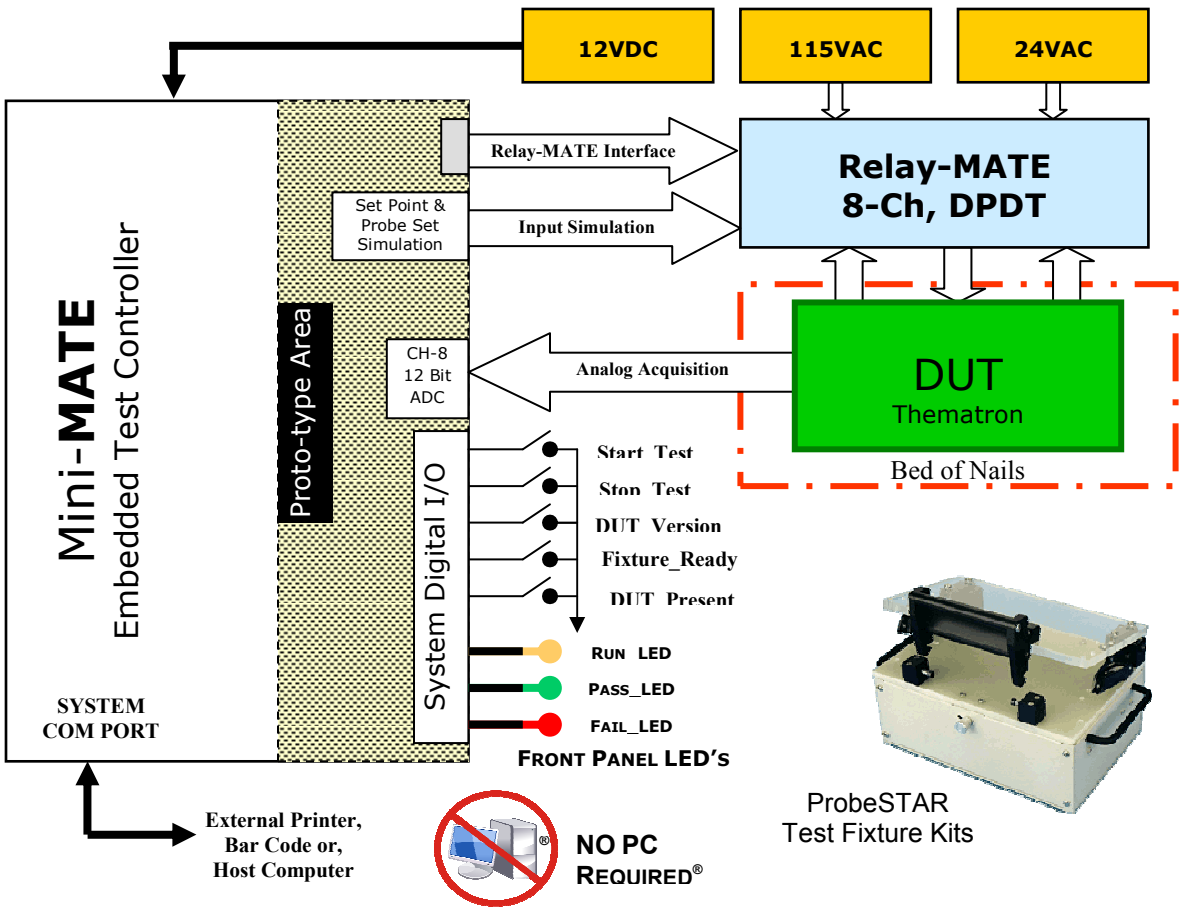
ProbeSTAR uses the ETS Series to "automate" a PCB, Functional Test process.

Frymaster is a leading supplier of commercial fryers, frying systems, water-bath rethermalizers, pasta cookers and related equipment.

Frymaster approached ProbeSTAR to develop a custom "automated" test fixture which would be used to perform a comprehensive Functional Test sequence for a low-volume PCB. There were three reasons that drove the decision to automate the test process. First, the company was concern because the PCB required the use of potentially lethal AC voltages, which could pose a danger to the test Operator or the test equipment itself. Also, the test fixture should have the means to select any one of (4) configurations to accommodate (4) different versions of the same PCB. Finally, at the completion of a test, the test fixture should engage a device that leaves a permanent mark on the PCB (which indicates a PASS unit).

We carefully evaluated those and other requirements, and quickly determined the ETS Series was the clear choice for the job. The diagram below illustrates the ease of adding low-cost "automation" to the mix. All of the components listed are built into a standard ProbeSTAR test fixture kit, which accesses the DUT through a mechanical bed-of-nails platform. The entire test process is controlled by the Mini-MATE, which is capable of driving a host of remote peripherals. The Mini-MATE contains ample bread-boarding area for housing the custom interface circuits that are used to control the DUT. The Relay-MATE is there to route "key" signals into and out of the DUT. During the test (which is outlined in the test sequence on the next page), the Mini-MATE is programmed to engage the Input Simulation circuit and then verify the DUT performance by validating proper responses. The software was written in BASCOM, ProbeSTAR's low-cost BASIC complier. The final program, complied-down to roughly 12K of code. All in all, the complete test process runs in less than 5 minutes.

For displaying fault conditions, the customer can order an optional LCD display or output to a serial printer. Otherwise the standard fixture comes with a large Red LED (to indicate FAIL), and Green LED (for PASS). Also, utilities found in TES-MATE, are provided to store and retrieve test results as well as Pass/Fail test limits.



ProbeSTAR
Test Fixture Kits

DUT Test Sequence

1.0 Initiate Test

1.1 Turn Fixture Pwr-OFF
1.1 Select assembly version number (set thumbwheel switch)
1.2 Turn Fixture Pwr-ON
1.3 Check if Start_button is pressed
1.4 If false, repeat 1.3
1.5 Else, check if Fixture_Ready is active
1.6 If false, repeat 1.3
1.7 Else, check if DUT_Present is active
1.8 If false, repeat 1.3
1.9 Else, Start Test Sequence

The Frymaster project, the software was written in BASIC using BASCOM. ProbeSTAR's TES-**MATE** was also used to accelerate the development process (see next page).

2.0 Power Test

2.1 Check DUT Version Sensor
2.2 If true, Apply DUT Pwr – 115VAC
2.3 If false, Apply DUT Pwr – 24VAC
2.4 Measure 8V_unreg and reject DUT if fail
2.5 Measure 8V_reg and reject DUT if fail
2.6 Measure V+ and reject DUT if fail
2.7 Measure Vref and reject DUT if fail
2.8 Else, Pass Test

3.0 Disable MELT Test

3.1 Set Probe input to 100ºF
3.2 Set Point input to 200ºF
3.3 Turn on Melt Disable (Switch connecting P10 to P11)
3.4 Verify that it is not in Melt Cycle and reject DUT if fail (Relay stays ON continuous)
3.5 Else, Pass Test

4.0 Melt Cycle Test

4.1 Set Probe input to 100ºF
4.2 Set Point input to 300ºF
4.3 Verify MELT ON and reject DUT if fail (Relay toggles ON/OFF)
4.4 Set Probe input to 200ºF
4.5 Set Point input to 300ºF
4.6 Verify MELT OFF and reject DUT if fail (Relay stays ON continuous)
4.7 Else, Pass Test

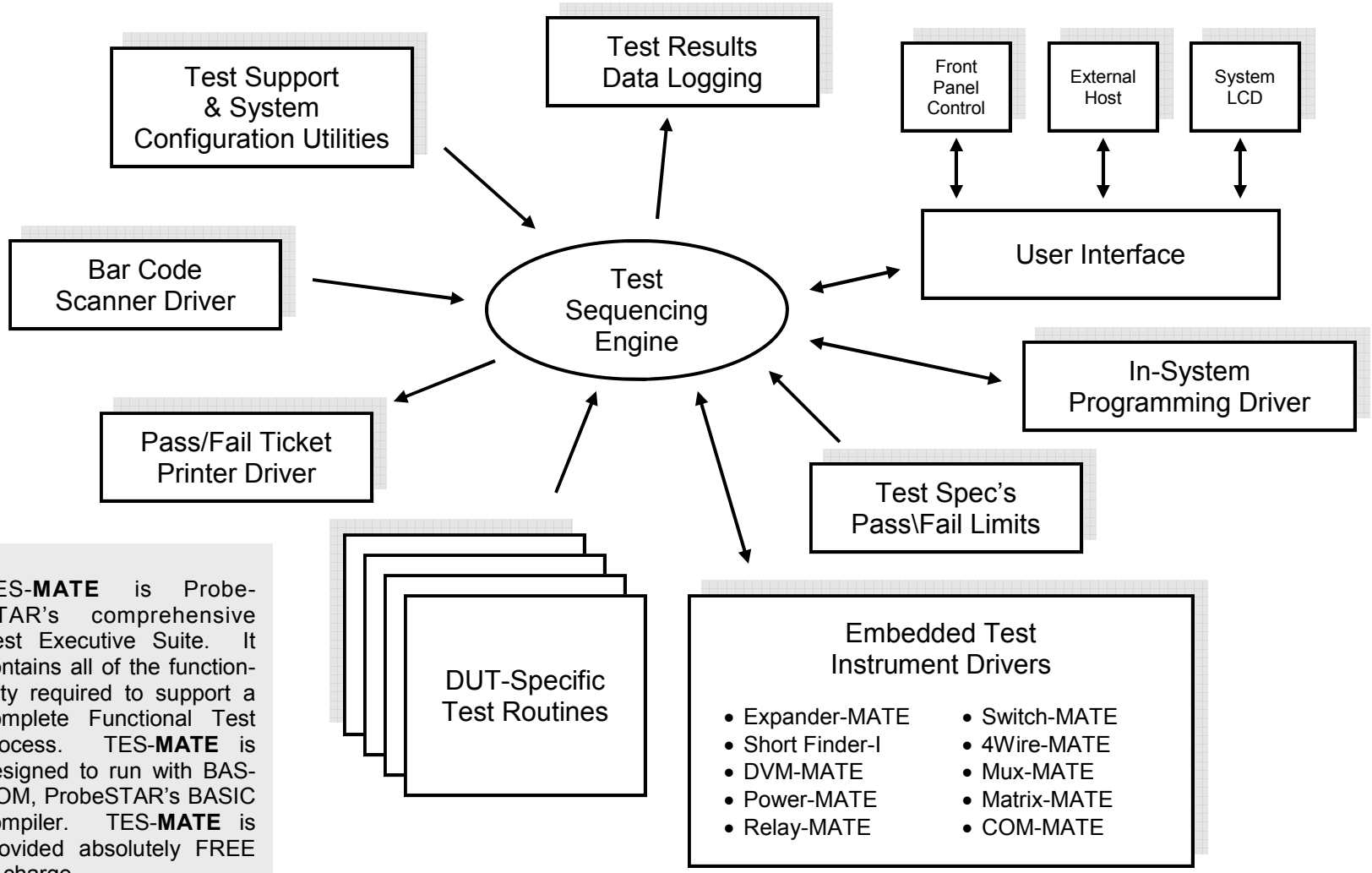
5.0 BOIL OUT Test

5.1 Set Probe input to 100ºF
5.2 Set Point input to 300ºF
5.3 Turn On BOIL OUT
5.4 Verify Relay is ON and reject DUT if fail
5.5 Set Probe input to 225ºF
5.6 Set Point input to 300ºF
5.7 Verify Relay is OFF and reject DUT if fail
5.8 Else, Pass Test

6.0 COOK Test

6.1 Set Probe input to 315ºF
6.2 Set Point input to 300ºF
6.3 Verify Relay is OFF and reject DUT if fail
6.4 Set Probe input to 315ºF
6.5 Set Point input to 350ºF
6.6 Verify Relay is ON and reject DUT if fail
6.7 Set Probe input to 365ºF
6.8 Set Point input to 350ºF
6.9 Verify Relay is OFF and reject DUT if fail
6.10 Else, Pass Test
6.11 Remove DUT Pwr
6.12 Turn on Board Marker for 1 sec.
6.13 Turn-ON Pass LED

ETS Series, EMBEDDED TEST SOLUTIONS
TES-**MATE**, Test Executive Suite



TES-**MATE** is ProbeSTAR's comprehensive Test Executive Suite. It contains all of the functionality required to support a complete Functional Test process. TES-**MATE** is designed to run with BASCOM, ProbeSTAR's BASIC compiler. TES-**MATE** is provided absolutely FREE of charge.

An economic case for the ETS Series

ProbeSTAR, Overton Claborne, April 1, 2007

Using the Frymaster project as an example, we will attempt to illustrate the cost benefits for the ETS Series as a viable alternative to traditional PC-based ATE. The table below breaks-down a list of "key" expenses that go into building a custom ATE solution. All-in-all, the ETS Series version takes less time to design and build, is a "singular" integrated solution, and cost less to purchase and maintain. The PC-based model costs $14,820 to develop and build, whereas the ETS Series is just $8,010 – that's a total savings of 45% (or $6,810.00). And think about this, with the cost savings you receive – you can purchase a second unit and have change to spare.

	PC-Based ATE	**ETS Series**	Comments
PC Equipment	$600.00	N/A	The cost of a standard configured DELL computer with Monitor, Mouse, Keyboard & Windows OS.
Mini-MATE Controller	N/A	$150.00	The Mini-MATE measures just "4 x 6" inches square, yet has the horse-power to completely replace the PC in a wide variety of dedicated test applications.
Data Acquisition & Control Hardware	$570.00 (Typical NI DAQ Card, Terminal Block & Cable)	$160.00 (Relay-MATE & Cables)	Beyond its low-cost, the ETS Series has the advantage because much of the control process is performed "jointly" with custom circuits installed directly on the Mini-MATE and the Embedded Test Instruments that it drives.
Development Software	$2,400.00 (NI LabView Full System)	$150.00 (BASCOM, plus a FREE version of TES-MATE)	No contest.
Custom Hardware Support Circuits	$900.00	$600.00	The cost of all of the custom hardware components that support the test process. The PC-based approach is priced lightly higher because the signal switching section is built upon discrete Relays as opposed to using the Relay-MATE.
Non-Recurring Engineering	HW Design - $2200.00 SW Design - $3200.00 Mechanical - $700.00	HW Design - $1600.00 SW Design - $2000.00 Mechanical - $400.00	Costs related to Engineering labor, roughly $100.00 per hour.
Mechanical Test Fixture Equipment & Accessories	$850.00	$850.00	The cost for acquiring the fixture kit and associated parts and materials.
Fabrication & Assembly	$3400.00	$2100.00	The labor required to fabricate, assemble, and test the end product.
Total	**$14,820.00**	**$8,010.00**	**- $6,810.00**