ME2100 Fine Fuel Moisture Meter
User Manual

CONTENTS   PAGE

1. Description of the Meter

The ME2100 Fine Fuel Moisture Meter is a versatile tool that can be used both in the field and in the laboratory. Its primary purpose is to measure the moisture content of fine fuels, such as leaves, twigs, and grasses. The moisture in these fine fuels is one of the most important factors in determining fire intensity, the forward rate at of spread and the potential of forward spotting. The meter provides this fine fuel data, which is applicable to wildfire behaviour and to the management of prescribed burns.

The ME2100 meter also has a Lab-Mode with a higher degree of accuracy than the field mode; it is capable of providing more precise measurements in controlled laboratory settings. The meter has been designed to meet the needs researchers studying forest ecology or investigating the effects of different moisture levels on fire behaviour.

The ME2100 Fine Fuel Moisture Meter is a valuable tool for officers involved in wildfire management and researchers studying forest ecosystems.

The conventional method of determining the moisture content of fine fuels through sample collection and oven-drying is slow, energy-consuming, and not practical for real-time field use. Diurnal and site-to-site variations, as well as live-fire variations, require frequent measurements across a range of locations over the course of a fire to ensure safety and effective fire management.

The ME2100 Fine Fuel Moisture Meter offers a fast and accurate alternative to the conventional method. By measuring the resistance of fine fuel samples, it can provide a quick and reliable estimate of moisture content without the need for samples being sent to a laboratory and dried for up to 24hrs to determine the % of Oven Dried Weight (%ODW). The speed of measurement by the ME2100 makes it especially useful in the case of prescribed burns, where fine fuel moisture content is a critical factor in the decision to burn or not to burn. This also applies to wildfires where fine fuel moisture content is a critical factor in determining the rate of the fires spread and subsequent deployment of resources.

The principle of the meters operation is the measurement of the resistance of the sample couple with the application of a predetermined coefficient. The coefficient is based on the fuel type and its condition. To achieve the accuracy of the %ODW, the meter is able to measure resistances in excess of 10 TOhms (10×10^{12}) which corresponds to fuel moisture contents as low or lower than 2% ODW. (The usable range of the meter is approx. 3 – 200% ODW).

It should be noted that cleaning the top surface of the test cell and keeping it clean is the most critical factor in achieving accurate readings. In measuring the moisture in a sample, the presence of mineral nutrients in the leaf matter can vary greatly. The meter is designed to factor out these nutrients, however even the slightest amount of residue on the top surface of the test cell can cause inaccurate readings.

The meter can store the data on up to 600 samples (Moisture Content, location identifiers, time and date) This data can be downloaded to a PC if required.

The ME2100's meters ability to store data can also be very useful when in Lab-Modes where it can provide researchers with the flexibility to gather accurate data in both controlled laboratory settings and real-world field conditions.

The meter is powered by a lithium LiFePO4 battery which will operate the meter continuously for over 20hrs before recharging is necessary. A feature of the meter to conserve energy is that it will turn itself off after 20 minutes, if no key has been pressed. Pressing the on/off switch will reactivate the unit. In addition, as each reading only takes a 1-2 minutes, in the prescribed burn/fire period, recharging may only be required once a month. However the meter can't be over charged, so a routine of charging weekly during the season maybe useful.

Due to variations in the moisture content within a leaf and between leaves, the sample must be homogenise before testing. A pair of multi-bladed scissors and a grinder is provided in the kit, these must be used, to ensure accurate measurements.
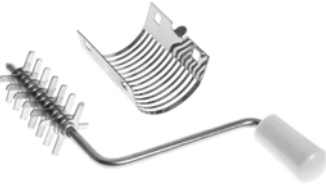
In addition, sample moisture content variation, even within a small area of forest, requires 2 or 3 sample from the site to be measured and average to achieve best practise of moisture content determination on the site. Overall, the ME2100 Fine Fuel Moisture Meter is a valuable tool for fire management and forest ecology research, offering a faster, more efficient and accurate alternative to traditional methods of measuring fine fuel moisture content.

1.1 Component List

This list indicates the complete ME2100 moisture meter kit which is supplied when a moisture meter is supplied. When ordering any parts separately from Wiltronics Research Pty Ltd, please use the indicated part number, or order online from https://www.wiltronics.com.au/product-category/spare-parts-for-fine-fuel-moisture-meter/

Part Number	Description
ME2100	Assembled Meter
ME2100 Flash Drive	Media containing ME2100 Manager software, FTDI USB Serial Port driver, meter manuals and calibration data current at release
105-0220	No12 S/1600R White Bristle Brush
ME2018	Hand compression tool
ME2010	Hand grinder (see note 1.1a)
ME2013	Multi-blade fine fuel scissors
HAM2.5-0001	M2.5 Hex key (to separate grinder for cleaning when necessary)
ME2005	Sample ring (stainless steel cylinder)

Component List (continued)

Part Number	Description
CM4052	One 1.8m USB A-type connector to B-type connector cable
ME2015	12VDC car cigarette lighter adapter lead for battery charging NOTE Replacement Fuse - 1.5A Fast Blow 3AG Fuse Part #FU0245
ME2016	12VDC, 1Amp mains (Australian) plug pack for battery charging
ME2011/PART	Sample 2pcs 99.8% Isopropyl Alcohol Wipes NOTE Supplied in 50pk - ME2011
ME2012	Replacement Cutter & Grill for Hand Grinder

Notes:

1.1a   The grinder has replaceable parts which may be ordered from Wiltronics Research Pty Ltd when required such as when damaged or worn out. Alternatively the grinder can be returned to Wiltronics Research Pty Ltd for repair or restoration.

1.1b   The use of 99.8% Isopropyl Alcohol Wipes are the only effective and approved cleaner for use with the test cell

1.2 Meter Layout (Inside)

Grinder

Test Cell

Charge Indicator

Compression Tool

Hex Key

2 x Isopropyl Alcohol (IPA) Wipes 99.8%

USB Drive

Battery Charger 12V Car Adaptor

1.2 Keypad Layout

0 REGION	1 BLOCK	2 COMP	3 COUPE
4 DATE	5 TIME	6 PG UP	7 PG DN
8	9	A SAMPLE	B TYPE
C RESET	D TEST	E	F ENTER
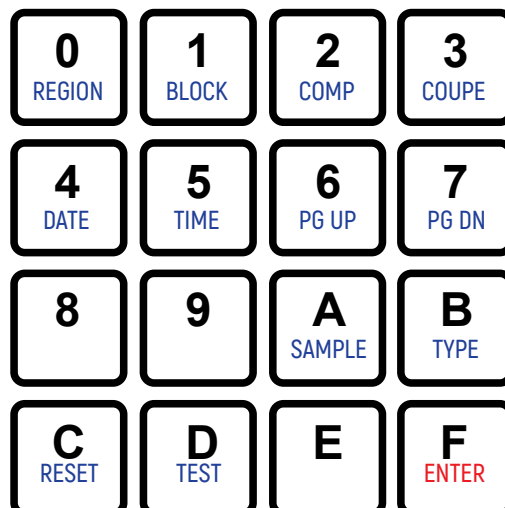
Most Keys serve two functions. The first function is for selecting the operation to be performed, e.g. Sample commands the meter to make a sample reading, Region commands the meter to accept the next two digits as the code for the region, etc. The second function is as an alphanumeric keypad entry, i.e. for entering 0 to 9 and A to E. The key labelled 'ENTER', although also marked as 'F' does not enable the entering of 'F' as data and functions purely as the ENTER key at all times.

Key 8 is for changing between Field Mode & Lab Mode.

NOTE the default mode is Field Mode, Meter will always start in Field Mode

List of Functions

|	
Region	commands the meter to accept the next two digits as the code for the region location
Block	commands the meter to accept the next three digits as the code for the block location
Comp	commands the meter to accept the next three digits as the code for the compartment location
Coupe	commands the meter to accept the next two digits as the code for the coupe location
Date	commands the meter to accept a new date setting entered from the keyboard
Time	commands the meter to accept a new time setting entered from the keyboard
PgUp	scrolls back through the stored moisture measurements one record at a time
PgDn	scrolls forward through the stored moisture records one at a time
Sample	commands the meter to measure the moisture content of the current sample
Type	select from a list of fuel types so that parameters used match the sample being measured
Reset	clears all stored measurements and resets the counter to one
Test	same as **Sample**, but the data is stored with an E prefix to signify it is a test not a fuel sample
Enter	signifies to the meter that a command is complete and ready for execution

1.4 Display Layout
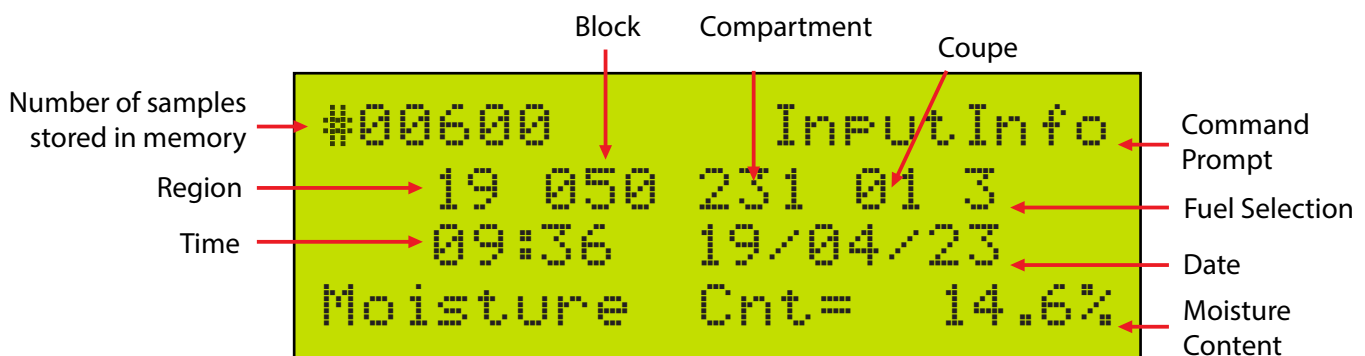
IMPORTANT NOTE:

Fuel selection indicates which fuel in the numbered list (from 1 to 8) stored in the ME2100 memory was selected for the test. This number is not related to fuel types in the fuel list found on the flash drive or in ME2100 Manager software.

It is important that the user make a note of which fuel specifically was used since if the fuel parameters in the ME2100 are changed or modified then the fuel selection number (as indicated in the diagram above) may no longer refer to the fuel parameters that were used in the test.

When downloading saved test results to a PC, Fuel Type data is also downloaded and should be saved to the same file with the test results for future use. See Section 6 Pages 13-15

1.5 Lab Mode

Lab Mode operates the same as Field Mode, except that the Moisture Reading takes up to 32 seconds and the results are more accurate. See SECTION 6 and the APPENDIXES for details on Data Storage etc.
NOTE: The meter is supplied in Field Mode as the Default Mode.
Press KEY 8 to change between modes

2. Checking the Operation of the Meter

2.1   Open the case

2.2   To Turn on the meter PRESS and HOLD the Power Button for 2-3 seconds
        Banner will display momentarily indicating the meter type and version number.

2.3   Testing the Fuel Cell
        On Start Up the meter will run a CLEAN CELL TEST
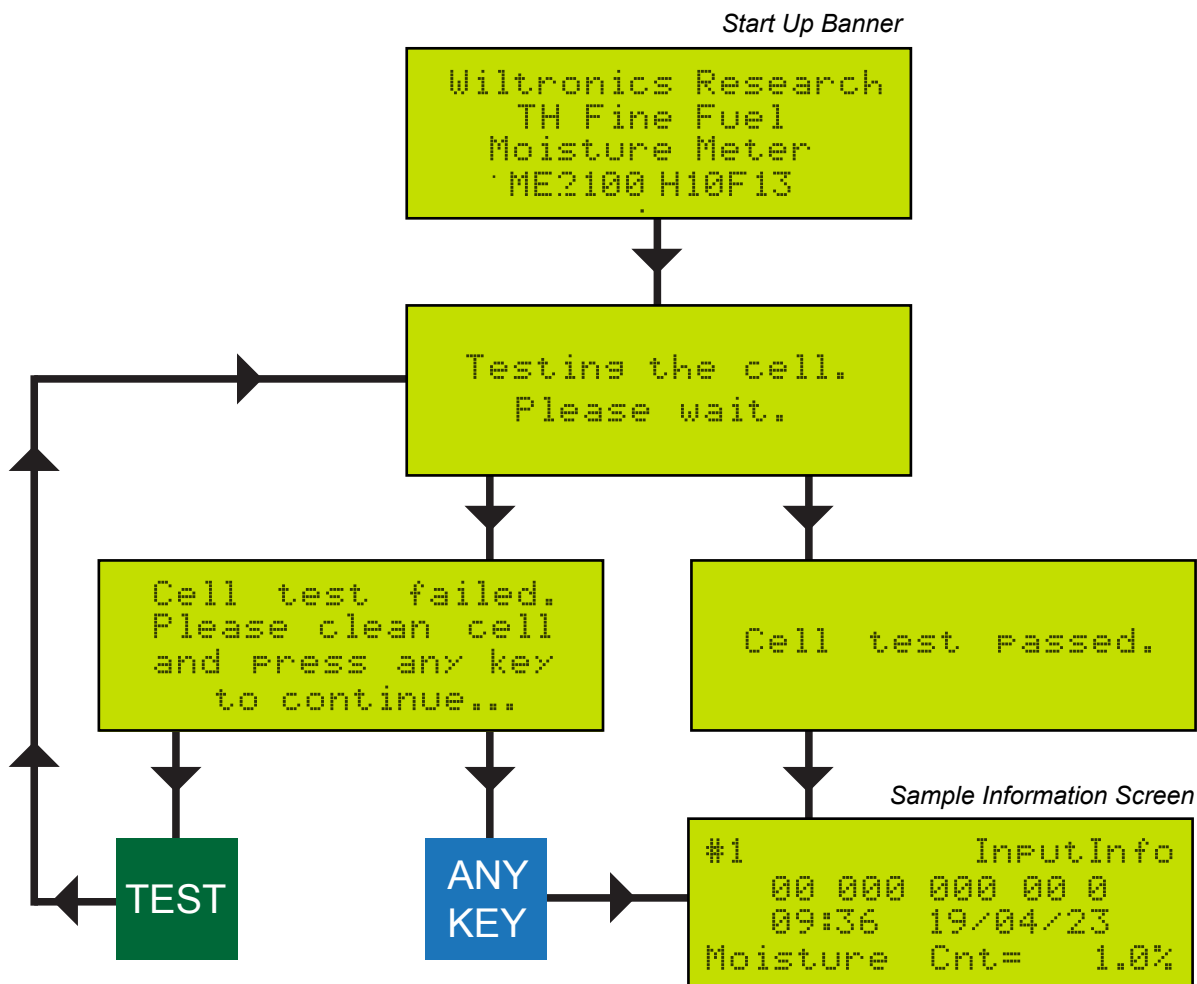
Start Up Banner

```
Wiltronics Research
    TH Fine Fuel
   Moisture Meter
 `ME2100 H10F13
        .
```

```
Testing the cell.
   Please wait.
```

```
Cell  test  failed.
Please clean cell
and press any key
  to continue...
```

```
Cell  test  passed.
```

TEST

ANY KEY

Sample Information Screen

```
#1              InputInfo
   00 000 000 00 0
   09:36  19/04/23
Moisture  Cnt=   1.0%
```

If the Test Passes, the next screen will be the Sample Information Screen. [See 1.4]

If the Cell test Fails the screen will indicate that the cell needs to be cleaned [See 4.0]

After cleaning press TEST button If the Test Passes, the next screen will be the
Sample Information Screen. [See 1.4]

If the cell test fails the screen will indicate that the cell test failed.
Please clean the cell and press any key to continue
Do not press the TEST key - but any other key will take you to the Sample information screen [1.4]

NOTE: if you continue to use the meter after CELL TEST FAILS it can cause from slight to extreme
inaccuracies in the moisture content reading. If the cell continues to fail the meter should be returned
to Wiltronics for repair.

2. Checking the Operation of the Meter (continued)

2.4   Enter location information if the results are to be stored and the location is important to you:

        Press **REGION** key followed by two digit code and finish with **ENTER**
        Press **BLOCK** key followed by three digit code and finish with **ENTER**
        Press **COMP**artment key followed by three digit code and finish with **ENTER**
        Press **COUPE** key followed by two digit code and finish with **ENTER**

*(**Note 1**: All or part of this location information may be omitted. Each component of the location information may be changed independently. The location data will remain constant until changed or the meter is turned off.)*

*(**Note 2**: If an error is made in entering a number, keep pressing until the correct code is displayed, only the last two (or three) digits entered will be displayed and stored.)*

2.5   To enter the fuel **TYPE** function and select any calibration from the listed fuels:

        Press the **TYPE** key
        Eight possible calibrations will be displayed on the screen

            NOTE: A standard set of fuel calibration values are supplied ready to use on the meter but these may be changed. Typically each fuel type calibration already loaded is representative of a fuel type group, named A, B, C, etc. See appendix 3 for further details on existing types and groups. The lists are not exhaustive and more fuel types are available in the fuels list in the ME2100 Manager software. If the required fuel type is not available on the meter, see section 5 of this manual for details on using ME2000 Manager to change the fuel types on the meter.

            Press a number between 1 and 8 to select the fuel type to be used in the test.

2.6   To make sure the sample cell is clean by pressing the TEST BUTTON
        If the test fails clean the top of the fuel cell with 99.8% Isopropyl Alcohol Wipe
        See Section 4.0 for Cleaning the Cell and recommended cell cleaning base on Fuel Condition

3. Measuring the Moisture Content of a Sample

3.1   Open the case

3.2   To Turn on the meter PRESS and HOLD the Power Button for 2-3 seconds

> *Banner will display momentarily indicating the meter type and version number.*
> *Sample information screen (see 1.4) will then display and stay resident on screen.*
> *Check and correct date/time if needed*

3.3   Enter location information if the results are to be stored and the location is important to you:

> Press **REGION** key followed by two digit code and finish with **ENTER**
> Press **BLOCK** key followed by three digit code and finish with **ENTER**
> Press **COMP**artment key followed by three digit code and finish with **ENTER**
> Press **COUPE** key followed by two digit code and finish with **ENTER**

(***Note 1***: *All or part of this location information may be omitted. Each component of the location information may be changed independently. The location data will remain constant until changed or the meter is turned off.*)

(***Note 2***: *If an error is made in entering a number, keep pressing until the correct code is displayed, only the last two (or three) digits entered will be displayed and stored.*)

3.4   To enter the fuel **TYPE** calibration to be used for the calculation of moisture cintent from the electrical resistance measure

> Press the **TYPE** key
> *Eight possible calibrations will be displayed on the screen*
> Press a single digit (1-8) corresponding to the appropriate fuel type to be measured
> Press Key "8" to change between Field and Lab Mode

NOTE: Default Power Up Mode is Field Mode which limits the test time to 10 seconds.
Lab Mode is more accurate and has a maximum test time of 32 seconds

3.5   Place the sample ring on the sample cell.

3.6   Mount the grinder on the sample cell.

3.7   For leaves of non-conifer trees (and grasses in general), grind about five leaves, one at a time, using a "two rotations forward and two rotations backward" action. For conifer types, take a small handful of leaves (needles, for example), cut them up into short lengths using the fine fuel scissors, placing the cuttings directly into the grinder, then proceed to grind them with the "two rotations forward and two rotations backward" action.

3.8   Remove the grinder and evenly spread the ground material in the sample ring over the surface of the test cell withyour finger. The ground material should fill about half the available volume in the ring on top of the test cell. If not then grind more leaf material into the sample ring as described previously in section 3.7.

3.9   Mount the compression tool on the sample cell and wind down the compressor until the ratchet slips.

3.10   Press SAMPLE key and wait for the sample's moisture content to be displayed.
Field Mode Sampling will take up to 10 seconds. Lab Mode Sampling will take up to 32 seconds before the moisture content is displayed.

> **A moisture content of 1.0% indicates a fuel type was not selected at step 4.*
> **A warning message (* RANGE *) will be displayed if the fuel sample is near the upper or lower limit of the measurement range.*
> **A warning message (*ERROR*) will be displayed if the fuel sample is outside measurable limit.*

3.11   Press **ENTER** if you want to store this reading or any other key other than TEST key if not.

3.12   Unscrew and remove the compression tool, remove the sample ring and clean away the compressed sample material with the supplied brush. Wipe the sample cell with a clean, dry cloth if necessary. If the sample has any sticky residue that remains on the test cell, press TEST and the meter will run a cell clean test, if necessary clean it off using 99.8% Isopropyl alcohol wipes. Using Isopropyl alcohol wipes circumvents the need to carry highly flammable liquid into the field.
See below for more detailed cleaning information and recommended cleaning frequency

3.13   Repeat procedure from step 3.6 for a second and third sample and average the results.

4. Cleaning The Test Cell

Note: Removing Contaminating Residues

To maintain the accuracy of your moisture readings, the most important thing in the field is to keep the surface of the test cell top face, residue free.

When or how often to clean the test cell is very subjective.
Pressing the TEST key at any time will run a clean cell test.

Recommended
Fragmenting to Grey
- 1-2 times a day
Grey to Brown
- after every session
Green and Fresh
- after every test

Factory testing has determined that the only test cell cleaning product that is effective and does not leave a contaminating residue is:
99.98% Isopropyl Alcohol
The most covenient product is 99.98% Isopropyl alcohol wipes
Due to its flammability, liquid 99.98% Isopropyl Alcohol is not recommended, particularly in the field.
All other products leave a contaminating residue. Particularly nail polish remover (liquid or wipes), 70% Isopropyl Alcohol (liquid or wipes) etc.
Wiltronics can supply 99.8% Isopropyl Alcohol wipes in packs of 50 as a consumable item
(Wiltronics Part No. ME2011)

5. Reviewing Stored Data

5.1   Open the case
5.2   Turn on the meter
        Banner will display momentarily indicating the meter type and version number.
        Meter will automatically run a CLEAN CELL TEST. See 2.3 for details
        Sample information screen (see 1.4) will then display and stay resident on screen.

5.3   Press PgUp or PgDn to activate the review mode. Press PgUp to view the previously stored moisture data to the one currently displayed on the screen or Press PgDn to view the next stored moisture data to the one displayed on the screen. Press ENTER (or any other key) to return to standby mode.
        New data will always be added to the end of the current list of data.

6. Using ME2100 Manager Software to Upload / Download Parameters and Data.

ME2100 Manager is a MS Windows application designed to simplify the process of entering new fuel types into the ME2100 meter, downloading current fuel type information for modification or saving to file, editing from a list of existing fuel types, etc.

ME2100 Manager is available on the flash drive that was provided with the meter and can be installed simply by copying the folder labelled, "ME2100 Manager", to the PC. It can also be executed directly from the flash drive.
Once installed, run ME2100 Manager and the following window will be displayed...
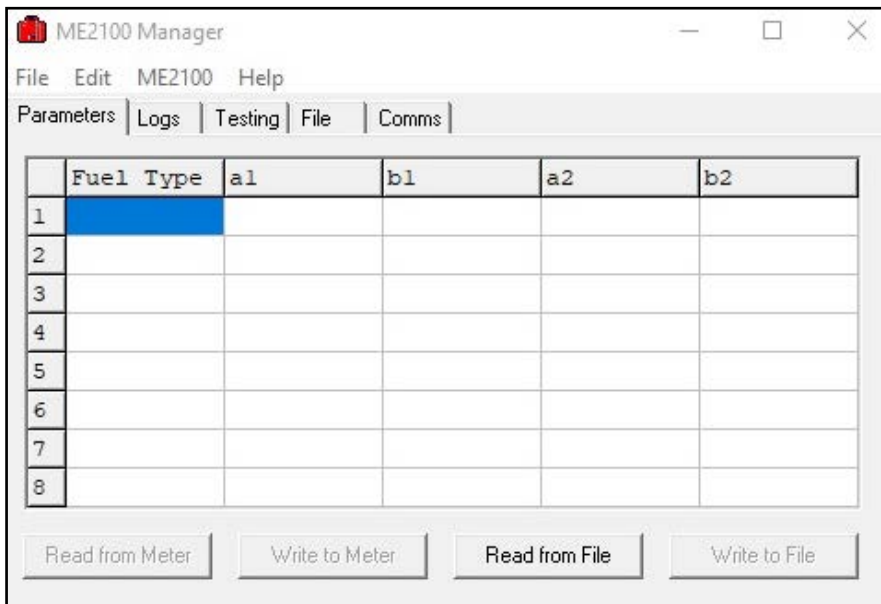
Note that the tabbed page displayed may differ if the software has been previously run, since settings are saved to the registry, when exiting the software, for use next time it is run.

Next, connect the ME2100 meter to the PC via USB port. See Appendix D for details on establishing a serial communications connection between the ME2100 meter and a PC if uncertain of the procedure. Ensure that the meter is switched on before proceeding further.

6.1 To download data and fuel parameters to ME2100 Manager:

6.1.1   With the mouse, left-click the "Parameters" tab to display the parameters tabbed page.

6.1.2   Click the "Read from ME2100" button or select "ME2100 → Parameter/Data Download" from the menu. Within a few seconds the table should be filled with fuel type names and parameters. These can be edited in the grid if new parameters are desired as outlined in section 6.2 and then uploaded back to the meter as detailed in section 6.3.

6.1.3   To save parameters, click the "Write to File" button or select "File → Save As", then follow the normal procedure for saving the parameters file using the "Save As" dialogue box. In this way, different sets of parameters can be saved to different file names for convenience when loading previous parameters.

6.1.4   Click the "Logs" tab to select the logs tabbed page. Any previously downloaded logged data from the ME2100 meter (from step 6.1.2) will appear in the logs tabbed page. To save any logged data, select "File → Save Logs" from the menu and use the dialogue box. An automatically generated file name will be displayed and this may be altered if so desired. Then select the "Save" button to save the logs file.

6.2 To modify fuel parameters for use in the ME2100

6.2.1   With the mouse, left-click the "Parameters" tab to display the parameters tabbed page.

6.2.2   With the left mouse button, click the grid cell to modify and type in the new data.
        This can be done with both the fuel type name cells and the numeric parameter cells.

6.2.3   If so desired, there is a large list of existing fuel parameters that can be selected from.
        Select the fuel parameter row in the grid to be changed using a left-click, then right-click and
        select "Import from Fuels List" or select "Edit → Import from Fuels List" from the menu.
        A large list of fuel parameters will appear.

6.2.4   To quickly locate a fuel in the list, enter a partial name in the search box at the top of the list and
        press enter. NOTE that since not all descriptions in the list follow a careful naming convention,
        it is often more effective to enter something like "euc" for eucalyptus types, since they are sometimes
        labeled as eucy and sometimes as eucalypt, etc. The search algorithm is very simple and does a
        simple case-insensitive text search.
        Clearing the search box and pressing enter will cause all fuels to reappear.

6.2.5   From the list of available fuel parameters in the "Fuel Parameters List" dialogue box, double left-click
        the desired fuel to import or left-click once and select "Select" from the menu. The new fuel parameters
        will now replace the previously selected ones in the parameters tabbed page.
        Note that the fuel type name may not be meaningful since it is truncated so it is advisable to modify
        it before uploading the new parameters to the ME2100

6.3 To upload fuel parameters to the ME2100 meter

NOTE: All cells in the parameters tabbed page grid must be filled with valid data prior to upload or the
software will not upload the parameters to the ME2100 meter.

6.3.1   With the mouse, left-click the "Parameters" tab to display the parameters tabbed page if not already
        selected. Any updates and modifications should be done in the grid. If merely changing just some of
        the existing meter parameters first download the existing meter parameters as outlined in section 5.1
        and then modify as required, outlined in section 5.2.

6.3.2   Once the desired fuel parameters have been entered into the parameters tabbed page grid, click the
        "Upload to ME2100" button or select "ME2100 → Parameter Upload" from the menu.

6.3.3   If the upload was successful then a small information dialogue should appear indicating "Upload Complete"
        Click "OK". If the "Upload Complete" information dialogue box does not appear within a few seconds,
        then there may be a problem with communications.
        Check that the meter power is still on and ensure communications is working, then try again.
        See Appendix 4 for further details.

6.4 Modifying the Fuel Parameters List

The "Fuel Parameters List" dialogue box contains a list of previously determined parameters for a variety of specific fuel types. This list can be edited. Fuel parameters in the "Parameters" tabbed page can be imported into the list and fuel types in the list can be modified or deleted.

6.4.1   To place the fuel parameters list in edit mode, select "Edit → Edit Fuels List"

6.4.2   To change a fuel parameter or fuel description, select the cell to modify and edit the cell contents directly.

6.4.3   To add a new fuel type, select the row which the new fuel will be placed above, then either right-click the row and select "Insert New Fuel" or select "Edit → Insert New Fuel" from the menu.
An empty row will be inserted and appropriate data can then be entered.

6.4.4   To delete an existing fuel, select the row to be deleted and either right-click and select "Delete Selected Fuel" or select "Edit → Delete Selected Fuel". A confirmation dialogue box will appear.
Click "Yes" to continue or "No" to cancel the delete.

6.4.5   When done, simply close the " Fuel Parameters List" window by selecting "Cancel" from the menu or clicking the system window close icon in the top right corner. Any changes will now be saved.

6.4.6   To export a fuel from the "Parameters" tabbed page fuel list to the "Fuel Parameters List", select the "Parameters" tabbed page if not already selected, left-click the fuel to export to the fuel parameters list, right-click and select "Export to Fuels List" or select "Edit → Export to Fuels List".
The fuel will be appended to the end of the list.

7. Clearing the Stored Data from the Moisture Meter.

With the moisture meter turned on, Press RESET followed by ENTER to clear all stored data.

8. Charging the Battery

The ME2100 meter is fitted with a Rechargeable Lithium LiFeP04 battery. There is no maintenance required. The battery should have a life of between four and five years.

When the battery voltage is low, the Charge Indicator on the meter will flash red. This indicates less than 15 minutes use available. Finish using unit, store data if necessary then turn off. Only use again after recharging unit.
NOTE: In the field the ME2015 Cigarette Lighter Adapter can be used to run the meter while the battery charges

When fully charged, the battery should operate the meter continuously for about 20 hours. This represents potentially hundreds of moisture readings.

Unlike a nickel cadmium battery, this battery can be charged whenever convenient, and in fact is best kept fully charged. When in regular use, it would be advisable to charge the battery at least once a week. A 5 hour charge cycle (or overnight) is sufficient to fully charge the battery from dead flat. Charging for longer than this is not necessary, but will not damage the battery. The charger could be left on continuously as the unit goes into trickle mode after initial boost charge, but this is not necessary. When the meter is not being used for extended periods, it is advisable to charge the battery about once every two months to keep it in good condition.

Charging the Battery (continued)

Charge Indicator - The light emitting diode (LED) will light when battery is being charged.
Red LED on indicates full charge current,
Green LED on indicates battery charged, trickle charge current.
Amber LED on indicates that the meter is 75% or more charged and may be used.
The operating time may be reduced to 15hrs continuos use
Flashing red LED indicates LOW battery volts.

Recommendations

Regular Use of Meter
Charge battery overnight once per week

In Storage
Fully charge battery before storage
Charge battery overnight once every three months

NOTE
Long term storage of the ME2100 without battery recharge can lead to a short battery life or even permanent battery operation impairment.

IMPORTANT CAUTION
FULLY CHARGE BATTERY BEFORE STORAGE OF THE METER

10. Scheduled Maintenance and Calibration

It is recommended that your ME2100 and the previous models should be returned annually for scheduled maintenance and calibration.
A "ME2100/ME2000/ME2000A Moisture Meter - Service Return Form" is available on the resources section of the "Wiltronics Fine Fuel Moisture Meter ME2100" on the website
www.wiltronics.com.au in the "Tools & Test Equipment" Section or email
info@wiltronics.com.au and request a copy of the form

Acknowledgements

The technology used in this meter has been developed by the Fire Research & Development group of the Centre for Forest Tree Technology (Department of Sustainability & Environment) in conjunction with the School of Engineering, Federation University. The major collaborators on this project were Kevin Tolhurst (CFTT, DCNR), Graeme Hood (Federation University), Andrew Wilson (DCNR) and Matt Fenwick.

Department of Sustainability & Environment

Federation UNIVERSITY•AUSTRALIA

CENTRE FOR FOREST TREE TECHNOLOGY
CFTT

WILTRONICS MANUFACTURING

Wiltronics has made significant changes to the meters performance and accuracy.
This has been achieved by upgrading hardware and software including

- A New Microprocessor
- New Fuel Test Cell [Fuel Cell Passed or Fuel Cell Requires Cleaning]
- Self Test Including Fuel Cell Test On Start Up
- Introduction Of Lab-Mode
- Increased Accuracy For Both Field And Lab Modes
- Improving Read Times To 10 Seconds For Field Mode And 32 Seconds For Lab-Modes
- And More.

An effort has been made to maintain the user interface so that users can move between old & new models of the meter without any significant operational change or training.

Appendix

Appendix A.   19
Specifications

Appendix B.   20
A Guide to Fuel Moisture Content and Fire Behaviour

Appendix C.   21 - 23
Calibration Equation and Parameters

Appendix D.   24 - 27
Establishing USB Serial Connection with a PC

APPENDIX A.   SPECIFICATIONS

Physical Dimensions

Length	330mm
Width	290mm
Height	150mm
Weight	4.2 Kg

Construction

Case	RPC 1314 ABS Equipment Case
Sample Cell	Stainless steel 316 with polyester film insulator.
Sample Ring	Stainless steel 316.
Grinder	P/N ME2010.
Stainless steel cutter and grill	Part No. ME2012.
Compression tool	Part No. ME2020.
Display	4 lines x 20 characters, backlit LCD.
Keypad	Membrane, surface mount, positive touch, 4 x 4 keys.
Power Consumption	280 mA in standby mode, 330 mA in measurement mode
Battery	6.4V 3.8AH Lithium LiFePO4
Battery Chargers	12VDC, 1A, double insulated, overload protected, mains plug pack with 2.5mm DC plug.
	12V car cigarette lighter adaptor with 1.5A Fast Blow SAG Glass Fuse, 1.5m lead, and 2.5mm DC plug
Charge Indicator	Tri-colour (red/amber/green) light emitting diode LED

Performance

Temperature Operating Range	0 to 50°C.
Resistance Measurement	5×10^2 to 5×10^{13} Ω
	* RANGE * warning given when resistance is below 8×10^2 or above 6×10^{12}.
Nominal moisture content range	3% to 200% ODW.
Reproducibility	0.1% of moisture content.
Accuracy	1% moisture content or 10% of the indicated moisture content, whichever is the greater.
Resolution	0.1% moisture content.

Communications

Serial interface	Virtual COM port via USB using an A-type to B-type USB cable
Baud Rate	19200
Data Bits	8
Stop Bits	1
Parity	none
Flow Control	none

APPENDIX B.　　A GUIDE TO FUEL MOISTURE CONTENT AND FIRE BEHAVIOUR.

Eucalypt

(Adapted from: McArthur, A.G. (1962,1967), For. & Timb. Bureau, Leaflets 80, 107)

Surface Fine Fuel Moisture Content (% ODW)	Indicative Fire Behaviour (Eucalypt Fuels)
< 4	*Fuel extremely dry.* Severe spotting, crown fire, uncontrollable.
4 - 6	*Litter very dry.* Fire behaviour could be severe, spotting likely, possible crown fire.
6 - 9	*Litter dry.* Conditions may not be suitable for fuel reduction burning, fuel very easy to ignite, spotting initiated by large firebrands only, but high intensity fire may develop**.**
9 - 13	*Litter is reasonably dry.* Eucalypt litter easy to ignite. Burning readily sustained. Fuel reduction may be carried out in light fuels under very mild weather conditions. Limited spotting from large firebrands.
13 - 16	*Litter just moist.* Eucalypt fuel moderately easy to ignite. Burning is sustained. A suitable range for fuel reduction when other conditions, particularly wind, are suitable. Spotting unlikely.
16 - 22	*Litter is damp.* Eucalypt fuel is difficult to ignite. Burning difficult to sustain. Low intensity fuel reduction burn could be patchy. No spotting.
22 - 28	*Litter is wet.* Fuel very difficult to ignite. Burning very difficult to sustain.

Radiata Pine

(Source: Woodman, M. & Rawson, R. (1982), Fire Research Report No. 14)

Fine Fuel Moisture Content (% ODW)	Indicative Fire Behaviour (Radiata Pine Fuels)
< 7	**Very intense wildfire possible**
7 - 10	*Elevated* dead needles carry fire of high intensity, which is difficult to control. *Surface* needles carry fire of moderate to high intensity.
10 - 15	*Elevated* dead needles carry fire of moderate intensity (e.g. ROS > 1 m/min). *Surface* needles easily ignited and carry fire of moderate intensity.
15 - 20	*Elevated* dead needles easily ignited and carry fire of low intensity (e.g. ROS up to 1 m/min). *Surface* needles ignite and carry slow moving fire (e.g. ROS < 0.5 m/min).
20 - 25	*Elevated* dead needles will ignite and just carry a fire (e.g. ROS < 0.2 m/min). *Surface* needles will just ignite and only carry fire with the assistance of wind
25 - 30	*Elevated* dead needles will just ignite and will carry fire only with the assistance of wind. *Surface* needles will not ignite.

NOTE 1. *Elevated* dead needles refer to dead pine needles lodged on branches, vegetation or debris on the forest floor so that they are well aerated and above the ground.

NOTE 1. *Surface* needles refer to the top part of the duff layer of dead pine needles. They are more compacted than elevated dead needles, but better aerated than the underlying part of the duff layer.

APPENDIX C.   CALIBRATION

As mentioned in the description this meter uses resistance to calculate the moisture content. Due to the different levels of mineral nutrients present in different fuel types it is necessary to calibrate the meter to a given fuel type and fuel condition in order to achieve accurate moisture measurements.

Most samples tested to date fall into a group of 13 calibration coefficients designated A to M. Some newer available coefficients associated with conifers have been added to the available list of coefficients.
A list of coefficients can be viewed using the ME2000 Manager software, see section 5 of this manual for further details.

The following tables indicate calibration coefficients, fuel types, leaf condition and coefficient groups regarding some of the generalised coefficients (A to M) and how they apply to some common fuel types.

The following table lists fuel group types and useful moisture reading limits associated with each type.

Minimum and Maximum possible moisture content readings in each fuel type group.		
FUEL TYPE GROUP	MINIMUM MOISTURE CONTENT (%)	MAXIMUM MOISTURE CONTENT (%)
A	18.5	127.8
B	15.3	133.8
C	12.8	141.7
D	10.8	151.9
E	8.6	168.3
F	6.5	196.1
G	4.8	127.8
H	3.7	200.0
I	2.8	200.0
J	2.2	200.0
K	1.6	200.0
L	1.3	200.0
M	2.5	200.0

When testing the meter, with no fuel sample, a reading less than or equal to the minimum moisture content %, for the fuel type group selected should be expected.

APPENDIX C. (cont)

The following table indicates categorisation of fuels according to condition.

Fuel (leaf) condition classification guide.	
Condition	**Description**
FRESH	Picked live from the plant, also referred to as live fuel.
GREEN	Cut from the tree and allowed to dry for up to one month with little or no rain. Typically fresh logging slash.
BROWN	Shiny nut brown, less than three months since removal from the plant and not yet having experienced heavy rains. Examples are recently fallen leaves or leaves in elevated slash.
GREY	Pale brown or fawn as a result of nutrient leaching but the leaves are still intact. Commonly appearing as surface litter for non-conifer or upper duff layer for conifer.
FRAGMENTED	Advanced state of decay. Rotting, fragmenting matter for non-conifer. Typically dark coloured, fragmenting matter in the lower duff layer for conifer.

The table below indicates fuel coefficients for the ME2100 meter for a range of fuel group types. These provide effective averages for fuels classified under each indicated fuel group type, from A to M. Some fuels have not been classified under any of these groups. The list provided in ME2000 Manager software indicates the fuel group for each fuel unless the fuel is not associated with a group in which case no group is indicated.

ME2100 Meter Fuel Group Type Calibration Coefficients.				
Fuel Group Type	a1	b1	a2	b2
A	21.037	-0.4154	3.5636	0.6811
B	21.273	-0.5165	3.6165	0.6798
C	21.673	-0.6254	3.6856	0.677
D	22.306	-0.7526	3.7741	0.672
E	23.522	-0.9449	3.9122	0.6613
F	26.034	-1.2699	4.1343	0.6387
G	29.965	-1.712	4.3957	0.6063
H	34.972	-2.23	4.6441	0.572
I	41.665	-2.885	4.8891	0.5363
J	49.153	-3.5879	5.091	0.5063
K	62.005	-4.7439	5.3334	0.4701
L	88.777	-7.0001	5.6284	0.4264
M	146.16	-11.301	5.9137	0.385

APPENDIX C. (cont)

According to species and leaf condition, generalised meter coefficients can be selected as indicated in the following table.

NOTE: Italicised data indicates estimated coefficients, not actually tested.

Species	Leaf Condition				
	Fresh	**Green**	**Brown**	**Grey**	**Fragments**
Acacia	**A**	*D*	**F**	*J*	*M*
Angophora	*C*	*E*	**H**	*K*	*M*
Banksia	**E**	*I*	**L**	*L*	*M*
Bracken	*A*	*C*	**G**	**M**	*M*
Bush Peas	**D**	*E*	*H*	*M*	*M*
Cassinia	**A**	*C*	*G*	*K*	*M*
Casuarina	**D**	*E*	*F*	**G**	*M*
Eucalypt (ash)	*B*	*D*	**F**	**K**	**M**
Eucalypt (blackbutt)	*B*	*D*	**I**	**J**	**M**
Eucalypt (bloodwood)	*B*	*D*	**G**	**K**	**M**
Eucalypt (box, coastal)	*B*	*D*	**G**	**K**	**M**
Eucalypt (box, inland)	*B*	*D*	**G**	**I**	**M**
Eucalypt (foothills)	**B**	**C**	*G*	*I*	**M**
Eucalypt (gum)	*C*	*E*	**F**	**H**	**M**
Eucalypt (ironbark)	*C*	*E*	**F**	**I**	**M**
Eucalypt (jarrah)	*C*	*E*	*G*	**K**	**M**
Eucalypt (mahogany)	*C*	*E*	*G*	**H**	**M**
Eucalypt (mallee)	**C**	*E*	*G*	**J**	**M**
Eucalypt (peppermint)	*B*	*E*	**H**	**I**	**M**
Eucalypt (silvertop)	*B*	*E*	*H*	**J**	**M**
Eucalypt (stringybark)	**B**	**C**	**H**	**I**	**M**
Grass (Kangaroo)	**E**	*G*	*J*	*L*	*M*
Grass (Wallaby)	**D**	*G*	*J*	*L*	*M*
Grevillea	**A**	*D*	*H*	*K*	*M*
Heath	**C**	*F*	*H*	*K*	*M*
Melaleuca	**E**	*G*	*I*	**J**	*M*
Pine (Pinaster)	*C*	*G*	**J**	*K*	*M*
Pine (Radiata)	*B*	*E*	*H*	**L**	*M*
Xanthorrhoea	**A**	*D*	*H*	**L**	*M*

PLEASE NOTE:
The above table is not exhaustive and an extensive table of fuel types and their specific parameters is available in the ME2100 Manager software. See section 6 of this manual for details on the use of ME2100 Manager for modifying fuel parameters and uploading and downloading parameters to the meter as well as accessing the parameters list.

APPENDIX D.   ESTABLISHING A SERIAL CONNECTION WITH A PC

In order to download parameters and data from the ME2100 meter it is necessary to first connect the ME2100 to a PC via its USB serial port. This is done using the USB cable (with A-type and B-type connectors) which is supplied with the ME2100..

Section D.1 details establishing the physical interface.

Section D.2 details using ME2100 Manager software to establish communications.

Note that "click" refers to a mouse left-click unless otherwise specified.

D.1 Connecting the USB Serial Communications Hardware.

D.1.1   Establishing the USB Serial Port Hardware Connection.

The ME2100 meter has a USB type-B connector and is supplied with a suitable cable to connect to a PC's USB port. An FTDI USB Serial Port interface is used in the ME2100.

Power up the ME2100 and connect it to the PC using the USB (A-type to B-type connectors) cable provided. Assuming that the serial cable was correctly installed, then proceed to section D.1.2.

For MS Windows 7, 8 and 10, the operating system should "discover" the connected USB device and proceed to load an appropriate driver. Normally, MS Windows will have the driver either readily available in the driver cache (typically already on the PC's hard disk) and there should be no problems, or will obtain the driver from the Internet if connected. The operating system should load the driver immediately. If there is an issue, then the necessary driver is supplied on the memory media flash drive that came with the ME2100 meter.
Plug the flash drive into a USB port and follow the operating system dialogue box prompts to enable the operating system to find the driver on the memory media. NOTE that it may require either one or two drivers to be loaded, depending on existing drivers available in the operating system.

Assuming that the driver was correctly installed, then proceed to section D.1.2.

If the driver failed to load then see section D.1.3.

D.1.2   Determining which Serial COM Port to use.

Now that a COM port is available, it is necessary to determine which COM port designator (COM number) it has been allocated (ie. whether COM1 or COM2, etc).

On the PC, select either "Start → Control Panel" or right-click Start (Windows icon in the lower left of the desktop screen) and select "Device Manager". In the case of using the Control Panel, in the window that appears, a number of items are displayed. Locate the "System" item and left-double-click it to bring up a tabbed page window. This may require that you have logged in as a system administrator. Click the "Hardware" tab.
Click the "Device Manager" button. (In MS Windows 10 run the Control Panel app, select System and Security, then select System in the main list, then in the left pane select Device Manager).

Once in the Device Manager window, there should appear a list of hardware device types. One of these items is "Ports (COM & LPT)". Double click it to expand it (or click [+] or the arrow next to it once.

APPENDIX D. (Continued)

All COM port type interface devices should appear. These will include any ports pertaining to actual physical serial (RS232) COM ports as well as any virtual COM ports including the COM port assigned to the USB Serial Interface of the ME2100, assuming that the driver was correctly installed and the meter is currently connected to the PC.

The name, "USB Serial Port (COMx)", will be visible where COMx can be one of COM1, COM2, COM3, etc. If there is more than one real or virtual COM ports marked as "USB Serial Port" then the quickest way to determine which one to select is to disconnect and reconnect the ME2100 USB interface and observe which COM port vanishes and then reappears. In Figure D.1, COM8 is the appropriate COM port.
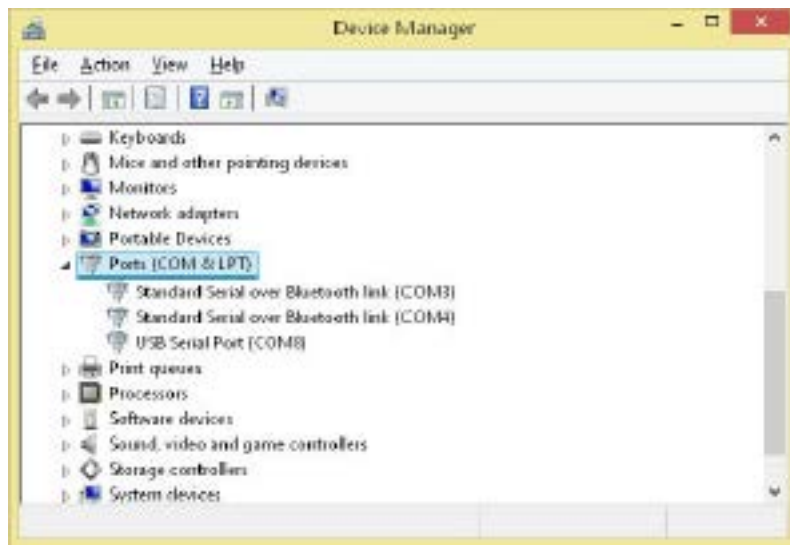
Figure D.1: Windows Device Manager.

Assuming that the USB Serial Port driver was correctly installed and the COM port designator has been determined, then if using ME2100 Manager software on the PC, proceed to section D.2.

If the USB Serial Port's COM port does not appear in the hardware list while it is connected to the PC then it is likely that the driver has failed to load or the hardware may be faulty. See section D.1.3.

D.1.3 Failure to load the USB Serial Port Driver.

If the USB-to-serial adapter driver was not successfully loaded, then consult the MS Windows help section on how to install new hardware. This can be quickly accessed by setting focus on a Windows window (such as a Windows Explorer window or the desktop or start screen) and pressing key F1. You should ensure that Internet access is enabled when doing so since a great deal of MS Windows help is available over the Internet with current MS Windows operating systems.

Enter "Add new hardware" into the "Search" entry box and press the "enter" key or click the icon next to the search entry box, then click on any of the most appropriate links displayed in the search results and follow the instructions.

If this fails then there may be a problem with the USB interface (on the PC or in the ME2000A) or the driver disk that was supplied. In such an event please contact Wiltronics Research Pty Ltd, Australia.

APPENDIX D2.
Connecting the ME2100 to a PC using ME2100 Manager.

ME2100 Manager was specifically designed to facilitate easier use of the ME2100 moisture meter in conjunction with a PC running an MS Windows operating system.

If ME2100 Manager has not already been installed, then install it on the PC using the supplied flash drive. The software does not require any special installation process and the directory on the supplied memory media containing the program can simply be copied directly to the PC's storage media directly or even executed from the supplied memory media. Ensure the you have the necessary operating system permission to execute or load new software. If not, see your system administrator.

Once loaded, run ME2100 Manager. The following window should appear:
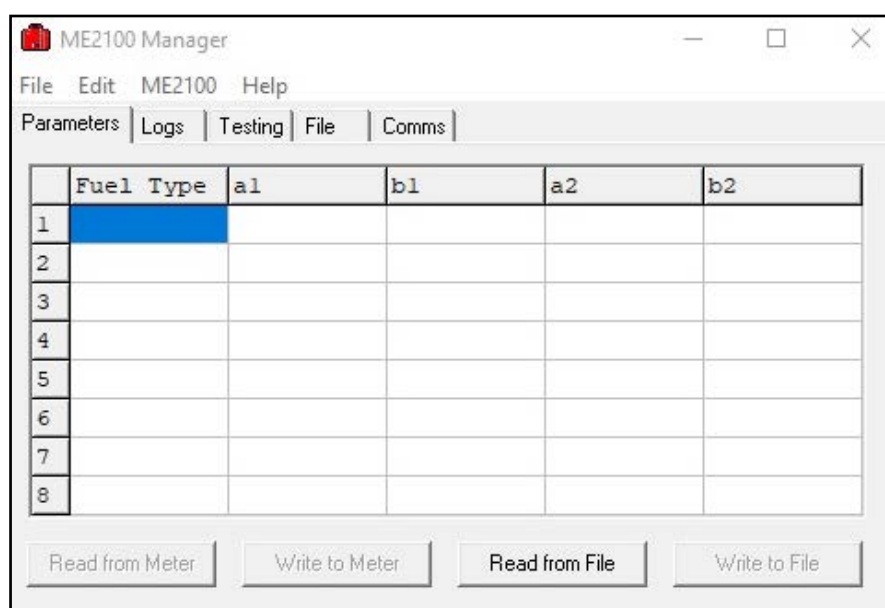
Figure D.2: ME2100 Manager.

If the software was previously loaded then the tabbed page that is displayed may differ from that shown in Figure D.2.

NOTE: ME2100 Manager is 32-bit software. If you have difficulty running the software it may be necessary to modify its compatibility properties. As of the time this document was created, it runs without problems on MS Windows 10.

To test that communications are working between the PC and the ME2100 meter, select the "Comms" tabbed page.
Go to "Edit → Comms Settings".
A small dialogue box should appear.
In the "Port" drop-down list, select the COM designator that was previously determined.
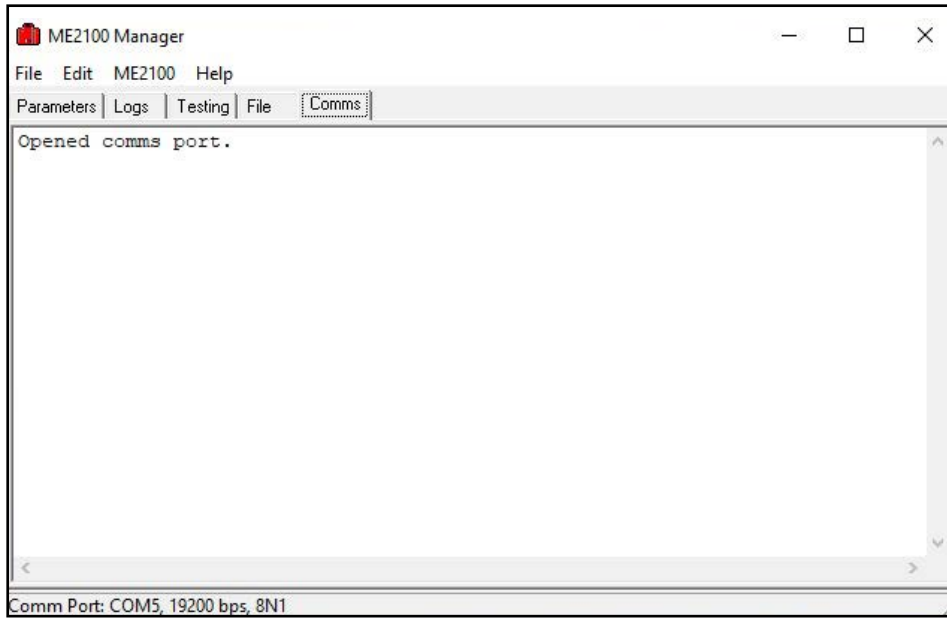For example, if COM4 is the designator, select COM4.
Only available COM ports will appear in the drop-down list. When done, click "OK".
Press the key marked "E" on the ME2100 keypad and the following should appear in the "Comms" tabbed page:

Figure D.3: Comms tabbed page of ME2100 Manager when checking the communications link.

The time stamp displayed will differ but the lines following show that the meter and the PC are now "talking". Once the settings have been correctly made, ME2100 Manager will remember the correct settings between sessions and the COM port does not have to be selected again.

If the COM designator is changed for some reason or communication later fails after starting ME2000 Manager at a later time, then check the setting as described in section D.1.2 and correct it in ME2100 Manager, setting it as described above, ensuring first that communications has been disabled.
Select "File → Close Comms Port" from the menu if the port has already been opened.

When a new COM designator has been selected, select "File → Open Comms Port" to re-enable the communications link.

NOTE: Do not open the communications port in ME2100 Manager when the ME2000A is switched off.
If this was done, click "File → Close Comms Port", then switch on power to the ME2000A, ensure the USB cable is connected to both the meter and the PC and then select "File → Open Comms Port".