Additionally, the receiver translates the signal to a frequency within the hearing range. For all receiver models, you can listen to what the receiver is picking up. Otherwise, you can use the tone decoder to see what the receiver is picking up. If the tone decoder picks up a transmitter's signal, a plus sign (+) will flash on the receiver's display to the left of the frequency. In order for the tone decoder to work, the audio control must be turned off.

Using either the tone decoder or the audio, the receiver can be tuned manually or programmed to scan a set of frequencies at a set interval.

CONNECTIONS

ATS receivers have five connectors except the model R2000 which has four. Figure 1 displays those connectors.

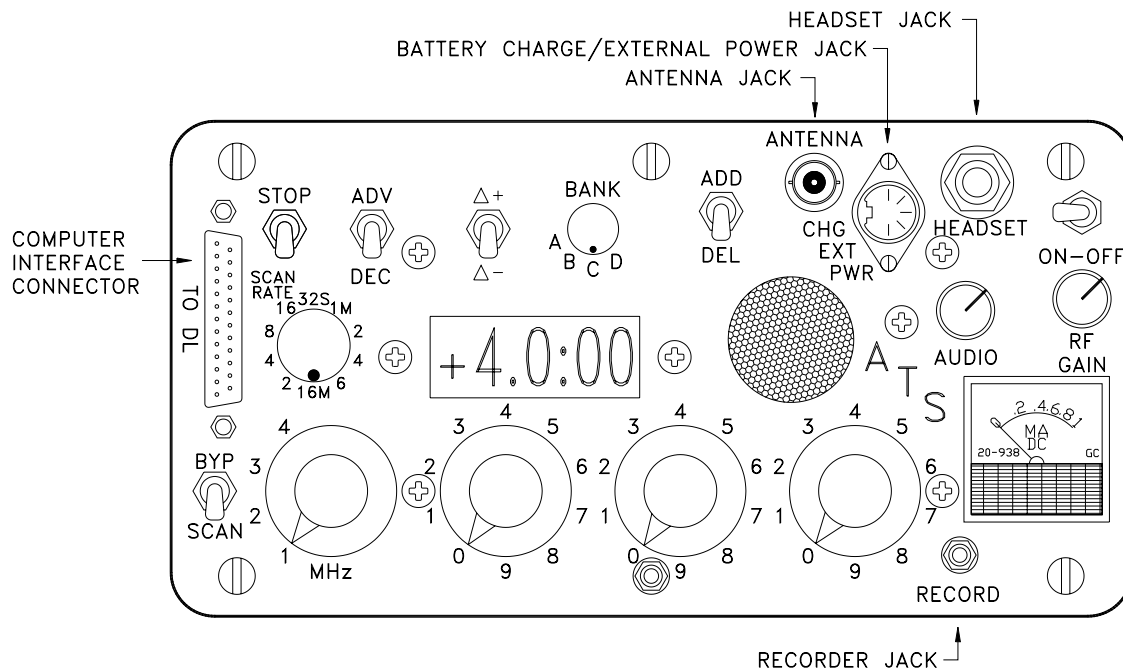


Figure 1 - Receiver Connections (Model R4000 shown)

- Antenna Jack

To connect an antenna to the receiver use the antenna jack. This jack requires a BNC connector to attach an external antenna.

- Battery Charge/External Power Jack

The Charge/Ext Power jack serves two purposes, as its name states. To charge the receiver's internal batteries, plug the charger in here. When the receiver's batteries are not charging, this jack can be used to power the receiver externally.

Using an external power cord, connect the external power source (11.5 - 15VDC) to the receiver. When an external power source is used, the receiver automatically switches from internal to external power. With Model R2000 receivers, you can hear a click when the receiver's relay switches from its internal batteries to an external power source.

NOTE: Having external power connected to the receiver will not recharge the receiver's internal batteries. To recharge the receiver's internal batteries, plug the battery charger ATS supplied into the receiver's CHG EXT PWR jack when the receiver is not operating.

An external power source can be a deep cycle marine battery, a solar panel, a cigarette lighter in a car, a gell cell battery, etc. Please note that ATS can provide you with the different cables needed to connect to external power sources.

Be sure the receiver is off when disconnecting the external power source. If the receiver is on, the receiver will revert to internal power and drain its batteries.

NOTE: Standard receivers use a 3-pin external power cord. Older receivers (purchased before April 1991) with the "computer controlled on/off" option require an external power cord with a 5-pin connector. These receivers have a toggle switch in their record jack (labeled "REC" and located in the lower right-hand corner of the receiver's faceplate).

- Computer Interface Connector

If you are using a Data Collection Computer (DCC), connect the receiver to the DCC via a ribbon cable attached to this connector.

The DCC will be programmed to control the receiver's operation, interpret the data received by the receiver, and store this data along with the date and time. Having a DCC interfaced with the receiver produces an automatic datalogging system.

- Headset Jack

To listen to the receiver's audio signal through a headset, plug the headset into the receiver's headset jack. When a headset is connected, the receiver's speaker is disabled. The headset jack accepts a standard 1/4" monaural plug. Standard stereo plugs are also acceptable if both head pieces are wired to the tip. Impedance into the headset jack is approximately 8 ohms. Headsets with impedances of 8 to 2000 ohms may be used.

- **Recorder Jack**

Plug a 0-1mA external recorder (ex. 0-1mA Model 288 Rustrak recorder) into the receiver's recorder jack. This jack requires a 1/8" diameter plug (switchcraft #750). The recorder jack connects the external recorder in series with the receiver's signal meter for chart recording. The external meter option is designed to read accurately for a 100 ohm external meter.

INTERACTING WITH THE RECEIVER

Most receivers contain three types of toggle switches on their faceplates. The three types are locking toggle, momentary toggle, and regular toggle switches. To move a locking toggle switch from its current position, you must pull up on the toggle and then move it. Locking toggles are often used for the on/off power control so that the power cannot be turned on or off inadvertently. A momentary toggle switch can be moved from its current position by pushing on it but it will always flip back to its former position. This type of toggle switch is always used for delta tune, add/del, and adv/dec switches because you do these functions one at a time. The regular toggles are moved by pushing them into the desired position. Regular toggles will stay in the position you move them to.

RECEIVER CONTROLS

This two-part section discusses each of the receiver's controls. The first part covers the receiver models R2000 and R2100. The second part covers the receiver model R4000.

Receiver Models R2000 and R2100

Refer to Figure 2 for the locations of the controls.

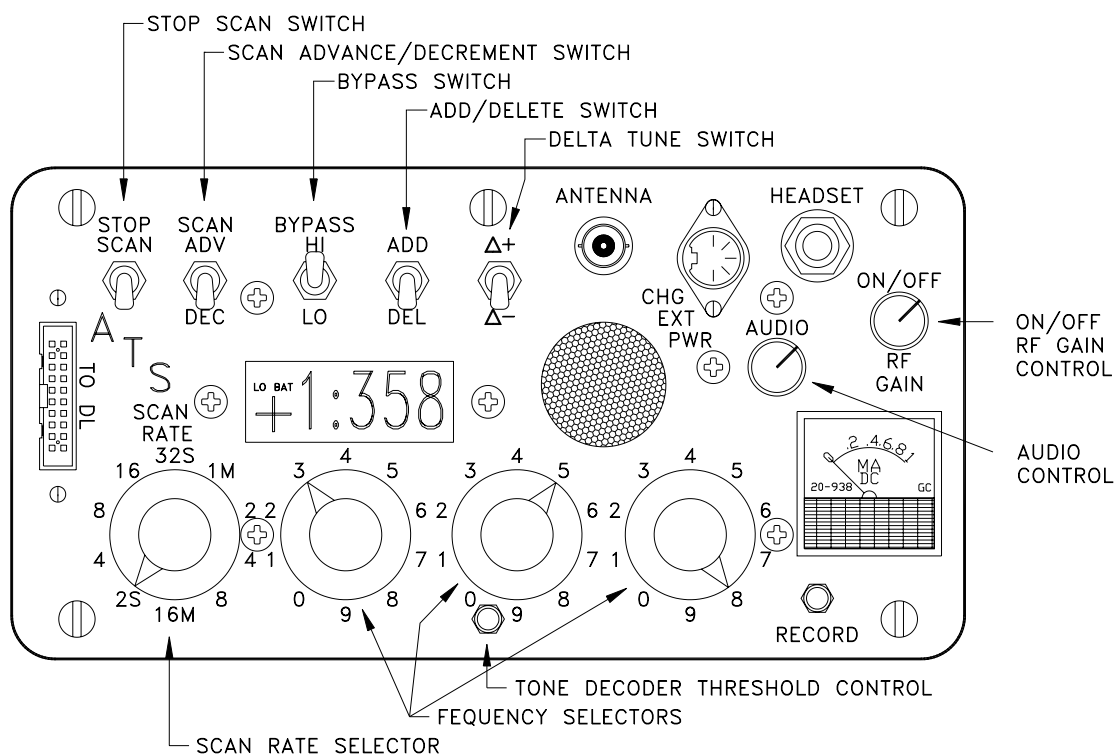


Figure 2 - Receiver Controls for Models R2000 and R2100

- **Add/Delete Switch**

Use this switch to add or delete a frequency to the memory when the bypass switch is in any position. Or, use this switch to program all frequencies into the memory or to delete all frequencies from the memory at once by holding it in the add or delete position (when the bypass switch is in the middle position).

- **Audio Control**

Controls the audio level of the speaker or headset. Maximum audio level occurs with the control positioned fully clockwise.

Model R2100

The audio control acts as a switch to turn the tone decoder on and off. When the audio control is off, the tone decoder is activated. The plus sign on the left side of the frequency display then indicates signal presence. The plus sign is normally on while the audio is on.

- **Bypass Switch**

Transfers control of receiver frequency selection from the memory to the frequency selectors or vice versa. It also switches the receiver from low to high band. If the frequency appears as four digits (with the first digit being a "1"), the receiver is in the high band. If the frequency appears as three digits, the receiver is in the low band. With the bypass switch in the middle position, the receiver's frequencies are selected by the memory.

Attention: When using a Model R2100 receiver with a Data Collection Computer (DCC) , set the bypass switch to either the HI or LO position.

- **Delta Tune Switch**

Use this switch to tune the receiver's frequency up or down by 4 kHz.

- **Frequency Selectors**

Use the three frequency selector knobs to tune the last three digits of the desired frequency. The frequency can be selected in 1 kHz increments over a 1 MHz range. The megahertz range (or the first digit of the frequency) is selected by setting the bypass switch.

- **On/Off RF Gain Control**

This control has two functions. First, it operates as a switch to turn power on and off. Second, it controls the gain of the intermediate frequency (IF) amplifiers. Maximum gain occurs with the control positioned fully clockwise. The sensitivity of the receiver is set with this control.

- **Scan Advance/Decrement Switch**

Allows you to rapidly move through the frequencies programmed in memory; moving forwards or backwards through the frequencies in numerical order. This switch overrides the scan rate and stop scan switches.

- **Scan Rate Selector**

Adjusts the length of time the receiver will monitor a frequency programmed in the receiver's memory. This control is effective only when the bypass switch is in the center or bypass position. A range of 2 seconds to 16 minutes is available.

- **Stop Scan Switch**

Stops the memory scan from advancing to the next frequency when placed in the upper position. The receiver will remain on the current frequency until the switch is lowered.

- **Tone Decoder Threshold Control**

Model R2100

To control the threshold of the tone decoder, turn this control clockwise to increase sensitivity (reduce the threshold level) or counterclockwise to decrease sensitivity (increase the threshold level).

Receiver Model R4000

Refer to Figure 3 for the locations of the controls.

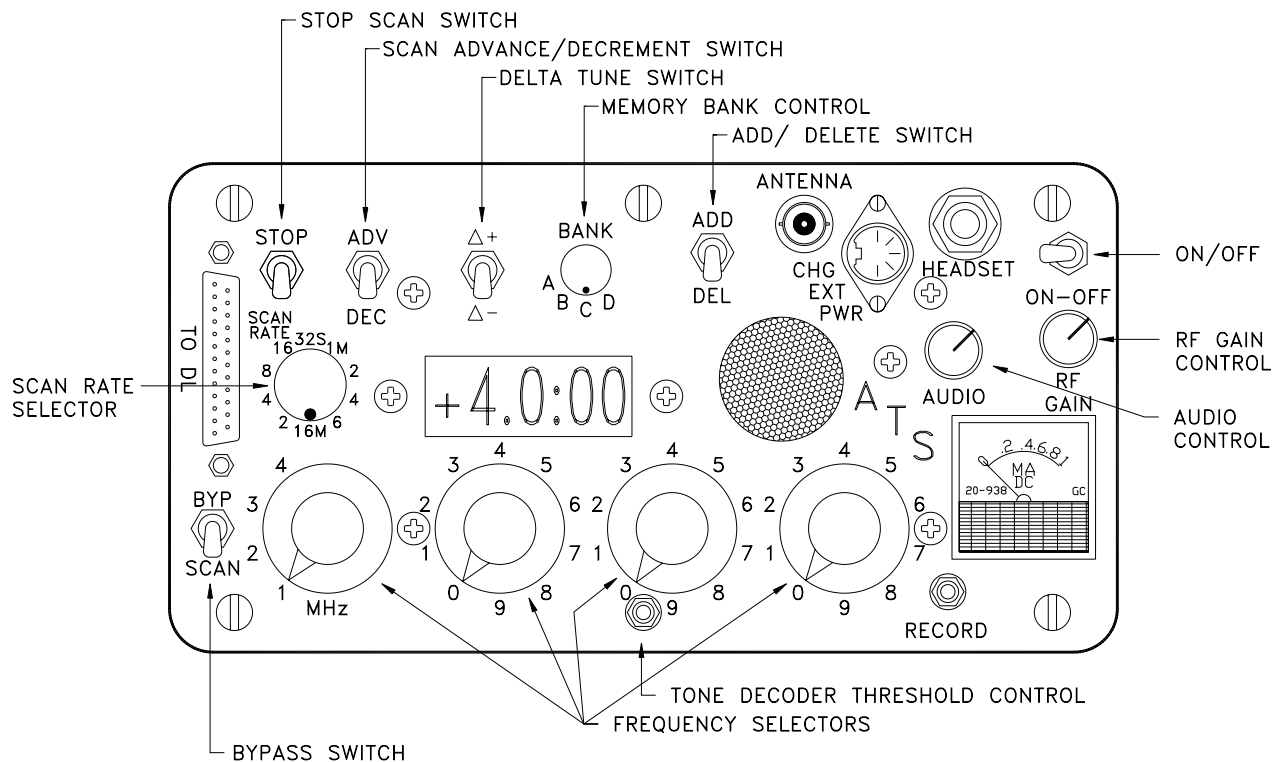


Figure 3 - Receiver Controls for Model R4000

- **Add/Delete Switch**

Use this switch to add or delete one frequency or all frequencies to the memory.

- **Audio Control**

Controls the audio level of the speaker or headset. Maximum audio level occurs with this control positioned fully clockwise.

The audio control acts as a switch to turn the tone decoder on and off. When the audio control is off, the tone decoder is activated. The plus sign on the left

side of the frequency display then indicates signal presence. The plus sign is normally on while the audio is on.

- **Bypass Switch**

Transfers control of receiver frequency selection from the memory to the frequency selectors or vice versa. If this switch is in the bypass position, the user can manually tune the frequency using the frequency selectors. If this switch is in the scan position, the receiver will begin scanning through the frequencies programmed in the receiver's memory.

- **Delta Tune Switch**

Use this switch to tune the receiver's frequency up or down by 4 kHz.

- **Frequency Selectors**

Use the four frequency selector knobs to tune the desired frequency. The frequency can be selected in 1 kHz increments over a 4 MHz range. The megahertz switch (the left-most knob) selects one of the four megahertz ranges.

- **Memory Bank Selector**

Use this dial to select which memory bank to use.

- **On/Off Switch**

Use this switch to turn the receiver on or off.

- **RF Gain Control**

This control varies the gain of the intermediate frequency (IF) amplifiers. Maximum gain occurs with the control positioned fully clockwise. The sensitivity of the receiver is set with this control.

- **Scan Advance/Decrement Switch**

Allows you to rapidly move through the frequencies programmed in memory; moving forward or backward through the frequencies in numerical order. This switch overrides the scan rate and stop scan switches.

- **Scan Rate Selector**

Adjusts the length of time the receiver will monitor a frequency programmed in the receiver's memory. This control is effective only when the bypass switch is in the center or bypass position. A range of 2 seconds to 16 minutes is available.

- **Stop Scan Switch**

Stops the memory scan from advancing to the next frequency when placed in the upper position. The receiver will remain on the current frequency until the switch is lowered.

- **Tone Decoder Threshold Control**

To control the threshold of the tone decoder, turn the control clockwise to increase sensitivity (reduce the threshold level) or counterclockwise to decrease sensitivity (increase the threshold level).



- Low Battery Indicator

When the receiver's internal batteries are low and need recharging, the words "LO BAT" flash on the receiver's display to the left of the frequency. See the section on **POWER CONSIDERATIONS** for directions on charging the receiver's batteries.

- Plus Sign

On the receiver's display to the left of the frequency, there may appear a plus sign. To learn about what this plus sign means, follow the flowchart in Figure 5.

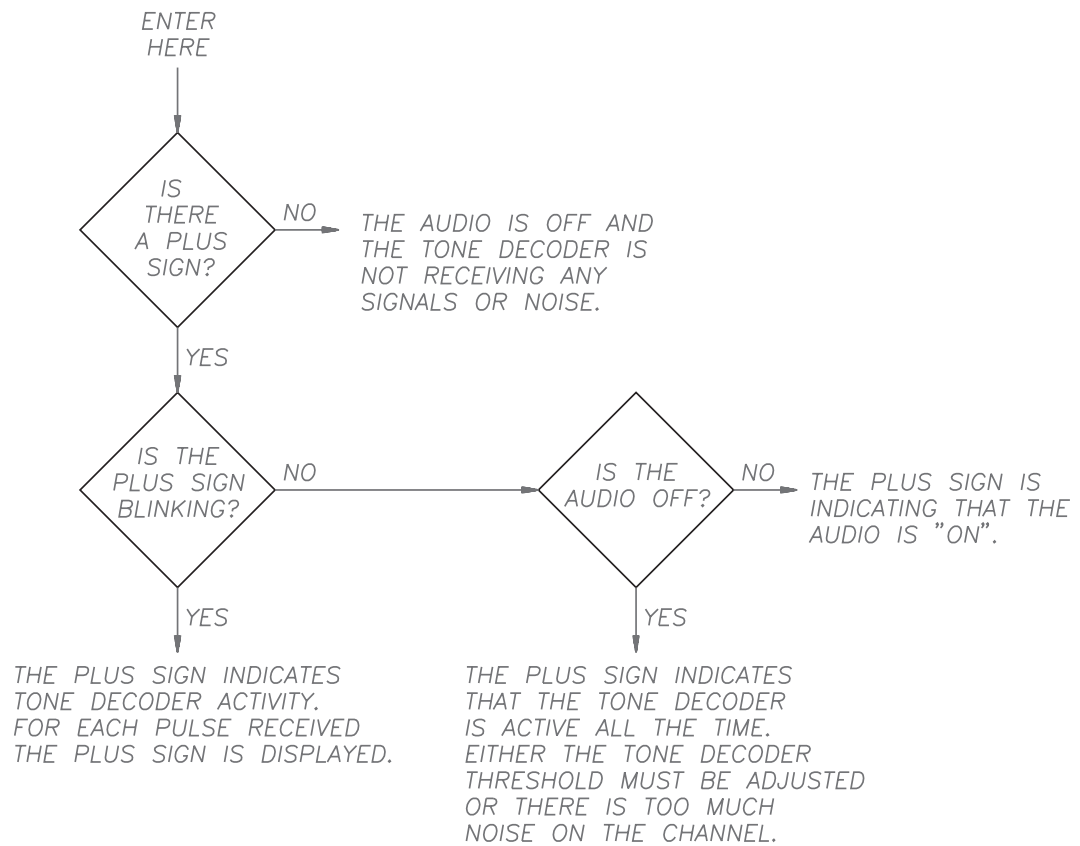


Figure 5 - Explanation of Plus Sign Indicator

- **Signal Meter**

The signal meter indicates the strength of the audio signal on the receiver's channel. It can be used as an indicator of signal strength in direction finding or as an indication of activity (if the activity behavior modifies the signal amplitude). Also, it integrates the signal level to make the meter less responsive to noise and to keep the meter needle from bouncing on pulsing transmitters. The meter level can be offset by an internal control adjustment.

- **Stored Frequency Indicator**

When a colon is present on the receiver's display, it means that the frequency displayed is stored in the receiver's memory.

PROGRAMMING THE RECEIVER

This section covers the steps to program the receiver's memory and scan rate.

To Add a Frequency to Memory

Models R2000 and R2100

1. Set the bypass switch in the HI or LO position.
2. Select the desired frequency with the frequency selectors.
3. Push the add/delete switch upward.
4. Watch to see that a colon appears between the hundredths digit and tenths digit.

The colon signifies that the frequency has been added to the memory. If a colon was present when the frequency was selected, the frequency was already in the memory.

Model R4000

1. Set the memory bank selector to choose which of the four memory banks to use.

Each memory bank is independent. A frequency may be added to one or all banks.

2. Put the bypass switch in the bypass position.
3. Select the desired frequency with the frequency selectors.
4. Push the add/delete switch upward.
5. Watch to see that a colon appears between the hundredths digit and tenths digit.

The colon signifies that the frequency has been added to the memory. If a colon was present when the frequency was selected, the frequency was already in the memory.

To Delete a Frequency from Memory

Models R2000 and R2100

1. Set the bypass switch in the HI or LO position.
2. Select the desired frequency with the frequency selectors.
3. Push the add/delete switch downward.
4. Watch to see that the colon disappears between the hundredths digit and tenths digit.

Model R4000

1. Set the memory bank selector to chose which memory bank to use.
2. Put the bypass switch in the bypass position.
3. Select the desired frequency with the frequency selectors.
4. Push the add/delete switch downward.
5. Watch to see that the colon disappears between the hundredths and tenths digits.

To Program All Frequencies into the Memory

Models R2000 and R2100

1. Set the bypass switch in the middle position.
2. Hold the add/delete switch upward for approximately 4 seconds.

After approximately 4 seconds, the receiver will start to scan, adding all the frequencies to the memory. If using a 150-151.999 MHz receiver, this would program every frequency from 150.000 to 151.999 MHz in 1 kHz increments into the memory.

Model R4000

1. Set the bypass switch in the scan position.
2. Hold the add/delete switch upward for approximately 4 seconds.

After approximately 4 seconds, the receiver will start to scan, adding all the frequencies into the memory. If using a 150-153.999 MHz receiver, this would program every frequency from 150.000 to 153.999 MHz in 1 kHz increments into the memory.

To Delete All Frequencies from Memory

Models R2000 and R2100

1. Set the bypass switch in the middle position.
2. Hold the add/delete switch downward for approximately 4 seconds.

After approximately 4 seconds, the receiver will start to scan, deleting all the frequencies stored in the memory.

Model R4000

1. Set the bypass switch in the scan position.
2. Hold the add/delete switch downward for approximately 4 seconds.

After approximately 4 seconds, the receiver will start to scan, deleting all the frequencies stored in the memory.

To Choose the Scan Rate

The scan rate selector controls how long the receiver remains tuned to each programmed frequency in the memory mode of operation. Scan rate is adjustable from 2 seconds to 16 minutes.

SCANNING FREQUENCIES STORED IN MEMORY

This section explains how to scan through the frequencies you have programmed in the receiver's memory.

To Start Scanning

Model R2000 and R2100

Place the bypass switch in the middle position to start the receiver scanning through the frequencies programmed in the receiver's memory.

Model R4000

Place the bypass switch in the scan position to start the receiver scanning through the frequencies programmed in the receiver's memory.

To Delete a Frequency from Memory while Scanning

1. Wait until the receiver stops on the frequency you wish to delete.
2. Push the add/delete switch downward.
3. Watch to see that the frequency disappears and the next frequency is displayed.

Deleting frequencies from the scanning cycle as the transmitters are found saves time, especially during aerial searches.

To Rapidly Move through Frequencies Programmed in Memory

The scan advance/decrement switch is used to skip over programmed frequencies at a fast rate. The memory advances or decrements in numerical order. Advance skips to the next higher frequency; decrement skips to the next lower frequency. The decrement feature is useful when a transmitter is heard at the end of the scan interval and the memory advanced to the next frequency before the stop scan switch could be activated. The scan advance/decrement switch overrides the scan interval set by the scan rate selector.

To Stop Scanning

The stop scan switch stops the memory scan indefinitely. When you want to stay on a programmed frequency, simply place this switch in the upper position. Place the switch in the lower position to resume scanning. The stop scan switch is useful when a signal is heard while searching for a number of animals and detailed information is needed as to where the animal is located.

RECEIVER OPERATIONS

This section explains how to use the receiver in audio mode. When you are using the receiver without an external recording device, you will want to use the receiver in the audio mode. The receiver's tone decoder is for use with an external recording device such as a Data Collection Computer (DCC).

1. Turn the ON/OFF RF Gain control fully clockwise.

The ON/OFF switch controls the power to the receiver whether the receiver is operating on its own internal batteries or an external power source (11.5 - 15VDC).

With the RF Gain control positioned fully clockwise, the receiver operates at maximum gain to achieve maximum sensitivity.

2. Set the audio control at a comfortable noise level on the speaker or in the headset.

The audio level does not affect the signal to noise ratio or sensitivity except for its effect on hearing sensitivity. It does, however, affect the signal meter indication.

3. Select a frequency.

Models R2000 and R2100

With the bypass switch in the middle position, the memory controls the frequency. With the bypass switch in the HI or LO position, the memory is disabled and the frequency selectors control the frequency. The frequency can be tuned in 1 kHz increments over a 1 MHz range. The LO and HI positions determine if the receiver is using the low or high frequency band. For example, using a 150-151.999 MHz receiver with the bypass switch in the LO position, the receiver would be in the 150-150.999 MHz range. With

the bypass switch in the HI position (again using a 150-151.999 MHz receiver), the receiver would be in the 151-151.999 MHz range. A “1” appears before the frequency indicating the high band.

Model R4000

With the bypass switch pointing to scan, the memory controls the frequency. With the bypass switch pointing to bypass, the frequency selectors control the frequency. The four frequency selectors let you tune in 1 kHz increments over a 4 MHz range.

4. Find the signal.

The delta tune switch allows you to check one IF bandwidth (± 4 kHz) on each side of the frequency without changing the frequency selectors. Use this switch if no signal is heard on the programmed frequency. Simply hold the switch in the desired position. The frequency display will not change when this switch is activated. The delta tune switch can be activated in both the bypass and memory modes. The delta tune switch is useful if it becomes necessary to retune the least significant digit of the frequency to compensate for frequency drift. It reduces the number of frequencies you would need to program if you had to check on both sides of the original transmitter frequency.

5. Reduce the RF gain by turning the RF gain control counter-clockwise.

Once the signal is found, the RF gain should be reduced to achieve a signal level where differences in signal amplitudes can easily be detected. The RF gain should also be reduced as you move toward a signal source to prevent overload of the receiver.

Although overload causes no damage, it can be confusing since it causes spurious signals to be generated. Overload (spurious signals) can result in signals appearing on frequencies where no signal sources are supposed to be. This problem usually does not occur during normal operations. However, there are two circumstances where this might occur.

- Placing the transmitter too close to the receiver.

If you are bench testing your transmitters and receiver, and they are close together, you can get receiver overload. To correct this problem, make sure the receiver is not connected to an antenna and turn the RF gain down as needed.

- Moving in on the transmitter's location.

As you move toward the transmitter's signal, you will have to turn down the RF gain to avoid overload. Also, verify that you are correctly tuned in on the transmitter's frequency.

Setting the RF gain control is the most critical for accurate and efficient signal source detection.

INTERPRETING THE DATA

Standard transmitters pulse on and off at a constant rate. Many of the standard transmitters use a rate of 60 pulses per minute (ppm). That is one pulse per second.

If you stay on a channel counting pulses for 10 seconds you should see (or hear) approximately 10 pulses during that time. You may see 8, 9, or 10 pulses if the transmitter is within range but what if you see 5 pulses, what does that mean? In that case, it could be a number of possibilities. It could mean there is no transmitter there at all, only noise. Although, if it was noise, it would not be pulsing on and off at a constant rate. It could also be a transmitter on the edge of the reception range or a transmitter which is not properly tuned in.

To avoid as many of these problems as possible, you should thoroughly field test the system. You will need to check for noisy channels. Tune your transmitters according to the directions in APPENDIX B. Also, learn how to correctly adjust the tone decoder threshold control on the receiver.

POWER CONSIDERATIONS

The receiver's internal Nicad batteries should be recharged approximately 1.5 hours for every 1 hour of use. Do not leave the charger on indefinitely because damage to the cells may occur.

NOTE: Only use the battery charger to recharge the receiver's internal batteries. Do not use the battery charger to power the receiver from an AC outlet. No harm will be done if you try this. However, using the battery charger in this way may not provide sufficient power over time and may also contribute noise. If you need to power the receiver from an AC outlet, you can purchase an AC adapter from ATS.

When the battery voltage is low (whether using the internal batteries or an external power source), the low battery indicator will flash on the frequency display. There is approximately 1 hour of battery life remaining at this time if you are using the internal batteries.

The memory is kept alive when the receiver is shut off by a small internal power source. This source should last at least five years.

MAINTENANCE

We designed the receiver to be trouble-free for extended periods of use. To help maintain its trouble-free status, we suggest the following:

1. Avoid extremes of temperature and humidity whenever possible. Storing the receiver on a vehicle dashboard in full sunlight will age the batteries and components faster.
2. Avoid placing the receiver or its antenna near high-powered radio transmissions such as CB radio transceivers. These can cause damage to the receiver.
3. Avoid dust and sand, whenever possible. Keep the receiver in its padded nylon case as much as possible. Although the switches have gaskets, some grit may enter causing the switches to wear out faster.
4. Check your receiver's batteries as follows:
 - a. Fully charge the batteries by leaving the charger in overnight.
 - b. Turn the receiver on.
 - c. Watch to see that the receiver operates for six hours before the low battery indicator begins to flash.
5. Keep the batteries charged during storage periods. Every 60-90 days, turn the receiver on for 4-6 hours until the low battery indicator comes on. Then, recharge the batteries and store the receiver.
6. Check the receiver's sensitivity by performing a range test in the field. In most cases, a malfunction causes a drastic reduction in range.
7. Service the receiver at our factory or one of our service centers.

APPENDIX A - WARRANTY

Advanced Telemetry Systems (ATS) warrants its receivers for a period of one year from the date of shipment. During the warranty period, ATS will repair or replace, at its option, any defective receivers.

Defective products must be returned to ATS in Isanti, Minnesota or to a designated service center for warranty service. The buyer shall prepay shipping charges to ATS; ATS will pay return shipping costs.

For service, return equipment to ATS. Please give a description of the services required on your equipment. For repairs, describe in detail any problems you are having, especially if problems are intermittent. Please visit our website at www.atstrack.com to obtain a repair form. If you are returning equipment from an international country, it is helpful to put the Tariff code of 9801.00.12 (Articles returned temporarily for repair) on your custom forms.

Limitations: Warranty does not apply to defects resulting from improper maintenance or use, physical damage, or operation outside environmental specifications.

No other warranties are expressed or implied. ATS specifically disclaims any implied warranties of merchantability and fitness for a particular use.

The remedies listed under this warranty are the buyers sole and exclusive remedy. ATS shall not be liable for any direct, indirect, special, incidental or consequential damages.

APPENDIX B - PROCEDURE FOR TUNING TRANSMITTERS

During the tuning process, the transmitter's temperature should be equivalent to the expected field temperature. Ideally, the final tuning should be done at the field site.

1. Place the transmitters 100 to 200 meters away from the receiving antenna.
2. Connect the receiving antenna to the receiver.
3. Turn the audio control on and turn the RF gain control to maximum.
4. Use the frequency selectors to tune in the transmitter's frequency.
5. Find the frequency range that the transmitter's signal comes in at (the range should be 3-5 kHz wide).

You may need to reduce the RF gain to keep the receiver from overloading.

6. The center frequency of this frequency range is the frequency you should use.

Note: For tuning transmitters for use with a DCC, see your DCC manual.

APPENDIX C - ADJUSTING THE THRESHOLD CONTROL

Models R2100 and R4000

You need to adjust the tone decoder threshold control if conditions are extremely noisy or extremely quiet.

1. Connect an antenna to the receiver.
2. Select a frequency where no valid signals are present.

Verify this by turning on the audio and if no pulses are heard, there are no valid signals present.

3. Turn the audio off.
4. Using a small flat screwdriver, turn the tone decoder threshold control clockwise until the “+” sign on the frequency display flashes.

The tone decoder is now triggering on noise.

5. Turn the tone decoder threshold control back (counter clockwise) until the “+” sign disappears.

APPENDIX D - QUESTIONS ??

If you have questions concerning your ATS receiver, call Advanced Telemetry Systems (ATS) at (763) 444-9267 or email sales@atstrack.com. You may also visit our website at www.atstrack.com.

APPENDIX E - RECEIVER SPECIFICATIONS

RECEIVER SPECIFICATIONS FOR MODELS R2000 AND R2100		
GENERAL	Frequency range: Channel spacing: Input impedance: Minimum discernable signal (MDS): Noise figure: Speaker: Tone decoder detection range: Tone decoder detection level: Frequency stability: Delta tune: IF frequency: IF bandwidth: Image rejection: RF gain control range: Operating voltage range: Dwell time:	Any specified 2 MHz range from 30 to 220 MHz 1 kHz 50 ohms -150 dBm (0.007 uv into 50 ohms) 3 dB maximum 8 ohms ± 2 kHz (Model R2100 only) -120 dBm minimum (Model R2100 only) ± 1 kHz -20 °C to + 50 °C + 4 kHz; -4 kHz 10.7 MHz 6 dB ± 2 kHz, 80 dB ± 7 kHz >150 dB >150 dB 9 to 18 volts DC Selectable 2 seconds to 16 minutes (10 positions)
CONTROLS	Frequency selectors (three) Audio level RF gain Delta Tune Add/Delete to memory	Auto scan/memory bypass Increment frequency up/down Dwell time (scan rate) Receiver on/off Tone decoder threshold (Model R2100 only)
MEMORY	All frequencies programmable Sequentially scanned Delete frequencies individually with single switch while scanning or in bypass mode Delete all frequencies Battery backed	
DISPLAYS	Selected frequency: Memory status: Battery status: Signal detection (Model R2100 only): Signal level:	LCD (0.5" H digits) with backlight for night use Colon in display indicates frequency stored in memory <i>Lo Bat</i> flashes when battery voltage is low + present in display indicates detection by tone decoder 0-1 mA meter
CONNECTIONS	Antenna: Headset: External Power/Recharge Receptacle: Signal Level: Computer Interface: (Model R2100 only)	BNC - female Receptacle for .250" phone plug 5 pin DIN 0.125" Phone Jack Receptacle For External 0-1 mA 100 ohm Current Meter 20 Pin Ribbon Cable (pins on receiver connector requires socket on cable)
POWER	12 volts DC nominal, 130 mA drain nominal Internal: External:	 1.2 Amp-hour Nickel Cadmium Battery Pack 8 Hour Nominal Operating Time 9 to 18 Volts DC, Negative Ground Switches Automatically to External Power When Present
COMPUTER INTERFACE (Model R2100 only)	4 Digits BCD (active high) Computer Control Select 5 Volt DC Regulated (5mA max) Ground Tone Decoder Output (active low)	
PHYSICAL	Size: Weight: Accessories (included): Accessories (optional):	4.3" wide x 8.3" long x 7" high (11 cm x 21 cm x 18 cm high) 5 lbs (2.3 kg) External Power Cord Battery Charger Padded Nylon Case Telex Aviation Grade Headset (Model R2100 only) Instruction Manual David Clark Aviation Grade Headset
ENVIRONMENTAL	Operating Temperature: Storage Temperature: Humidity:	-20 °C to +50°C -70 °C to +50 °C 95% Non-condensing
WARRANTY	One year parts and labor on materials and workmanship.	

RECEIVER SPECIFICATIONS FOR MODEL R4000		
GENERAL	Frequency range: Channel spacing: Input impedance: Minimum discernable signal (MDS): Noise figure: Speaker: Tone decoder detection range: Tone decoder detection level: Frequency stability: Delta tune: IF frequency: IF bandwidth: Image rejection: RF gain control range: Operating voltage range: Dwell time:	Any specified 4 MHz range from 147 to 220 MHz 1 kHz 50 ohms -150 dBm (0.007 uv into 50 ohms) 3 dB maximum 8 ohms ± 2 kHz -120 dBm minimum ± 1 kHz -20 °C to + 50 °C + 4 kHz; -4 kHz 10.7 MHz 6 dB ± 2 kHz, 80 dB ± 7 kHz >150 dB >150 dB 9 to 18 volts DC Selectable 2 seconds to 16 minutes (10 positions)
CONTROLS	Frequency selectors (four) Audio level RF gain Delta Tune Add/Delete to memory Auto scan/memory bypass	Increment frequency up/down Memory bank select Dwell time (scan rate) Receiver on/off Tone decoder threshold
MEMORY	Four distinct banks All frequencies programmable in each bank Sequentially scanned Delete frequencies individually with single switch while scanning or in bypass mode Delete all frequencies in a bank Battery backed	
DISPLAYS	Selected frequency: Memory status: Battery status: Signal detection: Signal level:	LCD (0.5" H digits) with backlight for night use Colon in display indicates frequency stored in memory <i>Lo Bat</i> flashes when battery voltage is low + present in display indicates detection by tone decoder 0-1 mA meter
CONNECTIONS	Antenna: Headset: External Power/Recharge Receptacle: Signal Level: Computer Interface:	BNC - female Receptacle for .250" phone plug 5 pin DIN 0.125" Phone Jack Receptacle For External 0-1 mA 100 ohm Current Meter 20 Pin Ribbon Cable (pins on receiver connector requires socket on cable)
POWER	12 volts DC nominal, 130 mA drain nominal Internal: External:	1.2 Amp-hour Nickel Cadmium Battery Pack 8 Hour Nominal Operating Time 9 to 18 Volts DC, Negative Ground Switches Automatically to External Power When Present
COMPUTER INTERFACE	4 Digits BCD (active high) Computer Control Select 5 Volt DC Regulated (5mA max) Ground Tone Decoder Output (active low)	
PHYSICAL	Size: Weight: Accessories (included): Accessories (optional):	4.3" wide x 8.3" long x 7" high (11 cm x 21 cm x 18 cm high) 5 lbs (2.3 kg) External Power Cord Battery Charger Padded Nylon Case Telex Aviation Grade Headset Instruction Manual David Clark Aviation Grade Headset
ENVIRONMENTAL	Operating Temperature: Storage Temperature: Humidity:	-20 °C to +50 °C -70 °C to +50 °C 95% Non-condensing
WARRANTY	One year parts and labor on materials and workmanship.	