Multi-Touch Ring Encoder Software Development Kit Users Guide

Ver1.1

Bulletin #1198

Grayhill

Contents

Introduction

What's in this Guide?

Welcome to the Grayhill Multi -Touch Ring Encoder (MTRE) User Guide. We'll first get your encoder up and running with a demo so you can quickly begin to appreciate the MTRE's many features and capabilities. Next we'll dive in deeper into the MTRE operation. Lastly, we'll introduce **Grayhill's Instinct Gesture Recognition Library** that makes product development a snap. **Let's get started!**

What's in the Kit?

The Multi-Touch Ring Encoder Software Development Kit contains a Quick Start Guide, and (1) Grayhill Multi-Touch Ring Encoder (Part number T101-5C3-111-M0) mounted in a case, with a USB cable ready to plug into your type "A" USB host connector on your hub or PC.

Multi-Touch Ring Encoder Features

The Grayhill Multi-Touch Ring Encoder has the following features:

- **A 50mm or 70mm round projected capacitive touchpad, that can track up to 5 touch positions.**

- **A rotating knob - detented with three different torque options, and encoded for 32 or 48 positions.**

- **Integral pushbutton**

- **Proximity sensor**

- **Overlay, with custom logo capabilities, backlit with 256 level adjustable brightness settings**

- **Highlight ring, backlit with 256 level adjustable brightness settings**

- **Interface connectors – (1) USB signaling , (1) redundant encoder (quadrature) and pushbutton I/O**

Multi-Touch Ring Encoder Medical Demo

Downloading the Medical Demo

The Medical Demo is a Windows XP or Windows 7 application that will introduce you to some of the basic features of the MTRE. The Demo is a simulation of some of the functions that may be required in a typical imaging application. To load and run the demo, follow these steps:

Plug in the USB cable into any convenient USB port on your PC. Your computer should automatically recognize the device without any special drivers.

Next find the Medical Demo Application at http://www.grayhill.com/instinct

For users of Google's Chrome browser

Click on the link: MTRE Demo – Medical (zip)

When the download is complete, click on the zip file MTREDemo_med.zip that should appear in the download area at the bottom of the screen.

Follow the instructions of your zip file extraction tool to extract and locate the file on your PC where it can be easily found (i.e. your desktop.)

For users of Mozilla's Firefox browser

Click on the link "MTRE Demo – Medical (zip)

The browser should open a pop up box. Under "What should Firefox do with this file?" select your zip file extraction tool under "Open with."

Follow the instructions of your zip file extraction tool to extract and locate the file on your PC where it can be easily found (i.e. your desktop.)

### For users of Microsoft Internet Explorer

Click on the link "MTRE Demo – Medical (zip)

The browser should open a pop up box. Under "Do you want to open or save this file?" select "Open." Under certain settings this step may be skipped.

Follow the instructions of your zip file extraction tool to extract and locate the file on your PC where it can be easily found (i.e. your desktop.)

Running the Demo

To run the demo, navigate to the file on your system where it was downloaded and double click the filename. There is no special installation necessary since the program is self-contained. The connect screen should appear as shown below:
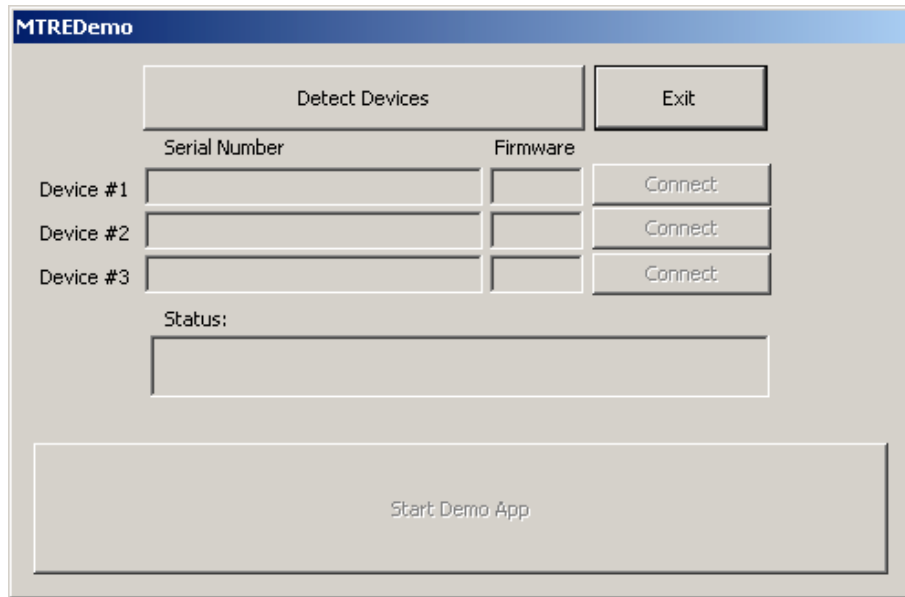
On the connect screen chose "Detect Devices" and a list of currently installed MTRE's will appear. You'll likely have only one unit connected, and this device should appear under device #1. If it does not, check your USB cable and click "Detect Devices" once again.
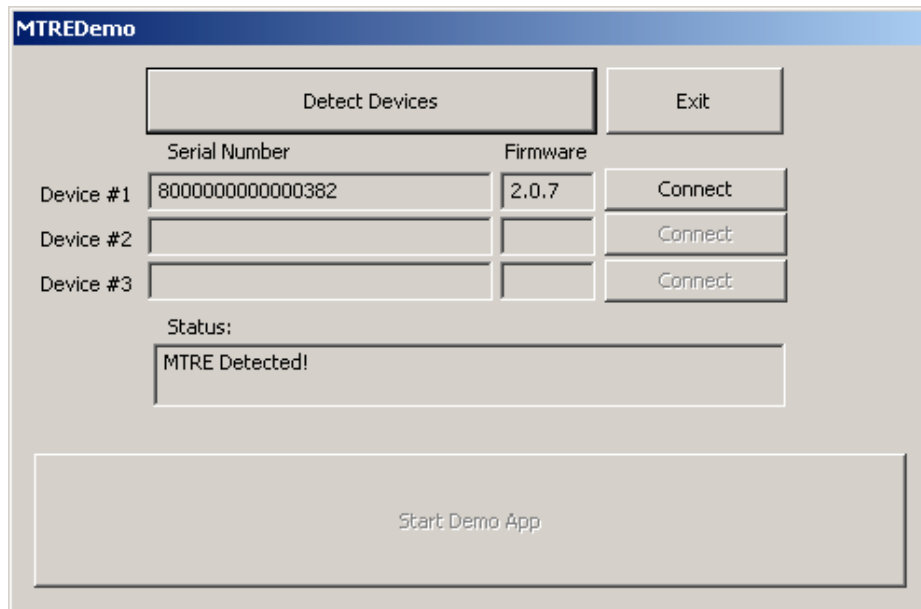
Next we'll need to connect to the device. To do this Click the "Connect" button next to the device that you wish to connect. Again, in this case, you'll probably only have one device connected, so select the "Connect" button next to Device #1.
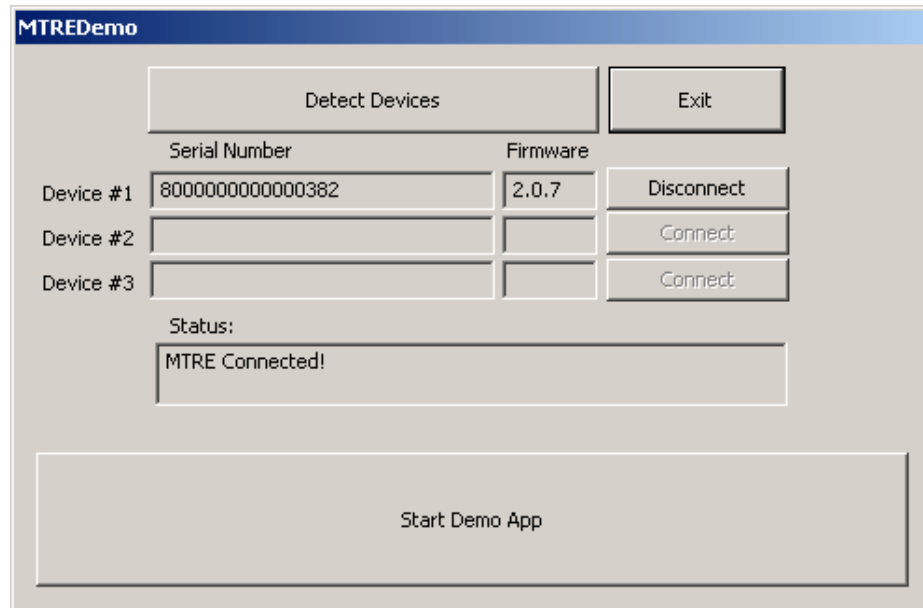
OK, if all that seems good so far, we're ready to start the demo. Hit the large "Start Demo App" button in the middle of the screen. You should see the splash screen shown below:

Next click on the splash screen with your mouse, or press the pushbutton on the MTRE to enter the demo screen. You can easily return to the connect screen afterward by hitting the "Esc" key on your keyboard.
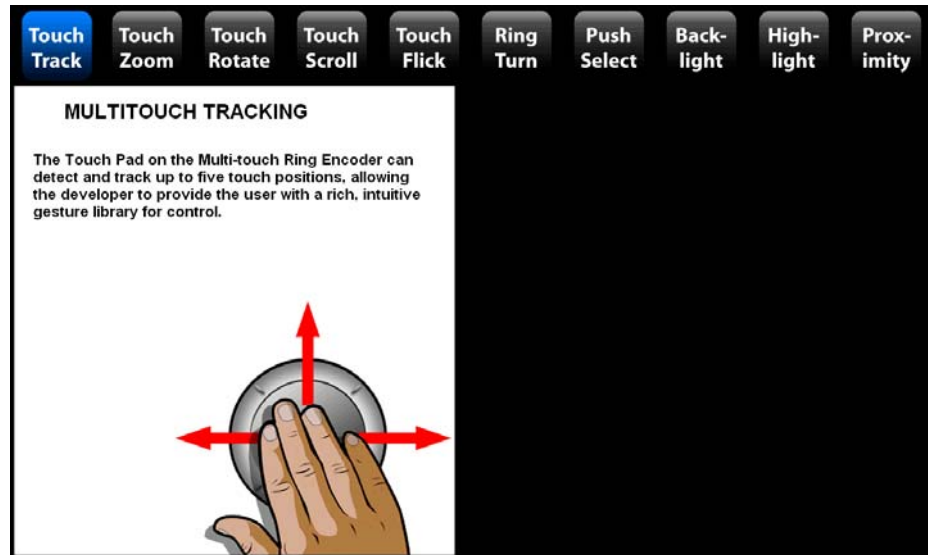
Once in the demo screen, you'll notice a row of MTRE functions across the top. To enter any of these modes click the function with your mouse, or alternately, use the pushbutton on the MTRE to scroll through until the desired function is highlighted. You'll notice that the rest of the screen is separated into two halves. On the left is a description of the current function, and a picture of how the function is performed (if applicable.) On the right you'll find the area where a simulation of an ultrasound screen is displayed.

Demo Functions

Touch Track
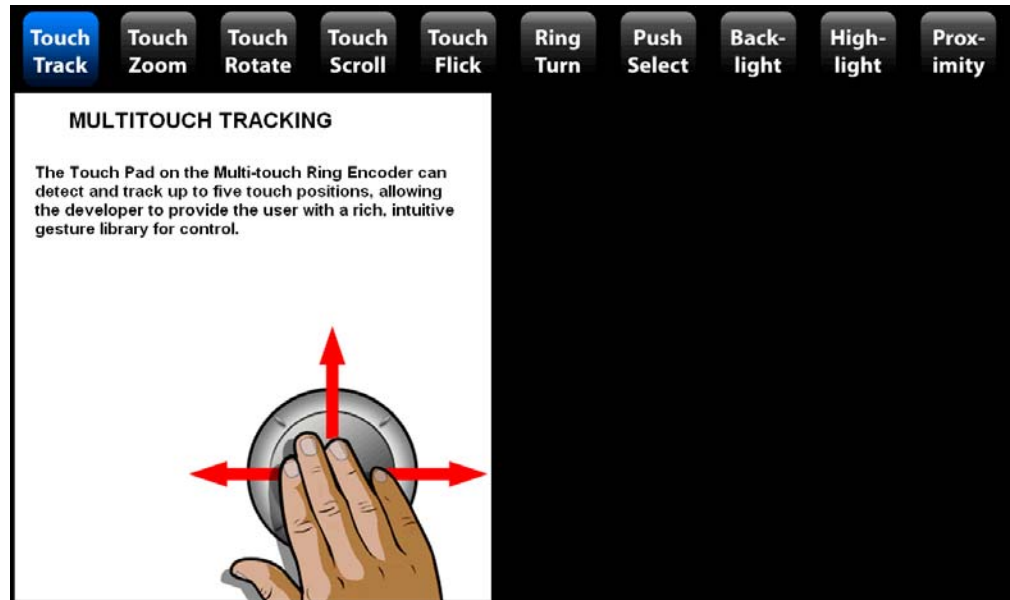
In the "Touch Track" function try touching the touch pad with up to five fingers and watch as your finger positions are tracked on the screen. Rotating the knob at this point alternately toggles between regular and persistent tracking mode.

Note: high levels of common mode power supply noise can affect projected capacitive touch sensing. If you see some rapid movement in the touch points, try a different power arrangement. Using a self- powered hub usually solves this problem.

Touch Zoom
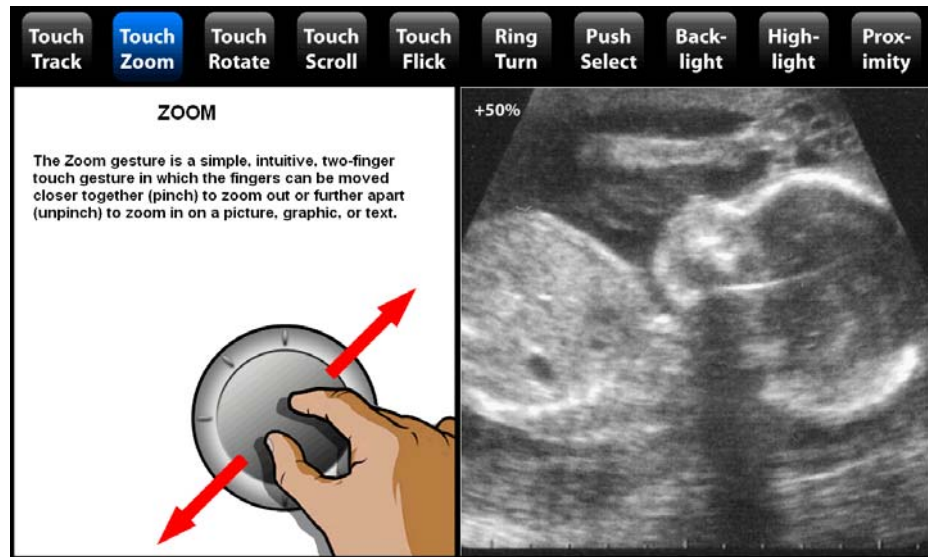
"Touch Zoom" is performed by making a pinch or un-pinch gesture with two fingers. It is commonly used to scale objects such as pictures, graphics or text.

Touch Rotate
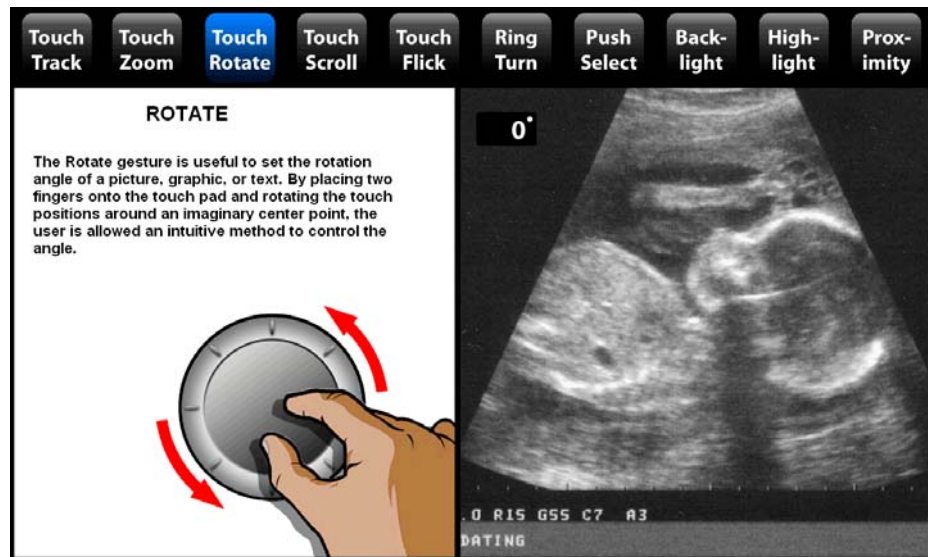
"Touch Rotate" is performed by rotating the position of two fingers about an imaginary center point on the screen. It can be useful for rotating pictures, graphics or text on the screen.

Touch Scroll
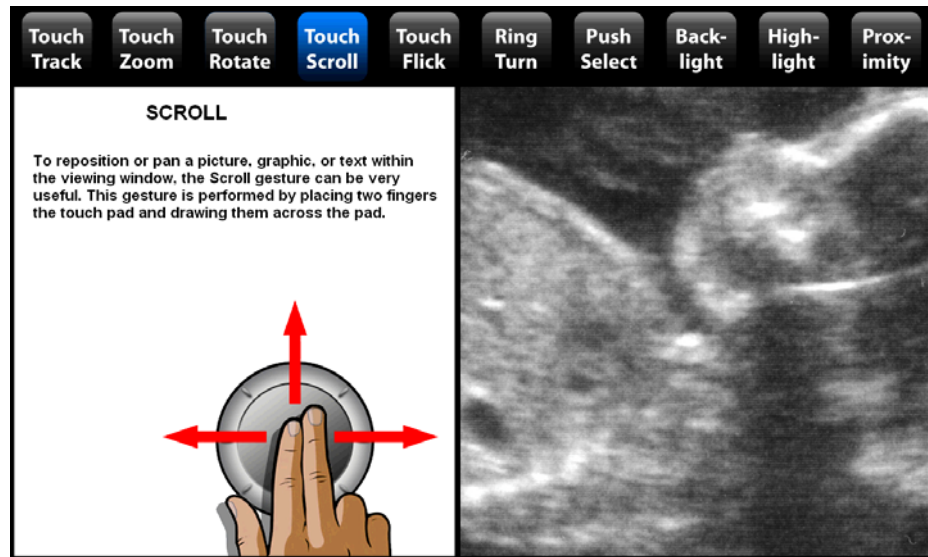
"Touch Scroll" is a two-finger gesture that allows the user to pan a picture, text or graphic. Note that the picture can be panned with momentum. Try lifting your fingers as you move them across the touchpad. This is very useful when panning a large picture or searching a long list.

Touch Flick
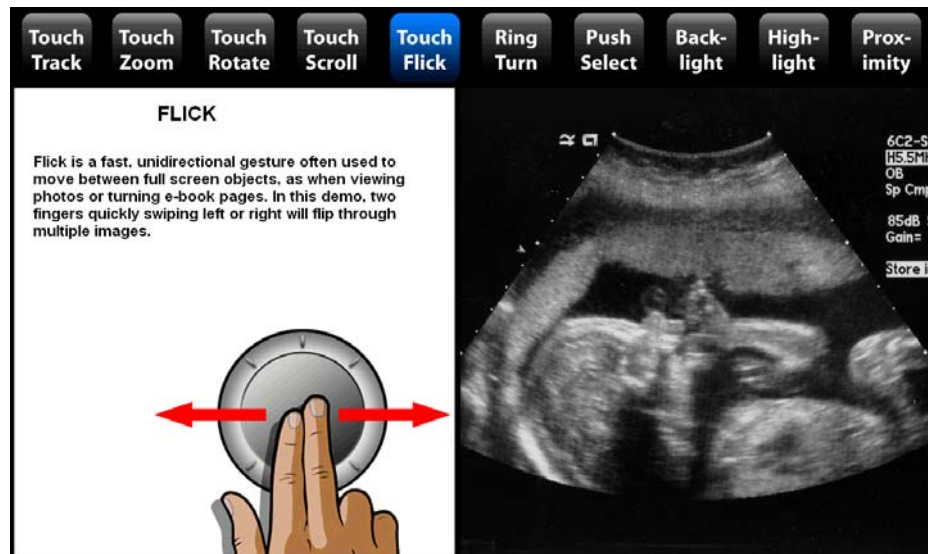
"Touch Flick" as demonstrated here is a two-finger gesture that can be used to move between screen objects. Be sure to hold your fingers slightly apart and flip your fingers horizontally across the screen – just like flipping pages in a book.

Ring Turn
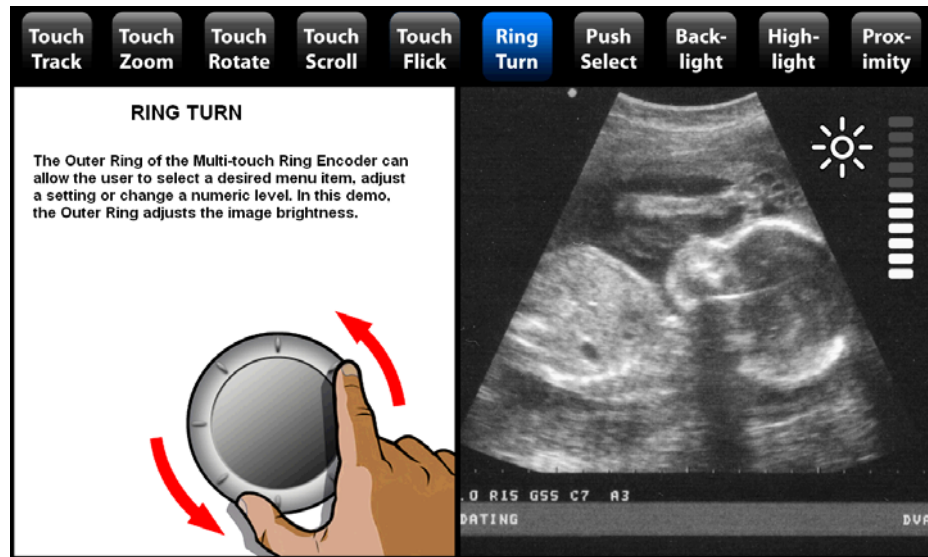
The MTRE touchpad has a unique outer ring that rotates. This ring is perfect for setting machine levels or switching between machine functions. Of course, the actual settings or function that the ring can control can be changed based on the current state of the machine.

Push Select
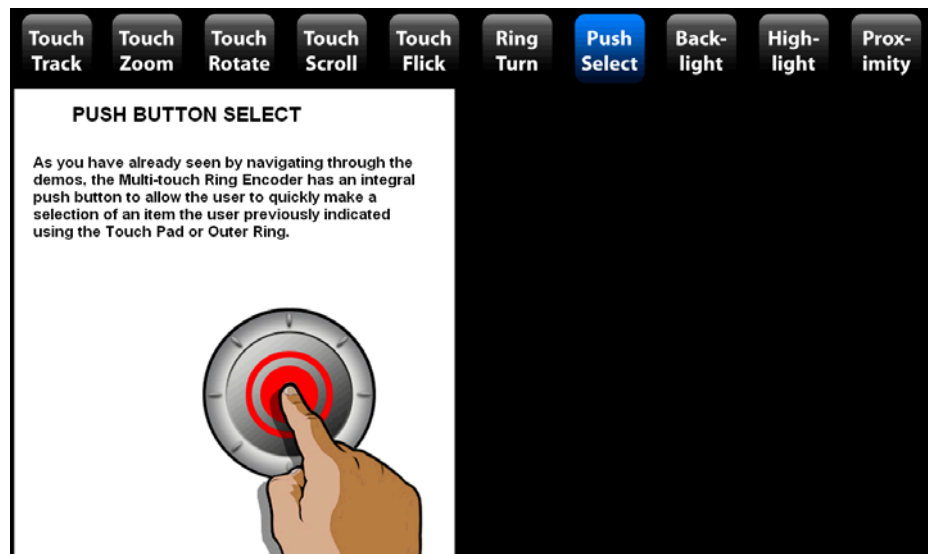
The pushbutton is used throughout the demo. It can be used to select a setting that was adjusted using the outer ring, or to select between functions, as in this demo.

Backlight
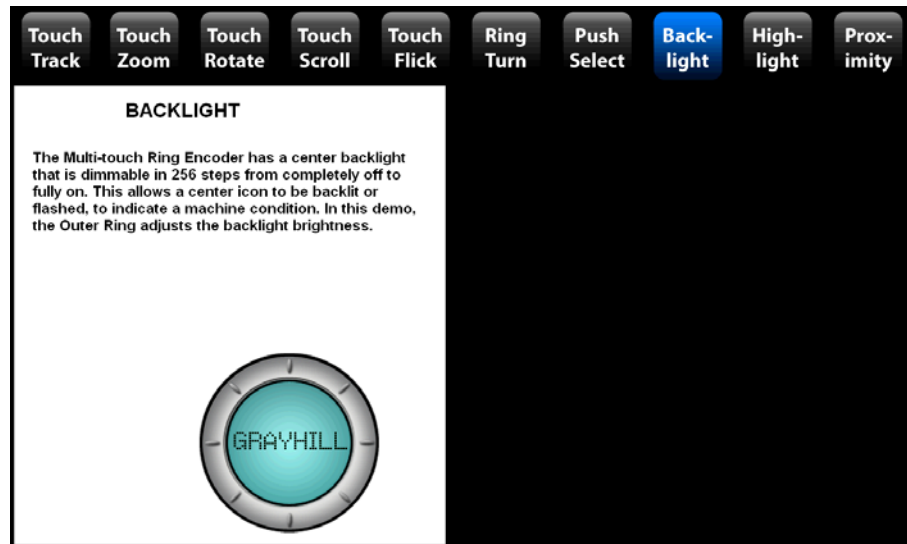
The touchpad on the MTRE is backlit to help the user identify the device location in a darkened room or to provide eye-popping visuals to your custom logo. While in the "Backlight" function of the demo, the ring can be used to demonstrate the backlight brightness levels. Of course, the backlight control is flexible. Flashing the backlight is a great way to draw the user's attention to the device.

Highlight
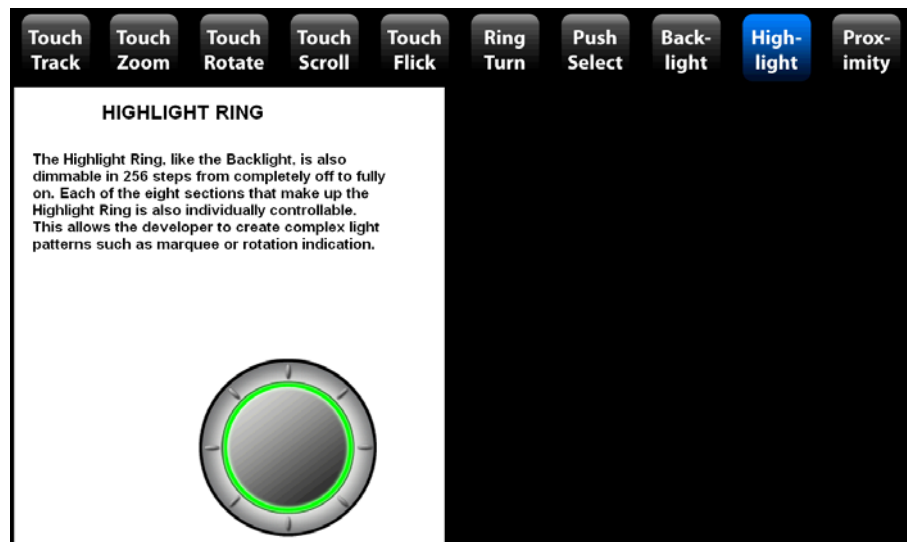
Another lighting function is demonstrated by selecting "Highlight." The brightness of the highlight ring can also be controlled using the ring in this demo. In a real application, even the on - off status of the 12 individual

lighting elements can also be controlled – this is useful for providing visual effects like Marquee.

Proximity
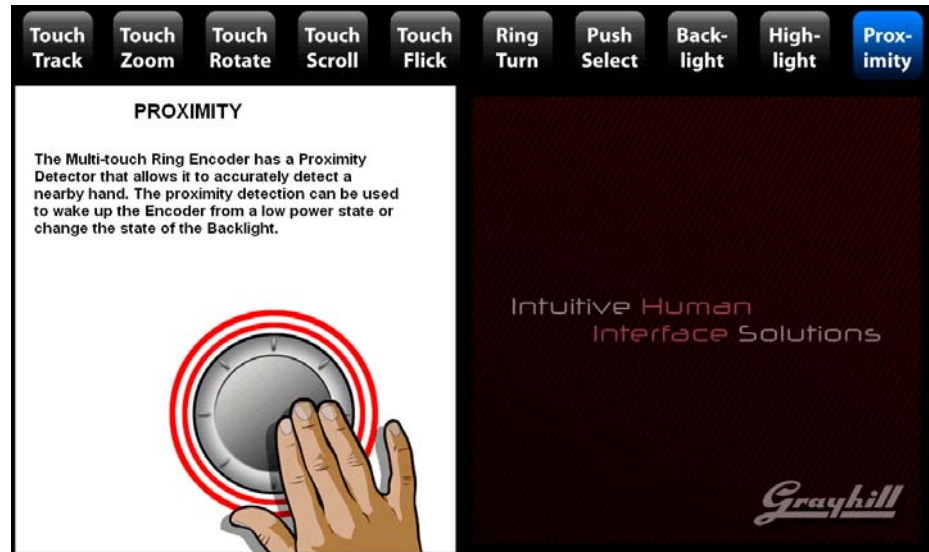
If your product needs to meet green energy requirements, the built in proximity sensor can be a big help. The machine can be placed in a low power state, and when the proximity is sensed, the MTRE can notify the machine that a user is present. For battery powered applications, custom firmware can be written for the MTRE so that even the MTRE itself can be placed in a low power mode - while still monitoring for proximity.

Exiting the Demo

To Exit the demo, hit the "ESC" key on your keyboard and then on the connect screen, hit the "Exit" button using the mouse.

Multi-Touch Ring Encoder Overview

We've demonstrated some of the functions of the MTRE with a simple demo application - but we've only scratched the surface of its possibilities. While the demo can show some examples of the ways the MTRE can be used, it cannot match your imagination of how it might be used. In this section we'll cover the basic operation of the MTRE so that you can appreciate its flexibility.

Mechanical Drawing

The Mechanical layout of the MTRE is shown below. The knob is
removable but the number of times it can be engaged is limited. For this
reason, the knob should not be removed by users in the field but should be
installed one time during manufacturing.

KNOB

BASE
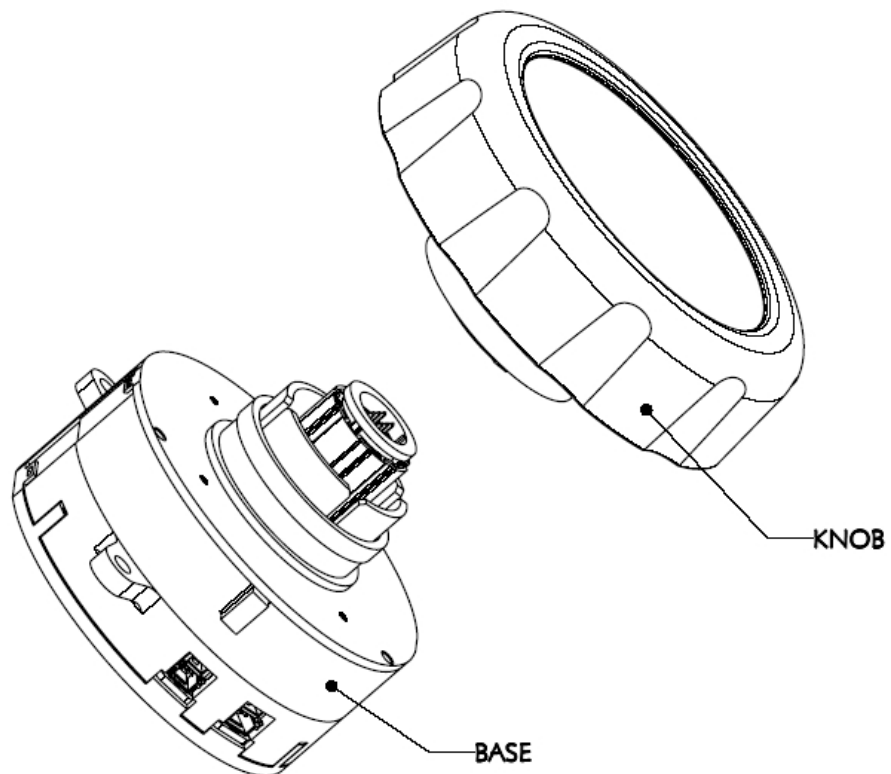
For the discussion of the components of the MTRE see the block diagram of
the MTRE shown below:

KNOB SECTION

```
                    TOUCHPAD

    TOUCHPAD              PROXIMITY
    CONTROLLER           SENSOR

    LIGHTING
    CONTROLLER
```

STEM

BASE SECTION

```
                              QUADRATURE
                                 A
                 ENCODER
                                 B

  POWER   POWER SUPPLY   PUSHBUTTON    PUSHBUTTON

  USB           MICROCONTROLLER
```
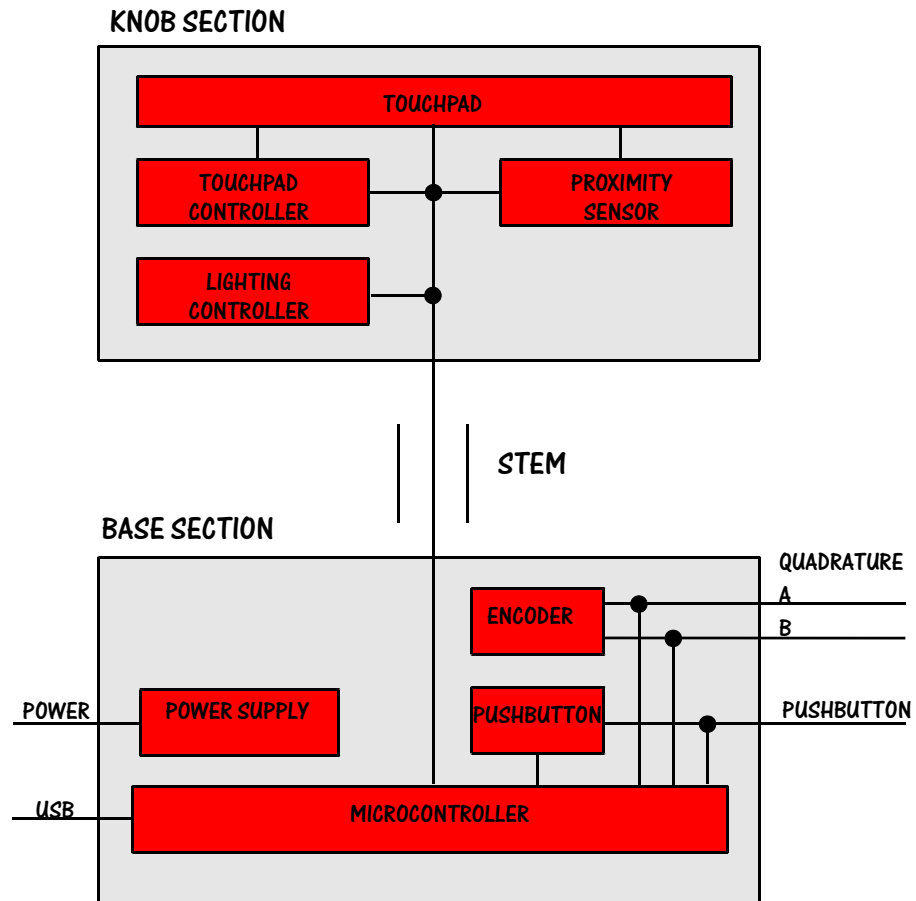
USB – I/O Interface

The MTRE has a built in full speed USB device interface. Data that is transmitted from the MTRE to the host includes the overall status, raw touch positions, proximity status, Encoder (outer ring) changes, and pushbutton status. Data can be sent to the MTRE to set the current touchpad/proximity mode, or change the backlight or highlight on - off or brightness status.

In addition to the USB connector, a redundant output is provided that contains the quadrature output I/O from the encoder and the pushbutton status.

Touchpad

The touchpad built into the MTRE uses the mutual projected capacitive method to track up to 5 touch positions simultaneously with a 20mS sample rate. Some features of the touchpad are listed below:

- As each individual touch is sensed, the touch is assigned the lowest number available from 1 to 5 for reporting.

- The touch is tracked under this number until it has been released.

- The screen has an overall resolution of 1280 x 1280, although because of the round shape, not all of these positions are utilized.

- No gesture recognition is provided in the MTRE, but "Instinct" - Grayhill's gesture recognition library, is available to our customers and will be introduced later in this guide.

- Two-touch differentiation can be sensed down to about 3mm.

- Touch sensing will work with latex gloves.

- The MTRE can be set to either Touch or Proximity mode, but they cannot be used simultaneously.

Ring Encoder

An encoder is connected to the outer ring, which in turn drives the I/O outputs and also is connected to the internal controller for assembly into USB packets. The encoder provides relative (not absolute) position of the outer ring. The USB packet contains the number of counts (up or down) since the last time the MTRE was polled (20ms sample rate.) The I/O connector provides the output directly from the encoder in quadrature format as shown below:
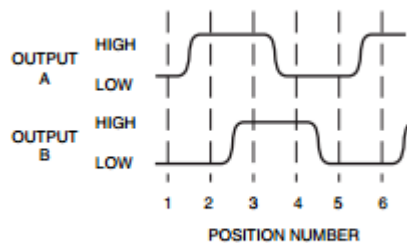
The ring encoder will be available in 32 or 48 positions with 3 different torque options. The ring encoder functions in either the touch or proximity mode.

Pushbutton

The pushbutton make and break codes are available on the USB and as a redundant I/O. The I/O is "low" whenever the pushbutton is active and "high" when inactive. The pushbutton functions in either the touch or proximity mode.

Proximity

The device has two modes of operation, touchpad, and proximity. The device is set to proximity mode by command over the USB. In Proximity mode the device sends make and break codes over the USB corresponding to the current status of the proximity sensor. Proximity is detected using the mutual projected capacitance method.

Backlight

There are four lighting elements that make up the backlight. Each element can be individually set to on or off. Additionally the four elements together (with a single setting) may be set to one of 256 different brightness levels. In the sample unit provided with the SDK, the backlight has a Grayhill logo, but the standard is a solid white backlight. Custom logo printing is available for the MTRE.

Highlight Ring

There are 12 lighting elements that make up the highlight ring. Each element can be individually set to on or off. Additionally the twelve elements together (with a single setting) may be set to one of 256 different brightness levels. The highlight ring comes in four different colors: White, Blue, Red, or Green. Custom colors are also available.

Additional Information

Please visit http://www.grayhill.com/instinct for updates to this document, updates and releases of demos, updates to unit firmware and settings files, Errata, and other application notes.

Documentation for the USB data input and output format is available to our customers with a signed Non-Disclosure Agreement. To request a form please email Grayhill at instinct@grayhill.com.

Grayhill's Instinct^{TM} Gesture Recognition Library Introduction

The **Grayhill Instinct Gesture Recognition Library** is a C code source library – which is intended to be included and built into your application. Simple initialization calls allow the flexible setup of parameters to fine-tune the recognition process for your application. During normal operation, data from the Grayhill touch device is passed directly to the library. The data is quickly processed and the results are passed back to your application.

What makes the Grayhill Instinct Gesture Recognition Library unique?

When we looked at Human/Machine interface we found two basic, but powerful types of gestures useful for machine control – we call them **Gesture Events** and **Dynamic Gestures**.

Gesture Events

A Gesture Event is defined as any gesture that is performed and recognized as a single exclusive event. For example Tap, Double-Tap, Tap-and-Hold etc – these are all gestures that usually cause immediate state changes. Note that these events don't require any position, timing, magnitude or directional information - they are simply recognized as the user performs them as single exclusive events. These types of events have a rich history in user interface. A mouse click, a key press, both can be thought of as an event. However, since a touch panel has many more dimensions than a simple pushbutton, these event gestures can be far more complex and powerful.

Gesture Events Recognized:

- TAP(1)   One Finger Tap
- TAP (2)   Two Finger Tap
- TAP (3)   Three Finger Tap
- TAP (4)   Four Finger Tap
- TAP (5)   Five Finger Tap
- Double_Tap(1)   One Finger Double Tap
- Double_Tap(2)   Two Finger Double Tap
- Double_Tap(3)   Three Finger Double Tap
- Double_ Tap(4)   Four Finger Double Tap
- Double_Tap(5)   Five Finger Double Tap
- Press&Hold (1)   One Finger Press and Hold
- Press&Hold (2)   Two Finger Press and Hold
- Press&Hold (3)   Three Finger Press and Hold
- Press&Hold (4)   Four Finger Press and Hold
- Press&Hold (5)   Five Finger Press and Hold

Dynamic Gestures

A Dynamic Gesture is not recognized as a single event, but rather, a continuous stream of control as long as the user performs the gesture. Dynamic gestures are very useful for viewing and positioning 2-D and 3-D objects or images, or positioning the view in a field of text. Pan, Zoom, Rotate and Scroll, are examples of dynamic gestures. Note that these gestures need not be exclusive (they can all occur simultaneously) and magnitude and direction information are very important in providing the most intuitive experience. This is why we feel it is best to describe these gestures by providing a continuous stream of data regarding the level at which each of these parameters are occurring, rather than simply acknowledging the gesture. Four basic parameters, as well as the number of touches provide all the necessary information. The parameters, MotionX, and MotionY provide the relative average X and Y movement of all the current touch positions and is useful for panning. The Angle parameter provides the average relative rotation of all the current touch positions and is useful for rotating. The Scale parameter provides the average relative

expansion or contraction scale for all the touch elements on the screen and is useful for zooming. In addition, all these parameters can have programmable momentum applied. If the touches are released with speed, the library will continue to provide intuitive movement based on the current momentum settings.

Additional Information

The Grayhill Instinct Gesture Recognition Library is available to our customers with a signed Non-Disclosure Agreement. To request a form please contact Grayhill at instinct@grayhill.com.