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Setup and Users Manual

TSHARC™ "Devil-Ray"

Auto Detect 4, 5 & 8 Wire

Analog Resistive Touch Screen Controller Board

(Auto Detect RS-232 and USB)

Version 2.x

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Introduction

This manual has been written for users of the Microchip **Devil Ray** touch screen micro-controller board. The TSHARC touch screen controller boards and software described within this document are assumed to be used with four, five or eight wire analog resistive touch screen products manufactured by a variety of touch screen manufacturers. Touch screens between manufacturers vary with regards to light transmission, sensitivity, contact resistance, capacitance and other electrical characteristics. Because touch screen quality and electrical characteristics may vary between touch screen technologies and manufacturers the actual, overall performance may vary between touch screen overlay manufacturers' products.

A great deal of attention has been paid to eliminate potential problems with various touch screen manufacturers. We have identified substantial specification variance within each manufacturer and between manufacturers touch screens. While most of the manufactures we tested did fall within a functional specification, it is important to request electrical and mechanical specifications from your touch screen overlay manufacturer to insure uniform quality and performance. The specification details that should be provided by your touch screen overlay supplier include lead to lead resistance, sheet resistance, and linearity of ITO.

Product Description

Standard TSHARC Devil Ray controller board auto-detects and configures for RS-232 and USB communications and manufacturers' 4, 5 or 8 wire analog resistive touch screens.

Firmware revision may be specified as a "Special Order". If firmware is not specified, the latest firmware revision will be supplied with all TSHARC™ Devil-Ray controller boards ordered.

Part Number

HS12-040E0A-03

TSHARC Devil Ray Core Features

- **RoHS Compliant**
- Power-up Timer (PWRT)
- Brown Out Detect
- Brown out Voltage: 2.7v
- Oscillator Start-up Timer (OST)
- Watchdog Timer (WDT)
- True 12-bit ratio metric analog to digital converter
- Flash/Data EEPROM Retention: > 40 years
- Hardware Enable/Disable
- Self-programmable under software control
- Automatically detected communication type
    - 4 byte RS-232 and USB
    - Low speed USB device HID compliant at 1.5Mbs/sec
    - Low power suspend mode for USB < 500uA
    - RS-232 Default is set to 9600, but other Baud rates are available upon request.
- Auto-detect all manufacturers analog resistive touch screens.
    - 4 wire
    - 5 wire
    - 8 wire
- Dynamic rise-time and sampling routines
- Touch Screen Resistance Specification is 50 – 2k ohm sheet resistance lead to lead.

Touch Screen Overview

4 and 8 wire touch screens are typically produced with higher resistance transparent conductive film (ITO Indium Tin Oxide) than 5 wire touch screens. Most often touch screen resistances falls within 100 – 400 Ohm per square. Because 4 and 8 wire touch screens typically have a higher resistance than 5 wire sensors, you will find most battery powered applications using this technology. You will also find that 4 and 8 wire touch screens are more linear than 5 wire. The advantage of a 5 wire touch screen is that they are typically more mechanically durable (top sheet does not need to be linear) and are less affected by environmental variation. Five Wire touch screens come in a wide variety of sheet resistance. In some cases, because of the 5 wire construction, the resistance may be lower than the 50 ohm specification. While these touch screens require more power to drive them, this does not imply poor quality.

Once resistance drops below an optimum level so does the resolution. In contrast, as resistance increases, depending upon the construction, contact resistance begins to negatively affect the touch screen's performance. The negative effect of a high or low resistance touch screen can be managed by properly implementing the correct circuit. It should be understood that extremes in either direction will negatively influence the performance of any efficient circuit design. In order to maximize efficiency and performance a higher resistance, linear, environmentally stable touch screen is recommended.

Your product design requirements will help you identify the touch screen technology and construction that will best suit your application. Please contact Microchip Technology Inc. for more unbiased touch screen material science information and a list of recommended TSHARC controller designs to fit your application.

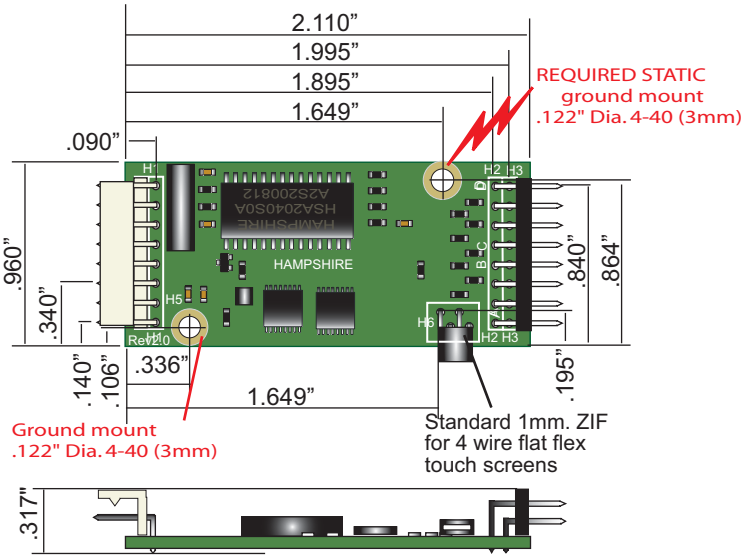
Software Device Drivers

Microchip Technology has device driver software available for all TSHARC touch screen controller chip and board solutions. The software drivers may be downloaded at no additional charge at: www.microchip.com. Reported Microchip resolution is dependent upon the hardware A-D converter specification. TSHARC device driver software is designed to deliver true 10- or 12-bit hardware resolution respective to the touch screen controller hardware.
The TSHARC device driver software enables you to configure the touch screen operation to meet your needs. The following is a list of features available with Microchip's software:

1) Touch screen calibration
2) Touch screen linearization
3) Touch screen alignment
4) Multi-monitor calibration and configuration
5) Adjustable calibration inset
6) Edge acceleration
7) Touch modes
    a. Normal mouse emulation
    b. Touch Up mode
    c. Touch Down mode
8) User adjustable Configurations
    a. Microchip's proprietary touch screen friendly timed right click event
    b. Touch event area setting
    c. Touch sound enable / disable
9) Other special features also included. Please see the complete driver manuals available at the www.microchip.com web site for further details.

Note: TSHARC device drivers vary between operating systems and operating system varieties and versions. Currently Microchip supports the following Windows® Operating systems: DOS, Win3.1x, 9x, ME, XP, XPe, 2k, CE, CENet, Tablet. TSHARC driver for Linux, and MAC are also included with all TSHARC touch screen controller products.

Mechanical Diagram



Connector Type	PC Board: 94V-0	Connector Type	Connector Type
AMP: 640457-8	UL#E231499	JST: 04FM-1.00ST	Sullins: PEC08DBAN
UL#E28476		UL# E60389	UL# E64287

NOTE
The board part number and version can be found on a label on the back side of the controller board. The firmware revision may be found on a label or a laser mark located on the 28 pin TSHARC™ Micro-controller on the top side of the controller board. Additional information is available about the labeling of Microchip products.



Although Microchip Technology Inc. has taken steps to protect your touch screen controller from transient voltage, it is important to make all grounding, communication and touch screen connections to the controller and touch screen. This must be done before powering on your computer, video monitor or touch screen controller. Failure to follow this procedure may result in damage to your controller and/or communication port. If you believe that your application will require additional static protection, it is up to you to determine the appropriate static protection needed to protect your electronics from transient voltage.

Failure to take the necessary precautions may result in damage to your controller. Microchip does not warranty the TSHARC controller board against transient static discharge damage.

Specifications

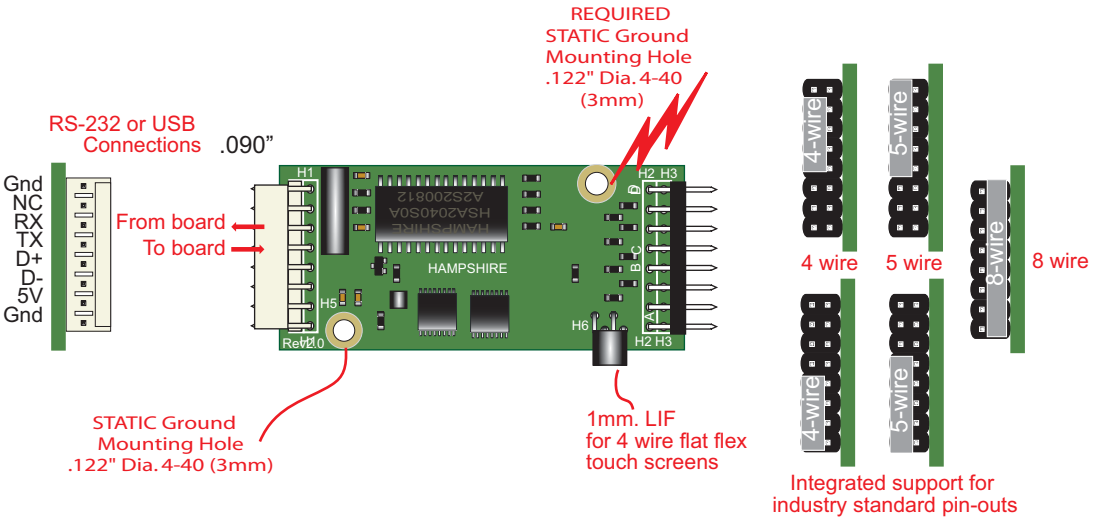
	Conditions	Min	Typical	Max	Units
Supply Voltage		4.75		5.25	V
Input Current - 4 or 8 Wire	Idle				µA
	RS232		22		
	USB		21		
	Touch				
	RS232		29		
	USB		28		
Input Current - 5 Wire	Idle				µA
	RS232		21		
	USB		21		
	Touch				
	RS232		45		
	USB		44		
Suspend Current	RS232			240	µA
	USB			330	
Operating Temperature		-10		70	°C
Resolution	Vcc = +5V, Vdd = Gnd		10		Bits
Response Time - Normal Mode	4/8 Wire		18		ms
	4/8 Wire - Waking		21.6		
	5 Wire		19.4		
	5 Wire - Waking		22.6		
Response Time - 100 pps Mode	4/8 Wire		11.2		ms
	4/8 Wire - Waking		14.1		
	5 Wire		12.2		
	5 Wire - Waking		15.2		
Rise Time Delay			750		µs
Detect Voltage Threshold			1.85		V
Sense Contact Resistance			2	10	Ω
Touch Screen Resistance		10		2500	Ω
Touch Capacitance			0.01	0.1	µF

Additional literature is available from Microchip Technology Inc. regarding definitions, touch screen specifications, and other general touch screen information.

Integrating the TSHARC Devil Ray Controller Board

Communication, Touch Screen and Power Connection Overview Diagram

The Devil Ray controller will automatically detect and configure itself for the communication and touch screen type connected. The controller can differentiate between the industry's two most common 4 and 5 wire touch screen pin-outs as well as detect an 8-wire touch screen connection. In addition, it will automatically detect a USB or a serial (RS-232) connection. This eliminates the need to configure the Devil Ray controller manually for any analog resistive touch screen type or RS-232 or USB communications.



Mounting the TSHARC™ Devil Ray controller

Take special care to insulate the controller from system and display electronic EMI and RFI generating components.

Use conductive 4-40 stand-offs or ground lead wires terminated to the grounded system enclosure or PC board to insure proper static protection and grounding. Sources for these are available on the website.
STANDOFFS MUST NOT TOUCH ANY PORTION OF THE CIRCUIT.
Locate the controller in a location that minimizes bending or creasing of the touch screen overlay connection tail.
The touch screen tail should not be creased. If it is necessary to crease the tail of the touch screen, check with the touch screen supplier to insure that they will warrantee this type of integration.

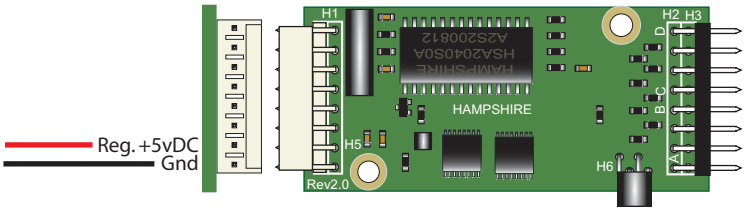
Communication and power Connection at "H1"

Communication connector type Amp 1 x 8, .100, .024"sq., .230" mating length, friction lock header 640457-8 is utilized to connect the controller to the computer for RS-232 or USB communication.

The TSHARC™ Devil Ray controller automatically detects RS-232 (9600 baud) and USB (HID compliant, low speed) communication. While these are Hampshire's standard communication formats, please contact Microchip Technology Inc. for other communication speeds or formats that may be available for special applications

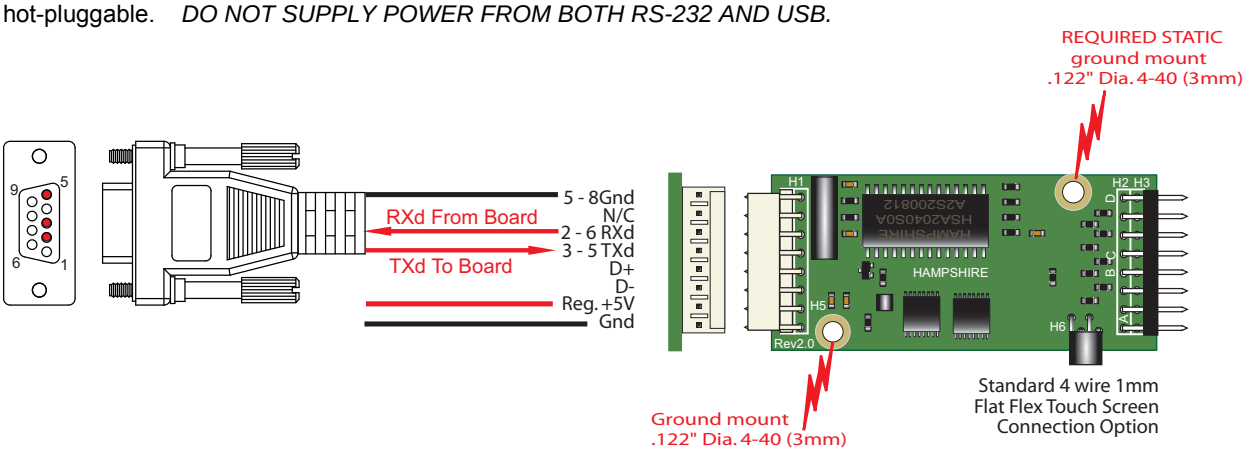
Power Connection

5vDC regulated power. Connect 5vDC regulated power to pins 1 and 2 at header position "H1". Be careful to check connections before powering on the Devil Ray controller board. *Reversing polarity WILL damage the board.*



Autodetect RS-232
The TSHARC™ Devil Ray controller is designed to automatically detect the communication type connected to it. There are no manual configuration settings required to connect the controller to a computer via RS-232. Follow the connection diagram below for connecting the RS-232 cable connection.

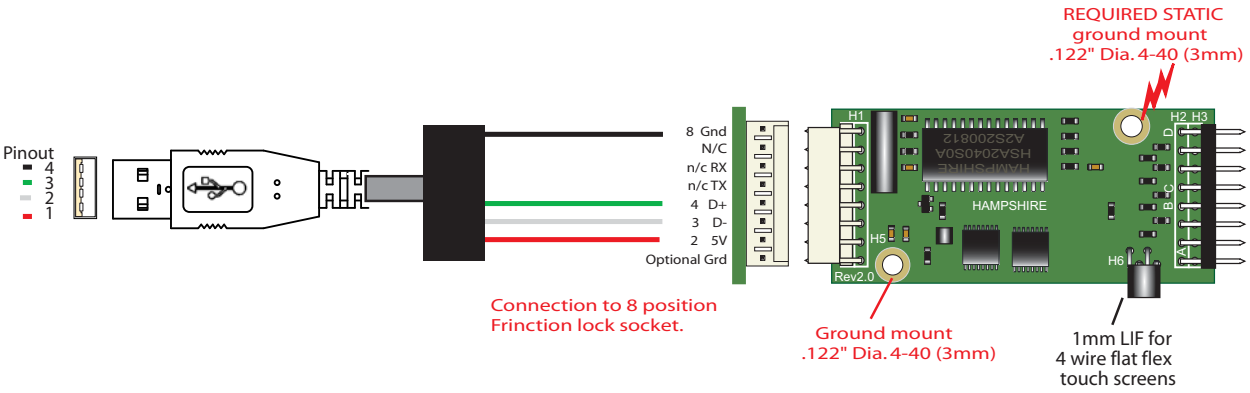
Once the communication connections are made and the controller is powered on the controller will automatically configure itself for the communication detected. Connecting the controller via an RS-232 (serial) connection with the power on may cause damage to the controller or your computer. RS-232 communications was not designed to be hot-pluggable. *DO NOT SUPPLY POWER FROM BOTH RS-232 AND USB.*



Part number C72-080S1F-09XDXF cable may be sourced directly from Microchip Technology Inc. This is a standard 6' long DB-9 female connector terminated to a (housing/contact) 8 position single row socket via a round shielded cable. This cable has a ground termination wire running the length of the cable which may be utilized to ground the controller board through the DB-9 connector. In any case, for best performance, a jacketed, shielded cable is recommended. *DO NOT SUPPLY POWER FROM BOTH RS-232 AND USB*.

Autodetect USB Communication
The TSHARC™ Devil Ray controller is designed to automatically detect the USB connection. There are no manual configuration settings required to connect the controller to a computer via USB. Follow the connection diagram below for connecting the USB cable connection. *DO NOT SUPPLY POWER FROM BOTH RS-232 AND USB.*

Once the communication connections are made and the controller is powered on the controller will automatically configure itself for the communication detected. You may order a 6' long, 8 position socket to a Type "A" USB plug, jacketed shielded USB cable part number: C72-080S1F-04XAXM-D from Microchip Technology Inc. For information about ordering this cable, please contact Microchip Technology, Inc.



WARNING: SUPPLYING POWER FROM TWO DIFFERENT POWER SOURCES WILL PERMANENTLY DESTROY YOUR CONTROLLER, YOUR COMPUTER, OR YOUR MONITOR.
If installing the TSHARC Devil Ray into a monitor application where the end user will decide to use USB communication or RS-232 communication, the board must be powered internally. Because the board can not be supplied with power from USB and internal 5v, it is recommended that the power (pin 1) contact be removed from the USB socket to insure that multiple power source connections are not permitted.

Communication Protocol

All TSHARC touch screen controllers communicate with the host computer via 4-byte (RS-232) or 5-byte (USB) communication protocol. Microchip's 4-byte communication protocol produces the industry's most reliable, accurate data transfer information without compromising touch speed.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0	0	0	0	0	0	0	P
2	X7	X6	X5	X4	X3	X2	X1	X0
3	0	0	0	0	X11	X10	X9	X8
4	Y7	Y6	Y5	Y4	Y3	Y2	Y1	Y0
5	0	0	0	0	Y11	Y10	Y9	Y8

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	1	P	X11	X10	X9	Y11	Y10	Y9
2	0	X8	X7	X6	X5	X4	X3	X2
3	0	Y8	Y7	Y6	Y5	Y4	Y3	Y2
4	0	0	0	0	X1	X0	Y1	Y0

Where: P - 0 Pen-Up, 1 Pen-Down
X11-X0 - 12 bit X position data
Y11-Y0 - 12 bit Y position data
PU - 0 no Pen-Up, 1 Pen-Up
PD - 0 no Pen-Down, 1 Pen-Down
CK7-CK0 - AAH + 55H + Sum of Bytes 2 through 9

Status LED Indicator

The TSHARC™ Devil Ray touch screen controller board is equipped with a status indicator LED. This LED will give information regarding the functionality of the controller.

When the Devil Ray controller is powered on it will detect the touch screen type as follows:

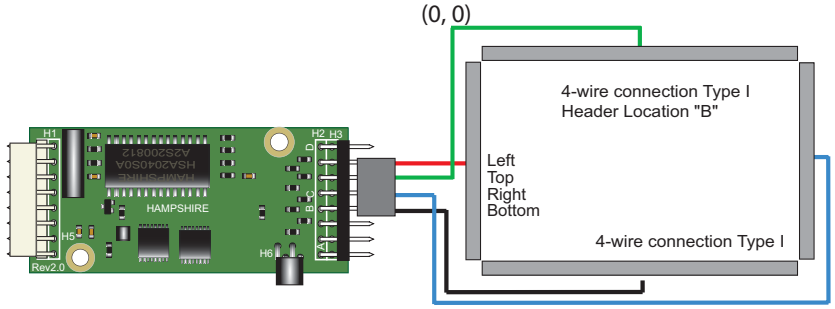
- Turns on and then off 2 times when the controller detects that it is connected to RS-232 or USB.
- The LED turns on and then off 1 time when it detects a 4, 5 or 8 wire touch screen.
- The LED will blink very rapidly (looks like it is on constant) when the touch screen is being touched.
- The LED will blink twice, first quickly and then a longer blink, when a hardware EEPROM reset is implemented upon power-up.

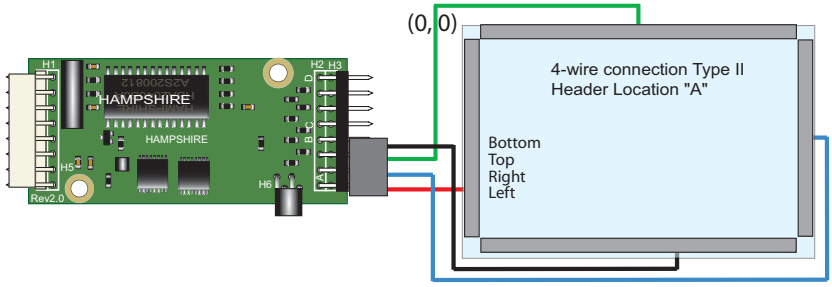
Touch Screen Connections

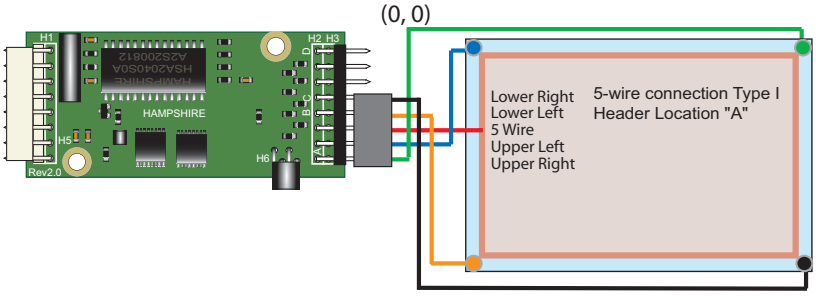
Touch screen connector type: 2 x 8, .100", .024"sq., .230" mating length, pin strip header. Sullins part number: PTC08DBAN.
The TSHARC calibration software supplied with the controller must be run to map the touch screen to the display.

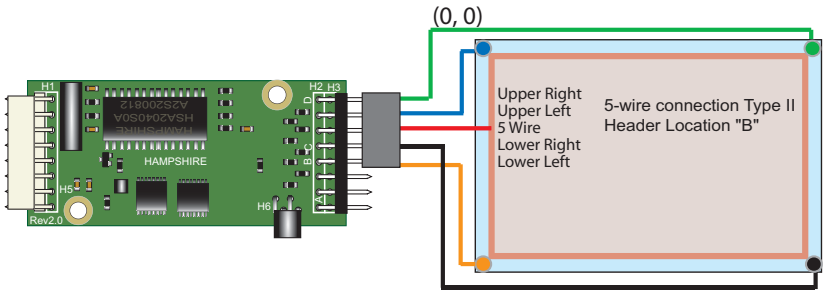
Auto detect 4, 5 and 8 wire touch screens connected to position "H2", "H3"
The Devil Ray controller will automatically detect and configure to decode both industry standard 4-wire touch screen pin-outs as well as both industry standard 5-wire touch screen pin-outs. It is important to connect the touch screen to the correct set of pins. Connect your 4 wire, 5 wire or 8 wire touch screen to the controller as identified in the diagram below. Once the controller is powered on, it will automatically configure itself for the touch screen connected.
In order to enable the Devil Ray board to autodetect 4, 5, and 8 wire touch screens it utilizes an on board multiplexor to decode three of the four sides of an 8 wire screen. The fourth side is decoded, but not through the multiplexor. In rare cases, and on some inexpensive, low resistance 8 wire touch screens, you may need to enable the ratiometric conversion on the fourth side of the screen. In this case, you may order the Devil Ray with 100% 8 wire ratio metric functionality. However, you will not be able to autodetect 4 and 5 wire touch screen technologies once the board is factory configured for exclusive 8 wire ratiometric conversion algorithms.

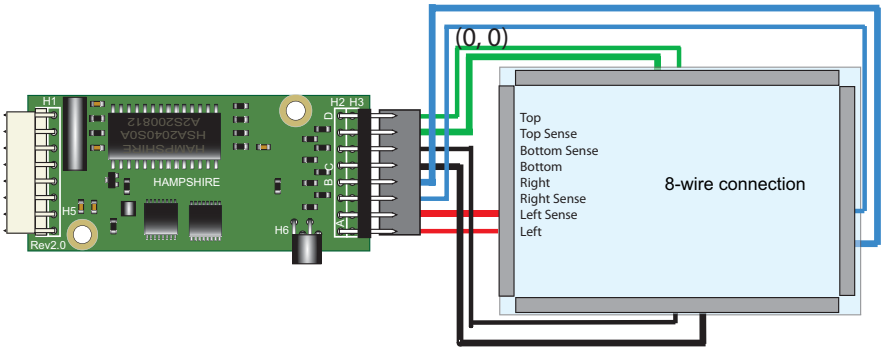
Sensor Configurations

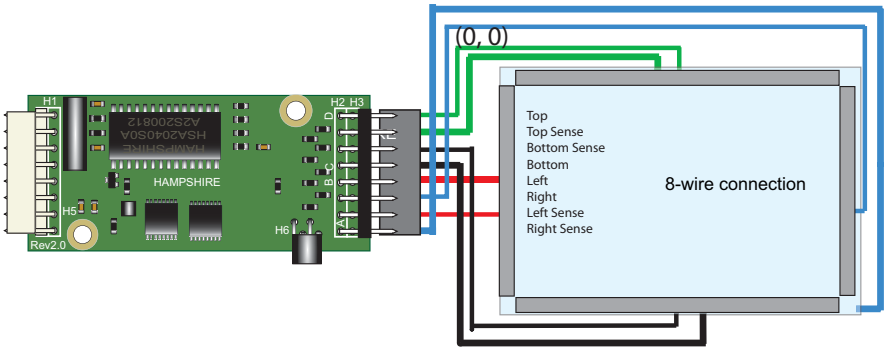


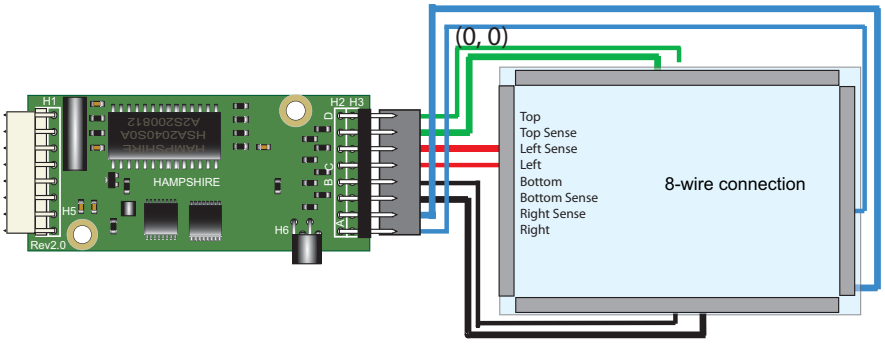






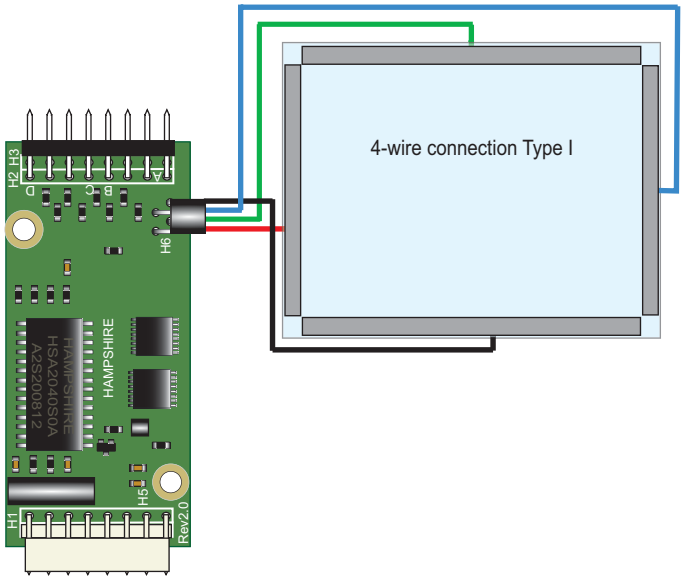






1mm ZIF touch screen connection

JST part number: JST-04FM-1.st (LF)(SN) (4 position low insertion force connector)



Cables Available from Hampshire

Figure 11.1: Communication Cables

Part Number:	Description
C72-080S1F-09XDXF	6' RS-232 cable. Direct connect to **H1** header to female DB-9 socket.
C72-080S1F-04XAXM-D	6' USB cable. Direct connect to **H1** header to male type "A" USB plug connector.

Figure 11.2: Touch Screen Cables

Part Number:	Description
C18-040S1F-040G1M	18" touch screen cable. Direct connect to H2. 4 position .100" socket to 4 position plug. "
C18-050S1F-050G1M	18" touch screen cable. Direct connect to H2. 5 position .100" socket to 5 position plug.
C18-080S1F-080G1M	18" touch screen cable. Direct connect to H3. 8 position .100" socket to 8 position plug.
C12-040S1F-041Z1F	12" 4 wire touch screen cable, .100" single row socket to 1mm ZIF conn for connecting 4 wire 1mm touch screens to all TSHARC boards 12" touch screen cable.

Developed and Supported In-House

All TSHARC touch screen controller products are designed to utilize Microchip TSHARC™ device drivers which are developed, supported and maintained in-house by Microchip engineers. Microchip Technology Inc. does not use third party technical resources to develop, support or maintain any of its software or hardware products.

Private Labeled Drivers

Private labeled software and hardware licenses are available which may be used to enable various non-TSHARC communication protocols, special functions, application specific utilities or OEM contact information. Contact Microchip for details.

TSHARC™ Controller Chip Solutions

Large volume OEM's who have in-house electrical and software engineers on staff may purchase a Microchip "Chip Only" touch screen controller solution which may be integrated on to their main board. Technical documentation is available from Microchip Technology Inc. to assist you in correctly integrating a chip solution into your product.

Please contact Microchip Technology Inc at (414) 355-4675 or www.microchip.com.

Support Services

All TSHARC products are 100% developed and supported in house by Microchip technical staff. As a result we have included a broad range of support documentation at www.microchip.com including users and setup manuals, device drivers, driver manuals and other software. In addition we have an e-mail based support. You may contact us via e-mail at: http://support.microchip.com.

In addition, Microchip also understands that there is often a need for "real time" technical support. Please contact Microchip via telephone at any point to discuss issues that you may have regarding our products.

In the event that you need to contact us via telephone or via our support e-mail, please take a minute to identify these items prior to contacting Microchip technical support staff.

1) TSHARC controller part number
2) Information about TSHARC reseller if not purchased directly from Microchip
3) TSHARC chip revision, located on the top of each micro-controller chip
4) Touch Screen type and Manufacturer
5) Communication type
6) TSHARC™ driver and revision
7) Operating system and service pack releases
8) A brief summary of the problem that you are having

Notes

TSHARC™

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