

Application Note: COACh III to COACh IV Differences

**Part Number E052761
Revision A**

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OVERVIEW

The COACH IV is the next generation in the COACH family of resistive touchscreen controller chipset solutions. It is intended as a 100% 'drop-in' replacement for the COACH III IC. However, there are some notable differences.

COACH IV code was written from the ground up and uses a different touch measurement system which returns to the algorithms of the previous COACH versions. The new code addresses existing deviations in the COACH III and adds some legacy commands as well as reinstating a number of legacy features. COACH IV version 1.3 firmware contains deviations that are considered to be non-disruptive in normal usage. These are identified in the section "KNOWN DEVIATIONS AND ISSUES IN COACH IV version 1.3".

REFERENCED DOCUMENTS

"COACH IV Application Manual", revision A, Elo TouchSystems document number SW600559.

SmartSet Technical Reference Manual SW000027, Elo TouchSystems, Inc., 301 Constitution Dr., Menlo Park, CA 94025. Part number 008217.

PHYSICAL DEVICE DIFFERENCES

Mechanically, the chip package is the same. Electrically, they have the same specifications except that the COACH III is a masked ROM device while COACH IV is a flash memory device. The flash memory of the COACH IV is not in-system programmable (i.e. field upgradeable) at this time.

TOUCHSCREEN MEASUREMENT ALGORITHM

Touchscreen measurement algorithms used in the COACH IV code are essentially the same as the original COACH design. This design reinstates the SmartSet controls that allow the user to tailor the measurement characteristics. These include controls for debounce and compensation of high resistance screens. A new filter has been added to enhance jitter performance.

Reinstated SmartSet Controls

SmartSet controls in the Filter command include the parameters SLen, Width, States, and Control. COACH III accepted values for these controls but did not change the actual touch measurement parameters. COACH IV implements them as defined in the SmartSet Technical Reference and the COACH IV Application Manual.

New Jitter Filter

COACH IV adds a new fuzzy filter to enhance jitter performance.

ADDED SUPPORT FOR LEGACY SMARTSET COMMANDS

In response to customer requests or inquiries, the COACH IV expands the SmartSet support of the COACH III with the addition of three legacy commands. These commands are defined in SmartSet Technical Reference and the COACH IV Application Manual.

Configuration Command, 'g', in USB Mode

The configuration command, 'g' query is not supported in USB mode by the COACH III. Within the code structure managing a large queue of packets is difficult and the use of this command is infrequent. It is not stated in the Application Manual that this command is not supported in USB mode and this resulted in a customer inquiry. The COACH IV code supports the 'g' command for both serial and USB modes.

Timer Command, 'H' / 'h'

Added Timer command support.

Parameter Command, 'P'

In addition to correcting the deviation stated in the section "COACH III DEVIATIONS REPAIRED IN COACH IV", the COACH IV adds legacy functions to the 'P' set command. The COACH IV Parameter command permits operation at the baud rates of 600, 1200, 2400, 4800, 14400, and 38400, in addition to the existing 9600 and 19200 baud. Also supported are standard configurations for data bits, stop bits, and parity.

Quiet Command, 'Q' / 'q'

Added Quiet command support.

MODIFIED SMARTSET COMMANDS / FEATURES

Filter Command 'F'

COACH IV adds a new filter and control of this filter is accomplished with two new parameters in the Filter command. These parameters are specified in the COACH IV Application Manual.

Owner Command, 'o'

COACH IV updates the Owner command query with the response 'TYCOELC'.

COACHIII DEVIATIONS REPAIRED IN COACHIV

COACH III deviations are described in this section. Each of these deviations has been repaired in the COACH IV.

Emulation Mode E271-60 ASCII with Touch Status

Initial and stream touch packets do not have the required ASCII 'carriage return' and 'line feed'.

Power-ON Self Test Does Not Queue Warning

A Power-ON Self Test (POST) warning is not queued in the acknowledge stack if POST fails. This was tested by performing a power-on with no touchscreen connected and also by a power-on with the NVRAM removed.

NVRAM Read Fails to Recall Calibration and Scaling Parameters

'N' command read of NVRAM values does not recall calibration and scaling parameters.

USB D+ Pull Up is Not Released with the Removal of VBUS

Once enumerated and in USB mode, removal of VBUS does not result in TRON disable, i.e. D+ pull up source remains active and is able to supply current on the data line contrary to USB 2.0 specification 7.1.5.

Incorrect Operation of Parameter Command, 'P'

Issuing a 'P' command with baud rate values not supported does not change the operation but the response is an acknowledge packet with no warnings. In addition, the 'p' query parameters values are actually changed and therefore do not reflect the real operating values.

USB Screen Origin Incorrect

USB or serial operation result in the same screen origin where the USB origin should be inverted with respect to the Y axis.

P parameter of ID Command Incorrect in USB Mode

The configuration command, 'g' is not supported in USB mode and therefore the ID command should indicate zero packets returned for the 'g' command when operating in USB mode.

Incorrect Operation of Filter Command, 'F'

'F' set command only works with TYPE of 0x00 or 0x01 instead of 0x30 or 0x31 as specified; 'f' query works properly

Incorrect Operation of Mode Settings in 140 Emulation Mode

140 emulation any format (ASCII/bin; with touch, without touch) ignores mode setting and always transmits streaming coordinates.

Incorrect Operation of Reset Command 'R'

Reset type '1' (warm boot) does not function as specified. It does not issue acknowledge packet and only responds to ASCII '1' for the TYPE (01h results in illegal subcommand error).

Incorrect USB Get_Status Response

USB get_status returns power state as bus powered and this should be self powered.

Incorrect Operation of Scaling Function with Negative Values

Scaling with a negative value in denominator does not operate correctly.

Incorrect Operation of Axis Inversion Function

The axis invert feature does not scale properly.

Incorrect Mode Operation with Out-of-range Plus Trim Enabled

Enabling both “out-of-range” and “trim” modes results in touch application outside the calibrated active area sends all coordinate types (status values) regardless of MODE settings. For example, if only untouch is enabled, a touch applied outside the calibration area results in the transmission of all initial, stream, and untouch coordinates.

Out-of-Range Bit Position Incorrect in Status Byte

The Out-of-Range bit is located in bit 7 of the Status byte instead of bit 6.

Incorrect Serial Number Paging

The ‘Page’ byte of the SmartSet serial number command, ‘u’N’ does not function as required. Page values of 1, 2, 3, and 4 should access the auxiliary serial number pages 1, 2, 3, and 4, respectively. COACH III accesses auxiliary pages 1, 2, and 3, solely based on the bit map of bits 0 and 1, thereby only accessing the legacy page (page 0) when the page value is a multiple of 4 instead of all page values excepting 1, 2, 3, and 4.

Incorrect USB Serial Number Structure

The USB serial number is to be composed of the hard coded value ‘50U’ concatenated with the six characters of the legacy page which includes the ‘Page’ byte. The COACH III only concatenates the five characters of the legacy page omitting the ‘Page’ byte. This limits the ability of manufacturing to build products with duplicate USB serial numbers which is a requirement for systems using multiple USB touch monitors.

KNOWN DEVIATIONS AND ISSUES IN COACH IV version 1.3

In this section known deviations and issues are described. Each of the deviations described are expected to be non-disruptive during normal usage of the COACH IV. Issues are functions or specifications that do not meet a specific expected result although that expectation has not necessarily been widely agreed upon and therefore may not be considered non-conforming.

Touch Stops Functioning If EP0 Not Flushed

If the USB host (software application, driver, host driver) has sent a USB request, including Vendor Specific requests (e.g. SmartSet command) and there are pending packets queued in endpoint0, touch measurement is suspended. This will have the symptomatic appearance of a non-functioning controller.

Incorrect IO Byte in Jumper Command, 'j' Query

A jumper command 'j' query always returns '0' in the IO byte regardless of the communication mode. This should be '1' when operating in USB mode.

Incorrect IO Byte in Parameter Command, 'p' Query

A parameter command 'p' query always returns '0' in the IO byte regardless of the communication mode. This should be '1' when operating in USB mode.

Erroneous Out-of-Range Indication

If the 'Out-of-Range' mode is enabled and the last coordinate transmitted is outside of the calibrated area, that is, "out-of-range", then disabling 'Out-of-Range' results in the 'Out-of-Range' bit in the status byte of the touch packet always being set regardless of mode setting or touch location. RESET is the only recovery solution.

Touchscreen Drive Test May Return Erroneous Results

The COACH IV may misidentify a 4-wire screen if touch is active during the drive test algorithm.

Issue: Inverted Scaling Using Negative Values

When the scaling is inverted by implementing negative parameters, the region at the axis toward the outer side of the calibrated area rounds in the opposite direction. This results in the same value on each side of the axis and an apparent value that is double in width to the normal distance of a single value. This is especially noticeable with a very course scaling range.

Issue: Firmware May Hang without I2C Pull Ups Installed

With the COACH III, the firmware will hang if the I2C pull up resistors are not present. This is presumably during the NVRAM test caused by an endless loop attempting to read data. It is unknown at this time if the COACH IV has the same problem. The current solution is to advise users to ensure I2C pull-ups are included in the design.

COMPARISON TABLE: COACH III version 1.0 VERSUS COACH IV version 1.3

Feature	COACH III v1.0	COACH IV v1.3
Mechanical		
Chip Packaging	Same	
Electrical		
Pin Functions	Same	
AC/DC Specification	Same	
Program Memory Type	Masked ROM	Flash (not field upgradeable)

Feature	COACH III v1.0	COACH IV v1.3
Functional		
Touch Algorithm: COACH III uses algorithms proprietary to a private third party, COACH IV reverts to the COACH algorithms with legacy SmartSet controls	COACH III, custom	COACH equivalent; added controls for fine tuning of touch algorithm
Touch Filter	Averaging	Averaging plus additional filter for enhanced jitter performance
SmartSet: COACH IV includes all of COACH III plus the additional modifications below	See COACH III Manual	See COACH IV Manual
Additional Legacy SmartSet		
Configuration command, USB mode	Not supported	Supported
Timer command	Not supported	Supported
Parameter command with legacy baud rates, communication configurations	Not supported	Supported
Quiet command	Not supported	Supported
Modified SmartSet Commands		
Filter command		Enabled touch control parameters; added Fuzzy Filter controls
Owner command	"Elo Inc."	"TYCOELC"
Deviations and Issues		
E271-60 emulation – CR/LF	Deviation	Repaired
Power-ON Self Test warning queued	Deviation	Repaired
NVRAM Read fails to recall Cal/Scaling	Deviation	Repaired
USB D+ Pull Up Not Released per 7.1.5	Deviation	Repaired
'P' command accepts invalid baud values	Deviation	Repaired
USB Y origin not inverted from serial	Deviation	Repaired
ID command incorrect 'P' value in USB	Deviation	Repaired
Filter command requires bad 'TYPE'	Deviation	Repaired
140 emulation ignores mode setting	Deviation	Repaired
Reset command accepts only ASCII '1'	Deviation	Repaired
Reset command type 1 does not ACK	Deviation	Repaired
Bus powered indicated in USB get status	Deviation	Repaired
Negative Scaling denominator fails	Deviation	Repaired
Axis inversion works incorrectly	Deviation	Repaired
Out-of-range touch with trim and out-of-range enabled, ignores mode setting	Deviation	Repaired

Application Note: Coach III To Coach IV Differences

Feature	COACH III v1.0	COACH IV v1.3
Out-of-range bit in wrong status position	Deviation	Repaired
Serial number Page function incorrect	Deviation	Repaired
USB serial number structure incorrect	Deviation	Repaired
Touch inactive if EP0 packet queued	N/A	Deviation ¹
IO byte in Jumper command always '0'	N/A	Deviation ¹
IO byte in Parameter command always '0'	N/A	Deviation ¹
Erroneous out-of-range indication	N/A	Deviation ¹
4 Wire autodetect may fail if touch applied during autodetect algorithm	N/A	Deviation ¹
Inverted scaling error at origin axis	Issue	Issue ¹
Firmware hang without I2C pull ups	Issue	Unknown

1. This deviation or issue is non-disruptive in normal usage.

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