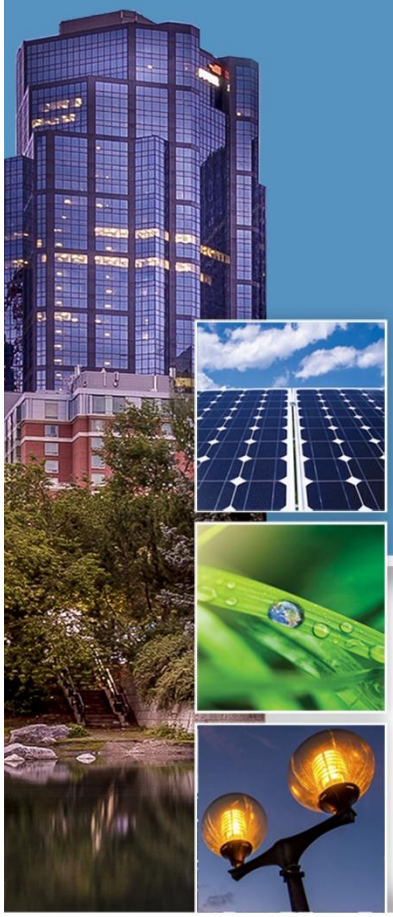
Energy Efficiency Toolbox Manual

This Manual provides an overview of the Energy Efficiency Toolbox, a description of it's contents, their purpose, and instructions on their appropriate use. The Energy Efficiency Toolbox has been designed to provide municipalities and residents access to tools which will help identify areas of improvement for energy efficiency.

August 2016



ASSESS | PLAN | ACT | EVALUATE

MCCAC
Municipal Climate Change Action Centre

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1.0 Overview

In 2010, buildings were responsible for nearly one-third of all energy consumption in Canada[1]. Addressing energy efficiency in buildings is an extremely important and easy way to drastically reduce energy consumption, thus saving on costs as well as minimizing greenhouse gas emissions. Only 8% of Albertans have conducted an energy audit in the past 10 years, suggesting that many economically viable energy efficiency measures remain undiscovered. The Energy Efficiency Toolbox is an effort by the Municipal Climate Change Action Centre (MCCAC) to address this issue and give municipalities the ability to see for themselves where opportunities for energy efficiency exist in their buildings.

This Energy Efficiency Toolbox Manual provides an overview of the intended use and contents of the Energy Efficiency Toolboxes which have been assembled by the MCCAC. The Energy Efficiency Toolboxes have been designed to help municipalities and their residents take energy efficiency measuring into their own hands and get an up close look at ways to conserve energy and lower costs in their municipal buildings and operations.

Note: Please handle all equipment in the Energy Efficiency Toolbox with care and once finished return the toolbox with all equipment inside. Please contact the MCCAC with any questions or concerns regarding the contents of the Energy Efficiency Toolbox. Please notify the MCCAC if any item(s) from the Toolbox are missing, functioning incorrectly, require replacement, or require new batteries.

[1] Office of Energy Efficiency, Energy Use Data Handbook, 1990 to 2010 (2013). http://oee.nrcan.gc.ca/publications/statistics/handbook2010/handbook2013.pdf

2.0 Introduction

The Energy Efficiency Toolbox contains a number of tools and and items which will each provide information on different energy consuming areas. Take the time to learn about each tool in the box including how to use it and how to interpret the resulting data.

Note: Using the Energy Efficiency Toolbox is not a replacement for undergoing a professional energy audit. Energy audits are conducted by trained professionals using a much wider range of tools to gather highly specific results and recommendations on energy usage and cost reduction measures. The Energy Efficiency Toolbox is simply a hands-on approach for municipalities and their residents to help learn first-hand where opportunities exist every day to conserve energy.

After exploring the contents of the Energy Efiiciency Toolbox and gaining a better understanding of the major areas of energy consumption in your buildings, you may come to the conclusion that you would like to explore options for a full professional building energy audit and possible building energy retrofits to help save money and reduce emissions. To help municipalities enhance their understanding of building energy performace, the MCCAC offers a free online energy benchmarking service. Municipalities are encouraged to submit data on their buildings to evaluate energy intensity and how their buildings compare to similar municipal facilities across Alberta. To benchmark your buildings, visit www.mccac.ca/building-benchmark.

The MCCAC also offers the Taking Action to Manage Energy (TAME+) program which provides tools and funding to help municipalities understand how energy is used in their buildings, identify key savings opportunities, and implement retrofit projects. The TAME+ program can help cover the costs of a professional energy audit up to $2,000, and the costs of implementing energy efficiency retrofits up to $100,000. For full information about eligibility, rebate rates, and more, visit www.mccac.ca/programs/TAME.

Note: The MCCAC is not responsible for any damage to self, others, or property due to the inapporpiate use of the equipment in the Energy Efficiency Toolbox. Take the time to carefully read directions in this manual as well as further detailed instructions in the accompanying operating manuals before using any piece of equipment. Always use caution when interacting with electrical systems.

3.0 Toolbox Contents

A) Electricity Usage Meter

B) Light Meter

C) Temperature and Humidity Data Logger Recorder

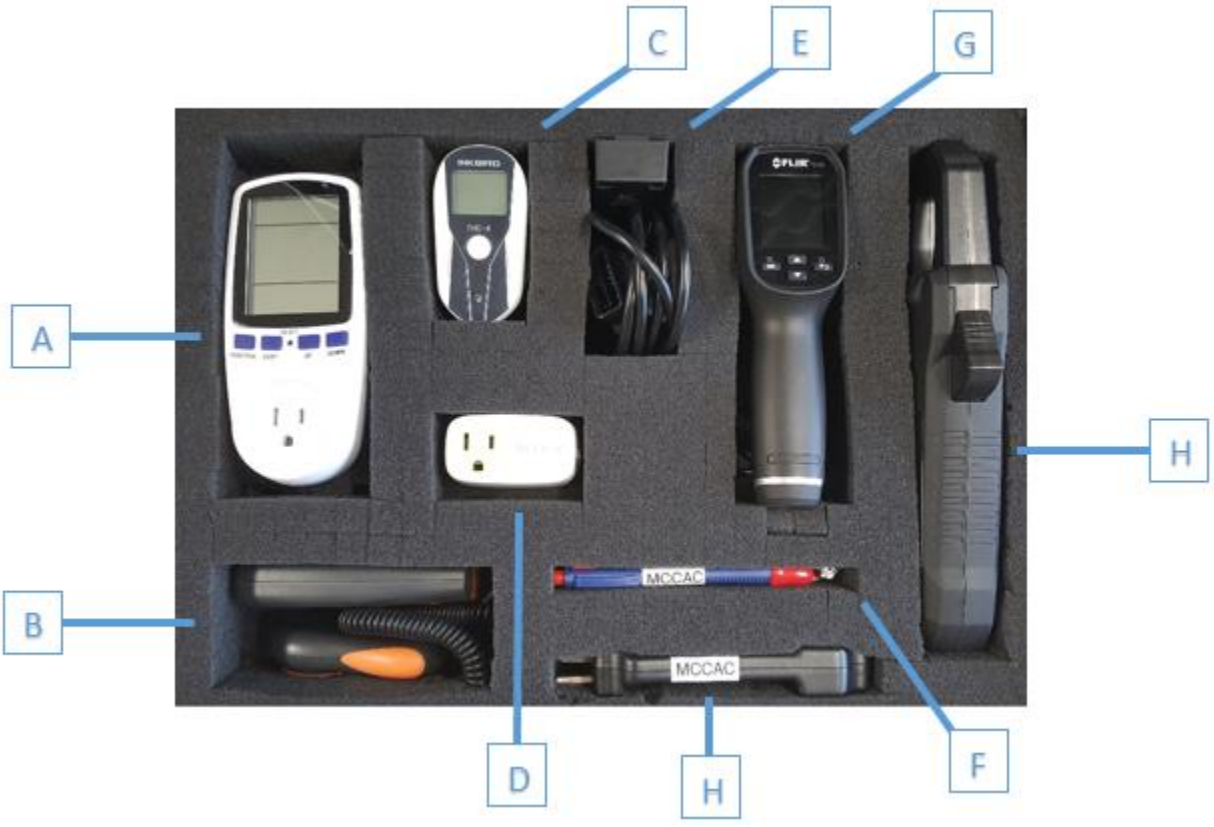
D) Conserve Power Switch

E) Multifunction Vehicle Trip Computer

F) Draft Detector

G) Imaging Infrared Thermometer

H) Power Clamp Meter + Line Splitter



4.0 Electricity Usage Meter

4.1 Description

The RioRand Plug Power Meter with Electricity Usage Monitor is a simple yet valuable tool to directly observe the amount of energy consumed by an electrical device. The Electricity Usage Meter has an instantaneous and cumulative kilowatt-hour monitor which displays volts, amps, watts, and kilowatt hours. It also calculates electricity expenses and forecasts costs.

4.2 Examples

The Electricity Usage Monitor can be used to measure a wide variety of electronic devices and small appliances to determine how much power they use and the associated cost. For example, try plugging the Electricity Usage Meter into the wall then plugging your computer into the meter to observe it's power consumption and cost. Examine the meter when the device is in use versus turned off. You will see how devices like lights, refrigerators, and computers still consume energy and therefore cost money even when they are "off" and in stand-by mode. The kWh/$ function can show just how much they are costing over the course of a day or week.

4.3 Directions

i. Plug the Electricity Usage Meter into a standard wall socket.

ii. Plug a desired electronic device into the meter.

iii. Pressing the function button will scroll through the various displays of the monitor (W, KWh, V, A).

iv. Pressing the cost button will quickly bring up calculated cost for the total energy consumption logged.

Note: Many devices that produce heat such as blow dryers, toaster ovens, or space heaters, will exceed the maximum load of the Electricity Usage Meter, causing it to break. Please consult the provided manual and compare device you are plugging in to ensure it has a maximum power consumption below 1600 watts (15 amps). For devices with higher power consumption, please use the provided Power Clamp Meter (pg. 13).

For full directions on the extended functions of the RioRand Plug Power Meter with Electricity Usage Monitor please see the provided instruction manual.

5.0 Light Meter

5.1 Description

The Dr. Meter LX1010B 100,000 Light Meter with LCD Display is a simple tool that allows for the measurement of the level of luminance: the amount of light falling on a given surface (measured in units of lux – equal to 1 lumen per square meter). The Light Meter has a highly accurate and responsive sensor, auto zeroing, over-range indication, and data memory.

5.2 Examples

The Light Meter can be used to effectively measure the illumination levels of a range of indoor spaces to determine the effectiveness of light fixtures or the need for increased light. For example, try placing the Light Meter on an office desk and compare it to the Recommended Illuminance Table (pg.9 of the Dr. Meter Operation Manual provided). You may find that the area is darker than recommended in which case increasing natural light or installing energy efficient LED lighting may be a good solution. On the other hand you may find that the area is already over illuminated and it may be worthwhile to turn off or remove some light fixtures to conserve energy and save money.

5.3 Directions

i. Remove the cover from the light sensor.

ii. Move the switch to the “ON” position.

iii. Hold the sensor and meter steady or place them on a surface in a room you want to measure.

iv. When the value shown by the meter becomes mostly stable, move the switch to the “HOLD” position.

v. Record the value and compare it to the Recommended Illumination table provided on page 9 of the Dr. Meter Operation Manual.

For full directions on the extended functions of the Dr. Meter LX1010B 100,000 Light Meter with LCD Display please see the provided instruction manual.

6.0 Temperature and Humidity Data Logger

6.1 Description

The Inkbird THC-4 Mini Temperature and Humidity Data Logger is a simple tool that automatically records and logs temperature and humidity in a given location. The Data Logger records up to 16,000 records of temperature in either farenheit and centigrade with the time and date. Using the included software, the logged data can be imported unto a computer for analysis.

6.2 Examples

The Temperature and Humidity Data Logger can be used to measure the temperature and humidity of any number of indoor spaces to determine areas for energy efficiency. For example, try placing the Temperature and Humidity Data Logger in an office space to measure how the average temperature and humidty of the space over the course of a day or week. The results can help to determine whether building controls are working properly and may suggest that building automation system or programmable thermostat could be beneficial to saving energy and money.

6.3 Directions

i. First, install the THC-4 temperature and humidity data logger data management software. (Windows compatible systems only). Connect the Temperature and Humidity Data Logger to a computer via the USB cable and install the USB driver according to the Installation Tips.

ii. Open the Temperature and Humidity Data Logger data management software and click the parameters icon. Set the parameters for the preferred temperature units and desired measurement interval time and click save.

iii. Place the Temperature and Humidity Data Logger on a surface in the area where you would like to gather data.

iv. Press and hold the “GO” button on the Temperature and Humidity Data Logger for four seconds, the play symbol will appear which means the recording is started.

v. Record data for the desired time period, then reconnect the Temperature and Humidity Data Logger to the computer and open the data management software where the data will be automatically uploaded and can be examined through a variety of graphs.

For full directions on the extended functions of the Inkbird THC-4 Mini Temperature and Humidity Data Logger please see the provided instruction manual.

7.0 Conserve Power Switch

7.1 Description

The Belkin Conserve Power Switch is an extremely simple tool that helps reduce “phantom” power consumption from electronics and appliances. The Conserve Power Switch cuts power to any device with the flip of a switch, saves energy, reduces utility costs, and allows you to leave power cords plugged in.

7.2 Examples

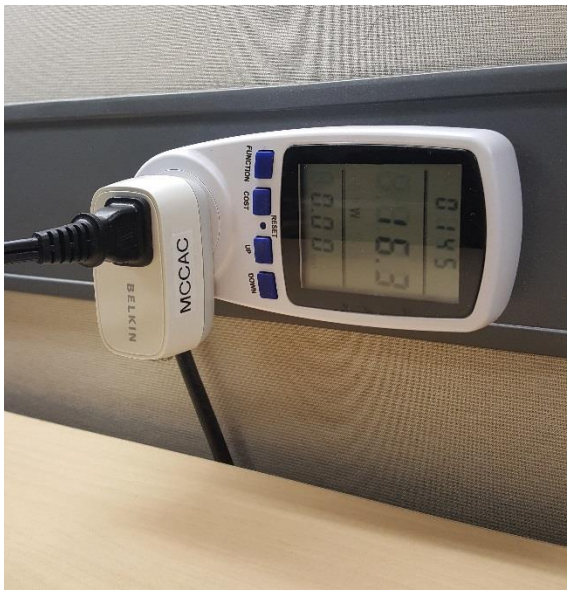
The Conserve Power Switch can be used to help demonstrate how much energy can still be used by devices that are off but still plugged in. For example, try plugging an electronic device directly into the Electricity Usage Meter (see above) and observe it’s power consumption when the device is off. Next, plug the Conserve Power Switch into the Electricity Usage Meter, then plug in the same device while it is off and the conserve power switch is activated. When observing the results it is very likely that you will find that a standard device considered to be “off” but still plugged in is drawing a non-neglibible amount of power, and properly using a Conserve Power Switch (or unplugging electronic devices when not in use) is an easy way to save on energy costs. Some common appliances with phantom energy loads include coffee makers, televisions, and laptop or phone chargers.

7.3 Directions

i. Plug the Conserve Power Switch into any standard wall outlet.

ii. Plug any small appliance or electronic device into the Conserve Power Switch.

iii. Push the button on the right hand side of the device to the “Off” position to completely cut power use from any device.



8.0 Multifunction Vehicle Trip Computer

8.1 Description

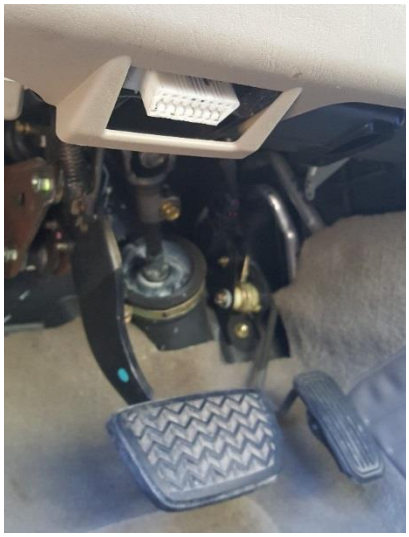
The ScanGauge Compact Multifunction Trip Computer with Customizable Real-Time Fuel Economy Digital Gauges is a comprehensive and valuable tool for use in vehicles. It provides information regarding vehicle use to help maximize fuel economy, minimize emissions, and save on costs. The Multifunction Vehicle Trip Computer plugs into the diagnostic connecter already built into all 1996 or newer cars and light trucks and, once properly calibrated, will provide real-time feedback on how driving style effects overall fuel use.

8.2 Examples

The Multifunction Vehicle Trip Computer is a tool that, with the proper investment of time, can be invaluable to providing a wide array of data on fuel economy for your vehicle and driving style. You can use this feedback to make the necessary changes to save on fuel costs. For example, try plugging the Multifunction Vehicle Trip Computer into your primary commuting vehicle or a daily work vehicle. Follow the directions in the device's instruction manual to properly set up and calibrate the device to your vehicle type. Begin to observe the data collected by the Multifunction Vehicle Trip Computer over the following days and weeks to observe your fuel consumption and trip data. The computer can display real-time and trip average fuel economy (in L/100km or MPG). This is helpful for older vehicles that do not have a gauge for this information. The instantaneous readout can influence driving behavior to be more fuel efficient by encouraging smooth acceleration and reducing fuel consumption at idle. The computer can also track trip distances, calculate fuel costs and associated greenhouse gas emissions, and it can provide output for a number of technical vehicle outputs that can be helpful in diagnosing vehicle performance issues. Seeing real-time feedback is the first step to understanding how to alter your vehicle use to save fuel and reduce emissions.

8.3 Directions

i. Locate the OBDII connector in your vehicle. It is normally found under the dash on either side of the steering column (seen in white in the image below).



ii. Route the cable from the OBDII connector and plug the small end of the cable into the back or side of the Multifunction Vehicle Trip Computer.

iii. Turn the vehicle on.

iv. Plug the Multifunction Vehicle Trip Computer into the OBDII socket. The Multifunction Vehicle Trip Computer will display the Connecting Screen then the Home Screen, meaning the device has successfully established a communication with the vehicle computer.

v. In order to provide information calibrated to your vehicle, you must update the engine size (litres) to the value corresponding to your vehicle. This can be accomplished by pressing the “x” button, then “y” button.

vi. The Trip Computer should now function anytime the vehicle is turned on. The measurements displayed on the screen, the measurement units, and a variety of other settings can be adapted as desired through the computer’s menu system.

For full directions on the extended functions of the ScanGauge E and how to properly set-up, calibrate, and use the device please see the provided instruction manual.

9.0 Draft Detector

9.1 Description

The Comfort Plus Draft Detector is a tool that helps provide valuable visible indications of where drafts and unwanted air flow patterns may exist in a building. The Draft Detector provides 30 minutes of continous smoke, is environmentally friendly, and has no hazardous or corrosive substances.

9.2 Examples

The Draft Detector can be a quick and effective way to identify and visualize drafts that may be easy opportunities to increase energy efficiency and save money. For example, take the Draft Detector, light it, and run it along the edge of a door frame in your building. Observe the smoke string to see whether the smoke blown away from the door. If this is the case, it is very likely that your door is not properly sealed and is continuosuly allowing cold air to flow inside the building, therefore wasting energy and costing money.

9.3 Directions

i. Remove the red plastic cap from pen top.

ii. Leave approximately 10 mm (1/3 in) of smoke stick outside the top of the pen holder (10mm equals roughly 2-3 minutes of smoke).

iii. Light the top of the smoke stick and let it burn on open flame for 10-15 seconds.

iv. Blow out the flame. The smoke stick will now release a stable and smooth smoke string.

v. Run the smoke string along various seals and observe the flow of the smoke string.

vi. To extinguish the smoke stick just place the red plastic cap back on top of the pen holder until the smoke stick goes out.

10.0 Imagining Infrared Thermometer

10.1 Description

The FLIR TG165 Imaging Infrared Thermometer is a valuable tool for measuring opportunities for energy efficiency. The Infrared Thermometer has a temperature range of -25˚C to 380˚C and saves images to an 8GB SD Card. The Imaging Infrared Thermometer has a laser pointer, a sensor and a camera display which allows the user to see the temperature of nearby objects and closely inspect the differences between them.

10.2 Examples

The Imaging Infrared Thermometer can be used in a number of different ways to determine opportunities for energy conservation. For example, try aiming the thermometer at the edges of a window or door leading outside and look for cooler areas (purples and blues on the standard color gradient) which may indicate leaks or drafts. This is most visible when the temperature differential between indoors and outdoors is highest, such as during the cold winter months, where a leak will show cold on the inside, and hot on the outside. Without the use of the Imaging Infrared Thermometer these leaks may not have been visible, but properly sealing and weatherizing them has the potential to easily save money on large energy costs by eliminating waste. Thermal imaging is also useful when viewing a building from the outside, as it can reveal areas in the building envelope where insulation is missing or not functioning appropriately.

10.3 Directions

To charge:

i. Plug the provided cable into the FLIR Infrared Thermometer charging box.

ii. Lift the flap on the top of the thermometer, revealing a micro USB port.

iii. Plug the cord into the micro USB port and plug the charging box into a standard wall outlet.

iv. The battery icon in the top right corner of the screen displays the current charge of the battery. Please completely recharge the device upon completion of use.

To use:

i. Press and hold the power button to turn on the device.

ii. The centre of the screen will show an infrared image, while the top left corner shows the temperature at the centre of the image (in the white square).

- Purples and blues represent colder temperatures
- Yellows, oranges, reds and whites represent warmer temperatures

iii. Aim the device at your intended target. Pulling the trigger will display two red dots on the surface you are aimed at.

iv. Release the trigger. The captured image will appear on screen.

iv. To save the image press the “OK” button on the left hand side. Images can be reviewed by opening the main menu, selecting the memory card icon at the top of the menu, and selecting the gallery icon. The image gallery can also be opened by pushing and holding the down arrow for four seconds from the camera screen.

v. To upload images to a computer plug the provided cord into the Imaging Infrared Thermometer and then into a micro USB port on your computer. Most computers will auto-detect and mount the camera as a drive allowing you to manage the files.Other photo management softwares already installed may also work.

Note: Individual images cannot be deleted from the gallery on the device itself. The device only supports a function to wipe the entire memory card, so be careful not to delete all of your images. To delete individual images first upload them to your own computer and manage the files accordingly.

For full directions on the extended functions of the FLIR T165 Infrared ImagingThermometer please see the provided instruction manual.

11.0 Power Clamp Meter + Line Splitter

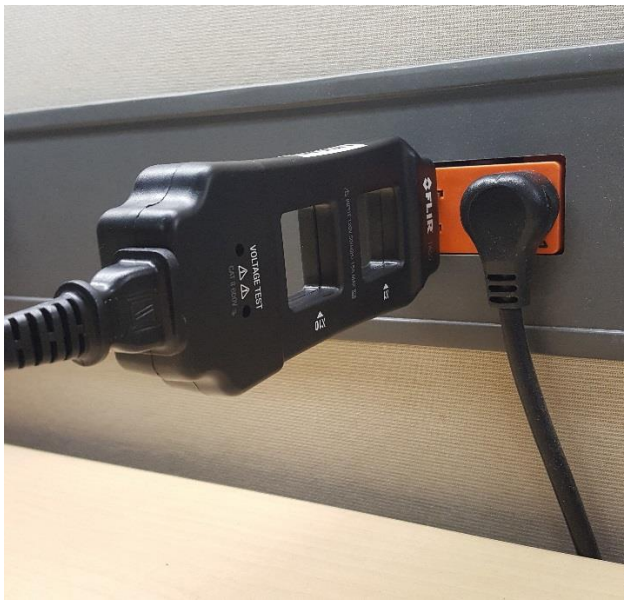
11.1 Description

The FLIR CM82 600A True RMS Power Clamp Meter with VFD Filter is a comprehensive industrial grade tool that provides basic and advanced power analysis for large electrical loads. The instrument is a fully functional multimeter capable of measure AC and DC voltage, AC and DC current, electrical resistance, capacitance, and power consumption. The Power Clamp Meter's inrush mode captures fast AC current spikes during appliance start-up, true RMS DMM functionality features reliable performance and expansive ranges.

Accompanying this tool is the FLIR TA55 AC Current Line Splitter. The Line Splitter provides a means to cleanly open a standard 120VAC line cord in order to make clamp type current measurements. One opening provides a one-to-one current reading and the other provides a times-ten reading so that small current will display with better resolution. Plugging the power connector into the line splitter separates the hot/live conductor from the neutral (and ground) for accurate current measurement that would otherwise only be accessible by manually splitting wires, which can be dangerous if not done correctly.

11.2 Examples

The Power Clamp Meter has a vast array of uses to measure current, voltage, capacitance, resistance and variety of other electrical properties. Most commonly this tool is used to measure the current or power of large electrical loads that exceed the capacity of the RioRand Plug Meter (e.g. furnace motors, electrical pump motors, power output from solar PV systems). The clamp component of the tool offers the ability to measure an electrical current on a live wire without interrupting the operation of the device. For example, find an appliance or electrical device with an accessible power cord where the AC electrical lines are separated. While the device is operating, set the Power Clamp Meter to 'A' and clamp around a hot wire to show the true current of the system in amperes. The results will help you to clearly see how much power some of the larger appliances and electrical devices are using. Identifying the devices that consume the most energy and proceeding to limit their use will result in energy cost savings and emissions reductions.



11.3 Directions

Using the Line Splitter for current measurements:

i. Plug the AC Line Splitter into the 120V receptacle.

ii. Plug the line cord from the load into the AC Line Splitter socket.

iii. Close the clamp-on jaws around either the X1 or X10 arm.

iv. If the X1 position is used, read the current directly on the meter.

v. If the X10 position is used, divide the meter reading by 10.

Using the Line Splitter for voltage measurments:

i. Plug the AC Line Splitter into the 120V receptacle.

ii. Insert the multimeter test leads into the two Voltage Test Jacks.

iii. Read the voltage on the multimeter.

Using the Power Clamp for electrical current (amps) measurements:

i. Choose the “A” function on the Power Clamp Meter Dial.

ii. Press and hold the jaw opening trigger and clamp around a single desired conductor. Note: many power cords contain positive and negative cables within the cable which must be separated in order for the measurement to be effective. Rather than doing this manually, for 120 VAC lines, please plug in to the provided Line Splitter. For smaller plug loads, we recommend using the RioRand Power Plug Meter instead.

iii. In most cases, the meter will automatically determine the appropriate measurement mode. Otherwise, use the mode button to select the appropriate setting for the intended measurement.

iv. Read the current value on the display.

Using the Power Clamp for power (watts) measurements:

The Power measurement setting requires that the device measure current and voltage at the same time, please follow the process described in section above to set up the device to measure the current with the clamp.

i. Choose the “W” function on the Power Clamp Meter Dial.

ii. Install the test leads with the red cable connected to the red input slot and the black cable connected to the COM slot.

iii. Measure the voltage by connecting the metal tip of the red lead cable to the positive end of the circuit (battery, motor, etc) and the black lead cable to the negative end of the circuit.

iv. In most cases, the meter will automatically determine the appropriate measurement mode. Otherwise, use the mode button to select the appropriate setting for the intended measurement.

v. Read the current value on the display.

Using the Power Clamp for voltage, resistance, capacitance, or other measurements:

i. Choose the function on the Power Clamp Meter Dial for what you would like to measure (e.g. V,Ω, -| |-, etc.).

ii. Install the test leads with the red cable connected to the red input slot and the black cable connected to the COM slot.

iii. Attach the conducting end of the test leads as required for the type of measurement being completed (refer to instruction manual as needed).

iv. In most cases, the meter will automatically determine the appropriate measurement mode. Otherwise, use the mode button to select the appropriate setting for the intended measurement.

v. Read the current value on the display.

The Power Clamp Meter has a vast array of functions to detect current spikes, harmonics to detect electrical noise, as well as non-contact voltage detection, and more. Each of these functions require different directions than listed above.

For full directions on the extended functions of the FLIR CM82 600A True RMS Power Clamp Meter with VFD Filter and the FLIR TA55 AC Current Line Splitter please see the provided instruction manuals.

Contact Us

Thank you for using the MCCAC’s Energy Efficiency Toolbox.

Questions about the Energy Efficiency Toolbox Manual or issues with the functionality of the provided equipment may be directed to:

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