SERVICE MANUAL **SVR-350™**

VHF, UHF, 700 & 800 Mhz Models

The Scalable Vehicular Repeater

PYRAMID
COMMUNICATIONS
Since 1990

MADE IN AMERICA

Table of Contents

Foreword

Scope of This Manual

This manual contains the specifications, functional description, operating instructions, programming instructions and a parts locator for the SVR-350 Guardian synthesized vehicular repeater.

This manual is intended for use by qualified service technicians to aid them with installation, interfacing, alignment and troubleshooting of the SVR-350 Guardian when used with other land mobile radios.

Service Manual Revisions

Component changes, additions and deletions may occur in the circuit design to improve operation and will be reflected in future releases of this service manual. Specifications and circuit changes are subject to change without prior notice or obligation by Pyramid Communications.

Safety Information

The SVR-350 Guardian is designed to operate within all applicable Federal regulations at the time of manufacture. Proper operation and service procedures will assure continued compliance with these regulations:

- Do not operate any SVR-350 Guardian without an antenna or appropriate RF load connected to the antenna connector.
- Do not operate any SVR-350 Guardian in the presence of unshielded electrical blasting caps or explosive environmental conditions.
- Do not operate any SVR-350 Guardian while refueling the vehicle or in the presence of explosive fumes.
- Do not operate any SVR-350 Guardian with persons standing closer than 3 feet from the mobile or repeater antenna.

FCC Information

The SVR-350 Guardian complies with the FCC rules parts 90 and 22 for radio frequency transmitters. The user must apply for a license to operate the SVR-350 Guardian transmitter pursuant to parts 90.243 and 90.247. Other FCC rules may apply depending on the class of service the user qualifies for. A complete listing of FCC rules and regulations may be ordered from:

Superintendent of Documents
Government printing office
Washington DC 20402

The following information pertaining to the SVR-350 Guardian should be included in the FCC license application:

	VHF	UHF	700 / 800 MHz
Type Acceptance:	LRUSVR-P250VA	LRUSVR-P250UA	LRU-SVRP250MB
Output Power:	1 - 2.0W	1 - 2.0W	0.25 - 1.0W
Frequency band:	136-174 MHz	380-470 MHz	764-776, 850-870 MHz
Number of Channels:	20	20	20
Emission designators:	10K0F1D, 10K0F1E, 10K0F7D,10K0F7E, 111K0F3E,12K3F1D, 16K0F3E, 4K80F2D 7K60F1D,8K10F1D, 8K10F1E, 8K10F7D, 8K10F7E, 8K40F2D		

1) FCC Interference Statement (Part 15.105 (b))

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Instructions for Class A devices

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

2) FCC Part 15 Clause 15.21:

“Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment”

3) FCC , unless the following statement is already provided on the device label:-

Receivers associated with the operation of a licensed radio service, e.g., FM broadcast under part 73 of this chapter, land mobile operation under part 90 of this chapter, etc., shall bear the following statement in a conspicuous location on the device:

This device complies with part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

4) RF Exposure Guidance

In order to comply with FCC / ISED RF Exposure requirements, this device must be installed to provide at least 90 cm separation from the human body at all times.

“Afin de se conformer aux exigences d'exposition RF FCC / ISED, cet appareil doit être installé pour fournir au moins 90 cm de séparation du corps humain en tout temps.“

5), Use the radio only with Pyramid Communications-approved antennas and attachments, and make only authorized modifications to the antenna otherwise you could damage the radio and violate FCC regulations.

ISED RSS-Gen Notice

“This device complies with Industry Canada’s licence-exempt RSSs. Operation is subject to the following two conditions:
(1) This device may not cause interference; and
(2) This device must accept any interference, including interference that may cause undesired operation of the device.”

“Le présent appareil est conforme aux CNR d’Industrie Canada applicables aux appareils radio exempts de licence. L’exploitation est autorisée aux deux conditions suivantes :
1) l’appareil ne doit pas produire de brouillage;
2) l’appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d’en compromettre le fonctionnement.”

6) RF Exposure Guidance

In order to comply with FCC / ISED RF Exposure requirements, this device must be installed to provide at least 90 cm separation from the human body at all times.

“Afin de se conformer aux exigences d'exposition RF FCC / ISED, cet appareil doit être installé pour fournir au moins 90 cm de séparation du corps humain en tout temps.“

Specifications

Transmitter:	**VHF**	**UHF-A**	**700 / 800 MHz**
Frequency Range:	136-174 MHz	380-470 MHz	764-776 + 850-870 MHz
RF power out:	0.5 - 12W	0.5 - 12W	0.25 - 12W
Spurious emissions:	-70dBc	-70 dBc	-70 dBc
Freq stability -30°~+60°C:	1.5 PPM	1.5 PPM	1.5 PPM
Hum and Noise:	43/-38dB (25/12.5Khz)	43/-38dB (25/12.5Khz)	40/-33dB (25/12.5Khz)
Audio response (300-3kHz):	Flat or +6dB/octave	Flat or +6dB/octave	Flat or +6dB/octave
Audio distortion:	<3% @ 60% deviation	<3% @ 60% deviation	<3% @ 60% deviation
Local mic sensitivity:	300mV-5VPP	300mV-5VPP	300mV-5VPP
FCC Type Acceptance:	LRUSVR-P250VA	LRUSVR-P250UA	LRUSVR-P250MB
Industry Canada Approval:	2390A-SVRP250VA	2390A-SVRP250UA	2390A-SVRP250MB

Receiver:

Frequency Range:	136-174 MHz	400-470 MHz	764-776 + 850-870 MHz
RF sensitivity Analog:	.28µV	.28µV	.28µV
Digital (5% BER):	.20µV	.20µV	.20µV
Squelch sensitivity:	.2µV to 2µV adjustable	.2µV to 2µV adjustable	.2µV to 2µV adjustable
Selectivity:	75/65dB (25/12.5Khz)	75/65dB (25/12.5Khz)	75/65dB (25/12.5Khz)
Spurious/image rejection:	75db	75db	75db
IMD response:	75db	75db	75db
Frequency stability:	1.5 PPM	1.5 PPM	1.5 PPM
Audio response (300-3kHz):	Flat or -6db/octave	Flat or -6db/octave	Flat or -6db/octave
Audio output:	0-5VPP AC coupled	0-5VPP AC coupled	0-5VPP AC coupled
Local Rx Audio:	400 mW 8 Ohms	400 mW 8 Ohms	400 mW 8 Ohms

Power Requirements:

DC Supply	13.6 VDC	13.6VDC	13.6VDC
Standby	350 mA	350 mA	350 mA
Receive	400 mA	400 mA	400 mA
Transmit	6A @ 12W	6A @ 12W	6A @ 12W

Physical:

Dimensions:	5.75"W x 8"L x 2.25"H
Weight:	80 oz.
Case:	One piece machined aluminum

Intellectual Property Rights

Functional Description

Generally, vehicular repeaters are used as mobile extenders in cross-band operation: the link is VHF, UHF or 7/800 MHz simplex and the mobile is VHF, UHF or 7/800 conventional or trunking. In-band operation is possible, but care must be taken to prevent interference between the mobile's higher power transmitter and the repeater receiver. Proper frequency selection and antenna placement are important even in cross-band operation, but especially for inband use. Low power pre-selector & notch filter cavities may be placed in line with the repeater antenna cable since it is simplex and low power.

☞ *Important Note Analog Operation*

The SVR-350 Guardian is designed to operate on simplex frequencies; part of the multi-vehicle format dictates that all of the SVR-350s must be able to monitor all link traffic on site and be able to determine if a handheld is transmitting, or if other repeaters are transmitting. In Analog mode, the handhelds must transmit CTCSS, but should be carrier squelch receive. ***The handhelds do not use CTCSS decode if the repeater is utilizing the multi-vehicle format***, as this will interfere with the priority sampling which is essential for multi-vehicle operation. Also, the handhelds would have to have different encode and decode tones in order for the repeater to be able to tell the difference between handhelds and other repeaters, so the handhelds would not be able to hear each other. ***The repeaters will not transmit CTCSS unless used only in a single vehicle environment***.

☞ *Important Note P25 Operation*

In P25 mode, the SVR-350 Guardian must also operate on simplex frequencies. The handhelds must transmit a different NAC code than the SVR-350 transmit NAC code, and the Handheld Receive NAC code must be F7Eh (all call) in order to hear the other handhelds and the SVR-350's which transmit different NAC codes for different functions.

When the user leaves the vehicle, they activate the SVR-350 Guardian via their mobile radio front panel or a separate switch. When the mobile radio is receiving carrier and proper tone, the SVR-350 will begin transmitting on the handheld’s receive frequency. The user is able to hear and respond to all radio traffic, including other handhelds at the site. In analog mode the SVR-350 can be programmed to give the handhelds priority in a conversation by periodically sampling for handheld activity (carrier and proper tone) during base-to-portable transmissions. During sampling, if the SVR-350 detects a handheld transmission, it will cease transmissions, key the mobile radio and repeat portable-to-base. This allows the handheld to respond during repeater hang time or during full duplex interconnect calls. Priority sampling can be enabled/disabled through PC programming and the interval can be programmed between .50 seconds and 2.5 seconds in .25 second increments. Priority sampling is not available in P25 mode.

The SVR-350 has a programmable time out timer for base-to-portable transmissions. If the mobile COR is active for more than the programmed time (and the SVR-350 is the priority unit) it will send a double blip and cease transmission until the mobile COR is inactive. The time-out is in effect regardless of whether the SVR-350 is programmed for priority sampling or not.

Optional Features

One of the key features of the SVR-350 Guardian is its ability to be upgraded with feature keys. Software Feature Keys (SFKs) can be purchased and loaded by the CPS software to add features such as P25 operation, EVRS or encryption.

Multi-Vehicle Operation

The SVR-350 has 2 different multi-vehicle priority formats; both are compatible with the existing SVR-200 and SVR-250 analog formats. The new SVR-350 with ESP logic has enhanced features that ensures a priority vehicle is selected and ready to transmit during the idle time rather than during voice transmissions. If EVRS is enabled, ESP must be used. The ESP Beacon is used for the "out of range" function of EVRS mode. The 2 formats are explained below:

SVR-200/SVR-250 Legacy Format

When the SVR-350 Guardian is first activated, it will transmit a short “lock tone” that alerts the user that the system is functioning. It will then assume the priority status and be ready to repeat any base-to-portable or portable-to-base transmissions. If another unit arrives on scene and is activated, it too will transmit the “lock tone”; when the first SVR-350 Guardian detects the lock tone from the second unit, it will increment a “priority counter” and will no longer repeat any transmissions. The recently arrived unit will be the priority repeater, and the first unit will be 1 count away from priority. This process will continue for each unit that arrives at the site, creating a priority hierarchy for up to 250 vehicles, each with a unique count and only one unit at priority status. The SVR-350 Guardian will not transmit its lock tone if the radio channel is busy when first enabled. It will wait in non-priority status until all transmissions cease, then send its lock tone and become the priority unit.

Even though the other SVR-350 Guardians are not at priority status, they will continue to monitor the channel for activity. If the priority unit were to leave the scene or become disabled, the other units will detect the condition to repeat and determine that there is no priority unit repeating the transmission. They will then begin to decrement their priority counters until one of them reaches the priority status and begins repeating the transmission. Since the SVR-350 Guardians are all at different counts, only one will reach priority status and begin transmitting. The other units will sense the new priority repeater and cease counting down, preserving the priority hierarchy.

If another unit were to arrive from a different scene and it is still the active priority, there will be two active repeaters on the air when a condition to repeat exists. When one of the SVR-350 Guardians unkeys to check for handheld activity (analog mode only), it will detect the presence of the other active SVR-350 Guardian and increment its priority counter and cease transmission. This is the self clearing mode to prevent radio collisions.

ESP™ Priority

The SVR-350 Guardian Enhanced Sensor Priority works similar to the SVR-200 and SVR-250 formats and is completely backward compatible with those systems. The SVR-350 determines if there is a priority (and re-establishes the priority if missing) during idle time between conversations rather than at the critical start of a conversation. When a condition to repeat exists, the SVR-350 is always ready.

The priority SVR-350 will transmit a short tone burst every 10 seconds. This serves 2 purposes: It informs the handheld operator that they are still within range of the vehicle and it alerts the non-priority units that a priority vehicle is still on scene. As long as the non-priority units hear this "beacon" every 10 seconds, they preserve their counts and maintain the priority hierarchy. If the priority vehicle leaves the scene, after 10 seconds, the non-priority vehicles will not hear the "beacon" and begin counting down. When one of the counts=0, that SVR-350 will send lock tone for 800 mS, assume priority and begin sending the "beacon" tone every 10 seconds as before. Since the "beacon" tone must be heard every 10 seconds, it does not have busy carrier lock out and will send the tone if 2 handhelds are communicating directly or in the presence of co-channel interference.

The ESP Beacon is also an integral part of the EVRS functionality. ESP must be enabled if EVRS is enabled. This beacon is used to notify the portable radio of the status of the trunking system as well as keep the portable radio RSSI indication up to date and provide an out of range function to the EVRS enabled Viking portable radio.

EVRS Operation

When the SVR-350 is connected to a Kenwood Viking or Harris XL mobile radio, EVRS mode can be enabled. EVRS (Enhanced Vehicular Repeater Solution) mode is a proprietary enhancement to the SVR-350 operation that creates a seamless trunking experience (talk permit, busy, denied call status) to the portable radio user. It also provides emergency functionality and out of range notifications to the portable radio.

EVRS options must be enabled in the Viking mobile and portable radio. In addition, the EVRS mode must be enabled on the SVR-350 to turn on this enhanced feature set.

When enabled, the SVR-350 uses a proprietary trunking protocol between the SVR-350 and Viking portable radio to create on scene trunking handshake between the portable radio and the SVR-350, which is contingent on the mobile radio acquiring a trunked channel. If the call is successful on the mobile radio/trunked network call, the portable radio will get a talk permit tone as expected. If the call fails on the mobile radio, the portable radio user will be notified of the status of the failure (busy, denied or out of range).

Emergency Operation

The SVR-350 Guardian can be programmed for Emergency operation on a per channel basis. If enabled, the SVR-350 Guardian can detect an Emergency Status in the P25 data packet. The emergency status will indicate an Emergency condition from the portable and will assert an output pin when decoded.

There are 2 different Emergency formats: EMG output only or EMG output with voice repeat.

EMG output only will assert pin 10 on the main cable for as long as the Emergency call is being received; it is used as a momentary output to the mobile to initiate an Emergency sequence. This is the common configuration with most radios.

EMG output with voice repeat will assert pin 10 as before, but will also key the mobile and repeat portable-to-base as long as the Emergency call is being received. This format is used with only some mobile radios that support an external emergency with PTT.

Additionally, there is a switch (S1, EMG) on the main logic PCB that determines if the EMG output signal pulls to ground (NO) or breaks ground (NC).

The Emergency can be configured on a per channel basis in both P25 and Analog mode. In P25, the SVR-350 looks for the emergency bit in the P25 LDU data to sense the emergency call. In Analog mode, a predefined CTCSS tone will be used to trigger the emergency call. This can be set in the Frequency Data screen in the SVR CPS using the EMG Code drop down if EMG is enabled on that channel.

Courtesy Beep

If enabled, the SVR-350 Guardian will send a short beep to the handheld user at the end of each portable-to-base transmission to confirm that the user is still within range.

Power Up Channel

The SVR-350 Guardian can be programmed to revert to the last channel used when powered down or first channel in the frequency list.

LEDs

The SVR-350 Guardian has a 2 digit channel display as well as eight status LEDs:

CPU:	Flashes at a 1 Hz rate to indicate proper operation of the microprocessor.
PRI:	When on, indicates that the unit is at priority count zero and will repeat all transmissions.
RCOR:	Repeater Carrier detect.
RTONE:	Repeater sub-audible decode; when on, indicates a condition to repeat portable-to-base.
RTX:	Repeater transmit indicator.
MCOR:	Mobile unmute detector indicating a condition to repeat base-to-portable.
MTX:	Mobile transmit indicator.
OPT:	Emergency Tone/Code Decode.

☞ If the 2 digit channel shows "- -", the unit is not enabled. Use the Blue Wire (pin 3) or the front control head switch to enable the SVR-350 Guardian.

☞ If the decimal point is illuminated in the 2 digit channel display it indicates a P25 channel is selected.

Installation

Before installing the SVR-350 Guardian, ensure that the mobile radio is properly aligned per the manufacturer's tuning instructions. All "Jumpers" are soft jumpers that can be set in the SVR-350 CPS Software in the SVR Interface and Alignment screen. No disassembly of the SVR is required to set these radio interface options.

J1 This software jumper controls the maximum drive level of the PTB transmit audio output to the mobile radio. If J1 is checked, output audio amp will have an adjustment range of 0-100 mVPP. If J1 is not checked, mobile transmit audio can be adjusted between 0-5VPP.

J2 This software jumper controls the output impedance of the transmit audio line to the mobile radio. Checking J2 sets the output impedance to 600 ohms. If J2 is not checked, the output impedance is 2.2Kohms. Install the jumper for radios that require a lot of modulation drive or that have low impedance microphone circuits.

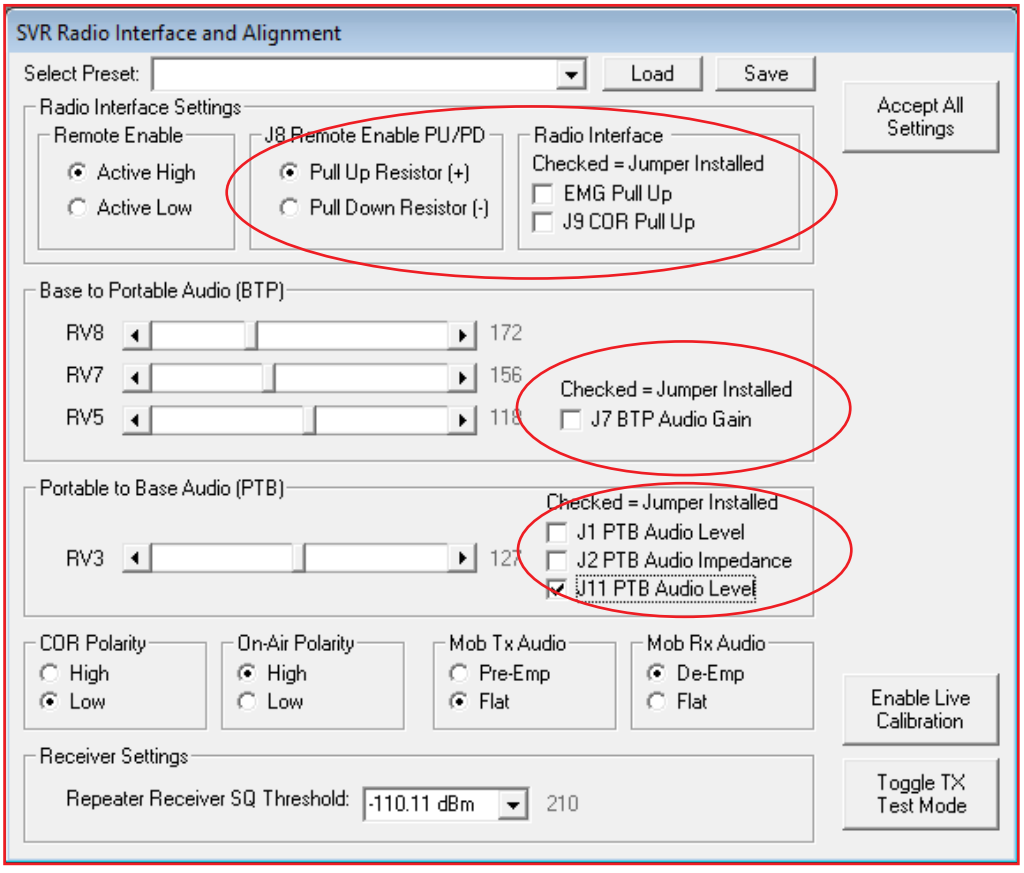
J7 This software jumper changes the maximum gain of the receive audio line input from unity (Not Checked) to 7x (Checked).

J8 This software jumper adds a pull up (+ position) or pull down (- position) resistor to the remote enable line (blue wire).

J9 This software jumper adds a pull up resistor (10K to 5VDC) to mobile COR line (violet)

J11 This software jumper adds a 100KOhm resistor in series with the Tx audio line for applications with low level mic audio and alternator whine problems (see Service Bulletin 113).

EMG Selects the Emergency output polarity: NO=pull to ground during Emg NC=break ground during Emg.



Make the connections between the mobile radio and the SVR-350 Guardian cable as follows:

Pin 1: *Black/Shield* — ***Ground***. Connect to the radio's chassis or ground plane.

Pin 2: *White* — ***Mobile transmit audio***. Connect to the mobile transmit audio path or tone input. If connected to the mobile mic input, ensure that the SVR-350 Guardian is programmed for flat (common data). If connected after pre-emphasis, ensure that the SVR-350 transmit audio path is programmed for pre-emphasis. Pin 2 is AC coupled and has an output impedance of 600 or 2.2Kohms (determined by J2). RV3 sets the transmit audio output level and J1 sets the adjustment range between 0-5VPP (J1 unchecked) or 0-100mVPP (J1 checked).

Pin 3: *Blue* — ***Remote enable/disable***. Connect to the radio's auxiliary output or a separate switch to remotely enable or disable the repeater. If this line goes high to activate the repeater, ensure that Remote Enable option is set to the "Active High" position. If this line goes to ground, set Remote Enable option to the “Active Low” position. Software jumper J8 has two settings to add a pull up (+) or pull down (-) resistor to this line if used with an open collector or dry contact output.

Pin 4: *Green* — ***Mobile PTT output***. Connect to mic PTT on the mobile radio, or a line that goes active low to transmit. Pin 4 is an open drain output rated at 2A at 15VDC.

Pin 5: *Red* — ***12 VDC input***. Connect to the radios 12V switched supply or a point capable of supplying at least 3A of current.

Pin 6: *Yellow* — ***Mobile receive audio.*** Connect this line to the mobile receive audio path before the volume control. If pin 6 is connected to the mobile discriminator, ensure that the SVR-350 Guardian receive path is programmed for de-emphasis (common data). If connected after de-emphasis, program the receive path for flat. Pin 6 is AC coupled and high impedance (>15K ohm). RV5 sets the receive audio level sensitivity; this input should be between 30mVPP and 5VPP. J7 sets the gain of the receive input amp. If open, the input has a maximum gain of one; if installed, the input has a maximum gain of 7.

Pin 7: *Violet* — ***Mobile COR detect.*** This line is used to indicate when the SVR-350 Guardian should repeat the transmission to the handheld. Connect to a logic point in the radio that indicates proper tone and carrier have been detected or the audio unmute line. If this line goes more positive during an unmute condition, program the mobile COR line as active high (common data). If the line goes more negative during an unmute condition, program the mobile COR line as active low. The input from pin 7 is high impedance and does not have to go rail to rail. The SVR-350 Guardian uses a voltage comparator as a COR threshold detector and is factory set at 1.6VDC. The COR input must go at least 0.5VDC on either side of this threshold.

Pin 8: *Brown* — ***RS-232 Transmit Data:*** This line is a serial data output used for certain mobile radio interfaces, including EVRS+ radio communications.

Connections(continued)

Pin 9: *Gray*
On Air Detect.
Conventional TXS: Connect to a point in the radio that indicates the mobile transmitter is actually on the air. This is not the same as mic PTT. If pin 9 goes positive during transmit, program the on-air detect line for active high (in the CPS/SVR Interface and Alignment screen). If pin 9 goes to ground during transmit, program the on air detect line for active low.
EVRS3/: This line is used as part of the communications between the SVR-350 and certain Viking mobile radio for EVRS communications.

Pin 10: *Black/White*
Emergency Output. Connect to the Emergency input on the mobile radio. On certain Motorola radios, the Emergency input opens from ground on activation and switch S1 should be in the "NC" position. On most all other radios, the Emergency input pulls to ground on activation and switch S1 should be in the "NO" position.

Pin 11: *Teal*
EVRS-1: This line is used as part of the communications between the SVR-350 and the Viking mobile radio for EVRS communications.

Pin 12: *Pink*
EVRS-2: This line is used as part of the EVRS communications.

Pin 15: *Orange*
RS-232 Receive Data: This line is a serial data input used for ceratin mobile radio interfaces, including EVRS+ radio communications.

Install the SVR-350 Guardian in the vehicle using the supplied mounting bracket and hardware. Install the unit where it will be easily visible by the driver and will not interfere with the drivers vision or constitute a hazard during a vehicle collision. The SVR-350 Guardian mounts in the bracket using the four 8-32 x ¼" machine screws. Do not use longer screws to mount the SVR-350 Guardian to the bracket or circuit damage may result.

Alignment

Before aligning the SVR-350 Guardian, ensure that the mobile radio is aligned per the manufacturer's service procedure; Ensure that the SVR-350 is properly programmed and the software jumpers are set per the previous section. *Refer to the technical Application Note for your mobile radio model on the Support section of the Pyramid website for help setting jumpers and radio interface options.*

In order to properly align the SVR-350 Guardian, you will need two service monitors and the mobile radio that the repeater will be installed with.

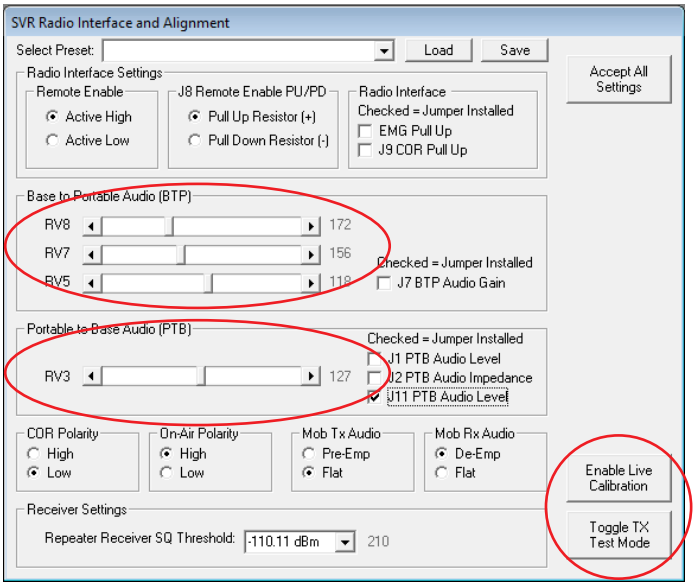
No disassembly of the SVR is required to perform an audio or RF alignment. All settings for the digital potentiometers are done in the SVR-350 CPS software. Start the CPS software and connect and read your SVR unit. Go to the SVR Radio Interface and Alignment screen. Next, connect one service monitor to the SVR-350 TNC jack and the other to the mobile antenna jack. Connect the cable from the mobile radio to the SVR-350 (See figure 4 on page 11).

SVR-350 Guardian Transmitter

1. ***Maximum deviation/lock tone deviation***: Press the Enable Live Calibration button and then Press Toggle TX Test Mode button and adjust RV7 (Lock Tone) for maximum. Adjust RV8 (repeater MAX deviation) until the waveform just enters clipping (2.5KHz deviation); adjust RV7 for total 1.5KHz deviation . Toggle TX Test mode off and verify that SVR is not transmitting.

2. ***Mobile COR***: Make note of the MCOR Led on the SVR-350 Guardian display. Ensure the mobile COR LED on the front panel is off. Set the mobile service monitor for the mobile receive frequency, 1mV RF output and CTCSS modulation of 300Hz deviation. Ensure the mobile COR LED on the front panel is on. If the mobile COR LED operates backwards, change the value of the COR Polarity in the CPS.

3. ***Base to Portable Audio (BTP)***: Set the service monitor connected to the mobile for the mobile receive frequency and 1mV RF output (full quieting). Modulate the signal generator with a 1kHz tone at 1.5KHz deviation and CTCSS tone at 300Hz deviation. Ensure that the SVR-350 Guardian mobile COR and repeater PTT LED's are on. Adjust RV5 in the SVR-350 Guardian CPS for 1.8KHz deviation if CTCSS/DCS transmit is programmed, adjust for 1.5KHz deviation if carrier squelch transmit, as read on the service monitor connected to the SVR-350 Guardian. Turn the RF output from the mobile service monitor off and ensure that the SVR-350 Guardian mobile COR and repeater PTT LEDs are off.



SVR-350 Guardian Receiver

1. ***Transmit audio output***: Adjust the service monitor RF output for 1mV (full quieting). Turn the CTCSS modulation on and set for 300Hz deviation. Confirm that the repeater COR, CTCSS and mobile PTT LED's are on. Adjust RV3 on the SVR-350 Guardian main board for 1.5KHz deviation as read on the service monitor connected to the mobile radio. Turn off the CTCSS modulation of the service monitor connected to the SVR-350 Guardian. Confirm that the repeater CTCSS and mobile PTT LED's are off.

2. ***Lock Tone/Code Decode Confirmation***: Change the 1kHz tone modulation to the lock tone frequency or proper LOCK/NAC in P25 mode. Confirm that the PRI LED goes off after approximately 800 milliseconds. Timing is critical, so ensure you only generate an ~ 800mS burst of lock tone with your service monitor.

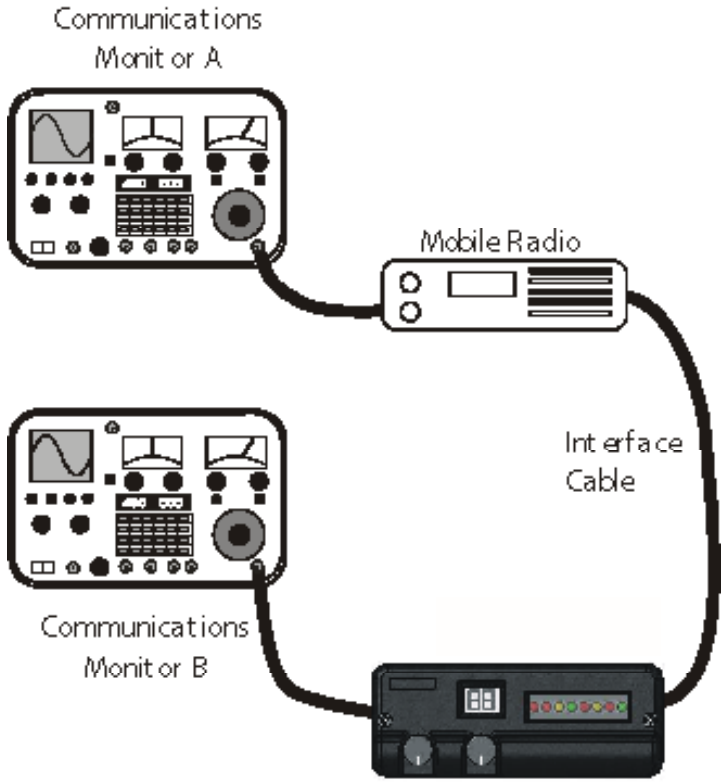


Figure 4

Radio Interface "Presets"

The SVR-350 CPS contains presets for specific radio models. You will find a comprehensive list of radio models in the drop down. Refer to the ***Radio Interface and Alignment*** section for more details on using the presets.

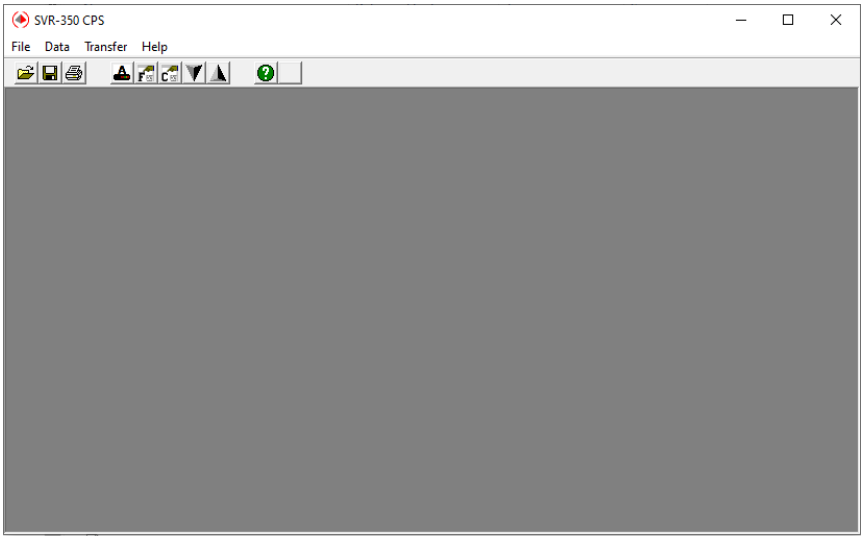
Programming

Using the Software

The SVR-350 Guardian CPS personalization software is used to program the SVR-350 Guardian for all of the operating parameters and options. The software is compatible with Windows operating systems. The software is menu driven and on-line help is available at any time by clicking the left mouse button on the HELP icon on the right side of the tool bar.

Important Note:

Before attempting to program the SVR-350 Guardian, start the software and ensure the FY-5 programming cable is plugged into a working USB port on your PC. Then plug the FY-5 programming cable into the USB connector on the rear of the SVR-350 Guardian. **A virtual com port will be assigned to the connection. You may need to view the port assigned in your Windows Device Manager.** Once known, the com port may be selected in the CPS software under the "Transfer" menu.



Menu selections

File

Open: Allows you to load a previously saved file from disk. Enter the file name or select from the Windows Dialog box. Only files with the .350 extension can be loaded.

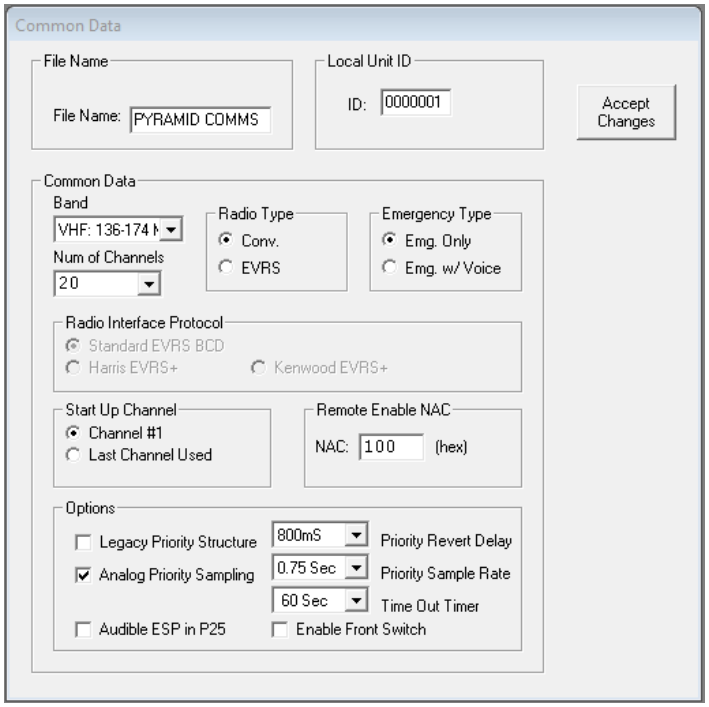
Save: Allows you to save the current configuration to disk. Enter the file name to save as or select a previous file from the Windows Dialog box to overwrite. The .350 extension is automatically added to the file name. The program will prompt you before overwriting an existing file.

Print: Sends the current configuration to the selected printer. Make sure the printer is online and paper is loaded before executing this command.

Exit: You will be asked to confirm before exiting the program. The software will also prompt you if the configuration has changed since program start up and data has not been saved to disk.

Common Data

File Name: 15 character name for this profile stored in E2PROM.



ID: Used for P25 channels only, each SVR-350 should have a unique Radio ID. Range is 0000001-9999999.

Number of Channels: Select 1-20 channels

Band: Select the frequency band to match your SVR-350 Guardian. Changing bands resets all data to default values (confirmation required)

Radio Type: Select either Conventional or EVRS mode. In Conventional mode, the SVR-350 will operate in a traditional mode. EVRS mode is only applicable when interfaced to Viking mobile radios with the EVRS option enabled.

Power Up Channel: Select either Last Channel or Channel #1 in the SVR-350.

Remote Enable NAC: Select a P25 NAC Code to optionally remotely activate the SVR with a P25 radio when in P25 mode.

Legacy Priority Structure: The SVR-350 Guardian has an enhanced signalling format (ESP) to determine if the priority vehicle has left the scene during idle time. Select SVR-200 Legacy Priority Structure to turn off theESP feature. Both formats are fully SVR-200 compatible.

Analog Priority Sampling: If the SVR-350 Guardian is used in a multi-vehicle environment, priority sampling must be enabled for proper operation. Priority sampling is in effect for ***Analog Channels Only***.

Audible ESP in P25: If the SVR-350 is using ESP (not Legacy Structure) in P25, the user has the option to hear or silence the ESP Beacon that occurs every 10 seconds. To enable an audible ESP Beacon, check this box. Disabling Audible ESP is for ***P25 Channels Only***.

Priority Revert Delay: Adjustable between 800 and 2500ms, the programmable Delay is used to prevent the SVR-350 from assuming the priority state when the mobile radio network has a delay longer than 800mS. Increasing this time should be used when the delay between the mobile Tx and another mobile Rx is greater than this time.

Priority Sampling Rate: If Priority sampling is enabled, this selects the sampling interval. Range is 0.25 seconds to 2.5 seconds in .25 sec increments. The higher this setting, the longer the handheld operator must wait before speaking after pressing PTT during base-to-portable sampling.

Time Out Timer: This is the maximum duration of a single base to portable transmission that will be allowed.

Enable Front Switch: If enabled, the SVR-350 Guardian will look for the remote enable line on the radio interface connection as well as the status of the on/off knob on the control head of the SVR-350 Guardian. The "ON" position of the control head knob will override a the signal from the mobile radio interface. If you want to use the control head as the primary control, set the radio interface to the "inactive" position.

Frequencies (Channel Data)

☞ ***Note:*** The number of channels available is determined by the setting in Common Data.

Tx and Rx Frequency: Enter the Transmit and Receive frequencies for each channel. The frequency must be in the range for the band selected under Common Data and will be rounded to the nearest channel step.

Squelch Type: Select either CTCSS, DCS or P25. These can be selected on a per channel basis, but cannot be mixed within a channel.

☞***Note:*** P25 will appear as an option, however, P25 operation may not be licensed on the SVR-350 Guardian.

Rx Code or NAC: The primary tone/code, when received will put the SVR-350 into portable-to-base repeat mode.

Tx Code(s) or NAC: In Analog mode, the SVR-350 does not normally transmit sub-audible signalling. In P25 mode, the SVR-350 must transmit a NAC code. If enabled, the Tx code should not be the same as the Rx or Emg Code.

Emg Code: The secondary PL tone, when received will initiate an Emergency sequence (analog only).

☞***Note:*** In P25/EVRS mode, the SVR-350 must transmit a pre-defined set of NAC codes depending on the mode of operation. The portable radio should be setup to receive NAC F7E, which is an ALL CALL receive code and will decode all P25 signaling.

Lock Code: This is the audible tone burst (Analog Mode) or NAC (P25 mode) first transmitted when the SVR-350 Guardian is enabled and sent every 10 seconds if ESP™ priority mode is selected. The tone must be the same in all vehicular repeaters in the system.

Encryption Key: In P25 mode this specifies which stored Encryption key is used. Range 1-4096.

Encryption: If selected the channel will be encrypted (P25 mode Only).

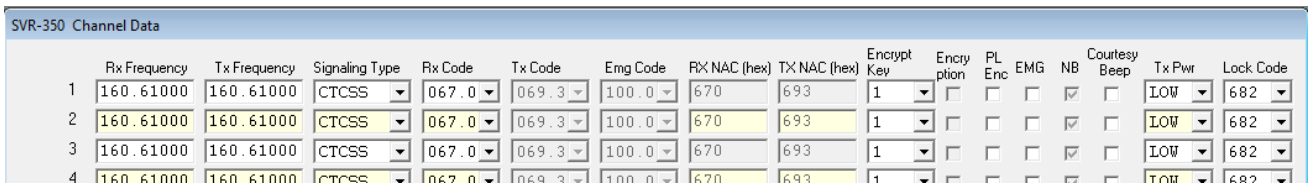
PL Encode: If selected, sub-audible transmit is enabled for that channel (Analog Mode Only).

EMG: If selected, the SVR will process an emergency on this channel.

NB: Allows Narrowband operation on certain analog frequency bands. Not applicable to P25 operation.

Courtesy Beep: If selected, a short beep will be sent to the handheld user at the end of each portable-to-base transmission to confirm they are still within range.

Tx Pwr: The transmitter power can be set on a per channel basis. Select 2W, 5W or 12W for VHF and UHF and .25W, .5W or 1W for 7/800 MHz bands



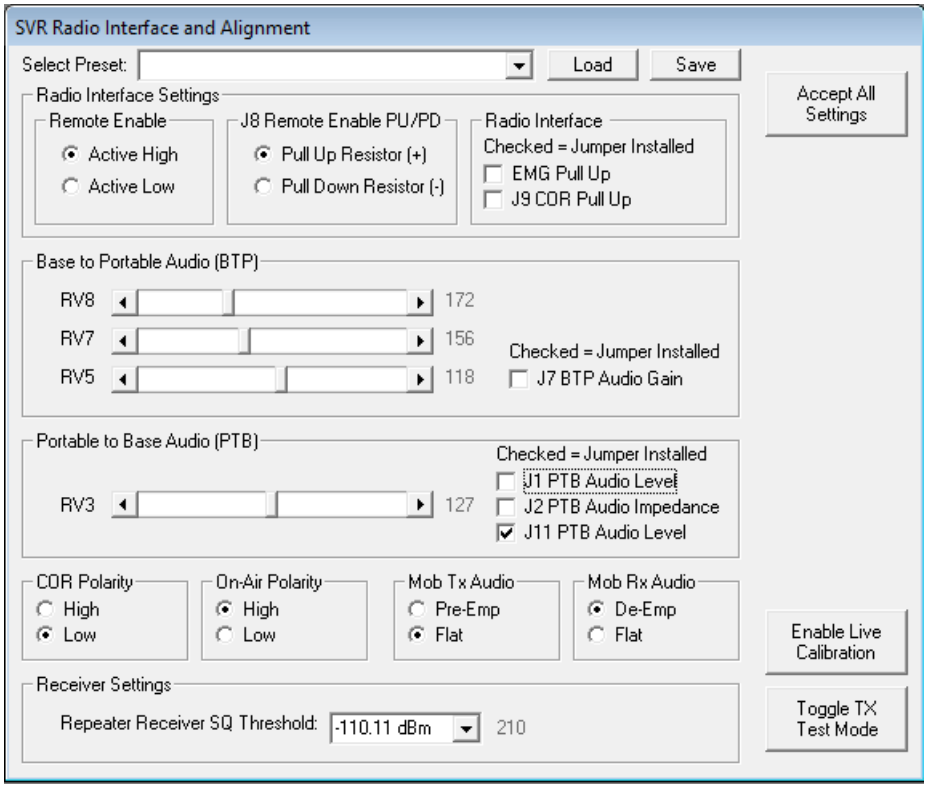
Radio Interface and Alignment

The SVR Radio Interface and Alignment screen allows configuration of the radio interface to the SVR-350. While other models of the SVR family require jumper settings and manual adjustments of potentiometers and RF inductors, the SVR-350 requires no disassembly in order to perform the radio interface. Further, the SVR-350 has Radio "Presets" that allow a very quick interface to the mobile radio variant you may have. You can also save your own presets for later use on similar installations.

Note: Loading a preset overwrites all settings on the screen.

It's important to note that when you enter this screen, you will be warned that the settings are not "Live" and not committed until you press "Accept All Settings". Furthermore, you must write the personality to the SVR using the standard upload menu option to save the settings to the SVR permanently.

There is an "Enable Live Calibration" button that will allow you to change the calibration adjustments and jumpers in real time while the SVR-350 is in operation. This allows for tuning the SVR with the service monitors to achieve proper audio alignment. Even though you are changing the settings real-time, they are NOT SAVED until you "Accept All Settings" and write the personality back to the SVR using the standard upload process.



Remote Enable Polarity: Determines the polarity of the remote enable input from the mobile radio or external switch.

J8 Remote Enable PU/PD : Determines state of adding a Pull Up or Pull Down jumper on the remote enable input line.

EMG Pull Up: Determines if a pull up resistor will be added to the emergency output line to the mobile radio. Some radios require a pull up to 5v, while others require an open collector output from the SVR. Note: There is a hardware switch internal to the SVR-350 that set's the NO/NC (Normally Open/Normally Closed emergency output hardware behavior.

J9 COR Pull UP: Determines state of adding a pull up resistor on the COR input line. This software jumper adds a pull up resistor (10K to 5VDC) to mobile COR line (violet wire on the interface cable)

COR Polarity: Determines if the COR signal from the mobile is active high or low.

On-Air Polarity: Determines if the Tx indication from the mobile is active high or low.

Mob Tx Audio: If the mobile Tx audio from the SVR-350 Guardian to the mobile is connected to the mic input, select Flat response. If connected after pre-emphasis, select Pre-Emp.

Mob Rx Audio: If the Rx audio from the mobile to the SVR-350 Guardian is connected to the discriminator, select De-Emp. If connected after de-emphasis, select Flat response.

Repeater Receiver SQ Threshold: This sets the SVR's receiver squelch threshold. Represented in dBm, you can adjust the SVR's squelch to be higher than the noise floor in the vehicle or surrounding area. The default value of about -110dBm represents a good baseline, however, this may need to be increased in order to squelch out noise from external sources such as other radio equipment or oscillators in a vehicle.

J1 This software jumper controls the maximum drive level of the PTB transmit audio output to the mobile radio. If J1 is checked, output audio amp will have an adjustment range of 0-100 mVPP. If J1 is not checked, mobile transmit audio can be adjusted between 0-5VPP.

J2 This software jumper controls the output impedance of the transmit audio line to the mobile radio. Checking J2 sets the output impedance to 600 ohms. If J2 is not checked, the output impedance is 2.2Kohms. Install the jumper for radios that require a lot of modulation drive or that have low impedance microphone circuits.

J7 This software jumper changes the maximum gain of the receive audio line input from unity (Not Checked) to 7x (Checked).

J11 This software jumper adds a 100KOhm resistor in series with the Tx audio line for applications with low level mic audio and alternator whine problems (see Service Bulletin 113).

RV8 ***Maximum deviation/lock tone deviation***: Set's the repeater MAX deviation or limiter. This is typically set in conjunction with RV7 in the alignment procedure for 2.5KHz of deviation.

RV7 **Lock tone deviation:** Set's the deviation (volume) of the supervisory tones generated by the SVR. In analog mode, set this to 1.5Khz deviation.

RV5 ***Base to Portable Audio***: Set's the audio between the mobile radio receiver and the SVR-350 transmitter. The objective is to set the audio path so that the level coming into the mobile radio is the same level being transmitted by the SVR to the portable radio. Follow the alignment procedure to set this level.

RV3 ***Transmit audio output***: Set's the audio between the SVR-350 receiver and the mobile radio transmitter. The objective is to set the audio path so that the level coming into the mobile radio is the same level being transmitted by the mobile radio that is being received from the portable radio. Follow the alignment procedure to set this level.

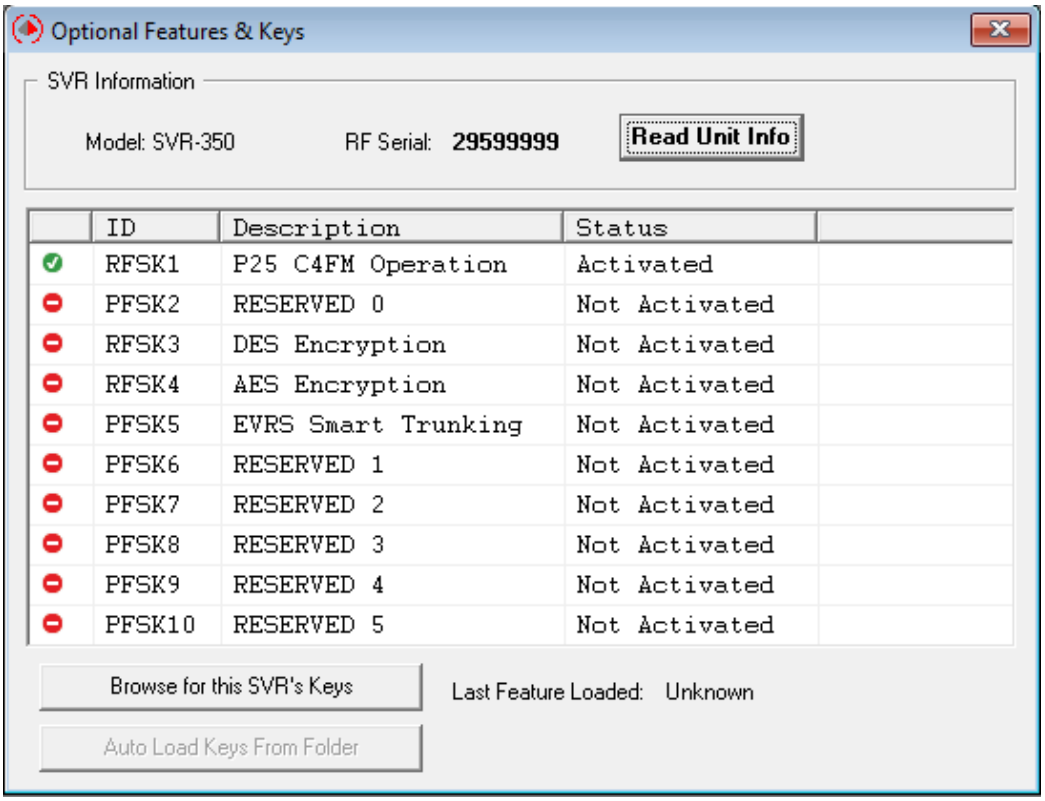
Transfer

Optional Feature Keys

The SVR-350 can be factory ordered several ways. In its simplest form, it comes as an analog only vehicular repeater. P25, EVRS and encryption are all optional features that can be purchased and added later, even in the field. The software features are unit specific and tied to the serial number of the unit. If you purchase a software feature, Pyramid will email a Software Feature Key (SFK) file to you.

The Optional Features and Keys screen allows the technician to read the unit and view which features are enabled on the unit as well as load new features by loading SFK files into the CPS subsequently activating them in the SVR-350.

When you first go into this screen,you should Read Unit Info to see what features are loaded and verify the serial number of the unit you are programming. You can use the Browse for this SVR's Keys button to load a key from your PC. Once a SFK file is selected, the feature screen will refresh, confirming the features activated.



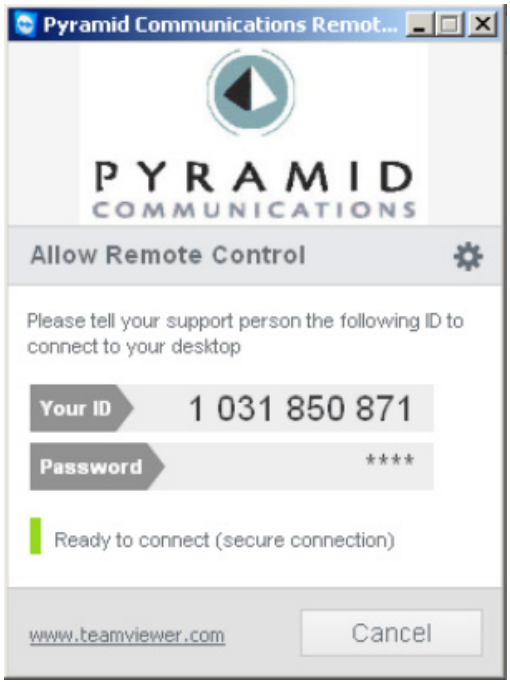
Send Upload: Downloads the current configuration to the SVR-350 Guardian. The program will prompt you to make the FY-5 connection before downloading. The Upload takes approx 2 seconds.

Receive Download: Uploads the current configuration from the SVR-350 Guardian. The program will prompt you to make the FY-5 connection before uploading. The Download takes approx 1 second.

Com Port: Selects the serial port to use for uploading and downloading between the PC and the SVR-350 Guardian. Comm ports 1-20 are supported.

Help

On-line context sensitive help is available for all entry fields by selecting the field on a form and clicking on the Help Icon on the tool bar.



Flash Programming

The SVR-350 Guardian uses an Atmel MCU which contains the operating system. The chip can be reprogrammed in-circuit using the internal bootloader in the MCU and flash utility from Pyramid Communications.

Warning- Do not attempt to re-flash the SVR-350 Guardian firmware unless you are familiar with operation of the SVR-350 Guardian and reasonably competent using Windows software. If the MCU is not programmed correctly, it could render the SVR-350 Guardian inoperable.

Install the CPS software onto your PC - the Pyramid Flash Utility will be located in the program files folder with the CPS; use the downloaded or provided (.hex) files from Pyramid. Ensure the HEX file is copied into a known directory on your computer. Perform the flash programming in the ***EXACT*** steps as outlined below:

1. Run the Pyramid Flash Utility (PyrProgGUI.exe).

2. Ensure your SVR is powered on and connected via USB to your PC. Select the comport from the list in the Pyramid Flash Utility.

3. Click Connect.

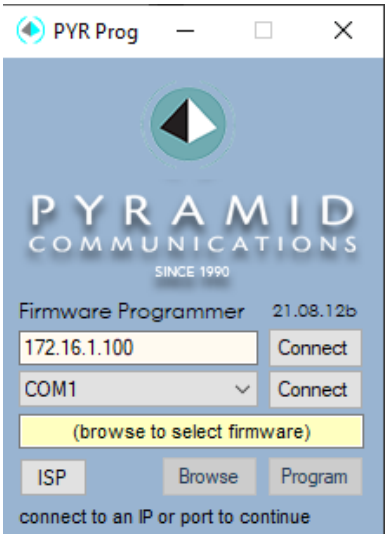
4. Browse for the firmware .HEX file provided by Pyramid Communications.

5. Click Program when ready.

6. The program will notify you when the flash is updated.

DO NOT REMOVE POWER or USB DURING THE PROCESS.

7. If any errors occur, try the process again or call Pyramid Communications technical support.



Encryption Key Loading

Key loading is accomplished by using our standard FY-4 programming cable, a Motorola KVL-3000-Plus (or later) key loading device and the Pyramid Communications KLA-250 key loader adapter connected as shown in figure 1.

The SVR-350 cannot be loaded with encryption keys unless ordered with AES / DES capability. Please read the Software Feature Key's enabled on your SVR-350 with the CPS software to verify the correct licenses are enabled. Contact Pyramid sales support if additional licenses are needed.

Preparing For Key Loading

Remove the SVR-350 control head from the chassis and leave the control head wiring connected to the unit so the channel display is visible. **Do not connect the FY-4 cable at this time.**

Loading Keys

When ready to load keys, **connect the FY-4 cable to the SVR-350.** The SVR-350 display will indicate "LL" when it is ready to accept a key load device. After you connect the FY-4 to the SVR-350 programming jack you will have 15 seconds of seeing the "LL" on the screen to connect your keyloader to the SVR-350. You can view and write keys as long as the display shows "LL".

If "Er" is displayed, a time out or communications error has occurred with the key load device. Start the process over from power up.

The SVR-350 must use encryption key CKR numbers between 1-4096. The CKR(s) is referenced in the SVR-350 CPS frequency/channel programming.