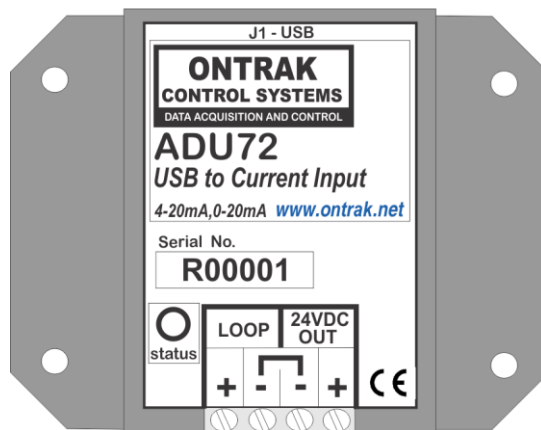


# ADU72 USB to Current Input ( 4-20mA, 0-20mA Receiver ) User Manual

Ver 1.0



# EU Declaration of Conformity

We, the undersigned,

<b>Manufacturer:</b>	Ontrak Control Systems Inc.
<b>Address, City</b>	764 Notre Dame Avenue, Unit 1, Sudbury
<b>Province, Country, Postal Code</b>	Ontario CANADA P3A2T2
<b>Phone and FAX</b>	(705) 671-2652 (705) 671-6127 ( FAX)
<b>Email Address</b>	tom@ontrak.net

certify and declare under our sole responsibility that the following Apparatus:

<b>Model No:</b> ADU72	<b>SN:</b> R00001 and higher.
<b>Description:</b>	<b>USB to Current Input Interface</b>
<b>Brand:</b>	<b>Ontrak Control Systems Inc.</b>

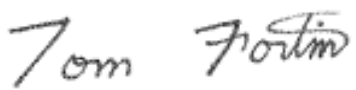
Conforms with the essential requirements of the EMC Directive 2004/108/EC, via Annex II, based on the following specifications applied:

<b>RF Emissions</b>	<i>EN55011:2009/A1:2010 Class B</i>
<b>ESD Immunity</b>	<i>IEC 61000-4-2:2008 Level 2 Criterion B</i>
<b>RF Immunity</b>	<i>IEC 61000-4-3:2006 +A1:2007 +A2:2010 Level 2 Criterion B</i>

And therefore complies with the essential requirements and provisions of the EMC directive.

The technical documentation is kept at the following address:

<b>Company:</b>	Ontrak Control Systems Inc.
<b>Address, City</b>	764 Notre Dame Ave, Unit 1, Sudbury
<b>Country, Postal Code</b>	Canada P3A 2T2
<b>Phone Number</b>	(705) 671-2652
<b>Fax, Email</b>	(705) 671-6127 tom@ontrak.net

<b>Name of Person binding the manufacturer.</b>	
Tom Fortin- Director Ontrak Control Systems Inc	Feb 28, 2017 Sudbury , Ontario, CANADA



# Table Of Contents

1.	What is Included and Where to Start	4
2.	ADU72 Features	4
3.	The ADU72 STATUS LED	5
4.	AduHidTest USB Device Test Program	6
5.	ADU72 Command Summary	10
6.	ADU72 Command Descriptions	11
	6a) RD Read Current in DECIMAL Format	11
	6b) RI Read Current in CURRENT Format	11
	6c) RH Read Current in HEX Format	12
7.	The ADU72 Connection Diagrams	13
	7a) Connecting to Two-Wire Transmitters	13
	7b) Connecting to Three-Wire Transmitters	14
	7c) Connecting to Four-Wire Transmitters	15
8.	Specifications	17
9.	Dimensions	18

## 1. What is Included and Where to Start

The ADU72 ships complete with a 10' USB cable, and this User Manual.

A complete SDK including DLL, programming language examples, and AduHidtest software is available at: <http://www.ontrak.net/programming.htm>

First time users should first review the command set for the ADU72 and then use AduHidTest USB test software to become familiar with the operation of the ADU72 commands.

Note: The AduHid DLL requires one of the following Windows operating systems; XP, Vista, Windows 7, 8, or 10. The programming section of the web site also contains examples for use with various other operating systems and provides details that facilitate use of the ADU72 without using the Windows based AduHid DLL

## 2. ADU72 Features

- Reads loop current with 16-bit resolution and outstanding accuracy.
- Conformal coating on sensing circuitry ensures reliable operation in humid environments.
- Retrieved data available in DECIMAL, HEX or CURRENT format.
- Connect two-wire process transmitters with no need for external power supply.
- Reads and powers 2-wire, 3-wire\* and 4-wire\* transmitters.
- Loop over-current protection ( 26mA).
- 2500V Isolation from USB connection to loop.
- Bus Powered.
- High retention USB Connector.
- CE Marked.
- Bi-colour LED status indicator.
- High quality cage-clamp type terminal blocks.
- Uses standard HID drivers included with Windows 98SE,2000,XP,7,8,10 32-bit or 64-bit.
- Mini-driver ( DLL ) provided for use with VB,VC, .NET, LabVIEW and TestPoint and others. See [Programming Page](#)
- Meets IEC61000-4-2 ESD protection for USB port.
- Available in flange ( standard ) or DIN rail mount.

\* 2-wire and 3-wire power available is 24VDC @ 35mA MAX

### 3. The ADU72 STATUS LED

The ADU72 STATUS LED is a bi-color ( Red/Green) led indicator used to identify the current status of the ADU71 USB connection.

The LED modes are;

RED -ADU72 powered but not enumerated.

GREEN -ADU72 powered and enumerated by host computer.

OFF -ADU72 disconnected from USB bus OR host computer has entered SLEEP/SUSPEND.

The ADU72 can be connected to the USB bus via the enclosed 10' A-B USB cable. The cable provides both power and communications connections to the ADU72. When first connected, the STATUS led will turn RED indicating power is applied. For Windows operating systems, a message may flash on the screen indicating;

#### **New hardware Found ADU72 USB to Current Input Interface**

Depending on the version of Windows, the host may prompt to search for a driver. Select,

#### **Let Windows Search for a Driver**

and click next.

After a few seconds, the STATUS led will turn green indicating enumeration is complete. The enumeration process is completely transparent to the application program as the ADU72 is a USB HID class device. Enumeration is completed by the Windows ( or other ) operating system standard USB HID drivers.

The ADU72 can be connected directly to the host hub or externally powered hubs.

**Caution: ( Use of System Sleep/Suspend ):** If the Windows ( or other ) operating system allows the host computer to enter sleep mode, attached USB devices will be set to suspend mode. In this mode the power draw of the ADU72 drops to less than 2.5mA ( USB 2.0 Specification ). In suspend mode the ADU72 Status LED is turned off. Once the host computer is revived from sleep/suspend mode, the ADU72 status LED will turn on. Ensure system power settings are set to ensure the host computer does not enter sleep or USB suspend mode during normal operation.

## 4. AduHidTest USB Device Test Program

AduHidTest is a Windows based USB device test program used to test the connection of ADU data acquisition devices to a USB port. The program is also a useful tool to allow programmers to become familiar with the ADU72 command set. AduHidTest software can be downloaded from the Ontrak website at: <http://www.ontrak.net/programming.htm> . Note that the program requires the AduHid.dll to operate and it should be copied to the same directory as the AduHidTest.exe file.

There are three steps to communicate with a USB device in any application software. The three steps are;

### **STEP 1: Obtain a handle for the ADU72**

A handle is a unique code that application software uses to identify a USB device for the purpose of reading and writing to the device. A USB bus can have up to 128 devices connected to a single host and there are three criteria that can be used to open a handle. The three criteria are, Vendor ID, Product ID and Serial Number. If a single device is connected to the bus, any of the three criteria may be used. If multiple devices are connected, we recommend using the Serial Number to open the handle.

( All ADU devices have their unique serial number printed on the top label )

When run, the AduHidtest Software will display the following window.

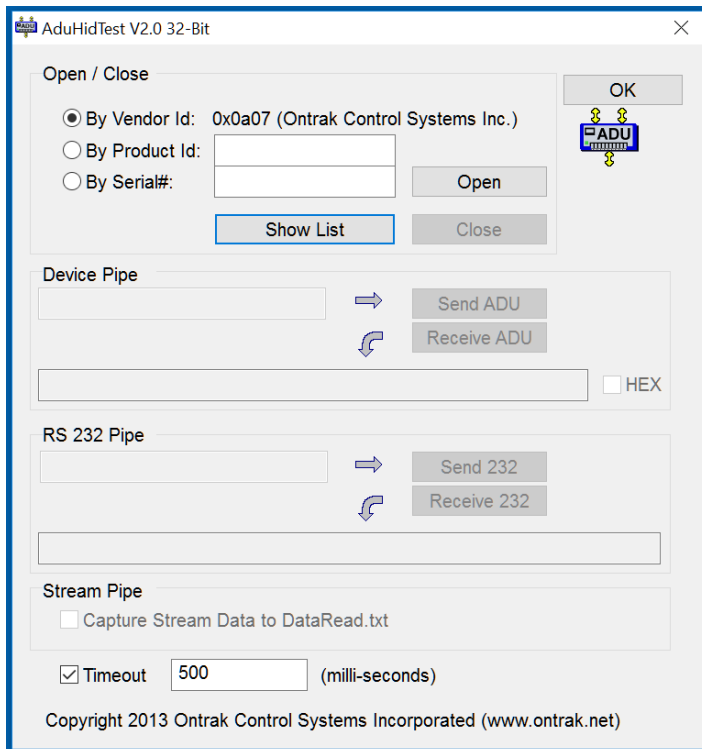


Figure 1: AduHidTest Software Window

The Open/Close section of the window is where the handle is determined. Click on the **Show List** button to view the devices connected to the USB bus. ( Note: Only ADU devices will be listed ) Figure 2 is the window that appears when the **Show List** Button is clicked.

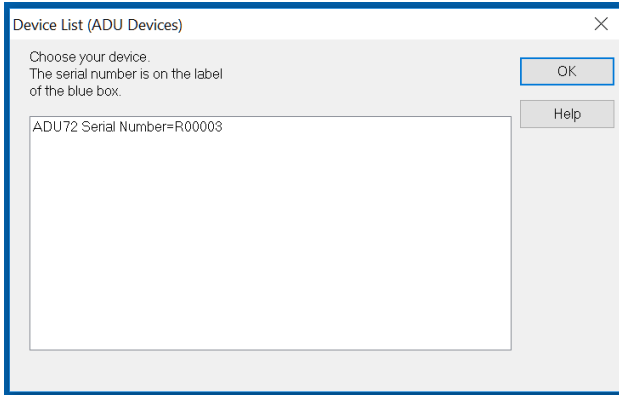


Figure 2: **ShowList** Window

The window indicates that there is one ADU72 connected with serial number R00003. Select the device by double clicking on the text “**ADU72 Serial Number = R00003**”. The AduHidTest main window will now display the product ID and Serial number. Click the **By Serial #** radio button and then click **Open** to open the handle to the selected ADU72.

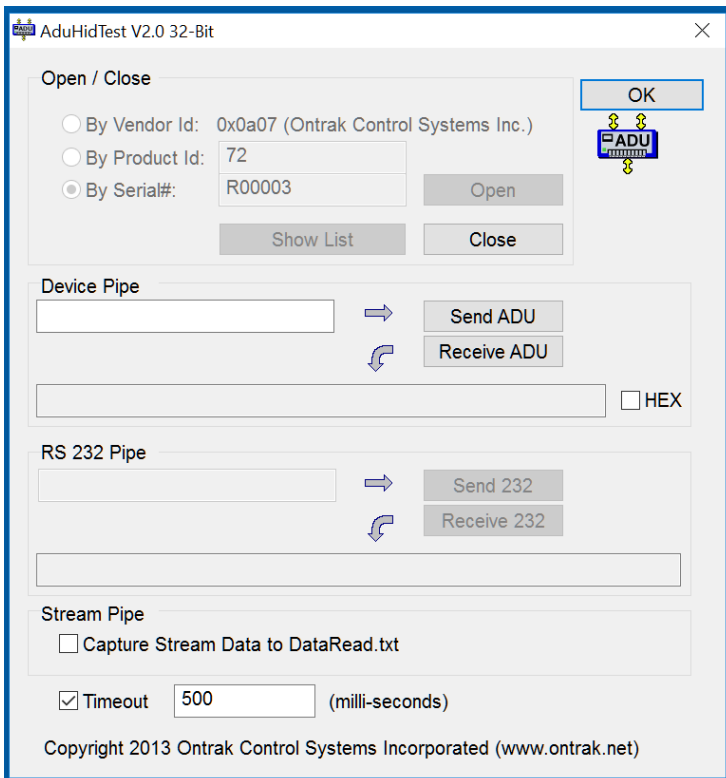


Figure 3: Handle Open to ADU72

## STEP 2: Sending Commands to the ADU72

Once connected, you may now send commands to the available "pipes" on the ADU72 device. Pipes are the individual connections to functional sections of the ADU72 . The **Device Pipe** is used to send standard ASCII ADU commands to control the peripherals built into the ADU72 including the current measurement circuitry. The ADU72 does not use the **RS232** or **Stream** pipes. Type "**RI**" ( Read Loop Current in CURRENT mode) into the device pipe send window and click **Send ADU** . An **OK** will appear beside the **Send ADU** button if successful. Sending this command instructs the ADU72 to read the loop current and return its value in CURRENT format which is an ASCII string in the range of 00.000 to 20.000 mA.

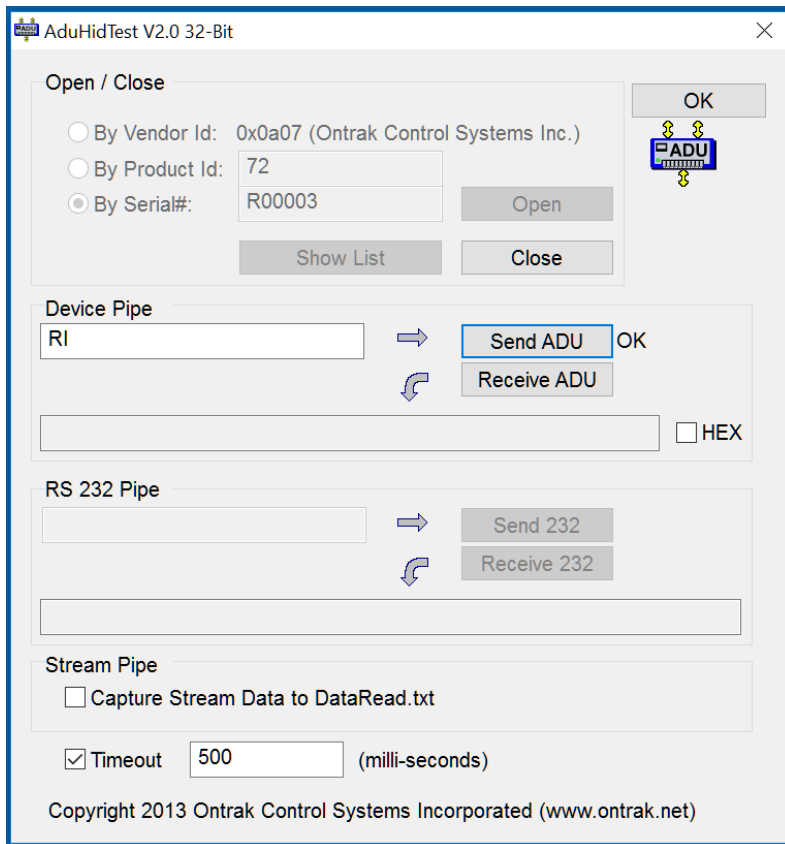


Figure 4: Sending "RI" Command



### STEP 3: Receiving Data from the ADU72

Once a read command has been sent to the ADU72, it will read the loop current and send the data back in the format requested. The data is not displayed automatically in the AduHidTest software. To view received data, simply click the **Receive ADU** button and the data will be displayed.

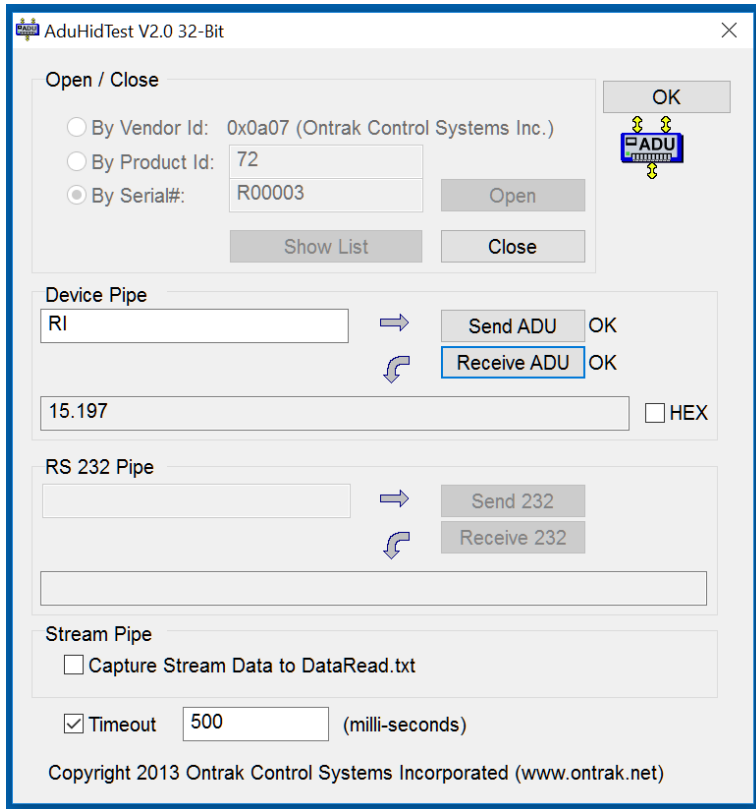


Figure 5: Receiving Response Data

The received data displays the present loop current to be 15.197mA.

These procedures can be repeated using the various commands available on the ADU72. Note that the current is read within one ms of the ADU72 receiving a valid command.

The AduHidTest software is an invaluable tool to use to become familiar with any ADU product.

## 5. ADU72 Command Summary

There are three commands available for the ADU72. Each command returns the present measured current in either, DECIMAL, CURRENT or HEXIDECIMAL format.

**RD** Returns present input current in DECIMAL format

(ASCII STRING-5 BYTES, 00000 - 65535 representing 0 to 20 mA )

**RI** Returns present input current in CURRENT format

( ASCII STRING-6 BYTES, 00.000 - 20.000 mA )

**RH** Returns present input current in HEXIDECIMAL format

( 2 BYTES, 0000 - FFFF representing 0 to 20mA )

## 6. ADU72 Command Descriptions

### **6a) RD – Read current and return value in DECIMAL format.**

The **RD** command returns the present current in DECIMAL format. The returned integer value ranges from 00000 to 65535. Actual current can be calculated using the following formula;

Reading/65535 X 20 = Current in mA

For example;

**RD**

returns...

**17348**

Current is  $17348/65535 \times 20 = 5.2942$  mA

**NOTE:** The **RD** command returns 5 bytes with leading zeros. Remainder of 63-byte packet is padded with nulls.

### **6b) RI- Read current and return value in CURRENT format.**

The **RI** command returns the present current in CURRENT format. The returned value ranges from 00.000 to 20.000 and is measured in mA

For example;

**RI**

returns...

**12.347**

Current is 12.347 mA

**NOTE:** The **RI** command returns 6 bytes with leading zeros in the following format nn.nnn. Remainder of 63-byte packet is padded with nulls.

### **6c) RH – Read current and return value in HEX format.**

The **RH** command returns the present current in HEXIDECIMAL format. The returned value ranges from 0000 to FFFF. Actual current can be calculated using the following formula:

Reading/FFFFh X 14h = current in mA ( Note that HEX14 = 20 in DECIMAL )

For example;

**RH**

**returns...**

**A04D**

Current is A04Dh/FFFFh X 14h = 12.5236mA

**NOTE:** The **RH** command returns 2 bytes with leading zeros in the following format MSB LSB . Remainder of 63-byte packet is padded with nulls.

#### **Notes to Operation:**

1. Maximum recommended sample rate is 500 samples per second.
2. Commands are case insensitive.
3. Measured currents above 20.000 mA return 20.000 mA. Negative currents ( reverse connection) return 00.000 mA.
4. Actual USB control data packets are 64 bytes for full-speed devices. The ADUHid.dll uses the first byte for internal use resulting in the 63- byte available size.

The ADU72 is a Full Speed USB product and requires the use of the new AduHidTestV2.0 and the Aduhid.dll Ver 2.0 or higher.

The V2.0 DLL and AduHidTest V2.0 Software can be downloaded at:  
<http://www.ontrak.net/programming.htm>

## 7. ADU72 Connection Diagrams

The ADU72 USB to Current Input interface enables measurement of 4-20mA and 0-20mA signals from standard process transmitters via a single USB connection. The ADU72 internally generated 24VDC loop supply eliminates the need for an external loop power supply.

Connecting external devices to the ADU72 is relatively simple, however, caution must be taken when making connections to the ADU72 internal 24VDC loop power supply.

**CAUTION - When using an external loop power supply, no connection should be made to the "+" of the ADU72 24VDC OUT terminals.**

### *7a) Connecting to 4-20mA Two-Wire, Loop Powered, Process Transmitters.*

Figure 6 shows the connections required to interface to a two-wire process transmitter using the ADU72 internal 24V supply to power the loop. The two connections shown are all that is required.

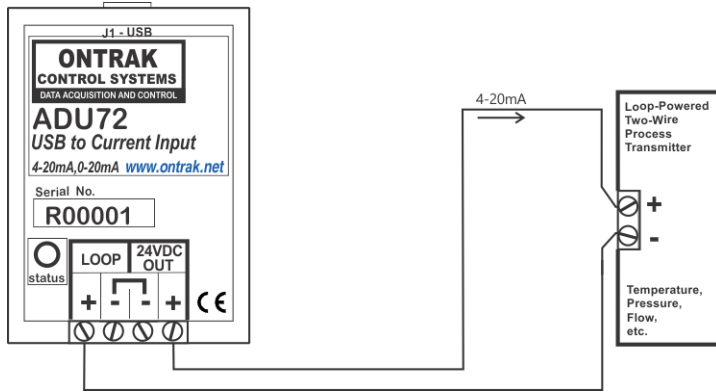


Figure6: ADU72 connections to a loop-powered, two-wire, process transmitter.

If desired, an external loop power supply can be used with loop-powered process transmitters. Connections are as shown in Figure 7.

**CAUTION - When using an external loop power supply, no connections should be made to either of the ADU72 24VDC OUT terminals.**

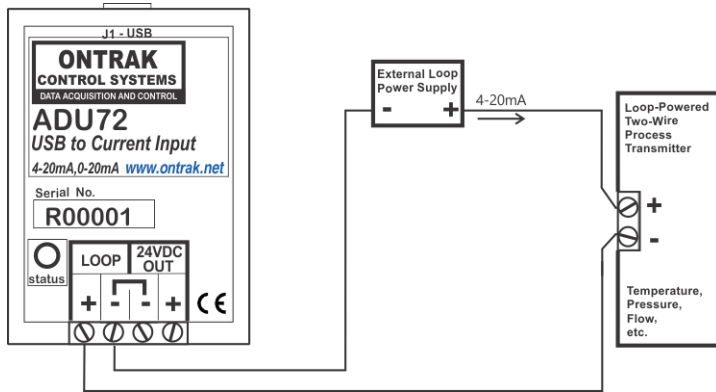


Figure 7: ADU72 connections to a two-wire transmitter using an external loop power supply.

### 7b) Connecting to 4-20mA Three-Wire Process Transmitters.

The ADU72 is capable of providing 24VDC at 35mA to power three wire process transmitters that operate on 35mA @ 24VDC or less. Figure 8 shows the proper connections for this configuration.

**CAUTION: Do not use this configuration if the three-wire process transmitter requires more than 35mA of supply current. Use external supply as shown in Figure 9.**

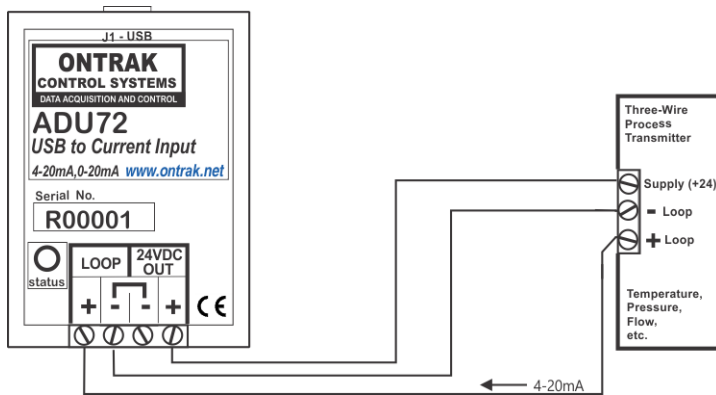


Figure 8: ADU72 connections to a three-wire process transmitter that operates on 35mA of supply current or less.

Figure 9 illustrates the proper connections to a three-wire process transmitter using an external power supply. This configuration is required if the process transmitter requires more than 35mA of supply current.

**CAUTION:** Make no connection to the ADU72 24VDC OUT "+" terminal in this configuration.

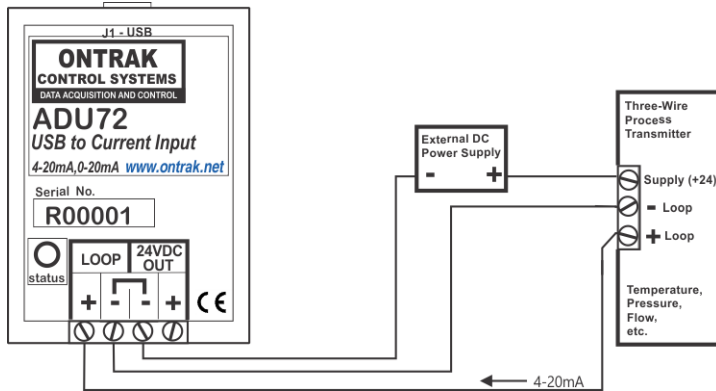


Figure 9: ADU72 connections to three-wire process transmitter using external power supply.

**7b) Connecting to 4-20mA Four-Wire Process Transmitters.**

The ADU72 is capable of providing 24VDC at 35mA to power four-wire process transmitters that operate on 35mA @ 24VDC or less. Figure 10 shows the proper connections for this configuration.

**CAUTION:** Do not use this configuration if the four-wire process transmitter requires more than 35mA of supply current. Use external supply as shown in Figure 11.

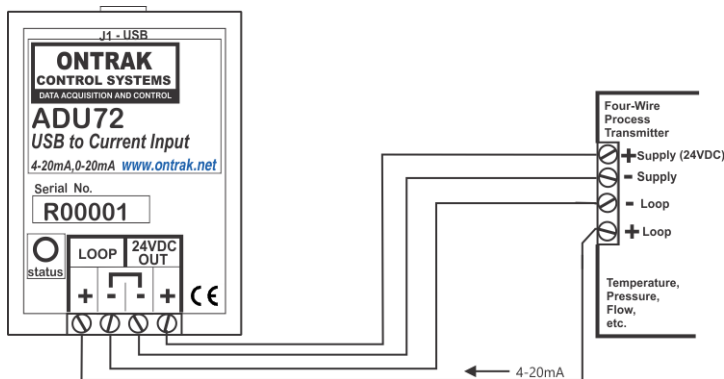


Figure 10: ADU72 connections to a four-wire process transmitter that operates on 35mA of supply current or less.

Figure 11 illustrates the proper connections to a four-wire process transmitter using an external power supply. This configuration is required if the process transmitter requires more than 35mA of supply current.

**CAUTION: Make no connection to the ADU72 24VDC OUT "+" terminal in this configuration.**

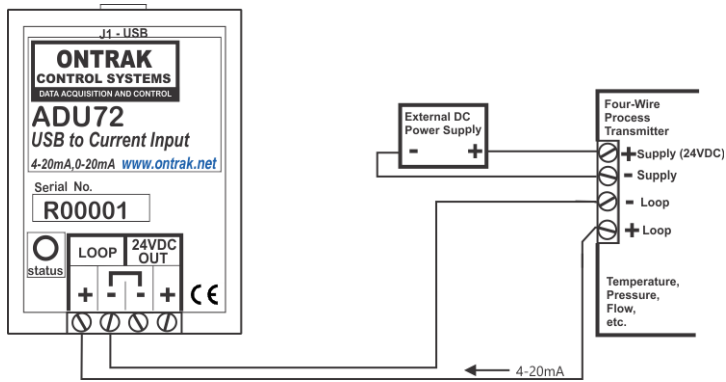
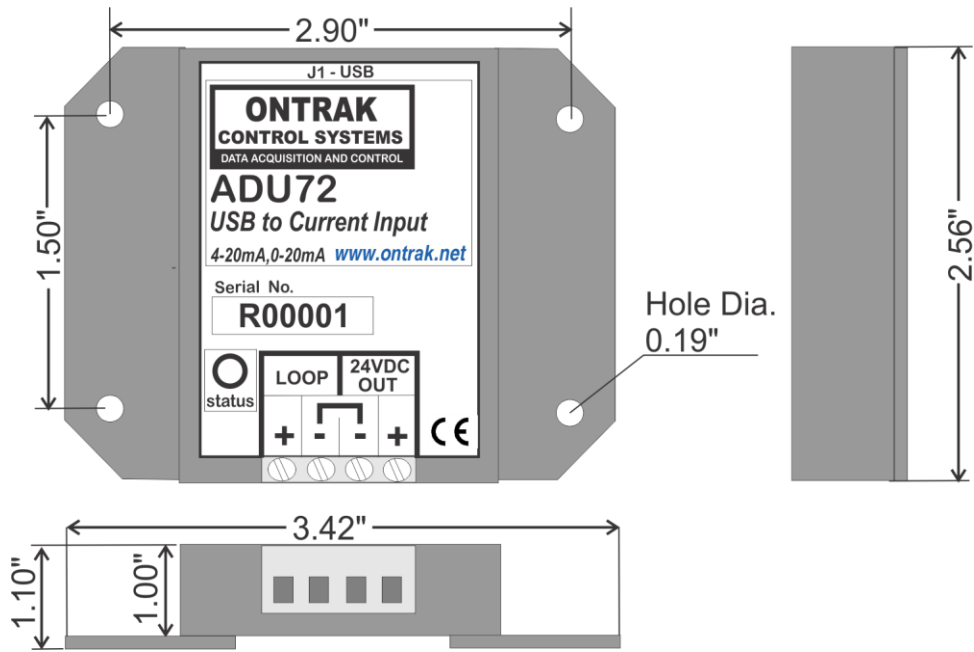


Figure 11 : ADU72 connections to a four-wire process transmitter using an external power supply.



## 8. Specifications and Dimensions

<b>General</b>	<b>ADU72</b>
Supply Voltage	NONE ( Bus Powered )
USB Supply Current ( using internal 24V supply )	180mA Typical      300mA Max
USB Supply Current ( using external loop supply )	90mA Typical      100mA Max
Isolation	2500V
Operating Temperature	-25C Min to 60C Max
<b>Current Loop Input</b>	
Resolution	16 Bits
Range	0-20mA
Total Unadjusted Error	+/- 0.05% FSR MAX
Full Scale Error	+/- 0.03% FSR MIN
Temperature Stability	+/- 50 ppm FSR/Degree C
Data Format	HEX or DECIMAL or CURRENT
Maximum Recommended Sample Rate	500 s/s
Operating Environment Humidity	0 to 90% RH (non condensing)
Loop Compliance Voltage	4V
<b>Internal Loop Power Supply</b>	
Voltage	24V Nominal
Isolation	2500V
Maximum Supply Current Output	35mA
<b>Special Functions</b>	
Internal Loop Power Supply	Internal 24VDC supply eliminates the need for an external loop power supply.
<a href="#">Mounting Options</a>	Flange Mount ( STANDARD ) , DIN Rail



Notes:

---



---



---



---



---



---



---



---



---



---

© 2017-Ontrak Control Systems Inc.