

Second Edition, May, 2015 (Japanese version)

First Edition, June, 2015 (English version)

! Read this first !

This manual provides important information that the customer should know before using. We recommend reading this first.

● Introduction ●

First of all, thank you for having purchased our development kit (STK430C-01) (the “Product”). This hardware manual (the “Manual”) provides an overview of the Product. We hope that you will read the Manual carefully and make use of it for efficient development.

● Important Information ●

1. The Product and this Manual may change without notice. Before using the Product, obtain the newest catalog, manual, etc., from the company website.
2. The Product is not designed to be used in systems or devices that can cause death, injury, or serious physical or environmental damage directly due to any malfunction of the Product (life support device, nuclear facility equipment, aircraft, traffic control equipment, various safety devices, etc.). Danger and damage due to the Product being used in the foregoing systems or devices are the sole responsibility of the customer.
3. We assume no responsibility for any damages due to the use or the operation of the Product in a misguided or wrongful way.
4. The usage examples outlined herein are only an explanation of the Product functions. We assume no responsibility for any complaints, accidents, or any disadvantages which may be caused by the use on the basis of the examples outlined in this Manual.
5. Manufacturing of microSD cards that are built into the customer’s products is not permitted if the customer is not a member of the SD Association. Customers should sufficiently understand the foregoing before commencing the manufacture of products. We accept no responsibility for any trouble.
However, we accept responsibility when building our finished substrates without modifications in customer’s products.
6. Remove or insert the microSD card only when the power is OFF.

Table of Contents

1. Product Composition	Page 4
2. General Specifications of Attached Articles	Page 4
3. Connection Method	Page 6
4. Method of Checking Operation	Page 7
5. 24-dot font Writing Method and Drawing Check	Page 13
6. BMP Image Data Registration and Drawing	Page 18
7. Front Panel (with Fittings) KSS43DFBP Dimensional Drawing	Page 26
8. Outline Drawing (including Front Panel)	Page 26
9. Mounting Panel Machining Drawing (Hollowing Dimension)	Page 27

1. Product Composition

- (1) An LCDC Board with a command-driven LCD controller “**LCDC430C-01**” (built in LCD panel).
- (2) LCD Panel (with touch panel)
TFT LCD “**LMTM043WQVNCB-4R**” (DENSITRON)
- (3) A front panel (with fittings) **KSS43DFBP**
- (4) A Set of Circuit Diagrams (CD-ROM)
- (5) A Set of Cables and Connectors
- (6) A Set of Manuals (CD-ROM)

2. General Specifications of Attached Articles

2-1 LCDC Board with Command-driven LCD Controller

The LCDC board mounts a command-driven LCD controller KS-430CT-11.
The model number is described below.

Model Number: LCDC430C-01

For the detailed specifications, refer to the manuals attached to the CD-ROM.

2-2 LCD Panel (with touch panel)

A WQVGA TFT LCD “LMTM043WQVNCB-4R” manufactured by DENSITRON is used.

2-3 Front Panel (with Fittings)

Our front panel (with fittings) KSS43DFBP is used.

2-4 A Set of Circuit Diagrams (CD-ROM)

The circuit diagrams of the LCDC board (LCDC430C-01) are attached to the starter kit for customers’ development. However, the use of the circuit diagrams should be conducted with caution, in which the customer takes full responsibility. The circuit diagrams do not ensure the operations.

2-5 A Set of Cables and Connectors

(1) Unconnected XH7 pin (for CN1) Model No. **KS-X7CB**

This is a harness for the CN1 of the LCDC board (LCDC430C-01.) The cable diagram is shown in Fig. 2-1.

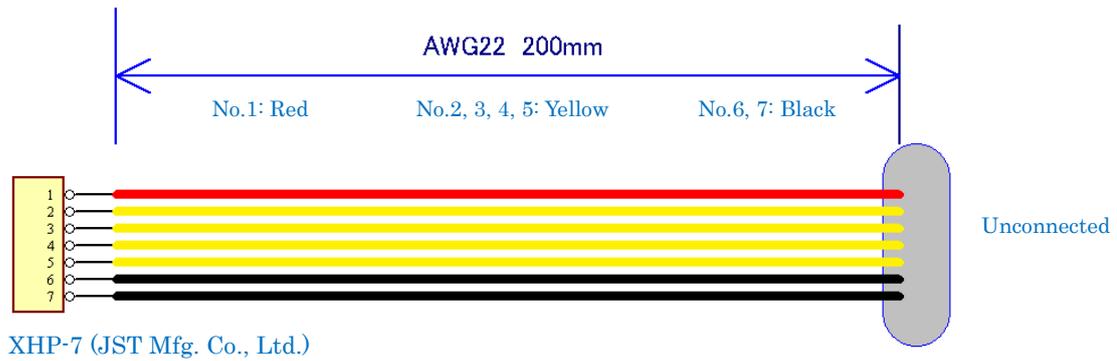


Fig. 2-1 Harness for CN1

Customers should prepare the connection cable on the unconnected side to connect to a board prepared by customers.

2-6 A Set of Manuals (CD-ROM)

The manual, LCDC board's manual, command-driven LCD controller's hardware manual, and command manual are attached.

3. Connection Method

The example of connection with the LCDC board, LCD, dedicated power supply unit KS-ELKIT (optionally available), and PC is shown in Fig. 3-1.

The RS-232C cable (Model No. KS-232CB-RE) with a 5V Power Y-terminal attached to the KS-ELKIT (option) includes the 7-pin connector (J.S.T. Mfg. XHP-7). Connect the connector to the CN1 on the LCDC board.

Connect the D-sub 9-pin connector of the RS-232C cable (Model No. KS-232CB-RE) to the COM port in the PC. When there is no COM port in the PC, use a commercial USB-serial conversion cable.

Connect these when the power is OFF. Also, release these connections (remove the cables from the connectors) when the power is OFF.

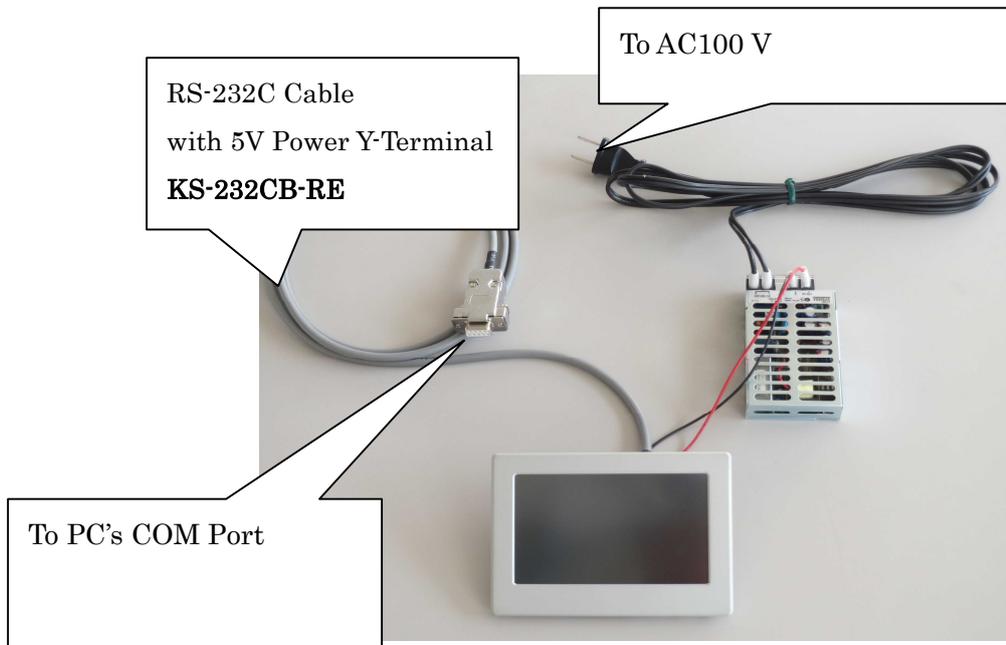


Fig. 3-1 Connection Diagram

4. Method of Checking Operation

The method of checking operation that submits commands to check the drawing functions with the Tera Term free communication software is described below.

4-1 Activation of the communication software and initialization

- (1) Activate the Tera Term. Then, the window shown in Fig. 4-1 will appear. Select the “Serial,” as shown in Fig. 4-2, to select the port type. Press the “OK button,” and then the screen shown in Fig. 4-3 will appear.

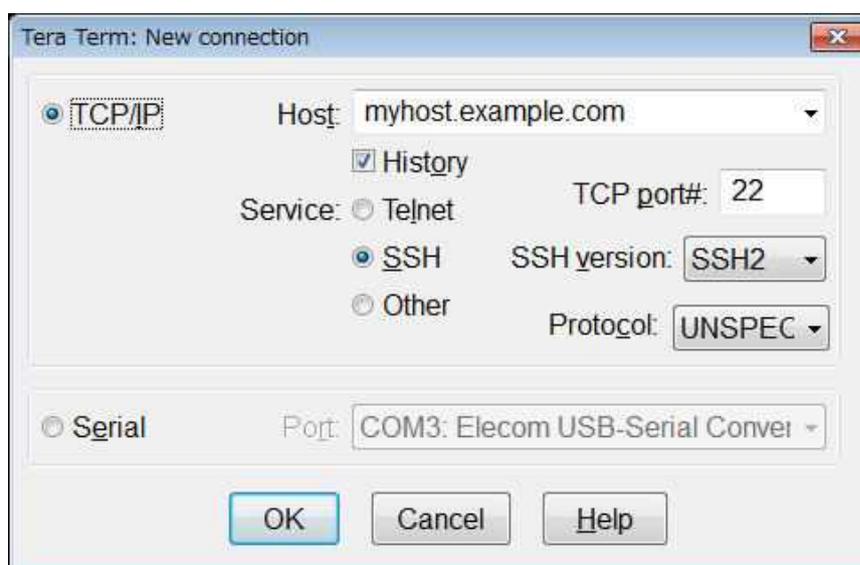


Fig. 4-1

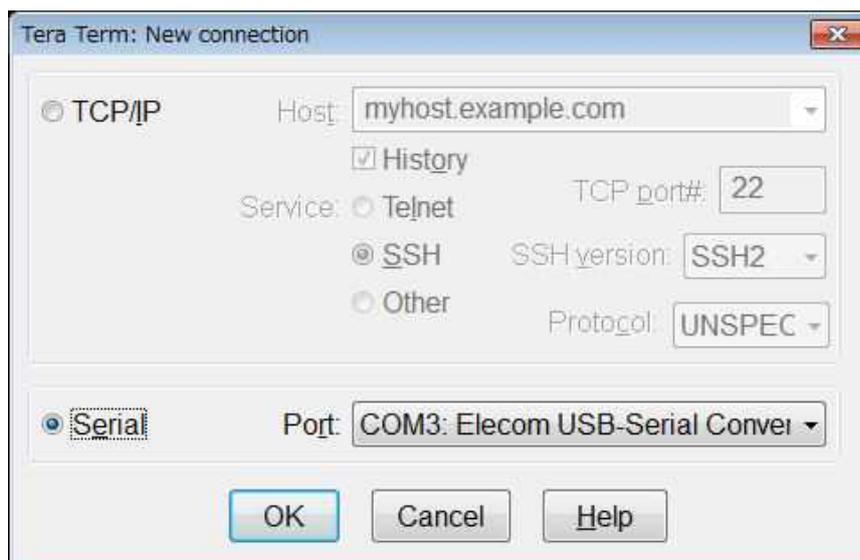


Fig. 4-2

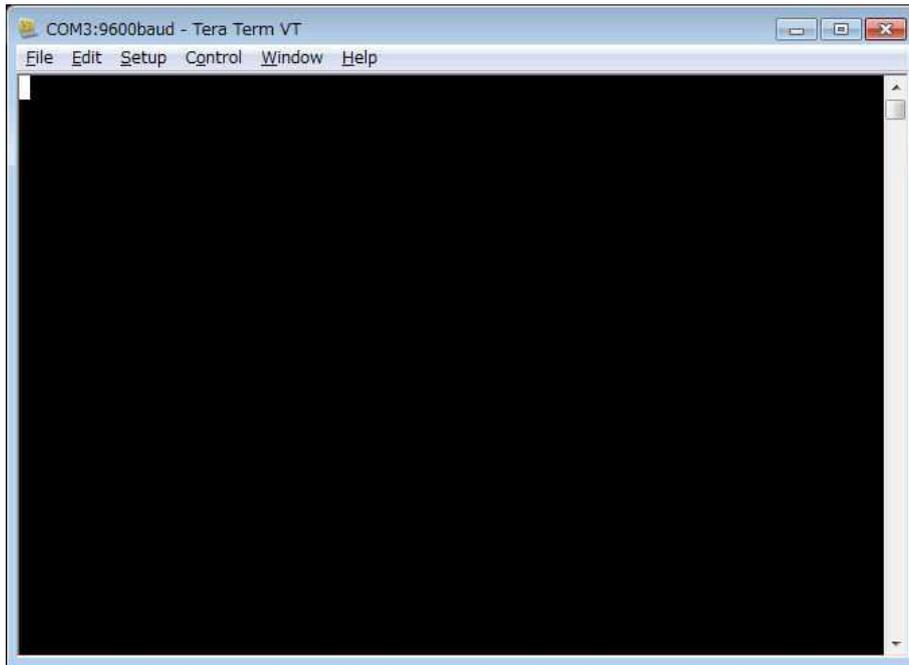


Fig. 4-3

- (2) Select the “Setting Menu → Serial Port”. Then, set the communication parameters.

The screen shown in Fig. 4-4 will appear. Set the parameters mentioned below.

- Baud Rate: 115200 bps
- Flow Control: hardware

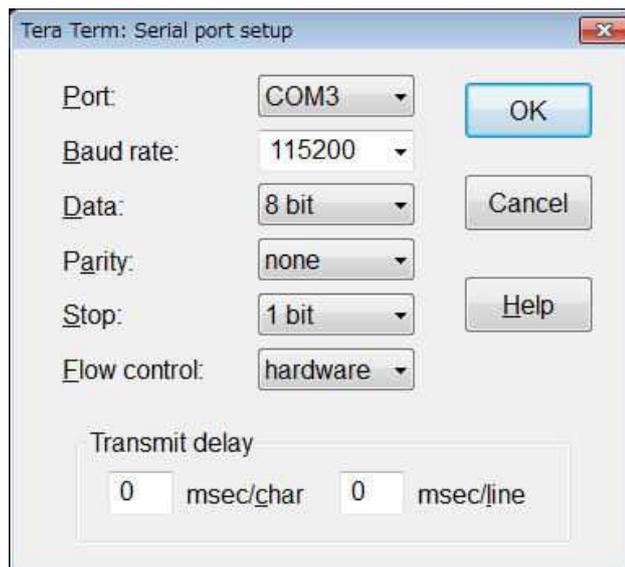


Fig. 4-4

-
- (3) Select the “Setting Menu → Terminal”. Then, set the terminal.

The screen shown in Fig. 4-5 will appear. Thus, set the terminal mentioned below.

Ignore other items, including the “locale,” in Fig. 4-5.

- New-line code Receive: CRLF
- Select the “Local echo.”
- Kanji – Transmission: SJIS

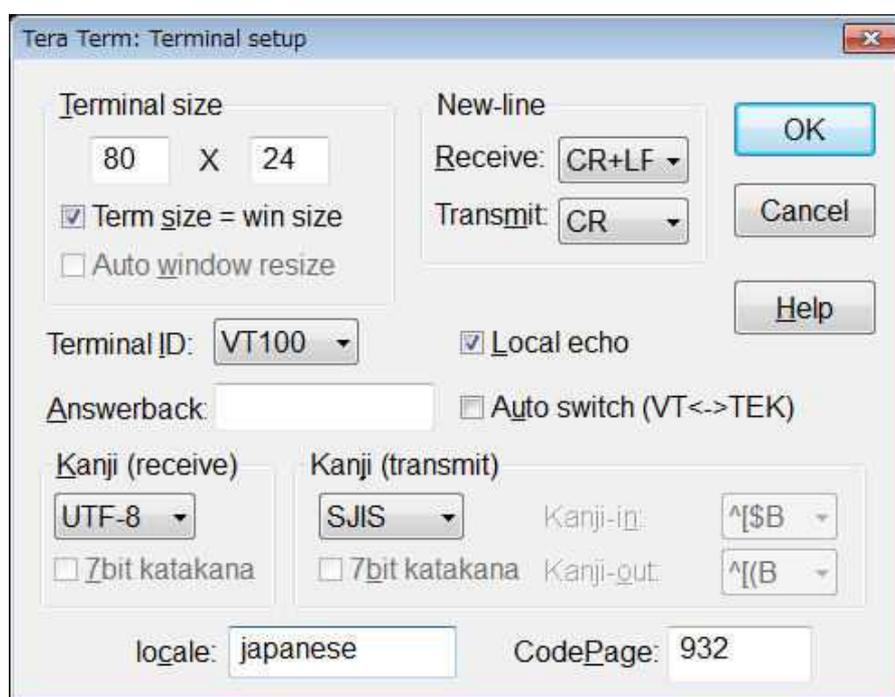


Fig. 4-5

- (4) After setting the above, save the set contents. Select the “Setting Menu → Save Set Contents.” Then, the screen shown in Fig. 4-6 will appear and give a file name to save it.

Subsequently, when opening the set file saved with the set read, the set will be the above

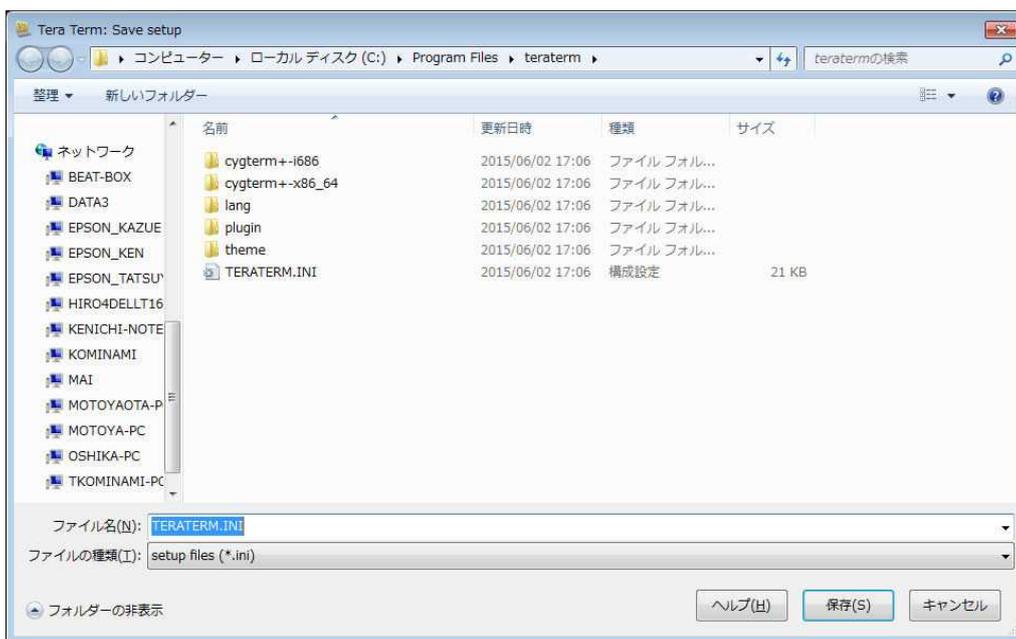


Fig. 4-6

4-2 Command transmission

The conditions when transmitting the commands from the Tera Term are shown in Fig. 4-7 to 4-9.

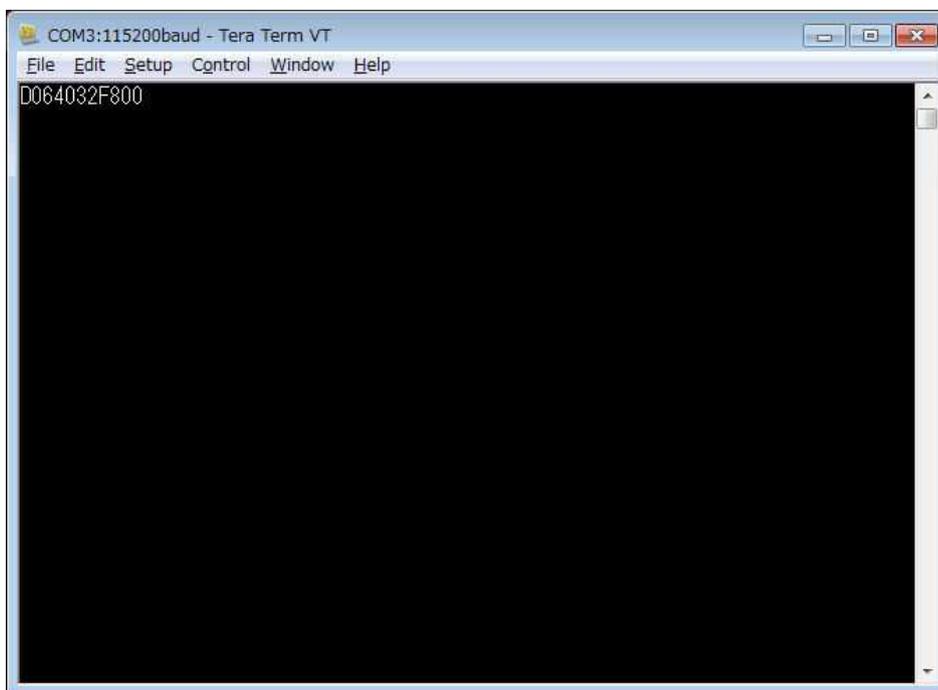


Fig. 4-7 Example of Dot Drawing Command Transmission

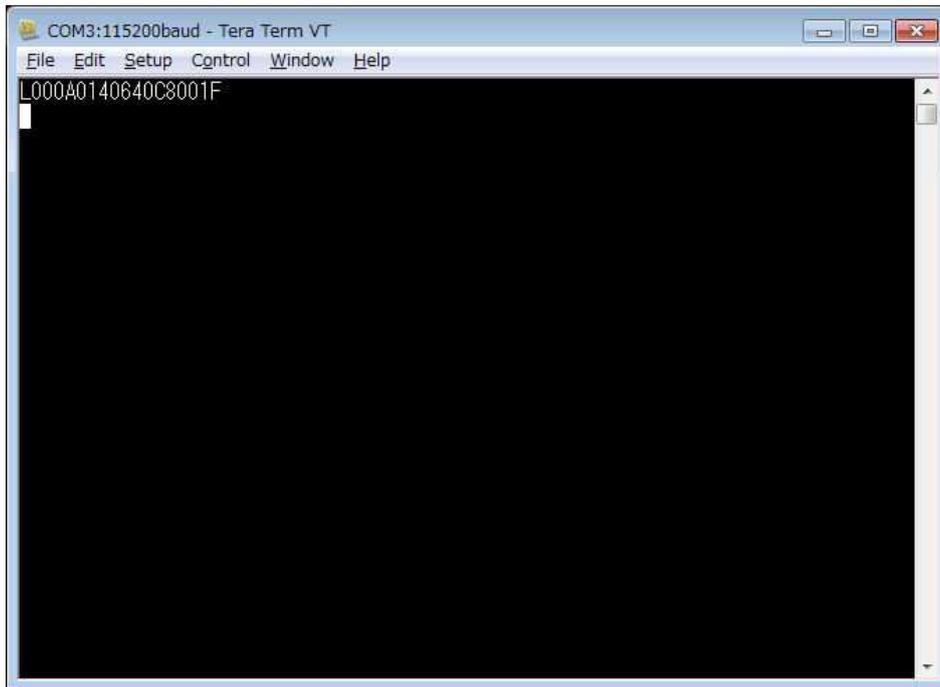


Fig. 4-8 Example of Line Drawing Command Transmission

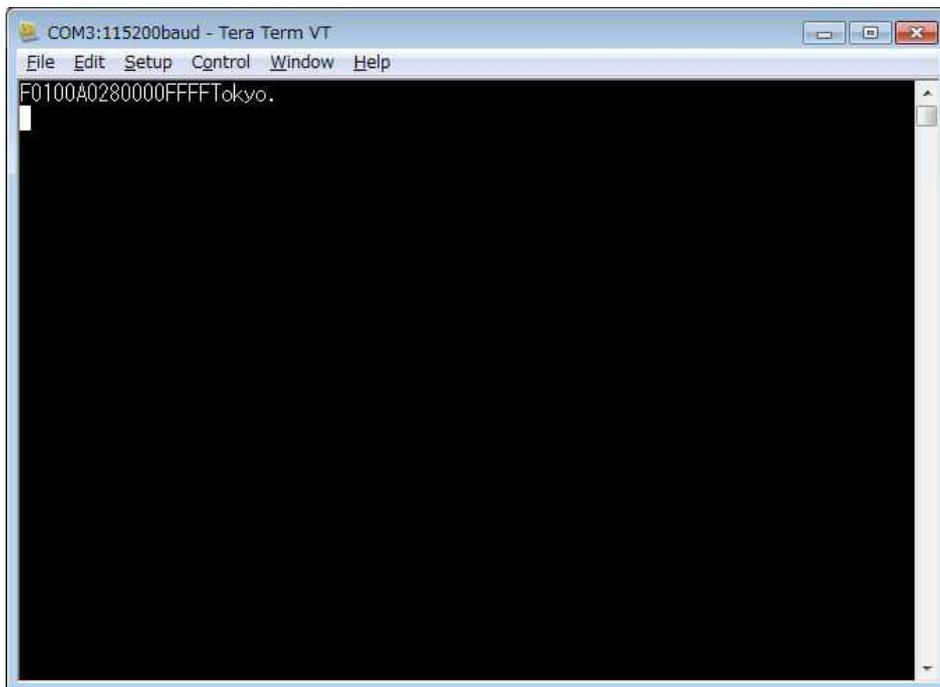


Fig. 4-9 Example of Character Drawing Command Transmission

Fig. 4-7 shows an example of the dot drawing command transmission, Fig. 4-8 shows an example of the line drawing command transmission, and Fig. 4-9 shows an example of the character drawing command transmission. These commands are transmitted. Then, dots, lines, and characters will appear on the LCD.

The command manual (command-driven LCDC command spec) includes examples of other commands. Try and test them.

5. 24-dot font Writing Method and Drawing Check

5-1 24-dot font writing method

The method for writing the 24-dot font data in the serial flash memory that is mounted on the LCDC board is described below.

The 24-dot font data has been written in the serial flash memory at our factory. Thus, such writing work is not necessary for customers.

When a customer purchases only the command-driven LCD controller and will prepare a customer's board, refer to the method.

- (1) First, copy the 24-dot font data file font24.bin in the CD-ROM attached to the starter kit to the root directory in the microSD card. The 24-dot font data file font24.bin includes the 12-24 dot half size font data (excluding half size Kana characters) and the 24-24 dot full size font data (JIS 1st and 2nd level Kanji.)
- (2) Check if the LCDC board power is OFF then insert the microSD card into the microSD card connector (CN2).
- (3) Turn on the LCDC board power then activate the communication software described in "4. Operation Checking Method."
- (4) Input the "0123456789," as shown in Fig. 5-1. Then, press the return key to transmit the characters. The character string that "Kanji code 24 Dot start OK" is returned from the LCDC board. Then, the string will appear on the screen of the communication software.

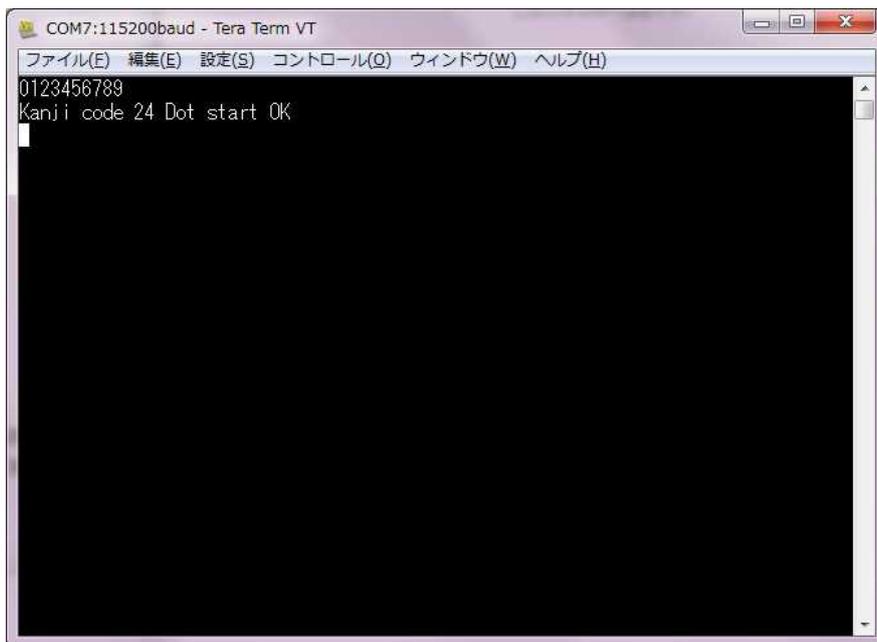


Fig. 5-1

- (5) Input the characters “Arela,” as shown in Fig. 5-2. Then, press the return key to transmit the characters.

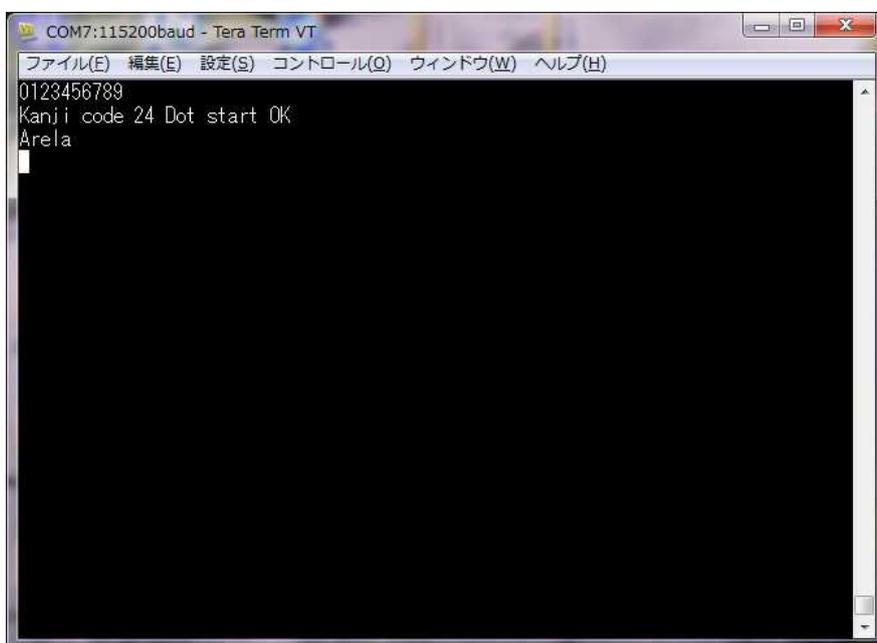


Fig. 5-2

-
- (6) The message “SFM is being erased” will appear on the LCD. Then, the serial flash memory mounted on the LCDC board will be erased (only the region in which the Kanji font data is stored will be erased.)
 - (7) After the serial flash memory has been erased, the message “SFM has been erased successfully” will appear for one minute. Then, the message “the font data is being written in SFM” will appear and the font data will be written.
 - (8) After the font data has been written, the message “Font data has been written in SFM” will appear.
 - (9) Next, check to determine whether the font data has been written normally. Input the characters “AFi,” as shown in Fig. 5-3. Then, press the return key to transmit the characters.

The character strings “f7” and “Flash rom check Sum end” are returned from the LCDC board. Then, the string will appear on the screen of the communication software.

If the “f7” is returned, the font data has been written normally.

If “f7” string is not returned, perform the wiring processing from step (5) again.

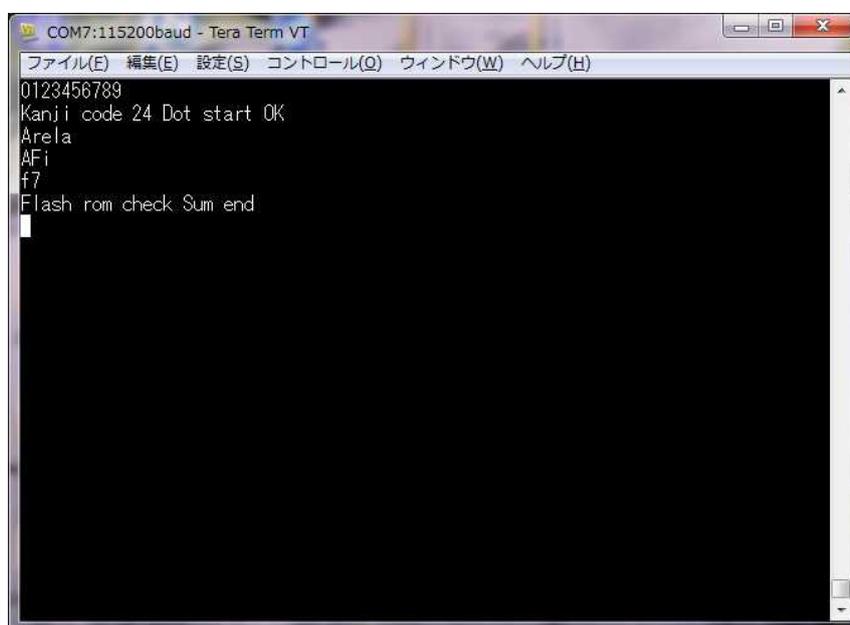


Fig. 5-3

- (10) Finally, input the characters “0123456789,” as shown in Fig. 5-4. Then, press the return key to transmit the characters.

The string “Kanji code 24 Dot end” is returned from the LCDC board. The string will appear on the screen of the communication software. Accordingly, the commands can be processed normally.

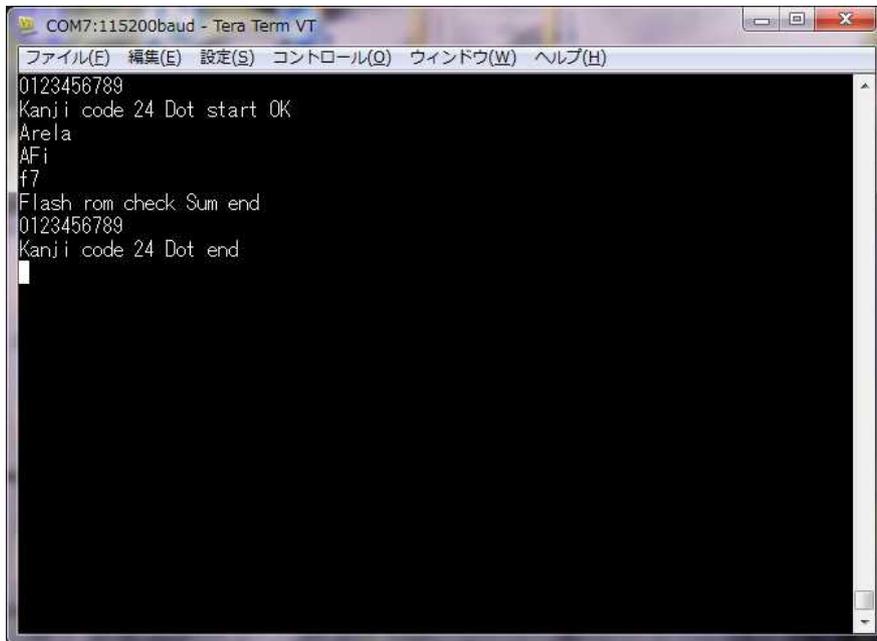


Fig. 5-4

5-2 Drawing check

The 24-dot font character drawing method is described below.

- (1) Turn on the LCDC board power and activate the communication software described in “4. Operation Checking Method.”
- (2) Input the command that “F10000017F800FFFFABCDEFGHJK”, as shown in Fig. 5-5, and then press the return key. The characters are drawn on the screen, as shown in Fig. 5-6.

The command manual (command-driven LCDC command spec) includes explanations of commands. Refer to them.

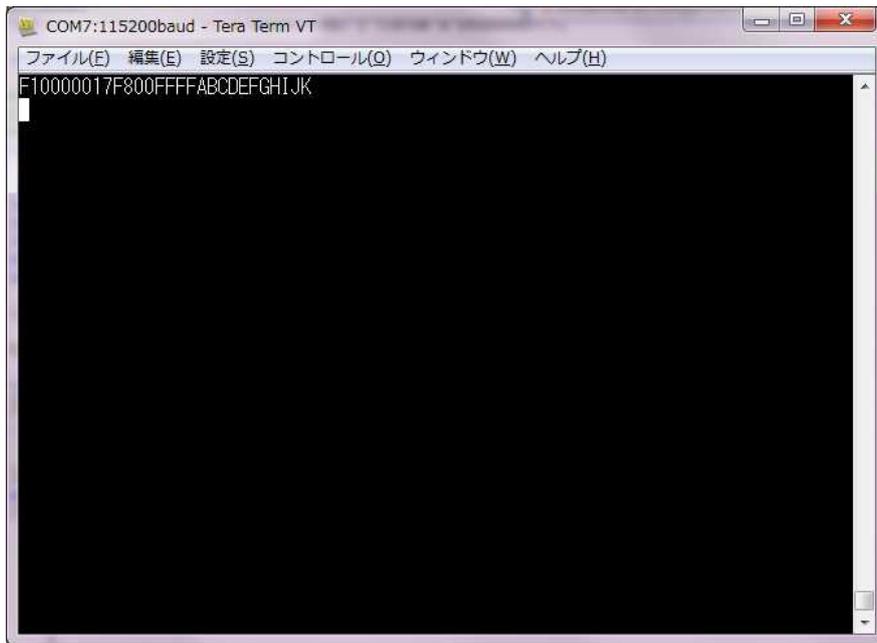


Fig. 5-5



Fig. 5-6

6. BMP Image Data Registration and Drawing

The methods for registering the BMP image data that is stored in the microSD card to the serial flash memory that is mounted on the LCDC board and for registering the BMP image data that is converted on the microSD card are described.

Also, the method for drawing the registered BMP image data to the LCD is described.

6-1 BMP image data preparation

6-1-1 BMP image data specifications

Prepare the BMP image data with the following specification data.

Table 6-1 BMP Image Specifications

Item	Specifications	Remarks
Format	Windows Bitmap	
Width of Image	Max. 480	
Height of Image	Max. 272	
Data size per 1 (one) pixel	24 bit true color	
Compression format	Not compressed	

There will be no problem when saving the BMP image that was created with a paint tool normally installed in Windows, if the file type is the format saved with the 24-bit bitmap.

6-1-2 BMP image file name

The BMP image file name should be increased by 1 (one) from the “00000” mentioned below.

00000.bmp

00001.bmp

00002.bmp

.

.

.

00010.bmp

.

.

.

6-1-3 Number of BMP data registration

A maximum of 8,192 BMP image data can be registered. However, when the BMP image data is registered in the serial flash memory, the number of the maximum images that can be registered decreases with the image size of the BMP image data. For the details, refer to the hardware manual of the command-driven LCD controller.

6-2 BMP Image Data Registration (W) Command

The command of the BMP image data registration is described below.

6-2-1 Description of Command

The BMP image data registration is performed.

The command and data column are represented with the following formats shown in Table 6-2.

Table 6-2 BMP Image Registration (W) Command Format

	Command	Data Column
Contents	W	Type of Data
Data	1 byte	1 byte

The type of data allows one to select a registration destination, as shown in Table 6-3.

Table 6-3 Type of Data

Type of Data	Registration Destination
'0'	Registers the microSD card to the flash memory.
'1'	Registers the microSD card to the microSD.

6-2-2 Example of Command

When registering the microSD card to the microSD card, the command is described in Table 6-4.

Table 6-4 Example of BMP Registration (W) Command

	Command	Data Column
Contents	W	Type of Data
Data	W	1

6-2-3 Command Error Condition

The following conditions will cause a command error.

- When setting of the type of data is not listed in Table 6-3
- When the numbers of command bytes are not matched
- When the checksums are not matched (when the checksums are enabled)

6-3 Method of registering image data in the serial flash memory

The sample BMP data is stored in the BMP sample folder in the CD-ROM that is attached to the starter kit.

The BMP data is registered in the serial flash memory by the following procedure.

- (1) Insert the microSD card into the PC.
- (2) Create the folder that “pixsbmp” in the root directory and copy the image data in the CD ROM to the folder.
- (3) Remove the microSD card from the PC and check if the LCDC board power is OFF. Then, insert the microSD card into the microSD card connector (CN2).
- (4) Turn on the LCDC board power and start up the communication software.
- (5) Input the characters “W0”, as shown in Fig. 6-1. Then, press the return key to transmit the characters.

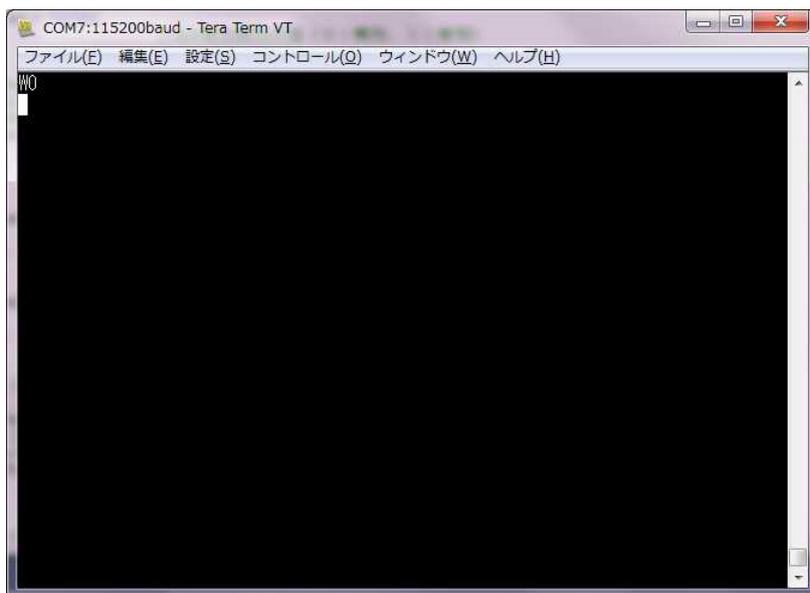


Fig. 6-1

- (6) The message “SFM is being erased” will appear on the LCD. Then, the serial flash memory that is mounted on the LCDC board will be erased (the range that will be erased will be only the region in which the Kanji font data is stored.)
- (7) After the serial flash memory has been erased, the message “SFM has been erased successfully” will appear for one minute. Then, the message “the image data is being written in SFM” will appear and the BMP image data will be written.
Also, during the writing, the file name of the BMP image data being written with “/pixsbmp/00001.bmp” will appear.
- (8) After all of the BMP image data has been written, the message “the BMP image data has been written to SFM” will appear. Thus, turn off the LCDC board power and remove the microSD card.

6-4 Method of registering image data on the microSD card

The BMP data is converted and registered to the microSD card by the following procedure.

- (1) Insert the microSD card into the PC.
- (2) Create the folder that “pixsbmp” in the root directory and copy the image data in the CD ROM to the folder.
- (3) Remove the microSD card from the PC and check if the LCDC board power is OFF. Then, insert the microSD card into the microSD card connector (CN2).
- (4) Turn on the LCDC board power and start up the communication software.
- (5) Input the characters “W1”, as shown in Fig. 6-2. Then, press the return key to transmit the characters.

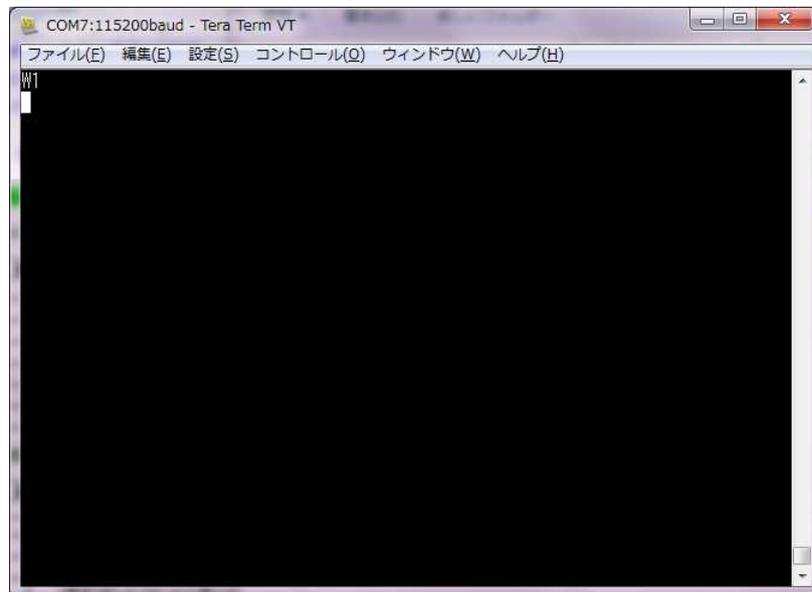


Fig. 6-2

- (6) The message that “Folder is being created” will appear on the LCD. Then, create the folders from “PIXBIN00” to “PIXBIN63” (a total of 64 folders are created.) in the root directory in the microSD card.
- (7) After the folders have been created, the message “the image data is being written” will appear and the BMP image data will be written.
Also, during the writing, the message that “/pixsbmp/00000.bmp” (the folder and file name of the conversion source) and “/pixbin00/00000.bmp” (the folder and file name of the conversion destination) will appear.

- (8) After all of BMP image data has been written, the message “BMP image data has been written” will appear on the LCD.

6-5 Image data drawing and drawing command

The functions are to read image data that is stored in the serial flash memory connected to the LCD controller or the microSD card and to draw image data on the screen. Specify the starting point coordinates (X, Y) and the number of images to be drawn by the commands.

The commands are described below.

6-5-1 Description of Command

The command and data column are represented with the formats shown in Table 6-5.

Table 6-5 Image Data Drawing (P) Command Format

	Command	Data Column			
Contents	P	Type of Data	X Coordinate	Y Coordinate	Image Number
Data	1 byte	1 byte	3 byte	3 byte	4 byte

The type of data allows one to select a transfer source, as shown in Table 6-6.

Table 6-6 Type of Data

Type of Data	Type
'0'	Transfers the image data from the serial flash memory to draw
'1'	Transfers the image data from the microSD card to draw

The image number allows one to specify the number of an image to be drawn. The image number ranges 0x0000 (0) to 0x1FFF (max. 8191). When using the serial flash memory, the number of images decreases from 8,192 images.

6-5-2 Examples of Command and Drawing

When the transfer source is the serial flash memory and the image with the starting point coordinates (0, 0) and the image number of “0” is drawn, the command is represented, as shown in Table 6-7.

Also, the drawing result when this command is executed is shown in Fig. 6-3.

Table 6-7 Example of Image Data Drawing (P) Command

Contents	Command	Data Column			
		Type of Data	X Coordinate	Y Coordinate	Image Number
Data	P	0	000	000	0000



Fig. 6-3 Condition when a dot was drawn on the screen

6-5-3 Command Error Condition

The following conditions will cause a command error.

- When the type of data is not listed in Table 6-6
- When the numbers of command bytes are not matched
- When the coordinates are not within the display range

When drawing with the starting point coordinates within the display range and the image exceeds the display range due to the image size, a command error will not occur.

Accordingly, drawing will be done continuously. In this case, be careful that it may be drawn on a separate page.

- When the image number is out of the range
- When the characters of the data column are not '0' – '9' or 'A' – 'F'
- When the checksums are not matched (when the checksums are enabled)

- When the processing in the drawing is not successful

When the transfer source is the serial flash memory, the following conditions will cause a command error.

- When the access to the serial flash memory is not successful
- When there is no image data in the image number specified

When the transfer source is the microSD card, the following conditions will cause a command error.

- When the microSD card is not inserted
- When the access to the serial flash memory is not successful
- When there is no image data in the image number specified
- When the image size exceeds the display range

6-6 Image data transfer time

The time of transferring the image data from the serial flash memory to the frame buffer memory is described in Table of 6-8.

Table 6-8 Image Data Transfer Time

Item	min	max	Unit	Condition
Transfer Time	280	300	msec	Image Size 480×272

Table 6-9 shows the transfer time result when the microSDHC card (Manufacturer: Toshiba, Capacity 32 GB) is used, and Table 6-10 shows the transfer time result when the microSD card (Manufacturer: Panasonic, Capacity 2 GB) is used.

Table 6-9 Transfer Time Result when the microSDHC card is used

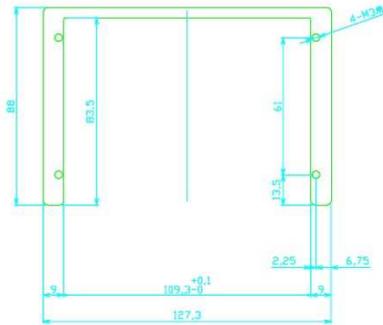
Item	min	max	Unit	Condition
Transfer Time	280	340	msec	Image Size 480×272

Table 6-10 Transfer Time Result when the microSD card is used

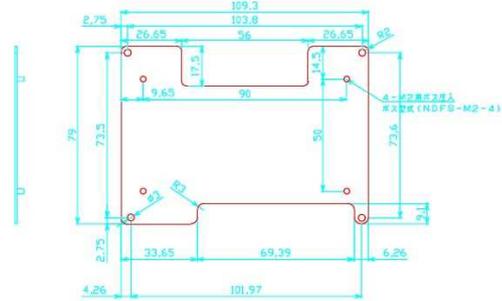
Item	min	max	Unit	Condition
Transfer Time	420	460	msec	Image Size 480×272

7. Front Panel (with Fittings) KSS43DFBP Dimensional Drawing

Mounting plate sus t1.5

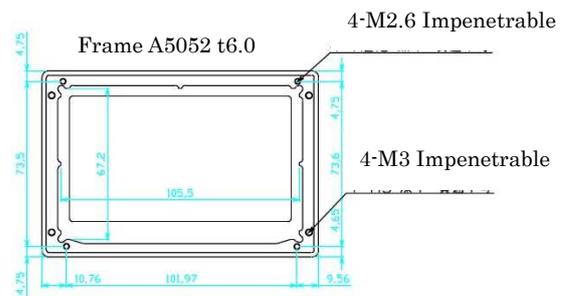
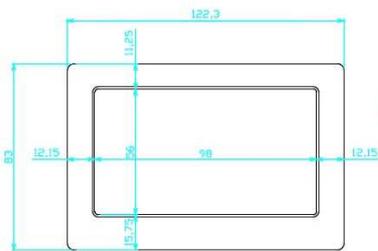


LCD retainer plate AL t1.0

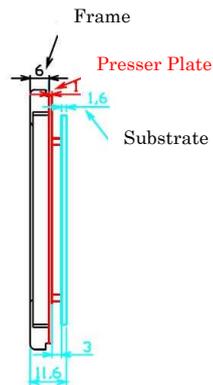


Frame

A5052



8. Outline Drawing (including Front Panel)



9. Mounting Panel Machining Drawing (Hollowing Dimension)

