

WebControl™

Technical Manual

| | |
|---------------------|---------------|
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| Hardware Version: | 2.0.2 |
| Firmware Version: | 2.1.8 |
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Table of Contents

| | | |
|--------|---|----|
| 1 | Introduction | 1 |
| 1.7 | Scope..... | 1 |
| 1.8 | References | 1 |
| 1.9 | Table of Definitions | 1 |
| 2 | WebControl™ I/O..... | 2 |
| 2.7 | Serial Data Ports..... | 2 |
| 2.8 | Power Supply Inputs..... | 2 |
| 2.9 | TTL Output Port..... | 3 |
| 2.10 | AUX Input Port..... | 3 |
| 2.11 | DS1822 Temperature Sensor Input..... | 3 |
| 2.12 | Humidity Sensor Input | 4 |
| 3 | Network Configuration | 5 |
| 3.7 | Connection Settings..... | 5 |
| 3.8 | Access Settings | 5 |
| 3.8.1 | Web login..... | 6 |
| 3.8.2 | FTP..... | 6 |
| 3.9 | Security Settings..... | 6 |
| 3.10 | Default Network Settings | 7 |
| 4 | System Inputs | 7 |
| 4.7 | Digital Inputs | 7 |
| 4.8 | Analog Inputs..... | 8 |
| 4.9 | DS1822 1 Wire Temperature Sensors..... | 8 |
| 4.10 | Honeywell 4000 Series Relative Humidity Sensor..... | 8 |
| 4.11 | Timers..... | 8 |
| 4.11.1 | Examples of Timer Configuration | 9 |
| 4.12 | View the System Inputs and Outputs..... | 9 |
| 5 | Controlling the TTL Output Port..... | 11 |
| 5.7 | The Boolean Run Engine..... | 11 |
| 5.8 | Boolean Expression Syntax..... | 11 |
| 5.8.1 | Writing Rules | 12 |
| 5.8.2 | Logical Operators | 12 |
| 5.8.3 | <i>Input Triggers</i> | 12 |
| 5.8.4 | Examples..... | 13 |
| 5.9 | Addition Features of the TTL output Port..... | 13 |
| 5.10 | TTL Output Port Control Defaults | 13 |

| | | |
|-----|---|----|
| 6 | Automated Email Setup | 14 |
| 6.1 | Email Settings..... | 14 |
| 6.2 | Requirements to Use Email | 14 |
| 7 | Real Time Clock..... | 16 |
| 7.1 | Network Requirements to Use the RTC | 16 |
| 7.2 | Real Time Clock without NTP..... | 16 |
| 8 | Regulations | 17 |
| 9 | Appendix J12 AUX Connector | 18 |
| 10 | Revision History | 19 |

Table of Figures

| | |
|---|----|
| Figure 1.0 WebControl™ PCB inputs and outputs diagram | 2 |
| Figure 2.0 WebControl™ Sensors Wiring | 3 |
| Figure 3.0 WebControl configurable connection settings..... | 5 |
| Figure 3.1 WebControl configurable access control settings | 5 |
| Figure 3.2 Mandatory pages required to use web login | 6 |
| Figure 3.3 Network defaults | 7 |
| Figure 4.0 String format for configuring timers..... | 9 |
| Figure 5.0 Logical operators of the Boolean expression syntax | 12 |
| Figure 5.1 Inputs terms supported by the Boolean expressions | 13 |
| Figure 5.2 TTL output port defaults..... | 13 |
| Figure 6.0 Email configuration parameters | 14 |
| Figure 7.0 WebControl™ J12 AUX I/O Connector | 18 |

1 Introduction

This document provides an overview of the technical aspects of using WebControl™. It mainly describes the inputs and outputs offered by the current version of the WebControl™ hardware and firmware. It is also intended to guide and provide key information on writing web pages and using the CGI commands to communicate with WebControl™.

1.7 Scope

The scope of this document is purely intended to be a guide to using the features provided by WebControl™. The reader is expected to be technically competent in all the technical areas within this document, and is strongly advised to use this document along side the other reference material listed in the reference section.

1.8 References

The following references are referred to through out this document. It is expected that the reader will use these along with this document in order to understand and use WebControl.

| Reference | Description |
|-----------|--|
| Ref1 | Pin out diagram of J12 the AUX input connector |
| | |
| | |

1.9 Table of Definitions

The following table is a list of definitions used though out the document.

| Definition | Description |
|------------|---|
| CGI | Common gateway interface |
| HTTP | Hypertext transfer protocol |
| DNS | Domain name server |
| SMTP | Simple mail transport protocol |
| SNTP | Simple network time protocol |
| 1-wire | Special bidirectional serial data bus from Maxim |
| RH | Relative humidity |
| FTP | File transfer protocol |
| NetBios | Human readable name used as an alternative to an IP address for accessing the server on a network. E.g. http://WebControl |
| IP | Internet protocol |
| DHCP | Dynamic host configuration protocol |
| ROM | Read only memory |

2 WebControl™ I/O

The current hardware version of WebControl™ is equipped with a number of inputs and outputs; these are shown in below in figure 1.0.

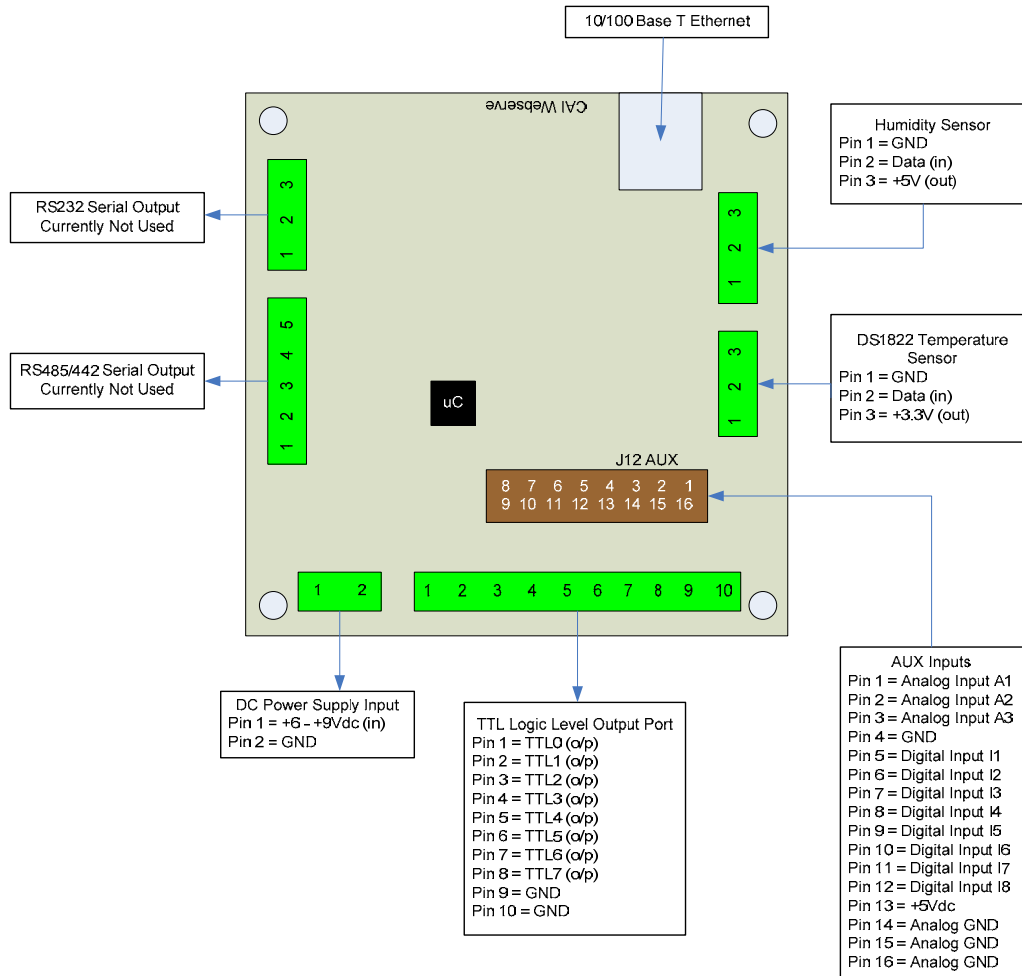


Figure 1.0 WebControl™ PCB inputs and outputs diagram

2.7 Serial Data Ports

Currently the RS232 and RS485/442 serial data ports provided by the hardware are not used by the firmware. The related chips are not installed on this version of hardware.

2.8 Power Supply Inputs

The DC power supply input is the main DC supply to the board. The input voltage range is 6 – 9V dc. Any voltage greater than 9V applied to this input may damage the board.

2.9 TTL Output Port

The TTL logic level output port has 8 TTL outputs that can each be set or cleared using CGI command codes, or by setting up a Boolean expression using the available inputs so that the particular output is set when a particular input condition is met. The maximum current that can be sourced or sinked by one of these outputs at a time is 24mA or 200mA for all eight ports. This output can directly drive optical coupled solid state relay with input voltage range 3-32VDC current ~20mA.

2.10 AUX Input Port

The AUX input connector offers digital and analog inputs that can be configured to set a TTL output upon a single input or a combination of inputs. 3 analog inputs are offered that have an input range of 0 – 5Vdc. 8 digital inputs are offered that use TTL input levels (0 and 5Vdc). The AUX input pin out diagram [ref3] shows the pin out of this port in more detail.

2.11 DS1822 Temperature Sensor Input

The temperature sensor input allows up to eight Maxim DS1822 1 wire temperature sensors to be connected in parallel. These sensors can then display the temperature via the HTTP server or be used as inputs to the Boolean engine controlling the TTL output port. Each DS1822 has unique internal ROM code. WebControl™ identifies them based on the sequence of the ROM code responded to ID inquiry. The ROM code is not shown outside the sensor. The only way to identify the ROM code is through the GUI interface. Please see Figure 2.0, DS1822 is the one on the left flat surface down.

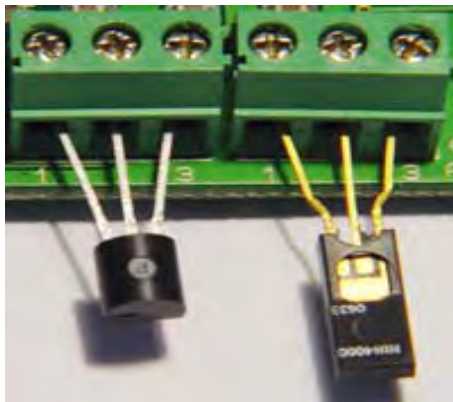


Figure 2.0 WebControl™ Sensors Wiring

2.12 Humidity Sensor Input

The current WebControl™ hardware has been designed to use the Honeywell 4000 series relative humidity sensor devices. Using any other humidity sensor may result in malfunction of this feature. The RH sensor can be used to display relative humidity via HTTP or be used to control the TTL outputs as an input into the Boolean run engine. Please note the Honeywell HIH-4000 sensor datasheet does not mark the pin number. For correct wiring, please refer to Figure 2.0. HIH-4000 is located on the right hand side.

3 Network Configuration

The network settings for WebControl™ are essentially split into three categories:

- ❑ Connection
- ❑ Access
- ❑ Restriction

Connection settings deal with the actual settings that enable WebControl™ to connect and listen for connections on a network. The access settings deal with providing log in services. The restriction settings provide configuration settings for limiting the allowed IP addresses that WebControl™ will allow connections from. All network settings are configured using CGI commands. See the CGI specification [ref1] for details on specific commands.

3.7 Connection Settings

These are the basic settings that need to be configured in order for WebControl™ to work successfully on a network. It may be necessary to connect the board directly to a PC and access it using its default IP address before connecting directly to a live network in order to configure it correctly. Figure 3.0 shows the connection settings WebControl™ has.

| Connection Parameter | Comments |
|----------------------|---|
| Host NetBIOS Name | Human readable name to use for connection to WebControl™ e.g. http://WebControl |
| Host IP address | WebControl™ server IP address |
| Subnet Mask | |
| Gateway IP address | |
| Primary DNS server | |
| Secondary DNS server | |
| MAC address | |
| DHCP | This enables or disabled DHCP |

Figure 3.0 WebControl™ configurable connection settings

3.8 Access Settings

These settings control the access from the user to the WebControl™ server. The table in figure 3.1 shows the access settings WebControl™ provides.

| Access Parameter | Comments |
|------------------|--|
| Web Login | This enables or disables web login |
| FTP | The enables or disables FTP |
| Username | This is the username used for web or FTP login |
| Password | The is the password used for web or FTP login |

Figure 3.1 WebControl™ configurable access control settings

3.8.1 Web login

When web login is enabled it provide a login screen when the user first tries to connect to WebControl™. The user is forced to provide a username and password to be granted access. In order to use web login the WebControl™ HTTP server must be provided with three mandatory web pages; these and detailed in figure 3.2.

| Mandatory Web Page | Usage |
|--------------------|--|
| login.cgi | Provides text boxes for the user to enter their username and password. And a submit button for these to be submitted to the WebControl™ server |
| logoff.cgi | Provide a submit button for the user to logoff the WebControl™ server |
| lginfail.cgi | The page will be displayed it the login fails |

Figure 3.2 Mandatory pages required to use web login

Once the user is logged in they have to use the logoff page to log off again. If the WebControl server detects that there has been no activity from the user for 30 minutes of being logged in, then the user will automatically be logged off WebControl™.

3.8.2 FTP

WebControl™ has an FTP server that is currently only used for the uploading of new web pages to the web server. In order to use FTP the user must know what the username and password of the WebControl™ server is.

3.9 Security Settings

The security settings of WebControl™ allow the server to be configured so that it only accepts connections from clients with predefined IP addresses. WebControl™ allows up to eight IP addresses and ranges to be specified that it will only allow connections from. Any client trying to connect which has an IP address other than what is allowed will be denied. If any IP address fields are set to 0.0.0.0 then WebControl™ allows connections from all clients. This is the default setting of this feature. X.y.z.0 will allow any host in network range in x.y.z.0/24 network to connect to the board. If you do not use login password, setup this security setting will help prevent unauthorized change to your configurations. The server name is also the board name can be set in this security page, which provides identification if you have more than one board installed on your location.

3.10 Default Network Settings

When WebControl™ is connected to the network for the first time or after receiving a reset defaults hardware input, the network defaults shown in figure 3.3 are used.

| Network parameter | Default Value |
|-------------------------------|-------------------|
| Host NetBIOS Name | WEBCONTROL |
| Host IP address | 192.168.1.15 |
| Subnet Mask | 255.255.255.0 |
| Gateway IP address | 192.168.1.1 |
| Primary DNS server | 192.168.1.1 |
| Secondary DNS server | 192.168.1.1 |
| MAC address | 00 22 12 XX XX XX |
| Web Login | Enabled |
| FTP | Enabled |
| DHCP | Enabled |
| Username | admin |
| Password | password |
| IP address allowed to connect | All |
| Server Name | WebControl1 |

Figure 3.3 Network defaults

Host NetBIOS name is for network identify this board, it equals to the host name on the network. By default, WebControl™ board will get all the IP address, gateway and DNS server from your DHCP server. If the board is installed in a location without DHCP server, the board's default IP address is 192.168.1.15. These values are also the factory reset value. In normal option, please keep FTP disabled; so that the firmware will not be overwrite by accident.

4 System Inputs

The system inputs of WebControl™ are used as inputs to the Boolean run engine (see section 5.1) or let host PC to directly query the input value and make decision for controlling the output. This section describes the configuration of these.

4.7 Digital Inputs

WebControl™ has eight digital inputs, each of which can be configured to be inverted upon input to the system. The Boolean run engine will then look for a true or false case of the input. User can use wget to access the <http://1.2.3.4/geti1.cgi> to retrieve the first digital inputs; geti1.cgi through geti8.cgi to get each one of the digital input value.

4.8 Analog Inputs

WebControl™ has three analogue inputs each having an input voltage range of 0 to +5V. Each digital input can be configured to have an upper and lower threshold which can then be used in the Boolean expressions. These upper and lower thresholds are specified as a percentage of the full-scale voltage range, i.e. 0 to 100% of +5V. To remotely access the analog input value from another host, user can use wget to retrieve the analog input values <http://1.2.3.4/geta1.cgi> through <http://1.2.3.4/geta3.cgi>.

4.9 DS1822 1 Wire Temperature Sensors

WebControl™ supports up to eight Maxim DS1822 1 wire temperature sensors. Each temperature sensor can be configured to provide an upper and lower temperature threshold to be used by in the Boolean expressions. Because all temperature sensors connect to the system on the 1 wire data bus it is necessary to tell WebControl™ which thresholds apply to which sensor. This is achieved by assigning a sensor ROM code to a sensor in the internal temperature sensor list WebControl™ keeps. CGI command codes are provided to do this. WebControl™ will enumerate the ROM codes of all connected DS1822's on start-up and will provide a list of available ROM codes that can be assigned to the internal temperature sensor list. To remotely retrieve the value of each temperature sensor, one can use <http://1.2.3.4/gett1.cgi> through <http://1.2.3.4/gett8.cgi> to retrieve the values.

4.10 Honeywell 4000 Series Relative Humidity Sensor

The WebControl™ hardware is designed to support the Honeywell 4000 series relative humidity sensors. These sensors output an 'almost' linear voltage between 0 - +5V dc proportional to the relative humidity. The board can only detect and read one humidity sensor. The value of the reading is percentage. CGI command codes are available to setup an upper and lower threshold for the humidity sensor that can then be used as a trigger in the Boolean expressions. For remote host retrieve this value, access <http://1.2.3.4/geth1.cgi> will return this value, where 1.2.3.4 is the IP address of this controller board.

4.11 Timers

WebControl™ provides up to 20 timers that can be configured to provide periodic or once only triggers that can then be used as inputs to the Boolean run engine via the Boolean expressions. CGI commands are available to configure all timers.

The CGI commands use text strings that the user inputs via the browser. These text strings use the format shown in figure 4.0.

```
<DD><Space><MMDD><Space><HH><: ><MM>
```

Figure 4.0 String format for configuring timers

Where:

- ❑ DD is a weekday identifier where 01 to 07 is Sunday to Saturday and 00 means that this field is not used
- ❑ MMDD is a date identifier where MM is the month 01 to 12 and DD is the day of the month. If the date identifier is not used then it should be set to 0000
- ❑ HH is the hour in 24hr format
- ❑ MM is the minute
- ❑ The spaces and colon in the string are required

4.11.1 Examples of Timer Configuration

To configure a timer to alarm at 17:00 every Thursday the configuration string would be:

```
06 0000 17:00
```

To configure a timer to alarm at 09:30 every Monday and on the 22nd November the configuration string would be:

```
02 1122 09:30
```

To configure a timer to alarm at 15:39 every the 15th February the configuration string would be:

```
00 0215 15:32
```

To configure a timer to alarm daily at 12:00 the configuration string would be:

```
00 0000 12:00
```

4.12 View the System Inputs and Outputs

Once the user login into browser interface, user can see the input and output status, as well as the temperature and humidity readings. There are sub URLs allowing user to see more details and configure certain parameters on the lower part the screen.

If there is a need to have a computer to retrieve those information without human intervention, one can use wget command line command (an open source software

can be download on Internet) to get or set each different input and output state. If you want to control this board in that way, you may turn off the login password, but use IP address security to secure the allowed host accessing this board. Please note once turn off the password, access to the home page of this board using URL <http://1.2.3.4/index.cgi> where 1.2.3.4 is the IP address you assigned to this board.

5 Controlling the TTL Output Port

Each WebControl™ board has 8 TTL output ports. These TTL output can be used as input to another WebControl™ boards, or driving optical isolated solid state relays to control any AC equipments (current limit 20mA per port). The WebControl™ firmware can be configured to set or clear outputs on the TTL output port in two ways:

1. By enabling browser control. This will then allow a TTL output pin to be set and cleared using CGI commands.
2. By enabling the Boolean run engine for the particular output and supplying a Boolean expression that uses a 'AND' 'OR' combinational logic by using the available triggers to automatically decide when to set or clear an output.

The above methods all use HTTP CGI commands.

When you use the CGI commands to configure the port you have to provide configuration for each individual output. The entire configuration for this should be provided through the built-in HTTP server CGI web pages.

5.7 The Boolean Run Engine

The Boolean run engine allows a 'AND' 'OR' combinational logic expression to be continuously run to control the true or false state of each TTL output pin.

Any combination of the system triggers can be used in either a combinational 'AND' or combinational 'OR' expression. One output can be used as trigger for controlling another output. The Boolean engine can be supplied with an expression to set the output true or an expression to set the output false or it can be supplied with both true and false expressions.

The three main steps required to configure the Boolean run engine for a TTL output are as follows:

1. Enable the Boolean run engine for the TTL output in question
2. Configure the system inputs that will be used in the expressions
3. Input the Boolean expressions to set the output true and false respectively

5.8 Boolean Expression Syntax

This section describes the syntax that is used to enter the Boolean expressions used by the Boolean run engine in order to control a TTL output.

5.8.1 Writing Rules

The syntax to specify each input term in the expression is:

```
<Logical operator><optional NOT operator><input trigger>
```

Each Boolean expression is made up of terms, which are a combination of the system inputs. Each term must have a logical operator associated with it. Even the input just one parameter, "&" operator must be precede the input trigger name. Each Boolean expression can be a total of no more that 48 characters this includes spaces. And no more than 16 individual terms can be contained in an expression.

5.8.2 Logical Operators

The supported logical operators are shown in the table in figure 4.0.

| Logical Operator | Description |
|------------------|---|
| ! | The NOT operator can be used to invert the input of the term. E.g. !C2 will mean when timer 2 is not true |
| & | The AND operator is used to and terms together |
| | The OR operator is used to OR terms together |

Figure 5.0 Logical operators of the Boolean expression syntax

An expression can contain OR and AND in sequence but they cannot be mixed E.g.

```
&C2 &I1 | T3 |O4 &A2      not compliant will function
                             incorrectly
&C2 &I1 &A2 /T3 /O4      compliant
```

Even if the expression only contains one trigger, that trigger must still have a logical operator attached to it. E.g.

```
C3      not compliant will fail
&C3     compliant
```

5.8.3 Input Triggers

The table in figure 5.1 shows the input triggers the Boolean expressions support and the strings that are used to specify them.

| String Input Term | Description |
|----------------------|---|
| "C1" "C2"... "C20" | Programmable system timers 1 to 20 |
| "I1" "I2"... "I8" | Digital inputs 1 to 8 |
| "A1U" "A2U" "A3U" | Analog inputs 1 to 3 upper thresholds |
| "A1L" "A2L" "A3L" | Analog inputs 1 to 3 lower thresholds |
| "T1U" "T2U"... "T8U" | Temperature sensors 1 to 8 upper thresholds |
| "T1L" "T2L"... "T8L" | Temperature sensors 1 to 8 lower thresholds |
| "H1U" | Humidity sensor upper threshold |

| | |
|-------------------|---------------------------------|
| "H1L" | Humidity sensor lower threshold |
| "O0" "O1"... "O7" | Digital outputs 0 to 7 state |

Figure 5.1 Inputs terms supported by the Boolean expressions

5.8.4 Examples

Set output true when input 2 is true and temperature sensor 1 has reached its upper threshold:

```
&I2 &T1U
```

Set output true when analog input 2 has reached its lower threshold or humidity sensor 1 has reached its upper threshold:

```
&A2L | H1U
```

Set output true when input 6 goes low and timer 18 has reached its time and analog input 3 has reached its lower threshold. OR temperature sensor 3 has reached its lower threshold:

```
&!I6 &C18 &A3L | T3L
```

5.9 Addition Features of the TTL output Port

A TTL output can also be configured in the following ways:

- ❑ Output can be inverted
- ❑ When the output changes state an email can be automatically generated and sent
- ❑ The browser control and Boolean run engine can both be disabled

5.10 TTL Output Port Control Defaults

When WebControl™ is first powered on from new or after receiving a reset defaults hardware input the TTL output port configuration is defaulted to the settings shown in shown in figure 5.2.

| Parameter | Default |
|---------------------------------|--------------|
| Browser Control | Disabled |
| Boolean Run Engine | Disabled |
| TRUE Boolean expression | None |
| FALSE Boolean expression | None |
| Invert output | Not inverted |
| Automated email on state change | Disabled |

Figure 5.2 TTL output port defaults

6 Automated Email Setup

WebControl™ can be configured to send an automated email when a TTL output changes state. **WARNING: due to sending email may take a few seconds, and the input trigger state may have changed by then, the email may not showing correct trigger caused the output state change.** Only when using the Boolean run engine to control the output can cause the email being sent for each trigger caused output state change. There is one set of SMTP email settings that need to be configured before email will function. Each TTL output that has email enabled has its own configuration for the message body of the email message. The email “to address” and other settings are the same for all outputs. The generated email message body it made up of the configured body message set up by the user for each TTL output and a snap shot of all system inputs generated dynamically at the time the email is sent.

6.1 Email Settings

The following table in figure 6.0 shows the settings that the user needs to configure in order for the SMTP email to work correctly. When the board is defaulted these settings are cleared.

| Parameter | Description |
|--------------------|---|
| SMTP Host | The name of the host SMTP server to use. E.g. smtp.mydomain.com or IP address |
| SMTP username | For SMTP servers that require authentication this is the users username. If no username is required then leave this field blank |
| SMTP password | For SMTP servers that require authentication this is the users password. If no password is required then leave this field blank |
| From email address | The email address the message is sent from this is the address of the SMTP email account. E.g. WebControl@mydomain.com |
| To email address | The email address messages will be sent to |
| Subject | A subject line all messages will have |

Figure 6.0 Email configuration parameters

6.2 Requirements to Use Email

- If WebControl™ is to be configured to generate and automated email then it must have DNS entry in the DNS server. The primary and secondary DNS server addresses of WebControl™ are required to be configured correctly. WebControl™ will use DNS server to resolve the SMTP server's address.

- A valid SMTP email account must be used for the sending of emails.

7 Real Time Clock

WebControl™ has a built in real time clock that is kept accurate by using an atomic clock via the simple network timer protocol (SNTP). Configuration is required to set the correct time zone of the clock. CGI commands are provided to do this. When NTP is not reachable, user can set the internal clock to let WebControl™'s clock to be the source for real time clock.

7.1 Network Requirements to Use the RTC

WebControl™ must be connected to a network that has access to a DNS server. The primary and secondary DNS server addresses of WebControl™ are required to be configured correctly. WebControl™ will use DNS to resolve the name of the timeserver pool.ntp.org . Please select proper timezone for the board, so that you can have timer function correctly.

7.2 Real Time Clock without NTP

User may enter the current time in the clock configuration screen for setting the internal clock. The format for enter the time is “format MM/DD/YYYY HH:MM:SS”. Due to no NTP to correct the time drift, the real time clocked maintained by the WebControl™ may not be as accurate as with NTP services.

8 Regulations



Notice to the USA

Compliance Information Statement (Declaration of Conformity

Procedure) DoC FCC Part 15: This device complies with part 15 of the FCC Rules.

Operation is subject to the following conditions:

- 1) This device may not cause harmful interference, and
- 2) This device must accept any interference received including interference that may cause undesired operation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try one or more of the following measures:

Reorient or relocate the receiving antenna.

Increase the separation between the equipment and the receiver.

Plug the equipment into an outlet on a circuit different from that of the receiver.

Consult the dealer or an experienced radio/television technician for help.

Notice for Canada

This apparatus complies with the Class B limits for radio interference as specified in the Canadian Department of Communications Radio Interference Regulations. (Cet appareil est conforme aux norms de Classe B d'interference radio tel que specifie par le Ministere Canadien des Communications dans les reglements d'interference radio.)



Notice for Europe (CE Mark)

This product is in conformity with the Council Directive 89/336/EEC, 92/31/EEC (EMC).

9 Appendix J12 AUX Connector



Figure 7.0 WebControl™ J12 AUX I/O Connector

10 Revision History

| Version | Whom | Date | Changes |
|---------|-------|------------|-----------------------|
| 1.1 | S.T. | 09/23/2008 | Updated |
| 1.0 | C. D. | 08/15/2008 | Initial first version |