



# 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 1.5*

#### ***Document Revision and Copyright***

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## Product Description

Standard TSHARC-10D devil ray controller board that auto-detects and configures for RS-232 and USB communications and is configurable for most 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.

Non-standard stock options are also available. For further information about these options, please contact Hampshire Company.

## Features

RoHS Compliant

Auto-Detect both industry standard 4 wire analog resistive touch screen types

Auto-Detect both industry standard 5 wire analog resistive touch screen types

Auto-Detect industry standard 8 wire (x, y, x, y) analog resistive touch screen types

Auto-Detect Serial (RS-232) or USB communications

Hampshire mini form factor

Dynamic 40 - 100 touch point verification algorithm or Fixed 100 pts/sec. touch points.

5vDC regulated power

4-40 (.118", 3mm) screw mounting holes

LED indicator lamp

Custom header configurations available

On Board EEPROM for use with calibrated point generation and calibration data storage

FLASH re-programmable, updateable Micro-controller

4-wire 1mm ZIF touch screen connector

EEPROM-Configurable Options Available per request:

- Enable RS-232 sleep modes

- Enable USB hibernation modes

- Semtech™ support

- Microtouch™ Support

- Elo™ support

- Change baud rate from 1200 to 19.2k baud (9600 standard)

- Force communication type (auto-detected by default)

- Force touch screen type (auto-detected by default)

### Upgrading from a sole sourced MicroTouch™ (3M™) controller

Hampshire has touch screen controller firmware available, which enables easy migration from sole sourced MicroTouch™ (3M™) and Elo™ controllers to a more flexible, cost effective, higher performance TSHARC controller. Hampshire has developed controller and device driver software to help you manage legacy and communication issues often associated with migrating from these sole sourced products. Please contact Hampshire Company for details of this product.

### \*HM1000y00D, 5 byte MicroTouch™ (special order only)

Hampshire's MicroTouch™ 5-Byte, RS-232, emulation "Bridge Building" touch screen controller boards, chips and device driver software are available upon request.

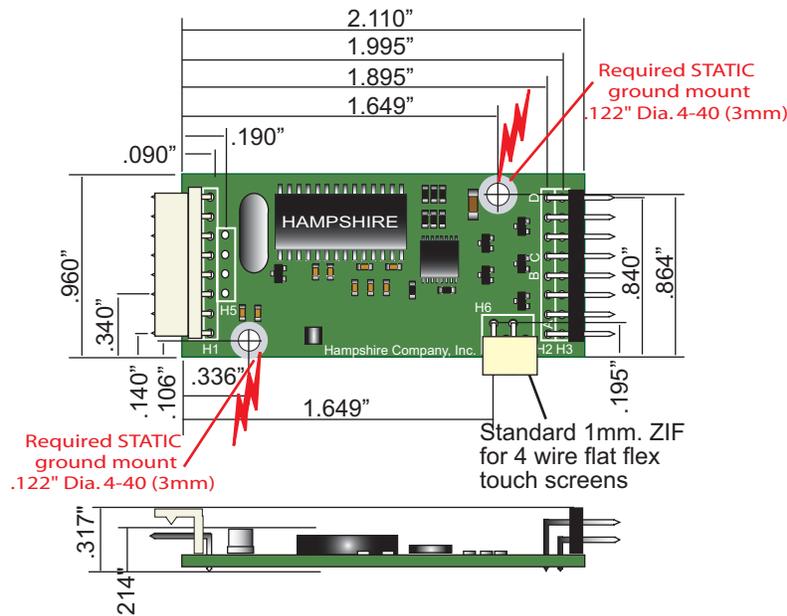
*\*These products may be used exclusively to migrate from a sole sourced touch screen controller to Hampshire TSHARC universal products and are not available for forward product development.*

## Introduction

This manual is for users of the Hampshire Company's automatic touch screen and communication-detecting TSHARC-10D, "Devil Ray" touch-screen controller board. The TSHARC touch screen controller 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 vary between touch screen technologies and manufacturers, the actual, overall performance of the combined system will vary between touch screen overlay manufacturers' products. While Hampshire's touch screen controllers and drivers improve the performance of low quality or damaged touch screens, Hampshire does not guarantee the performance of, or recommend the use of, low quality touch screen overlay products in any touch screen implementation.

## Mechanical Diagram

Figure 4.0: Mechanical Diagram of Devil Ray Touch Screen Controller Board



### 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 Hampshire products.

### Static Protection Warning

The TSHARC-10D controller has internal static protection to +/- 15kV for static discharge from the touch screen to the controller. This static protection is adequate for most applications but is only effective once the board is grounded via the mounting holes. In some applications, it may be necessary to protect the controller board from excess transient voltage.

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. Hampshire does not warrantee the TSHARC controller board against transient static discharge damage.**

## IMPORTANT DOCUMENT AND USER INFORMATION

This document is to be used as a guide only. The information contained in this document is subject to change without notice. This document and all of its contents are protected under US and international copyright law. Hampshire Company trademarks, patents and copyrights are the exclusive property of Hampshire Company, Inc and may not be used without the express written consent of Hampshire Company, Inc.

Due to the vast range of application variables that fall outside of Hampshire's expertise and control, Hampshire assumes no responsibility for the usability or the suitability of Hampshire products in customer application(s). Hampshire assumes those responsible for the application and use of Hampshire Company products and documentation have taken all necessary steps to insure that the application of Hampshire products meet any and all safety and performance requirements including any laws, regulations, codes and standards associated with the application. In no case does Hampshire warrant the usability or suitability of its products in any medical, aviation, military or other life critical applications. User should contact Hampshire Company before integrating any Hampshire hardware or software product into these types of applications.

All Hampshire standard software products, including but not limited to device driver software, are provided "as is" and may be used exclusively with an authentic Hampshire TSHARC touch screen controller. Hampshire does not warrant or guarantee the usability of any of its software products.

Hampshire Company warrants to the original purchaser, or a third party who is listed on the Hampshire "Multi Party Authorization Agreement", that for the warranty period identified by Hampshire warranty for the specific product that you have purchased, that the goods will be in conformance with Hampshire specifications. In addition to Hampshire specifications, the warrantee includes Non-Hampshire specifications agreed-to, in writing, by Hampshire in advance for the limited purpose between the customer and Hampshire Company. The warrantee also insures that the goods will be free from defects in design and material for the warrantee period. Hampshire Company, at its option, will repair or replace the nonconforming or defective goods, issue a credit memorandum, or refund the purchase price, as its sole obligation: provided that the nonconforming or defective goods are rejected in writing (including a reasonable failure analysis statement) to Hampshire Company and returned to Hampshire Company within the relevant warranty period and provided that the nonconformance or defect was not caused by misuse, alteration, accident, or abnormal conditions of storage, operation or handling, as determined by Hampshire Company.

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### General Information

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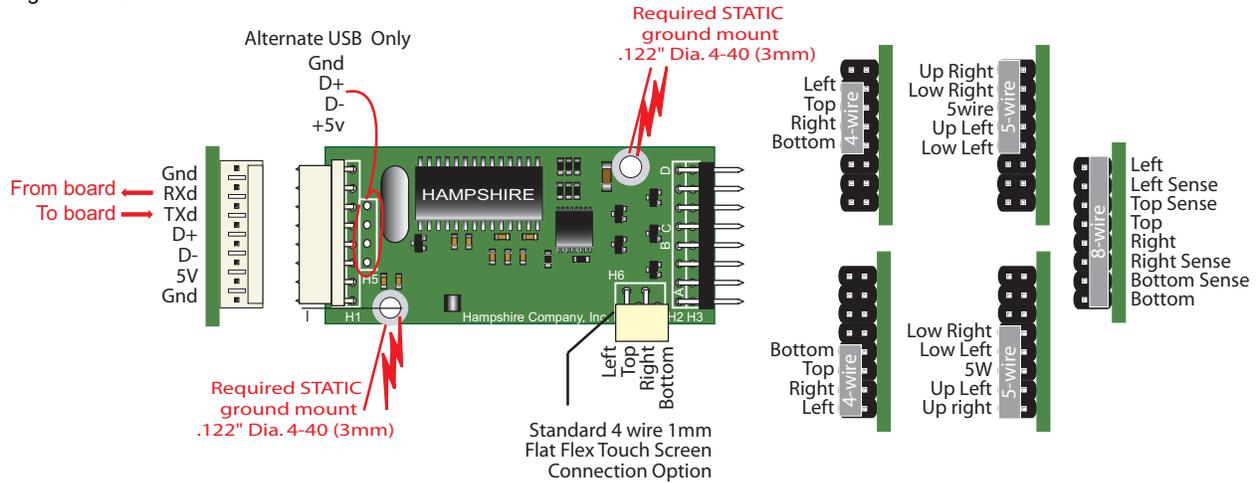
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# Communication, Touch Screen and Power Connection Overview Diagram

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. Refer to Fig. 6.0 for the correct connection procedures.

Figure 6.0: Connector View



## Specifications

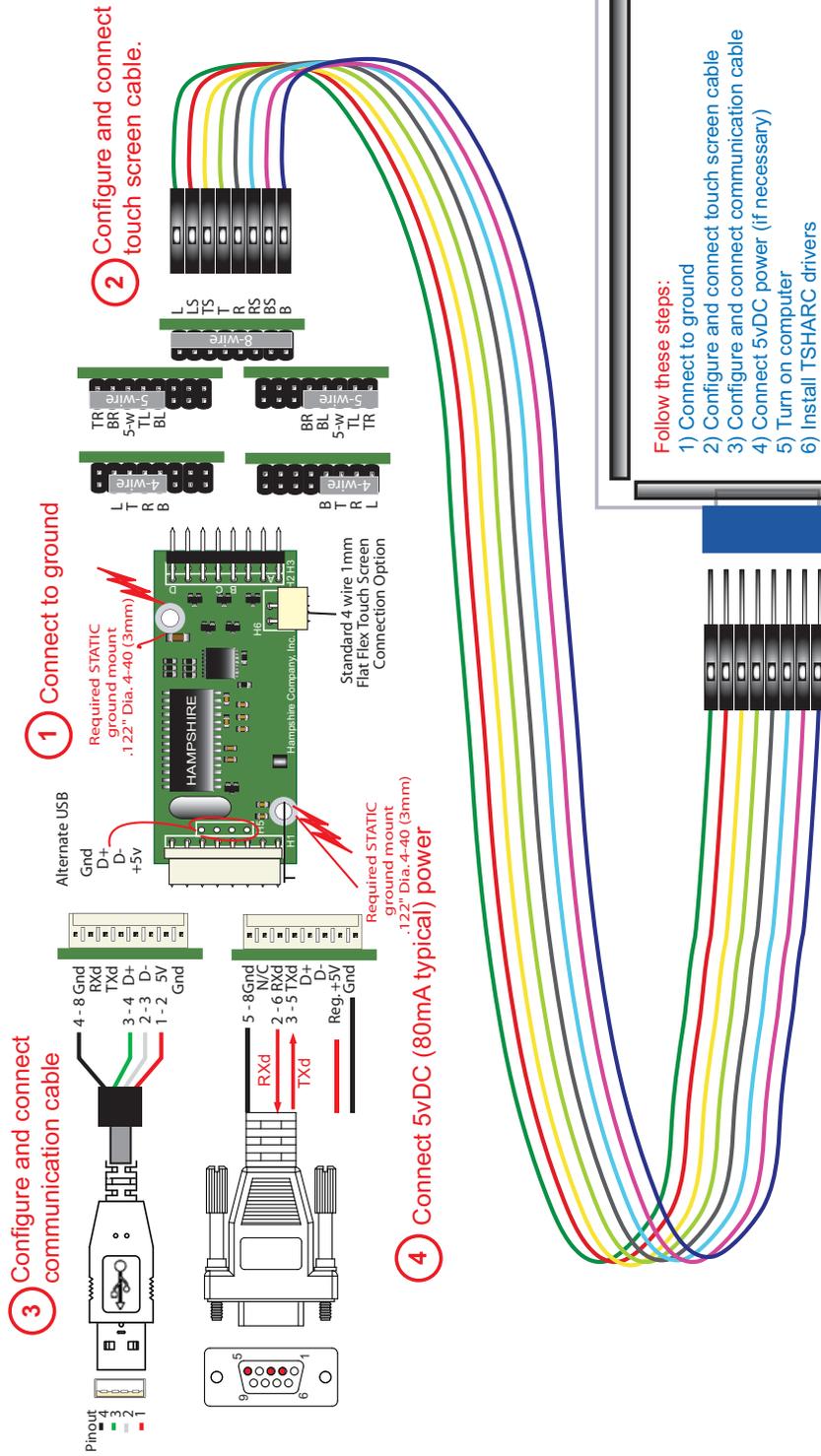
Figure 6.1: Devil Ray Electrical Specifications

	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				
Input Current - 5 Wire	Idle				µA
	RS232		21		
	USB		21		
	Touch				
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 Hampshire Company regarding definitions, touch screen specifications, and other general touch screen information.

# Quick Setup View

Figure 7.0: Quick Setup View Diagram



**Follow these steps:**

- 1) Connect to ground
- 2) Configure and connect touch screen cable
- 3) Configure and connect communication cable
- 4) Connect 5vDC power (if necessary)
- 5) Turn on computer
- 6) Install TSHARC drivers
- 7) Follow instructions on screen

**Note:** If you are using a USB hub to connect the TSHARC Devil Ray controller, the hub must have sufficient power for all devices attached. Check your hub specifications to insure that it is capable of powering all devices attached.

## Integrating the TSHARC™ Devil Ray controller

### 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”.

*Optional USB header “H5”*

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.

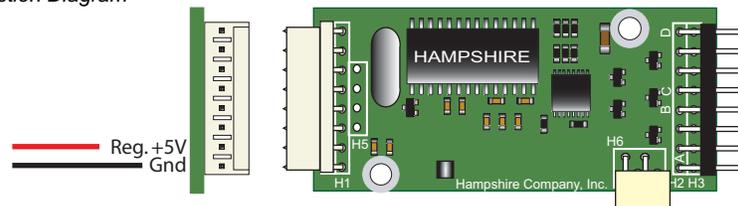
An optional 4 position USB connection may be mounted as identified in Fig. 8.0. Contact Hampshire for details about ordering the controller with this connection configuration. Although Hampshire has taken steps to eliminate the effects of EMI/RFI noise, using a shielded cable will help improve the performance of your touch screen system.

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 Hampshire Company 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.**

Figure 8.0: Power Connection Diagram

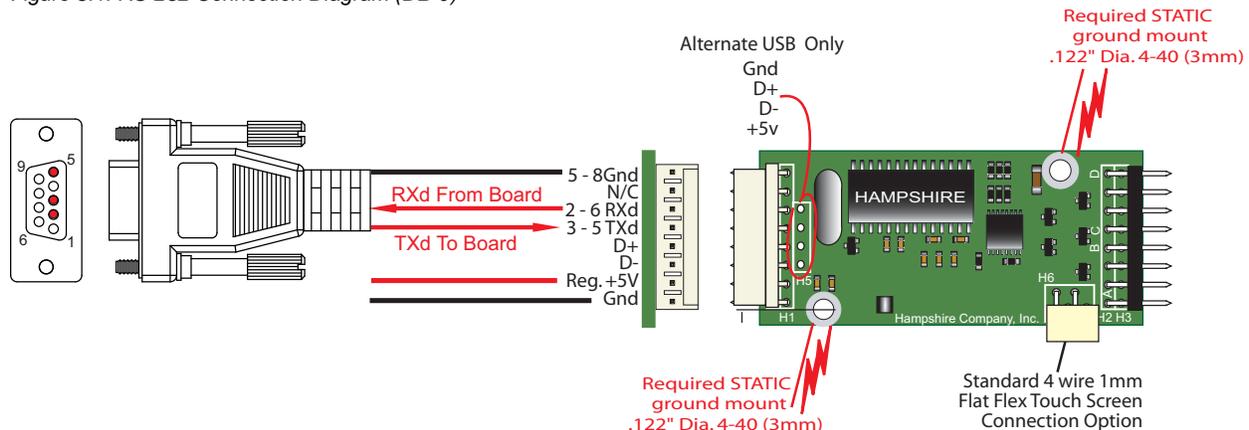


#### Autodetect RS-232

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.**

Figure 8.1: RS-232 Connection Diagram (DB-9)



Part number C72-080S1F-09XDXF cable may be sourced directly from Hampshire Company. 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

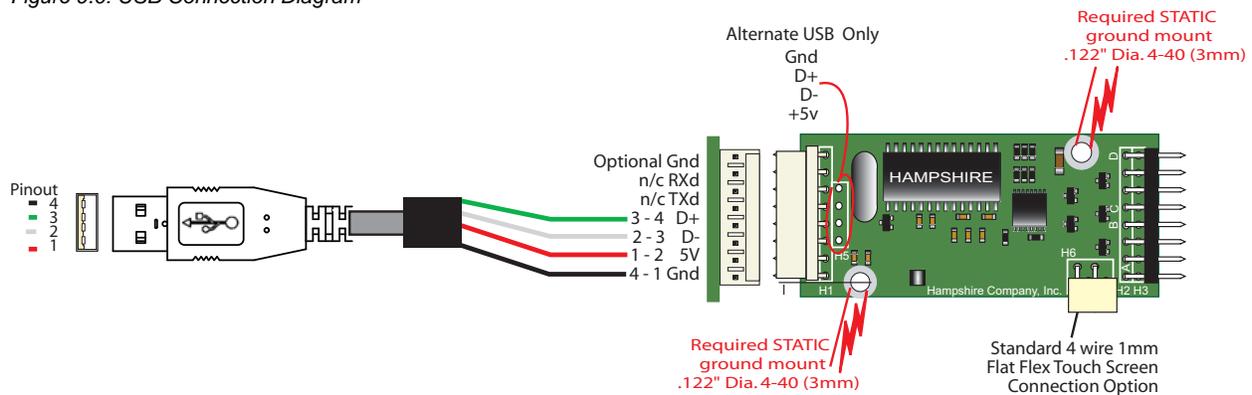
controller board through the DB-9 connector. In any case, for best performance, a jacketed, shielded cable is recommended. **DO NOT SUPPLY POWER FROM BOTH RS-232 AND USB.**

## 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 from Hampshire Company, Inc. For information about ordering this cable, please contact Hampshire Company, Inc.

Figure 9.0: USB Connection Diagram



### **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.

## Hampshire RS-232 and USB Communication Protocol

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

Figure 9.1: USB Protocol

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

Figure 9.2: RS232 Protocol

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

### Elo™ and Microtouch™ Communication Options

Many Hampshire controllers may be configured to communicate with other industry protocols such as 3M's 5-Byte or Elotouch™ 10 byte, and Semtech™ communication protocol. It is important to note that the overall performance of the Hampshire controller will be changed to that standard's level of performance. Hampshire has device driver software as well as TSHARC controller hardware products to help you migrate from a competitive product to a Hampshire product.

In no case does Hampshire authorize the use of any driver software to enable a Hampshire controller without proper authorization from the software developer or rightful owner of the software. Please contact your supplier to determine if you may legally utilize that software.

## Connect the Touch Screen (Header positions “H2” and “H3”)

Touch screen connector type: 2 x 8, .100", .024"sq., .230" mating length, pin strip header. Sullins part number: PTC08DBAN.

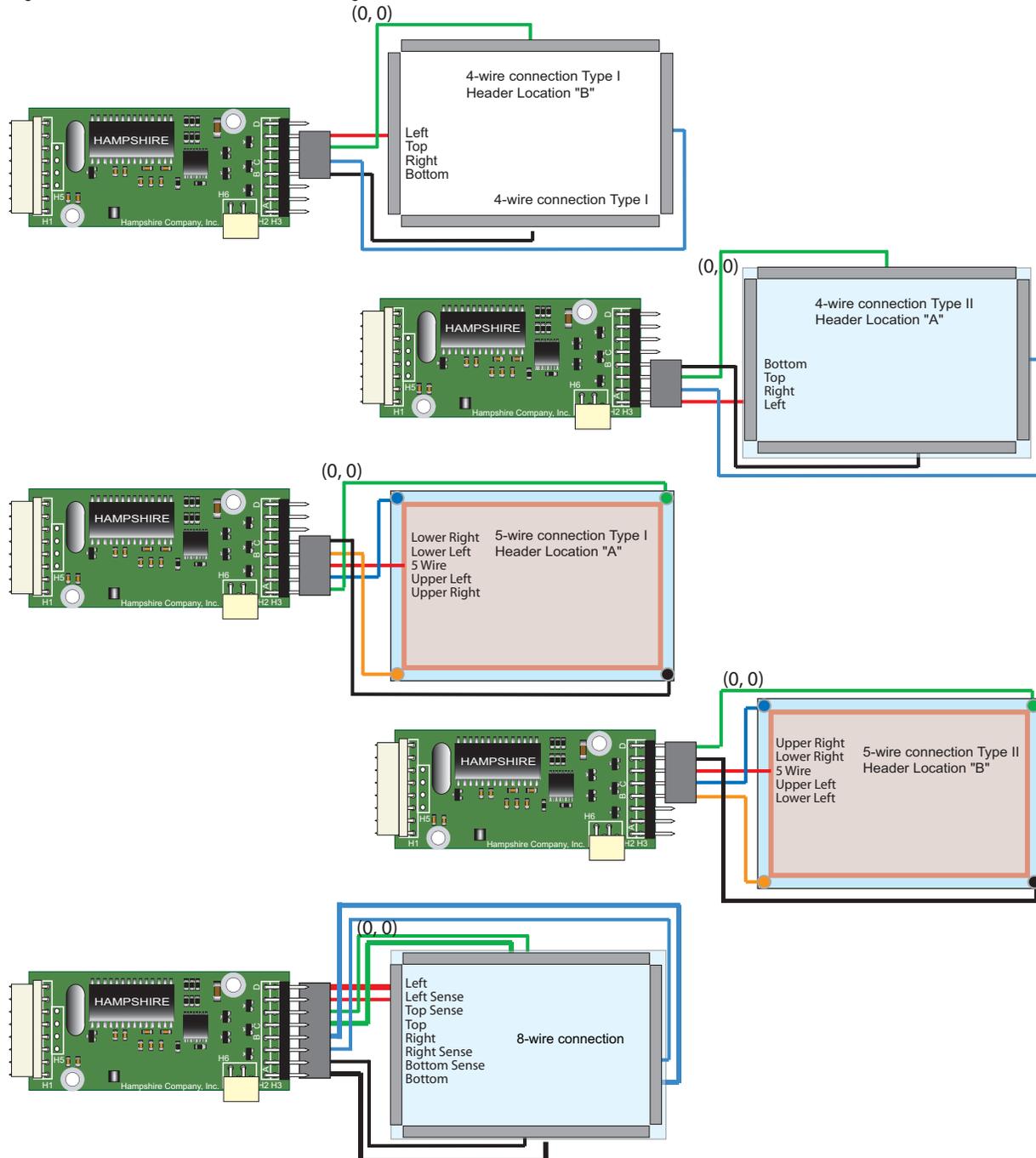
The TSHARC calibration software supplied with the controller must be run to map the touch screen to the display.

### 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.

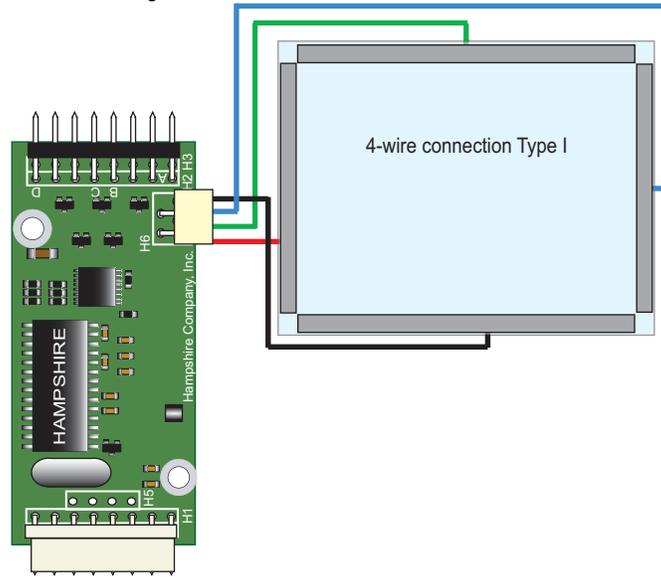
Figure 10.0: Touch Screen Connection Diagrams



## 1mm ZIF touch screen connection

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

Figure 11.0: ZIF touch screen connection Diagram



### 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.

#### Devil Ray LED indicator codes

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.

## Cables Available from Hampshire

Figure 11.1: Communication Cables

Part Number:	Description
C72-080S1F-09XDXF	6' RS-232 cable. Direct connect to <b>H1</b> header to female DB-9 socket.
C72-080S1F-04XAXM-D	6' USB cable. Direct connect to <b>H1</b> header to male type "A" USB plug connector.
C72-040S1F-04XAXM	6' USB cable. Direct connect to <b>H5</b> header to male type "A" USB plug connector.

Figure 11.2: Touch Screen Cables

Part Number:	Description
C18-040S1F-040G1M-XX	18" touch screen cable. Direct connect to H2. 4 position .100" socket to 4 position plug. "XX" identifies pin-out
C18-050S1F-050G1M-XX	18" touch screen cable. Direct connect to H2. 5 position .100" socket to 5 position plug. "XX" identifies pin-out
C18-080S1F-080G1M-XX	18" touch screen cable. Direct connect to H3. 8 position .100" socket to 8 position plug. "XX" identifies pin-out
C12-040S1F-041Z1F-XX	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 (NOT RoHS Compliant)12" touch screen cable.
C12-050-S1F-051Z1f-XX	12" 5 wire touch screen cable, .100" single row socket to 1mm ZIF connector for connecting 5 wire 1mm touch screens to all TSHARC boards. Rev A. RoHS Compliant

Drawings for the communication cable types can be located on [Hampshirecompany.com](http://Hampshirecompany.com)

## Software and Device Drivers

All Hampshire device drivers are designed specifically and exclusively to be used with Hampshire TSHARC™ touch screen controller products. Hampshire Company develops, supports and maintains all products sold with the Hampshire® or TSHARC™ trademark and does not use any third party technical resources to develop any of its software, device drivers or hardware products.

*Custom or private labeled drivers and firmware are available.* Customized and private labeled software and hardware licenses are available which may be used to enable various non-Hampshire communication protocols, special functions, application specific utilities and OEM Company and contact information. Contact Hampshire for details.

*The touch screen must be calibrated via a calibration software utility before the touch screen will function properly. Hampshire provides device driver software which includes calibration utilities and a number of other touch screen enabling utilities.*

### Available TSHARC™ Drivers

TSHARC™ device drivers are included at no additional charge with all standard Hampshire touch screen controllers. Drivers are available for DOS, Windows™ 3.11, NT, 9x, ME, 2000, XP, XPe, Windows CE™, QnX, Linux™ WindRiver™. Please review the driver user's manual for instructions for installing the driver. Hampshire TSHARC™ drivers may be found at the Hampshire Web site: [www.hampshirecompany.com](http://www.hampshirecompany.com)

### All Hampshire TSHARC™ drivers are developed and supported in-house.

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

### Custom and Private Labeled Drivers

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

## TSHARC™ Controller Chip Solutions

Large volume OEM's who have in-house electrical and software engineers on staff may purchase a Hampshire "Chip Only" touch screen controller solution which may be integrated on to their main board. A complete set of technical documentation is available from Hampshire Company to assist you in correctly integrating a chip solution into your product. Contact Hampshire Company, Inc.

## Mounting Hardware

Due to the wide variety of mounting options available for the TSHARC™ Devil Ray board we do not stock mounting hardware. Please visit the RAF web site to review the available mounting hardware.

[http://www.rafdwe.com/RAF\\_site/OnlineCatalog/EHCoverFrame.html](http://www.rafdwe.com/RAF_site/OnlineCatalog/EHCoverFrame.html)

## Hampshire Support Services

All of Hampshire products are 100% developed and supported in house by Hampshire technical staff. As a result we have included a broad range of support documentation on the Hampshire web site [www.hampshirecompany.com](http://www.hampshirecompany.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: [support@hampshirecompany.com](mailto:support@hampshirecompany.com). In addition, Hampshire also understands that there is often a need for "real time" technical support. Please contact Hampshire via telephone at any point to discuss issues that you may have regarding our products. Hampshire's telephone number: 414-873-4675.

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 Hampshire technical support staff.

- 1) Hampshire controller part number
- 2) Information about Hampshire reseller if not purchased directly from Hampshire
- 3) Hampshire 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.

