3M[™] MicroTouch[™] Controller DX123 Reference Guide

Read and understand all safety information contained in this document before using this product.





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About This Manual

Overview

3M Touch Systems, Inc. offers many sensor controllers designed for reliability and easy installation. Each controller provides superior performance and delivers excellent stability, sensitivity, accuracy, and fast response.

This reference manual, directed to developers of 3M[™] MicroTouch[™] Dispersive Signal Technology (DST) touch systems, provides installation and configuration information for the DX123 controller. Dual mode enables you to run your DST sensor in either USB or serial mode from the same controller

This document includes information on integrating the DX123 controller into your design, communicating with the controller and troubleshooting setup problems. It also includes a complete description of the firmware commands, a guide to interpreting status LED conditions, and controller specifications.

What You Need to Know

This document assumes you are familiar with firmware commands and how to use them. Executing some commands may alter the performance of your touch product. You should be aware of the results of using these commands before executing them.

Note: The DST sensor works exclusively with a mated DX123 controller for optimal performance. DST sensors and controllers are packaged two to a box. Be sure to match the serial number on the sensor with the serial number on the controller throughout the integration process.

Important Safety Information

Read, understand, and follow all safety information before using this product. Follow all instructions marked on the product and described in this document. Pay close attention to the following installation warnings and safety precautions.

Intended Use

The DX123 Controller was designed to enable touch in conjunction with other 3MTM MicroTouchTM DST products. This controller is designed for internal use only and is not suitable for use in hazardous locations.

Explanation of Signal Word Consequences

WARNING: Indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury and/or property damage.

CAUTION: Indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury and/or property damage.

CAUTION: Indicates a potentially hazardous situation, which, if not avoided, may result in property damage.



WARNING

To reduce the risk of fire and/or explosion which could result in serious injury or

Do not install or use this product in a hazardous location.

To reduce the risk of fire and/or explosion which could result in serious injury or property damage:

Do not use this product in any outdoor environment unless NEMA (or other similar) standards, such as IP rating, are followed.



CAUTION

To reduce the risks associated with improper disposal, which if not avoided may result in minor or moderate injury from ground water contamination:

Dispose of components in accordance with federal, state and local regulations.

To reduce the risk of possible environmental contamination which may result in minor or moderate injury:

Dispose of the display in accordance with federal, state and local regulations.

3M Touch Systems Support Services

3M Touch Systems, Inc. provides extensive support services through our website and technical support organization. Visit the 3M Touch Systems website at http://www.3Mtouch.com/, where you can download sensor software and drivers, obtain regularly updated technical documentation on 3MTM MicroTouchTM products, and learn more about our company.

Whenever you contact Technical Support, please provide the following information:

- Display manufacturer and model number
- Sensor size, part number and serial number
- Current driver version
- Operating system used
- Information on additional peripherals

Technical Support is available Monday through Friday 8:30 a.m. to 5:30 p.m. with limited call back service after 5:30 p.m. until 8:00 p.m. US Eastern Standard Time – 9 a.m. to 5 p.m. throughout Europe.

You can contact 3M Touch Systems, Inc. Technical Support (US only -- Eastern Standard Time) by calling the hot line, sending email or a fax.

Technical Support Hot Line: 978-659-9200
Technical Support Fax: 978-659-9400
Toll Free: 1-866-407-6666 (Option 3)
Email: US-TS-techsupport@mmm.com

Contact 3M Touch Systems

Contact information for all offices can be accessed through the website: http://www.3Mtouch.com/.

CHAPTER 1

Integrating the 3M[™] MicroTouch[™] DX123 Controller

Overview

The 3MTM MicroTouchTM Dispersive Signal Technology (DST) touch system offers a fundamentally different touch system solution. From exceptional optics and stylus support, to the ability to rest objects on the screen and still activate a touch, MicroTouchTM DST exemplifies the innovation expected from 3M. Our world-class support and service organization provides expert technical consulting wherever your products are designed, integrated or delivered. It is this total system solution approach that ensures exceptional service and support, backed by 3M.

The MicroTouchTM DX123 Dual Mode (USB and Serial) controller is capable of supporting the entire range of 3MTM MicroTouchTM DST sensors.

This chapter describes how to install the controller for use with your MicroTouchTM DST sensor. The DST sensor works exclusively with a DX123 controller.

This chapter covers the following DX123 controller specifications:

- Cable connections
- Mounting requirements
- Power requirements and options
- Status LED codes

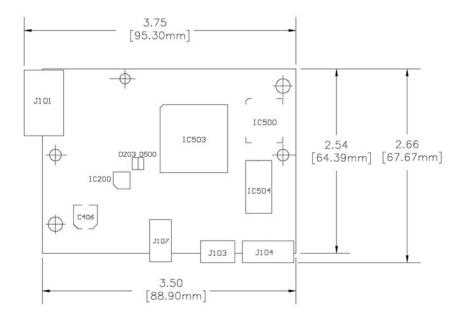
The DX123 controller works as either a HID compatible USB controller or a serial RS-232 controller. To integrate and test the DX123 controller, you need the following items:

- A MicroTouch DST sensor. The sensors are available in a variety of large formats.
- A method of establishing communication between the controller and your system. You can use either the standard 3MTM MicroTouchTM USB communications cable (P/N 7319420) or serial communications cable (P/N 7319630).
- A 5V or 12V power source.
- A sensor utility or driver with a calibration routine.

Note: You can use MicroTouchTM software, which includes the sensor device driver and utilities software. Refer to *Using Your DST Sensor* at the end of this chapter for additional information.

The DX123 controller measures 2.66 in (67.6 mm) x 3.75 in (95.3 mm) total profile over the connectors. Each controller board is 3.5 in (89 mm) by 2.54 in (64 mm) by 0.3 in (8 mm). These controllers are intended for internal installation only. Allow additional clearance for the mating connectors. The total height profile is 0.40 inches from the thruhole pins on the trace side of the board to the top of the highest component on the opposite side. The DX123 has an 8-pin sensor connector (J101), a 5-pin USB connector (J103), an 8-pin serial connector (J104), and a 3-pin power connector (J107) for input power.

Figure 1. DX123 Controller Overall Dimensions

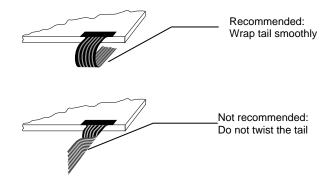


Mounting the Controller

The controller is designed for internal mounting only. Choose a convenient spot away from high-voltage, high power cables and electronics. Use 4-40 metal screws to mount the controller using the two diagonal mounting holes in the board. The controller should be mounted in line with the sensor cable exit point to minimize cable flexing. The controller should be mounted internally behind or on the side of the display on stand offs to allow room for the sensor cable connector.

Avoid awkward electrical connections by ensuring that the tail and controller are aligned such that the tail remains straight (90°) , not pulled or twisted in an odd angle from the sensor.

Figure 2. Recommendation for Tail Connection



If necessary, to make the sensor cable reach to the controller location, you can extend the length of the tail with a one-to-one, non-shielded, flat ribbon cable extender. The connector must be compatible with the connector manufacturer, i.e., Amp should connect to Amp. Be sure to use tin compatible contact pins.

EMI Considerations

The DX123 controller meets FCC and EU emissions Class A standards. If Class B is required, the controller must be mounted behind a metal cover with just the sensor flex cable exiting to the display (no shield is required on the flex cable). This metal cover can be part of the housing for the display. Some displays have an internal metal cover and a plastic outer housing and some use a metal cover as the outer rear cover. Mounting the controller inside either metal cover should be sufficient to meet Class B.

Handling and ESD Protection

Note: When handling the DST sensor and associated electronics make sure you wear an ESD strap to prevent electrostatic discharge to electrical components on the sensor.

When mounting the sensor and controller, use normal precautions for handling electrostatic sensitive devices. The DX123 controller has internal protection to $\pm 20 \text{ kV}$ for ESD air discharges to the sensor (not to the controller directly) that may occur during normal operation of the sensor. Refer to Appendix A for more detailed specifications.

Establishing the Data Connection

The DX123 controller can operate in either USB or serial mode – no need for different controllers. You cannot operate in both modes at the same time. If you try to connect both USB and serial cables, the controller will default to USB mode only.

USB Connection

In USB mode, the controller uses a 3M[™] MicroTouch[™] USB communication cable (P/N 7319420) PC 99 compatible or equivalent interconnect. One end of this cable plugs into the USB connector (J103) on the DX123 controller. The other end has a Type-A connector, and plugs into a USB port on your PC.

When creating a custom cable, use the Molex 51004-0500 mating connector. The following table describes the interconnections of the 3MTM MicroTouchTM USB cable.

Table 1. USB Cable for DX123 Controllers

PC Si	PC Side (USB Type A)		Cont	roller Side (5-Pin Molex)
Pin	USB Assigned	Color	Pin	Description
1	+5Vdc (VBUS)	Red	1	+5Vdc VBUS power
2	Data (DN)	Gray	2	Data (DN) differential pair
3	Data (DP)	Green	3	Data (DP) differential pair
4	0V	Black	4	Power return
5	Cable Shield Shell	Charcoal	5	Outer cable shield around signal and
		Gray		power lines. Chassis (earth) ground

Serial Connection

For serial mode, the DX123 controller uses a 3MTM MicroTouchTM RS-232 plug and play cable (P/N 7319630) or an equivalent interconnect.

One end of this cable plugs into the RS-232 connector (J104) on the DX123 controller. The other end, which has a 9-pin D connector, plugs directly into a serial COM port on your PC. The 9-pin D connector also has an input in the connector body for an external 5V power supply. The following table describes the interconnections for the 3MTM MicroTouchTM RS-232 cable.

Table 2. Serial Cable for DX123 Controllers

	PC Side (9-Pin	Со	ntroller Side (8-Pin Molex)	
Pin	RS-232 Assigned	Jumper to:	Pin	Description
1	Data Carrier Detect (DCD)	4 and 6 DTR and DSR	8	DCD, DTR, DSR
2	Receive Data (RXD)		2	Transmit Data (TXD)
3	Transmit Data (TXD)		3	Receive Data (RXD)
4	Data Terminal Ready (DTR)	1 and 6 DCD and DSR	8	DCD, DTR, DSR
5	Signal Ground		5	Power supply ground
6	Data Set Ready (DSR)	1 and 4 DCD and DSR	8	DCD, DTR, DSR
7	Request to Send (RTS)		1	Request to Send (RTS)
8	Clear to Send (CTS)		4	Clear to Send (CTS)
9	Not Used			Do not ground
Sleeve	5V		6	DC power jack (+5 VDC)
Pin	Ground		7	Cable shield connected to
				ground. DC power jack
				ground

Supplying Power to the Controller

The DX123 controller must be self-powered by a separate 5 VDC or 12 VDC power input. The USB 5 V bus power is only used for the USB pull up and to establish USB communications. The power source should deliver 5 VDC or 12 VDC at 80 mA; 100 mA max, \pm 10% regulation, with a maximum ripple and noise of 50 mV peak-to-peak.

Note: You need only to supply **either** 5V or 12V -- whichever is most convenient that will provide sufficient power for you as the integrator. Refer to the following section for information on locating power for your controller.

You supply power to the DX123 controller using the 3-pin power connector J107 (Molex 22-05-3031). Use a mating 3-pin connector (Molex 22-01-3037 and Pins 08-50-0114), pin 1 is 5 VDC, pin 2 is the GND return, and pin 3 is 12 VDC.



⚠ CAUTION

To avoid possible damage to the controller, you must provide a path for electrostatic discharge. The controller mounting hole nearest the sensor connector should be used to connect to chassis safety ground and must be attached by the shortest possible route to a good earth return (chassis) in all applications.

The controller must be properly grounded through the mounting holes. Note that there are 5 possible mounting holes on the DX board – at least two must be used.

Locating Power for the Controller

To power your controller, you need to tap a power source within the display. It is helpful to locate this power source before beginning the controller installation. A multi-meter or the display schematic can be used to locate an appropriate power source on the display's main board.

The power source must meet the following requirements:

- Minimum current supplied: 120 mA power source
- Maximum voltage drop allowed: 100 mV
- 50 mV peak to peak voltage ripple

To determine the display's voltage drop at the power source conduct the following test:

- 1. Measure voltage across the power source contacts
- 2. Connect the sensor to the controller, and the controller to the power source.
- 3. Power up the display and allow it to warm up for at least 10 minutes.
- 4. Measure voltage across the power source again.
- 5. A separate standalone power supply can also be added for the touch controller.

Note: The difference in voltages before and after the wires are connected cannot exceed 100 mV. If this voltage drop is exceeded, a different tap point location must be found.

Mounting the DST Sensor

There are several methods for mounting the sensor depending on your application. For instructions from 3M Touch Systems on how to incorporate a DST sensor into your design, refer to the 3MTM MicroTouchTM DST Integration Guide (P/N 25739). All 3M Touch Systems documentation is available from the corporate website at www.3Mtouch.com.

Note: The DST sensor works exclusively with a mated DX123 controller for optimal performance. DST sensors and controllers are packaged two to a box. Be sure to match the serial number on the sensor with the serial number on the controller throughout the integration process.

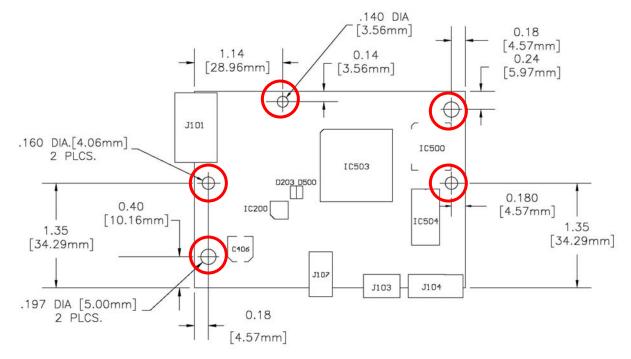
Completing Controller Mounting

Note: The method and location selected in mounting a controller internally is dependent on the mechanical design and assembly of the display being integrated. There may be several alternatives to integrating the controller. The following illustrates one mounting method that may work for some display products.

In order to mount the controller board to the housing, two mounting holes must be drilled. The mounting holes are dimensioned in the controller layout drawing below.

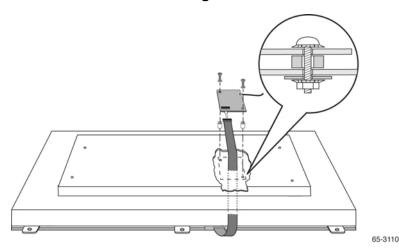
Note: Ensure that the two controller mounting holes are connected to the chassis ground of the display. Ensure the star washers do not overlap the mounting hole rings.

Figure 3. 3M™ MicroTouch™ DX123 Controller Grounding Hole Dimensions



- 1. We recommend you mount the controller board to the housing using metal screws in the mounting holes nearest the sensor connection and the mounting hole nearest the controller connection.
- 2. Insert a metal thru-hole spacer between the controller board and the metal chassis as shown in the following diagram. These spacers will prevent the pins and/or traces on board from shorting to the chassis. Make sure the spacer diameter is less than the screw head diameter.

Figure 4. Adding Spacers to the Controller Mounting



- 3. Plug the sensor cable into the controller board, making sure that the pins are oriented in the correct direction.
- 4. Connect the USB or serial connector. You can also use an extension cable to run from the controller board to the chassis bulkhead USB or serial connector.
- 5. Connect the 3-pin +5 VDC or 12 VDC power supply to the power connector.
- 6. Check the controller operation by powering up the unit. LED D203 should be on to indicate the device has power. LED D500 should toggle when touched (on one touch, off the next.)

With the video and controller boards properly mounted, all cables connected, and excess wiring cable-tied, the metal shield can be attached.

Sensor Flex Tail Connector

The standard 12-inch sensor flex tail has an 8-pin single row locking female connector that plugs into the controller. The calibration process sorts out left/right and up/down if the screen is not used in the standard orientation.

If necessary, to make the sensor flex tail reach to the controller location, you can extend the length of the tail with a one-to-one, non-shielded, flat ribbon flex tail extender. The connector must be compatible with the connector manufacturer, i.e., Amp should connect to Amp. Be sure to use tin compatible contact pins.

Table 3. Flex Tail Connectors

Pin	Description
1	Lower right channel 3
2	Upper right channel 2
3	Sensor voltage (+5V) power supply
4	Reserved for future use

Pin	Description
5	A GND, 0 VDC
6	Sensor voltage (+5V) power supply
7	Upper left channel 0
8	Lower left channel 1

As mentioned earlier, it may be necessary to make changes to the metal shield and the rear display housing to accommodate the sensor flex tail. Usually it is necessary to make a hole in the shield and the housing so that the sensor flex tail can be routed through, however some models may have an existing opening that can be used.

Turning On Your System

Before you turn on your custom system, ensure that all cables are connected properly and that the controller is properly mounted. Be sure to tighten all cable connector screws.

To start up your system

- 1. Turn on your display and computer.
- 2. Adjust the contrast and brightness to suit your personal preference and working environment.
- 3. If necessary, adjust the horizontal and vertical position controls on the display to center the image on the screen.

Status Light (LED) Diagnostics

The DX123 controller provides two light emitting diodes (LEDs) D203 and D500 on the component side of the board to indicate the status of the sensor unit.

Normal LED operation:

- D500 indicates touch activity. If the controller senses touch activity the LED will toggle from on to off or off to on. Each touch will cause the LED to toggle.
- D203 indicates an active state when on. The LED will blink once during enumeration and then remain on. When the controller is in standby/suspend mode, the LED will be off.

Wake on Touch (USB Only)

If the controller is powered from a source inside the system that will not be shut down by power management, the DX123 controller will wake up the system from standby mode when touched.

Using Your DST Sensor

Since this is a USB HID (human interface device) compatible controller, when in USB mode, the controller can operate independent of a 3MTM MicroTouchTM MT 7 software driver. However, you must obtain the HID calibration utility from the 3M Touch Systems website to ensure proper operation.

MT 7 software includes the driver and control panel that enables your sensor to work with your computer. When you install this software, the correct driver for your system will automatically load. 3M Touch Systems currently supports drivers for the following PC operating systems.

MT 7 Software

- Microsoft® Windows® 7
- Microsoft® Windows® Vista
- Microsoft® Windows® XP
- Microsoft® Windows® XP embedded
- Microsoft® Windows® CE 4 and 5
- Linux® (Kernel 2.6)

These drivers, as well as relevant technical documentation and legacy drivers, can be found on the web at www.3Mtouch.com. After the software is installed, restart your computer to load and activate the sensor driver. To complete the setup of your touch display, make sure you calibrate the sensor.

When using the DX123 controller in USB mode, the controller is HID compliant and can be used without a driver on most PC operating systems. 3M Touch Systems provides a calibration tool on its website to align the sensor to your desktop.

Refer to the *MicroTouch*TM *MT 7 Software User Guide* for additional information.

CHAPTER 2

3M™ MicroTouch™ USB Communications

This chapter discusses the fundamentals of communicating with the DX123 controller in USB mode. The firmware commands, which are usually issued by a driver or utility program on the host system, control the operation of the sensor controller. This chapter lists the recommended firmware commands and describes how to use each of these commands.

Overview of USB Firmware Communications

Developers may use this information when writing touch applications, developing custom drivers or touch configurations, or testing their touch systems. Developers can issue commands to initialize the controller, select operating modes, and execute diagnostic functions.

Most sensor users do *not* have to use firmware commands to use their touch systems. For example, users can use MicroTouchTM software or equivalent software to calibrate the sensor or to determine the controller type and firmware version.

Note: This document assumes you are familiar with USB standards and modes of communication with USB devices, as well as firmware commands and how to use them. Executing some commands may alter the performance of your sensor and render it inoperable. You should be aware of the results before executing any firmware commands.

To optimize the performance of the DX123 USB controller and simplify the development of custom drivers, 3M Touch Systems recommends you use the commands listed in this chapter for current development.

Communication Basics

This section provides information on sending firmware commands to the controller and interpreting the responses that the controller returns. The default operation of the DX123 controller is USB HID 1.1 @ 12 MHz.

The USB command set is implemented by using vendor requests and vendor reports, i.e., vendor specific transactions. The controller issues some reports without prompting the computer. The computer can also send requests to the controller to change how it operates or receives information about the controller. The controller issues a synchronous report in response to some of these requests.

You need to know the product ID (0300H) and the vendor ID (0596H) to write your own driver. These values are required for identifying the controller.

Note: The DX123 command set conforms to the HID protocol. The HID protocol allows the DX123 controller to be used with operating systems that support HID. The only required software is a calibration tool (available from 3M Touch Systems) used for aligning the sensor to the display.

Receiving Reports from the Controller

The controller sends a variety of reports to the computer. The first byte of each report is the Report ID that defines the structure and content of the report. The controller sends some reports as a direct response to a computer request (synchronous). The controller will also send some reports as the result of an external event, such as a touch (asynchronous).

USB Command Set

The USB command set is implemented by using HID Get Feature and Set Feature commands. The various requests and reports are grouped together by report size under a common feature ID.

The following commands are currently used by 3M Touch Systems for optimal communications. 3M Touch Systems recommends that you use only these commands for DX123 controller communications.

Sending Commands to the Controller

To send a command, the program must construct a USB request packet. The request format is described in the following table. This is known as the setup stage. Any data appended immediately after the setup stage is referred to as the data stage.

If using Windows, you may want to use the Set and Get Feature functions, respectively HidD_SetFeature and HidD_GetFeature. The buffers for these routines are the data stages of the requests. Note that HidD_GetFeature requires you to populate the first byte of the buffer with the desired report ID.

Table 4. Request Format

Offset	Field	Size	Value	Description
0	bmRequestType	1	d0100001	Characteristics of request (dir, type, receipt)
				D7: Data transfer direction
				0 = Host to device
				1 = Device to host
				D65 Type
				0 = Standard
				1 = Class (all commands)
				2 = Vendor
				3 = Reserved
				D40 Recipient
				0 = Device
				1 = Interface (all commands)
				2 = Endpoint
				3 = Other
				4 to 31 = Reserved
1	bRequest	1	0xXX	Request number
2	wValue	2	0x03XX	Command parameters where XX is the feature
				report ID
4	wIndex	2	0	Must be 0 (zero)
6	wLength	2	0xXXXX	Number of bytes in the data stage

Note that the device stalls endpoint 0 if it cannot process a request. If you are writing your own driver it is your responsibility to reestablish communications. Some possible reasons for a command failure include:

- The command was not formatted correctly.
- The system parameters were not set up to allow command execution.
- The controller does not support the command.

Controller Initialization

To initialize the DX123 USB controller, 3M Touch Systems recommends that the host system issue a Reset command whenever the host system is powered on and is attempting to establish communication with the controller.

Touch Reports

The DX123 sends a touch report to the host computer when a user interacts with the sensor. Usually this is handled by the operating system's HID software. Most applications will not use these reports. However, if you are writing a custom driver or possibly a diagnostics program, your program will process these reports.

Under normal circumstances, the controller sends the HID coordinate data report (report 1). If you use a custom driver, it should recognize this report and translate it into mouse events. Depending on how you design your custom driver, diagnostic programs may also have access to this report.

If you use the operating system's HID driver, an application does not have access to this report. Instead, your application must change how the controller reports touches. In this case, the application should send a SetAsyncReport request to place the controller in the mode and then issue a series of GetTouchReportUtility requests to obtain the touch report. Details on this are given in the GetTouchReportUtility and SetAsyncReport requests.

HID Coordinate Data Report

This report is sent by the controller whenever there is some touch event (touchdown, drag, or liftoff) indicating some user action. It reports the state of the touch (contact, no contact) and the position of the touch on the screen. Unlike the standard MicroTouch coordinate system, the DX123 uses the HID standard and treats the upper left corner as the (0,0) coordinate.

This is an asynchronous report that is normally enabled. It is disabled when utility reports are enabled.

Offset	Field	Size	Value	Description
0	ReportID	1	0x01	HID coordinate report
1	TouchState	1	ddddddd	Touch State bit mask
				D7-D2: reserved
				D1: $1 = \text{touch report}$, $0 = \text{no touch report}$
				D0: $1 = \text{contact}$, $0 = \text{no contact}$
2	XCoord	2	0x0XXX	X-coordinate of touch event (0-0x03FF)
4	YCoord	2	0x0XXX	Y-coordinate of touch event (0-0x03FF)
6	Not used	2	0x0000	Not used

When this report is received, the software should check the D1 bit of the TouchState field. If this bit is 0, the report should be ignored.

If the D1 bit is 1, then the software should process the touch event. When the user initially touches the sensor, the D0 bit (contact) is set to 1. The controller continues to send reports with this bit set as long as the user maintains contact. When the user breaks contact, the controller sends one report with D0 set to 0 at the last known location of the previous contact. At all other times, when the user is not interacting with the sensor, the controller does not send this report.

Although the details of interfacing with various operating systems differ, generally the first contact report should be treated as a mouse button down event, the following contact reports as mouse drag events, and the final no contact report as a mouse button up event.

GetTouchReportUtility

Some applications need to monitor touch locations directly from the controller. If you are using a standard Windows HID driver, the HID Coordinate Data Report is not available. You can use the GetTouchReportUtility request to monitor touch events.

Use the SetAsyncReports to enable and disable the GetTouchReportUtility. Once you enable this report, you can issue this request as often as you want. When you finish monitoring touch, you can disable the report.

While utility reports are enabled, the usual HID touch reports are disabled. In this mode, touch is effectively disabled if you are using a standard HID driver.

Table 6. GetTouchReportUtility

Offset	Field	Size	Value	Description
0	bmRequestType	1	0xA1	Device-to-host
1	bRequest	1	0x01	Get Report
2	wValue	2	0x0307	07 = Feature report ID
4	wIndex	2	0	Always 0
6	wLength	2	8	Length of the data stage

Table 7. Data Stage

Offset	Field	Size	Value	Description
0	ReportID	1	0xXX	0x07 = Utility coordinate report
				0x01 = HID coordinate report
1	TouchState	1	ddddddd	Touch State bit mask
				D7-D2: reserved
				D1: $1 = \text{touch report}, 0 = \text{no touch}$
				report
				D0: $1 = \text{contact}$, $0 = \text{no contact}$
2	XCoord	2	0x0XXX	X-coordinate of touch event (0-0x03FF)
4	YCoord	2	0x0XXX	Y-coordinate of touch event (0-0x03FF)
6	Not used	2	0x00	Not used

The data stage of this request is almost identical to the HID Coordinate Data Report (report 1). Refer to the previous section for details on how to interpret the data stage.

Note: Early versions of this controller inadvertently placed a report ID of 1 in the data stage. Any program using GetTouchReportUtility should be prepared to accept data stages with report IDs of either 1 or 7.

Basic Commands

These commands provide basic support for software control over the controller and include:

- Calibration
- Get Status
- Reset
- Restore Defaults
- Controller ID
- Set Async Report

Calibration

This request initiates a calibration to determine the position of the sensor relative to the display.

Table 8. Calibration

Offset	Field	Size	Value	Description
0	bmRequestType	1	0x21	Host-to-device
1	bRequest	1	0x09	Set Report
2	wValue	2	0x0303	03 = Feature report ID
4	wIndex	2	0	Always 0
6	wLength	2	8	Length of data stage

Table 9. Data Stage

Offset	Field	Size	Value	Description
0	ReportID	1	0x03	Feature report ID
1	ReportSubtype	1	0x04	Calibration request
2	bCalType	1	0x01	Calibration type
3	Not used	5	0	Not used

The request cannot be processed if an invalid calibration type is given in the wValue field.

This request puts the controller into a special calibration state. A calibration program must issue a series of GetStatus requests to monitor the progress of the calibration command

You must perform a calibration after issuing a RestoreDefaults request. The sensor positioning information is restored to factory defaults after the command. The touch reported to the system may no longer be under your finger unless you calibrate again.

Using GetStatus for Calibration

Calibration will fail if either of the two calibration touches does not fall within certain bounds established by the firmware. These bounds require that the touches be in opposite quadrants of the sensor.

The host should issue GetStatus requests to determine the status of the calibration request.

Table 10. Data Stage

Command Status Byte	Description
0	Calibration failed
1	Controller is waiting for a touch on the lower-left target
2	Controller is waiting for a touch in the upper-right corner
3	Calibration completed successfully

There are no timeouts. Use the soft reset command to abort the calibration.

Here are several guidelines for using the Calibration command:

- The controller uses the initial tap to register a calibration touch. Therefore, you need only tap the coordinate target and then lift off. Instructing users to touch this way results in a more accurate calibration. A hard stylus can also be used. It is important to accurately tap the display screen target to ensure a good calibration.
- The controller stores the data in non-volatile memory. Therefore, you do not have to calibrate the screen each time you power on the system. However, you may need to recalibrate the sensor any time the video display changes size or resolution.
- You can restart calibration at any time during this sequence by issuing a Reset command.

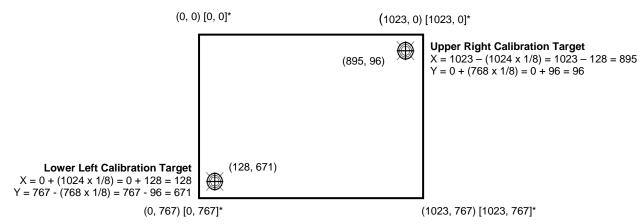
Determining Target Areas

The calibration targets (points) are located 12.5% (1/8) inward from the lower-left and upper-right corners of the video image. For example, suppose the display resolution of your Windows-based display is 1024 x 768. The Calibration command calculates the amount to move inward as follows:

- Amount to move inward in the X direction: $1024 \times 1/8 = 128$
- Amount to move inward in the Y direction: $768 \times 1/8 = 96$

A calibration program should then position the first calibration target inward from the lower left corner (0,767) and the second calibration target inward from the upper right corner (1023,0). The following illustration shows how the calibration targets are calculated for a Windows-based system. Your operating system may be different.

Figure 5. USB Calibration Target Locations



^{*}Both the video (0, 0) and controller [0, 0] coordinates origin are in the upper left corner of the screen. The controller outputs 0 to 16K on both axes independent of display screen resolution.

GetStatus

This is a request to obtain status information about the controller. It is also used to track the progress of some functions, such as calibration.

Table 11. GetStatus Request

Offset	Field	Size	Value	Description
0	bmRequestType	1	0xA1	Device-to-host
1	bRequest	1	0x01	Get Report
2	wValue	2	0x0306	06 = Feature report ID
4	wIndex	2	0x0000	Always 0
6	wLength	2	0x0008	Length of the data stage

Table 12. Data Stage

Offset	Field	Size	Value	Description
0	ReportID	1	0x06	Feature report ID
1	POCStatus	1	0xXX	Power On check status (see below)
2	CmdStatus	1	0xXX	Command status (see below)
3	TouchStatus	1	0xXX	0x00 = Sensor is not being touched
				0X01 = Sensor is being touched
4	AsyncReports	1	0xXX	0x00 = Asynchronous touch reports off
				0x01 = Asynchronous touch reports on
5	Reserved	1	0xXX	Reserved for future use
6	PassthruMode	1	0xXX	0x00 = Passthru mode off
				0x01 = Passthru mode on
7	Reserved	1	0xXX	Reserved for future use

Power-On Check (POC) Status

Various systems are checked when the controller first starts. If any failures in these systems are detected, a POC flag is set. The POC status field reports the state of these flags.

A failure in the POC also causes a flashing pattern in the controller's diagnostic LEDs.

Table 13. Power On Check Bit Fields

Bit	LED Flashes	Description
0	1	Not used
1	2	Program code checksum error
2	3	Not used
3	4	Nonvolatile memory error
4	5	Communication overflow from DSP
5	6	Communication overflow to DSP
6	7	Communication overflow from host
7	8	Communication overflow to host

Command Status

The command status contains the status of the last command request. This field is used to determine whether the last request was processed successfully. It is also used to track the progress of a multiple-stage request, such as calibration.

The GetStatus request does not affect the contents of this field. The successful or unsuccessful processing of a previous GetStatus request does not cause the command status field to change.

Table 14. Valid Command Status Field Entries

Response	Description
0x00	Failure in command processing
0x01	Command being processed
0x02	First stage processing complete for multiple-stage commands
0x03	Command complete
0x04	Soft reset occurred
0x05	Hard reset occurred

Reset

This request performs a controller reset.

Table 15. Reset

Offset	Field	Size	Value	Description
0	bmRequestType	1	0x21	Host-to-device
1	bRequest	1	0x09	Set Report
2	wValue	2	0x0303	03 = Feature report ID
4	wIndex	2	0	Always 0
6	wLength	2	8	Length of the data stage

Table 16. Data Stage

Offset	Field	Size	Value	Description
0	ReportID	1	0x03	Feature report ID
1	ReportSubtype	1	0x07	Reset request
2	ResetType	1	0x01	Reset
3	Not used	5	0	Not used

The request cannot be processed if the reset type specified by the ResetType field is invalid.

To initialize the DX123 USB controller, 3M Touch Systems recommends that the host system issue a Reset command whenever the host system is powered on and is attempting to establish communication with the controller.

Restore Defaults

This request restores the default values in the controller to the factory presets. You must recalibrate after this command since this request also restores the calibration settings and sensor orientation.

Table 17. Restore Defaults Request

Offset	Field	Size	Value	Description
0	bmRequestType	1	0x21	Host to device
1	bRequest	1	0x09	Set Report
2	wValue	2	0x0303	03 = Feature report ID
4	wIndex	2	0	Always 0
6	wLength	2	8	Length of the data stage

Table 18. Data Stage

Offset	Field	Size	Value	Description
0	ReportID	1	0x03	Feature report ID
1	ReportSubtype	1	0x08	Restore defaults request
2	Not used	6	0	Not used

Controller ID

This is a request to get information about the front end processor, including the controller type, firmware revision level, and the memory revision levels.

Table 19. Controller ID Request

Offset	Field	Size	Value	Description
0	bmRequestType	1	0xA1	Device-to-host
1	bRequest	1	0x01	Get Report
2	wValue	2	0x0304	04 = Feature report ID
4	wIndex	2	0x0000	Always 0
6	wLength	2	0x0010	Length of the data stage

Table 20. Data Stage

Offset	Field	Size	Value	Description
0	ReportID	1	0x04	Feature report ID
1	Controller Type	2	0x4F53	ASCII controller type 'OS'
3	Firmware major version	1	0xXX	Front end processor firmware major version (BCD encoding)
4	Firmware minor version	1	0xXX	Front end processor firmware minor version (BCD encoding)
5	Reserved	1	0xXX	Reserved for future use
6	ROM Checksum	2	0xXXXX	ROM checksum (little endian)
8	MaxParamSize	2	0x0040	Maximize size of data that can be accessed by the SetParameter and GetParameter request (little endian)
10	Reserved	6	0xXX	Reserved for future use

SetAsyncReport

This request starts or stops the sending of various asynchronous endpoint 1 and synchronous endpoint 0 reports. Once enabled, the controller sends an asynchronous report whenever data is available. The controller defaults to a HID-compatible coordinate report after power-up or reset. Refer to the GetTouchReportUtility and GetPassthruRawDataBlock requests for more details.

Table 21. SetAsyncReport

Offset	Field	Size	Value	Description
0	bmRequestType	1	0x21	Host-to-device
1	bRequest	1	0x09	Set Report
2	wValue	2	0x0303	03 = Feature report ID
4	wIndex	2	0	Always 0
6	wLength	2	8	Length of the data stage

Table 22. Data Stage

Offset	Field	Size	Value	Description
0	ReportID	1	0x03	Feature Report ID
1	ReportSubtype	1	0x05	SetAsyncReport
2	Not used	2	0x0000	Not used
4	ReportCmd	1	0xXX	6 = Enable Utility Touch Report 7 = Restore HID Touch Report 8 = Enable Passthru Report 9 = Disable Passthru Report
5	Not Used	3	0x00	Not used

Parameter Access

There is some information and configuration data available in the DX123. These are accessed as parameters. This section describes how to set and read parameters.

The following table contains a list of supported parameters and the settings necessary to properly access the parameters. Note that some parameters may only be read. Attempting to set these parameters will fail.

Table 23. Available Parameters

Parameter	Controller Number	Copyright
Memory Area	0x00	0x00
SubArea	0x05	0x65
Index	0x00	0x00
DataLength	0x04	0x40
Data Type	Binary, MSB first	ASCII
Access	Read/Write	Read Only

The Controller Number is application-specific and is useful for identifying individual controllers in a multiple controller system. The controller does not use this value.

The Copyright is ASCII text containing the copyright notice for the controller.

SetParameter

This is a request to modify the specified parameter in the controller's EEPROM. Refer to Table 22 for a list of available parameters.

Table 24. Set Parameter Request

Offset	Field	Size	Value	Description
0	bmRequestType	1	0x21	Host-to-device
1	bRequest	1	0x09	Set Report
2	wValue	2	0x0305	05 = Feature report ID
4	wIndex	2	0	Always 0
6	wLength	2	0x48	72 bytes in the data stage

Table 25. Data Stage

Offset	Field	Size	Value	Description
0	ReportID	1	0x05	Feature report ID
1	ReportSubtype	1	0x01	Parameter report
2	MemoryArea	1	0xXX	See Table 22
3	Not used	1	0	Not used
4	SubArea	1	0xXX	See Table 22
5	Index	1	0xXX	See Table 22
6	DataLength	1	0xXX	See Table 22
7	Not used	1	0	Not used
8	wData	64	0xXX	Data (trailing pad bytes are
				ignored)

The command cannot be processed if the memory area is not valid. It cannot be processed if the request is attempting to access data that is outside the specified memory area. This may happen if the index is too large or too much data has been requested.

The host can send a status request, as long as the endpoint is not stalled, to determine if this request was executed properly.

SetParameterIndex

This is the first part of a request to read a parameter. This sets the parameter to return with the next GetParameter request.

This request does not change the parameter's value as the SetParameter request does.

Table 26. Set Parameter Index

Offset	Field	Size	Value	Description
0	bmRequestType	1	0x21	Host-to-device
1	bRequest	1	0x09	Set Report
2	wValue	2	0x0303	03 = Feature report ID
4	wIndex	2	0	Always 0
6	wLength	2	8	Always 8

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Offset	Field	Size	Value	Description
0	ReportID	1	0x03	Feature Report ID
1	ReportSubtype	1	0x02	Set parameter index
2	MemoryArea	1	0xXX	See Table 22
3	Not used	1	0	Not used
4	SubArea	1	0xXX	See Table 22
5	Index	1	0xXX	See Table 22
6	DataLength	1	0xXX	See Table 22
7	Not used	1	0	Not used

GetParameter

This is a request to read a parameter from the controller. A SetParameter or a SetParameterIndex command must be sent *before* this command in order to specify which parameter is to be read. The controller returns the parameter's location (MemoryArea, SubArea, and Index) as part of the response.

Table 28. Get Parameter

Offset	Field	Size	Value	Description
0	bmRequestType	1	0xA1	Device-to-host
1	bRequest	1	0x01	Get Report
2	wValue	2	0x0305	05 = Feature Report ID
4	wIndex	2	0	Always 0
6	wLength	2	0x48	Number bytes in the data stage

Table 29. Data Stage

Offset	Field	Size	Value	Description
0	ReportID	1	0x05	Feature Report ID
1	Not used	1	0	Not used
2	MemoryArea	1	0xXX	See Table 22
3	Not used	1	0	Not used
4	SubArea	1	0xXX	See Table 22
5	Index	1	0xXX	See Table 22
6	DataLength	1	0xXX	See Table 22
7	Not used	1	0	Not used
8	Data	64	0xXX	Value of the parameter

The command cannot be processed if the parameter's location (MemoryArea, SubArea, and Index) is not valid.

Serial Communications In USB Mode

The DX123 controller supports the serial protocol when connected through USB mode. Use SetPassthruRawDataBlock to send raw serial data.

There are two ways to read the serial data from the touch controller. The first method uses the GetPassthruRawDataBlock to synchronously read the data. The second method uses the RawData asynchronous report.

As in standard serial communications, you may need to issue a series of GetPassthruRawDataBlock commands or receive multiple RawData reports to get a complete serial response from the touch controller.

SetPassthruRawDataBlock

This is a request to send a block of raw data to the touch controller.

Table 30. SetPassthruRawDataBlock

Offset	Field	Size	Value	Description
0	bmRequestType	1	0x21	Host-to-device
1	bRequest	1	0x09	Set Report
2	wValue	2	0x0309	Feature Report ID
4	wIndex	2	0x0000	Always 0
6	wLength	2	0x0040	64 bytes in the data stage

Table 31. Data Stage

Offset	Field	Size	Value	Description
0	ReportID	1	0x09	Feature Report ID
1	ReportSubtype	1	0x0A	Subtype RawDataBlock
2	ByteCount	1	1-56	Number of serial data bytes to send
3	Not Used	5	0	Not used, all bytes set to zero
8-63	RawData	56	ASCII data	Raw serial bytes to send; padding ignored

GetPassthruRawDataBlock

This is a request to get a block of raw serial data to the touch controller. It returns the any data currently in the controller's serial input buffer.

Table 32. GetPassthruRawDataBlock

Offset	Field	Size	Value	Description
0	bmRequestType	1	0xA1	Device-to-host
1	bRequest	1	0x01	Get Report
2	wValue	2	0x0309	Feature Report ID
4	wIndex	2	0x0000	Always 0
6	wLength	2	0x0040	64 bytes in the data stage

Table 33. Data Stage

Offset	Field	Size	Value	Description
0	Report ID	1	0x09	Feature Report ID
1	ReportSubtype	1	0x0A	Subtype: RawDataBlock
2		5	0	Not used

Offset	Field	Size	Value	Description
7	ByteCount	1	0xXX	Number of serial data bytes read
				(1 through 56)
8	RawData	56	0xXX	A block of raw data bytes

To use this mode, you must use the enable Passthru mode with the SetAsyncReport command. When you are finished, you should exit Passthru mode and return the controller to its normal operating state.

RawDataBlock Report

This asynchronous report may be sent whenever it has serial data. This report is identical to the data stage of the GetPassthruRawDataBlock command.

This report is normally enabled. This report can be disabled with a SetAsyncReport command. This report is enabled as soon you exit Passthru mode.

This report is useful only if you are using a custom driver. If you are using a standard HID driver, that driver may block this report.

CHAPTER 3

Serial Communications

This chapter discusses the fundamentals of communicating with the DX123 in serial mode. The firmware commands, which are usually issued by a driver or utility program on the host system, control the operation of the sensor controller; however developers can enter these commands directly. This chapter:

- Describes the controller default settings.
- Lists the recommended firmware commands.
- Describes how to use each of these commands.
- References additional commands developers may need to use.

The description of each command includes the command syntax, the default value, how the command works, and the expected response from the controller.

Serial Controller Default Settings

Communication Parameters

The DX123 controller communication parameters are N81 (no parity, 8 data bits, and 1 stop bit) at 9600 baud.

Data Format

Data format refers to the type of packet the controller uses to send the X/Y touch coordinates to the host system. Format Tablet is the default format for the DX123 controller. In Format Tablet, the controller sends 5 bytes per point and provides the most rapid response time to a touch.

- Format Tablet is supported by all current 3MTM MicroTouchTM controllers.
- It is the standard for current 3M Touch Systems product development and is the format used by all sensor drivers written by 3M Touch Systems.

Operating Mode

The *operating mode* specifies the conditions under which the controller sends the X/Y touch coordinates (input data packet) to the host system.

Mode Stream is the default operating mode for the DX123 controller. In Mode Stream, the controller sends a continuous stream of data packets when the screen is touched. The controller sends the data as long as a touch continues on the sensor.

Mode Stream provides the best response time and overall feel.

3M Touch Systems recommends that the sensor driver generate an interrupt as each packet in the data stream arrives. Because touchdown and liftoff events are specially coded, provided that the interrupts are sent as recommended, your software always knows exactly what the user is doing. This enables instant feedback and prevents data loss.

Communicating with the Controller

This section provides information on sending firmware commands to the controller and interpreting responses.

The commands listed in Table 33 are those that 3M Touch Systems currently uses for development and recommends that you use only these commands.

Commands to the controller are sent on the signal **Receive Data** (RXD) line as a serial data stream. For each command it receives, the controller sends a response to the host on the signal **Transmit Data** (TXD) line also as a serial data stream.

Sending Commands to the Controller

When you send a command to the controller, you must use the correct command format. The general format of a command is as follows:

<Header>Command<Terminator>

Note: The following descriptions of header, command, and terminator, use 3M Touch Systems terminal emulator key sequences. You may need to enter the sequence in a different format, depending on your emulator.

The *header* is the first character in the command string and is the ASCII start-of-header control character SOH. The hexadecimal code for the ASCII SOH control character is 01. To start the command sequence, use the key combination Ctrl A (^A). If you are working with an IBM PC compatible system, the Ctrl A key combination immediately returns an ASCII © character.

The *command*, which always follows the header, consists of ASCII uppercase letters and numbers only (printable characters).

The *terminator* is the last character of each command string and is an ASCII carriage return CR. An ASCII CR control character is 0D hexadecimal. To enter a carriage return ending the command sequence, use Enter or the key combination Ctrl M (^M).

This chapter lists each command as a string of ASCII control characters and printable characters consisting of a header, the command, and a terminator as follows:

<SOH>Command<CR>

Receiving Responses from the Controller

After executing a command, the controller returns a response to the host system. Each controller response consists of a header, the command response, and a terminator in the following format:

<Header>Command Response<Terminator>

Note: The following descriptions of header, response, and terminator, use 3M Touch Systems terminal emulator key sequences. The format of controller responses varies depending on the terminal emulation mode you are using.

The *header* is the first character in the response string and is the ASCII start-of-header control character SOH. The hexadecimal code for the ASCII SOH control character is 01. If you are working with an IBM PC compatible system in terminal mode, the SOH control character returns a \odot character to the screen.

The *response*, which always follows the header, is a range of ASCII characters depending on the type of command sent. Responses can be in many forms. For example, one standard response is **0** (ASCII character 'zero' or 30 hexadecimal). This response indicates a successful command completion for most commands, while it indicates a failed completion for other commands. Refer to the Firmware Commands section for a description of what the response indicates for *each* particular command.

Another standard response is 1 (ASCII character 'one' or 31 hexadecimal). In most cases, this response indicates the command failed. The controller received an invalid command that it could not execute.

Some possible reasons for a command failure include:

- The command was not formatted correctly.
- The system parameters were not set up to allow command execution.
- The controller does not support the command.

The *terminator* is the last character of each response string and is an ASCII carriage return CR. The hexadecimal code for the ASCII CR control character is 0D hexadecimal. The value returned in the response will be the ASCII control character for a carriage return, displayed on the screen as the cursor moving to the next line.

In this chapter, responses are shown as a string of ASCII characters consisting of a header, the response, and a terminator as follows:

<SOH>Response<CR>

Controller Initialization

To initialize the DX123 serial controller for new development, 3M Touch Systems recommends that the host system issue a Reset command whenever the host system is powered on and is attempting to establish communication with the controller.

Firmware Commands

Developers may use this information when writing touch applications, developing custom drivers or touch configurations, or testing their touch systems. Developers can use firmware commands to initialize the controller, select operating modes, specify data formats, and execute diagnostic functions.

Most sensor users do *not* have to use firmware commands to use their touch systems. For example, users can use MicroTouchTM software or equivalent software to calibrate the sensor or to determine the controller type and firmware version.

Caution: This document assumes you are familiar with firmware commands and how to use them. Executing some commands may alter the performance of your sensor and render it inoperable. You should be aware of the results before executing any firmware commands.

To optimize the performance of the DX123 serial controller and simplify the development of custom drivers, 3M Touch Systems recommends you use only the commands listed in the following table for current development.

Note: When you enter commands in terminal mode, precede each command with <CTRL> A to enter the start of header.

Table 34. Firmware Commands for DX123 Serial Development

Command	Code	Description
Calibrate 2 Point	CX	Initiates a 2-point calibration routine.
Get Controller	Q002	Used to determine a controller ID number for
Number		multiple display applications.
Hard Reset	Н	Reboots the processor from flash
Null Command	Z	Queries the controller and waits for a response.
Output Identity	OI	Identifies the controller type and the firmware
		version.
Parameter Restore	PRD	Restores default Q Parameters to working values
Defaults		
Reset	R	Aborts a command in process
Restore Defaults	RD	Returns the controller to the factory default
		operating parameters. Note: the serial port is reset to
		N81 format tablet and calibration data is lost.
Set Controller	W002	Used to determine a controller ID number for
Number		multiple display applications.
Unit Type	UT	Returns controller unit type string and status.

Calibrate Extended

Syntax: <SOH>CX<CR>

Note: This command should not be used when MT 7 Software is being used. The CX command will interfere with the auto orientation algorithm. To calibrate, use the 2-point calibration in MT 7 Software.

Description: Initiates an interactive 2-point calibration.

During the calibration process, you define the active area of the sensor by mapping locations to an absolute X/Y coordinate system. You touch two *target areas* on the screen. Touching the target areas sends the X/Y coordinates for those touch points to the controller. The controller calculates all other touch points based on these two points.

The Calibrate Extended command sets the calibration targets (points) inward from the corner of the video image. Setting the targets inward makes the calibration process easier and more accurate.

Guidelines for Calibrate Extended

Here are several guidelines for using the Calibrate Extended command:

- The controller uses the data immediately before liftoff to register a calibration touch. Therefore, you can touch the screen, move your finger to the target, hold for a few seconds, and then lift off. Instructing users to touch this way results in a more accurate calibration.
- The controller stores the data in non-volatile memory (NOVRAM). Therefore, you do not have to calibrate the screen each time you power on the system. You should, however, recalibrate the sensor any time the video display changes size or resolution.
- You can restart calibration at any time during this sequence by issuing a Reset command and reissuing a CX command.

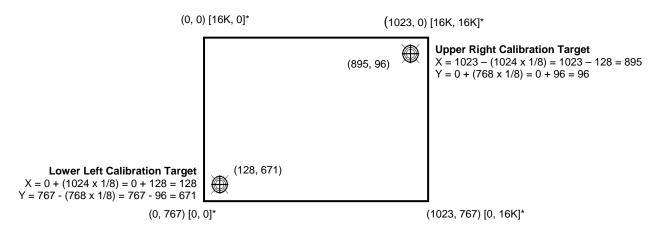
Determining Target Areas

The default calibration targets (points) are located 12.5% (1/8) inward from the corners of the video image. For example, suppose the display resolution of your display is 1024 x 768. The Calibrate Extended command calculates the amount to move inward as follows:

- Amount to move inward in the X direction: $1024 \times 1/8 = 128$
- Amount to move inward in the Y direction: $768 \times 1/8 = 96$

The Calibrate Extended command then positions the first calibration target inward from the lower left corner and the second calibration target inward from the upper right corner. The following illustration shows how the calibration targets are calculated.

Figure 6. Serial Calibration Target Locations



*The coordinates are in *video* terms, with the origin (0, 0) in the upper left corner of the screen. Examples from the *controller's* perspective, however, place the origin at the lower left corner of the screen (numbers in brackets). The controller outputs 0 to 16K on both axes independent of display screen resolution.

Calibrate Extended Procedure

To use the CX command:

- 1. Enter the Calibrate Extended (CX) command. The controller sends an initial acknowledgment of <SOH>0<CR>.
- 2. Touch the screen at a lower left target, which is located 12.5% (1/8) in from the corner of the video image. The controller returns an acknowledgment of <SOH>1<CR>. This is a positive response. If you receive a negative response <SOH>0<CR>, you can cancel the calibration by issuing a Reset command and then start over again.
- 3. Touch the screen at an upper right target, which is located 12.5% (1/8) in from the corner of the video image. The controller returns an acknowledgment of <SOH>1<CR>. This is a positive response. If you receive a negative response, you must start over again.

Touching the two valid calibration points results in a successful calibration. If either calibration point is invalid, the calibration fails. The EX II 9720SC controller restores the previous calibration values. If the Calibrate Extended failed, repeat the CX process.

Response:

<SOH>1<CR> Positive response.

Indicates that the controller received a valid touch coordinate (point) when the target was touched. Two valid touch points indicate a successful calibration.

<SOH>0<CR> Negative response

Indicates that the touch point is out of range of the expected target area. If you receive a negative response, you must start over again.

No Response

Indicates that the user did not touch the target long enough to provide an accurate calibration point.

Get Controller Number

Syntax: <SOH>Q002<CR>

Response: <SOH>XXXXXXXXXCR> where each X is a hexadecimal digit, most significant digit

first.

Description: This command is used to get a controller number for applications use. The controller does

not use this value. This is useful for identifying individual controllers in a multiple

controller system.

Null Command

Syntax: <SOH>**Z**<CR>

Response: <SOH>0<CR> Positive response.

Description: Queries the controller and waits for a response.

Use Z to determine that you are communicating with the controller or to make sure that a utility is communicating with the controller. Using this command does not affect the

controller's current operating parameters.

Output Identity

Syntax: <SOH>OI<CR>

Response: <SOH>*CcXxxx*<CR>

where:

Cc = Two ASCII characters that describe the type of $3M^{TM}$ MicroTouchTM

controller.

Xxxx = This is a unique identifier not necessarily the actual firmware revision number.

Description: Returns a 6-character identifier, which describes the controller type and the firmware

version number. The output identity for the DX123 controller is OSXxxx.

Restore Defaults

Syntax: <SOH>**RD**<CR>

Response: <SOH>0<CR> Positive response.

Description: Returns to the factory default operating parameters. The Restore Defaults command

copies the 3M Touch Systems factory default parameters from ROM to the non-volatile

memory (NOVRAM) and then executes a Reset command.

The following table lists the factory defaults for the DX123 serial controller. The Restore Defaults command is useful in situations where inadvertent commands to the controller

have rendered the sensor inoperative.

Table 35. DX123 Factory Default Settings

Operating Parameter	Default
Baud Rate	9600
Serial Communication Settings	N, 8, 1
Data Format	Format Tablet
Operating Mode	Mode Stream
Return to Factory Calibration	Yes

Note: After you issue a Restore Defaults command, you must recalibrate your sensor.

Set Controller Number

Syntax: <SOH>W002<CR>xxxxxx<CR> Where each x is a hexadecimal digit, most significant

digit first.

Response: <SOH>0<CR> Positive response.

Description: This command is used to set a controller number for applications use. The controller does

not use this value. This is useful for identifying individual controllers in a multiple

controller system.

Unit Type

Syntax: <SOH>UT<CR>

Response: <SOH>0<CR> Positive response.

Responds with an 8-character identity string. This string identifies the type of controller currently attached to the system, lists the features supported by the controller, and outputs

the status of the controller hardware (a self-test code).

Description: Returns an identification code up to 8 ASCII characters in the following format:

<SOH>*TtFfffSs*<CR>

where:

Tt = Two ASCII characters that identify the controller type.

B1 Indicates a DX123 controller

Ffff = Four ASCII characters that indicate the features supported by the controller.

**** Indicates no additional features configured

Ss = Two ASCII characters that provide status information about the controller hardware. The two characters represent one byte. Each character is in the range 0 to 9 and A to F.

Each bit can be set to 1 or 0, where $\mathbf{1} =$ an error and $\mathbf{0} =$ no error. So a response of:

00 = No diagnostic errors (normal response)08 = No default parameters

The DX123 running with no errors returns the following string:

<SOH> **B1****00** <CR>

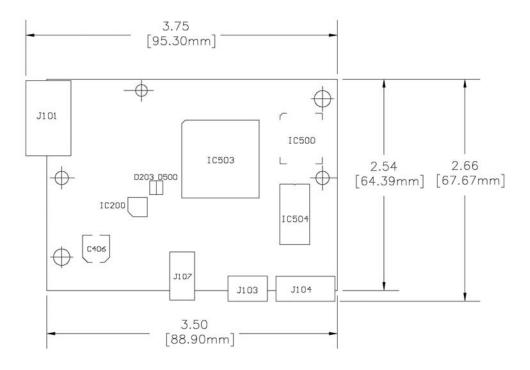
APPENDIX A

DX123 Controller Specifications

This section provides controller specifications such as power and environmental requirements. The DX123 controller can be either USB or serial communications. This controller should be internally mounted in your display.

The following figure shows the overall dimensions of the DX123 controller and the locations of the mounting holes and connectors.

Figure 6. DX123 Controller Dimensions



Technical Specifications

The information provided in this document is intended as a guide only. For the latest detailed engineering specifications, please contact your 3M Touch Systems, Inc. Application Engineer. 3M Touch Systems, Inc. is committed to continually improving product designs, as a result, product specifications may be subject to change without notification.

Physical Dimensions

2.66 in. (67.6 mm) x 3.75 in. (95.3 mm) x 0.45 in.(11.4 mm)

Board Level Functions

Power 5 VDC / 12 VDC (80 mA typical, 100 mA max); \pm 10% regulation 50 mV maximum ripple and noise

Regulatory Requirements

CE			Compliant
Radiated Emissions – EN 55022:1998	Class A		Compliant
AC Mains Conducted Emissions – EN 55022:1998	Class A		Compliant
Telco Lines Conducted Emissions	N/A		N/A
RFI – EN 61000-4-3 / ENV 50140	Class A		Compliant
CRFI – EN 61000-4-6	N/A	Cable <3 meters long	N/A
EFT (Burst Immunity) – EN 61000-4-4	Class B		Compliant
ESD Susceptibility – IEC 61000-4-2	Class B		Compliant
Surge – EN 61000-4-5	Class B		Compliant
Harmonics – EN 61000-3-2	Class A		Compliant
Voltage Dips – EN 61000-4-11	Class B	< 5% V	Compliant
	Class C	< 70% V	
Voltage Interruptions – EN 61000-4-11	Class C		Compliant
FCC Class A / CISPR22 Class A	Class A		Compliant
VCCI Class A ITE Emissions (Japan)	Class A		Compliant
AS/NZS 3548:1995/CISPR 22 Class A ITE	Class A		Compliant
Emissions (Aus)			
UL/cUL			Compliant

Compliant

Ambient Operating and Storage Environmental Conditions

Note: All humidity is non-condensing

Operating Temperature Range -40°C to +70°C

Operating Humidity Range <36° C 0-90% RH ≥36° C (refer to Figure 7)

Storage Temperature Range -50°C to +85°C

Storage Humidity Range $<36^{\circ}$ C 0-90% RH $\geq 36^{\circ}$ C (refer to Figure 7)

Performance and Reliability

Minimum Touch Response 20 msec.

Touch Resolution – (Maximum addressable coordinates generated by the 16K x 16K

controller)

ESD Susceptibility¹

±8 kV Contact Discharge* – Class 2 per section 9 of IEC 61000-4-2 Compliant

1 false touch allowed

±20KV Air Discharge – Class 1 per section 9 of IEC 61000-4-2

Normal Operation – No false touches

MTBF (by MIL Std. 217F Calculation) 200,000 Hours

3M Touch Systems Parameters

Accuracy vs. Dynamic Temperature Change

Maintains 99.0% Accuracy

(tested at 0° C to 60° C with a 0.5° C/minute temperature

ramp)

Sensor Compatibility 3MTM MicroTouchTM Dispersive Sensors

Communications Protocol Serial RS-232 and USB Rev 1.1

¹ ESD discharges to a 3M Touch Systems sensor connected to the controller



