ONTRAK
CONTROL SYSTEMS
DATA ACQUISITION AND CONTROL

1545 Maley Drive
Unit # 3
Sudbury, Ontario
CANADA P3A 4R7
(705) 671-2652

ADU200 USB Relay I/O Interface

User Manual

Ver 2.1
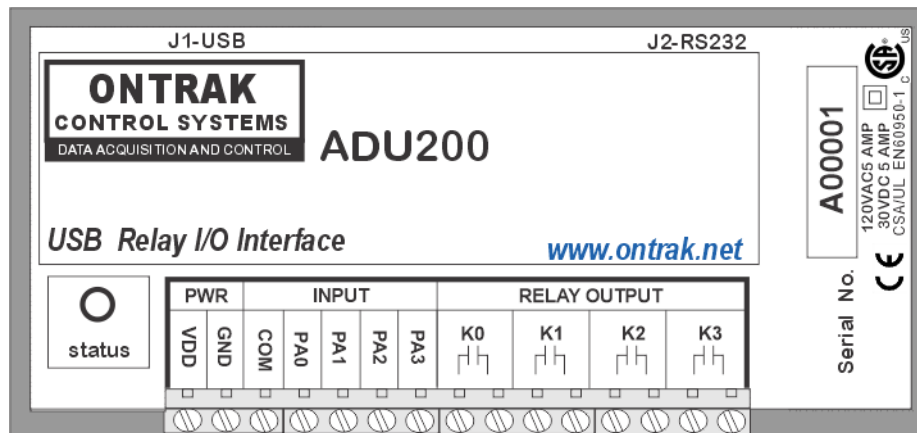
EU Declaration of Conformity

We, the undersigned,

Manufacturer:	Ontrak Control Systems Inc.
Address, City	1545 Maley Drive, Unit 3, Sudbury
Province, Country, Postal Code	Ontario CANADA P3A 4R7
Phone and FAX	(705) 671-2652 (705) 671-6127 (FAX)
Email Address	tom@ontrak.net

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

Model No: ADU200	**SN:** A00001 and higher
Description:	**USB Relay I/O Interface**
Brand:	**Ontrak Control Systems Inc.**

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

RF Emissions	*EN55011:2009/A1:2010 Class B*
ESD Immunity	*IEC 61000-4-2:2008 Level 2 Criterion B*
RF Immunity	*IEC 61000-4-3:2006 +A1:2007 +A2:2010 Level 2 Criterion B*
Safety	*EN60950-1 2nd Edition (CSA/UL)*

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

The technical documentation is kept at the following address:

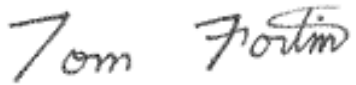|	
Company:	Ontrak Control Systems Inc.
Address, City	1545 Maley Drive, Unit 3, Sudbury
Country, Postal Code	Ontario CANADA P3A 4R7
Phone Number	(705) 671-2652
Fax, Email	(705) 671-6127 tom@ontrak.net

Name of Person binding the manufacturer.	*Tom Fortin*
Tom Fortin- Director Ontrak Control Systems Inc	January 10, 2018 Sudbury , Ontario, CANADA

Table Of Contents

1.   What is Included and Where to Start

The ADU200 ships complete with a 10' USB cable, and this User Manual.

A complete Windows SDK including DLL, programming language examples (MatLab, LabView, Visual C, Visual Basic, .NET, Linux, Python, OSX etc.), and our AduHidtest software is available at:

www.ontrak.net/programming.htm

First time users should first review the ASCII command set for the ADU200 and then use AduHidTest USB test software to become familiar with the command syntax, and the operation of the various features of the product.

Note: The AduHid DLL requires one of the following Windows operating systems, Windows XP, Windows 7, 8, 10 or higher. The programming section of the web site also contains examples for use with various other operating systems, and provides details that allow use of the ADU200 without using the Windows based AduHid DLL

2.   ADU200 Features

- Bus Powered, no external power supply required.
- Uses high quality Panasonic APAN3105 relays.
- 4, N. O. Mechanical Relay outputs rated 5.0A @ 120VAC, 5.0A @ 30VDC
- 4 Digital inputs suitable for contact or TTL Input, also accept up to 24VDC
- 4, 16-bit event counters associated with digital Inputs.
- CSA/UL Approved, CE Marked
- High Retention USB connector.
- Bi-colour LED status indicator.
- High quality cage-clamp type terminal blocks.
- Uses standard HID drivers included with Windows 7,8,10 or higher.
- Mini-driver (DLL) provided for use with Windows based software including LabVIEW and MatLab.
- Programming examples and sample code available for VB, VB.NET, Visual C, Python and others.
- Meets IEC61000-4-2 ESD protection for USB port.
- Available as standard DESKTOP mount, or optional FLANGE, DIN RAIL, or VELCRO mount.

3.   The ADU200 STATUS LED

The ADU200 STATUS LED is a bi-colour (Red/Green) led indicator used to identify the status of the ADU200 USB connection.

The LED modes are;

RED   -ADU200 powered but not enumerated.
GREEN   -ADU200 powered and enumerated by host computer.
OFF   -ADU200 disconnected from USB bus.

The ADU200 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 ADU200. 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
ADU200 USB Relay I/O 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 several seconds, the STATUS led will turn green indicating enumeration is complete. The enumeration process is completely transparent to the application program as the ADU200 is a low-speed USB HID class device. Enumeration is completed by the Windows (or other) operating system using standard USB HID drivers. The ADU200 can be connected directly to the host hub or externally powered hubs.

Caution: (Use of System Sleep): If the operating system allows the host computer to enter sleep mode, attached USB devices will be set to suspend mode. **In suspend mode the ADU200 relay outputs remain in their last state.** Ensure system power settings are set such that the host computer does not enter sleep mode during normal operation.

Caution: If the operating system **USB Selective Suspend** is enabled, after the ADU208/ADU218 is physically connected and enumerated (LED Green), the host may suspend the connection if no handle is opened to the ADU200. **In suspend mode the ADU200 relay outputs remain in their last state.**

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 ADU200 command set before programming in other languages.   AduHidTest software can be downloaded from the Ontrak website at: 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 in using a USB device in any application software. The three steps are;

1. Obtain a handle for the USB device.
2. Send commands to the USB device.
3. Receive data from the USB device.

STEP 1: Obtain a handle for the ADU200

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.)

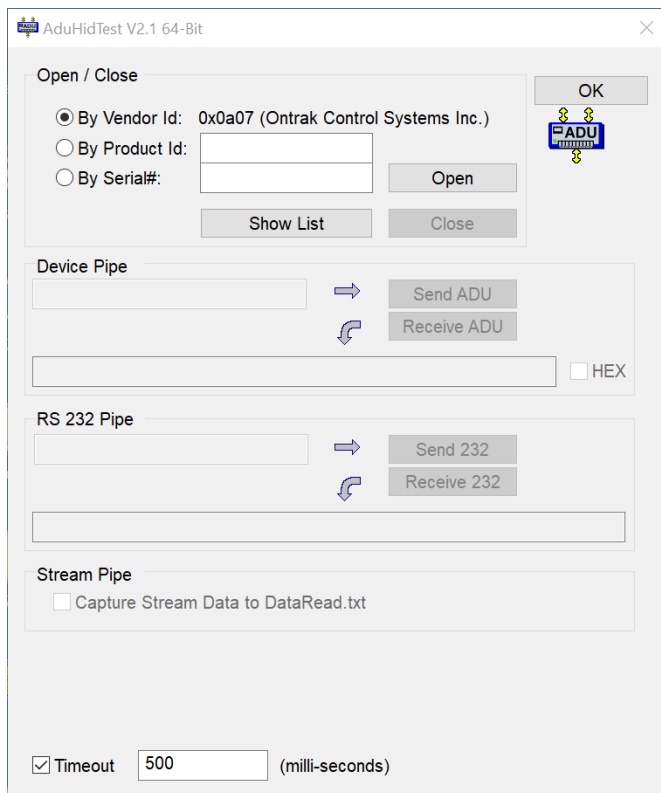Figure1 shows the AduHidTest software opening window.

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.
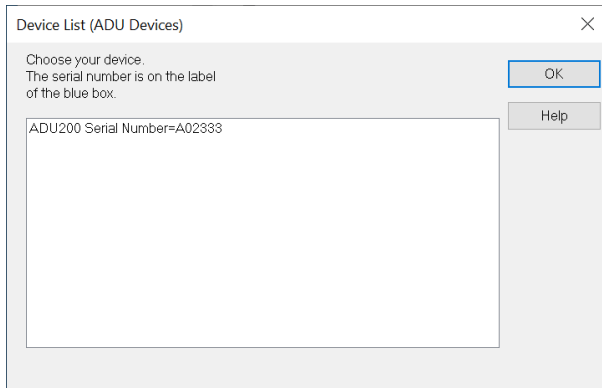

Figure 2: *ShowList* Window

The window indicates that there is one ADU200 connected with serial number A02333. Select the device by double clicking on the text *"ADU200 Serial Number = A02333"*. 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 ADU200. Figure 3 shows the AduHidTest window with the handle open to the ADU200.
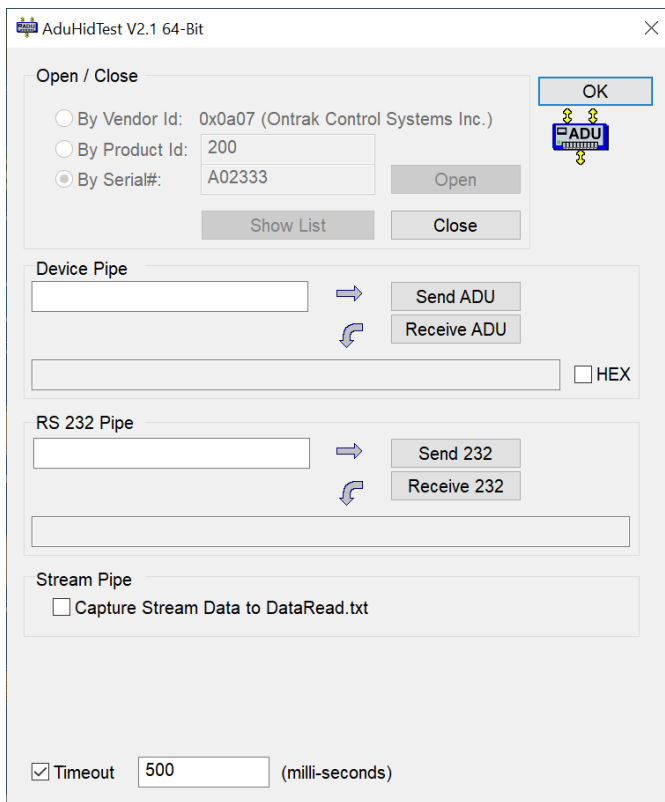

Figure 3: Handle Open to ADU200

STEP 2: Sending Commands to the ADU200

Once connected, you may now send commands to the available "pipes" on the ADU200 device. Pipes are the individual connections to functional sections of the ADU200. The **Device Pipe** is used to send standard ASCII ADU commands to control the peripherals built into the ADU200. The ADU200 does not use the **Stream** pipe.   Type "**SK0**" (set relay K0) into the device pipe send window and click **Send ADU**. An **OK** will appear beside the **Send ADU** button if successful, as shown in Figure 4, and the ADU200 relay K0 will close. Note that ADU commands are not case sensitive.
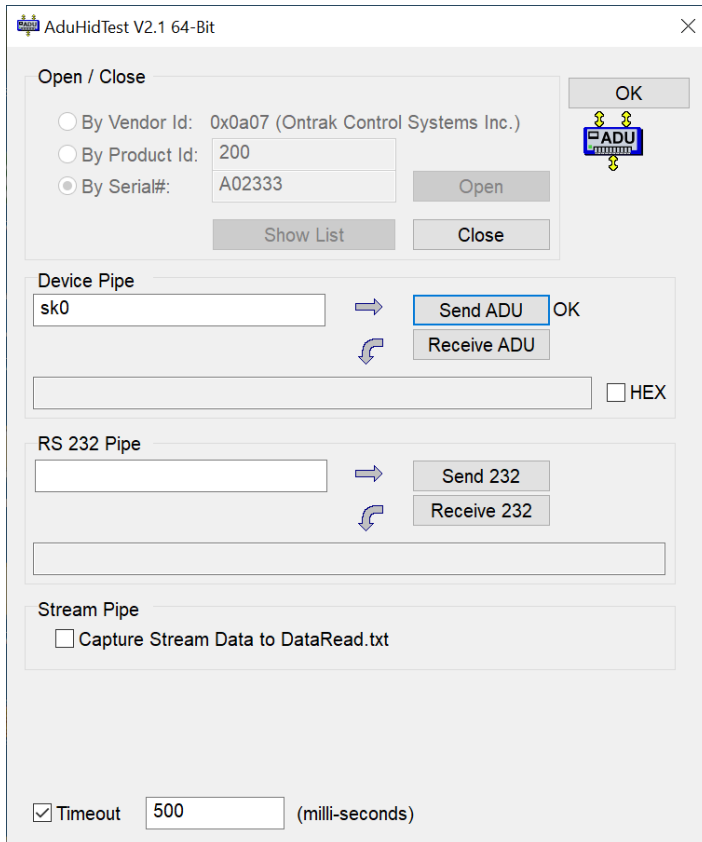

Figure 4: Sending "SK0" Command

STEP 3: Receiving Data from the ADU200

Some commands cause a response to be sent from the ADU200 back to the host computer. For example, if an "**RE3**" (read event counter on PA3) command is sent, the ADU200 will send back the value of the event counter. To read responsive commands, simply click the ***Receive ADU*** button and the data will be displayed.
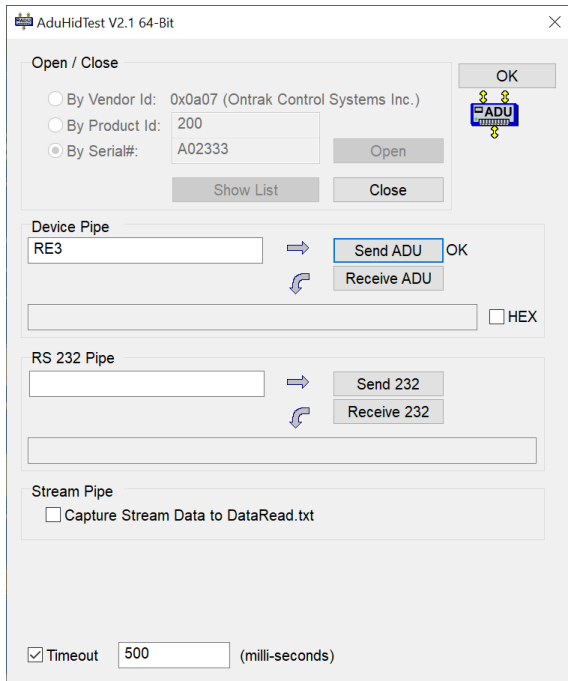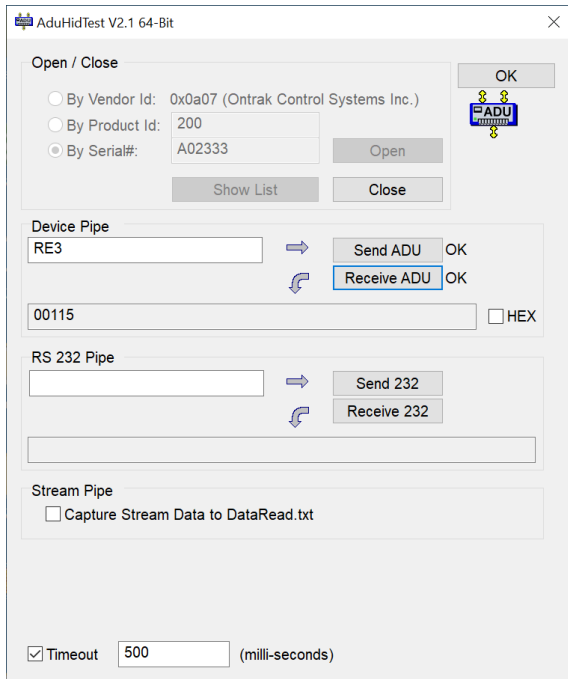

Figure 5: Sending "RE3" Command

Figure 6: Receiving Data

The received data indicates Event counter 3 is at 115 counts. These procedures can be repeated using the various commands available on the ADU200. The AduHidTest software is an invaluable tool to allow programmers to become familiar with ADU commands before programming in various other languages and/or operating systems.

5.   ADU200 Command Summary

Relay Commands (PORT K)

SKn   Sets relay specified by n (n = 0 to 3)
RKn   Resets relay specified by n (n = 0 to 3)
MKdd   Sets PORT K to decimal value dd (dd=00 to 15)
SPKxxxx   Sets PORT K to binary value xxxx. (x=1 or 0)
RPK   Returns status of PORT K in binary format.
RPKn   Returns value of relay specified by n. (n = 0 to 3)
PK   Returns value of PORT K in decimal format.

Digital Input Commands (PORT A and PORT B)

RPAn   Returns status of input line in PORT A specified by n (n= 0, 1, 2 or 3)
RPA   Returns status of PORT A in binary format.
PA   Returns status of PORT A in decimal format.

Event Counter Commands (PORT A and PORT B)

REn   Returns present count of event counter (n = 0 - 7)
RCn   Returns present count and clears event counter (n = 0 - 7)
DBn   Sets de-bounce time of event counters (n=0, 1 or 2)
               (0 =10ms, 1 = 1ms, 2 = 100us)
DB   Returns present de-bounce setting.

Watchdog Commands

WDn   Sets watchdog timeout length. (n=0, 1, 2 or 3)
               (0=WD OFF,   1=1s,   2=10s,   3=1min)
WD   Returns watchdog setting.

6. ADU200 Command Descriptions

6a) Relay Commands (PORT K)

The ADU200 interface feature four relay outputs. They are configured as PORT K with individual assignments of K0 thru K3. The relay contacts have no polarity requirements and switch either AC or DC loads.

SKn   Sets relay specified by n (n = 0 to 3)

Ex.

SK3   Closes relay K3

RKn   Resets relay specified by n (n = 0 to 3)

Ex.

RK2   Opens relay K2

MKdd Sets PORT K to value dd (dd = 00 to 15)

Ex.

MK15 Turns on all relays

SPKxxxx   Sets PORT K to value xxxx (x = 0 or 1))

Ex.

SPK0000   Turns off all relays

RPK   Returns status of PORT K in binary format.

Ex.

RPK

1100   Response (K3 and K2 are closed, K1 and K0 are open)

RPKn   Returns value of relay specified by n. (n = 0 to 3)

Ex.

RPK0   Returns value of relay K0

0   Response (relay K0 is presently OPEN)

PK   Returns value of PORTK in decimal format.

Response is 2 bytes (00 to 15 in decimal)

Ex.

PK

01   Response (K0 is closed (SET), K1-K3 are open (RESET)
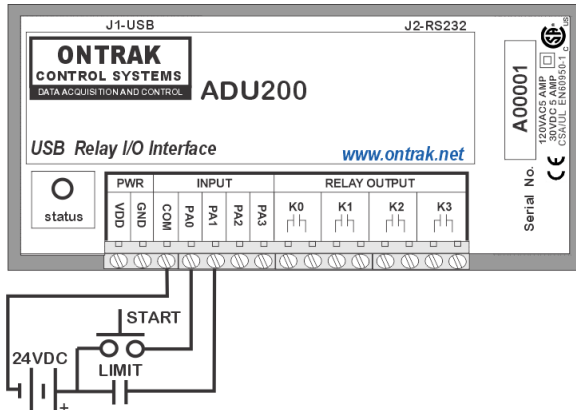
6b) Digital Input Commands (PORT A)

The ADU200 interface contains one 4-bit input port labelled PORT A. PORTA is isolated from all other external connections using opto-isolators with better than 2500V isolation. The COM connection is for connection of input device voltage common. Input devices can be connected using external DC voltages of up to 28V. The VDD output terminals provide a nominal 5VDC output that can be used as a supply to "wet" dry contact inputs (switches, pushbuttons etc.) to the digital inputs. When using the internal VDD supply to connect dry contact inputs, GND must be connected to COM to allow a return path for input current. Figure 6A shows how dry contacts can be connected using the ADU200 internal supply. Note that GND is connected to COM A.
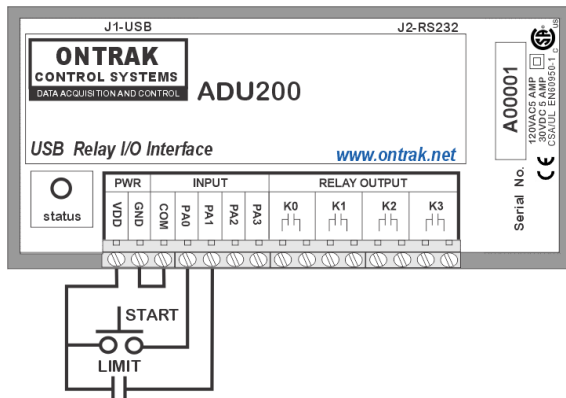
CAUTION: VDD and GND connections are not isolated from USB supply. Use to "wet" dry contacts only.

Figure 6A: Dry Contact Connections Using Internal VDD Supply.

Figure 6B demonstrates the connection of dry contact inputs using an external DC supply. Note that the common of the external supply is connected to COM B, as the inputs used in this example are PB2 and PB3.

CAUTION: When using an external supply with input devices make NO connection to VDD or GND terminals.

Figure 6B: Dry Contact Connections Using External Supply

The digital input port commands are:

RPAn   Returns status of input line in PORT A specified by n (n= 0 , 1, 2 or 3)

Ex.
RPA2
1   Response (PA2 is high)

RPA   Returns status of PORT A in binary format.
                  Response is 4 bytes (0000 to 1111 binary) (order is MSB-LSB)

Ex.
RPA
0100   Response (PA2 is High, PA0, PA1 and PA3 are Low)

PA   Returns status of PORT A in decimal format.
                  Response is 2 bytes (00 to 15 in decimal)

Ex.
PA
15   Response (All lines of PORTA are High)

6c) Event Counter Commands

Each digital input line of PORT A has an event counter associated with it. The event counters count low to high transitions and are stored in a 16-bit counter that can be read, or, read and cleared. The event counters are numbered 0 to 3 and count from 00000 to 65535 followed by a rollover to 00000.   Table 1 identifies the event counter port assignments.

Counter	PORT Assignment
0	PA0
1	PA1
2	PA2
3	PA3

Table 1: Event Counter Port Assignments

The event counters are read using either the RE command, or the RC command if the counter is to be cleared following the read.

REx   Returns present count of event counter (x = 0 - 3)

                Response 5 bytes (00000 to 65535 in decimal)

Ex.

RE1

00023   Response (PA1 has seen 23 low to high transitions)

RCx   Returns present count and clears event counter (x = 0 - 3)

                Response 5 bytes (00000 to 65535 in decimal)

Ex.

RC3

00156   Response (PA3 has seen 156 low to high transitions, event counter 3 is cleared)

6c) Event Counter Commands (continued)

The de-bounce time of the event counters can be set from 100us to 10ms (DEFAULT = 1 ms) using the DB command as outlined below;

DBn   Sets de-bounce time of event counters (n=0, 1 or 2)

                 (0 =10ms,   1 = 1ms (Default),   2 = 100us)

Ex.

DB0   De-bounce is set to 10ms

DB   Returns present de-bounce setting.

Ex.

DB

  0   Response (De-bounce is currently set to 10ms)

6d) Watchdog Commands

The ADU208/ADU218 features a host watchdog function. The host watchdog, when enabled, resets all relays, and resets the watchdog setting to 0 (WD OFF), when a watchdog timeout occurs. Following the enabling of the watchdog timer, commands must be continuously received by the ADU208/ADU218 within the selected timer interval or a watchdog timeout will occur. After a watchdog timeout occurs, the watchdog setting must be reloaded. The host application should poll the watchdog setting to determine if a watchdog timeout has occurred. Note that the watchdog timer is reset when any command is received by the ADU208/ADU218. This includes invalid commands.

WDn   Sets watchdog timeout length.
                 (0=WD OFF, 1=1s, 2=10s, 3=1min)
Ex.
WD2   Sets the watchdog timeout to 10 seconds and enables watchdog timer.

WD   Returns watchdog setting.

Ex.
WD
3   Response (WD timeout setting is 1 minute)

7.   Specifications

	ADU200
Supply Voltage	NONE (Bus Powered)
USB Supply Current (relays de-energized)	20mA Typical
USB Supply Current (all relays energized)	95mA Typical
USB Connection Type	Low -Speed USB 1.1 HID
Operating Temperature	-25C to 85C Max
Isolation Voltage	2500Vrms
Digital Inputs (8)	
Vin HIGH (MAX)	28 VDC
Vin HIGH (MIN)	2 VDC
Vin LOW(MAX)	0.7 VDC
Vin LOW (MIN)	0 VDC
Input Z	2700 ohms
Event Counters (8)	
Resolution	16 Bits
Input Type	Contact, TTL, Voltage up to 28VDC
Max Frequency	1KHz
Input Z	2700 ohms
Programmable Debounce	10ms, 1ms, or 100us
Relay Outputs (8)	
Type	A (N.O.) Mechanical
AC Ratings	5Amps@120VAC
DC Ratings	5Amps@30VDC
On-State Resistance Typical	30mOhm (Initial)
Relay Used	Panasonic APAN3105
Maximum Recommended Operating Speed	10 CPS
Safety Approvals	CSA/UL EN60950-1 2nd Edition
Mounting Options	Desktop (STANDARD), Flange Mount, DIN Rail, Velcro

8. Dimensions (Drawings not to scale)

DESKTOP (STANDARD)
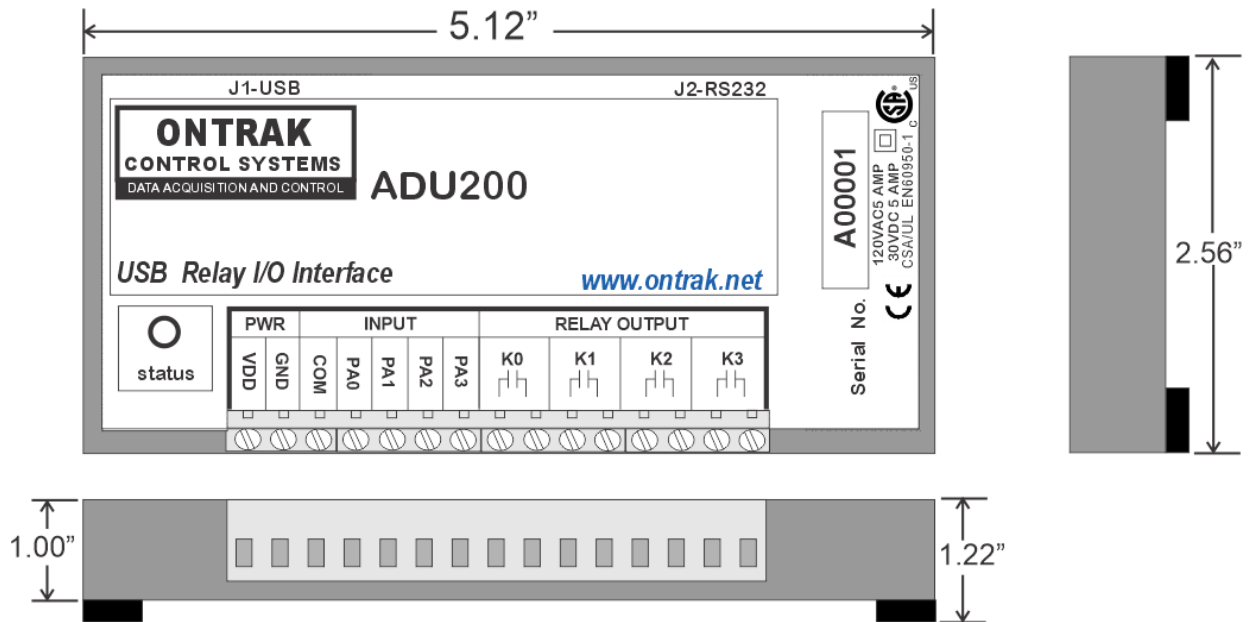
FLANGE (OPTIONAL)
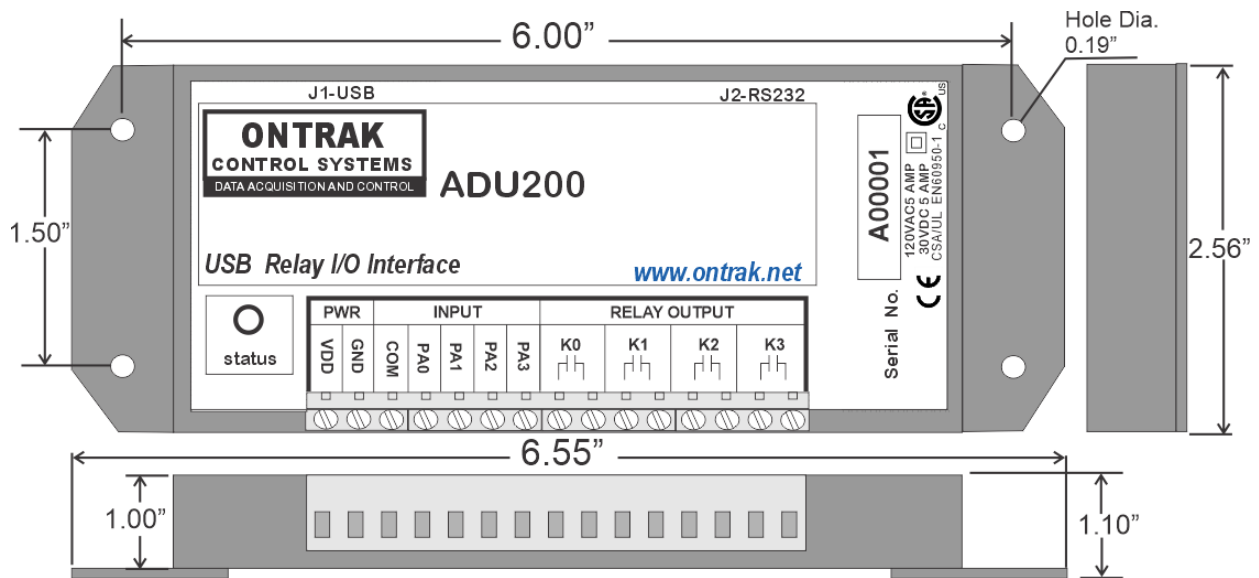
(See www.ontrak.net for DIN RAIL options and dimensions.)