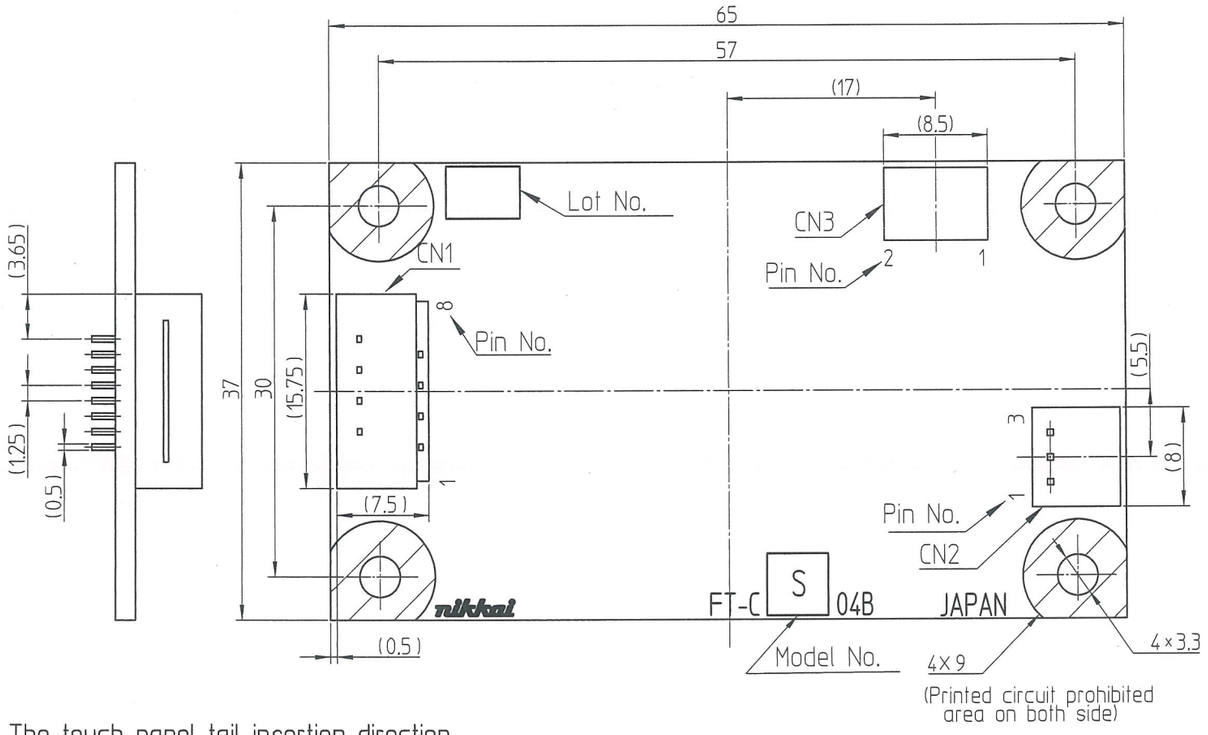
PRODUCT SPECIFICATION 1/6

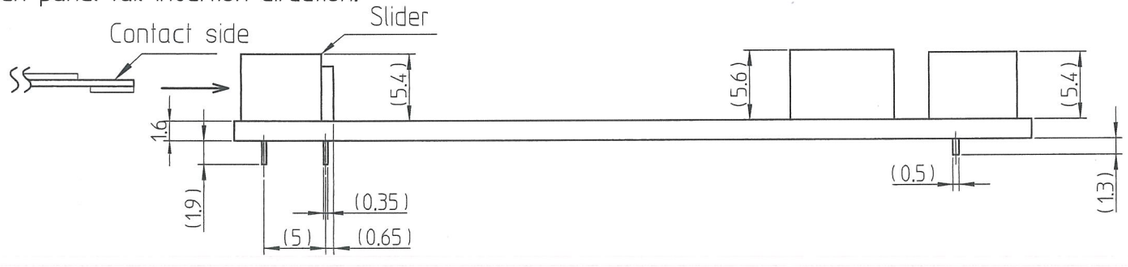
## 1.Outline

This product performs position detection on which the touch panel was touched by using combining NKK analog touch panel and has the function to transmit the position coordinates to hosts, such as a computer. The position coordinates of a touch panel can be transmitted as serial data by A/D conversion processing of 10 bits of decomposition ability being performed by controller chip (FT-CSU564 NKK SWITCHES CO., LTD.), and connecting with the serial port (RS-232C) of a host computer.

## 2.Outer Dimension



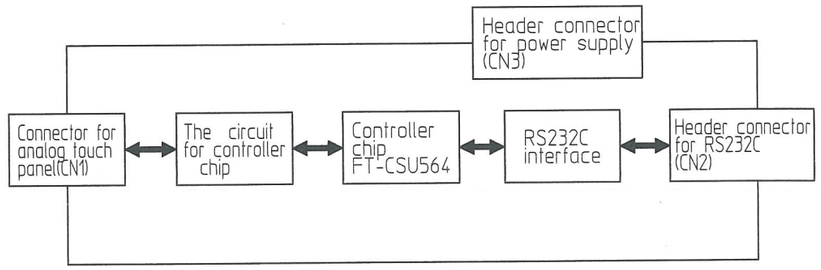

The touch panel tail insertion direction.




## 3.Connectors

| Symbol | Description | Application | No. | Note |
|---|---|---|---|---|
| CN1 | Connector | 8 pins (Molex 5597-08APB7F) | 1 | Connect to analog touch pannel. |
| CN2 | Header connector | 3 pins (HIROSE Electric DF3A-3P-2DS) | 1 | Conect to RS232C(Please use DF3-3S-2C(HIROSE Electric) for receptacle connector, and DF3-2428SCF (HIROSE Electric) for sockets.) |
| CN3 | Header connector | 2 pins (HIROSE Electric DF3Z-2P-2H(20)) | 1 | Conect to power supply(Please use DF3-2S-2C(HIROSE Electric) for receptacle connector, and DF3-2428SCF (HIROSE Electric) for sockets.) |

## 4.Block Diagram




## 5.Basic Specification

| Item | Specifications |
|---|---|
| Controller chip | FT-CSU564 (NKK) |
| Interface | RS232C standard |
| Clock frequency | 6MHz |
| Supply voltage | 5.0V |
| A/D converter resolution | 10 bits |
| Consumption current | 40mA Max. |
| Communication speed | 9600 bps |
| Communication format | Data length : 8bit Parity : none<br>Stop bits : 1 |

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| CHECKED BY: M.TAMURA | May.27 '14 | DIMENSIONS IN mm | |
| CHECKED BY: H.KADOWAKI | May.27 '14 | Unless otherwise specified tolerances | |
| DRAWN BY: K.MATSUSHITA | May.26 '14 | Dimensions range | Tolerances |
| | | Up to 6 | ±0.3 |
| | | Over 6 up to 30 | ±0.5 |
| | | Over 30 up to 50 | ±0.8 |
| | | Over 50 | ±1.2 |

MODEL No. FT-CS04B

NKK SWITCHES CO., LTD.

No.T140040

1E-FT-CS04B_1

様式 No.6435

## 6.Absolute Maximum Rating

| Item | Symbol | Rated vaue | | Unit | Conditions |
|---|---|---|---|---|---|
| | | Min. | Max. | | |
| Supply voltage | Vcc | -0.3 | +5.5 | [V] | |
| Input voltage | VTP | —— | Vcc | [V] | Analog touch panel |
| | VRS | -15 | +15 | [V] | RS232C |
| Operating temperature | TOPR | 0 | +70 | [℃] | |
| Storage temperature | TSTG | -25 | +85 | [℃] | |

## 7.Recommeded Conditions

| Items | Symbol | Rated value | | | Unit | Conditions |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| Power supply | Vcc | +4.75 | +5 | +5.25 | [V] | |
| Operating temperature | TOPR | 0 | —— | +70 | [℃] | No dew condensation. |

## 8. Pin assignment for connectors

(1)CN1 Connector for analog touch pannel(8 pins)

| Pin No. | Symbol | Descriptions |
|---|---|---|
| 1,2 | Y0 | For analog touch panel YUp or YLo. |
| 3,4 | Y1 | |
| 5,6 | X0 | For analog touch panel XRi or XLe. |
| 7,8 | X1 | |

(2)CN2 Header connector for RS232C.(3 pins)

| Controller board | | | Host computer Descriptions |
|---|---|---|---|
| Pin No. | Symbol | Descriptions | |
| 1 | RD | Receive data input (IN) | Send data |
| 2 | SD | Send data output (OUT) | Receive data |
| 3 | GND | GND | GND |

(3)CN3 Header connector for power supply (2 pins)

| Pin no. | Symbol | Descriptions |
|---|---|---|
| 1 | Vcc | Power supply |
| 2 | GND | GND |

## 9. Function details

(1)Function explanation

| Function | Contents | Explanation |
|---|---|---|
| Interface | Serial communication | The asynchronous serial |
| Sampling rate | Set to the optional value. | Calibration data mode Max130(p/s)<br>Source data mode Max190(p/s) |
| Coordinates data format | 4 bytes binary | See the "11. Format of the coordinates data" |
| Coordinates calculation method | Source data mode | A/D converted data is sent to the host CPU. |
| | Calibration data mode | Calibrated data is sent to the host CPU. |
| Data output mode | Point mode | It outputs the coordinates value of the first pen down only. |
| | Stream mode | It outputs a coordinates value continuously while the pen remains down. |
| Duplicate coordinate processing function | Duplicate coordinates are not sent | Compares the coordinates value transferred in the previous operation with the current coordinate data and if the coordinate values are the same, the controller does not send the current coordinate data. (Only valid in stream mode) |
| Time-out function | Sets the time-out time | If the required data was not received within the preset time-out time, the controller sends error code "F3h" to the host CPU. |
| Low power function | Stop mode | Stop mode : It stops oscillation.<br>The way of wake up : Pen down reset, stop cancellation command |
| | Way of switching to each mode | The command which switches to each low power mode has the following two kinds.<br>Direct : After receiving a command, it shifts to the low power mode immediately.<br>Auto : After the last coordinate input, if there is no input for a preset time, the controller switches to the low power mode. |
| | Transition times | Transition from normal mode to low power mode : about 5μs<br>Transition from low power mode to normal mode : clock stable time + 5μs |



| | | | |
|---|---|---|---|
| MODEL No. | FT-CS04B | | |
| NKK SWITCHES CO., LTD. | | | |
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| DRAWN BY: K.MATSUSHITA | May.26 '14 | Dimensions range | Tolerances |
| | | Up to 6 | ±0.3 |
| | | Over 6 up to 30 | ±0.5 |
| | | Over 30 up to 50 | ±0.8 |
| | | Over 50 | ±1.2 |

PRODUCT SPECIFICATION 3/6

## ( 1 ) Function explanation (Continued)

| Function | Contents | Explanation |
|---|---|---|
| Status function | Controller setting state confirmation | It sends the setting state of the controller to the host CPU. |
| Interface test function | Tests the interface | It tests whether the communication between the controller and the host CPU, normally using by the optional data. |
| Pen up code function | 1 byte | Send 1 byte pen up code when pen up. |
| | 4 bytes | Send 4 bytes pen up code when pen up. |
| Lock function | Starts and clears the lock function | If a lock command is issued, after transmitting the coordinate data currently being transmitted, the controller halts transmission. The lock state is cleared by sending a lock clear command. |
| Reset | Software reset | Reset by the command |
| | Power on reset | Reset when turning on the power supply |
| | Watchdog reset | When the software of controller is out of controll, the reset function works automatically. |
| A/D converter | A/D converter resolution | 10bit |
| Power source indicator | Power source | Blink LED on and off while the controller chip is active. |

# 10. RS232C Specification and Commands details

## ( 1 ) RS232C Specification

| Item | Specifications |
|---|---|
| Communication speed | 9600 bps |
| Communication format | Data length : 8bit Parity : none<br>Stop bits : 1 |

## ( 2) Commands

| Function | Command | Command value | Number of the bytes | Description |
|---|---|---|---|---|
| Sampling rate | Setting of sampling rate | 91h | 3 | Initial setting : 80(p/s) |

Sends an optional value 10 to maximum (p/s) according to the following format.

| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | Bit0 |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | 0 | z3 | z2 | z1 | z0 |
| 0 | 0 | 0 | 0 | z7 | z6 | z5 | z4 |

z0 to z7 : The binary number of sampling rate (z). (z7 is the high-order bit)

There is a maximum sampling rate of each mode as follows :
Calibration data mode - 130 ( p/s )
Source data mode - 190 ( p/s )
Note : Becareful not to settle more than the maximum sampling rate. The coordinate data may becomes abnormal.

| Function | | | | Description |
|---|---|---|---|---|
| Coordinates calculation method | Source data mode | 80h | 1 | Initial setting : Calibration data mode |
| | Calibration data mode | 81h | 1 | |
| Data output mode | Point mode | A0h | 1 | Initial setting : Stream mode |
| | Stream mode | A1h | 1 | |
| Duplicate coordinate processing function | Enable | 84h | 1 | Initial setting : Enable |
| | Disenable | 85h | 1 | |
| Time-out function | Time-out value (z) | 88h | 3 | Initial setting : 100 |

According to the following format, it sets time-out value (z).

| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | Bit0 |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | z3 | z2 | z1 | z0 |
| 0 | 0 | z9 | z8 | z7 | z6 | z5 | z4 |

z0~z9 : The binary number of time-out value (z). (z9 is the high-order bit)

It calculates time-out time by the following formula and it sets a time-out value.
Time-out time (ms)=4 × time-out value
Be careful the minimum of time-out value is z ≧ 1.

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| DRAWN BY: K.MATSUSHITA | May.26 '14 | Dimensions range | Tolerances |
| | | Up to 6 | ±0.3 |
| | | Over 6 up to 30 | ±0.5 |
| | | Over 30 up to 50 | ±0.8 |
| | | Over 50 | ±1.2 |

MODEL No. FT-CS04B

NKK SWITCHES CO., LTD.

No.T 140040

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# PRODUCT SPECIFICATION 4/6

| Function | Command | Command value | Number of the bytes | Description |
|---|---|---|---|---|
| Calculate Calibration ratio | Calibration ratio | 83h | 17 | |

According to the following format, controller calculate and sets a calibration ratio.

| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | Bit0 | |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | ← command |
| 0 | 0 | 0 | 0 | x3 | x2 | x1 | x0 | The 1st LCD reference point |
| 0 | 0 | x9 | x8 | x7 | x6 | x5 | x4 | x0~x9 : The binary number of the horizontal axis coordinates x of the 1st reference point |
| 0 | 0 | 0 | 0 | y3 | y2 | y1 | y0 | y0~y9 : The binary number of the vertical axis coordinates y of the 1st reference point (x9, y9 are the high-order bit). |
| 0 | 0 | y9 | y8 | y7 | y6 | y5 | y4 | |
| 0 | 0 | 0 | 0 | X3 | X2 | X1 | X0 | The 2nd LCD reference point |
| 0 | 0 | X9 | X8 | X7 | X6 | X5 | X4 | X0~X9 : The binary number of the horizontal axis coordinates X of the 2st reference point |
| 0 | 0 | 0 | 0 | Y3 | Y2 | Y1 | Y0 | Y0~Y9 : The binary number of the vertical axis coordinates Y of the 2st reference point (x9, y9 are the high-order bit). |
| 0 | 0 | Y9 | Y8 | Y7 | Y6 | Y5 | Y4 | |
| 0 | 0 | 0 | 0 | Ax3 | Ax2 | Ax1 | Ax0 | The A/D value of the 1st reference point |
| 0 | 0 | Ax9 | Ax8 | Ax7 | Ax6 | Ax5 | Ax4 | Ax0~Ax9 : The binary number of the A/D value which horizontal axis coordinates x of the 1st reference point |
| 0 | 0 | 0 | 0 | Ay3 | Ay2 | Ay1 | Ay0 | Ay0~Ay9 : The binary number of the A/D value which vertical axis coordinates y of the 1st reference point (x9, y9 are the high-order bit). |
| 0 | 0 | Ay9 | Ay8 | Ay7 | Ay6 | Ay5 | Ay4 | |
| 0 | 0 | 0 | 0 | AX3 | AX2 | AX1 | AX0 | The A/D value of the 2nd reference point |
| 0 | 0 | AX9 | AX8 | AX7 | AX6 | AX5 | AX4 | AX0~AX9 : The binary number of the A/D value which horizontal axis coordinates X of the 2nd reference point |
| 0 | 0 | 0 | 0 | AY3 | AY2 | AY1 | AY0 | AY0~AY9 : The binary number of the A/D value which vertical axis coordinates Y of the 2nd reference point (x9, y9 are the high-order bit). |
| 0 | 0 | AY9 | AY8 | AY7 | AY6 | AY5 | AY4 | |

The absolute value of margin between the A/D value (AX,AY) of the 2nd reference point and the A/D value (Ax,Ay) of the 1st reference point are as follows.
|AX-Ax|>100, |AY-Ay|>100

Sent after calibration command (17 bytes) please wait more than 50 msec to send next command.

| Low power function | | | |
|---|---|---|---|
| | Auto stop | B1h | 2 |
| | Direct stop | B3h | 1 |
| | Auto clear | B4h | 1 |
| | Stop clear | E2h | 1 |

The codes and the wait time at auto mode

| Codes | 00h | 01h | 02h | 03h |
|---|---|---|---|---|
| Wait time (second) | 01 | 10 | 30 | 60 |

The way of wake up from the stop mode: Pen down, reset (only without EEPROM), stop clear command

When canceling an auto stop mode, first send a "stop clear" command (E2h), second send an "Auto clear" command (B4h). Take an interval time (more than 50msec) between first and second commands.

When returning from the stop mode, be sure to use stop clear command (FFh).

(When sending a command except the stop clear command (FFh), operation doesn't guaranteed.)

In order to change wait time at auto mode plese generate reset before change wait time. There maybe wrong wait time might be set if reset is not generated.

| Function | Command | Command value | Number of the bytes | Description |
|---|---|---|---|---|
| Status function | Status | C3h | 2 | |

| Mode | Code | Output return value |
|---|---|---|
| Coordinates calculation method | 00h | 01h : Source data mode<br>02h : Calibration data mode |
| Data output mode | 01h | 01h : Stream mode<br>02h : Point mode |
| Sampling rate | 03h | 1st byte<br>0xh:x is the return value of lower order sampling rate value (z3~z0).<br>2nd byte<br>0xh:x is the return value of higher order sampling rate value (z7~z4). |
| Time-out value | 05h | 1st byte return value<br>0xh:x is the lower order time-out value (z3-z0).<br>2nd byte return value<br>0xh:x is the higher order time-out value (z9-z4). |
| Duplicate coordinate processing function | 06h | 00h : Duplicate coordinate processing function disenable<br>01h : Duplicate coordinate processing function enable |
| Low power function | 07h | 00h : Direct<br>01h : Auto mode |
| Lock function | 08h | 00h : lock condition<br>01h : lock clear |

| | | | | |
|---|---|---|---|---|
| Interface test function | Interface | C4h | 2 | |
| | A after the reception of 2 bytes data which 1 byte of interface diagnosis command (C4h) and 1 byte of optional data from the host CPU, the controller sends 1 byte of received optional data to the host CPU. | | | |
| Pen up code function | 4 bytes | E3h | 1 | Initial setting : 1 byte |
| | 1 byte | E4h | 1 | |
| | Set the bytes of pen up code. 4 bytes or 1 byte | | | |
| Lock function | Lock condition | E0h | 1 | Initial setting : Lock clear |
| | Lock clear | E1h | 1 | |
| Reset | Reset | C0h | 1 | |
| | Software reset | | | |
| EEPROM reset | EEPROM Reset | C5h | 1 | |
| | EEPROM reset | | | |

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| CHECKED BY: H.KADOWAKI | May.27 '14 | Unless otherwise specified tolerances | |
| DRAWN BY: K.MATSUSHITA | May.26 '14 | Dimensions range | Tolerances |
| | | Up to 6 | ±0.3 |
| | | Over 6 up to 30 | ±0.5 |
| | | Over 30 up to 50 | ±0.8 |
| | | Over 50 | ±1.2 |

MODEL No. FT-CS04B

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### (3) Error codes

- F1 : When receiving an undefined command (the command undefined by this specification), the controller sends F1h to the host CPU.
- F2 : When receiving data which isn't defined by the command composed by plural bytes, the controller sends F2h to the host CPU.
- F3 : When the continuing data can not be received in the command after the time-out time passed, the controller sends F3h to the host CPU.
- F4 : When receiving a new command while receiving a plural composed command, the controller sends F4h to the host CPU.

Notice : Error code "F2" doesn't correspond to all plural composed commands.

## 11. Format of the coordinates data (4-byte)

| bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | |
|---|---|---|---|---|---|---|---|---|---|
| | ph | 0 | 0 | P | X3 | X2 | X1 | X0 | 1st byte |
| | 0 | 0 | X9 | X8 | X7 | X6 | X5 | X4 | 2nd byte |
| | 0 | 1 | 1 | 1 | Y3 | Y2 | Y1 | Y0 | 3rd byte |
| | 0 | 0 | Y9 | Y8 | Y7 | Y6 | Y5 | Y4 | 4th byte |

ph : Phase bit , always set to 1.
P : Pen status (pen down=1, pen up=0)
" 0 " : Always set to 0.
X0 to X9 : The binary number of horizontal axis coordinates value (X). (X9 is the high-order bit)
Y0 to Y9 : The binary number of vertical axis coordinates value (Y). (Y9 is the high-order bit)

According to the pen up code setting, it outputs pen up code data.

(a) Pen up code setting: 1 byte
It outputs "80h" as the pen up code data.

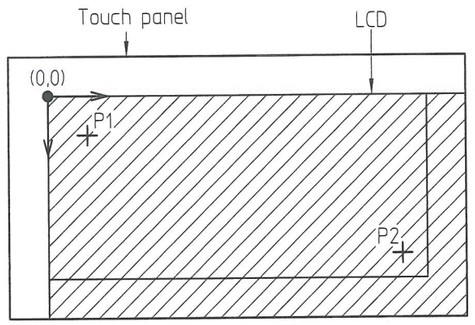
(b) Pen up code setting: 4 bytes
The last data would be as follows
ph (phase bit) : 1
p (pen status) : 0
coordinate data (X0-X9,Y0-Y9) : 00h

Notice: During and after reset, the controller chip sometimes send invalid data (ex. 00h, FFh, F0h, etc.). Please ignore these data by host CPU.

## 12. How to set calibration ratio to controller

(a) Set the controller to the source data mode
(b) Display the 1st reference point P1 to the LCD.
(c) Touch the 1st reference point P1 with the stylus.
(d) Display the 2nd reference point P2 to the LCD.
(e) Touch the 2nd reference point P2 with the stylus.
(f) Host computer receive the A/D value of each 1st reference point P1 and 2nd reference point P2.
(g) Send a calibration ratio command code (83h).
(h) Send the LCD coordinates value of each 1st (P1) and 2nd (P2) reference point (8 bytes).
P1→P2
(i) Send the A/D value of each 1st (P1) and 2nd (P2) reference point (8 bytes).
P1→P2
(j) Switch the controller to the calibration data mode.

Calculate calibration command




P1 : The 1st reference point as first pen down
P2 : The 2nd reference point as 2nd pen down
The area where data is output (The calibration data mode)



| | | | |
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MODEL No. FT-CS04B
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No.T 140040
1E-FT-CS04B_5

## 13 NOTICE TO USE EEPROM

(1) As EEPROM is already mounted on controller, the updated commands are stored to EEPROM and after reboot the controller will start from the updated status. In order to clear the data of EEPROM please follows the steps below.

(a) Send EEPROM clear command (C5h)
(b) Reset the controller chip

(2) There is the limitation for number of data rewrite times to EEPROM. Please avoid to send the commands often from host CPU.

## 14. About the interval time

When canceling an auto stop mode or resetting controller (hardware reset, software reset, power on reset, watch dog reset), the stable time of controller must be taken. The interval time must be more than 150 (ms).

## 15. Notes on use

(1) This product becomes the outside for a guarantee of operation, in use by the combination with touch panels not assembled by NKK SWITCHES CO., LTD.

(2) On the occasion of the handling of this product, be careful enough to static electricity and take the measures against a ground of a worker and a work place.

(3) Please switch on the power supply of this product after connection with a host and a touch panel. Moreover, please switch on the power supply of this product before host starting.

(4) Please be sure the slider of connector CN1 is pulled out, to perform extraction and insertion of a touch-panel tail to the connector CN1. Please give the number of times of extraction and insertion of tail as 10 times or less.

(5) Please do not perform reconstruction of this product.

(6) This product may change the contents without a preliminary announcement for improvement.

(7) Please do not use the commands except shown 10(2).

(8) It cannot assume all the responsibilities to the damage that occurs by having used this product.

(9) Please separate the tail that ties to the control board the touch panel from the noise source (inverter for the LCD drive etc.) as much as possible to avoid the malfunction by the noise.

(10) It will assume the guaranteed term to be one year after delivery.

(11) Even once calibration was generated, the gap may occured between touch position and cursor position by change in ambient environment such as secular distortion, temperature change, extraction and insertion of touch panel tail to the connector, etc. In this case, calibrate again to accurate the touch and cursor position.



| | | | |
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