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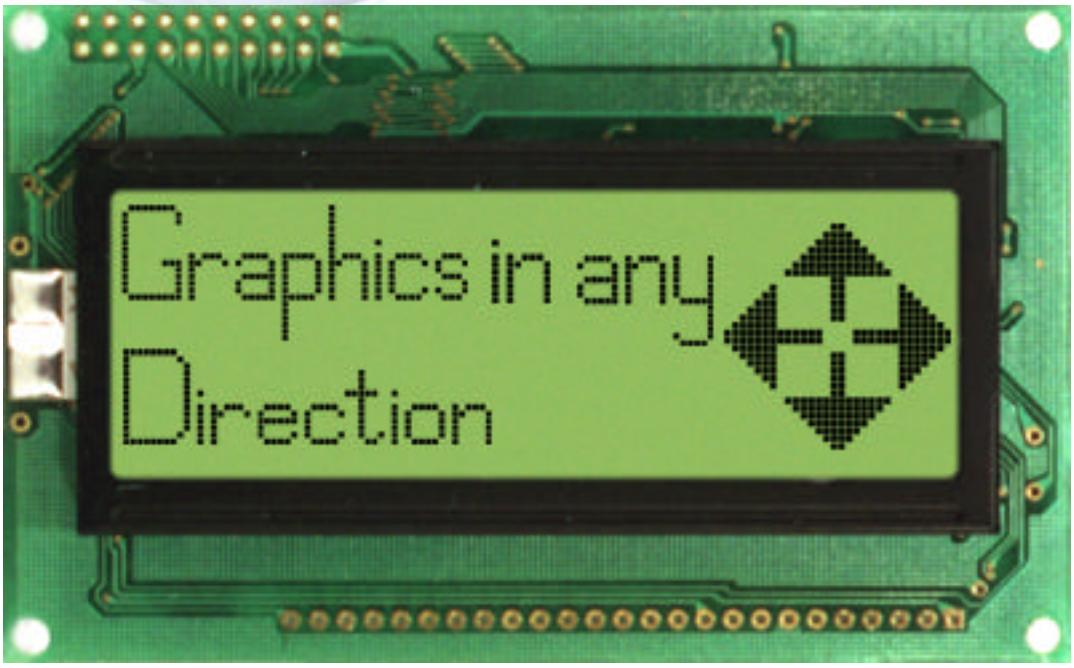
Matrix Orbital Corporation

GLK12232-25

User Manual



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Connecting GLK12232-25

The GLK12232-25 serial interface display has two types of communications: RS-232 and I²C.

The pin functions on the GLK12232-25 are as follows:

I²C

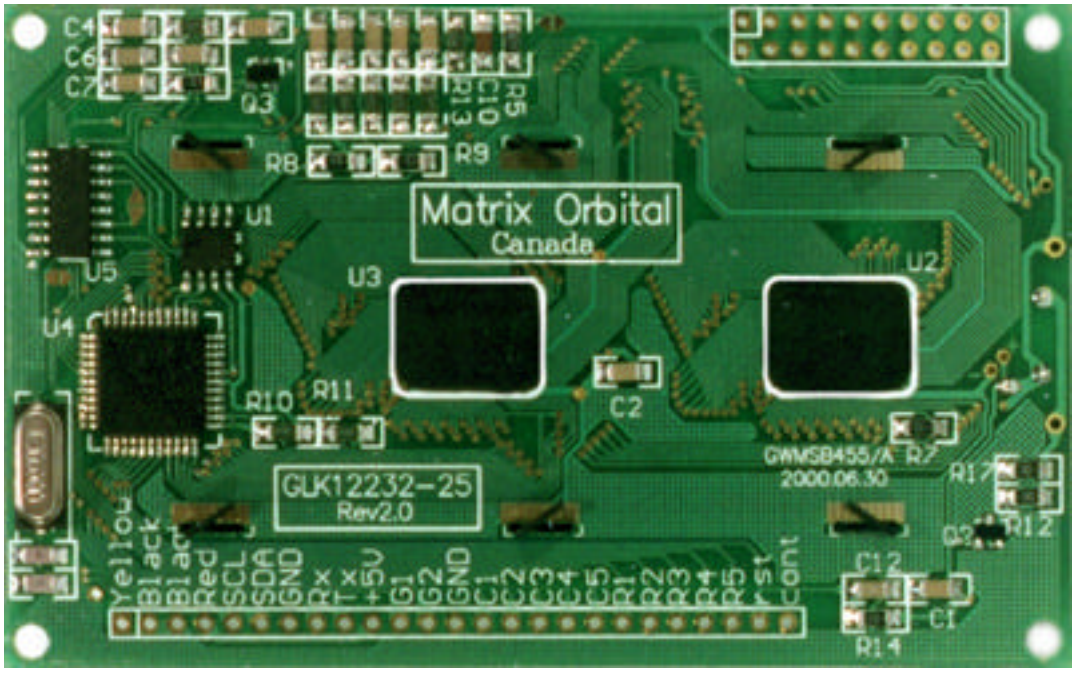
Pin 4: +5Vdc
Pin 5: SCL
Pin 6: SDA
Pin 7: GND

RS-232

Pin 7: GND
Pin 8: Rx
Pin 9: Tx
Pin 10: +5V

Keypad Connector

Pin 14: Column 1
Pin 15: Column 2
Pin 16: Column 3
Pin 17: Column 4
Pin 18: Column 5
Pin 19: Row 1
Pin 20: Row 2
Pin 21: Row 3
Pin 22: Row 4
Pin 23: Row 5



Additional Pins
Note: All of the pin functions listed here are No Connect

Pin 1: N.C. (Pin 1)
Pin 2: GND
Pin 3: GND
Pin 11: N.C. (G1)
Pin 12: N.C. (G2)
Pin 13: GND
Pin 24: N.C. (Rst)
Pin 25: N.C. (Cont)

Warning:

Do not apply any power with reversed polarization
Do not apply any voltage other than the specified voltage
Do not under any circumstances use an unmodified floppy drive cable.

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Fonts, Bitmaps and the File System

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Matrix Orbital graphic modules contain a sophisticated file system for storing and retrieving font information, bitmaps and system parameters: Not unlike the way that a computer deals with files on a hard drive. However, the modules use no moving parts, therefore, data is stored far more reliably than data on a home PC.

Operationally, there is one important difference between the Matrix Orbital file system and that of a PC. While a PC will allow fragmentation of its files across the available file space, the Matrix Orbital file system takes great care to ensure that all parts of a file are stored together. This system works well to maximize storage space and operational efficiency, however, during file downloads, the modules may need to spend considerable time moving files to make room for the new file. This delay during download can be as much as a minute, but generally it will not exceed 10 seconds.

When a file is being downloaded with the same "name" or reference number as previously existing file, the old file needs to be deleted first. Since we cannot know if the new file is exactly the same size as the old file, that space vacated by the old files filled by moving previously existing files down to fill up the vacated space. This ensures that no file space is wasted.

Of course, the average module will simply have files loaded into it and it will then get to work, without ever having to perform this file reorganization task. The file space may be rewritten up to 100 000 times, but most users will simply load in their fonts and bitmaps once and that will be it.

The Matrix Orbital Interface program mogd.exe which is provided on the disk and the website generates and downloads fonts larger than 14 pixels in height.

To make use of smaller fonts it is recommended that you use a pre-generated font. You will find these fonts on the disk or the website. Unfortunately, integrating these fonts is not as straight forward as generating the fonts yourself. To make use of these fonts you must place the font files in your font directory as defined in the interface program. You can find and define this directory under settings. A font file consists of a single file with an extension .mgf and a directory which contains bitmaps for every character. All .mgf files are contained within the font directory and all bitmap directories are sub directories of the font directory. After download of the font file use a “Zip” program to “UnZip” the .mgf file and bitmap sub-directory into your font directory. Start or restart the interface program and push the font tab. You should now see your new pre-generated font listed in the font list. For Information on uploading fonts and bitmaps visit this URL: http://www.matrix-orbital.com/fileformat/fileformat.htm

The Keypad Interface

Keypad Interface via I²C

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 Philips.

The module contains a ten key press buffer so that it can be polled for key presses at an infrequent rate (every 500 to 1000 mS is typical). All returned key presses indicate the presence or absence of additional logged key presses by the most significant bit (MSB - bit 7). If the user has pressed two keys since the last poll of the keypad interface, the first read will return the key code with bit 7 set and the second read will return the key code with bit 7 clear. The application must take into account this bit to keep up with user key presses. If there are no keypresses detected, the module will return zero (0x00).

Keypad Interface via RS - 232

By default on any press of a key, the module will immediately send out the key code at the selected baud rate.

Auto Transmit:

If the auto transmit mode is on (default) then on any keypress, the module will immediately send out the key code at the selected baud rate. If auto transmit is off, when the poll command is sent, the module will immediately send the key code.

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Auto Repeat:

Two Modes of auto repeat are available and are set via the same command.

1)Resend Key Code: This mode is similar to the action of a keyboard on a PC and is set via the '~" command with a value of 0 as outlined in the Command Set section of this manual. 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 I²C interface.

2)Key down / Key up codes: This mode may be used when the typematic parameters of the Resend Key code mode are unacceptable or if the unit 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. This mode is entered via the '~' command with a data value of (0x01). 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 40 hex. The key code associated with key code '0' (0x30) is pressed, the release code is 'p' (0x70).

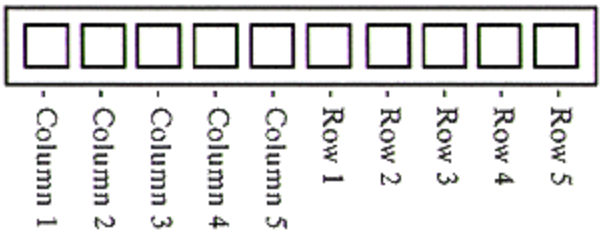
In RS - 232 polled mode or via the I²C interface, theses codes are available in the same manner as keypresses without auto repeat; however, the user should be careful to ensure that the poll rate is high enough so that simulated key repeats are avoided after the release of the key but before the next poll.

Physical Layout:

The returned key codes are as follows, but note that your keypad may be laid out in a different pattern. If this is the case, the user will need to interpret the key codes differently. The diagram 1 shows the logical layout (row 1, column 1 in upper left). The connector for the keypad is a 10 pin .1" spacing male header. Pin 1 is indicated on the connector layout diagram. Pins 1 through 5 are columns and pins 6 through 10 are row. 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.

		COLUMNS				
		1	2	3	4	5
ROWS	1	A	B	C	D	E
	2	F	G	H	I	J
	3	K	L	M	N	O
	4	P	Q	R	S	T
	5	U	V	W	X	Y

Keypad Connector



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Basic Operation

The operation of the GLK12232-25 is simple and user friendly. By transmitting commands listed within this section of the manual the user is able to display text, graphics, and primitives. The user can also alter the screen or behavior of the GLK by transmitting certain commands.

Writing Text to the Display

When the display receives a character, it then displays that character at the position currently defined. The next character sent to the module then advances to the following position on the display. Characters are drawn using the currently selected font, and only characters defined by the current font are actually processed. Characters that are not defined by the current font are ignored, and the positioning is not advanced for the next character.

The position where text is to be displayed is a single pixel location stored in the GLK's volatile memory and maintained internally by the GLK's firmware. It can be manually manipulated with two commands. One command positions the characters using a text oriented coordinate system, dividing the display into character cells. The other command positions the character at a specific pixel, allowing more "fine grained" control when needed.

Commands

To access the GLK's features and use the command set the user must sent a command prefix byte followed by a command byte. Some commands require parameters, and are not executed until all parameters are received. Others require no additional information and are executed immediately when received.

The command prefix is the single byte 0xFE (decimal 254). Sending the command prefix to the GLK instructs it to await another byte containing the command that needs to be executed. When the GLK receives the command byte, it will either act on the command immediately if parameters are not necessary, or will wait for more data if parameters are required.

Contained within the command set of the GLK12232-25 are basic commands, advanced commands, and graphic commands. Basic commands include instructions such as "Set Current Text Position", "Clear Display", and "Set Contrast" along with various other primary commands. The advanced commands provide access to more complex features, such as "Set Font Metrics" and "Set RS-232 Port Speed" the functions of these types of commands are usually management of graphics, memory, configuration and fonts. The graphics command section of the command set covers areas that are mainly limited to graphics displays. "Draw Line", "Draw Rectangle" and "Display Saved Bitmap" are examples of these specialized commands.

Basic Commands

All commands are prefixed by the command 0xFE, Hex FE, Decimal 254

Auto Repeat Mode On

ASCII '~', Hex 7E, Decimal 126
Syntax 0xFE 0x7E

To turn auto repeat on and select mode, send a command prefix followed by the character '~', followed by either 0x00 or 0x01:

= 0: 200ms typematic rate
= 1: Key down / Key up codes are sent
In either case, auto repeat is turned on.
Please see details in Keypad Interface section.

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Auto Repeat Mode Off
ASCII '`', Hex 60 Decimal 96
Syntax 0xFE 0x60

To turn auto repeat off, send a command prefix followed by the character '`'.

Auto Line Wrap On
ASCII 'C', Hex 43, Decimal 67
Syntax 0xFE 0x43

This command enables the automatic line wrap function. Transmitted characters which overrun the width of the display will automatically wrap to the next line. The bottom line wraps to line 1 of the display. To carry out this command the user must send a command prefix followed the character 'C'.

Auto Line Wrap Off
ASCII 'D', Hex 44, Decimal 68
Syntax 0xFE 0x44

This command disables the automatic line wrapping function. To turn off the auto line wrapping, send a command prefix followed by the character 'D'.

Auto Scroll On
ASCII 'Q', Hex 51, Decimal 81
Syntax 0xFE 0x51

To enable auto scroll, send a command prefix followed by the character ‘Q’. When auto scrolling is on, it causes the GLK to shift the entire display’s contents up to make room for a new line of text when the text reaches the scroll position defined by the “Set Font Metrics” command in the GLK memory.

Auto Scroll Off
ASCII 'R', Hex 52, Decimal 82
Syntax 0xFE 0x52

When auto scrolling is disabled, text will wrap to the top left corner of the display area. Existing graphics or text in the display area are not erased before text is placed; when using proportional fonts without auto scrolling, care should be taken to clear areas where text is being written , particularly when wrapping occurs.

Clear Display
ASCII 'X', Hex 58, Decimal 88
Syntax 0xFE 0x58

To clear the screen of the GLK, send a command prefix followed by the character ‘X’. This command clears the display and resets the text write position to the top left of the screen.

Set Contrast
ASCII 'P', Hex 50, Decimal 80
Syntax 0xFE 0x50 <contrast>

This command sets the display's contrast to <contrast>, where <contrast> is a value between 0x00 and 0xFF (between 0 and 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 GLK modules will also differ slightly from each other in appearance. In addition, values for optimal viewing while the GLK backlight is on may differ from values used when backlight is off.

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Set Contrast and Save Value
Hex 91, Decimal 145
Syntax 0xFE 0x91

This command works in exactly the same way as the “Set Contrast” command. The only difference is it saves the contrast value in the memory of the module, whereas, the previous command only changes the value for the duration of use.

Backlight On
ASCII 'B', Hex 42, Decimal 66
Syntax 0xFE 0x42 <minutes>

To turn the backlight on, send a command prefix followed by the character ‘B’, followed by a value defining the amount of time the backlight will remain on. This command turns on the backlight, it requires the time in , this specifies how long the backlight will remain on after receipt of the command. If is zero (0), the backlight will remain on indefinitely. Note: backlight is always on by default on power up.

Backlight Off
ASCII 'F', Hex 46, Decimal 70
Syntax 0xFE 0x46

This command turns the backlight of the GLK off.

Auto Transmit Keypresses On
ASCII 'A', Hex 41, Decimal 65
Syntax 0xFE 0x41

To activate the automatic transmission of keypresses, send a command prefix followed by the character 'A'. In this mode, all keypresses are sent immediately to the host system without the use of poll keypad command. This is the default mode on power up.

Auto Transmit Keypresses Off
ASCII 'O', Hex 4F, Decimal 79
Syntax 0xFE 0x4F

To disable the automatic transmission of keypresses, send a command prefix followed by the character 'O'. In this mode, up to 10 keypresses are buffered until the unit is polled by the host system via the poll keypad command.

Clear Key Buffer
ASCII 'E', Hex 45, Decimal 69
Syntax 0xFE 0x45

This command clears any unread keypresses. In a menuing 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 to, in effect, reset the keypad in case the application resets for whatever reason. To execute this command, send a command prefix followed by the character 'E'.

Poll Keypad
ASCII '&', Hex 26, Decimal 38
Syntax 0xFE 0x26

To return any unbuffered keypresses via the RS - 232 interface, send a command prefix followed by the character '&' and then set up the host system to receive the key codes. When a keypad module receives this command it will immediately return any unbuffered keypresses which may have not been read already. If there is more than one keypress buffered, then the high order bit of this returned keycode will be set. If this is the only buffered keypress, then the high order bit will be cleared. If there are no buffered keypresses, then the returned code will be 0x00. Please note to make use of this command the “Auto Transmit Keypress” mode should be off.

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Enter Buffer Return Status Mode
ASCII ':', Hex 3A, Decimal 58
Syntax 0xFE 0x3A <almost full> <almost empty>

To enter buffer return status mode, send a command prefix followed by the character ':'. The module will now wait for the two bytes which define the parameters: Where <almost full> is the number of bytes that will be left in the buffer when the unit sends a "buffer is almost full" message to the host system, and where <almost empty> is the number of unprocessed bytes that will be left in the buffer when the unit sends a "buffer is almost empty" message.

Entering this mode tells the host system when the buffer of the display is almost full or almost empty. When the data being sent to the module reaches the user defined value of almost full, the module will relay the message 0xFE to the host system. The module will also relay this message for every byte that overruns the limit defined by the value for . When the buffer is almost empty the module will then relate back to the host system the message 0xFF, this informs the host system that the buffer is almost empty.

Whether the user is in 'Buffer Return Status Mode' or not, the module will ignore display or command bytes which would overrun the buffer. While in 'Buffer Return Status Mode' the unit will return 0xFE when buffer is almost full even though it may have already thrown rejected data away.

When using this command in an application, selection of the value for the buffer almost full should be considered very carefully. This is a critical aspect of using this command to it's full potential. When using a host system or PC which contains a FIFO, the user should set the value of 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 should be set to 16 or greater.

This mode must not be used during loading of fonts and bitmaps. It is highly recommended to use with mulitple pixel placements.

Exit Buffer Return Status Mode
ASCII ';', Hex 3B, Decimal 59
Syntax 0xFE 0x3B

The command allows the user exit buffer return status mode.

Set Debounce Time
ASCII 'U', Hex 55, Decimal 85
Syntax 0xFE 0x55

To set the time between key press and key read, send a command prefix followed by the character 'U' and a number to define the debounce time. All key types with the exception of latched piezo switches will "bounce" for a varying time, depending on their physical characteristics. The default debounce time for the module is about 65mS, which is adequate for most membrane keypads. This time equates to a setting of 8 using this command as there is a debounce time resolution of 8192 microseconds.

Set Current Text Position
ASCII 'G', Hex 47, Decimal 71
Syntax 0xFE 0x47 <column> <row>

This command sets the cursor position to the <column> and <row> specified. This command positions the cursor using the base size of the current font (this command does not position the cursor at a specific pixel). The pixel column used is determined by multiplying the width of the widest character in the font by <column>. The pixel row used is determined by multiplying the height of the font by <row>. If precise pixel-based cursor positioning is required, refer to the "Set Current Text Position (Graphic)" command.

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General Purpose Output On
ASCII ‘V’, Hex 56, Decimal 86
Syntax 0xFE 0x56

To turn the general purpose output on, send a command prefix followed by the character ‘V’.

General Purpose Output Off
ASCII ‘W’, Hex 57, Decimal 87
Syntax 0xFE 0x57

To execute this command, send a command prefix followed by the character ‘W’.

Advanced Commands

Set Current Font
ASCII '1', Hex 31, Decimal 49
Syntax 0xFE 0x31 <font identifier>

This command instructs the GLK to use the font specified by <font identifier> as the default font. The value specified should refer to a font already present in the GLK's memory.

Set Font Metrics
ASCII '2', Hex 32, Decimal 50
Syntax 0xFE 0x32 <left margin> <top margin> <x space> <y space> <scroll row>

This command defines the metrics of a font already present in the GLK's memory. <left margin> specifies the first pixel column to user for the first character in a row. In some instances, a font may not evenly fit on the screen, and dividing the extra space between the margins will improve the overall appearance of the font. <top margin> specifies the top pixel row to begin drawing the first row of text on the display area. <x space> specifies the number of pixels to place between characters (i.e. line spacing). <y space> specifies the number of pixels to place between rows of text (i.e. line spacing). <scroll row> specifies the pixel row where scrolling should start (or, if auto scrolling is off, where wrapping should occur). Typically, this value should be set to the first pixel row immediately below the last row of text that will fit the display.

Set I²C Address
ASCII '3', Hex 33, Decimal 51
Syntax 0xFE 0x33

To write the I²C address of the module, send a command prefix followed by the character '3', followed by a write address. This command sets the I²C write address of the module. This value must be an even number and the read address is one higher. For example if the I²C write address is set to 0x50, then the read address is 0x51. The change in address is immediate. This address is 0x50 by default, and is reset temporarily back to that value when the "Manual Over-ride" jumper is used on power up. Refer to the Appendix for more details.

Set Serial Number
ASCII '4', Hex 34, Decimal 52
Syntax 0xFE 0x34 <serial number byte one> <serial number byte two>

To set the serial number of the module, send a command prefix followed by the character '4', followed by two values defining the first and second serial byte. This command sets the two byte serial number of the module. Upon the execution of this command, the module will echo these two bytes back over the RS-232 interface. The serial number may be set only once. Any future attempt to execute this command will result in no change and the module will return to the originally set serial number.

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Read Module Type Value
ASCII '7', Hex 37, Decimal 55
Syntax 0xFE 0x37

To read the module type value, send a command prefix followed by the character '7'. This command will return, over the RS-232 interface, the model type value of the module. Values for various models at the time of this publication are as follows:

LCD0821 – 0x01	LCD2021 – 0x03	LCD1641 – 0x04
LCD2041 – 0x05	LCD4021 – 0x06	LCD4041 – 0x07
LK202-25 – 0x08	LK204-25 – 0x09	LK404-55 – 0x0A
VFD2021 – 0x0B	VFD2041 – 0x0C	VFD4021 – 0x0D
VK202-25 – 0x0E	VK204-25 – 0x0F	GLC12232 – 0x10
GLC12864 – 0x11	GLC128128 – 0x12	GLC24064 – 0x13
GLK12864-25 – 0x14	GLK24064-25 – 0x15	GLK128128-25 – 0x21
GLK12232-25 – 0x22	LK404-AT – 0x31	VFD1621 – 0x32
LK402-12 – 0x33	LK162-12 – 0x34	LK204-25PC - 0x35

Set RS-232 Port Speed
ASCII '9', Hex 39, Decimal 57
Syntax 0xFE 0x39 &<speed>;

This command sets the GLK's 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 GLK 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 on the GLK controller board during power up. This command is ignored until this jumper is removed again.

Speed Value	Speed
20 Hex	9600 baud
0F Hex	19200 baud
95 Hex	57600 baud
03 Hex	76800 baud
8A Hex	115000 baud

Erase File
ASCII '-', Hex B0, Decimal 176
Syntax 0xFE 0xB0 <type> <reference number>

To erase a file within the GLK memory, send a command prefix followed by the character '-', followed by the type of file and the reference number corresponding to that file within the GLK memory. This command erases a single file at a time. This command needs to be given two parameters. First the user must define what type of file it is <type>. There are two types of files, fonts<0x01 and bitmaps<0x05>. Then the user must define the reference number of the file in the GLK memory <reference number>. Once this command is completed all files "move up" and recover the empty space for efficient memory management.

Memory Purge

ASCII '!', Hex 21, Decimal 33
Syntax 0xFE 0x21 0x59 0x21 (!Y!)

To delete the GLK memory, send a command prefix followed by the characters '!' (Hex 21), 'Y' (Hex 59), and '!' (Hex 21). This command completely erases the GLK's non-volatile memory. This removes all fonts, font metrics, bitmaps, and settings (current font, communication speed, etc.). It is an "odd" command in that it is three bytes in length. This is to prevent accidental execution.

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Set Drawing Color
ASCII 'c', Hex 63, Decimal 99
Syntax 0xFE 0x63 <color>

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 0 Hex, and black is 255 Hex.

Draw Line
ASCII 'l', Hex 6C, Decimal 108
Syntax 0xFE 0x6C <color> <x1> <y1> <x2> <y2>

This command will draw a line using color <color> from (<x1>,<y1>) to (<x2>,<y2>). This command will not alter the global drawing color set by the 'c' command. Lines may be drawn from any part of the display to any other part, but 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.

Continue Line
ASCII 'e', Hex 65, Decimal 101
Syntax 0xFE 0x70 <x> <y>

This command will draw line with the current drawing color from the last line end (<x2>,<y2>) to (<x>,<y>). This command uses the global drawing color so the 'c' command should be used before the first line segment if required.

Put Pixel
ASCII 'p', Hex 70, Decimal 112
Syntax 0xFE 0x70 <x> <y>

This command will draw a pixel at (<x>,<y>) using the current drawing color

Draw Rectangle
ASCII 'r', Hex 72, Decimal 114
Syntax 0xFE 0x72 <color> <x1> <y1> <x2> <y2>

This command will draw a solid rectangle using color <color> from (<x1>,<y1>) to (<x2>,<y2>) (bottom right).

Draw Square
ASCII ‘x’, Hex 78, Decimal 120
Syntax 0xFE 0x78 <color> <x1> <y1> <x2> <y2>

To draw a square, send a command prefix followed by the character ‘x’. The user must then specify the <color> of the square and the position of the square on the GLK screen. The position of the square is set by pixels (<x1>,<y1>) being the top left and (<x2>,<y2>) being the bottom right. This command will draw a solid square.

Initialize Bar Graph
ASCII 'g', Hex 67, Decimal 103
Syntax 0xFE 0x67 <reference number> <type> <x1> <y1> <x2> <y2>

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:

Vertical bottom referenced (<type> = 0)
Vertical top referenced (<type> = 2)
Horizontal left referenced (<type> = 1)
Horizontal right referenced (<type> = 3)

The bar graphs may be located anywhere on the display, but if they overlap, they will not display properly. Note: it is important that <x1> is less than <x2>, and <y1> is less than <y2>.

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Write to Bar Graph
ASCII 'i', Hex 69, Decimal 105
Syntax 0xFE 0x69 <reference number> <value>

This command sets the bar graph <reference number> to value <value>

Set Current Position (Graphic)
ASCII 'y', Hex 79, Decimal 121
Syntax 0xFE 0x79 <x position> <y position>

This command sets the next position for text placement via a individual pixel location. The coordinate (<x position>,<y position>) defines a pixel on the screen where the top left corner of the screen is defined as (0,0). This pixel location will be used as the top left corner of the next character of text which is sent to the module without any regard to "font metrics" like character spacing or line spacing.

Display Saved Bitmap
ASCII 'b', Hex 62, Decimal 98
Syntax 0xFE 0x62 <reference number> <x location> <y location>

This command causes a previously stored bitmap referenced by <reference number> to be displayed to the screen at pixel location (<x location>, <y location>) where this location defines the top left corner of the bitmap.

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GLK12232-25 Specifications

Environmental Specifications	
	Standard Temperature
Operating Temperature	-0ºC to +50ºC
Storage Temperature	-20ºC to +70ºC
Operating Relative Humidity	90% Max Non - Condensing
Vibration (Operating)	4.9 m/s2 XYZ Directions
Vibration (Non-Operating)	19.6 m/s2 XYZ Directions
Shock (Operating)	29.4 m/s2 XYZ Directions
Shock (Non-Operating)	490 m/s2 XYZ Directions

Electrical Specifications (Ta = 25ºC, Vin = 5V)	
Supply Voltage	4.75 - 5.25 Vdc
Supply Current	18 mA typical
Backlight Supply Current	110 mA typical

Optical Characteristics	
Pixel Layout	122 pixels x 32 pixels XxY
Number of Characters	80 Characters (maximum 20 Characters x 4 Lines w/ 5x7 font)
Display Area	69.50 mm x 20.76 mm XxY
Dot Size	0.52mm x 0.62mm (XxY)
Dot Pitch	0.53mm x 0.53mm (XxY)
LED Backlight Life	100 000 hours typical
Color of Illumination	Yellow Green

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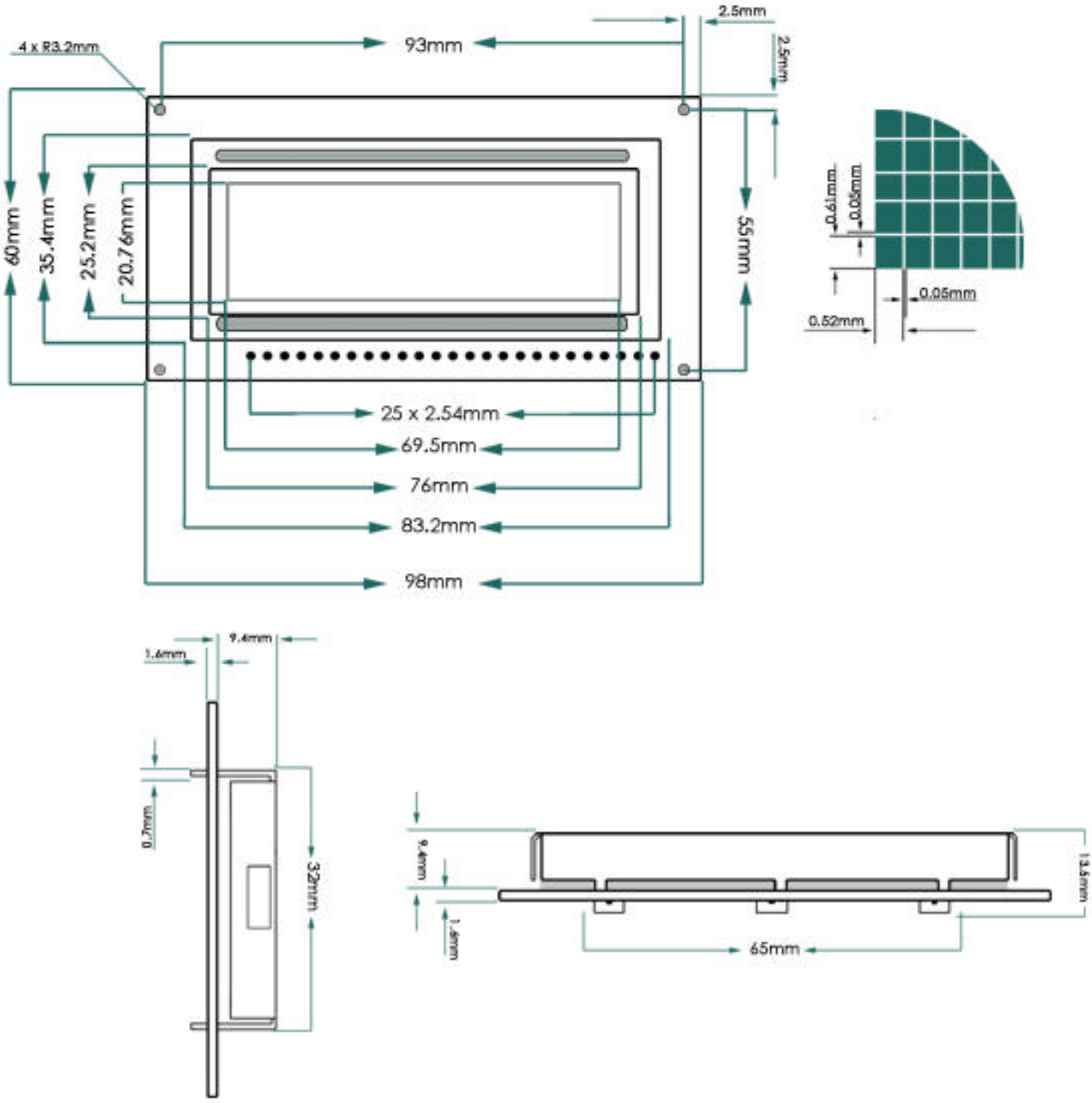

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Appendix

Hex numbers are specified in C language convention as 0xUL - where U is the upper nibble and L is the lower nibble. E.g.: 0xFE is 1111 1110 in binary. This is equivalent to ULH or ULh as in the binary number.

1111	1110
Upper	Lower
Nibble	Nibble

Manual Override

Manual override should only be required in one instance. If for some reason the module is set at a baud rate which cannot be produced by the host system and all communication to the display is lost, then the user should follow this simple procedure:

1) Turn off the display
2) Put a jumper on pins 5 and 6 of the keypad connector.
3) Power up the display.
4) Remove the jumper and change the RS-232 port settings to a baud rate recognized by the host system.
5) Turn off the display.
6) Power up the display.

*Please refer to the “Set RS-232 Port Speed” command for acceptable baud rates.

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Note: Currently only carries LCD2041, LK204-25

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