

WebControl™

Technical Manual

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Table of Contents

1	Introduction	1
1.1	Scope.....	1
1.2	References	1
1.3	Table of Definitions	1
2	WebControl™ I/O.....	2
2.1	Serial Data Ports.....	2
2.2	Power Supply Inputs.....	2
2.3	TTL Output Port.....	3
2.4	AUX Input Port.....	3
2.5	DS1822 Temperature Sensor Input.....	3
2.6	Humidity Sensor Input	3
3	Network Configuration	5
3.1	Connection Settings.....	5
3.2	Access Settings	5
3.2.1	Web login.....	6
3.2.2	FTP.....	6
3.3	Security Settings.....	6
3.4	Default Network Settings	7
4	System Inputs	7
4.1	Digital Inputs	7
4.2	Analog Inputs.....	7
4.3	DS1822/DS1820 1 Wire Temperature Sensors.....	7
4.4	Honeywell 4000 Series Relative Humidity Sensor.....	8
4.5	Timers.....	8
4.5.1	Examples of Timer Configuration	9
4.6	View the System Inputs and Outputs.....	9
5	Controlling the TTL Output Port.....	10
5.1	The Boolean Run Engine.....	10
5.2	Boolean Expression Syntax.....	10
5.2.1	Writing Rules	10
5.2.2	Logical Operators	11
5.2.3	Input Terms	11
5.2.4	Additional Operators.....	12
5.2.5	Examples.....	12
5.3	Addition Features of the TTL output Port.....	12

5.4	TTL Output Port Control Defaults	13
6	Automated Email Setup	14
6.1	Email Settings.....	14
6.1.1	Requirements to Use Email.....	14
7	Real Time Clock.....	15
7.1	Network Requirements to Use the NTP.....	15

Table of Figures

Figure 1.0 WebControl™ PCB inputs and outputs diagram	2
Figure 2.0 WebControl™ configurable connection settings	5
Figure 2.1 WebControl™ configurable access control settings.....	5
Figure 2.2 Mandatory pages required to use web login	6
Figure 2.3 Network defaults	7
Figure 3.0 String format for configuring timers.....	8
Figure 4.0 Logical operators of the Boolean expression syntax	11
Figure 4.1 Inputs terms supported by the Boolean expressions	11
Figure 4.2 TTL output port defaults.....	13
Figure 5.0 Email configuration parameters	14

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 control WebControl™.

1.1 Scope

The scope of this document is not to teach how to write HTML web pages nor is it intended to teach any other technical aspect related to hardware or firmware. It 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.

1.2 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	WebControl™ web server CGI code specification V1.0
Ref2	Demo and test web page source files for WebControl™
Ref3	Pin out diagram of J12 the AUX input connector

1.3 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.

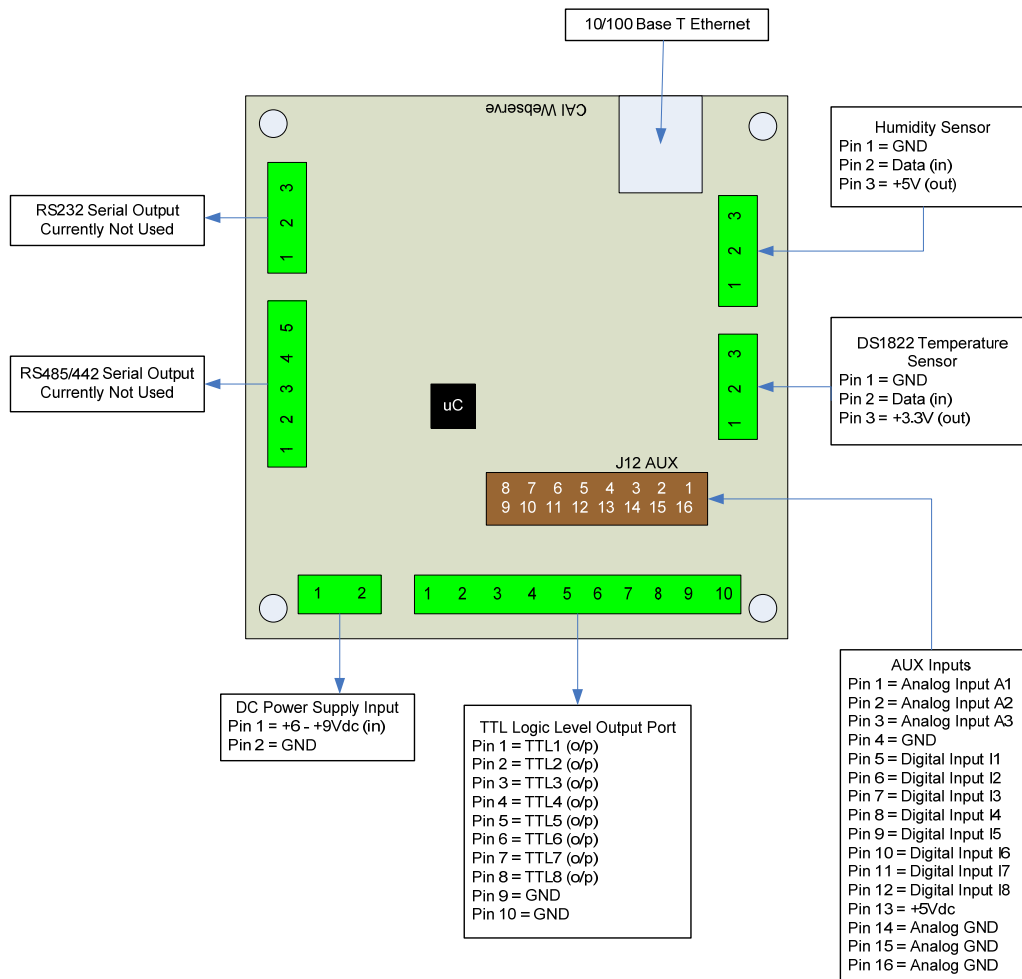


Figure 1.0 WebControl™ PCB inputs and outputs diagram

2.1 Serial Data Ports

Currently the RS232 and RS485/442 serial data ports provided by the hardware are not used by the firmware.

2.2 Power Supply Inputs

The DC power supply input is the main DC supply to the board. The input voltage range is 6.5 – 9V dc. Any voltage greater than 9V applied to this input may overheat the board.

2.3 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 20mA or 100mA for the whole port.

2.4 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 – 10Vdc. 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. Connector is TYCO ELECTRONICS - 1658622-3 .

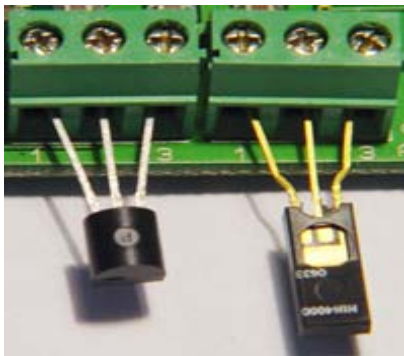
2.5 DS1822 Temperature Sensor Input

The temperature sensor input allows up to eight Maxim DS1822/DS18B20 1-wire temperature sensors to be connected. 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.

2.6 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 with out careful consideration 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.

When DS182x temp sensor located away from the board, you may want to



connect an external 5V supply to pin 3 of the DS182x sensors and a 4.7K pull up resistor from the 5V external power supply to pin 2 of the DS18 sensors. However, most common DS18B20 reading problem was caused by power supply not providing enough voltage or current.

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.

3.1 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 2.0 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 2.0 WebControl™ configurable connection settings

3.2 Access Settings

These settings control the access from the user to the WebControl™ server. The table in figure 2.1 shows the access settings WebControl™ provides.

Access Parameter	Comments
Web Login	This enables or disables web login requirement
Wipe GUI Firmware	The enables or disables Overwrite GUI firmware
Username	This is the username used for web or FTP login
Password	The is the password used for web or FTP login

Figure 2.1 WebControl™ configurable access control settings

3.2.1 Web login

When web login is enabled it provides 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 are detailed in figure 2.2.

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
loginfail.cgi	The page will be displayed if the login fails

Figure 2.2 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™.

When connecting from another server or computer to WebControl™, disabling web login may be desirable. When web login is disabled, you can use host ID to secure the access and control of the WebControl™ through Security settings.

3.2.2 FTP

WebControl™ has an FTP server that is currently only used for uploading of new GUI portions of the firmware to the board. It will destroy the existing GUI firmware. Such an action is irreversible and voids warranty. There is no download feature implemented in the firmware. In order to use FTP the user must know what the username and password of the WebControl™ server is.

3.3 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/ranges. WebControl™ allows up to eight IP addresses/ranges to be specified that it will only allow connections from. 192.168.1.0 will be considered whole class C access range. Any client trying to connect which has an IP address other than what is predefined will be ignored. If all eight 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.

3.4 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 2.3 are used.

Network parameter	Default Value
Host NetBIOS Name	NetDev
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 04 A3 00 00 00
Web Login	Enabled
Wipe Firmware through FTP	Enabled
DHCP	Enabled
Username	admin
Password	password
IP address allowed to connect	All
Server Name	NetDev1

Figure 2.3 Network defaults

4 System Inputs

The system inputs of WebControl™ are used as inputs to the Boolean run engine (see section 5.1). This section describes the configuration of these.

4.1 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. Additionally when using the inputs with the Boolean run engine an input delay can be specified for each input so the reaction to the input is delayed. The value of this delay can be 0 to 255 seconds.

4.2 Analog Inputs

WebControl™ has three analog inputs each having an input voltage range of 0 to +10V. 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 use the full scale range of 0 – 1023. This is new in this version firmware.

4.3 DS1822/DS18B20 1 Wire Temperature Sensors

WebControl™ supports up to eight Maxim DS1822 /DS18B20 12bit 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.

4.4 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. This output is fed into one of the A/D converter channels on the microcontroller. CGI command codes are available to setup an upper and lower threshold for the humidity sensor that can then be used in the Boolean expressions.

4.5 Timers

WebControl™ provides up to 20 timers that can be configured to provide periodic or once only alarms 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 3.0.

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

Figure 3.0 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

4.5.1 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
```

4.6 View the System Inputs and Outputs

To integrate with other servers, directly query I/O status maybe desirable. Using wget command from other servers or computers, user can directly query each input and output status. The following HTTP commands are directly return the I/O values:

“geta1.cgi, geta2.cgi, geta3.cgi” – to query analog input values

“geth1.cgi” – to query the humidity sensor readings

“geti1.cgi, geti2.cgi,...geti8.cgi” – to query each digital input values

“geto1.cgi, geto2.cgi,...geto8.cgi” – to query each TTL output status

“gett1.cgi, gett2.cgi,...gett8.cgi” – to query each temperature sensor value

5 Controlling the TTL Output Port

The current 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 inputs 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 HTTP server CGI web pages.

5.1 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 inputs can be used in either a combinational 'AND' or combinational 'OR' expression. 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

5.2 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.

5.2.1 Writing Rules

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

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

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. 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.

5.2.2 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 4.0 Logical operators of the Boolean expression syntax

A single expression can contain OR and AND terms 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 term, that term must still have a logical operator attached to it. E.g.

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

5.2.3 Input Terms

The table in figure 4.1 shows the input terms 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
"O1" "O1"... "O8"	Digital outputs 1 to 8 state
[x]..[xxx]	Delay from 0 to 255 seconds

Figure 4.1 Inputs terms supported by the Boolean expressions

5.2.4 Additional Operators

The optional “[]” operator is used to specify an input delay for a digital input, or a digital output. The value placed between the square brackets is a value of 0 to 255 seconds that specifies the delay to the reaction of the input once triggered. It is appended to the input identifier as follows:

`&I2[5]` - this will cause the input 2 to be delayed by 5 seconds

This operator is optional, if omitted then the reaction to the digital input is treated as instantaneous.

Or,

`O3[10]` -this will cause the input signal of output 3 to be delay by 10 seconds.

5.2.5 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`

Set the output true when digital input 3 is high but only after 10 seconds:

`&I3[10]`

5.3 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
- ❑ The output can be used as a momentary output by specifying a momentary value in seconds using a CGI configuration parameter. The resolution of the momentary output timer is 0.1 seconds. The momentary output will be set ON once triggered by the browser control and after the specified period of time (0 to 6553 seconds) the output will return to its false state again. Specifying a value of 0.0 seconds disables the momentary output and it is treated as a normal output. Using momentary feature with Boolean Run Engine has unpredictable result (output may be repeatedly ON and OFF).

5.4 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 4.2.

Parameter	Default
Browser Control	Enabled
Boolean Run Engine	Enabled
TRUE Boolean expression	None
FALSE Boolean expression	None
Invert output	Not inverted
Automated email on state change	Disabled
Momentary output	Disabled (Value of 0.0 seconds)

Figure 4.2 TTL output port defaults

6 Automated Email Setup

WebControl™ can be configured to send an automated email when a TTL output changes state. Only when using the Boolean run engine to control the output. 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 is 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 5.0 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 IP address of the ISP SMTP server to use. E.g. 66.77.88.99 (resolve from smtp.myISP.com)
SMTP Port	The SMTP port number, default is 25
SMTP username	For SMTP servers that require authentication this is the user's username. If no username is required then leave this field blank
SMTP password	For SMTP servers that require authentication this is the user's 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. myemail@myISP.com
To email address	The email address messages will be sent to
Subject	A subject line all messages will have

Figure 5.0 Email configuration parameters

6.1.1 Requirements to Use Email

- If WebControl™ is to be configured to generate and automated email then it 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.
- 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 available, WebControl™ will use its own crystal to maintain the clock accurate. If NTP is available, only need to set the timezone in the clock page. If NTP is not available, please set your local clock in the clock page also. Without NTP, its internal clock may not as accurate.

7.1 Network Requirements to Use the NTP

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.