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Radio Bridge User Guide

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Product Name: Voisus

Radio Bridge User Guide

ASTi

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Revision history

Date	Revision	Version	Comments
4/19/2017	B	0	Updates "Virtual-to-live radio bridge"and "Live-to-virtual radio bridge"topics; makes minor style and grammar edits to content.

Contents

1.0 Introduction

The Voisus Radio Bridge performs two major functions:

- *Voice Rx/Tx*: connect real radios to your network and stream live, over-the-air traffic to and from Voisus operators and the Distributed Interactive Simulation (DIS) network.
- *Remote Control*: remotely control live radios over the network.

Figure 1: Remote Control diagram

1.1 Voice Rx/Tx

ASTi's Voice Rx/Tx connects live and simulated training environments, distributing live, over-the-air voice traffic via data networks. It is officially supported for the following radio transceivers (RTs):

Description	Model
SINCGARS, SIP	RT-1523C/D
SINCGARS, ASIP	RT-1523E/F
Falcon II	PRC-117
Multiband Inter/Intra Team Radio (MBITR), JTRS Enhanced MBITR (JEM)	PRC-148
LOS Transceiver	URC-200

Table 1: Radio transceiver types

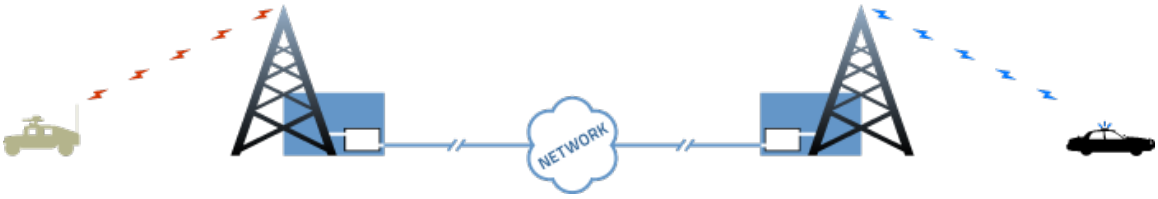
Other radio types are supported by manually configuring In Gain, In Threshold, Out Gain, and Rx Delay. ASTi recommends that manual configurations are done with support to ensure optimal performance.

1.2 Radio Bridge features

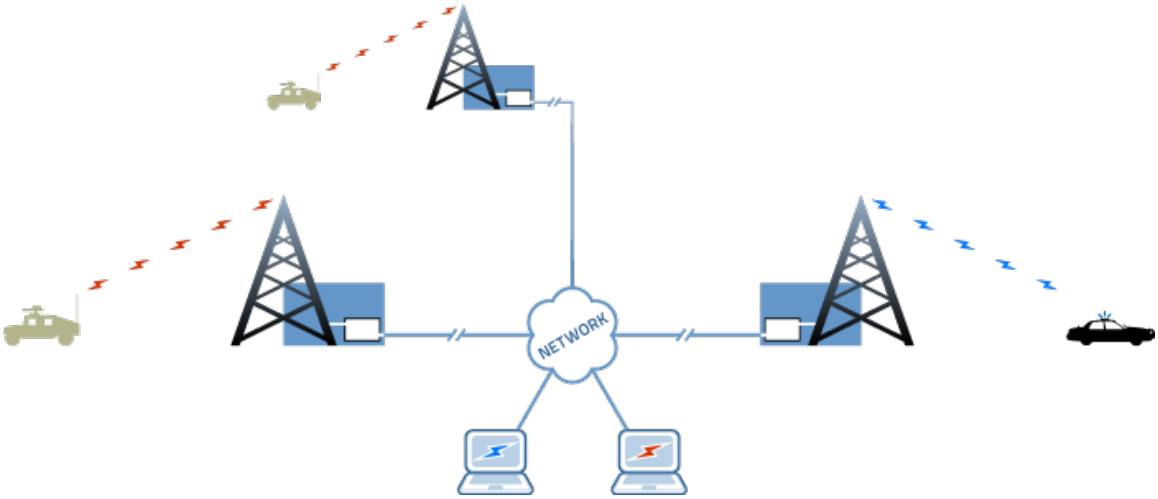
Voisus Radio Bridge includes the following features:

- *Radio retransmission*: extends live radio communication among distant sites through data networks.

- *Radio interoperability*: bridge incompatible radio systems and join multiple radio nets into conferences.



- *Flexibility*: combine a wide variety of live and simulated radios.



1.3 System architecture

Live base radios connect to ACE-RIU or AI-S devices, linking the live radios to the simulated training environment over the network.

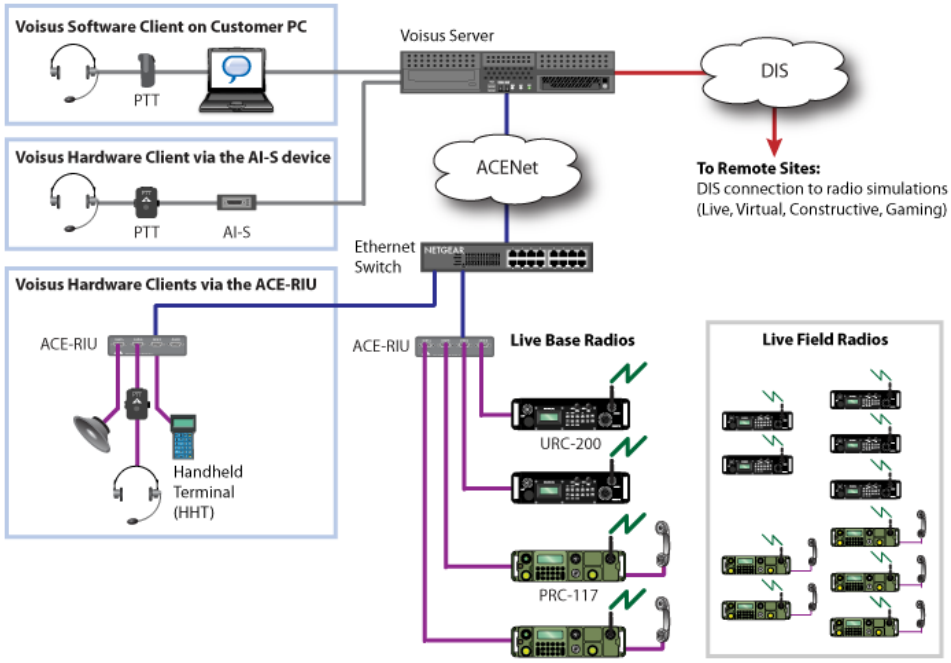


Figure 2: Radio Bridge diagram

2.0 Voice Rx/Tx operation

The following figure shows the Voice Rx/Tx process:

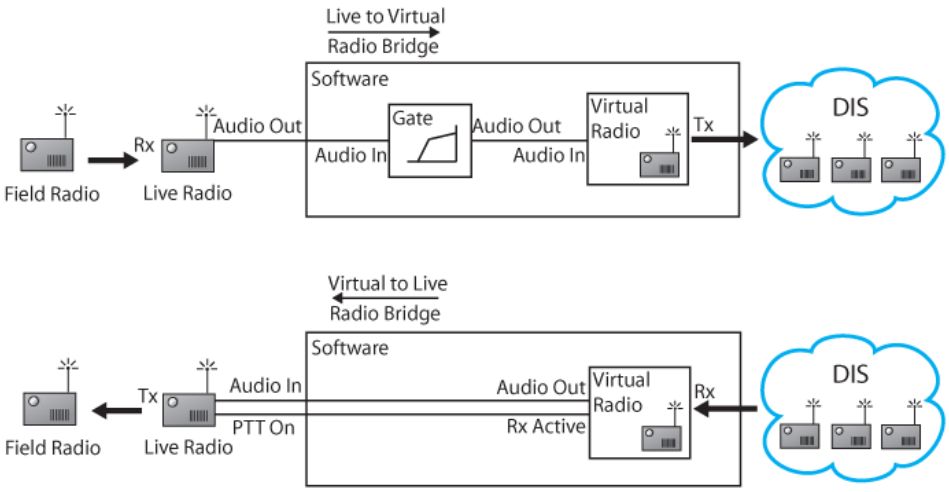


Figure 3: Voice Rx/Tx

2.1 Live-to-virtual radio bridge

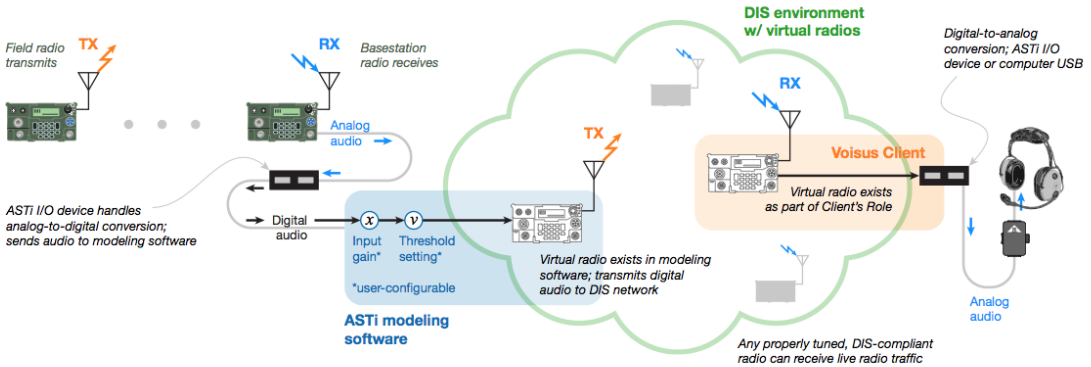


Figure 4: Live-to-virtual radio bridge

When the base station radio receives a transmission, the following sequence of events occurs:

1. A live field radio transmits audio to a base station radio, which is connected to an ASTi input/output (I/O) device (e.g., AI-S, ACU2, ACE-RIU).
2. The I/O device converts the audio from analog to digital and sends it to the ASTi modeling software.
3. The I/O device relays the digital audio to a virtual radio in the ASTi modeling software.

4. The ASTi modeling software contains input gain and threshold settings. The input gain controls the audio level, while the threshold setting determines whether or not the virtual radio transmits.
5. When the live radio is idle, the audio falls below the threshold. When it is actively receiving, the audio rises above the threshold. As a result, the virtual radio only transmits when the live radio is actively receiving.
6. The ASTi modeling software sends the audio to an in-tune virtual radio in the Distributed Interactive Simulation (DIS) environment. This virtual radio exists as part of the Voisus client's role.
7. An ASTi I/O device or computer USB port connects the receiving operator to the Voisus client. The I/O device or computer converts the digital audio back to analog.
8. The operator receives the audio in his or her headset.

2.2 Virtual-to-live radio bridge

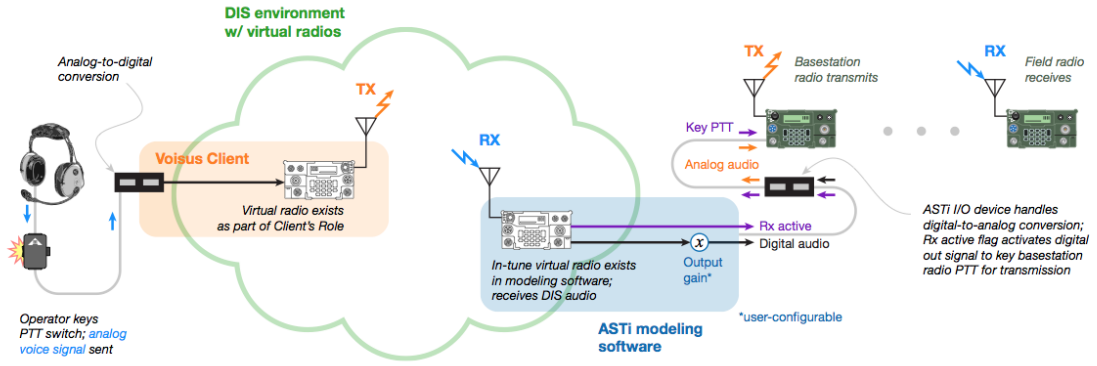


Figure 5: Virtual-to-Live Radio Bridge

When an operator transmits audio using a radio bridge, the following sequence of events occurs:

1. The operator presses the press-to-talk (PTT) button and speaks into his or her microphone.
2. The PTT device transmits the analog voice signal from the headset to the I/O device (e.g., AI-S, ACU2, or ACE-RIU).
3. The I/O device converts the audio from analog to digital and sends it to the Voisus client.
4. The Voisus client sends the digital audio to a virtual radio that exists as part of its role.
5. The virtual radio transmits the audio to an in-tune virtual radio in the ASTi modeling software.
6. The ASTi modeling software adjusts the audio's volume according to the configured output gain setting.

7. The I/O device receives the digital audio and converts it back to analog.
8. When the base station radio receives the analog signal, the digital keying signal replicates PTT functionality, allowing the radio to transmit audio.
9. The live field radio receives the audio from the base station radio.

2.3 Live-to-Virtual and Virtual-to-Live transition

Transitions between transmit states occur after a period of measured inactivity. If a live radio is sensed as actively receiving, it must cease receiving before it can transmit. Likewise, if a virtual radio is actively receiving, it must cease receiving before it can transmit.

3.0 Radio Bridge setup

The following sections describe how to set up a Radio Bridge device:

1. Install live base and field radios.
2. Add and name new hardware channels.
3. Manage scenarios.
4. Edit the Comm Plan.
5. Configure Distributed Interactive Simulation (DIS) settings.
6. Configure Voice Rx/Tx settings.

3.1 Step 1: Install live radios

Follow the steps below to install and configure the live base radios and live field radios. The live base radios are the radios that are connected to audio distribution devices (i.e., ACE-RIU and AI-S devices). The live field radios are the remote radios out in the field. To install a live radio, follow these steps:

1. Configure the following settings on the live base radio:

Setting	SINCGARS RT-1523C/D	SINCGARS RT-1523E/F	PRC-117	PRC-148	URC-200
Volume	Max (Full CW)	9	9	4	Max (Full CW)
Mic Gain	Whisper = OFF	Whisper = OFF	N/A	Mic Lvl = High	N/A
Squelch	ON	ON	ON	ON	ON
Model	SC or FH	SC or FH	SC or FH	SC or FH	SC or FH
COMSEC	PT or CT	PT or CT	PT or CT	PT or CT	PT or CT

Table 2: Base radio settings

2. *(Optional)* The PRC-148 requires additional configuration:
   a. Set MODE/Audio Path to TOP AUDIO.
   b. Disconnect the PRC-148 from the ACE-RIU.
   c. Switch the Audio Path to TOP AUDIO. "Hot switching" the radio's audio path may cause the ACE-RIU to go offline, requiring system reboot.

3. Connect the base radio's handset connection point to an ACE-RIU or AI-S device using the appropriate cable:

Device	ASTi Cable
ACE-RIU	CA-D9M-NC6M-25-C
AI-S	CA-D15M-NC6M-25-C

Table 3: Base radio cables

4. Ensure that the ACE-RIU or AI-S device is connected to the Voisus Server.

***Note**: The ACE-RIU connected to the live radio must be labeled "ACE-RIU Radio," indicating that its jumper settings are configured to interface with live radios. For more details, see ACE-RIU Configuration for Radio Bridge and Remote Control in the ACE-RIU Technical User Guide.*

5. Configure unique SC frequencies or FH net settings for each base radio. These settings must be unique to ensure proper system performance.
6. If MODE-FH or COMSEC-CT settings are selected on any of the radio nets, follow the proper procedures for loading the FH Data or COMSEC Keys into the base and field radios. For fill procedure details, refer to the radio's manual.
7. Ideally, the base radio should be installed so that a high fidelity radio link with field radios is established using LOW transmit power on the base radio. OE-254 (tower) antennas are highly recommended for increasing ranges, improving RF link fidelity and greatly reducing the chance of Radio Frequency Interference (RFI).

   The base radio may be set to MEDIUM transmit power, but the possibility of RFI between the base radio and the ASTi system is increased. If system malfunctions occur, such as spurious transmissions or increased audio noise, reestablish the base radio to field radio links using LOW power.

   Base radios should not use HIGH transmit power. RFI will occur between the base radios and the ASTi system.
8. Configure the nets on field radios with MODE and COMSEC panel settings that match the corresponding nets on the base radios.
9. The final step in the live radio installation procedure is to perform a standard radio check between each set of base and field radios as part of the system operational checkout.

3.2 Step 2: Configure hardware

To add and name new hardware channels in the Voisus Web Interface, follow these steps:

1. From the toolbar on the right-hand side, click **Manage**  , and then click **Hardware Devices**.

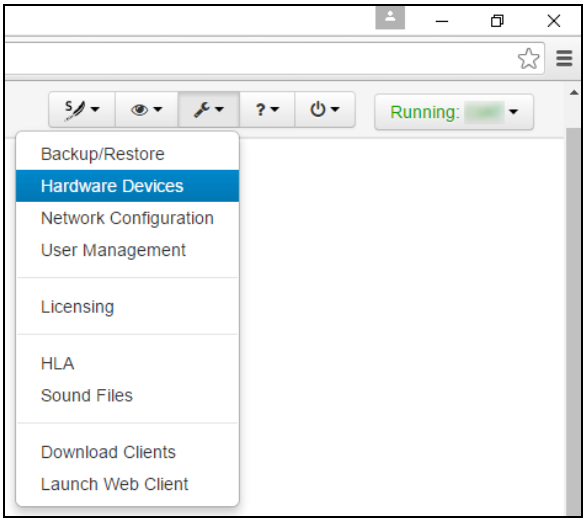


Figure 6: Hardware Devices navigation

2. On the **AI-S** tab, under **Other AI-S devices**, locate the new ACENet device, and select the corresponding check box. Devices are listed by MAC address.

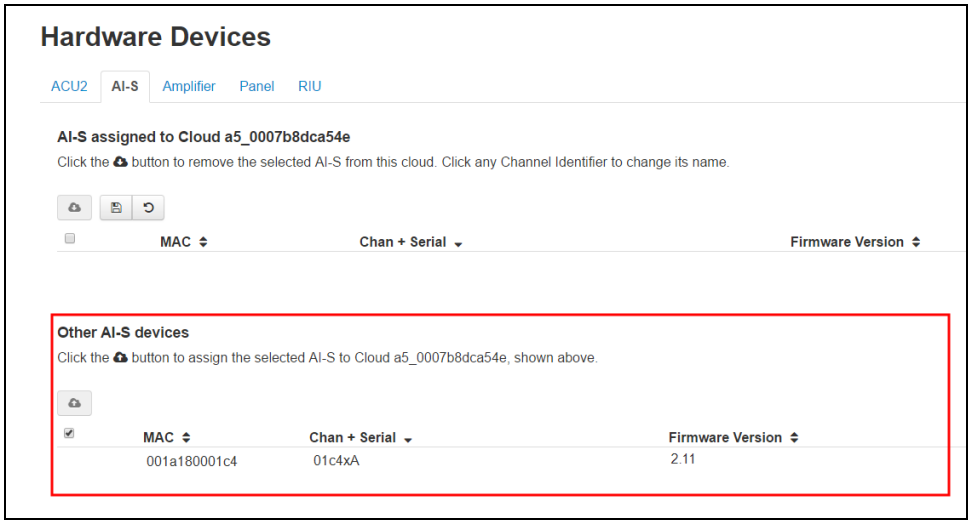


Figure 7: Other devices

3. Click **Add to Cloud**  , and the AI-S appears under **AI-S assigned to Cloud**.

Figure 8: Assigned to Cloud

4. Create a unique channel identifier for each channel connected to a base radio.

3.3 Step 3: Scenario management

To create and run a new Scenario, follow these steps:

1. Create a new Scenario. If desired, use the **RadioBridge4** or **RadioBridge8** example Scenario, which are preconfigured with virtual nets in the Comm Plan.
2. Run the Scenario, and open it.

3.4 Step 4: Comm Plan

If necessary, edit the net names, frequencies, waveforms, and other parameters to match the virtual radio nets that will bridge to the live radio.

3.5 Step 5: DIS settings

Configure the Distributed Interactive Simulation (DIS) settings for your specific exercise.

3.6 Step 6: Voice Rx/Tx

On the **Voice Rx/Tx** page, map the live radio's channel identifier to a virtual net.

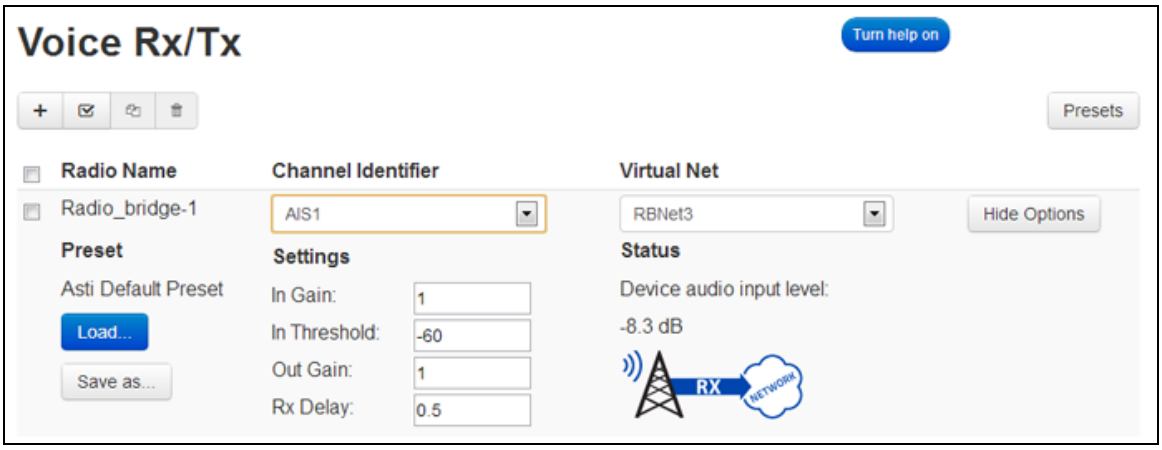


Figure 9: Voice Rx/Tx

3.6.1 Add a live radio

To add a live radio in the Voisus Web Interface, follow these steps:

1. To add a new radio, click +.
2. Click the radio name to edit it.
3. Click the **Channel Identifier** drop-down box, and then click the channel identifier associated with the live radio. Channel identifiers are named on the **Hardware Devices** page.
4. Click the **Virtual Net** drop-down box, and then click the virtual net for communication between the live radio and virtual radios. The live radio will now be able to communicate with simulated radios over the virtual net.

3.6.2 Advanced configuration

The S**how Option**s button displays advanced settings that can be used to fine-tune the audio characteristics of the live radio interface. In most cases, with a standard, supported live radio, these parameters should not need to be modified. Use the following advanced settings for advanced configuration:

- ***Preset***: if changes are made to the settings, use the **Save As...** button to save them for future use. The **Load...** button loads presets saved to your server.
- ***Settings***: fine-tune the audio characteristics of the live radio interface.

- ***In Gain***: a gain multiplier applied to live radio receive audio. This gain is applied before the audio gets to the detection logic. A larger value results in network operators receiving live radio audio at a higher level.
- ***In Threshold***: a value in dB used as a threshold for detecting receive audio from the live radio.
- ***Out Gain***: a gain multiplier applied to live radio transmit audio. A larger value results in live radio operators (e.g., in the field) receiving transmissions from network operators at a higher level.
- ***Rx Delay***: a delay value in seconds used to prevent spurious live radio retransmissions (i.e., "chatter") that can occur with certain radio types. This is sometimes referred to as "hang time" or "drop out delay." In most cases, this value does not need to be adjusted.

- ***Status***: view Rx/Tx status for live-to-virtual communications.

4.0 Remote Control

ASTi's Remote Radio Control has the ability to control live radio assets remotely through the Voisus Web Interface and the Voisus Client for Desktops & Tablets. Live radios can be located in the same room or in a facility miles away. Radio configuration is performed quickly and conveniently over the network from any computer with a suitable web browser. Changes can be made on the fly without interruption to training and while monitoring the radio state to ensure that radios are operating properly and in the correct configuration.

Remote Radio Control is currently available for the following radios:

- URC-200
- PRC-117F
- PRC-117G
- PRC-152

To learn more about other live radios, contact ASTi.

4.1 Equipment

The following sections describe hardware and radio control kit equipment needed for Remote Control.

4.1.1 Hardware

The following hardware is required for remote radio control:

- Voisus Server
- ACE-RIU or AI-S device

***Note**: Label the ACE-RIU connected to the live radio "ACE-RIU Radio," indicating that its jumper settings are configured to interface with live radios. For more details, see ACE-RIU Configuration for Radio Bridge and Remote Control in the ACE-RIU Technical User Guide.*

4.1.2 Radio control kit

ASTi sells a radio control kit for each supported radio, which includes the following:

- *Serial Data Cable*: connects the live radio to the Serial Data Converter.
- *Serial Data Converter*: a compact module that converts serial data protocol from radio RS-232 to RIU RS-422. It is powered through the serial data line.
- *Modular Data Cable*: connects the Serial Data Converter to the ACE-RIU serial data port.

Live Radio	Conversion Kit P/N
URC-200	RCK-URC-200-01
PRC-117F	RCK-PRC-117F
PRC-117G	RCK-PRC-117G

Table 4: Radio control kit cables

4.2 Remote Control setup

If Remote Control qualifies as part of your solution (as ordered from ASTi), its setup documentation is included on the ASTi Docs CD that shipped with your system(s). If you cannot locate it, contact ASTi to receive a new CD, or individual documents at your request.