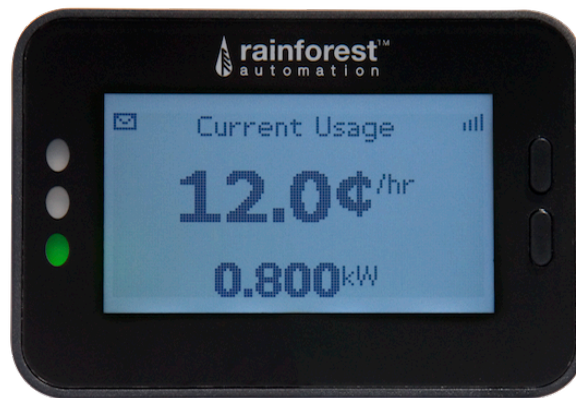




EMU-2™

Energy Monitoring Unit



User Manual

Version 2.1
July 2019

Copyright © 2019 by RAINFOREST AUTOMATION, INC (“RFA”). All rights reserved.
No part of this manual may be reproduced or transmitted in any form without the expressed, written permission of RFA.

Under copyright law, this manual or the software described within, cannot be copied, in whole or part, without the written consent of the manufacturer, except in the normal use of the software to make a backup copy. The same proprietary and copyright notices must be affixed to any permitted copies as were affixed to the original. This exception does not allow copies to be made for others, whether or not sold, but all of the material purchased (with all backup copies) can be sold, given, or loaned to another person. Under the law, copying includes translating into another language or format.

Rainforest Automation may have patents, patent applications, trademarks, copyrights, or other intellectual property rights covering subject matter in this document. Except as expressly provided in any written license agreement from Rainforest Automation, the furnishing of this document does not give you any license to these patents, trademarks, copyrights, or other intellectual property.

Trademarks

Third-party brands and company names mentioned herein may be trademarks and/or registered trademarks of their respective companies and are the sole property of their respective manufacturers.

Notice

The author(s) assumes no responsibility for any errors or omissions that may appear in this document nor does it make a commitment to update the information contained herein.

EMU-2™ – Energy Monitoring Unit

RFA-Z105-2
Version 2.1

User Manual

Table of Contents

Regulatory information	4
Quick Setup.....	5
Features of Your EMU-2™.....	9
Introduction to Your EMU-2™	10
Screen Navigation Flowchart.....	12
EMU-2™ Display Screens	13
Startup	13
Current Time	13
Meter Reading	13
Current Usage.....	14
Daily Totals	14
Total to Date	15
Previous Totals	16
Current Price.....	16
Message	17
Confirm Message.....	17
EMU-2™ Configuration Screens.....	18
Restart	18
Select Language	18
Set Rate	18
Time Options.....	19
Set Time Options	19
Power Source	20
Troubleshooting Guide	21
Technical Support.....	22

Regulatory information

FCC Notices

This device complies with part 15 of the FCC Rules. Operation is subject to the following two 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. Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

FCC/IC RF Exposure Statement

This equipment complies with FCC and Industry Canada radiation exposure limits set forth for an uncontrolled environment. The antenna(s) used for this equipment must be installed to provide a separation distance of at least 8 inches (20cm) from all persons.

ICES-003 Compliance

This Class B digital apparatus complies with Canadian ICES-003.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. 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 to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Compliance Regulations For Australia and New Zealand

This equipment complies with the C-Tick labeling requirements for Australia and in New Zealand. As a radio transmitter, this device complies with the requirements of AS/NZS 4268:2008 as designated in the Radiocommunications (Short Range Devices) Standard 2004 for Australia and as required by the Radiocommunications Regulations (General Users Radio License for Short Range Devices) Notice 2011 for New Zealand. This device is a Category A device as defined in the Radiocommunications (Compliance Labeling - Electromagnetic Radiation) Notice 2003.

Quick Setup

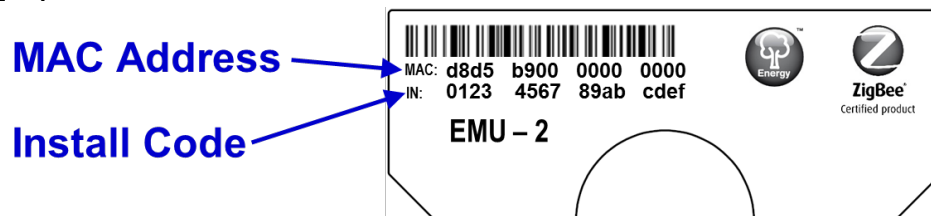
Step 1: Check Contents of the box

The box should contain the following items:

- a) 1 x **EMU-2™** Display unit
- b) 2 x AAA Batteries
- c) 1 x AC Power Adapter

Step 2: Register your EMU-2™

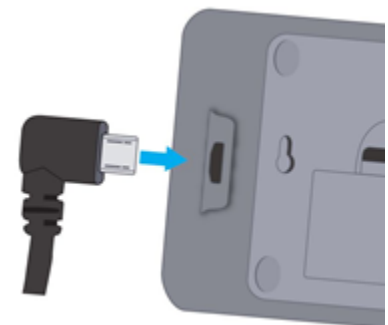
Your **EMU-2™** must be registered with your utility to connect to the smart meter. It may come to you preregistered. If so, you can skip to the next step. If not, you will need to contact your utility to register your device. You will need the following information, which is found on the Information Label on the back of your **EMU-2™**:



Note that it may take some time for your utility to enable the smart meter to connect with your device. You must wait until this process is complete before proceeding; your **EMU-2™** will not function correctly until the smart meter is enabled.

Step 3: Power up your EMU-2™

- a. Plug the AC Adapter into a convenient power outlet.
- b. Plug the AC Adapter cord into your **EMU-2™**.
- c. Batteries may also be installed, and can be used as a source of short-term alternative power. However, the **batteries are not intended to be the primary source of power**, and may only last a few days of continuous use. If you choose to install batteries, they should be inserted exactly as shown on inside of the battery compartment. Note that putting a battery in backwards can be hazardous, and may cause extensive damage to your **EMU-2™**. Always use alkaline batteries; never mix battery types. Replace all batteries at the same time.

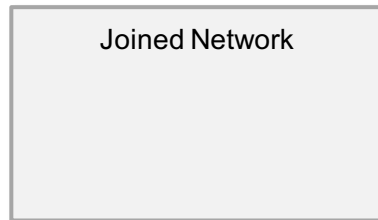


Step 4: Wait for your EMU-2™ to join the smart meter

Your **EMU-2™** will attempt to connect to the smart meter. You will see these two screens:



You may see these two screens a few times. This could take 1-2 minutes. When your **EMU-2™** finds the smart meter and successfully communicates with it, you will see this screen:



A short time later, the *Current Time* screen will appear, with dashes instead of digits:



As soon as the dashes are replaced with the current time and date, it means that your **EMU-2™** has successfully read the meter, and is ready for use.

Step 5: Configure your EMU-2™

- Press both of the buttons on your **EMU-2™** simultaneously and release.



- Press the Bottom Button.



- Select the language you would like your **EMU-2™** to use.



- d. If your meter does not provide pricing (ask your utility), you will need to set your energy price.



The digit to be modified will be flashing, starting on the right, and working left. After you have entered all 5 digits of the energy price, you will see this screen:

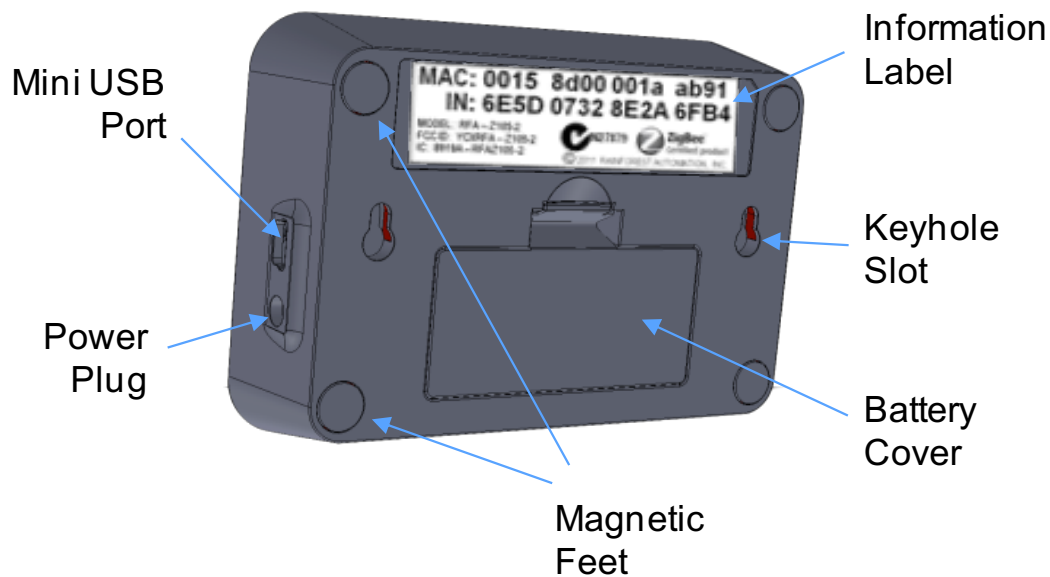


- e. If you need to change the time zone, press the Top Button and follow the directions for the *Set Time Options* screen in the **Configurations Screens** section of this manual. Otherwise, press the Bottom button to see the *Power Source* screen:



- f. Press any button to return to regular monitor mode. Your **EMU-2™** is ready to use.

Features of Your EMU-2™



Introduction to Your EMU-2™

Congratulations on getting an **EMU-2™**, the easiest way to get access to your smart meter energy information. This simple device tracks your energy usage for you, and makes you aware of your consumption – while it is happening. Just like your watch makes you aware of the time, and helps you stay on schedule, your **EMU-2™** will help you know when to take action to lower your utility bills and save energy.

Your **EMU-2™** is normally plugged into its AC Adapter, but it can also be powered by standard AAA batteries for short periods of time. This allows you to take your **EMU-2™** with you and see the results on-the-spot when major appliances are turned on or off.

Most of the time, your **EMU-2™** will be in Rest Mode. In this mode, the Display backlight will be off, but the Display can still be read. To put the unit into Active Mode, simply press one of the buttons, and the backlight will come back on. After 4 minutes of inactivity, your **EMU-2™** will automatically return to Rest Mode.

If you unplug your **EMU-2™**, so that it is powered only by the backup batteries, then the unit will run with the backlight off all the time, and will go into Sleep Mode after 2 minutes of inactivity. In Sleep Mode, the Display and the Indicator LED Lights will be off, but the **EMU-2™** will communicate occasionally with the smart meter. Pressing one of the buttons will wake the unit up, and the Display will come back on. Note that your **EMU-2™** is intended to be used with the AC Adapter plugged in; the batteries are not intended to last for long periods of time.

Your **EMU-2™** has two buttons that are used to make selections. By default, they are used to scroll through the different Display screens. The Top Button pages up, and the Bottom Button pages down. The screens are displayed in a circular sequence. Once you cycle through to the end of the sequence, the first screen is displayed again.



On some screens, the **EMU-2™** may need a response from you. For these screens the buttons will behave differently. The button functions will be indicated on the right side of the screen. When the **EMU-2™** presents you with options to choose from, pressing the

Top Button cycles through the different options to select, and pressing the Bottom Button saves the selected option and pages to the next screen.

Your **EMU-2™** communicates wirelessly with the smart meter to get usage information, and presents this information on the Display. The accumulated usage information is updated every 4 minutes while the unit is in Active Mode. If the electricity price per kWh is provided by the smart meter, the price is checked every 2 minutes.

Your **EMU-2™** checks every 2 minutes for a new text message from your utility. An envelope icon is shown in the upper left hand corner of the screen if there is an active message stored on your **EMU-2™**.

The quality of the wireless signal from the smart meter is indicated by the small bar graph in the upper right hand corner of the Active Mode screens. Four bars are shown for a good signal; fewer bars indicate a lower quality signal. If the connection to the smart meter is lost, a large "X" will replace the bar graph.

There are also a number of configuration screens. These are accessed by pressing and releasing both buttons simultaneously to put your **EMU-2™** into Configuration Mode. Note that your **EMU-2™** should have successfully connected to the smart meter before putting it into Configuration Mode.

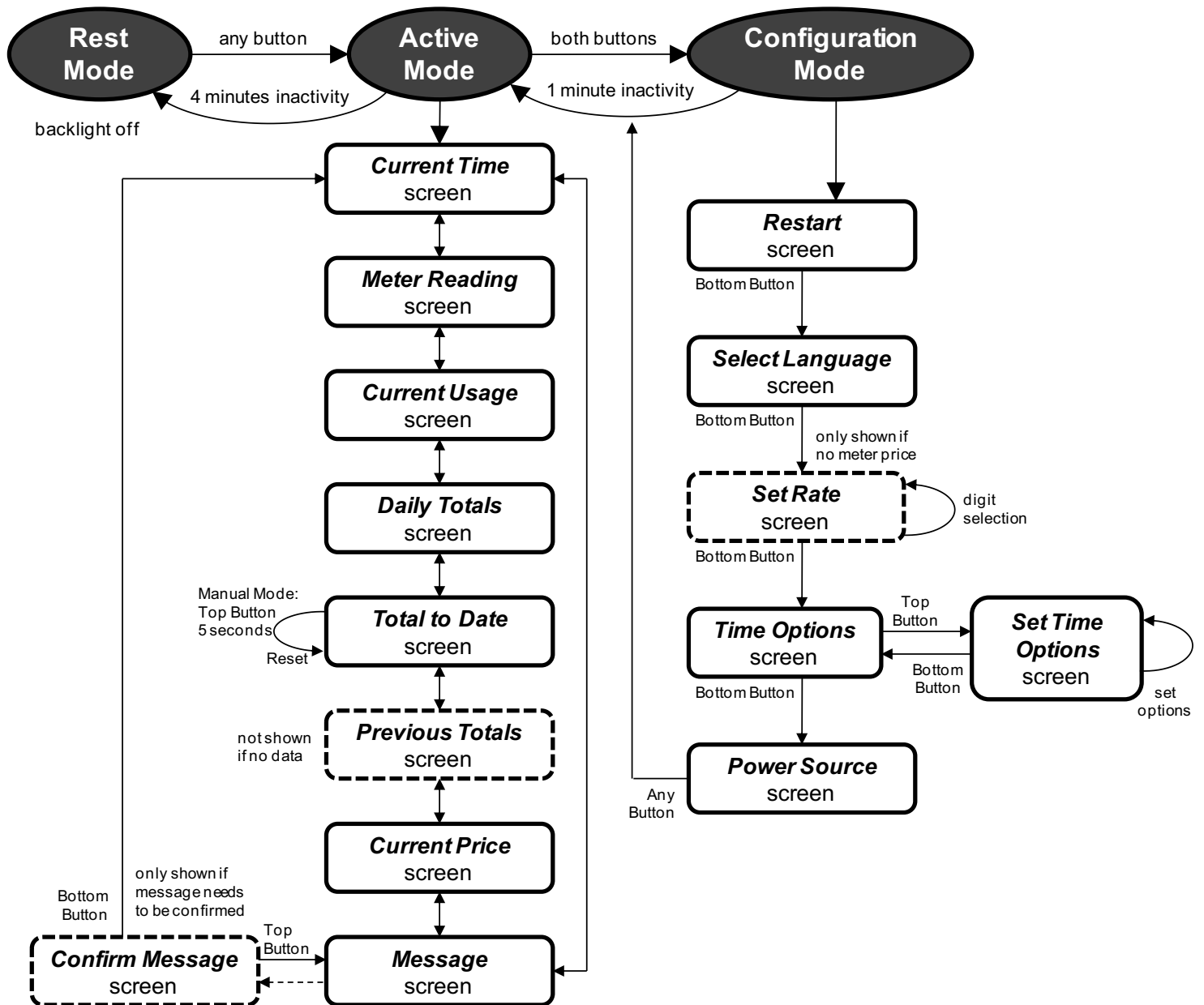
There are Indicator LED Lights to the left of the Display that show your rate of energy usage in relation to a threshold that you can set. The Red light means you are consuming a lot of energy; the Green light means your usage is low. Also, when there is a new text message waiting to be read, the red and yellow LEDs will flash in an alternating pattern.

The **EMU-2™** displays your immediate energy usage on the *Current Usage* screen. Use this screen like a speedometer for your home; it shows you how fast you are using energy right now. This screen reacts quickly to changes in electricity use, so you can observe changes in real time and see what a difference it makes when you turn electrical loads on and off.

Your **EMU-2™** also keeps track of your energy usage over time. The *Daily Totals* screen displays the total cost and usage, as well a graph of usage for each hour, for the previous day and the current day so far. This allows you to spot patterns in your daily electricity use, and to compare one day to the next.

The *Total to Date* and *Previous Totals* screens give you information about your energy consumption over longer periods of time. You can start and stop the accumulation period just like a stopwatch. Holding down the Top Button for 5 seconds, while viewing the *Total to Date* screen, will restart the accumulation and transfer all of the data from the prior accumulation period to the *Previous Totals* screen.

Screen Navigation Flowchart



EMU-2™ Display Screens

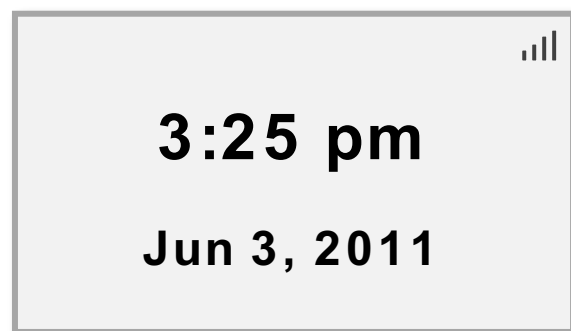
Startup

The *Startup* screen is shown when your **EMU-2™** is powering up for the first time.



Current Time

The *Current Time* screen shows the present time and date, as read from the smart meter. Your **EMU-2™** synchronizes its clock with the smart meter every 15 minutes.

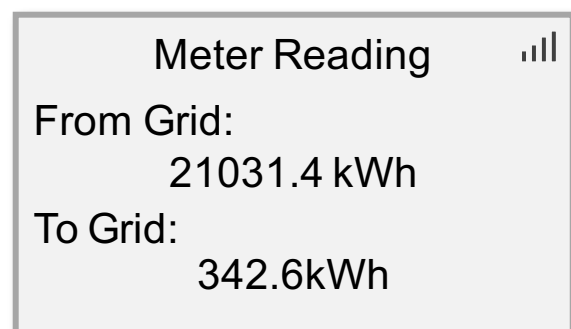
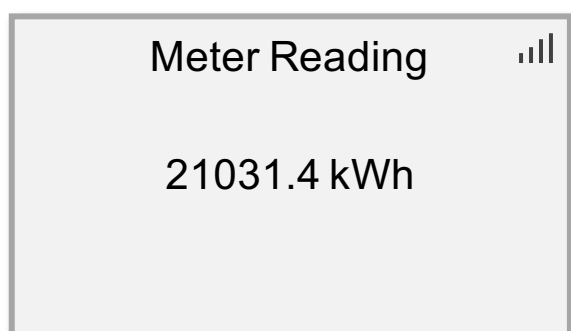


Meter Reading

The *Meter Reading* screen shows the raw total accumulated electricity usage reading in kilowatt-hours from the smart meter.

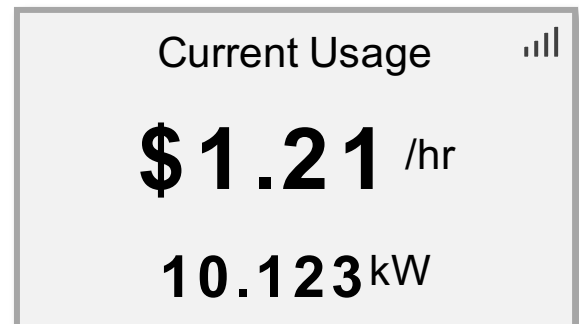
Your **EMU-2™** updates this data every 4 minutes while it is in Active Mode.

If you are generating your own electricity, and have a Net Metering agreement with your utility, then there may be times when you will be producing more energy than you are using, and electricity will flow out to the grid. In this case, the *Meter Reading* screen will show two totals: the amount of electricity delivered from the grid into your home (labeled "From Grid"), and the amount of surplus electricity you have delivered out to the grid (labeled "To Grid").



Current Usage

The *Current Usage* screen shows the rate of energy consumption and the estimated cost per hour in dollars (or cents, if it is less than one dollar). The estimated cost is calculated from the current price per unit multiplied by the current rate of energy consumption. The data is updated from the meter every 8 seconds while this screen is shown.



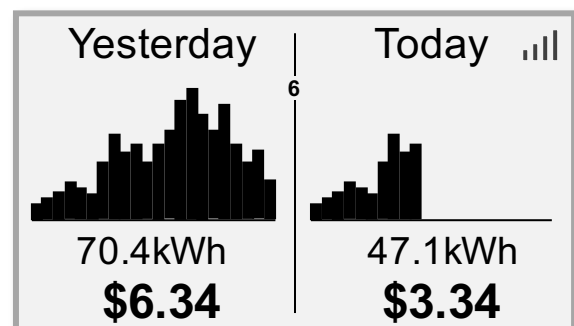
This is like the speedometer in your car; it shows you how fast you are consuming energy.

The *Current Usage* screen also allows you to set your baseline consumption rate for the Indicator LED Lights. To set the baseline, press and hold the Top Button for 5 seconds. You should see all three Lights come on together. This indicates that the baseline has been set to the current usage rate shown on the screen. After that, the Green light will be on when the current consumption rate is below the baseline. When consumption is at the baseline rate or greater (up to 5x the baseline rate), the Amber light will be on. When consumption is more than 5x the baseline rate, the Red light will be on.



Daily Totals

The *Daily Totals* screen shows your accumulated totals in graphical and numerical format for energy consumption and estimated cost for the current day and the previous day. The current day ("Today") shows a running total from the start of the day (midnight) up to the present. At midnight, today's totals will be transferred to "Yesterday", and a new running total is started.



The graphs show hourly data, with a bar for each hour. The height of the bars is proportional to the number of kWh consumed for each hour. The graphs are auto-scaling, and meant to show relative, rather than absolute values. The small number

near the top of the center line indicates the value (in kWh) of the highest bar in the graphs.

When you first start up your **EMU-2™**, there may be no Yesterday usage data if the meter does not store previous readings. If so, you will see dashes in the place of numbers until the end of the first day. Note that historical pricing is not stored in the meter, so estimated cost will be displayed as dashes for Yesterday until the end of the first day.

Total to Date

The *Total to Date* screen shows your accumulated totals for energy consumption and estimated cost for the current time period. The start date of the current time period is shown at the top of the screen. The number of elapsed days so far in this time period is shown in the upper right of the screen. The number of days is shown to the nearest one-tenth of a day. The cumulative energy

consumption for the time period is shown as recorded by the smart meter. The estimated cost for the recorded energy consumption is shown in dollars (or cents, if it is less than one dollar), and is based on the current price value during the period. The average cost per day for the current time period is shown in the lower right of the screen.

This is like the odometer in your car; it shows you the total energy used so far.

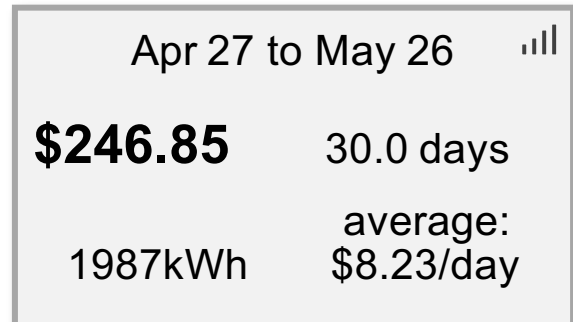


IMPORTANT: The **EMU-2™** displays the usage as recorded by the smart meter, and costs based on your input; these numbers may differ from what is shown on your actual utility bill.

The current time period resets manually by the user, or automatically on your billing cycle date, depending on your utility. Manual reset is done by pressing and holding the Top Button for 5 seconds, which will save all of the accumulated totals in the *Previous Totals* screen, and restart all of the current counters from zero. Automatic billing period reset will happen on the date that your billing cycle rolls over. *Note: Automatic billing cycle changing will only work when supported by your utility and will disable the manual reset capability.*

Previous Totals

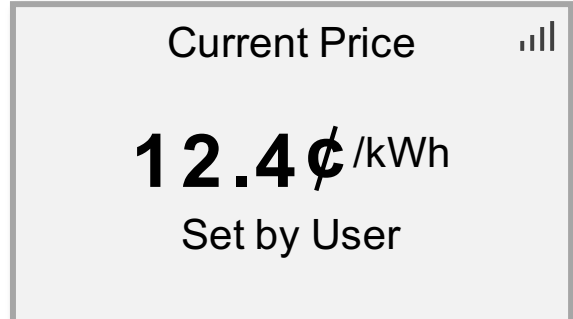
The *Previous Totals* screen shows your accumulated totals for energy consumption and estimated cost for the previous time period. The start and end dates of the previous time period are shown at the top of the screen. The number of days in the previous time period (to the nearest one-tenth of a day) is shown in the upper right of the screen. The average cost per day for the previous time period is shown in the lower right of the screen.



This screen is overwritten with the values from the *Total to Date* screen each time the current time period is restarted. If the current time period has not been restarted at least once, then there will be no data values for this screen and it will not be displayed.

Current Price

The *Current Price* screen shows the price of electricity that is currently in effect. The rate is shown in cents per kilowatt-hour. The current price is usually obtained from the value you manually set in the *Set Rate* screen. To manually set the current price value, simply press and release both buttons simultaneously. This will put you in Configuration Mode. Move through the *Restart* screen and *Select Language* screen to get to the *Set Rate* screen, where you can change the current price value. This new value will become the current price, and the Rate Label will be displayed as "Set by User".

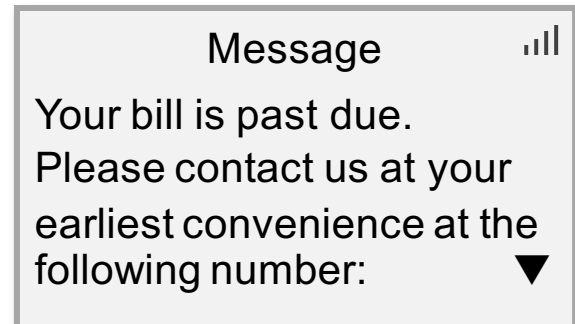


It is also possible to read the price directly from the smart meter. If the meter supports this feature, then the **EMU-2™** will check the price with the meter every 2 minutes. If no price value has been set – either by the smart meter or manually – then dashes are shown for the price digits.

For some utilities, the price can also be set by a special message sent to the meter by the utility. This message will be displayed as a text message on the *Message* screen, and the price will be automatically set. This will override any price value that has been set manually.

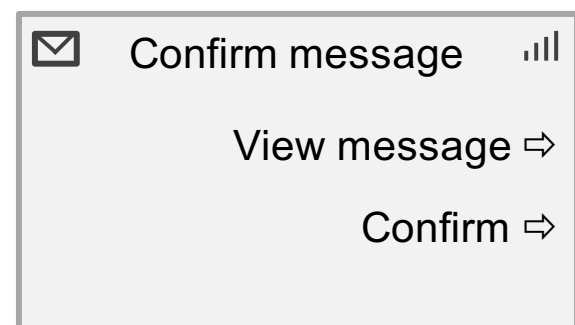
Message

The *Message* screen will display a text message when there is a message from your utility. Your **EMU-2™** checks every 2 minutes for a new message. When a new message is received, the Indicator LED Lights will flash in a special red-yellow sequence to show that a new message is waiting for you to see. The envelope icon will also appear in the upper left hand corner of the screen to indicate that there is an active message. To see the message, use the buttons to go to the *Message* screen, and the message will be displayed. A message can be up to 100 characters long. If the message is too long to fit on the screen, a continuation character (“▼”) will be shown at the end of the bottom line, and the message will automatically scroll up until the whole message has been displayed. Once the end of the message is reached, it will start again after a short pause. If the message requires an acknowledgment, you will automatically be sent to the *Confirm Message* screen. Viewing the message resets the Indicator LED Lights, but the envelope icon will remain on until the message has expired.



Confirm Message

The *Confirm Message* screen allows you to send a confirmation to your utility, telling them that you have read the latest text message that they have sent to you. If you wish to view the message again, press the Top Button, and you will be sent back to the *Message* screen. Once the message has been displayed, you will be returned to the *Confirm Message* screen. To send your confirmation, press the Bottom Button. You will then be sent to the *Current Time* screen.



EMU-2™ Configuration Screens

Restart

The *Restart* screen allows you to perform a device restart by pressing the Top Button. This will reboot your **EMU-2™** without losing the connection to the smart meter. To access this screen, press both buttons simultaneously, then release.

Pressing the Bottom Button sends you to the *Select Language* screen.



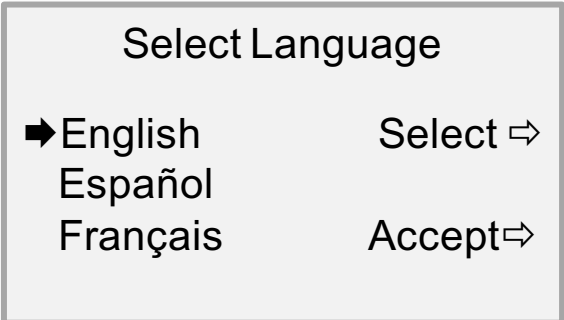
Restart?

Restart ⇨

Skip ⇨

Select Language

The *Select Language* screen is used to change the language displayed by your **EMU-2™**. This screen can only be accessed in Configuration Mode, after going through the *Restart* screen. To enter Configuration Mode, press and release both buttons simultaneously. Then press the Bottom Button to get to the *Select Language* screen. The currently selected language will have an arrow beside it. Press the Top Button to cycle between the different languages. Press the Bottom Button to save the selected language. You will then be sent to the *Set Rate* screen (if your there is no price in the meter), or the *Time Options* screen (If price is provided by the meter).



Select Language

➡ English	Select ⇨
Español	
Français	Accept ⇨

Set Rate

The *Set Rate* screen allows you to manually set the current price for electricity in cents per kWh. This screen can only be accessed in Configuration Mode, after going through the *Restart* and *Select Language* screens. The price shown will zero, unless it has been previously set in



Set Rate

000.00¢/kWh Change ⇨

Keep ⇨

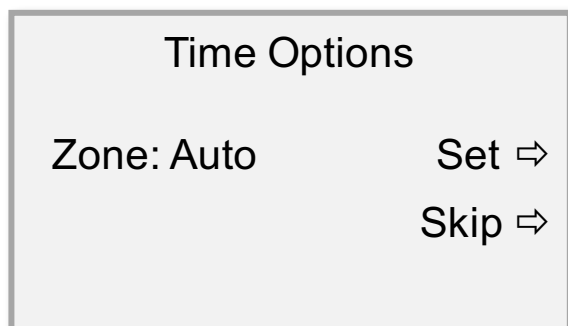
this screen. The rightmost digit of the price will be flashing. To change this digit, press the Top Button and cycle through the numbers 0-9 until the desired value is displayed. Then press the Bottom Button to save this digit. The next digit to the left will then be flashing. Repeat the process until all five digits show the desired values. After the last digit is saved, your **EMU-2™** will go to the *Time Options* screen.

Time Options

The *Time Options* screen shows how the time is calculated by your **EMU-2™**. In most cases, the meter provides the local time, and the Zone is set to “Auto”. This means the **EMU-2™** will automatically read the local time from the meter.

In some cases, the meter will not provide the local time, and the local time will have to be calculated. To do this, you will need to set up the Time Zone and Daylight Savings Time (DST) options in the *Set Time Options* screen. Press the Top Button to get to the *Set Time Options* screen.

The *Time Options* screen can only be accessed in Configuration Mode, after going through the *Restart*, *Select Language* and *Accumulation Period* screens. Once this screen shows the correct parameters for getting the time, press the Bottom Button to go to the *Battery* screen.

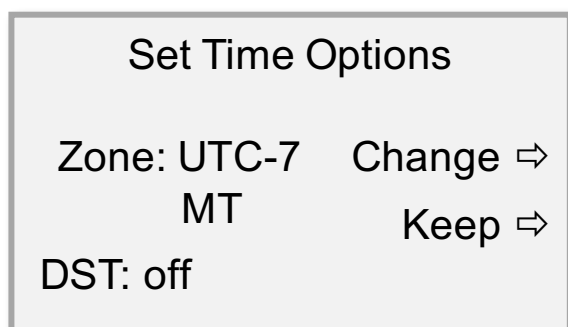


Set Time Options

The *Set Time Options* screen can only be accessed from the *Time Options* screen. It is used when the meter does not provide the local time. It allows you to set the current Time Zone that is in effect, as well as whether Daylight Savings Time (DST) is calculated.

The “Zone:” field shows the offset in hours from Coordinated Universal Time (UTC) (also known as Greenwich Mean Time or GMT) for the current time zone. Beneath this is the abbreviation for the Time Zone:

- PT = Pacific Time (UTC-8)
- MT = Mountain Time (UTC-7)



The “DST:” field shows whether Daylight Savings Time will be calculated. If DST=on, then Daylight Saving Time will be automatically calculated when needed. If DST=off, then Daylight Saving Time will not be calculated, and you will always see Standard Time.

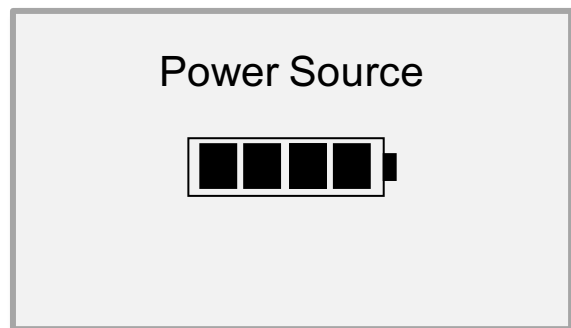
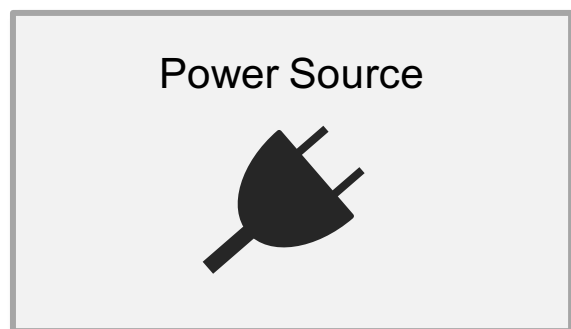
When you enter the screen, the “Zone:” field value will be flashing. To change this value, press the Top Button to cycle through all of the supported time zones. Press the Bottom Button to save the value that is displayed. Then the “DST:” field value will be flashing, and you can cycle between “on” and “off” values using the Top Button. Finally, save the DST value by pressing the Bottom Button, and you will exit back to the *Time Options* screen.

Power Source

When your **EMU-2™** is powered by its AC adapter, the *Power Source* screen will show a graphic of a power plug.

When your **EMU-2™** is running on battery power, the *Power Source* screen will show the outline of a battery that contains a bar graph that indicates the charge level of the batteries. Four bars indicates the batteries have a good charge. Fewer bars indicate the battery charge is reduced. The batteries should be replaced if the *Power Source* screen shows only one bar.

Pressing any button returns you to Active Mode.



Troubleshooting Guide

Generally, there are only 3 things that can go wrong with your **EMU-2™**:

1. The device stops working and needs to be restarted
2. There is no power to the unit
3. The device cannot connect to the smart meter

If the screen is dark and the unit does not respond to button presses, then either there is a problem with power (see Step 2 below), or the unit requires a restart (see Step 1).

If the wireless link bar graph in the upper right corner of the screen is down to 1 bar, or has been replaced by an "X", then your **EMU-2™** is having trouble connecting to the smart meter (see Step 3).

Step 1. Restart the EMU-2™

If the **EMU-2™** screen is not displaying anything, and it does not respond to button presses, then try restarting the unit.

To restart your **EMU-2™**:

- a) Remove the batteries, if installed
- b) Unplug the power plug
- c) Wait 10 seconds
- d) Plug the power plug back in
- e) Check the display to verify **EMU-2™** is working

Step 2. Check the Power

If the **EMU-2™** is not responsive, and restarting it has no effect, check to see if the AC Adapter is working correctly. This can easily be done by unplugging the unit and installing new batteries. If the **EMU-2™** works with the batteries, then the AC Adapter is probably faulty.

Notes on Battery Replacement

Your **EMU-2™** uses 2 AAA batteries for short-term alternative power. To ensure a trouble-free battery operation:

- a) Replace the batteries when the battery indicator shows 1 bar.

- b) Replace all batteries at the same time with **new** batteries.
- c) Use new batteries with a current **best before date**.
- d) Do not use rechargeable batteries unless they are marked as 'rechargeable alkaline' and have a rating of 1.5V.

Step 3. Check the Smart Meter Connection

The wireless connection between your **EMU-2™** and the smart meter can be disrupted for a variety of reasons.

Try the following:

- a) Move the **EMU-2™** to a different location that is closer to the smart meter.
- b) Move the **EMU-2™** away from wireless routers, cordless phones, microwave ovens, or large metal objects.
- c) Try different areas of your house and different orientations in each room until you find one that works.

If there is a power outage in your neighborhood at the moment, please wait until power is restored and try again.

Technical Support

For more information: www.rainforestautomation.com/emu2_support