

---

# ***RTR-4***



## **RTR-4 Portable Digital X-ray Imaging System Operators Manual**

**120300 Rev B**

---

**SAIC**  
16701 West Bernardo Drive  
San Diego, CA. 92127  
U.S.A.

Copyright © 1999 SAIC  
All rights reserved. Printed in the United States of America.

All data and information contained in or disclosed by this document are confidential and proprietary information of SAIC and its affiliates and all rights therein are expressly reserved. By accepting this material, the recipient agrees that this material and the information contained therein are held in confidence and in trust and will not be used, copied, or reproduced in whole or in part, nor its contents revealed in any manner to others without the express written permission of SAIC Incorporated.

This technology is controlled by the United States Government. Diversion contrary to U.S. law prohibited.

**SAIC Proprietary:** For employees of SAIC. Release to other parties is not authorized without SAIC's written permission.

SAIC reserves the right to change or revise this information without notice. Reasonable effort has been made to ensure that the information in this manual is accurate; however, SAIC assumes no responsibility for inaccuracies or omissions of any kind. SAIC makes no warranty for the use of its product.

SAIC is a registered trademark of Science applications International Corporation.

RTR-4™ is a trademark of SAIC.

RTR-4 Portable Digital X-ray Imaging System - Operators Manual

120300 Rev B

March 3, 2000

---

# ***FCC Compliance Statements***

---

## **FEDERAL COMMUNICATIONS COMMISSION RADIO AND TELEVISION INTERFERENCE STATEMENT FOR A CLASS 'B' DEVICE**

Changes or modifications not expressly approved by Science Applications International Corporation could void the user's authority to operate the equipment.

NOTE: This product was FCC certified under test conditions that included the use of shielded I/O cables and connectors between system components. To be in compliance with FCC regulations, the user must use shielded cables and connectors and install them properly.

## **X-Ray Receiver Only**

## **FEDERAL COMMUNICATIONS COMMISSION RADIO AND TELEVISION INTERFERENCE STATEMENT FOR A CLASS 'B' DEVICE**

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 interference to radio or television reception, which can be determined by turning the equipment off and then on, the user is encouraged to try to correct the interference by one of more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver
- Connect the equipment into a different outlet so that the equipment and receiver are on different branch circuits.
- Consult the dealer or an experienced radio/TV technician for help.

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

Changes or modifications not expressly approved by Science Applications International Corporation could void the user's authority to operate the equipment.

# Revision History

---

Version	Release Date	Notes
—	June 15, 1999	Initial release
A	April 16, 1999	Minor revisions
B	March 3, 2000	Minor updates, added Appendix F, Wireless Option, moved document into new template format, updated Chapter 5 with new information and screen shots. Reordered chapters and appendices.

# Table of Contents

---

<b>Introduction</b> .....	<b>ix</b>
Purpose and scope .....	ix
RTR-4 technical support .....	ix
Document revisions .....	ix
Symbols .....	x
Acronyms and abbreviations .....	x
<b>Before You Begin</b> .....	<b>1-1</b>
Introduction .....	1-1
Safety Information .....	1-1
Danger and Warning Icons: .....	1-1
Operating Precautions .....	1-2
System Components .....	1-4
<b>Setup and Operation</b> .....	<b>2-1</b>
Setup and Operation .....	2-1
Component Overview .....	2-2
Control Unit .....	2-2
X-Ray Source and Imager .....	2-6
Setup Procedures .....	2-7
Power Considerations .....	2-8
Battery Power Considerations .....	2-9
The Main Menu .....	2-10
Acquiring an Image .....	2-12
Editing an Image .....	2-13
<b>RTR-4 Menu Options</b> .....	<b>3-1</b>
The RTR-4 Menu Options .....	3-1
The Main Menu .....	3-1
The Acquire... Menu .....	3-3
Acquire... F1 .....	3-3
Sum .....	3-4
The File Menu .....	3-5
Open... (F3) .....	3-5
Quick Save (F2) .....	3-6
Save As... (F4) .....	3-7
Print Ctrl+P .....	3-8
Exit (Alt+X) .....	3-8
The Display Menu .....	3-9
Zoom .....	3-9

Palettes .....	3-10
Automatic Stretch (F6) .....	3-11
Contrast Stretch (F5) .....	3-11
Grid Overlay .....	3-12
Distance Measurement .....	3-13
Show .....	3-13
Switch Buffers (F7) .....	3-15
Clear Buffer .....	3-15
The Modify Menu .....	3-15
Region of Interest (ROI) Processing .....	3-16
Annotate .....	3-16
Sharpen .....	3-18
Smooth .....	3-19
Noise Reduction .....	3-19
Edge Detect .....	3-20
Emboss .....	3-21
Add Images .....	3-21
Subtract Images .....	3-22
Histogram Equalize .....	3-22
Rotate Image .....	3-23
The Preferences Menu .....	3-24
Multiple Originals .....	3-24
Shrink-to-Fit .....	3-24
Preserve Aspect Ratio .....	3-25
Icon Bar .....	3-25
Status Bar .....	3-25
Distance in Centimeters .....	3-25
Buffer Protection .....	3-25
Invert All Images .....	3-26
Automatic Stretch All .....	3-26
The Window Menu .....	3-26
Cascade .....	3-26
Tile Horizontal .....	3-27
Tile Vertical .....	3-27
Arrange Icons .....	3-28
Minimize All .....	3-28
The Help Menu .....	3-29
Help (F10) .....	3-29
Key Map (Ctrl+K) .....	3-29
About .....	3-30
<b>Imaging Techniques .....</b>	<b>4-1</b>
Imaging Techniques .....	4-1
Target Density and Exposure Duration .....	4-1
X-Ray Beam Filtering .....	4-2
<b>Procedures for Modem Use .....</b>	<b>5-1</b>

Sending and Receiving Files .....	5-1
<b>SPAN DRC22-1535 Smart Battery Recharger.....</b>	<b>6-1</b>
<b>Wireless Option.....</b>	<b>7-1</b>
Introduction .....	7-1
Connections .....	7-8
Operation .....	7-9
Disconnection .....	7-11
Troubleshooting .....	7-11
<b>Maintenance .....</b>	<b>A-1</b>
Preventive Maintenance .....	A-1
System Care and Cleaning .....	A-1
Battery Maintenance .....	A-1
Disk Space .....	A-2
<b>Troubleshooting.....</b>	<b>B-1</b>
Repair Instructions .....	B-1
Troubleshooting Guide .....	B-1
Potential Error Messages .....	B-3
Variable Text Messages .....	B-6
<b>Radiation Survey Measurements .....</b>	<b>C-1</b>
Radiation Survey Measurements .....	C-1
Introduction .....	C-1
Dose Measurements .....	C-1
Legal Dose Limitations .....	C-3
Monitoring .....	C-4
Source Registration .....	C-4
References .....	C-4
Dose Control Tables .....	C-4
State Radiation Safety Contact List .....	C-6
<b>Components .....</b>	<b>D-1</b>
Components .....	D-1
Standard Components .....	D-1
Optional Components .....	D-2





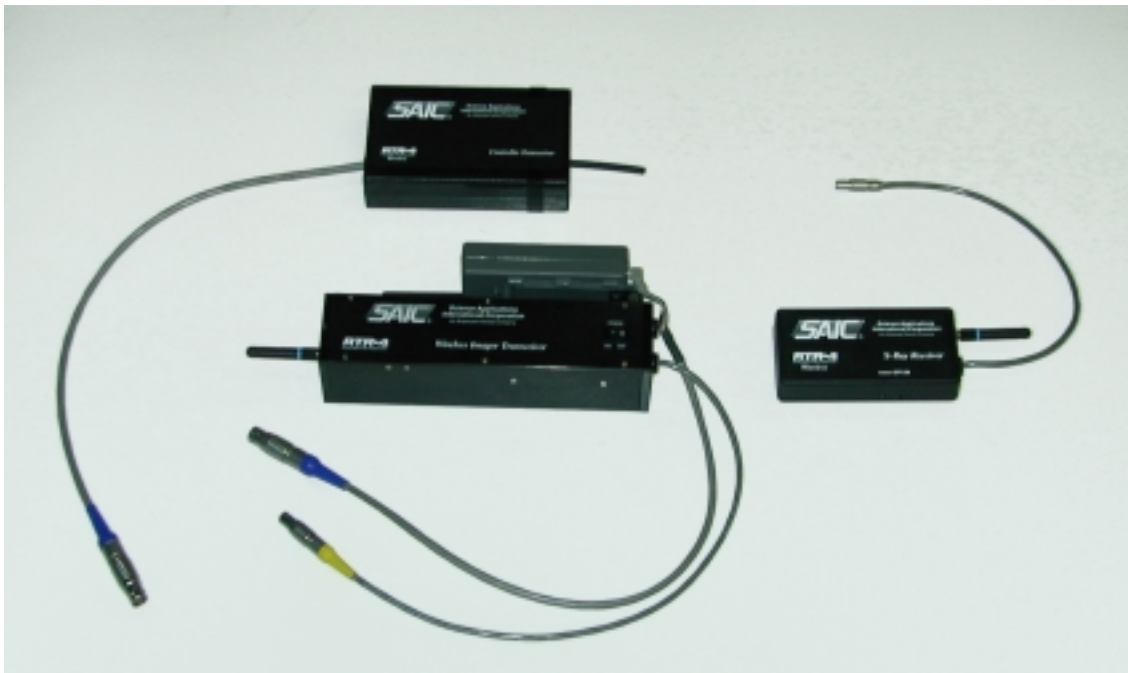
# 7 Wireless Option

---

## Introduction

The Wireless option consists of three devices: the Controller Transceiver, the X-Ray Receiver, and the Wireless Imager Transceiver. (Refer to Figure 7-1.)

Figure 7-1. RTR-4 Wireless Option



### Controller Transceiver

The Controller Transceiver is a device that attaches to the controller to exchange data with the imager. (Refer to Figure 7-2.) Specifically, it sends commands to the imager and receives images and other data from the imager. This unit is powered from the controller, and therefore needs no battery. The Controller Transceiver is powered via the controller key. (Refer to Figure 7-3.) There are no user-serviceable devices in the Controller Transceiver, so dismantling this is discouraged.

Figure 7-2. Controller Transceiver



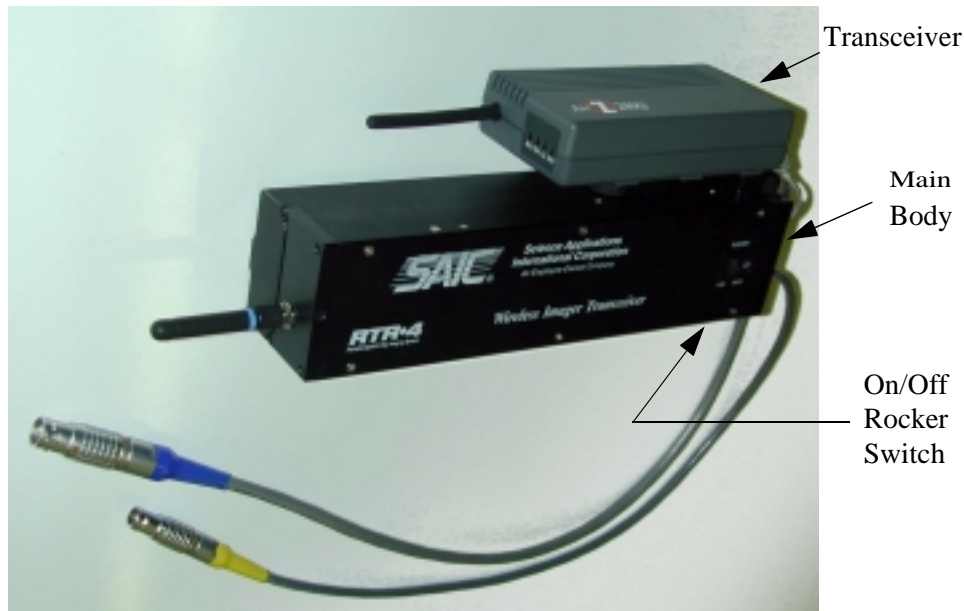
Figure 7-3. Controller Keyswitch



### Wireless Imager Transceiver

The Wireless Imager Transceiver is a device that interfaces with the imager to exchange data with the controller. (Refer to Figure 7-4.) Specifically, it receives commands from the controller, returns images and other data to the controller, and transmits commands to the X-Ray Receiver. This unit is powered from a battery of the same type found in the controller, and powers both itself and the imager. There is an on/off rocker switch on the main body of this unit.

Figure 7-4. Wireless Imager Transceiver



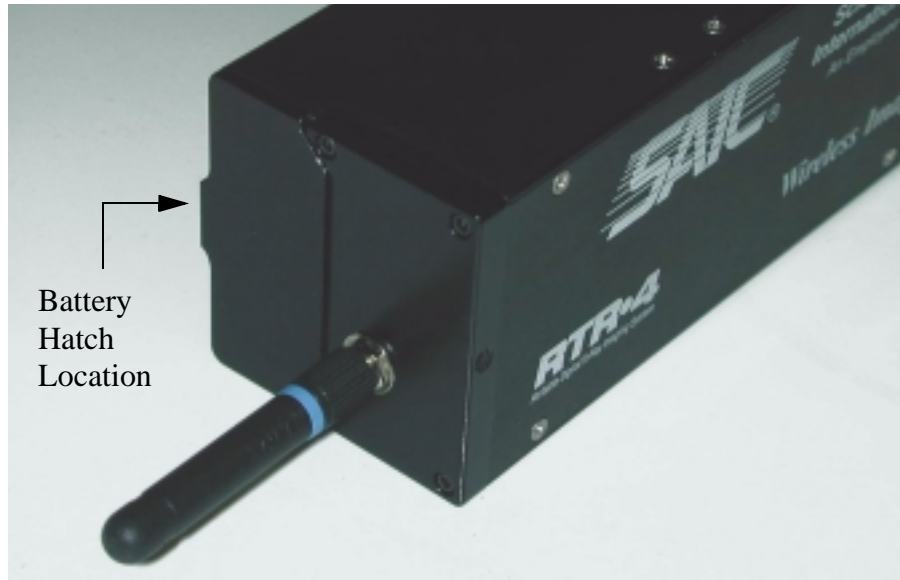
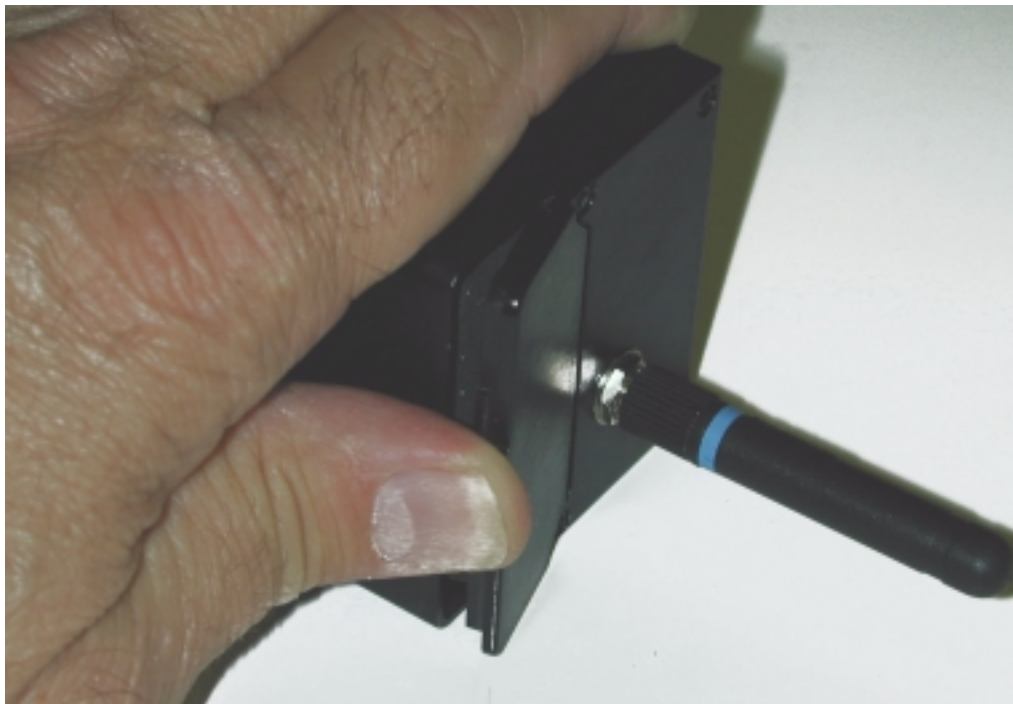
The Wireless Imager Transceiver consists of three parts, the transceiver, the main body, and the battery. The battery is inside the main body.

The transceiver is the gray plastic box with smoothed corners. This is the device that exchanges data with the controller. There are two cables connecting the main body and the transceiver, one for power and one for data. The power comes through the round plug.

The main body is the large black, aluminum box that has two cables for connection with the Imager, and a blue-striped transmitter antenna that is used to send commands to the X-Ray Receiver. There is a hinge attached to the main body that supports the transceiver.

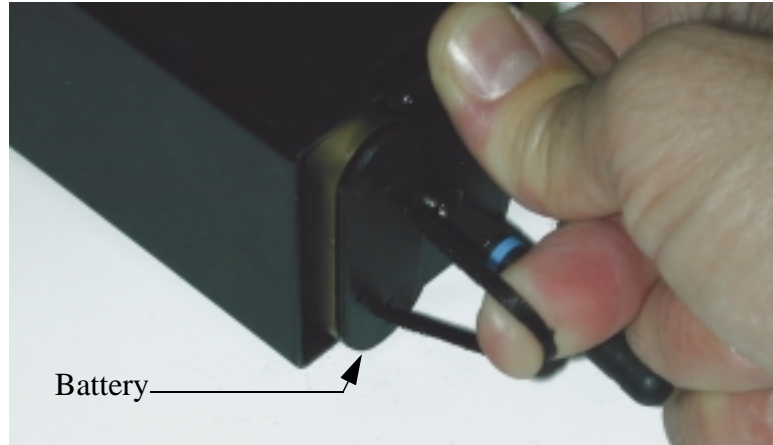
**Steps****Removing the Battery**

1. Open the hatch near the transmitter antenna. (Refer to Figure 7-5.) To accomplish this, push the flange toward the transmitter antenna and lift away from the main body. (Refer to Figure 7-6.)

**Figure 7-5. Wireless Imager Transceiver Battery Hatch Location****Figure 7-6. Wireless Imager Transceiver Battery Hatch Removal**

- Grab the strap on the top of the battery and gently pull the battery out of the main body. (Refer to Figure 7-7.) Note the button on the battery that powers LEDs to indicate state of charge when the button is pressed. Replace the hatch after removing the battery to prevent losing the hatch.

Figure 7-7. Wireless Imager Transceiver Battery Removal

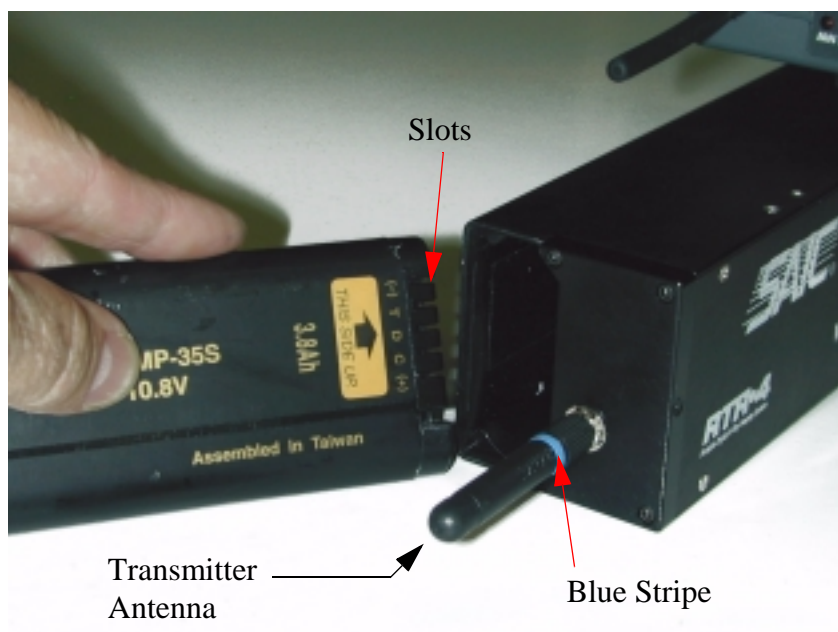


### Steps

#### Replacing the battery:

- Remove the battery as directed in the previous section.
- Position the battery with the slots toward the transmitter antenna (antenna with blue stripe, refer to Figure F.7-8).

Figure 7-8. Wireless Imager Transceiver Battery Orientation



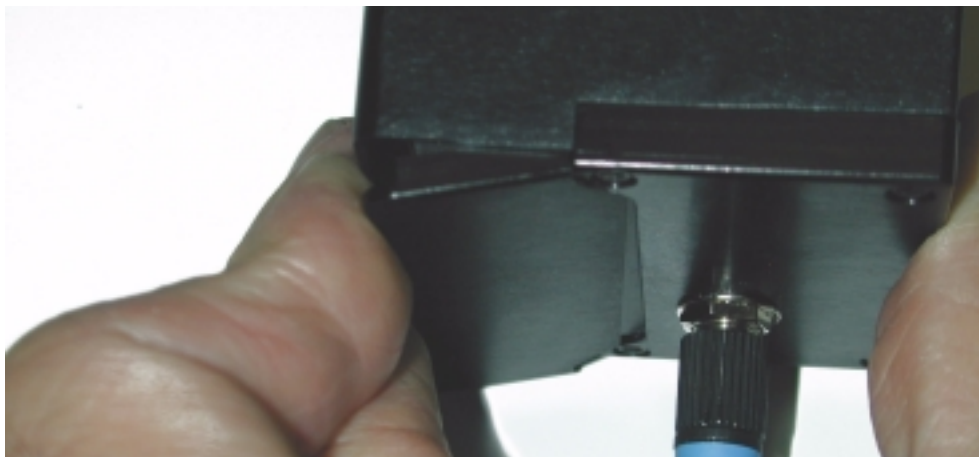
3. Gently slide the battery into the cavity, taking care to prevent the battery strap from encircling the transmitter antenna, until it slips below the shoulders in the cavity. (Refer to Figure 7-9.)

Figure 7-9. Wireless Imager Transceiver Battery Position Before Hatch Replacement



4. Suppressing the battery strap and taking care not to pinch your finger, insert the hatch diagonally into the cavity and slide it under the lip until the hatch snaps into place. (Refer to Figure 7-10.)

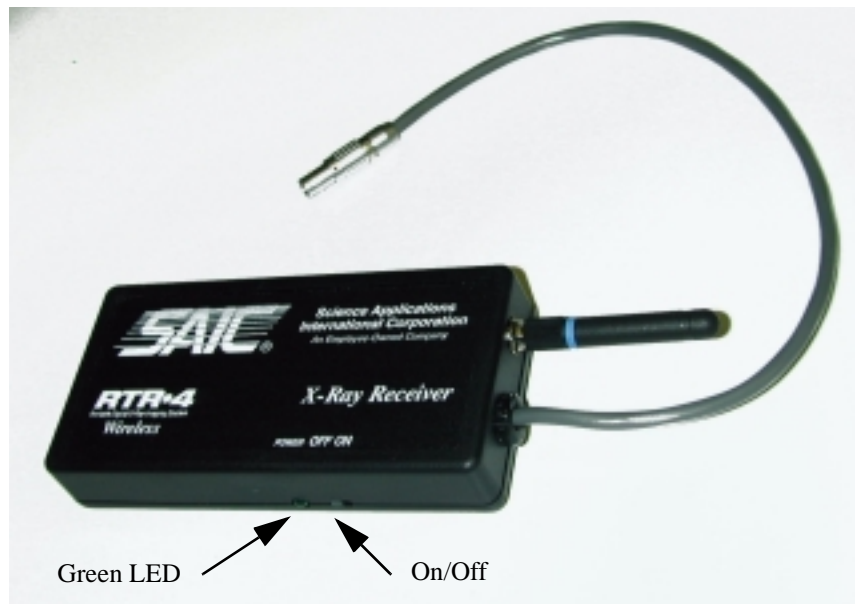
Figure 7-10. Wireless Imager Transceiver Hatch Replacement



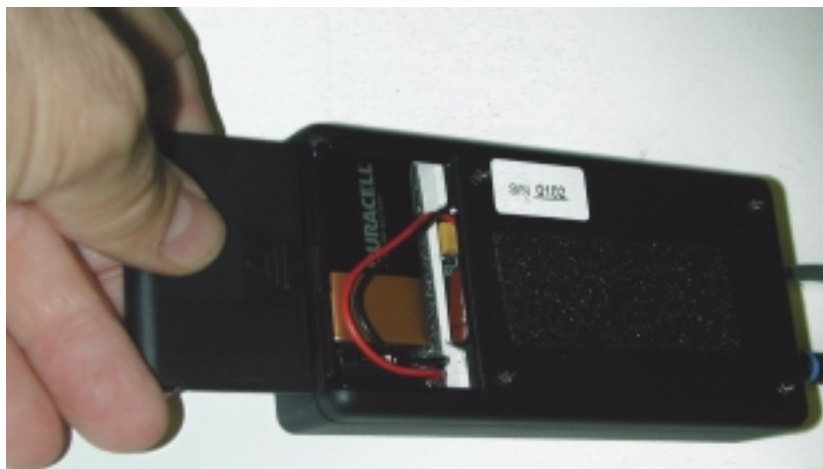
### X-Ray Receiver

The X-Ray Receiver is a device that receives commands from the Wireless Imager Transceiver and controls firing of the X-Ray source. (Refer to [Figure 7-11.](#)) This unit is powered by a 9-volt transistor radio battery. There is an on/off slide switch on the side with a power LED indicator, a receiving antenna (with a blue stripe) and a cable to attach to the XR-200 X-ray source. The 9-volt battery is accessed by removing the slide cover on the back side of the X-Ray Receiver. (Refer to [Figure 7-12.](#))

**Figure 7-11. X-Ray Receiver**



**Figure 7-12. X-Ray Receiver Battery Hatch Removal**



## Connections



### Steps

---

#### Connecting the Controller Transceiver

1. Referring to Figure 7-14, attach the Controller Transceiver to the back of the controller using the Velcro strip and plug the cable into the connection used for the Imager cable.

Figure 7-13. Controller Transceiver with Velcro Strip



### Steps

---

#### Connecting the Imager Transceiver

1. Place the imager and source, then place the Wireless Imager Transceiver on top of the imager as shown in [Figure 7-14](#).
2. Attach the two cables where they fit, as shown in [Figure 7-14](#). Extend the hinge to make the transceiver antenna vertical.
3. Power the Wireless Imager Transceiver by pressing the “1” side of the rocker switch. See the LED indicators on the transceiver illuminate in a sequence, with the yellow ON LED flashing slowly after a few seconds. (If no LEDs illuminate, replace the battery.)





## Steps

### Connecting the X-Ray Receiver

1. Attach the X-Ray Receiver to the source via the Velcro strip, and attach the cable to the source where the imager cable is usually attached. Refer to Figure 7-14.
2. Slide the power switch on, see the green LED illuminate (if the LED is not illuminated, replace the battery).

Figure 7-14. RTR-4 Configured with Wireless Option



## Operation

1. Start the controller, wait until the RTR-4 application has finished loading and the screen stops changing.
2. For best results, position the controller so the Controller Transceiver has a clear line of sight with the Imager Transceiver.
3. Turn on the controller key.



## Note

**The Wireless Imager Transceiver should be powered first, then the controller. It is extremely unlikely that the system will work if powered any other way. If the system reports that the imager is not connected, turn the controller key off and cycle power on the Wireless Imager Transceiver first, then turn the controller key back on.**

*If the source fails to fire, then the next time the X-Ray Receiver is commanded to fire, it may not. The following time, it should. This is the way the system is designed, and is not an error. After the source is commanded to fire, the X-Ray Receiver needs another attempt to regain the proper code sequence and to fire again. This is true for any reasonable number of attempted firings where the X-Ray Receiver is out of range, is not powered, or has a dead battery.*

**Note**

The LED indicators ([Refer to Figure 7-15](#)) are not reliable indicators of system state.

**Figure 7-15. LED Indicators**



- If the yellow NW LED flashes slowly, then the mating transceiver has not been found.
- If the yellow NW LED blinks twice with a second between blinks, then the imager cables are probably not plugged-in.
- If the LEDs are not on, then the unit has no power.
- When the yellow NW LED is flashing rapidly, it is likely that a connection has been made. When the connection is blocked, the yellow NW LED usually continues to flash rapidly, as the unit does not perceive the loss of connection after connection is initially made.

The Wireless Imager Transceiver should last at least five hours with a full battery, regardless of the number of images taken.

The X-Ray Receiver battery should last for 20 hours of use before needing replacement.

## Disconnection

1. Remove the controller key and shut down the controller first. Unplug the cable and remove the Controller Transceiver from the controller.
2. Power-down the X-Ray Receiver second, and disconnect the cable from the source.
3. Power-down the Wireless Imager Transceiver third, fold the hinge down and unplug the cables.
4. Remove the battery from the Wireless Imager Transceiver before returning it to the carrying case or if the system will not be used for an extended period of time.
5. If the system will not be used for an extended period of time, for example, a month, then also remove the battery from the X-Ray Receiver.

## Troubleshooting

If trouble persists, please call the 800 number listed in the About box in the application and ask for RTR-4 Wireless Troubleshooting Support. There are several problems that can be corrected in the field.

