



User Manual

E-Paper Display Module EPM-880

Wireless ePaper Display Solution

ADVANTECH

Enabling an Intelligent Planet

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This warranty does not apply to any products which have been repaired or altered by persons other than repair personnel authorized by Advantech, or which have been subject to misuse, abuse, accident or improper installation. Advantech assumes no liability under the terms of this warranty as a consequence of such events.

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1. Collect all the information about the problem encountered. (For example, CPU speed, Advantech products used, other hardware and software used, etc.) Note anything abnormal and list any onscreen messages you get when the problem occurs.
2. Call your dealer and describe the problem. Please have your manual, product, and any helpful information readily available.
3. If your product is diagnosed as defective, obtain an RMA (return merchandise authorization) number from your dealer. This allows us to process your return more quickly.
4. Carefully pack the defective product, a fully-completed Repair and Replacement Order Card and a photocopy proof of purchase date (such as your sales receipt) in a shippable container. A product returned without proof of the purchase date is not eligible for warranty service.
5. Write the RMA number visibly on the outside of the package and ship it prepaid to your dealer.

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Technical Support and Assistance

1. Visit the Advantech web site at www.advantech.com/support where you can find the latest information about the product.
2. Contact your distributor, sales representative, or Advantech's customer service center for technical support if you need additional assistance. Please have the following information ready before you call:
 - Product name and serial number
 - Description of your peripheral attachments
 - Description of your software (operating system, version, application software, etc.)
 - A complete description of the problem
 - The exact wording of any error messages

Packing List

Before setting up the system, check that the items listed below are included and in good condition. If any item does not accord with the table, please contact your dealer immediately:

- 1 x EPM-880-101:31.2" ePaper display module
- 4 x 1700031315-01: F cable FFC 50P-0.5/50P-0.5 5.6cm
- 1 x 1700029192-01:M cable USB-A 4P(M)/Mirco USB-B 5P(M) 60cm
- 1 x 96PSA-A60W12W7-3: ADP A/D 100-240V 60W 12V

Ordering Information

P/N	Description
EPM-880-101	31.2" 16 Gray level, Ultra low power in wide temperature display module
96PSA-A60W12W7-3	ADP A/D 100-240V 60W 12V C14 LOCKABLE DC PLUG
1700031315-01	F cable FFC 50P-0.5/50P-0.5 5.6cm
1700029192-01	M cable USB-A 4P(M)/Mirco USB-B 5P(M) 60cm

Safety Instructions

1. Read these safety instructions carefully.
2. Keep this User Manual for later reference.
3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
4. For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.
5. Keep this equipment away from humidity.
6. Put this equipment on a reliable surface during installation. Dropping it or letting it fall may cause damage.
7. The openings on the enclosure are for air convection. Protect the equipment from overheating. **DO NOT COVER THE OPENINGS.**
8. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
9. Position the power cord so that people cannot step on it. Do not place anything over the power cord.
10. All cautions and warnings on the equipment should be noted.
11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
12. Never pour any liquid into an opening. This may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
14. If one of the following situations arises, get the equipment checked by service personnel:
 - The power cord or plug is damaged.
 - Liquid has penetrated into the equipment.
 - The equipment has been exposed to moisture.
 - The equipment does not work well, or you cannot get it to work according to the user's manual.
 - The equipment has been dropped and damaged.
 - The equipment has obvious signs of breakage.

DISCLAIMER: This set of instructions is given according to IEC 704-1. Advantech disclaims all responsibility for the accuracy of any statements contained herein.

Consignes de Sécurité

1. Lisez attentivement ces instructions de sécurité.
2. Conservez ce manuel de l'utilisateur pour référence ultérieure.
3. Débranchez cet appareil de toute prise secteur avant le nettoyage. Utilisez un chiffon humide. N'utilisez pas de détergents liquides ni en spray pour le nettoyage.
4. Pour les équipements enfichables, la prise de courant doit être située à proximité de l'équipement et doit être facilement accessible.
5. Gardez cet équipement à l'abri de l'humidité.
6. Placez cet équipement sur une surface fiable lors de son installation.
7. Les ouvertures de l'enceinte sont destinées à la convection de l'air. Protégez le matériel contre la surchauffe. **NE COUVREZ PAS LES OUVERTURES.**
8. Assurez-vous que la tension de la source d'alimentation est correcte avant de connecter l'équipement à la prise de courant.
9. Placez le cordon d'alimentation de sorte que personne ne puisse marcher dessus. Ne placez aucun objet sur le cordon.
10. Toutes les mises en garde et avertissements sur l'équipement doivent être notés.
11. Si l'équipement n'est pas utilisé pendant une longue période, débranchez-le de la source d'alimentation pour éviter tout dommage dû à une surtension transitoire.
12. Ne jamais verser de liquide dans une ouverture sous peine de provoquer un incendie ou un choc électrique.
13. Ne jamais ouvrir l'appareil. Pour des raisons de sécurité, cet équipement ne doit être ouvert que par du personnel qualifié.
14. Si l'une des situations suivantes se produit, faites vérifier l'équipement par le personnel de service:
 - Le cordon d'alimentation ou la fiche est endommagé.
 - Un liquide a pénétré dans l'appareil.
 - L'équipement a été exposé à l'humidité.
 - L'équipement ne fonctionne pas bien ou vous ne pouvez pas le faire fonctionner conformément au manuel d'utilisation.
 - L'équipement est tombé et a été endommagé.
 - L'équipement présente des signes évidents de rupture.

AVERTISSEMENT: Cet ensemble d'instructions est donné conformément à la norme CEI 704-1. Advantech décline toute responsabilité quant à l'exactitude des déclarations contenues dans le

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Chapter 1

Introduction

1.1 Introduction

EPM-880 is an ultra-low power Wireless ePaper Display integrated with 31.2" B/W EPD and 4096 colors filter in an ARM Cortex-M7 processor. The module is designed for hospital, factory, warehouse and retail applications. Advantech EPD-322 provides multiple interfaces for application control. These are highly integrated with the EPD driver and offer a low power consumption system.

The main features of EPM-880 is:

- ARM Cortex-M7 Core Processor
- 31.2" ePaper panel display: EPM-880 for 16-levels gray scale
- Wide range temperature from -15-65 °C

1.2 Specifications

EPM-880 Specifications (EPD Driving Board only)		
Computing System	MCU	32-bit Arm [®] Cortex [®] -M7 480MHz MCUs, 128 KB Flash
	Memory	1 MB RAM
Display	Screen Size	697.2 (H) x 402.8 (V) mm
	Resolution	2560 x 1440 pixels for 16 gray level
I/O (on-board)	Power connector	
	USB	USB for host control
	EPD connector	50P for ePaper connector
Power	DC 12V	
	Power consumption	–System change 1pc image: 276 mA on EPD-880 driving board –System stay power saving mode: spend 39 mA on EPD-880 driving board
Environment	Operational Temperature	Wide Range Temperature supports in -15 - 65 °C in 1 bits color
	Non-Operational Temp.	-25 ~ 70 °C (B/W)
	Assembly Temperature	10 ~ 40 °C
	Operating Humidity	5 ~ 85% Relative Humidity, non-condensing
Physical Characteristics	Dimensions (W x H)	PCBA: 400 x 65 mm
	Weight	5.3 kg

Note! To create an image for EPD follow these instructions.



1. The Image needs to be set to 2560*1440 pixels, do not resize it after completing the image which will cause jaggy edges.
2. 4-bit/BMP format for 16 gray level panel.
3. 1-bit/BMP format for wide range temperature.

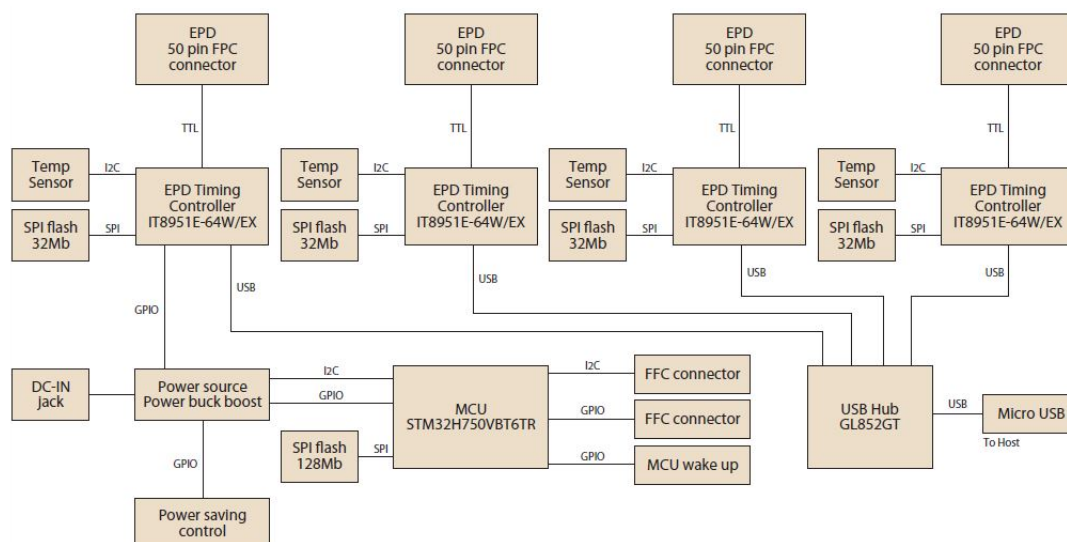


Figure 1.1 Block Diagram

1.3 Advantech EPM-880 ePaper Display Module Solution

The Advantech EPM-880 driving board provides a USB interface that enables connection to a host computer. Advantech provides ready-to-install SW on a host computer to control the ePaper and push an image through to the EPM-880 driving board.

Chapter 2

EPM-880 Hardware Specifications

2.1 EPM-880 Hardware Specification

This section provides board level PCBA design EPM-880 information. The diagram below shows the top view (figure 2.1), and the bottom view (figure 2.2.)

EPD-880 PCBA specifications:

- PCBA: 400 x 65 x 10 mm
- PCB thickness: 1.6 mm \pm 10%
- Module input voltage: 12 V DC-in
- Connector current rating: 5 A / Power contact

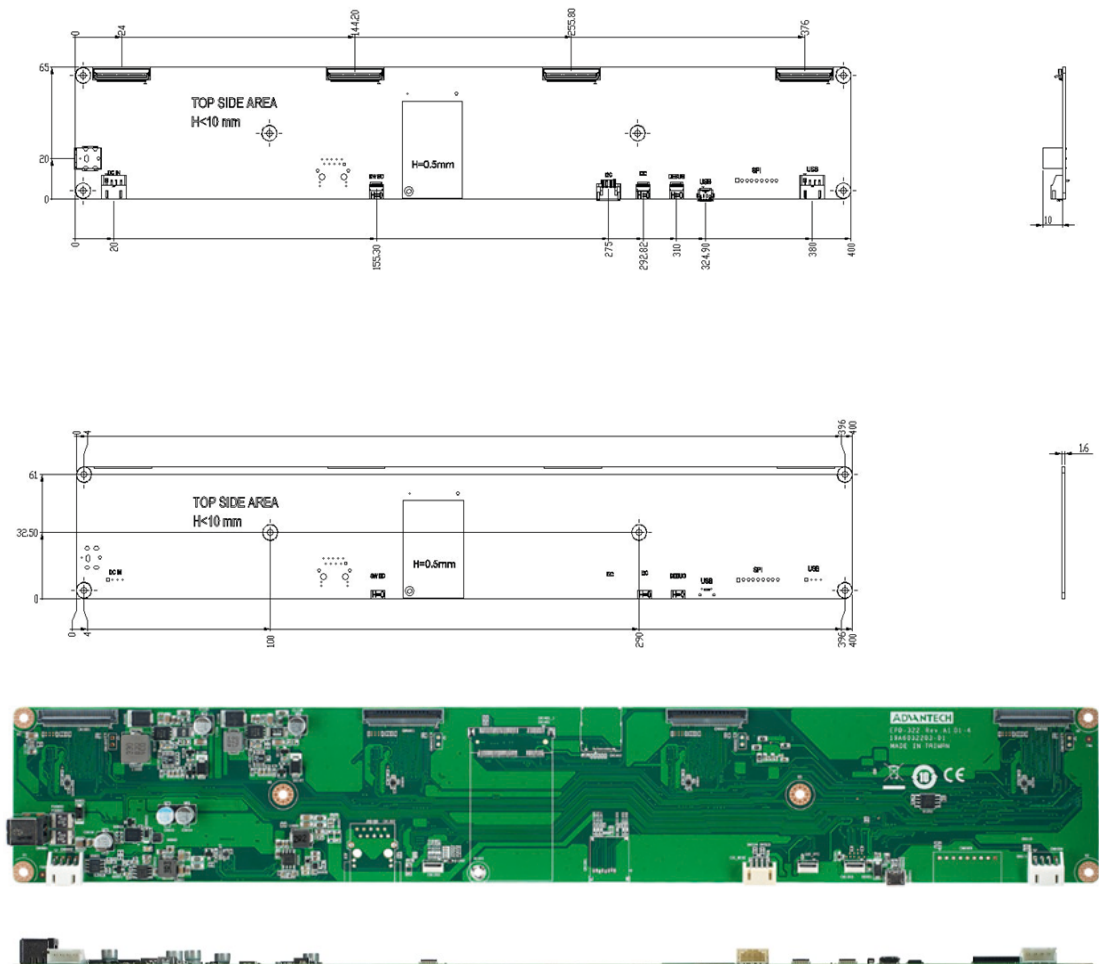


Figure 2.1 Module top view

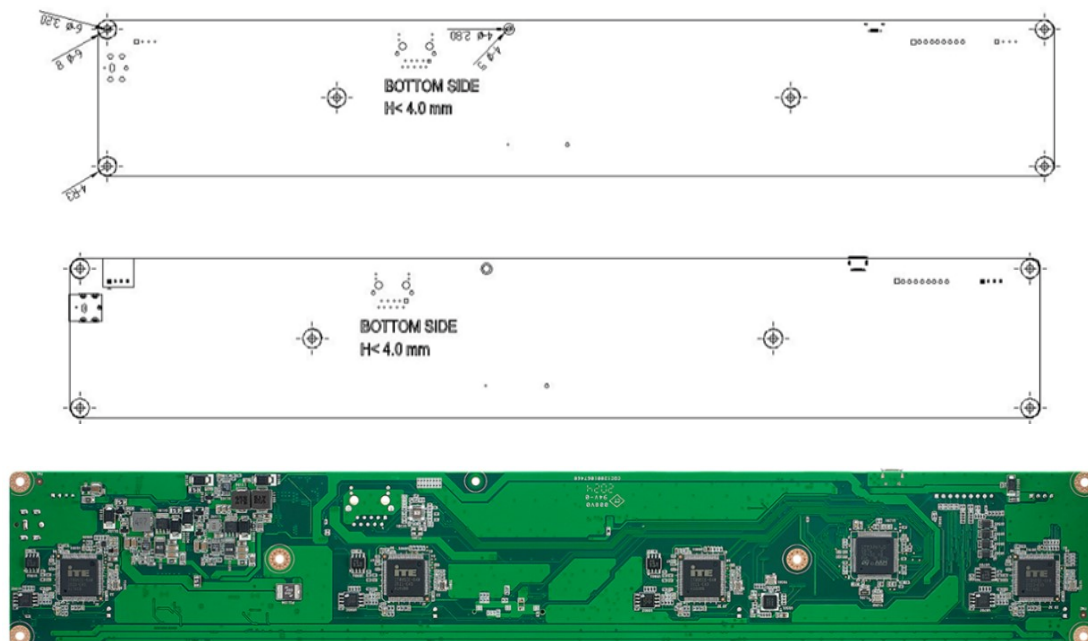


Figure 2.2 Module bottom view

31.2" EPD (PN: 968DD00076) spec:

- Panel Size: HxWxD: 697.2 × 402.8 × 0.805 mm.
- PN: 968DD00076 operating temperature range: -10 - 65 °C for 16 gray level color.
- For E ink Panel inspection criteria refer to the E ink CAS & Inspection standard document.

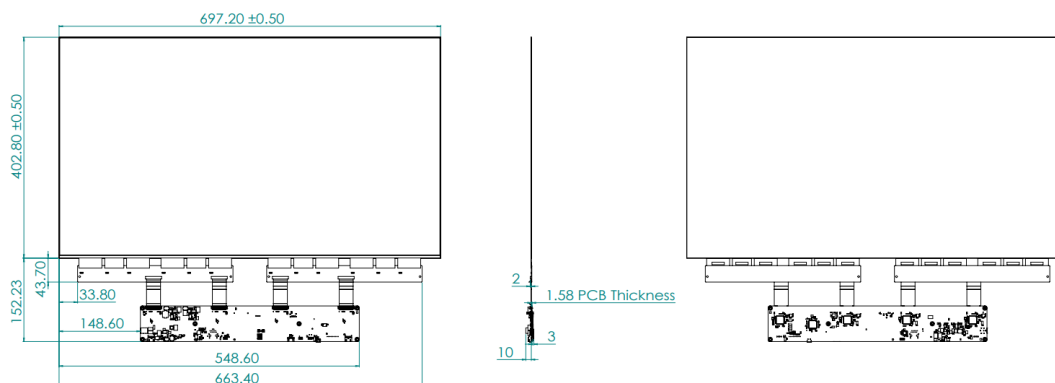


Figure 2.3 Module connection to panel specifications

Note! *E Ink recommend conditions for storage:*
 Temperature: -25-70 °C degree
 Humidity: 60% RH+-10% RH, Non-condensing

Note! *If the panel module has been in low temperatures between 0 to -25°C degrees for a while, we recommend to leave it between 20° to 30°C degrees for an additional 4 days before assembly.*

2.2 Board Level I/O

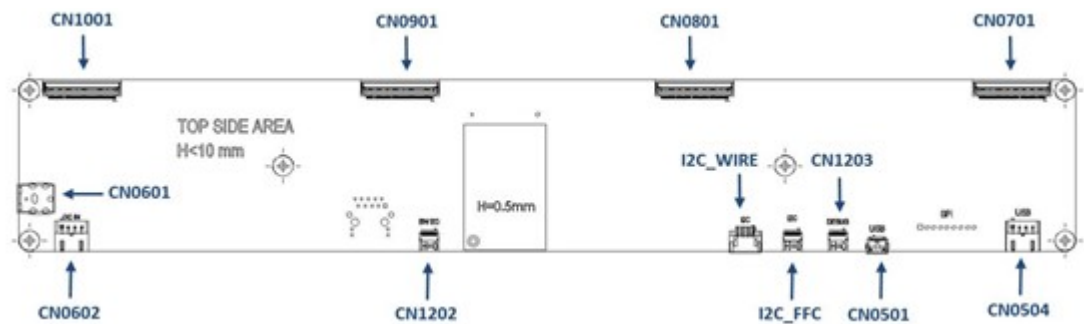


Table 2.1: I/O Connector

NAME	Description
CN0501	External Micro USB Port
CN0504	4-pin wafer connector for USB
CN0601	2-pin DC jack for DC-IN power
CN0602	4-pin Wafer connector for DC-IN power
CN0701	50-pin FPC to connect to e-paper panel
CN0801	50-pin FPC to connect to e-paper panel
CN0901	50-pin FPC to connect to e-paper panel
CN1001	50-pin FPC to connect to e-paper panel
CN1202	10-pin FFC connector for external GPIO
CN1203	10-pin FFC connector for debug
I2C_FFC	10-pin FFC connector for I2C
I2C_WIRE	4-pin Wafer connector for I2C

2.2.1 Micro USB (CN0501)

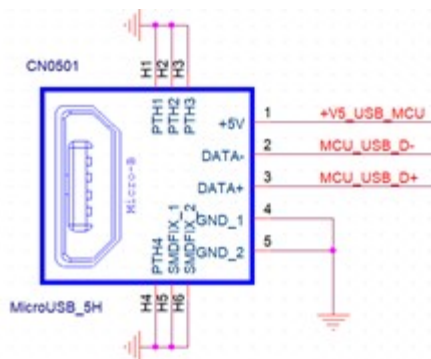
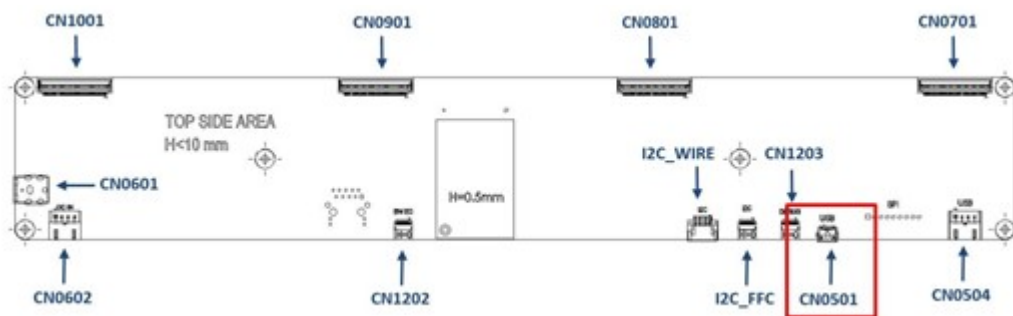


Table 2.2: Micro USB (CN0501)

PIN	PIN_NAME
1	+V5_USB_MCU
2	MCU_USB_D-
3	MCU_USB_D+
4	GND
5	GND

2.2.2 Wafer USB (CN504)

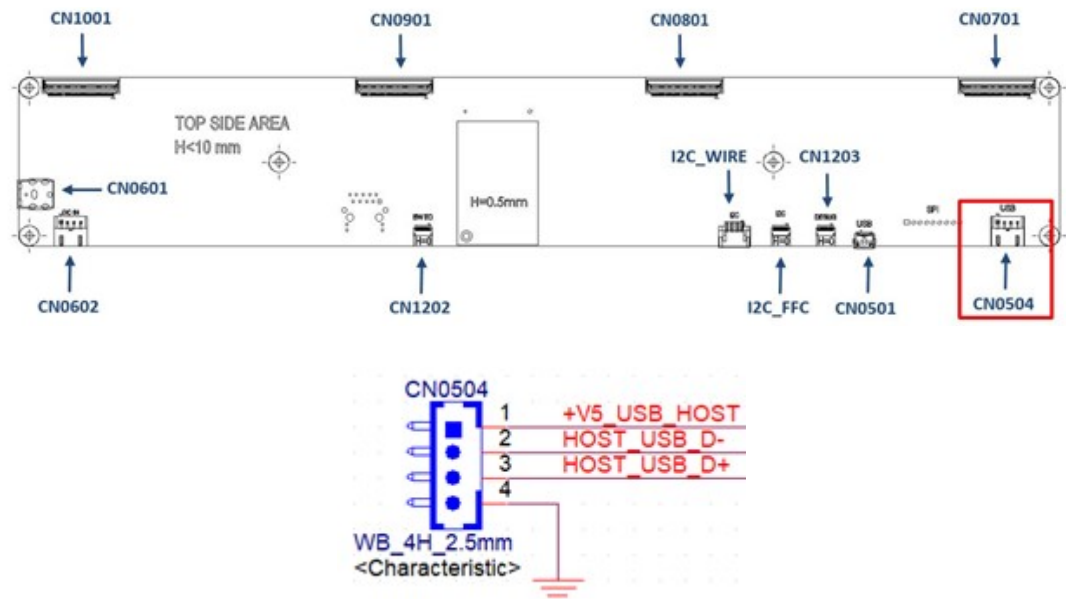


Table 2.3: Wafer USB (CN504)

PIN	PIN_NAME
1	+V5_USB_HOST
2	HOST_USB_D-
3	HOST_USB_D+
4	GND

2.2.3 DC-Jack (CN0601)

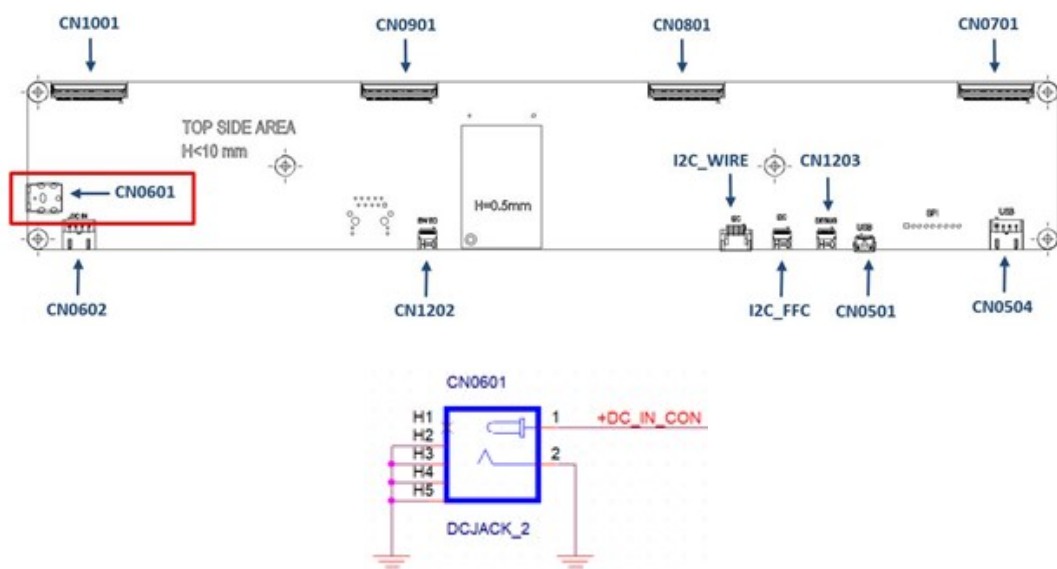


Table 2.4: DC-Jack (CN0601)

PIN	PIN_NAME
1	+DC_IN_CON
2	GND

2.2.4 Wafer DC-IN (CN0602)

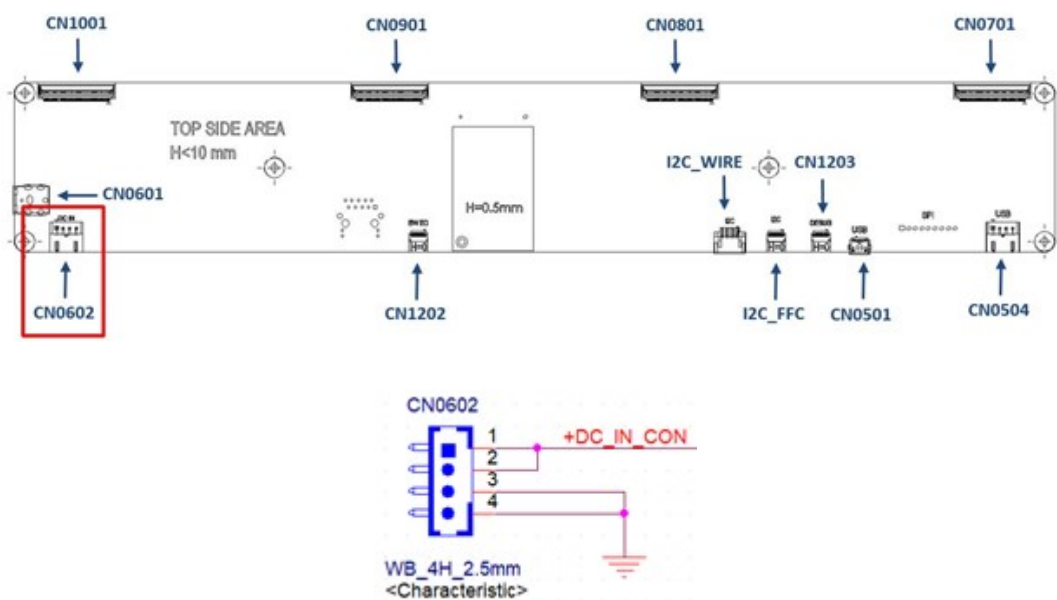


Table 2.5: Wafer DC-IN (CN0602)

PIN	PIN_NAME
1	+DC_IN_CON
2	+DC_IN_CON
3	GND
4	GND

2.2.5 EPD FPC connector (CN0701)

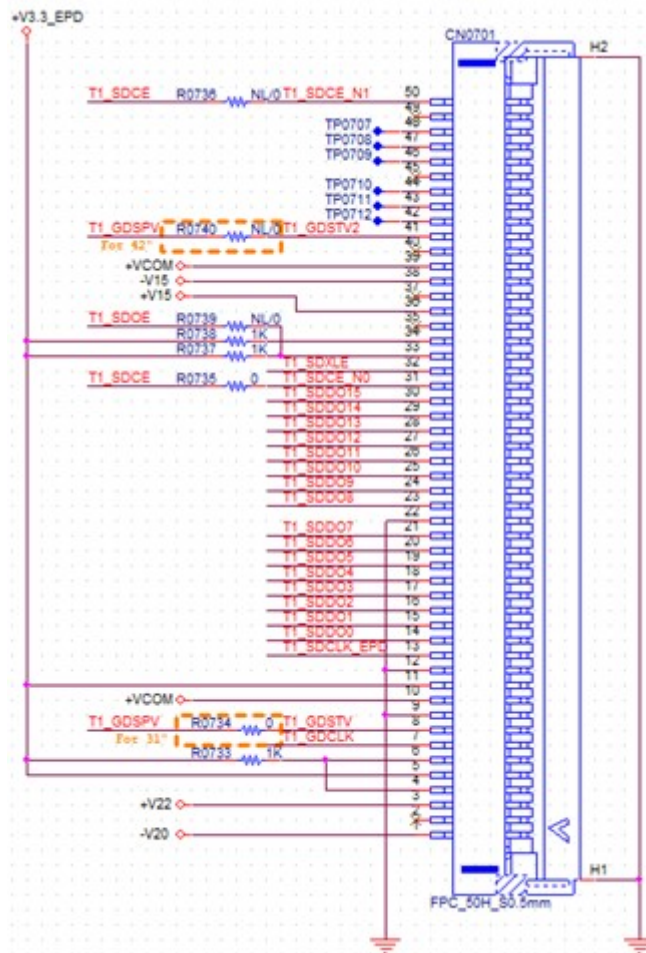
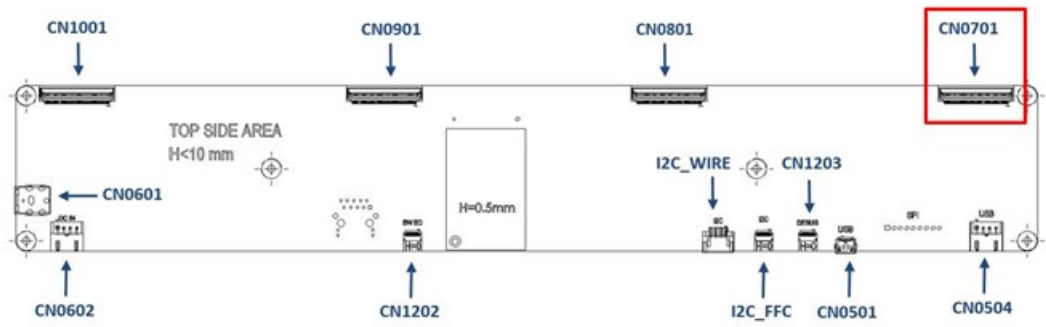


Table 2.6: EPD connector (CN0701)

PIN	PIN_NAME	PIN	PIN_NAME
1	-V20	2	NC
3	+V22	4	Mode2
5	+V3.3_EPD	6	Mode1
7	T1_GDCLK	8	T1_GDSTV
9	GND	10	+VCOM
11	+V3.3_EPD	12	GND
13	T1_SDCLK_EPD	14	T1_SDDO0
15	T1_SDDO1	16	T1_SDDO2
17	T1_SDDO3	18	T1_SDDO4
19	T1_SDDO5	20	T1_SDDO6
21	T1_SDDO7	22	GND
23	T1_SDDO8	24	T1_SDDO9
25	T1_SDDO10	26	T1_SDDO11
27	T1_SDDO12	28	T1_SDDO13
29	T1_SDDO14	30	T1_SDDO15
31	T1_SDCE_N0	32	T1_SDXLE
33	T1_SDOE	34	ISEL
35	NC	36	+V15
37	NC	38	-V15
39	+VCOM	40	NC
41	T1_GDSTV2	42	NC
43	NC	44	NC
45	NC	46	NC
47	NC	48	NC
49	NC	50	T1_SDCE_N1

2.2.6 EPD FPC connector (CN0801)

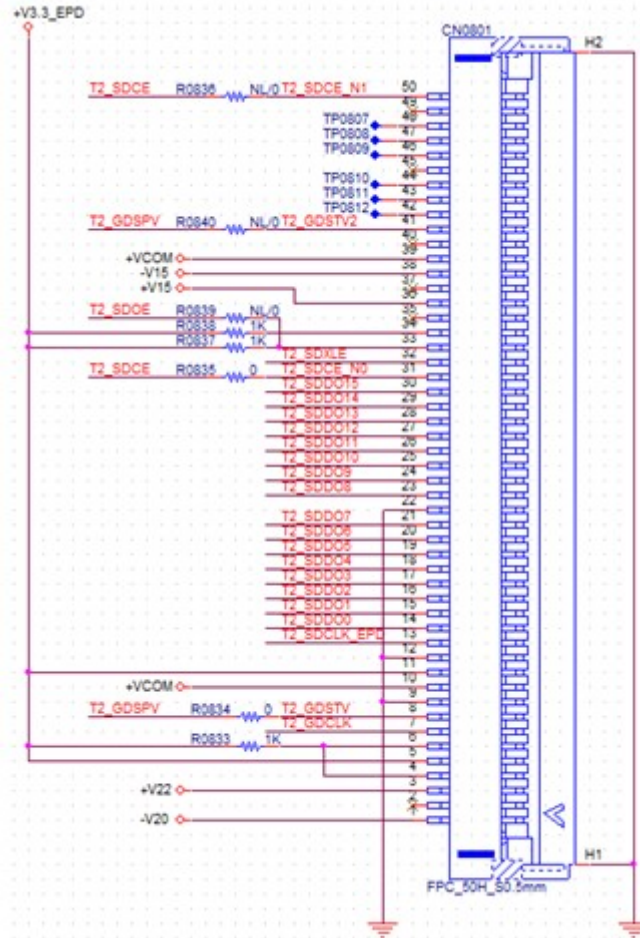
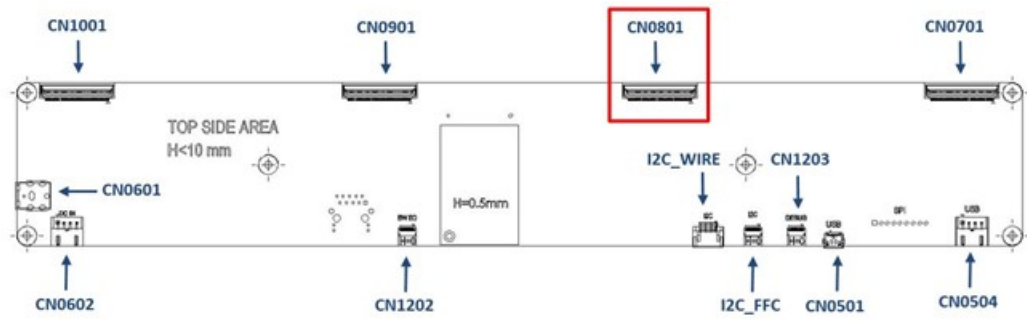


Table 2.7: EPD connector (CN0801)

PIN	PIN_NAME	PIN	PIN_NAME
1	-V20	2	NC
3	+V22	4	Mode2
5	+V3.3_EPD	6	Mode1
7	T2_GDCLK	8	T2_GDSTV
9	GND	10	+VCOM
11	+V3.3_EPD	12	GND
13	T2_SDCLK_EPD	14	T2_SDDO0
15	T2_SDDO1	16	T2_SDDO2
17	T2_SDDO3	18	T2_SDDO4
19	T2_SDDO5	20	T2_SDDO6
21	T2_SDDO7	22	GND
23	T2_SDDO8	24	T2_SDDO9
25	T2_SDDO10	26	T2_SDDO11
27	T2_SDDO12	28	T2_SDDO13
29	T2_SDDO14	30	T2_SDDO15
31	T2_SDCE_N0	32	T2_SDXLE
33	T2_SDOE	34	ISEL
35	NC	36	+V15
37	NC	38	-V15
39	+VCOM	40	NC
41	T2_GDSTV2	42	NC
43	NC	44	NC
45	NC	46	NC
47	NC	48	NC
49	NC	50	T2_SDCE_N1

2.2.7 EPD FPC connector (CN0901)

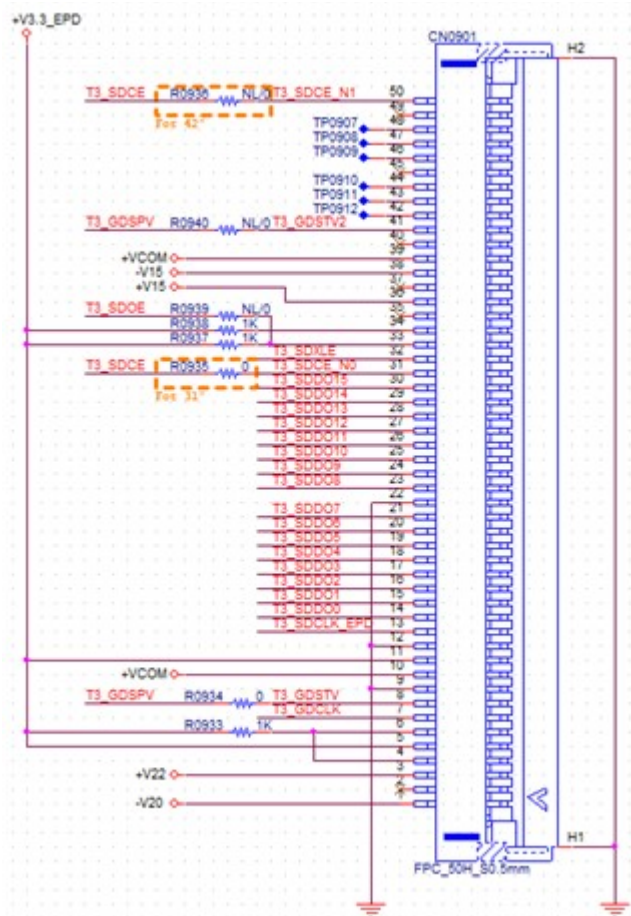
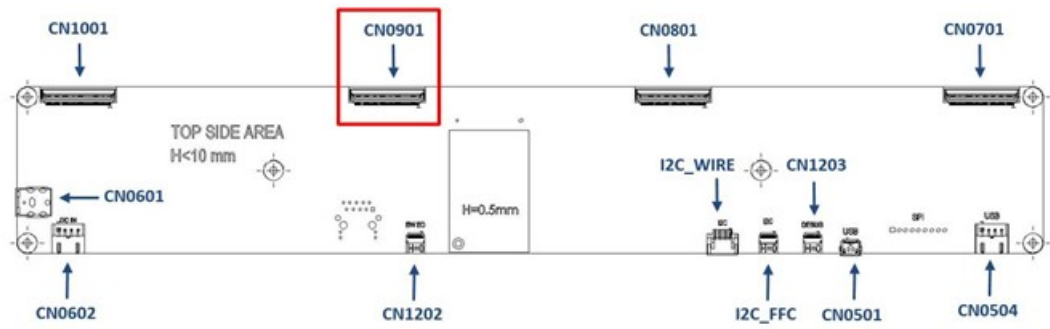


Table 2.8: EPD connector (CN0901)

PIN	PIN_NAME	PIN	PIN_NAME
1	-V20	2	NC
3	+V22	4	Mode2
5	+V3.3_EPD	6	Mode1
7	T3_GDCLK	8	T3_GDSTV
9	GND	10	+VCOM
11	+V3.3_EPD	12	GND
13	T3_SDCLK_EPD	14	T3_SDDO0
15	T3_SDDO1	16	T3_SDDO2
17	T3_SDDO3	18	T3_SDDO4
19	T3_SDDO5	20	T3_SDDO6
21	T3_SDDO7	22	GND
23	T3_SDDO8	24	T3_SDDO9
25	T3_SDDO10	26	T3_SDDO11
27	T3_SDDO12	28	T3_SDDO13
29	T3_SDDO14	30	T3_SDDO15
31	T3_SDCE_N0	32	T3_SDXLE
33	T3_SDOE	34	ISEL
35	NC	36	+V15
37	NC	38	-V15
39	+VCOM	40	NC
41	T3_GDSTV2	42	NC
43	NC	44	NC
45	NC	46	NC
47	NC	48	NC
49	NC	50	T3_SDCE_N1

2.2.8 EPD FPC connector (CN1001)

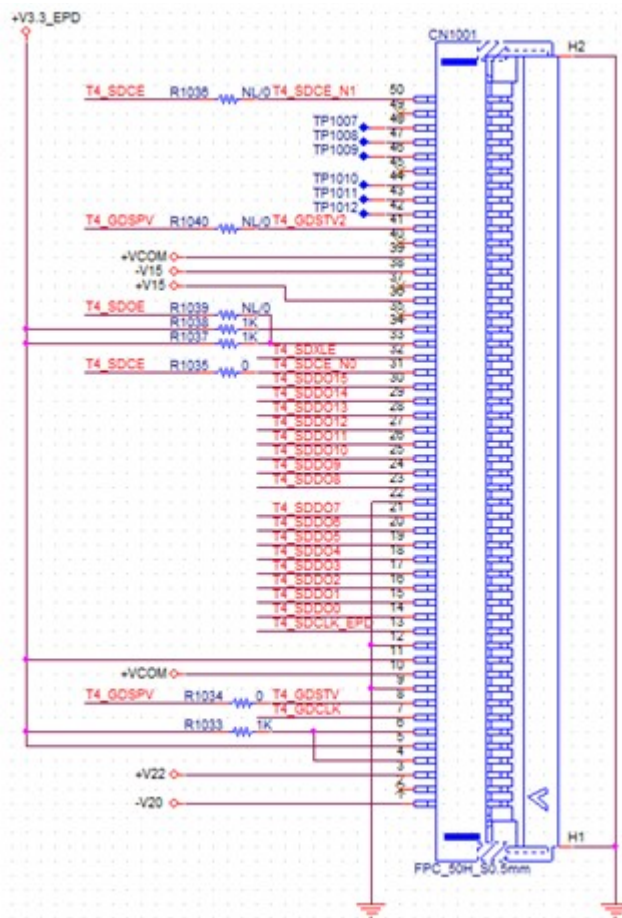
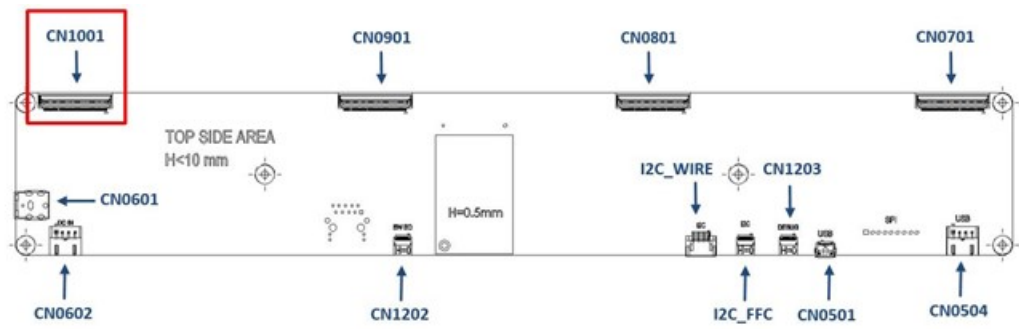


Table 2.9: EPD connector (CN1001)

PIN	PIN_NAME	PIN	PIN_NAME
1	-V20	2	NC
3	+V22	4	Mode2
5	+V3.3_EPD	6	Mode1
7	T4_GDCLK	8	T4_GDSTV
9	GND	10	+VCOM
11	+V3.3_EPD	12	GND
13	T4_SDCLK_EPD	14	T4_SDDO0
15	T4_SDDO1	16	T4_SDDO2
17	T4_SDDO3	18	T4_SDDO4
19	T4_SDDO5	20	T4_SDDO6
21	T4_SDDO7	22	GND
23	T4_SDDO8	24	T4_SDDO9
25	T4_SDDO10	26	T4_SDDO11
27	T4_SDDO12	28	T4_SDDO13
29	T4_SDDO14	30	T4_SDDO15
31	T4_SDCE_N0	32	T4_SDXLE
33	T4_SDOE	34	ISEL
35	NC	36	+V15
37	NC	38	-V15
39	+VCOM	40	NC
41	T4_GDSTV2	42	NC
43	NC	44	NC
45	NC	46	NC
47	NC	48	NC
49	NC	50	T4_SDCE_N1

2.2.9 External GPIO (CN1202)

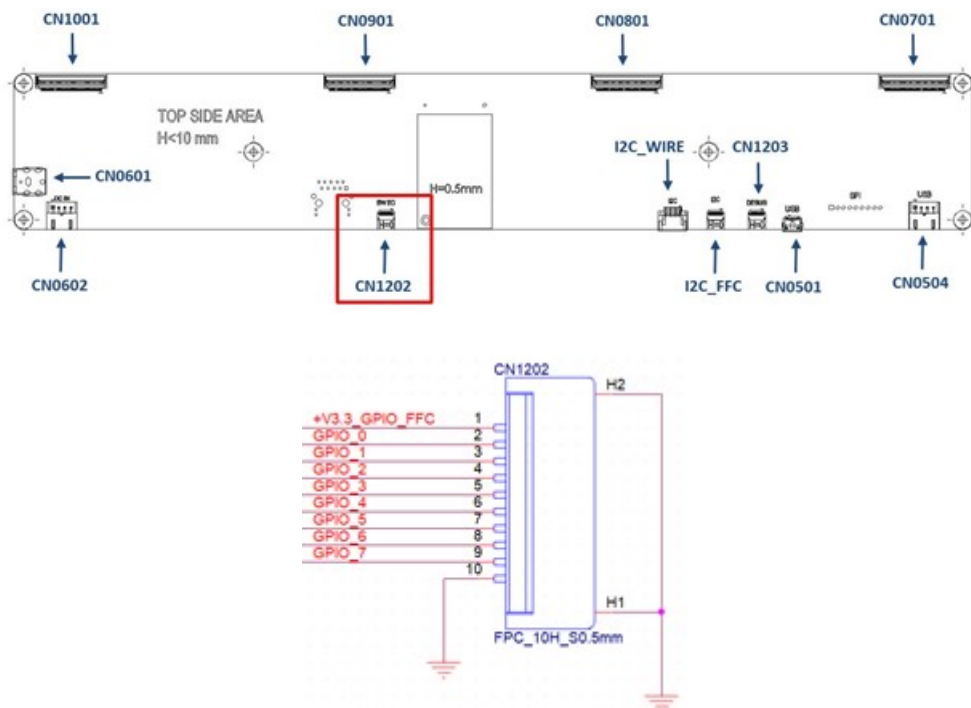


Table 2.10: External GPIO (CN1202)

PIN	PIN_NAME
1	+V3.3_GPIO_FFC
2	GPIO_0
3	GPIO_1
4	GPIO_2
5	GPIO_3
6	GPIO_4
7	GPIO_5
8	GPIO_6
9	GPIO_7
10	GND

2.2.10 Debug (CN1203)

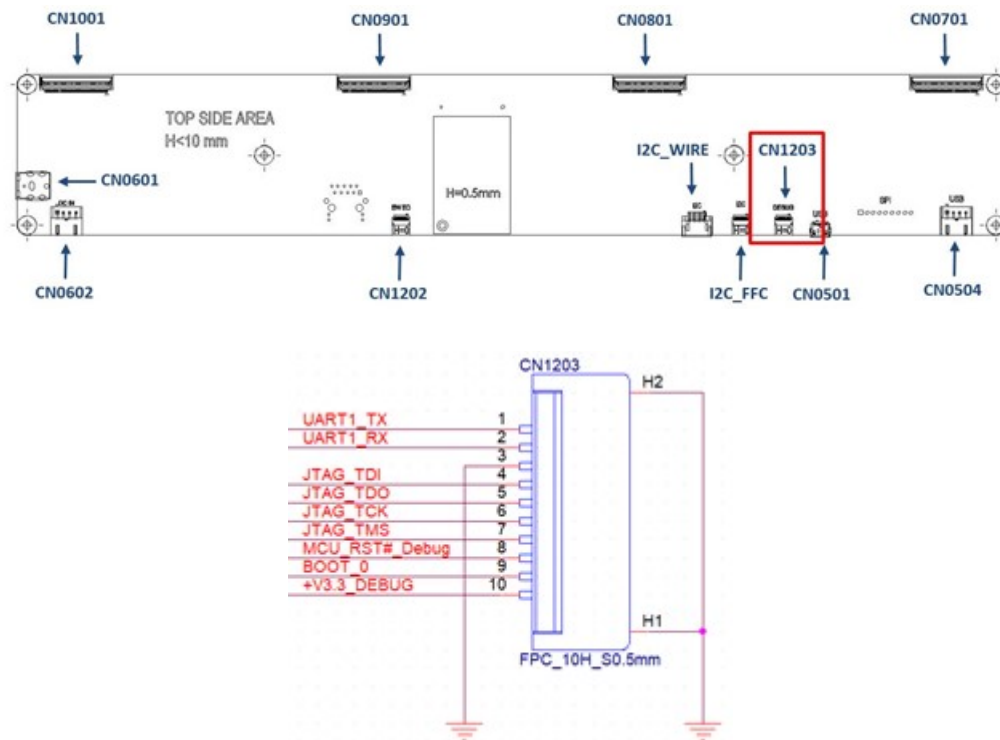


Table 2.11: Debug (CN1203)

PIN	PIN_NAME
1	UART1_TX
2	UART1_RX
3	GND
4	JTAG_TDI
5	JTAG_TDO
6	JTAG_TCK
7	JTAG_TMS
8	MCU_RST#_Debug
9	BOOT_0
10	GND

2.2.11 I2C FFC connector (I2C_FFC)

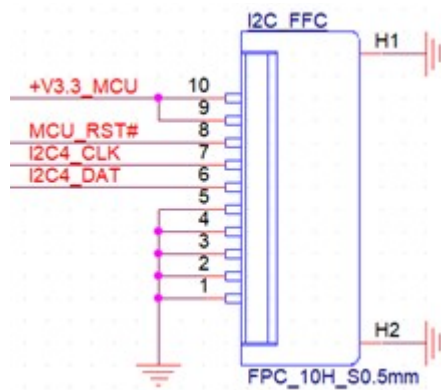
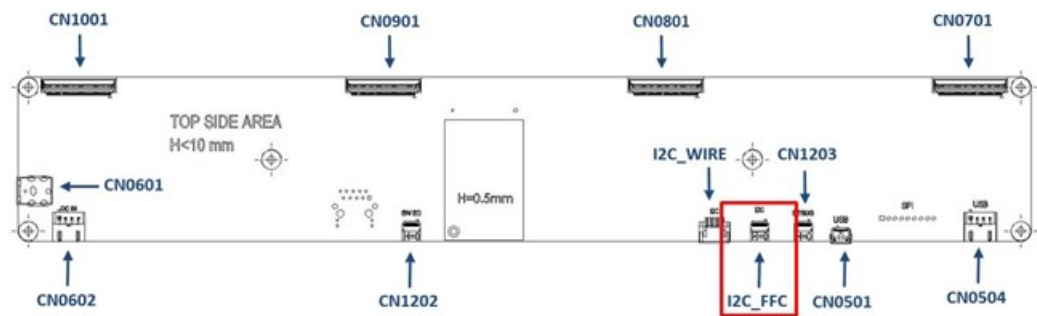


Table 2.12: I2C FFC connector (I2C_FFC)

PIN	PIN_NAME
1	GND
2	GND
3	GND
4	GND
5	GND
6	I2C4_DAT
7	I2C4_CLK
8	MCU_RST#
9	+V3.3_MCU
10	+V3.3_MCU

2.2.12 I2C Wafer connector (I2C_WIRE)

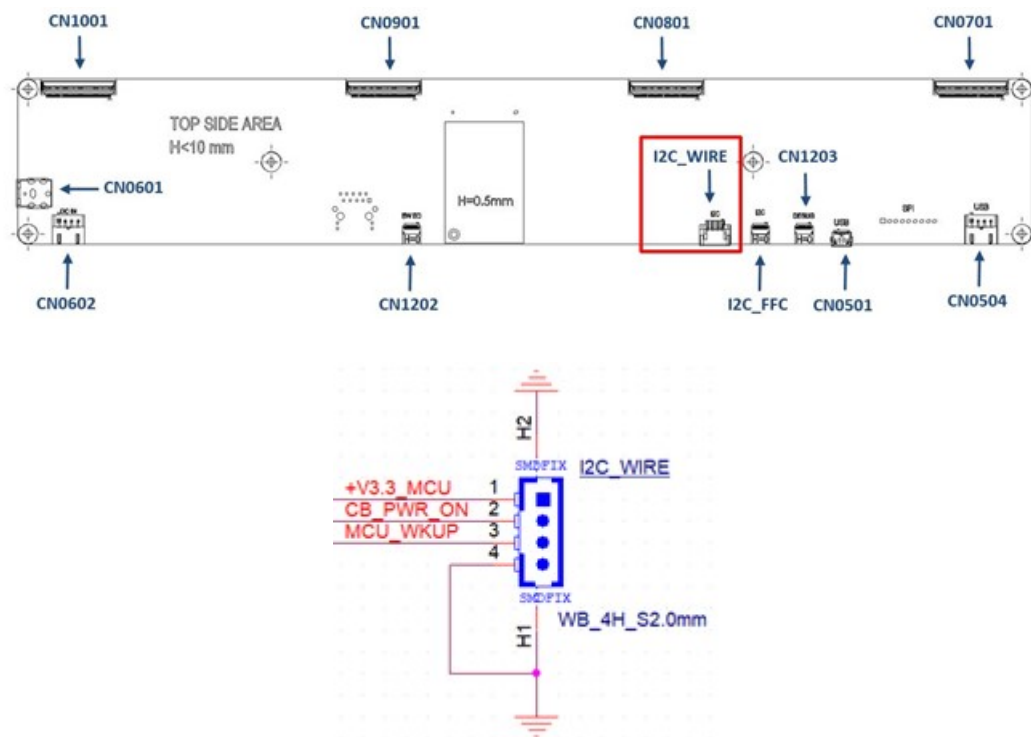


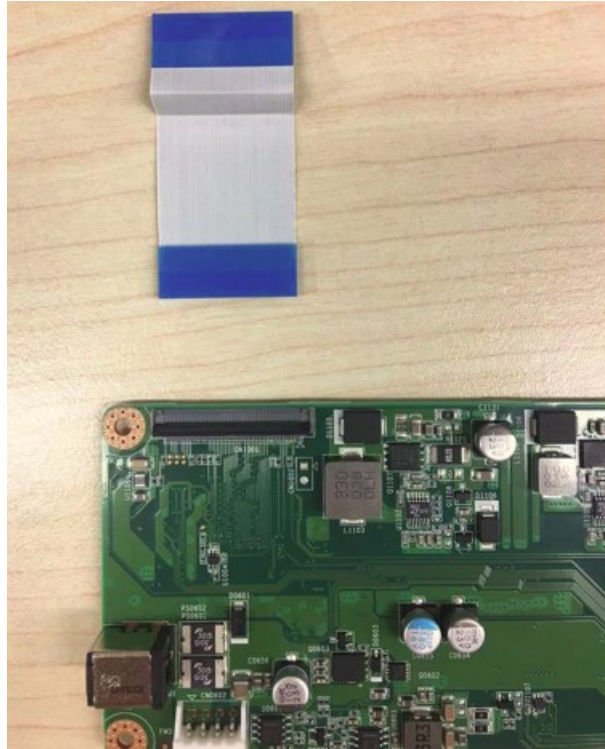
Table 2.13: I2C Wafer connector (I2C_WIRE)

PIN	PIN_NAME
1	+V3.3_MCU
2	CB_PWR_ON
3	MCU_WKUP
4	GND

2.3 Panel, PCBA, Connector, and USB Data Transmission Connector

2.3.1 Connected EPM FFC to mainboard

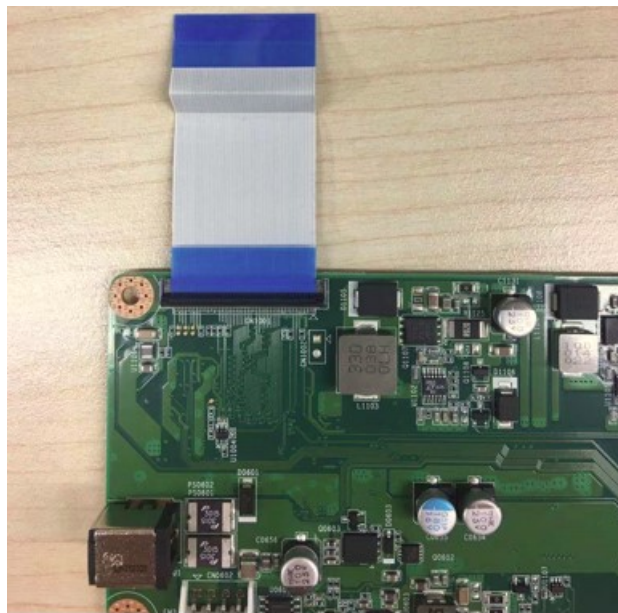
1. See the below FFC from the ePaper display.



2. Release rotary latch of the connector on the control board.



3. Blend the FFC carefully to the control board direction.



4. Insert the FFC into the connector on the control board.



5. After connecting steadily, lock the rotary latch.



6. Check if the connection is correct and tight.

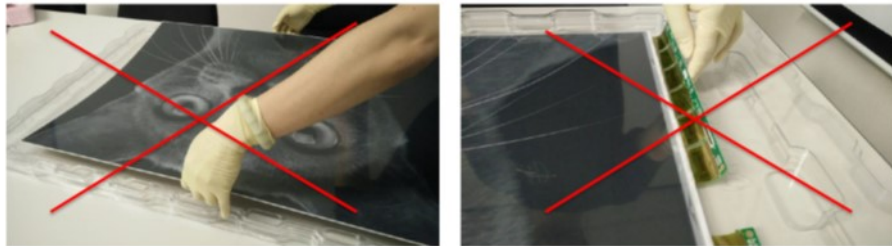




Note! When connecting the FFC to EPC, please follow these instructions:



1. Do NOT plug in/out the panel while the system power is on.
2. Ensure FFC connection is securely fixed when assembling to the system board.
3. Oblique connections might lead to shorting issues and damage on PCBA.



Note! When connecting the FFC to EPC, please follow these instructions:



1. Do not lift the panel without the jig, as it may bend the panel.
2. Do not bend the COF.

Chapter 3

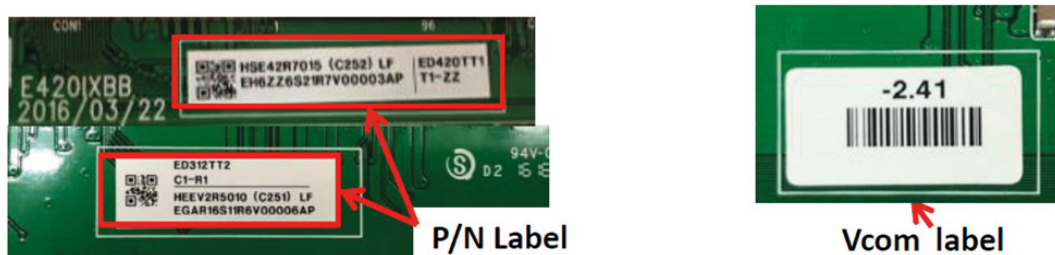
Software
Specifications

3.1 Software

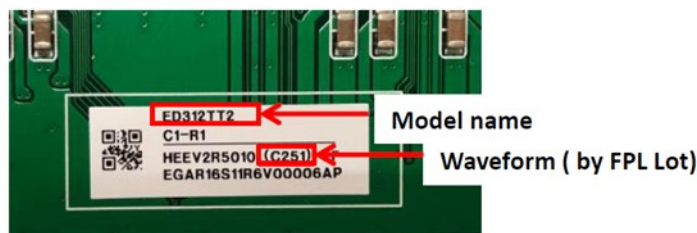
This chapter is the panel and tool usage guideline for the E ink and ITE modules. All information is subject to change when new products are released.

3.2 Panel Information Confirm

Using the wrong waveform & bin file may affect the display quality of the panel. The compatibility of the panel and driving board has been confirmed and the waveform & bin is consistent with the panel. When you receive the panel, you need confirm the panel has a product label and a VCOM label.



Product label includes model name and WF information.



VCOM Voltage

- VCOM uses DC current for driving voltage, to match the panel for optimum display performance, it needs to be adjustable because of each EPD display with differing VCOM values.
- For example, the voltage value on the panel above is -2.41V (tolerance of Vcom voltage would be $\pm 0.1\text{V}$).
- The Vcom value needs to match the panel label, or a wrong Vcom might cause permanently damage the EPD.

All VCOM have been configured on the driving board before shipping to customers.

3.3 UI Application Guidelines

3.3.1 Pattern design

Suggest the background is a picture to avoid using a gray pattern, If you really need a gray pattern, use the “GC16” mode for a clear image.

3.3.2 Waveform information

Advantech pairs the display and driving board by production lot, display size, and waveform type in production, so do not re-pairing to different driving boards and panels with different shipping and packages.

3.3.3 Waveform “Init mode”

Only use on boot up, could not use at pattern transition. Or it will harm the panel eternity.

3.3.4 Waveform mode in signage

■ INIT (Global update WF)

Initialize is used to completely clear the display, if it's left in an unknown state. (i.e. if the previous image has been lost by a re-boot).

■ DU (Local update WF)

Direct update Non-flashing waveform that can be used to update. It can update any changed gray tone pixel to black or white only.

■ GC16 (Global update WF)

Grayscale Clear, 16 Levels A “flashy” waveform used for 16 level grayscale images. All the pixels are updated or cleared.

■ GCC16 (Global clear update WF)

Grayscale Clear, 16 Levels A “more flashy” waveform used for 16 level grayscale images. All the pixels are updated or cleared.

This provides the best image appearance.

■ A2 (Local update WF)

Animation, 2 Levels is a non-flashing waveform that can be used for fast updates and simple animation.

This waveform support black & white updates only.

Image quality and ghosting is reduced in exchange for the quicker response time.





■ GL16 (Local update WF when white to white, Global update when 16 gray levels)

The GL16 waveform is used to update anti-aliased text with reduced flash. GL16 should be used only with Full Display Update.

The entire display except pixels staying in white will update as the new image is written. The GL16 waveform has 16 unique gray levels.

Mode 0	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5
INIT	DU	GC16	GCC16	A2	GL16

3.3.5 WF Guidelines Overview

<i>USER EXPERIENCE</i>	<i>DESCRIPTION</i>	<i>EXPERIENCE-ENABLING WAVEFORM MODE</i>
	<ul style="list-style-type: none"> ➤ FAST PAGE FLIP ➤ MENU SCROLLING 	<p>A2 – FAST, NON-FLASH UPDATE</p> <ul style="list-style-type: none"> ➤ GRAYTONE TO BLACK OR WHITE ONLY ➤ BLACK/WHITE ANIMATION ➤ 120MS @25C UPDATE TIME (85Hz FRAME RATE) ➤ REDUCED CONTRAST
	<ul style="list-style-type: none"> ➤ FAST UPDATES ➤ POP-UP MENU ➤ TYPING ➤ PEN INPUT ➤ CURSOR 	<p>DU – DIRECT UPDATE</p> <ul style="list-style-type: none"> ➤ DU DRIVES TO WS OR DS ➤ DU : 260MS @25C UPDATE TIMES (50Hz FRAME RATE) ➤ NO FLASH
	<ul style="list-style-type: none"> ➤ ANTI-ALIASED TEXT ➤ IMAGES ➤ ICONS 	<p>GL16 - GRAYSCALE (16 LEVEL)</p> <ul style="list-style-type: none"> ➤ DRIVE BETWEEN ANY (4-BIT) GRAYTONE ➤ 980MS @25C UPDATE TIME (50Hz FRAME RATE) ➤ LOW FLASH
	<ul style="list-style-type: none"> ➤ HIGH-QUALITY IMAGES ➤ DETAILED ICONS 	<p>GC16 /GCC16 – GRAYSCALE CLEAR (16 LEVEL)</p> <ul style="list-style-type: none"> ➤ DRIVES BETWEEN ANY (4-BIT) GRAYTONE ➤ 980MS / 1240MS @25C UPDATE TIME (50Hz FRAME RATE) ➤ MEDIUM FLASH

* GLR16, GLD16 require support components—e.g., display controller and SW—provided by E Ink’s ecosystem partners.

3.4 ePaper Driving Board Software

3.4.1 EPD Application

EPM-880 is a display module. Advantech provides both Ubuntu and Windows driver. End users can integrate the driver into their system and refresh the images on device.

3.4.1.1 System Environment

Before running the EPD application, users must install a program driver on Windows 10 and Ubuntu.

No	Device1	OS	Version
1	EPM-880	Ubuntu	20.04
		Windows	10

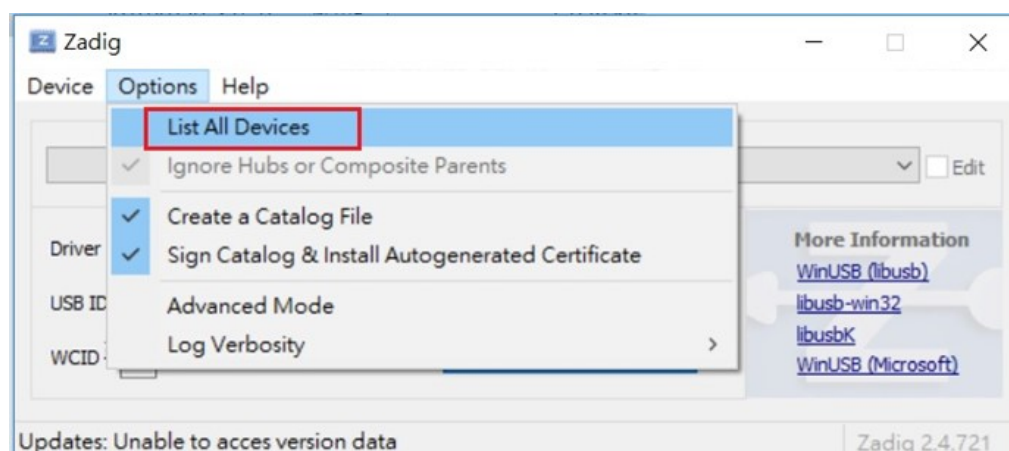
Windows 10:

USB driver installation as follows:

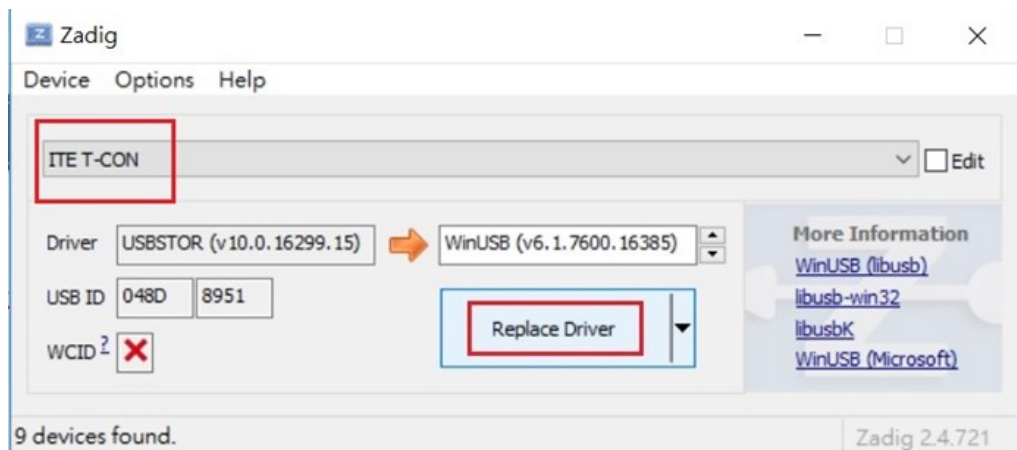
1. Download the USB driver tool “zadig USB tool” from the Internet. Search for key word “zadig USB tool” on Google search, and execute the software.



2. Check EPM-880 control board has been connected to the host computer and execute zadig.exe. First click Option->List All Devices on zadig USB tool. This software will scan for how many devices there are on the host computer automatically.



3. Select "ITE T-CON" in the list then click the **Replace Driver** button and wait for the installation to finish.



4. Repeat step 3 to replace the others three ITE T-CON drivers, there are a total of 4 x ITE T-CON drivers.

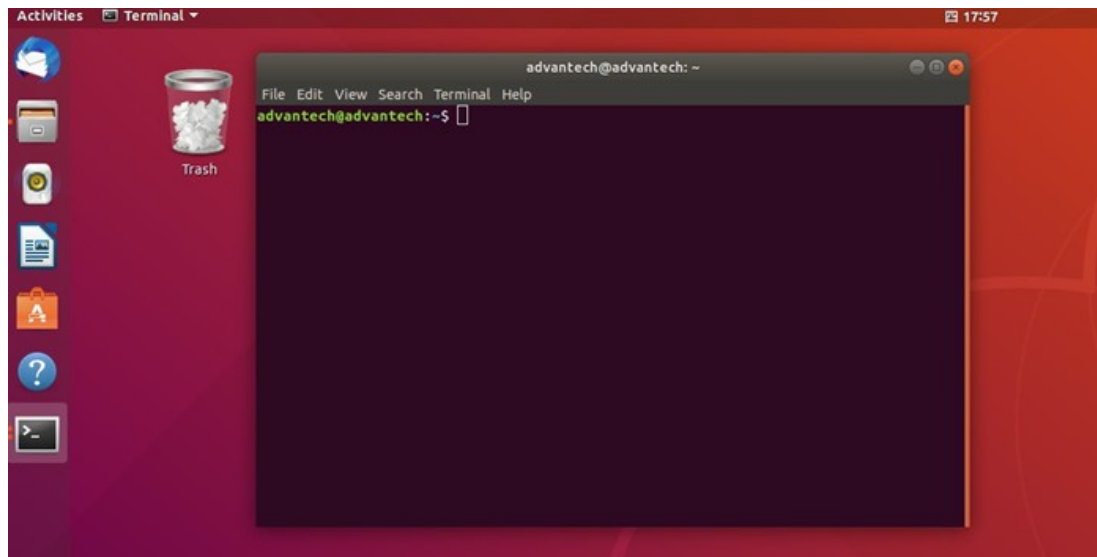
Linux Ubuntu

The driver library install steps and command line are shown below:

Caution! Users must follow all steps to install the driver library properly before executing the EPD application, otherwise error messages will pop up.



1. Open the command line in Ubuntu.



2. Refresh system.

```
$ sudo apt-get update  
$ sudo apt-get upgrade
```


3. Installed libUSB 1.0.0.

```
$sudo apt-get install libUSB-1.0-0-dev
```

4. Installed OpenCV dependency package.

```
$ sudo apt-get install build-essential cmake git libgtk2.0-dev pkg-config libavcodec-dev libav-
format-dev libswscale-dev
$ sudo apt-get install python3.5 python3-numpy libtbb2 libtbb-dev
$ sudo apt-get install libjpeg-dev libpng-dev libtiff5-dev libdc1394-22-dev libeigen3-dev lib-
theora-dev libvorbis-dev libxvidcore-dev libx264-dev sphinx-common libtbb-dev yasm lib-
faac-dev libopencore-amrnb-dev libopencore-amrwb-dev libopenexr-dev libgstreamer-
plugins-base1.0-dev libavutil-dev libavfilter-dev libavresample-dev
$ sudo apt-get install software-properties-common
$ sudo apt-get install python-software-properties
$ sudo add-apt-repository "deb http://security.ubuntu.com/ubuntu xenial-security main"
$ sudo apt update
$ sudo apt install libjasper1 libjasper-dev libtiff-dev
```

5. Download OpenCV 2.4.13 source code from OpenCV official release.

6. Build OpenCV library.

Untar `opencv-2.4.13.tar.bz2` source code and below example we assume OpenCv file path is in `/opt/opencv` but it should depend on the user's environment.

```
$ cd /opt/opencv
$ mkdir release
$ cd release
$ mkdir my_build_dir
$ cd my_build_dir
```

`/opt/opencv` is an assumed path, it should depend on the OpenCV path of the user's environment.

```
$ cmake -D BUILD_TIFF=ON -D WITH_CUDA=OFF -D ENABLE_AVX=OFF -D
WITH_OPENGL=OFF -D WITH_OPENCL=OFF -D WITH_IPP=OFF -D WITH_TBB=OFF -D
BUILD_TBB=ON -D WITH_EIGEN=OFF -D WITH_V4L=OFF -D WITH_VTK=OFF -D
BUILD_TESTS=OFF -D BUILD_PERF_TESTS=OFF -D CMAKE_BUILD_TYPE=RELEASE
-D CMAKE_INSTALL_PREFIX=/usr/local -D OPENCV_EXTRA_MODULES_PATH=/opt/
opencv_contrib/modules /opt/opencv/
$ make -j4
$ make install
```

Check OpenCV version.

```
$ pkg-config --modversion opencv
```

3.4.1.2 How to upgrade into Ubuntu 22.04

1. Request SW package "Ubuntu_v22.04_EPM880" from Advantech.
2. Required to install following packages for EPD_4Tcon program
 - sudo apt-get install libusb-1.0-0-dev
 - sudo apt-get install libopencv-dev
3. Use EPD_4Tcon program to display image by following steps
 - cd EPD_application
 - sudo ./EPD_4Tcon setting.xml or sudo ./EPD_4Tcon setting_carousel.xml

Note! Please check the `image_path` setting within xml file if it's set with correct path for image directory before running EPD_4Tcon.



3.4.1.3 How to execute the EPD application

This application has two main file in package:

- **file 1. main binary**
- **file 2. description xml file**

Steps to execute EPD application:

1. Configure your file setting to *.xml file.
2. Execute EPD application.

The EPD application depends on information in the xml file. So the user must configure the setting.xml from the EPD application package.

Please contact your Advantech contact window to get the latest EPD application package.

Xml file Configure

The setting.xml file includes an image path and display attributes. The EPD application program depends on the setting.xml file to find and refresh the image. You should open setting.xml in a text editor as shown below.

```
<?xml version="1.0"?>
<epd_config>
  <epd name="EPD 31.2">
    <color>KW</color> <!--KW/COLOR -->
    <image_path>C:\Users\EPD_application\photoImg</image_path>
    <image_name>
      <full_update>
        <img>1.bmp</img>
      </full_update>
      <stop>stop</stop>
    </image_name>
    <slide_interval>0</slide_interval>
    <en_set_temperature>0</en_set_temperature> <!--_Enable:1,_Disable:0_-->
    <temperature>25</temperature>
    <waveform_mode>2</waveform_mode>
    <rotate>180</rotate>
  </epd>
</epd_config>
```

We suggest the user sets up image path to match the user's environment in the EPD package file and put the image file into the image path.

**Tag attributes in xml below:

<image path>: Users must make sure the image path exists in the user's operating system and the file has been put into this path. If file is not in this path, the EPD application may lead to errors.

****: Write the image name between and the image file should put in the image path. It can be assigned more than one tag name between <full_update> and </full_update>. The EPD application will display the image in sequence. It only supports .bmp and jpg extension types.

```
<?xml version="1.0"?>
<epd_config>
  <epd name="EPD 31.2">
    <color>KW</color> <!--KW/COLOR -->
    <image_path>C:\Users\EPD_application\photoImg\</image_path>
    <image_name>
      <full_update>
        <img>1.bmp</img>
        <img>2.bmp</img>
        <img>3.bmp</img>
      </full_update>
    </image_name>
    <slide_interval>10</slide_interval>
    <en_set_temperature>0</en_set_temperature> <!-- Enable:1, Disable:0 -->
    <temperature>25</temperature>
    <waveform_mode>2</waveform_mode>
    <rotate>180</rotate>
  </epd>
</epd_config>
```

<stop>: Stop tag is used to load an image immediately. EPD application is terminated after 1.bmp update is done. In carousel mode, the stop tag must be removed from content in xml.

<slide_interval>: Slide interval is the delay time in seconds between every image display.

<set_temperature>: 0 is disable. Users should not change this to other values.

<waveform_mode>: Waveform mode. Usually choose mode 2 for image refresh.

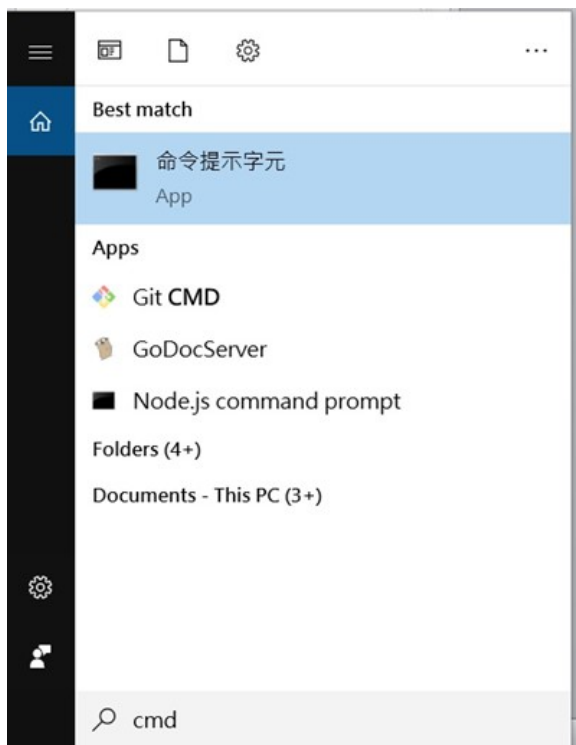
<rotate>: The image will present different rotations on the panel and there are only 4 options to choose from: 0, 90, 180 and 270° degrees of angle.

Execute EPD application

Make sure the image path exists in the host system before executing the program or the EPD application may generate errors.

1. Open command line.

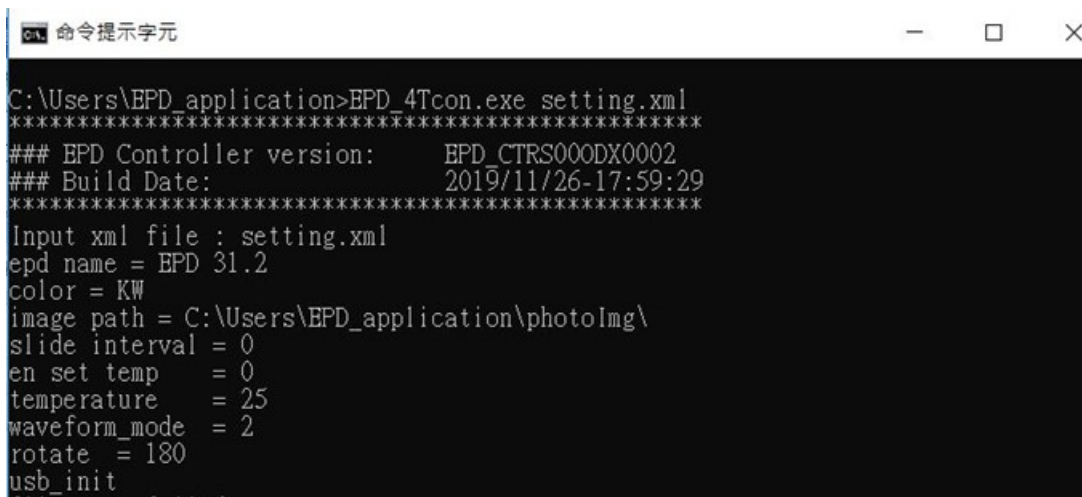
Use the **cmd** keyword to search the start menu.



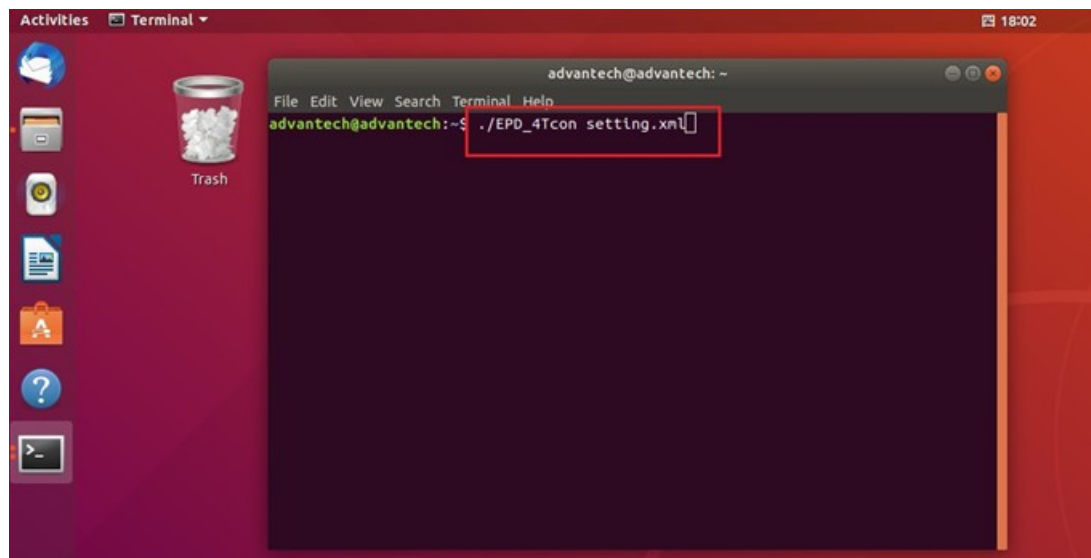
2. Below is an example. The user can switch path depending on the location of the EPD application package on the host computer.



3. Executing the EPD_4TCON command with parameters.
Windows: "EPD_4Tcon.exe setting.xml"



Linux: `./EPD_4Tcon setting.xml`



3.4.2 Quick start

To use this “Quick start” feature, the user must have completed the 3.3.2.1 software preparation steps.

Single mode and carousel mode examples are described below:

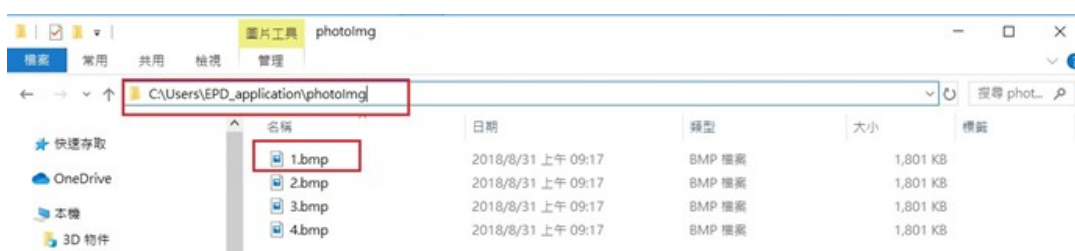
Single mode:

This application refreshes 1.bmp once to end.

1. Download the EPD application package.
2. Configure setting.xml - we assume the image path is “C:\Users\EPD_application\photoImg\” and image name is 1.bmp in this example.

```
<?xml version="1.0"?>
<epd_config>
  <epd name="EPD 31.2">
    <color>KW</color> <!--KW/COLOR -->
    <image_path>C:\Users\EPD_application\photoImg\</image_path>
    <image_name>
      <full_update>
        <img>1.bmp</img>
      </full_update>
      <stop>stop</stop>
    </image_name>
    <slide_interval>0</slide_interval>
    <en_set_temperature>0</en_set_temperature> <!--_Enable:1,_Disable:0-->
    <temperature>25</temperature>
    <waveform_mode>2</waveform_mode>
    <rotate>180</rotate>
  </epd>
</epd_config>
```

3. Make sure image file exists in this path.



- Execute command "EPD_4Tcon.exe setting.xml" in the command line.

```

C:\Users\EPD_application>EPD_4Tcon.exe setting.xml
*****
### EPD Controller version:   EPD_CTRS000DX0002
### Build Date:              2019/11/26-17:59:29
*****
Input xml file : setting.xml
epd name = EPD 31.2
color = KW
image path = C:\Users\EPD_application\photoImg\
slide interval = 0
en set temp   = 0
temperature   = 25
waveform_mode = 2
rotate       = 180
usb_init

```

Carousel mode:

Carousel mode is a non-stop application except system signal, so users could stop running the procedure by using the SIGINT, SIGKILL signal.

Below setting.xml is a format in carousel mode that three images display in sequence every 10 seconds interval time.

- Image path depends on user's defined path. We defined a default path in /usr/local/photolmg in this example.
- There are three images to display, we should put 1.bmp, 2.bmp, 3.bmp in the image path and put img tag in the xml.
- Removed tag <stop>.
- We define a 10 second time interval to change the image and write 10 at the tag of <slide_interval>.

Below is the carousel mode format content in setting.xml.

```

<?xml version="1.0"?>
<epd_config>
  <epd name="EPD 31.2">
    <color>KW</color> <!--KW/COLOR -->
    <image_path>C:\Users\EPD_application\photoImg\</image_path>
    <image_name>
      <full_update>
        <img>1.bmp</img>
        <img>2.bmp</img>
        <img>3.bmp</img>
      </full_update>
    </image_name>
    <slide_interval>10</slide_interval>
    <en_set_temperature>0</en_set_temperature> > <!--_Enable:1,_Disable:0_-->
    <temperature>25</temperature>
    <waveform_mode>2</waveform_mode>
    <rotate>180</rotate>
  </epd>
</epd_config>

```

- Execute command "EPD_4Tcon.exe setting_carousel.xml" in the command line.

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