

AWC

**GP1 LCD RS232
Terminal Kit**

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V1.2 30 Aug 2003

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Overview

The GP1 is an RS-232 terminal that allows you to use a standard PS/2 keyboard and parallel interface LCD to communicate with serial devices. The terminal is highly customizable and adaptable for many uses. Features include:

- Flexible system interfaces with most character LCDs (including 8x2, 16x1, 16x2, 10x2, 20x2, 24x2, 30x2, 32x2, 40x2, 16x4, and 20x4 displays (standard Hitachi-style 14 pin interface)
- VT100 subset
- Support for scrolling, line wrapping, and local/remote echo
- Operation at 19,200, 9600, 2400, and 1200 baud
- Fixed 8 bit, no parity, 1 stop bit operation
- RTS/CTS hardware handshaking
- True RS232 on a DCE connector
- Configuration stored in EEPROM

If You Need Help

If you require assistance, please feel free to contact us. The best way to get support is via e-mail (stamp@al-williams.com). However, you may also call between 9AM - 4PM Central Time at (281) 334-4341. You can also fax to (281) 754-4462. Be sure to check out our Web page for updates at www.al-williams.com/awce.

Building

Please follow the directions included for building the GPMPU kit. The board requires no modifications to work with the GP1.

However, you may want to consider any special power supply connections or serial connections you'd like to make. In addition, you'll need to connect the PS/2 connector and your LCD.

If you are prototyping, you may want to install the header at JP1 and use it to connect the LCD through a solderless breadboard. You can also solder wires to RB0 and RB5 (along the long edge of the board near IC1) to connect to a breadboard and then to the PS/2 connector.

For a permanent installation, you'll want to omit the header at JP1 and simply make the connections to the LCD and PS/2 connector to fit your installation (you can cut the connector from the PS/2 connector and solder it directly to the board or replace it with a connector of your choice).

In any event, make your connections according to this chart (this assumes the standard 14 pin LCD pin out – your LCD may vary; also the colors provided match the PS/2 connector supplied but these are not standard so be sure to verify any other connector):

| <i>Device</i> | <i>Pin</i> | <i>Connect To</i> | <i>Description</i> |
|---------------|------------|-------------------|--|
| PS/2 | 1 | RB5 | PS/2 data (red) |
| | 3 | ICSP-3 or JP2-1 | PS/2 ground (brown) |
| | 4 | ICSP-2 or JP2-11 | PS/2 +5V (yellow) |
| | 5 | RB0 | PS/2 clock (green) |
| LCD | 1 | JP1-1 or JP2-1 | LCD Ground |
| | 2 | JP1-11 or JP2-11 | LCD +5V |
| | 3 | Contrast | Your LCD may require a connection to ground, a connection to a pot, or a negative voltage to set the |

| <i>Device</i> | <i>Pin</i> | <i>Connect To</i> | <i>Description</i> |
|---------------|------------|-------------------|---|
| | | voltage | contrast voltage. Refer to your LCD documentation. This voltage is not supplied by the GP1. |
| | 4 | JP1-5 | LCD register select |
| | 5 | JP1-2 | LCD R/W |
| | 6 | JP1-4 | LCD E |
| | 11 | JP1-10 | LCD D4 |
| | 12 | JP1-9 | LCD D5 |
| | 13 | JP1-8 | LCD D6 |
| | 14 | JP1-7 | LCD D7 |



PS/2 connector (female, looking into connector)

There are other customizations you might consider. For example, if you need an inverted TTL-level port, you may wish to omit the MAX232 and install jumpers across IC2 (pins 9 and 8, 12 and 13, 10 and 7, along with pins 11 and 14). If you need a DTE port instead of the default DCE port, you might use an external DB9 and connect it in the holes provided for J1. You can also use a null modem adapter (not supplied) connected to J1 to convert to DTE.

If you don't intend to connect a keyboard, ground RB4. If you aren't connecting an LCD, ground RB3. Otherwise, the GP1 will hang looking for the appropriate device.

The board uses RTS/CTS handshaking. If you don't want handshaking, you can wire a jumper from pin 2 of IC2 to pin 8 of IC2. Alternately, you can cut the trace from pin 9 of IC2 and short pin 22 of IC1 to ground.

Operation

The GP1 acts as a standard terminal that uses a hardware-selectable baud rate, 8 bits, no parity, and 1 stop bit. It uses RTS/CTS handshaking. For normal operation, do not connect anything to the reset header. If you short the two pins of the reset header and then remove the short, the device will reset. A keyboard correctly connected to the unit should blink its LEDs when power is applied and when the device is reset. In addition, the NumLock, CapsLock, and ScrollLock LEDs should respond as you'd expect – if you don't get this behavior, something is wrong as you should consult the Troubleshooting section of this manual.

To select a baud rate, you can use wire jumpers on ICSP pin 4 and 5. Normally, leave these pins disconnected, and the unit will use 19200 baud. You can connect the pins to ground to select other baud rates (baud rates are only set at device reset):

| <i>Pin 4</i> | <i>Pin 5</i> | <i>Baud Rate</i> |
|--------------|--------------|------------------|
| GND | GND | 1200 |
| N/C | GND | 2400 |
| GND | N/C | 9600 |
| N/C | N/C | 19200 |

Because the GP1 can accommodate many different LCDs, you'll need to configure it to properly handle your particular LCD. By default, the unit is configured for a 40 character by 2 line LCD. If you connect the unit to a PC, for example, and connect using a terminal program (like Hypterterminal) you should be able to see at least the first 8 characters on any LCD. You can use Escape c (that is, press the Esc key and a lower case C) to reset the GP1. The LED on the board will blink as the unit receives serial data.

There are several items you can set to program the LCD type. Note that parameters, such as the LCD width, are in ASCII digits, so 20 represenets the character "2" and the character "0", not a single byte with the value of 20. Also, characters are case sensitive, so Esc[@W and Esc[@w are two different commands. Here are the commands of interest for LCD setup:

- **Esc[@Xl** – Set the LCD line count to X. (Note: the last character is a lower case L.) So for a 4 line LCD, you'd enter Esc[@4l.
- **Esc[@Xw** – Set the LCD width. So for a 20 character wide display, you'd enter Esc[@20w.
- **Esc[@XB** – Set the GP1 options. X is a number that represents the bits shown in this table:

| <i>BitOption</i> | | <i>Add Default</i> | |
|------------------|-------------------------|--------------------|----|
| 7 | VT100 Keys Only | +128 | On |
| 6 | Auto scroll enable | +64 | On |
| 5 | Auto line feed (output) | +32 | On |
| 4 | Auto line feed (input) | +16 | On |
| 3 | Line wrap mode | +8 | On |

| <i>BitOption</i> | | <i>Add Default</i> | |
|------------------|------------------------|--------------------|-----|
| 2 | Echo local characters | +4 | Off |
| 1 | Echo remote characters | +2 | Off |
| 0 | LCD line split | +1 | Off |

So to enable autscroll and local echo (disabling everything else) you'd set X to $64+2 = 66$. For the LCD, bit 0 is important. Many 16x1 line displays are organized as 2 separate 8 character lines. If you are using this style of display, you need to set bit 0 of the option word. If not (the default) you need to leave this bit clear. The default value for X is 248.

By default, the unit assumes that line 0 of the LCD is at address 0, line 1 is at hex address 40, line 2 is at hex address 20, and line 3 is at hex address 60. You should not need to change this, but if you do, you can change it with the Esc[@N;XO command (see the reference section).

Once you have the LCD set correctly, you'll want to issue the Esc[@W command. This will save the values in EEPROM so you won't have to change them again unless you want different values. The Esc[@w command resets the settings to their factory defaults (but does not store the values in EEPROM).

Reference

The GP1 uses a subset of the VT100 command codes. Commands are case sensitive and consist of ASCII characters. Spaces are shown for readability, but are not part of the commands (for example: "Esc [c" is sent "Esc[c").

Many commands require numeric arguments. These are indicated below by an underline so, "Esc [@ N w" is telling you to replace the N with a decimal number (for example, " Esc [@ 2 0 w").

Input Codes

Reset – Esc c

This completely resets the GP1. Note that this causes the baud rate to be recomputed and the parameters read from EEPROM.

Terminal Type Request – Esc [c

The GP1 responds to this code with "Esc [? 1 ; 0 c" to indicate its terminal type.

Terminal Status Request – Esc [5 n

Send this command to request a status check. The GP1 always returns Esc [0 n to indicate it is functioning.

Cursor up – Esc [A

Cursor down – Esc [B

Cursor right – Esc [C

Cursor left – Esc [D

These commands move the cursor one unit in the direction specified. You can provide an optional count. So to move the cursor 5 places to the right, you could send Esc [5 C.

Save Cursor – Esc 7 or Esc [s

Recall Cursor – Esc 8 or Esc [u

These sequences save the cursor and later restore its position. When you save the cursor's position, any previous position stored is lost.

Set Tab Stops – Esc [@ X T

The GP1 expands tabs to the nearest cursor position that is an integer multiple of the tab stop parameter (default is 4). The tab stop parameter is saved in EEPROM with other parameters.

Set Cursor Position – Esc [L ; C H or Esc [L ; C f

Use either of these Escape sequences to set the current cursor position. The first number indicates the line number (lines start at 1) and the second number is the column number (also starting at 1). So to move the cursor to the top left corner of the screen, send "Esc [1 ; 1 H". Note that sending invalid cursor numbers will have unpredictable results.

Report Cursor Position – Esc [6 n

When the GP1 receives this command it will respond with "Esc [Y ; X R" where X and Y are the current cursor column and line respectively.

Erase from cursor to start of line – Esc [1 K

Erase from cursor to end of line – Esc [K

Erase line – Esc [2 K

Erase to end of screen – Esc [J

Erase from cursor to start of screen – Esc [1 J

Erase screen – Esc [2 J

These commands erase part or all of the current line or the screen. Note they do not alter the cursor position, so while Esc [2 J clears the screen, it does not move the cursor to the home position.

Line Wrap On – Esc [7 h

Line Wrap Off – Esc [7 l

These commands enable or disable line wrapping (you can also change this in the options word with Esc [@ X B). When word wrapping is off, text just continues overwriting the last character of the line. This parameter is saved in EEPROM.

Set Options – Esc [@ X B

The number you enter here sets the options used by the GP1. This parameter is stored in EEPROM. Refer to this table:

| <i>Bit</i> | <i>Option</i> | <i>Add</i> | <i>Default</i> |
|------------|-------------------------|------------|----------------|
| 7 | VT100 Keys Only | +128 | On |
| 6 | Auto scroll enable | +64 | On |
| 5 | Auto line feed (output) | +32 | On |
| 4 | Auto line feed (input) | +16 | On |
| 3 | Line wrap mode | +8 | On |
| 2 | Echo local characters | +4 | Off |
| 1 | Echo remote characters | +2 | Off |
| 0 | LCD line split | +1 | Off |

A standard VT100 does not have home, insert, end, and other similar keys. Setting bit 7 prevents the GP1 from sending its special characters for these keys.

When autoscroll is enabled, the GP1 automatically scrolls when you reach the end of the screen.

Bits 5 and 4 allow you to append line feeds to carriage returns when they are incoming or outgoing.

The line wrap mode is the same as the mode set by Esc[7h and Esc[7l.

Bit 2 causes the GP1 to echo characters you type on the LCD. It also locally obeys standard cursor commands in this mode.

Bit 1 causes the GP1 to echo received characters back to the sender.

Bit 0 sets LCD split mode. This is used for 16x1 LCDs that are organized as two 8 character lines.

Set Cursor and Display – Esc [@ X D

You can use this command to control the display and the cursor appearance. The following numbers are supported: 0 – normal cursor; 1 – blank display; 2 – no cursor; 3 – blinking cursor.

Read Error Count – Esc [@ A

This command causes the GP1 to write [@ E a where the E represents the number of framing and overrun errors that have occurred. The number always has 5 digits (e.g., 00000).

Set LCD Width – Esc [@ X w

Set LCD Lines – Esc [@ X l

Set the width and number of lines the attached LCD can accommodate. Note that in LCD split mode, you must set the line count to 1.

Set LCD Offsets – Esc [@ N ; X O

This sets the address for the start of each line in the LCD. The first number is the line number (0 to 3) and the second number is the offset (from 0 to 255). The default offsets are nearly always what you want (0, 64, 32, and 96). If LCD split mode is set, line 1's offset is actually the starting position of the second half of the line (usually 64).

Save EEPROM – Esc [@ W

Restore defaults – Esc [@ w

When the GPI powers up it reads the following parameters from EEPROM: All parameters set with Esc [@ X B, the tab stop value, the LCD width and height, and the LCD offsets. If you restore the defaults, this does not write over your EEPROM settings. If you wish to restore the EEPROM settings, you should load the defaults and then save the new set to EEPROM.

Set Padding – ESC [@ N P

You can add small amounts of time inbetween sent characters (effectively adding stop bits). N must be from 0 to 255. The default is 0 and the current setting is saved in EEPROM. The approximate delay is about 60uS per unit.

Output Codes

Function keys

The Function keys output Esc [O (for F1) to Esc [Z (for F12).

Cursor keys

The cursor arrow output Esc [A, Esc [B, Esc [C, and Esc D (up, down, right, and left respectively).

If bit 7 of the options is clear, the GP1 also outputs these non-standard characters:

- Home – Esc [% A X
- PgUp – Esc [% C X
- End – Esc [% G X
- PgDn – Esc [% I X
- Ins – Esc [% J X
- Del – Esc [% K X
- Numeric 5 (w/o NUMLOCK) – Esc [% E X

Troubleshooting

If you experience difficulty with the GP1, consider the following items:

- If the keyboard lights blink when you reset the GP1, the keyboard is working. If it doesn't the keyboard is not working and you likely have a power or connection problem. Also, the lock LEDs on the keyboard should respond to the corresponding lock key.
- If the LED on the board blinks, the terminal is receiving data.
- Many LCDs do not appear to work until the correct contrast voltage is applied. Some LCDs will accept ground or a voltage between 0 and 5V on this pin. Some require negative voltages. You can try a 10K pot from ground to 5V and supply the contrast voltage from the pot's wiper. Be aware that the GP1 always sets two line mode, and that the contrast in two line mode may be different from that in one

line mode. In general, you should be able to change the contrast voltage until you see black blocks in each character position and then back it off slightly.

- If you are not using the GP1's power supply, be sure you have enough power to drive the GP1, the keyboard, and the LCD.

**Special Note: ~ and **

Most LCDs do not correctly display the ~ and \ characters. To rectify this, the GP-1 programs two custom characters into the LCD and substitutes them for these characters. In the unlikely event that your LCD does not support custom characters, the display may fail to render these two special characters at all. Other characters will display as your LCD shows them. Control characters (31 and below) are not displayed.

Notes

Board Layout

