V-M.O.L.E.®
PROFILING SYSTEM
*Solar*

ECD®
SINCE 1964

This procedure guides you through a typical data collection process. If you need additional detail, consult the Users Help Guide in the software.

The M.O.L.E.® Thermal Profiler depends on the MAP (Machine-Assembly-Process) software to control how it collects and interprets data. Several kinds of data runs may need to be performed to achieve desired information, or the same data run may be performed repeatedly over time to monitor one process. Either way, each data run must be set up at least once.

The MAP software includes wizards that help you get started quickly, even if you are a beginner or infrequent user. With settings for the five likely -workflows, you can get up and running in no time. This Guide documents the process used with the *Fresh Start* workflow wizard.

Step 1: Set MAP information

1) Double-click the M.O.L.E.® MAP application icon to start the software.
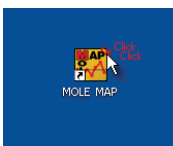
2) Using the USB cable, connect the M.O.L.E.® Thermal Profiler to the computer.

3) Make sure the M.O.L.E.® Thermal Profiler Power Pack battery is fully charged. When a M.O.L.E.® Thermal Profiler is selected, the software status bar displays the current battery voltage.

4) On the *File* menu, click *New*. The Start dialog box appears with the five workflow wizard options.
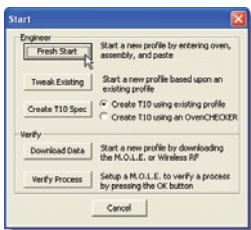
When navigating through the wizard, the step list on the left of the dialog box uses a color key to inform the user of the progression through the wizard.
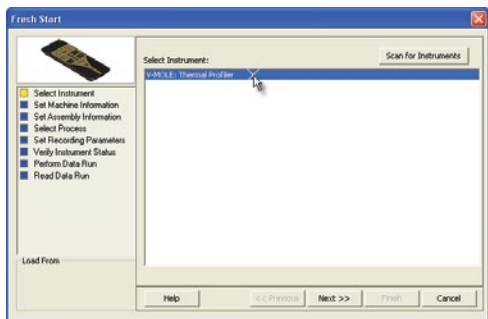
☐ Current   ☐ Completed   ☐ Remaining

5) On the *Start* dialog box, click the *Fresh Start* command button and the workflow wizard appears.

6) Select the desired instrument from the list box to make active. If there are none listed, click the *Scan for Instruments* command button to detect all available instruments.

7) Click the *Next* command button.

8) Select a machine from the drop-down list. If the desired machine does not appear in the list, click the *New* command button to create a new machine.

9) Set the machine recipe settings, such as Conveyor Speed, Zone Temperatures and Temperature units.
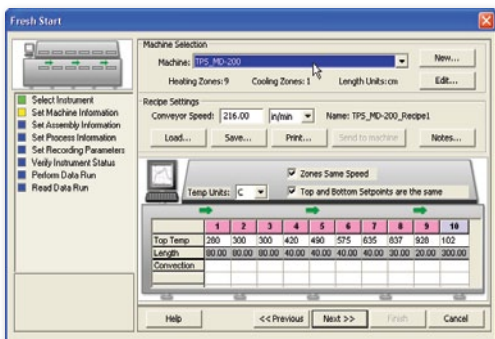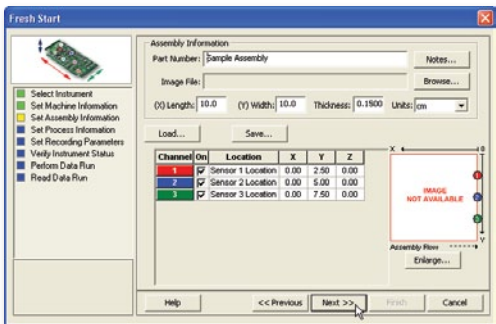

The software includes features to save and load machine recipe setting files (*.OVS*) These files are helpful so the user can quickly recall machine information and ensure it is always the same.

10) Click the *Next* command button.

11) Enter the assembly information such as part number, test product size, sensor locations and a product image.

12) Click the *Next* command button.

13) Unwind the sensor leads and insert the connectors into the M.O.L.E.® Thermal Profiler. Make sure to connect them to the same channel(s) that were configured in the wizard workflow.

14) Locate the thermocouple sensors on a test solar cell.

> When locating a thermocouple sensor on a test solar cell, make sure it is slightly curved creating the proper tension required to remain in place.

15) Select your process specification. The user can select a standard or user created *Paste* from the database. Then choose the *Profile Type* (Ramp-Soak-Spike or Ramp-to-Spike). If your Paste does not appear in the database list click the *New* command button to create a new one.

When the user selects a paste from the database, they can use the radio buttons below the drop down box to filter the user created pastes from the master paste specifications.

16) Click the *Next* command button.

17) Set Recording Parameters such as the instrument name, recording interval, start parameters and stop parameters. This step is where the user can also turn a sensor channel **ON** or **OFF**, set the sensor location description and sensor type.

> The M.O.L.E.® Thermal Profiler should be programmed to record data every 0.1 seconds which is optimal for solar metallization processes.

18) Click the *Next* command button.

19) Verify the instrument status. This dialog box displays the health of the M.O.L.E. Thermal Profiler such as battery charge, internal temperature, thermocouple temperatures.

> If everything is *OK*, the dialog box displays a **GREEN** sign. If there are any items that may prevent the user from collecting good data, they are highlighted and a **RED** sign is displayed.
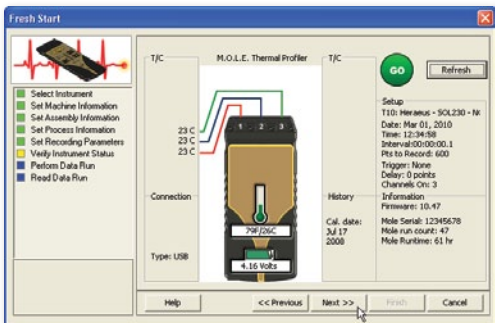
20) Click the *Next* command button.

21) Review the oven settings and click the *Next* command button to continue.

Step 2: Perform Data Run

1) Place the M.O.L.E.® Thermal Profiler in the thermal barrier.

> Never permit the M.O.L.E.® Thermal Profiler to exceed the absolute maximum warranteed internal temperature, as permanent damage may result. The thermal barrier supplied with the system is specifically designed to protect the M.O.L.E.® through typical solar metallization processes.
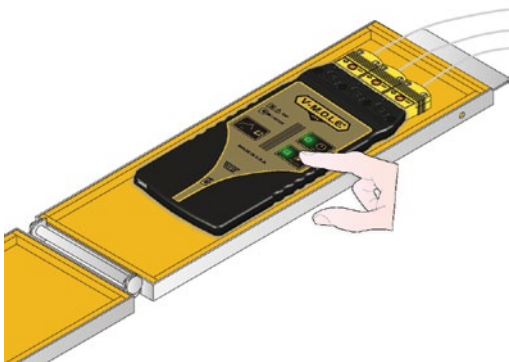
2) After the oven stabilizes:
• Press the *ON*/OFF button.
• Press the *Record* button.
• Close the thermal barrier making sure it is fully latched and the thermocouple sensor wires are not damaged.

The ***Record*** button will need to be pressed even if the M.O.L.E.® Thermal Profiler is configured to begin recording data if start parameters ***Trigger Temperature*** or ***Points Delay*** are configured.

3) Pass the thermally protected M.O.L.E.® Thermal Profiler and test solar cell through your process.

It is highly recommended that protective gloves are used when retrieving the thermal barrier from the oven and when opening the thermal barrier.

4) As the test solar cell and M.O.L.E.® Thermal Profiler emerge from the machine carry to a table or flat surface.

5) Open the thermal barrier and if the *Record LED* is still flashing this means the M.O.L.E.® Thermal Profiler is still recording and it must be stopped by pressing the *Record* button.

> If a thermocouple sensor is removed before the M.O.L.E.® Thermal Profiler has stopped recording data, the data for that channel will show as OPEN T/C.
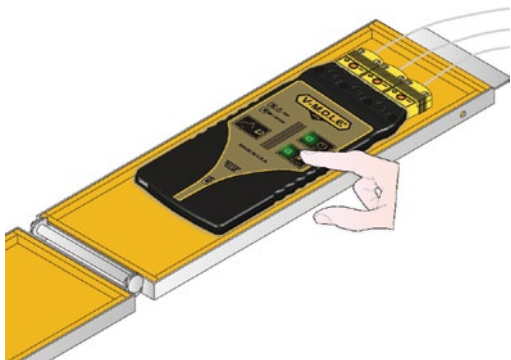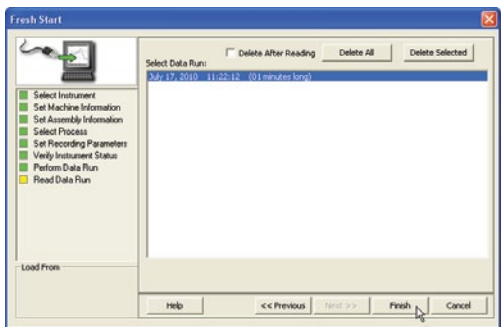

6) Remove the M.O.L.E.® Thermal Profiler from the thermal barrier. Handle it carefully, as the case may still be warm.

7) Disconnect the thermocouple sensors from the M.O.L.E.® Thermal Profiler.

Step 3: Read Data Run

1) Restore the software and click the *Finish* command button to read the data run from the M.O.L.E.® Thermal Profiler.

On this step of the wizard, the user has the ability to remove a selected data run from the V-M.O.L.E.® Thermal Profiler by either selecting the *Delete After Reading* check box or selecting the *Delete* command button and removing it before downloading.
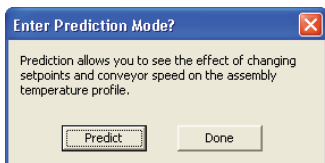
2) When the data run has been down-loaded, the software will prompt the user to save the data run file (***.XMG**).
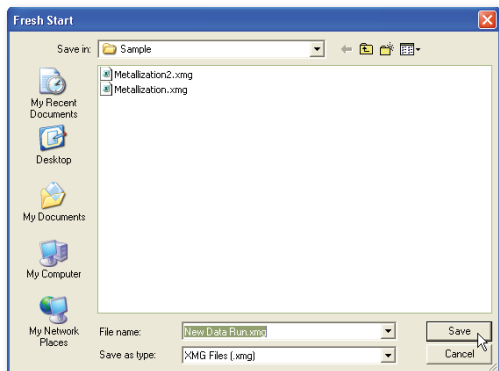
3) When finished, click the *Save* command button.

4) The software then prompts the user if they want to enter Prediction mode. Entering prediction mode enables the user to change a zone temperature values or the conveyor speed and predict the outcome of that change on the data run profile.

Enter Prediction Mode?

Prediction allows you to see the effect of changing setpoints and conveyor speed on the assembly temperature profile.

[Predict]   [Done]

5) Click the *Predict* command button to enter Prediction mode or *Done* to complete the workflow wizard.

The information is automatically saved in the data run file (***.XMG**) and the experiment data can now be analyzed with the software tools.

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