

AI-USB Series

A Line of ARCNET® Fixed-Port Active Hubs with USB Interface

INSTALLATION GUIDE

INTRODUCTION

The AI-USB Series of hubs work like AI Series hubs, but also provide computer access via USB. Each device acts as a hub with three-ports, two external and one internal. The internal port connects to USB ARCNET adapter circuitry within the hub. A USB front panel socket gives access to a laptop or desktop PC.

The AI-USB complies with the USB 2.0 and USB 1.1 standards to provide fast, convenient access to an ARCNET LAN with no need of a network interface module in the computer.

The AI-USB can permanently connect to the ARCNET network as a bus extender while giving a laptop computer temporary access. Thus, field wiring is undisturbed while a computer connects to monitor, configure or test the devices on the ARCNET network. There are coaxial, twisted-pair and AC- or DC-coupled EIA-485 models.

The internal USB adapter consists of a COM20022 ARCNET controller and high-speed microcontroller. The 128K bytes of receiver buffering aids reception of broadcast messages. With a 480 Mbps USB link, dropped ARCNET packets are rare.

The AI-USB has the same power connectors as the AI Series of hubs and requires only low-voltage power from either an AC (8–24 volts) or DC (10–30 volts) source. Approved companion transformers are available for UL and CE Mark applications. Provisions exist for redundant power connections. Each unit is shipped with both panel and DIN-rail mounting hardware and a disk containing AI-USB software for Windows® 2000/XP. A USB cable is also provided.

SPECIFICATIONS

Electrical

	DC	AC
Input voltage:	10–36 volts	8–24 volts
Input power:	7 W	7 VA
Input frequency:	N/A	47–63 Hz

Environmental

Operating temperature:	0°C to +60°C
Storage temperature:	–40°C to +85°C
Humidity:	10% to 95%, non-condensing

ARCNET Data Rates

Transceiver	Data Rate (bps)							
	78K	156K	312K	625K	1.25M	2.5M	5M	10M
-CXS							■	
-TB5							■	
-485	■							
-485X						■		

Table 1 — ARCNET Data Rates

Shipping Weight

1 lb. (.45 kg)

Compatibility

ANSI/ATA 878.1

LED Indicators

Port Activity — green

Recon — yellow

Status — green

USB — green

Regulatory Compliance

CE Mark; CFR 47, Part 15 Class A

UL 508 Listed Device (intended for use with Class 2 circuits)

Connector Pin Assignments (5-pin screw terminal)

	485	485X	
A	Line +	Line	
B	Line –	Line	
SH	Shield	Shield	

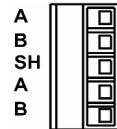


Figure 1 — 5-pin Screw Terminal

MECHANICAL

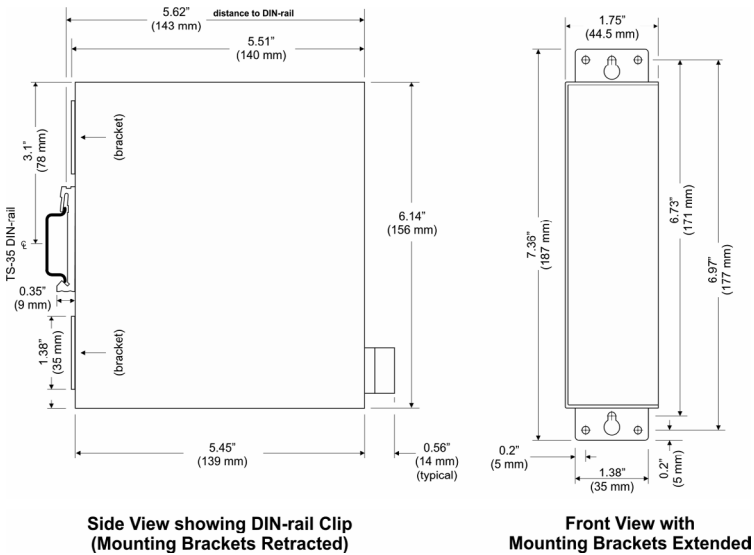
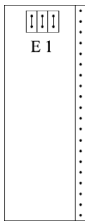
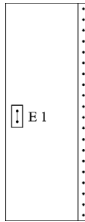


Figure 2 — AI-USB Dimensions

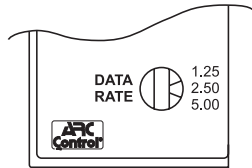
Daughter Board Jumper Blocks for EIA Bias and Termination



**Figure 3
DC-Coupled**



**Figure 4
AC-Coupled**



**Figure 5 — EIA-485
Data Rate Switch**

EIA-485 ROTARY DATA RATE SWITCH

Although the switch in Figure 5 displays stops for only 3 data rates, *every* rate in Table 1 has a stop. Count the clicks to determine the *five unlabelled* rates. At one stop *clockwise* past the 5.00 position, you get 10 Mbps. The next clockwise stop selects the 78 kbps rate — then 156 kbps, 312 kbps and 625 kbps in turn — until the 1.25 (Mbps) label is reached.

INSTALLATION

Mounting

The AI-USB is designed for mounting in a wiring closet or an industrial enclosure using either set of the provided mounting hardware listed below:

TS-35 DIN Rail Mounting
DIN rail clip
DIN rail clip support bracket
4-40 screws, pan-head (2)

Panel Mounting
Panel mounting bracket
4-40 screws, flat-head (4)

For quick snap-mounting to 35 mm DIN rail, a reinforced DIN rail clip is pre-attached to the back of the enclosure with two #4-40 pan-head screws. If the clip is removed, the unit can be panel-mounted by extending the top and bottom brackets which are shipped in retracted position. The extended brackets can then anchor the unit to a wall or other flat vertical surface with two #8 pan-head screws (not provided). The left illustration of *Figure 6* shows a rear view of the AI-USB with brackets in retracted position. The right illustration of *Figure 6* shows the brackets extended and secured to the AI-USB enclosure with the same screws that were used in the retracted position.

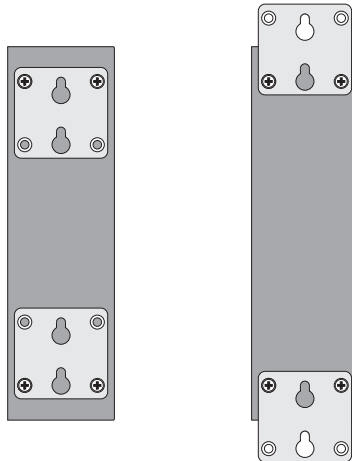


Figure 6 — Using the Panel-Mounting Brackets

Software

Driver installation instructions are provided in the *readme* file located on the disk that accompanies the product.

Powering The AI-USB

The AI-USB requires low voltage AC or DC power applied to its four-pin removable keyed plug. Consult the **Specifications** page for the power requirements. Several methods to provide power are described below.

DC Powered

Make connections as shown in *Figure 7*. The AI-USB uses a DC-DC converter that accepts a wide range of voltage (10–30 VDC) which it converts for internal use. The “0 Vdc” terminal is not connected to chassis within the AI-USB. The input connections are reverse-voltage protected.

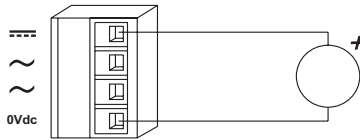


Figure 7 — DC Powered

Redundant DC Powered

Redundant diode-isolated DC power inputs are provided on the AI-USB for when a concern exists that the AI-USB remain operational in the event of a primary power failure. Make the connections as shown in *Figure 8*. Each power supply must be capable of powering the AI-USB. Do not assume that input currents from the two supplies will be balanced.

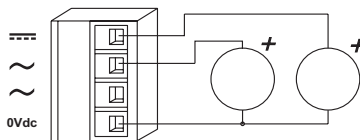


Figure 8 — Redundant DC Power

AC Powered

If AC power is desirable, the AI-USB can be powered by the secondary of a low-voltage transformer (*Figure 9*) whose primary is connected to the AC mains. The secondary voltage must be in the range of 8–24 VAC and must not be grounded. When using a grounded secondary transformer, refer to *Figure 10*. For convenience, two AC power adapters are available from Contemporary Controls: the AI-XFMR is for 120 VAC primary power and the AI-XFMR-E is for 230 VAC primary power.

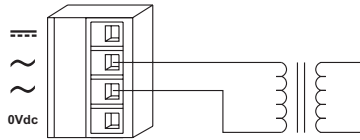


Figure 9 — AC Powered

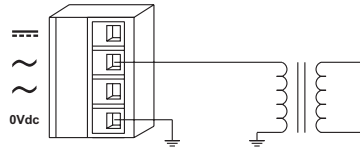


Figure 10 — AC Power with Grounded Secondary

AC Powered with Battery Backup

The AI-USB can also be powered from *both* an AC and DC source. Usually the DC source is from a battery connected as the DC-powered option. Refer to *Figure 11* for details. In this application the AI-USB does not charge the battery, so separate provisions are required for charging. If the AC source fails, the AI-USB will operate from the battery.

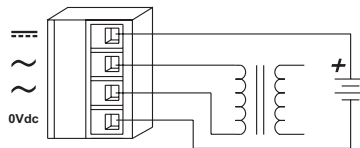


Figure 11 — AC Power with Battery Backup

Indicator Lights

PORT (#s): Any of the three port activity LEDs will glow green whenever data is passing through its associated port.

RECON: This LED will flash yellow in response to any ARCNET reconfiguration event. Repeated flashing of this LED indicates a fault with cabling or a node device.

STATUS: During boot, this LED flashes green to indicate that the AI-USB is in standby mode. Once traffic is received on one of the ARCNET ports and the hub begins to regenerate the traffic, this LED glows solid to indicate the unit is operational.

USB: This LED glows green so long as a valid active USB connection exists to an attached computer. This connection is required *before* the port 3 LED can turn on.

Electromagnetic Compatibility

All AI-USB units comply with Class A radiated and conducted emissions as defined by EN55022 and CFR 47, Part 15. This equipment is intended for use in non-residential areas.

Warning

This is a Class A product as defined in EN55022. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Field Connections

The AI-USB Series is available in four transceiver options for connecting to an ARCNET LAN with a particular type of cable. Each transceiver is identified by a three-character suffix (CXS, TB5, 485 or 485X) separated from the model number by a forward slash mark.

The implementation considerations of the various transceiver options are described in the following pages.

CXS Coaxial Star

There are generally two types of coaxial cables that are used with ARCNET, RG-59/u and RG-62/u. RG-59/u is 75-ohm cable which does not match the impedance of the transceivers used on the AI ports. This cable will work, but communication distances are reduced compared to RG-62/u because of the higher attenuation of RG-59/u cable. We recommend RG-62/u because it is a better match to the transceivers and a full 2000 foot segment distance can be achieved using this cable. Both cables support male BNC connectors which the CXS port accommodates. When connecting to a CXS port, do not apply a terminator or BNC “T” connector to the port. Simply connect the coaxial cable directly to the BNC port.

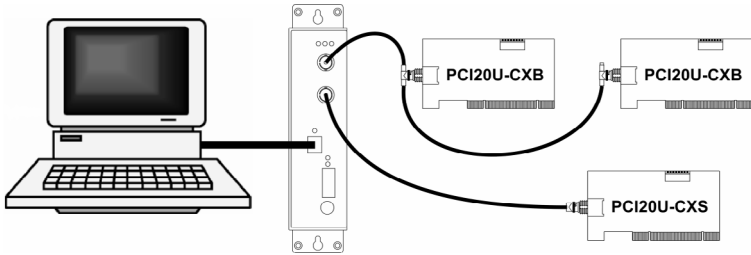


Figure 12 — Typical Connections for the AI-USB/CXS

TB5 Twisted-pair Bus

The TB5 transceiver accommodates twisted-pair cabling via a pair of RJ-45 jacks. This option allows the insertion of a hub at any point along a bus segment. Usually IBM type 3 unshielded twisted-pair cable (UTP) is used, although shielded cable can be used as well. End devices require a passive terminator that matches the impedance of the cable (typically 100 ohms).

The dual connectors allows daisy-chaining of the hub at any location on the bus segment and provides continuous shielding between devices. When the TB5 port is located at the end of a bus segment, passive termination to match the cable impedance is required at the unused jack. For this purpose, a 100-ohm terminator in an RJ-45 module (part number TB5-TER) is supplied with the hub.

485 DC-Coupled EIA-485

A removable 5-position screw connector (*Figure 1*) is provided for each DC-coupled EIA-485 segment. Two terminals are provided for differential signal phase A and two for phase B. The middle pin connects directly to chassis (the enclosure). A DC-coupled segment can be up to 900 feet of IBM type 3 (or better) STP or UTP cable, and as many as 17 nodes can occupy a segment. Make sure the phase integrity of the wiring remains intact. All phase A signals on the network interface modules and hubs must be connected together. The same applies to phase B. If shielded cable is used, the shield should tie to the middle pin on the connector. Be sure the data rate is the same for all network devices (see *Figure 5* and associated explanation).

Termination

Each end of the 485 segment must be terminated in the characteristic impedance of the cable. An internal resistance can be invoked with a jumper on the EIA-485 daughter board. With the middle jumper inserted at E1 on the daughter board, 120 ohms of resistance is applied across the twisted-pair. With the jumper removed, no termination is applied. To apply external termination instead, remove this jumper and install a 120-ohm 1/4 watt resistor across pins A and B of the screw terminal connector. A value under 120 ohms is not recommended because it may excessively load the EIA-485 transceivers.

Bias

In addition to termination, bias must be applied to the ends of a twisted-pair network (and nowhere else) so that when the line is floated, differential receivers will not assume an invalid logic state. There are two precision bias resistors of equal value on the daughter board, one tied to +5 V and the other to ground. Each resistor has a jumper associated with it. If both jumpers are installed, the resistor tied to +5 V is connected to the (+) signal and the grounded resistor is connected to the (-) line.

The termination and bias rules are simple: If the AI-USB is at the segment end, install all three jumpers at location E1 on the daughter board (*Figure 3*). Otherwise, remove all jumpers. To use external termination, remove the middle jumper at E1.

Ground

For EIA-485 DC operation, it is important that all devices on the segment be referenced to the same ground potential so the common mode voltage requirement (± 7 Vdc) of the EIA-485 specification is achieved. This can be accomplished by a separate ground wire tied to all devices or using the third wire ground of the power connector. Alternately, connect the DC common of each node to a cold water pipe. Connected systems having different grounds, can cause unreliable communications or can damage the drivers. Therefore, adequate grounding must be implemented. A ground connection can be made to the middle terminal of .

485X AC-Coupled EIA-485

The AC-coupled EIA-485 transceiver offers advantages over the DC-coupled version. No bias adjustments are needed and wiring polarity is unimportant. Much higher common mode voltage levels can be achieved with AC coupling because the transformer coupling has a breakdown rating of 1000 VDC.

However, AC-coupling also has disadvantages. AC-coupled segments are shorter (700 feet max) and are limited to 13 nodes compared to the 17 nodes of DC-coupling. Also, AC-coupled transceivers operate only at 1.25, 2.5 and 5.0 Mbps while DC-coupled transceivers function over all six standard data rates.

Cabling rules for 485X are similar to those for 485. Wire nodes in a daisy-chain fashion. On the end devices, insert a jumper at E1 on both 485X daughter boards (Figure 4) to invoke 120 ohms of termination or leave the jumpers open and install a 120-ohm, $\frac{1}{4}$ watt resistor across pins A and B of the screw terminals at each end of the bus segment. Refer to for connector wiring. Termination should not be applied to any device located between the two ends of the segment. Do not mix 485 and 485X devices on the same segment; however, bridging the technologies is possible with active hubs having appropriate transceivers. To extend 485X segments, use a hub as discussed under the 485 section, but the active hub ports must now be 485X types. Cable inversion is insignificant: Be sure that the data rate is the same for all network devices (see Figure 5 and its associated explanation).

NEED MORE HELP INSTALLING THIS PRODUCT?

More information can be found at www.arcontrol.com. This includes our online technical manuals, downloadable software drivers and utility programs that can test the product. When contacting one of our offices, just ask for Technical Support.

Warranty

Contemporary Controls (CC) warrants its product to the original purchaser for two years from the product's shipping date. Product returned to CC for repair is warranted for one year from the date that the repaired product is shipped back to the purchaser or for the remainder of the original warranty period, whichever is longer.

If a CC product fails to operate in compliance with its specification during the warranty period, CC will, at its option, repair or replace the product at no charge. The customer is responsible for shipping the product; CC assumes no responsibility for the product until it is received.

CC's limited warranty covers products only as delivered and does not cover repair of products that have been damaged by abuse, accident, disaster, misuse, or incorrect installation. User modification may void the warranty if the product is damaged by the modification, in which case this warranty does not cover repair or replacement.

This warranty in no way warrants suitability of the product for any specific application. **In no event will cc be liable for any damages including lost profits, lost savings, or other incidental or consequential damages arising out of the use or inability to use the product even if cc has been advised of the possibility of such damages, or for any claim by any party other than the purchaser.**

The above warranty is in lieu of any and all other warranties, expressed or implied or statutory, including the warranties of merchantability, fitness for particular purpose or use, title and noninfringement.

Returning Products for Repair

Before returning a product for repair, contact Customer Service. A representative will instruct you on our return procedure.

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DECLARATION OF CONFORMITY

Applied Council Directives:

Electromagnetic Compatibility Directive, 89/336/EEC Council Directive as amended by Council Directive 92/31/EEC & Council Directive 93/68/EEC

General Product Safety Directive 92/59/EEC

Standards to which Conformity is Declared

EN 55022:1995 CISPR22: 1993, Class A, Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment

EN 55024:1998, Information Technology Equipment — Immunity Characteristics — Limits and Methods of Measurement

Manufacturer:

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Downers Grove, IL 60515 USA

Authorized Representative:

Contemporary Controls Ltd
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Sir William Lyons Road
Coventry CV4 7EZ UK

Type of Equipment:

Industrial local area network hub

Models:

AI-USB/CXS

AI-USB/TB5

AI-USB/485

AI-USB/485X

I, the undersigned, hereby declare that the products specified above conform to the listed directives and standards.

George M. Thomas, President

July, 2005