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ACU2 Technical User Guide

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Product Name: ACU2

ACU2 Technical User Guide

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ASTi

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Revision history

Date	Revision	Version	Comments
12/8/2017	L	1	Convert original content to XML and edit for grammar and accuracy.
6/13/2018	L	2	Add fourth status indicator LED light to "Status indicator lights."
8/29/2018	L	3	Remove polarity signs from "Digital output" image and add "Digital Out/Digital Out Return" label.

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1.0 Introduction

The ACU2 is a compact, 48 kHz digital and audio distribution module that connects remotely located operator stations and live radios to the ACENet network. The ACU2 is compatible with the Telestra and Voisus platforms. The ACU2 provides low noise, analog-to-digital conversion, and low-latency audio distribution.

The ACU2 integrates press-to-talk (PTT) units, volume controls, simulated communication panels, hand-held terminals (HHTs), and live radios into the simulated communications environment.

The ACU2 supports the following features:

- *Stereo support:* stereo operation (i.e., independent left and right output) is supported on a single DB-15 connector, which reduces cabling complexity and installation footprint for applications requiring stereo operators.
- *Compact footprint:* each device supports four configurable mono or stereo operator positions in a single compact unit, which fits easily on a desktop. Alternatively, rackmount two devices side by side in 1U 19" rack space.
- *High fidelity audio:* 48 kHz digital audio and balanced pro-audio interfaces.
- *Software-based configuration:* software-adjustable amplifier or preamplifier gains and microphone power for easy, direct connection to military and commercial headsets and a wide variety of audio and communication systems and peripherals.
- *Serial data ports:* control interface for ASTi HHTs, simulated panels, and live radio control.
- *Integrated I/O:* configurable digital and analog input/output (I/O) for direct connection of PTT units, volume control, switch detection, radio PTT activation, and other control applications.

The following figure shows an example of an ACU2 hardware configuration:

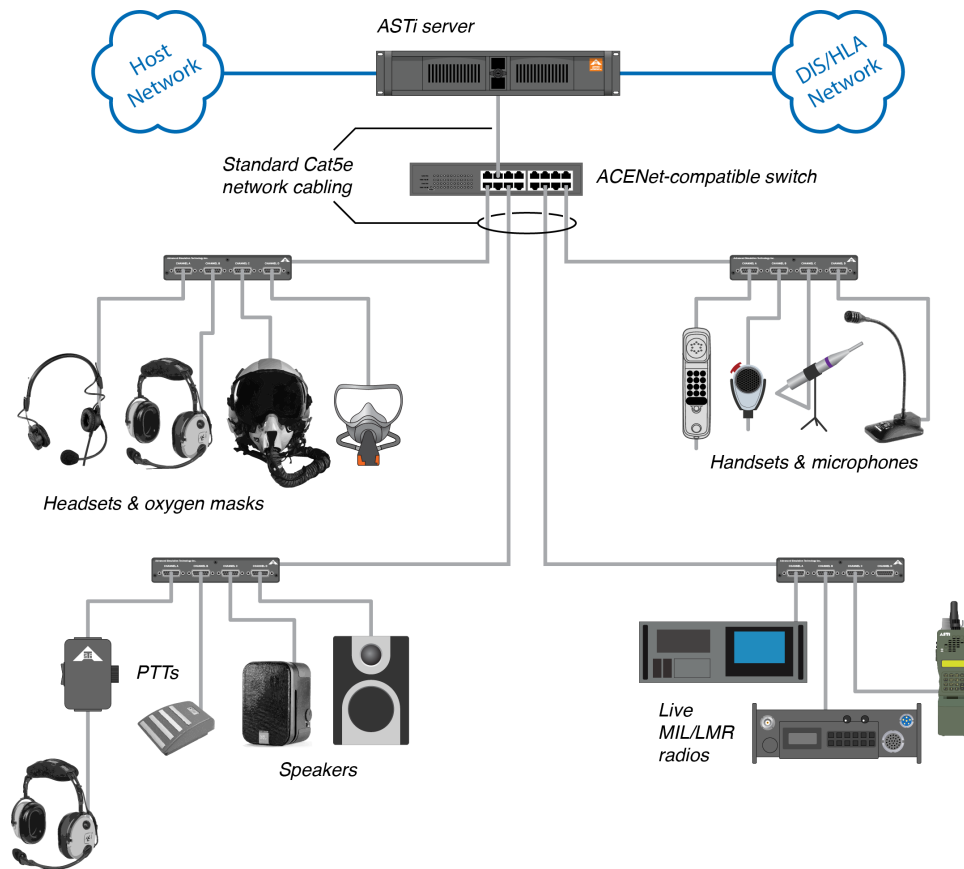


Figure 1: ACU2 hardware configuration

2.0 Physical description

This chapter provides a physical description of the ACU2:

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

2.1 ACU2 with bezels

The ACU2 has two bezels, encompassing the front and rear panels. This ACU2 is Conformité Européenne (CE)/Restriction of Hazardous Substances (RoHS) certified. Removing the bezels voids the CE certification. The following figure shows the ACU2 front bezel:

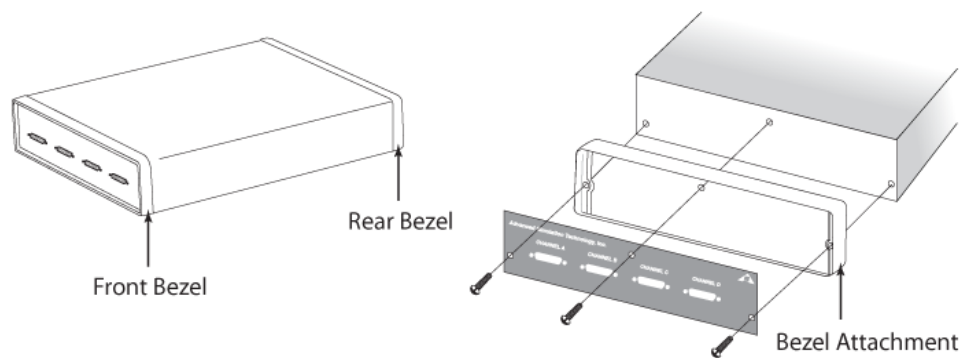


Figure 2: ACU2 front bezel

The following figure shows ACU2 height and width dimensions:

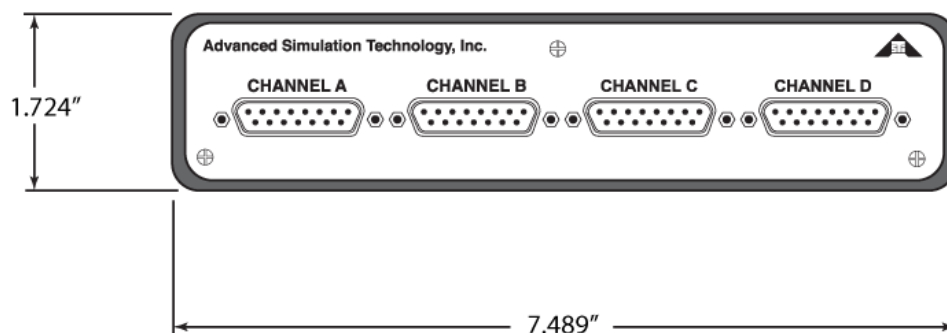


Figure 3: ACU2 height and width dimensions

The following figure shows ACU2 bezel side dimensions:

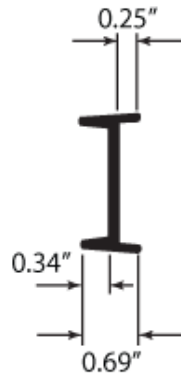


Figure 4: ACU2 bezel side dimensions

2.2 ACU2 without bezels

Older versions of the ACU2 do not have bezels. The following table shows the specification for ACU2s without bezels:

Specification	Description
Length	7.5"
Width	7"
Height	1.55"

Table 1: Specifications for ACU2s without bezels

2.3 Weight

A packaged ACU2 weighs 2 lbs. The power supply included with the ACU2 weighs 0.5 lbs.

2.4 Front panel

The following figure shows the ACU2's front panel:

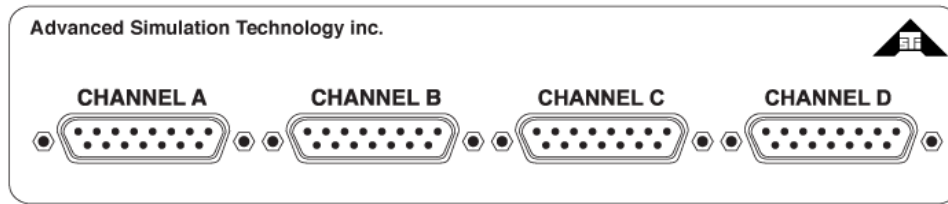


Figure 5: Front panel of ACU2 without bezel

The front panel features four DB-15 connectors that are compatible with a variety of audio and press-to-talk (PTT) devices.

2.4.1 Audio interface: DB-15 pinout

The following figure shows a DB-15 pinout for the ACU2 audio interface:

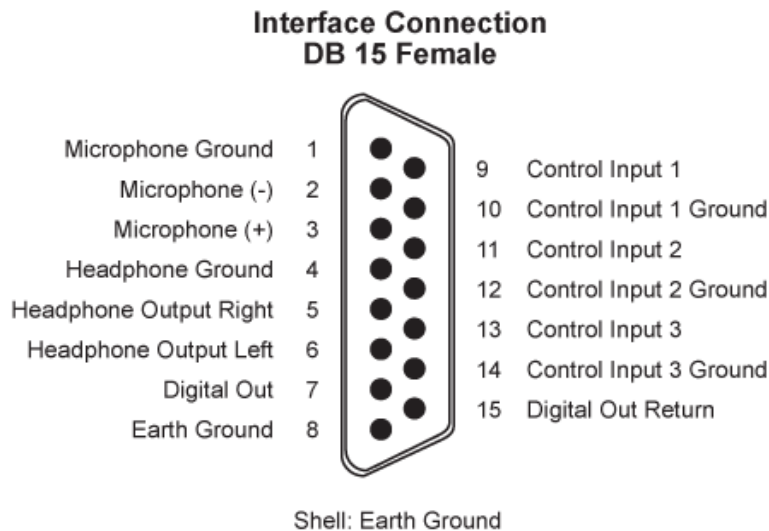


Figure 6: Interface connection DB-15 female

2.5 Rear panel

The following figure shows the ACU2 rear panel:

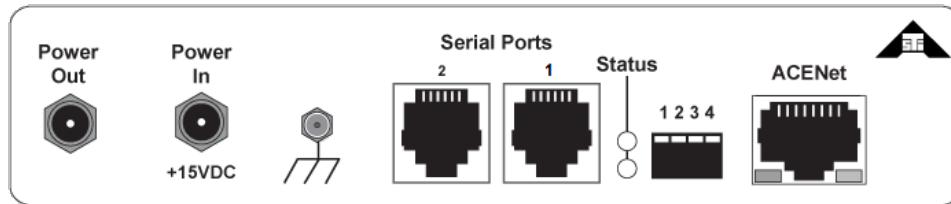


Figure 7: Rear panel of ACU2 without bezels

2.5.1 Serial ports

The ACU2 has two serial ports that provide a control interface for ASTi hand-held terminals (HHTs), simulated panels, and live radio control. The following figure shows an RJ-12 female serial connection in RS-422 mode:

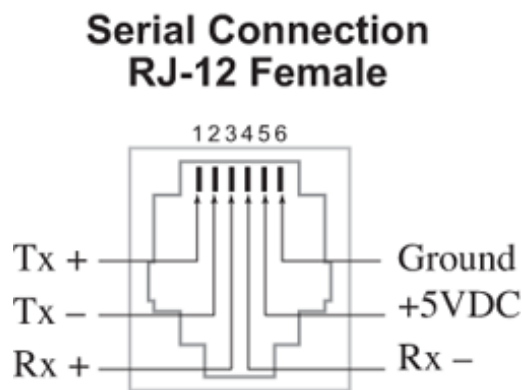


Figure 8: RJ-12 pin out: RS-422 mode

The following figure shows an RJ-12 female serial connection in RS-232 mode:

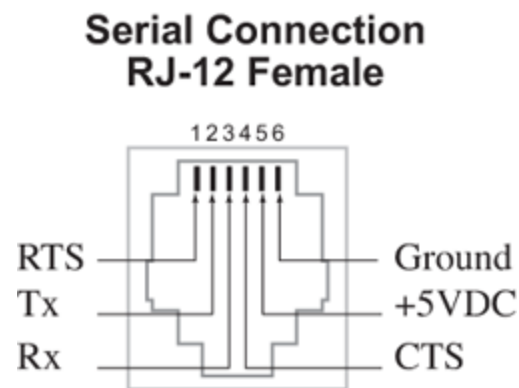


Figure 9: RJ-12 pin out: RS-232 mode

2.5.2 Status indicator lights

The ACU2 LED indicator lights display the ACU2's status:

LED Lights	Location	Status
Flashing green	Bottom	Normal operation.
Solid green	Bottom	The ACU2 started up properly, but the ACENet is disconnected.
Red	Top	Internal board failure.
One red flash + three green flashes	N/A	No LAN link.

Table 2: ACU2 status indicator lights

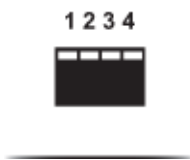
LED Lights



2.5.3 DIP switch positions

Dual in-line package (DIP) switches toggle between normal operation mode and firmware update mode. For additional guidance, go to Section 8.0, "Update firmware" on page 20.

Dip Switches



The following figure shows DIP switch positions:



Position	Status
	Position 1 down allows for firmware updates.
	Default position for normal operation.

Table 3: DIP switch positions

2.5.4 ACENet connection

The ACU2's ACENet port connects to an ACENet-compatible switch via a Category 5e (CAT5e) cable or better.

Device	Cable Length
ACU2	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 ACU2 can connect directly to the Telestra or Voisus server using a crossover cable. The ACU2 does not support daisy-chaining to additional units or internal switching across networks.

2.5.4.1 RJ-45 ACENet connection pinout

The following figure shows an RJ-45 ACENet connection pinout:

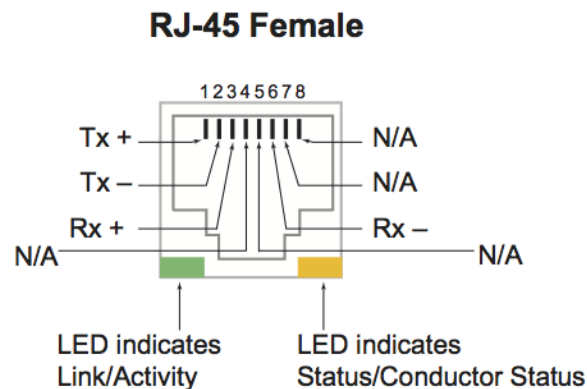


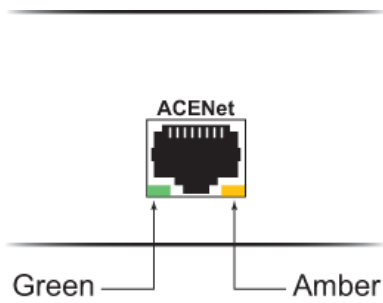
Figure 10: RJ-45 ACENet connection pin out

2.5.4.2 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



3.0 Audio input and output

The chapter discusses ACU2 audio input and output specifications.

3.1 Audio input

The following table shows ACU2 audio input characteristics and values:

Input Impedance	4.6 k
Input Level	3.25 V _{pp} max (6.5 V _{pp} differential)
Input Gain	-8 dB, +2 dB to +57 dB, software configurable <i>Note: The ACU2 gain covers a total range of 65 dB. Between +2 dB and +57 dB, the gain can be set in 1 dB steps. A value of -8 dB is available for input signals greater than line level. The range -8 dB to +2 dB cannot be selected as a function of design.</i>
Microphone Power	+12.5 VDC, software-enabled
Frequency Response	20 Hz to 20 kHz, +/- 1.5 dB

Table 6: Audio input characteristics

3.1.1 Microphone power

In Telestra systems, microphone power is configured in the Remote Management System (RMS). Input levels can be adjusted in the RMS to accommodate line level signals as well as microphone level signals. R1 and R2 connections are only active when power mode is enabled in the software:

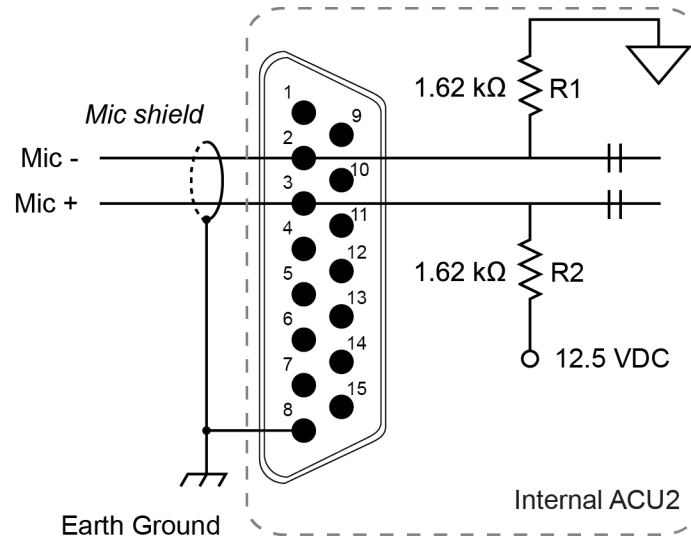


Figure 11: Microphone power diagram



Caution: Do not connect a microphone requiring phantom power to an ACU2 device, as this will damage the microphone. If you are unsure of the difference between microphone power and phantom power, contact the microphone manufacturer or ASTi before connecting equipment. Most military headsets use microphone power.

3.1.2 Input frequency response

The following figure shows an ACU2's input frequency response:

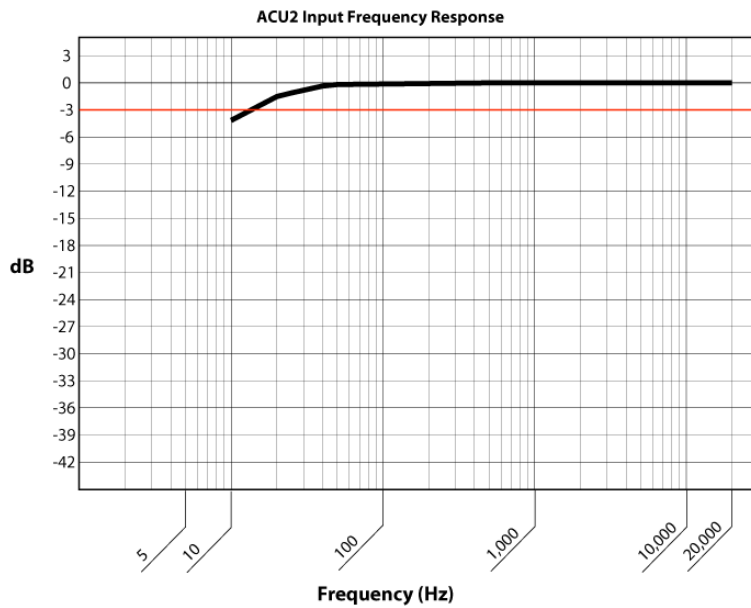


Figure 12: ACU2 input frequency response

3.2 Audio output

The following table shows an ACU2's audio output:

Output Impedance	10 Ohms
Output Current	0.201 A at 8 Ohms
Output Gain	-25 dB to +10 dB
Output Level	1.61 VAC rms into 8 Ohms
Output Power	0.32 W at 8 Ohms
Frequency Response	20 Hz to 20 kHz
Max Output Signal	10 Vpp

Figure 13: ACU2 audio output

3.2.1 Audio isolation characteristics

The following table shows audio isolation characteristics:

Between	Isolation	Frequency
Ch. 1 left to Ch. 1 right output channels	-81 dB at +4 dBu	20 Hz to 20 kHz
Ch. 1 to Ch. 2 output channels	-77 dB at +4 dBu	
Ch. 1 output to Ch. 1 input	> -100 dB at +4 dBu	
Ch. 1 output to Ch. 2 input		
Ch. 1 input to Ch. 2 input		

Table 7: Audio isolation characteristics

3.2.2 Output frequency response

The following figure shows an ACU2's output frequency response:

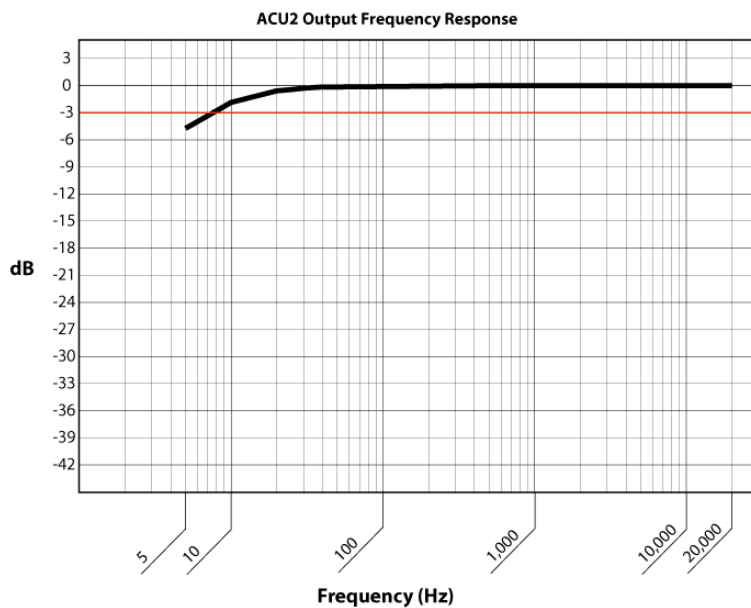


Figure 14: ACU2 output frequency response

4.0 Control input and output

The following sections describe ACU2 control input and output specifications.

4.1 Control input

The control inputs are contact sensing; no voltage is required. Connect the control input and control input ground lines together using a switch or other suitable device, such as a press-to-talk (PTT) device. The control input can function as a digital input or an analog input. In both cases, the ACU2 component in the model will be able to read the control input value and use this value as required for the application.

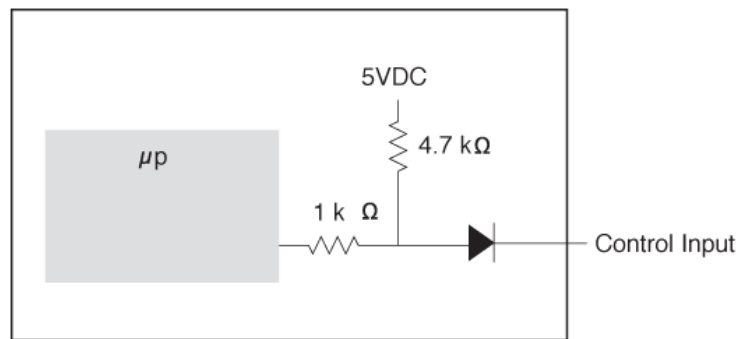


Figure 15: Control input timing diagram

The control input can be used as an analog input by inserting a resistance between the control input and control input ground pins. With this configuration, the ACU2 component in the model maps the voltage to a uint8 value that you can use to model your application. For example, the four-channel selector knob contains a switch that changes the resistance between the control input and control input ground pins. The uint8 number read in the ACU2 software component varies by a given percentage based on the tolerances of all the components involved.

Four-channel selector knob

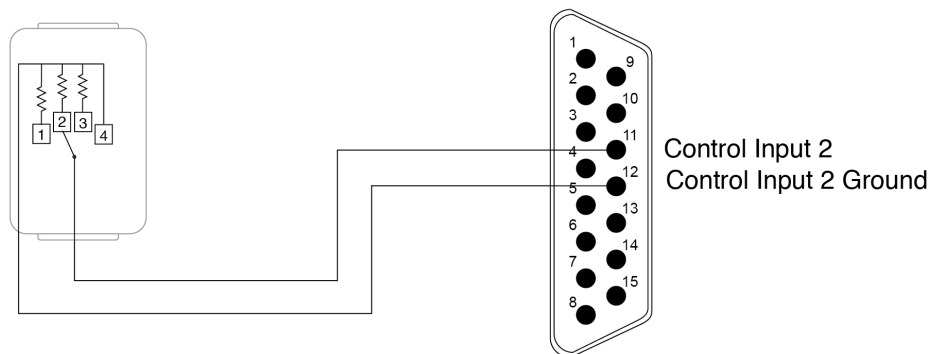


Figure 16: Four-channel selector knob

4.1.1 Control input used as a digital input

To use the control input as a digital input, short or open the required pins. For example, if you short pins 9 and 10, Control Input 1 is true. If the pins are open, Control Input 1 is false. In this example, the control input acts like an on/off switch.

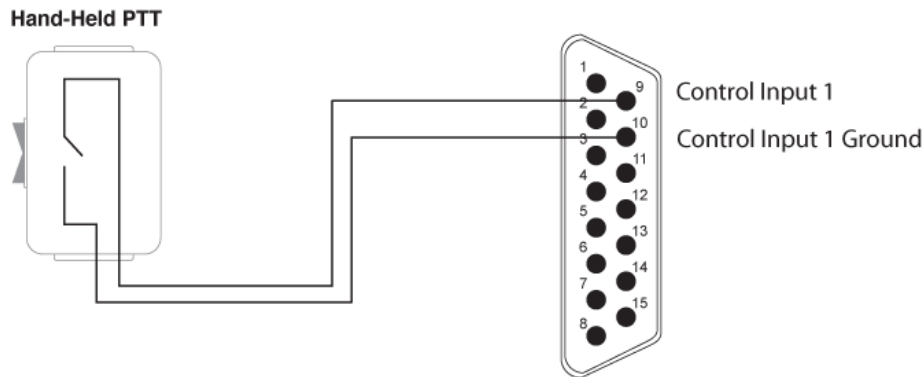


Figure 17: Digital In

4.1.2 Control input used as analog input

The control input can be used as an analog input by inserting a resistance between the control input and control input ground pins. With this configuration the ACU2 component in the model will map the voltage to an uint8 value that can be used in modeling your application. The four-channel selector knob, for example, contains a switch that is used to change the resistance between the control input and control input ground pins. The uint8 number read in the ACU2 software component will vary by a given percentage based on the tolerances of all of the components involved.

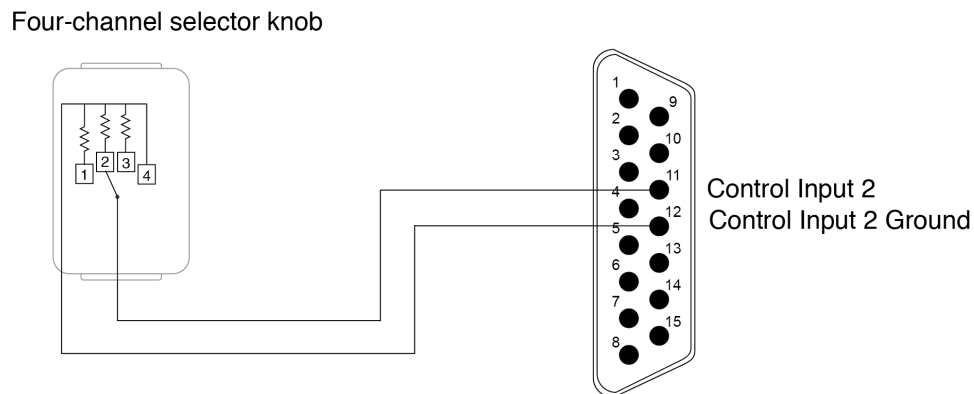


Figure 18: Analog In

4.2 Digital output

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

Type	Opto-isolated Field-Effect Transistor (FET)
Maximum continuous current rating	120 mA
Maximum power dissipation	180 mW
Maximum frequency responses	500 Hz

Table 8: Digital output Opto-isolated FET values

4.2.1 Digital output circuitry

The following figure shows digital output circuitry:

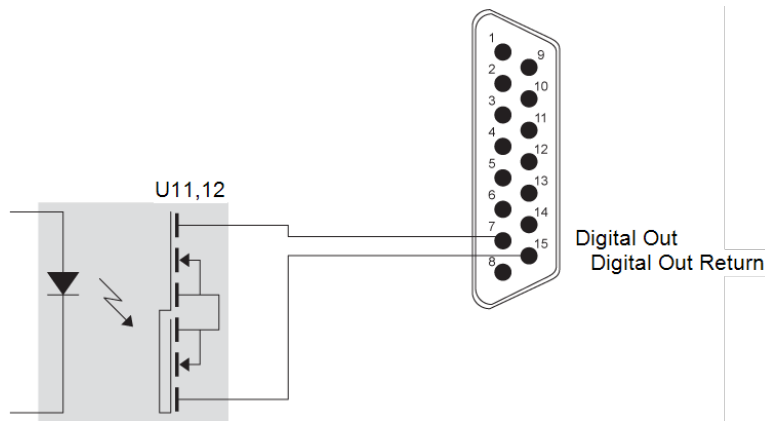


Figure 19: Digital output circuitry

5.0 Typical headset connections

The following sections show diagrams for mono and stereo headset connections.

5.1 Mono headset connection

The following figure shows a mono headset connection:

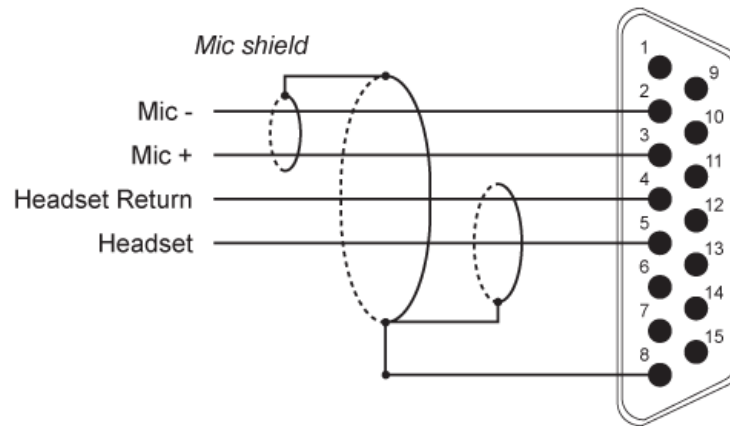


Figure 20: Mono headset connection

5.2 Stereo headset connection

The following figure shows a stereo headset connection:

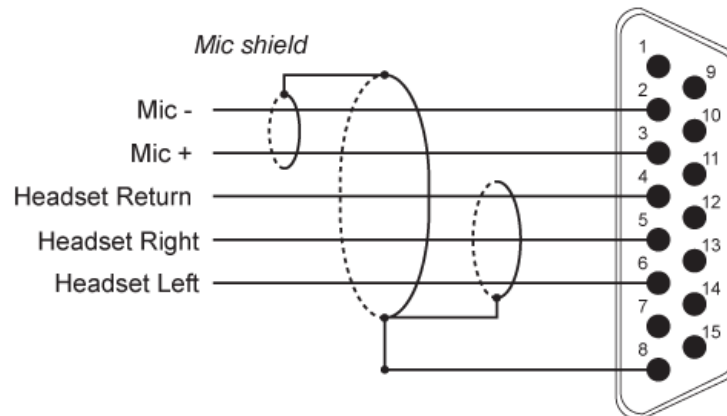


Figure 21: Stereo headset connection

6.0 Software configuration

For software configuration instructions, reference the following:

Name	Description
Telestra	Go to the <i>Telestra Remote Management System User Guide</i> : support.asti-usa.-com/telestra/index.html
Voisus	Go to “Voisus Hardware Clients” in the <i>Voisus Client User Guide</i> : support.asti-usa.-com/voisus/index.html

Table 9: Software configuration

7.0 Earth-ground the ACU2

ASTi does not require the ACU2 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)

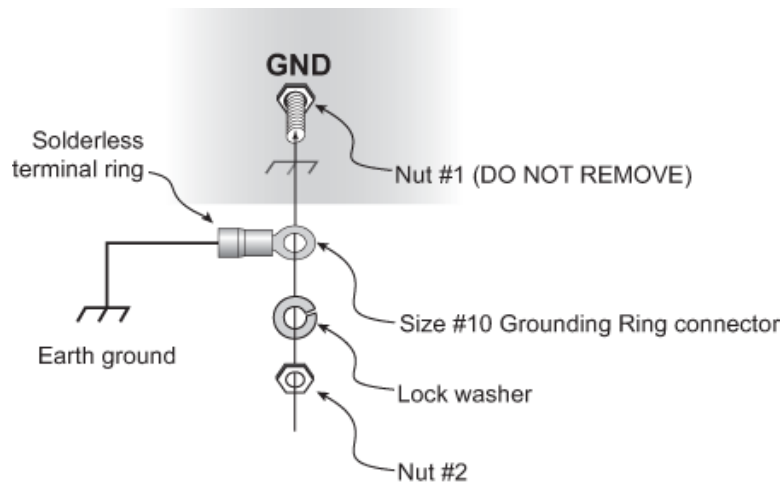


Figure 22: Grounding



Important: Do not remove nut #1 from the screw as it will cause the screw to fall inside the ACU2 chassis.

To ground the ACU2, 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.

8.0 Update firmware

The following table provides ACU2 firmware update instructions for Telestra and Voisus software:

Update	Instructions
Telestra	To update ACU2 firmware, go to the <i>Telestra Remote Management System User Guide</i> : support.asti-usa.com/telestra/index.html
Voisus	To update ACU2 firmware for Voisus, follow these steps: <ol style="list-style-type: none">1. In the Voisus web interface, from the top-right navigation bar, go to Manage > Hardware Devices.2. Go to the ACU2 tab. A message displays if any connected ACU2s need a firmware update.3. To complete the procedure, follow the instructions on the screen.

Table 10: Software firmware updates

9.0 Rackmount ACU2s

The available rackmounting bracket accommodates two ACU2s side by side and measures 1U high and 19" wide. To install the rackmount, follow these steps:

1. Remove the two bottom corner screws and the top middle screw on the front of the ACU2.
2. Use a nut driver (3/16") to remove the two jackscrews from each side of the four connectors.
3. Remove the faceplate with the white lettering and the bezel. Save the bezel for when you remove the ACU2 from the rackmount.
4. Place the ACU2 into the backside of the rackmount. The rackmount fits in place of the bezel.
5. Place the faceplate on the front side of the rackmount. Install the three black screws, starting with the top middle screw first for proper alignment.
6. Install the jackscrews on each side of the four connectors.

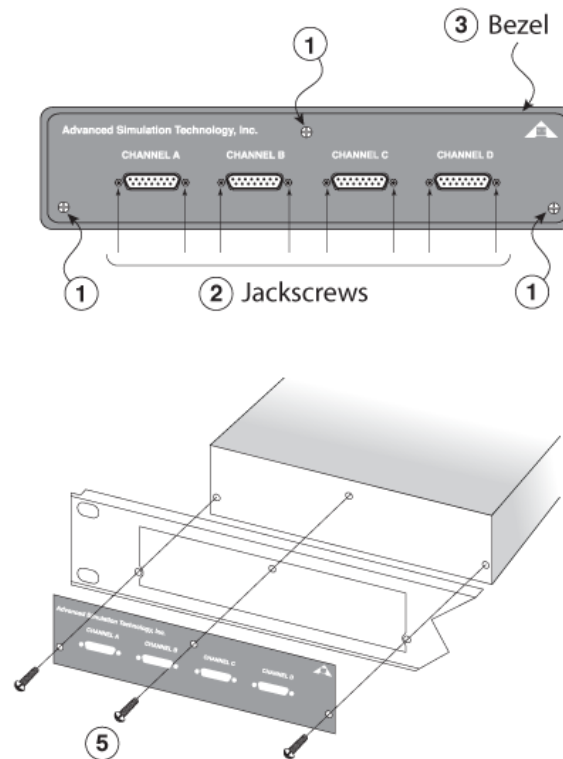


Figure 23: ACU2 rackmount installation

9.1 Power daisy chain

The power daisy chain connection enables operation of two rackmounted ACU2 units from a single-power supply. Daisy chaining ACU2 power requires an upgraded power supply (model number TR7 A15 from CINCON Electronic Co. LTD). Contact ASTi for details. The daisy chain cable (P-760K-S765K-16-A) is included with the upgraded power supply.

Name	Model/Part No.
Power In Connector (Black)	Switchcraft 760K
Power Out Connector (Black)	Switchcraft S765K

Table 11: Power daisy chain connections

The following figure shows power daisy chain connectors:

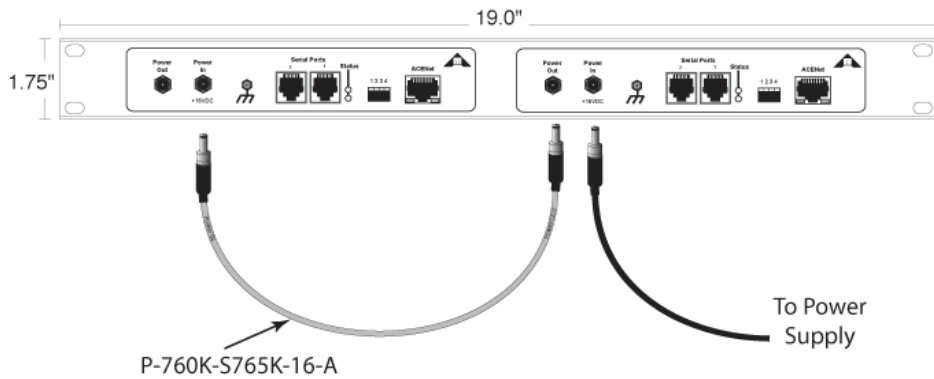


Figure 24: Power daisy chain connectors

10.0 Specifications

This chapter describes the following ACU2 specifications:

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

10.1 Power requirements

The ACU2 is shipped with a standard power supply, which provides power to one ACU2. The power supply should only be connected to a grounded outlet. To rackmount the ACU2s, you may need to purchase an upgraded power daisy chain. For more information about the power daisy chain, go to Section 9.1, "Power daisy chain" on the previous page.

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.

Input to PSL-UM-001	100–240 VAC, 50–60 Hz, 1.5 A _{RMS} , (120 VAC), 0.75 A _{RMS} (240 VAC)	
Power In Connector	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
Power Out Connector	Inside Diameter 0.080", Outside Diameter 0.218", locking, center positive	
	Connector P/N:	Switchcraft 722RA supplied with P2439 Hex Nut (5/16–32) and P2441 Washer
	Mating Connector P/N:	Switchcraft S765k
Power Consumption	+15 VDC, 2A (add-in AC/DC converter supplied with each unit)	

10.2 Memory devices

The ACU2 memory devices are summarized in the table below:

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

Table 12: ACU2 memory devices

The ACU2 does not contain media storage capability (i.e., removable or non-removable disk drives, tape drives, memory cards, etc.).

10.3 Temperature and humidity ranges

The following table shows ACU2 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 13: Temperature and humidity ranges

10.4 Reliability

The following table shows an ACU2'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 14: ACU2 MTBF rates

Appendix A: Warranty information

ASTi covers the equipment by warranty for one year following purchase. For equipment upgrades, the warranty applies to the upgraded component's original shipment date. Unless otherwise stated, ASTi also covers other provided or purchased commercial equipment (e.g., monitors, amplifiers, speakers, and fiber optic links).

The warranty does not cover improper equipment handling or improperly packaged returns. Extended warranties are available. Contact ASTi for details at (703) 471-2104.



Caution: *This device does not contain any user-serviceable components. Opening equipment (e.g., a chassis) voids the warranty. ASTi does not support board-level repair; therefore, fuses are not user-replaceable.*

A-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. 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.
 - a. Always double-box the device.
 - b. 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.
 - c. 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 does not begin work without prior customer approval.

The customer is 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 non-warranty items, including return shipping. The customer is responsible for return shipping charges on non-warranty 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.