# GLK19264-7T-1U
# Technical Manual

## Revision: 1.2

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# 1 Getting Started

Figure 1: GLK19264-7T-1U

The GLK19264-7T-1U is an intelligent graphic LCD display designed to decrease development time by providing an instant solution to any project. With the ability to communicate via serial RS-232/TTL and $I^2C$ protocols, the versatile GLK19264-7T-1U can be used with virtually any controller. The GLK19264-7T-1U-USB has the ability to communicate via USB. The ease of use of these displays is further enhanced by an intuitive command structure to allow display settings such as backlight brightness, contrast and baud rate to be software controlled. Additionally, text and fonts may be uploaded to the display and stored in the on board memory.

## 1.1 Display Options Available

Both the (Non-USB) GLK19264-7T-1U and the (USB) GLK19264-7T-1U-USB modules come in two colour options, grey text with white background and white text with blue background. Temperature options are also available to allow you to select the display which will best fit your project needs.

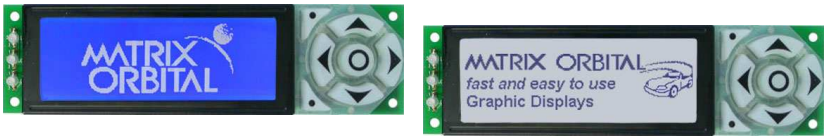



Figure 2: GLK19264-7T-1U Options

## 1.2 Accessories

**NOTE** Matrix Orbital provides all the interface accessories needed to get your display up and running. You will find these accessories and others on our e-commerce website at http://www.matrixorbital.com. To contact a sales associate see Section 16.6 for contact information.

Figure 4: 5V Power Adapter

Figure 3: Standard Power

Figure 5: 3ft Mini-B USB Cable

Figure 6: Breadboard Cable

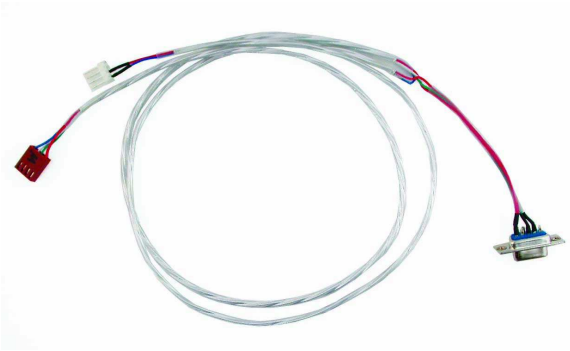


Figure 7: Communication & Power Cable

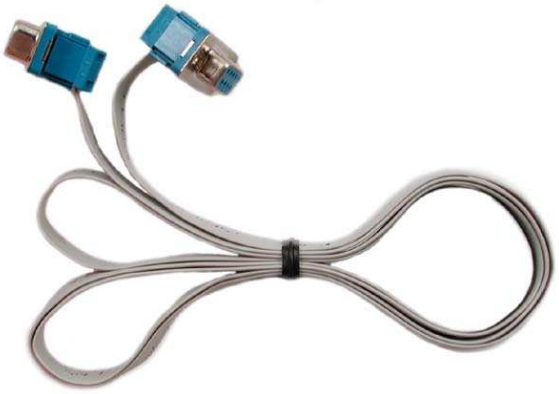


Figure 8: Serial Cable

Figure 9: PC Bay Insert

## 1.3 Features

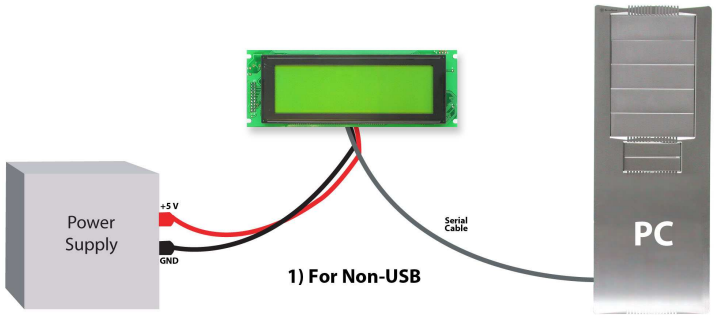
- 192 x 64 pixel graphics display
- Selectable communication protocol, RS-232 or $I^2C$ for Non-USB model; USB only for USB models
- 128 byte buffered communication
- 16 KB flash memory for fonts and bitmaps
- Lightning fast communication speeds, up to 115 kbps for RS-232 and 100 kbps for $I^2C$
- Adjustable contrast and backlight brightness
- Extended temperature available for extreme environments of -20C to 70C
- Low Voltage Power Supply Available
- Built in tactile keypad
- Built in LED's

## 1.4 Connecting to a PC

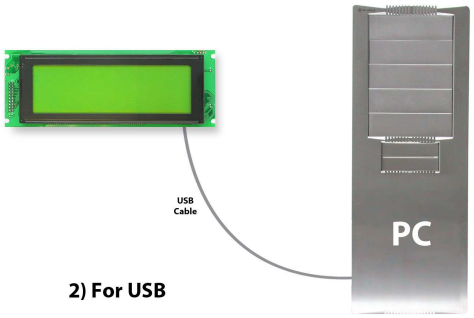
The GLK19264-7T-1U Non-USB connects seamlessly to a PC and it is an excellent means of testing the functionality and uploading new fonts and bitmaps. You will require a standard RS-232 9-pin serial cable such as the one pictured in Figure 8, as well as a modified 5V power adapter such as the one pictured in Figure 4.

In order to connect your Non-USB display to a personal computer follow these easy instructions:

1. Plug the serial cable into the com port you wish to use.
2. Connect the modified 5V power adapter to a power lead from your PC power supply (you will have to open your computer case).
3. Connect the serial cable to the DB-9 connector on the back of the display.
4. Connect the 5V power adapter to the 4-pin connector on the back of the display.




In order to connect your USB display to a personal computer simply plug the mini-B USB cable from the PC to the USB connector on the display.




In order to power your USB display from a non-USB source simply plug the Power Cable Standard into the back of the display and the other end to a suitable power source. There is no communication through the Power Cable Standard.

## 1.5 Installing the Software

### 1.5.1 MOGD#

MOGD# is the latest updated version of MOGD and can be used to manage font and graphics downloads as well as exercise all of the features of our graphical displays. MOGD# provides a new user friendly interface as well as many feature enhancements.

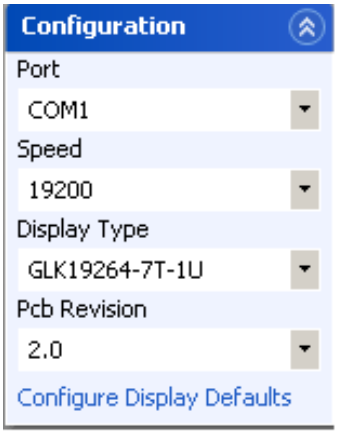
To install MOGD# from the Matrix Orbital website, follow the following steps:

1. Go to the website location: http://www.matrixorbital.ca/software/software_graphic/MOGDsharp/
2. Click on “Download Here”

3. Locate the file MogdSharp.zip on your desktop
4. Unzip MogdSharp.zip to a temporary directory using a program such as Winzip, Pkzip, etc.
5. Double click on "setup.exe"
6. Follow the instructions on the screen to complete the installation
7. MOGD# requires the .NET framework 2.0 and will download and install it automatically

After the installation is complete there will be a Matrix Orbital entry under "Start->Programs->Matrix Orbital" in the start menu. Click on the 'Mogd Sharp' entry to run the program.

Be sure to check the information selected in the configuration panel the first time MOGD# is run. Once this information is entered correctly the program can be used to control all functions of the graphic display.




**Port**

The serial port the display is plugged in to.

**Speed**

The communication speed the display module is set to. (Default 19,200)

**Display Type**

The type of display (GLK19264-7T-1U)

**PCB Revision**

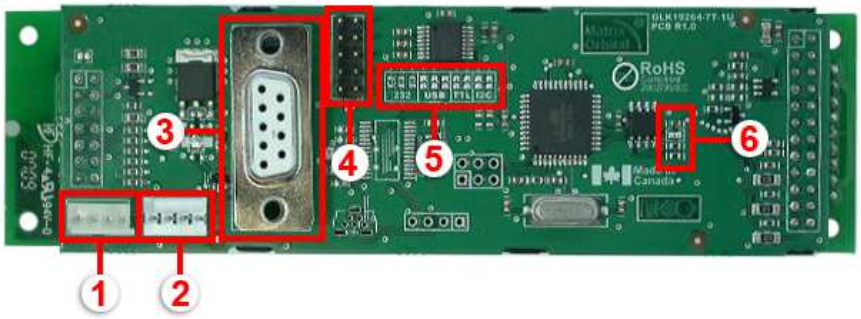
The revision of the display you are using. (Found on the back of the PCB).

Figure 10: Mogd Sharp Settings

- Winzip is available as a free download from http://www.winzip.com

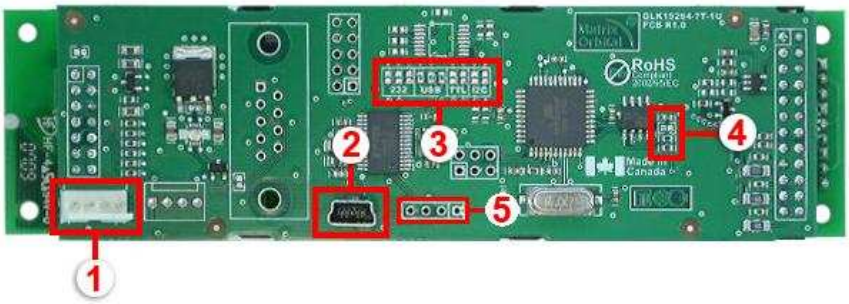
# 2 Hardware Information

Refer to the following diagram for this chapter:




**1** **Power Cable Standard Connector**
**2** **Power/Data Connector**
**3** **DB9 Connector**
**4** **Serial Header**
**5** **Protocol Select Jumpers**
**6** **Filesystem Lock Jumper**

Figure 11: GLK19264-7T-1U Non-USB



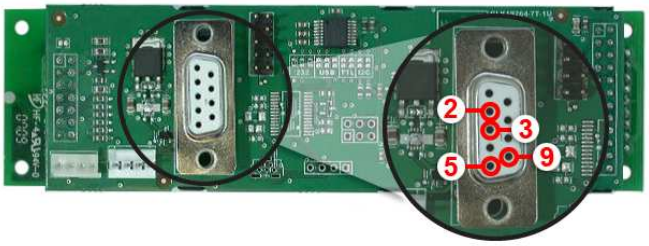

**1** **Power Cable Standard Connector**
**2** **USB mini-B Connector**
**3** **Protocol Select Jumpers**
**4** **Filesystem Lock Jumper**
**5** **Location for optional internal USB cable header***

Figure 12: GLK19264-7T-1U USB

**NOTE** * The USB module can have a header populated at your request to allow for an internal USB cable, talk to a Sales representitive for details.

## 2.1 DB-9 Connector - For Non-USB modules only

The GLK19264-7T-1U provides a *DB-9 Connector* to readily interface with serial devices which use the EIA232 standard signal levels of ±30V. It is also possible to communicate at TTL levels of 0 to +5V by setting the *Protocol Select Jumpers* to TTL. As an added feature it is also possible to apply power through pin 9 of the *DB-9 Connector* in order to reduce cable clutter. However, in order to accomplish this you must set the *Power Through DB-9 Jumper*.




| | |
|---|---|
| **Pin 2** | TX/SDA (I2C data) |
| **Pin 3** | RX/SCL (I2C clock) |
| **Pin 5** | GND |
| **Pin 9** | PWR *(Must solder power through DB-9 jumper. See table* **??** on page ?? *for power requirements.)* |

Figure 13: RS-232 Pin-out

### 2.1.1 Power Through DB-9 Jumper - for Non-USB modules only

In order to provide power through pin 9 of the *DB-9 Connector* you must place a solder jumper on the *Power through DB-9 Jumper* pictured in Figure 14 below. The GLK19264-7T-1U allows all voltage models to use the power through DB-9 option, see table **??** for display module voltage requirements.

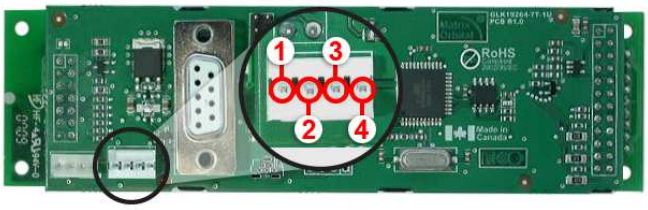
Figure 14: Power Through DB-9 Jumper

**NOTE** We do not recommend that you use pin 9 (Ring Indicator) of the PC to power the display module. You will have to make a special DB9 cable.

**WARNING** Do not apply voltage through pin 9 of the DB-9 connector AND through the Power/Data Connector at the same time.

## 2.2 Power/Data Connector for Non-USB modules only

The *Power/Data Connector* provides a standard connector for powering the display module. The GLK19264-7T-1U requires five volts for the standard display module. The voltage is applied through pins one and four of the four pin *Power/Data connector*. Pins two and three are reserved for serial transmission, using either the RS-232/TTL or the $I^2C$ protocol, depending on what has been selected by the *Protocol Select Jumpers.*




| | |
|---|---|
| **Pin 1** | PWR *(see table* **??** *on page ??)* |
| **Pin 2** | RX/SCL (I2C clock) |
| **Pin 3** | Tx/SDA (I2C data) |
| **Pin 4** | GND |

Figure 15: Power Connector and Pin-out for GLK19264-7T-1U Non-USB

**WARNINGS**

- Do not apply any power with reversed polarization.
- Do not apply any voltage other than the specified voltage.

## 2.3 Serial Header for Non-USB modules only

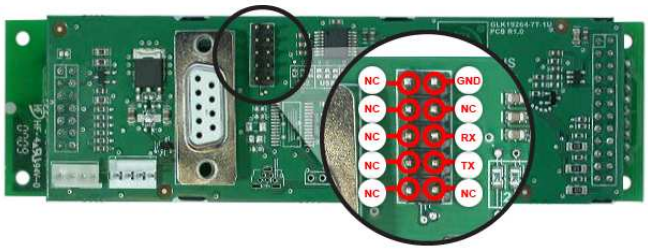



Figure 16: Serial Header

## 2.4 Protocol Select Jumpers

The *Protocol Select Jumpers*, pictured below in Figure 17, provide the means necessary to toggle the display module between RS-232, TTL and $I^2C$ protocols. As a default for the Non-USB module, the jumpers are set to RS-232 mode with zero ohm resistors on the 232 jumpers. In order to place the display module in $I^2C$ mode you must first remove the zero ohm resistors from the 232 jumpers and then solder the resistors on to the $I^2C$ jumpers, or bridge solder across the pads. The display will now be in $I^2C$ mode and have a default slave address of 0x50 unless the $I^2C$ address has been changed. Similarly, in order to change the display to TTL mode, simply remove the zero ohm resistors from the 232 or $I^2C$ jumpers and solder them to the TTL jumpers. Although RS-232, USB, TTL and $I^2C$ are present, only 232/TTL/$I^2C$ are for use in the Non-USB module. For the USB module operation the USB jumpers must be in place. There are three, one is for power. If you wish to power it up from a non-USB source, you must remove one of the jumpers. The jumper to remove is the rightmost USB jumper as seen if Figure 18.

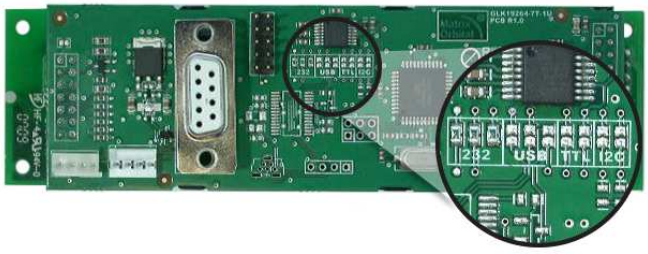



Figure 17: Protocol-Select-Jumpers for GLK19264-7T-1U Non-USB

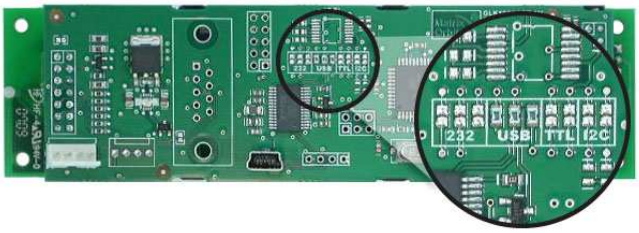



Figure 18: Protocol-Select-Jumpers for GLK19264-7T-1U USB

## 2.5 Manual Override

The *Manual Override* is provided to allow the GLK19264-7T-1U to be reset to some of the factory defaults. This can be particularly helpful if the display module has been set to an unknown baud rate or $I^2C$ slave address and you are no longer able to communicate with it. If you wish to return the module to its default settings you must press the bottom left button at power up. Please see figure 19.

Table 1: Default Values

| | |
|---|---|
| **Contrast** | 128 |
| **Backlight** | 255 |
| **Baud Rate** | 19.2 kbps |
| **$I^2C$ Slave Address** | 0x50 |
| **Data Lock** | False |
| **RS232AutoTransmitData** | True |

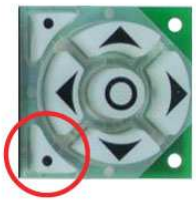


Figure 19: Manual Override Button

**NOTE** The display module will revert back to the old settings once turned off, unless the settings are saved.

## 2.6 Filesystem Lock Jumper

The Filesystem Lock Jumper allows you to lock the filesystem on the GLK19264-7T-1U so that no fonts or bitmaps can be either written or deleted from the on board memory. This feature is useful in order to protect data integrity of production units, if protection of other settings is required see Section 13

To lock the filesystem, solder a zero ohm resistor or use a solder jumper pictured in Figure **??** below.

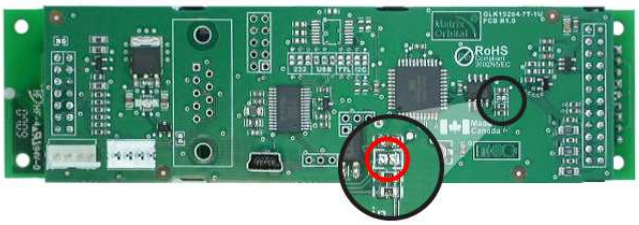


Figure 20: Filesystem Lock Jumper for Non-USB

# 3 Troubleshooting

## 3.1 The display does not turn on when power is applied.

- First, you will want to make sure that you are using the correct power connector. Standard floppy drive power cables from your PC power supply may fit on the Power/Data Connector however they do not have the correct pinout as can be seen in Figure **??**. Matrix Orbital supplies power cable adapters for connecting to a PC, which can be found in the Accessories Section on page 1.
- The next step is to check the power cable which you are using for continuity. If you don't have an ohm meter, try using a different power cable, if this does not help try using a different power supply.
- The last step will be to check the *Power / Data Connector* on the GLK19264-7T-1U. If the *Power / Data Connector* has become loose, or you are unable to resolve the issue, please contact Matrix Orbital see 16.6 on page 66 for contact information.

## 3.2 The display module is not communicating.

- First, check the communication cable for continuity. If you don't have an ohm meter, try using a different communication cable. If you are using a PC try using a different Com port.

- Second, please ensure that the display module is set to communicate on the protocol that you are using, by checking the *Protocol Select Jumpers*. To change the protocol used by the display module see Section 2.4 on page 10.
- Third, ensure that the host system and display module are both communicating on the same baud rate. The default baud rate for the display module is 19200 bps.
- If you are communicating to the display via $I^2C$ please ensure that the data is being sent to the correct address. The default slave address for the display module is 0x50.

---

**NOTE** $I^2C$ communication will always require pull up resistors.

---

- Finally, you may reset the display to it's default settings using the Manual Override Key, see Section 2.5 on page 11.

## 3.3 The display module is communicating, however text cannot be displayed.

- The cause of this is often that no font has been loaded onto the display. To load a font onto the display see Section 4.2.1 on page 16.
- Another common cause may be that the contrast settings have been set to low. The solution to this problem is to adjust the contrast settings, the default setting that will work in most environments is 128

---

**NOTE** Optimal contrast settings may vary according to factors such as temperature, viewing angle and lighting conditions.

---

## 3.4 There is a problem uploading fonts or bitmaps.

- First, ensure that you can communicate to the display. A good test is to use a PC, with MOGD# installed, to connect to the display. See Section 1.4 on page 4for setting up a PC to test the GLK19264-7T-1U.
- Second, ensure that the Filesystem Lock Jumper has not been jumpered. See Section 2.6 on the previous page.
- Third, please ensure that the display module's memory is not full. The GLK19264-7T-1U has 16 Kb of memory for fonts and bitmaps.

---

**NOTE** If you are unable to resolve any issue please contact Matrix Orbital. See 16.6 on page 66 for contact information.

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# 4 Communications

## 4.1 Introduction

The commands listed in this chapter describe how to configure data flow on the GLK19264-7T-1U.

### 4.1.1 I²C Communication Summary

The GLK19264-7T-1U is capable of communicating at 100 KHz in I²C mode, with 127 units addressable on a single I²C communication line. However, in order to communicate via I²C you must first ensure that pull up resistors, with a nominal value of 1K to 10K, are placed on the SCL and SDA communication lines coming from pins two and three of the Data / Power Connector respectively. Data responses by the module are automatically output via RS232, in case the host will be querying the module, it is necessary for the host to inform the module that its responses are to be output via I²C. This can be done by sending command 254 /160 / 0 to turn off auto transmission of data in RS232. This will keep the data in the buffer until the master clocks a read of the slave. The I²C data lines operate at 5V normally or 3.3V for -1U style units. The GLK19264-7T-1U uses 8-bit addressing, with the 8th or Least Significant Bit (LSB) bit designated as the read/write bit, a 0 designates a write address and a 1 designates a read address. The default read address of the display module will be 0x51, whereas the write address is 0x50 by default. This address may be changed by using cmd 254 / 51 / <address>. The GLK19264-7T-1U should only be sent addresses that are even (LSB is 0). When the I²C master wishes to write to the display, the effective address is $50 (0101 0000) , since the LSB has to be 0 for an I²C master write. When the I²C master wishes to read the GLK19264-7T-1U, the effective address is $51 (0101 0001), since the LSB has to be 1 for an I²C master read.

If we take a standard Phillips 7 bit address of $45 (100 0101), Matrix Orbital's GLK19264-7T-1U would describe this Phillips I²C address as $8A (1000 1010). The read address would be $8B (1000 1011).

The unit does not respond to general call address ($00).

When communicating in I²C the GLK19264-7T-1U will send an ACK on the 9th clock cycle when addressed. When writing to the display module, the display will respond with a ACK when the write has successfully been completed. However if the buffer has been filled, or the module is too busy processing data it will respond with a NAK. When performing a multiple byte read within one I²C transaction, each byte read from the slave should be followed by an ACK to indicate that the master still needs data, and a NAK to indicate that the transmission is over.

The GLK19264-7T-1U has some speed limitations, especially when run in I²C mode. Here are some considerations when writing I²C code:

* to be able to read the replies of query commands (eg. cmds 54, 55) the following command must be sent (only needs to be sent once, so this can be done somewhere in init): 254 / 160 / 0 this command puts the reply data in the I²C output buffer instead of the RS232 output buffer. Please note that due to a 16 byte output buffer, query commands that reply with more than 16 bytes cannot be read (eg cmd Get FileSystem Directory)

* 3ms delay between the read commands

* 625us delay in between data bytes within a transaction is necessary

* 375us between transactions is necessary

**NOTE** These delays are consrevative, and may be decreased based on performance

### 4.1.2 I²C Transaction Example

The typical I²C transaction contains four parts: the start sequence, addressing, information, and stop sequence. To begin a transaction the data line, SDA, must toggle from high to low while the clock line, SCL, is high. Next, the display must be addressed using a one byte hexadecimal value, the default to write to the unit is 0x50, while read is 0x51. Then information can be sent to the unit; even when reading, a command must first be sent to let the unit know what type of information it is required to return. After each bit is sent, the display will issue an ACK or NACK as described above. Finally, when communication is complete, the transaction is ended by toggling the data line from low to high while the clock line is high. An example of the use of this algorithm to write a simple “HELLO” message can be seen in 2.

Table 2: I²C Transaction Algorithm

| | |
|---|---|
| **START** | Toggle SDA high to low |
| **Address** | 0x50 |
| **Information** | 0x48 0x45 0x4C 0x4C 0x4F |
| **STOP** | Toggle SDA low to high |

### 4.1.3 Serial Communication

In addition to being able to communicate via I²C the GLK19264-7T-1U communicates natively through the RS-232 protocol at at a default baud rate of 19,200 bps and is capable of standard baud rates from 9600 to 115,200 bps. Furthermore the GLK19264-7T-1U is also capable of reproducing any non-standard baud rate in between using values entered into our baud rate generation algorithm and set through command 164 (0xA4). The display module communicates at standard voltage levels of -30V to +30V or at TTL levels of 0 to +5V by setting the *Protocol Select Jumpers* to TTL.

### 4.1.4 USB Communication

The GLK19264-7T-1U is a USB device that offers identical communication protocol as the serial com-port. capable of communicating via a USB interface. The USB communications are identical to the serial communications. Communication is via a virtual com port, which is created in the operating system by the drivers necessary to install the USB display. The GLK19264-7T-1U communicating via USB is capable of baud rates of 19,200 bps to 115,200 bps. Other baud rates are subject to the limitation of the virtual com port driver. For further information regarding supported operating systems, and driver limitations please contact technical support.

## 4.2 Turn Flow Control On

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0x3A [full] [empty] |
| Decimal | 254 58 [full] [empty] |
| ASCII | 254 ":" [full] [empty] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| full | 1 | Bytes remaining before issuing a almost full message. (Full is 0) |
| empty | 1 | Bytes available before issuing a almost empty message. (Empty is 128) |

Description

This command enables flow control. When the buffer fills so that only [full] bytes are available, the display will return an "almost full" message (0xFE) to the host controller. When the buffer empties so that only [empty] bytes remain, the display will return an "almost empty" message (0xFF) to the host controller.

The display will return the "almost full" message for every byte sent to the display until the used buffer space once more drops below the [full] level. Whether the user is in 'flow control mode' or not, the module will ignore display or command bytes which would overrun the buffer.

While in 'flow control mode' the unit will return 0xFE when buffer is almost full even though it may have already thrown rejected data away.

The buffer size for the display is 128 bytes.

When using this command in an application, selection of the value for the buffer [full] should be considered very carefully. This is a critical aspect to be able to use this feature to it's full potential. When using a host system or PC which contains a FIFO, the user should set the value of [full] equal to or greater than the size of the FIFO. The reason for this is that the FIFO may be full when the host system receives 0xFE. In the case of 16550 UART the size at its maximum is 16, therefore the value of [full] should be set to 16 or greater. It is suggested that the "almost full" parameter be equal to the largest chunk of data the host will be sending the display (should be less than 127).

**NOTE** This command is not available in $I^2C$ mode.

Remembered Yes

Default Off

## 4.3 Turn Flow Control Off

| | | |
|---|---|---|
| Syntax | Hexadecimal | 0xFE 0x3B |
| | Decimal | 254 59 |
| | ASCII | 254 “;” |

Description: This command turns off flow control. Bytes may overflow the buffer without warning.

**NOTE** This command is not available in $I^2C$ mode.

Remembered: Yes

## 4.4 Changing the $I^2C$ Slave Address

| | | |
|---|---|---|
| Syntax | Hexadecimal | 0xFE 0x33 [adr] |
| | Decimal | 254 51 [adr] |
| | ASCII | 254 “3” [adr] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| adr | 1 | The new $I^2C$ write address (0x00 - 0xFF). |

Description: This command sets the $I^2C$ write address of the module between 0x00 and 0xFF. The $I^2C$ write address must be an even number and the read address is automatically set to one higher. For example if the $I^2C$ write address is set to 0x50, then the read address is 0x51.

**NOTE** The change in address is immediate.

Remembered: Always
Default: 0x50

## 4.5 Changing the Baud Rate

| | | |
|---|---|---|
| Syntax | Hexadecimal | 0xFE 0x39 [speed] |
| | Decimal | 254 57 [speed] |
| | ASCII | 254 “9” [speed] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| speed | 1 | Hex value corresponding to a baud rate. |

Description This command sets the RS-232 port to the specified [speed]. The change takes place immediately. [speed] is a single byte specifying the desired port speed. Valid speeds are shown in the table below. The display module can be manually reset to 19,200 baud in the event of an error during transmission, including transmitting a value not listed below, by setting the manual override jumper during power up. However, it should be noted that this command will be ignored until the manual override jumper is removed again.

| Hex Value | Baud Rate |
|---|---|
| 0xCF | 9600 |
| 0x8A | 14400 |
| 0x67 | 19200 |
| 0x44 | 28800 |
| 0x33 | 38400 |
| 0x22 | 57600 |
| 0x19 | 76800 |
| 0x10 | 115200 |

Remembered Always
Default 19,200 bps

## 4.6 Setting a Non-Standard Baud Rate

Syntax
| | |
|---|---|
| Hexadecimal | 0xFE 0xA4 [speed] |
| Decimal | 254 164 [speed] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| speed | 2 | Inputed LSB MSB from baud rate formula (12-2047). |

Description This command sets the RS-232 port to a non-standard baud rate. The command accepts a two byte parameter that goes directly into the modules baud generator. Use the formula, $speed = \frac{CrystalSpeed}{8 \times DesiredBaud} - 1$ to calculate the [speed] for any baud rate setting. The speed can be anywhere from 12 to 2047 which corresponds to a baud range of 977 to 153,800 baud. Setting the baud rate out of this range could cause the display to stop working properly and require the Manual Override jumper to be set.

Remembered Always

Examples

**Crystal Speed** 16 Mhz

**Desired BAUD** 13,500

$$speed = \frac{crystalspeed}{8 * DesiredBaud} - 1 \qquad speed = \frac{16,000,000}{8 * 13,500} - 1$$

$$speed = 148.15 - 1 \qquad speed = 147.15$$

- **LSB** = 0x93 (rounded)
- **MSB** = 0x00
- Intended Baud Rate: 13,500 baud Actual Baud Rate: $\frac{16,000,000}{8(147+1)}$ =13,514 Percent Difference: 0.1%

**NOTES**

- Results from the formula are rounded down to the nearest whole number (i.e 73.07 = 73).
- This formula becomes less acurate as baud rates increase, due to rounding.
- Place the speed result backwards into the formula to receive the actual baud rate. ($Baud = \frac{CrystalSpeed}{8(speed+1)}$)
- The actual baud rate must be within 3% of the intended baud rate for the device to communicate.

# 5 Fonts

## 5.1 Introduction

The GLK19264-7T-1U comes loaded with the 'Small Filled' and 'Futura Bk BT 16' fonts by default. However, it is capable of displaying any font that is uploaded to it in the correct format. MOGD# provides a simple method of generating font files from your installed fonts. For instructions on how to install MOGD# see ***Section 1.5.1 on page 5***.

### 5.1.1 Font File Format

A font file consists of three parts, a header, a character table and bitmap data.

1. Header (4 bytes)
   (a) Nominal Width (1 byte)

(b) Height (1 byte)
(c) ASCII Start Value (1 byte)
(d) ASCII End Value (1 byte)

2. Character Table (3 bytes for every character between the ASCII Start and End values inclusive)

   (a) High Offset MSB (1 byte)
   (b) Low Offset LSB(1 byte)
   (c) Character Width (1 byte)

3. Bitmap Data

### 5.1.2 Creating a Font

The following is an example of how to create a font file for the letters *h*, *i* and *j*.

First you must create the bitmaps containing the character data in bitmap form. ***Figure 21*** below illustrates the bit pattern for the *h*, *i* and *j* bitmap data.

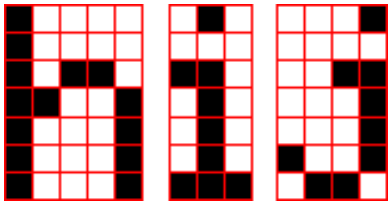


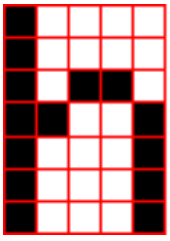
Figure 21: Bitmaps for h, i, and j

Second you may begin to create the font file starting with the header. The header will contain the nominal width, the height and the ASCII start and end values inclusive that you wish to create characters for.

Table 8: Font File Header

| Nominal Width | Height | ASCII Start Val | ASCII End Val |
|---|---|---|---|
| 0x05 | 0x07 | 0x68 | 0x6A |

Next we will have to find out how many bytes each character will use up, in order to create the character table. The bitmaps are encoded horizontally and may have variable widths, *h* has a width of five, *i* a width of three and *j* a width of four, see the figure below for an example of encoding the first letter *h:*



| Bitmap Data | | | | | Byte | Hex Value |
|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | | |
| 1 | 0 | 0 | 0 | 0 | 10000100 | 0x84 |
| 1 | 0 | 1 | 1 | 0 | 00101101 | 0x2D |
| 1 | 1 | 0 | 0 | 1 | 10011000 | 0x98 |
| 1 | 0 | 0 | 0 | 1 | 11000110 | 0xC6 |
| 1 | 0 | 0 | 0 | 1 | 00100000 | 0x20 |
| 1 | 0 | 0 | 0 | 1 | | |

Figure 22: Bitmap Encoding

As you can see the letter *h* will take up five bytes with the last five bits being zero padded to form a full byte. So if you continue the process you will get the character data as seen in ***table 5.1.2***.

Character Data

| | Character Data | | | | | Byte Size (*For Reference*) |
|---|---|---|---|---|---|---|
| ***h*** | 0x84 | 0x2D | 0x98 | 0xC6 | 0x20 | 0x05 |
| ***i*** | 0x43 | 0x24 | 0x84 | | | 0x03 |
| ***j*** | 0x2D | 0x98 | 0x19 | 0x60 | | 0x04 |

The second part of the font file is the character table. The character table is comprised of three bytes for every glyph in the font file.

The first two bytes represents the position, in bytes, of the glyph stored MSB LSB referenced from the beginning of the file (including the header. The third byte is the width of the glyph in pixels. So because there will be 0x09 bytes in the character table (three bytes for each glyph) and four bytes in the header section, the first entry in the table will be 13, or 0x00 0x0D in hexadecimal, and 0x05 for the width.

To calculate the second entry in the character table, representing the position and width of the second glyph, take the offset of the first entry and add the size of the first bitmap in bytes. Since the first glyph occupies 0x05 bytes as seen in table 5.1.2 above, and the offset is 0x00 0x0D, the offset of the second entry will be 0x00 0x12 and the width of the glyph is 0x03.

Calculate the third entry the same way as the second to get ***table 9*** below.

Table 9: Character Table

| | High Offset (MSB) | Low Offset (LSB) | Character Width |
|---|---|---|---|
| ***h*** | 0x00 | 0x0D | 0x05 |
| ***i*** | 0x00 | 0x12 | 0x03 |
| ***j*** | 0x00 | 0x15 | 0x04 |

Once completed, place the character table after the header and the character data aat the end, as seen in ***table 10***.

Table 10: Sample Font File

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0x05 | 0x07 | 0x68 | 0x6A | 0x00 | 0x0D | 0x05 | 0x00 |
| 0x12 | 0x03 | 0x00 | 0x15 | 0x04 | 0x84 | 0x2D | 0x98 |
| 0xC6 | 0x20 | 0x43 | 0x24 | 0x84 | 0x2D | 0x98 | 0x19 |
| 0x60 | | | | | | | |

Red = **Header**
Blue = **Character Table**
Purple = **Character Data**

## 5.2 Uploading a Font File

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0x24 [refID] [size] [data] |
| Decimal | 254 36 [refID] [size] [data] |
| ASCII | 254 “$” [refID] [size] [data] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| refID | 1 | A unique font identification number. |
| size | 2 | Font file size (LSB to MSB). |
| data | x | Font file data. |

Description

In order to upload a font to the GLK19264-7T-1U you must first initiate the upload font file command (0xFE 0x24), you must then pass it a reference identification number, which must be unique for every font on the display module. You may then pass the display module the two byte file size, which needs to be transfered LSB, then MSB. The last part of uploading a font is transmitting the font file data.
For detailed instructions on uploading a file to the GLK19264-7T-1U see ***Section 12 on page 44***.

**NOTE** This command is available but not supported in $I^2C$.

Remembered

Always

## 5.3 Setting the Current Font

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0x31 [refID] |
| Decimal | 254 49 [refID] |
| ASCII | 254 “1” [refID] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| refID | 1 | A unique font identification number. |

Description

In order to set the font on the GLK19264-7T-1U you must know the font identification number of the font that you wish to use. The font ID is established when the font is saved to the display. The default installed fonts are “Small Filled” and “Futura Bk BT 16” and their font ID’s are 0x01 and 0x02 respectfully, with “Small Filled” being the default selected font.
Once you are aware of the font ID for the font that you wish you use, simply send the command bytes (0xFE 0x31) and then send the font ID corresponding to the font. A directory listing of the contents of the entire filesystem may be obtained by using the “Get Filesystem Directory” command, see Section 12.5 on page 49 for more detailed information.

Remembered

Yes

## 5.4 Font Metrics

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0x32 [lm] [tm] [csp] [lsp] [srow] |
| Decimal | 254 50 [lm] [tm] [csp] [lsp] [srow] |
| ASCII | 254 “2” [lm] [tm] [csp] [lsp] [srow] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| lm | 1 | Left margin: Location in pixels. |
| tm | 1 | Top margin: Location in pixels. |
| csp | 1 | Character Spacing: Amount of space in pixels between characters. |
| lsp | 1 | Line Spacing: Amount of space between lines in pixels. |
| srow | 1 | Scroll Row: The Y location of the last row in pixels. |

Description

Font metrics define where the characters are positioned on the screen, by setting where the rows and columns begin based on the [lm][tm][csp][lsp][srow] parameters. [lm] defines the leftmost position and [tm] the topmost. [csp] controls the amount of pixels that are placed in between characters and [lsp] controls the amount of pixels that are placed in between lines. [srow] is the location of the top of the last row that will be displayed on the GLK19264-7T-1U. It defines the row that, when filled, will cause the display to auto scroll if auto scrolling is enabled. The font metrics will have to be reconfigured after changing to a different font.

Remembered

Yes

## 5.5 Set Box Space Mode

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0xAC [value] |
| Decimal | 254 172 [value] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| value | 1 | Value (0: Off, 1: On) |

Description

This command will toggle the box space mode. Box space mode is when a box, the size of the character to be written, is printed to the display before a character is written.

Remembered

Yes

Default

On

# 6 Text

## 6.1 Introduction

The GLK19264-7T-1U is an intelligent display module, designed to reduce the amount of code necessary to begin displaying data. This means that it is able to display all ASCII formated characters and strings that are sent to it, which are defined in the current character set. The display module will begin displaying text at the top left corner of the display area, known as home, and continue to print to the display as if it was a page on a typewriter. When the text reaches the bottom right row, it is able to automatically scroll all of the lines up and continue to display text, with the auto scroll option set to on.

### 6.1.1 Character Set

The graphic displays such as the GLK19264-7T-1U, do not have built in character sets. Instead fonts are uploaded to the display using the commands detailed in Section 5 on page 19.

### 6.1.2 Control Characters

In addition to a full text set, the GLK19264-7T-1U display supports the following ASCII Control characters:

**0x0A** Line feed / New line - when this value is not defined in the font file. This command will create a new line on the display. If scrolling is on and the display is at the bottom of the screen, the whole screen is scrolled up.

## 6.2 Move Cursor Home

| | | |
|---|---|---|
| Syntax | Hexadecimal | 0xFE 0x48 |
| | Decimal | 254 72 |
| | ASCII | 254 “H” |
| Description | This command moves the text insertion point to the top left of the display area (Row 1, Column 1). | |
| Remembered | No | |

## 6.3 Setting the Cursor Position

| | | |
|---|---|---|
| Syntax | Hexadecimal | 0xFE 0x47 [col] [row] |
| | Decimal | 254 71 [col] [row] |
| | ASCII | 254 “G” [col] [row] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| col | 1 | Column |
| row | 1 | Row |

Description: This command sets the text insertion point to the [col] and [row] specified. The insertion point is positioned using the base size of the current font (this command does not position the insertion point at a specific pixel). The column used is determined by multiplying the width of the widest character in the font by the [column]. The row used is determined by multiplying the height of the font by [row + Metrics: line spacing].

Remembered: No

## 6.4 Setting the Cursor Coordinate

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0x79 [x] [y] |
| Decimal | 254 121 [x] [y] |
| ASCII | 254 “y” [x] [y] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| x | 1 | The horizontal position in pixels. |
| y | 1 | The vertical position in pixels. |

Description: This command positions the insertion point at a specific pixel (X,Y), which references the top left corner of the font insertion point.

Remembered: No

## 6.5 Auto Scroll On

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0x51 |
| Decimal | 254 81 |
| ASCII | 254 “Q” |

Description: When auto scrolling is on, it causes the display to shift the entire display’s contents up to make room for a new line of text when the text reaches the end of the scroll row defined in the font metrics (the bottom right character position) see ***Section 5.4 on page 23***.

Remembered: Yes
Default: On

## 6.6 Auto Scroll Off

| | | |
|---|---|---|
| Syntax | Hexadecimal | 0xFE 0x52 |
| | Decimal | 254 82 |
| | ASCII | 254 “R” |
| Description | When auto scrolling is disabled, text will wrap to the top left corner of the display area when the text reaches the end of the scroll row defined in the font metrics (the bottom right character position) see ***Section 5.4 on page 23***. Existing text in the display area is not erased before new text is placed. A series of spaces followed by a “Cursor Home” command may be used to erase the top line of text. | |
| Remembered | Yes | |

# 7 Bitmaps

## 7.1 Introduction

One of the main features of the GLK19264-7T-1U is its ability to display bitmap images, that are either loaded onto its on board memory, or written directly to the screen. This chapter will cover creating a bitmap, uploading the bitmap, as well as drawing the bitmap from memory and directly.

## 7.2 Uploading a Bitmap File

| | | |
|---|---|---|
| Syntax | Hexadecimal | 0xFE 0x5E [refID] [size] [data] |
| | Decimal | 254 94 [refID] [size] [data] |
| | ASCII | 254 “^” [refID] [size] [data] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| refID | 1 | A unique bitmap identification number. |
| size | 2 | Bitmap file size (LSB to MSB). |
| data | x | Bitmap data. |

Description

The GLK19264-7T-1U is capable of storing 128 font and bitmap files up to 16 Kbytes total. In order to upload a bitmap to the GLK19264-7T-1U you must first initiate the upload font file command (0xFE 0x5E), you must then pass it a reference identification number, which must be unique for every font on the display module. You may then pass the display module the two byte file system size, which needs to be transfered LSB, then MSB. This is almost always the entire 16kB, meaning the values 0x00 0x40 0x00 0x00 must be issued. The last part of uploading a bitmap is transmitting the bitmap file data.
For detailed instructions on uploading a file to the GLK19264-7T-1U see ***Section 12 on page 44***.

**NOTE** This command is available but not not supported in $I^2C$.

Remembered

Always

## 7.3 Drawing a Bitmap from Memory

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0x62 [refID] [X] [Y] |
| Decimal | 254 98 [refID] [X] [Y] |
| ASCII | 254 “b” [refID] [X] [Y] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| refID | 1 | The bitmap identification number. |
| X | 1 | Left bounds. |
| Y | 1 | Top bounds. |

Description

This command will draw a bitmap that is located in the on board memory. The bitmap is referenced by the bitmaps reference identification number, which is established when the bitmap is uploaded to the display module. The bitmap will be drawn beginning at the top left, from the specified X,Y coordinates. A directory listing of the contents of the entire filesystem may be obtained by using the “Get Filesystem Directory” command, see Section 12.5 on page 49 for more detailed information.

Remembered

No

## 7.4 Drawing a Bitmap Directly

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0x64 [X] [Y] [W] [H] [D] |
| Decimal | 254 100 [X] [Y] [W] [H] [D] |
| ASCII | 254 “d” [X] [Y] [W] [H] [D] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| X | 1 | Left bounds. |
| Y | 1 | Top bounds. |
| W | 1 | Width |
| H | 1 | Height |
| D | (width*height)/8 | Data |

Description

Drawing a bitmap to the GLK19264-7T-1U, without first uploading the image to the memory can be a very useful feature for drawing images that are not used very often. In order to accomplish this, you must supply the display module with the X,Y coordinates, representing the top left corner of where you would like to draw the bitmap on the screen, as well as the width and the height of the bitmap. After you have supplied this data you may then upload the bitmap data to the GLK19264-7T-1U. The length of this file is the bitmap width multiplied by height, divided by eight. The bitmap data is encoded into bytes horizontally and is transfered the same as if you were uploading a file, see ***Section 12 on page 44*** for more information about transferring data to the display module.

**NOTE** Drawing a bitmap directly to the display is supported by flow control. This command is available but not support in $I^2C$ mode.

Remembered

No

# 8 Bar Graphs and Drawing

## 8.1 Introduction

Supplementary to the ability of the GLK19264-7T-1U to display bitmaps and fonts, the GLK19264-7T-1U also allows for a robust 2D drawing environment. With the ability to draw by pixel, line or rectangle, as well as the ability to continue a line to form a polygon, we are certain that you will spend less time, developing and creating better looking projects. With the addition of custom bar and strip graphs, you are sure to find the right tools to make any graphical layout a success.

## 8.2 Set Drawing Color

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0x63 [color] |
| Decimal | 254 99 [color] |
| ASCII | 254 “c” [color] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| color | 1 | Drawing color (0: White, 1-255: Black). |

Description This command sets the drawing color for subsequent graphic commands that do not have the drawing color passed as a parameter. The parameter [color] is the value of the color where white is 0 and black is 1-255.

Remembered No

## 8.3 Draw Pixel

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0x70 [x] [y] |
| Decimal | 254 112 [x] [y] |
| ASCII | 254 “p” [x] [y] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| x | 1 | X screen location. |
| y | 1 | Y screen location. |

Description This command will draw a pixel at (x,y) using the current drawing color. The unit processes these requests fast enough to keep up with a steady stream at 115 Kbps so flow control is not required.

Remembered No

## 8.4 Drawing a Line

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0x6C [x1] [y1] [x2] [y2] |
| Decimal | 254 108 [x1] [y1] [x2] [y2] |
| ASCII | 254 “l” [x1] [y1] [x2] [y2] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| x1 | 1 | Left bounds. |
| y1 | 1 | Top Bounds. |
| x2 | 1 | Right Bounds. |
| y2 | 1 | Bottom Bounds. |

Description This command will draw a line from (x1,y1) to (x2,y2) using the current drawing color. Lines may be drawn from any part of the display to any other part. However, it may be important to note that the line may interpolate differently right to left, or left to right. This means that a line drawn in white from right to left may not fully erase the same line drawn in black from left to right.

Remembered No

## 8.5 Continue a Line

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0x65 [x] [y] |
| Decimal | 254 101 [x] [y] |
| ASCII | 254 “e” [x] [y] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| x | 1 | Left bounds. |
| y | 1 | Top Bounds. |

Description

This command will draw a line with the current drawing color from the last line end (x2,y2) to (x,y). This command uses the global drawing color.

Remembered

No

## 8.6 Draw a Rectangle

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0x72 [color] [x1] [y1] [x2] [y2] |
| Decimal | 254 114 [color] [x1] [y1] [x2] [y2] |
| ASCII | 254 “r” [color] [x1] [y1] [x2] [y2] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| color | 1 | Drawing color (0: White, 1-255: Black). |
| x1 | 1 | Left bounds. |
| y1 | 1 | Top Bounds. |
| x2 | 1 | Right Bounds. |
| y2 | 1 | Bottom Bounds. |

Description

This command draws a rectangular box in the specified color (0: White, 1: Black). The top left corner is specified by (x1,y1) and the bottom right corner by (x2,y2).

Remembered

No

## 8.7 Drawing a Solid Rectangle

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0x78 [color] [x1] [y1] [x2] [y2] |
| Decimal | 254 120 [color] [x1] [y1] [x2] [y2] |
| ASCII | 254 “x” [color] [x1] [y1] [x2] [y2] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| color | 1 | Drawing color (0: White, 1-255: Black). |
| x1 | 1 | Left bounds. |
| y1 | 1 | Top Bounds. |
| x2 | 1 | Right Bounds. |
| y2 | 1 | Bottom Bounds. |

Description This command draws a solid rectangle in the specified color (0: White, 1: Black). The top left corner is specified by (x1,y1) and the bottom right corner by (x2,y2). Since this command involves considerable processing overhead, we strongly recommend the use of flow control, particularly if the command is to be repeated frequently.

Remembered No

## 8.8 Initializing a Bar Graph

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0x67 [refID] [type] [x1] [y1] [x2] [y2] |
| Decimal | 254 103 [refID] [type] [x1] [y1] [x2] [y2] |
| ASCII | 254 “g” [refID] [type] [x1] [y1] [x2] [y2] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| refID | 1 | Reference number |
| type | 1 | Type of bar graph. |
| x1 | 1 | Left bounds. |
| y1 | 1 | Top Bounds. |
| x2 | 1 | Right Bounds. |
| y2 | 1 | Bottom Bounds. |

Description This command initializes a bar graph referred to by number [reference number] of type [type] with size from (x1,y1) (top left) to (x2,y2) (bottom right). A maximum of 16 bar graphs with reference numbers from 0 to 15 can be initialized as:

| [type] | Direction | Bar Start Point |
|---|---|---|
| **0** | Vertical | Bottom |
| **1** | Horizontal | Left |
| **2** | Vertical | Top |
| **3** | Horizontal | Right |

The bar graphs may be located anywhere on the display, but if they overlap, they will not display properly.
It is important that [x1] is less than [x2], and [y1] is less than [y2]. This command doesn’t actually draw the graph, it must be filled in using the Fill Bar Graph command. The unit saves time by only drawing that part of the bar graph which has changed from the last write, so the representation on the screen may not survive a screen clear or other corrupting action. A write of value zero, followed by new values will restore the proper look of the bar graph.

Remembered No

## 8.9 Drawing a Bar Graph

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0x69 [ref] [value] |
| Decimal | 254 105 [ref] [value] |
| ASCII | 254 “i” [ref] [value] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| ref | 1 | Initialized bar graph reference number. |
| value | 1 | The number of pixels to fill. |

Description

Once the bar graph has been initialized it can be filled in using this command. This command sets the bar graph specified by the [ref] number to fill in [value]. [value] is given in pixels and should not exceed the available height/width of the graph. (If it does the graph will simply be written to its maximum size.)

Remembered

No

## 8.10 Initializing a Strip Chart

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0x6A [refID] [x1] [y1] [x2] [y2] |
| Decimal | 254 106 [refID] [x1] [y1] [x2] [y2] |
| ASCII | 254 “j” [refID] [x1] [y1] [x2] [y2] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| refID | 1 | Reference number |
| x1 | 1 | Left bounds. |
| y1 | 1 | Top Bounds. |
| x2 | 1 | Right Bounds. |
| y2 | 1 | Bottom Bounds. |

Description

A strip chart is an area of the screen reserved for horizontal scrolling. This is normally used as follows:

- Initialize the strip chart, which reserves the appropriate area of the screen.
- Draw a line segment at the right or left side of the strip chart.
- Shift the strip chart to the right or left.
- Draw the next line segment.
- Used this way the strip chart can produce a graph which scrolls smoothly horizontally in either direction. With text the strip chart can produce a marquis effect.

**NOTE** If the strip chart is used with text we recommend the use of a 6 or 7 pixel wide fixed width character set, with each character placed 8 pixels from the start of the previous one.

Up to 7 strip charts ([ref] = 0 - 6) may be defined. To initialize a strip chart the user must define an area on the display in which to place the strip chart.(x1,y1) is the top left corner of the area to be used, where [x1] is the placement of the column where the strip chart is to begin and [y1] is the row. The user must then define [x2] as the bottom right column of the area to be utilized and [y2] as the bottom right row.

**NOTE** The definition of x must lie on byte boundaries. That is, x must be defined as 0x00, 0x08, 0x10, etc. This restriction does not apply to y values.

Remembered

No

## 8.11 Shifting a Strip Chart

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0x6B [ref] |
| Decimal | 254 107 [ref] |
| ASCII | 254 “k” [ref] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| ref | 1 | Reference number of a strip chart that has already been created. |

| | |
|---|---|
| Description | This command shifts the strip chart left or right. [ref] determines both which strip chart is used and which direction it will shift. The direction is selected by the most significant bit (MSB):<br><br>• MSB: 0 shifts left<br>• MSB: 1 shifts right<br><br>For example if [ref] is 1:<br><br>• 254 107 1 (hex FE 6B 01) shifts left<br>• 254 107 129 (hex FE 6B 81) shifts right<br><br>This command shifts the contents of the area defined in the Initialize Strip Chart command 8 pixels at a time. |
| Remembered | No |

# 9 General Purpose Output

## 9.1 Introduction

The GLK19264-7T-1U has 6 General purpose outputs which are connected to 3 tri-colour LEDs. The LEDs consist of red, green and orange-yellow colours. The LEDs are hence software controlled with functions to turn them on/off. A pair of GPOs control one LED. GPO1 and GPO2 control LED1, GPO3 and GPO4 control LED2 and GPO5 and GPO6 control LED3. The tables below illustrate the relation. “0” is off, “1” is on. For example to turn the LED 1 to green GPO1 must be turned on and GPO2 must be turned off.

Figure 23: GLK19264-7T-1U LEDs

Table 33: LED 1 - top

| | GPO2 | GPO1 |
|---|---|---|
| Yellow | 0 | 0 |
| Green | 0 | 1 |
| Red | 1 | 0 |
| Off | 1 | 1 |

Table 34: LED 2 - middle

| | GPO4 | GPO3 |
|---|---|---|
| Yellow | 0 | 0 |
| Green | 0 | 1 |
| Red | 1 | 0 |
| Off | 1 | 1 |

Table 35: LED 3 - bottom

| | GPO6 | GPO5 |
|---|---|---|
| Yellow | 0 | 0 |
| Green | 0 | 1 |
| Red | 1 | 0 |
| Off | 1 | 1 |

## 9.2 General Purpose Output Off

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0x56 [Num] |
| Decimal | 254 86 [Num] |
| ASCII | 254 “V” [Num] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| Num | 1 | GPO number. |

Description

This command turns OFF general purpose output [num].

**NOTE** OFF means that the output is pulled LOW.

Remembered

Yes

## 9.3 General Purpose Output On

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0x57 [Num] |
| Decimal | 254 87 [Num] |
| ASCII | 254 “W” [Num] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| Num | 1 | GPO number. |

Description

This command turns ON general purpose output [num]. The standard GPO’s on the GLK19264-7T-1U output 20mA of current at 5V.

**NOTE** ON means the output is pulled HIGH.

Remembered

Yes

## 9.4 Set Startup GPO state

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0xC3 [Num] [state] |
| Decimal | 254 195 [Num] [state] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| Num | 1 | GPO number. |
| state | 1 | Startup state (0: Off, 1: On) |

Description

This command will set the startup state for the GPO on the next power up. A value of one will cause the GPO to be off on the next startup while a value of one will cause the GPO to be on.

**NOTE** This command does not affect the current state of the GPO.

Remembered

Always

# 10 Keypad

## 10.1 Introduction

The GLK19264-7T-1Usupports up to a 7 Key, matrix style, embedded keypad and may be configured to allow key presses to be automatically transmitted via RS-232 or polled through $I^2C$. The GLK19264-7T-1U also allows for auto-repeating key presses. The keypad is scanned whenever a key is pressed;there is no continuous key scan. This means that key presses are dealt with immediately without any appreciable latency. This also prevents electrical noise which is often caused by continuous key scans.

The keypad is tactile with seven keys. The value of each key is listed in the table below.

Table 39: Keypad Values

| | |
|---|---|
| up arrow | 0x42 |
| down arrow | 0x48 |
| left arrow | 0x44 |
| right arrow | 0x43 |
| center | 0x45 |
| top left | 0x41 |
| bottom left | 0x47 |

**NOTE** Please note that keypads may be laid out in a different pattern. If this is the case, the user will need to interpret the key codes differently. Also included are two extra pins on each end of the connector to be used for ground strapping. This can be used in conjunction with your keypad if a ground strap connection is required or if a common ground connection is needed.

## 10.2 Auto Transmit Key Presses On

| | | |
|---|---|---|
| Syntax | Hexadecimal | 0xFE 0x41 |
| | Decimal | 254 65 |
| | ASCII | 254 “A” |
| Description | In this mode, all key presses are sent immediately to the host system without the use of the poll keypad command. This is the default mode on power up. | |
| Remembered | Yes | |
| Default | On | |

## 10.3 Auto Transmit Key Presses Off

| | | |
|---|---|---|
| Syntax | Hexadecimal | 0xFE 0x4F |
| | Decimal | 254 79 |
| | ASCII | 254 “O” |
| Description | In this mode, up to 10 key presses are buffered until the unit is polled by the host system, via the poll keypad command 254 38. Issuing this command places the unit in polled mode. | |
| Remembered | Yes | |

## 10.4 Poll Key Press

| | | |
|---|---|---|
| Syntax | Hexadecimal | 0xFE 0x26 |
| | Decimal | 254 38 |
| | ASCII | 254 “&” |

Description: This command returns any buffered key presses via the serial interface. The host system must be set up to receive key codes. When the display receives this command, it will immediately return any buffered key presses which may have not been read already. If there is more than one key press buffered, then the high order bit (MSB) of the returned key code will be set (1). If this is the only buffered key press, then the MSB will be cleared (0). If there are no buffered key presses, then the returned code will be 0x00. Please note that to make use of this command, the “Auto Transmit Key Presses” mode should be off.

Remembered: No

## 10.5 Clear Key Buffer

| | | |
|---|---|---|
| Syntax | Hexadecimal | 0xFE 0x45 |
| | Decimal | 254 69 |
| | ASCII | 254 “E” |

Description: This command clears any unread key presses. In a menu application, if the user presses a key which changes the menu context, any following key presses may be inaccurate and can be cleared out of the buffer between menu changes to prevent jumping around the menu tree. It may also be used, in effect, to reset the keypad in case the host application resets for whatever reason.

Remembered: No

## 10.6 Set Debounce Time

| | | |
|---|---|---|
| Syntax | Hexadecimal | 0xFE 0x55 [time] |
| | Decimal | 254 85 [time] |
| | ASCII | 254 “U” [time] |

Parameters:

| Parameter | Length | Description |
|---|---|---|
| time | 1 | Debounce time in increments of 6.554ms (0 - 255). |

Description This command sets the time between key press and key read. All key types with the exception of latched piezo switches will 'bounce' for a varying time, depending on their physical characteristics. The [time] value is in increments of 6.554ms. The default debounce time for the module is 8 (about 52ms), which is adequate for most membrane keypads.

Remembered Yes
Default 8

## 10.7 Set Auto Repeat Mode

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0x7E [mode] |
| Decimal | 254 126 [mode] |
| ASCII | 254 "~" [mode] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| mode | 1 | Auto Repeat Mode (0: Resend Key , 1: Key Up/Down) |

Description Two auto repeat modes are available and are set via the same command:

- **Resend Key Mode:** 0x00
- **Key Up/Down Mode:** 0x01

**Resend Key Mode** This mode is similar to the action of a keyboard on a PC. In this mode, when a key is held down, the key code is transmitted immediately followed by a 1/2 second delay. After this delay, key codes will be sent via the RS-232 interface at a rate of about 5 codes per second. This mode has no effect if polling or if using the $I^2C$ interface.

**Key Up/Down Mode** This mode may be used when the typematic parameters of the "Resend Key Code" mode are unacceptable or if the unit is being operated in polled mode. The host system detects the press of a key and simulates an auto repeat inside the host system until the key release is detected. In this mode, when a key is held down, the key code is transmitted immediately and no other codes will be sent until the key is released. On the release of the key, the key release code transmitted will be a value equal to the key down code plus 20 hex.

Remembered Yes

Examples

When the key code associated with key 'P' (0x50) is pressed, the release code is 'p' (0x70). In RS-232 polled mode or via the $I^2C$, the "Key Down / Key Up" codes are used; however, the user should be careful of timing details. If the poll rate is slower than the simulated auto-repeat it is possible that polling for a key up code will be delayed long enough for an unwanted key repeat to be generated.

## 10.8 Auto Repeat Mode Off

| | | |
|---|---|---|
| Syntax | Hexadecimal | 0xFE 0x60 |
| | Decimal | 254 96 |
| | ASCII | 254 "`" |
| Description | This command turns auto repeat mode off. See Set Auto Repeat Mode. | |
| Remembered | No | |

## 10.9 Assign Keypad Codes

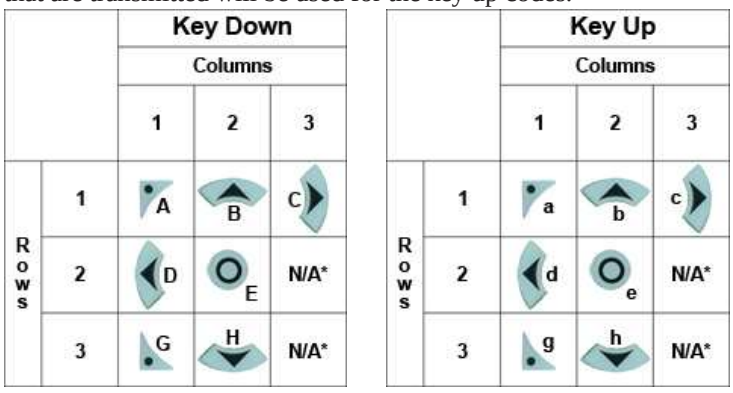
| | | |
|---|---|---|
| Syntax | Hexadecimal | 0xFE 0xD5 [KDown] [KUp] |
| | Decimal | 254 213 [KDown] [KUp] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| KDown | 9 | Key down codes |
| KUp | 9 | Key up codes |

Description

This command will allow you to reassign the key codes that correspond to the key presses on the matrix style key pad. The first 9 bytes that are transmitted will be used for the key down codes and the next 9 bytes that are transmitted will be used for the key up codes.




For the above diagrams the mapping is as follows:
Row 1, Column 1 = byte 1
R1, C2 = byte 2
R1, C3 = byte 3
R2, C1 = byte 4
R2, C2 = byte 5
R2, C3 = byte 6
R3, C1 = byte7
R3, C2 = byte 8
R3, C3 = byte 9

**NOTE** * not mapped to a physical key on the attached keypad.

Remembered

Always

# 11 Display Functions

## 11.1 Introduction

The GLK19264-7T-1U employs software controlled display settings, which allow for control over, clearing the screen, changing the brightness and contrast or setting timers for turning it on or off. The combination of these allow you complete software control over your display's appearance.

## 11.2 Clear Screen

| | | |
|---|---|---|
| Syntax | Hexadecimal | 0xFE 0x58 |
| | Decimal | 254 88 |
| | ASCII | 254 “X” |

Description: This command clears the display and resets the text insertion position to the top left position of the screen defined in the font metrics.

Remembered: No

## 11.3 Display On

| | | |
|---|---|---|
| Syntax | Hexadecimal | 0xFE 0x42 [min] |
| | Decimal | 254 66 [min] |
| | ASCII | 254 “B” [min] |

Parameters:

| Parameter | Length | Description |
|---|---|---|
| min | 1 | Minutes before turning the display on (0 to 90). |

Description: This command turns the backlight on after the [minutes] timer has expired, with a ninety minute maximum timer. A time of 0 specifies that the backlight should turn on immediately and stay on. When this command is sent while the remember function is on, the timer will reset and begin after power up.

Remembered: Yes

Default: 0

## 11.4 Display Off

| | | |
|---|---|---|
| Syntax | Hexadecimal | 0xFE 0x46 |
| | Decimal | 254 70 |
| | ASCII | 254 “F” |

Description: This command turns the backlight off immediately. The backlight will remain off until a ’Display On’ command has been received.

Remembered: Yes

## 11.5 Set Brightness

| | | |
|---|---|---|
| Syntax | Hexadecimal | 0xFE 0x99 [brightness] |
| | Decimal | 254 153 [brightness] |

Parameters:

| Parameter | Length | Description |
|---|---|---|
| brightness | 1 | Display brightness setting (0 to 255). |

Description This command sets the display [brightness]. If the remember function is on, this command acts the same as 'Set and Save Brightness'.

Remembered Yes
Default 255

## 11.6 Set and Save Brightness

Syntax
| | |
|---|---|
| Hexadecimal | 0xFE 0x98 [brightness] |
| Decimal | 254 152 [brightness] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| brightness | 1 | Backlight setting (0 to 255). |

Description This command sets and saves the display [brightness] as default.

Remembered Always

## 11.7 Set Contrast

Syntax
| | |
|---|---|
| Hexadecimal | 0xFE 0x50 [contrast] |
| Decimal | 254 80 [contrast] |
| ASCII | 254 "P" [contrast] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| contrast | 1 | Contrast value (0 to 255). |

Description This command sets the display's contrast to [contrast], where [contrast] is a value between 0x00 and 0xFF (between 0 to 255). Lower values cause 'on' elements in the display area to appear lighter, while higher values cause 'on' elements to appear darker. Lighting and temperature conditions will affect the actual value used for optimal viewing. Individual display modules will also differ slightly from each other in appearance. In addition, values for optimal viewing while the display backlight is on may differ from values used when backlight is off.
This command does not save the [contrast] value, and is lost after power down; but this command has the option of remembering the settings when issued with the Remember function 'on' . When this is the case, this command is the same as the Set and Save Contrast command.

**NOTE** This command has only 32 levels for X-Board based displays, meaning eight contrast settings will have the same single effect. Efectively, values 0 through 7, 8 through 15, and so on will result in the same setting.

Remembered Yes
Default 128

## 11.8 Set and Save Contrast

Syntax
Hexadecimal 0xFE 0x91 [contrast]
Decimal 254 145 [contrast]

Parameters

| Parameter | Length | Description |
|---|---|---|
| contrast | 1 | Contrast value (0 to 255). |

Description
This command sets the display's contrast to [contrast], where [contrast] is a value between 0x00 and 0xFF (between 0 to 255). Lower values cause 'on' elements in the display area to appear lighter, while higher values cause 'on' elements to appear darker. Lighting conditions will affect the actual value used for optimal viewing. Individual display modules will also differ slightly from each other in appearance. In addition, values for optimal viewing while the display backlight is on may differ from values used when backlight is off.

**NOTE** This command saves the [contrast] value so that it is not lost after power down.

Remembered Yes
Default 128

# 12 Filesystem

## 12.1 Introduction

The GLK19264-7T-1U incorporates a 16 Kbyte on board flash memory in order to allow up to 128 font and bitmap files to be transfered directly onto the display and recalled whenever necessary. The filesystem can address font and bitmap files combined up to 16 Kbytes. It is recommended that fonts and bitmaps are uploaded when possible all together after a filesystem wipe ro preserve memory integrity. These fonts and bitmaps can then be locked to ensure they remain intact. This section covers uploading, downloading, deleting and moving files, as well as getting the remaining space or wiping the filesystem.

### 12.1.1 File Upload Protocol

In order to allow fonts and bitmaps to be uploaded to the on board flash memory Matrix Orbital has developed a simple protocol that supports RS-232/TTL or $I^2C$ communications. In order to begin a file transmission the first step will be to provide the display module with the appropriate command bytes, meaning the command prefix, 0xFE, followed by the command number, 0x24 for a font file, or 0x5E for a bitmap file. This will begin the file transfer sequence. The next step will be to request a reference identification number (ref ID) which will allow you to identify the file for future use. Reference ID numbers can be any byte between 0x00 and 0x7F, however each ID must be unique.

The next part of uploading a font file is to provide the display module with the two byte file size of the

| Host | Display | Comments |
|---|---|---|
| 0xFE | | Command Prefix |
| 0x24 | | Upload Font File Command |
| 0x01 | | Reference ID |
| 0x19 | | Size (LSB) |
| 0x00 | | Size (MSB) |
| | 0x01 | Confirmation Byte |
| 0x01 | | Confimation Byte |
| 0x05 | | Font Width |
| | 0x05 | Echo Font Width |
| 0x01 | | Confimation Byte |
| 0x07 | | Font Height |
| | 0x07 | Echo Font Height |
| 0x01 | | Confimation Byte |
| 0x49 | | Font ASCII Start Value |
| | 0x49 | Echo Font ASCII Start Value |
| 0x01 | | Confimation Byte |
| ... | ... | ... |
| 0x60 | | Last Font File Byte |
| | 0x60 | Echo Last Font File Byte |
| 0x01 | | Confirm Upload Finished |

Table 55: Upload Protocol

data that you wish to transfer, LSB to MSB. The LSB must be transmitted first followed by the MSB. After receiving the MSB the display module will send a confirm byte, 0x01, if the file fits and continue, or decline byte, 0x08, and terminate the session.

| Byte | Description |
|---|---|
| 0x01 | Confirm: Will continue the file transfer. |
| 0x08 | Decline: Terminate the session. |

The last part of uploading a font file is to upload the file data. After transmitting each byte of the file the module will echo the byte and wait for a confirmation byte of 0x01 until the file has completed uploading. Below is an example of uploading the font file which we created in ***Section 5.1.2 on page 20***.

At times that the display or the host sees anything else other than 0x01 for confirmation (usually a 0x08) the upload is aborted.

**NOTES**

- The GLK19264-7T-1U has watch dog timer, set to 2.1 seconds in between transmissions, in order prevent the display module from staying in a waiting state.
- Once the timeout has been reached the timer will reset the display and issue a 0xFE 0xD4 response to the host to signal that this has happened.

### 12.1.2 XModem Upload Protocol

In addition to its original simple upload format, Matrix Orbital has added an XModem based protocol. This facilitates much faster download speeds by increasing the packet size from 1 byte to 128 bytes greatly increasing throughput. A two byte CRC check is preformed at the end of each packet in place of the byte echo system seen in the original protocol. However, the overall protocol remains much the same as the original, but much faster.

To begin the upload, a series of command bytes are sent, much like the original protocol. However, no distinction is made between bitmap and font as the XModem protocol is used to upload bin or ebin files that contain all the bitmaps and fonts required for the unit. Once the command bytes are sent, the size of the file is sent in two bytes, least signifcant byte first. Then two additional bytes are sent of the value zero.

At this point the display will respond with an ACK if the file fits, or a NAK otherwise. Please note that these values are different than those of the orignal protocol as seen in the table below. If a NAK is seen at any point by the host, the upload is to be aborted in the same fashion as the regular protocol.

If the file will fit, the start of header byte will be sent by the host, follwed by a block count representing the number of 128 byte blocks remaing to upload in regular and inverted forms. The display will then check to make sure the block count value matches its own before ACKing. The host can then send a 128 byte block of data followed by that blocks high and low CRC16 bytes. The display then preforms a CRC check on the data receive and ACKs if it matches that which was sent. Transfer continues with a block count and continues in this way until the end of file is reached.

Once the end of the upload file is reached, the host should transmit a single end of transmission byte. If the end of file is expected, the display will ACK one last time. This EOT byte along with the other special characters mentioned above is listed in the table below.

| Character | Byte | Description |
|---|---|---|
| ACK | 0x06 | Acknowledged; successful data transmission |
| NAK | 0x21 | Not Acknowledged; transmission unsuccessful, abort upload |
| SOH | 0x01 | Start of Header; begin upload process |
| EOT | 0x04 | End of Transmission; file upload complete |

Below is an example of uploading a bin or ebin file using the XModem protocol.

## 12.2 Wipe Filesystem

| Host | Display | Comments |
|---|---|---|
| 0xFE | | Command Prefix |
| 0xDB | | XModem Upload Command |
| 0x85 | | Command byte 1 |
| 0x06 | | Command byte 2 |
| 0x30 | | Command byte 3 |
| 0x00 | | Size Low Byte |
| 0x40 | | Size High Byte |
| 0x00 | | 0 |
| 0x00 | | 0 |
| | 0x06 | ACK (NAK if file is too big) |
| 0x01 | | Start of Header |
| 0x80 | | Block Count |
| 0x7F | | 255 - Block Count |
| | 0x06 | ACK (NAK if counts don't match) |
| <128 bytes> | | Data Block |
| 0x1E | | CRC High Byte |
| 0x47 | | CRC Low Byte |
| | 0x06 | ACK (NAK if CRCs don't match) |
| 0x7F | | Block Count |
| 0x80 | | 255 - Block Count |
| | 0x06 | ACK (NAKif counts don't match) |
| <128 bytes> | | Data Block |
| 0x5A | | CRC High Byte |
| 0x0D | | CRC Low Byte |
| | 0x06 | ACK (NAKif CRCs don't match) |
| ... | ... | ... |
| 0x04 | | End of Transmission |
| | 0x06 | ACK (NAK if EOT is not expected) |

Table 56: XModem Upload Protocol

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0x21 0x59 0x21 |
| Decimal | 254 33 89 33 |
| ASCII | 254 “!” “Y” “!” |

Description

This command completely erases the display’s non-volatile memory. It removes all fonts, font metrics, bitmaps, and settings (current font, cursor position, communication speed, etc.). It is an “odd” command in that it is three bytes in length in order to prevent accidental execution.

**NOTE** After deleting the file system it is important to cycle power to your display to ensure the removal process is completed.

Remembered

Yes

## 12.3 Deleting a File

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0xAD [type] [refID] |
| Decimal | 254 173 [type] [refID] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| type | 1 | Type of file (0:Font, 1:Bitmap) |
| refID | 1 | Reference ID of the file to delete. |

Description

This command erases a single file at a time within the GLK19264-7T-1U memory when given two parameters: [type] and [refID]. The file type and reference number are defined when the file is saved to the GLK19264-7T-1U.

- [type] = 1: Bitmap
- [type] = 0: Font

**NOTE** After deleting a file it is important to cycle power to your display to ensure file system integrity.

Remembered

Yes

## 12.4 Get Filesystem Space

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0xAF |
| Decimal | 254 175 |

Description

This command will return 4 bytes, LSB to MSB for how many bytes are remaining in the 16 KB on board memory.

Remembered

No

## 12.5 Get Filesystem Directory

Syntax
Hexadecimal 0xFE 0xB3
Decimal 254 179

Description
This command will return a directory of the contents of the file system. The first byte returned will be a hex value representing the number of entries in the filesystem, followed by four bytes for each entry. See the following tables:

| Filesystem Header | |
|---|---|
| Bytes | Description |
| 1 | Hex value representing the number of entries in the filesystem |

| File Entry | |
|---|---|
| Bytes | Description |
| 1 | Flag: Hex value of 0x00 indicates that this file entry has not been used. |
| 1 | FileID/Type: 1st bit is the file type (0: Font, 1: Bitmap). Next 7 bits are the file ID. |
| 1 | File Size: LSB |
| 1 | File Size: MSB |

Remembered
No

## 12.6 Filesystem Upload

Syntax
Hexadecimal 0xFE 0xB0 [Size] [Data]
Decimal 254 176 [Size] [Data]

Parameters

| Parameter | Length | Description |
|---|---|---|
| Size | 4 | LSB to MSB filesystem image data |
| Data | var | Actual data to upload |

Description
This command will upload a filesystem image, LSB to MSB to the display (16KB). The size used is almost always the entire 16kB, meaning the values 0x00 0x40 0x00 0x00 must be issued. Afterwhich the filesystem data can be uploaded LSB to MSB in the same manner as a font or bitmap file.

Remembered
Always

## 12.7 Downloading a File

| | | | |
|---|---|---|---|
| Syntax | Hexadecimal | 0xFE 0xB2 [Type] [refID] | |
| | Decimal | 254 178 [Type] [refID] | |
| Parameters | Parameter | Length | Description |
| | Type | 1 | File type (0:Font File, 1:Bitmap) |
| | refID | 1 | Reference ID number |
| Description | Download a specified file from the filesystem. The first 4 bytes will be the length of the file (LSB to MSB) followed by 2 bytes representing the width and height of the image then the data contained in the file. | | |
| Remembered | No | | |

## 12.8 Moving a File

| | | | |
|---|---|---|---|
| Syntax | Hexadecimal | 0xFE 0xB4 [oldT] [oldID] [newT] [newID] | |
| | Decimal | 254 180 [oldT] [oldID] [newT] [newID] | |
| Parameters | Parameter | Length | Description |
| | oldT | 1 | Old file type |
| | oldID | 1 | Old file ID |
| | newT | 1 | New file type |
| | newID | 1 | New file ID |
| Description | This command can be used to move a file to a new file ID, or correct the type of a file that was uploaded incorrectly. The command first checks to see if there is a file identified by [oldT] and [oldID]. If it does exist, and there is no file already with the desired type and ID, the ID and type of the old file will be changed to [newT] and [newID] respectively. | | |
| Remembered | Always | | |

# 13 Data Security

## 13.1 Introduction

Ensuring that your GLK19264-7T-1U display's exactly what you want it to can be the difference between a projects success and failure. This is why we incorporate features such as Data Lock into the GLK19264-7T-1U With this new feature you now are in control over of how and when settings will be changed so there is no need to worry about the module acting exactly like you expected it to because all the settings may be locked and remembered for the next power up.

## 13.2 Set Remember

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0x93 [switch] |
| Decimal | 254 147 [switch] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| switch | 1 | 0: Do not remember, 1: Remember |

Description

This command allows you to switch the remember function on and off. To use the remember function, set remember to on, then set all of the settings that you wish to save, settings that are listed as 'Remember: Yes' support being saved into the non-volatile memory. After you have set all of the commands that you wish to save, you may then cycle the power and check the display settings to ensure that all the settings have been saved. If you wish to use remember again after cycling the power, you must set it to on again.

**NOTES**

- Writing to non-volatile memory is time consuming and slows down the operation of the display.
- Non-volatile memory has a 'write limit' and may only be changed approximately 100,000 times.

Remembered: No

Default: Do not remember

## 13.3 Data Lock

Syntax

| | |
|---|---|
| Hexadecimal | 0xFE 0xCA 0xF5 0xA0 [level] |
| Decimal | 254 202 245 160 [level] |

Parameters

| Parameter | Length | Description |
|---|---|---|
| level | 1 | Sets the data lock level |

Description

Paranoia allows you to lock the module from displaying information, as well as enables the protection of the filesystem and module settings. Each bit corresponds corresponds to a different lock level, while sending a zero will unlock your display as the following tables explains:

| Bit | Data Lock Level | Description |
|---|---|---|
| 0-2 | Reserved | Should be left 0 |
| 3 | Communication Speed Lock | When this bit is set (1) the Baud Rate and $I^2C$ Slave address are locked |
| 4 | Setting Lock | When this bit is set (1) the display settings such as backlight, contrast and GPO settings are locked. (Internal EEPROM) |
| 5 | Filesystem Lock | When this bit is set (1) the external EEPROM is locked, this has the same effect as the File System Jumper |
| 6 | Command Lock | When this bit is set (1) all commands but commands 202/203 are locked. (cmd lock) |
| 7 | Display Lock | When this bit is set (1) the module is locked from displaying any new information. (text lock) |

**NOTES**

- Sending a new data lock level will override the previous data lock level.
- Data lock levels may be combined.

Remembered Always
Default 0
Examples

| Hex | Dec | Binary | Description |
|---|---|---|---|
| 0x00 | 0 | 0 | Unlock |
| 0x50 | 80 | 01010000 | Setting and Command Lock |

## 13.4 Set and Save Data Lock

| | | |
|---|---|---|
| Syntax | Hexadecimal | 0xFE 0xCB 0xF5 0xA0 [level] |
| | Decimal | 254 203 245 160 [level] |

| Parameters | Parameter | Length | Description |
|---|---|---|---|
| | level | 1 | Sets the data lock level |

Description: This command will set and save the data lock level. See the Data Lock section for more information.

Remembered: Always
Default: 0

## 13.5 Dump the Filesystem

| | | |
|---|---|---|
| Syntax | Hexadecimal | 0xFE 0x30 |
| | Decimal | 254 48 |
| | ASCII | 254 “0” |

Description: This will allow you to dump the filesystem for debugging purposes. It will return a 4 byte value LSB to MSB followed by 16384 bytes making up the file system.

Remembered: No

## 13.6 Write Customer Data

| | | |
|---|---|---|
| Syntax | Hexadecimal | 0xFE 0x34 [data] |
| | Decimal | 254 52 [data] |
| | ASCII | 254 “4” [data] |

| Parameters | Parameter | Length | Description |
|---|---|---|---|
| | data | 16 | Writes the customer data |

Description: Writes the customer Data. 16 Bytes of data can be saved in non-volatile memory.

Remembered: No

## 13.7 Read Customer Data

| | | |
|---|---|---|
| Syntax | Hexadecimal | 0xFE 0x35 |
| | Decimal | 254 53 |
| | ASCII | 254 “5” |

Description Reads whatever was written by Write Customer Data.

Remembered No

# 14 Miscellaneous

## 14.1 Introduction

This chapter covers the 'Report Version Number' and 'Read Module Type' commands. These commands can be particularly useful to find out more information about the display module before contacting technical support.

## 14.2 Read Version Number

Syntax
- Hexadecimal 0xFE 0x36
- Decimal 254 54
- ASCII 254 "6"

Description This command will return a byte representing the version of the module, see the following table as an example:

| Hex Value | Version Number |
|---|---|
| 0x19 | Version 1.9 |
| 0x57 | Version 5.7 |

Remembered No

## 14.3 Read Module Type

Syntax
- Hexadecimal 0xFE 0x37
- Decimal 254 55
- ASCII 254 "7"

Description This command will return a hex value corresponding to the the model number of the module see the following table:

| Hex | Product ID | Hex | Product ID |
|---|---|---|---|
| **1** | LCD0821 | **2** | LCD2021 |
| **5** | LCD2041 | **6** | LCD4021 |
| **7** | LCD4041 | **8** | LK202-25 |
| **9** | LK204-25 | **A** | LK404-55 |
| **B** | VFD2021 | **C** | VFD2041 |
| **D** | VFD4021 | **E** | VK202-25 |
| **F** | VK204-25 | **10** | GLC12232 |
| **13** | GLC24064 | **14** | Unused |
| **15** | GLK24064-25 | **16** | Unused |
| **21** | Unused | **22** | GLK12232-25 |
| **23** | Unused | **24** | GLK12232-25-SM |
| **25** | GLK24064-16-1U-USB | **26** | GLK24064-16-1U |
| **27** | GLK19264-7T-1U-USB | **28** | GLK12232-16 |
| **29** | GLK12232-16-SM | **2A** | GLK19264-7T-1U |
| **2B** | LK204-7T-1U | **2C** | LK204-7T-1U-USB |
| **31** | LK404-AT | **32** | MOS-AV-162A |
| **33** | LK402-12 | **34** | LK162-12 |
| **35** | LK204-25PC | **36** | LK202-24-USB |
| **37** | VK202-24-USB | **38** | LK204-24-USB |
| **39** | VK204-24-USB | **3A** | PK162-12 |
| **3B** | VK162-12 | **3C** | MOS-AP-162A |
| **3D** | PK202-25 | **3E** | MOS-AL-162A |
| **3F** | MOS-AL-202A | **40** | MOS-AV-202A |
| **41** | MOS-AP-202A | **42** | PK202-24-USB |
| **43** | MOS-AL-082 | **44** | MOS-AL-204 |
| **45** | MOS-AV-204 | **46** | MOS-AL-402 |
| **47** | MOS-AV-402 | **48** | LK082-12 |
| **49** | VK402-12 | **4A** | VK404-55 |
| **4B** | LK402-25 | **4C** | VK402-25 |
| **4D** | PK204-25 | **4E** | Unused |
| **4F** | MOS | **50** | MOI |
| **51** | XBoard-S | **52** | XBoard-I |
| **53** | MOU | **54** | XBoard-U |
| **55** | LK202-25-USB | **56** | VK202-25-USB |
| **57** | LK204-25-USB | **58** | VK204-25-USB |
| **5B** | LK162-12-TC | **5C** | Unused |
| **71** | Unused | **72** | GLK240128-25 |
| **73** | LK404-25 | **74** | VK404-25 |
| **77** | Unused | **78** | GLT320240 |
| **79** | GLT480282 | **7A** | GLT240128 |

Remembered No

# 15 Command Summary

## 15.1 Communications

| Description | Syntax | | Page |
|---|---|---|---|
| Turn Flow Control On | Hexadecimal | 0xFE 0x3A [full] [empty] | 16 |
| | Decimal | 254 58 [full] [empty] | |
| | ASCII | 254 ":" [full] [empty] | |
| Turn Flow Control Off | Hexadecimal | 0xFE 0x3B | 16 |
| | Decimal | 254 59 | |
| | ASCII | 254 ";" | |
| Changing the $I^2C$ Slave Address | Hexadecimal | 0xFE 0x33 [adr] | 17 |
| | Decimal | 254 51 [adr] | |
| | ASCII | 254 "3" [adr] | |
| Changing the Baud Rate | Hexadecimal | 0xFE 0x39 [speed] | 17 |
| | Decimal | 254 57 [speed] | |
| | ASCII | 254 "9" [speed] | |
| Setting a Non-Standard Baud Rate | Hexadecimal | 0xFE 0xA4 [speed] | 18 |
| | Decimal | 254 164 [speed] | |

## 15.2 Fonts

| Description | Syntax | | Page |
|---|---|---|---|
| Uploading a Font File | Hexadecimal | 0xFE 0x24 [refID] [size] [data] | 21 |
| | Decimal | 254 36 [refID] [size] [data] | |
| | ASCII | 254 "$" [refID] [size] [data] | |
| Setting the Current Font | Hexadecimal | 0xFE 0x31 [refID] | 22 |
| | Decimal | 254 49 [refID] | |
| | ASCII | 254 "1" [refID] | |
| Font Metrics | Hexadecimal | 0xFE 0x32 [lm] [tm] [csp] [lsp] [srow] | 23 |
| | Decimal | 254 50 [lm] [tm] [csp] [lsp] [srow] | |
| | ASCII | 254 "2" [lm] [tm] [csp] [lsp] [srow] | |
| Set Box Space Mode | Hexadecimal | 0xFE 0xAC [value] | 23 |
| | Decimal | 254 172 [value] | |

## 15.3 Text

| Description | Syntax | | Page |
|---|---|---|---|
| Move Cursor Home | Hexadecimal | 0xFE 0x48 | 24 |
| | Decimal | 254 72 | |
| | ASCII | 254 "H" | |

| Description | Syntax | | Page |
|---|---|---|---|
| Setting the Cursor Position | Hexadecimal | 0xFE 0x47 [col] [row] | 24 |
| | Decimal | 254 71 [col] [row] | |
| | ASCII | 254 “G” [col] [row] | |
| Setting the Cursor Coordinate | Hexadecimal | 0xFE 0x79 [x] [y] | 25 |
| | Decimal | 254 121 [x] [y] | |
| | ASCII | 254 “y” [x] [y] | |
| Auto Scroll On | Hexadecimal | 0xFE 0x51 | 25 |
| | Decimal | 254 81 | |
| | ASCII | 254 “Q” | |
| Auto Scroll Off | Hexadecimal | 0xFE 0x52 | 25 |
| | Decimal | 254 82 | |
| | ASCII | 254 “R” | |

## 15.4 Bitmaps

| Description | Syntax | | Page |
|---|---|---|---|
| Uploading a Bitmap File | Hexadecimal | 0xFE 0x5E [refID] [size] [data] | 26 |
| | Decimal | 254 94 [refID] [size] [data] | |
| | ASCII | 254 “^” [refID] [size] [data] | |
| Drawing a Bitmap from Memory | Hexadecimal | 0xFE 0x62 [refID] [X] [Y] | 27 |
| | Decimal | 254 98 [refID] [X] [Y] | |
| | ASCII | 254 “b” [refID] [X] [Y] | |
| Drawing a Bitmap Directly | Hexadecimal | 0xFE 0x64 [X] [Y] [W] [H] [D] | 27 |
| | Decimal | 254 100 [X] [Y] [W] [H] [D] | |
| | ASCII | 254 “d” [X] [Y] [W] [H] [D] | |

## 15.5 Bar Graphs and Drawing

| Description | Syntax | | Page |
|---|---|---|---|
| Set Drawing Color | Hexadecimal | 0xFE 0x63 [color] | 28 |
| | Decimal | 254 99 [color] | |
| | ASCII | 254 “c” [color] | |
| Draw Pixel | Hexadecimal | 0xFE 0x70 [x] [y] | 29 |
| | Decimal | 254 112 [x] [y] | |
| | ASCII | 254 “p” [x] [y] | |
| Drawing a Line | Hexadecimal | 0xFE 0x6C [x1] [y1] [x2] [y2] | 29 |
| | Decimal | 254 108 [x1] [y1] [x2] [y2] | |
| | ASCII | 254 “l” [x1] [y1] [x2] [y2] | |
| Continue a Line | Hexadecimal | 0xFE 0x65 [x] [y] | 29 |
| | Decimal | 254 101 [x] [y] | |
| | ASCII | 254 “e” [x] [y] | |

| Description | Syntax | | Page |
|---|---|---|---|
| Draw a Rectangle | Hexadecimal | 0xFE 0x72 [color] [x1] [y1] [x2] [y2] | 30 |
| | Decimal | 254 114 [color] [x1] [y1] [x2] [y2] | |
| | ASCII | 254 “r” [color] [x1] [y1] [x2] [y2] | |
| Drawing a Solid Rectangle | Hexadecimal | 0xFE 0x78 [color] [x1] [y1] [x2] [y2] | 30 |
| | Decimal | 254 120 [color] [x1] [y1] [x2] [y2] | |
| | ASCII | 254 “x” [color] [x1] [y1] [x2] [y2] | |
| Initializing a Bar Graph | Hexadecimal | 0xFE 0x67 [refID] [type] [x1] [y1] [x2] [y2] | 31 |
| | Decimal | 254 103 [refID] [type] [x1] [y1] [x2] [y2] | |
| | ASCII | 254 “g” [refID] [type] [x1] [y1] [x2] [y2] | |
| Drawing a Bar Graph | Hexadecimal | 0xFE 0x69 [ref] [value] | 31 |
| | Decimal | 254 105 [ref] [value] | |
| | ASCII | 254 “i” [ref] [value] | |
| Initializing a Strip Chart | Hexadecimal | 0xFE 0x6A [refID] [x1] [y1] [x2] [y2] | 32 |
| | Decimal | 254 106 [refID] [x1] [y1] [x2] [y2] | |
| | ASCII | 254 “j” [refID] [x1] [y1] [x2] [y2] | |
| Shifting a Strip Chart | Hexadecimal | 0xFE 0x6B [ref] | 33 |
| | Decimal | 254 107 [ref] | |
| | ASCII | 254 “k” [ref] | |

## 15.6 General Purpose Output

| Description | Syntax | | Page |
|---|---|---|---|
| General Purpose Output Off | Hexadecimal | 0xFE 0x56 [Num] | 35 |
| | Decimal | 254 86 [Num] | |
| | ASCII | 254 “V” [Num] | |
| General Purpose Output On | Hexadecimal | 0xFE 0x57 [Num] | 36 |
| | Decimal | 254 87 [Num] | |
| | ASCII | 254 “W” [Num] | |
| Set Startup GPO state | Hexadecimal | 0xFE 0xC3 [Num] [state] | 36 |
| | Decimal | 254 195 [Num] [state] | |

## 15.7 Keypad

| Description | Syntax | | Page |
|---|---|---|---|
| Auto Transmit Key Presses On | Hexadecimal | 0xFE 0x41 | 37 |
| | Decimal | 254 65 | |
| | ASCII | 254 “A” | |
| Auto Transmit Key Presses Off | Hexadecimal | 0xFE 0x4F | 37 |
| | Decimal | 254 79 | |
| | ASCII | 254 “O” | |
| Poll Key Press | Hexadecimal | 0xFE 0x26 | 38 |
| | Decimal | 254 38 | |
| | ASCII | 254 “&” | |

| Description | Syntax | | Page |
|---|---|---|---|
| Clear Key Buffer | Hexadecimal | 0xFE 0x45 | 38 |
| | Decimal | 254 69 | |
| | ASCII | 254 “E” | |
| Set Debounce Time | Hexadecimal | 0xFE 0x55 [time] | 38 |
| | Decimal | 254 85 [time] | |
| | ASCII | 254 “U” [time] | |
| Set Auto Repeat Mode | Hexadecimal | 0xFE 0x7E [mode] | 39 |
| | Decimal | 254 126 [mode] | |
| | ASCII | 254 “~” [mode] | |
| Auto Repeat Mode Off | Hexadecimal | 0xFE 0x60 | 40 |
| | Decimal | 254 96 | |
| | ASCII | 254 “‘” | |
| Assign Keypad Codes | Hexadecimal | 0xFE 0xD5 [KDown] [KUp] | 40 |
| | Decimal | 254 213 [KDown] [KUp] | |

## 15.8 Display Functions

| Description | Syntax | | Page |
|---|---|---|---|
| Clear Screen | Hexadecimal | 0xFE 0x58 | 41 |
| | Decimal | 254 88 | |
| | ASCII | 254 “X” | |
| Display On | Hexadecimal | 0xFE 0x42 [min] | 42 |
| | Decimal | 254 66 [min] | |
| | ASCII | 254 “B” [min] | |
| Display Off | Hexadecimal | 0xFE 0x46 | 42 |
| | Decimal | 254 70 | |
| | ASCII | 254 “F” | |
| Set Brightness | Hexadecimal | 0xFE 0x99 [brightness] | 42 |
| | Decimal | 254 153 [brightness] | |
| Set and Save Brightness | Hexadecimal | 0xFE 0x98 [brightness] | 43 |
| | Decimal | 254 152 [brightness] | |
| Set Contrast | Hexadecimal | 0xFE 0x50 [contrast] | 43 |
| | Decimal | 254 80 [contrast] | |
| | ASCII | 254 “P” [contrast] | |
| Set and Save Contrast | Hexadecimal | 0xFE 0x91 [contrast] | 44 |
| | Decimal | 254 145 [contrast] | |

## 15.9 Filesystem

| Description | Syntax | | Page |
|---|---|---|---|
| Wipe Filesystem | Hexadecimal | 0xFE 0x21 0x59 0x21 | 46 |
| | Decimal | 254 33 89 33 | |
| | ASCII | 254 “!” “Y” “!” | |

| Description | Syntax | | Page |
|---|---|---|---|
| Deleting a File | Hexadecimal | 0xFE 0xAD [type] [refID] | 48 |
| | Decimal | 254 173 [type] [refID] | |
| Get Filesystem Space | Hexadecimal | 0xFE 0xAF | 48 |
| | Decimal | 254 175 | |
| Get Filesystem Directory | Hexadecimal | 0xFE 0xB3 | 49 |
| | Decimal | 254 179 | |
| Filesystem Upload | Hexadecimal | 0xFE 0xB0 [Size] [Data] | 49 |
| | Decimal | 254 176 [Size] [Data] | |
| Downloading a File | Hexadecimal | 0xFE 0xB2 [Type] [refID] | 49 |
| | Decimal | 254 178 [Type] [refID] | |
| Moving a File | Hexadecimal | 0xFE 0xB4 [oldT] [oldID] [newT] [newID] | 50 |
| | Decimal | 254 180 [oldT] [oldID] [newT] [newID] | |

## 15.10 Data Security

| Description | Syntax | | Page |
|---|---|---|---|
| Set Remember | Hexadecimal | 0xFE 0x93 [switch] | 51 |
| | Decimal | 254 147 [switch] | |
| Data Lock | Hexadecimal | 0xFE 0xCA 0xF5 0xA0 [level] | 51 |
| | Decimal | 254 202 245 160 [level] | |
| Set and Save Data Lock | Hexadecimal | 0xFE 0xCB 0xF5 0xA0 [level] | 53 |
| | Decimal | 254 203 245 160 [level] | |
| Dump the Filesystem | Hexadecimal | 0xFE 0x30 | 53 |
| | Decimal | 254 48 | |
| | ASCII | 254 “0” | |
| Write Customer Data | Hexadecimal | 0xFE 0x34 [data] | 53 |
| | Decimal | 254 52 [data] | |
| | ASCII | 254 “4” [data] | |
| Read Customer Data | Hexadecimal | 0xFE 0x35 | 53 |
| | Decimal | 254 53 | |
| | ASCII | 254 “5” | |

## 15.11 Miscellaneous

| Description | Syntax | | Page |
|---|---|---|---|
| Read Version Number | Hexadecimal | 0xFE 0x36 | 54 |
| | Decimal | 254 54 | |
| | ASCII | 254 “6” | |
| Read Module Type | Hexadecimal | 0xFE 0x37 | 54 |
| | Decimal | 254 55 | |
| | ASCII | 254 “7” | |

## 15.12 Command By Number

| Command Hex | Description Dec | Page ASCII | | |
|---|---|---|---|---|
| 0x21 | 33 | “!” | Wipe Filesystem | 46 |
| 0x24 | 36 | “$” | Uploading a Font File | 21 |
| 0x26 | 38 | “&” | Poll Key Press | 38 |
| 0x30 | 48 | “0” | Dump the Filesystem | 53 |
| 0x31 | 49 | “1” | Setting the Current Font | 22 |
| 0x32 | 50 | “2” | Font Metrics | 23 |
| 0x33 | 51 | “3” | Changing the $I^2C$ Slave Address | 17 |
| 0x34 | 52 | “4” | Write Customer Data | 53 |
| 0x35 | 53 | “5” | Read Customer Data | 53 |
| 0x36 | 54 | “6” | Read Version Number | 54 |
| 0x37 | 55 | “7” | Read Module Type | 54 |
| 0x39 | 57 | “9” | Changing the Baud Rate | 17 |
| 0x3A | 58 | “:” | Turn Flow Control On | 16 |
| 0x3B | 59 | “;” | Turn Flow Control Off | 16 |
| 0x41 | 65 | “A” | Auto Transmit Key Presses On | 37 |
| 0x42 | 66 | “B” | Display On | 42 |
| 0x45 | 69 | “E” | Clear Key Buffer | 38 |
| 0x46 | 70 | “F” | Display Off | 42 |
| 0x47 | 71 | “G” | Setting the Cursor Position | 24 |
| 0x48 | 72 | “H” | Move Cursor Home | 24 |
| 0x4F | 79 | “O” | Auto Transmit Key Presses Off | 37 |
| 0x50 | 80 | “P” | Set Contrast | 43 |
| 0x51 | 81 | “Q” | Auto Scroll On | 25 |
| 0x52 | 82 | “R” | Auto Scroll Off | 25 |
| 0x55 | 85 | “U” | Set Debounce Time | 38 |
| 0x56 | 86 | “V” | General Purpose Output Off | 35 |
| 0x57 | 87 | “W” | General Purpose Output On | 36 |
| 0x58 | 88 | “X” | Clear Screen | 41 |
| 0x5E | 94 | “^” | Uploading a Bitmap File | 26 |
| 0x60 | 96 | “‘” | Auto Repeat Mode Off | 40 |
| 0x62 | 98 | “b” | Drawing a Bitmap from Memory | 27 |
| 0x63 | 99 | “c” | Set Drawing Color | 28 |
| 0x64 | 100 | “d” | Drawing a Bitmap Directly | 27 |
| 0x65 | 101 | “e” | Continue a Line | 29 |
| 0x67 | 103 | “g” | Initializing a Bar Graph | 31 |
| 0x69 | 105 | “i” | Drawing a Bar Graph | 31 |
| 0x6A | 106 | “j” | Initializing a Strip Chart | 32 |
| 0x6B | 107 | “k” | Shifting a Strip Chart | 33 |
| 0x6C | 108 | “l” | Drawing a Line | 29 |
| 0x70 | 112 | “p” | Draw Pixel | 29 |
| 0x72 | 114 | “r” | Draw a Rectangle | 30 |

| Command Hex | Description Dec | Page ASCII | | |
|---|---|---|---|---|
| 0x78 | 120 | “x” | Drawing a Solid Rectangle | 30 |
| 0x79 | 121 | “y” | Setting the Cursor Coordinate | 25 |
| 0x7E | 126 | “~” | Set Auto Repeat Mode | 39 |
| 0x91 | 145 | | Set and Save Contrast | 44 |
| 0x93 | 147 | | Set Remember | 51 |
| 0x98 | 152 | | Set and Save Brightness | 43 |
| 0x99 | 153 | | Set Brightness | 42 |
| 0xA4 | 164 | | Setting a Non-Standard Baud Rate | 18 |
| 0xAC | 172 | | Set Box Space Mode | 23 |
| 0xAD | 173 | | Deleting a File | 48 |
| 0xAF | 175 | | Get Filesystem Space | 48 |
| 0xB0 | 176 | | Filesystem Upload | 49 |
| 0xB2 | 178 | | Downloading a File | 49 |
| 0xB3 | 179 | | Get Filesystem Directory | 49 |
| 0xB4 | 180 | | Moving a File | 50 |
| 0xC3 | 195 | | Set Startup GPO state | 36 |
| 0xCA | 202 | | Data Lock | 51 |

# 16 Appendix

## 16.1 Specifications

### 16.1.1 Environmental

Table 84: Environmental Specifications

| | **Standard Temperature** | **Extended Temperature** |
|---|---|---|
| **Operating Temperature** | 0°C to +50°C | -20°C to +70°C |
| **Storage Temperature** | -20°C to +70°C | -30°C to +80°C |
| **Operating Relative Humidity** | 90% max non-condensing | |
| **Vibration (Operating)** | 4.9 $m/s^2$ XYZ directions | |
| **Vibration (Non-Operating)** | 19.6 $m/s^2$ XYZ directions | |
| **Shock (Operating)** | 29.4 $m/s^2$ XYZ directions | |
| **Shock (Non-Operating)** | 490 $m/s^2$ XYZ directions | |

### 16.1.2 Electrical

Table 85: Electrical Specifications

| | Standard | -LV |
|---|---|---|
| **Supply Voltage** | +5Vdc ±0.25V | +3.3Vdc ±0.25V |
| **Minimum Current** | 55mA typical | |
| **USB Version** | add 10mA (65mA) typical | |
| **Backlight On (YG)** | add 25mA (80mA) typical | |
| **Backlight On (GW & WB)** | add 40mA (95/105mA) typical | |
| **GPO (onboard LEDs)** | add up to 10mA each | |
| **GPO (external)** | add up to 20mA each | |

## 16.2 Optical Characteristics

Table 86: Optical Characteristics

| | |
|---|---|
| **Pixel Layout** | 192 x 64 pixels |
| **Number of Characters** | 256 (maximum 32 characters x 8 Lines with 5x7 font) |
| **Display Area** | 82 x 28.4mm |
| **Dot Size** | 0.36 x 0.36mm |
| **Dot Pitch** | 0.39 x 0.39mm |
| **LED Backlight Half-Life (YG)** | 20,000 hours typical |
| **LED Backlight Half-Life (GW &WB)** | 10,000 hours typical |
| **Backlight** | White or Green LED |

**NOTE** To prolong life, it is recommended that the backlight be turned off when the display is not in use.

## 16.3 Physical Layout

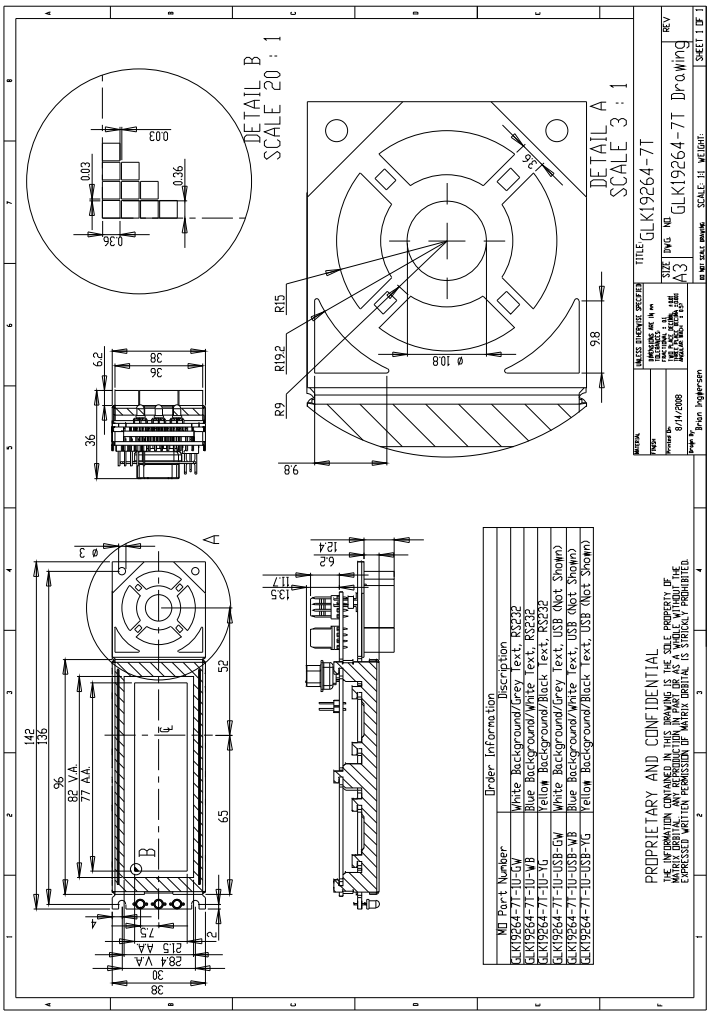



Figure 24: Physical Diagram

**NOTE** Autocad version is downloadable from the Matrix Orbital Manual download location.

| G | L | K | 192 | 64 | -7T | -1U | -USB | -YG | | -E |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |

Table 87: Part Numbering Scheme

| # | Description | Options |
|---|---|---|
| 1 | Screen Type | G: Graphic |
| 2 | Display Technology | L: Liquid Crystal Display |
| 3 | Input Interface | K: Keypad |
| 4 | Width | 192: Pixel Width Count |
| 5 | Height | 64: Pixel Height Count |
| 6 | Keypad Buttons | -7T: Seven Integrated Tactile Keys |
| 7 | Form Factor | -1U: Fits a 1U Opening |
| 8 | Protocol | NP: Standard RS232/TTL/$I^2C$<br>-USB: Universal Serial Bus Only |
| 9 | Colour (Text/Background) | -YG: Grey/Yellow-Green<br>-GW: Grey/White<br>-WB: White/Blue |
| 10 | Input Voltage | NP: Standard (4.75-5.25V)<br>-LV: Low Voltage (3.30V) |
| 11 | Temperature | NP: Standard (0°C to +50°C)<br>-E: Extended Temperature (-20°C to +70°C) |

Table 88: Part Options

## 16.4 Ordering Information

## 16.5 Definitions

**E** Extended Temperature (-20C to 70C)

**LV** Low Voltage (+3.3V DC)

**GW** White Backlight (Grey text on White Background)

**WB** White Backlight (White text on Blue Background)

**YG** Yellow Green Backlight with Grey text

**MSB** Most Significant Byte

**LSB** Least Significant Byte

## 16.6 Contacting Matrix Orbital

**Telephone**

Sales: 1(403)229-2737
Support: 1(403)204-3750

**On The Web**

Sales: http://www.MatrixOrbital.com
Support: http://www.MatrixOrbital.ca
Forums: http://www.lcdforums.com

## 16.7 Revision History

Table 89: Revision History

| Revision Number | Description | Author |
|---|---|---|
| 1.0 | Initial Manual | Clark |
| 1.1 | -LV Option Added | Clark |
| 1.2 | Updated Backlight Life | Clark |

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Matrix Orbital:

GLK19264-7T-1U-WB-USB GLK19264-7T-1U-YG GLK19264-7T-1U-USB-YG GLK19264-7T-1U-USB-GW GLK19264-7T-1U-GW GLK19264-7T-1U-FGW-E GLK19264-7T-1U-FGW-LV GLK19264-7T-1U-USB-YG-E GLK19264-7T-1U-YG-E GLK19264-7T-1U-YG-LV GLK19264-7T-1U-YG-V GLK19264-7T-1U-YG-LV-E GLK19264-7T-1U-FGW-LV-E