

Volume

1

A-WIT TECHNOLOGIES INC.

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CS4100[1 | 2]0 LCD Displays Reference Guide

Version 1.4

A-WIT TECHNOLOGIES INC.

CS4100[1|2]0 LCD Displays Reference Guide Manual

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Introduction to the LCD Displays

The CS4100[1|2]0 Intelligent Serial LCD displays with backlight are very functional and low-cost LCD that can be easily controlled by a C Stamp. The LCD displays provides basic text wrapping so that your text looks right on the display. The LCD display is compatible with the C Stamp microcomputer's supplies and signal levels. In addition, these Intelligent Serial LCD also provides you with full control over all of its advanced LCD features, allowing you to move the cursor anywhere on the display with a single instruction and turn the display on and off in any configuration. The CS4100[1|2]0 LCD displays requires only a 5 V power supply and the connection related to transferring data to the LCD via the UART protocol. Many useful text formatting functions are built into the operation of the LCD. With this display and the C Stamp, users can design a professional-looking text user interface on any microcontroller application, supply an easy-to-use debugging interface that does not require a PC, and provide real-time sensor data output on autonomous robotic applications.

Registering Your C Stamp or C Stamp Related Product

At A-WIT Technologies we respect your privacy; however, we do ask you to register your C Stamp or C Stamp related product, so you can receive free of charge product updates. The registration procedure is simple. Just send an e-mail to tech_support@a-wit.com with the word "REGISTRATION x" in the subject line, where "x" is the product number that you purchased. If you purchased more than one product, send an e-mail for each different product.

Introduction to the CS4100[1|2]0 LCD Displays

Traditional Text Liquid Crystal Displays (LCDs) requires 7 - 11 pins from a Microcontroller or Microprocessor to display text on the LCD. These Serial LCD Displays allow any device to display to the LCDs with only 1 pin using the standard

Serial RS-232 protocol. This simplifies the effort and reduces the code required by your Microcontroller. Because only 1 pin is required, other pins can be used for other purposes.

The LCD modules consumes only 6mA of current while active if the backlight is not switched on, thus is suitable for battery powered applications. Users are also able to Hard Reset the LCD display; this means the user need not physically switch off and back on the unit to reset it.

Pictures of the front and back of the CS410010 and CS410020 LCD Displays are shown below.



CS410010:



CS410020:

Features

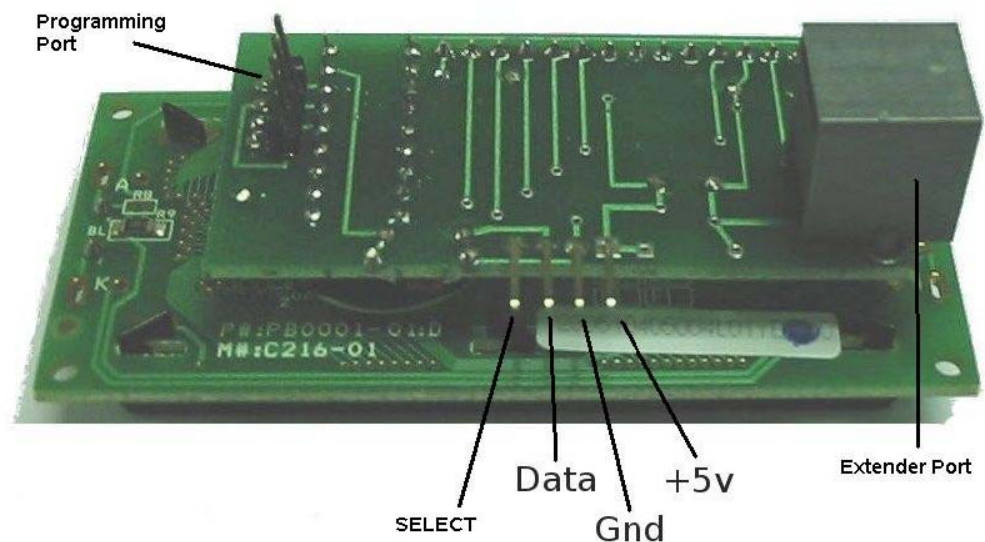
The system level features of the LCD displays are as follows:

1. Text positioning directly references to line numbers, allowing portable code that works with different LCD displays.
2. Auto Power Off for BackLight to save power / battery.
3. Automatic Text Wrap at the end of each line to the next line.
4. Correct handling of Carriage Return <CR> character, moves to next line.
5. BackLight control commands.

6. Hard Reset function which powers down the LCD display and up again.
7. Can work with RS232 or TTL voltage levels with any settings. The LCD expects RS232 inversion. In other words, a logic 0 is 5V and a logic 1 is a lower voltage.
8. Correct handing of Backspace character.
9. Commands to clear any Display Line without clearing the whole screen.
10. Automatic contrast setting, which can be set to Light, Normal or Dark by a serial commands.
11. Able to display byte value as a decimal number on the LCD.
12. Able to display byte value as a number with a zero in front if number is less than 10. Very useful for Date, Time and Cents displays.
13. Able to display byte value as a Hexadecimal number on the screen. Very important for debugging.
14. All commands can be tested from a PC terminal for easy verification.

Connectivity and More Information

The following figures describe the pin-out connectivity for both LCDs.



When using the LCDs, the following should be kept in mind:

Allow a 0.8 second delay after power is applied before sending text or commands to the LCD module.

The power supply should be +5 volts regulated capable of supplying at least 60mA if you want to use the LCD backlight.

The Select Pin can be used to reduce the baud rate to 2400bps by pulling it to ground. Leaving the Select Pin unconnected keeps the baud rate at 9600bps.

The serial data is sent to the LCD module via the Data pin.

The Extender Port is optional. It allows moving the LCD module up to 20 feet away from a PC or Microcontroller using a standard 4 wire flat phone cable with RJ11 connector.

The Programming port is used for future upgrades of the LCD firmware and should not be connected.

Serial Interface Settings:

The LCD modules can accept both standard RS232C signals (+12V to -12V) or TTL Level signals (+5V to 0V). It can also work directly with 3.3v Microcontrollers. The LCD expects RS232 inversion. In other words, a logic 0 is 3.3V and higher, and a logic 1 is a lower voltage.

Before sending text to the LCD to be displayed, make sure the baud rate and other serial settings are correct.

The default baud rate is 9600bps. To change the baud rate to 2400bps, connect the Select pin to ground. Upon power up, the new baud rate will be shown on the screen.

The other serial settings should be: 1 Start Bit, 1 Stop Bit, 8 Data bits, No parity bit, and No Flow Control.

Don't worry if you are not sure about all these settings above, because they are actually standard default settings for serial ports.

To use these LCDs with the C Stamp, the Data pin must be connected to Pin 24 of the C Stamp. Make sure that you have the Data pin connected to pin 24 and pin 25 grounded in the C Stamp. Make sure that you remove these connections before connecting the PC/programming cable for the C Stamp, and vice versa.

These LCDs can also be used with any regular I/O pin connected to the LCD Data pin, and using the C Stamp SEROUT2 function, but you need to put an inverter like the CS459020 between the C Stamp pin and the LCD.

Getting Started

This chapter is a quick start guide to using the CS4100[1|2]0 LCD with the C Stamp. This assumes you have a C Stamp and an appropriate connection kit or development board with the RESET and START circuitry and the LCD properly connected to the C Stamp. You will also need a programming cable, power supply, PC running Windows® 2000/XP/Media/Vista, with a quantity of RAM recommended for the OS, sufficient free hard disk drive space for the software installations, CD-ROM drive, Internet access (recommended only), and available port compatible with your programming cable.

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Getting Support

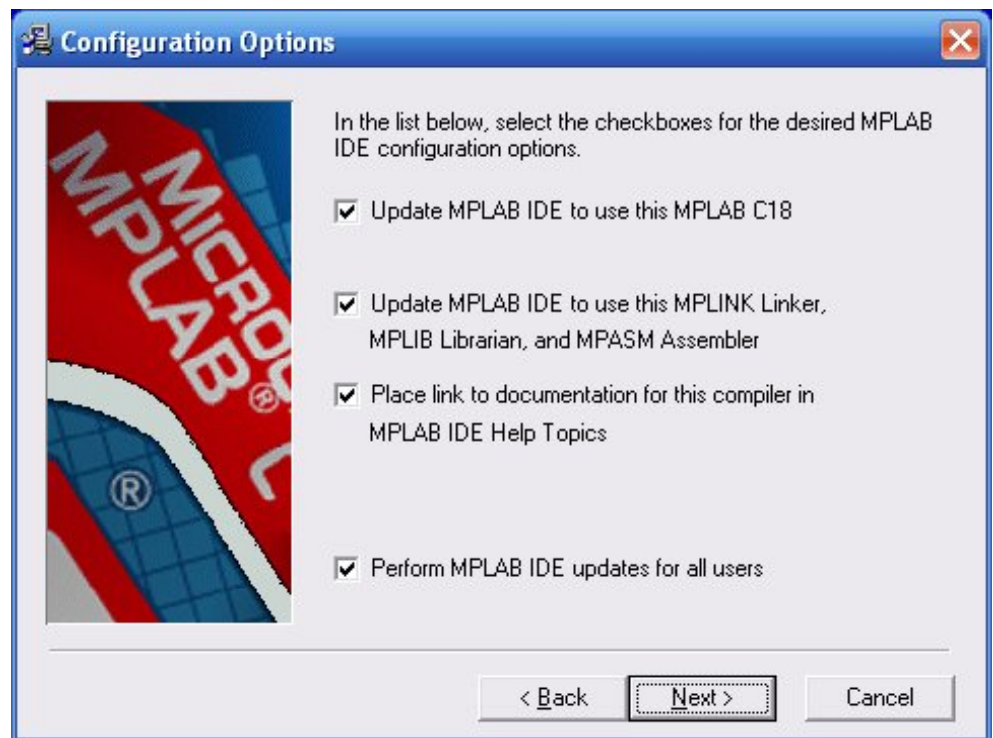
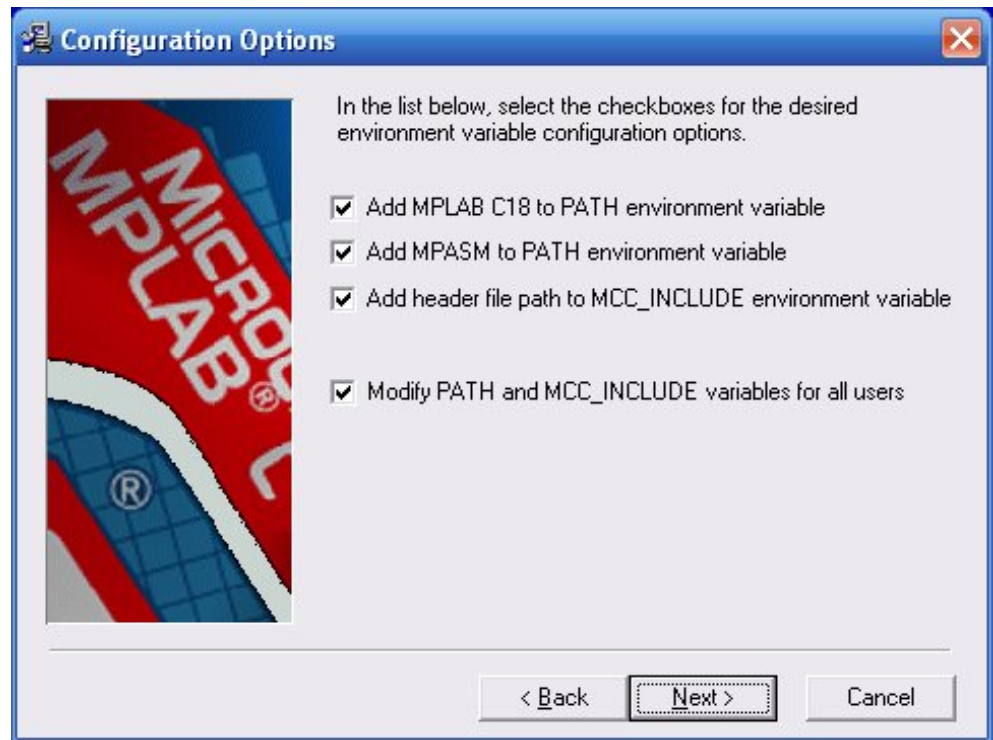
If possible, please check the C Stamp website www.c-stamp.com under SUPPORT for any updates to documentation, changes, or notices that may have become available since your Installation CD was produced. If you continue to have any issues for which a solution is not found in the aforementioned website, please e-mail tech_support@a-wit.com for help.

Installing the Microchip MPLAB and C Compiler Software

The first step is to install the Microchip MPLAB software that you will use to develop your programs.

Insert your A-WIT provided Installation CD in your CD drive. Go to the MPLAB directory in the CD and double click on the “MPLAB vX.XX Install” file in that directory. Follow the installation steps, prompts, and directions provided by the installer software, accepting all the default options.

After the MPLAB installation is complete, switch to the C18 directory in the CD, and double click on the file in that directory. Follow the installation steps, prompts, and directions provided by the installer software, accepting all the default options. The only exceptions to accepting all the default options is that on the 5th and 6th windows of the installation process for the C18 Compiler, you have to select everything as shown in the figures below. This will ensure that MPLAB is configured to use the C18 Compiler.



Installing the A-WIT C Stamp Quick Programmer

To install the A-WIT C Stamp Quick Programmer, switch to the CSTAMPQP directory in the CD using Windows Explorer, and double click on the file in that directory. Follow the installation steps, prompts, and directions provided by the installer software, accepting all the default options.

Installing the USB Software

If you purchased a product with a USB download cable, make sure that the A-WIT provided CD is in the CD drive of your PC and insert the USB cable in the USB port of your PC. Windows auto detects the new USB device. If Windows prompts you to install drivers for the USB cable device, follow the installation steps, prompts, and directions provided by the installer software, accepting all the default options.

After the USB adapter has been installed, open a Windows Explorer window from the Accessories sub-menu in the Start menu, and right click on My Computer. Proceed to select Properties, and then select the Hardware tab. Click on the Device Manger button, and expand the Ports (COM & LPT) branch. Make a note of the COM port that has been assigned to the USB-to-Serial adapter. This is the port that should be selected in the C Stamp programmer software.

Setting Up the C Stamp Software Templates

To set up the C Stamp Software Templates, switch to the CSTAMP_Template directory in the CD using Windows Explorer, and double click on the file in that directory. Follow the installation steps, prompts, and directions provided by the installer software, accepting all the default options.

Documentation

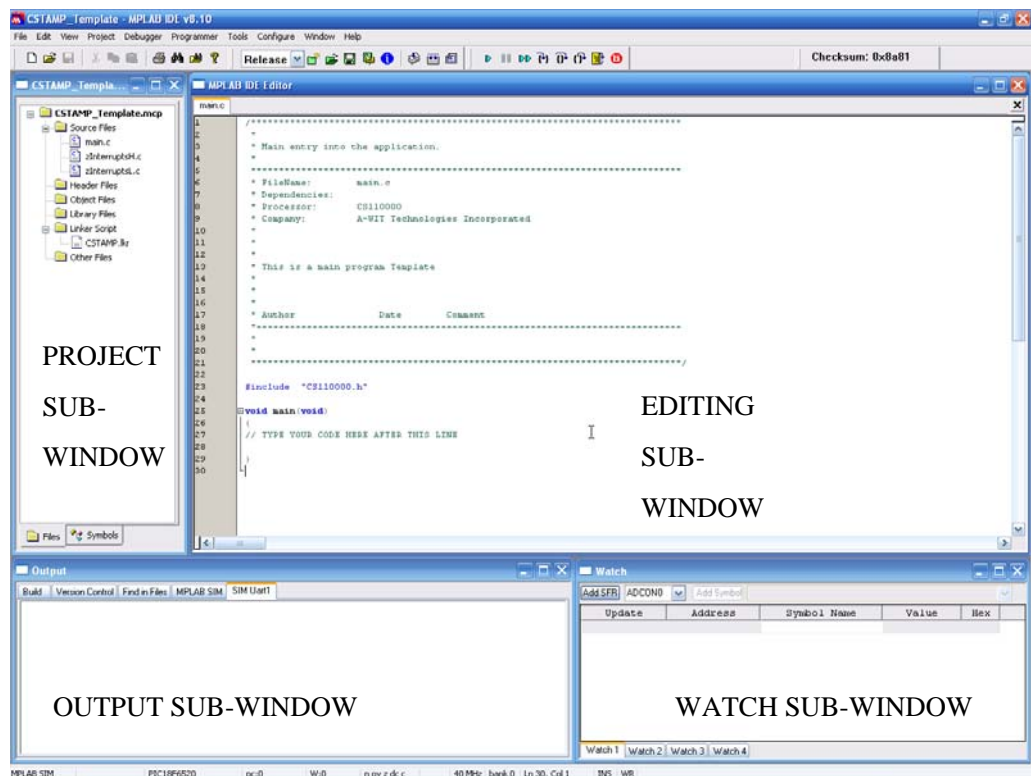
Copy the DOCS directory from the C Stamp Installation CD to your C:\A-WIT directory. This directory contains all the C Stamp related documentation in PDF format.

Creating your LCD C Stamp Program

Create a directory where you want to have all the files for your program; for example LCD_APP. We recommend making this directory under your C:\A-WIT directory, so you can have all your CSTAMP related files in one place.

Copy the all files in your C Stamp Software Templates directory C:\A-WIT\CSTAMP_Template to the directory you just made.

Open the Microchip MPLAB IDE application. As shown the following figure, the IDE has several sub-windows. Depending on the resolution of your screen, your sub-windows may have a different layout. However; you can move and resize these into the position that you want to fit your screen, and your layout for that particular project will get saved upon answering yes to the prompt of saving the workspace when you exit the software development environment.



Go to the “File” menu to “Open Workspace...”. Then navigate to your program directory, and open CSTAMP_Template.mcw.

Right click on CSTAMP_Template.mcp in the “Project” sub-window, and “Save as...” the name of your program project after you have navigated to your program

directory. For example, your program project could be named “LCD_APP”. Now when you open the Microchip MPLAB IDE (Integrated Development Environment), and go to your program directory to open the workspace for your program, you will see a .mws file with the name of your program preceding it. This is the file that you should open any time you want to work on your program.

Double click on the main.c source and type the following code fragment where it is indicated. You can omit the comments for brevity, as they are written here to offer clarifications of what the code does. Do pay attention; however, to the indentation of the code blocks between curly brackets for loops, if statements, etc. Although indenting the code is not a requirement for the compiler to parse your code (i.e. any blank spaces are ignored by the compiler), it does help tremendously to make your code much more readable, and consequently, it makes finding any errors easier. Keywords and function names in the code fragment below are bolded.

After you START the C Stamp in user mode as explained in the “Downloading and Running Your Program” section (this will not be the RESET/BOOT/DOWNLOAD mode), the program will run. This program assumes that your LCD is connected. The program will display “Hello” in the LCD.

To send a string of text to the LCD module, just send the string via a serial pin. There is no need for any other commands. See example below.

C-Stamp Example:

```
// Allocate message
  BYTE Buff[] = "Hello";

  PAUSE(800);
// Display string at 9600 baud, 8 bits, no parity,
// no flow control, no pace
  SEROUT(0, 0, 9.6, 0, 8, 0, 0, Buff, 5);
```

Save your program from the “File” menu or by clicking on the appropriate icon in the tool bar. Then “Build All” from the “Project” menu or from the tool bar.

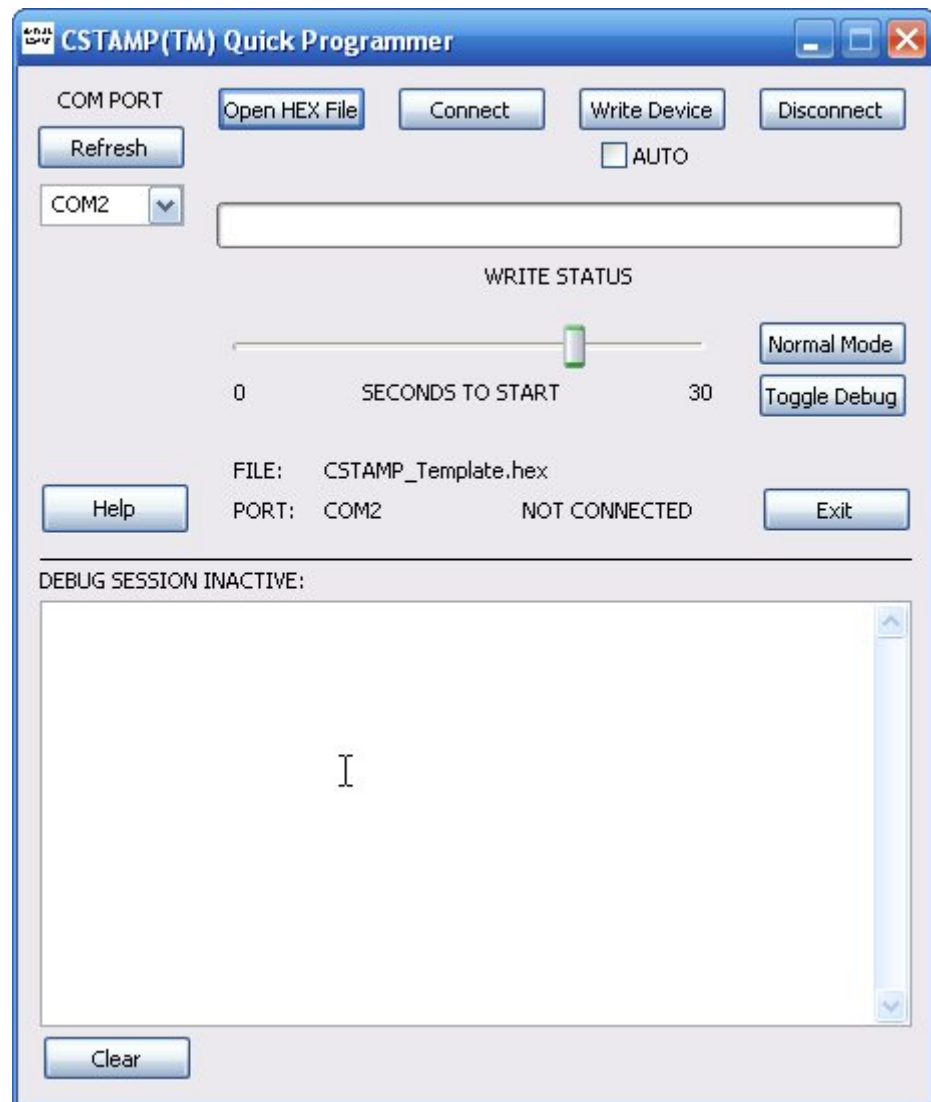
If the code was typed correctly, you will have a file in your program directory with the name of your program project and a .HEX extension. An example is LCD_APP.HEX. This is the file that you will download to the C Stamp, as explained up ahead.

If you get an error message or an indication that your program did not build successfully in the “Output” sub-window of the IDE, you probably have one or more syntax error(s). Double click on the line of the “Output” sub-window that mentions the error, and the program line that most likely contains the error will be indicated in

the sub-window where you were editing your program. Correct as necessary, and “Build All” again until you get a successful .HEX file output.

Downloading and Running Your Program

Power up your KIT, and connect the KIT to the PC with the provided cable. Upon power up, the C Stamp will be in RESET/BOOT/DOWNLOAD mode. To go back to this mode at any time, just push and let go of the RESET button. Then open the A-WIT C Stamp Quick Programmer application shown in the next figure.



The first step is to choose the serial port that you are using from the drop-down menu. Then click on “Refresh”, so that the program registers your selection. Your selection

should show in the status area of the program next to "PORT:". Then click on "Open HEX File" and load/select the HEX file that you had previously created during the development of your program. The status area should indicate that the file has been loaded successfully. This is what will be downloaded to the C Stamp. Then click on "Connect", and the PC will be connected to the C Stamp, and the status area should indicate so. To download the HEX file to the C Stamp, just click on "Write Device", and you should see the progress bar after a few seconds, as the HEX file is downloaded. At this point, you can click on "Disconnect" to disconnect the PC from the C Stamp, disconnect the serial cable from both the PC and the C Stamp, and start your program manually at the C Stamp. To do this just push and let go of the RESET button while pushing the START button. Then you can let go of the START button. Alternatively, you can click on "Normal Mode" to start your program from the PC. This will also disconnect the program/PC from the C Stamp. Then you can disconnect the serial cable from the PC and the KIT. You can also instruct the CSTAMP™ Quick Programmer to wait several seconds before starting your program from the PC and disconnecting by adjusting the "SECONDS TO START" slide. This feature is useful in case you want to keep the PC connected with the serial cable, but need time to manually set up something in a circuit that you have built. If this is not the case it can just be left at the default of "0", and your program will start from the PC right away. After you click "Normal Mode" and your program is started, the CSTAMP™ Quick Programmer will not be communicating with the C Stamp any longer, so if you want to reconnect, you must click on "Connect" again.

Additional Functions and Commands Reference

This chapter describes the functions and commands that are specific to the LCDs to complement the function and projects developed with the C Stamp. All commands must be preceded by a ESC (decimal 27) character. For example, to clear the screen, you must send char 27 before sending char 1.

LCD Commands

<i>CMD</i>	<i>Description</i>	<i>Character Sequence</i>	<i>Remarks</i>
1	Clear screen	ESC, '1'	After clear, wait 10ms for LCD to recover.
I	Set cursor at line number, column 1	ESC, I, '2'	This example sets the cursor at Line2, Column 1 without clearing line 2.
L	Clear one line and sets cursor at column 1 of that line	ESC, L, '2'	This example clears all text on Line2 and sets the cursor at Line2 Column 1.
C	Show cursor	ESC, C	Shows the cursor.
O	Hide cursor	ESC, O	Hides the cursor.
M	Show number	ESC, M, BYTE	If the value of BYTE is 138, the screen will display "138".

<i>CMD</i>	<i>Description</i>	<i>Character Sequence</i>	<i>Remarks</i>
N	Show number with zero padding in front if less than 10	ESC, N, BYTE	If the value of BYTE is 9, the screen will display “09”. Useful for displaying minutes or cents.
H	Show BYTE value as a Hexadecimal number	ESC, H, BYTE	If the value BYTE is 171 decimal, then “AB” will be displayed. Useful for debugging.
B	Switch on backlight	ESC, B, 0x0A	In this example, the LCD backlight will be switched on for 10 seconds. The 3rd byte allows 2 to 255 seconds ON time. Backlight cannot be switched on indefinitely.
S	Switch off backlight	ESC, S	The LCD backlight will be switched off immediately.
0	Hard Reset module	ESC, 0	After this command, wait 0.9 seconds for LCD to recover.
P	Set cursor position	ESC, P, 0xC0	Set exact cursor location, for example line 1, col 1 = 0x80, line 1, col 3 = 0x83, line 2, col 1 = 0xC0, line 2, col 4 = 0xC4.
D	Set display contrast	ESC, D, + ESC, D, - ESC, D, =	Sets Display Contrast to Darkest. Set Display Contrast to Lightest. Set Display contrast to Normal. This is the default setting at power up.

LCD Commands Examples

These are examples of how to send commands to these LCDs.

```
// Allocate message for clearing screen
```

```
BYTE cls[] = {27, '1'};

// Allocate message for backlite

BYTE lite[] = {27, 'B', 0x0A};

PAUSE(800);

// Clear screen

SEROUT(0, 0, 9.6, 0, 8, 0, 0, cls, 2);

PAUSE(800);

// turn backlite on for 10 seconds

SEROUT(0, 0, 9.6, 0, 8, 0, 0, lite, 3);
```

Terms & Conditions

Quality Assurance

A-WIT has stringent quality control procedures in place to insure the best quality products.

90-Day Limited Warranty

A-WIT Technologies, Inc warrants its products against defects in materials and workmanship for a period of 90 days. If you discover a defect, A-WIT Technologies, Inc. will, at its option, repair, replace, or refund the purchase price. After 90 days, products can still be sent in for repair or replacement, but there will be a \$10.00USD minimum inspection/labor/repair fee (not including return shipping and handling charges).

14-Day Money-Back Guarantee

If, within 14 days of having received your product, you find that it does not suit your needs, you may return it for a refund. A-WIT will refund the purchase price of the product in the form of a check, excluding shipping/handling costs, once the product is received. This refund does not apply if the product has been altered or damaged. If you decide to return the products after the 14-day evaluation period, a 20% restocking fee will be charged against a credit.

Disclaimer

Warranty does not apply if the product has been altered, modified, or damaged. A-WIT makes no other warranty of any kind, expressed or implied, including any warranty of merchantability, fitness of the product for any particular purpose even if that purpose is known to A-WIT, or any warranty relating to patents, trademarks, copyrights or other intellectual property. A-WIT shall not be liable for any injury, loss, damage, or loss of profits resulting from the handling or use of the product shipped.

How to Return a Product

When returning, you must first e-mail sales@a-wit.com for a Return Merchandise Authorization number. No packages will be accepted without the RMA number clearly marked on the outside of the package. After inspecting and testing, we will return your product, or its replacement using the same shipping method used to ship the product to A-WIT within 30 days. In your package, please include a daytime telephone number and a brief explanation of the problem.

Please contact our Sales Department at sales@a-wit.com if you have any questions regarding our warranty policy or if you are requesting an RMA number.

