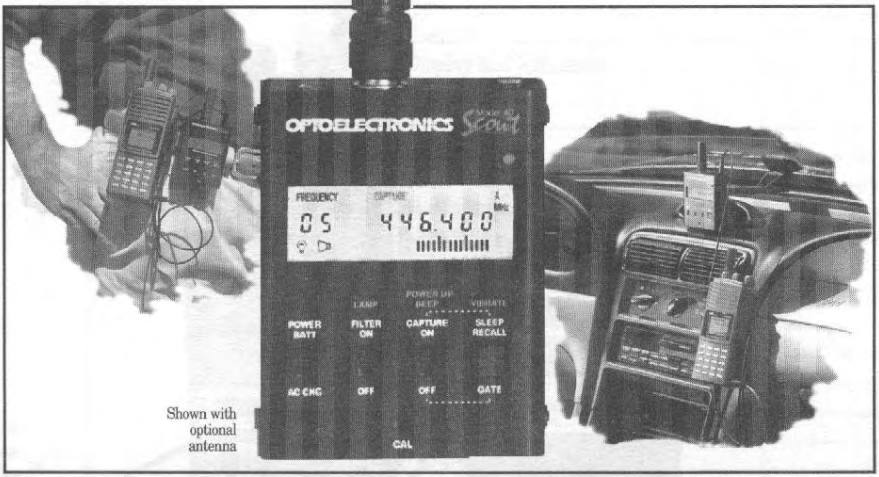
SCOUT OWNERS MANUAL

FREQUENCY RECORDER



Shown with optional antenna

OPTOELECTRONICS

Scout Model 40 Reaction Tunes The AR8000 Hand Held Scanner

TABLE OF CONTENTS

Introduction 4
External Connections 5
Internal Jumpers 6
Front Panel Controls 7
Front Panel Display and Indicators 10
Operation
- Power-Up 11
- LCD EL Backlight 12
- RF Signal Strength Bargraph 13
- NORMAL Mode 13
- FILTER Mode 14
- CAPTURE Mode 15
- RECALL Mode 17
- Memory Clear 18
- Rapid Charge Operation 19

Using the Scout 20
Antenna and Accessory Recommendations 21
CI-V Interface 22
AR8000/2700 Reaction Tune 24
Product Warranty 29
Factory Service 30

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INTRODUCTION

The Scout™ is the latest advance in hand-held frequency test instruments. It excels at finding and recording frequencies for security, law enforcement, and recreational monitoring applications. Patent pending technology developed by Optoelectronics employs statistical analysis to filter out actual radio transmission frequencies from the background RF.

The Scout™ is more than a test instrument in the traditional sense because it is useful for finding frequencies being used for two way radio communications. Designed to work with an antenna to pick up transmitted radio frequencies, it is actually a frequency recorder. Up to 400 unique frequencies can be stored in memory, along with up to 255 hits on each frequency. The recorded frequencies can be played back on the LCD display or data linked to a computer, a CI-V equipped communications receiver or an AOR AR2700/8000 hand held receiver.

The counter circuitry produces a coherent and stable count when there is a single dominant signal 10 to 20 dB stronger than any other signal or the RF floor. An embedded microprocessor evaluates each measurement statistically to determine when an actual RF frequency is dominant. This is the digital filter processing which makes automatic capture and recording possible.

Reaction tuning is when the Scout™ tunes a communications receiver, such as the OptoScan456 equipped PRO-2006 or the ICOM R7100, to any frequency passing the digital filter. Receiver tuning also occurs in RECALL mode. Scout™ can also tune the AOR AR8000 and AR2700 receivers.

For discreet recording, the Scout™ is small enough to fit in the pocket. A pager-style vibrator is built in to let the operator know when frequencies are recorded during a walk-by. For drive-by monitoring, a beeper can be activated to indicate new frequencies being recorded as well as hits on those recorded previously.

Other features include a signal level Bargraph, EL Backlight, rapid charge high capacity internal NiCad batteries, and single range operation. No antenna or input accessories are included with the base model Scout™. This is traditional with frequency counters because of the wide variety of applications that require different accessories. Check the current catalog for information on available accessories.

EXTERNAL CONNECTIONS

The Scout™ has three external connections located on the top panel. The functions of each are briefly described below. A more detailed discussion of the functions of the external connections is given in the OPERATION section.

POWER

DC power is supplied to the Scout™ through the POWER connector, a standard 5.5 mm o/d., 2.1 mm i/d. coaxial DC power jack located on the top panel (9 - 12 VDC, 500-1200 mA max., center positive). The POWER input is used for operation of the Scout™ from an external power source, as well as for charging the internal NiCad battery pack.

RF INPUT

The RF INPUT connector is a BNC connector located on the top panel, which provides a 50 Ohm RF input to the Scout™. This input is intended for antenna input use.

CI-V

The CI-V connector is a subminiature (2.5 mm) phone jack used to connect the Scout™ to a computer for the purpose of remote control, automatic data logging, and downloading stored frequency information. The connector is also used to connect the Scout™ to a scanning receiver for reaction tuning. The serial interface conforms to the ICOM CI-V interface standard. The TIP carries the TTL serial data, and the SHIELD provides the return. See the CI-V INTERFACE section for more information. AR8000/2700 transmit data format can be selected during power up.

INTERNAL JUMPERS

The Scout™ has two internal jumpers located on the printed circuit board inside the cabinet. Their function is briefly described below. A more detailed discussion of the function of the internal jumpers is given in the OPERATION section.

CI-V ADDRESS

There are two jumpers located on the Scout™ circuit board which are used to select the CI-V interface address. Four different addresses are available, making it possible for up to four Scout™ units to be connected to a CI-V interface bus. In order to communicate with the Scout™, the computer software must specify the address selected by the two jumpers. The CI-V address jumper settings are listed in Table 1. All addresses are specified in hexadecimal notation. The factory default setting, address 90, is shown in bold type.

Table 1. CI-V Address Jumper Settings.

U2 PIN 6	U2 PIN 7	ADDRESS
OPEN	**OPEN**	**90**
SHORT	OPEN	91
OPEN	SHORT	92
SHORT	SHORT	93

The Scout™ has four front panel controls. The functions of each are briefly described below. A more detailed discussion of the functions of the front panel controls is given in the OPERATION section.

POWER

The POWER switch activates the Scout™. When the POWER switch is in the ON position, the Scout™ is powered from the internal NiCad battery pack. If external power is present then trickle charge and a single rapid charge cycle can occur. When the POWER switch is in the OFF position and the Scout™ is powered from an external power source, the battery pack will charge automatically.

FILTER

The FILTER switch, in conjunction with the CAPTURE switch, is used to select the operating mode of the Scout™. When the FILTER and CAPTURE switches are both in the OFF position, NORMAL mode is selected, and the Scout™ functions as a conventional frequency counter. When the FILTER switch is in the ON position and the CAPTURE switch is in the OFF position, FILTER mode is selected. When the FILTER and CAPTURE switches are both in the ON position, CAPTURE mode is selected. When the FILTER switch is in the OFF position and the CAPTURE switch is in the ON position, RECALL mode is selected.

The FILTER switch also has an alternate function. When the Scout™ is turned on with the FILTER switch in the ON position, the LCD EL Backlight is enabled. Turning the Scout™ on with the FILTER switch in the OFF position disables the LCD EL Backlight.

CAPTURE

The CAPTURE switch, in conjunction with the FILTER switch, is used to select the operating mode of the Scout™, as described above.

The CAPTURE switch also has two alternate functions. When the Scout™ is turned on with the CAPTURE switch in the ON position, the beeper is enabled. Turning the Scout™ on with the CAPTURE switch in the OFF position disables the beeper.

The switch position is initially read when power is applied. It is also monitored during the display self-test interval. The CAPTURE switch can be used to toggle the communications language between CI-V and AR8000(AR2700). To change the communications language, simply change the initial position of the CAPTURE switch during the display self-test but before "SCOUT™ 3.1" is displayed. The selection will remain even when power is turned off so it is only necessary to follow this procedure when a change is desired. Following the 'SCOUT™" display, the communications language will be displayed, either "CI-5" (for CI-V) or "AR8000" (for AR8000 and AR2700). The AOR communications language is a send data only and so can only be used for Reaction Tune and Recall Tune.

GATE/RECALL/CLEAR

The GATE/RECALL/CLEAR push-button switch has three main functions. When the Scout™ is in NORMAL mode or FILTER mode, the push-button switch changes the gate time, and hence the measurement resolution. The Scout™ has four gate settings. Each time the push-button switch is pressed, the next gate setting is selected. The currently selected gate setting is indicated by the position of the decimal point on the frequency display. The gate time, measurement time, and measurement resolution corresponding to each gate setting are summarized in Table 2.

Table 2. Scout Gate Settings.

GATE SETTING	GATE TIME	MEASUREMENT TIME	MEASUREMENT RESOLUTION	EXAMPLE (MHz)
1	800 uS	8 mS	10 KHz	162.55
2	8 mS	14 mS	1 KHz	162.550
3	80 mS	90 mS	100 Hz	162.5500
4	800 mS	810 mS	10 Hz	162.55000

When the Scout™ is in CAPTURE mode, the 1 KHz resolution gate setting is automatically selected.

When the Scout™ is in RECALL mode, the push-button switch changes the frequency memory location displayed on the front panel display. The Scout™ can store up to 400 frequencies, along with the number of occurrences of each frequency. Each time the push-button switch is pressed, the next memory location frequency or count is displayed. When the Scout™ is in RECALL mode, the 1 KHz resolution gate setting is automatically selected.

The Scout™ frequency memory is protected and will not lose data unless there is an abrupt battery failure or disconnection. Clear the memory by holding down the GATE/RECALL/CLEAR push-button switch while switching the power off.

The push-button switch also has an alternate function. When the Scout™ is turned on while pressing and holding the push-button switch, the vibrator is enabled. Enabling the vibrator disables the LCD EL Backlight and the beeper, regardless of the setting of the FILTER and CAPTURE switches at power-up. Turning the Scout™ on without holding down the push-button switch disables the vibrator.

FRONT PANEL DISPLAY AND INDICATORS

The Scout™ incorporates a combination of visible, audible, and tactile indicators for use in a variety of applications. A more detailed discussion of the functions of the indicators is given in the OPERATION section.

DISPLAY

The Scout™ front panel display consists of a custom ten-digit Liquid Crystal Display (LCD) module. The results of all frequency measurements are displayed here, as well as signal strength Bargraph measurements and stored frequencies. The LCD module incorporates an electroluminescent (EL) Backlight, which permits viewing of the Scout™ display in low-light conditions or total darkness. The LCD EL Backlight can be enabled or disabled by the operator.

LED

The Light-Emitting Diode (LED) front panel indicator flashes each time a measurement is successfully completed. The rate at which the LED indicator flashes is dependent upon the gate setting and the operating mode.

BEEPER

The beeper, when enabled, provides an audible indication that a measurement has been successfully completed in either the FILTER mode or the CAPTURE mode. It provides essentially the same information as the LED indicator. However, in CAPTURE mode, a double beep is used to indicate the capture of a new frequency, while a single beep is used to indicate the capture of a frequency already stored in one of the memory locations. The beeper is useful in applications in which it may not be possible or convenient to look at the front panel (when driving, for example).

VIBRATOR

The vibrator, when enabled, provides a tactile indication that a measurement has been successfully completed in either the FILTER mode or the CAPTURE mode. It provides essentially the same information as the LED indicator. The vibrator is useful in applications in which secrecy is required. When the vibrator is enabled, the beeper and the LCD EL Backlight are automatically disabled.

In this section, the operation of the Scout™ is described in detail. A discussion of the front panel control functions in the various operating modes is provided, as well as the corresponding action of the front panel display and the various indicators.

POWER-UP

When the Scout™ is turned on, a display self-test is performed. The self-test consists of illuminating all front panel display segments and annunciators for approximately two seconds. followed by displaying SCOUT™ for another two seconds and then the communications language enabled for two seconds. The Scout™ then begins operation in the operating mode selected by the FILTER and CAPTURE switches.

If the FILTER switch is in the ON position at power-up, the LCD EL Backlight is enabled, and the Backlight annunciator is displayed. If the CAPTURE switch is in the ON position at power-up, the beeper is enabled, and the beeper annunciator is displayed. To enable the vibrator, press and hold the GATE/RECALL/CLEAR push-button switch before turning on the Scout™. Once the display self-test begins, release the push-button switch. When the vibrator is enabled, the corresponding annunciator is displayed. Enabling the vibrator disables the LCD EL Backlight and the beeper, regardless of the setting of the FILTER and CAPTURE switches at power-up. If the beeper is enabled, it sends the word S-C-O-U-T in Morse Code during the power-up display self-test.

Changing the position of the CAPTURE switch during the display self-test will toggle the serial communications language between CI-V and AR8000 (AR2700). The switch position will have already have been noted during power up and during display self-test any movement of the switch will toggle the communications mode. After the "SCOUT™" screen, the communications will be displayed for two seconds. Any CAPTURE switch movement after display self-test will not cause any changes.

Receiver initialization commands are transmitted via the serial interface during the power-up display self-test to initialize a scanning receiver which may be connected to the Scout™. Therefore, if the Scout™ is to be

Power-Up continued; LCD EL Backlight

used to tune a receiver, it is important that the receiver be connected to the interface and turned on before the Scout™ is turned on. During the power-up sequence, commands are issued to the receiver to select remote control (CI-V only) and narrow band FM mode (Note: Scout™ is designed to find VHF/UHF two way communications frequencies and so only tunes FMN). In the case of a Realistic PRO-2006 scanning receiver equipped with an Optoelectronics OptoScan456 board (or a PRO-2035 with an OptoScan535) , the front panel display of the PRO-2006 will go blank immediately after the Scout™ is turned on. This is an indication that the Scout™ has successfully initialized the receiver. The receiver is also initialized each time the operating mode is changed to any mode other than NORMAL mode.

LCD EL BACKLIGHT

The LCD EL Backlight permits viewing of the Scout™ front panel display in low-light conditions or total darkness. The Backlight can be enabled or disabled by the operator. To enable the LCD Backlight, place the FILTER switch in the ON position before turning the Scout™ power on. After the power-up display self-test begins, the FILTER switch setting may be changed as desired. Once the Backlight is enabled, it will remain enabled until the Scout™ power is turned off.

In order to conserve battery power, the LCD EL Backlight is controlled by an intelligent algorithm which automatically turns the Backlight on and off. The Backlight is turned on any time the GATE/RECALL/CLEAR push-button switch is pressed or the setting of the FILTER switch or CAPTURE switch is changed. The Backlight is also turned on any time a frequency measurement is successfully completed in either the FILTER mode or the CAPTURE mode. If none of the above conditions occur within ten seconds after the Backlight is turned on, the Backlight is automatically turned off.

RF SIGNAL STRENGTH BARGRAPH

The 16-segment Bargraph display is a part of the Scout™ LCD front panel display which provides a relative indication of RF signal strength. The Bargraph indication at a given time does not necessarily reflect the signal strength of the frequency shown on the display, but rather provides an aggregate signal level indication of all RF energy detected by the Scout™ at that instant. It is important to note that the RF signal strength Bargraph always provides a real-time signal level indication, whereas the frequency display may show a frequency which was detected at some time in the past.

The RF signal strength Bargraph functions the same in all operating modes, including RECALL mode. A Bargraph indication in RECALL mode does NOT indicate the signal level of the frequency stored in a given memory location. It indicates the composite RF signal level detected by the Scout™ at that instant. The RF signal strength Bargraph is ideal for uses such as the location of nearby transmitters and antenna pattern testing.

NORMAL MODE

NORMAL mode is selected by placing both the FILTER switch and the CAPTURE switch in the OFF position. In this mode, the Scout™ functions as a conventional, free-running frequency counter.

In NORMAL mode, frequency measurements are taken continuously. As each measurement is completed, the result is displayed, the LED indicator is flashed, and a new measurement is started. The amount of time between flashes of the LED indicator is equal to the measurement time corresponding to the currently selected gate setting. At the shortest measurement time, the LED indicator will flash so fast that, to the human eye, it will appear to be continuously illuminated.

The gate setting can be changed by pressing the GATE/RECALL/CLEAR push-button switch on the front panel. Changing the gate setting changes the gate time, and hence the measurement resolution, of the frequency counter. The Scout™ has four gate settings. Each time the push-button switch is pressed, the next gate set-

ting is selected. The currently selected gate setting is indicated by the position of the decimal point on the frequency display. The gate time, measurement time, and measurement resolution corresponding to each gate setting are summarized in Table 2.

When NORMAL mode is selected, the Scout™ accepts remote control commands via the CI-V serial interface. This is true even if AR8000 mode is selected because the communications mode only applies to Reaction Tune or Recall Tune and not to NORMAL mode. The command set allows many of the Scout™ functions to be accessed remotely by a host computer. These functions include reading the current frequency measurement result, reading the current gate setting, changing the gate setting, reading the current signal strength Bargraph measurement result, reading one or more frequency or count memory locations, and clearing all frequency and count memory locations. See the CI-V INTERFACE section for more information.

FILTER MODE

FILTER mode is selected by placing the FILTER switch in the ON position and the CAPTURE switch in the OFF position. FILTER mode is indicated by the "FILTER" annunciator on the front panel display. In this mode, random counting, noise, and false signals are reduced or eliminated. A unique digital filtering algorithm permits only meaningful measurements to be displayed. This makes using the Scout™ much easier and makes frequency finding much more powerful, because distant or short duration signals can be picked out of the background clutter.

In FILTER mode, as in NORMAL mode, frequency measurements are taken continuously. However, only those measurements which pass the digital filtering algorithm are displayed. Therefore, the frequency display always shows the most recent successful frequency measurement result. Correspondingly, the LED indicator only flashes when a measurement passes the filter. The gate setting may be selected the same as in NORMAL mode.

If the LCD EL Backlight is enabled, then the Backlight is turned on, if it is not already on, each time a measurement passes the filter. If ten seconds have elapsed since the last successful frequency measurement, then the Backlight is automatically turned off. If the beeper is enabled, then a single beep is sounded to indicate when a measurement passes the filter. If the vibrator is enabled instead, then the vibrator is activated for approximately one second. If frequency measurements are continuously passing the filter in rapid succession (i.e., reception of a continuous signal), then the vibrator will be on for one second, then off for one second repeatedly for the duration of the signal.

When FILTER mode is selected, the Scout™ automatically tunes a scanning receiver connected to the serial interface. Each time a frequency measurement passes the filter, a corresponding tuning command is transmitted to the receiver. This feature allows an operator to instantly monitor narrowband FM transmissions as they are detected by the Scout™. Note: ICOM receivers must be placed into Transceive Mode for Reaction Tune operation. Check the owners manual for information on how to place the receiver into Transceive mode. AOR AR8000/2700 receivers automatically go into Remote mode when ever a command is received

CAPTURE MODE

CAPTURE mode is selected by placing both the FILTER switch and the CAPTURE switch in the ON position. CAPTURE mode is indicated by the flashing "CAPTURE" annunciator on the front panel display. In this mode, the Scout™ uses its powerful digital filtering algorithm to capture and store up to 400 unique frequencies. In addition, the number of occurrences, or hits, of each frequency is stored in memory along with the frequency itself. An occurrence is defined as a transmission of any duration. For example, if a transmitter is keyed for six seconds, then unkeyed for one second, then keyed for one hour, it will be logged as two occurrences. However, if reception is marginal, dropouts in reception may be interpreted as multiple occurrences.

In CAPTURE mode, the 1 KHz resolution gate setting is automatically selected. When a frequency mea-

Capture Mode continued

surement passes the filter, it is first compared against all previously captured frequencies stored in memory to determine if it is a duplicate. If the newly received frequency is within 10 kHz of one of the frequencies already stored in memory, it is declared to be a duplicate, and the frequency count of the corresponding memory location is incremented. If the newly received frequency is not a duplicate, then it is stored in the next available memory location and logged as the first occurrence. In either case, the LED indicator is flashed, and the appropriate memory location is displayed on the front panel, along with the frequency stored in that location.

Memories are displayed as four banks of 100 memories. The "A" and "B" annunciators are used to indicate which bank is currently being displayed. Solid "A" indicates memories 0 - 99, solid "B" indicates memories 100 - 199, flashing "A" indicates memories 200 - 299, and flashing "B" indicates memories 300 - 399.

After 400 unique frequencies have been stored in memory, new frequencies will continue to be displayed as they are detected, but no memory location will accompany the displayed frequency. Each memory location can log up to 255 occurrences of the frequency stored in that location. If the number of occurrences of the frequency stored in a given memory location exceeds 255, then the frequency count will cease to be incremented, but the memory location and frequency will still be displayed as before. In other words, the Scout™ will continue to detect and display frequencies as long as CAPTURE mode is selected, even if all memory locations and their frequency counts are full.

If the LCD EL Backlight is enabled, then the Backlight is turned on, if it is not already on, each time a new or existing frequency is captured. If ten seconds have elapsed since the last frequency captured, then the Backlight is automatically turned off. If the beeper is enabled, then a double beep is sounded to indicate the capture of a new frequency, and a single beep is sounded to indicate the capture of a frequency already stored in memory. If the vibrator is enabled instead, then the vibrator is activated for approximately one second upon capturing a new or existing frequency.

If the GATE/RECALL/CLEAR push-button switch is pressed in CAPTURE mode, the Scout™ enters

SLEEP mode, which allows stored frequencies to be saved when the Scout™ is turned off. See the SLEEP MODE section for more information.

When CAPTURE mode is selected, the Scout™ automatically tunes a scanning receiver connected to the serial interface. Each time a new or existing frequency is captured, a corresponding tuning command is transmitted to the receiver. The Scout™ will continue to tune the receiver even after the memory locations and/or frequency counts are full. This feature allows an operator to instantly monitor narrowband FM transmissions as they are detected by the Scout™.

RECALL MODE

RECALL mode is selected by placing the FILTER switch in the OFF position and the CAPTURE switch in the ON position. RECALL mode is indicated by the "RECALL" annunciator on the front panel display. In this mode, the operator can view all 400 frequencies and counts stored in memory. No frequency measurements can be made when RECALL mode is selected. However, the RF signal strength Bargraph continues to function as before.

As in CAPTURE mode, memories are displayed as four banks of 100 memories, using the "A" and "B" annunciators to indicate which bank is currently being displayed. When RECALL mode is first selected, the frequency stored in memory location 0 is displayed on the front panel. Pressing and releasing the GATE/RECALL/CLEAR push-button switch causes the number of occurrences, or count, of the frequency stored in memory location 0 to be displayed. Pressing and releasing the push-button switch a second time causes the frequency stored in memory location 1 to be displayed. Pressing and releasing the push-button switch a third time causes the frequency count stored in memory location 1 to be displayed, and so on. After memory location 399 is displayed, the sequence starts again at memory location 0. To scroll rapidly through the 400 memory locations, simply press and hold the push-button switch. Notice that when the frequency stored in a given memory location is displayed, it is accompanied by the "FREQUENCY" and "MHz" annunciators. When a frequency count

is displayed, the annunciators disappear. A frequency and count of zero indicates an unused memory location.

The captured frequencies will remain stored in memory as long as the Scout™ power remains on. Switching back to CAPTURE mode will cause the Scout™ to resume capturing frequencies, but the frequencies already stored in memory will be preserved. New occurrences of previously captured frequencies will continue to increment the frequency count as before. In other words, new activity will only add to the existing data, not replace it.

When RECALL mode is selected, the Scout™ automatically tunes a connected scanning receiver to the frequency stored in the currently displayed memory location. This is true whether the frequency or the count is displayed. Each time the displayed memory location is changed by pressing the GATE switch, a corresponding tuning command is transmitted to the receiver. This feature allows an operator to instantly monitor narrowband FM transmissions on frequencies which have been previously captured by the Scout™.

MEMORY CLEAR

Because memory data is protected from all but catastrophic power loss, it is necessary to manually clear the memory when it is full. Memory Clear is accomplished by holding down the GATE/RECALL/CLEAR push-button switch while turning the power switch off. If the Scout™ memory is cleared, all captured frequencies and counts stored in memory are lost. To keep a permanent record of the frequencies and frequency counts stored in memory, be sure to select NORMAL mode and download them to a personal computer before clearing the memory.

RAPID CHARGE OPERATION

The red LED on the top panel of the Scout™ is the Rapid Charge indicator. When plugged into external power, the LED will illuminate to indicate when rapid charging is in progress. If the LED does not illuminate, then charging is complete or a fault condition has occurred.

The Rapid Charge circuitry monitors battery voltage and aborts charge when voltage parameters are not satisfied. If the battery pack is permitted to completely discharge, Rapid Charge may terminate after only 2-10 minutes. This is a safety feature to protect the battery pack, the Scout™, and the operator. If this happens, charging can be restarted by re-applying power (unplug the power adapter and plug it back in).

The Scout™ will automatically shut down when the battery pack is discharged. If the battery is not recharged and is permitted to discharge even further, the Rapid Charge circuit must be restarted several times before a complete charge cycle will occur.

The Scout™ is designed to rapid charge the NiCad batteries and automatically terminate when fully Charged. Automatic termination based on full charge detection requires the use of a 12V 1A adapter. Using anything less, rapid charge termination will be based on a programmed 1.5 hour time limit.

After Rapid Charge is complete, the batteries will be automatically trickle charged. A new attempt to Rapid Charge will terminate if the batteries are at full charge. Rapid Charge will not begin immediately if the battery pack is fully discharged. It will trickle charge to bring up the battery cell voltage and then begin Rapid Charge.

Using the AC90 adapter supplied, the 90 minute (approximate) time limit that will be reached is enough time to fully charge the batteries. To Rapid Charge in less than one hour, it is necessary to use at least a 1 amp adapter such as the Radio Shack 273-1653. In a vehicle, the 12V cigar lighter circuit can be utilized, along with a Radio Shack model 270-1562 high current DC adapter set for 9V.

It is normal for the Scout™ to become quite warm to the touch during Rapid Charge. The temperature rise meets commercial standards. It is advisable to closely monitor the Scout™ during Rapid Charge for excessive temperature rise. Make sure that the ambient temperature is not excessive and that there is sufficient air flow to help cool the unit.

USING THE SCOUT™

The Scout™ has the ability to differentiate between real coherent RF signals and the much more random combination of internal self oscillation and composite RF background. It can filter and capture an RF signal that is dominant. This is accomplished by a microprocessor that samples the counter output and performs statistical analysis. This method works very well, though there will be occasional false counts that pass the filter. Falses are caused either by statistical coincidence, or by a decrease in randomness. This is caused by the influence of signals that are not strong enough to be accurately counted. The Scout™ uses Patent Pending circuitry to nearly eliminates false captures.

To check for the degree of randomness, turn on the Scout™ with the FILTER and CAPTURE switches OFF. With no antenna, you will likely see the frequency display changing in the MHz digit and below. If you select CAPTURE mode, you will notice an occasional false count being recorded.

If you perform the same test as above with an antenna such as the RD800 cellular rubber duck, you will likely notice that the tens of MHz digit on the display is now changing as well as the lower order digits. The greater randomness of oscillation of the display digits means fewer false counts that pass the filter. This test assumes that there are no strong signals present. If there are, then the Scout™ will be influenced by them, thus decreasing the randomness.

The current Scout™ uses an exclusive dithering circuit that greatly reduces the occurrences of false captures. The improvement is dramatic and makes it possible to use almost any antenna. It is still advisable to have several different antennas and to test them with the Scout™ to determine the best combinations. UHF antennas will work at VHF and below, and will keep the degree of randomness of oscillation high. You will also find that the Scout™ exhibits different characteristics when hand held, placed on a surface, or plugged into an adapter cable.

To enhance the operation of the Scout™, a wide assortment of antennas and accessories are available from Optoelectronics. The following paragraphs will help you choose the right antennas and accessories for your application.

ANTENNAS

Antennas that work well with the Scout™ include the TA100S, RD440 and RD800. The DB32 is an extremely small dual band VHF/UHF antenna. It will not pick up VHF as well as the others, but it is excellent for discreet, in the pocket use because of its small size. The RD27 would be useful for 27 through 100 MHz.

FILTERS

The N100 FM broadcast notch filter will remove the influence from local stations, and will permit the Scout™ to pick up other signals that were being masked. The CF802 will bring in cellular signals from a much greater distance, nearly a 10X improvement. The BHP800, when used with a RD800 antenna, will eliminate all frequencies below, and increase the pick up distance for those above, 800 MHz. The APS104 active preselector works very well with the scout™, and, if the situation warrants, it is well worth the cost. Use the BLP70 only if your focus is below 70 MHz.

Data Interface

For a data interface cable, use a 3.5 mm to 3.5 mm mono phone plug (Radio Shack cat. no. 42-2420) along with a 3.5 mm jack to 2.5 mm plug adapter (Radio Shack cat. no. 274-327). For connection to the COM port of a computer, a TTL to RS-232C converter, such as the Optoelectronics CX12AR, is required. For connection to the OptoScan456 board, the cable and adapter are all that is needed.

Carry Case

The model CC12 carry case will hold the Scout™, antenna, and adapter. Do not rapid charge the Scout™ when it is inside the carry case.

CI-V INTERFACE

The serial interface on the Scout™ Surveillance Counter conforms to the ICOM CI-V interface standard. It allows the unit to be connected to a personal computer for the purpose of remote control, automatic data logging, and downloading stored frequency information. The interface is also used to automatically tune a scanning receiver. The CI-V interface is an asynchronous, half-duplex, TTL serial interface connected in a wire-OR (bussed) configuration. Several different devices can be connected to the bus simultaneously, and each device has its own unique address. Software developers are strongly encouraged to obtain a copy of the ICOM Communication Interface - V Reference Manual from ICOM, Inc. for detailed information on the CI-V interface protocol.

This two-wire interface is accessible via a subminiature phone jack located on the top panel, and consists of Serial Data (TIP) and Signal Ground (SHIELD). In order to connect the Scout™ to a personal computer, an external RS-232C interface converter (Model CX12AR) is required to convert the TTL signal levels to RS-232C levels compatible with most PC serial interfaces. No interface converter is required to connect the Scout™ to a scanning receiver equipped with a CI-V interface.

The electrical parameters given in Table 3 are specified relative to Signal Ground (SHIELD).

Table 3. Scout™ CI-V Interface Electrical Specifications.

Serial Data - Receive (To Scout™)	Logic "0"	0 - 0.7 VDC (50 A max. load current)
	Logic "1"	2.0 - 5.0 VDC (50 A max. load current)
Serial Data - Transmit (From Scout™)	Logic "0"	0 - 0.45 VDC (1.6 mA max. sink current)
	Logic "1"	2.4 - 5.0 VDC (60 A max. source current)

The communications parameters given in Table 4 are used for data transfers on the CI-V interface.

Data Rate	9600 bps
Start Bits	1
Data Bits	8
Parity	NONE
Stop Bits	1

Table 4. Scout™ CI-V Interface Communications Parameters.

When NORMAL mode is selected, the Scout™ recognizes eight different commands. This command set allows many of the Scout™ functions to be accessed remotely by a host computer. It also allows the contents of the 400 memory locations to be downloaded to the host computer. The CI-V interface commands supported by the Scout™ are summarized in Table 5. For individuals interested in developing application software for the Scout™, detailed information on the Scout™ serial interface commands can be found in the Scout Version 2.0 Serial Interface Specification from Optoelectronics.

Table 5. Scout™ CI-V Interface Command Summary.

COMMAND	SUB-COMMAND	DESCRIPTION
03	-	Read frequency.
15	02	Read signal strength.
7F	09	Read identification
7F	20	Read gate setting.
7F	21	Write gate setting.
7F	22	Read frequency memory.
7F	23	Read count memory.
7F	24	Clear memory.

When FILTER mode, CAPTURE mode, or RECALL mode is selected, the Scout™ will not respond to commands on the CI-V interface. Instead, the Scout™ will automatically transmit tuning commands to a scanning receiver connected to the CI-V interface as frequencies are detected or memories are recalled.

Reaction Tune AR8000/2700

The two options for connecting the Scout to the AOR hand held radios include using the SAC8000 and modifying the radio by adding a data jack.

Reaction Tune Using the SAC8000 Without Modification

AOR and Optoelectronics engineers developed the SAC8000 to make Reaction Tuning possible without any modification or disassembly. Simply contact the factory (800-327-5912) to order the SAC 8000 kit. It comes complete with an FFC to mini phone plug adapter cable and a slotted battery compartment cover. Instructions are included.

Hardware Modification for Reaction Tune

The hardware modifications include adding a small jack to the radio to make it possible to connect the Scout™ with a flexible cable using 2.5mm phone jacks cables, and plugs available from Radio Shack. The modifications described will permit easy connection from the Scout™ to the Radio for Reaction Tune operation. These modifications may however void the manufacturer's warranty. Keep this in mind and make sure that you are aware of that possibility. Optoelectronics will not make these modifications to a customer's radio and will not assume any responsibility or liability for their effect on warranty service. Optoelectronics will not service or repair any AOR products.

Having been warned, it can be stated that the addition of the jack described here is easily done by a qualified electronics technician who is experienced in working on two way radios and scanners. Careful soldering of the wires to the locations shown in the photographs is necessary. If you are not experienced at soldering or taking apart hand held radios you should seek assistance from a qualified technician.

Disassemble the radio and check the jack location against the photograph below. Make sure that all batteries are removed and that the power adapter is disconnected. When modifying an AR2700, it is necessary to partially remove the center PC board as shown in the photo (Don't attempt to completely remove it from the unit!)

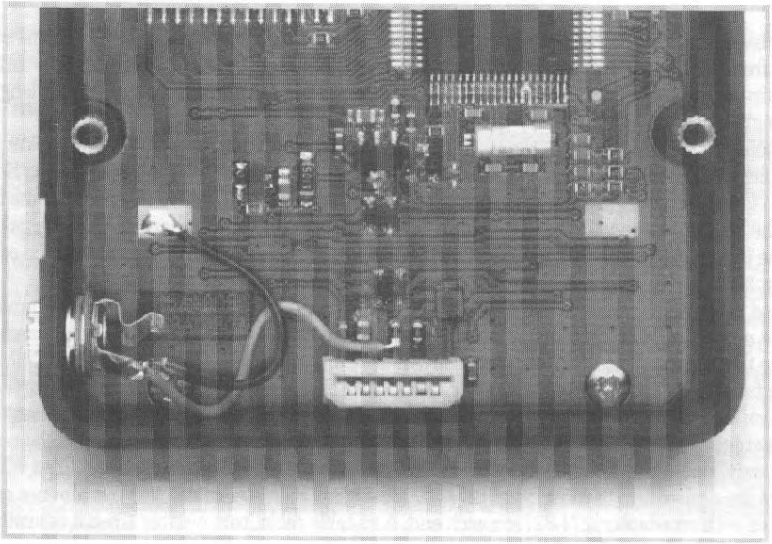
The Jack being installed is a 2.5mm (3/32") phone jack, Radio Shack part number 274-295. The center or tip connection from the Scout™ carries data to the radio. The wires used are number 24 stranded. In the AR8000, the wire lengths are short, a little more than an inch. In the AR2700, use wires about 4" long and custom cut the length when installing.

It is not necessary to drill a hole for the jack. Locate the position of the hole relative to the power jack as shown in the photos. Take a few minutes to see that the jack location will not interfere with the PC Boards when the radio is re-assembled. To create a hole in the plastic case, use an X-acto knife and place the point in the center of the location desired. Rotate the blade creating a hole in the soft plastic. Keep checking the hole size against the jack to make sure that you don't make it too large. It may be necessary to bevel the edge of the hole for the nut to fit on the jack. It is safer to create the hole in this manner than to use a drill.

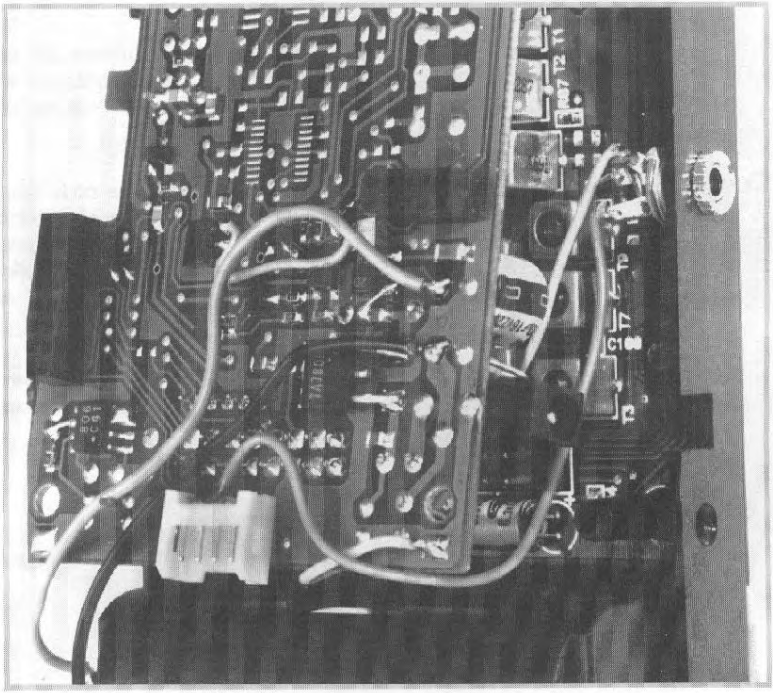
The ground connections can be made where ever it is convenient. The photo locations for both radios work well. The Data connection in the AR8000 is taken directly from a chip resistor as shown. Solder carefully to prevent damage to the resistor. The AR2700 connection is a little difficult to see. The wire is soldered directly to the second pin from the left on the white connector. Make sure that the wire can not move and short to any other pin. Check for continuity between the nut on the outside of the jack and the ground connection to the radio's PC Board using a tester. If this checks out and polarity is not reversed then re-assemble the radio.

Unfortunately, Radio Shack does not carry a cable with 2.5mm phono plugs on each end. You will need to make one up to the desired length using plugs (274-328) and small diameter cable. You can also use as a 42-2420 mono cable with an adapter, 274-327, on each end. A suitable cable, part number CB-RT, is available from Optoelectronics. Call the factory for information.

AR8000 PHOTO SHOWING JACK INSTALLATION



AR2700 PHOTO SHOWING JACK INSTALLATION



SCOUT REACTION TUNES AR2700

PRODUCT WARRANTY

Optoelectronics, Inc. warrants all products and accessories for one (1) year against defects in materials and workmanship to the original purchaser. Products returned for warranty service will be repaired or replaced at Optoelectronics' option.

Specifically excluded are any products returned under this warranty that, upon examination, have been modified, had unauthorized repairs attempted, have suffered damage to the input circuitry from the application of an excessive input signal, have suffered damage to the charging circuitry or internal batteries from the application of excessive voltage, or show other evidence of misuse or abuse. Optoelectronics reserves sole right to make this determination.

No other warranties are expressed or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Optoelectronics, Inc. is not liable for consequential damages.

FACTORY SERVICE

WARRANTY

Products under warranty must be returned, transportation prepaid, to Optoelectronics' Fort Lauderdale Service Center. All parts replaced and labor performed under warranty are at no charge to the customer.

NON-WARRANTY

Products not under warranty must be returned, transportation prepaid, to Optoelectronics' Fort Lauderdale Service Center. Factory service will be performed on a time and materials basis at the service rate in effect at the time of repair. A repair estimate prior to commencement of service may be requested. Return shipping will be added to the service invoice and is to be paid by the customer.

The Optoelectronics Service Department will provide rapid turnaround of your repair. No return authorization is required. Do not cause delays. Enclose complete information as follows:

1. Copy of sales receipt if under warranty.
2. Detailed description of problem(s).
3. Complete return address and phone number (UPS street address for USA).
4. Proper packaging (insurance recommended). Note: Carriers will not pay for damage if items are improperly packaged.
5. Proper remittance including return shipping, if applicable (Visa/MasterCard number with expiration date, Money Order, Company PO., etc.).

Address all items to:

Optoelectronics, Inc.
Service Department
5821 NE 14th Avenue
Fort Lauderdale, FL 33334

If in question, contact the factory for assistance. Service Department: (954) 771-2050

OPTOELECTRONICS

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