

GLK12232-25 Technical Manual

Revision: 3.0

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1 Getting Started

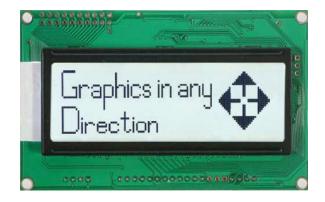


Figure 1: GLK12232-25

The GLK12232-25 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 GLK12232-25 can be used with virtually any controller. The ease of use 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

The GLK12232-25 comes in a variety of color and temperature options to allow you to select the display which will best fit your project needs.

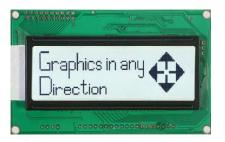


Figure 2: GLK12232-25 Options

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 16.5 on page 61 for contact information.





Figure 3: 5V Power Cable Adapter

Figure 4: 12V Power Cable Adaptor (V Models)

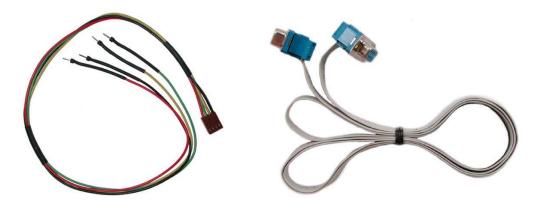


Figure 5: BreadboardCable

Figure 6: Serial Cable (4ft)

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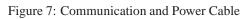




Figure 8: 4X4 Keypad

1.3 Features

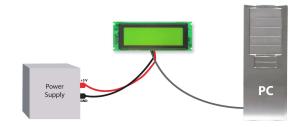
- 122 x 32 pixel graphics display
- Selectable communication protocol, RS-232 or I²C
- Two, 5V 20mA, general purpose outputs for a variety of applications
- 128 byte buffered communication
- Lightning fast communication speeds, up to 115 kbps for RS-232 and 100 kbps for I^2C
- Default 19.2 kbps serial communication speed
- Extended temperature available for extreme environments of -20C to 60C
- Extended voltage and efficient power supply available
- Display text and images using 16 KB memory to store user defined fonts and bitmaps
- Support for up to a twenty-five key matrix style keypad
- Adjustable contrast and backlight brightness

1.4 Connecting to a PC

The GLK12232-25 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 Communication and 5V Power Cable such as the one shown in Figure 5.

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

- 1. Plug the DB9 end of the Communication and 5V Power cable cable into the com port you wish to use.
- 2. Connect the power connector end of the Communication and 5V Power cable into the PC power supply (you will have to open your computer case if you do not have a separate power supply).
- 3. Connect the power and data connector of the Communication and 5V Power cable into the back of the display, see Section 2.1 for details.



WARNING DO NOT use the standard floppy drive power connector, as this will not provide you with the correct voltage and will damage the display module. Also note that the V/VPT module is an add-on. Please contact a Sales-Representative for additional information.

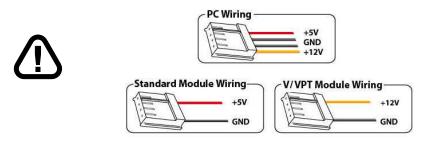


Figure 9: PC vs Matrix Orbital Display Module Wiring

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 CD, 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.

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Configuration	۲
Port	
COM1	-
Speed	
19200	-
Display Type	
GLK24064-25	-
Pcb Revision	
2.0	•
Configure Display Defaults	

PortThe serial port the display is plugged in to.SpeedThe communication speed the display
module is set to. (Default 19,200)Display TypeThe type of display. (GLK12232-25)PCB RevisionThe revision of the display you are using.
(Found on the back of the PCB)

Figure 10: Mogd Sharp Settings

NOTES

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

2 Hardware Information

Refer to the following diagram for this chapter:

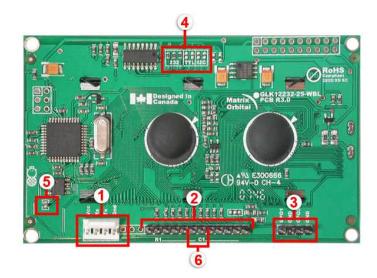


Figure 11: GLK12232-25

Table 1: Hardware Information1 Power / Data Connector4 Protocol Select Jumpers2 Keypad connector5 Filesystem Lock Jumper3 GPO6 Manual Override

2.1 Power/Data Connector

The *Power/Data Connector* provides a standard connector for powering the display module. The GLK12232-25 requires five volts for the standard display module. Extended voltage options are available as an add-on, please contact a sales representative for additional information. 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 I²C protocol, depending on what has been selected by the *Protocol Select Jumpers*.

Pin 1

Pin 2

Pin 3 Pin 4 PWR (See table 2) Rx \setminus SCL (I²C clock)

GND

 $Tx \setminus SDA$ (I²C data)



Figure 12	: Power	Connector	and	Pin-out
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Table 2:	Power	Rea	uirements
10010Δ	1 0 1 01	ILUU	uncincinto

Supply Voltage	+5Vdc ±0.25V	
Supply Current	46 mA typical	
Supply Backlight Current	84 mA typical	



WARNINGS

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

2.2 Keypad Interface Connector

The GLK12232-25 provides a *Keypad Interface Connector* which allows for up to a four by four matrix style keypad to be directly connected to the display module. Key presses are generated when a short is detected between a row and a column. When a key press is generated a character, which is associated with the particular key press, is automatically sent on the Tx communication line. If the display module is running in I^2C mode, the "Auto Transmit Keypress" function may be turned off, to allow the key presses to remain in the buffer so that they may be polled. The character that is associated with each key press may also be altered using the "Assign Key Codes" command, for more detailed information see the *Keypad Section, on page 35*.

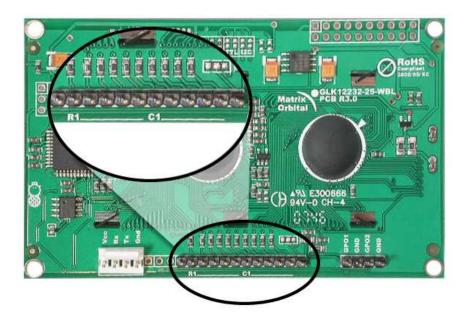
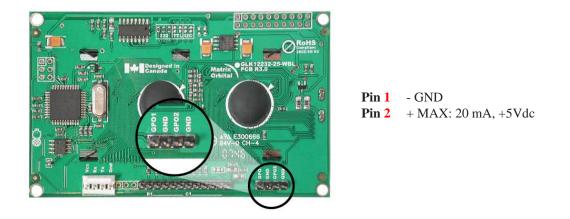
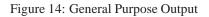


Figure 13: Keypad Interface Connector

2.3 GPO

A unique feature of the GLK12232-25 is the ability to control relays and other external devices using a *General Purpose Output (3)*, which can provide up to 20 mA of current and +5Vdc from the positive side of the GPO. This is limited by a 240 ohm resistor which is located directly above the positive pin as pictured below in *figure 14*. If the device, which is being driven by a GPO, requires a relatively high current (such as a relay) and has an internal resistance of its own greater than 250 ohms, then the 240 ohm resistor may be removed and replaced with a Jumper.







WARNING If connecting a relay, be sure that it is fully clamped using a diode and capacitor in order to absorb any electro-motive force (EMF) which will be generated.

2.4 Protocol Select Jumpers

The *Protocol Select Jumpers*, pictured below in *figure 15*, provide the means necessary to toggle the display module between RS-232, TTL and I²C protocols. As a default, the jumpers are set to RS-232 mode with zero ohm resistors on the 232 jumpers. In order to place the display module in I²C mode you must first remove the zero ohm resistors from the 232 jumpers and then solder the resistors on to the I²C jumpers. The display will now be in I²C mode and have a default slave address of 0x50 unless it has been changed. Similarly, in order to change the display to TTL mode, simply remove the zero ohm resistors from the 232 or I²C jumpers.

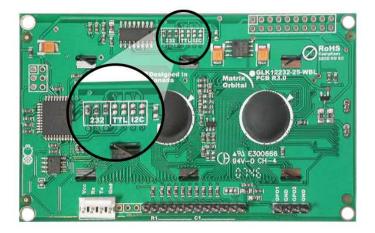


Figure 15: Protocol Select Jumpers

2.5 Filesystem Lock Jumper

The *Filesystem Lock Jumper* allows you to lock the filesystem on the GLK12232-25 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 on the *Filesystem Lock Jumper* pictured in *figure 16* below.

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Figure 16: Filesystem Lock Jumper

2.6 Manual Override

The *Manual Override* is provided to allow the GLK12232-25 to be reset to some of its 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:

- 1. Power off the display module.
- 2. Place a Jumper on the *Manual Override* pins 1 and 2 as pictured below.
- 3. Power up the display module.
- 4. The display module is now set to its default values listed below in *table 3*.
- 5. Edit and save settings.



Figure 17: Manual Override Jumper

Table 3: Default Values		
Contrast	128	
Backlight	255	
Baud Rate	19.2 kbps	
I ² C Slave Address	0x50	
Data Lock	False	
RS232AutoTransmitData	True	

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

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 9 on page 5*. Matrix Orbital supplies power cable adapters for connecting to a PC, which can be found in the *Accessories Section on page 2*.

- 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 GLK12232-25. If the *Power / Data Connector* has become loose, or you are unable to resolve the issue, please contact Matrix Orbital see *16.5 on page 61* 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 9*.
- 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 I²C please ensure that the data is being sent to the correct address. The default slave address for the display module is 0x50.

NOTE I²C communication will always require pull up resistors.

• Finally, you may reset the display to it's default settings using the *Manual Override Jumper*, see *Section 2.6 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*
- 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 4* for setting up a PC to test the GLK12232-25.
- Second, ensure that the File System Lock Jumper has not been set. See Section 2.5 on page 10.

• Third, please ensure that the display module's memory is not full. The GLK12232-25 has 16 Kb of memory for fonts and bitmaps.

NOTE If you are unable to resolve any issue please contact Matrix Orbital. See *16.5 on* page 61 for contact information.

4 Communications

4.1 Introduction

The commands listed in this chapter describe how to configure data flow on the RS232/TTL and I²C port.

4.1.1 I²C Communication Summary

The GLK12232-25 is capable of communicating at 100 Kbps in I²C mode, with 127 units addressable on a single I²C communication line. However, in order to communicate via I²C you must first set the Protocol Select Jumpers as can be seen in Section 2.4 and 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. These pins are shared with RS232 and must be switched to I2C if this is how the host will be communicating with the display. 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. The GLK12232-25 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 GLK12232-25should 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 GLK12232-25, 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 GLK12232-25 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 I^2C the GLK12232-25 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 I^2C 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 GLK12232-25 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

Because of the considerable amount of delays necessary for I2C, it is suggested that the users explore the possibility of using other built in graphic commands to clear areas of the display when refreshing all or part of the display. For example, instead of sending the clear screen command, consider sending a rectangle command with the proper size, this is much faster than clearing everything and re-drawing or writing spaces over the area.

4.1.2 Serial Communication

In addition to being able to communicate via I²C the GLK12232-25 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 GLK12232-25 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 $\pm 30V$ to $\pm 30V$ or at TTL levels of 0 to $\pm 5V$ by setting the *Protocol Select Jumpers* to TTL.

4.2 Turn Flow Control On

Syntax	Hexadecimal Decimal	0xFE 0x3A [full] [empty] 254 58 [full] [empty]	
	ASCII	254 ":" [full] [e	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 I2C 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 bu without warning.	

NOTE This command is not available in I2C mode.

Remembered Yes

4.4 Changing the I²C Slave Address

Syntax	Hexadecimal	0xFE 0x33 [adr]]
	Decimal	254 51 [adr]	
	ASCII	254 "3" [adr]	
Parameters	Parameter	Length	Description
	adr	1	The new I ² C write address (0x00 -
			0xFF).
Description	and 0xFF. The I address is autom	² C write address in the address of	address of the module between $0x00$ nust be an even number and the read e higher. For example if the I ² C write ad address is $0x51$.

NOTE The change in address is immediate.

Remembered	Always
Default	0x50

4.5 Changing the Baud Rate

Syntax	Hexadecimal	0xFE 0x39 [spe	ed]
	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

NOTE This command is not available in I2C mode.

Remembered	Always
Default	19,200 bps

4.6 Setting a Non-Standard Baud Rate

Syntax	Hexadecimal	0xFE 0xA4 [spe	eed]
	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 pc	ort to a non-standard baud rate. The
	modules baud g calculate the [sp anywhere from 153,800 baud. S	enerator. Use the f beed] for any baud 12 to 2047 which Setting the baud ra working properly a	meter that goes directly into the formula, $speed = \frac{CrystalSpeed}{8 \times DesiredBaud} - 1$ to rate setting. The speed can be corresponds to a baud range of 977 to te out of this range could cause the and require the Manual Override
Remembered	Always		

Examples

Crystal Speed 16 Mhz

Desired BAUD 13,500

$$speed = \frac{crystalspeed}{8 * DesiredBaud} - 1$$
 $speed = \frac{16,000,000}{8 * 13,500} - 1$
 $speed = 148.15 - 1$ $speed = 147.15$
LSB = 0x93 (rounded)

• $\mathbf{MSB} = 0 \times 00$

• 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.

NOTES

• This command is not available in I2C mode.

5 Fonts

5.1 Introduction

The GLK12232-25 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) ASČII Štart 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 18* below illustrates the bit pattern for the h, i and j bitmap data.

	▏▁▁▁ ▁▁

Figure 18: 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 9: Font File Header					
Nominal Width	Height	ASCII Start Val	ASCII End Val		
0x05	0x07	0x49	0x4B		

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 19: 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

		Cha	racter I	Byte Size (For Reference)		
h	0x84	0x2D	0x98	0xC6	0x20	0x05
i	<i>i</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 10* below.

	Table 10: 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 11*.

Matrix Orbital

			/ 111 Sul				
0x05	0x07	0x49	0x4B	0x00	0x0D	0x05	0x00
0x12	0x03	0x00	0x15	0x04	0x84	0x2D	0x98
0xC6	0x20	0x43	0x24	0x84	0x2D	0x98	0x19
0x60							

Table 11: Sample Font File

Red = **Header**

Blue = **Character Table** Purple = **Character Data**

5.2 Uploading a Font File

Syntax	Hexadecimal	0xFE 0x24 [re	fID] [size] [data]
•	Decimal	254 36 [refID]	[size] [data]
	ASCII	254 "\$" [refII	D] [size] [data]
Parameters	Parameter	Length	Description
	refID	1	A unique font identification
			number.
	size	2	Font file size (LSB to MSB).
	data	Х	Font file data.
Description	In order to uploa	ad a font to the (GLK12232-25 you must first initiate the
	upload font file	command (0xFI	E 0x24), you must then pass it a
	reference identit	fication number,	which must be unique for every font on
	the display mod	ule. You may th	en 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 GLK12232-25 see		
	Section 12 on p	age 42.	

NOTE This command is not available in I2C.

Remembered Always

5.3 Setting the Current Font

Syntax	Hexadecimal Decimal	0xFE 0x31 [refl 254 49 [refID]	[D]
	ASCII	254 "1" [refID]	
Parameters	Parameter	Length	Description
	refID	1	A unique font identification
			number.

simply send the command bytes (0xFE 0x31) and then send the font IE 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 46 for more detailed information.	Description	entire filesystem may be obtained by using the "Get Filesystem Directory" command, see Section 12.5 on page 46 for more detailed
---	-------------	---

Remembered Yes

5.4 Font Metrics

Syntax	Hexadecimal	0xFE 0x32 [li	m] [tm] [csp] [lsp] [srow]		
•	Decimal	254 50 [lm] [t	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 det	fine where the c	haracters are positioned on the screen,		
	by setting where	e the rows and c	columns begin based on the		
	[lm][tm][csp][ls	sp][srow] param	eters. [lm] defines the leftmost position		
	and [tm] the top	most. [csp] con	trols 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 GLK12232-25. It defines the row that,				
	when filled, will cause the display to auto scroll if auto scrolling is				
	enabled. The fo	nt metrics will l	have to be reconfigured after changing to		
	a different font.				

Remembered Yes

5.5 Set Box Space Mode

Syntax	Hexadecimal Decimal	0xFE 0xAC [va 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 Default	Yes On		

6 Text

6.1 Introduction

The GLK12232-25 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 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 GLK12232-25, 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 GLK12232-25 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).

6.3 Setting the Cursor Position

Syntax	Hexadecimal	0xFE 0x47 [co	l] [row]
	Decimal	254 71 [col] [r	ow]
	ASCII	254 "G" [col]	[row]
Parameters	Parameter	Length	Description
	col	1	Column
	row	1	Row
Description	row 1 Row 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 wid 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: lin spacing].		positioned using the base size of the not position the insertion point at a l is determined by multiplying the width nt by the [column]. The row used is

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
	Х	1	The horizontal position in pixels.
	У	1	The vertical position in pixels.
Description	This command j	positions the inser	rtion point at a specific pixel (X,Y),
	which reference	s the top left corr	er 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 <i>Section 5.4 on page 23</i> .
Remembered	Yes
Default	On

6.6 Auto Scroll Off

Syntax	Hexadecimal Decimal	0xFE 0x52 254 82
	ASCII	254 "R"
Description	the display area in the font metri <i>on page 23</i> . Exi text is placed. A	lling is disabled, text will wrap to the top left corner of when the text reaches the end of the scroll row defined cs (the bottom right character position) see <i>Section 5.4</i> sting text in the display area is not erased before new series of spaces followed by a "Cursor Home" be used to erase the top line of text.

Remembered Yes

7 Bitmaps

7.1 Introduction

One of the main features of the GLK12232-25 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 Decimal	0xFE 0x5E [refID] [size] [data] 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	Х	Bitmap data.

Description The GLK12232-25 is capable of storing font and bitmap files up to 16 Kbytes. In order to upload a bitmap to the GLK12232-25 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 size, which needs to be transfered LSB, then MSB. The last part of uploading a bitmap is transmitting the bitmap file data. For detailed instructions on uploading a file to the GLK12232-25 see *Section 12 on page 42*.

NOTE This command is not available in I2C.

Remembered Always

7.3 Drawing a Bitmap from Memory

Syntax	Hexadecimal	0xFE 0x62 [re	efID] [X] [Y]	
-	Decimal	254 98 [refID] [X] [Y]	
	ASCII	254 "b" [refII	D] [X] [Y]	
Parameters	Parameter	Length	Description	
	refID	1	The bitmap identification number.	
	Х	1	Left bounds.	
	Y	1	Top bounds.	
Description	This command	will draw a bitm	hap 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 Dire	system Directory" command, see Section 12.5 on page 46 for more		
	detailed information	ation.		

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	
	Х	1	Left bounds.	
	Y	1	Top bounds.	
	W	1	Width	
	Н	1	Height	
	D	1	Data	
Description	Drawing a bitma	p to the GLK1	2232-25, without first uploading the	
L	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			
	GLK12232-25. 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 42 for more information about transferring data to the display			
	module.		bout transferring data to the display	
	module.			

NOTE Drawing a bitmap directly to the display is supported by flow control. This command is not available in I2C mode.

Remembered No

8 Bar Graphs and Drawing

8.1 Introduction

Supplementary to the ability of the GLK12232-25 to display bitmaps and fonts, the GLK12232-25 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 Decimal	0xFE 0x63 [color] 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.

8.3 Draw Pixel

Syntax	Hexadecimal	0xFE 0x70 [x] [[y]
	Decimal	254 112 [x] [y]	
	ASCII	254 "p" [x] [y]	
Parameters	Parameter	Length	Description
	Х	1	X screen location.
	у	1	Y screen location.
Description	This command	will draw a pixel a	at (x,y) using the current drawing
	color. The unit j	processes these re	quests fast enough to keep up with a
	steady stream at	115 Kbps so flow	w control is not required.
	·	-	-

Remembered No

8.4 Drawing a Line

Syntax	Hexadecimal	0xFE 0x6C [x	1] [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. I	Lines may be dr	awn from any part of the display to any
	other part. How	ever, it may be i	important to note that the line may
	interpolate diffe	rently right to le	eft, or left to right. This means that a line
	drawn in white	from right to lef	t may not fully erase the same line
	drawn in black f	from left to righ	t.
Remembered	No		

8.5 Continue a Line

Syntax	Hexadecimal Decimal ASCII	0xFE 0x65 [x] 254 101 [x] [y] 254 "e" [x] [y]	[y]
Parameters	Parameter	Length	Description
	Х	1	Left bounds.
	у	1	Top Bounds.
Description	This command	will draw a line w	vith the current drawing color from the
	last line end (x2	(x,y2) to (x,y) . This	s command uses the global drawing
	color.		

8.6 Draw a Rectangle

Syntax	Hexadecimal	0xFE 0x72 [color] [x1] [y1] [x2] [y2]	
	Decimal	254 114 [color	r] [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 rectangu	alar box in the specified color (0: White,
	1: Black). The t	op 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 Decimal ASCII	254 120 [colo	olor] [x1] [y1] [x2] [y2] or] [x1] [y1] [x2] [y2] r] [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.

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 har graph referred to by number [reference			

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	Тор
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

8.9 Drawing a Bar Graph

Syntax	Hexadecimal	0xFE 0x69 [re	f] [value]
	Decimal	254 105 [ref] [value]
	ASCII	254 "i" [ref] [v	/alue]
Parameters	Parameter	Length	Description
	ref	1	Initialized bar graph reference
			number.
	value	1	The number of pixels to fill.
Description	Once the bar gra	aph has been init	ialized it can be filled in using this
	command. This	command sets the	he bar graph specified by the [ref]
	number to fill in	[value]. [value]	is given in pixels and should not
	exceed the avail	able height/widt	h of the graph. (If it does the graph will
	simply be writte	en to its maximu	m size.)
Remembered	No		

8.10 Initializing a Strip Chart

Syntax	Hexadecimal Decimal		efID] [x1] [y1] [x2] [y2] D] [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. 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):

- MSB: 0 shifts left
- MSB: 1 shifts right

For example if [ref] is 1:

- 254 107 1 (hex FE 6B 01) shifts left
- 254 107 129 (hex FE 6B 81) shifts right

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

General purpose outputs allow you to connect devices, such as LEDs, to the GLK12232-25 and supply them with up to 20mA of current at 5V. The GLK12232-25 has 2 GPOs which are software controlled, with functions to turn them on/off and set the power state for the next startup.

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 t	turns OFF general	l purpose output [num].	

NOTE OFF means that the output is pulled HIGH.

Remembered Yes

9.3 General Purpose Output On

Syntax	Hexadecimal	0xFE 0x57 [Nu	m]		
•	Decimal	254 87 [Num]			
	ASCII	254 "W" [Num]			
Parameters	Parameter	Length	Description		
	Num	1	GPO number.		
Description	This command t	turns ON general	purpose output [num]. The standard		
	GPO's on the G	LK12232-25 out	put 20mA of current at 5V.		
	NOTE ON me	eans the output is	pulled LOW.		

Remembered Yes

9.4 Set Startup GPO state

Syntax	Hexadecimal	0xFE 0xC3 [Ni	um] [state]
-	Decimal	254 195 [Num]	[state]
Parameters	Parameter	Length	Description
	Num	1	GPO number.
	state	1	Startup state (0: Off, 1: On)
Description	up. A value of o	ne will cause the	p state for the GPO on the next power GPO to be off on the next startup ne GPO to be on.

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

Remembered Always

10 Keypad

10.1 Introduction

The GLK12232-25 supports up to a 25 key, matrix style, keypad and may be configured to allow key presses to be automatically transmitted via RS-232 or polled through I²C. The GLK12232-25 also allows for auto-repeating key presses, and remapping of all keypad character codes.

The connector is not keyed so the keypad will probably plug in either of two ways. The display will not be damaged by reversing the connector. However, the keypad will generate a different ASCII character mapping for each position. If the connector has fewer than 10 pins it should be centered on the display connector. 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.

10.1.1 I2C Interface

The keypad is read by I2C master read. In short, this means that a read of the module will always return the first unread key press. A read is initiated by writing to the module with its base address plus 1, then clocking the module's return byte after the module releases the SDA line. Much more detail on this basic I2C function can be found in the I2C specification by Phillips.

10.1.2 RS232 Interface

By default on any press of a key, the module will immediately send out the key code at the selected baud rate. This behavior can be modified using commands found in the next section.

10.2 Auto Transmit Key Presses On

Syntax	Hexadecimal Decimal	0xFE 0x41 254 65
	ASCII	254 "A"
Description		key presses are sent immediately to the host system of the poll keypad command. This is the default mode

NOTE This command is not available in I2C.

Remembered Yes Default On

10.3 Auto Transmit Key Presses Off

Syntax	Hexadecimal0xFE 0x4FDecimal254 79ASCII254 "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.	
	NOTE This command is not available in I2C.	
Remembered	Yes	

10.4 Poll Key Press

Syntax	Hexadecimal	0xFE 0x26
	Decimal	254 38
	ASCII	254 "&"
Description	The host system receives this cor presses which m key press buffer code will be set will be cleared (returned code w	returns any buffered key presses via the serial interface. In must be set up to receive key codes. When the display mmand, it will immediately return any buffered key hay have not been read already. If there is more than one red, then the high order bit (MSB) of the returned key (1). If this is the only buffered key press, then the MSB (0). If there are no buffered key presses, then the rill be 0x00. Please note that to make use of this Auto Transmit Key Presses'' mode should be off.
	NOTE This co	ommand is not available in I2C. To read keys in I2C mode, o

NOTE This command is not available in I2C. To read keys in I2C mode, one just needs to address the module and read a byte. No preceding commands are necessary. If there are no keys pressed the read will result in a 0x00.

Remembered

10.5 Clear Key Buffer

No

Syntax	Hexadecimal Decimal ASCII	0xFE 0x45 254 69 254 "E"
Description	the user presses key presses may between menu c	clears any unread key presses. In a menu application, if a key which changes the menu context, any following be inaccurate and can be cleared out of the buffer hanges to prevent jumping around the menu tree. It may effect, to reset the keypad in case the host application wer 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	types with the ex varying time, de value is in incre	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 [mo	ode]
•	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	t modes are availa	ble and are set via the same command:
		Key Mode: 0x00 Down Mode: 0x0	01
	a PC. In t transmitte this delay of about 5	his mode, when a ed immediately fo y, key codes will b	s similar to the action of a keyboard on a key is held down, the key code is ollowed by a 1/2 second delay. After be sent via the RS-232 interface at a rate d. This mode has no effect if polling or
	parameter if the unit detects th host syste key is hel other cod the key, th	rs of the "Resend t is being operated e press of a key a em until the key re d down, the key c es will be sent un	e may be used when the typematic Key Code" mode are unacceptable or d in polled mode. The host system nd simulates an auto repeat inside the elease is detected. In this mode, when a code is transmitted immediately and no til the key is released. On the release of de transmitted will be a value equal to hex.
Remembered	Yes		

When the key code associated with key 'P' (0x50) is pressed, the release Examples code is 'p' (0x70). In RS-232 polled mode or via the I²C, 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 t	turns auto repeat mode off. See Set Auto Repeat Mode.
Remembered	No	

10.9 Assign Keypad Codes

Syntax	Hexad	ecima	1 02	xFE ()xD5	[]	KDo	wn]	[KU	p]			
5	Decin	al	25	54 21	3 [K]	Do	own	[KU	Jp]				
Parameters	Param	eter		Lei	ngth		Γ	Desci	iptic	on			
	KDow	'n		2	2.5		ŀ	Key d	lowr	code	es		
	KUp			2	25		ŀ	ζey ι	ip co	des			
Description	-	nman	d will	allov	<i>w</i> vou	ı t					code	es th	at correspond
I I					•			-		-			bytes that are
		• •					-		-				ext 25 bytes
							-					10 110	
		that are transmitted will be us Key Down				Key Up							
					-								
		2	3	4	5			1	2	3	4	5	
	1 A	В	С	D	E		1	а	b	с	d	e	
	2 F	G	Η	Ι	J		2	f	g	h	i	j	
	3 K	L	Μ	Ν	0		3	k	1	m	n	0	
	4 P	Q	R	S	Т		4	р	q	r	S	t	
	5 U	V	W	Х	Y		5	u	V	W	Х	у	
Remembered	Always												

Remembered

Always

11 Display Functions

11.1 Introduction

The GLK12232-25 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 of	clears the display and resets the text insertion position to
	the top left posit	tion of the screen defined in the font metrics.

11.3 Display On

Remembered

No

Syntax	Hexadecimal Decimal ASCII	0xFE 0x42 [mi 254 66 [min] 254 "B" [min]	n]
Parameters	Parameter	Length	Description
	min	1	Minutes before turning the display
			on (0 to 90).
Description	expired, with a the backlight sh	ninety minute ma ould turn on imm it while the remen	at on after the [minutes] timer has aximum timer. A time of 0 specifies that nediately and stay on. When this mber function is on, the timer will reset
Remembered Default	Yes 0		
Default	U		

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 [brigh	tness]	
Parameters	Parameter	Length	Description	
	brightness	1	Display brightness setting (0 to	
			255).	
Description		1	brightness]. If the remember function is as 'Set and Save Brightness'.	
Remembered	Yes			
Default	255			

11.6 Set and Save Brightness

Syntax	Hexadecimal	0xFE 0x98 [brightness]		
-	Decimal	254 152 [brig	htness]	
Parameters	Parameter	Length	Description	
	brightness	1	Backlight setting (0 to 255).	
Description	This command s	sets and saves th	ne display [brightness] as default.	
Remembered	A Imovo			
Kemembered	Always			

11.7 Set Contrast

Syntax	Hexadecimal	0xFE 0x50 [contrast]		
•	Decimal	254 80 [contras	st]	
	ASCII	254 "P" [contra	ast]	
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.

Remembered	Yes
Default	128

11.8 Set and Save Contrast

Syntax	Hexadecimal	0xFE 0x91 [co	ontrast]
·	Decimal	254 145 [cont	rast]
Parameters	Parameter	Length	Description
	contrast	1	Contrast value (0 to 255).
Description	This command s	sets the display'	s contrast to [contrast], where [contrast]
	is a value betwe	en 0x00 and 0x	FF (between 0 to 255). Lower values
	cause 'on' elem	ents in the displ	ay area to appear lighter, while higher
	values cause 'or	n' elements to ap	pear darker. Lighting conditions will
	affect the actual	value used for o	ptimal viewing. Individual display
	modules will als	so differ slightly	from each other in appearance. In
	addition, values	for optimal view	ving while the display backlight is on
	may differ from	values used wh	en backlight is off.
	•		
	NOTE This co	ommand saves t	he [contrast] value so that it is not lost after power down.
			· · · · · · · · · · · · · · · · · · ·
Remembered	Yes		
Default	128		

12 Filesystem

12.1 Introduction

The GLK12232-25 incorporates a 16 Kbyte on board flash memory in order to allow 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. 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 0x01 and 0xFF, 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 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. Decline: Terminate the session.			
	0x08				

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*.

	r	1	
	host	display	
	254		
	'\$' (command)		
	reference Id		
	size low byte		
	size high byte		
		0x01 is returned if size can be accomodated, otherwise 0x08 and the display aborts this command	
	check reply if not 0x01, upload is aborted		
	data O		
		echo data O	
	confirm the echo with 0x01, otherwise if data is different, 0x08 is sent		
Matrix Orbital	GLK12	232-25	
	data 1		
		echo data 1	
	confirm the ache with		

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 GLK12232-25 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.

12.2 Wipe Filesystem

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 font	s, font metrics, bitmaps, and settings (current font,	
	cursor position,	communication speed, etc.). It is an "odd" command in	
	that it is three by	ytes in length in order to prevent accidental execution.	
D 1 1	* *		

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 GLK12232-25			
memory when given two parameters: [type] and [ref			eters: [type] and [ref]. The file type and	
	reference numb	ence number are defined when the file is saved to the		
GLK12232-25.				
	r. 1 1	D		
	• [type] = 1	1		
	• $[type] = 0$: Font			

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. Se		
	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	1 File Size: LSB			
1 File Size: MSB				
No				

Remembered

12.6 Filesystem Upload

Syntax	Hexadecimal Decimal	0xFE 0xB0 [data] 254 176 [data]	
Parameters	Parameter	Length	Description
	data	4	LSB to MSB filesystem image data
Description	This command to the display (1		r byte filesystem image, LSB to MSB
Remembered	Always		

12.7 Downloading a File

Syntax	Hexadecimal Decimal	0xFE 0xB2 [7 254 178 [Type	
Parameters	Parameter	Length	Description
1 drameters		1	1
	Туре	1	File type (0:Font File, 1:Bitmap)
	refID	1	Reference ID number
Description			the filesystem. The first 4 bytes will be (SB) followed by the data contained in
Remembered	No		

12.8 Moving a File

Syntax	Hexadecimal	0xFE 0xB4 [oldT] [oldID] [newT] [newID]		
-	Decimal	254 180 [old]	[] [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 of	can be used to r	nove a file to a new file ID, or correct the	
	type of a file that	t 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 w	ill be changed t	o [newT] and [newID] respectively.	
Remembered	Always			

13 Data Security

13.1 Introduction

Ensuring that your GLK12232-25 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 GLK12232-25 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

S	Syntax	Hexadecimal	0xFE 0x93 [s	witch]	
		Decimal	254 147 [swit	tch]	
I	Parameters	Parameter	Length	Description	
		switch	1	0: Do not remember, 1: Remember	
Ι	Description	This command a	allows you to sv	witch the remember function on and off.	
		To use the reme	mber function,	set remember to on, then set all of the	
		settings that you	ı wish to save, s	settings that are listed as 'Remember:	
		Yes' support be	ing saved into th	he non-volatile memory. After you have	
		set all of the cor	nmands that yo	u wish to save, you may then cycle the	
		power and chec	k the display set	ttings to ensure that all the settings have	
		-	· ·	remember again after cycling the power,	
		you must set it t			
		5	0		
		NOTES			
	• Writing to non-volatile memory is time consuming and slow			nemory is time consuming and slows down the operation of	
		the displa			
			tile memory ha	a 'write limit' and may only be changed approximately	
F	Remembered	No			
	Default	Do not rememb	er		
_					
13.3	Data Lock	L			

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	When this bit is set (1) the
	Speed Lock	Baud Rate and I2C 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 dis-
		playing any new informa-
		tion. (text lock)

NOTES

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

Remembered	Alway	/S		
Default	0			
Examples				
		Hex	Dec	Binary

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

13.4 Set and Save Data Lock

Hexadecimal Decimal	0xFE 0xCB 02 254 203 245 1	xF5 0xA0 [level] 60 [level]
Parameter	Length	Description
level	1	Sets the data lock level
		the data lock level. See the Data Lock
Always 0		
	Decimal Parameter level This command v section for more	Decimal254 203 245 1ParameterLengthlevel1This command will set and savesection for more information.Always

13.5 Dump the Filesystem

Syntax	Hexadecimal	0xFE 0x30
-	Decimal	254 48
	ASCII	254 "0"
Description		you to dump the filesystem for debugging purposes. It yte value LSB to MSB followed by 16384 bytes making m.
Remembered	No	

13.6 Writes the Customer Data

Syntax	Hexadecimal Decimal ASCII	0xFE 0x34 [dat 254 52 [data] 254 "4" [data]	a]
Parameters	Parameter	Length	Description
	data	16	Writes the customer data
Description	Writes the custo memory.	omer Data. 16 By	tes of data can be saved in non-volatile

Remembered No

13.7 Reads the 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		will return a byte representing the version of the module, g table as an example:

Hex Value	Version Number
0x10	Version 1.0
0x20	Version 2.0
0x42	Version 4.2

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 model number of the module see the following table:

Hex	Product ID	Hex	Product ID
1	LCD0821	38	LK204-24-USB
2	LCD2021	39	VK204-24-USB
5	LCD2041	3A	PK162-12
6	LCD4021	3B	VK162-12
7	LCD4041	3C	MOS-AP-162A
8	LK202-25	3D	PK202-25
9	LK204-25	3E	MOS-AL-162A
Α	LK404-55	40	MOS-AV-202A
В	VFD2021	41	MOS-AP-202A
С	VFD2041	42	PK202-24-USB
D	VFD4021	43	MOS-AL-082
Е	VK202-25	44	MOS-AL-204
F	VK204-25	45	MOS-AV-204
10	GLC12232	46	MOS-AL-402
13	GLC24064	47	MOS-AV-402
15	GLK24064-25	48	LK082-12
22	GLK12232-25	49	VK402-12
24	GLK12232-25-SM	4 A	VK404-55
26	GLK24064-16-1U	4B	LK402-25
27	GLK19264-7-1U	4 C	VK402-25
28	GLK12232-16	4D	PK204-25
29	GLK12232-16-SM	54	XBoard-U
31	LK404-AT	55	LK202-25-USB
32	MOS-AV-162A	56	VK202-25-USB
33	LK402-12	57	LK204-25-USB
34	LK162-12	58	VK204-25-USB
35	LK204-25PC	72	GLK240128-25
36	LK202-24-USB	73	LK404-25
37	VK202-24-USB	74	VK404-25
No	-		

Remembered

15 Command Summary

15.1 Communications

Description	Syntax		Page
Turn Flow Control On	Hexadecimal	0xFE 0x3A [full] [empty]	15
	Decimal	254 58 [full] [empty]	
	ASCII	254 ":" [full] [empty]	

Description	Syntax		Page
Turn Flow Control Off	Hexadecimal	0xFE 0x3B	16
	Decimal	254 59	
	ASCII	254 ";"	
Changing the I ² C Slave	Hexadecimal	0xFE 0x33 [adr]	16
Address	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	Hexadecimal	0xFE 0xA4 [speed]	18
Baud Rate	Decimal	254 164 [speed]	

15.2 Fonts

Description	Syntax		Page
Uploading a Font File	Hexadecimal	0xFE 0x24 [refID] [size] [data]	22
	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"	
Setting the Cursor	Hexadecimal	0xFE 0x47 [col] [row]	25
Position	Decimal	254 71 [col] [row]	
	ASCII	254 "G" [col] [row]	
Setting the Cursor	Hexadecimal	0xFE 0x79 [x] [y]	25
Coordinate	Decimal	254 121 [x] [y]	
	ASCII	254 "y" [x] [y]	
Auto Scroll On	Hexadecimal	0xFE 0x51	25
	Decimal	254 81	
	ASCII	254 "Q"	

Description	Syntax		Page
Auto Scroll Off	Hexadecimal	0xFE 0x52	26
	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	Hexadecimal	0xFE 0x62 [refID] [X] [Y]	27
Memory	Decimal	254 98 [refID] [X] [Y]	
	ASCII	254 "b" [refID] [X] [Y]	
Drawing a Bitmap	Hexadecimal	0xFE 0x64 [X] [Y] [W] [H] [D]	27
Directly	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]	
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	Hexadecimal	0xFE 0x78 [color] [x1] [y1] [x2] [y2]	30
Rectangle	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]	

Description	Syntax		Page
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
- 1	Decimal	254 107 [ref]	
	ASCII	254 "k" [ref]	

15.6 General Purpose Output

Description	Syntax		Page
General Purpose Output	Hexadecimal	0xFE 0x56 [Num]	34
Off	Decimal	254 86 [Num]	
	ASCII	254 "V" [Num]	
General Purpose Output	Hexadecimal	0xFE 0x57 [Num]	34
On	Decimal	254 87 [Num]	
	ASCII	254 "W" [Num]	
Set Startup GPO state	Hexadecimal	0xFE 0xC3 [Num] [state]	35
	Decimal	254 195 [Num] [state]	

15.7 Keypad

Auto Transmit KeyHexadecimal0xFE 0x41Presses OnDecimal254 65ASCII254 "A"Auto Transmit KeyHexadecimal0xFE 0x4FPresses OffDecimal254 79ASCII254 "O"Poll Key PressHexadecimal0xFE 0x26Decimal254 38ASCII254 "&"Clear Key BufferHexadecimal0xFE 0x45Decimal254 69ASCII254 "E"Set Debounce TimeHexadecimal0xFE 0x55 [time]Decimal254 85 [time]ASCII254 "U" [time]Hexadecimal0xFE 0x7E [mode]Decimal254 126 [mode]ASCII254 "~" [mode]	Page		Syntax	Description
Auto Transmit KeyHexadecimal 254 "A"Presses OffDecimal 254 79Poll Key PressHexadecimal $0xFE 0x26$ Decimal $254 38$ ASCII $254 38$ ASCII $254 * \&$ "Clear Key BufferHexadecimalDecimal $254 69$ ASCII $254 * \&$ "Set Debounce TimeHexadecimalOxFE 0x55 [time]Decimal $254 85$ [time]ASCII $254 * \mathbb{C}$ "Set Auto Repeat ModeHexadecimalOxFE 0x7E [mode]Decimal $254 126$ [mode]ASCII $254 * ~$ " [mode]	36	 0xFE 0x41	Hexadecimal	Auto Transmit Key
Auto Transmit KeyHexadecimal0xFE 0x4FPresses OffDecimal254 79ASCII254 "O"Poll Key PressHexadecimal0xFE 0x26Decimal254 38ASCII254 "&"Clear Key BufferHexadecimal0xFE 0x45Decimal254 69ASCII254 "E"Set Debounce TimeHexadecimal0xFE 0x55 [time]Decimal254 85 [time]ASCII254 "U" [time]Set Auto Repeat ModeHexadecimal0xFE 0x7E [mode]Decimal254 126 [mode]ASCII254 "~" [mode]		254 65	Decimal	Presses On
Presses OffDecimal254 79Poll Key PressHexadecimal0xFE 0x26Decimal254 38ASCII254 *&"Clear Key BufferHexadecimal0xFE 0x45Decimal254 69ASCII254 "E"Set Debounce TimeHexadecimal0xFE 0x55 [time]Decimal254 85 [time]ASCII254 "U" [time]Set Auto Repeat ModeHexadecimal0xFE 0x7E [mode]Decimal254 126 [mode]ASCII254 "~" [mode]		254 "A"	ASCII	
ASCII254 "O"Poll Key PressHexadecimal0xFE 0x26Decimal254 38ASCII254 "&"Clear Key BufferHexadecimal0xFE 0x45Decimal254 69ASCII254 "E"Set Debounce TimeHexadecimal0xFE 0x55 [time]Decimal254 85 [time]ASCII254 "U" [time]Set Auto Repeat ModeHexadecimal0xFE 0x7E [mode]Decimal254 126 [mode]ASCII254 "~" [mode]	36	0xFE 0x4F	Hexadecimal	Auto Transmit Key
Poll Key PressHexadecimal0xFE 0x26Decimal254 38ASCII254 '&"Clear Key BufferHexadecimal0xFE 0x45Decimal254 69ASCII254 "E"Set Debounce TimeHexadecimal0xFE 0x55 [time]Decimal254 85 [time]ASCII254 "U" [time]Set Auto Repeat ModeHexadecimal0xFE 0x7E [mode]Decimal254 126 [mode]ASCII254 "~" [mode]		254 79	Decimal	Presses Off
For Hey TressDecimal254 38Decimal254 38ASCII254 "&"Clear Key BufferHexadecimal0xFE 0x45Decimal254 69ASCII254 "E"Set Debounce TimeHexadecimal0xFE 0x55 [time]Decimal254 85 [time]ASCII254 "U" [time]Set Auto Repeat ModeHexadecimal0xFE 0x7E [mode]Decimal254 126 [mode]ASCII254 "~" [mode]		254 "O"	ASCII	
Decimal254 38ASCII254 "&"Clear Key BufferHexadecimal0xFE 0x45Decimal254 69ASCII254 "E"Set Debounce TimeHexadecimal0xFE 0x55 [time]Decimal254 85 [time]ASCII254 "U" [time]Set Auto Repeat ModeHexadecimal0xFE 0x7E [mode]Decimal254 126 [mode]ASCII254 "~" [mode]	37	0xFE 0x26	Hexadecimal	Poll Key Press
Clear Key BufferHexadecimal0xFE 0x45Decimal254 69ASCII254 "E"Set Debounce TimeHexadecimal0xFE 0x55 [time]Decimal254 85 [time]ASCII254 "U" [time]Set Auto Repeat ModeHexadecimal0xFE 0x7E [mode]Decimal254 126 [mode]ASCII254 "~" [mode]		254 38	Decimal	-
Decimal254 69ASCII254 "E"Set Debounce TimeHexadecimalDecimal254 85 [time]Decimal254 85 [time]ASCII254 "U" [time]ASCII254 "U" [time]Decimal0xFE 0x7E [mode]Decimal254 126 [mode]ASCII254 "~" [mode]		254 "&"	ASCII	
Decimal254 69ASCII254 "E"Set Debounce TimeHexadecimalDecimal254 85 [time]Decimal254 85 [time]ASCII254 "U" [time]Hexadecimal0xFE 0x7E [mode]Decimal254 126 [mode]ASCII254 "~" [mode]	37	0xFE 0x45	Hexadecimal	Clear Key Buffer
Set Debounce TimeHexadecimal0xFE 0x55 [time]Decimal254 85 [time]ASCII254 "U" [time]Set Auto Repeat ModeHexadecimal0xFE 0x7E [mode]Decimal254 126 [mode]ASCII254 "~" [mode]		254 69	Decimal	
Set Decounce TimeDecimal254 85 [time]Decimal254 "U" [time]ASCII254 "U" [time]Hexadecimal0xFE 0x7E [mode]Decimal254 126 [mode]ASCII254 "~" [mode]		254 "E"	ASCII	
Set Auto Repeat ModeASCII254 "U" [time]Hexadecimal0xFE 0x7E [mode]Decimal254 126 [mode]ASCII254 "~" [mode]	37	0xFE 0x55 [time]	Hexadecimal	Set Debounce Time
Set Auto Repeat ModeHexadecimal0xFE 0x7E [mode]Decimal254 126 [mode]ASCII254 "~" [mode]		254 85 [time]	Decimal	
Decimal 254 126 [mode] ASCII 254 "~" [mode]		254 "U" [time]	ASCII	
ASCII 254 "~" [mode]	38	0xFE 0x7E [mode]	Hexadecimal	Set Auto Repeat Mode
		254 126 [mode]	Decimal	-
		254 "~" [mode]	ASCII	
: O-1:4+1 CL V10020-05		 		
ax Orbitai GLK12232-25		12232-25	GLK	ix Orbital

Description	Syntax		Page
Auto Repeat Mode Off	Hexadecimal	0xFE 0x60	39
	Decimal	254 96	
	ASCII	254 "'''	
Assign Keypad Codes	Hexadecimal	0xFE 0xD5 [KDown] [KUp]	39
	Decimal	254 213 [KDown] [KUp]	

15.8 Display Functions

Description	Syntax		Page
Clear Screen	Hexadecimal	0xFE 0x58	40
	Decimal	254 88	
	ASCII	254 "X"	
Display On	Hexadecimal	0xFE 0x42 [min]	40
	Decimal	254 66 [min]	
	ASCII	254 "B" [min]	
Display Off	Hexadecimal	0xFE 0x46	40
	Decimal	254 70	
	ASCII	254 "F"	
Set Brightness	Hexadecimal	0xFE 0x99 [brightness]	41
-	Decimal	254 153 [brightness]	
Set and Save Brightness	Hexadecimal	0xFE 0x98 [brightness]	41
	Decimal	254 152 [brightness]	
Set Contrast	Hexadecimal	0xFE 0x50 [contrast]	41
	Decimal	254 80 [contrast]	
	ASCII	254 "P" [contrast]	
Set and Save Contrast	Hexadecimal	0xFE 0x91 [contrast]	42
	Decimal	254 145 [contrast]	

15.9 Filesystem

Description	Syntax		Page
Wipe Filesystem	Hexadecimal	0xFE 0x21 0x59 0x21	45
	Decimal	254 33 89 33	
	ASCII	254 "!" "Y" "!"	
Deleting a File	Hexadecimal	0xFE 0xAD [type] [refID]	45
-	Decimal	254 173 [type] [refID]	
Get Filesystem Space	Hexadecimal	0xFE 0xAF	45
	Decimal	254 175	
Get Filesystem Directory	Hexadecimal	0xFE 0xB3	46
	Decimal	254 179	
Filesystem Upload	Hexadecimal	0xFE 0xB0 [data]	46
	Decimal	254 176 [data]	

Description	Syntax		Page
Downloading a File	Hexadecimal	0xFE 0xB2 [Type] [refID]	47
	Decimal	254 178 [Type] [refID]	
Moving a File	Hexadecimal	0xFE 0xB4 [oldT] [oldID] [newT] [newID]	47
	Decimal	254 180 [oldT] [oldID] [newT] [newID]	

15.10 Data Security

Description	Syntax		Page
Set Remember	Hexadecimal	0xFE 0x93 [switch]	48
	Decimal	254 147 [switch]	
Data Lock	Hexadecimal	0xFE 0xCA 0xF5 0xA0 [level]	48
	Decimal	254 202 245 160 [level]	
Set and Save Data Lock	Hexadecimal	0xFE 0xCB 0xF5 0xA0 [level]	50
	Decimal	254 203 245 160 [level]	
Dump the Filesystem	Hexadecimal	0xFE 0x30	50
· ·	Decimal	254 48	
	ASCII	254 "0"	
Writes the Customer Data	Hexadecimal	0xFE 0x34 [data]	50
	Decimal	254 52 [data]	
	ASCII	254 "4" [data]	
Reads the Customer Data	Hexadecimal	0xFE 0x35	50
	Decimal	254 53	
	ASCII	254 "5"	

15.11 Miscellaneous

Description	Syntax		Page
Read Version Number	Hexadecimal	0xFE 0x36	51
	Decimal	254 54	
	ASCII	254 "6"	
Read Module Type	Hexadecimal	0xFE 0x37	51
• •	Decimal	254 55	
	ASCII	254 "7"	

15.12 Command By Number

Command Description Dage				
Command Description Page				
Hex	Dec	ASCII		
0x21	33	"!"	Wipe Filesystem	45
0x24	36	'' \$''	Uploading a Font File	22
0x26	38	"&"	Poll Key Press	37

Command Description Page				
Hex	Dec	ASCII		
0x30	48	"0"	Dump the Filesystem	50
0x31	49	"1"	Setting the Current Font	22
0x32	50	"2"	Font Metrics	23
0x33	51	"3"	Changing the I ² C Slave Address	16
0x34	52	"4"	Writes the Customer Data	50
0x35	53	"5"	Reads the Customer Data	50
0x36	54	"6"	Read Version Number	51
0x37	55	"7"	Read Module Type	51
0x39	57	"9"	Changing the Baud Rate	17
0x3A	58	·····	Turn Flow Control On	15
0x3B	59	····››	Turn Flow Control Off	16
0x41	65	"A"	Auto Transmit Key Presses On	36
0x42	66	"В"	Display On	40
0x45	69	"Е"	Clear Key Buffer	37
0x46	70	"F"	Display Off	40
0x47	71	"G"	Setting the Cursor Position	25
0x48	72	"H"	Move Cursor Home	24
0x4F	79	"O"	Auto Transmit Key Presses Off	36
0x50	80	"P"	Set Contrast	41
0x51	81	"Q"	Auto Scroll On	25
0x52	82	"R"	Auto Scroll Off	26
0x55	85	"U"	Set Debounce Time	37
0x56	86	"V"	General Purpose Output Off	34
0x57	87	"W"	General Purpose Output On	34
0x58	88	"X"	Clear Screen	40
0x5E	94	" Λ"	Uploading a Bitmap File	26
0x60	96	,	Auto Repeat Mode Off	39
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	"1"	Drawing a Line	29
0x70	112	"p"	Draw Pixel	29
0x72	114	"r"	Draw a Rectangle	30
0x78	120	"х"	Drawing a Solid Rectangle	30
0x79	121	"y"	Setting the Cursor Coordinate	25
0x7E	126	" _∼ "	Set Auto Repeat Mode	38
0x91	145		Set and Save Contrast	42
0x93	147		Set Remember	48
0x98	152		Set and Save Brightness	41

Command	l Descript	tion Page		
Hex	Dec	ASCII		
0x99	153		Set Brightness	41
0xA4	164		Setting a Non-Standard Baud Rate	18
0xAC	172		Set Box Space Mode	23
0xAD	173		Deleting a File	45
0xAF	175		Get Filesystem Space	45
0xB0	176		Filesystem Upload	46
0xB2	178		Downloading a File	47
0xB3	179		Get Filesystem Directory	46
0xB4	180		Moving a File	47
0xC3	195		Set Startup GPO state	35
0xCA	202		Data Lock	48

16 Appendix

16.1 Specifications

16.1.1 Environmental

	Standard Temperature	Extended Temperature
Operating Temperature	0° C to $+50^{\circ}$ C	-20° C to $+60^{\circ}$ C
Storage Temperature	-10° C to $+60^{\circ}$ C	-20° C to $+70^{\circ}$ C
Operating Relative Humidity	90% max non-condensing	5
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

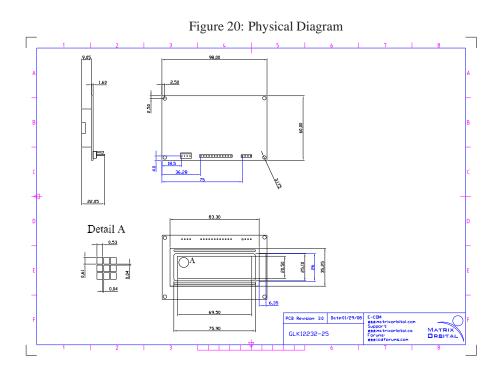
Table 80: Electrical Specifications		
Supply Voltage	+5Vdc ±0.25V	
Supply Current	57 mA typical	
Supply Backlight Current	92 mA typical	

16.2 Optical Characteristics

14010 01.	Optical Characteristics		
Pixel Layout122 x 32 pixels XxY			
Number of Characters	s 80 (maximum 20 characters x 4		
	Lines with 5x7 font)		
Display Area 69.5mm x 20.5mm XxY			
Dot Size	.52mm x .62mm		
Dot Pitch 0.53 x 0.53mm (XxY)			
LED Backlight Life	Life 20,000 hours typical		
Backlight	White LED		

Table 81: Optical Characteristics

16.3 Physical Layout



16.4 Definitions

E Extended Temperature (-20C to 60C)

GW Grey Text / White BackgroundWB White Text / Blue Background

MSB Most Significant Byte

LSB Least Significant Byte

16.5 Contacting Matrix Orbital

Telephone

Sales and Support: 1(403)229-2737

On The Web

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