

Volume

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A-WIT TECHNOLOGIES INC.

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# CS490000 Humidity Sensor Reference Guide Manual

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Version 1.2

A-WIT TECHNOLOGIES INC.

# CS490000 Humidity Sensor Reference Manual

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## Introduction to the CS490000 Humidity Sensor

**T**he CS490000 is a single chip relative humidity and temperature multi sensor module comprising a calibrated digital output. Application of industrial CMOS processes with patented micro-machining (CMOSens® technology) ensures the highest reliability and excellent long term stability. The sensor head is connected to the pins by a small bridge to minimize heat conduction and response time. A 2-wire serial interface and internal voltage regulation allows easy and fast system integration with a C Stamp. The Sensor is compatible with the C Stamp microcomputer's supplies and signal levels.

### 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@awit.com](mailto:tech_support@awit.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 CS490000 Humidity Sensor

The CS490000 is a single chip relative humidity and temperature multi sensor module comprising a calibrated digital output. Application of industrial CMOS processes with patented micro-machining (CMOSens® technology) ensures the highest reliability and excellent long term stability. The sensor head is connected to the pins by a small bridge to minimize heat conduction and response time. All pins are gold plated to avoid corrosion even under the harshest operating conditions. The device includes a capacitive polymer sensing element for relative humidity and a band-gap temperature

sensor. Both are seamlessly coupled to a 14-bit analog to digital converter and a serial interface circuit on the same chip. This results in superior signal quality, a fast response time and insensitivity to external disturbances (EMC) at a very competitive price. Each CS490000 is individually calibrated in a precision humidity chamber. The calibration coefficients are programmed into the sensor's non-volatile memory. These coefficients are used internally during measurements to calibrate the signals from the sensors. The 2-wire serial interface and internal voltage regulation allows easy and fast system integration with a C Stamp. Its tiny size and low power consumption makes it the ultimate choice for even the most demanding applications. The Sensor is compatible with the C Stamp microcomputer's supplies and signal levels. Communicating with the Sensor is made easy with A-WITT's supplied software command HUMSIN. This simple one command interface is all that is required to setup and acquire Relative Humidity, Temperature, and Dew Point readings from the Sensor.

## Technical Specifications

High precision relative humidity and temperature sensors

Measurement range: 0-100% RH

Humidity Accuracy:  $\pm 3.0\%$  RH

Repeatability RH:  $\pm 0.1\%$  RH

Temperature Accuracy:  $\pm 0.4$  °C

Dew point

Fully calibrated, digital output

Excellent long-term stability

No external components required

Fast response time < 4 seconds

Ultra low power consumption (typ. 30  $\mu$ W)

Small size

Automatic power down

Applications include Weather Stations, humidifiers, dehumidifiers, Test & Measurement, Data logging, and automation

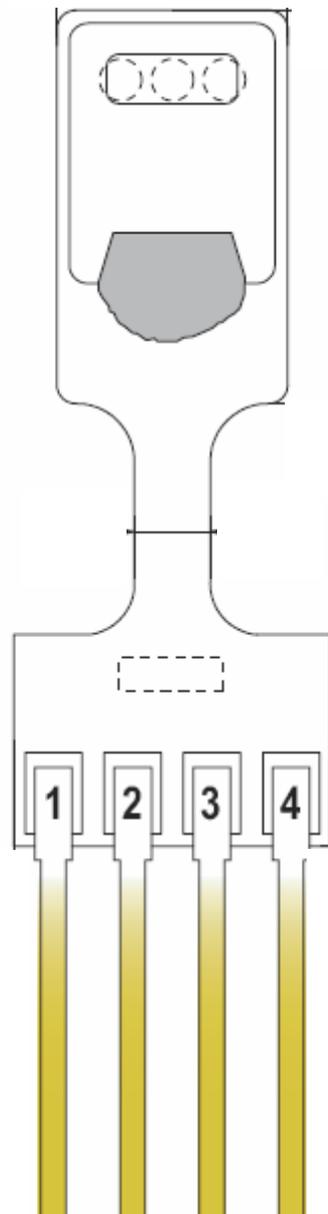
4-pin SIP package

Compact and breadboard-friendly

Compatible with C Stamp microcomputer

## Detailed Pin Description

The figure below shows the pins arrangement of the CS490000, and the following table shown the Detailed Pin Description.



The pin out figure is with the actual sensor chip (black) facing you.

<i>Humidity Sensor Pin-Out Connectivity</i>		
<i>Pin</i>	<i>Symbol</i>	<i>Description</i>
1	SCK	Serial clock input. Connect to any C Stamp I/O pin.
2	VDD	Supply 2.4 – 5.5 V.
3	GND	Ground pin.
4	DATA	Serial bidirectional data. Connect to any C Stamp pin from the following list: 28, 29, 31 – 38.

## Getting Started

**T**his chapter is a quick start guide to using the CS490000 Humidity Sensor 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 Humidity Sensor properly connected to the C Stamp. You will also need a programming cable, power supply, PC running Windows® 2000/XP/Media, 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.

### Notices

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CONNECTION WITH THE SOFTWARE OR FIRMWARE OR THE USE OF OTHER DEALINGS IN THE SOFTWARE OR FIRMWARE.

## Getting Support

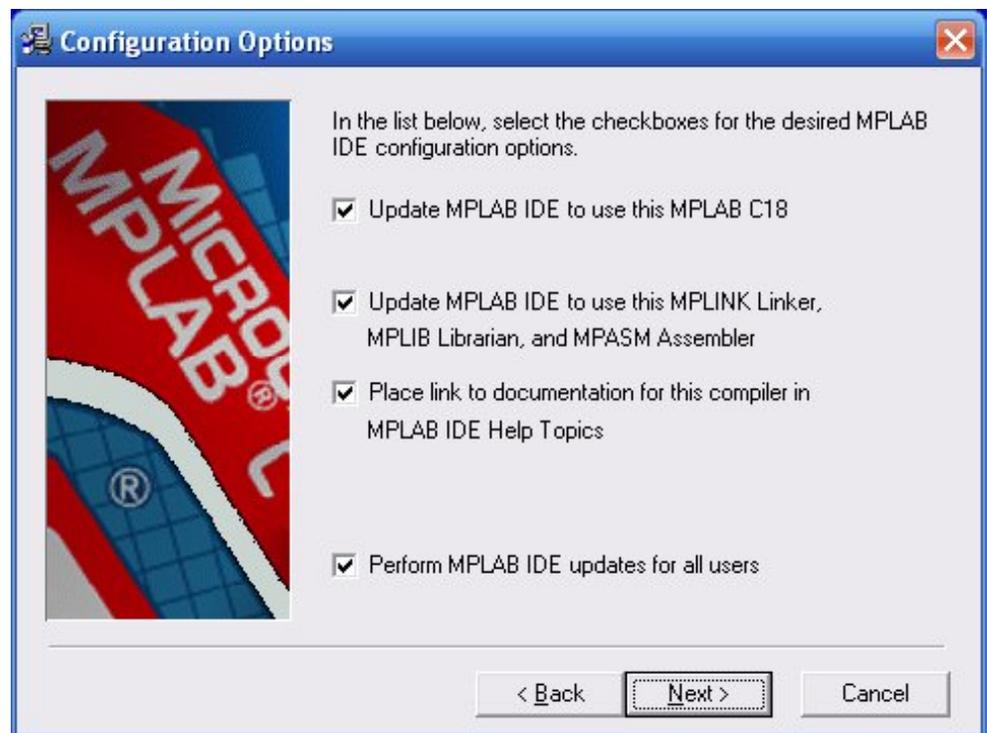
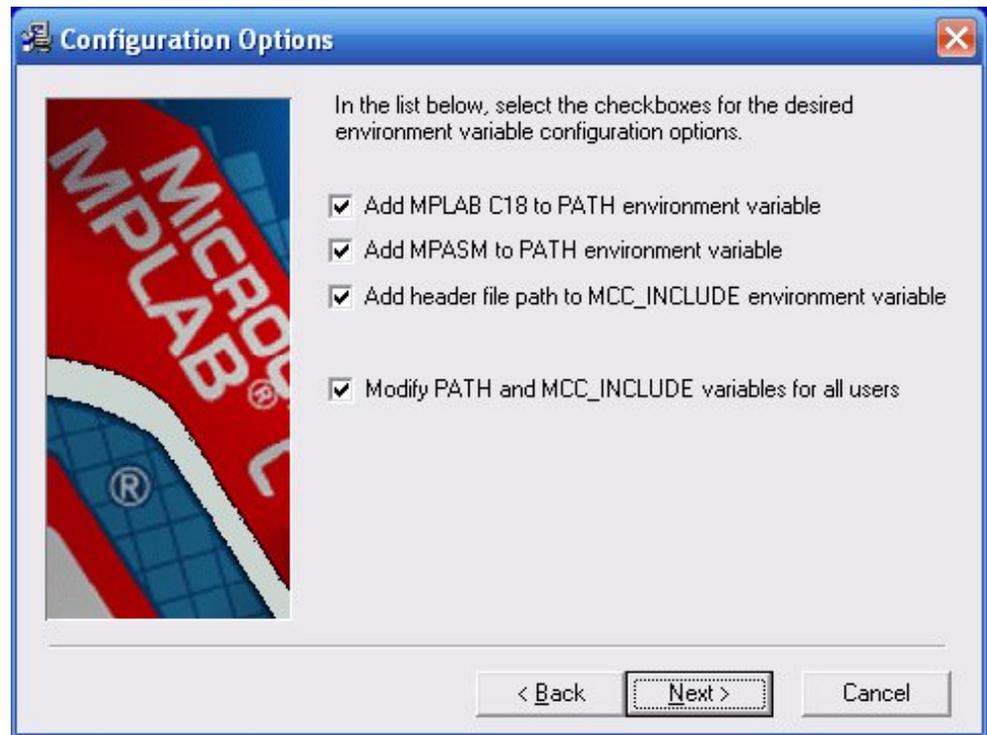
If possible, please check the C Stamp website [www.c-stamp.com](http://www.c-stamp.com) under SUPPORT for any updates to documentation, changes, or notices that may have become available since your Installation CD was produced. If you continue to have any issues for which a solution is not found in the aforementioned website, please e-mail [tech\\_support@a-wit.com](mailto: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 5<sup>th</sup> and 6<sup>th</sup> 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

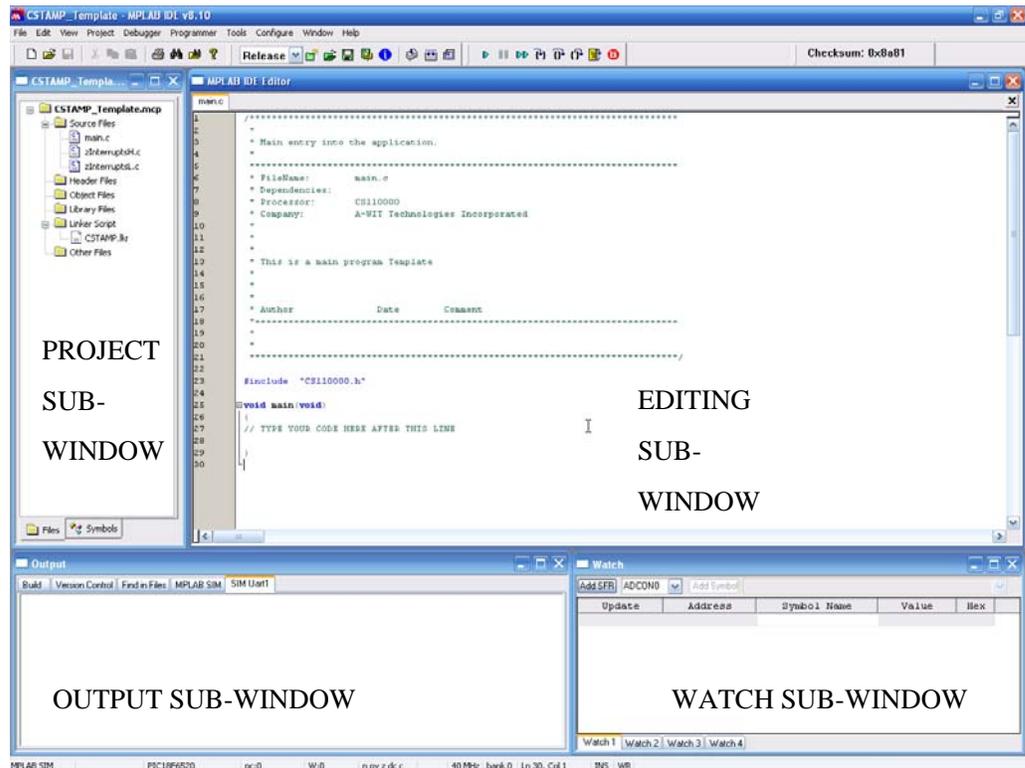
Copy the DOCS directory from the C Stamp Installation CD to your C:\A-WIT directory. This directory contains all the C Stamp related documentation in PDF format.

## Creating your Humidity Sensor C Stamp Program

Create a directory where you want to have all the files for your program; for example HUMS\_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.



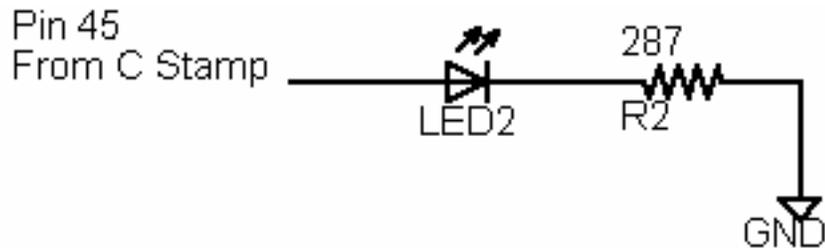
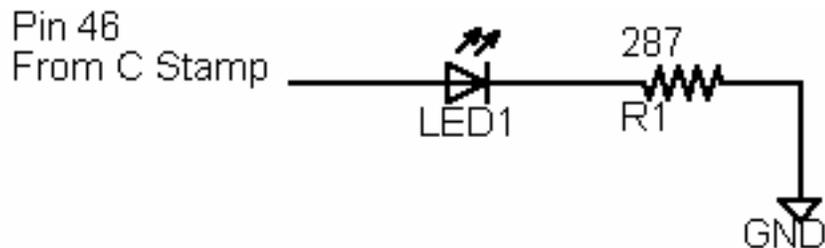
Go to the “File” menu to “Open Workspace...”. Then navigate to your program directory, and open CSTAMP\_Template.mcw.

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 “HUMS\_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 Humidity Sensor is connected to the C Stamp with the clock pin connected to pin 1 and the data pin connected to pin 28. You will also need an LED connected to the C Stamp at pin 46 with a 287  $\Omega$  resistor and another connected to pin 45 as shown in the figure below. If you are using the CS310X00 BOL, then the LED connections are available in the board already.



The program will light LED1 if the Relative Humidity (RH) is below 50.5%, and it will light LED2 if the RH is equal or above 50.5%. The program executes indefinitely until you restart it by pushing and releasing the RESET button while holding the START button and then letting go of the latter.

```

while(1){
// Get temperature and set LEDs appropriately
  if(HUMSIN_CS490000(28, 1, HUMS_REH, ZERO) < 50.5){
    STPIND(46, HIGH);
    STPIND(45, LOW);
  }
  else{
    STPIND(46, LOW);
    STPIND(45, HIGH);
  }
}

```

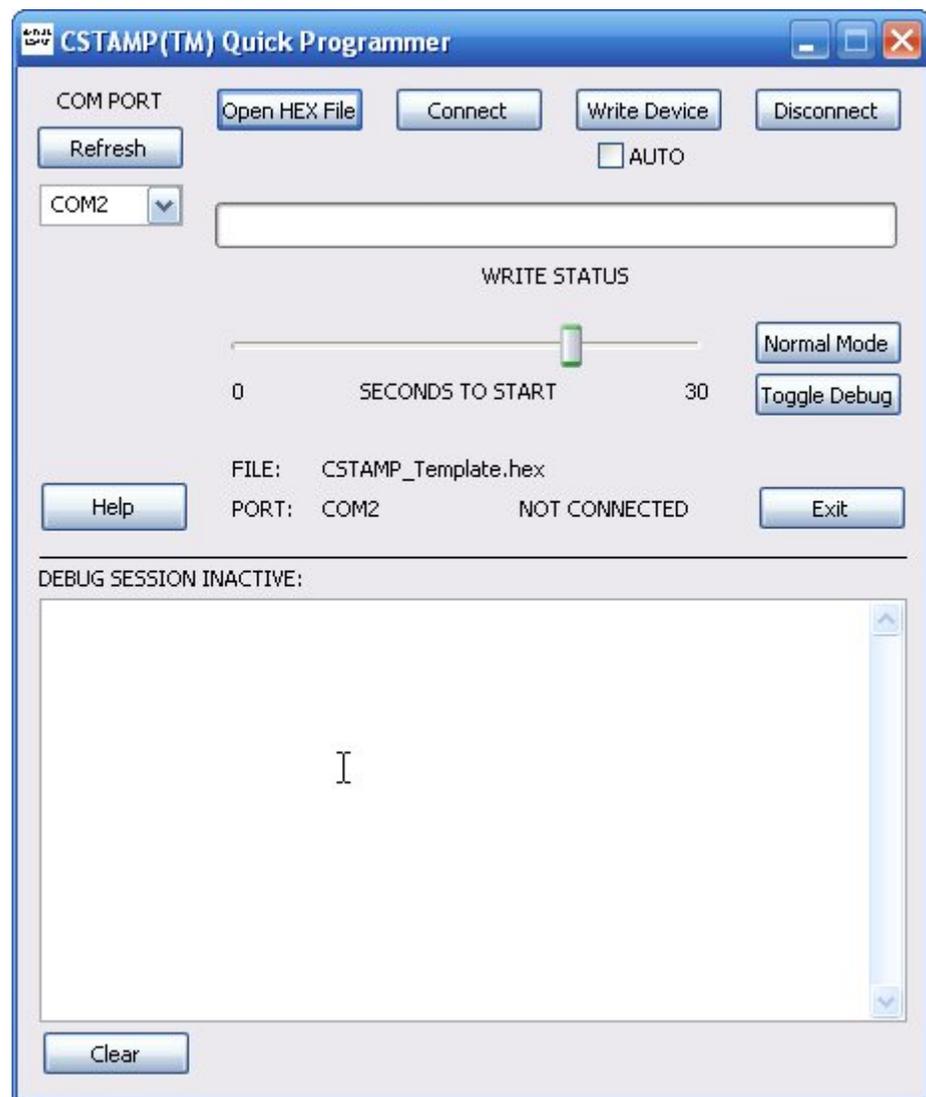
Save your program from the “File” menu or by clicking on the appropriate icon in the tool bar. Then “Build All” from the “Project” menu or from the tool bar.

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 HUMS\_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 KIT, 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 KIT, disconnect the serial cable from both the PC and the KIT, and start your program manually at the KIT. 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 KIT. 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.

## Accessory Specific Functions and Commands Reference

**T**his chapter describes the functions and commands that are specific to the software support of different types of accessories that are available from A-WIT Technologies to complement the function and projects developed with the C Stamp. The user should consult the manual for a specific accessory for full information on connectivity and usage.

### HUMSIN\_CS490000

```
float HUMSIN_CS490000(BYTE Dpin, BYTE Cpin,  
                      NIBBLE command, NIBBLE format);
```

The **HUMSIN** function returns a measurement of Relative Humidity, Temperature, Dew Point. If the function is not successful, it returns the value of 500, which is outside the range of any measurement by the sensor in any of the available formats. This could mean that there was an error in the arguments of the function or some other problem.

**Dpin** is a variable/constant/expression that specifies the I/O pin to be used as the DATA pin.

**Cpin** is a variable/constant/expression that specifies the I/O pin to be used as the SCK pin. This pin will be set to output mode.

**command** is a variable/constant/expression (1 – 3) indicating the measurement to get from the sensor.

<i>Command Symbol</i>	<i>Value</i>	<i>Description</i>

<i>Command Symbol</i>	<i>Value</i>	<i>Description</i>
<b>HUMS_REH</b>	1	Returns the Relative Humidity.  Range: 0% – 100%
<b>HUMS_TMP</b>	2	Returns the Temperature in the scale given by <b>format</b> .  Range: -40 – 123.8 °C, or  Range: -40 – 254.9 °F, or  Range: 233.15 – 396.95 °K
<b>HUMS_DPT</b>	3	Returns the Dew Point Temperature in the scale given by <b>format</b> .  Range: -40 – 123.8 °C, or  Range: -40 – 254.9 °F, or  Range: 233.15 – 396.95 °K

**format** is a variable/constant/expression that indicates the format for the returned Temperature or Dew Point value according to the table below. This argument is not used if the measurement requested is Relative Humidity. In this case, any value can be passed to the function (e.g. **ZERO**), and it will be ignored. However; something always must be passed in all the arguments.

<i>Symbol</i>	<i>Value</i>	<i>Temperature Scale</i>
<b>TEMPS_C</b>	1	Degrees Celsius
<b>TEMPS_F</b>	2	Degrees Fahrenheit
<b>TEMPS_K</b>	3	Degrees Kelvin

## 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](mailto: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](mailto:sales@a-wit.com) if you have any questions regarding our warranty policy or if you are requesting an RMA number.

