# 3M™ MicroTouch™ Controller RX142 Reference Guide

## Formerly
## SC400 Serial Resistive

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

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# Contents

# Introduction

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

This reference guide, designed for developers of touch systems, provides installation and configuration information for the 3M™ MicroTouch™ RX142 controller. This document includes information on integrating the RX142 controller into your design, communicating with the controller, installing the MT 7 software user interface, and troubleshooting setup problems. It also includes a complete description of the firmware commands and controller specifications.

3M Touch Systems is committed to being a premier supplier in touch systems throughout the world. As a 3M Touch Systems customer, you are aware that we have strong internal programs that meet or exceed environmental regulations of our customers and the regions in which we conduct business.

## 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.

## 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 RX142 controller was designed to enable touch in conjunction with other 3M™ MicroTouch™ products. This controller is intended for internal mounting 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.<br>⚠ **CAUTION:** Indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury and/or property damage.<br>**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 death:**<br>Do not install or use this product in a hazardous location.<br>**To reduce the risk of fire and/or explosion which could result in serious injury or property damage:**<br>Do not use this product in any outdoor environment unless NEMA standards (or similar standards such as IP rating) are followed.<br>**To avoid the risk of electric shock which could result in serious injury or death:**<br>• Do not use a damaged power supply.<br>• Do not use a power cord that is frayed or otherwise damaged. |

| ⚠ CAUTION |
| --- |
| **To reduce the risks associated with improper disposal, which if not avoided may result in minor or moderate injury from ground water contamination:**<br>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:**<br>Dispose of the display in accordance with federal, state and local regulations.<br>**To reduce the risk of the potentially hazardous situations associated with the use of isopropyl alcohol which may result in minor or moderate injury or property damage:**<br>Follow all instructions and recommendations in the manufacturer's Material Safety Data Sheet and product label. |

## 3M Touch Systems Support Services

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

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

- Display 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 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 found on our website at:
http://www.3M.com\touch/

CHAPTER 1

# Integrating the RX142 Controller

The 3M™ MicroTouch™ RX142 serial resistive controller is an accurate, small outline, low cost, temperature stable controller capable of supporting a wide range of resistive sensors. It is designed for internal mounting in OEM applications.

This chapter covers the following RX142 controller specifications:

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

## Overview of the RX142 Controller

The RX142 controller is an uncased device using an RS-232 serial interface. The communication parameters for the RX142 are N81 -- no parity, 8 data bits, and 1 stop bit.

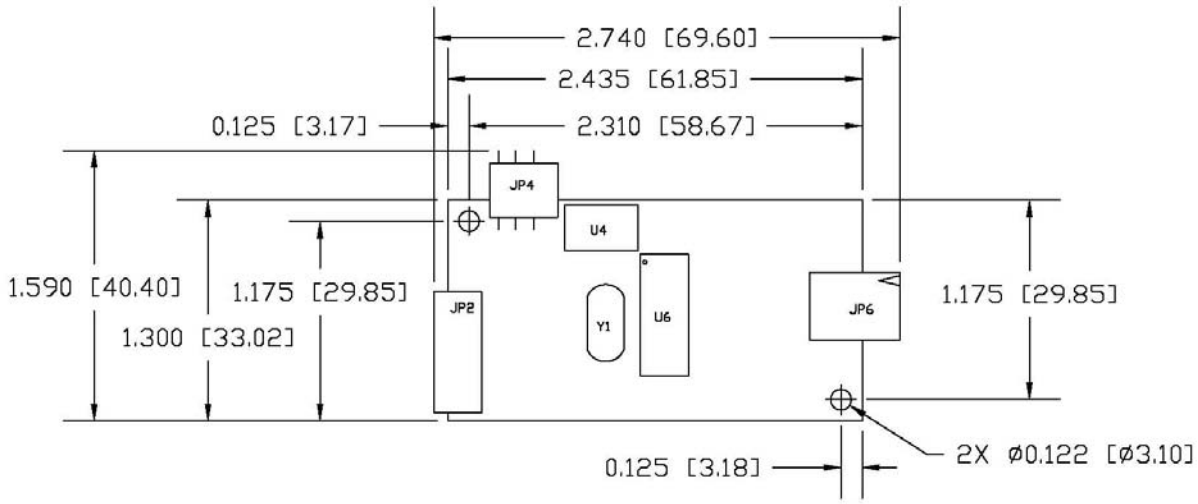
To integrate and test the RX142 controller, you need the following items:

- A 4-wire resistive sensor.
- A method of establishing the serial data communication between the controller and your system. The standard 3M™ MicroTouch™ RS-232 plug and play serial cable (P/N 7319630) is recommended.
- A power source.
- A software utility or driver with a calibration routine.

**Note:** You can use MicroTouch™ Software, which includes the touch driver and utilities software.

The controller measures 1.3 x 2.4 inches, or 1.6 x 2.7 inches total profile over the connectors. Allow additional clearance for the mating connectors. The total height profile is 0.40 inches from the thru hole pins on the trace side of the board to the top of the highest component on the opposite side. The RX142 has a 4-pin sensor connector (JP6), an 8-pin serial plug and play cable connector (JP2), and a 3-pin power connector for selectable input voltages.

**Figure 1. RX142 Overall Dimensions**




## Handling and ESD Protection

When mounting the sensor and controller, use normal precautions for handling electrostatic sensitive devices. The RX142 has internal protection to ±20 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 further specifications.

## Establishing the Data Connection

The RX142 controller requires an RS-232 serial plug and play communication cable attached to connector JP2. You can use a standard 3M™ MicroTouch™ RS-232 plug and play cable (P/N 7319630) or an equivalent interconnect. One end of this cable plugs into the RS-232 connector (JP2) on the RX142 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. Table 1 describes the interconnections for the RS-232 cable.

**Table 1 COM Cable for RX142 Controller**

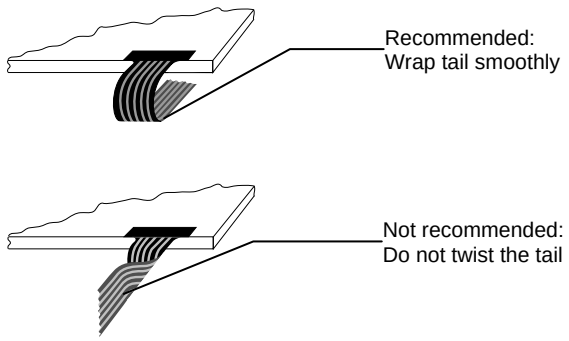
| PC Side (9-Pin D) | | | Controller Side (8-Pin Molex) | |
|---|---|---|---|---|
| **Pin** | **RS-232 Assigned** | **Jumpered to:** | **Pin** | **Description** |
| 1 | Data Carrier Detect (DCD) | 4 and 6 DTR and DSR | 8 | DCD, DTR, DSR |
| 2 | Receive Data (RXD) | | 2 | Transmit Data (TXD) |
| 3 | Transmit 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 |

| PC Side (9-Pin D) | | | Controller Side (8-Pin Molex) | |
|---|---|---|---|---|
| **Pin** | **RS-232 Assigned** | **Jumpered to:** | **Pin** | **Description** |
| 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 | | | 6 | DC power jack (+5 VDC) |
| Pin | | | 7 | Cable shield connected to ground. DC power jack ground |
| Shell | | | 7 | Chassis (earth) ground |

## 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.

Ensure 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. Good engineering design avoids awkward electrical connections.




## Supplying Power to the Controller

You must supply the RX142 controller with power. The source must deliver (for 5 VDC) 16 mA typical, 27 mA touching; ± 5% regulation or (for 12 VDC) 19 mA typical, 30 mA touching; ± 5% regulation, with a maximum ripple and noise of 50 mV peak-to-peak.

You can supply power to the RX142 controller using any of the following methods. The voltage input can be either +5VDC or +12VDC. In Sleep Mode the controller draws less than 5 mA.

**⚠ CAUTION**

**To avoid possible damage to the controller,** you must provide a path for electrostatic discharge (ESD). The controller mounting hole near 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.

**Note:** To avoid possible damage to one or both of the power supplies, do not supply both internal power and external power to the controller. Power from two sources could cause damage.

### Using an Internal Power Supply to JP4

Provide power directly to the controller using JP4 (AMP 640457-3). Use a mating 3-pin connector (AMP 3-640469-3 or equivalent) and connect Pin 1 to 5VDC power and Pin 2 to the return or (alternately) 12VDC to Pin 3 and Pin 2 to the return.

### Using an Internal Power Supply with a Custom Serial Cable Design

When creating a custom serial cable connection, you can provide power to the controller through the mating Molex connector. Refer to Table 1 for more information on actual cable connections. Unlike using JP4 to supply power, you can only use 5VDC at the serial interface.

1. Obtain an 8-pin Molex connector 51004-0800.
2. Attach power and ground to the connector, (Pin 6: +5V, Pin 7: Ground).

## Mounting the Sensor

The RX142 controller will work with sensors that meet the following specifications. The sensor may work beyond these limits but with reduced performance.

| | Minimum | Maximum |
|---|---|---|
| Capacitance top sheet to substrate | None | 70nF |
| Resistance corner to corner or side to side | 100 Ohm | 500 Ohm |
| Resistance top sheet | 100 Ohm | 5k Ohm |

It is critical for you to understand the tail orientation of your sensor prior to connecting the controller. This will affect how the controller interprets your touch on the sensor. Refer to the Chapter on controller communications for additional details.

## Sensor Cable Connector

The sensor cable has a 4-pin single row locking female connector that plugs into the controller. The controller is compatible with the “XYXY” latched connector pinout, not the “”XXYY” style, non-latched connector pinout. Here, X or Y refers to one or the other sheet, and + or – refers one or the other side of a sheet. The calibration process sorts out left/right and up/down.

Connector pins 1 and 3 must be connected to one sheet and pins 2 and 4 must be connected to the other sheet.

1. Y-
2. X+
3. Y+
4. X-

## Status Light (LED) Diagnostics

3M Touch Systems controllers are highly reliable units; however, there may be occasions when the controller does not perform exactly as you expected. The RX142 controller provides diagnostic feedback with a light emitting diode (LED) on the component side of the board that indicates the status of the sensor unit. During normal operation, when you touch the sensor the LED becomes bright as long as the controller detects a touch. A flashing (or blinking) LED during power-up indicates the controller's power-on self-test failed. Refer to the following table for a description of each error code.

**Table 2 LED Diagnostic Codes for RX142 Controllers**

| Flashes | Self Test Condition | Self Test Bit | Description | What to do… |
|---|---|---|---|---|
| 1 | Reserved. | 0 | Reserved | |
| 2 | ROM Error | 1 | Firmware EPROM checksum verification error | No recovery. Replace the controller. |
| 3 | Reserved. | 2 | Reserved | |
| 4 | Block 1 checksum Error | 3 | Operating parameters invalid (using defaults). | Cycle power off and on. |
| 5 | Hardware error | 4 | Power up sensor connector voltages out of range | Check connections to sensor |
| 6 | Reserved. | 5 | Reserved | |
| 7 | Reserved. | 6 | Reserved | |

## 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 monitor and computer.
2. Adjust the contrast and brightness to suit your personal preference and working environment.
3. Adjust the horizontal and vertical position controls on the monitor to center the image on the sensor.

## Installing 3M™ MicroTouch™ Software

3M™ MicroTouch™ Software includes the driver that enables your sensor to work with your computer. 3M Touch Systems has touch drivers for many operating systems, including Windows Vista, XP, XP embedded, 2000, 9X, Windows Me, Windows CE, and Windows NT 4.0 (refer to the website for a complete listing). You must be sure to install the correct software for your operating system.

3M™ MicroTouch™ Software includes a control panel for setting your sensor preferences and a diagnostic utility. If you are experiencing problems with the sensor, you can use the diagnostic utilities provided to locate the controller and test the sensor.

For more information on connecting your cables and installing and using the sensor control panel and utilities, refer to the 3M™ MicroTouch™ Software User Guides available on the corporate website at www.3Mtouch.com.

CHAPTER 2

# RX142 Controller Communications

This chapter discusses the fundamentals of communicating with the RX142 controller. The firmware commands, which are usually issued by a driver or utility program on the host system, control the operation of the 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.

## Controller Default Settings

### Communication Parameters

The RX142 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 format for the RX142 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 3M™ MicroTouch™ controllers.
- It is the standard for current 3M Touch Systems product development and is the format used by all touch drivers written by 3M Touch Systems.

Refer to the Format Tablet command in the firmware reference section.

### 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 operating mode for the RX142 controller. In Mode Stream, the controller sends a continuous stream of data packets when the sensor 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 touch 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 the following table 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 ☺ character to the sensor.

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. See the firmware reference 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 sensor 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 RX142 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 touch system users do *not* have to use firmware commands to use their touch systems. For example, users can use MicroTouch™ 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 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 RX142 touch 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 3 Firmware Commands for RX142 Development**

| Command | Code | Description |
|---|---|---|
| Calibrate 3 Point | C3 | Initiates a 3-point calibration routine. |
| Enter Sleep | ES | Controller enters low power mode. |
| Format Tablet | FT | Outputs the X/Y touch coordinate data in a five-byte packet. |
| Get Controller Number | Q002 | Used to determine a controller ID number for multiple monitor applications. |
| Mode Stream | MS | Sends a continuous stream of X/Y coordinate data when you touch the sensor. |
| Null Command | Z | Queries the controller and waits for a response. |
| Output Identity | OI | Identifies the controller type and the firmware version. |
| Reset | R | Initializes the hardware and the firmware, causes the controller to stop sending data, and recalculates the environmental conditions. |
| 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 Number | W002 | Used to determine a controller ID number for multiple monitor applications. |
| Unit Type | UT | Returns controller unit type string and status. |

## Calibrate 3 Point

Syntax: <SOH>**C3**<CR>

Response: <SOH>**0**<CR> Positive response to initializing the command. When C3 is first issued the controller responds with <SOH>**0**<CR>. After that, as the user touches each of the three targets, the controller issues an <SOH>**1**<CR>.

<SOH>**1**<CR> Positive touch response.
A valid touch coordinate (point) response (‘1’) signifies that a touch coordinate was detected and is in range of the expected sensor target area. Three valid point responses indicate successful calibration.

<SOH>**0**<CR> Negative touch response.
An invalid touch coordinate (point) response (‘0’) is returned if the touch coordinate is out of range. If either calibration point is invalid, the touch coordinates are discarded and the calibration points remain unchanged from their previous values. If you receive a negative response, you must start over again.

<SOH>**2**<CR> Negative touch response.
An invalid touch coordinate (point) response (‘2’) is returned if the user did not touch the target long enough to provide an accurate calibration point.

Description: Initiates an interactive 3-point calibration.

In addition to scaling the Format Tablet output to the display, this command corrects for sensor orientation and sensor pinout variations. This information will be maintained by the controller. The Calibrate 3 Point command initiates an interactive calibration procedure which defines the active area of the sensor by mapping locations to an absolute X,Y coordinate system. Touch points generated subsequent to a successful calibration operation are calculated based upon these calibration points. Calibrate 3 Point utilizes inset calibration points located 12½ percent inboard from the sensor corners (at touch X,Y locations 128,128, 895,895 and 128,895) for accuracy and ease of operation.

## Guidelines for the C3 Commands

Here are several guidelines for using the C3 commands:

- The controller uses the data immediately before liftoff to register a calibration touch. Therefore, you can touch the coordinate 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. Therefore, you do not have to calibrate the sensor each time you power on the system. You should, however, recalibrate the sensor any time the video display area changes physical size.
- You can restart calibration at any time during this sequence by issuing a Reset command and reissuing a C3 command.

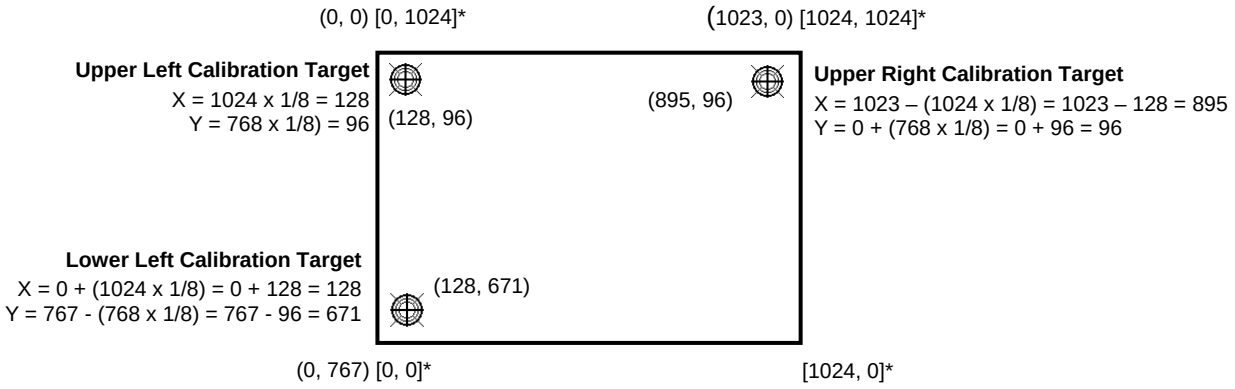
### Determining Target Areas

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 monitor is 1024 x 768. The C3 calculates the amount to move inward as follows:

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

The C3 command then positions the first calibration target inward from the lower left corner and the second calibration target inward from the upper right corner. Figure 2 shows how the calibration targets are calculated.

**Figure 2 Calibration Target Locations**




***** The coordinates are in *video* terms, with the origin (0, 0) in the upper left corner of the sensor. Examples from the *controller's* perspective however, place the origin at the lower left corner of the sensor (numbers in brackets). The controller outputs 0 to 1024 for both axes, regardless of display resolution.

## Enter Sleep

Syntax: <SOH>**ES**<CR>

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

Description: This command is a power management feature that lets you put the controller into a low power mode (4-5 mA) when not in use. Send this command to put the controller in a low power state. The controller returns to a normal power level on touch. If you need to send a command to the controller when it is in a low power state, first raise CTS.

## Format Tablet

Syntax: <SOH>**FT**<CR>

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

The controller will respond with ACK for compatibility with older controllers. This format is the only format supported by this controller.

With the controller in Format Tablet mode, touching the sensor causes the controller to return a response in the following format:

*SXxYy*

*S* = Status byte, first byte of data. Refer to Table 4.
*Xx* = X (horizontal) coordinate data; second and third bytes of data.
*Yy* = Y (vertical) coordinate data; fourth and fifth bytes of data.

Description: Outputs the X/Y touch coordinate data in a 5-byte packet. The packet includes 1 status byte and 4 bytes of binary X/Y coordinate data. The protocol also establishes the X and Y coordinate output as 14 binary bits providing a range of 0 to 16,383.

The low order bits (X3 – X0 and Y3 – Y0) are not significant in a 1024 by 1024 sensor because data can fluctuate with each touch, and therefore may not be completely accurate.

**Table 4 Data Sequence**

| | | MSB | | | Bits | | | | LSB |
|---|---|---|---|---|---|---|---|---|---|
| **Data Sequence** | | **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| S | Byte 1 | 1 | S6 | S5 | S4 | S3 | S2 | S1 | S0 |
| X | Byte 2 | 0 | X6 | X5 | X4 | X3 | X2 | X1 | X0 |
| X | Byte 3 | 0 | X13 | X12 | X11 | X10 | X9 | X8 | X7 |
| Y | Byte 4 | 0 | Y6 | Y5 | Y4 | Y3 | Y2 | Y1 | Y0 |
| Y | Byte 5 | 0 | Y13 | Y12 | Y11 | Y10 | Y9 | Y8 | Y7 |

Table 5 defines the status bits (Byte 1) for the Format Tablet data.

**Table 5 Format Tablet Status Bits**

| Bit | Description | Values |
|---|---|---|
| S0 – S5 | Reserved | — |
| S6 | Proximity (touch state) | 1 = Sensor is being touched (a touchdown or a continued touch).<br>0 = Sensor is not being touched (a touch liftoff or inactive).<br>When the proximity bit changes from 1 to 0 (touch liftoff), the controller outputs one final set of X/Y coordinate data with the bit equal to 0 and the X/Y coordinate data equal to the last touch point. |
| S7 | Packet synchronization | Always 1. |

## Get Controller Number

Syntax: <SOH>**Q002**<CR>

Response: <SOH>**XXXXXXXX**<CR> 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.

## Mode Stream

Syntax: <SOH>**MS**<CR>

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

The controller will respond with ACK for compatibility with older controllers. This format is the only format supported by this controller.

Description: Sends a continuous stream of X/Y coordinate data when you touch the sensor. The controller continues to send data as long as you touch the sensor. The controller sends the data even if the touch is stationary and unchanging.

The format of the coordinate data depends on the last format command received by the controller.

## 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 Touch Systems 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 RX142 controller is SC*Xxxx*.

## Reset

Syntax: <SOH>**R**<CR>

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

Description: Initializes the hardware and the firmware, causes the controller to stop sending data, and recalculates the environmental conditions (for example, stray and offset values). The Reset command also cancels the Format Raw, Calibrate Raw, and Calibrate Extended commands and returns the controller to normal operation.

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.

The amount of time needed to execute a Reset command ranges from 225 milliseconds to 800 milliseconds. Therefore, the application program should wait and be sure it receives the command response before issuing another command to the controller following the reset.

## 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 RX142 controller. The Restore Defaults command is useful in situations where inadvertent commands to the controller have rendered the sensor inoperative.

**Table 6 RX142 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 (a multi-step command)

Syntax: <SOH>**W002**<CR>
Response: <SOH>**0**<CR> Positive response

Syntax: **xxxxxxxx**<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

<SOH>**UT**<CR>

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).

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.

**SC** Indicates the RX142 series of controllers

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

**R** Indicates a resistive controller
**4** Indicates either 4 wire controller (RX142) or an 8 wire controller (RX182)
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.

Table 2 defines the meaning of each bit in the status byte. Each bit can be set to 1 or 0, where **1** = an error and **0** = no error. So a response of:

**00** = No diagnostic errors (normal response)

The RX142 running with no errors returns the following string:

<SOH> **SCR4**00** <CR>

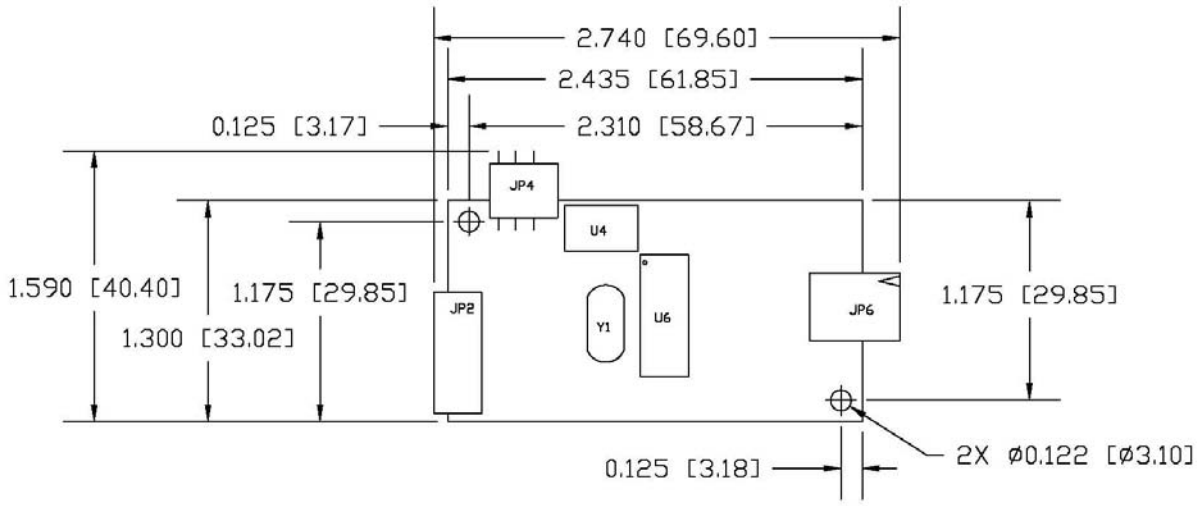
APPENDIX A

# RX142 Controller Specifications

This section provides controller specifications such as power requirements, environmental requirements, and cable connectors. The RX142 controller is a compact RS-232 serial controller. This controller was designed to be mounted inside your monitor.

The following figures show the overall dimensions of the RX142 controller and the locations of the mounting holes and connectors.

**Figure 3 RX142 Touch Controller**



# Technical Specifications

## Physical Dimensions

2.74 in. x 1.49 in. x 0.45 in. (69.6 mm x 37.8 mm x 11.4 mm)

## Board Level Functions

| | |
|---|---|
| Power | 5 VDC (16 mA typical, 27 mA with touch); ± 5% regulation |
| | 12 VDC (19 mA typical, 30 mA with touch); ± 5% regulation |
| | 50 $mV_{pp}$ maximum ripple and noise |

## Regulatory Requirements

| | | | |
|---|---|---|---|
| CE | | | Compliant |
| Radiated Emissions – EN 55022:1998 | Class B | | Compliant |
| AC Mains Conducted Emissions – EN 55022:1998 | Class B | | Compliant |
| Telco Lines Conducted Emissions | N/A | | N/A |
| FCC Class B / CISPR22 Class B | Class B | | Compliant |
| VCCI Class B ITE Emissions (Japan) | Class B | | Compliant |
| AS/NZS 3548:1995/CISPR 22 Class B ITE Emissions (Aus.) | Class B | | Compliant |
| 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 1 | | Compliant |
| Surge – EN 61000-4-5 | Class B | | Compliant |
| Harmonics – EN 61000-3-2 | Class A | | Compliant |
| Flicker – EN 61000-3-3 | | | Compliant |
| Power Frequency Magnetic Field – EN 61000-4-8 | Class A | | Compliant |
| Voltage Dips – EN 61000-4-11 | Class B | < 5% V | |
| | Class C | < 70% V | Compliant |
| Voltage Interruptions – EN 61000-4-11 | Class C | | Compliant |
| UL/cUL | | | Compliant |

## Ambient Operating and Storage Environmental Conditions (All Humidity is Non-Condensing)

| | |
|---|---|
| Operating Temperature Range | 0 °C to +65 °C |
| Operating Humidity Range | < 36° C 0-95% RH |
| | ≥ 36 °C see Figure 1 below |
| Storage Temperature Range | - 20 °C to +75 °C |
| Storage Humidity Range | < 36°C 0-80% RH |
| | ≥ 36 °C see Figure 1 below |

## Performance & Reliability

Minimum Touch Duration 14 ± 1 msec

Touch Resolution – 1024 x 1024
(Maximum number of addressable coordinates generated by the controller)

ESD Susceptibility

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

±20 kV Air Discharge* – Class 1 per section 9 of IEC 61000-4-2 Compliant
Normal Operation – No false touches

* ESD discharges to a sensor connected to the controller

MTBF (by MIL Std. 217F Calculation) > 400,000 Hours

## Touch System Parameters

Accuracy vs. Dynamic Temperature Change Maintains 1% Accuracy
(tested at 0 deg. C to 60 deg. C with a 0.5 deg. C/minute temperature ramp)

Communications Protocol Serial RS 232

## Storage and Operating Temperature with Humidity Conditions