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Client: Alion Science and Technology
Model: Sensors Communication Module
FCC ID: U3M-SCM2007
Standard: FCC 15.247

Appendix H: Manual

Please refer to the following pages.

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User's Manual

Sensors Communications Module

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This device complies with Part 15 of the FCC Rules.
Operation is subject to the following two conditions:
1. this device may not cause harmful interference, and
2. this device must accept any interference
received, including interference that may cause
undesired operation.

FCC ID: U3M-SCM2007

IMPORTANT NOTE: To comply with FCC RF exposure compliance requirements, the antenna
used for this transmitter must not be co-located or operating in conjunction with any other
antenna or transmitter.

**Changes or modifications to this unit not expressly approved by Alion Science and
Technology could void the user's authority to operate this equipment.**

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1   Purpose

This document provides operating instructions for users of Alion's Sensors Communications Module (SCM).

2   Relevant Documents

SCM Software Requirements Document
Interface Design Specification for the Sensor Communication Module Management Port

2.1 Overview

The SCM is a general purpose device for the collection and dissemination of sensor data. It is comprised of built in sensors, external sensor interfaces, an RTLS radio, and a microcontroller. It also has an LCD display, 3 push button switches, 3 LEDs, and a buzzer that are user configurable. The SCM contains built-in temperature, humidity, and contact closure sensors, and may optionally contain a GPS receiver. In addition, the SCM has an external serial port that can be used to interface to other sensors. The serial port also serves as the management port through which the SCM is placed into **Manage Mode** as described by this document.

The SCM operates in either **Run Mode** or **Manage Mode**. **Run Mode** is the normal mode of operation where the SCM collects data from the various sensors and either stores it in NVM or transmits it via the RTLS radio. Data can be collected and transmitted at timed intervals, or as specified by certain events. Events include threshold settings, button presses, and external inputs.

The **Manage Mode** allows the user to define how the SCM will function during **Run Mode**. Execution of **Management Commands** allows the user to tailor this behavior to meet their specific operational needs. **Manage Mode** also provides for a **Test Command** that causes the SCM to execute a built-in-test (BIT). Likewise, **Management Commands** provide a means for the user to retrieve SCM configuration settings as well as any data contained in nonvolatile memory (NVM). NVM data may hold data logged from prior SCM utilization, or it may contain BIT results.

SCM Configuration Application Program (SCMCAP) is an automation of **Management Command**s with built-in error checking. SCMCAP allows users to configure the SCM for specific applications and uses.

3   SCMCAP Instructions

SCMCAP operates as a stand-alone Microsoft Windows PC application. Insert the SCM software disk into the PC CDROM drive. It will automatically install. Follow the on-screen instructions during installation.
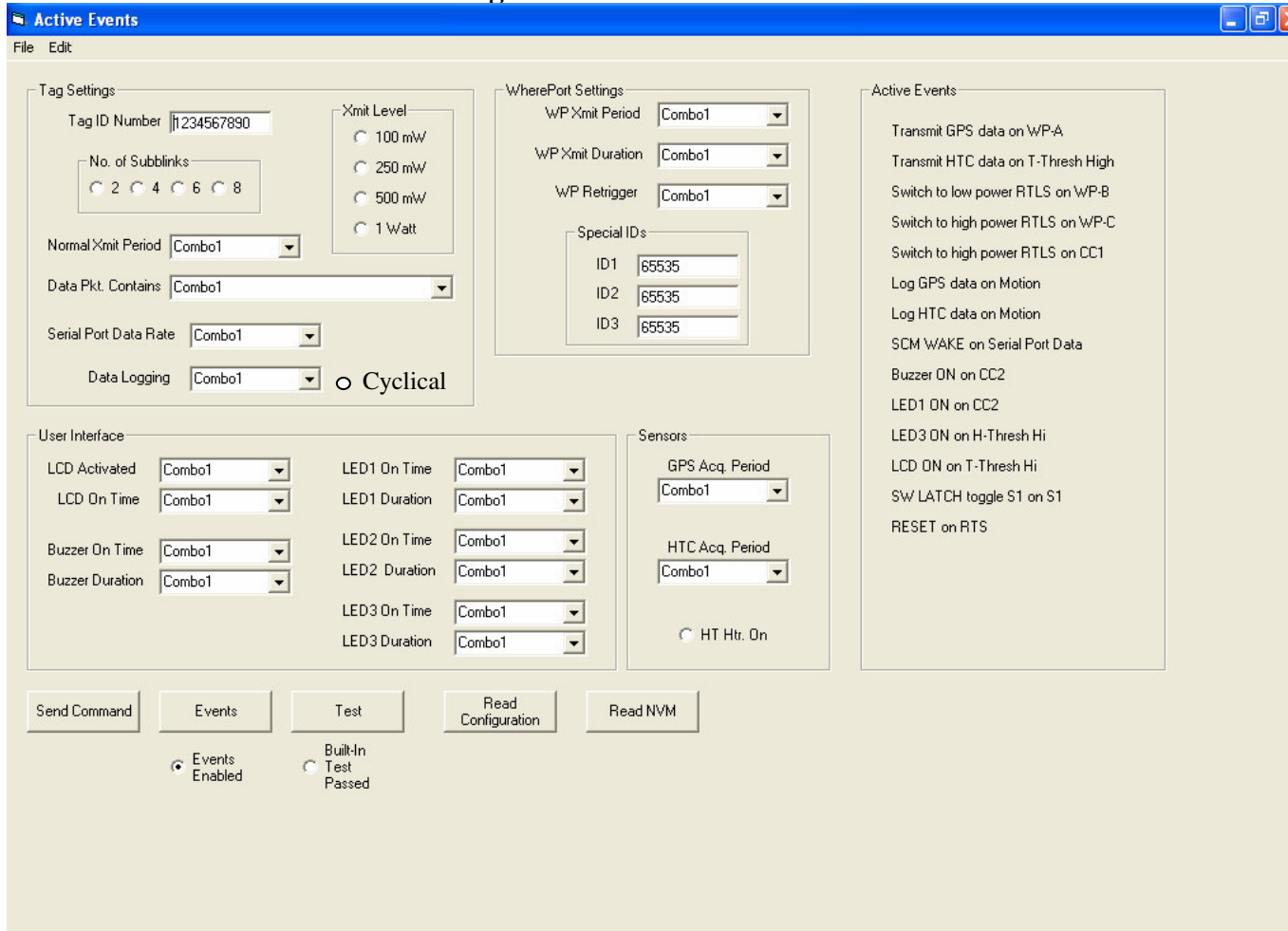
Connect an SCM to the PC's serial port using the cable provided in the kit. Start the SCMCAP program.

When launched, the SCMCAP **Main Form** will appear as shown in Figure 1. It contains the following provisions:

a) Writing new configuration settings to the SCM
b) Setting Tag parameters
c) Defining user interface characteristics
d) Configuring the built-in sensors
e) Setting event-driven Actions
f) Reading the current configuration settings from an SCM
g) Retrieving SCM Nonvolatile memory
h) Testing the SCM
i) Placing the SCM in **Run Mode**

Placing the mouse pointer over a button or title will cause a definition of that field's function to be displayed.

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Figure 1: Main Form

Active Events

File   Edit

Tag Settings
Tag ID Number 1234567890

Xmit Level
○ 100 mW
○ 250 mW
○ 500 mW
○ 1 Watt

No. of Subblinks
○ 2 ○ 4 ○ 6 ○ 8

Normal Xmit Period Combo1

Data Pkt. Contains Combo1

Serial Port Data Rate Combo1

Data Logging Combo1   ○ Cyclical

WherePort Settings
WP Xmit Period Combo1
WP Xmit Duration Combo1
WP Retrigger Combo1

Special IDs
ID1 65535
ID2 65535
ID3 65535

Active Events
Transmit GPS data on WP-A
Transmit HTC data on T-Thresh High
Switch to low power RTLS on WP-B
Switch to high power RTLS on WP-C
Switch to high power RTLS on CC1
Log GPS data on Motion
Log HTC data on Motion
SCM WAKE on Serial Port Data
Buzzer ON on CC2
LED1 ON on CC2
LED3 ON on H-Thresh Hi
LCD ON on T-Thresh Hi
SW LATCH toggle S1 on S1
RESET on RTS

User Interface
LCD Activated Combo1
LCD On Time Combo1

Buzzer On Time Combo1
Buzzer Duration Combo1

LED1 On Time Combo1
LED1 Duration Combo1

LED2 On Time Combo1
LED2 Duration Combo1

LED3 On Time Combo1
LED3 Duration Combo1

Sensors
GPS Acq. Period Combo1

HTC Acq. Period Combo1

○ HT Htr. On

Send Command   Events   Test   Read Configuration   Read NVM

○ Events Enabled   ○ Built-In Test Passed

EXAMPLE

3.1 Writing New Configuration Settings to the SCM

1   After setting SCM configuration parameters, click on the Send button to write the settings to the SCM.

2   SCMCAP settings can be saved using the pull down menu File-Save. The user will be prompted to save the settings before writing them to the SCM.

3   SCMCAP will perform an error check on the configuration data set. The user is notified if errors are found and what they are. The write is terminated without execution until all errors have been corrected.

3.2 Setting Tag Parameters

SCMCAP provides a means to set the following tag parameters:

a) ID Number
b) Transmit Power Level
c) Number of Subblinks
d) Normal Transmit Period
e) Serial Port Data Rate
f) Data to be Logged
g) Time and Date

Requirements for each of these parameters are given in the paragraphs below.

3.2.1 Tag Identification Number

1   SCMCAP will provide a way to assign an ID number to the SCM using a free-form data entry field, such as a Text Box. The Tag Identification Number is a numeric field of 1 to 10 digits. Only the numbers 0-9 are acceptable digit values.

3.2.2 RTLS Power Level

1   Tthe RTLS transmit power level can be set to one of three possible settings using an Option Button or Check Box for each. Only one entry may be set

3.2.3 Number of Subblinks per transmission

1   Set the number of subblinks transmitted per RTLS transmission using this Option Button or Check Box. Only one entry may be set

3.2.4 Normal Transmit period

Set the RTLS transmit period in seconds. The list contains settings for:

a) 0, 5, 10, 15, 20, 30, 45 seconds
b) 1, 2, 5, 10, 15, 30, 45 minutes
c) 1 – 24 hours (1 hour increments)

3.2.5 Data Packet Contents

Specify what data is transmitted in RTLS packets. SCMCAP allows entry selection from a finite list of choices. The list will contain settings for:

a) Tag Settings
b) GPS data only
c) HTC data only
d) Serial Port buffer data only
e) Both GPS and HTC data
f) Both GPS and Serial Port buffer data

3.2.6 Serial Port Data Rate

1   Sets the Serial Port data rate. Serial port is always 8 data bits, no parity, 1 stop bit. Settings are:

   a) Disable port for data
   b) 2400
   c) 9600
   d) 19200
   e) 57600

2   The user is prompted if, on writing to the SCM, it determines that the current data rate is different than that entered here. The user is given the option to proceed or to abort the **Send Command** action.

3.2.7 Data Logging

1   Define data to be logged to nonvolatile memory (NVM). The settings are:

a) Disable data logging
b) GPS only
c) GPS and Time

d) Temperature Only
e) Temperature and Time
f) Humidity Only
g) Humidity and Time
h) GPS, Temperature, Time
i) GPS, Humidity, Time
j) GPS, Temperature, Humidity, Time
k) Serial Port and Time
l) GPS, Serial Port, Time

2   Data logging will stop once the buffer is filled unless the "Cyclical" button is selected. If the "Cyclical" button is selected the data will write over the earliest entry once the buffer is full.

3   Unless **Disable data logging** is selected, the user is prompted that any existing data in NVM may be lost. The user is given the option to proceed or abort the **Send Command** action.

3.2.8 Time and Date

1. Set the time and date used by the SCM. SCMCAP will check the time against the resident computer time and date, and prompt the user if they are different by more than one (1) minute.

3.2.9 LCD Activate On Measurement

Sets which measurement turns on the LCD and displays the measured data. Occurs for both timed and event driven measurements. S3 can always be used to activate the LCD Menu. Available choices are:

a) Off
b) GPS
c) HTC
d) Serial Port

3.2.10 LCD On Time

Sets the time in seconds that the LCD display remains on before turning off. Applies to all conditions that activate the LCD, except S3 activation. SCMCAP will allow entry selection from a finite list of choices. Available choices are:

a) Disabled
b) 10, 15, 20, 30, 60,120
c) Indefinitely

3.2.11 LED Number 1 Blink Rate

Sets the time in milliseconds that LED1 remains on per 5 seconds. Applies to all events that specify LED1. Available choices are:

a) Off
b) 200 mS
c) 500 mS
d) 700 mS
e) 1 Second
f) 2 Second

3.2.12 LED Number 1 Blink Duration

Specifies the time in minutes that LED1 will blink at the specified blink rate. Applies to all events that specify LED1. Available choices are:

a) Disabled
b) 1,2, 5, 10, 20, 30, 60, 120, 240
c) Indefinitely

3.2.13 LED Number 2 Blink Rate

Sets the time in milliseconds that LED2 remains on per 5 seconds. Applies to all events that specify LED2. Available choices are:

a) Off
b) 200 mS
c) 500 mS
d) 700 mS
e) 1 Second
f) 2 Second

3.2.14 LED Number 2 Blink Duration

Specifies the time in minutes that LED2 will blink at the specified blink rate. Applies to all events that specify LED2. Available choices are:

a) Disabled
b) 1, 2, 5, 10, 20, 30, 60, 120, 240
c) Indefinitely

3.2.15 LED Number 3 Blink Rate

Sets the time in milliseconds that LED3 remains on per 5 seconds. Applies to all events that specify LED3. Available choices are:

a) Off
b) 200 mS
c) 500 mS
d) 700 mS
e) 1 Second
f) 2 Second

3.2.16 LED Number 3 Blink Duration

Specifies the time in minutes that LED3 will blink at the specified blink rate. Applies to all events that specify LED3. Available choices are:

a) Disabled
b) 2, 5, 10, 20, 30, 60, 120, 240
c) Indefinitely

3.2.17 Buzzer On Time

Specifies the time in seconds that the Buzzer remains on. Applies to all events that specify BUZZER_ON. Available choices are:

1, 2, 5, 10, 20, 30 seconds.

When Buzzer On Time exceeds the current settings for Buzzer Period and Buzzer Duration, SCMCAP will automatically adjust Buzzer Period and Buzzer Duration to the lowest possible valid settings. The user is notified of the changes.

3.2.18 Buzzer Period

Specifies the time interval in seconds between Buzzer activations of Buzzer On Time. Applies to all events that specify BUZZER_ON. Available choices are:

2, 5, 10, 20, 30, 60, 120, 240 seconds.

SCMCAP will check that Buzzer Period is greater than or equal to Buzzer On Time. Those settings that are not will be insensitive and unavailable to the user. Alternatively, the user will be prompted of the error and the last entry ignored.

3.2.19 Buzzer Duration

Specifies the time in minutes over which the Buzzer cycle will occur. Applies to all events that specify BUZZER_ON. Available choices are:

a) Disabled
b) 1, 2, 5, 10, 20, 30, 60,120,240
c) Indefinite

SCMCAP swill check that Buzzer Duration is greater than or equal to Buzzer Period. Those settings that are not will be insensitive and unavailable to the user. Alternatively, the user will be prompted of the error and the last entry ignored.

3.3 Configuring the Built-In Sensors

3.3.1 GPS Acquisition Period

Set the time between GPS attempts to acquire a location fix. SCMCAP will allow entry selection from a finite list of choices. The list will contain settings for:

a) Disabled
b) 2, 5, 10, 20, 30 seconds
c) 1, 5, 10, 15, 20, 30, 45 minutes
d) 1, 2, 4, 6, 8, 12, 24 hours

3.3.2 Humidity and Temperature Acquisition Period -HTAcPer

Sets the time between measurements of temperature, humidity, and the states of the external contact closures. SCMCAP will allow entry selection from a finite list of choices. The list will contain settings for:

a) Disabled
b) 1, 2, 5, 10, 20, 30 seconds
c) 1, 5, 10, 15, 20, 30, 45 minutes
d) 1, 2, 4, 6, 8, 12, 24 hours

3.3.3 High Temperature Threshold – THi

Defines the high temperature threshold in degrees Fahrenheit that is used to trigger events as defined by the **Event** command.

The field will only accept numbers 0-9, up to 3 digits and the sign symbols + and -. No sign symbol is interpreted as positive. The allowed range of valid entries will be limited to the range of -41 to +254

The user will be prompted when errors are made entering data.

3.3.4 Low Temperature Threshold – TLo

Defines the low temperature threshold in degrees Fahrenheit that is used to trigger events as defined by the **Event** command.

The field will only accept numbers 0-9, up to 3 digits and the sign symbols + and -. No sign symbol is interpreted as positive. The allowed range of valid entries will be limited to the range of -40 to +253

The user will be prompted when errors are made entering data.

3.3.5 High Humidity Threshold – HHi

Defines the high relative humidity threshold as a percent that is used to trigger events as defined by the **Event** command.

The field will only accept numbers 0-9, up to 2 digits. The allowed range of valid entries will be limited to the range of 1 to 100

The user will be prompted when errors are made entering data.

3.3.6 Low Humidity Threshold – HHi

Defines the high relative humidity threshold as a percent that is used to trigger events as defined by the **Event** command.

The field will only accept numbers 0-9, up to 2 digits. The allowed range of valid entries will be limited to the range of 1 to 100

The user will be prompted when errors are made entering data.

3.4 Setting Event-Driven Actions

3.4.1 Summary Event List

SCMCAP will display on the Main Form a summary list of all event-driven actions currently set. The list will include the Action and the event that causes it.

The summary list will be updated immediately to reflect changes made by the user.
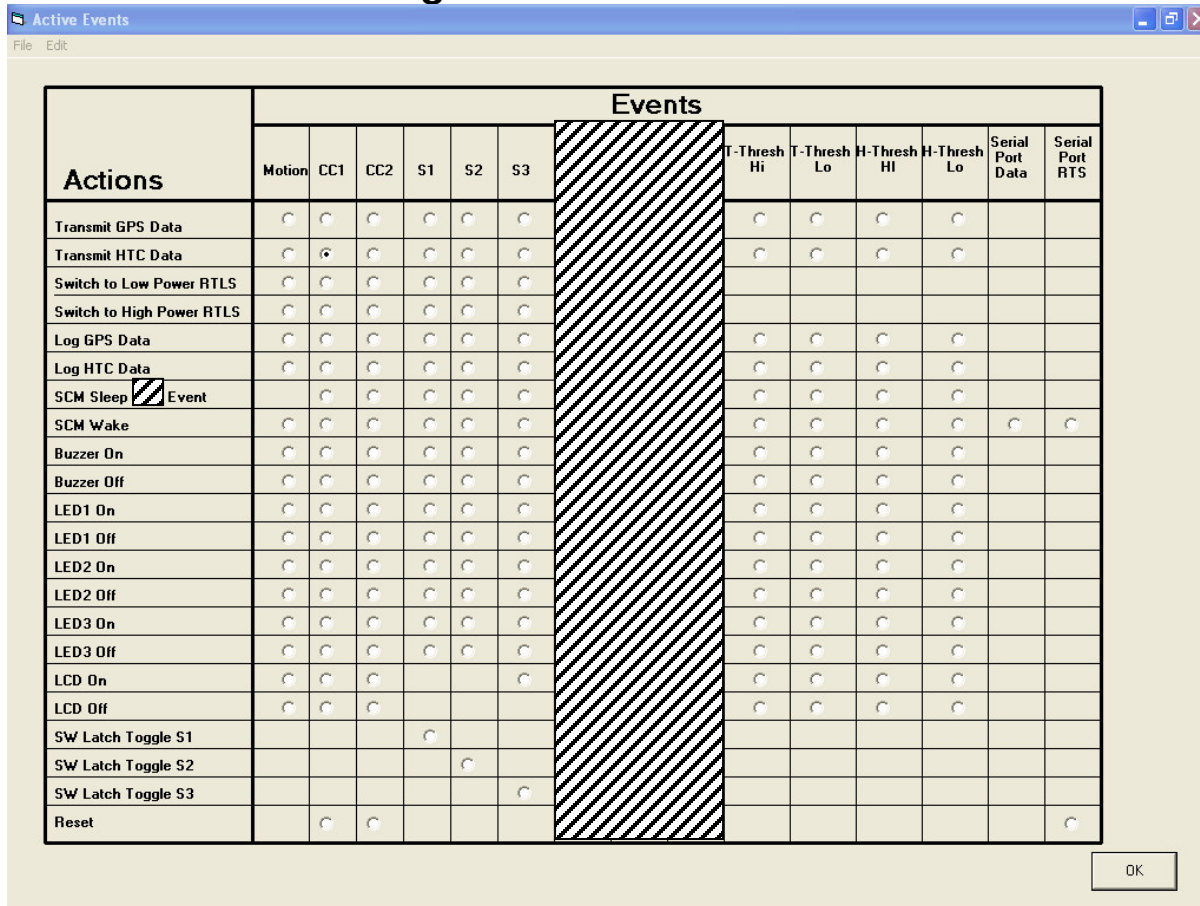
3.4.2 Events Command Button

The main form of SCMCAP will contain an **Events Command Button** that when clicked on by the user causes an **Actions-Events Entry Table** to open as a separate form in its own window.

The **Actions-Events Entry Table Form** will contain all possible actions, and the events that may cause such actions, in a manner that allows the user to quickly set or clear them as desired.

SCMCAP will perform the necessary checking to ensure that mutual exclusivity is retained correctly, and it will automatically make changes to the Form settings as the user selects or deselects items accordingly to maintain exclusivity rules.

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Active Events

File   Edit

Events

Actions	Motion	CC1	CC2	S1	S2	S3		T-Thresh Hi	T-Thresh Lo	H-Thresh HI	H-Thresh Lo	Serial Port Data	Serial Port RTS
Transmit GPS Data													
Transmit HTC Data		●											
Switch to Low Power RTLS													
Switch to High Power RTLS													
Log GPS Data													
Log HTC Data													
SCM Sleep Event													
SCM Wake													
Buzzer On													
Buzzer Off													
LED1 On													
LED1 Off													
LED2 On													
LED2 Off													
LED3 On													
LED3 Off													
LCD On													
LCD Off													
SW Latch Toggle S1													
SW Latch Toggle S2													
SW Latch Toggle S3													
Reset													

OK

Example

3.5 Reading Configuration Settings from the SCM

The Main Form of the SCMCAP will include a Command Button that retrieves the current SCM configuration settings.

SCMCAP will populate the Main Form with the retrieved data.

Before doing so, SCMCAP will prompt the user that current settings will be lost and offer to the user to save them before execution of the data retrieval.

3.6 Reading Nonvolatile Memory

The Main Form of SCMCAP will include a Command Button that retrieves the contents of Nonvolatile Memory (NVM).

SCMCAP will prompt the user for a file name and location to save the retrieved data.

SCMCAP will then saved the data to the file specified as a simple, space-delimited text file.

3.7 Test the SCM

The Main Form of SCMCAP will include a Command Button that causes the SCM to execute a Built-In Test (BIT).

SCMCAP will warn the user that BIT will erase any data held in NVM and offer the user the option to abort BIT.

SCMCAP will display an indicator that BIT is in progress, and for the user to wait until BIT is complete before proceeding.

SCMCAP will inform the user when the test is complete, indicating pass or fail, and pointing out that the results are now available in NVM for retrieval.

SCMCAP will sense that the BIT is complete, and whether it passed or failed. SCMCAP will indicate on the Main Form whether BIT passed or failed by setting and clearing the appropriate Built-In Test Status Radio Button.

3.7.1 Placing the SCM in Run Mode

SCMCAP will provide a Command Button that, when clicked on by the user, places the SCM in normal **Run Mode**.

The user will be prompted that they are about to exit **Manage Mode**, and given the option to abort the command.