



**Advanced Simulation Technology inc.**  
500A Huntmar Park Drive  
Herndon, Virginia 20170 USA  
Tel. (703) 471-2104 • Fax. (703) 471-2108  
asti-usa.com

# **ACE-RIU Technical User Guide**

**Document: DOC-HW-RIU-UG-K-0**



Product Name: ACE-RIU

ACE-RIU Technical User Guide

© Copyright ASTi 2020

Restricted Rights: Use, duplication, or disclosure by the Government is subject to restrictions as set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.227-7013.

This material may be reproduced by or for the U.S. Government pursuant to the copyright license under the clause at DFARS 252.227-7013 (1994).

ASTi

500A Huntmar Park Drive

Herndon, Virginia 20170 USA

# Revision history

Date	Revision	Version	Comments
4/26/2019	J	1	Converted content to XML. Updated content for grammar and accuracy.
1/27/2020	K	0	Added "Bottom mounting diagram."

# Contents

<b>1.0 Introduction</b> .....	<b>1</b>
<b>2.0 Physical description</b> .....	<b>2</b>
2.1 Dimensions .....	2
2.2 Weight .....	2
2.3 Front panel .....	2
2.4 Rear panel .....	3
2.5 RJ-12 serial port pinout .....	3
2.6 DB-9 connector pinout .....	4
2.7 Terminal block pinout .....	4
2.8 Status indicator lights .....	5
2.9 Dip switch positions .....	5
<b>3.0 ACENet connection</b> .....	<b>6</b>
3.1 RJ-45 ACENet connection pinout .....	6
3.2 ACENet indicator lights .....	7
<b>4.0 Audio input and output</b> .....	<b>8</b>
4.1 Audio input .....	8
4.1.1 Input gains .....	8
4.1.2 Microphone power .....	9
4.2 Audio output .....	10
<b>5.0 Digital input and output</b> .....	<b>13</b>
5.1 Digital input .....	13
5.2 Digital output .....	14
5.2.1 Surge protection for digital output circuitry .....	14
<b>6.0 Software configuration</b> .....	<b>15</b>
<b>7.0 ACE-RIU rack mounts</b> .....	<b>16</b>
7.1 Bottom mounting diagram .....	17

<b>8.0 Additional information</b> .....	<b>18</b>
8.1 Access the ACE-RIU's internal board .....	18
8.2 Earth-ground the ACE-RIU .....	18
8.3 Update firmware .....	20
<b>9.0 Specifications</b> .....	<b>21</b>
9.1 Power requirements .....	21
9.2 Memory devices .....	21
9.3 Temperature and humidity ranges .....	22
9.4 Reliability .....	22
<b>Appendix A: Set up Radio Bridge and Remote Control</b> .....	<b>23</b>
A-1 Set up internal jumpers .....	23
<b>Appendix B: Warranty information</b> .....	<b>24</b>
B-1 Repairs and returns .....	24

# 1.0 Introduction

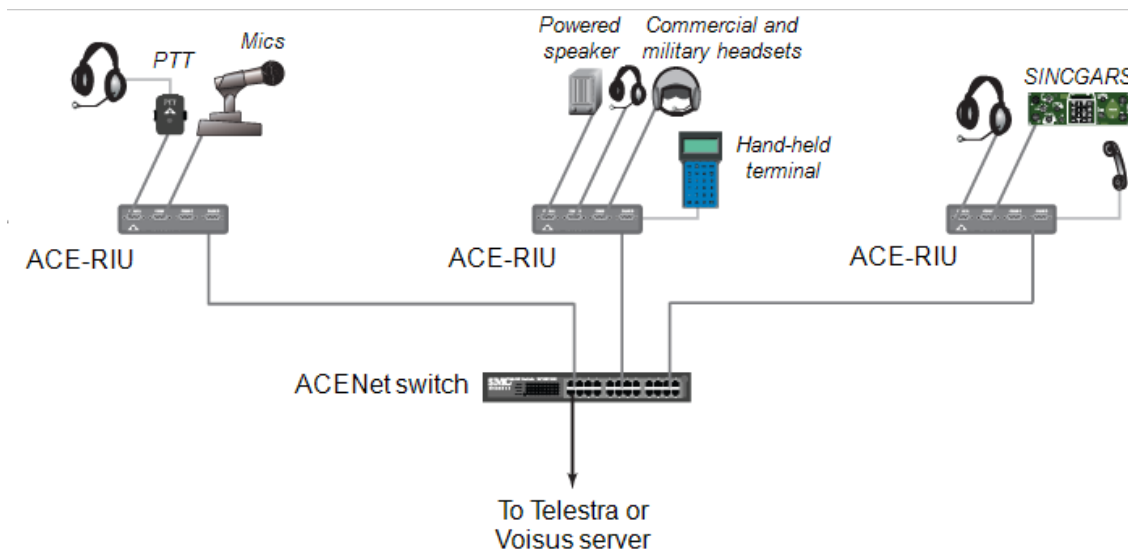
The ACE-RIU is a compact, 48 kHz digital and audio distribution module that connects remotely located operator stations and live radios to the Audio Communications Environment Network (ACENet). The ACE-RIU is compatible with the Telestra and Voisus platforms. The ACE-RIU provides low-noise analog-digital conversion and low-latency audio distribution.

The ACE-RIU integrates press-to-talk (PTT) units, volume controls, simulated communications panels, handheld terminals, and live radios into the simulated communications environment.

The ACE-RIU includes the following features:

- Four digital inputs (i.e., one per channel, four channels total)
- Four digital outputs (i.e., one per channel, four channels total)
- Two RS-422 serial ports

Figure 1, "ACE-RIU network configuration" below shows an example of an ACE-RIU network configuration:



*Figure 1: ACE-RIU network configuration*

## 2.0 Physical description

This chapter provides a physical description of the ACE-RIU:

- Dimensions
- Weight
- Diagrams
- Front and rear panels
- Pinouts

### 2.1 Dimensions

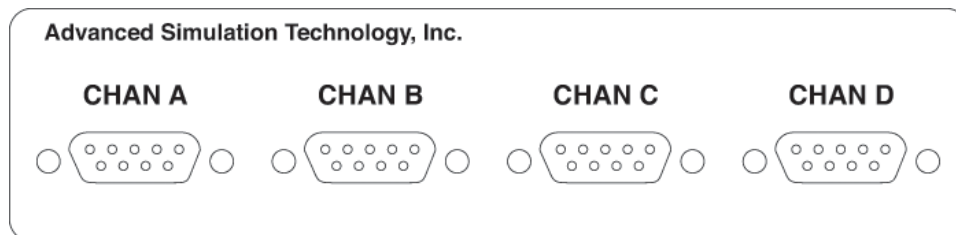
7.5" length × 5.55" width × 1.55" height

### 2.2 Weight

A packaged ACE-RIU weighs 1.5 lbs. The power supply included with the ACE-RIU weighs 0.5 lbs.

### 2.3 Front panel

Figure 2, "Front panel of ACE-RIU" below shows the ACE-RIU's front panel:



*Figure 2: Front panel of ACE-RIU*

The front panel features four DB-9 connectors that provide digital and audio input and output.



## 2.4 Rear panel

Figure 3, "Rear panel of ACE-RIU" below shows the ACE-RIU rear panel:

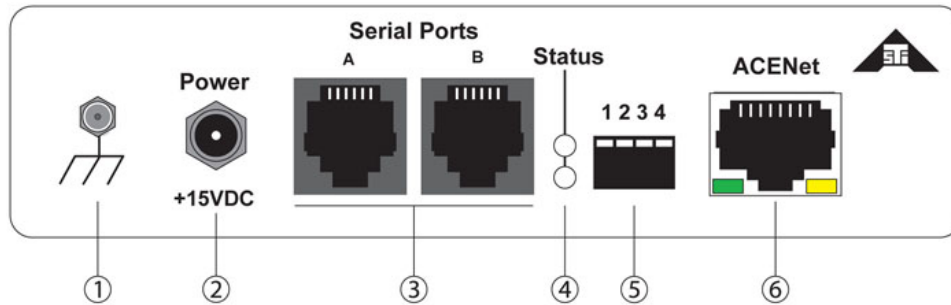


Figure 3: Rear panel of ACE-RIU

Number	Description
①	Earth ground
②	Power
③	Two RJ-12 serial ports
④	Status indicator lights
⑤	Dip switches
⑥	One RJ-45 ACENet connection

Table 1: ACE-RIU rear panel callouts

## 2.5 RJ-12 serial port pinout

Figure 4, "RJ-12 port pinout" below shows the RJ-12 port pinout:

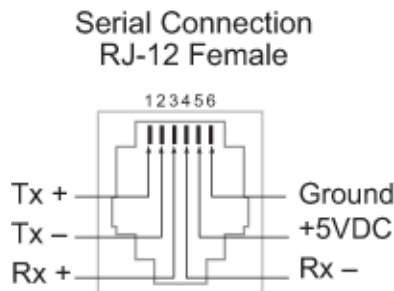
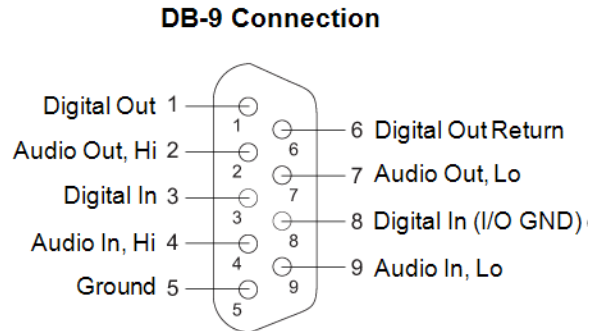


Figure 4: RJ-12 port pinout

## 2.6 DB-9 connector pinout

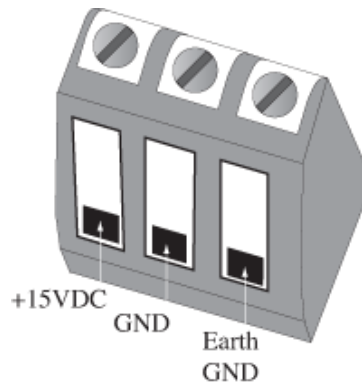
Figure 5, "ACE-RIU DB-9 connector pinout" below shows the ACE-RIU's DB-9 connector pinout:



*Figure 5: ACE-RIU DB-9 connector pinout*

## 2.7 Terminal block pinout

Figure 6, "ACE-RIU terminal block pinout" below shows the ACE-RIU's terminal block pinout:



*Figure 6: ACE-RIU terminal block pinout*

## 2.8 Status indicator lights

The ACE-RIU LED indicator lights display the ACE-RIU's status:

LED Lights	Location	Status
Flashing green	Bottom	Normal operation.
Solid green	Bottom	The ACE-RIU started up properly, but the ACENet is disconnected.
Red	Top	Internal board failure.

*Table 2: ACE-RIU status indicator lights*

### LED Lights



## 2.9 Dip switch positions

The dip switches are used to toggle between normal operation mode and firmware update mode. Go to Section 8.0, "Additional information" on page 18 for guidance regarding firmware updates.

### Dip Switches



Table 3, "Dip switch positions" below shows the ACE-RIU's dip switch positions:

Position	Status
	One down allows for firmware updates.
	Default position for normal operation.

*Table 3: Dip switch positions*

## 3.0 ACENet connection

The ACE-RIU's ACENet port connects to an ACENet-compatible switch via a Category 5e (CAT5e) cable or better.

Device	Cable Length
ACE-RIU	100 meters (328 feet)
Server	100 meters (328 feet)

**Table 4: Maximum cable length to ACENet switch**

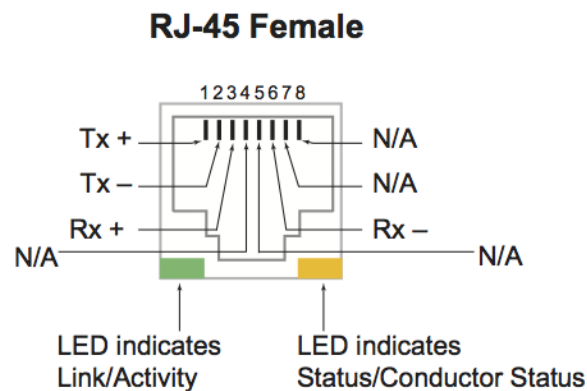


**Important:** Customer-made cables are the primary reason for product failure. ASTi recommends high-quality, manufactured CAT5e cables.

Alternatively, the ACE-RIU can connect directly to the Telestra or Voisus server using a crossover cable. The ACE-RIU does not support daisy-chaining to additional units or internal switching across networks.

### 3.1 RJ-45 ACENet connection pinout

Figure 7, "RJ-45 ACENet connection pin out" below shows an RJ-45 ACENet connection pinout:



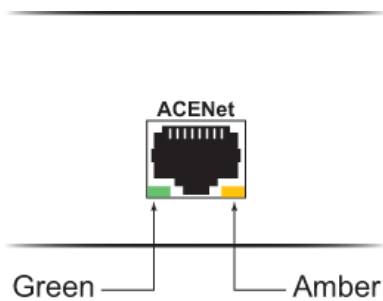
**Figure 7: RJ-45 ACENet connection pin out**

## 3.2 ACENet indicator lights

The ACENet LED indicator lights display the port status:

LED Light	Status
Solid green	Network link.
Flashing green	Network activity.
Solid or flashing amber	One ACENet device per network functions as the ACENet master and is identified with a flashing amber light. All other ACENet devices should report a solid amber light.

*Table 5: ACENet indicator lights*

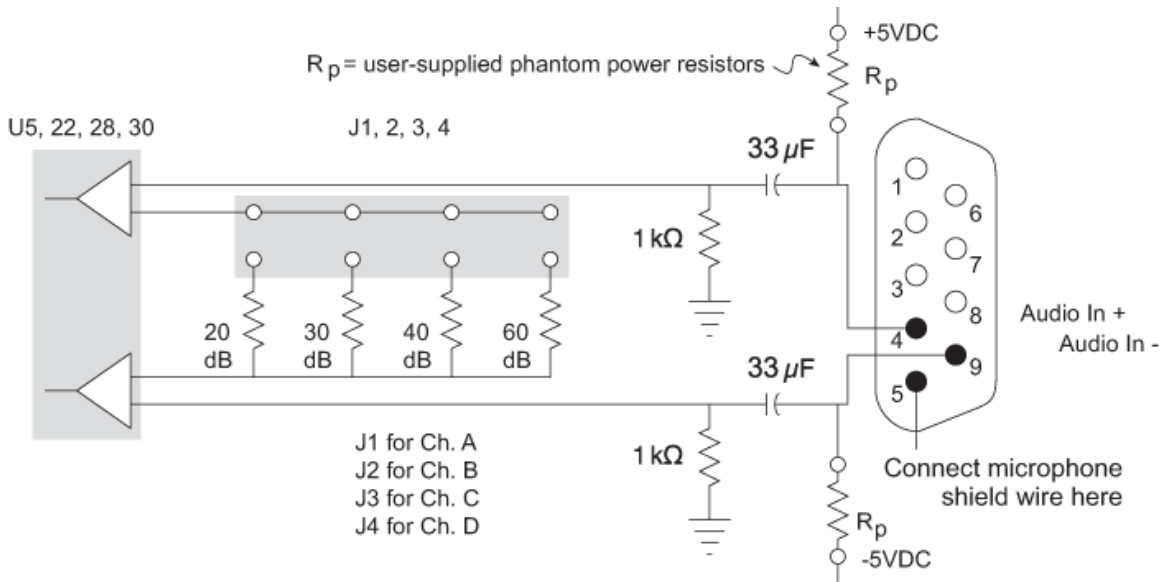


# 4.0 Audio input and output

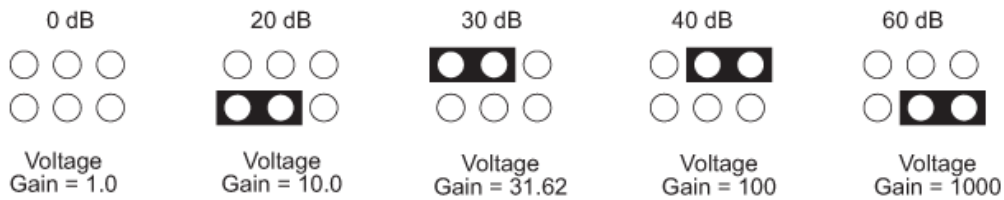
The chapter discusses ACE-RIU audio input and output specifications.

## 4.1 Audio input

The ACE-RIU is capable of receiving audio inputs from a wide variety of devices, such as microphones (freestanding and headset mics), PC sound cards, VCRs, and tape drives. The nominal input impedance of each stage is 1 k.



Setting the gains:



### 4.1.1 Input gains

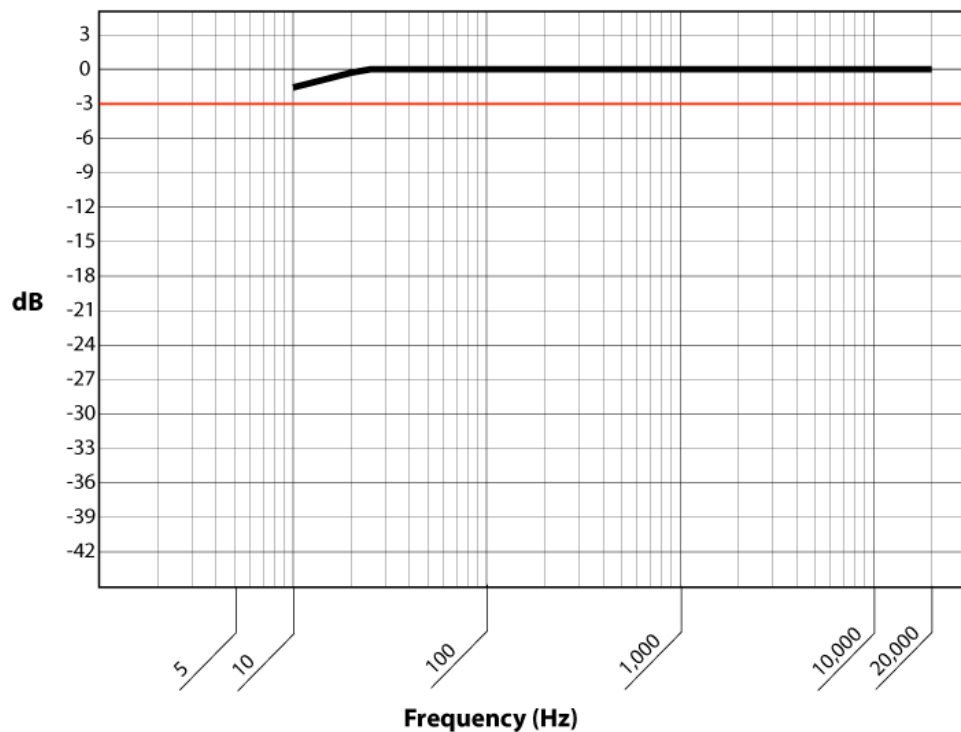
To adjust the input gains, you will need to access the ACE-RIU internal board. Go to Section 8.0, "Additional information" on page 18 for instructions. The input gains for each channel are set using jumper blocks J1 (ChA), J2 (ChB), J3 (ChC) and J4 (ChD). Gain values are: no jumper = 0 dB (line level input), 20, 30, 40, or 60 dB.

With a 0 dB gain setting, the maximum input signal level that can be applied without distortion by the ACE-RIU is  $2.5 V_{pp}$ . Theoretically, an input signal as small as  $\pm 5 mV_{peak}$  could be applied to the audio input. However, it might not be possible to actually use a  $\pm 5 mV_{peak}$  signal input to the ACE-RIU due to on-board circuit noise, ambient noise (both audio and electronic), interface cabling construction, and microphone characteristics.



*Note: If you are unsure of your headset's compatibility with the ACE-RIU, ASTi provides a headset evaluation service.*

Figure 8, "ACE-RIU input frequency response" below shows the ACE-RIU's input frequency response:

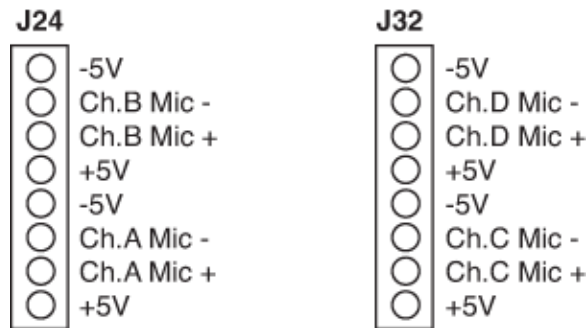


*Figure 8: ACE-RIU input frequency response*

## 4.1.2 Microphone power

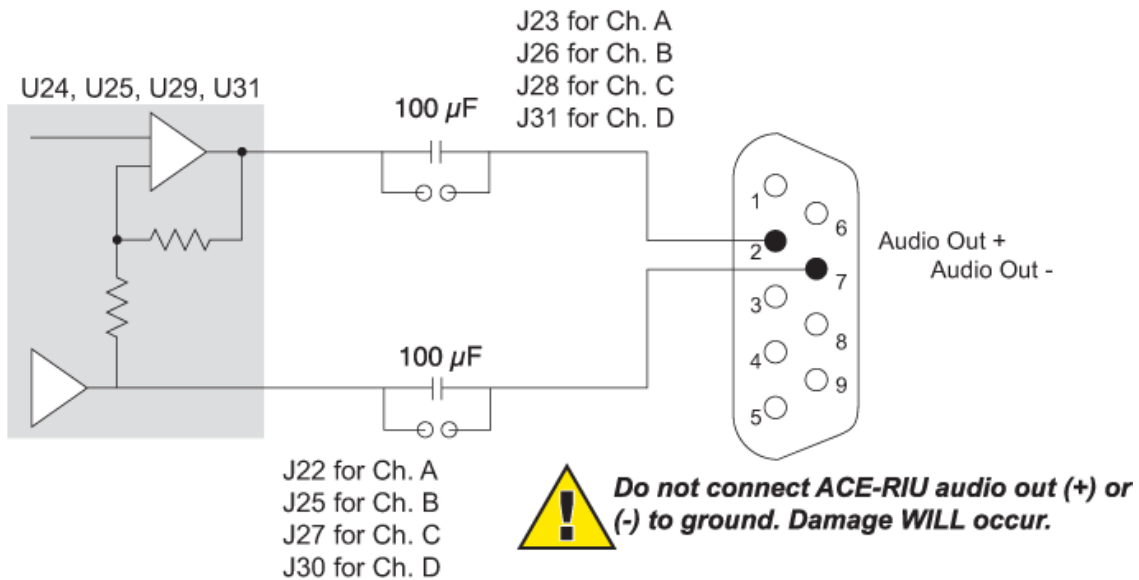
The ACE-RIU can provide mic power voltage to electret-type microphones. A +10 VDC potential is created across the audio in + and lines by populating resistor packs in connectors J24 and J32. Installing resistors in J24 provides mic power to ACE-RIU channels A and B, where installing resistors in J32 provides power to channels C and D.

The resistor values range from 470–10 k based on the type of microphone used. Resistor selection is based on the current required to drive the microphone preamplifier.

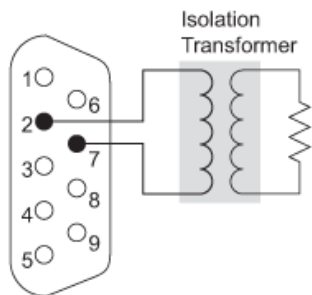


## 4.2 Audio output

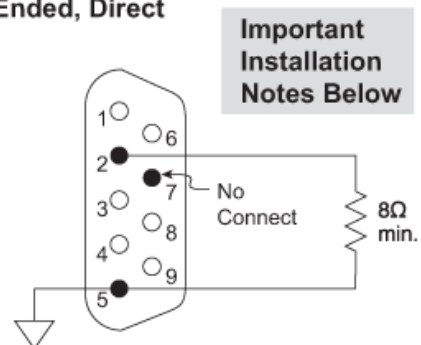
Each ACE-RIU channel features a high-performance differential audio amplifier that is capable of driving a wide variety of audio interfaces.



### Single-Ended, Isolation Transformer



### Single-Ended, Direct





The ACE-RIU audio output can drive bridged loads or single-ended loads. Bridged loads are not connected to an external ground point. Examples include differential inputs to professional audio recorders, mixers, amplifiers, headsets and “floating” speakers. Single-ended loads have signal returns that are connected to an external ground point. Examples include inputs to consumer-grade audio devices like tape recorders and PC sound cards.

Each channel is capable of supplying 1 Watt RMS into a bridge connected 8 W load. If a single-ended 8 load is connected to the output, the ACE-RIU is capable of supplying 250 mWatts RMS.

The output impedance of each channel is typically 0.1 into an 8 load.

Each ACE-RIU channel provides a balanced output with a maximum signal level of  $10 V_{pp}$ . When used to drive a single ended load, the output maximum signal level is  $5 V_{pp}$ . When driving bridge-connected loads (differential, with no ground connection), connect both the Audio Out + (pin 2) and Audio Out (pin 7) to the load.

When driving single-ended loads (with external ground connection), connect only the Audio Out + (pin 2) to the input side of the load and Ground (pin 5) to the grounded side of the load. Audio Out (pin 7) must be left unconnected. The single-ended configuration ties the ACE-RIU signal return ground to the external ground, which may introduce noise from the external ground into the ACE-RIU audio circuit. If external ground noise is introduced into the ACE-RIU in the single-ended configuration, it may be necessary to connect the ACE-RIU output to the load through a bridge-connected isolation transformer (see figure above). By default, the ACE-RIU has a DC blocking capacitor in line. ASTi does not recommend adding the jumper to remove the DC blocking capacitor.



**Caution:** Failure to follow the installation instructions for single-ended applications may result in ACE-RIU damage that is not covered by the product warranty.

Figure 9, "ACE-RIU output frequency response" below shows the ACE-RIU output frequency response:

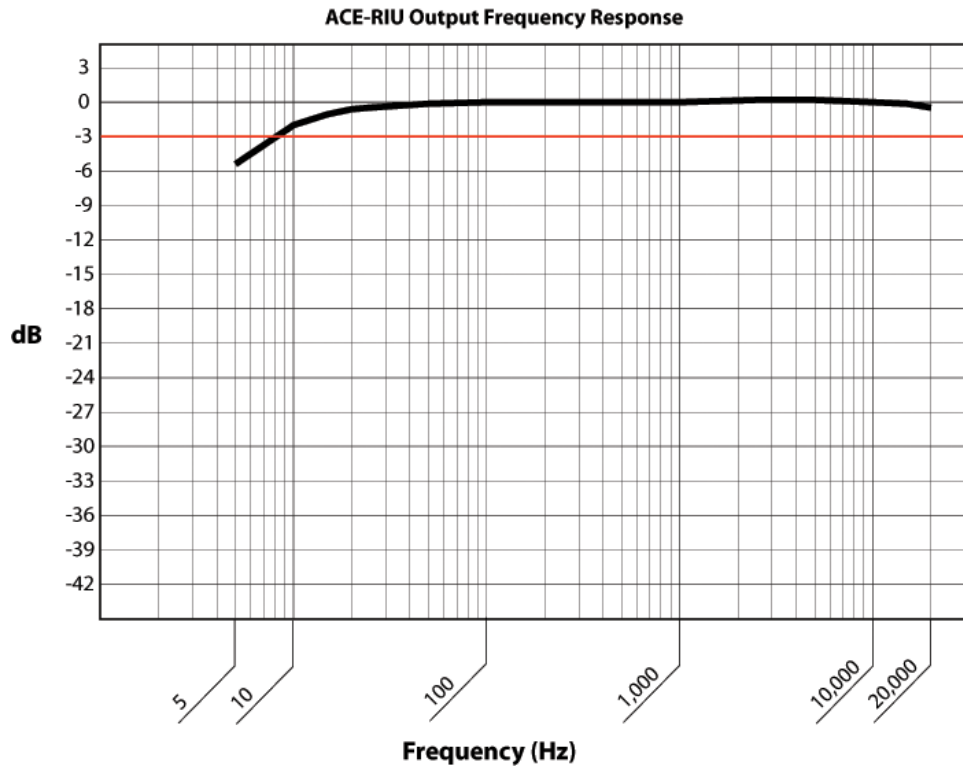


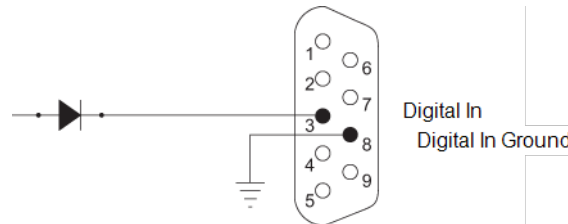
Figure 9: ACE-RIU output frequency response

## 5.0 Digital input and output

This chapter discusses the ACE-RIU's digital input and output.

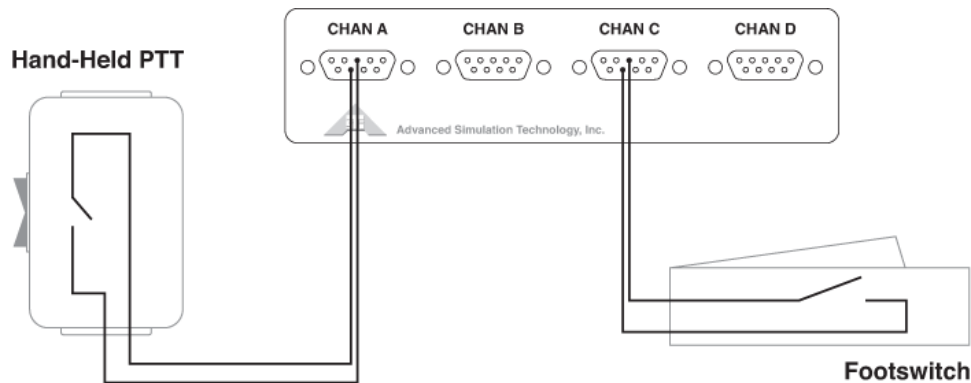
### 5.1 Digital input

The ACE-RIU provides contact-sensing digital inputs. No power is required. Connecting the digital input and digital input ground lines together triggers the digital input.



*Figure 10: ACE-RIU digital input*

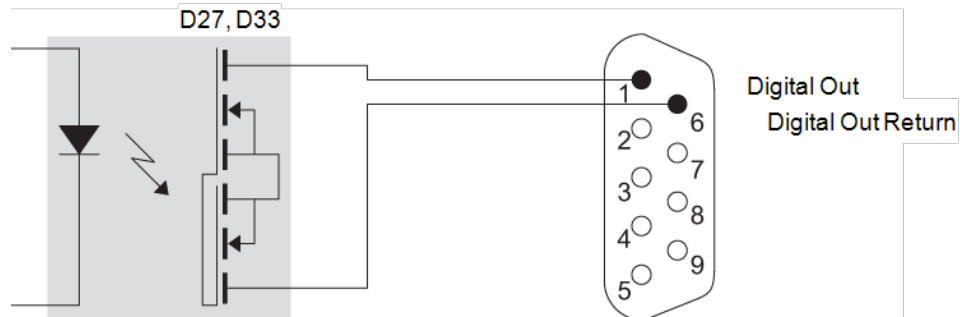
The digital inputs on the ACE-RIU are useful for providing a direct interface with press-to-talk (PTT) switches. The PTT input is fed directly into the model, thereby eliminating control latency associated with host I/O systems.



*Figure 11: Hand-held PTT and foot switch*

## 5.2 Digital output

The digital output circuitry consists of an opto-isolated, solid-state relay for switching power to external loads.

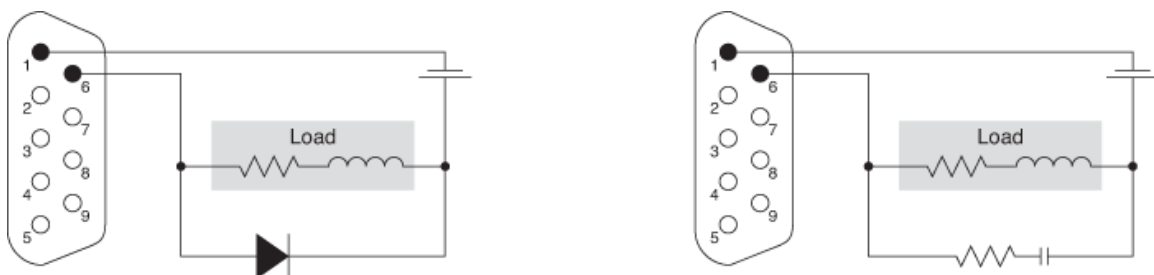


Each digital output circuit has a continuous current rating of 120 mA maximum and a maximum power dissipation rating of 180 mW. While providing 10 mA of load current, the MOSFET on-state resistance is typically 21. The relay's maximum response frequency is 500 Hz.

Type	Opto-isolated
Maximum continuous current rating	120 mA
Maximum power dissipation	180 mW
Maximum frequency response	500 Hz

### 5.2.1 Surge protection for digital output circuitry

When driving an inductive load (e.g., a relay coil), always use a C/R snubber or clamping diode in parallel with the load to suppress large spikes.



## 6.0 Software configuration

For software configuration instructions, reference the following:

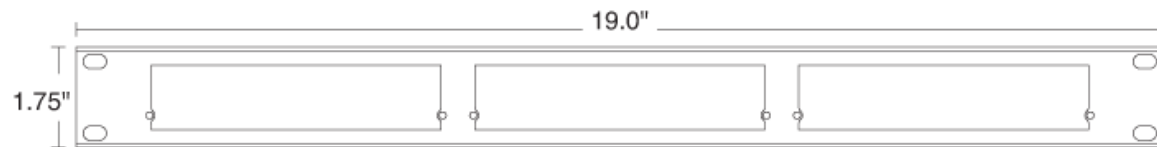
Name	Description
Telestra	Go to the <i>Remote Management System User Guide</i> : <a href="http://support.asti-usa.com/telestra/index.html">support.asti-usa.com/telestra/index.html</a>
Voisus	Go to "Manage hardware devices" in the <i>Voisus Client User Guide</i> : <a href="http://support.asti-usa.com/voisus/index.html">support.asti-usa.com/voisus/index.html</a>

*Table 6: Software configuration*

## 7.0 ACE-RIU rack mounts

ACE-RIUs may be rack-mounted in a 1U high, 19 wide bracket. The bracket will accommodate up to three ACE-RIUs. Allow at least two inches of space in front of and behind the module for cable access and clearance. The brackets can be supplied unassembled, or ASTi can mount the components for a small fee.

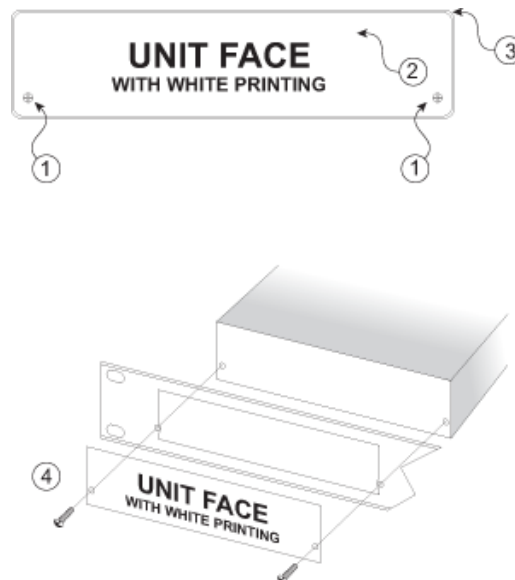
When the ACE-RIU is rack-mounted, the front bezel of the ACE-RIU case is not used. Keep the bezel in the event that the ACE-RIU is removed from the bracket and used as a stand-alone unit. Without the bezel, the end plate of the ACE-RIU will not fit on the case correctly.



*Figure 12: ACE-RIU rack mount*

To install the ACE-RIU's rackmount, follow these steps:

1. Remove and retain screws near bottom of faceplate
2. Remove faceplate with white printing.
3. Remove plastic bezel surrounding faceplate. Retain this plastic piece for re-installation if ACE-RIU is removed from the rackmount bracket.
4. Using original screws, attach faceplate to front of mounting bracket. Attach body of ACE-RIU to rear of mounting bracket, as shown here.



*Figure 13: ACE-RIU rack mount installation*

## 7.1 Bottom mounting diagram

Figure 14, "ACE-RIU bottom mounting diagram" below shows ACE-RIU mounting dimensions:

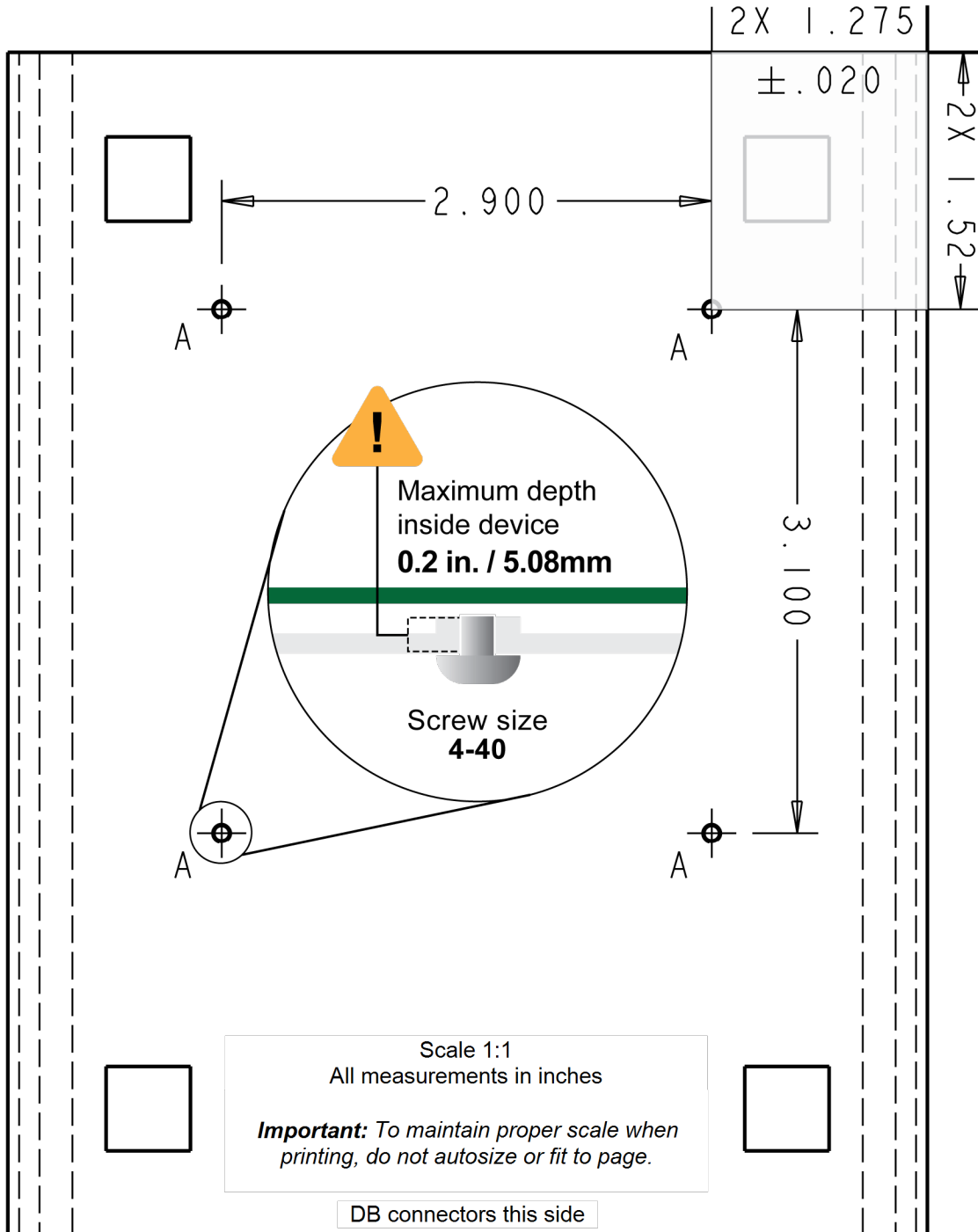


Figure 14: ACE-RIU bottom mounting diagram

## 8.0 Additional information

This chapter explains how to complete the following additional tasks:

- Access the ACE-RIU's internal board
- Earth-ground the ACE-RIU
- Update the ACE-RIU's firmware

### 8.1 Access the ACE-RIU's internal board

You may wish to access the ACE-RIU internal board to set the gains or provide microphone power. To access the ACE-RIU internal board, follow these steps:

1. Using a Phillips-head screwdriver, remove the two side screws on the front panel of the ACE-RIU.
2. Using a 3/16" nut driver, remove the eight jackscrews from the front faceplate.
3. Remove the faceplate with the white printing.
4. Remove the plastic bezel surrounding the faceplate.
5. Slide the black cover off the board.
6. Set the gains or install the resistors as needed.

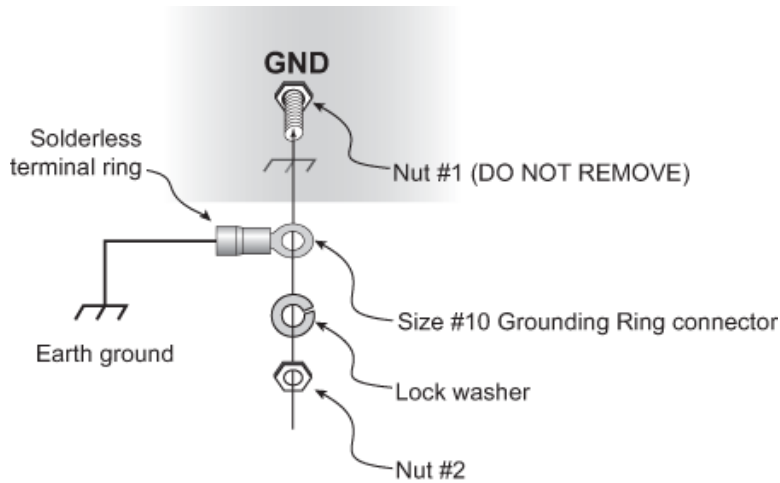
### 8.2 Earth-ground the ACE-RIU

ASTi does not require the ACE-RIU to be grounded. However, it was designed to accommodate customers with strict grounding policies and requirements. To reduce resistance, keep your grounding wire as short as possible. This practice effectively dissipates an unwanted electrical charge.



The following equipment is required:

- #10 grounding ring connector
- Ground wire (i.e., stranded, braided, or strap wire; 18 gauge American wire gauge (AWG) minimum)



**Figure 15: Grounding**



**Important:** Do not remove nut #1 from the screw as it will cause the screw to fall inside the ACE-RIU chassis.

To ground the ACE-RIU, follow these steps:

1. Remove nut #2.
2. Slip the grounding ring connector onto the threaded end of the jackscrew.
3. Insert nut #2 onto the threaded end of the jack screw. Take care not to cross thread or over-tighten the nut when reattaching.

## 8.3 Update firmware

Table 7, "Software firmware updates" below provides ACE-RIU firmware update instructions for Telestra and Voisus software:

Update	Instructions
Telestra	To update ACE-RIU firmware, go to the <i>Remote Management System User Guide</i> : <a href="http://support.asti-usa.com/telestra/index.html">support.asti-usa.com/telestra/index.html</a>
Voisus	To update ACE-RIU firmware for Voisus, follow these steps: <ol style="list-style-type: none"><li>1. In the Voisus web interface, from the top-right navigation bar, go to <b>Manage &gt; Hardware Devices</b>.</li><li>2. Go to the <b>ACE-RIU</b> tab. A message displays if any connected ACE-RIUs need a firmware update.</li><li>3. To complete the procedure, follow the instructions on the screen.</li></ol>

*Table 7: Software firmware updates*

## 9.0 Specifications

This chapter describes the following ACE-RIU specifications:

- Power requirements
- Memory devices
- Temperature and humidity ranges
- Reliability

### 9.1 Power requirements

The hardware is powered by an individual power supply included with ACE-RIU shipment. The power adapter inlet connector is an IEC 320 type C14 or C8, requiring a matching cord set equipped with an IEC 320 C13 or C7 connector (i.e., female line cord). Country-specific power connectors must be acquired separately for international use.

<b>Input to PS-A-R-01</b>	100–240 VAC, 50–60 Hz, 1.5 A <sub>RMS</sub> , (120 VAC), 0.75 A <sub>RMS</sub> (240 VAC)	
<b>Power In Connector</b>	Inside Diameter 0.100", Outside Diameter 0.218", locking, center positive	
	Connector P/N:	Switchcraft 712RA supplied with P2439 Hex Nut (5/16–32) and P2441 Washer
	Mating Connector P/N:	Switchcraft 760k
<b>Power Consumption</b>	+15 VDC, 2A	

### 9.2 Memory devices

The ACE-RIU memory devices are summarized in the table below:

Name	Memory
<b>Volatile memory</b>	
MCU Internal SRAM	69 kb
<b>Non-volatile memory</b>	
MCU Internal	256 kb
Flash	8 Mb

*Table 8: ACE-RIU memory devices*

## 9.3 Temperature and humidity ranges

Table 9, "Temperature and humidity ranges" below shows ACE-RIU temperature and humidity ranges:

Type	Suggested Range
Operating Temperature Range	+10°C to 32°C (50°F to 90°F)
Operating Max. Temperature Gradient	20°C (68°F) per hour
Operating Humidity Range	10% to 70% non-condensing
Storage Temperature Range	0°C to 55°C (32°F to 135°F)
Storage Max. Temperature Gradient	30°C (86°F) per hour
Storage Humidity Range	5% to 95%

*Table 9: Temperature and humidity ranges*

## 9.4 Reliability

The following table shows an ACE-RIU's typical Mean Time Between Failure (MTBF) rate for commercial off-the-shelf (COTS) and military (MIL) systems:

Category	MTBF Rate
COTS	108,100.75 hours
MIL	48,390.23 hours

*Table 10: ACE-RIU MTBF rates*

# Appendix A: Set up Radio Bridge and Remote Control

The ACE-RIU is sold in two different configurations:

- *Operator ACE-RIU*: interface module for operator stations. The device is labeled “ACE-RIU.”
- *Radio ACE-RIU*: interface module for live radios. Used with Voisus Radio Bridge and Remote Control. The device is labeled “Radio ACE-RIU.”

Each ACE-RIU is preset before shipping. If you wish to verify the settings or change the configuration, follow the instructions below.

## A-1 Set up internal jumpers

Access the ACE-RIU's internal board. Instructions can be found in Section 8.1, "Access the ACE-RIU's internal board" on page 18. Adjust the internal jumpers to the values listed below for an Operator ACE-RIU or Radio ACE-RIU.



**Important:** This operation must be performed at an approved ESD station to avoid damaging the equipment and voiding the manufacturer warranty.

Description	Jumper Settings	Operator ACE-RIU	Radio ACE-RIU
Input Gain, Channel A	J1	40 dB	0 dB
Input Gain, Channel B	J2		
Input Gain, Channel C	J3		
Input Gain, Channel D	J4		
Output Coupling, Channel A	J5	OPEN	OPEN
Output Coupling, Channel B	J6		
Output Coupling, Channel C	J7		
Output Coupling, Channel D	J8		

## Appendix B: Warranty information

To view ASTi's warranty, go to “Standard Terms and Conditions” at [www.asti-usa.com/legal/terms.html](http://www.asti-usa.com/legal/terms.html).

### B-1 Repairs and returns

To return equipment to ASTi, observe the following procedures:

1. Request a Return Material Authorization (RMA) number through the form on the RMA User Account at [rma.asti-usa.com/rma](http://rma.asti-usa.com/rma). ASTi's Production department cannot receive a repair without an RMA number. The shipping label must also include the RMA number. Any items received from customers without RMA numbers or appropriate contact information will not be tested. After 60 days, ASTi reserves the right to scrap all hardware received in this condition.
2. When packaging the equipment in question, make sure it is well-protected. Failure to properly package the equipment during shipping could void the warranty.
  - Always double-box the device.
  - The inner container should employ some semi-rigid, contour-fitting foam, while the exterior container should use a more pliant, shock-absorbing material, such as styro-foam peanuts.
  - To prevent possible Electrostatic Discharge (ESD) damage, properly enclose the device in an antistatic bag.
3. Do not send accessory pieces, such as rack mount kits, power supplies, or software. Only include items that do not work.
4. Describe the problem, noting the following information:
  - Serial number for the unit in question
  - Point of contact information (i.e., name, telephone number, and equipment return address)

Failure to include this information could extensively delay the return of equipment.

5. If you are an international customer, include the correct product value on all shipping documents. For proper harmonized tariff codes, contact ASTi. The customer is responsible for duties, taxes, and fees incurred during shipment.

ASTi evaluates equipment free of charge and will not start work without prior customer approval.

You are responsible for shipping charges to ASTi for warranty and non-warranty repairs. If equipment is not under warranty, a purchase order is required to cover any repairs. ASTi will provide a quote for all nonwarranty items, including return shipping. The customer is responsible for return shipping charges on nonwarranty equipment. ASTi ships equipment still under warranty back to the customer via FedEx, unless otherwise directed. ASTi is responsible for return shipping charges on domestic items under warranty.

If ASTi does not receive the equipment 30 days after the RMA was issued, ASTi closes the RMA and designates it as unused.