2850A RF Power Transfer Standard

10 MHz to 50 GHz

User Manual

October 2024 2850A-900 Revision AA

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Safety Information and Precautions

The following safety information applies to both operation and service personnel. Safety precautions and warnings may be found throughout this instruction manual and the equipment. These warnings may be in the form of a symbol or a written statement.

CAUTION:

DO NOT USE IN EXPLOSIVE ENVIRONMENTS!

The 2850A is not designed for operation in explosive environments.

WARNING:

DO NOT OPERATE WITHOUT COVERS!

This device should be operated with all panels and covers in place. Operation with missing panels or covers could result in personal injury.

Terms in this Manual

CAUTION:

CAUTION indicates a potentially hazardous situation that, if not avoided, could result in minor or moderate injury, and/or property damage. CAUTION is also used for property-damage-only accidents.

WARNING:

WARNING indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury, and/or property damage.

DANGER:

DANGER indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury. DANGER is limited to the most extreme situations.

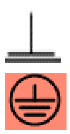
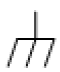
NOTE statements identify best practices or tips for efficiency.

Terms on Equipment

CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property including the equipment itself.

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

Symbols as Marked on Equipment

	CAUTION – RISK OF DANGER
	DANGER – Risk of Electric shock
	Earth ground terminal
	Frame or Chassis terminal
	CE label – This product complies with the applicable European directives

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Product Overview and Specifications

Specifications

Measurement Ranges	Specification	
Frequency (MHz)	10 MHz to 50 GHz	
Max Power (mW)	Typical usable range: -20 to +10 dBm (0.01 to 10 mW) *Calibrated attenuator(s) available to extend the dynamic range.*	
Connector Type (Output)	2.4mm (female)	
Calibration Factor Accuracy *(typical)*	10 MHz to <50 MHz	±1.4%
	50 MHz to <4.0 GHz	±1.25%
	4.0 GHz to <12 GHz	±1.5%
	12.0 GHz to <17.5 GHz	±1.9%
	17.5 GHz to <26.5 GHz	±2.5%
	26.5 GHz to <44.0 GHz	±3.2%
	44.0 GHz to 50.0 GHz	±4.2%
Reflection Coefficient / Equivalent Source Match at Test Port *(typical)* $\|\Gamma\|$(V/V)	10 MHz to <100 MHz	0.01
	100 MHz to <2.0 GHz	0.02
	2.0 GHz to <12.4 GHz	0.06
	12.4 GHz to <18.0 GHz	0.09
	18.0 GHz to <26.5 GHz	0.12
	26.5 GHz to <40.0 GHz	0.15
	40.0 GHz to 50.0 GHz	0.25
Individual Calibration Factors Supplied at the following frequencies	10 to 100 MHz in 10 MHz steps, 100 MHz to 2 GHz in 50 MHz steps, 2 GHz to 4 GHz in 100 MHz steps, 4 to 12.4 GHz in 200 MHz steps, 12.75 to 18 GHz in 250 MHz steps, 18 to 26.5 GHz in 500 MHz steps, 27 to 34 GHz in 1 GHz steps, 34.5 GHz, 35 to 50 GHz in 1 GHz steps	
Calibration Factor Drift	< 0.5% per year	
RF Impedance	50 Ω (nominal)	

Loss Factor (typical)	8.5 dB nominal, up to 11 dB total (splitter and sensor)
Power Linearity	CF Change of <0.5% from 1 to 10 mW. CF change of <0.5% from 0.01 to 1 mW.
Zero Drift and Zero Set Accy (typical after warm up)	Drift: +/- 5.5nW/hr / Set: +/- 25nW
RF Input Port	2.4mm (Female)
Communication Interface	USB, type A 2.0 connector (rear panel)
Physical Dimensions (W x H x D)	21.7 x 10.5 x 33.8 cm / 8.5 x 4.1 x 13.3 in
Weight *(approximate)*	2.9 kg / 6.3 lbs
Operating Temp/Humidity	15 to 30 °C (59 to 86 °F) / < 75% RH non-condensing
Storage Temp/Humidity	-40 to +70 °C (-40 to 158 °F) < 90% RH non-condensing
Warranty	3-year Parts & Workmanship

Additional items (required and optional) for operation and maintenance *(contact your AE-TEGAM representative for more information).*

PC	Windows 10 or higher
PS-Cal	RF Power Sensor Calibration Software Version 4.9 or higher
Power Meter Application	AE-TEGAM Power Meter Application (free download)
USB 2.0 Type A cable	Included with purchase

Product Overview

Model 2850A RF Power Transfer Standard (necessary optional items not shown)

Utilizing AE-TEGAM's transfer standard techniques applied to an internally referenced thermoelectric sensor, the 2850A performs faster while retaining excellent overall performance and accuracy.

With a USB communication port, the 2850A operates without a power meter. Using PS-CAL paired with a PC both for data collection and as a digitized power meter, you retain the benefit of making manual measurements when you want them and collecting data automatically when a visual power reading is not needed.

The 2850A is EEPROM based. This means that calibration constants are stored within the sensor, eliminating the need for a separate electronic data media.

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Installation and Set-Up

Unpack the Shipment and Inspect the Contents

Each 2850A is put through a series of electrical and mechanical inspections before shipment to the customer.

1. Upon receipt of your instrument unpack all the items from the shipping carton.
2. Inspect for damage that may have occurred during transit. Report any damaged items to AE and the shipping agent. Retain and use the original packing material for reshipment if necessary.
3. Inspect the carton for the following items:

Table 1: Packing List

Item	Part Number
AE-TEGAM 2850A RF Power Transfer Standard	2850A
Technical (Operation and Maintenance) Manual	2850A-840 (CD) or -900 (file name)
USB Cable	CA-14-2M

Recommended Installation Environment

Normal calibration laboratory practice dictates the environment should be closely controlled. This minimizes errors introduced by temperature and humidity changes. A nominal temperature of +23ºC (+73.4ºF) provides good working conditions. A tolerance of ±1ºC gives an ideal temperature spread. Controlled temperatures also stabilize the aging process of the standard.

⚠ CAUTION:

The 2850A has a specified operating temperature range of +15°to +30°C (+59°to +86°F). Operating beyond these limits can affect the accuracy of the instruments and damage internal circuitry.

Installation Options

The 2850A is shipped with four plastic feet mounted to the bottom cover. When it is placed on a bench or table, the feet support the instrument.

For rack mounting of the 2850A use rack mount kit, P/N 1830-910 (single unit) or 1830-911 (dual unit).

Typical Equipment List

The following equipment is required to perform automated DUT calibrations with the 2850A:

- AE-TEGAM 2850A, RF Power Transfer Standard
- Computer with PS-Cal software (Version 4.9 or higher)
- VNA[1] *(PS-Cal compatible)*
- RF Signal Generator *(PS-Cal compatible)*
- DUT Power Meter *(If required)*

[1] If laboratory is including reflection (S11) measurements with DUT calibrations.

Instrument Connections

The 2850A has a 2.4mm (female) input port for connection to an RF signal generator and 2.4 mm (female) output port for connection to the DUT.

The 2850A must be connected to a computer via USB to use.

1. Connect the USB Cable to the port on the back of the 2850A.

Figure 1: Rear of 2850A

2. Connect other end of USB cable to computer

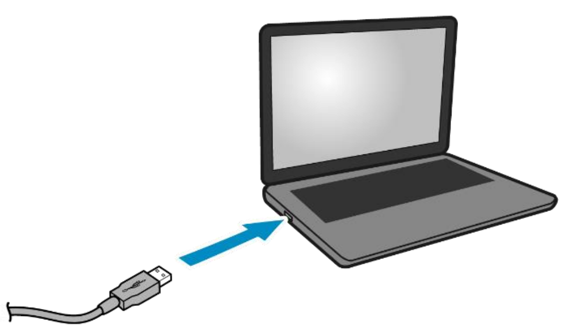
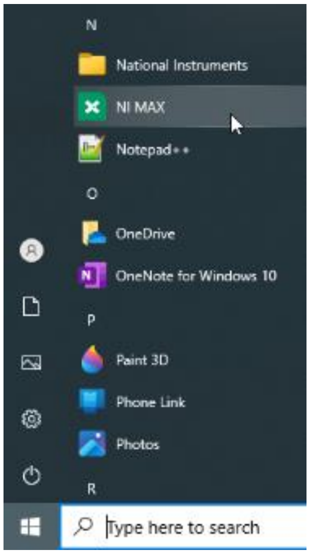


Figure 2: Computer USB Connection

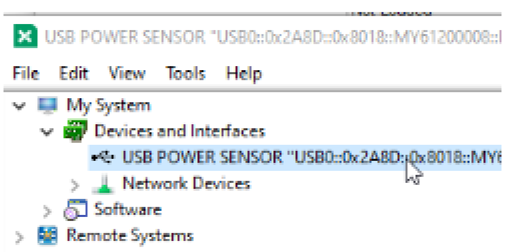
3. Start the appropriate software to access the 2850A

PS-Cal Setup

1. Open NI MAX on the system workstation

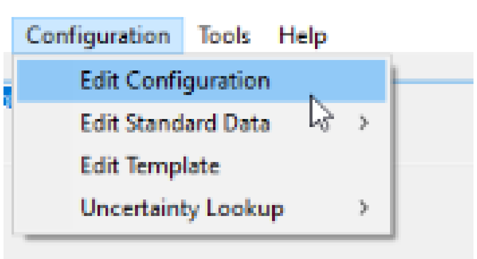


2. Select USB POWER SENSOR

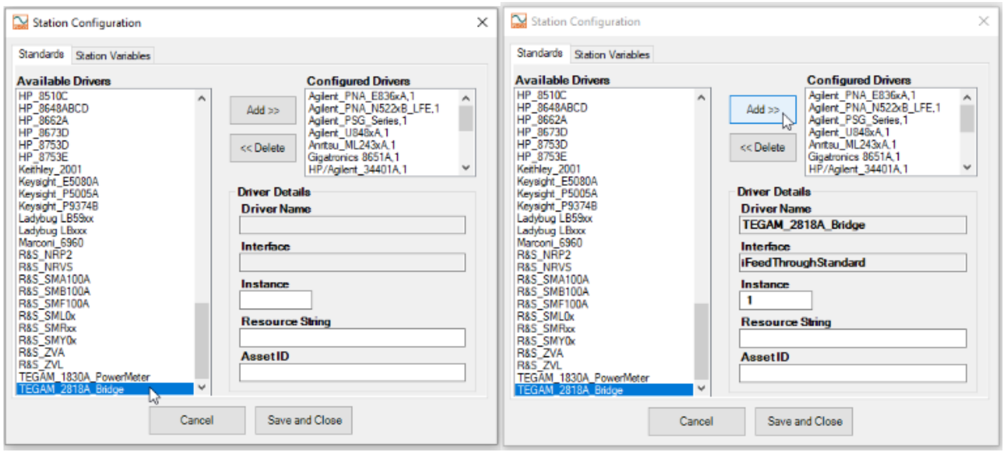


3. Copy the VISA Resource Name

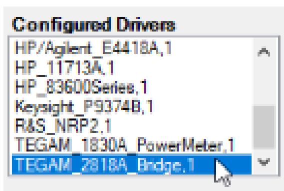
4. In PS-Cal, select “Edit Configuration”



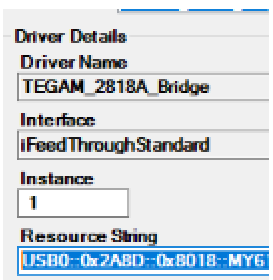
5. Select TEGAM_2850A_Bridge and press **Add**



6. Select "TEGAM_2850A_Bridge"



7. Paste the VISA Resource name from step 3 into the "Resource String" field



8. Click **Save and Close**

Software Setup

The 2850A is intended for use with AE-TEGAM PS-Cal software. It can also make measurements manually with the AE-TEGAM RF Power Meter (Display) App (available within PS-Cal software package or free to download from the AE-TEGAM website).

1. Install the 28xx RFPower Display program on the system workstation
2. Double-click the 28xx Power Display icon to start the program

Standalone Software Use

1. Launch the 28xx RFPower Display program on the system workstation.

2. Select the frequency to be measured from the drop-down box. The software will automatically apply the calibration factor for that frequency.

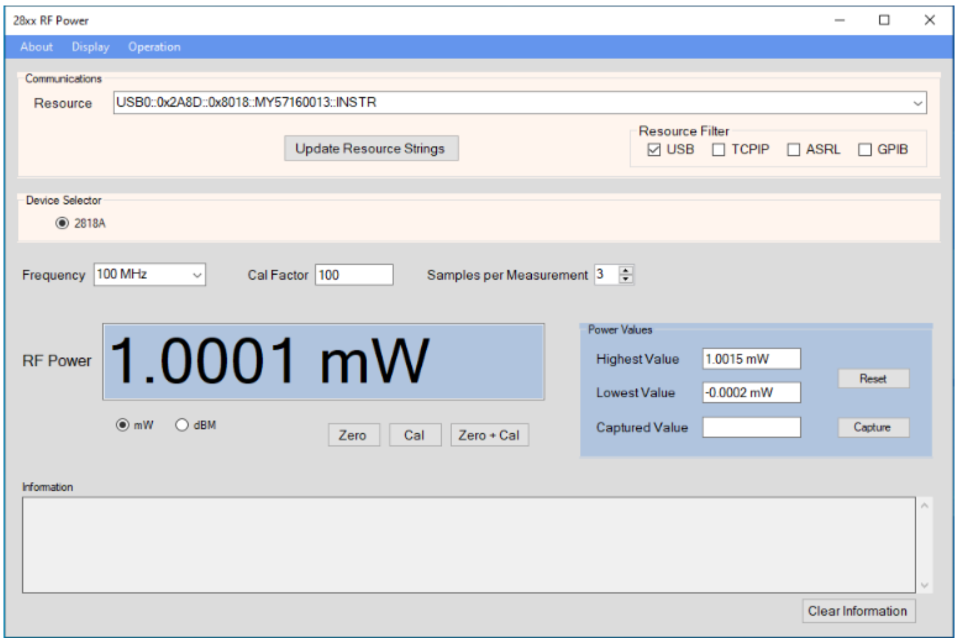


Figure 3: RF Power Display main window

3. A feature description list can be found below

Selection	Description
Frequency	Select desired frequency to measure
Cal Factor	Calibration factor for selected frequency. By default, this value is downloaded from the EEPROM of the 2850A but it can be changed manually if desired.
Samples per Measurement	Number of samples between each measurement displayed. This value can be between 1 and 20
RF Power	Power measured at TEST SENSOR port
mW/dBm	Measurement unit
Zero/Cal/Zero+Cal	Use to Zero or calibrate the unit to its internal 50 MHz reference
Highest Value	Highest value recorded. Use "Reset" button to clear
Lowest Value	Lowest value recorded. Use "Reset" button to clear
Captured Value	Press "Capture" to hold value
Information Window	Diagnostic information

Table 1: RF Power Display feature description list

Software Access from PS-Cal

1. In PS-Cal, select the Tools menu (see *Figure 12* below).
2. Click **28xx RF Power**

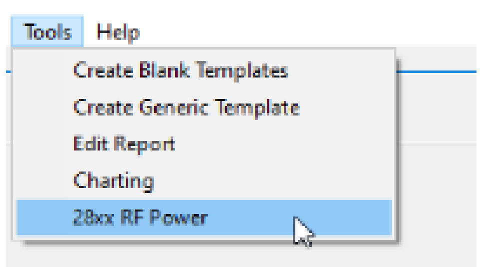


Figure 4: Accessing 28xx RF Power Display program from PS-Cal

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Maintenance

Calibration

The 2850A should be calibrated periodically to maintain accuracy. The frequency and method of calibration can vary based on the customer's requirement. AE-TEGAM recommends annual calibration of the 2850A for typical applications. AE-TEGAM maintains full capability to calibrate these standards. Contact AE-TEGAM to discuss your specific needs or to set up a return RMA to have your standard calibrated.

Care and Handling of Assemblies

To ensure accurate measurements and optimal performance of AE-TEGAM products, the microwave coaxial cable assemblies used in system and test setups must be properly used and maintained. Proper connections, routine inspection of all cables, and cleaning of the connectors are extremely important procedures which can prolong the longevity and accuracy of equipment.

Cable Inspection

Routinely check external cables for signs of cracked insulation, dents, twists, flattening, signs of jacket abrasion, or other signs of abuse. Wrinkles in the jacket indicate that the minimum bend radius has been exceeded. Most often, this occurs near the marker tubes and connectors.

Also inspect the connector interfaces for the following:

- Bent pins (male).
- Bent or missing tines (female).
- Worn or chipped plating.
- Damaged or displaced dielectric inserts.
- Thread damage.
- Folded or mushroomed outer interface rims.
- Mushroomed pin shoulders (male) or tine ends (female).
- Score lines on pins and outer interface rims visible to the unaided eye.
- Recessed or protruding pins.

It is advisable to clean the connectors prior to inspection to make subtle damage more apparent.

Inspect the connector interface for signs of debris.
Debris may be in the form of:

- Plating chips or other metal particles.
- Dust and other miscellaneous foreign particles

- Oily films.

Making Initial Connections

Exercise caution when mating cables. Poor connections lead to poor system performance. They can also damage not only the cable assembly, but more significantly, front or rear panel connectors on the equipment itself which may be more difficult to repair.

Aligning Connectors

Align the center lines of two connectors before actual mating. Male retaining nuts contain a small amount of necessary play which may make it possible to mate the threads without the pins being properly aligned. Pin misalignment can damage pins and dielectric inserts.

Mating Connectors

Gently mate the connectors by hand, taking care not to force the coupling nut at the slightest resistance. It is often possible to feel whether the pins are mated. If the coupling nut is difficult to turn, either the pins are not mated, the coupling nut is cross-threaded, or one of the connectors has been damaged by excess torque.

Never hold a male connector coupling nut stationary while screwing a female connector into it. This rotation can erode the plating and damage both the outer interface rim as well as the pin. If the pins become locked, serious damage can result to both the equipment and the cable assembly.

Gaging Connectors

Use the following guidelines to gage connectors:

- Always inspect and clean the gage before use.
- Zero the gage before use.
- DO NOT hold the gage by the dial.
- DO NOT use a connector that is out of specification.

Over-Torque

Once connectors have been properly mated, apply only the proper amount of torque. Over-torque damages both connectors involved. Also, a connector which has been damaged by over-torque, in turn, damages every connector to which it is subsequently mated. It usually leads to poor system performance as well. Over-torque can cause:

- Bent pins.
- Recessed or protruding pins.
- Recessed or protruding dielectrics.
- Chipped plating.
- Damaged coupling threads.
- Coupling nut retaining ring damage.
- Mushroomed outer interface shells.
- Mushroomed pin shoulders.

Proper Torque of an APC Type N Connector Hex Nut

To mate a connector of the hex-nut type, always use a torque wrench set to the correct torque value. Tighten the connector slowly until the wrench snaps. Tightening too quickly can cause the wrench to exceed its set limit. Do not snap the wrench more than once as this also causes over-torque.

CONNECTOR RECOMMENDED TORQUE (Type 2.4mm): 8.0 in/lbs

Cleaning Connector Interfaces

Use the following guidelines in cleaning connector interfaces:

- Do not use chlorinated solvents including common tap water. These solvents are extremely penetrating and sometimes ruin otherwise good devices and assemblies.
- Moisten a cotton swab with isopropyl alcohol. Roll the swab on a paper towel to remove excess.
- Use the moistened cotton swab to wipe away debris. Do not try to dissolve the debris by over-wetting the swab.
- Repeat the cleaning process using additional swabs as necessary. If metallic particles are embedded in the dielectric, use an eyeglass and a sharp pick in an attempt to dislodge them. Swab again.
- When satisfied that the interfaces are clean, blow them dry with dry compressed air, or preferably dry nitrogen (pressurized spray cans work well). Do not use breath.
- Clean the mating connectors. These may be the source of the debris.

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Troubleshooting Guide

Table 3: General Troubleshooting Guide

Symptom	Corrective Action
Communication error in software	Ensure that all equipment on station can communicate with the workstation using NI MAX
Device not recognized by Operating System	Verify USB connection between 2850A and workstation
Inaccurate readings	Check all RF cables and adapters in system for possible source of signal loss or impedance mismatch

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Appendix A - Calculating Calibration Factors

When using an RF Power Meter with an RF Power Sensor to make an RF Power Measurement the user must know that the measurement is accurate and there is traceability to a known standard. All diode, thermo-electric, and thermistor power sensors have calibration factors associated to frequencies that are used to insure an accurate power measurement. Technicians and engineers use these calibration factors when making measurements, but where do these calibration factors really come from?

During calibrations, calibration factors are transferred from a terminating reference to a feed-through (transfer) standard, and then into the DUT. In some procedures, this transfer occurs all in one session, and in others time is saved by transferring into the feed-through once and then using that feed-through calibration to calibrate DUT's for some time.

Calibration factors of a terminating power sensor relates standard RF power to the total RF power *incident* on the sensor being used. For this purpose, incident means all the RF propagating toward the sensor reference plane, including power that is subsequently reflected. On the signal flow diagram (figure 4), the incident power is $P_i = |a_l|^2$.

Calibration factor of a feed-through power calibration setup relates the standard's RF power to the power delivered out of the DUT port into a load of exactly the nominal characteristic impedance of the system, or Z_0. If we think of the feed-through DUT port as the output of a leveled generator, then the output into a perfect load is $P_{g_{zo}}$.

So, for a terminating sensor (using the "M" subscript):

$$k_M = \frac{P_{SubM}}{P_i}$$

And for a feed-through standard, (using the "F" subscript):

$$k_F = \frac{P_{SubF}}{P_{g_{zo}}}$$

Where:
k_M = Calibration factor of the Terminating Mount
k_F = Calibration factor of the Feed-through Mount
P_{SubM} = Power measured terminating mount
P_{SubF} = Power measured Feed-through mount

In a perfect world, the terminating sensor would present a perfect load, and then by reorganizing the above two definitions with incident and output power equal, we would have,

$$k_M = k_F \frac{P_{SubM}}{P_{SubF}}$$

Because power sensors are always imperfect loads, additional analysis and sometimes correction is required.

Figure 4 shows a signal flow diagram of two one-port devices connected. The left-hand port is the "output", or "generator" port and is designated on the diagram using the subscript, "g". The right-hand port is the "input", or "load" port and is designated using the subscript "l". It's clear from the diagram that port reflections dominated by the Gamma vectors generally cause the power that the generator port would output into an ideal load, $P_{g_{z0}}$, to not be equal to the power P_i, incident on the load. We must consider the combination of reflections, or "port match" to come up with a general understanding of calibration transfer.

Start with the signal flow diagram. In this case, a Generator "g" is represented by an ideal source "s", and its port reflection, and the sensor is termed the load, "l".

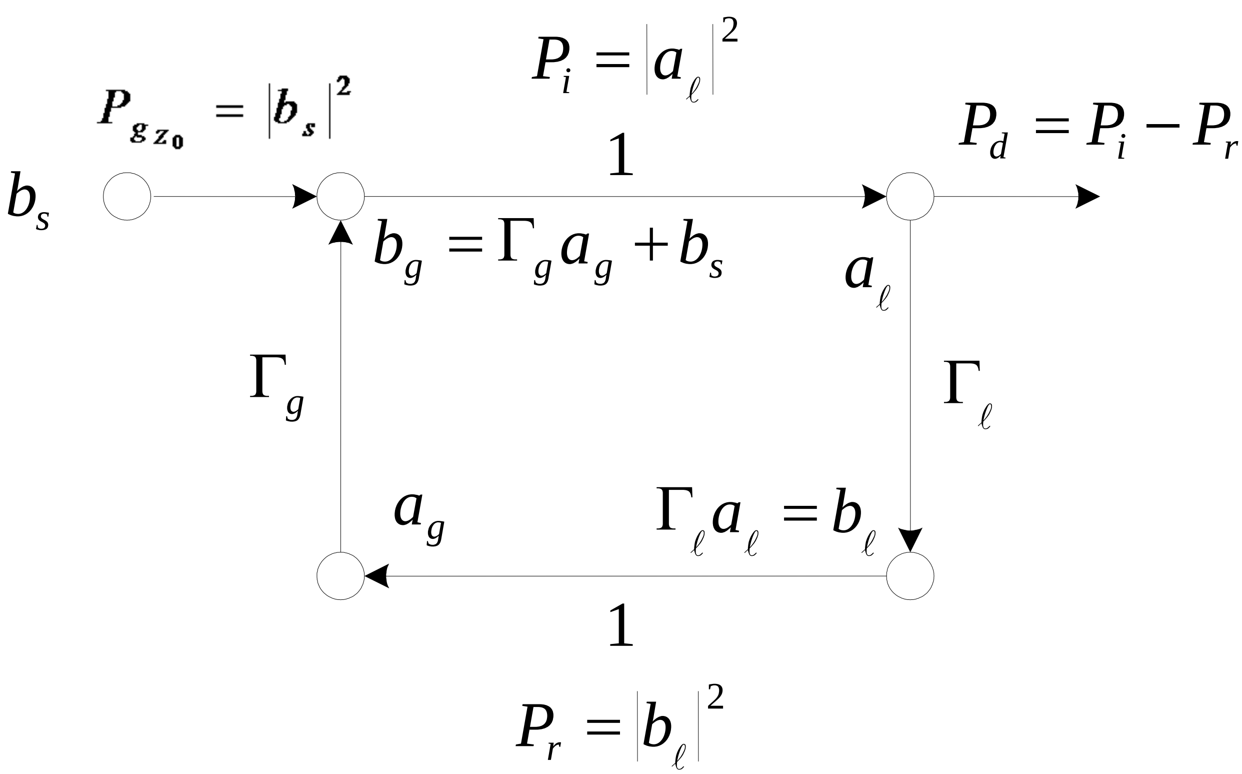

Figure 4 - Signal Flow Diagram

From the diagram,

$$b_g = b_s + \Gamma_g a_g$$

But also,

$$a_g = b_l = \Gamma_l a_l = \Gamma_l b_g$$

So, substituting the second equation into the first:

$$b_g = b_s + \Gamma_l \Gamma_g b_g$$

And then re-arrange to collect b_g:

$$b_g = \frac{b_s}{1 - \Gamma_l \Gamma_g}$$

Now rewrite as power, substituting in $P_{g_{z0}} = |b_s|^2$, and $P_i = |b_g|^2$:

$$P_i = \frac{P_{g_{z0}}}{|1 - \Gamma_l \Gamma_g|^2}$$

Armed with this last result, and calling the Feed-through stand (F subscript) the "generator" (g subscript) and terminating sensor (M subscript) the "load" (l subscript), and substituting in the definitions for cal factor from earlier, we get the more general equation for transferring between a feed-through and a terminating sensor:

$$k_M = k_F \frac{P_{SubM}}{P_{SubF}} |1 - \Gamma_M \Gamma_F|^2$$

Where:

k_M = Calibration factor of the Terminating Mount
k_F = Calibration factor of the Feed-through Mount
P_{SubM} = Power measured terminating mount
P_{SubF} = Power measured Feed-through mount
G_M = Gamma Correction full vector data Terminating Mount
G_F = Gamma Correction full vector data Feed-through Mount

Now in this general equation, the Gamma terms are the reflection scattering parameter of the respective port noted in the subscript. Gamma is a complex vector with scalar values denoting the real and imaginary magnitudes:

$$\Gamma \equiv \rho\angle\phi = \rho\cos\phi + \mathrm{i}\rho\sin\phi$$

In the general transfer equation, the term, $|1 - \Gamma_M \Gamma_F|^2$ is the scalar "gamma correction" or "port match" term. Inside the absolute value brackets, however, is a *vector* subtraction. Expanding out to make the angles explicit, this becomes:

$$|1 - \rho_M \rho_F \cos(\phi_M + \phi_F) - i\, \rho_M \rho_F \sin(\phi_M + \phi_F)|^2$$

Where the *i* represents $\sqrt[2]{-1}$, or the "imaginary" component.

The absolute value, or length of a vector, is given by the Pythagorean formula, which is the square root of the square of the magnitudes of the real and imaginary components. It's convenient that we are looking for the square of the magnitude, so we don't have to worry about the square root part. Our correction term becomes the scalar,

$$(1 - \rho_M \rho_M \cos(\phi_M + \phi_F))^2 + (\rho_M \rho_F \sin(\phi_M + \phi_F))^2$$

When the squares are evaluated, this expands to:

$$1 - 2\rho_M \rho_F \cos(\phi_M + \phi_F) + {\rho_M}^2 {\rho_F}^2 \cos^2(\phi_M + \phi_F) + {\rho_M}^2 {\rho_F}^2 \sin^2(\phi_M + \phi_F)$$

Noting that if we collect the two terms beginning with ${\rho_M}^2 {\rho_F}^2$, we get,

$$1 - 2\rho_M \rho_F \cos(\phi_M + \phi_F) + {\rho_M}^2 {\rho_F}^2 (\cos^2(\phi_M + \phi_F) + \sin^2(\phi_M + \phi_F))$$

The term, $\cos^2(\phi_M + \phi_F) + \sin^2(\phi_M + \phi_F)$ is always identically equal to 1, so the final simplified equation becomes,

$$1 - 2\rho_M \rho_F \cos(\phi_M + \phi_F) + {\rho_M}^2 {\rho_F}^2$$

Or combining this result with the general transfer equation,

$$k_M = k_F \frac{P_{SubM}}{P_{SubF}} (1 - 2\rho_M \rho_F \cos(\phi_M + \phi_F) + {\rho_M}^2 {\rho_F}^2)$$

If we look at the scalar result of the mismatch term, the "1" part is what would happen if at least one of the ports was "perfect" or had no reflection. In that case, one of the ρ is zero. The right-most element has magnitude of ρ^4, which is typically so much smaller than the middle term that it can be ignored for most connections.
The middle part, $2\rho_M \rho_F \cos(\phi_M + \phi_F)$, contains the bulk of the impact of port mismatch. Since it is multiplied by *k*, the sensitivity to this change is equal to *k,* or about 1. In an *UNCORRECTED* transfer, this part represents the probable error of the transfer. Since we can't know the angles in an uncorrected transfer, we let cos() take its limits of +/- 1, and say that the uncertainty of the uncorrected transfer is $2\rho_M \rho_F$. That is a little pessimistic, because that is worst-case rather than probable, but it's what the industry usually does. Unless the rhos were measured on a scalar analyzer, we must use manufacturer's worst-case values.

Some common power sensor calibration practices do not always use gamma correction. An argument could probably be made that this was a reasonable practice at lower frequencies. We typically see this at 18 GHz and lower. A value of 0 would be inserted for G_M making that portion of the formula "1".
This would make the formula look like:

$$k_M = k_F \frac{P_{SubM}}{P_{SubF}}$$

This revision of the original formula assumes many things that are not necessarily true. Things that may not necessarily show up at lower frequencies but will certainly show up at higher frequencies where connectors change from the very rugged N-type connector to the more sensitive 3.5 mm and 2.4 mm connectors.

Appendix B – Service Assistance

Returns for Repair

Once you have verified that the cause for the 2850A malfunction cannot be solved in the field and the need for repair and calibration service arises, contact AE-TEGAM customer service to obtain an RMA, (Returned Material Authorization), number. You can contact AE-TEGAM customer service via the AE-TEGAM website, www.advancedenergy.com or by calling 440.466.6100 (All Locations) OR 800.666.1010 (United States Only).

The RMA number is unique to your instrument and will help us identify you instrument and to address the service request by you which is assigned to that RMA number.

Of even importance, a detailed written description of the problem should be attached to the instrument. Many times, repair turnaround is unnecessarily delayed due to a lack of repair instructions or of a detailed description of the problem.

This description should include information such as measurement range, and other instrument settings, type of components being tested, are the symptoms intermittent, conditions that may cause the symptoms, has anything changed since the last time the instrument was used, etc. Any detailed information provided to our technicians will assist them in identifying and correcting the problem in the quickest possible manner.

Once this information is prepared and sent with the instrument to our service department, we will do our part in making sure that you receive the best possible customer service and turnaround time possible.

Warranty

TEGAM, Inc. warrants this product to be free from defects in material and workmanship for a period of three years from the date of shipment. During this warranty period, if a product proves to be defective, TEGAM Inc., at its option, will either repair the defective product without charge for parts and labor, or exchange any product that proves to be defective.

TEGAM, Inc. warrants the calibration of this product for a period of 1 year from the date of shipment. During this period, TEGAM, Inc. will recalibrate any product which does not conform to the published accuracy specifications.

To exercise this warranty, TEGAM, Inc., must be notified of the defective product before the expiration of the warranty period. The customer shall be responsible for packaging and shipping the product to the designated TEGAM service center with shipping charges prepaid. TEGAM Inc. shall pay for the return of the product to the customer if the shipment is to a location within the country in which the TEGAM service center is located. The customer shall be responsible for paying all shipping, duties, taxes, and additional costs if the product is transported to any other location. Repaired products are warranted for the remaining balance of the original warranty, or

90 days, whichever period is longer.

Warranty Limitations

The TEGAM, Inc. warranty does not apply to defects resulting from unauthorized modification or misuse of the product or any part. This warranty does not apply to fuses, batteries, or damage to the instrument caused by battery leakage.

Statement of Calibration

This instrument has been inspected and tested in accordance with specifications published by TEGAM Inc. The calibration of this instrument is traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST) or other recognized National Metrology Institutes, by comparison to equipment and standards maintained in the laboratories of TEGAM Inc.

Document publishing dates may lag product changes.
Visit www.advancedenergy.com to download the latest version of this manual.

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TEGAM

Storage and Shipment

⚠ **CAUTION:**

Damage can result from using packaging materials other than those specified.

Storage

When the 2850A is to be stored for extended periods, pack the instrument into a container. Place container in a clean, dry, temperature-controlled location. If the instrument is to be stored for more than 90 days, place desiccant with items before sealing container. The safe environmental limits for storage are -40° to +70° C (-40° to +158° F) at less than 90% non-condensing relative humidity.

Package 2850A for Shipment

Use the following steps to package the Power Standard for shipment to AE-TEGAM for service:

1. Complete the Expedite Repair & Calibration Form (found on next page) and attach it to the power standard. Please be as specific as possible about the nature of the problem. Send a copy of any or all the following information:
   - Any error messages that appeared in the software.
   - Any information on the performance of the 2850A.

2. Use the original packaging materials or a strong shipping container. The carton must be both large enough and strong enough to accommodate the power standard and allow at least three to four inches on all sides of the power standard for packing material.

3. Seal the shipping container securely with strong nylon adhesive tape.

4. Mark the shipping container "FRAGILE, HANDLE WITH CARE" to ensure careful handling.

Expedite Repair & Calibration Form

Use this form to provide additional repair information and service instructions. The completion of this form and including it with your instrument will expedite the processing and repair process.

RMA #:	Instrument Model #:
Serial Number:	Company:
Technical Contact:	Phone Number:
Additional Info:	

REPAIR INSTRUCTIONS:

☐ Evaluation ☐ Repair & Calibration
☐ Calibration Only ☐ Repair only
☐ Provide Data (May incur extra charge)

Detailed Symptoms:

Include information such as measurement range, instrument settings, type of components being tested, is the problem intermittent? When is the problem most frequent? Has anything changed with the application since the last time the instrument was used?, etc.