

USER GUIDE

Display Evaluation Kit K_MSP430

for

**1.1", 1.38", 2.1", and 3.1" displays
on Ultrachip platform**

and for

**4.0", 4.9", 4.7", and 10.7" displays
on Epson and Drivers-only platform**

Valid for Evaluation Kit Part No.:

303001, 303002, 303004, 303006, 303010

Revision 1

15-February-2018

Revision Status	Date	Author	Reason of Modification
1	15-Feb-2018	RP	Initial Version

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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.

Prior to unpacking the kit, the user is strongly urged to take appropriate ESD and safety precautions. Remove the kit from the anti-static bags and perform a visual inspection

2 About this document

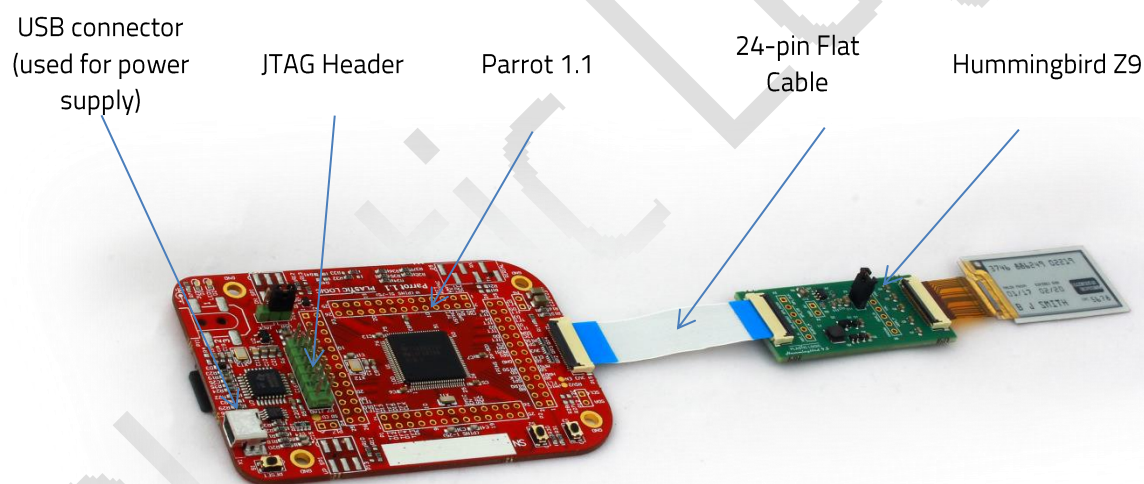
This document is a user start guide for the **microcontroller-based** display evaluation kits. It is only to be used for kits containing a TI MSP430 microcontroller on a Parrot board.

3 Evaluation Kits for 1.1", 1.38", 2.1" and 3.1" displays

3.1 Unpacking the Kit

The kit is shipped with the items listed in the table below. Please ensure that the items listed on the next page have been included in your kit.

No.	Item	Description
1	Board 1	Plastic Logic Parrot 1.1 microcontroller board
2	Board 2	Plastic Logic Hummingbird Z9 interface
3	Flat Ribbon Cable	Cable to connect board 1 and 2. This cable is already connected to the Z9-board at one side.
5	Micro - SD Card	Contains slide-show images, display specific waveforms and voltages, documentation, source code. The Micro-SD card is mounted in the socket of board 1.
6	SD Card Adaptor	Adaptor from Micro-SD to standard SD form-factor
7	USB cable	Currently only used for power supply



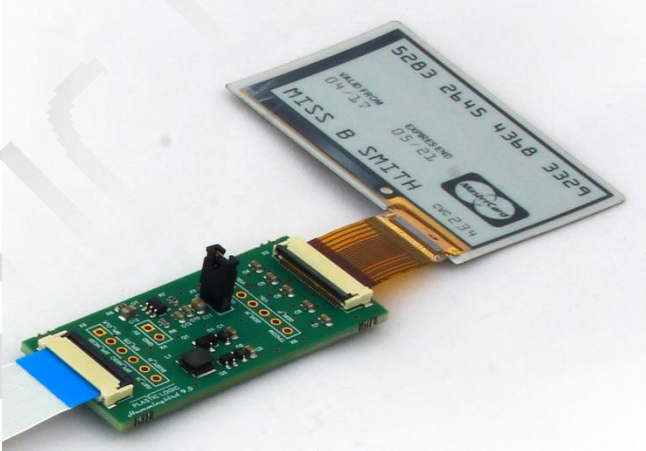



Note: Image shows M_T430U with C_HBZ9.5 and S014_T1.

3.2 Connecting up the Kit

Connect the Parrot board with the Z9 board using the Flat Ribbon Cable. Plug in the display into the display connector of the Hummingbird Z9 board. It is important to connect the display before powering up the kit to avoid damages of any parts.

Attention: Do not change or remove the display during the kit is powered up!

Display S011_T1.1	
S014_T1.1	
S021_T2.1	
S031_T1.1	

3.3 Setting the Display Type

The Display Type should be set on the SD Card so the MCU can select the display settings accordingly. On the root folder of the SD Card is a file named display-type.txt.

There the first line specifies the display type.

Valid Types are:

- S011_T1.1
- S014_T1.1
- S021_T1.1
- S031_T1.1

4 Evaluation Kits for 4.0", 4.7", 4.9" and 10.7" displays

4.1 Unpacking the Kit

The kit is shipped with the items listed in the table below. Please ensure that the items listed have been included in your kit.

No.	Item	Description
1	Parrot Board	MSP430-Based microprocessor board
2	USB Cable	USB Cable for powering the Parrot board and communication interface
3	Display Power Board	For 4.0" display: Hummingbird Z6 board
		For 4.7" and 10.7" display: Raven board
		For 4.9" display: Hummingbird Z7 board
4	Display Adapter Board	Only for 4.7" display: Helios 1 board
		Only for 10.7" display: Hermes 3 board
5	SD-Card	SD-Card with images, display binaries, documentation and source code
6	24 pin FFC Cable	Cable to connect the Parrot board with the Display power board
7	50 pin FFC Cable	Only for 10.7" display: Cable to connect the Raven board to the Hermes 3 board

5V Power Supply Socket

JTAG Header

Micro SD Card Socket

USB Socket

Display Power Board Connector

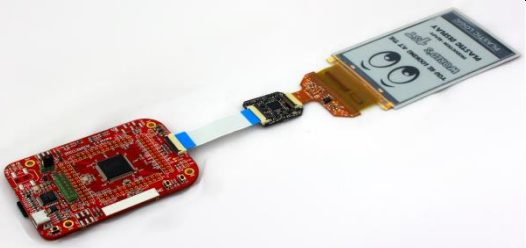
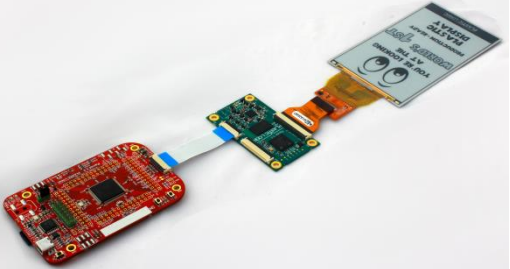
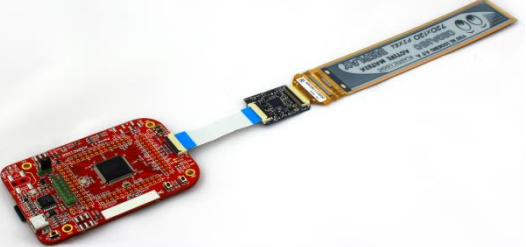
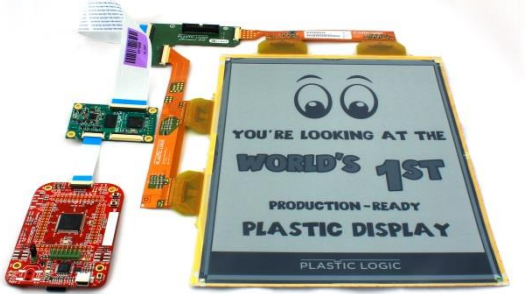


4.2 Connecting up the Kit

Connect the Parrot Board to the display power board through the flat cable. It is important to connect the cable with contact down on both sides. It is also important to connect the display before powering up the kit to avoid damages of any parts.

Attention: Do not change or remove the display during the kit is powered up!

See the following table for connection details

Kit No.	Components	Component No.	Connection Image
303002: K_MSP430 for 4.0" display Type S040_T1.1	M_T430E C_HBZ6	301008 301014	
303006: K_MSP430 for 4.7" display Type S047_T2.1	M_T430E C_RV1 B_H1	301008 301002 301018	
303004: K_MSP430 for 4.9" display Type S049_T1.1	M_T430E C_HBZ7	301008 301015	
303010: K_MSP430 for 10.7" display Type D107_T3.1	M_T430E C_RV1 B_HM3	301008 301002 301021	

4.3 Setting the Display Type

This kit can be used for multiple displays. To select the display that should be used:

- insert the SD card from the kit into the PC (with supplied micro-SD adapter).
- Open file config.txt in root directory of SD card
- Edit line starting with "display_type" to the display type to be used according to the table
- Put SD card back into Parrot board of the kit

4.4 System Boot and Image Display

After the display is plugged in please connect the USB cable to the Parrot board to power up the kit. The image slideshow will start after a few seconds.

4.5 Further Information

Please remove the Micro-SD card from the switched off kit and insert it into a PC. Please check the folders "Documentation" for further information.

4.6 Sequence File

An optional plain text file named `slides.txt` can be put in the image directory

0: /<display_type>/img to tell the software to run a specific sequence of updates instead of simply cycling through all the images found in this folder as a slideshow.

This sequence supports simple animations including regional updates, individual delays between updates, use of different waveform modes, etc.

4.6.1 Format of the file `slides.txt`

- each line corresponds to a single command
- each line is processed sequentially
- commands cannot be nested and there is no flow control
- each line has a maximum length of 80 characters (fixed by buffer size in software)
- only ASCII characters can be used in the file
- line endings can be either DOS or Unix like
- each line is composed of values separated by commas and any number of spaces
- not all commands take the same number of arguments, so lines can have varying numbers of values
- a line starting with a hash sign # is a comment and is ignored by the software
- blank lines are allowed
- there is no limit to the length of the file other than what the file system infrastructure permits

The software will not keep more than one line in memory at a time, and it will automatically jump back to the beginning of the file when it has processed the last line to keep playing the sequence continuously. It is worth noting that copying areas of image files into the EPD frame buffer can take a significant amount of time compared to the duration of a display update. Drawing operations are separated from display updates, which take little time to start, so it is still possible to achieve some basic animation effects with appropriate sequencing of the drawing and display update commands.

4.6.2 Supported commands

update, WAVEFORM, UPDATE_MODE, LEFT, TOP, WIDTH, HEIGHT, DELAY

Update the display with the given WAVEFORM (see [Waveform identifiers](#)) with the UPDATE_MODE (see [Update Modes](#)) in the area starting with the (LEFT, TOP) pixel coordinates and the given WIDTH and HEIGHT. The software will wait until the update request has been processed by the controller, and then wait for DELAY in milliseconds.

Note

WIDTH must be exactly divisible by 2 and the specified rectangle must not exceed the bounds of the display.

power, ON_OFF

Turn the display power either on or off based on the value of ON_OFF, which can be either on or off. When turning the power off, the software will wait for any on-going update to complete.

fill, LEFT, TOP, WIDTH, HEIGHT, GREY_LEVEL

Fill a rectangle starting with the (LEFT, TOP) pixel coordinates and the given WIDTH and HEIGHT with the given GREY_LEVEL which is a number between 0 and 15 - 0 being black and 15 white.

Note

WIDTH must be exactly divisible by 4 and the specified rectangle must not exceed the bounds of the display.

image, FILE, LEFT_IN, TOP_IN, LEFT_OUT, TOP_OUT, WIDTH, HEIGHT

Copy an area from an image file FILE starting to read from (LEFT_IN, TOP_IN) pixel coordinates into the EPD buffer at (LEFT_OUT, TOP_OUT) pixel coordinates with the given WIDTH and HEIGHT.

Note

WIDTH must be exactly divisible by 2 and the specified rectangles must not exceed the bounds of the image file or the display.

sleep, DURATION

Sleep for the given DURATION in milliseconds.

4.6.3 Example sequence

The following listing shows a sample sequence for S040_T1.1 400x240 displays:

```
# Fill the screen with white and trigger a refresh update
#
# x, y, w, h, gl
fill, 0, 0, 400, 240, 15
power, on
update, 2, 0, 0, 0, 400, 240, 50
power, off
# Load some image data in 4 different areas
#
# file, i_x, i_y, o_x, o_y, wid, hgt
image, 01_N.PGM, 290, 65, 290, 20, 100, 120
image, 06_N.PGM, 150, 50, 10, 10, 140, 180
image, 11_N.PGM, 150, 0, 155, 0, 130, 90
image, 13_N.PGM, 20, 20, 150, 150, 240, 80
# Update the same 4 areas with a small delay in between each
#
# waveform, update mode, left, top, wid, hgt, delay
power, on
update, 2, 0, 290, 20, 100, 120, 50
update, 2, 0, 10, 10, 140, 180, 50
update, 2, 0, 155, 0, 130, 90, 50
update, 2, 0, 150, 150, 240, 80, 50
power, off
```

4.6.4 Waveform identifiers

The following waveforms are always available in Plastic Logic's waveform libraries:

ID	Waveform Mode	Grey levels	Description	Update Speed
----	---------------	-------------	-------------	--------------

2	GC16	16	Full refresh with 16 grey levels	slow
1	DU	2	Faster update going to B/W only	medium
0	INIT	only white	Use to recover from unknown state e.g. after start up	slow

4.6.5 Update modes

The following update modes are always available in Plastic Logic's waveform libraries:

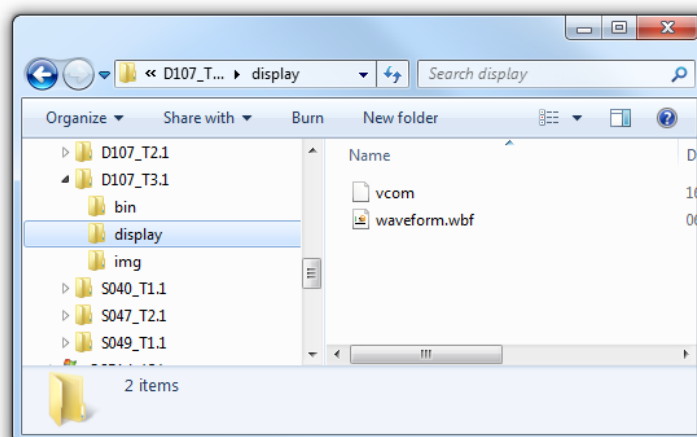
Update Mode	ID	Description
Full	0	All pixels are updated.
Partial	2	Only changing pixels are updated.

The update modes might be combined with all Waveform IDs except ID 0.

4.7 Setting Display Specific Waveform and VCOM

Each display type has its own folder on the SD-Card for the display specific waveform and VCOM file. Both files must be stored in the folder named as the display type:

Example: 0:\D107_T3.1\display\



Note: For the 4.0" and 4.9" displays, the waveform file must have the extension .bin.

The VCOM -file is a plain text document with just the VCOM voltage in millivolts. Files named not "waveform.wbf" (or .bin for 4.0" and 4.9") and VCOM are ignored. So it is necessary to rename the waveform file after copying it to the SD-Card.

In most cases the delivered waveform on the SD-Card fits the display best and the VCOM value is set to an average value for good display performance. In case of low display performance please request the display waveform and VCOM by emailing techstport@plasticlogic.com providing the S/N from the display label.

5 Preparing Your Own Images

5.1 Image Format

The EPD controllers used for this kit requires the image data in PGM format. For details on the format see: http://en.wikipedia.org/wiki/Netpbm_format.

5.2 Generate Images

PGM files can be generated or converted by several image software tools. A good free option is for example GIMP (<http://www.gimp.org/downloads/>).

GIMP export:

- File → Export As ...
- Choose "PGM image (*.pgm)"
- Change file-name extension to .pgm
- Click "Export" button
- Choose "Data formatting" = "Raw" and click "Export" button

5.3 Copy new images to the SD card

1. Disconnect the Parrot-board from power
2. Remove μ SD-card from Parrot-board
3. Copy the converted images to the image folder of the display type used e.g.
`0:\<display_type>\img`
4. Put the μ SD-card back to the Parrot-board
5. If you power the Parrot-board now again, you the new images will be shown in the slideshow

6 Troubleshooting

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 Parrot is powered correctly. Is P16 jumper fitted on Position 2-3 (USB)?
- Check if all connections are properly set up and that the SD-Card is fitted to the SD-Card-Slot
- Check if the SD-Card has been set to the correct display type in the file 0:/config.txt in root directory of SD-Card

If a fatal error occurs while running the code, the type of error is indicated via the status LED. Specifically the status LED will be flashed on/off a number of times, followed by a delay, after which the pattern will repeat. The error types are as follows (see also assert.h):

Flashes	Description
1	General error initialising GPIO
2	Error initialising MSP430 comms
3	Error reading HWINFO EEPROM. Could be a comms error or a content error
4	Error initialising I2C (Epson)
5	Error reading display information. Could be many errors (comms error, content error, missing or invalid file, etc). Also depends on preprocessor settings
6	Error initialising HVPSU. Most likely to be a comms error, but could indicate a failed PMIC
7	Error initialising EPDC. Could be many errors (comms error, EPDC failure, failed to load init code, failed on one of several commands needed to initialise the EPDC, failed to load waveform, etc)
8	Failed while running application. Multiple causes for this, depending on application that is running. Most likely failures are due to missing/invalid files or hardware problems such as POK or comms failure
9	Failed assert statement (debug use only)
10	Failed to read the config file
0 (off)	Undefined error
0 (on)	No error

Additional information relating to the error can be obtained by inspecting stderr via the debugger or the serial port. If nothing seems to work or in case of any other trouble with the kit, please contact techsupport@plasticlogic.com