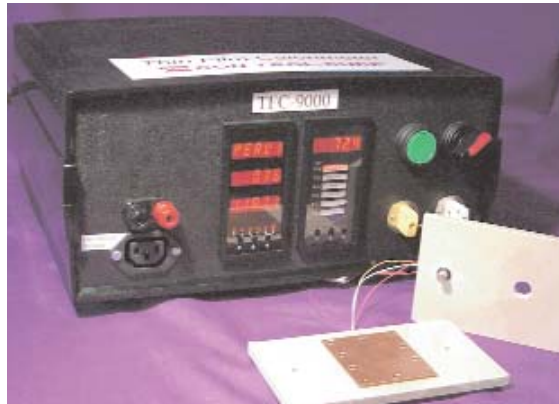




CON-TROL-CURE[®]

The TFC-9000[™] User Manual



Operator's Manual for
the Thin Film Calorimeter
(Part Number N008-030)

Version 1.0
12/22/04

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TABLE OF CONTENTS

The TFC-9000 [™]	1
The Test Station	2
Testing Procedures	3
Digital Data Displays	4
Optional Accessories	6

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THE TFC-9000™

You need a radiometer to ensure the performance and curing effectiveness of your UV lamps. So, how do you ensure the performance and curing effectiveness of your inks, coatings and adhesives? Up until now, it was mostly guess work. If you had curing problems and had ruled out your UV lamps as the culprit, your next target was most likely your chemistry. But there really was no cost effective and accurate way for you to quantitatively prove or disprove your hunch. That is no longer the case.

The CON-TROL-CURE's® TFC-9000™ system allows you to test your inks, coatings and adhesives to ensure that they are curing to your expectations and consistently, batch-to-batch. The Thin Film Calorimeter (or TFC) rapidly measures the exothermic heat reaction from a polymerizing sample through a highly sensitive sensor. Evaluating curing characteristics by using calorimetry is advantageous because measurements are not affected by crosslinking reactions and they offer direct measurement of the polymerization rate.

As with all equipment that produces UV light, proper eye protection is encouraged.

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1


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The Test Station

The TFC-9000™ **Test Station** is designed to provide the most versatile area to present a polymer for testing. The base is made of Phenolics (High Pressure Laminate), a hard, dense, layered material. It has excellent dimensional stability, high insulation resistance and dielectric strength with high heat resistance. A heat sensor is mounted at the center of the station, under a copper plate that is screwed into the base for easy upgrade or replacement. This configuration permits a high heat transfer and allows for easy cleanup. The Test Station is 5"L x 3"W x ¼"D (127mm x 76.2mm x 6.4mm) and is supported by ¼" (6.4mm) rubber feet. An included **1cm² Mask** establishes and maintains a repeatable amount of light exposure for each test. This mask has 2¼" alignment pins that ensure target accuracy. The pins have a rubber bumper on them to set the spacing of the Mask over the Copper Test Plate.



There is a 10 ft (3.05m) cable that connects the Test Station to the TFC-9000™ with two, 2-pronged connector plugs. The **Yellow Plug** is for Temperature readings and the **White Plug** is for Heat Flux. Each gets plugged into the receptacle that matches its corresponding color. The plug has prongs of different sizes so they are only able to be plugged in one way. The 10 ft cable gives significant freedom for test placement or location. This allows the Test Station to be placed under any UV light source, not necessarily the included UV-LED lamp. Most UV light sources produce heat that needs to be subtracted from the test (the UV-LED lamp produces no heat). This calculation is simply done by executing a test without the polymer present and then again, with the polymer. The resultant 2 curves are overlaid and the difference between the curves is that of the polymer without the added heat.



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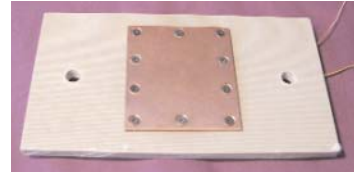
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2


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Testing Procedures

The open and accessible design of the Test Station allows for a variety of polymer application methods. One suggested method is to first apply a 2" strip of clear poly adhesive tape across the top of the copper test station. This will allow easy cleanup after the test is finished. Note that the tape may affect the heat transfer in very low exothermic reactions. So the tape's effect on such sensitive results should be carefully noted and evaluated.



Next, a spacer is placed in the middle of the test zone. The repeatability of this test is dependent on consistent polymer thickness. We offer a variety of spacers to help the operator achieve sample consistency. Each variety of spacer is widely accepted for scientific testing. There are round Teflon spacer rings, stainless steel u-shaped shims, and glass or ceramic spacer beads/spheres.

Then place a drop of your ink, coating, or adhesive in the center of the test zone. A glass/quartz cover slip or slide is placed over the spacer and pressed down until the glass makes contact with the spacer.

Now, the 1cm² mask should be positioned over the test station and the UV curing source is placed above.

Simply press the green start button on the TFC-9000™ and the lamp will illuminate, exposing the polymer.



Once the test is complete, the resultant data can be recorded by hand or exported to a computer via the serial port at the back of the unit. Software will be available soon.



Upon completion of the test, the clear poly adhesive tape should be removed from copper test plate, bringing with it the cured and uncured polymer which can be properly disposed. Apply a new strip of tape to the copper test plate and it's ready for the next test.

Digital Data Displays

There are 2 **Digital Displays** on the instrument.

The left display contains 3 windows of data:

1. The top window displays 2 different components:
 - a. While the test is running, it displays **Heat Flux** generated.
 - b. After the test is complete, the same top window shows the **Peak Value of Heat** (in BTU's) generated during the test. If the value is not displayed it can be accessed by pressing the up arrow button below the 3 windows.
2. The middle window displays **Time** in seconds of the test. (within 1/100th of a second.)
3. The bottom window is the calculated **Slope of the Curve** for "time to peak" vs. "heat generated."



The second display (the one on the right), displays 4 selectable data values. Each of the values is accessed by pressing the "P" button on the bottom of the display. This will scroll from top to bottom to display each value. The 4 values are:

1. **Temperature** (current temperature in °F, measured in real time from the test station)
2. **Total Heat** measured during the test (in BTU's)
3. The **Peak Value of Heat**. (Transferred from the left display)



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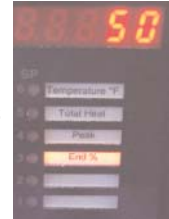
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4


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Digital Data Displays (Cont.)

4. The **End of Test Value**. This is the selectable % of heat drop from the Peak Value that ends the test. To change the End of Test Value, select it (it will be lit up) and press the up arrow. The display will now read "Edit." Press either the up arrow or down arrow to change the End of Test Value. When the desired number is selected, press the "P" button.



NOTE: At the start of each test, it is important that there is a stable setting (constant/unchanging temperature) and that the two displays are able to transfer data between them. Note the light at the bottom of the left display above the number "6". This light is a ready light indicating that the instrument is now stable and the test station's heat flux is stable from previous tests. You are now ready to commence your next test.



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5


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Optional Accessories

Optional accessories for this instrument include plates similar the 1cm² mask. Like the 1cm² mask, these plates are placed directly over the polymer. They serve as supports for liquid light guides and are available in the standard sizes for light guides in the market today (5cm, 8cm, 10cm).

Other optional accessories include a series of small, 2" UV lamps (mercury, gallium, iron, etc.) to replace the included UV-LED as the curing source. These UV lamps are powered by a small electronic ballast featuring a universal power input. Using these lamps to perform the tests will require a small shutter assembly which is activated by the instrument at the start of the test. Alternative UV light sources such as these connect to the red and black connectors on the left side of the machine. They function as an external relay to serve as a controller or switching port. They are used to turn on/off a lamp or open/close a shutter. A controller wire is routed through this normally open connection. Then, when the test begins, the path closes (completing the circuit) for the duration of the test.

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