

# **USER GUIDE**

## **Display Evaluation Kit K\_i.MX6**

**for**

**4.7", 10.7", and 15.4" displays  
on Drivers-only platform**

**Valid for Evaluation Kit Part No.:  
303008, 303012, 303013**

**Revision 1**

**15-February-2018**

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## 1 About Plastic Logic's Display Evaluation Kit

Plastic Logic's Display Evaluation Kit (PLDEK) has been designed to be used for a range of activities including:

1. Evaluating Plastic Logic's display technology.
2. Evaluating the appearance of customer and 3<sup>rd</sup> party content on Plastic Logic displays.
3. Building expertise with Plastic Logic Display systems prior to designing products or systems that incorporate our displays.
4. Application development.
5. To be used as reference design for customer electronic and software

## 2 About this document

This document is a user guide for the PL Display Evaluation Kit (PLDEK\_F6-HBZ3) for different driver-only Displays. It is only valid for kits containing Hummingbird Z3.4. It is intended to give sufficient information to:

1. Safely unpack and power up the PLDEK.
2. Start displaying images in .png format.
3. Understand how to start using the Plastic Logic software development Kit (PLSDK).

## 3 Glossary of terms / abbreviations

COF	Chip On Flex. A packaging technology used by Plastic Logic for packaging source and gate driver chips.
EPD	An electrophoretic display (EPD) typically consists of a layer of small capsules of fluid which also contains electrically charged dye particles. When an electric field is applied to the capsules, the dye particles will tend to move in a direction determined by the sign of the charge.
Display Controller	This part of the display system converts a target image which is due to be displayed into a sequence of sub-frames.
EPDC	Electrophoretic Display Controller the i.MX6sl has a built in EPDC.
FPC	Flexible Printed Board (display connector)
PLDEK	Plastic Logic Display Evaluation Kit
SDK	Software Development Kit
HVPMIC	High Voltage Power Management Integrated Circuit
Waveform	A sequence of signals needed to be generated in order to update each pixel from one state to another.

## 4 Quick Start Guide

This Quick Start Guide is a subset of the User Guide, which can be found on the SD-Card

Prior to unpacking the kit, the user is strongly urged to take appropriate ESD and safety precautions.

### 4.1 Safety Points



#### Warning:

- To avoid risk of electric shock or damage to the display, disconnect the display module from its power source before handling it.
- Do not touch the connections or circuits whilst the display is in operation.



#### Caution:

- Follow ESD handling procedures to avoid circuit damage. Use a grounded wrist strap.
- Do not press on the display panel or its edges as damage can result.

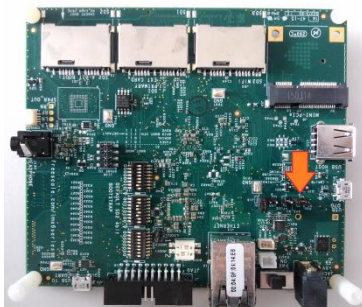
#### Important Notice

The Plastic Logic Display Evaluation Kit ("the Kit") is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by Plastic Logic to be a finished end-product fit for general consumer use. Persons handling the Kit must have electronics training and observe good engineering practice standards. As such, the kit being provided is not intended to be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety and environmental measures typically found in end products that incorporate such semiconductor components or circuit boards. The kit does not fall within the scope of the European directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and therefore may not meet the technical requirements of these directives or other related directives.

### 4.2 Supported Operating Systems

Please note the current supported operating systems are Win XP and Win7 via SSH or FTP connection. All described procedures are based on a Win7 system.

### 4.3 Unpacking and connecting the Kit

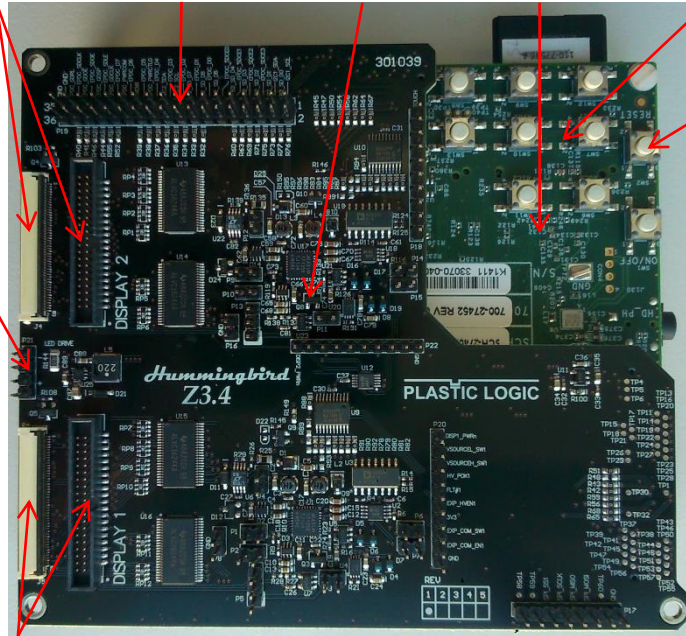


Location of J17 on the i.MX6sL-EVK

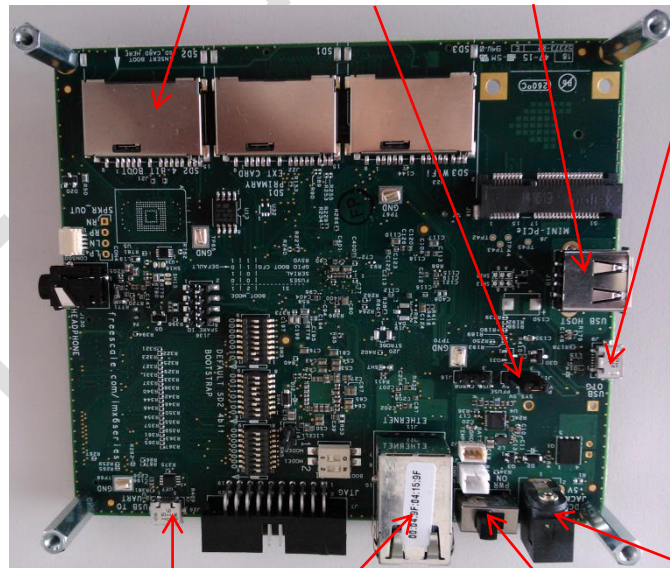
The PLDEK kit consists of the Plastic Logic Hummingbird Z3.4 for display power management and display interface and a standard Freescale i.MX6SL-EVK as microcontroller board. For power reasons make sure that the jumper is fitted on position 2-3 on pin header J17.

Ensure Hummingbird board is properly connected to the Freescale i.MX6SL-EVK and SD card is inserted into boot slot (see images below).

Frontlight Header    Display 2 Connectors    EPD Debug Header    Hummingbird Z3.4 Board    Freescale i.MX6sl Eval. Board    i.MX6sl-Keypad    Reset Button



Display 1 Connectors    Boot SD-Card-Slot    J17    USB-Host Port    OTG-USB Port

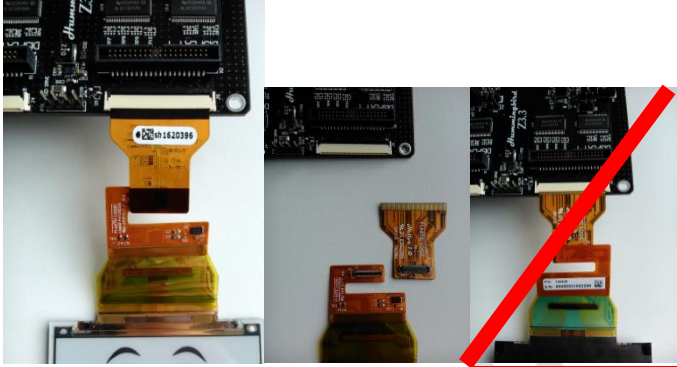




USB-Serial Connector    Ethernet Connector    Power Switch    Power Connector



## 4.4 Connecting up the Display

1. See table below for which connector boards should be used for what display.

<p>Kit Part-No: 303008 Connector board: Helios1 Display Type: S047_T2.1</p>	
<p>Kit Part-No 303012 Connector board: Hermes 3 Display Type: D107_T3.1</p>	
<p>Kit Part-No: 303013 Connector board: Hermes 3 (2 times) Display Type: Q154_T3.1</p>	

2. Check that the connectors on both ends of each ribbon cable are properly engaged into their respective box headers.
3. Ensure that the display connectors are fully engaged with their respective flip-lock connectors on the display connectors. If not, lift up the black plastic flip-lock, fully insert the display connector and push down to close the flip-lock.
4. Connect the 5V power cable to the processor board.

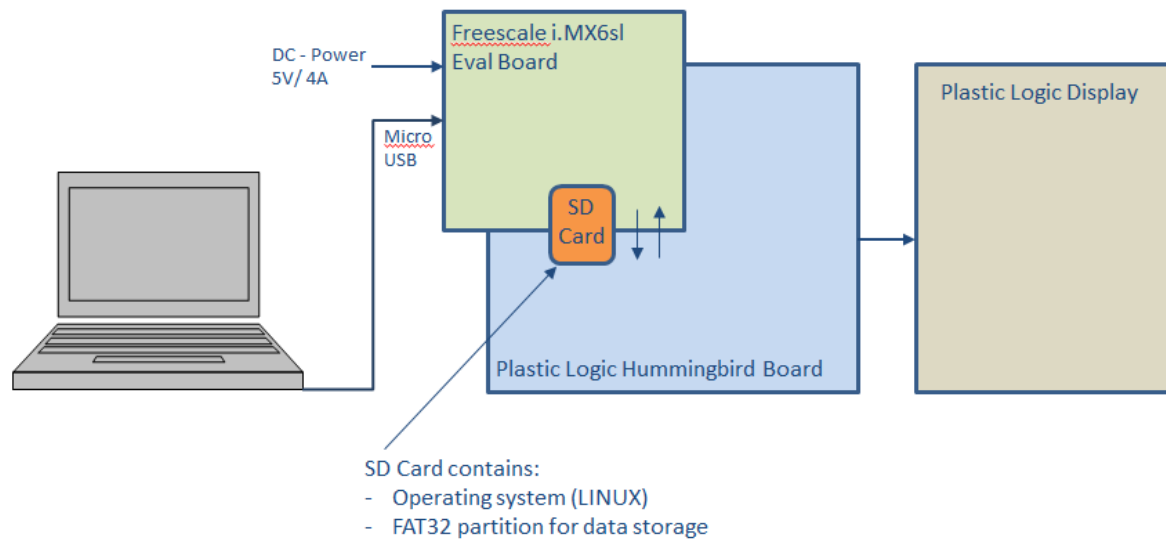
## 4.5 System boot and image display

1. Turn on the power at the mains and move the Freescale boards power slider switch to 'on'
2. A green LED on the Freescale Board should be illuminated.
3. Now wait for approximately 45 seconds for the Freescale processor to boot and load the operating system.
4. Shortly afterwards, the Plastic Logic display should start being updated with a sequence of images at approximately 5 second intervals.

## 5 Troubleshooting

In case of any problems please email [techsupport@plasticlogic.com](mailto:techsupport@plasticlogic.com)

## 6 Block Diagram

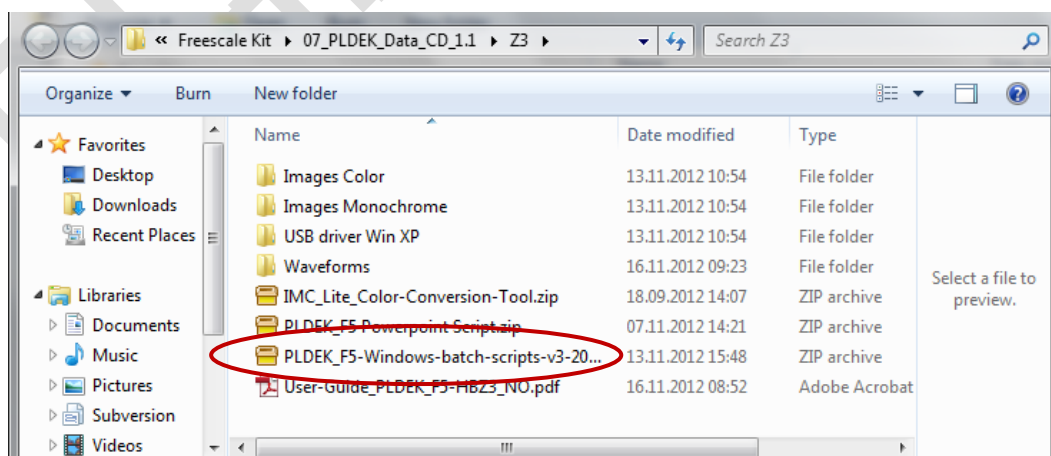


The block diagram shows the main components of the PLDEK. For further information of the hardware please look into chapter 9

## 7 Data Transfer and Remote Commands

### 7.1 General information

To control the PLDEK from your PC or upload and display your own images it is necessary to set up an Ethernet connection. For these standard operations currently a connection via Micro-USB (attached cable) is supported. On the PLDEK SD-Card you can find a ZIP archive called "PLDEK\_F6-Windows batch scripts..." which should be unpacked and stored on your own PC. It consists of remote commands to control the PLDEK with your PC.

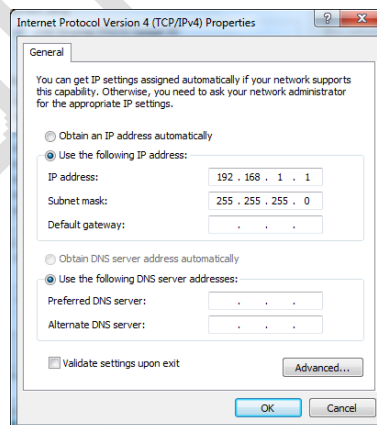


## 7.2 Connect PLDEK to your PC

### 7.2.1 Ethernet via USB

First it is necessary to set up an Ethernet connection via USB between the PLDEK and your PC. If the system is powered up and the slideshow is running, please connect the kit with the provided micro-USB cable to your PC. Please use USB type A plug in your PC, type B plug (Micro USB) in the PLDEK. A new hardware ("USB Ethernet/ RNDIS Gadget") should be detected. For Win XP an additional USB driver (available on the SD Card) must be installed before [5]. For the following configuration steps local admin privileges will be required:

- The PLDEK has the fixed IP address 192.168.1.10. For setting up the Ethernet connection it is important to use a different address in the same subnet as the PLDEK for your PC e.g. 192.168.1.1
- Please note if you would like to use more than one USB port on your PC for connecting the PLDEK it is necessary to define a special IP address for each port and repeat this procedure (e.g. 192.168.1.1. for port 1; 192.168.1.2 for port 2 and so on)
- Open up the "Network and Sharing Center" of your PC (Path: Start/Control Panel/Network and Sharing Center)
- Choose "Change Adapter Settings" and double click "Local Area Connection"
- A device named "USB Ethernet/RNDIS Gadget xx" should be visible ("xx" can be empty or any number; it depends on your PC hardware setup)
- Go to "Properties" and double click "Internet Protocol Version 4"
- After that select "Use the following IP address" and enter IP address and subnet mask like shown in the following image
- Confirm all dialogs



Please NOTE:

- If your PC and PLDEK lost connection by some reason (reboot of the PLDEK) it is important to remove the micro-USB cable from the PLDEK and reconnect it.
- It is not possible to run the PLDEK powered by the micro-USB from your PC only. This may cause errors and malfunctions. In that case please restart the PLDEK (by disconnecting and connecting the power supply cable) and wait till the slideshow is running before connecting the Micro-USB again

## 7.2.2 USB-Serial Connection (Virtual COM Port)

- Connect your PC to the Freescale board with a *usb* cable to the USB to UART labelled USB port
- Check the device manager to find out which com port is assigned to the USB-Connection.
- In PuTTY choose a Serial connection type and fill in the Port No. of your virtual COM Port.
- The Speed must be set to 115200
- The connection persists on reboot of the PLDEK.

## 7.3 Manual Data Transfer

### 7.3.1 PLDEK data storage (SD Card)

The SD Card (mounted in board 1 – Freescale i.MX6sl) consists of two partitions. One is the PLDEK operating system (LINUX) and software to control display electronic. The other is a FAT32 partition where you can store your own images in a special named “customer” folder.

SD-Card Memory Layout	
8MB unpartitioned	u-boot
1GB fat32, mmcblk0p1	USERDATA (images, waveforms, scripts, documentation), <b>Linux Kernel and device tree binary</b>
1GB ext4, mmcblk0p2, root	Linux Debian Rootfs

**Note:** Make sure to read at least 2008MB from the SD-Card if it is needed to save/restore the SD-Card image.

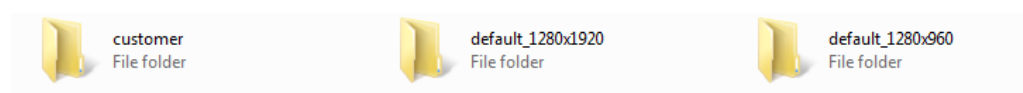
### 7.3.2 Create FTP connection

If your PC is successful connected via USB-Ethernet to the PLDEK please open up your Windows explorer (please do not use the Internet explorer) and fill in the known IP address of the PLDEK (insert: “ftp://192.168.1.10”). If connected successful the FAT32 partition of the SD card will be visible.



### 7.3.3 Image upload

If you would like to display custom images with the PLDEK you will find a special folder named “img/customer”. You can store your own content by dragging and dropping images into this folder. Please consider that the images have the PNG format and a maximum size of 1280x960 for 10.7” displays (smaller images will be shown with their native resolution and larger images will be cropped).



## 7.3.4 Preparing Color Images

To ensure the best quality of your color images with the kit it is necessary to do some preprocessing before displaying them.

First of all it is recommended to use 24bpp (bit-per-pixel) RGB "true color" images only. For text highlighting, user interfaces or buttons the "Eight basic colors palette" is useful. Supported are black, white, red, green, blue, cyan, magenta and yellow. This is linked to RGB (W) filters, other color palettes would not be recommended.

Secondly, there are two options for displaying color images:

- If mainly the eight basic colors are used you can proceed with chapter 8.1.5 (epview -f).
- For further optimization, please use the driver side color conversion. This reduces the resolution to the half of the physical display resolution. E.g. 1280x960 will be decreased to 640x480. The driver-side-color conversion does not need image preparation and works with all display types. The images must only have the reduced resolution. See Chapter 8.2 for how to enable color mode.

## 7.4 Main Remote Commands for PLDEK

This chapter contains the procedure how to control the PLDEK with an Ethernet connection via USB from your PC. Please note that this requires the PLDEK to be paired with Freescale's i.MX6sl EVK [4] and the "PLDEK\_F5-Windows batch scripts..." are unpacked and stored somewhere on your own PC. Below the main commands will be explained.

### 7.4.1 Display image scripts

Images are located in the "img" folder. There are subfolders for your own images named "customer", for "monochrome" and "color" with the Plastic Logic default images. Before a slideshow is running you should activate (double click on script) the following function. At delivery it is enabled.

- slideshow-enable.bat

To start or stop a slideshow you can use the following scripts.

- slideshow-start.bat
- slideshow-stop.bat

To change between the available slideshows you should use the following scripts. Before changing the slideshow it is recommended to stop a running slideshow by using the script "slideshow-stop.bat".

- slideshow-set-default-monochrome.bat
- slideshow-set-default-color.bat
- slideshow-set-default-customer.bat (if you have uploaded custom images)

## 7.4.2 Waveform update

At delivery of the PLDEK a default waveform is activated. To ensure the best quality of the displayed images every display has its specific tuned waveform.

To set another waveform active, please store the waveform file on the PLDEK SD Card in the folder wfl and call the epdc-restart.sh script. This script will copy all waveform files to the PLDEK rootfs to make them available to the kernel epd driver. Use the parameter -w to select the desired waveform:

```
$ epdc-restart.sh -t [display type] -v [vcom value in millivolts] -w [desired waveform file]
```

## 7.5 Overview All Remote Scripts

### 7.5.1 Operation remote script overview

#### display-image.bat <image>

*Description:* Updates the display with a single image stored on the PLDEK.

*Parameters:* Image: absolute path of the image on the PLDEK, e.g. "/mnt/data/img/customer"

*Dependencies:* plink.exe

*Example:* "display-image.bat /mnt/data/img/customer/test.png"

*Implementation:* Opens an SSH connection to the PLDEK and executes "/usr/bin/epview <image>" on the PLDEK.

#### slideshow-enable.bat

*Description:* Enables the slideshow on the PLDEK to be started manually respectively to be started automatically after the PLDEK boots.

*Dependencies:* plink.exe

*Implementation:* Opens an SSH connection to the PLDEK and executes "/mnt/data/bin/slideshow-enable.sh" on the PLDEK.

#### slideshow-disable.bat

*Description:* Disables the slideshow on the PLDEK to be started manually respectively to be started automatically after the PLDEK boots.

*Dependencies:* plink.exe

*Implementation:* Opens an SSH connection to the PLDEK and executes "/mnt/data/bin/slideshow-disable.sh" on the PLDEK.

#### slideshow-set-default-monochrome.bat

*Description:* Configures the slideshow to show the default monochrome images located in "/mnt/data/img/default\_1280x960/monochrome" on the PLDEK.

*Dependencies:* plink.exe

*Implementation:* Opens an SSH connection to the PLDEK and executes  
"/mnt/data/bin/ slideshow-select.sh default monochrome" on the PLDEK

## **slideshow-set-default-color.bat**

*Description:* Configures the slideshow to show the default color images located in  
"/mnt/data/img/default\_1280x960/color" respectively in  
"/mnt/data/img/default\_1280x1920/color" on the PLDEK.

*Dependencies:* plink.exe

*Implementation:* Opens an SSH connection to the PLDEK and executes  
"/mnt/data/bin/ slideshow-select.sh default color" on the PLDEK.

## **slideshow-set-default-customer.bat**

*Description:* Configures the slideshow to show the customer images located in  
"/mnt/data/img/customer on the PLDEK depending on the setup of the PLDEK

*Dependencies:* plink.exe

*Implementation:* Opens an SSH connection to the PLDEK and executes  
"/mnt/data/bin/ slideshow-select.sh customer" on the PLDEK.

## **slideshow-start.bat**

*Description:* Starts the slideshow on the PLDEK with all images contained in one of the following locations depending on the current configuration:

- "/mnt/data/img/default\_1280x960/monochrome"
- "/mnt/data/img/default\_1280x960/color"
- "/mnt/data/img/customer".

delay of 3s between image updates.

The slideshow uses a

*Dependencies:* plink.exe

*Implementation:* Opens an SSH connection to the PLDEK and executes  
"/mnt/data/bin/slideshow-start.sh" on the PLDEK.

## **slideshow-stop.bat**

*Description:* Stops the slideshow on the PLDEK (if it is running).

*Dependencies:* plink.exe

*Implementation:* Opens an SSH connection to the PLDEK and executes  
"/mnt/data/bin/slideshow-stop.sh" on the PLDEK.

## **copy-waveform.bat**

*Description:* Copies the waveform files stored in /mnt/data/wfl to the PLDEK's rootfs.

*Dependencies:* plink.exe

*Implementation:* Opens an SSH connection to the PLDEK. Executes "/mnt/data/bin/copy\_waveform.sh" on the PLDEK to copy the waveforms placed in /mnt/data/wfl to the rootfs /lib/firmware/imx so they can be used by epdc-restart.bat

## **epdc-restart.bat <type> <vcom> <waveform> <nvm> <scrambling>**

*Description:* Restarts the display driver with the given parameters

All parameters must be set to a value.

*Parameters:*

type:

"D107\_T3.1" for a 10,7" PL D107\_T3.1 display

"Q154\_T3.1" for a dual display of two D107\_T3.1 displays (normally laminated into one big display)

"S047\_T2.1" for a PL 4.7" S047\_T2.1 display

vcom:

A number in millivolts to set the corresponding VCOM voltage to the display or two values for dual display configuration

waveform:

String containing the filename of the waveform file to be used.

nvm:

Specifies if the nvm on the display will be read for display configuration.

scrambling:

Specifies if the driver shall scramble the images for use in scrambled displays. This does only needed for S115\_T1 and S079\_T1 displays if the images are not prescrambled

*Dependencies:* plink.exe

*Example:*

"epdc-restart.bat D107\_T3.1 5500 epdc\_D107\_T3.1.fw 0 0 "

"epdc-restart.bat Q154\_T3.1 5500,5500 epdc\_D107\_T3.1.fw 0 0 "

"epdc-restart.bat S115\_T1.1 4000 epdc\_D107\_T3.1.fw 0 1"

*Implementation:* Opens an SSH connection to the PLDEK and executes

"/mnt/data/bin/epdc-restart.sh on the PLDEK. This includes a restart of the display driver.

## **7.5.2 Data transfer script overview**

### **ftp-slideshow-images.bat <local directory>**

*Description:* Transfers image files stored locally to "/mnt/data/img/customer" on the PLDEK to be displayed in the slideshow.



*Parameters:* local directory: absolute/relative path of local directory containing the image files (\*.png)

*Dependencies:* ftp-slideshow-images.ftp

*Example:*

```
"ftp-slideshow-images.bat ../myimages"           "ftp-
slideshow-images.bat myimages"                   "ftp-
slideshow-images.bat c:/myimages"
```

## 8 Software Development Kit (SDK)

Please note that the PLDEK is paired with Freescale's i.MX6sl EVK [4]. A PC with a serial connector with terminal emulator software such as PuTTY[1] installed may be required for users wishing to explore the SDK or to help debug any problems should they occur. This is not included in the kit.

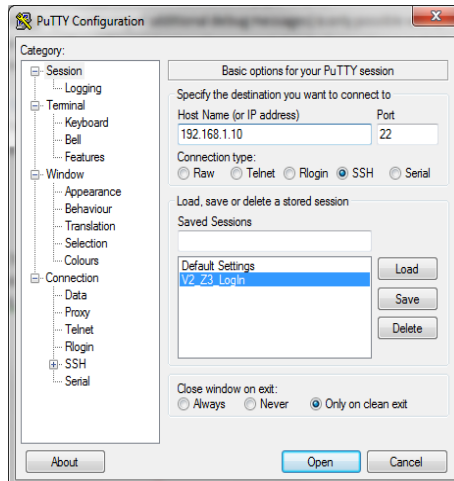
### 8.1 Applications

This SDK contains several libraries and applications to control an e-paper display and demonstrate its operation. Please note debugging (monitoring of additional debug messages) is only possible with a serial connection. Ethernet over USB and the serial connection support standard operations e.g. start or stop of a slideshow as well.

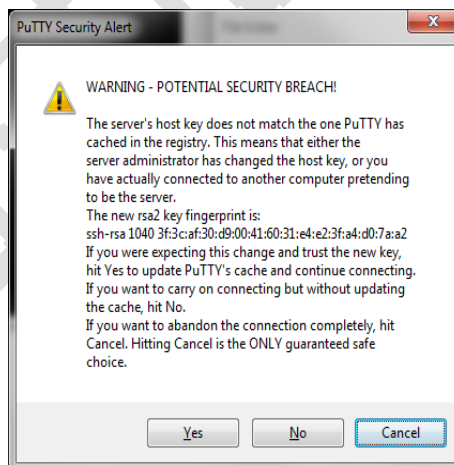
## 8.1.1 Setting up the system with USB connection

The steps for setting up the system are identical to those given in the “Getting Started” chapter. Please ensure that an emulator software such as PuTTY[1] will be installed on your PC.

- Connect your PC to the Freescale board via Ethernet over USB and run PuTTY.exe
- Use connection type SSH (port 22) and connect it to the PLDEK’s fixed IP address 192.168.1.10.

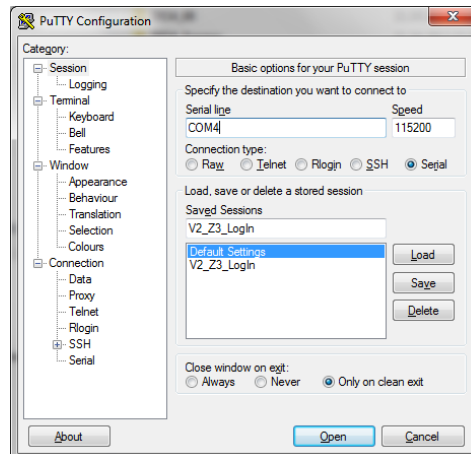


- If you connect the PLDEK and your PC with PuTTY via USB the first time the following warning occurs and has to be confirmed with “YES”.



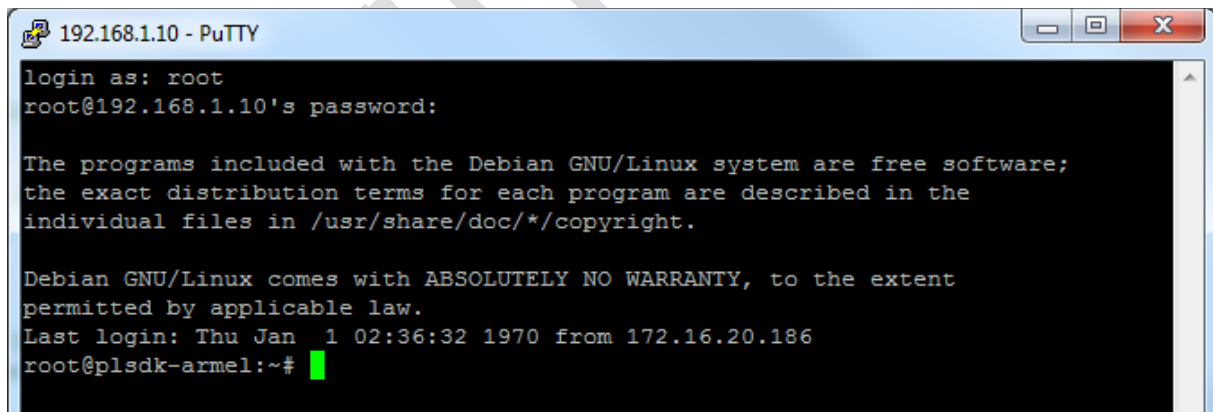
## 8.1.2 Setting up the system with Serial connection

- Connect your PC to the Freescale board via a USB cable to the USB-To-UART-Port and run PuTTY.exe. If your PC do not have a serial connection an additional adapter to USB is necessary
- Check in the Device Manager of your PC which Port No. is shown by the system (e.g. COM4), choose a Serial connection type and fill in this Port No. in PuTTY
- The Speed must be set to 115200



## 8.1.3 Logging in

After approximately 45 seconds a login prompt should appear. Type in "root" followed by "password " for the password.



**Note:** The serial connection (virtual COM port) does not require a login. It will use root auto login.

## 8.1.4 eptest: e-paper test application

This application draws test patterns and shows the use of various e-paper features such as waveform selection and region screen updates. To clear the screen and run a basic test pattern sequence:

```
eptest
```

To get help with this command or run different test pattern sequences please insert:

```
eptest --help
```

## 8.1.5 epview: e-paper document viewer application

Documents can be shown on an e-paper display using epview. Currently only PNG images are supported. The image size should match the native display resolution which is 1280x960 (width x height) pixels for 10.7" single. Smaller images will not make use of the full size of the display. Larger images will be cropped.

There are a number of example images for both display types on the kit. To give an example for a 10.7" single display use `"/mnt/data/img/default_1280x960/monochrome"` or `"/mnt/data/img/default_1280x960/color"`.

These images can be displayed using the following command:

```
epview /mnt/data/img/default_1280x960/monochrome/01_eyes_1280x960.png
```

To display all images one after another, e.g. with a three seconds delay, there are two options:

1. `for f in monochrome/*.png; do ./epview "$f"; sleep 3; done`
2. `epview -g 3000 /mnt/data/img/customer/*.png`

The slideshow script `"/mnt/data/bin/slideshow-start.sh"` also uses epview:

```
#!/bin/sh

set -e

if [ -e /var/tmp/slideshow-disabled ]; then
    echo "Slideshow disabled"
    exit 1
fi

rm -f /var/tmp/slideshow-stop
sync

while true; do
    for f in /var/tmp/slideshow/*.png; do
        if [ -e /var/tmp/slideshow-stop ] then
            echo "Stopping slideshow"
            exit 1
        fi
        epview -r auto -a center,middle -b black "$f"
        sleep 3
    done
done
exit 0
```

To get help further with this command please use:

```
epview -help
```

## 8.1.6 plinput

Usage:

```
plinput <OPTIONS>
```

Listen for input events on a given input device and print them out.

To be completed in a future version

## 8.1.7 3.2.4 plottest

Usage:

```
plottest <OPTIONS>
```

Listen for input events from a given mouse-like input device and draw thin lines on the screen between the received coordinates.

To be completed in a future version

```
plhwtools epdc opt clear_on_exit 1  
plhwtools epdc opt temperature_auto 0  
plhwtools epdc opt temperature 12
```

## 8.2 Services

### 8.2.1 EPDC: Display driver service

To restart the ePDC with custom settings you may want to use the interactive epdc-restart.sh script. With this script you are able to set the options VCOM, DisplayType, CFA-use, waveform, nvmm-use, clear-display-on startup and the use of scrambling.

The service is available and can be called with parameters or interactively without. Call

```
$ epdc-restart.sh -t D107_T3.1 -v 5500 -c -w epdc_D107_T3.1.fw
```

to restart the display driver D107\_T3.1 with color processing, 5,500V VCOM and using epdc\_D107\_T3.1.fw waveform file. Call epdc-restart-interactive.sh to get into interactive mode:

```
$ epdc-restart-interactive.sh
```

Type 'c' for using values from epdc.conf or 'e' to enter them.

VCOM=?

TYPE=?

CFA=?

WAVEFORM=?

SCRAMBLING=?

USE\_NVM=?

INIT\_CLEAR=?

VCOM is a display specific constant and must be entered in millivolts.

TYPE is the display type i.e. D107\_T3.1 or Q154\_T1.1

CFA is the color filter array option. This only applies – and should be set – for color displays

WAVEFORM specifies the waveform file to be used by the driver. This file must be either inside the /lib/firmware/imx folder or in the wfl folder on the USERDATA partition. If nothing is entered here, the driver assumes epdc\_[display type].fw

SCRAMBLING sets driver side scrambling algorithm to be activated for all images. Only needed for scrambled displays like S115\_T1.x and S079\_T1.x.

USE\_NVM specifies if the driver should (try to) read the display's NVM to detect the display type, waveform type and VCOM value. Should be set to 0 if multiple displays (S079/S115) are attached to the board.

INIT\_CLEAR enables the display to be cleared on init with the init-waveform. Set to 0 to avoid clearing on driver reload. Useful to change from color to B/W-mode silently.

## 8.3 If anything is not working as expected

If the PLDEK is not showing the slideshow on startup, there are a set of steps to sort out what went wrong:

- Check if the Kit is powered correctly. Is the green LED on the imx6sl evk enlightened?
- Is the Hummingbird Z3.4 properly connected to the imx6 board?
- Check if all connections are properly set up and that the SD-Card is fitted to the SD-Card-Slot labelled with SD2
- Check if you can access the Imx6's command line.
  - SSH to the imx6 (i.e. using PuTTY):
    - Use the USB-Cable and connect to 192.168.1.10:22 or
    - Use the UART-Port to connect to the serial console
- Check if the Imx6booted correctly
  - `$ dmesg` will show all messages during the boot process. Check for errors on module load and file system errors
- Check if the slideshow is running correctly:
  - Check if the slideshow starts and if it stops check the image which did not show up correctly.

- Check if the autostart- and slideshow-scripts are in place and enabled.
  - **Note: Unfortunately the SD-Card might be damaged if the Kit is not powered down correctly. That can lead to booting problems.**
  - `$ ls /var/lib/systemd/system/ | grep slideshow`
  - `$ ls /mnt/data/bin/ | grep slideshow`
- If nothing seems to work or in case of any other trouble with the kit, please contact [techsupport@plasticlogic.com](mailto:techsupport@plasticlogic.com)

## 9 The PLDEK Hardware

### 9.1 Overview

The PLDEK hardware requires a 5V/2.5A power supply which is supplied as part of the kit. The PLDEK hardware consists of 3 main parts which can be seen in Figure 1:

- Freescale i.MX6sl EVK board
- Plastic Logic High Voltage board – Hummingbird Z3.4
- Plastic Logic display with specific adapter board

### 9.2 Freescale i.MX6sl EVK board

The following documentation is recommended

- i.MX6sl EVK board Schematics [2]
- i.MX6sl Processor Reference manual [3]

In particular chapter 22 entitled Electrophoretic Display Controller (EPDC) is useful for understanding the i.MX6sl's built in hardware EPDC.

### 9.3 Plastic Logic Hummingbird Z3.4

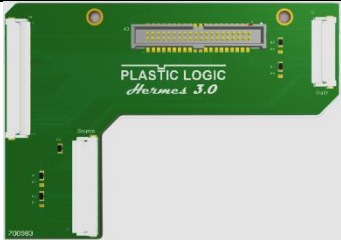
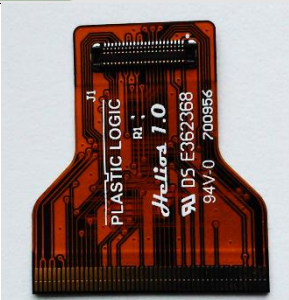
The Hummingbird board provides the following functions:

- gate supply voltages (+28V, 0, -42V)
- source supply voltages (+15V, 0, -15V)
- VCOM supply for the display (0 to 10V – controlled by Maxim HVPMIC MAX17135)
- ADC for VCOM and power consumption measurement

Schematics for the Hummingbird board are available on the SD-Card.



## 9.4 Plastic Logic Display Adapter Boards

Display Type	Adapter Board Name	Picture
D107_T3.1	Hermes 3	
T154_T3.1	2x Hermes 3	
Q154_T3.1		
S047_T2.1	Helios 1.0	

## 9.5 Plastic Logic Displays

The PLDEK supports a number of Plastic Logic Displays. All displays are fitted with a nvm storage which stores the display type and will be automatically detected at startup (for single display use only). See 9.5.1 for details.

D107\_T3.1



Q154_T3.1	
S047_T2.1	

Key features of the displays are:

- Organic TFT active matrix backplane
- Bi-stable electrophoretic front plane
- Ultra-wide viewing angle

The FPCs distribute the display input signals to the source and gate driver chips contained within COFs. The gate flexi is connected to a pair of cascaded gate chips which drive the gate lines of the display. The source flexi is connected to 3 source COFs which drives the source lines.

## 10 Build your own PLDEK

The PLDEK SD-Card includes the source code and build instructions to create your own PLDEK SD-Card image to be able to start developing hard and software based on Plastic Logic Displays.

On the SD card is a Folder labelled **source**, there you can find a build instruction file and the corresponding source files and binaries. It is recommended to save the files to a local hard disk to be prepared in case the sd-card crashes.

All Plastic Logic source code used with this PLSDK is available at Github. See <https://github.com/plasticlogic> or the Build Instructions for further details.

## 11 References

- [1] [www.chiark.greenend.org.uk/~sgtatham/putty/download.html](http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html)
- [2] i.MX6SL EVK Board Schematics  
[http://cache.freescale.com/files/product/hardware\\_tools/MCIMX6SLEVK.pdf](http://cache.freescale.com/files/product/hardware_tools/MCIMX6SLEVK.pdf)
- [3] i.MX 6SoloLite Applications Processor Reference Manual.  
[http://cache.freescale.com/files/32bit/doc/ref\\_manual/IMX6SLRM.pdf](http://cache.freescale.com/files/32bit/doc/ref_manual/IMX6SLRM.pdf)
- [4] i.MX6 software & development tool resources. [http://www.freescale.com/products/arm-processors/i.mx-applications-processors-based-on-arm-cores/i.mx-6-processors/i.mx6qp/i.mx-6sololite-processors-single-core-low-power-epd-controller-arm-cortex-a9-core:i.MX6SL?fsp=1&tab=Design\\_Tools\\_Tab](http://www.freescale.com/products/arm-processors/i.mx-applications-processors-based-on-arm-cores/i.mx-6-processors/i.mx6qp/i.mx-6sololite-processors-single-core-low-power-epd-controller-arm-cortex-a9-core:i.MX6SL?fsp=1&tab=Design_Tools_Tab)
- [5] Instructions for installation of the USB driver for Win XP [http://embedded.seattle.intel-research.net/wiki/index.php?title=Setting\\_up\\_USBnet](http://embedded.seattle.intel-research.net/wiki/index.php?title=Setting_up_USBnet)