

User's Guide

USB2TCM_v1.2

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1 Introduction

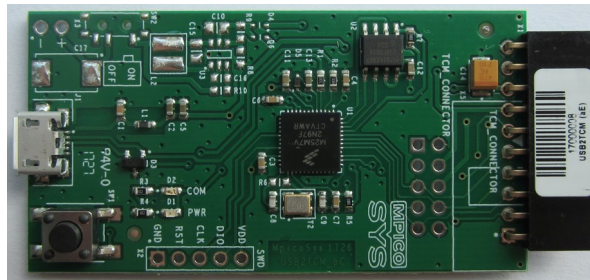


Figure 1.1: UCB2TCM_v1.2

USB2TCM_v1.2 interface is an easy to use USB Mass Storage device, which allows uploading images from a computer to MpicoSys Timing Controller Module (TCM) for Pervasive Displays and E Ink ePaper displays.

NOTE USB2TCM is designed to be used for quick-start and demo only. For professional solutions it is recommended using the TCM SPI interface directly.

It is assumed that the reader is familiar with the respective TCM Developer's Guide before reading this User's Guide.

2 Compatibility Note

USB2TCM_v1.2 is designed to connect a computer and the following TCM devices:

ePaper Display Vendor	ePaper Display Size	Compatible TCM Product Code
Pervasive Displays	4.41"	<ul style="list-style-type: none"> • TCM-P441_v1.1 • TCM-P441-230_v1.0 • TCM-P441-230_v1.1 • TCM2-P441-231_v1.0 • TCM2-P441-231_v1.1
	7.4"	<ul style="list-style-type: none"> • TCM-P74-110_v1.1 • TCM-P74-220_v1.1 • TCM-P74-230_v1.0 • TCM-P74-230_v1.1 • TCM2-P74-231_v1.0
	10.2"	<ul style="list-style-type: none"> • TCM-P102-220_v1.1 • TCM2-P102-231_v1.0 • TCM2-P102-231_v1.1 • TCM2-P102-231_v1.2
E Ink	13.3"	<ul style="list-style-type: none"> • TCM2-E133-320_v1.0 • TCM2-E133-320_v1.1 • TCM2-E133-320_v1.2
	31.2"	<ul style="list-style-type: none"> • TCM2-E312-220_v1.0 • TCM2-E312-220_v1.1

Table 2.1: List of products compatible with USB2TCM_v1.2

NOTE TCM2-E133 and TCM2-E312 are supported by USB2TCM in 1-bit image mode only. For 2-bit images, please use the TCM SPI interface directly.

2.1 Supported Operating Systems

- Microsoft Windows XP and above (32-bit and 64-bit)
- Apple OS X (tested on OS X Mavericks)
- Linux (tested on Ubuntu 13 64-bit)

NOTE Different operating systems may handle the USB2TCM flash memory differently. Some operating systems may not erase all the files, leaving some residual files on the disk. An appropriate use case of USB2TCM_v1.2 requires having only single EPD and optionally single EPC file in the memory to guarantee the image will not be incomplete or mismatched on the display.

3 Usage

3.1 Power Restrictions

USB power is likely to be severely limited (usually to 100 mA when powered directly from computer). This implicates a USB2TCM power limitation to display the most energy-consuming images. The more frequent display gate/source switches are required to display a picture, the more energy-consuming the picture is, with 1-by-1 pixel checkerboard being the worst case image. By default, USB2TCM_v1.2 can serve as a tool for displaying pictures without intensive dithering.

3.2 Connection

Use a micro-USB cable to connect the USB2TCM_v1.2 to a computer USB port.

NOTE USB2TCM_v1.2 may not work properly when connected to a passive USB hub (i.e. a USB hub with no external power supply). Please make sure to use a fully-powered (100 mA) USB socket.

Connect the USB2TCM_v1.2 10-pin female header with the TCM 10-pin male header. Please mind the correct orientation i.e. the components on both the boards should be facing the same direction.

USB2TCM_v1.2 utilizes USB 1.1 standard.

3.3 Uploading Image to TCM

When connected to a computer, the USB2TCM is recognized as a flash drive. Images in the EPD format¹⁾ can be copied on that drive and will be automatically sent to TCM²⁾, where the e-paper display will be updated.

The procedure is as follows:

1) For more information regarding EPD file format please refer to TCM Developer's Guide.

2) USB2TCM executes commands UploadImageData with EPD image as its argument and DisplayUpdate, which are described in TCM Developer's Guide. Invoking other TCM commands require communicating with TCM's SPI directly through other SPI master device (e.g. computer via SPI host adapter).

- 1) Check that the USB2TCM is properly connected to the computer and to the TCM
- 2) Check whether PWR LED on USB2TCM is on
- 3) Check whether USB2TCM is properly recognized and mounted by your operating system (it should be visible as Removable Disk with 484 KB free space)
- 4) Make sure that USB2TCM removable disk does not contain any folders or files other than the EPC configuration file
- 5) Copy an image in EPD format suitable for TCM module used (P441, P74, P102, E133, E312) to the USB2TCM Removable Disk
- 6) After copying, the USB2TCM will forward this image to the TCM, which is indicated by the COM LED being lit constantly
- 7) If the image was sent correctly, COM LED will turn off. If an error was encountered with the TCM operation – COM LED will blink until the device is restarted
- 8) Remove the previously-sent EPD file from USB2TCM Removable Disk before uploading a new one

NOTE If the COM LED continues blinking, the transfer from the USB2TCM_v1.2 to the TCM failed. The USB2TCM_v1.2 must be reset by pressing the button or by power cycling – disconnecting and reconnecting the USB cable.

3.4 EPC Configuration File

By default, USB2TCM executes DisplayUpdate command with default settings: slot No 0 and default image transition type. Optionally, a configuration file in EPC format may be stored in the USB2TCM memory to override those settings.

EPC file is only compatible with TCMs Generation 2 (designated TCM2-XXX). First generation TCMs do not allow to change the image transition type and the slot number.

EPC format is a 3-byte binary file with the following values:

Byte No.	Description	Example Value (For flashless transition from slot No. 1)
0	Data length in bytes – constant value	0x02
1	Display transition type – matches DisplayUpdate command INS ³⁾ value	0x85
2	Slot number – matches DisplayUpdate command P2 ³⁾ value	0x01

Table 3.1: EPC file structure

3) See the respective TCM Developer's Guide.

3.5 Operation Workflow

USB2TCM operates according to the workflow shown below:

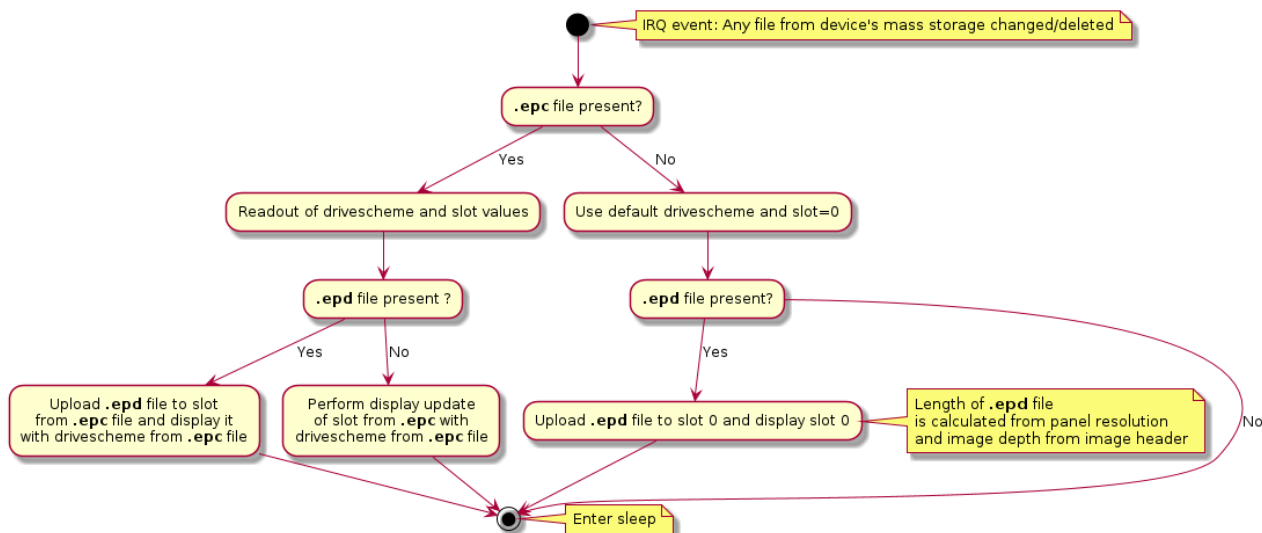


Figure 3.1: Operation workflow

If any error returned from TCM is detected during image upload or display update, the procedure stops and yellow LED will be blinking with ~2Hz freq. This will take place for example if the slot selected by EPC file is not available for image upload.

3.6 Image Conversion to EPD Format

Image in the typical format like JPEG or PNG can be converted to EPD by using the convert tools. The convert tools are available in the GitHub repository at <https://github.com/MpicoSys/USB2TCM> and are located in Sources/ImageConvert catalog.

E Ink

For E Ink ePaper displays, Python scripts are available. The scripts are run by the following command input in the command line:

```
TCM2-EXXX_Xbit.py -i <inputfile>
```

The scripts accept images in ePaper display resolution. Two files are generated as an output:

- EPD
- DLZ (compressed EPD)

Please note that only EPD file can be loaded via USB2TCM. DLZ file can be loaded to the TCM2 via the SPI interface.

Pervasive Displays

For the legacy Pervasive Displays ePaper panels, a Java convert software is available.

The Convert tool accepts any image resolution, aspect ratio and colour depth, however for the best results it is recommended to prepare an input image file already scaled-down to the target display resolution and orientation and to monochrome in a graphical program on your computer.

Run the Convert application using Java Runtime Environment.

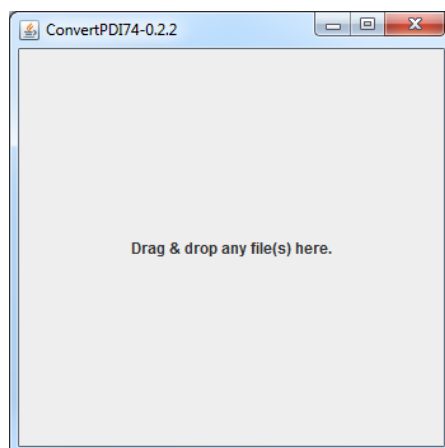


Figure 3.2: Convert application for TCM-P74

To convert an image simply drag and drop the file from the file explorer window to the Convert window area. Application will then create output folder with output files in the same location as the original image file.

Output folder named *PDlxx_Converted* contains four output files:

- *PDlxxx_ImageName_1bit.epd* – file with image converted to EPD format
- *PDlxxx_ImageName_1bit.h* – C-type header file – an array with bytes corresponding to the image pixels, that can be directly included in your C project source code
- *PDlxxx_ImageName_1bit.png* – PNG image file in 1-bit colour scale – for preview on a computer

where:

- *xxx* – the display type for which the image is created (PDI441, PDI74, PDI102)
- *ImageName* – original image file name

File suitable to be sent to TCM is the one with the EPD extension.

3.7 Reset Button

The reset button located next to the mini-USB socket can be used to reset the USB2TCM_v1.2 e.g. when the COM LED is blinking. The reset is automatically followed by sending the stored image to the TCM and refreshing the display.

4 Known Issues

When the USB2TCM_v1.2 is plugged in a USB port on a Mac OS computer with TCM disconnected, the COM LED will blink. In that case please connect the TCM and reset USB2TCM_v1.2 by pressing the reset button or by disconnecting the USB cable and connecting it again.

This issue is caused by the Mac OS writing proprietary hidden files to any FAT-formatted drive.

5 Troubleshooting

Issue	Possible cause	Solution
USB2TCM_v1.2 device is not found by the operating system	USB cable damage	Check whether PWR LED on USB2TCM board is on. Replace the USB cable.
COM LED is blinking constantly	Problem with TCM module connection	Check connection between USB2TCM and TCM board. Restart USB2TCM board by USB cable disconnecting and connecting again or by pressing the reset button.
Image on the display is distorted	EPD file uploaded to TCM is not appropriate for the used TCM	Ensure that EPD file is according to used panel size.
EPD file can't be copied on USB2TCM drive – not enough space	USB2TCM memory is occupied	Delete previously sent EPD file from USB2TCM removable disk.

Table 5.1: Troubleshooting

6 Revision History

Document Revision	Release Date	Document Status	Supersedes
B	2018-05-24	Approved	B
A	2017-07-24	Approved	All the draft versions

Table 6.1: Revision history

Document Revision	Change Log
B	Added information on TCMs for E Ink displays
A	Initial version

Table 6.2: Change log

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