MSP430 Touch Pro Tool

This document describes the MSP430 Touch Pro Tool GUI and its features.

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1   Overview

The MSP430 Touch Pro tool is a PC based tool used to verify capacitive touch button, slider and/or wheel design(s). The tool receives and visualizes captouch sensor data to help the user quickly and easily evaluate, diagnose, and tune button, slider, and wheel designs.

Features of Touch Pro tool include:

- Receive real time data from target board up to 10 signals

- Points Connected or bar chart display styles for viewing real-time data waveforms

- User configurable auto-ranging or manual ranging of y-axis

- Data recording and recall

- Print waveforms

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- User selectable individual signal or multi-signal waveform display

1.1 Touch Pro Tool Revision

V1.00.00.00	Initial release
V1.10.00.00	Added Bar Chart, plot grid lines, plot signal aliases
V1.20.00.00	Modified to populate COM port list with all active ports

2 Hardware and Software Requirements

The following items are required to run the Touch Pro tool :

- Microsoft Windows 7 32_bit or 64_bit operating system

- USB 1.1-compatible input

- Java Development Kit, JDK1.5 or greater

2.1 Hardware

The MSP430™ Touch Pro Tool can be demonstrated with the MSP430 LaunchPad™ Value Line development kit (MSP-EXP430G2) together with the MSP430 Capacitive Touch BoosterPack™ (430BOOST-CAPTOUCH) daughterboard. Both are available for purchase from TI eStore:

LaunchPad: https://estore.ti.com/Product3.aspx?ProductId=2031

BoosterPack: https://estore.ti.com/430BOOST-SENSE1-Capacitive-Touch-BoosterPack-P2361C42.aspx

The LaunchPad kit is connected to a PC or laptop with a mini-USB cable, which is provided with the LaunchPad (see Figure 1). Make sure that all of the jumpers are connected in their default configuration.
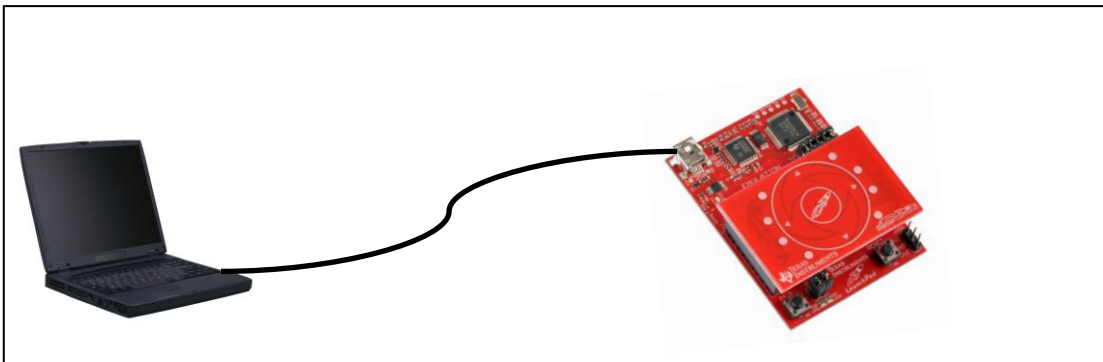
Figure 1. Hardware Connection

2.2 *Demonstration Projects*

The CCS and IAR source code for the demonstration projects are available in the installation package.

The demo projects require Code Composer Studio™ (CCS) version 5.3 or newer or IAR Embedded Workbench® (IAR) version 5.50 or newer.

The CCS and IAR projects directory contain two code example files both intended to work with the MSP430G2553 microcontroller. The example that is labeled TouchProTool_Demo_Bit_Banging supports the MSP430G2xx2 and MSP430G2xx3 Value Line MSP430 microcontrollers. The example that is labeled TouchProTool_Demo_UART supports only MSP430G2xx3 Value Line MSP430 microcontrollers, because it requires a UART interface. The UART module should be wired according to the instructions listed in the LaunchPad document.

After either the CCS or IAR project has been loaded into its respective workspace, connect the LaunchPad, with a MSP430G2553 controller, to the host PC and download the firmware.

3 Launch MSP430 Touch Pro Tool

The tool can be launched either by double clicking the touchpro.jar file located in the installed directory or by selecting the tool in the Windows Start menu.

3.1 Main window

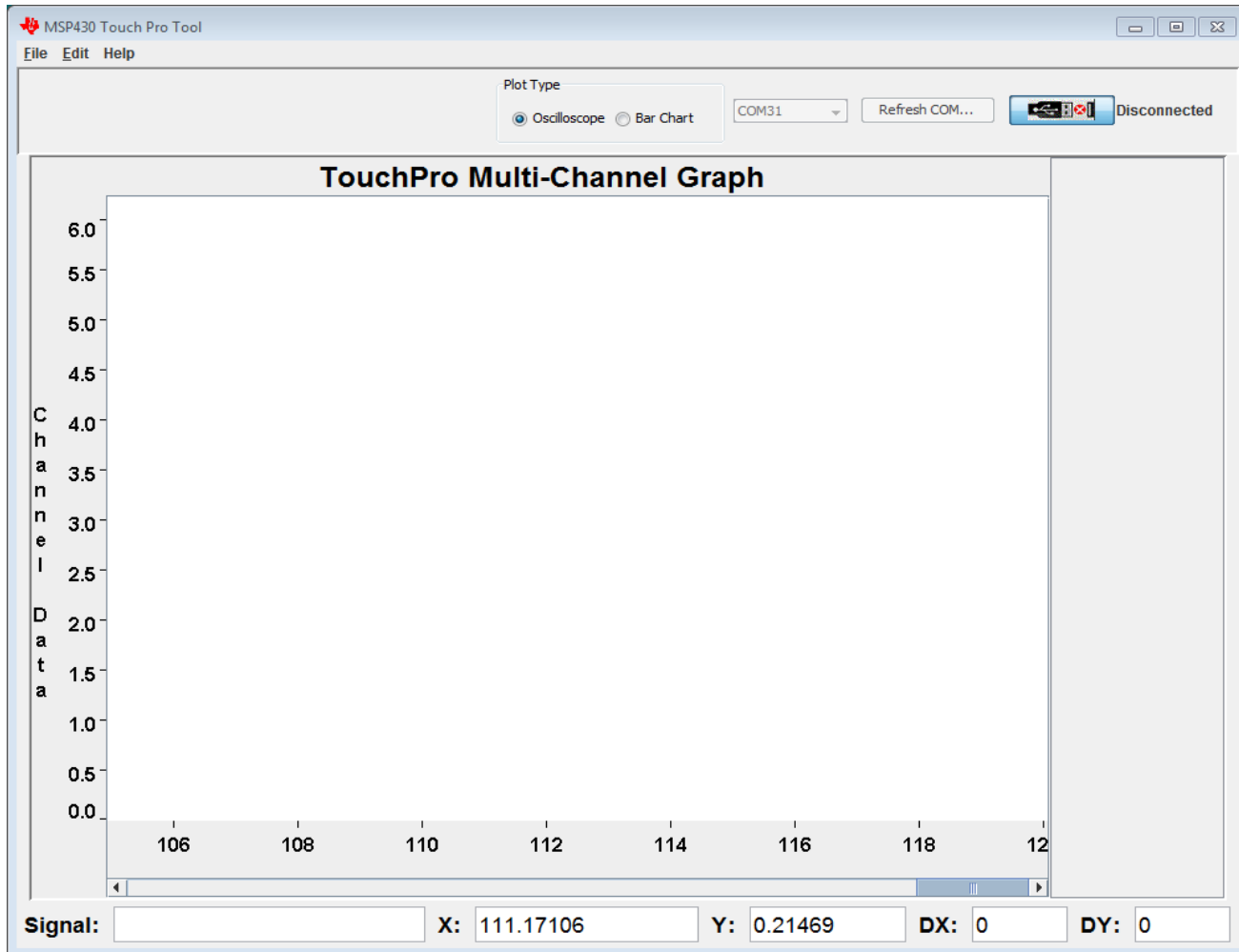When the Touch Pro tool runs, the screen shown in Figure 2 is displayed.

Figure 2. Startup Screen

The main window (see Figure 2) is divided into four working zones:

- Main Menu: File, Edit and Help

- Plot type selection and COM Communication: Select COM, Refresh COM, Pause/Un-pause buttons

- Display Area: Data display canvas

- Data Information: Signal, X-Value, Y-Value and distance between two points

3.2 Communication Setup

To select the COM port to which the LaunchPad is attached, click the Select COM button. In the drop down menu, select the appropriate COM port for the target device (see Figure 3). If the COM port is not listed in the dropdown menu, click the Refresh COM button and then click Select COM again.

NOTE: More than one COM port may be listed in the COM window. To identify the appropriate COM port for the Touch Pro Tool, bring up Windows Device Manager and select the COM port with the *MSP430 Application UART name.*
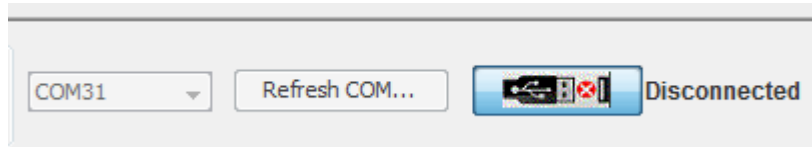

Figure 3. COM Port

NOTE*:* If the COM port cannot be opened, a warning is shown.

3.2.1 COM open

When COM port is open, the Select COM and Refresh COM buttons are disabled and the Pause/un-Pause button is enabled. A legend with checkboxes for selecting and deselecting signals is also displayed.

The tool starts to display data curves when the COM port opens. The data flow can be paused and un-paused without closing the COM port.

3.2.2 COM closed

The COM port can be closed in one of two ways; either by selecting to open a history file or by exiting the GUI.

Opening a history file (see Section 3.3.2.2), closes the COM port, enables the Select COM and Refresh COM buttons, and disables the Pause/Un-Pause button.

With the COM port closed, the tool stops displaying data.

3.2.3 Pause/Un-Pause

The data flow can be paused for reviewing or un-paused by clicking the Pause/un-Pause button.

3.2.4 Refresh COM

The Refresh Com button repopulates the COM dropdown box with available COM ports. This allows the user to plug in the USB cable while the Touch Pro Tool is open.   The Refresh COM button is disabled when a COM port is open, and it is enabled when COM port is closed.

3.3 Plot Types

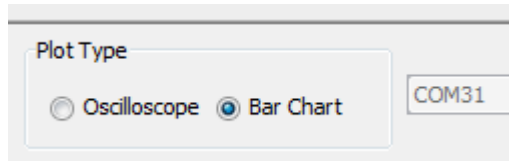The tool can display real-time data in two different plot formats, Oscilloscope or Bar Chart.

Figure 4. Plot type selection

3.3.1 Oscilloscope

The Oscilloscope view, displays data for each signal as a continuous line on the plot.
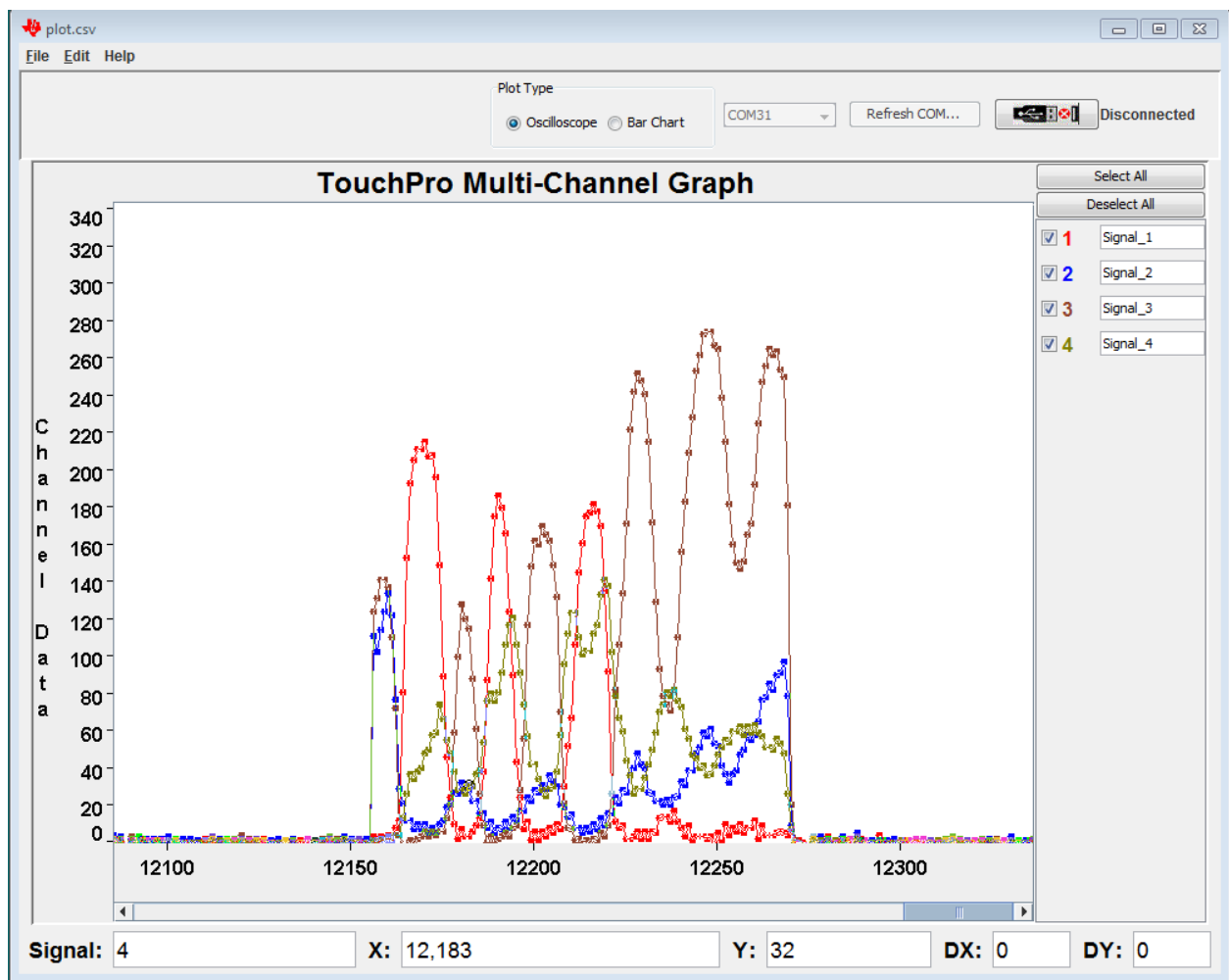

Figure 5. Oscilloscope plot view

3.3.2 Bar Chart

The Bar Chart view displays the most recent delta value for each signal as a bar. It also provides the capability to set a manual threshold value for the displayed signal.
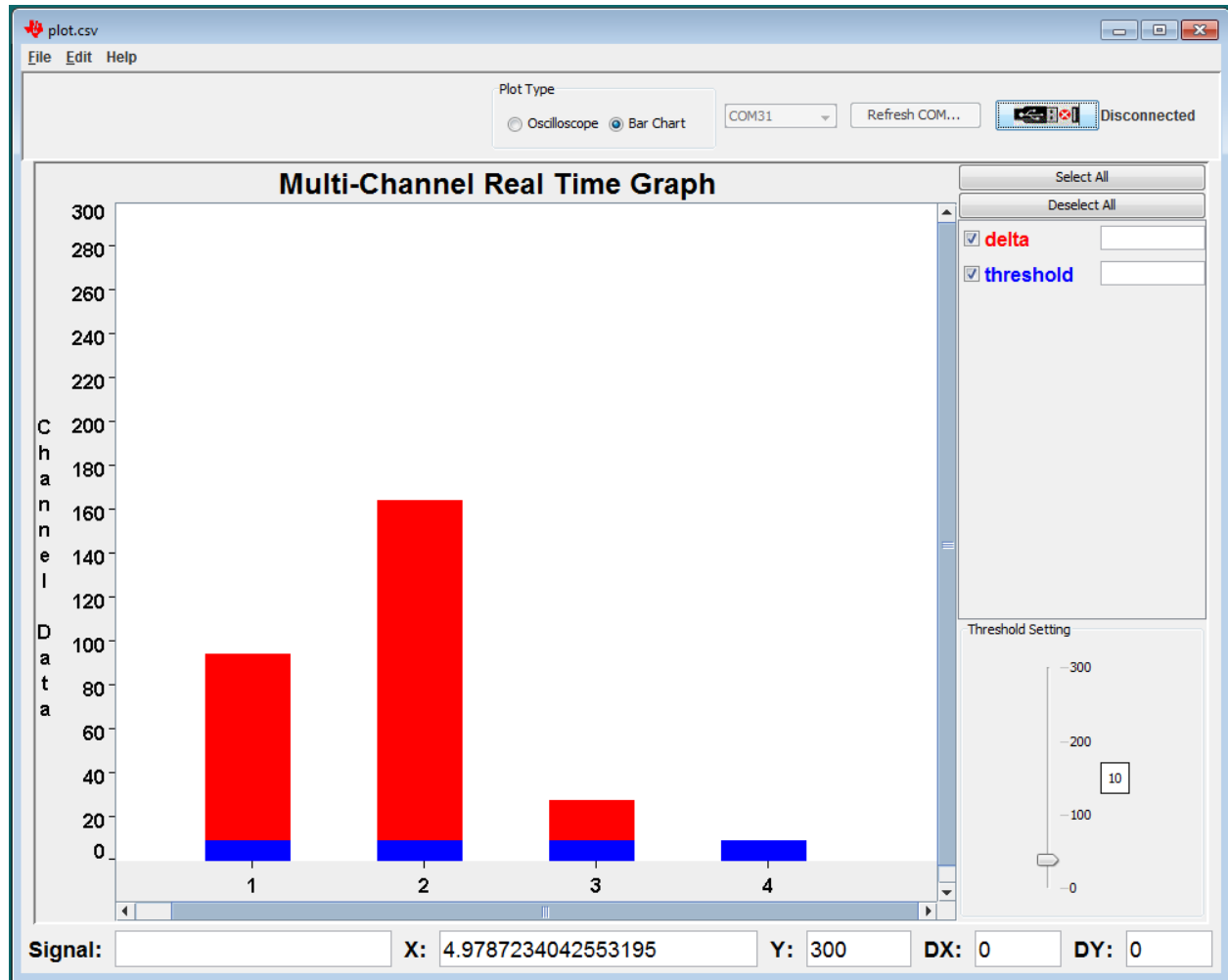

Figure 6. Bar Chart plot view

3.4 Data Types

In the Oscilloscope view, data can be viewed in real-time or historical mode, whereas in Bar Chart view, only real-time data can be viewed. In real time mode, the tool displays data received from the COM port in real time. In historical data mode, data that was previously saved to a CSV file is displayed (see Section 3.4.2.1 for details).

3.4.1 Real-Time Data Display

The real-time data display, supported both in Oscilloscope and Bar Chart views, allows the user to view data in real time. When COM port opens, all signals that are sent from the target board are displayed. Data curves or bars can be observed and are displayed in real time in the display area (see Figure 5 and Figure 6).

The user can click on the Pause/Un-Pause button (see Figure 7) to switch between stopping and starting of plotting data. In the pause mode, data acquisition and data plotting are stopped.
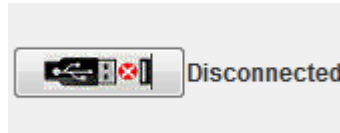

Figure 7. Pause/un-Pause button

3.4.2 Historical Data Display

Historical data can be recalled for viewing and analyzing from saved CSV type data files. Historical data display is only supported in the Oscilloscope view.

3.4.2.1 Saving Data

To save data, click File->Save or File->Save As. Data can be saved in real time mode or in pause mode. Data is saved in CSV type formatted files.

3.4.2.2 Data Recall

To recall data, click File->Open and select the directory and the desired CSV data file. Historical data can be recalled either in real time mode or in pause mode.

When a stored data file is opened, the tool automatically closes the COM port. The display area is cleared of all existing data and historical data is displayed.

3.5 Signal Selection

The display of each received signal can be individually turned on or off. To turn on the display of a signal, click the checkbox for that signal (see Figure 5). To turn off the display of a signal, clear the checkbox. To select all signals, click Select All. To deselect all signals, click Deselect All. When the COM port is opened, all signals sent by the target are automatically selected.

3.6 Signal Alias

Each plot signal can be assigned a user-defined alias. This can be helpful to map signal numbers to meaningful identifiers (see Figure 8).
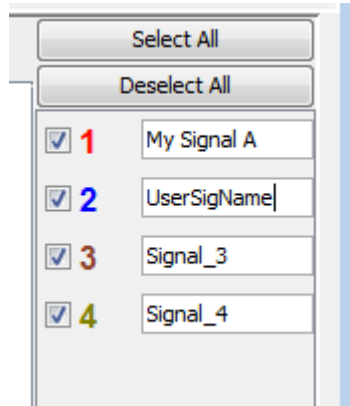
Figure 8. Signal selection and alias

3.7 X and Y Axes Description

- Y-axis points are data values

- X-axis points are index counts

The y-axis can be labeled. Click Edit->Display Defaults->Axis Defaults and then enter the label for Y Title (see Figure 9).

3.7.1 Auto and Manual Ranging

If the Y-axis data points vary widely, the values that are displayed can be restricted to a user-defined range.   Click Edit->Display Defaults->Axis Defaults and select Manual Ranging Y-Axis (see Figure 9). Enter a minimum Y value and a maximum Y value. The changes to the Y-axis are seen the next time the COM port opens.

The Y-Axis Boundary Settings can be set either during real time data flow or when the data flow is paused. The manual range's minimum and maximum values are stored when tool closes. However, Auto Ranging Y-Axis is the default setting that is used by the tool when it is opened. To apply the manual range values to the Y-axis after re-starting the tool, select Manual Ranging Y-Axis again.
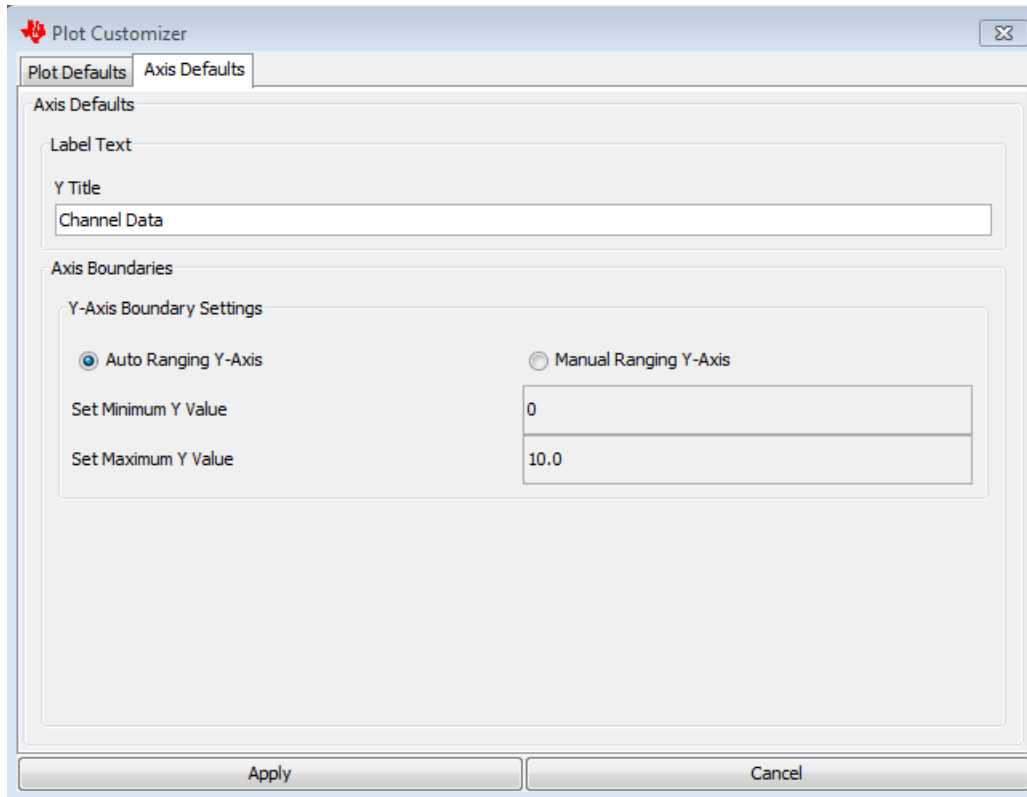
Figure 9. Display Chart Ranging (Axis Defaults Tab)

3.8   Display Chart Styles

Two styles of display charts are available: Points Connected and Bar Chart. To select the chart type, click Edit->Display Defaults->Plot Defaults and select either Points Connected or Bar (see Figure 10).

3.9   Display Chart Grid Lines

The user can select to display the horizontal and vertical grid lines by selecting Edit->Display Defaults->Plot Defaults window. (see Figure 10).
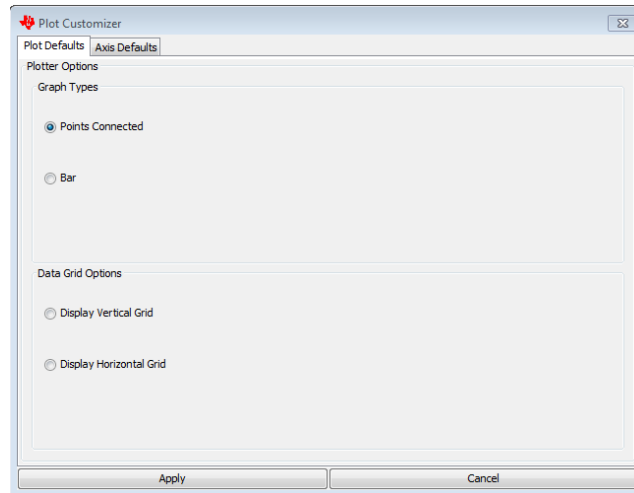
Figure 10. Display Chart Styles (Plot Defaults Tab)

3.10 Data Protocol Between MCU and Touch Pro Tool

For Touch Pro tool to display data, the user application must send data in a defined format. The data frame definition of the UART protocol that the Touch Pro Tool expects from the target MCU is show in Figure 11:
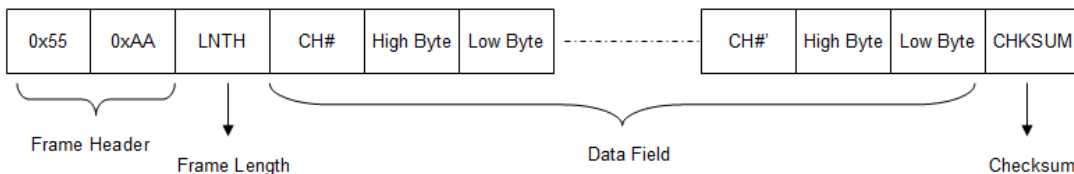

Figure 11. Data Frame Definition

Frame Header: This is a fixed value. The value is always 0x55 + 0xAA

Length: Indicates total number of bytes following the frame header bytes.

Length = 3 * Signal Numbers + 1.

For example, when there is only 1 signal of data to send, the length will be 3*1 + 1 = 4 and for 5 signals of data, the length will be 3*5 + 1 =16.

The one is added to the length to account for the checksum byte

Each signal number is multiplied by 3 to account for Signal number, high order byte and low order byte.

CH#: Valid signal numbers range from 0 to 9. That means a total of 10 signals can be observed by Touch Pro Tool.

High Byte: High 8-bit data of the signal data.

Low Byte: Low 8-bit data of the signal data.

CheckSum: Low byte of the value derived from the sum of header bytes, frame length, signal number and data bytes. The GUI will ignore the data package if checksum is wrong

For example, if the data frame is the following:

0x55	0xAA	0x0A	0x01	0x0	0x0A	0x14

Frame Header

Frame Length

Data Field
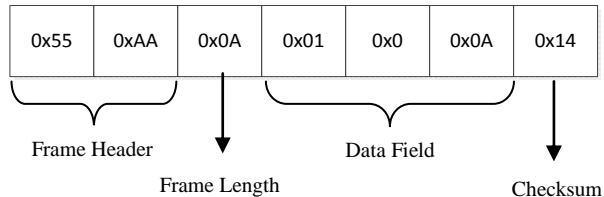
Checksum

Data Frame total = 55+AA+0A+01+0+0A = 114
Checksum = 14

Data is sent at a fixed rate of 9600 baud.

3.11 Waveform Operations

The following operations can be performed on the displayed waveforms:

- Zoom in and zoom out

- Show point values

- Show distance between points

- Print

3.11.1 Zoom In and Zoom Out

Zoom in and zoom out are possible while data flow is paused or during data recall.

To zoom into a waveform, press and hold the left mouse button and draw a box from *top to bottom* around the area of interest. To zoom out partially, press and hold the left mouse button and draw a box from *bottom to top* around the area of interest. To zoom out fully, click the right mouse button.

3.11.2 Show Points Values

The X and Y points value is displayed in the Data Information zone of the GUI. When the cursor is over a point in the display, the corresponding signal number, X value, and Y value are listed in the boxes labeled Signal, X, and Y, respectively*.*   Figure 12 shows an example point value.
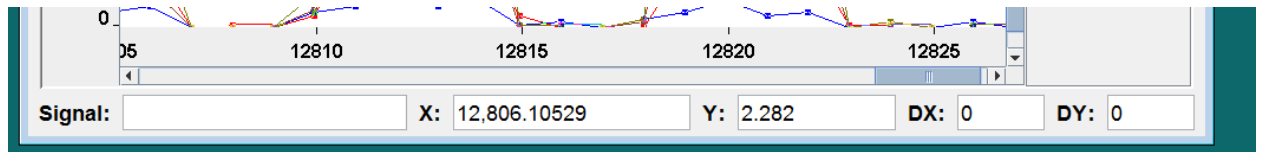
Figure 12. Show Points Values

3.11.3 Show Difference Between Points

To calculate the difference between two point values: select the first point, press and hold the right mouse button, drag the line that appears to the second point, and release the button.

The boxes labeled DX and DY show the difference between the two point values in the X and Y coordinates.

3.11.4 Print Waveforms

To print the waveforms that are shown in the display area of the tool, pause the data flow and then click File->Print.

3.11.5 Clear Display

To clear the display of waveforms, click Edit->Clear.   The display can be cleared in real time or when data flow is paused.

3.11.6 Reset Axes

To reset axes after zooming in, click Edit->Reset Axes. The display resets the x and y axes values to the values prior to the zoom in.