






TC51854 CONTROLLER

USER MANUAL

Revised November, 2012

www.tvielectronics.com

 2211 Rayford Rd., Ste. 111-332 • Spring, TX 77386  281-408-4051  281-408-4052

THIS PAGE INTENTIONALLY LEFT BLANK

IMPORTANT NOTICE

TVI Electronics shall not be liable in any action against it in any way related to the products or software for any loss or damages, whether non-specified direct, indirect, special, incidental or consequential (including downtime, loss of profits or goodwill) regardless of the legal theory asserted.

TVI Electronics reserves the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products sold by TVI Electronics are subject to company's terms and conditions of sale supplied at the time of order acknowledgment.

User is responsible for determining whether the TVI Electronics products and software are fit for User's particular purpose and suitable for its method of production, including intellectual property liability for User's application.

WARRANTY

TVI Electronics warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TVI Electronics' standard warranty.

All TVI Electronics products have been manufactured to your company's or your own specifications as a part for use in your company's or own general electronic products. It is guaranteed to perform according to delivery specifications.

This evaluation board being sold by TVI Electronics is intended for use for ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY. We cannot take responsibility if the product is used in medical devices, nuclear power control equipment, aerospace equipment, fire and security systems, or any other applications in which there is a direct risk to human life and where extremely high levels of reliability are required.

1. We cannot accept responsibility for any defect, which may arise from additional manufacturing of the product (including disassembly and reassembly), after product delivery.
2. We cannot accept responsibility for any defect, which may arise after the application of strong external force to the product.
3. We cannot accept responsibility for any defect, which may arise due to the application of static electricity after the product has passed your company's acceptance inspection procedures.

Customers are responsible for their products and applications using TVI Electronics components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TOUCH SCREEN LCD MODULE HANDLING PRECAUTIONS

The following precautions will guide you in handling of our product correctly:

1. Liquid crystal display devices:
 - 1.1. The liquid crystal display device panel used in the liquid crystal display module is made of plate glass. Avoid any strong mechanical shock on LCD and touch screen. Should the glass break, handle it with care.
 - 1.2. The polarizer adhering to the surface of the LCD is made of a soft material. Guard against scratching it.
 - 1.3. Wash your hands or clothes if you touch liquid crystal!
2. Avoid Static electricity!
 - 2.1. When working with the module, use your naked or gloved hand and wear non-conductive work suit to prevent generating static electricity by friction. ESD ground straps should be utilized.
 - 2.2. Be sure to ground any electrical appliances you may be using, such as soldering iron, cutting pliers, tweezers, etc.
 - 2.3. Floors, doors, and work tables must be grounded to discharge electricity.
3. When the LCD module alone must be stored for long periods of time:
 - 3.1. Protect the modules from high temperature and humidity.
 - 3.2. Keep the modules out of direct sunlight or direct exposure to ultraviolet rays.
 - 3.3. Protect the modules from excessive external forces.
4. Use the module with a power supply that is equipped with an over current protector circuit, since the module is not provided with this protective feature.
5. Do not ingest the LCD fluid itself should it leak out of a damaged LCD module. Should hands or clothing come in contact with LCD fluid, wash immediately with soap.
6. Conductivity is not guaranteed for models that use metal holders where solder connections between the metal holder and the PCB are not used.
7. Do not stack up modules since they can be damaged by components on neighboring modules.
8. Do not place heavy objects on top of the product. This could cause glass breakage.
9. Do not scratch LCD or touch screen!
10. In order to maintain module reliability, do not touch or hold by the connector area.
11. Avoid any bending, pulling, or other excessive force on flexible cables, which can result in broken connections.



PREFACE

About This Manual

This user's manual describes the function and operation of the TC51854 controller Firmware rev. 2.0 and higher. This manual will help you quickly set up the touch screen controller evaluation board and its accompanying software, so that you can rapidly test and evaluate their usefulness for your application.

If You Need an Assistance

If you have any questions about this evaluation board, feel free to e-mail TVI Electronics Support Team at support@tvielectronics.com. Include the product name in the subject heading.

Copyright

Copyright © 2012, TVI Electronics, LLC. All rights reserved. TVI Electronics reserves the right to make changes and improvements to its product without notification.

Notice to Users

When a system failure may cause serious consequences, protecting life and property against such consequences with a backup system or safety device is essential. The user agrees that protection against consequences resulting from system failure is the user's responsibility. This device is not approved for life-support or medical systems.

CONTENTS

1. FUNCTIONS AND STRUCTURE.....	1
1.1. GENERAL.....	1
1.2. FEATURES.....	1
1.2.1. RS-232 communication interface with nine programmable baud rates	1
1.2.2. 4Mb flash memory.....	1
1.2.3. Touch screen controller.....	1
1.2.4. AVRISP interface	1
1.2.5. Draw/Clear Line/Rectangle/Circle	1
1.2.6. Voltage regulator.....	2
1.2.7. Multiple display modes	2
1.2.8. Software control	2
1.2.9. Display Pixel Control	2
1.2.10. Animation.....	2
1.2.11. Fonts.....	2
1.2.12. 180° screen rotation.....	2
1.2.13. Spare pins on Atmega16.....	2
1.2.14. Optional Display Parallel Connection.....	2
1.2.15. Firmware update.....	2
1.3. POWER REQUIREMENTS	3
2. GETTING STARTED	4
2.1. HARDWARE CONNECTION.....	4
2.2. POWER UP	4
2.3. QUICK START	5
3. OPERATION	6
3.1. TC51854 CONTROLLER CONNECTION	6
3.1.1. Baud Rate Settings.....	7
3.1.2. Serial Communication	7
3.1.3. Firmware Update	8
3.2. TC51854 COMMANDS LIST	8
4. PHYSICAL DESCRIPTION	16
4.1. TC51854 CONTROLLER BOARD PHYSICAL DIMENSIONS.....	16

FIGURES

<i>Figure 2-1 Hardware Connection</i>	4
<i>Figure 2-2 Default Software Screen</i>	5
<i>Figure 3-1 TC51854 Controller Board Layout</i>	6
<i>Figure 3-2 PC to TC51854 Controller Connection</i>	7
<i>Figure 3-3 MCU to TC51854 Controller Connection</i>	8

TABLES

<i>Table 3-1 Jumpers</i>	6
<i>Table 3-2 Switches</i>	6
<i>Table 3-3 Connectors</i>	7

EXAMPLES

<i>Example 2-1 Default Power Up Screen</i>	4
--	---

1. FUNCTIONS AND STRUCTURE

1.1. GENERAL

The TC51854 is an intelligent LCD controller with an integrated touch screen control that supports Optrex F-51854 160x128 F-STN Monochrome Graphic Transflective LCD with a 4.7-inch diagonal viewing area for characters and/or graphics display. This controller allows user to individually control each display pixel. This independent pixel control allows user to display both text and pictures simultaneously. The TC51854 uses an ATMEGA32 microcontroller and 4M bit AT45DB041B Flash. The microcontroller can be reprogrammed at any time by using AVRISP device.

1.2. FEATURES

1.2.1. RS-232 communication interface with nine programmable baud rates

The TC51854 controller has RS-232 protocol interface. Communication parameters are: 8 Bit, No Parity and 1 Stop Bit. The TC51854 controller is shipped set at 9600 baud rate. The baud rate can be changed by a command and stored. A regular DB9 connector on board allows communication with PC through the standard serial cable. TVI Electronics offers this cable as part number DB9MF. A serial TTL interface is supplied at J9. For TTL interface, remove the jumpers on J9 header, see jumpers configuration.

1.2.2. 4Mb flash memory

4M bites of Flash Memory are divided into 2048 pages of 256 bytes each. The lower 40 pages of this memory contain text fonts used to display text. The remaining memory can be used to store up to 200 full-screen images. A utility program allows converting and downloading bmp images with 160x128 pixels resolution to display.

1.2.3. Touch screen controller

The touch screen controller can respond by sending X and Y coordinates of touch screen contact location or by sending digits (if used as a 4x4 keypad) to main microprocessor or computer. In 4x4 Keypad Mode, the screen is divided on 16 boxes 40x32 pixels each. Controller sends digits from 1 to 16 according to the touch location. 4x4 Keypad Mode provides a Flip option which reverses colors of the touched box. The TC51854 controller provides touch screen calibration routine for more accurate results.

1.2.4. AVRISP interface

AVRISP (In-System Programmer) interface allows user to program own code into microcontroller, AVRISP device is required.

1.2.5. Draw/Clear Line/Rectangle/Circle

The TC51854 controller simplifies drawing and clearing of horizontal, vertical and skew lines and shapes, such as rectangle and circle.

1.2.6. Voltage regulator

The TC51854 has a built-in voltage regulator with input 9 - 12 VDC (connectors J2 PIN5, J3, J4).

1.2.7. Multiple display modes

The TC51854 controller supports multiple display modes (Normal, Reverse, Mixed) that can be freely mixed on F-51854 LCD.

1.2.8. Software control

Software allows controlling LCD contrast, backlight ON/OFF and display ON/OFF.

1.2.9. Display Pixel Control

The TC51854 controller allows user to individually control each display pixel. This independent pixel control allows user to display both text and pictures simultaneously.

1.2.10. Animation

The TC51854 controller allows auto alternation of images previously stored in a Flash.

1.2.11. Fonts

The TC51854 controller supports 4 built in font sizes: 7 pixels (H), 14 pixels (H), 14 pixels (H) Bold and 22 pixels (H). The bmp font files are stored as screens 1-4 in controller's memory. Different font sizes can be freely mixed on the screen.

1.2.12. 180° screen rotation

The TC51854 controller allows 180° screen rotation.

1.2.13. Spare pins on Atmega16

5 port pins of ATmega16 microcontroller (PA6, PD2, PD5, PD6, PD7) are available for a personal use.

1.2.14. Optional Display Parallel Connection

The TC51854 controller allows establishing a parallel connection to LCD by disconnecting the entire controller board circuit. To use this feature, cut traces between the header pads.

1.2.15. Firmware update

The TC51854 controller's firmware can be updated through the serial port.

1.3. POWER REQUIREMENTS

Power of 9 - 12 VDC to the TC51854 is derived from the external power supply through J2 PIN5, J3 or J4 connectors, requires installation of jumper on J7#2. Since it is regulated on the TC51854, this input voltage does not need to be regulated as long as it falls within this range. Central pin on J4 connector, PIN5 on J2 connector and PIN1 on J3 connector connect to "+" on a power supply.

Power of regulated 5 VDC to the TC51854 is derived from the external power supply through J2 PIN4 or J11 PIN1 connectors, remove jumper on J7#2 and install jumper on J7#3.

- * Make sure the polarity is correct! Reversed power will damage the device and/or power supply!

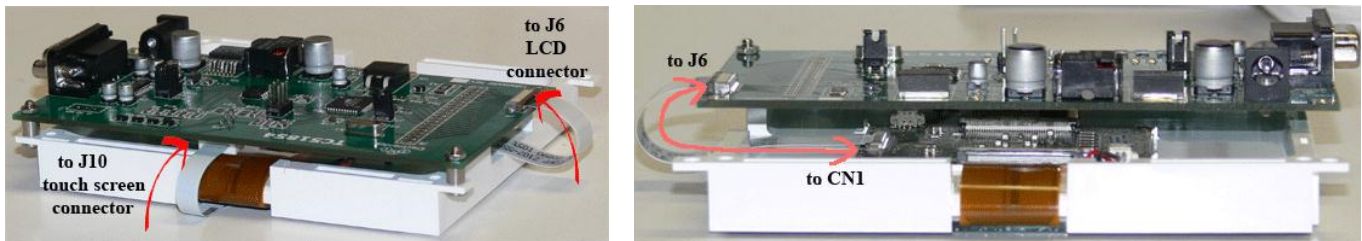
2. GETTING STARTED

This chapter guides you through the hardware connection, powering up the TC51854 controller and setting up the software for initial testing.

2.1. HARDWARE CONNECTION

Carefully open the display data connector latch CN1 and TC51854 connector latch J6 by pulling the brown latches outwards. Insert one end of the flat data cable contacts side up into the CN1 connector and the other end of the flat data cable contacts side down into the TC51854 J6 connector being sure the cable is fully seated, push the latches back in being sure both ends are pushed all the way in. If you have a touch screen carefully pull the latch on connector J10 out. Insert the touch screen cable into J10 being sure it is seated, push the latch back in.

Figure 2-1 Hardware Connection



2.2. POWER UP

Connect a power supply to J4 power jack; make sure the polarity is correct. Screen #5 is the power up screen which will be displayed each time the unit is powered up. The power up screen can be customized through DCA software. The factory default will show TVI Electronics logo and current controller firmware revision as shown on Default Power Up Screen below.

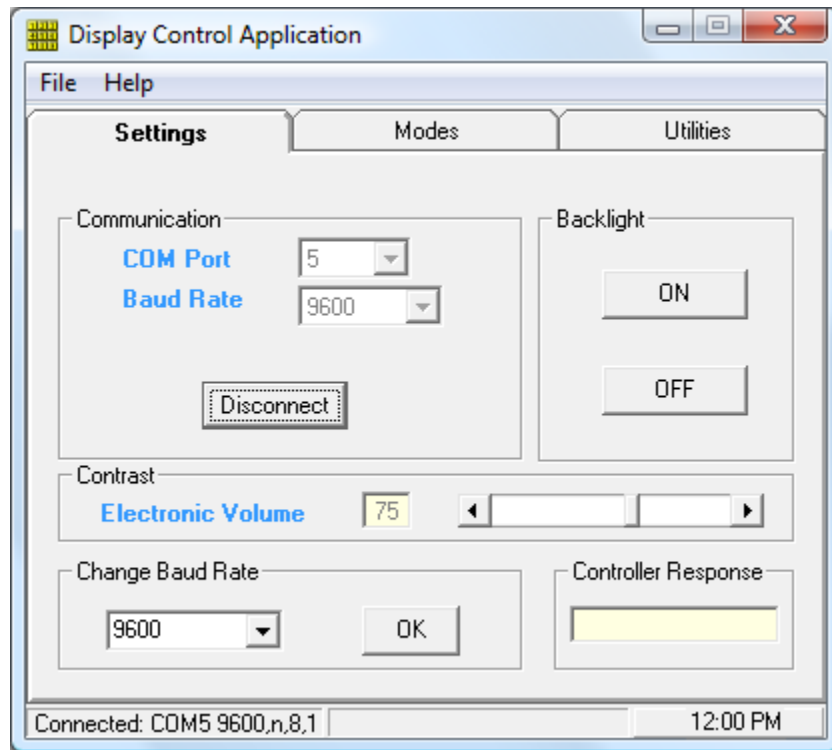
Example 2-1 Default Power Up Screen



2.3. QUICK START

Download and install Display Control Application software on your PC. Follow instructions that the installer gives you. When installation is complete, connect a serial cable from your PC to the TC51854 controller. Once this connection is made, launch the Display Control Application software on your PC. Select the appropriate COM Port, Baud Rate (default 9600), and click Connect. Now you may begin using the software to evaluate the TC51854 controller board.

Figure 2-2 Default Software Screen



3. OPERATION

This chapter describes each function of TC51854 controller.

3.1. TC51854 CONTROLLER CONNECTION

Figure 3-1 TC51854 Controller Board Layout

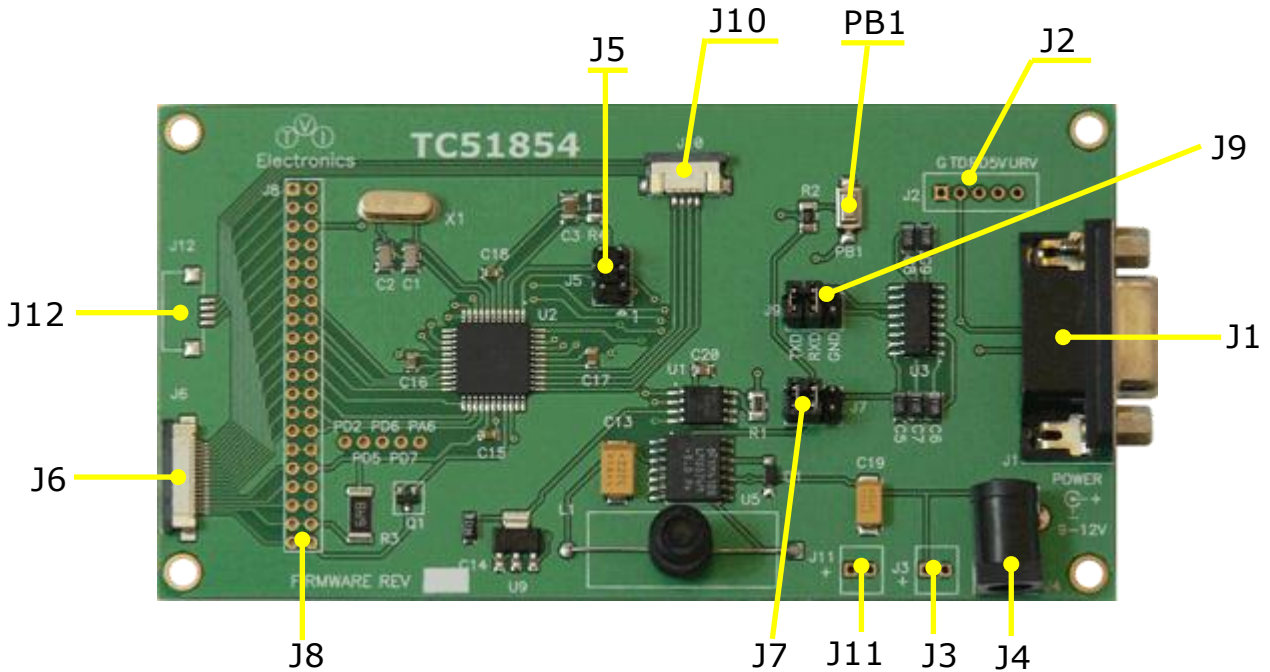


Table 3-1 Jumpers

Reference Designator	Function	Setting	Subsection
J7	#1 - Baud Rate 9600	ON	3.1.1
	#1 - User Defined Baud Rate	OFF	
	#2 - 9-12 VDC through J2, J3 or J4	ON	1.3
	#3 - 5 VDC through J2 or J11	ON	
J9	Serial Communication through RS232	ON	3.1.2
	Serial Communication through Atmega16 UART	OFF	

Table 3-2 Switches

Reference Designator	Function	Setting	Subsection
PB1	Programming	-	3.1.3

Table 3-3 Connectors

Reference Designator	Function
J1	DB9 Connector for RS232
J2	Optional Connector RS232, 5 VDC, 9-12 VDC
J3, J4	9-12 VDC Input
J5	AVRISP (In-System Programmer) Interface
J6	LCD Connector FFC/FPC 20 pin, 0.5 mm pitch
J8	Optional Parallel Connection to LCD
J10	Touch Screen connector FFC/FPC 4 pin, 1.0 mm pitch
J11	External 5 VDC Input
J12	Optional Touch Screen Connector

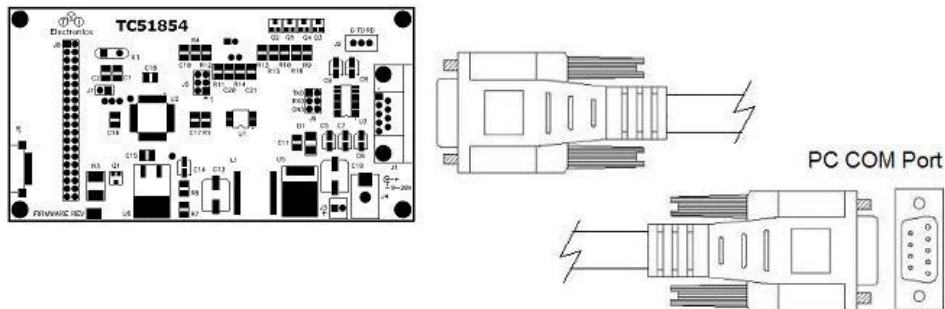
3.1.1. Baud Rate Settings

The TC51854 controller has nine programmable baud rates. The TC51854 controller is shipped set at 9600 baud rate. A baud rate is set by a command and stored. The baud rate can be changed at any time by removing jumper J7#1.

3.1.2. Serial Communication

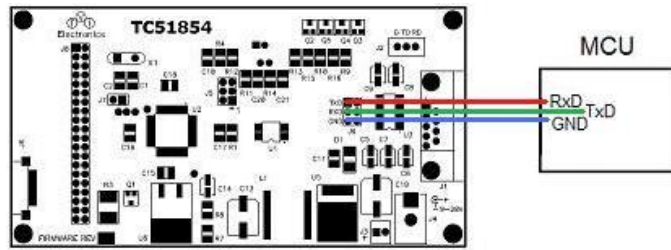
Communication with TC51854 controller through RS232 requires installation of jumpers on J9 (Factory Default).

Figure 3-2 PC to TC51854 Controller Connection



Communication with TC51854 controller through Atmega16 UART requires removal of two jumpers on J9. Use J9 as a header to connect TXD, RXD, and GND from external application.

Figure 3-3 MCU to TC51854 Controller Connection



3.1.3. Firmware Update

TC51854 controller supports firmware updates. The utility for firmware update is included with the product, which also can be downloaded from <http://www.tvielectronics.com>. The new firmware for the TC51854 controller can be downloaded at <http://www.tvielectronics.com>.

To enter the programming mode:

1. Turn off the TC51854 controller board.
2. Press PB1 button on TC51854 controller and apply power.
3. Release the PB1 button.
4. Start the utility to update firmware.

* Note: DO NOT power off TC51854 controller while the firmware update is progressing, this may damage the TC51854 controller.

3.2. TC51854 COMMANDS LIST

- Text Mode

Print a single character:

Address								Data (ASCII)							
0	0	0	0	0	0	1	0	x	x	x	x	x	x	x	x

First character is Address 0x02, second - is ASCII Data for a character.

Print a string:

Address								Data (ASCII) or String Terminator							
0	0	1	0	0	1	1	0	x	x	x	x	x	x	x	x

The string starts with Address 0x26 followed by ASCII Data for every character. The max string size is 45 ASCII characters. For a string less than 45 characters, use a string terminator 0x0D.

- Graphic Mode

To operate in Graphic Mode, the controller requires two characters per command.

Address								Data							
0	0	0	0	0	0	1	1	x	x	x	x	x	x	x	x

Address 0x03, Data - 8 bit for a desired graphic pattern

- XY Mode allows control of a single pixel as well as drawing shapes, such as rectangle and circle and horizontal, vertical or skew lines according to the entered coordinates.

In a Pixel mode the controller will rewrite the contents of the display data RAM for a given pixel.

(0,0) is a coordinate at the top left corner of the screen.

(159,127) is a coordinate at the lower right corner of the screen.

Pixel ON/OFF:

Address								Data							
0	0	0	0	1	0	1	0	x	x	x	x	x	x	x	x

X Coordinate								Y Coordinate							
0	x	x	x	x	x	x	x	0	0	x	x	x	x	x	x

Step 1. Address 0x0A, Data - number of coordinates in the string

Step 2. X (from 0 to 159), Y (from 0 to 127) coordinates

If the specified number of coordinates > 1, repeat Step 2.

For more than 128 (X and Y) coordinates, repeat Steps 1 & 2.

Overwriting the same coordinate will reverse a pixel on the screen (ON/OFF).

To draw a line:

Address								Data							
0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0

X1 Coordinate Start								Y1 Coordinate Start							
0	x	x	x	x	x	x	x	0	0	x	x	x	x	x	x

X2 Coordinate End								Y2 Coordinate End							
0	x	x	x	x	x	x	x	0	0	x	x	x	x	x	x

Address 0x1E, Data 0x00, Data X1, Data Y1, Data X2, Data Y2

(X1,Y1) - Start coordinate (X2,Y2) - End coordinate

To clear a line:

Address								Data							
0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0

X1 Coordinate Start								Y1 Coordinate Start							
0	x	x	x	x	x	x	x	0	0	x	x	x	x	x	x

X2 Coordinate End								Y2 Coordinate End							
0	x	x	x	x	x	x	x	0	0	x	x	x	x	x	x

Address 0x1F, Data 0x00, Data X1, Data Y1, Data X2, Data Y2
 (X1,Y1) - Start coordinate (X2,Y2) - End coordinate

To draw a rectangle:

Address								Data							
0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	1

X1 Coordinate Start								Y1 Coordinate Start							
0	x	x	x	x	x	x	x	0	0	x	x	x	x	x	x

X2 Coordinate End								Y2 Coordinate End							
0	x	x	x	x	x	x	x	0	0	x	x	x	x	x	x

Address 0x1E, Data 0x01, Data X1, Data Y1, Data X2, Data Y2
 (X1,Y1) - upper left corner (X2,Y2) - lower right corner

To clear a rectangle:

Address								Data							
0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	1

X1 Coordinate Start								Y1 Coordinate Start							
0	x	x	x	x	x	x	x	0	0	x	x	x	x	x	x

X2 Coordinate End								Y2 Coordinate End							
0	x	x	x	x	x	x	x	0	0	x	x	x	x	x	x

Address 0x1F, Data 0x01, Data X1, Data Y1, Data X2, Data Y2
 (X1,Y1) - upper left corner (X2,Y2) - lower right corner

To draw a filled rectangle:

Address								Data							
0	0	0	1	1	1	1	0	0	0	0	0	0	0	1	0

X1 Coordinate Start								Y1 Coordinate Start							
0	x	x	x	x	x	x	x	0	0	x	x	x	x	x	x

X2 Coordinate End								Y2 Coordinate End							
0	x	x	x	x	x	x	x	0	0	x	x	x	x	x	x

Address 0x1E, Data 0x02, Data X1, Data Y1, Data X2, Data Y2
 (X1,Y1) - upper left corner (X2,Y2) - lower right corner

To clear a filled rectangle or a specified area:

Address								Data							
0	0	0	1	1	1	1	1	0	0	0	0	0	0	1	0

X1 Coordinate Start								Y1 Coordinate Start							
0	x	x	x	x	x	x	x	0	0	x	x	x	x	x	x

X2 Coordinate End								Y2 Coordinate End							
0	x	x	x	x	x	x	x	0	0	x	x	x	x	x	x

Address 0x1F, Data 0x02, Data X1, Data Y1, Data X2, Data Y2
 (X1,Y1) - upper left corner (X2,Y2) - lower right corner

To reverse pixels of a specified rectangle:

Address								Data							
0	0	0	1	1	1	1	0	0	0	0	0	0	0	1	1

X1 Coordinate Start								Y1 Coordinate Start							
0	x	x	x	x	x	x	x	0	0	x	x	x	x	x	x

X2 Coordinate End								Y2 Coordinate End							
0	x	x	x	x	x	x	x	0	0	x	x	x	x	x	x

Address 0x1E, Data 0x03, Data X1, Data Y1, Data X2, Data Y2
 (X1,Y1) - upper left corner (X2,Y2) - lower right corner

To draw a circle:

Address								Radius							
0	0	1	0	0	0	0	0	x	x	x	x	x	x	x	x

X Coordinate								Y Coordinate							
0	x	x	x	x	x	x	x	0	0	x	x	x	x	x	x

Address 0x20, Data R, Data X, Data Y
 R - circle radius X,Y - circle center point

To clear a circle:

Address								Radius							
0	0	1	0	0	0	0	1	x	x	x	x	x	x	x	x

X Coordinate								Y Coordinate							
0	x	x	x	x	x	x	x	0	0	x	x	x	x	x	x

Address 0x21, Data R, Data X, Data Y
 R - circle radius X,Y - circle center point

- Specify Start page and column

Start page:

Address								Data							
0	0	0	0	0	1	1	0	0	0	0	0	x	x	x	x

Address 0x06, Data x
x - page address from 0 to 15

Start column:

Address								Data							
0	0	0	1	0	0	1	0	x	x	x	x	x	x	x	x

Address 0x12, Data x
x - column address from 0 to 159

- Select Screen font:

Address								Data							
0	0	0	1	0	1	0	1	0	0	0	0	0	x	x	x

Address 0x15, Data x
7 pixels (default): x = 1, 14 pixels: x = 2,
14 pixels Bold: x = 3, 22 pixels: x = 4

- Backlight:

Address								Data							
0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	x

Address 0x09, Data x
ON: x = 1, OFF: x = 2

- The touch screen controller can respond by sending X and Y coordinates of a touch screen contact location or by sending digits (if used as 4x4 keypad) to main microprocessor or computer. In 4x4 Keypad Mode, the screen is divided on 16 boxes 40x32 pixels each. Controller sends digits from 1 to 16 according to the touch location. 4x4 Keypad Mode provides a Flip option which reverses colors of the touched box. The TC51854 controller is calibrated for touch screen. The controller responds with '\$' character on touch screen release.

Touch screen in XY Coordinates Mode (allow 2% inaccuracy):

Address								Data							
0	0	0	0	0	1	0	1	0	0	0	0	0	0	x	x

Address 0x05, Data x
ON: x = 1, OFF: x = 2

Controller response:

X Coordinate								Comma							
x	x	x	x	x	x	x	x	0	0	1	0	1	1	0	0

Y Coordinate								String Terminator							
y	y	y	y	y	y	y	y	0	0	1	0	0	0	0	0

Example: x 0x2C y 0x20

Keypad Mode:

Address								Data							
0	0	0	1	1	1	0	0	0	0	0	0	0	0	x	x

Address 0x1C, Data x

Keypad without Flip: x = 1, Keypad with Flip: x = 2, OFF: x = 3

Touch Screen Calibration:

Address								Data							
0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	1

Address 0x19, Data 1

The calibration routine is provided to compensate for the normal touch screen variation. You will be asked to touch two corners of the touch screen. A "Dot" along with comments will appear on the screen indicating where to make a touch. After successful calibration the controller will print "Done!" on the screen.

The TC51854 controller provides an option to restore a factory default calibration.

Address								Data							
0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	1

Address 0x1A, Data 0x01

- Display power save mode:

Address								Data							
0	0	0	0	1	1	0	1	0	0	0	0	0	0	x	x

Address 0x0D, Data x

ON: x = 1, OFF: x = 2

- Display background color

The TC51854 controller supports multiple display modes (Normal, Reverse, Mixed) that can be freely mixed on F-51854 LCD. Normal and Reverse Modes commands allow pixel ON/OFF state to be reversed without having to rewrite the contents of the display data RAM. Mixed Mode commands will rewrite the contents of the display data RAM. In order to clear the data RAM use a Clear Screen command.

Address								Data							
0	0	0	0	1	0	1	1	0	0	0	0	0	x	x	x

Address 0x0B, Data x

Normal: x = 0, Reverse: x = 1

Top (8 pages) Normal Bottom (8 pages) Reverse: x = 2

Top Reverse Bottom Normal: x = 3

Right (80 columns) Reverse Left (80 columns) Normal: x = 4

Diagonal from Top Right to Bottom Left: x = 5

Diagonal from Top Left to Bottom Right: x = 6

- Flip Page (Highlight):

Address								Data							
0	0	0	1	1	1	0	1	0	0	0	0	0	x	x	x

Address 0x1D, Data x

x - page number from 0 to 15

- Clear screen

The Clear Screen command allows clearing of a single page or a whole screen.

Address								Data							
0	0	0	0	0	0	0	1	0	0	0	0	x	x	x	x

Address 0x01, Data x

x - page number from 0 to 15

x = 16 - whole screen

- Contrast

The Optrex F-51854 series LCD modules provide 7-bits of software contrast adjustment called "Electronic Volume". The contrast value is stored and will default to the stored value.

Address								Data							
0	0	0	1	0	0	0	0	0	x	x	x	x	x	x	x

Address 0x10, Data x

x - from 0 to 127

- Animation

The TC51854 controller allows automatic alternation of images previously stored in Flash. Any command sent to the controller while animation is running will stop the animation and clear the screen.

Address								Delay							
0	0	0	1	1	0	1	1	x	x	x	x	x	x	x	x

Start Screen								Stop Screen							
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Address 0x1B, Delay - from 3 to 255 (each unit represents 100ms)
 Start Screen - from 1 to 202
 Stop Screen - from 2 to 203

- Set baud rate

The baud rate value is stored and will default to the stored value.

Address								Data							
0	0	0	0	1	1	1	1	0	0	0	0	x	x	x	x

Address 0x0F, Data x
 2400bps: x = 0, 4800bps: x = 1, 9600bps: x = 2, 14400bps: x = 3,
 19200bps: x = 4, 28800bps: x = 5, 38400bps: x = 6, 57600bps: x = 7,
 76800bps: x = 8, 115200bps: x = 9

- 4M bites of Flash Memory are divided into 2048 pages of 256 bytes each. The lower 40 pages of this memory contain text fonts used to display text. The remaining memory can be used to store up to 199 full-screen images. A utility program allows converting and downloading bmp images with 160x128 pixels resolution to display.

Load screen from Flash:

Address								Data							
0	0	0	0	1	0	0	0	x	x	x	x	x	x	x	x

Address 0x08, x - from 5 to 203

Save current screen:

Address								Data							
0	0	0	1	0	0	0	1	x	x	x	x	x	x	x	x

Address 0x11, x - from 5 to 203

Upload screen to the host (PC or MCU)

The DCA utility software doesn't support this function.

Address								Data							
0	0	1	0	0	0	1	0	x	x	x	x	x	x	x	x

Address 0x22, x - from 1 to 203

- 180° screen rotation

The TC51854 controller allows 180° screen rotation. The screen's orientation and bitmap are stored and will default to the stored values.

Address								Data						
0	0	1	0	0	1	1	1	0	0	0	0	0	0	x

Address 0x27, Data x
 0°: x = 0, 180°: x = 1

* The controller will respond with exclamation mark (!) 0x21 when ready for the next command.

4. PHYSICAL DESCRIPTION

This chapter contains the TC51854 controller board physical dimensions.

4.1. TC51854 CONTROLLER BOARD PHYSICAL DIMENSIONS

- 134.0 mm (W) x 67.0 mm (H) x 14.0 mm (D)
 5.28" (W) x 2.64" (H) x 0.55" (D)