

WEL Ultra™ Configuration Guide.

By Phil Malone: 7/13/2013

This document describes how to use a Web Browser to configure the data collection, processing and upload capabilities of a WEL Ultra™. This process is only performed ONCE to create a Master cloning source. All subsequent copies of this configuration can then be installed automatically.

The process comprises 7 steps, with an optional final step.

1. Create a Sensor Map spreadsheet to show how sensors will be connected and named.
 2. Determine the Ultra's IP address, and access the home page.
 3. Verify the operation of any connected sensors.
 4. Enter the Device parameters, based on the Sensor Map.
 5. Create any required Expressions, based on any required real-world calculations.
 6. Verify correct operation of all Devices and Expressions.
 7. Upload the Master configuration to the Central Server.
8. *Configure charts and viewing data.*

The Sample Scenario:

This document shows the configuration process based on a "sample application" where two temperature sensors and a current switch are used to determine the heat extracted from a ground loop. In this instance we will assume that a constant flow AC pump is being used to circulate water in a ground loop.

The rate of heat extraction can be expressed as:

$$\text{BTUH} = \text{Delta T (F)} * \text{GPM} * 500$$

This scenario can be implemented using the Ultra-DEV kit which contains:

- 1 x WEL Ultra-OEM
- 1 x Ultra-DEV board
- 1 x Power Supply
- 2 x TSENSE-SS1-5M temperature sensors
- 1 x CR-9380 Clip-On Current Switch.

The configuration process for this scenario will be described in the following section.

Step 1: Create a Sensor Map.

This step is essential a planning and preparation process. The WEL Ultra™ identifies its attached Devices by knowing where they are connected. This is a much more “traditional” approach than the standard WEL, but it is more flexible than a typical “1-sensor-per-line” approach since each Ultra bus line can have one of EACH 1-wire device family attached. Families refer to the “Family Code” associated with 1-wire sensors. Eg: a DS18S20 temperature sensor has a family code of 16, a DS18B20 temperature sensor has a family code of 40, and a DS2438 battery monitor has a family code of 38. Therefore one of each of these sensors could be attached to a single Ultra Bus Line.

The best way to plan your device interfaces is to fill out a Sensor Map spreadsheet. Blank Sensor Map spreadsheets can be obtained from <http://www.WELserver.com/OEM> . It is just a matter of deciding on the Device name you want to assign to each sensor, and then entering each one into the cell corresponding to the physical connection you will make to the Ultra-OEM. In the chart, vertical columns represent physical connection on the Ultra, and horizontal rows correspond to sensor families and individual channels on multi-input devices.

A Sensor Allocation Map for the sample scenario is shown below.

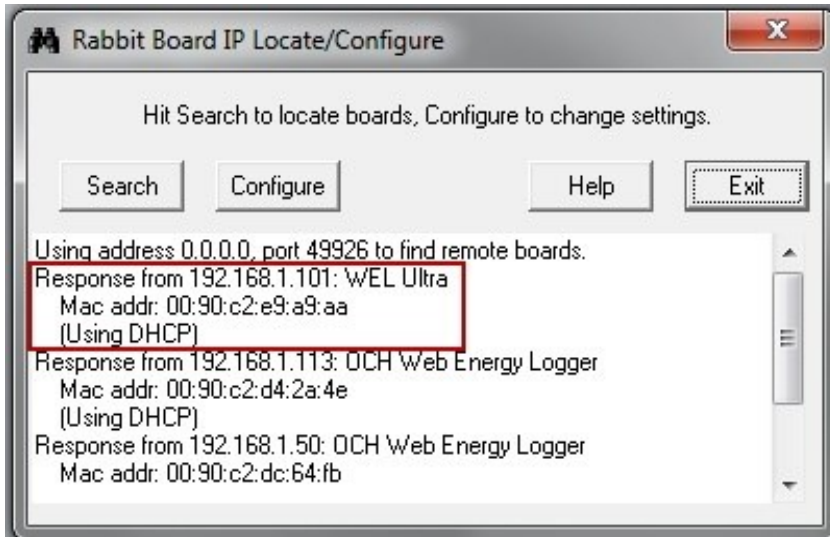
Sensor Map:		Configuration Guide Sample		Color Key:		Temperature	On/Off	Counter	Voltage
1-Wire Sensors									
	Chan	Line 1	Line 2	Line 3	Line 4	Line 5	Line 6	Line 7	Line 8
18B20	Ch1	LoopTIn	LoopTOut						
18S20	Ch1								
2406	Ch1								
2408	Ch1								
	Ch2								
	Ch3								
	Ch4								
	Ch5								
	Ch6								
	Ch7								
	Ch8								
2423	Ch1								
	Ch2								
2438	Ch1								
	Ch2								
	Ch3								
2450	Ch1								
	Ch2								
	Ch3								
	Ch4								
On-Board Sensors									
	Chan	Line 1	Line 2	Line 3	Line 4	Line 5	Line 6		
Voltage	Ch1								
Counter	Ch1								
Run	Ch1	LoopGPM							

In this sample, only three devices are defined: LoopTIn, LoopTOut and LoopGPM.

Step 2: Determine Ultra's IP and Connect to home page.

The WEL Ultra identifies itself on the network in the same way as the original WEL. It can be found by using the LocateIP program. Download LocateIP.exe from www.WELserver.com/OEM and run it on a Windows PC. The program will search the Local Area Network (LAN) for all WEL units, and display the devices it finds.

Here is a sample display showing how LocateIP found one WEL Ultra (inside red box), and two standard WELs.



This indicates that the Ultra is at IP Address: 192.168.1.101, and that it is using dynamic IP addressing (DHCP).

To access the Ultra's home page, simply enter this IP address into your favorite browser.

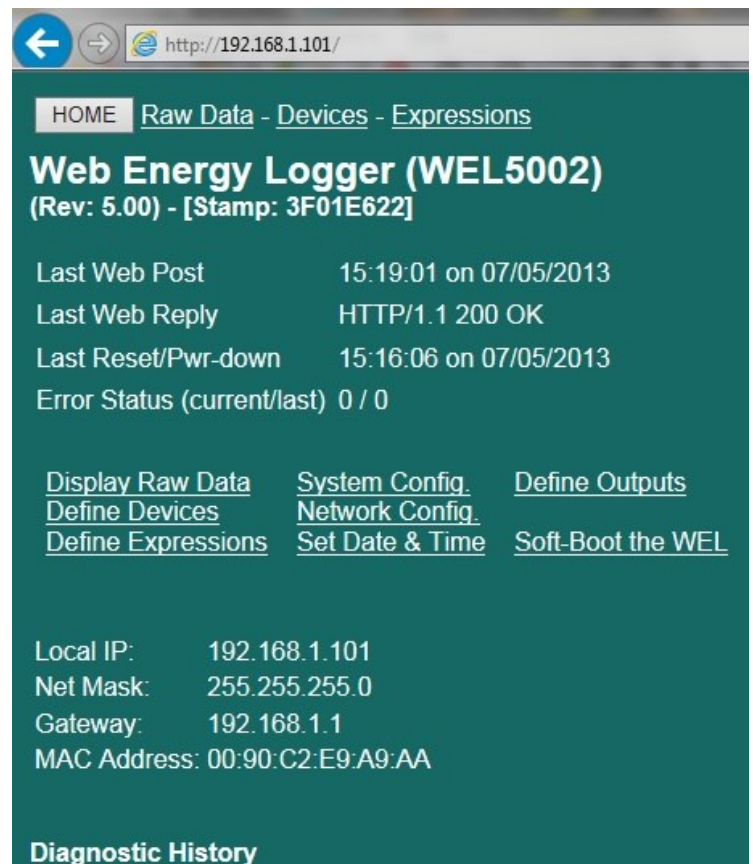
*Note: There is **no need** to add a port number to the end of the IP, as the Ultra does not require it.*

So in this case you would just enter <http://192.168.1.101> into your browser's "Location" box. The dark green home page should be displayed (as shown on the right).

Note that this page displays a wide range of status information, including the WEL ID and software revisions, post and error status information, network addresses and a selection of menu options.

At the bottom of the page is a running Diagnostic History. A variety of processes can post diagnostic data, so you should always keep an eye on this area if you want to know what is happening on the Ultra.

A standard menu appears at the top of this, and all other all pages, which link to the most frequently used functions.



Step 3: Verify Sensor operation.

For testing, the three sensors should be attached to the system at this time. This is not **required** for system configuration, but it does enable you to ensure that the configuration matches the way the sensors are attached.

Note: Refer to the “Ultra-OEM Tech Spec” for connection details.

If you were using the Ultra-DEV board for system testing, the sensors would be attached as shown on the right. Bus Lines 1 and 2 are used for the two temperature sensors, and Pulse/Run 1 is used for the current switch.

From the Ultra Home page, click on the “Raw Data” link.

The following page should be displayed, interpreted as follows:



http://192.168.1.114/devices.zhtml

HOME Raw Data - Devices - Expressions

1-Wire Device Status

Line	1	2	3	4	5	6	7	8
Action	SCAN	SCAN	SCAN	SCAN	SCAN	SCAN	SCAN	SCAN
BUS	OK	OK	none	none	none	none	none	none
18B20	1	1	0	0	0	0	0	0
18S20	0	0	0	0	0	0	0	0
2406	0	0	0	0	0	0	0	0
2408	0	0	0	0	0	0	0	0
2423	0	0	0	0	0	0	0	0
2438	0	0	0	0	0	0	0	0
2450	0	0	0	0	0	0	0	0

1-Wire Device Values

Line	1	2	3	4	5	6	7	8
18B20	23.999998	24.749998	0	0	0	0	0	0
18S20	0	0	0	0	0	0	0	0
2406	0	0	0	0	0	0	0	0
2408	0	0	0	0	0	0	0	0
2423	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
2438	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0	0,0,0
2450	0,0,0,0	0,0,0,0	0,0,0,0	0,0,0,0	0,0,0,0	0,0,0,0	0,0,0,0	0,0,0,0

Dedicated Device Values

Line	1	2	3	4	5	6
Analog	0.03871	0.03871				
Counter	26	0	0	0		
Run Input	1	0	0	0	0	0

The two light green “OK” boxes indicate that there is an active 1-wire device on lines 1 and 2. If there was a short on these lines they would be Red. All other lines show “none” which means nothing is connected.

The two green “1” boxes indicate that both lines have a DS18B20 installed, which is a temperature sensor.

The two boxes in the “1-Wire Device Values” table, with non-zero values in them, indicate the current temperature readings on lines 1 and 2 (in degrees Celsius)

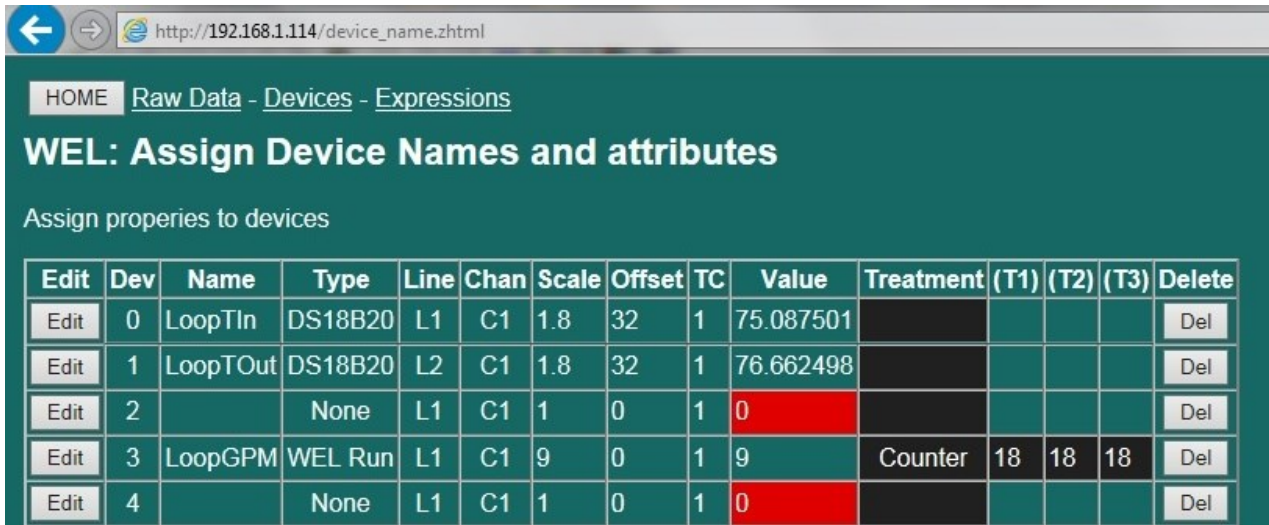
The bottom table shows the floating analog voltages on Analog lines 1 and 2, as well as a counter value of 26 and a Run status or ‘1’ on Pulse-Run line 1.

The counter value shows that the Current Switch is responding to the pump turning on and off, and the Run Input shows that the pump is currently on.

Step 4: Enter Device parameters.

This step involves telling the Ultra where the sensors are connected. Use the “Devices” link at the top of the page to jump to the Devices page. Each row on this page corresponds to a single sensor channel. Our sample system has three sensors. Click the “Edit” button on a line to enter “Edit Mode”. Once editing, type a **name** for the sensor and then set its **type**, **line** and **channel**, based on your Sensor Map spreadsheet.

You may also need to set a **scale** and **offset** for the sensor. Eg. temperature sensors read in degrees Celsius, so to display Fahrenheit, you will need a scale of 1.8 and an offset of 32.0. Once you are done editing, you must click the “Save” button to record your sensor’s parameters. Your sample page should look like the one below when you are done.



HOME Raw Data - Devices - Expressions

WEL: Assign Device Names and attributes

Assign properties to devices

Edit	Dev	Name	Type	Line	Chan	Scale	Offset	TC	Value	Treatment	(T1)	(T2)	(T3)	Delete
Edit	0	LoopTIn	DS18B20	L1	C1	1.8	32	1	75.087501					Del
Edit	1	LoopTOut	DS18B20	L2	C1	1.8	32	1	76.662498					Del
Edit	2		None	L1	C1	1	0	1	0					Del
Edit	3	LoopGPM	WEL Run	L1	C1	9	0	1	9	Counter	18	18	18	Del
Edit	4		None	L1	C1	1	0	1	0					Del

Notice that the third line does not have a sensor definition. Blanks may be left in the table for future use.

Even though LoopGPM is a “WEL Run” input, which is a simple on/off sensor, it has a scale of 9. This is because our pump has a flow rate of 9 GPM, so when the current switch senses the operation of the pump, it automatically sets the flow rate to 9. If we had a flow meter instead, we could set the sensor type to “WEL Counter” and put in a Scale Factor based on the amount of water corresponding to one pulse. Also note that we have set a “Counter” treatment. This will totalize the current value every minute, and generate a daily, monthly and yearly total of gallons used.

A RED background color is used to indicate when a Device value is not valid. This may be because:

- No Device has been entered for this line.
- Device values are updated once a minute, so a newly created device may not have a value yet.
- The sensor that the device is based on is not present, or is not reading correctly.

Once all the Devices have been defined, you should return to the Raw Data page. If a Device depends on a 1-wire sensor that is not currently connected, a blue box will appear in the 1-Wire Device Status table, indicating the sensor that is missing. A “Device Not Found” Diagnostic status will also be added to the list on the home page.

Step 5: Create Expressions

Expressions are used to calculate derived values from Devices and other Expressions, and they are defined on the Expressions page. Use the “Expressions” link at the top of any page to go to the correct page. Each row (or Slot) on the expression page corresponds to a single expression, which can combine one or two inputs to create an output value. To create or modify an expression, simply click the “Edit” button for that line. Click the “Save” button when you are done editing, otherwise your changes will be lost. One change in the way expressions are defined is that an input can be the name of a device, the name of an expression, or an actual number (thus eliminating the “constant expression” from the current WEL).

Below is the final Expression page for our Sample system. It contains three expressions:

Edit	Slot	Name	=	Input 1	src	Operator	Input 2	src	Scale	Offset	Value	Treatment	(T1)	(T2)	(T3)	Delete
Edit	0	LoopDT	=	LoopTIn	Live	-	LoopTOut	Live	1	0	-1.462494					Del
Edit	1	AbsLoopDT	=	LoopDT	Live	Absolute		Live	1	0	1.462494					Del
Edit	2		=		Live			Live	1	0	0					Del
Edit	3	LoopBTUH	=	AbsLoopDT	Live	*	LoopGPM	Live	500	0	6581.2221	K Accumulate	0.329061	0.329061	0.329061	Del
Edit	4		=		Live			Live	1	0	0					Del
Edit	5		=		Live			Live	1	0	0					Del

1. LoopDT: Subtracts LoopTOut from LoopTIn.
2. AbsLoopDT: Takes the Absolute value of LoopDT so BTU calculations will always be positive.
3. LoopBTUH: Calculates the rate of heat extraction, and also accumulates total heat extracted.

A RED background color is used to indicate when an Expression value is not valid. This may be because:

- No Expression has been entered for this line (see slot 2).
- Expression values are updated once a minute, so a newly created expression may not have a value yet.
- The Device that the expression is based on is not valid (see devices page).
- An invalid name has been entered for Input 1 or Input 2. (Check spelling and capitalization)

The best way to explain the elements of an expression is to work through the edit process. Since LoopBTUH is the most elaborate expression, let’s first look at how it was created. Clicking on its Edit button will enable us to modify it. The LoopBTUH edit page is shown below. Notice that the editing is done “in-line” rather than in a separate area as in the earlier WEL units.

Edit	Slot	Name	=	Input 1	src	Operator	Input 2	src	Scale	Offset	Value	Treatment	(T1)	(T2)	(T3)	Delete
Edit	0	LoopDT	=	LoopTIn	Live	-	LoopTOut	Live	1	0	1.012512					Del
Edit	1	AbsLoopDT	=	LoopDT	Live	Absolute		Live	1	0	1.012512					Del
Edit	2		=		Live	+		Live	1	0	0					Del
Save	3	LoopBTUH	=	AbsLoopDT	Live	*	LoopGPM	Live	500	0	0	K Accumulate	0	0	0	
Edit	4		=		Live	/		Live	1	0	0					Del
Edit	5		=		Live	Sqrt		Live	1	0	0					Del
Edit	6		=		Live	Power		Live	1	0	0					Del
Edit	7		=		Live	Average		Live	1	0	0					Del
Edit	8		=		Live	Negated		Live	1	0	0					Del
Edit	9		=		Live	Integer		Live	1	0	0					Del
Edit	10		=		Live	Absolute		Live	1	0	0					Del
Edit	11		=		Live	Higher		Live	1	0	0					Del
Edit	12		=		Live	Lower		Live	1	0	0					Del
Edit	13		=		Live	And		Live	1	0	0					Del
Edit			=		Live	Or		Live	1	0	0					Del
Edit			=		Live	Equal		Live	1	0	0					Del
Edit			=		Live	Less than		Live	1	0	0					Del
Edit			=		Live	Greater than		Live	1	0	0					Del
Edit			=		Live	Invert		Live	1	0	0					Del
Edit			=		Live	Filter		Live	1	0	0					Del
Edit			=		Live	Sample		Live	1	0	0					Del
Edit			=		Live	Positive		Live	1	0	0					Del

Working from left to right, the edit line contains the following edit fields:

- **Name:** This is where you type the name that represents the resultant value of this expression.
- **Input 1:** This can be one of three items. The name of a Device, the name of an Expression, or an actual number.
Note: If a number was entered here, and nothing else was entered on the line, the Expression would simply take on the value of the number entered.
- **Src:** For each input you can choose to use its live value or one of its treatment values (T1 to T3).
- **Operator:** This defines how to process the one or two input values. A pulldown list presents all the possible operators. In this sample '*' (multiply) is chosen.
- **Input 2:** A second input is not always required (eg: as with Absolute operator), but it can also be one of three things, like Input 1.
- **Src:** As per Input 1.
- **Scale & Offset:** To further modify the expression, a numeric scale and offset can be entered. The final result will be: Value = (Expression * Scale) + Offset
- **Treatment:** Treatments are follow-on processing applied to the Expression Value, and made available as additional uploaded Values. Treatments are selected from a pull-down list. Treatments are uploaded to the logging server with names that are derived from the original expression name. In the sample example, these would be LoopBTUH_T1, LoopBTUH_T2 & LoopBTUH_T3.
- **T Values:** T Values are the current values of the three treatments. These may be modified or reset to zero in the edit process.

So this expression combines the results of prior expressions to form the following results:

- LoopBTUH = |LoopTIn – LoopTOut| * LoopGPM * 500 (expressed as BTUs per Hour)
- LoopBTUH_T1 = Daily Accumulated BTUs (expressed as KBTU)
- LoopBTUH_T2 = Monthly Accumulated BTUs (expressed as KBTU)
- LoopBTUH_T3 = Yearly Accumulated BTUs (expressed as KBTU)

Step 6: Verify Correct Operation.

Before considering the configuration process complete, you should observe the system running for several minutes to verify the Device and Expression values.

Note: The values on the Raw Data page are updated every 12 seconds, but those on the Device and Expression page only update once a minute, so you will need to be patient while testing the system.

Ensure that no errors are reported on the Home page, and that no unexpected RED cells appear on any of the other pages. Check each of the sensor, device and expression values to ensure they are reasonable. Check that the calculations are generating reasonable results, and that the treatments are performing as desired.

Step 7: Upload the Master Configuration.

After spending time to create and test this configuration, it's important to save it. WEL Ultra configuration data is saved on a series of small files in its FLASH memory. These can be uploaded to the central server to be used for backup or cloning purposes. Access these function from the System Configuration page. A link to this page is provided on the Ultra's home page. The System Configuration page is shown below.

HOME Raw Data - Devices - Expressions

WEL: System Configuration

Parameter	Value
Site ID: (Do not modify)	WEL5002
Password: (Do not modify)	■■■■■■■■■■
Host Domain: (Data is sent here)	www.WelServer.com
Post Page: (CGI Script)	/cgi-bin/WEL_ultra.cgi
Proxy Server: (Leave blank if none) eg: 100.10.1.123:8080	
WEB Post Interval (Minutes)	1
Automatic Time-Sync mode <small>(via Internet)</small>	On Startup ▾
Local Timezone (in Hours from UTP) eg: New York: -5, San Diego: -8	-5
Do you want extra security? Enable Password Login when using Port Forwarding for remote access. Use Site ID for User Name.	No, I'm fine. ▾

Submit Reset

Code Version: 5.00 - Datestamp: [3F01E622]

Request Code Update

Request Config Backup

Request Config Restore

To make a backup of your configuration, click the "Request Config Backup" button. This will cause the Ultra to initiate a backup NEXT TIME it posts data to the central server. The Ultra will actually request a backup and the server will issue the required commands in its reply.

So it's important to give the Ultra enough time to do this backup before you say, remove its power.

The Ultra will indicate that a backup is pending by displaying the following status on several pages:

Code Version: 5.00 - Datestamp: [3F01E622] Config. will be saved on next post.

Request Code Update

8: Configure Charts and View Data.

Configuring charts and live data for an Ultra is done in the same way that it's done for a regular WEL.

You first go to the Setup Overview page <http://welserver.com/cgi-bin/setup/WEL.cgi> where you will be prompted for your User ID and Password. The Username is (for initial configuration) will be the WEL ID (eg: WEL4123) and the password will be a unique one assigned to the WEL.

The key difference with the Ultra, is that the page for viewing the live data and charts has a new URL.

Previously the page for WEL4123 would have been:

<http://www.WELserver.com/WEL4123>

The new location for this page has a sub-folder inserted into the path, that corresponds to the "thousands" part of the WEL ID. So the new location will be:

<http://www.WELserver.com/4/WEL4123>