

*PROPRIETARY
INFORMATION*



GRAPHITI

Proto 4C – User Manual

18th March 2019
Version 0.30

Contents

1	INTRODUCTION	4
2	HOW THE GRAPHITI PROTOTYPE IS USED	4
2.1	STAND-ALONE MODE	4
2.2	REMOTE MODE	4
3	FEATURES	4
4	ORIENTATION	5
5	USER INTERFACES	7
5.1	DEVICE KEYPAD	7
5.2	TOUCH PANEL	7
5.3	USB	8
5.4	HDMI	8
5.5	BLUETOOTH	8
5.6	EXTERNAL STORAGE MEDIA (SD CARD AND USB DRIVE)	8
5.6.1	<i>Error Handling</i>	9
5.7	PC KEYBOARD	9
6	POWERING ON AND OFF	9
6.1	RESET	10
6.2	SLEEP	10
6.2.1	<i>Automatic Power Down</i>	11
7	CHARGING THE DEVICE	11
7.1	BATTERY	11
8	MESSAGE BAR	12
9	VIBRATION INDICATION	12
10	PREFERENCE MENU	13
10.1	KEY CONTROLS FOR THE PREFERENCE MENU	13
10.2	MENU ITEMS	14
11	CLOCK CONFIGURATION	18
12	TOUCH FEATURES	18
12.1	TOUCH GESTURES	18
12.2	DRAW FEATURE	19
12.2.1	<i>Erasing</i>	20
12.2.2	<i>Saving drawings</i>	20
12.2.3	<i>Automatic File Saving</i>	20
12.2.4	<i>Reviewing drawings</i>	21
12.2.5	<i>Creating a new image</i>	21
12.2.6	<i>Modifying existing images</i>	21
12.2.7	<i>User Indication during drawing</i>	21
12.2.8	<i>Canvas</i>	22
12.3	UNDO REDO FEATURE	25
13	REMOTE OPERATIONS	25
13.1	GUI (PC UTILITY)	25
13.2	HDMI	26
13.2.1	<i>Interface and Resolution</i>	26
13.2.2	<i>Configuration</i>	26
13.2.3	<i>HDMI Mode</i>	27

13.2.4	Review HDMI Frame-----	27
13.3	BLUETOOTH FEATURE -----	27
13.3.1	Simple steps to work in Bluetooth mode -----	27
13.3.2	Connection and Pairing -----	28
13.3.3	Working with Standard Host (PC, Mobile or any other device) -----	28
13.3.4	General Guide -----	28
13.4	MASS STORAGE-----	29
13.5	API-----	29
14	STANDALONE OPERATION -----	29
14.1	FILE MANAGER COMMANDS-----	30
15	REVIEWING IMAGES -----	32
15.1	IMAGE PROCESSING ALGORITHM VARIANTS:-----	32
15.2	COMMANDS FOR REVIEWING IMAGES -----	32
16	REVIEWING CSV FILES (FOR CUSTOM DRAWINGS) -----	34
16.1	FILE FORMAT -----	35
17	REVIEWING PDF FILES-----	36
17.1	USER INDICATION -----	36
18	REMOTE OPERATIONS WITH ORION TI-84 PLUS-----	36
18.1	REVIEW ORION TI-84 PLUS SCREEN ON GRAPHITI -----	36
18.2	IMPORTANT NOTES -----	37
19	SLIDESHOW MODE-----	37
20	FIRMWARE UPGRADE-----	37
21	BIST MODE -----	38
22	SYSTEM LOG -----	38
23	LIMITATIONS-----	38
24	COMPATIBILITY -----	39
25	TROUBLESHOOTING -----	39
26	APPENDICES -----	40
26.1	APPENDIX A: REVISION HISTORY -----	40
26.2	APPENDIX B: PROTO 4C UNIT SPECIFIC LIMITATIONS AND CHANGES -----	41

1 Introduction

Graphiti is a tactile graphic display prototype. The prototype is used either in a standalone mode or by connecting to a PC through utility. Graphiti allows you to draw, save and review pre-stored images from the device or PC and has the following features:

1. 60 horizontal and 40 vertical pins to display that can be transformed to accurately represent graphics/images
2. Reads the graphical content of files on an SD™ (Secure Digital) card for the Stand-Alone Mode
3. Remote connectivity to PCs and mobile devices for use with a host application

2 How the Graphiti Prototype Is Used

2.1 Stand-Alone Mode

Graphical content stored on an SD card is read in one of two ways:

1. Copied from PC to the device.
2. Drawn on the device and stored on the SD card.

In Stand-Alone mode, Graphiti displays the graphical contents of files, stored on an SD card.

2.2 Remote Mode

Connect the device to a computer and then do one of the following:

1. Browse the image on the PC application to see on the device
2. Create images and store on the SD card of the device

The screen reader helps you to create and see the graphics as per your choice.

3 Features

Graphiti has the following features:

1. 2400 pins tactile display
2. Eight Input keys and a Space bar
3. Navigation pad with four directional buttons (Up, Down, Left, Right) and the Select button
4. SD card slot
5. Bluetooth® wireless technology
6. HDMI port
7. USB port
8. User-replaceable, rechargeable battery
9. Power Status LED

4 Orientation

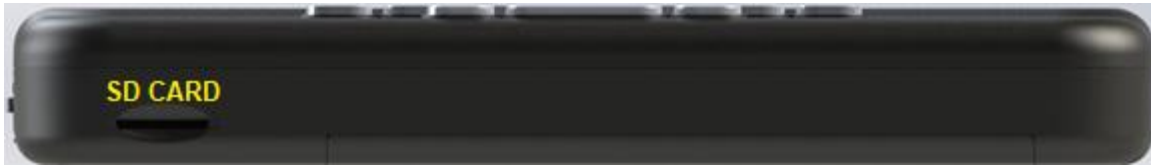
Orientation of buttons, keys, cells, and slots is important for understanding how the device operates and how you input and receive information on the device.

To begin with, place the device on a flat surface in front of you with the keypad closest to you. This is the proper operational orientation.

On top surface of the unit, closest to you are the user keys. Further away from you is the tactile display panel, composed of an array of 60 dots horizontally and 40 dots vertically. To the left of the keypad are two LEDs, which indicate power and status. The Proto 4C unit 3 and later has one LED to the left of the keypad for indicating power and status of the device.



On the front vertical face of the unit, closest to you, from left to right, is an SD-card slot.



On the left vertical face of the unit, from front to back, are the device ON/OFF button, HDMI connector, USB-host connector, micro-USB connector, main power-supply slider switch and the power jack. To turn on the device, move the slider switch away from you.

Please note: The slider switch is not available in the Proto-4C unit 5 and later units. Power button and power jack is on the right vertical face on the Proto-4C unit 6 and later units.



There are tactile dots underneath of sockets as shown in table below.

Power socket	1 dot
Micro USB socket	2 dots
Standard USB socket	3 dots
HDMI Socket	4 dots

These tactile dots will help you to access particular socket.

The device can be used either by connecting to a host device or in the standalone mode for reviewing the images.

It supports the following operations in both remote and standalone modes.

1. Navigation through images
2. Zoom in and Zoom out
3. Panning through zoomed image
4. Rotate image
5. Invert image color
6. Selection of different image processing algorithm variants
7. Support for different image file types:
 1. *.bmp
 2. *.jpg
 3. *.png
 4. *.gif
 5. *.tiff
 6. *.svg

8. Support for pdf files.
9. Support for customized csv files.
10. Ability to display input image properties
11. Image editing

Images can be reviewed from the host using one of the following interfaces:

1. USB
2. Bluetooth
3. HDMI

Alternatively, images can also be reviewed in standalone mode from the SD card and/or USB stick.

5 User Interfaces

Inputs can be given to the system through the following interfaces:

1. Device Keypad
2. Touch panel
3. USB
4. HDMI
5. Bluetooth
6. External Storage Media (SD Card and USB Drive)
7. PC keyboard

5.1 Device Keypad

Moving towards the top and near to you, find a row of three keys, with a wider key in the middle. The wide key is the Space bar. The Dot 7 input key is to the left of the Space Bar, and the Dot 8 input key is to the right of the Space Bar.

Above the three keys, is a navigation pad in the middle, between the Braille Input keys and Space bar. The navigation pad contains four directional arrow buttons (Up, Down, Left, Right) and the Select button.

The six traditional braille input keys are aligned horizontally above the navigation pad and below the display, Dots 3 2 1 on the left and Dots 4 5 6 on the right.

In short, the keypad layout is as shown in the figure below.

DOT 3	DOT 2	DOT 1	UP	DOT 4	DOT 5	DOT 6
LEFT			SELECT	RIGHT		
DOWN						
DOT 7			SPACE/CHORD	DOT 8		

5.2 Touch Panel

The touch panel provides control and navigation inputs for performing various operations in local as well as in remote mode.

Draw mode allows you to create a new image or edit an existing one. Refer to [Touch feature](#) for more details.

5.3 USB

There are two USB ports in Graphiti, one for the USB host and the other for the USB device functionality.

Graphiti supports USB classes as shown below:

In Host mode, Mass storage class and
In Device mode

1. HID
2. Serial (VCP)
3. Mass-storage class

You can connect the USB stick to the unit's host port and the PC to the USB device port.

The driver installation in a host PC is necessary in USB serial mode. If Graphiti is connected to the internet enabled PC, it will automatically install the device driver. Automatic driver installation is however, recommended. You can also refer "Graphiti Serial (VCP) Driver Installation Guide" for installing the driver manually.

5.4 HDMI

A standard HDMI socket allows connection to any HDMI source, such as a computer, using commonly available HDMI cables. In HDMI mode, operations like zoom, navigate, edit, etc. can be performed on the captured image. For more information, refer [HDMI](#) section.

5.5 Bluetooth

Graphiti has a Bluetooth interface that provides wireless communication between the hosts. For example, between PC or a mobile device and Graphiti. Once paired and connected with the host, you can review images using the currently available PC software GUI or through a custom GUI (using the standard API).

Refer [Bluetooth](#) for more details.

5.6 External Storage Media (SD Card and USB Drive)

The device supports SD cards and USB drives for the storage media. Both, SD card and USB is shown as two separate storage drives in file manager, when inserted in the device. You can perform operations like cut, copy, paste, rename, image editing and reviewing and navigation among the files and folders.

In addition, the device supports file search operations. Type the initial letters of the file name for the device to automatically start searching the files starting with those letters in the current directory. The default language for any file and folder name is English (US).

Graphiti uses standard full-size SD cards from 4GB to 32GB in capacity. The card must be formatted as FAT32. There is no way to format a card on the device. Most cards come already formatted. However, you can format one as FAT32 on a desktop computer for use with Graphiti.

5.6.1 Error Handling

The device shows all error messages in the message bar.

1. If there is no SD card or USB drive inserted, the device shows, "no storage media".
2. If there are no files on the SD card/USB drive, the device shows "no files".
3. If there is an error in reading the storage device, the device shows "storage media err xx", where xx is the error number.

When a storage media is removed from the device, any ongoing activity (such as reading/editing/copying etc.) gets cancelled immediately and the device displays drive removal message.

5.7 PC keyboard

Once the device is connected with the user GUI, the navigation controls provided in utility can also be operated using keys on the PC keyboard. A few keys share dual functionality, which can be activated under certain conditions. For example, the up/down arrow keys are used to scroll through image list as well as navigate the pan window after applying the zoom function on the image.

Note that the PC utility needs to be active in order to use PC keyboard with the device.

6 Powering ON and OFF

To power On the device, follow the steps mentioned below.

1. Plug the power cord into the power jack and turn on the main supply by moving the slider switch away from you. Please note, the slider switch is available in the Proto-4C unit 4 and earlier units only.
2. Power availability is indicated by the red LED.
3. Connect the micro-USB cable between the main USB port and the PC (Optional).
4. Press the power button for two seconds. The device will emit a single long vibration pulse.
5. The Proto-4C unit 3 and later units emit vibration pulses once in every two seconds while the device initialization.
6. Once initialized, again the device will emit a single long vibration pulse. The green LED will turn on indicating that the device is ready for use. For Proto 4C unit 3 and later units, the red color LED will turn green.
7. The device shows one of the following messages in the message bar (If the message bar is enabled previously):
 1. serial mode

2. hid mode
3. Name of the inserted storage device. i.e. SD mode
4. hdmi mode
5. bluetooth mode
6. mass storage mode
8. Start the PC utility (Optional).

To power Off the device, follow the steps mentioned below.

The device can be turned off by pressing the power button for 2 seconds. On pressing the power button, the device

1. Emits two short vibrations
2. Displays “shutting down” message for 5 seconds and then disappears. (Please note, the power off time is 15-20 seconds after the message disappears.)
3. Sets all the pins on the display to home position (below the surface).

The Proto-4C, unit 3 and later units emit vibration pulses once every two seconds while powering off. After the device is shut down completely, it again gives two short vibrations and turns off the green LED.

The Proto-4C, unit 12 and later units will enter the ghost mode if the charger is plugged and you turn off the device. During Ghost mode, the device will automatically shut down once it is fully charged or if the charger is removed.

Pressing the power off key for 10 seconds will turn off the device forcefully.

6.1 Reset

Following are the ways to reset or turn off the system.

To...	Do this on the Device
Reboot System (Up to unit -11)	Press and hold the Down Arrow key and tap the Dot 8 key
Reboot System (Unit -12 and later units)	Press and hold the Dot 8 key and tap the Power button
Turn Off the System Forcefully	Press Power key for 10 seconds

6.2 Sleep

This feature puts the device into the low power consumption mode if there is no user activity for 50 minutes while in standalone mode. Device can be put in sleep mode manually by tapping the power button while in remote or standalone mode.

Sleep time-out is configurable from the preference menu.

Once the device enters sleep mode, it clears the display content and turns off the green LED with a single short vibration. However, you can configure settings in preference menu to retain the display content as and when the device enters sleep mode.

To exit the sleep mode, tap the power button. The LED turns green with a single long vibration pulse. The device resumes its last activity or shows the last opened file from the storage media if it was in local mode. Similarly, if it was in USB HID, VCP (Serial) or HDMI mode, it will display the last opened file.

Note:

1. Bluetooth does not connect automatically on exiting sleep mode. It should be connected manually only.
2. The device will show last opened file only if the 'keep display' option is enabled from the preference menu.

6.2.1 Automatic Power Down

In local mode, If the device is in sleep mode and there is no activity for 50 minutes, the device shuts down automatically.

In remote mode, the device will shut down automatically after APD time without entering the sleep mode.

The device will show "automatic power down" message on the display and will shut down after APD timeout.

You can change the APD time (increase or decrease) or disable it from the preference menu.

7 Charging the Device

To charge the device, plug the power cord into the power jack. The display shows the message "charger connected" or "charger unplugged" with a single short vibration pulse, when the charger is connected or unplugged, respectively.

Note: The device shows these messages only when it is On. If the device is OFF when the charger is connected or disconnected, then the device will emit a single short vibration and will show charging indication by Red LED. The device can be used while charging.

7.1 Battery

The power percentage can be checked from the Menu. The Menu will show "battery xx%", where xx is the percentage number. It shows "charging xx%" when the unit is charging and "low battery", when the battery is low. Press Dot 7 to exit the Menu.

When the battery reduces to 10%, the device will emit a single long vibration pulse once in every minute to indicate low battery. Also, the last two dots of the 40th row on the display blinks on and off. This behavior is normal for indicating low battery. If the battery gets to 0% and the charger is not plugged, it gives two long vibration pulses and turns off.

Note:

1. If the device battery is fully drained, it will take nearly 12 minutes to turn on after the charger is connected.
2. Only Graphiti Proto 4C unit 5 and later units can be used with battery power.

8 Message Bar

By default, the entire display area is used for displaying graphics. However, if there are any system messages to be shown, the top four rows of the tactile display become the message bar. You can change the message bar placement to bottom of the display area (bottom four rows) from the preference menu.

The message bar will show messages like file or folder name, information and error messages and is active for only 15 seconds. For instance, when you open a file, the device shows the file name on the message bar and the image is displayed in the remaining area of the display. After 15 seconds, the device automatically hides the message bar and the contents are shown on the entire display.

Note:

1. The messages will be shown in the computer braille code.
2. The system messages will be in small letter only. The file/image name will be displayed as it is.
3. You can enable/disable the message bar and change its timeout value from the preference menu.
4. Shortcut key to enable/disable the message bar is Space + Dot 3.

There are some messages which can be cleared by pressing Dot 7 only. These messages are:

1. charger connected/ unplugged
2. hdmi cable inserted/ unplugged
3. usb drive inserted/ removed
4. sd card inserted/ removed
5. upgrade successful/ timeout

9 Vibration Indication

Graphiti has vibration indications for different scenarios as per the table below. The Proto 4C unit 8 will give tone indications along with vibration indication.

User Scenario	Mode/Sub Mode	Vibration Indication
Device Power On	Power On	Single long vibration
Device Power Off	NA	Two short vibrations
Entering sleep mode	Sleep Mode	Single short vibration
Exiting sleep mode	Sleep Mode	Single long vibration

Entering any sub-mode (like Draw, Erase, Review, Gesture Mode)	Remote/Local	Single short vibration
Exiting any sub-mode	Remote/Local	Two short vibrations
Change in device mode	Remote/Local	Single short vibration
Change in image	Local	Single short vibration
File saving Indication	Remote/Local	Single short vibration
File saving error	Remote/Local	Single long vibration
SD card insertion error	Remote/Local	Single long vibration
File navigation limits	Remote/Local	Two short vibration
Canvas block extension or Navigation limit	Draw Mode	Single long vibration
Charger insertion/removal	Remote/Local/Power Off	Single short vibration
Battery status is 10% or less	Remote/Local	Single long vibration once in a minute
Battery status is 0%	Remote/Local	Two long vibration (shutdown indication)
Device internal error	Remote/Local	Two short vibration followed by long vibration once in every 5 seconds

10 Preference Menu

The preference menu is used to view and update the device settings. For example, you can switch to different operating modes, enable or disable the message bar and so on.

10.1 Key controls for the preference menu

Key controls for the preference menu are as shown in the table below.

#	Key	Key Function
1	Space + Dots 7 8	Open menu
2	Up arrow	Move to the previous menu item
3	Down arrow	Move to the next menu item
4	Left arrow	Left scrolling in case there are more characters on the left side
5	Right arrow	Right scrolling in case there are more characters on the right side
6	Select	Select the item
7	Dot 7	Exit the menu

10.2 Menu items

The following table shows the menu and sub-menu items.

#	Item name	Choices	Resulting message display (If not selected / If selected)	Description
1	battery status	NA	battery: xx% or charging: xx%	Device will show battery status like “Battery: 80%” without charger and “Charging: 80%” with charger.
2	firmware version	NA	xx.xx.xx.xxxx	The current software version is xx.xx.xx.xxxxxx
3	reset defaults	NA	NA	Resets settings to default and shows first menu item
4	serial number	NA	MB xx xx xxxxx	The current unit serial number is MB xx xx xxxxx
5	usb	serial (default)	serial / <u>serial</u>	USB mode “Serial” selected
		hid	hid / <u>hid</u>	USB mode “HID” selected
6	bluetooth	on (default)	on / <u>on</u>	Bluetooth device is discoverable
		off	off / <u>off</u>	Bluetooth device is not discoverable
7	pair	just works (default)	just works / <u>just works</u>	Allows the host to pair with the device without your interaction
		confirm code	confirm code / <u>confirm code</u>	You need to confirm the code shown on the device message bar with the code shown on the host device
8	mode	stand-alone	stand-alone / <u>stand-alone</u>	Enables local mode
		usb (default)	usb / <u>usb</u>	Enables last HID/Serial remote mode.
		bluetooth	bluetooth / <u>bluetooth</u>	Enables remote mode and turns on BT
		hdmi	hdmi / <u>hdmi</u>	Enables remote mode for HDMI interface
		mass storage	mass storage / <u>mass storage</u>	Activates the device as a mass storage device
9	message bar status	five seconds	five seconds / <u>five seconds</u>	Displays message and auto hides after 5 seconds

		ten seconds	ten seconds / <u>ten seconds</u>	Displays message and auto hides after 10 seconds
		fifteen seconds (default)	fifteen seconds / <u>fifteen seconds</u>	Displays message and auto hides after 15 seconds
		auto hide off	auto hide off / <u>auto hide off</u>	Disables auto hide message bar
		disable	disable/ <u>disable</u>	Disables the message bar
10	message bar position	top (default)	top / <u>top</u>	Displays message bar on top of the panel
		bottom	bottom / <u>bottom</u>	Displays message bar at the bottom of the panel
11	sleep time	ten minutes	ten minutes / <u>ten minutes</u>	The device will enter sleep mode if there is no activity during the time mentioned.
		twenty minutes	twenty minutes / <u>twenty minutes</u>	
		fifty minutes (default)	fifty minutes / <u>fifty minutes</u>	
		hundred minutes	hundred minutes / <u>hundred minutes</u>	
		disable	disable / <u>disable</u>	Disables automatic sleep mode
12	apd time	ten minutes	ten minutes / <u>ten minutes</u>	Sets automatic power down time
		twenty minutes	twenty minutes / <u>twenty minutes</u>	
		fifty minutes (default)	fifty minutes / <u>fifty minutes</u>	
		hundred minutes	hundred minutes / <u>hundred minutes</u>	
		disable	disable / <u>disable</u>	Disables the APD
13	display config-sleep	keep display	keep display / <u>keep display</u>	Keeps contents as it is on the device display in sleep.
		clear display (default)	clear display / <u>clear display</u>	Clears display at the time of sleep.
14	hdmi frame rate	one second (default)	one second / <u>one second</u>	Shows HDMI frame after every 1 second in HDMI mode.
		five seconds	five seconds / <u>five seconds</u>	Shows HDMI frame after every 5 seconds in HDMI mode.
		ten seconds	ten seconds / <u>ten seconds</u>	Shows HDMI frame after every 10 seconds in HDMI mode.

		fifteen seconds	fifteen seconds / <u>fifteen seconds</u>	Shows HDMI frame after every 15 seconds in HDMI mode.
15	hdmi frame resolution	640x480 (default)	640x480 / <u>640x480</u>	Sets the HDMI frame resolution to 640x480
		720x480	720x480 / <u>720x480</u>	Sets the HDMI frame resolution to 720x480
		800x600	800x600 / <u>800x600</u>	Sets the HDMI frame resolution to 800x600
		1024x768	1024x768 / <u>1024x768</u>	Sets the HDMI frame resolution to 1024x768
		1280x720	1280x720 / <u>1280x720</u>	Sets the HDMI frame resolution to 1280x720
16	ti-84 axes tick options	height level 1 (default)	height level 1 / <u>height level 1</u>	Sets the axes and axes-tick information at pin height level 1 in image received from Orion TI-84 Plus
		height level 2	height level 2 / <u>height level 2</u>	Sets the axes and axes-tick information at pin height level 2 in image received from Orion TI-84 Plus
		height level 3	height level 3 / <u>height level 3</u>	Sets the axes and axes-tick information at pin height level 3 in image received from Orion TI-84 Plus
		height level 4	height level 4 / height level 4	Sets the axes and axes-tick information at pin height level 4 in image received from Orion TI-84 Plus
17	ti-84 graph data options	height level 1	height level 1 / <u>height level 1</u>	Sets the graph information at pin height level 1 in image received from Orion TI-84 Plus
		height level 2	height level 2 / <u>height level 2</u>	Sets the graph information at pin height level 2 in image received from Orion TI-84 Plus
		height level 3 (default)	height level 3 / <u>height level 3</u>	Sets the graph information at pin height level 3 in image received from Orion TI-84 Plus
		height level 4	height level 4 / <u>height level 4</u>	Sets the graph information at pin height level 4 in image received from Orion TI-84 Plus
18	tone indication	enable	enable / <u>enable</u>	Enables the tone indication (Supported in A0008 and later units)

		disable (default)	disable / <u>disable</u>	Disables the tone indication (Supported in A0008 and later units)
19	clock configuration	date	<u>dd</u> -mm-yyyy / dd- <u>mm</u> - yyyy/ dd-mm- <u>yyyy</u>	Allows you to modify the date
		time	<u>hh</u> :mm:ss / hh: <u>mm</u> :ss / hh:mm: <u>ss</u>	Allows you to modify the time
20	slideshow interval	one second	one second / <u>one</u> <u>second</u>	Shows new image after every 1 second in Slideshow mode.
		five seconds (default)	five seconds / <u>five</u> <u>seconds</u>	Shows new image after every 5 seconds in Slideshow mode.
		ten seconds	ten seconds / <u>ten</u> <u>seconds</u>	Shows new image after every 10 seconds in Slideshow mode.
		fifteen seconds	fifteen seconds / <u>fifteen seconds</u>	Shows new image after every 15 seconds in Slideshow mode.
21	file sorting options	name (default)	name / <u>name</u>	Files in the file list are sorted in alphabetical order
		date	date / <u>date</u>	Files in the file list are sorted as per their last modified date
		size	size / <u>size</u>	Files in the file list are sorted based on their size
		last	last / <u>last</u>	Files in the file list are sorted based on the last time they were accessed
		ascend (default)	name ascend / <u>name</u> <u>ascend</u>	Arranges files from first to last. This option applies to Name, Date, Size and Last options.
		descend	name descend / <u>name descend</u>	Arranges files from last to first. This option applies to Name, Date, Size and Last options.

General notes:

1. The device clears the display on entering the preference menu.
2. By default, the Menu shows the first menu item on the message bar.
3. Pressing [Select] over an already selected item will not make any changes to it.
4. It is not possible to deselect an item. You need to select another option.
5. On exiting the menu, device will return to file manager, file review or remote mode depending on your last activity.
6. Currently selected menu item is indicated by an underline (with dot 7 and dot 8 raised).
7. Pressing Up/Down Arrows or Select button will not function on the menu items having no sub-items such as, software version.

8. On scrolling beyond the first or last menu item, the list rolls over.
9. The device will switch to the selected mode as soon as the menu item is selected.

11 Clock Configuration

Graphiti has the clock configuration which helps to configure date and time of the device through the preference menu. It can also be configured using the Graphiti standard API explained in the API command document.

Select the 'date' option in the preference menu to check the present device date. It will be displayed in DD-MM-YYYY format, with the cursor set on DD. Similarly, on selecting the 'time' option, the device displays the present device time in HH:MM:SS format with cursor set on HH. To modify the date and time, use the Arrow keys of the device keypad. To set the date and time, press 'Select' key to apply the changes or dot 7 key to discard the changes.

The device supports 24hrs format for time and year ranges from 2015 to 2037. The device gives a long vibration pulse in case of invalid configuration.

12 Touch Features

The touch panel provides control and navigation inputs for performing various operations in local mode as well as in remote mode.

For the touch interface, you can select one of the two sub-modes as mentioned below:

1. Gesture
2. Draw

12.1 Touch Gestures

By default, the device is in review mode. Press Space + g (Dots 1 2 4 5) key combination to enable the gesture mode. Press the same key combination again to disable it and enable the review mode to review the updated image on the panel.

The gestures supported by the device is broadly categorized as follows:

1. Single finger swipe in four directions (Up, Down, Left and Right)
2. Double taps

While viewing images, use gestures to navigate within the image (for zoomed view of the image) or navigate to the next/previous image. Double tap to move the location of a zoomed image to the center of the device display.

Note: Gestures are not supported in draw mode.

12.2 Draw feature

Draw mode helps to create a new image or edit an existing one. Draw mode can be enabled by pressing Space + Dot 1. Drawing is performed using the touch interface of the unit.

Graphiti allows to switch between the Draw and Review mode any time, for reviewing the drawn patterns. Refer section [‘Reviewing Drawings’](#) for more information on Reviewing Mode.

Note: Draw mode is not allowed when the device is in mass-storage mode. In such a case, pressing Space + Dot 1 will give a single long vibration.

Following are the key controls in draw feature:

Description	Key	Additional Information
Enter or Exit from Draw Mode	Space + Dot 1	To enter or exit draw mode
Create new image	Space + n (Dots 1 3 4 5)	To create a new drawing using Space + n
Enable or Disable Erase	Dot 5	To erase a particular pixel(s) on the panel
Enable or Disable Review Mode	Dot 6	To enable or disable review mode using this key. Disabling the review mode, re-enables the draw mode.
Erase entire image	Dot 7	To erase the entire image by using this key. The device will ask for your confirmation. Press Dot 8 to confirm and Dot 7 to cancel erase.
Save File (Full image)	Space + s (Dots 2 3 4)	To save the entire drawing on the SD card.
Save File (Screenshot)	Space + S (Dots 2 3 4 7)	To save 40 x 60 image only. This feature is not available for CSV file.
Height Level 1	Dot 1	Selects pixel height level 1 for draw mode
Height Level 2	Dot 2	Selects pixel height level 2 for draw mode
Height Level 3	Dot 3	Selects pixel height level 3 for draw mode
Height Level 4	Dot 4	Selects pixel height level 4 for draw mode

When the draw mode is enabled, pins are raised at points of the display where touch input is detected. The height of the pin raised is determined by the height level adjusted by you using the key controls described in the table above. Default pin height is level 4 (maximum). In order to adjust the height of an already raised pin, select the desired height level using key controls (Dot 1/Dot 2/Dot 3/Dot 4) and touch the pins of which the height is to be altered.

To reflect the current drawing of the display on the Graphiti PC application in real time, connect the application through either USB or Bluetooth. This feature is basically useful for a person to observe what a visually impaired person is drawing. For instance, a teacher observing what a student is drawing.

12.2.1 Erasing

To enable the Erase mode from the Draw mode press Dot 5. When the erase mode is enabled, pins are set to their down positions at the points of display panel where touch input is detected. This feature makes the corrections in the drawing. To disable the erase mode and go back to draw mode, press Dot 5 again.

To clear the contents of the entire display, press Dot 7. A “confirm action” message is displayed on the device. Press Dot 8 to confirm and erase the entire image or Dot 7 to cancel the action and continue drawing.

Note: Confirming the erase by pressing Dot 8 will lower down all the pins to their bottom-most positions.

12.2.2 Saving drawings

To save the Drawings in the current directory of the SD card / USB Drive, press SPACE + S (Dots 2 3 4) key combinations.

To save the currently displayed part of the image only (i.e. 40x60 screenshot), press SPACE + S (Dots 2 3 4 7) key combinations. The device will show an edit box in the message bar with the default file name. To rename the file name using the braille keys, navigate through the file names using Left and Right Arrow keys. To discard the file saving, press Dot 7 + Select keys.

Note: Once the edit box is enabled, only the file name can be entered. The device will not respond to any key commands. For example, if Dot 2 is pressed, the device will show ‘1’ in the edit box instead of zooming the image.

After renaming the file, press Select key to save the image file and go back to the last sub-mode of the draw mode.

Note:

1. If the file is not renamed, it will be saved with the default name “NewImage_x.bmp”. If the default file name already exists, then the device will automatically append the appropriate number to file name. For example, “NewImage_1.bmp”.
2. The device will save images in the BMP file format only.
3. In order to save a drawing to the PC, use the option available on the PC GUI “Save to PC”.

12.2.3 Automatic File Saving

1. Graphiti automatically saves the last edited drawing in following instances:

1. When exiting the drawing mode
2. When directly switching the device mode from draw mode
3. When powering off the device from draw mode
4. When creating a new drawing.
2. Editing the already exiting file, the file will be saved as an autosaved file. For instance, "map(autosave).bmp".
3. Creating a new drawing will have the default name as "NewImage(autosave).bmp".
4. The device will automatically append the number in the file name while autosaving the new file, if the file name exists.
5. The device will always copy original file at first place and then the drawing will be saved in the new file only.
6. If you have already saved the file, the device will continue autosaving in that file only.
7. By default, the autosaved file will be saved only in the ".Autosaved" directory at root directory of the SD card. If the SD card is not present then the file be saved in the USB drive if attached.

The indications while automatic saving is as below:

Scenario	Message
Automatically file saving	"saving please wait." (with blinking dot)

12.2.4 Reviewing drawings

Press Dot 6 to enable the review mode to review the drawing patterns during or after drawing operations. This locks the display and disables touch input. After reviewing, press Dot 6 again to go back to the draw mode.

12.2.5 Creating a new image

To create a new image, enable the draw mode using keys SPACE + Dots 1 3 4 5 (space + n). The device provides blank display for new drawing.

Note: The new image will be created in local mode only with either SD card or USB drive inserted in the device.

12.2.6 Modifying existing images

Existing files can be edited from the storage media of Graphiti. In order to do so, first open a file that requires editing and then enable the draw mode to edit the file. Save the edited file in the storage media or on the PC as described above. The device saves the modified image as a separate new file, keeping the original source file unchanged.

12.2.7 User Indication during drawing

In draw mode, the device hides the message bar automatically. On exiting draw mode, the device displays the messages automatically if the message bar is not disabled.

In draw mode, the device gives vibration indication as shown in the table below.

User Scenario	Vibration Indication
Entering draw mode	Single short vibration
Exiting draw mode	Two short vibrations
Change in pin height level using Dot 1/2/3/4	Single short vibration
Entering erase mode	Single short vibration
Exiting erase mode	Two short vibrations
Entering review mode	Single short vibration
Exiting review mode	Two short vibrations
Erase full drawing	Single short vibration
If you try to enter in draw mode when the device is in mass storage mode	Single long vibration

12.2.8 Canvas

The Canvas feature of Graphiti helps you to extend the drawing beyond the existing array size (40 rows x 60 columns) for a newly created image or extend beyond the original image size in an existing image.

Canvas can be extended by a single line or group of lines in any direction (left, right, above or below) using the appropriate keys. Canvas drawing up to 25 Mega pixels can be created.

On exiting draw mode, all operations like zooming, rotating, inverting etc. can be performed on the image made by the canvas drawing as explained in the [‘Reviewing Images’](#) section.

12.2.8.1 Extending Image Size

Graphiti provides an option of extending the image size. For example, if you wish to extend the boundaries of the current drawing as shown below in Figure 1, press the hot key sequence (e.g. Space + Right key). This will add 60 columns on the right side of the current drawing and the extended image becomes 40x120 as shown below in Figure 2. Similarly, if 40 rows are added in the downward direction, then the final resolution of the drawing becomes 80x120 as shown below in Figure 3.

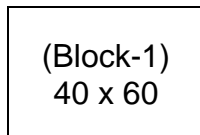


Figure-1: 40x60 Resolution

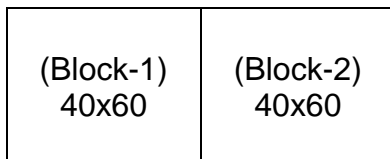


Figure-2: 40x120 Resolution

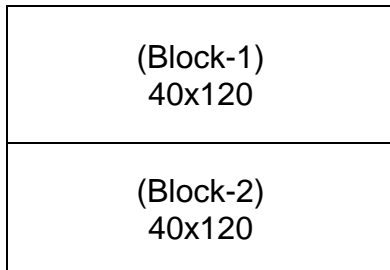


Figure-3: 80x120 Resolution

The following key controls are available for the canvas feature:

Description	Key
Add a single row canvas to the top side (after the navigation limit) / Jump to an already existing upper row	Up
Add a single row canvas to the bottom side (after navigation limit) / Jump to already existing lower row	Down
Add a single column canvas to the right side (after navigation limit) / Jump to already existing right column.	Right
Add a single column canvas to the left side (after navigation limit) / Jump to already existing column	Left
Add a canvas block to the upper side of the current block (after navigation limit) / Jump to already existing upper block	Space + Up
Add a canvas block to the lower side of the current block (after navigation limit) / Jump to already existing lower block	Space + Down
Add a canvas block to the right side of current block (after navigation limit) / Jump to already existing right block	Space + Right
Add a canvas block to the left side of the current block (after navigation limit) / Jump to already existing left block	Space + Left

Canvas drawing can be added at any zoom level. Once the navigation limit is reached (for example left side), the device will give a long vibration indication. By pressing arrow key or space + arrow keys once again, the device will add 1 line or a block canvas on the left side.

If the image resolution is less than 40x60, (say for example if the image resolution is 10x10), then the image will be displayed at the center of the device display. Drawing outside the 10x10 area will add the canvas automatically. If a single horizontal line is drawn 5 rows above the 10x10 image, the device will add a canvas automatically and the resultant image resolution will be 15 (rows) x 10 (columns).

12.2.8.2 Canvas Block Size:

The size of the canvas block changes depending on the resolution of the image and the zoom level at the time of canvas drawing.

For example, if you are interested in extending the 1000x1000 (Rows x Columns) image at maximum zoom level, adding one canvas block at the top of the image will change the image resolution to 1040x1000. Similarly, if a canvas block is added on the right side of the image, then the image size will become 1000x1060. This means that it will add either 40 rows or 60 columns as the case might be.

But, when a canvas block is added to an image that is not zoomed and is in default view mode, adding one canvas block on the top side of the image will change the image resolution to 2000x1000 (Rows x Columns). Similarly, if a canvas block is added to the right side of the image, then the image size will become 1000x2500 (Rows x Columns). This means it will add 1000 rows or 1500 columns.

12.2.8.3 User Notification:

The device gives indications during canvas drawing as shown in the table below.

The device will emit	If
Single short vibration pulse	Canvas block or row or column added successfully.
Long vibration pulse	There is insufficient memory.
Single short vibration pulse once every 2 seconds.	The device is saving the current drawing.

General notes:

1. Canvas drawing can be added in draw mode only.
2. After adding a canvas in default view (i.e. zoom out max), the device considers the final resolution of the image and then resizes it to 60x40 to fit in the display.
3. The device reads and edits standard image files with resolution up to (X) * (Y) = 25 megapixels. Here, X and Y resolution can be set to any number but the total number of pixels (X * Y) should not be more than 25 megapixels. Please refer to some of the examples below for different resolutions,
 1. 5000 x 5000
 2. 3000 x 3000

3. 1000 x 9000
4. 2000 x 4000
5. 5000 x 1800
4. A canvas block can be added at any zoom level but for a better view of the image, it is recommended that you add the canvas block only after applying maximum zooming.

12.3 Undo Redo Feature

To perform undo and redo operations on the drawing, press Space + Dots 1 3 5 6 (z) and Space + Dots 1 3 4 5 6 (y) key combinations, respectively.

Graphiti can undo last 15 pixels of the drawing 10 times. It retains the last pixel state in undo. For example, if you draw a pattern with pixel height 4 and change the pattern with pixel height 3 and then perform the undo operation, the device will reset the pixel height of the last 15 pixels to 4.

The Redo operation can be done after the undo operation has been executed at least once. In the above example, if Redo is performed after Undo is applied, then the device will set the last 15 pixels height back to height 3.

These operations can also be performed while reviewing the drawing in draw mode.

13 Remote Operations

The Graphiti unit can be connected to remote devices like PC, or the Orion TI-84 Plus using the USB, HDMI or Bluetooth interfaces. However, the unit needs to be put in the appropriate interface mode before connecting to remote devices.

For USB operations, select one of the following modes:

1. USB Serial Mode
2. USB HID Mode
3. USB Mass Storage Mode

Press Space + Dot 7 to select USB HID mode or Space + Dot 8 to select VCP mode. Keep the unit in HDMI mode for HDMI operations and in Bluetooth mode for Bluetooth operations.

For USB Serial, USB HID and Bluetooth, Graphiti requires an application running on the host device to communicate with it using standard Graphiti APIs.

Graphiti acts as a mass storage media when mass storage mode is selected using the Space + Dot 5.

The HDMI interface does not require any application. In this mode, Graphiti will work as a display monitor device.

13.1 GUI (PC utility)

GUI helps to browse the images and review it by zooming and panning. You can draw on the GUI and review it on the device. There are many user-friendly

features like for instance, sending the image file to the device using the command window etc.

For Graphiti PC application interface, select any one of the communication modes in Graphiti as mentioned below:

1. USB Serial Mode (Space + Dot 8)
2. USB HID Mode (Space + Dot 7)
3. Bluetooth (Space + Dot 4)

Please refer Graphiti PC Application User Manual vx.x.pdf for more details.

13.2 HDMI

13.2.1 Interface and Resolution

Any HDMI source (with HDMI v1.4 and later) can be connected to Graphiti system through an HDMI cable.

Graphiti captures the HDMI frame in the following resolution.

1. 640 x 480 (VGA) (Default)
2. 720 x 480
3. 800 x 600 (SVGA)
4. 1024 x 768 (XGA)
5. 1280 x 720 (HD 720)

The default resolution is 640 x 480 that can be changed from the preference menu. If the selected resolution is 640 x 480 then the device will act as 640 x 480 (VGA) display. Similarly, if the selected resolution is 800 x 600 then the device will act as 800 x 600 (SVGA) display.

Note: It is possible that some of the HDMI source (Laptop or any other device) will not support lower resolutions. In such case, try higher side resolution i.e. 800 x 600 or above.

13.2.2 Configuration

Following are the steps to configure HDMI to work with Windows machine.

1. First connect Graphiti to the host using HDMI cable and press SPACE + Dot 6 for HDMI mode.
2. For windows PC, go to Advanced display settings → Multiple displays → Duplicate these display and press apply button.
3. In most of the cases, the host will change its screen resolution to VGA automatically, but If it is not changing the monitor resolution, then you can set it manually from Display setting → Device adaptor properties → Adaptor setting → List All modes → and select VGA resolution
Note: The host configuration mentioned above is required only for the first time or unless you change it for different options.

13.2.3 HDMI Mode

Graphiti shows a video with configurable frame rates. Enable the HDMI mode by pressing Space + Dots 6 keys and set the frame rate from one frame per second to one frame every 15 seconds from the preference menu.

The device shows “HDMI mode” and will start capturing the frame automatically. In case the device is not connected with HDMI source, it shows an error message “hdmi source error”.

13.2.4 Review HDMI Frame

By default, the device shows down-sampled images (60x40 resolution) on the tactile display. To apply different types of image processing algorithms on the captured frame, press Select key. For better viewing, use the keys for zoom in, zoom out, invert and rotate the captured frame. For more details, refer [Reviewing Images](#).

After zooming, panning can be done through the arrow keys. You can also use swipe gesture for panning after zoom. To activate/deactivate the Gesture mode, press Space + g (Dots 1 2 4 5) key combination.

To view a 60x40 pixel portion of the captured frame, zoom it to a maximum level using Select + Dot 4 key, and navigate through the frame using the arrow keys available on the device keypad.

The device maintains the zoom level, filters and panning location unless you change it. This helps to view similar types of images.

To edit or modify the captured frame, refer the '[Draw Feature](#)' section.

To save the image on the SD card, press Space + Dots 2 3 4 or Space + Dots 2 3 4 7 keys. Please refer section "[Saving drawings](#)" for more details about the key commands.

Limitations:

1. The system does not process audio from HDMI source.
2. The system does not support the CEC (consumer electronics control) channel.
3. For HDMI video, if the frame rate is less than 5 seconds, then the device updates the display without displaying the previous frame completely.

13.3 Bluetooth Feature

The device supports Bluetooth SPP profile. Here, the device should be paired with the Host PC to review the images through the standard API (Serial based) or by using the user GUI.

13.3.1 Simple steps to work in Bluetooth mode

Please refer these steps to work in the Bluetooth mode.

1. Turn on the device by following power sequence guide.
2. Turn on Bluetooth from the Preference Menu (only if it is not already enabled).
3. Set device mode to “Bluetooth” from the preference menu or by pressing hot keys Space + Dot 4.
4. Set “Just Works” pairing option from the preference menu.
5. At Host side, turn on the Bluetooth, scan for the Bluetooth device and pair it with the device with the name “MB xx xx xxxxx”.
6. Run the user GUI and press “Auto connect”.
7. On successful connection with the host, the device shows “BT connected” on the tactile display.
8. Review images (Just like USB mode).

13.3.2 Connection and Pairing

Pairing method can be selected from the preference menu. Following are the pairing options.

Option-1: Just Works

The device pairs with the host without any type of confirmation.

Option-2: Confirm Key

The device pairs with a host by confirming the passcode displayed on the host. Once pairing request is initiated by the host, the passcode is displayed on Graphiti message bar, which will be similar to the passcode shown on the host device. Accept the pairing request by pressing Dot 8 from the device keypad. If the passcode does not match, the pairing request can be cancelled by pressing Dot 7. Device will show “Pairing successful” or “Pairing cancelled” as the case may be.

13.3.3 Working with Standard Host (PC, Mobile or any other device)

1. Use the standard API (VCP/Serial based) on the host side in order to communicate with Graphiti using Bluetooth. A custom application is required on the host side that uses this standard API to send an image to the unit.
2. The Graphiti PC application software also can be used in Bluetooth mode.

13.3.4 General Guide

1. The device (Bluetooth) discovery can be enabled or disabled from the preference menu.
2. On power up, Bluetooth in the device is on discoverable mode by default (only if it is not disabled from the preference menu).
3. You can switch from Bluetooth to USB interface or standalone mode anytime. If you switch from Bluetooth to USB interface mode, the device automatically exits the Bluetooth mode.
4. As per Bluetooth standard, the host saves the pairing information and so pairing is not required for the Host while switching back to the Bluetooth mode.
5. The device saves Bluetooth mode even after power off and APD.

6. The device does not accept any inputs other than the commands included in the API.

13.4 Mass Storage

Graphiti acts as a mass storage device when mass storage mode is selected using Space + Dot 5.

When the device is attached to the PC in mass storage mode, files and folders can be copied from/to the device.

Here, the SD card content will be displayed on the PC and provide alternate option to SD card reader for accessing files and folders of the SD card.

13.5 API

It is possible for third parties to create applications on any computing platform (computers, mobile devices, Raspberry Pi boards, etc.) to communicate with Graphiti, using its standard API. The complete API is described in a separate document.

The API allows sending image data to the device and receiving the following data from the device:

1. General information
2. Device display information
3. Keypad information
4. Touch information

There are two ways to send image data to the device:

1. *Send an already processed image*
Here the application converts each pixel of an actual image into different height levels (height level 0 to 4) before sending the raw pixel data to the device.
2. *Send the original image file, e.g. BMP, PNG, etc.*
In this method, the application directly sends a supported image file to the device for display.

14 Standalone Operation

In this mode, the device accesses images from external storage media such as, SD card and/or USB drive.

The device shows external storage media in form of the directory. If both, the SD card and USB drive are present, the device shows two main directories. Refer [“External Storage Media \(SD card and USB drive\)”](#) for more details on SD and USB drive.

To invoke the Standalone mode, press Space + Dot 2 key combination. Once entered, all features related to standalone mode will be enabled. In standalone mode, the device supports all standard image types as mentioned previously.

14.1 File Manager Commands

The following file management operations are available in standalone mode.

Description	Device Keypad	Touch Panel	Additional Information
Open a file or folder	Select	Not Available	Press [Select] key to open the file or folder. If it is file then contents will be displayed on tactile display. Message bar on tactile display shows the file name.
Go to previous file or folder	Up Arrow	Down Swipe	To go to previous file or folder in the current directory.
Go to next file or folder	Down Arrow	Up Swipe	To go to the next file or folder in the current directory.
Review previous file after image is zoomed	Dot 3	Not Available	To navigate to previous image when the currently displayed image is zoomed.
Review next file after image is zoomed	Dot 6	Not Available	To navigate to next image when the currently displayed image is zoomed.
Move to first file	Space + Dots 1 2 3	Not Available	Press [Space + Dots 1 2 3] to move the selection to the first file in the current folder.
Move to the last file	Space + Dots 4 5 6	Not Available	Press [Space + Dots 4 5 6] to move the selection to the last file in the current folder.
Close a file or folder	Dot 7	Not Available	If you are already in the File Management mode, press [Dot 7] to move to parent directory. If you are in File Viewer mode, then currently opened file will be closed. If you are at the root level, [Dot 7] does nothing.
Scroll through file information	Left Arrow	Right Swipe	This command moves through the file information/properties by moving in the backward direction.
Scroll through file information	Right Arrow	Left Swipe	This command moves through the file information/properties by moving in the forward direction. Also, if the name of the file is more than the display size, first it scrolls through the complete name and then displays the file properties.

Create a new Folder	Space + O (Dots 1 3 5)	Not Available	This command opens the Edit Box where you can type the name of the new folder.
Delete a file or folder	Space + D (Dots 1 4 5)	Not Available	This action deletes the currently selected file or folder.
Rename a file or folder	Space + R (Dots 1 2 3 5)	Not Available	The Rename File command allows you to change the name of a file or folder. To use it, press the Rename command. The device responds with an Edit Box containing the original file or folder name. Edit the name or type a new one and press select key. To discard changes, press Select + Dot 7 keys.
Cut a file	Space + X (Dots 1 3 4 6)	Not Available	This action cuts the currently selected file from its location and places it on the clipboard to be used with the paste command.
Copy a file	Space + C (Dots 1 4)	Not Available	The Copy File command makes a copy of the currently selected file and places it on the clipboard to be used with the paste command.
Paste a file	Space + V (Dots 1 2 3 6)	Not Available	This action pastes the file or folder into the current location in the File Manager.
Multiple files/folders selection	Space + M (Dots 1 3 4)	Not Available	Selects presently displayed file/folder for cut/copy/delete operation

Graphiti gives an option of Fast searches by typing any letter. For example, on pressing dots 1 and 2, file manager will show the first file name starting with the letter b.

Once the image is opened, the device will switch its keypad functionalities for reviewing the images. Refer [Reviewing Images](#) for key commands.

Note that file manager commands are not available when the image is open except for commands listed below:

1. File navigation
2. Close a file

The device remembers the file name and its path. Whenever you enter the standalone mode, the device automatically jumps to the last directory and shows the last file name.

While navigating through the file list, the device rolls over from first to last or last to first file automatically after the navigation limit and emits a long vibration pulse.

To discard file or folder's paste operation any time, press Dot 7 key. After pressing Dot 7 key, the device asks for "Confirm action". Press Dot 8 to cancel or Dot 7 to continue paste operation.

The device will show the message "sd wr protected" if write protection is enabled.

15 Reviewing Images

Once an image is displayed on the device from any source like a PC, storage media, HDMI, the device provides the following functionality:

1. Navigation through images
2. Zoom in and Zoom out
3. Panning through zoomed image
4. Rotate image
5. Invert image color
6. Selection of different image processing algorithm variants

15.1 Image Processing Algorithm Variants:

There are 6 different processing variants which can be changed by pressing 'Select' key from the device keypad. The user can navigate through the processing variants using key combinations. Refer [Commands for Reviewing Images](#) for more information.

Different variants work better on different types of input images. For example, for images containing line drawing, "1 Bit Monochrome" is preferable, while for color images, "8 Bit Gray" generate better results. Therefore, the device allows you to explore the effects of different algorithms on the input image.

The supported image variants are:

1. 1 Bit Monochrome
2. 2 Bit Grayscale
3. 8 Bit Grayscale
4. 8 Bit Sharpen level 1
5. 8 Bit Sharpen level 2
6. 8 Bit Sharpen level 3
7. 8 Bit Sharpen level 4

This processing includes different levels of gray scaling and sharpening of the image after resizing it to the device's native pin grid size (40 x 60).

15.2 Commands for Reviewing Images

The key sequences for invoking operations related to image processing are as listed in the table below.

Description	GUI Button	PC Keyboard	Device Keypad	Touch Panel
Zoom in: Incremental zoom in by 1x, up to 32x	Zoom In	Add ('+') key	Dot 5	Not Available

Zoom in with small step size 0.1	Not Available	Ctrl + Plus key	Dot 4	Not Available
Zoom in max: Displays the original image	Zoom in Max	Alt + Plus key	Select + Dot 4	Not Available
Zoom out: Incremental zoom out by 1x, up to default image view	Zoom Out	Minus ('-') key	Dot 2	Not Available
Zoom out with small step size 0.1	Not Available	Ctrl + Minus key	Dot 1	Not Available
Zoom out max: Resets the view to its default state	Zoom Out Max	Alt + Minus key	Select + Dot 1	Not Available
Review previous file after image is zoomed	Not Available	Up Arrow key after pressing Alt + F	Dot 3	Not Available
Review next file after image is zoomed	Not Available	Down Arrow key after pressing Alt + F	Dot 6	Not Available
Rotate Image Left – 90 Degree	Rotate Left	Ctrl + 'L'	Select + Left	Not Available
Rotate Image Right – 90 Degree	Rotate Right	Ctrl + 'R'	Select + Right	Not Available
Navigates the pan window in the upward direction by 25 percent of display size	Up	Up Arrow	Up Arrow	Down Swipe
Navigates the pan window in the downward direction by 25 percent of display size	Down	Down Arrow	Down Arrow	UP Swipe
Navigates the pan window in the right direction by 25 percent of display size	Right	Right Arrow	Right Arrow	Left Swipe
Navigates the pan window in the left direction by 25 percent of display size	Left	Left Arrow	Left Arrow	Right Swipe
Navigates the pan window by a single pixel in the upward direction	Not Available	Ctrl + Up Arrow	Space + Up Arrow	Not Available
Navigates the pan window by a single pixel in the downward direction	Not Available	Ctrl + Down Arrow	Space + Down Arrow	Not Available

Navigates the pan window by a single pixel in the left direction	Not Available	Ctrl + Left Arrow	Space + Left Arrow	Not Available
Navigates the pan window by a single pixel in the right direction	Not Available	Ctrl + Right Arrow	Space + Right Arrow	Not Available
Moves to the top left corner of the image	Not Available	Not Available	Left Arrow + Up Arrow	Not Available
Moves to the bottom left corner of the image	Not Available	Not Available	Left Arrow + Down Arrow	Not Available
Moves to the top right corner of the image	Not Available	Not Available	Right Arrow + Up Arrow	Not Available
Moves to the bottom right corner of the image	Not Available	Not Available	Right Arrow + Down Arrow	Not Available
Image Variants	Not Available	Ctrl+ 'A' key then Up or Down Arrow key	Select key	Not Available
Selects next image variant	Not Available	Not Available	Dot 5 6	Not Available
Selects previous image variant	Not Available	Not Available	Dot 2 3	Not Available
Selects first image variant	Not Available	Not Available	Dot 1 2 3	Not Available
Selects last image variant	Not Available	Not Available	Dot 4 5 6	Not Available
Centers the pan window to the desired location	Not Available	Not Available	Not Available	Double Tap
Inverts the image	Invert tick box	Ctrl + 'I'	Dot 8 5	Not Available
Loads the image with latest timestamp from the current folder (Only supported in operations with GUI)	Not Available	F5	Not Available	Not Available

16 Reviewing CSV Files (for custom drawings)

The device supports and shows custom drawings created using a csv file. You can create such drawings (files) on a computer or mobile device and can view it either from the user GUI or from the SD card.

16.1 File format

A file can be created by providing height level values and blinking rate values for each pixel. Values for height level and blink rate is as shown in the table below.

Value	Height Level
0	No height
1	Height Level 1
2	Height Level 2
3	Height Level 3
4	Height Level 4

Value	Blinking Rate
0	No Blinking
1	100ms
2	200ms
3	300ms
...	...
50	5 seconds

This file contains two sections namely “Pixel Height” and “Blinking rate”. Pixel height section contains the height value of each pixel and blinking rate section contains the blinking interval for each pixel.

The following example shows an image that is 5 x 5 pixels in size and shows a 3 x 3 pixels rectangle with pixels of height 4 a flashing pixel in its middle, blinking once every 5 seconds.

Pixel height

```
0,0,0,0,0
0,4,4,4,0
0,4,4,4,0
0,4,4,4,0
0,0,0,0,0
```

Blinking rate

```
0,0,0,0,0
0,0,0,0,0
0,0,50,0,0
0,0,0,0,0
0,0,0,0,0
```

17 Reviewing PDF Files

Review the Pdf files on the device in the standalone mode. The supported file types are:

1. PDF
2. PDF-a

The device shows the pdf page converted to image on the device display. After the image is displayed, you can perform the image processing operations as described in [Reviewing Images](#) section.

Note: PDF processing time is high. If you want to cancel the operation at any point of time, press Dot 7. The device will bring you to the file manager. Also, please note that the device will show only the first page of the pdf file.

17.1 User Indication

Scenario	Message	Vibration Indication
After opening the PDF file and using the “Select” key	“please wait.”	Single short vibration pulse once in every 2 seconds
Indication during PDF processing	File Name	Vibration pulses once in every 2 seconds
For invalid PDF file	“invalid file”	Long vibration pulse

18 Remote Operations with Orion TI-84 Plus

Graphiti also can also be operated using the Orion TI-84 Plus device as per the steps below:

1. Connect Orion TI-84 Plus with Graphiti using the OTG cable. Use HOST USB port on the Orion TI-84 Plus and micro USB port on the Graphiti.
2. Turn on both the devices. Please make sure that the battery is charged enough, otherwise plug the charger.
3. For Orion TI-84 Plus interface, Graphiti must be in USB HID mode. If previous mode is USB VCP then change the mode by pressing “Space + Dot 7” keys together on the Graphiti keypad.
4. Turn on Orion TI-84 Plus unit (If it is Off).
5. On successful connection to the Orion TI-84 Plus interface mode, Orion TI-84 Plus announces “Braille display connected” message.
6. After Orion TI-84 Plus completes the announcement, Graphiti will display it. Graphiti displays any screen image provided by TI-84 Plus after processing it.

18.1 Review Orion TI-84 Plus Screen on Graphiti

As the image resolution sent by Orion TI-84 Plus is larger than Graphiti screen, Graphiti down-samples it and shows the processed image in the default view. The original image sent by TI-84 Plus shows on Graphiti using the zoom-in function. Navigate through the original image using the navigation controls available on the device keypad after performing the zoom-in function. Refer [Commands for Reviewing Images](#) for more information.

Graphiti automatically uses the image processing filters: 1bit monochrome and 2-bit Gray scale so, it is recommended not to change it.

18.2 Important Notes

1. Graphiti updates the display whenever there is a new event performed on the TI-84 Plus device.
2. Make sure, the current version of the software in the Orion TI-84 Plus supports the Graphiti interface.

19 Slideshow Mode

The Slideshow mode can be activated by pressing “SPACE + Dots 1 3 4 8” in the local mode. The device starts displaying the image from the present folder.

1. Images from the present directory gets displayed one by one. The device rolls over from the last image file to the first image file automatically.
2. Only supported images gets displayed in the Slideshow mode.
3. The device shows “No Files” and emits long vibration in case of no valid files or empty directory. It exits the Slideshow mode automatically.
4. To navigate within the files, use the keys (Up Arrow / Down Arrow) and gestures in the Slideshow mode.
5. The Slideshow mode can be stopped by pressing any key except Up, Down Arrow and Space + g (Dots 1 2 4 5) key combination (these keys are used for navigation and gesture control). The device performs the operations according to the pressed keys. For example, pressing Dot 2 key in the Slideshow mode zooms-in the presently displayed image and exit the Slideshow mode.
6. The default time interval between two images displayed is 5 seconds. This setting can be changed from the menu.
7. The Slideshow mode works only in local mode and make sure the images exist in the present working directory.

20 Firmware Upgrade

Graphiti firmware can be upgraded by copying the firmware binary to SD card and following the upgrade procedure.

The firmware binary can be copied to SD card using the following ways:

1. Copying the new binary into SD card using an SD card reader.
2. Attaching the unit to a PC in mass storage mode and copying the new binary.

Once the SD card is inserted into the device with the latest binary, enter the firmware upgrade mode and upgrade the device. The device will emit short vibration pulses every two seconds to show the upgrade progress. On successful upgradation, the device reboots and shows the message “upgrade successful” on the display. Please refer “Graphiti Upgrade Manual” for more details.

21 BIST Mode

The BIST mode is used to check the pins working.

BIST Entry: Press and hold Space bar and tap Power key five times.

BIST Exit: Press and hold Space bar and tap Power key five times. The device returns to the previous mode on exiting the BIST.

Once you are in BIST mode, the pin test commands are as described in the table below:

To...	Do this on the Device Keypad	Additional Information
Set all pins Up	Select + Up Arrow	Sets all pins at height level 4
Set all pins Down	Select + Down Arrow	Resets all pins to height level 0
Set all pins at home position	Select + Space	All pins moves in the downward direction to home position just below the touch panel surface.

22 System Log

The system log helps to debug the problem when it occurs at user end while using the device.

The device logs this information in its internal memory. To copy a file in the SD card, press Space + t (Dots 2 3 4 5). If the log file size is more, the device can take a few seconds and displays “Please wait” indication along with buzzes at the time of copy. After successful copy, the device shows “transfer completed” message. Once the log file is copied to the SD card, access it either using the card reader or by putting the device in mass storage mode. Send that log to us for further analysis.

To...	Do this on the Device Keypad
Transfer system log to storage media (SD card or USB Stick)	Space + Dots 2 3 4 5

23 Limitations

1. Two finger gestures are not supported.
2. The PDF conversion time in local mode is high.
3. Drawing and reviewing can be done simultaneously, but with inconsistency. The reviewing finger may switch to drawing finger anytime.
4. The device will not show progress for file and folders' cut, copy and paste operations.
5. The device will save the drawn pattern on the PC in the form of a CSV file.
6. 'Recent file' feature will not work when SD card is write-protected.

24 Compatibility

In Graphiti, the USB interface (VCP and HID mode) are tested and verified with Windows 10. It is expected to work with Windows 7 and 8 as well as with the other host platforms (Mac, iOS, Android, Linux, etc.) provided appropriate drivers are available. However, operation and performance are not tested on these platforms.

The PC utility is tested and verified with Windows 10 only. It may work with Windows 7 and later versions but is not tested with these. The PC utility is not compatible with other host platforms.

The HDMI interface is compatible with versions 1.4 and 1.4A of the HDMI standard. It is expected to work with all the HDMI versions as HDMI is forward and backward compatible.

25 Troubleshooting

In case the device does not work as expected, the following steps will help you to troubleshoot the issue.

1. Graphiti in either of the USB mode:
 1. Check whether the external power supply is properly connected or not.
 2. Close the utility, turn off the device and retry the normal startup procedure.
2. Graphiti in USB-Serial (VCP) mode:
 1. Make sure that the device driver is installed in your PC. Refer to the Graphiti VCP driver folder for more details.
 2. After proper installation of USB drivers, check whether the USB port is generated in the “Device Manager” window. The Device Manager can be opened by following the procedure below:

Right click “My Computer” → Select “Manage” option → Select “Device Manager” option under “System Tools” → Open the “Ports” section.
 3. A port named “PI USB to Serial (COMx)” should be generated. If no such port is generated, try using a different USB port on the PC or restart the PC by following the normal startup procedure.
3. SD Mode:
 1. If the device shows SD error message, then remove and insert the SD card again.
 2. If the error persists, then do the device power cycle.
4. Bluetooth Mode:
 1. If the Host PC is not showing the device, turn Off the Bluetooth in the Host and On it again after 5-10 seconds and check. The host will display the device name like “MB PR 4C A000x”.
 2. If the host is not showing the device name, make sure the device Bluetooth is On and the device is in Bluetooth mode. Check device setting in preference menu.

3. In case of a problem, you can also try steps as shown in the “[Bluetooth Feature](#)” section.
5. HDMI mode: In case of “HDMI source error”, you can remove the HDMI cable and insert it again and refer “[HDMI](#)” interface section again.

26 Appendices

26.1 Appendix A: Revision History

Rev.	Date	Description of Changes	Author
0.0	23rd August 2017	Included Proto 4B features	
0.1	23rd August 2017	Added Proto 4C specific features	
0.2	6th October 2017	Removed non- supported features	
0.3	10th October 2017	Minor correction	
0.4	23rd October 2017	Updated user GUI section	
0.5	28th October 2017	Added Touch Gesture section, updated preference menu and limitations section	
0.6	5th December 2017	Updated limitations section	
0.8	27 th December 2017	Minor corrections and keypad functionality changes	
0.9	5 th January 2018	Minor correction	
0.11	8 th February 2018	Updated canvas drawing, preference menu and USB sections and added firmware upgrade section	

0.13	15 th March 2018	Added details for PDF feature, undo redo and create new file in draw mode, demo mode, file filter and file rename. Modification for zoom and pan in section: Reviewing Images	
0.14	9 th April 2018	Modified for new features support	
0.15	10 th April 2018	Edits	
0.16	16 th April 2018	Added Battery section, renamed Demo mode to Slideshow mode and updated preference menu section	
0.17	18 th April 2018	Edits	
0.18	26 th April 2018	Added Automatic file saving feature details, added reference details for user GUI and updated CSV file section	
0.19	28 th May 2018	Updated Images	
0.20	26 th June 2018	Added tone indication details and keypad functionality changes	
0.21	30 th June, 2018	Edits	
0.22	19 th July 2018	Removed reboot software details and added BIST details	
0.23	10 th August 2018	Updated the key details in slideshow mode	
0.24	21 st August 2018	Added “HDMI Frame Resolution” menu in preference menu	
0.25	30 th August 2018	Updated inter document links	
0.26	25 th September 2018	Added “Orion TI-84 Plus Interface” details	
0.27	25 th October 2018	Updated preference menu for Orion TI-84 Screen Settings and modified ‘zoom in max’ key	
0.28	24 th November 2018	Minor Edits	
0.29	26 th December 2018	Added “disable” sleep option in preference menu	
0.30	18 th March, 2019	Updated vibration and power off section	

26.2 Appendix B: Proto 4C Unit Specific Limitations and Changes

1. Proto 4C unit 1 and 2:
 1. These two units are without battery and can be used with power supply adaptor only.
 2. HDMI cable and charger insertion and removal indications are not present due to the hardware limitation.
 3. Charger insertion and removal indications are not present.

4. Tone indication is not present.
2. Proto 4C unit 3 and 4:
 1. These units are without battery and can be used with power supply adaptor only.
 2. Tone indication is not present.
 3. HDMI cable and charger insertion and removal indications are not present due to the hardware limitation.
3. Proto 4C unit 3 and later units: HDMI cable and charger insertion and removal detection are present.
4. Proto 4C unit 5 and 6: Tone indication is not present.
5. Proto 4C unit 5 and later units: Battery based units.
6. Proto 4C unit 8 and later units: Tone indication is present.
7. Proto 4C unit 12 and later units: Hard reset keys are changed from DOT 8 + Down arrow key to DOT 8 + power key.