

Tips for using the ^{Sure}CAL[®] Power Sensor Support Package with the HP 11760S

The ^{Sure}CAL[®] Power Sensor Support Package works with a wide variety of test equipment, including the TEGAM / Weinschel System II and the HP 11760S. Although the ^{Sure}CAL[®] software comes pre-configured for the TEGAM suite of standards, it can be easily modified to utilize the HP equipment. This document offers some tips for users who want to tailor their software to operate with the HP 11760S system.

THE BASICS:

As far as the ^{Sure}CAL[®] Power Sensor Support Package is concerned, power sensors come in two varieties: **Terminating Types** and **Feedthrough Types**.

TERMINATING TYPE POWER SENSORS:

Ninety-nine percent of all power sensors are terminating types. That is, they act as a terminating load to the power source they are measuring. The quintessential terminating power sensor is the HP 8481A:

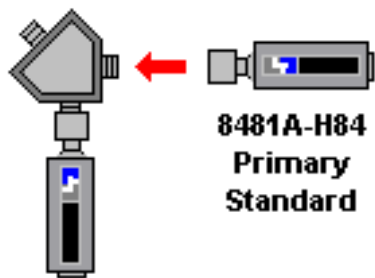


Terminating Type Sensor

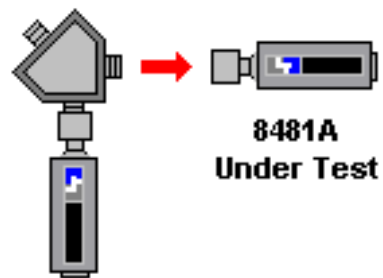
Practically all of the power sensors that you need to calibrate will be terminating types. Even your primary standard sensor (an HP 8481A-H84) will be a terminating type.

FEEDTHROUGH TYPE POWER SENSORS:

A feedthrough sensor is simply a terminating sensor that is connected to a power splitter. Feedthrough type sensors have only one purpose in life: to act as a **Transfer Standard** between two terminating types. You'd like to be able to directly compare your primary standard 8481A-H84 sensor to your 8481A Unit Under Test sensor, but they won't mate. The feedthrough sensor solves this problem.



Calibrating the Feedthrough Sensor using the 8481A-H84



Calibrating the 8481A UUT using the Feedthrough Sensor

So, calibrating a typical power sensor is really a two step process. First, you use your primary standard 8481A-H84 to calibrate a feedthrough sensor, then you use that feedthrough sensor as a transfer standard to calibrate other terminating sensors.

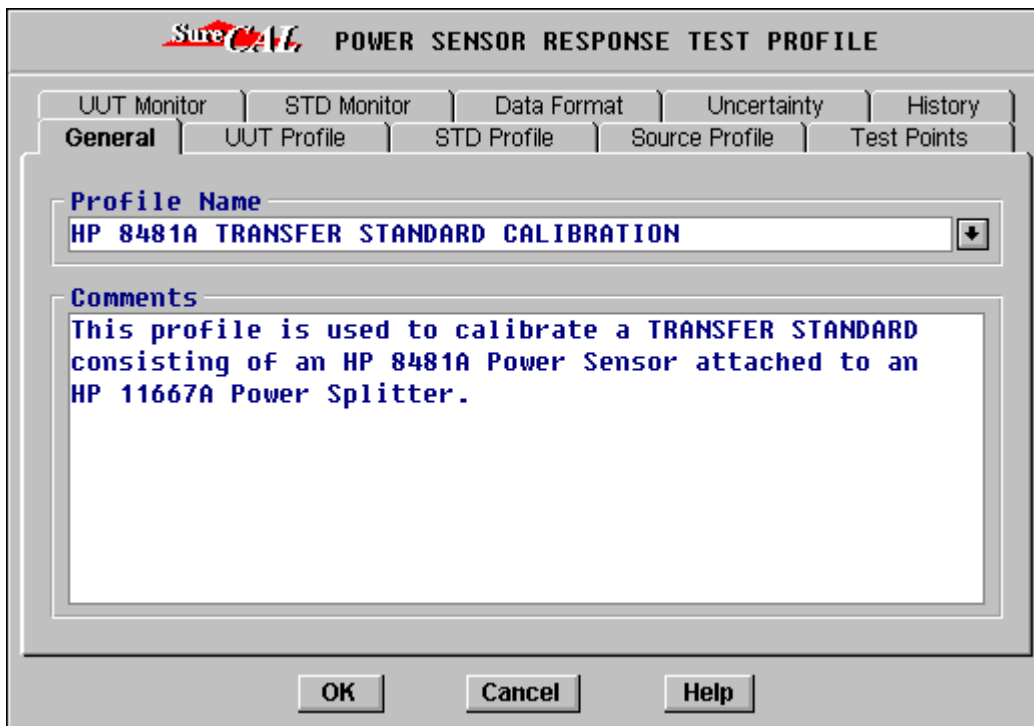
HOW DO YOU CALIBRATE THE FEEDTHROUGH SENSOR?

This is where you have to modify the SureCAL[®] software to support your HP 11760S system.

The Power Sensor Support Package comes pre-configured for the TEGAM / Weinschel System II suite of standards, so there isn't a pre-written procedure for calibrating the type of feedthrough sensor normally used with the HP 11760S (an HP 8481A connected to an HP 11667A splitter). However, it is easy to create a new Test Profile for doing this.


Start by modifying an existing profile, such as the "8481A (Standard Cal – 21 points)" profile used in the default 8481A procedure. Follow the steps below to create a new test profile for calibrating your feedthrough sensor:

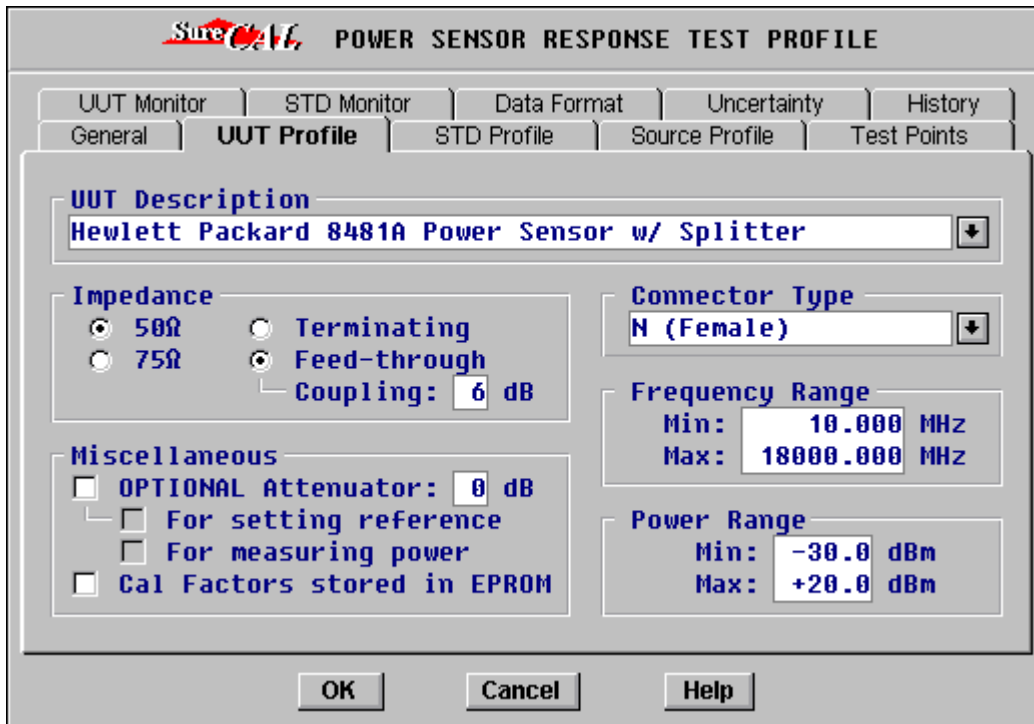
Step #1: Edit the Profile Name and Comments on the General Tab to look something like this:



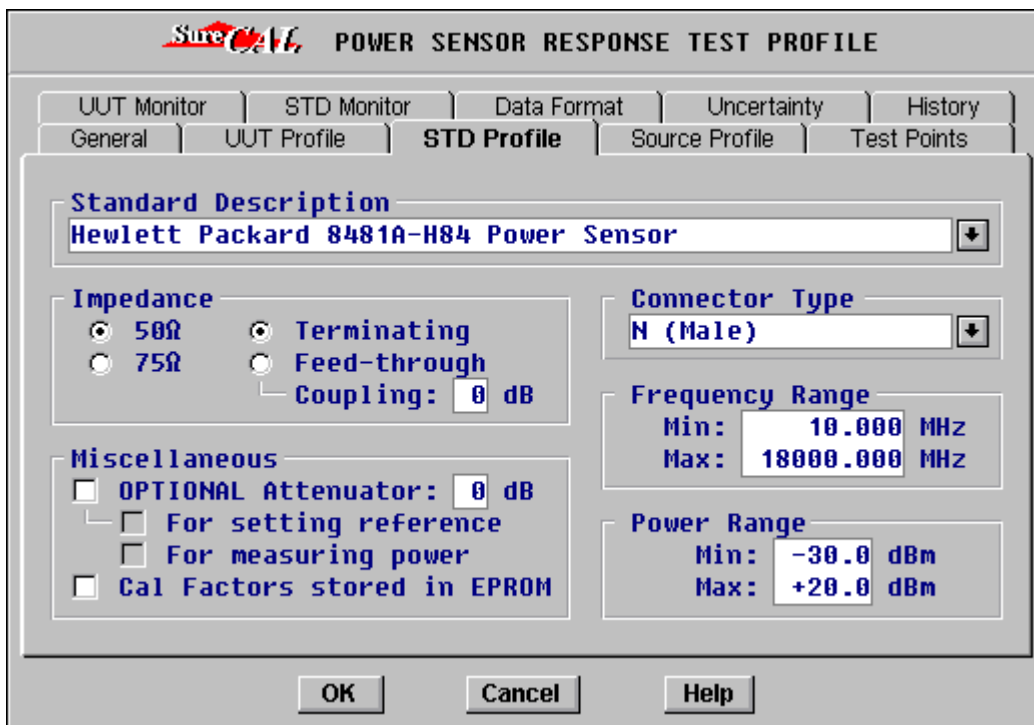
You can type any Profile Name or Comments you like, but the Profile Name must be unique to distinguish it from other test profiles.

Step #2: Edit the UUT Profile Tab to look like the illustration on the following page.

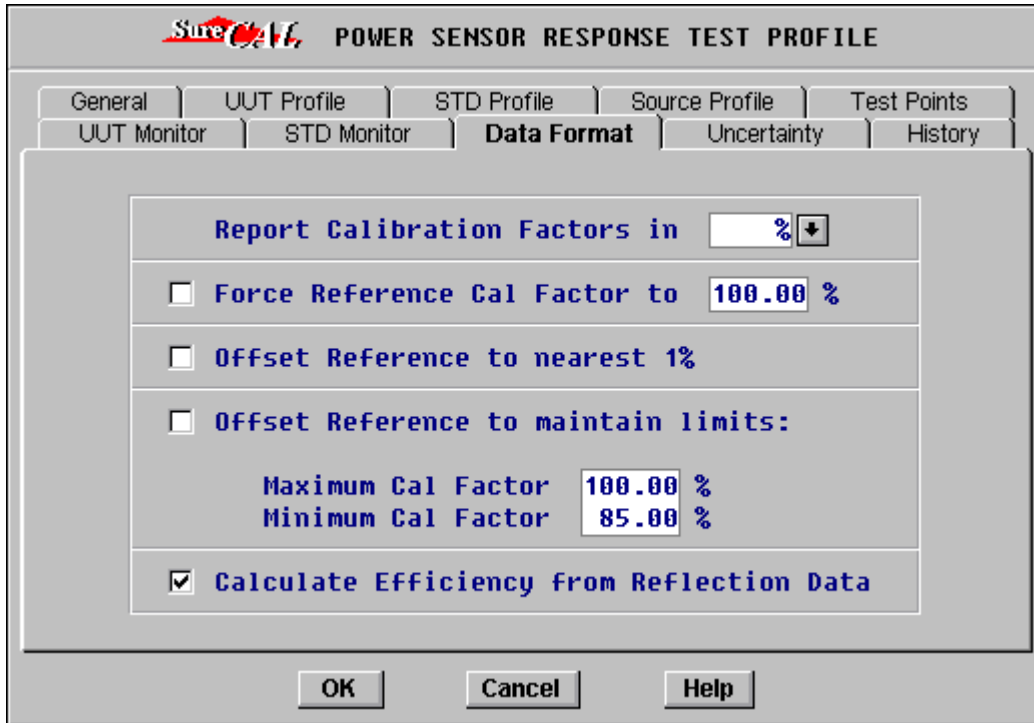
NOTE: The easiest way to set up the UUT and Standard Profile Tabs is to make use of the pick-list to the right of their respective Description fields. Press the  button to access the list. It is always better to edit a previous definition than to enter all the fields from scratch. This not only makes entries easier, but it ensures that the appropriate graphic images are displayed in hook-up diagrams.



Step #3: Edit the STD Profile Tab to look like this:



Step #4: Edit the Data Format Tab to look like this:

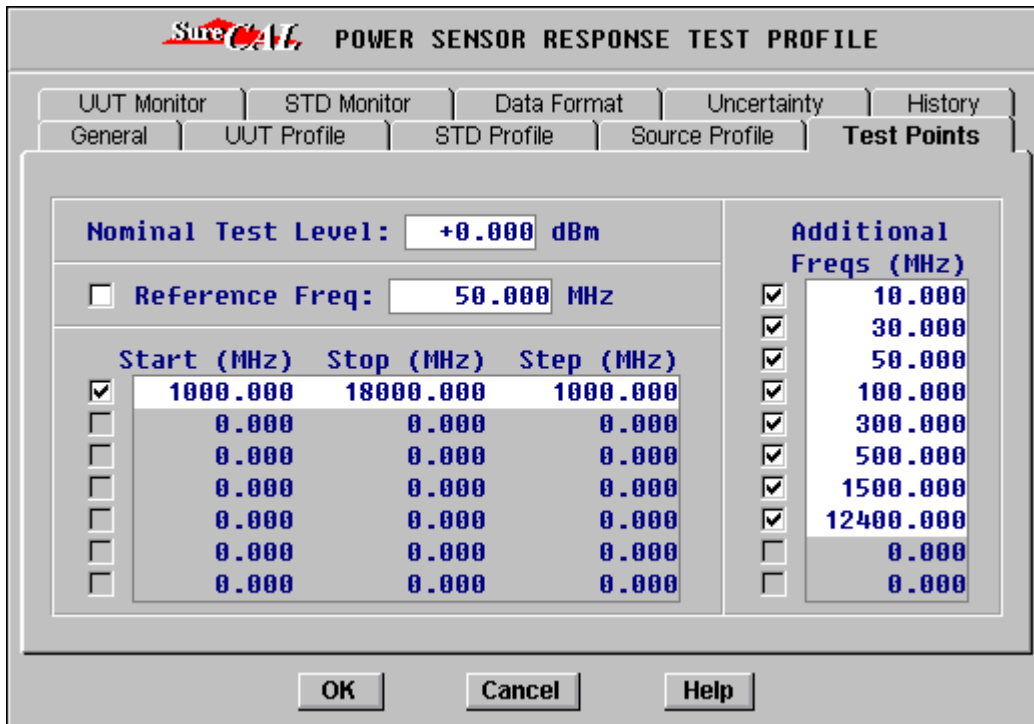


It is important to un-check any boxes that force a particular Reference Cal Factor or shift its value. Remember, the feedthrough sensor being calibrated will act as a transfer standard for calibrating other sensors. Not all of the UUT sensors you will calibrate later will have a reference cal factor, so the transfer standard should be calibrated against an absolute reference, not a relative one. This will have no effect on the calibration of sensors that use a reference cal factor, but it will avoid unexpected offsets when calibrating sensors that don't use a one.

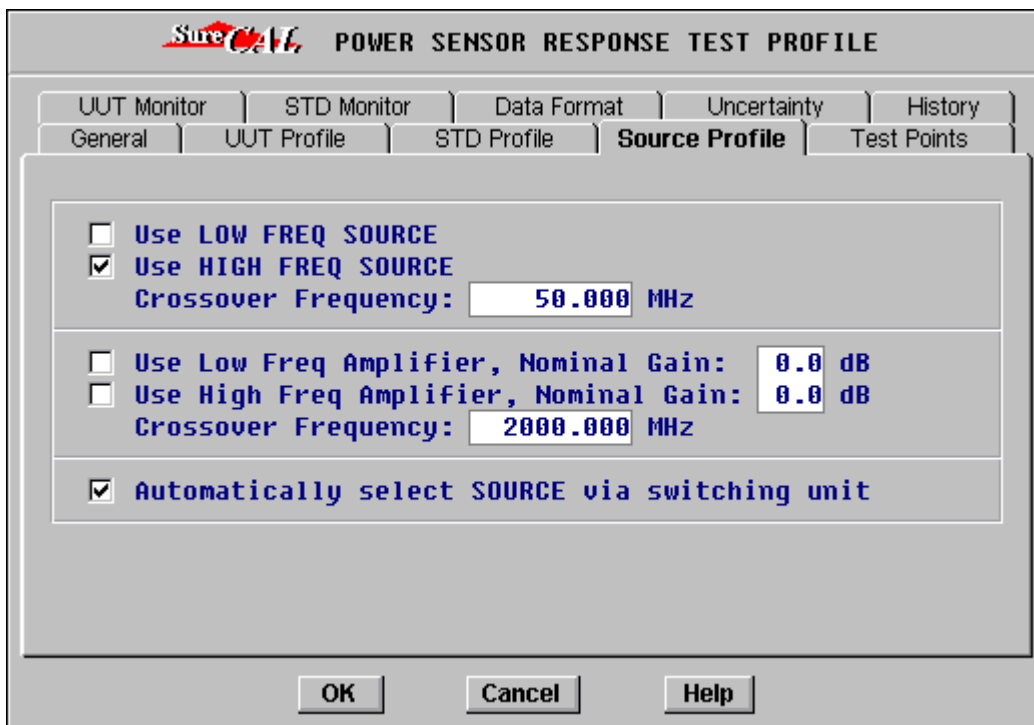
Ideally, if you know you're going to be calibrating sensors that don't use a reference cal factor, such as HP 478A Thermistor Mounts, it would be best to employ similar sensors at each step of the process. If you have a primary standard 8478A-H84 from HP, use it to calibrate an 8478A-plus-splitter assembly. That will produce the highest accuracy for your thermistor mount UUTs. If you have to use your HP 8481A-H84 as the primary standard for these sensors, your absolute cal factors will be offset by any power reference error of the HP power meter used to monitor the primary standard. This can be avoided by using thermistor mount type sensors as your primary and transfer standards. (This is, incidentally, how the TEGAM / Weinschel System II works.)

Step #5: Edit the Test Points Tab to look like the illustration on the following page.

The Reference Cal Factor box should be un-checked, but be sure to include the 50 MHz test point elsewhere in the list of frequencies. The frequencies listed should match those reported on the datasheet for your HP 8481A-H84.

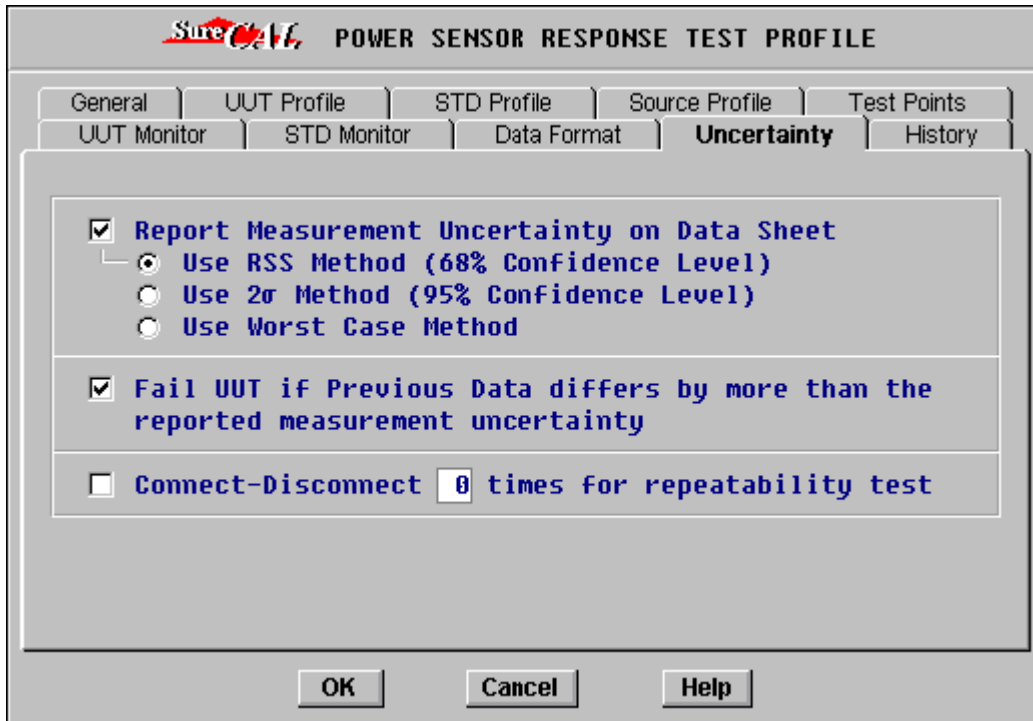


Step #6: Edit the Source Profile Tab to look like this:



NOTE: If you are using the 11760S-K01 RF Interface, be sure to check the last checkbox. Note also that if you are using a 3325A Synthesizer as your LOW FREQ SOURCE, the SureCAL[®] software will attempt to use it's front panel output, rather than the rear panel output.

Step #7: Edit the Uncertainty Tab to look like this:



NOTE: The RSS Method is appropriate for calibrating the transfer standard. This ensures that the proper one-sigma uncertainty is used in subsequent calculations. You may wish to specify a two-sigma uncertainty when using this transfer standard to calibrate other sensors.

Step #8: Save the new profile!

Click "OK" then select "ADD NEW PROFILE", then click "OK" again.

You are now ALMOST ready to calibrate your feedthrough type transfer standard.

Step #9: Create a data file for your HP 8481A-H84 sensor.

Use Notepad[™] to edit the SENSOR.DAT data file. Fill in the data from the HP datasheet. Include the FREQUENCY, CAL FACTOR, UNCERTAINTY, S11 MAG and S11 PHASE columns. Rename the SENSOR.DAT file to a recognizable name, like "8481AH84.DAT".

Okay. NOW you're ready.

Step #10: Calibrate the feedthrough sensor transfer standard.

Be sure to zero and calibrate the primary standard HP 8481A-H84 prior to running this test. Any reference cal offset will affect the accuracy of calibrations of thermistor mount UUTs. (As noted earlier, it is better to use an HP 8478A-H84 primary standard and an HP 8478A-plus-splitter transfer standard for calibrating thermistor mounts.)

When choosing data files, select the “8481AH84.DAT” file for the STD SENSOR and choose “Proceed Without Data” for the UUT SENSOR.

The SureCAL[®] software will generate a new data file for the feedthrough sensor. It will be labeled internally as a “TRANSFER STANDARD” type. This file type includes columns for S22 MAG and S22 PHASE. These columns will be blank.

If you have S22 data for the power splitter’s test port, you may use Notepad™ to enter these values into the file.

You are now ready to use your freshly calibrated transfer standard to calibrate terminating type UUTs.

HOW OFTEN DO YOU HAVE TO GO THROUGH ALL THAT?

Because you saved a new “HP 8481A TRANSFER STANDARD CALIBRATION” profile, you won’t ever have to set that up again. (You will have to set up any other profiles you may require, such as a profile to calibrate an 8485A-plus-splitter feedthrough assembly.) Once these profiles are saved, you can recall them from the General Tab and rerun them as often as required.

HOW OFTEN IS THAT?

That depends on several factors. You need to rerun it when any of the following conditions occur:

- If the feedthrough sensor assembly is ever disconnected. That is, if the sensor and splitter making up the feedthrough sensor are ever separated.
- If your calibration results make you suspect that something has changed.
- If you are using an 848x feedthrough sensor to calibrate a thermistor mount or any other sensor that uses **absolute** cal factors, you must recalibrate the transfer standard often to avoid offsets due to reference cal drift. This problem can be avoided if you use a thermistor mount for the feedthrough sensor.

If care is taken to avoid separating the feedthrough sensor components and a thermistor type sensor is used in the feedthrough assembly, the calibration can be performed every 6 months. (The thermistor type sensor can be replaced by a regular 848x sensor if all your UUT sensors use a reference cal factor.) Regardless of what sensor is used in the transfer standard assembly, a daily check-standard run is highly recommended.

MODIFYING OTHER TEST PROFILES:

Once you have created data files for your various feedthrough type transfer standards, you can edit the test profiles for all your UUT sensors to switch them from the TEGAM / Weinschel default standard to your custom built standards. Whenever you see “TEGAM / Weinschel 1807” on the STD Profile Tab, replace it with “Hewlett Packard 8481A with Splitter”. Whenever you see “TEGAM / Weinschel F1117A”, replace it with “Hewlett Packard 8485A with Splitter” and so on.