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DATA ACQUISITION AND CONTROL

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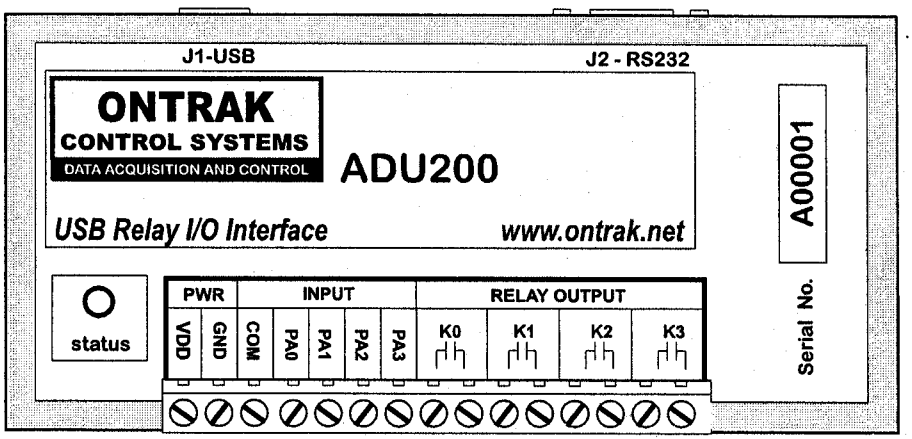
ADU200 USB Relay I/O Interface
User Manual

Ver 1.2



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1. What is Included and Where to Start

The ADU200 ships complete with a 10' USB cable, this User Manual and a 3.5" diskette titled ADU-SDK.

The ADU-SDK diskette inlcudes the following files;

AduHid.dll		DLL to allow applications to communicate with the ADU200 on the USB bus.
AduHidTest.exe		Software application used to test ADU products and allow programmers to become familiar with the ADU ASCII commands.
AduHidHelp.chm		Software development kit (SDK) in CHM (Windows Help File) format.
VisualC-EG	(folder)	Visual C program examples from SDK
VisualBasic-EG	(folder)	Visual Basic program examples from SDK
BorlandC-EG	(folder)	Borland C program examples from SDK
Various support files		

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

Note: The AduHid DLL requires one of the following Windows operating systems. 98SE, 2000 or XP

Application programs should be written using the Software Design Kit (SDK) located on the ADU-SDK diskette. The SDK contains explanations of how the various communication pipes can be accessed using the AduHid DLL. Example code is given for Visual Basic, Visual C and Borland C. The SDK help file is designed to be run on the development PC when programming. This allows programmers to cut-and-paste specific functions directly into an application. Additional examples and applications are posted on our web site at **www.ontrak.net**

2. ADU200 USB Relay I/O Interface Features

-Provides a standard PC with PLC (programmable logic controller) functions.
-Low-cost .
-Bus Powered, No external power supply required.
-4, N. O. relay contact outputs rated 5.0A @ 120VAC, 5.0A @ 30VDC
-High quality Aromat PA-series relays offer superior performance.
-4 Digital inputs suitable for contact or TTL Input , also accept up to 24VDC
-Inputs feature optical isolation to 3500V (500V channel to channel)
-Programmable watchdog functions.
-Bi-colour LED status indicator.
-Self-resetting, fused 5V output
-Auxillary RS232 port for connecting legacy RS232 devices. (ADR series)
-High quality cage-clamp type terminal blocks.
-Uses standard HID drivers included with Windows 98SE,2000,XP
-Mini-driver (DLL) provided for use with VB,VC, LabVIEW and TestPoint
-Programming examples and sample code included for VB, Visual C++
-Four, 16-bit event counters
-Programmable debounce setting for event counters.
-Meets IEC61000-4-2 ESD protection for USB port.
-Available in enclosure or as PCB only.

3. Connecting the ADU200 to a 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. A message will 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 a few seconds, the STATUS led will turn green indicating enumeration is complete. The enumeration process is completely transparent to the application program as it is completed by the Windows operating System

The STATUS led will remain green unless a watchdog timeout (See Special Commands Section) occurs.

The ADU200 can be connected directly to the host hub or either, external powered, or non-powered hubs.

Caution: (Use of System Standby): If the Windows operating systems puts the system into " Suspend " mode, all USB hubs are issued a Reset when the Suspend mode is exited. This will cause the ADU200 to lose power briefly, resulting in the event counter data being lost and all relays to reset. Open the power options section in the Windows control panel and ensure "System Standby" is set to never.

Caution: (Use of PWR Terminals): The auxiliary power connections labelled VDD and GND are a non-isolated output and no external power supply should be connected to these terminals. The power output is provided to allow use of dry contact inputs to the digital input lines. If the supply is to be used with dry contact inputs, GND should be connected to COM, and the dry contact connections made between VDD and the selected digital input line. If this power output is used for external circuits, no more than 5mA should be drawn if all relays are to be energized at once. Up to 65 mA can be drawn depending on how many relays are to be energized at one time. Derate this current by 15mA per relay.

4. AduHidTest USB Device Test Program

AduHidTest is a 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 ADU command set. The program is located in the root directory of the ADU-SDK disk. The program can be run from floppy or transferred to the hard drive. Note that the program requires the AduHid.dll to operate and it should be copied to the dame directory as the AduHidTest.exe file.

Getting Started:

There are three steps in using a USB device in any application software. The three steps are ,

1. Obtain a handle for the ADU200.
2. Send commands to the ADU200.
3. Receive data from a ADU200.

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) The AduHidTest program main Window is shown in Figure 1.

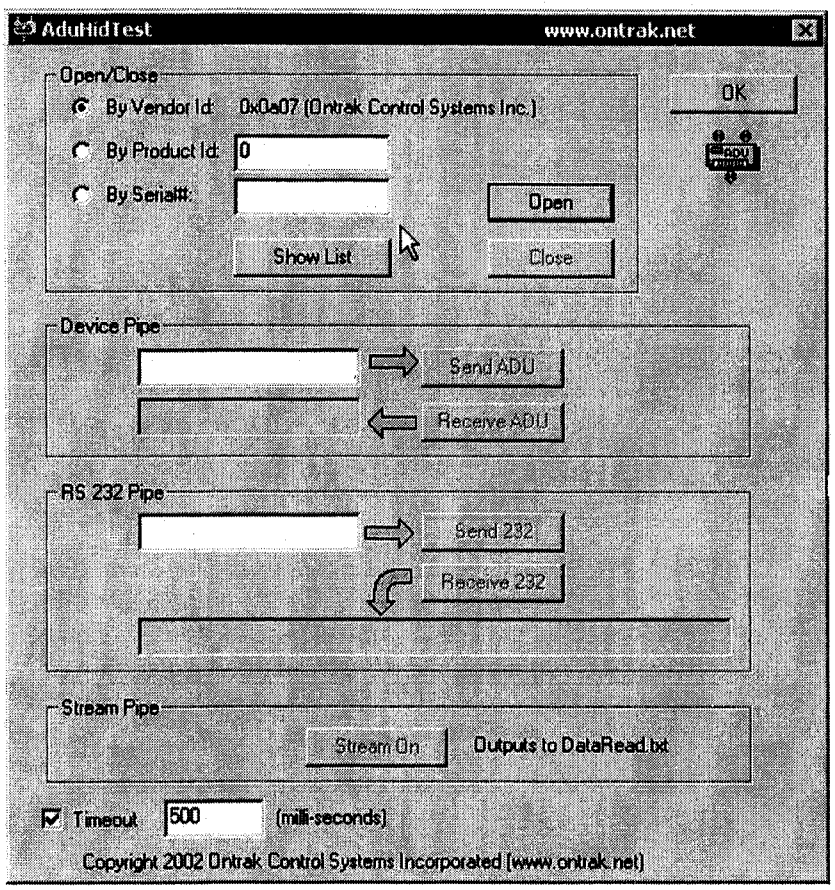


Figure 1: AduHidTest Main Window

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.

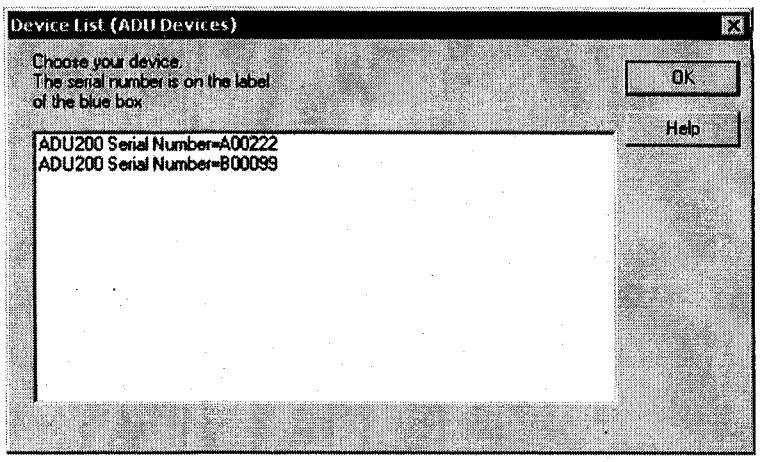


Figure 2: " Show List " Display

The display indicates that there are two ADU200 devices connected with serial numbers A00222 and B00099. Select a device by clicking on the desired device. 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.

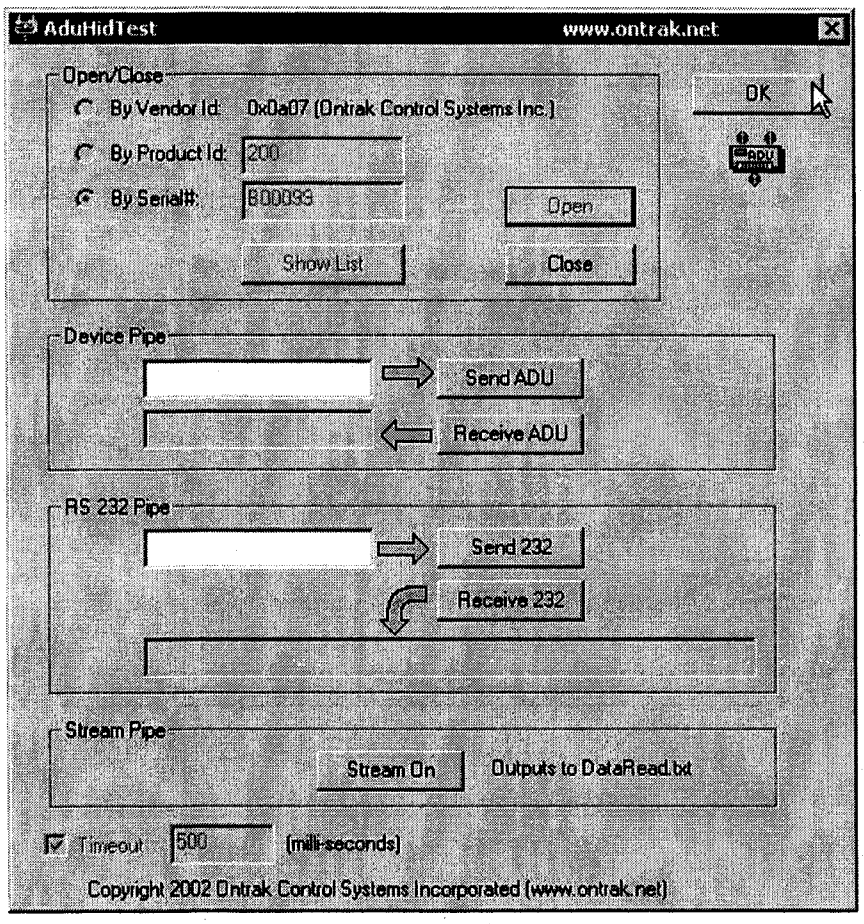


Figure 3: Connected to B00099

STEP 2: Send Commands to the ADU200

Once connected, you may now send commands to the available "pipes" on the 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 such as the relay outputs or event counter inputs. Type "sk3" (Close relay K3) into the device pipe send window and click Send ADU . Relay K3 on the ADU200 will close and the software will display a small "OK" next to the Send ADU button indicating the command was sent.

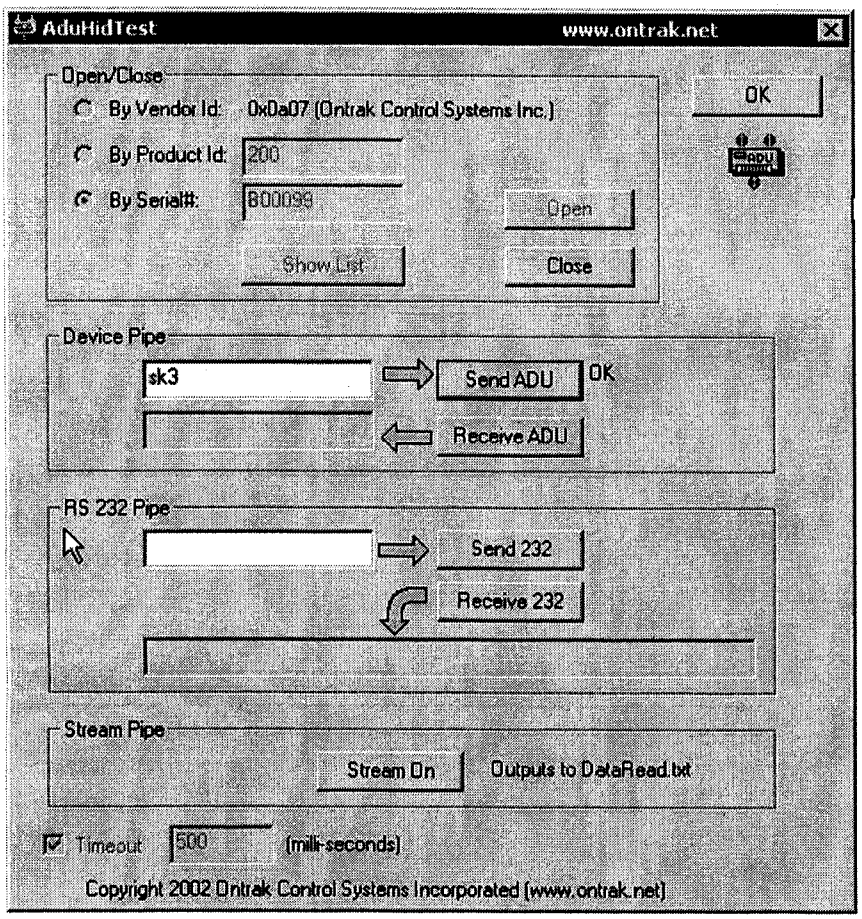


Figure 4: Sending "sk3" Command

STEP 3: Receive Data from the ADU200

Some commands will cause a response to be sent from the ADU device to the host computer. For example, if an "re1" (read event counter 1) command is sent, the ADU200 will send back the 5 digit count. To read responsive commands, simply click the Receive ADU button and the data will be displayed.

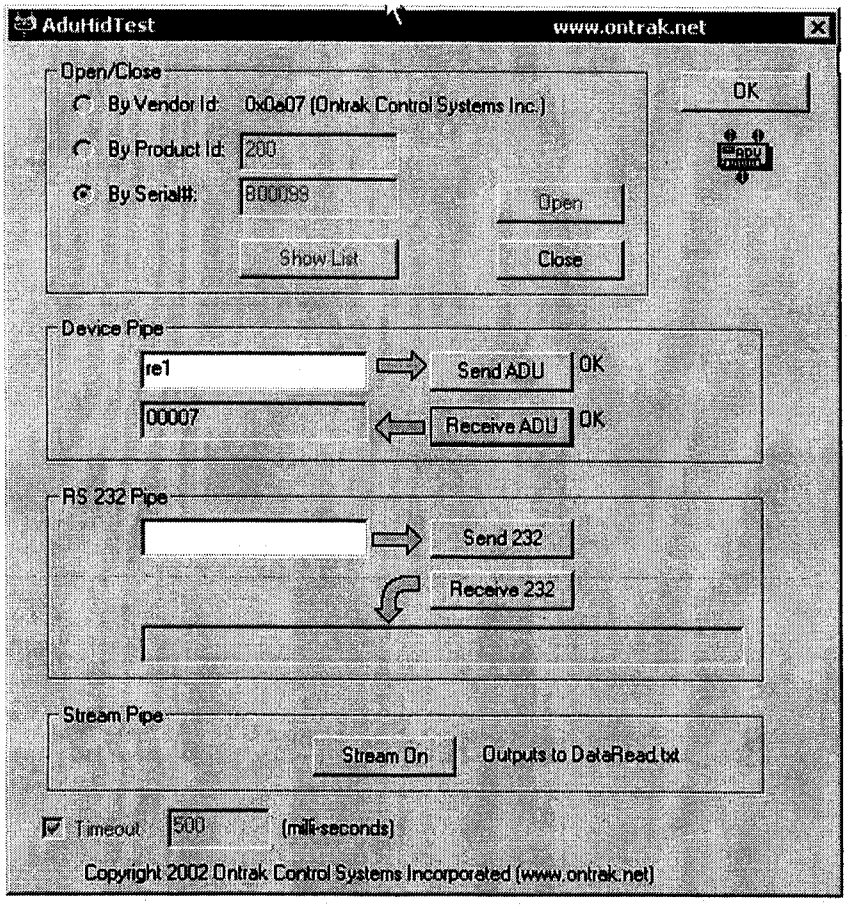


Figure 5: Sending "re1" and Receiving Count Data

The RS232 Pipe is used to send and receive ASCII strings to any RS232 based device connected to the ADU200 auxiliary serial port. The method of sending commands is identical to device pipe, in that you simply enter the ASCII command string, and click the Send 232 button. Data is received, and then displayed when the Receive 232 button is clicked.

In the following example, an "rd" (analog array read) command is sent to an ADR2000B Data Acquisition Interface connected the the ADU200 auxiliary serial port. Figure 6 shows the "rd" command being sent and Figure 7 shows the returned data displayed after the Receive 232 button is clicked.

Note1: The RS232 pipe is designed to send and receive ASCII strings which use a CR (0Dh) as a termination character. AduHidTest automatically adds the CR to the string being sent. The maximum string length for both send and receive is 40 characters. The ASCII string should not contain any NULL (00h) characters in both incoming and outgoing strings.

Note2: The ADU200 does not support the stream pipe and so no explanation of its operation is listed in this document.

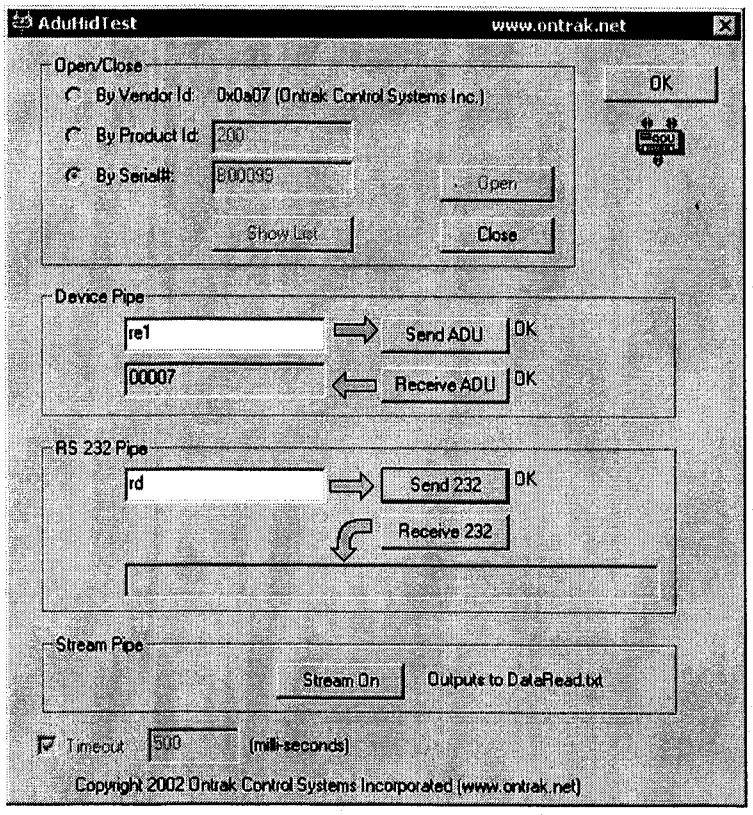


Figure 6: Sending "rd" Command to RS232 Pipe

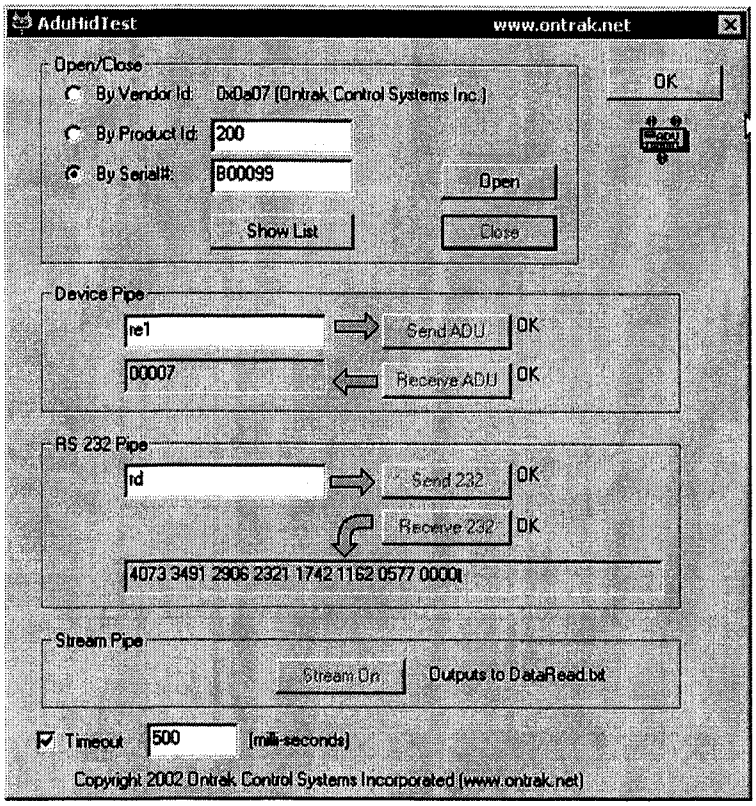


Figure 7: Receiving Data on RS232 Pipe

5. ADU200 Command Summary

RELAY COMMANDS (PORT K)

SKn	Sets relay specified by n (n = 0 ,1,2 or 3)
RKn	Resets relay specified by n (n= 0 , 1, 2 or 3)
MKdd	Sets PORTK to decimal value dd (dd= 0 to 15)
SPKxxxx	Sets PORT K to binary value xxxx (x= 0 or 1)
RPKn	Returns status of relay specified by n (n= 0 , 1, 2 or 3)
RPK	Returns status of PORT K in binary format.
PK	Returns status of PORT K in decimal format.

DIGITAL COMMANDS (PORT A)

RPAn	Returns status of Input 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 COMMAND SUMMARY

REx	Returns present count of event counter (x = 0,1,2 3)
RCx	Returns present count and clears event counter (x = 0,1,2, 3)
DBn	Sets de-bounce time of event counters (n= 0,1 or 2) (0 =10ms, 1 = 1ms, 2 = 100us)
DB	Returns present de-dounce setting.

SPECIAL FEATURE COMMAND SUMMARY

SBn	Sets baud rate of auxillary RS232 port. (n = 0,1,2 or 3) (0 =9600, 1 = 19.2K, 2 =38K, 3 = 56K)
SB	Returns present baud rate setting.
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

All commands are specified as non-terminated ASCII strings. The maximum length of command and data strings is 7 bytes. Commands are passed via the AduHid DLL to the ADU200 as a seven byte packet and unused bytes are sent as NULL (00h).

6a) RELAY COMMANDS (PORT K)

There are 4 type A relay contact outputs on the ADU200 rated at 5A@120VAC or 5A at 30VDC. The relays may be SET or RESET individually or as a 4 bit port. The relay commands are;

SKn Sets relay specified by n (n = 0 ,1,2 or 3)
# of Bytes 3
Response NONE

Example; SK2 ;closes contact K2

RKn Resets relay specified by n (n= 0 , 1, 2 or 3)
# of Bytes 3
Response NONE

Example; RK1 ;opens contact K1

MKdd Sets PORTK to decimal value dd (dd= 0 to 15)
# of Bytes 3 or 4
Response NONE

Example; MK15 ;Closes all relays.

SPKxxxx Sets PORT K to binary value xxxx (x= 0 or 1) MSB-LSB
# of Bytes 7
Response NONE

Example; SPK1100 ;Closes K3,K2, Opens K1,K0

RPKn Returns status of relay specified by n (n= 0 , 1, 2 or 3)
# of Bytes 4
Response 1 byte (0 or 1)

Example; RPK2 ;Relay K2 is closed.
1 (response)

RPK Returns status of PORT K in binary format.
# of Bytes 3
Response 4 bytes (0000 to 1111 in binary) MSB-LSB

Example; RPK ;Relay K3 is closed, K0,K1 and K2 are open.
1000 (response)

PK Returns status of PORT K in decimal format.
# of Bytes 2
Response 2 bytes (00 to 15 in decimal)
Example; PK ;Relay K1 is closed, K0,K2 and K3 are open.
02 (response)

6b) DIGITAL COMMANDS (PORT A)

PORTA is a 4 byte optically isolated input port. The port lines can be read individually or as a 4 bit port.

RPAn Returns status of Input specified by n (n= 0 , 1, 2 or 3)
# of Bytes 4
Response 1 byte (0 or 1)

Example; RPA2 ;PA2 is High.
1 (response)

RPA Returns status of PORT A in binary format.
# of Bytes 3
Response 4 bytes (0000 tp 1111 binary)

Example; RPA ;PA2 is High, PA0,PA1 and PA3 are Low
0100 (response)

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

Example; PA ;All lines are High..
15 (response)

6c) EVENT COUNTER COMMANDS

Each digital input line on PORTA has an event counter associated with it. The event counters count low to high transitions and store them 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. The de-bounce time of the event counters can be set from 100us to 10ms.

REx Returns present count of event counter (x = 0,1,2 3)
# of Bytes 3
Response 5 bytes (00000 to 65535 in decimal)

Example; RE1 ;PA1 has seen 23 Low to High Transitions
00023 (response)

RCx Returns present count and clears event counter (x = 0,1,2, 3)
# of Bytes 3
Response 5 bytes (00000 to 65535 in decimal)

Example; RC3 ;PA3 has seen 156 Low to High Transitions
00156 (response) ; (Event Counter 3 is cleared)

DBn Sets de-bounce time of event counters (n=0,1 or 2)
(0 =10ms, 1 = 1ms (Default) , 2 = 100us)
# of Bytes 3
Response NONE

Example; DB0 ;De-bounce is set to 10ms

DB Returns present de-bounce setting.
# of Bytes 2
Response 1 bytes (0,1, or 2)

Example; DB ;De-bounce is set to 10ms
0 (response)

6d) SPECIAL FEATURE COMMANDS

The ADU200 has several special features including a host watchdog timer and an auxiliary serial (RS232) port. The following commands are used to implement these features.

The RS232 port has a programmable baud rate from 9600 to 56K. This setting determines the BAUD rate used for both transmit and receive. This parameter should be set before RS232 transmission or reception commences.

SBn Sets baud rate of auxiliary RS232 port. (n = 0,1, 2 or 3)
(0 =9600 (Default) , 1 = 19.2K, 2 =38K, 3 = 56K)
# of Bytes 3
Response NONE

Example; SB3 ;Sets Baud rate to 56K

SB Returns present baud rate setting.
# of Bytes 2
Response 1 bytes (0,1, 2 or 3)

Example; SB ;Baud Rate is 9600
0 (response)

A programmable host watchdog is provided to allow predicted operation in the event the host PC stops communicating with the ADU200. Upon timeout, all relays are RESET, WD =0, and the status indicator will turn from GREEN to RED. Any command sent to either the DEVICE or RS232 pipe will reset the watchdog timer. To determine if a watchdog timeout has occurred, read the timer setting. If the watchdog was set to 2, and no command was sent for 10 seconds, a 0 will be returned indicating a timeout has occurred. Following a timeout, the host must reload the timer setting as a timeout causes the setting to be set to 0 (WD OFF)

WDn Sets watchdog timeout length (n = 0, 1, 2 or 3)
(0 =WD OFF (DEFAULT) , 1 = 1s, 2 =10s, 3 = 1min.)
# of Bytes 3
Response NONE

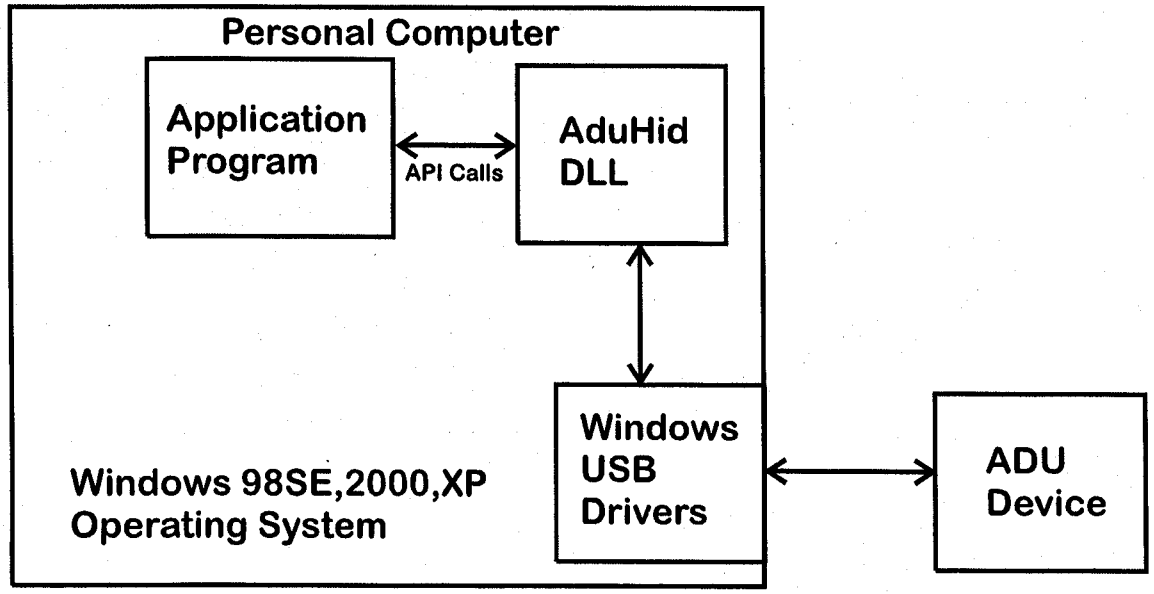
Example; WD2 ;Sets WD timeout to 10s

WD Returns watchdog setting.
# of Bytes 2
Response 1 bytes (0,1,2 or 3)

Example; WD ;Watchdog not enables or timeout has occurred.
0 (response)

7. The ADU200 Software Development Kit (SDK)

Application programs must use the AduHid DLL provided to send commands and receive data from the ADU200. This is done using simple API calls from the application language



AduHid DLL location

The SDK is located on the ADU-SDK diskette and includes explanations of how the pipes to the various ADR200 features operate.

The SDK contains examples for use with Visual Basic, Visual C and Borland C. Additional programming tutorials and applications are located at **www.ontrak.net**

8. Specifications

Bus Supply Voltage	4.10-5.25VDC
Bus Supply Current	20mA Typical (Relays De-energized)
Bus Supply Current	95mA Typical (All Relays Energized)
Operating Temperature	0-50C
Auxiliary VDC out	4.10-5.25VDC (Bus voltage)
Max Output Current	65mA (All Relays De-energized)
Max Output Current	5mA (All Relays Energized)
Contact Outputs (4)	**Type A (Normally Open)**
AC Ratings	5.0 Amps @ 120VAC MAX
DC Ratings	5.0 Amps @ 30VDC MAX
Relay Approvals	UL, CSA,TUV
Digital Inputs (4)	**(TTL or Contact Input)**
Vin HIGH (MAX)	28VDC
Vin HIGH (MIN)	2.0VDC
Vin LOW (MAX)	0.7 VDC
Vin LOW (MIN)	0VDC
Input Z	2700 ohm
Event Counters (4)	
Resolution	16-bit
Input Type	Contact, TTL Voltage or up to 24VDC
Input Z	2700 ohms
Max Frequency	1Khz
Programmable De-bounce	10ms, 1ms, 100us, NONE
Special Functions	
Auxiliary RS232 Port	Allows connection to ASCII based serial interfaces. Programmable baud rate from 9600 to 56K.
Programmable Watchdog	Timout = 1,10 or 60 seconds.
Mounting Options	Desktop, Velcro, Panel, DIN Rail