Atouch

Analog Resistive
Touch Screen Controller

Version 1.5

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Revised

February 18, 1997	**ECO #2270**
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1. INTRODUCTION

The Atouch touchscreen controller is a general purpose, 12 bit analog resistive controller which supports Computer Dynamics' analog resistive touch screen overlays. These overlays are available in various sizes and configurations that provide resistive touchscreen support for the Computer Dynamics Display-PAC product line. The standard analog resistive product line includes the AR1, AR2, AR3, and AR4 while bezeled versions suitable for NEMA 12 and NEMA 4 applications are offered as NEMA 12: CN1, CN3, CN5 and NEMA 4: CN2, CN4, CN6. Via factory setting, the Atouch controller board is configurable to support both 4 wire analog resistive technology, as well as the 5 wire analog resistive technology. The Atouch Controller offers a resolution of 4096x4096 and 100,000 touchpoints per inch squared.

Features:

- Standard 5 wire analog resistive interface
- Optional 4 wire analog resistive interface
- 12 bit resolution
- High accuracy and fast response
- Dedicated RS232 serial port for direct interface to any Computer Dynamics SBC product
- Low power, 5 Volt only operation

1.1 SPECIFICATIONS

• EEPROM	93C46 - (Reference Designator U4 in schematic. Atouch boards use this for storing configuration data.)
• Communications	1 dedicated serial port to interface with the different SBC boards.
• Panel Interfaces	1 4-wire resistive touch interface (Optional). 1 5-wire resistive touch interface.(Factory default)
• Physical	2.2 inches width X 4 inches length X 0.25 depth
• Power	+5 Volts @ 250mA

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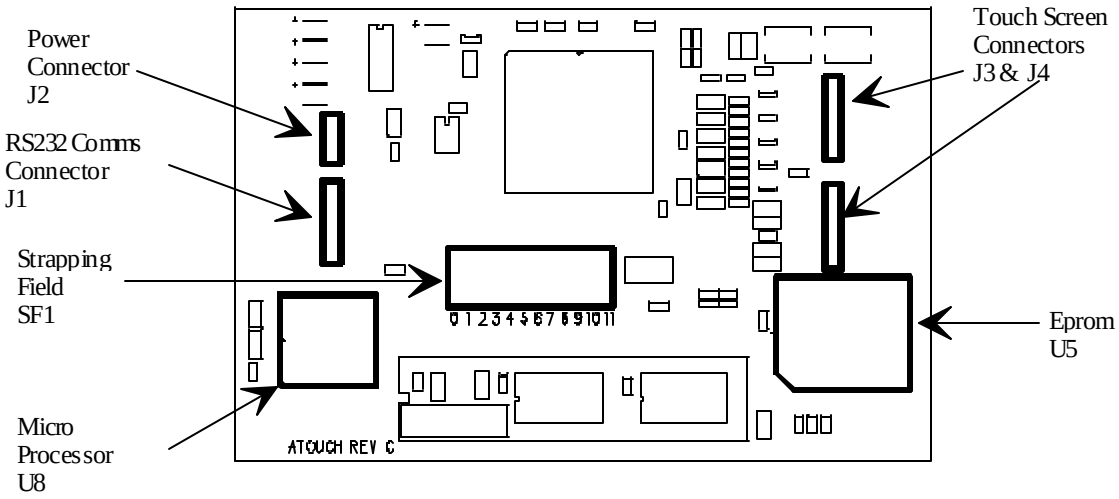
2. HARDWARE CONFIGURATION



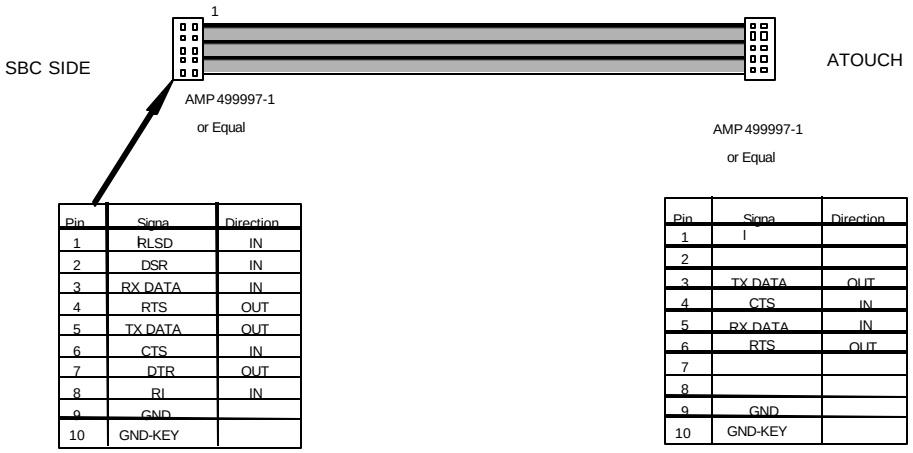
Before using your Atouch touch screen controller, you may need to set or confirm the locations of the connectors and the setting of the strapping field. The drawing above will allow you to locate the power connector (J2), 5-Wire/4-Wire touch screen connector (J3 or J4), Power On Configuration (SF1, and RS-232 port (J1). Concerning SF1, please note that the J designators were used in order to be consistent with previous conventions, and the pins have been numbered 0 to 11 for easier location of the strapping field on the board. Number 0 is at the same position as J0.

2.1 Power Connector (J2)

Power Connections

Ensure +5 Volts power is supplied to the Atouch board. Either connection shown above is sufficient.

2.2 Serial Port Interface (J4)



Pin	Signal	Direction
1	RLSD	IN
2	DSR	IN
3	RX DATA	IN
4	RTS	OUT
5	TX DATA	OUT
6	CTS	IN
7	DTR	OUT
8	RI	IN
9	GND	
10	GND-KEY	

Pin	Signal	Direction
1		
2		
3	TX DATA	OUT
4	CTS	IN
5	RX DATA	IN
6	RTS	OUT
7		
8		
9	GND	
10	GND-KEY	

SBC TO SERIAL CONNECTOR (J4)

Serial communications to and from the Computer Dynamics SBC product line is via a straight through 10-wire cable with a 2x5 female connector on both ends. The Atouch board is configured as a Data Communications Equipment (DCE) device.

2.3 5-Wire Touch Screen Interface (J8)

If you have a 5-Wire touch screen, connect the 5-wire touch screen panel to J8. There should be a mark denoting Pin 1 on the flex cable attached to the touch screen panel.

Touch Screen Sensor Connectors

Connectors J3 & J4*	Description
1	HDRIVE
2	XDRIVE
3	SENSE
4	YDRIVE
5	LDRIVE

*Both connectors have the same pin-out, but physically on the board they're 180 degrees opposite each other (pin 1 is clearly marked on the PCB board for each connector).

2.4 Strapping Fields

The following section provides strapping information for all the currently available options.

2.4.1 Power On Configuration (SF1)

Strapping Table

SF1	Description	Strapped	Unstrapped
J0	**Baud Rate**	**$$$**	**$$$**
J1	**Baud Rate**	**$$$**	**$$$**
J2	**Output Format**	**Ascii**	**Binary**
J3	**H/W Hand Shaking**	tied low	tied low
J4	**Data Mode**	**Single point**	**Stream**
J5	**Reserved**	tied high	tied high
J6	**Reserved**	tied high	tied high
%J7	**Power-On**	**Jumpers**	**NVRAM**
J8	**Reserved**	tied high	tied high
J9	**Reserved**	tied high	tied high
J10	**Emulation Mode**	*******	*******
J11	**Emulation Mode**	*******	*******

$$$ - See Baud Rate Table
*** - See Emulation Mode Table
Note: Reserved positions must be left open
% - If J7 is not installed, the controller will ignore J4, since EEPROM based operating information is used. Conversely, no information in the EEPROM will be utilized upon power up if J7 is installed. The controller will read emulation mode and desired baud rate from the jumper settings even if J7 is not installed.

2.4.1 Power On Configuration (SF1) continued

Baud Rate Table

Strapping Field 1		
J0	**J1**	**Baud Rate**
Strapped	**Strapped**	**300**
Strapped	**No Strap**	**2400**
No strap	**Strapped**	**1200**
***No strap**	***No Strap**	***9600**

* Factory Default

Emulation Mode Table

Strapping Field 1		
J10	**J11**	**Emulation Mode**
No Strap	**No Strap**	**None, pass-through**
***No Strap**	***Strapped**	***E281A-4002**
Strapped	**No Strap**	**E271-140**
Strapped	**Strapped**	**E261-280, Duratouch**

* Factory Default

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3. SOFTWARE CONFIGURATION

The firmware in the Atouch Controller is capable of supporting four modes of operation in much the same way as the Elographics E271-2210 Serial Controller. The four modes are SMARTSET, E261-280 (an emulation of the Elographics DuraTouch 280 Controller), E271-140, and E281A-4002 emulation. Each of these modes will be covered in detail. Firmware revision 1.2.2 or later is assumed.

3.1 Definition of Terms

The following are terms that are used while defining this command set.

Single-Point Mode:
This mode only sends data to the host on a Touch or an Untouch. No data is sent otherwise.

Stream (Continuous) Mode:
Continuous Mode sends data to the host continuously while the sensor is being touched. No data is transmitted if there is no interaction with the touch screen. A continuous touch action with identical coordinates will transmit those coordinates on every scan of the touch screen. Identical touches are not filtered out.

Untouch Flag:
The Untouch Flag is an optional flag in the data transmitted to the host to help determine the touch screen status in the current data packet. The format of the Untouch flag will vary depending on the mode of operation, and whether the output is ASCII or Binary.

ASCII Mode:
In ASCII mode, data is transmitted to the host in 8 bit ASCII, 1 Start Bit, 1 Stop Bit, No Parity, at the specified Baud rate. The data coordinate for each axis is transmitted as a two-byte Hex value using the ASCII characters from 0-9 and uppercases A-F to create the coordinate position. This mode is less efficient than Binary since each nibble of a hex number must be transmitted as a separate byte. Packet content depends on the mode of operation. Packets are normally terminated by the CR/LF sequence.

Binary Mode:
In Binary mode, data is transmitted as raw hex numbers. Packet content depends on the mode of operation. This mode is more efficient than ASCII since a single character represents two hex digits.

3.2 Baud Rates Supported

The Atouch supports baud rates of 300, 1200, 2400, and 9600. The CDI default is 9600, which requires no straps in J0 and J1.

3.3 Supported Modes

Straps J10 and J11 specify the mode.

3.3.1 SMARTSET Protocol J10-N / J11-N

When the Atouch board is configured for this protocol, all SMARTSET commands are available to the user. All communication occurs in 10 byte packets, whether originating from the host or the Atouch board. Refer to Elographics Technical Reference Manual for a description of available commands.

The untouch packet will be identified by bit 2 of the status byte in the touch packet if in binary mode. If the bit is clear, this is an untouch. In ASCII mode, touch or untouch is specified by an uppercase T or U. This letter will immediately proceed the terminating <CR><LF> and is separated from the Y coordinate with a comma. If untouch is disabled, the packet will not be transmitted. ASCII mode is achieved by strap placement.

3.3.2 Elographics DuraTouch E261-280 Emulation Protocol J10-Y / J11-Y

No Parity. 8 Stop Bits. 1 Start Bit. The data transfer protocol is described below. Please note that <SOH> is 0x01.

3.3.2.1 Command Protocol

The protocol for interfacing directly to the Atouch is as follows:

1) Host sends an <SOH> (binary 1) to the Atouch.
2) Atouch acknowledges by sending an <SOH> back to the host.
3) Host sends Control-Byte1
4) Atouch acknowledges by sending an <SOH> back to the host.
5) Host sends Control-Byte2
6) Atouch acknowledges by sending an <SOH> back to the host.
7) Atouch immediately initiates the changes requested by the host in the two control bytes.

See section 3.3.2.2 for definitions of Control-Byte1 and Control-Byte2. This protocol requires that the host wait for the acknowledgement from the Atouch between each command byte that is sent. It also requires that the Atouch take no action until it has received both control bytes and has responded with the final <SOH>.

3.3.2.2 Command Set

All commands are issued by sending two Control Bytes to the Atouch in the protocol specified in section 3.3.2.1. Following is a breakdown of the two Control Bytes. To arrive at the final value for each byte, just logically OR the appropriate bits together.

Control-Byte 1

BIT	Default Setting	Definition	
†0	1	0 = Disable Controller Data Output 1 = Enable Controller Data Output	
†1	0	0 = Normal Operation 1 = Report Controller Status	
†2	0	0 = Normal Operation 1 = Report Firmware Revision Level	
3	0	- RESERVED - Must Be 0	1 = Factory Controller Calibration Bit
4	0	- RESERVED - Must Be 0	00 - X Low 01 - X High 10 - Y Low 11 - Y High
5	0	- RESERVED - Must Be 0	
6	1	X Axis Orientation 0 = Invert 1 = Normal	
7	1	Y Axis Orientation 0 = Invert 1 = Normal	

† The controller reads these 3 bits in a specific sequence. Bit 2 is evaluated first. If set, the firmware revision level is reported and all other bits are ignored along with all of Byte 2. Bit 1 is evaluated next. If set, the controller will return its current values for Byte1 and Byte 2. All other bits are ignored along with all of Byte 2. Finally, Bit 0 is evaluated. If clear, the controller will disable further touch reporting, ignore all other bits and all Byte 2. If bit 0 is set, touch reporting is ensured, and the remaining bits are evaluated normally.

Control-Byte 2

BIT	Default Setting	Definition (refer to section 3.1 for definition of each mode)	
0	1	0 = Untouch Flag Disabled 1 = Untouch Flag Enabled	Data Value from 0-FFh if Control-Byte 1 is set to one of the calibration commands.
1-2	11	00 = ASCII Mode 11 = Binary Mode	
3	0	- Reserved - Must Be 0	
4	0	- Reserved - Must Be 0	
5	1	0 = Point Mode 1 = Stream Mode	
6-7	1 0	Baud Rate 7 6 - bits 0 0 - Reserved 0 1 - 300 Baud 1 0 - 9600 Baud 1 1 - 1200 Baud	

3.3.2.3 Calibration

The controller relies on bits 3-5 to receive incoming calibration commands. For standard DuraTouch emulation, these bits are normally reserved, and thus always zero, but have been redefined for the CDI Atouch controller. If bit 3 is set, bits 4-5 should specify which calibration value is being relayed via Byte 2. In this instance, all other bits in Byte 1 must be zero. Thus, valid values for Byte 1 are 0x08 (X low), 0x18 (X high), 0x28 (Y low), and 0x38 (Y high). Byte 2 will be a hex value specifying the value (0 -0xFF). The calibration sequence is as follows:

host: <SOH><08h><00h>

host: <SOH><18h><FFh>

host: <SOH><28h><00h>

host: <SOH><38h><FFh>

Atouch: 'clears' all four cal points. Note: both high and low values must be received before the Atouch sets a given axis.

host: determines the 4 cal points by prompting the user to touch specific points on the sensor.

Atouch: responds with actual touches.

host: <SOH><08h><x_low_value>

host: <SOH><18h><x_high_value>

host: <SOH><28h><y_low_value>

host: <SOH><38h><y_high_value>

The Atouch will store the calibration points in an EEPROM.

3.3.2.4 Axis inversion

Axis inversion is possible via bits 6-7 of Byte 1. 0xC0 = normal operation (no inversion). 0x40 = invert x. 0x80 = invert y. 0x00 = invert x and y.

3.3.2.5 Operating Mode Data Format

The operating mode refers to how the controller will transmit touch information, and is specified in bits 0-5 of Byte 2. The eight possible formats are described below.

In binary mode, 0x01 as the first byte of the 3-byte packet will specify a touch. Untouch will be 0x81. In ASCII mode, touch will be specified by 'T' and untouch by 'U'. If untouch is disabled, this packet will not be transmitted.

Mode 00 – ASCII/Single-Point/No Untouch. Packet length is 7 bytes.
XX <,> YY <CR> <LF>
Mode 01 – ASCII/Single-Point/Untouch. Packet length is 9 bytes.
XX <,> YY <,> <T|U> <CR. <LF>
Mode 20 – ASCII/Stream/No Untouch. Packet length is 7 bytes.
XX <,> YY <CR> <LF>
Mode 21 – ASCII/Stream/Untouch. Packet length is 9 bytes.
XX <,> YY <,> <T|U> <CR> <LF>
Mode 06 – Binary/Single-Point/No Untouch. Packet length is 3 bytes.
<0x01> <X byte> <Y byte>
Mode 07 – Binary/Single-Point/Untouch. Packet length is 3 bytes.
<0x01> <X byte> <Y byte>
Mode 26 – Binary/Stream/No Untouch. Packet length is 3 bytes.
<0x01> <X byte> <Y byte>
Mode 27 – Binary/Stream/Untouch. Packet length is 3 bytes.
<0x01> <X byte> <Y byte>

This is the **default** mode. No commands need to be sent in order to receive touch information in this way once the board is strapped for DuraTouch emulation. The controller will relay touch information to the host continuously while the sensor is being acted upon including touch, untouch, or movement.

3.3.2.6 Baud rate

Although specified in control Byte 2, the baud rate can not be changed and can only be set by the straps. Thus, bits 6-7 of Byte 2 are ignored, but should reflect the proper baud rate.

3.3.2.7 Data Limits

Data ranges returned to the host will be from (0,0) to (0xFF, 0xFF). The Home (0,0) Position's physical location on the screen is considered to be the upper left corner of the touchscreen.

3.3.3 E281A-4002 Emulation J10-N / J11-Y

3.3.3.1 Command protocol

All communication takes place in 6-byte packets, 2 bytes for each axis (X, Y, & Z).

3.3.3.2 Host initiated commands supported

The only way for a host to send commands to the Atouch board is through TouchTest (version 4.4.2 or later), provided by CDI, which will allow factory calibration. The Atouch will store the new calibration points in its EEPROM. No other software will be able to communicate to the Atouch. Also, TouchTest is able to send a detection sequence to the Atouch which will answer in such a way that TouchTest will know the board is present.

3.3.3.3 Packet description

This emulation mode has Z data enabled. Binary output is specified. Following is a breakdown of a 6-byte packet as received from the Atouch:

Byte	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
1	1	1	X11	X10	X9	X8	X7	X6
2	1	0	X5	X4	X3	X2	X1	X0
3	0	1	Y11	Y10	Y9	Y8	Y7	Y6
4	0	0	Y5	Y4	Y3	Y2	Y1	Y0
5	0	0	Z11	Z10	Z9	Z8	Z7	Z6
6	0	0	Z5	Z4	Z3	Z2	Z1	Z0

The Z coordinate is a 4-bit number, so Z4-Z11 will always be zero. On untouch, both Z bytes will be zero.

3.3.4 E271-140 Emulation J10-Y / J11-N

This mode is identical to the E281A-4002 mode except the Z-axis data is omitted. Please refer to that mode for details. The E271-140 mode will also communicate with Touch Test v4.4.3 or later.

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