Model PSP Series

Power Sensor, Pulse and PulsewARe Instruction Manual Rev A

Part Number 100xxxx

Serial Number xxxxx

rf/microwave instrumentation

AR RF/Microwave Instrumentation
160 School House Rd
Souderton, PA 18964
Phone: 215-723-8181 (Sales or general information)
Applications Engineering: 800-933-8181
Service Phone: 215-723-0275 Email: service@arworld.us
Website: www.arworld.us

USB Power Sensor EMC Statement

AR declares conformance to CE EMC directives for the **PSP Series USB Power Sensor** as indicated in the ***PSP Series CE Declaration of Conformity*** document. To support the declaration, EMC testing has been performed on these USB Power Sensors to the following methods:

Test Method	Test Results
CISPR 11, Radiated Emissions, Class A	Complied
IEC 61000-4-2, Electrostatic Discharge	Complied
IEC 61000-4-3, Radiated Immunity	Complied
IEC 61000-4-4, Electrical Fast Transient/Burst, I/O Ports	Complied
IEC 61000-4-6, Conducted Immunity, I/O Ports	Complied

While EMC testing to the relevant standards was performed on a single model in the PSP Series, AR feels there is strong justification to extend EMC test results for that model to the other models in the PSP Series based upon the following rationale:

- All PSP Series USB power sensor models use identical digital hardware. This includes the CPU, FPGA, ADC, USB interface and I/O circuitry. Clock rates are identical.
- All PSP Series USB power sensor models use identical firmware and FPGA programming
- All PSP Series USB power sensor models use identical power supply hardware.
- All PSP Series USB power sensor models use identical or very similar analog hardware (RF detection and video amplifier circuitry).
- The PSP has the widest analog (video) bandwidth and highest sensitivity of the PSP Series models, so was judged to be most likely to experience RF immunity issues. Since no immunity issues are observed, it is assumed that other PSP Series models will perform as well or better.
- The PSP complies with radiated emissions limits by a comfortable margin (>15dB), so it is judged exceedingly unlikely that slight video amplifier differences between the various PSP Series models will result in other models exceeding emissions limits.

Instructions for European EMC Conformity

It is the responsibility of the user of this equipment to provide electromagnetic shielding, filtering and isolation which is necessary for EMC compliance to Directive 2014/30/EU. The equipment must therefore be operated in a shielded area which provides a sufficient level of attenuation to meet the radiated emissions and immunity specifications. The following minimum levels are suggested for use in accordance with the rated power of the equipment.

Rated Power	Minimum shielding attenuation
100 watts	50 dB
101 - 1000 watts	60 dB
1001 - 10,000 watts	70 dB

Since this equipment is designed to generate high levels of Radio Frequency energy, it is also essential that the user read and follow the "Instructions for Safe Operation" in this manual. If other equipment is operated in the shielded room it may be disturbed by the amplifier.

Der Benutzer dieses Gerätes ist dafür verantwortlich, daß die elektromagnetische Abschirmung und Filterung gewährleistet ist, welche gemäß Richtlinie 2014/30/EU notwendig ist. Das Gerät muß deshalb in einem geschirmten Raum betrieben werden, welcher eine ausreichenden Schirmung bietet, um die Emissions- und Störfestigkeitsspezifkation einzuhalten. Es werden folgenden Minimalwerte der Schirmdämpfung und Filterung in den unterschiedlichen Leistungsklassen empfohlen.

Hochfrequenzleistung	min. Schirmdämpfung
100 Watt	50 dB
101-1000 Watt	60 dB
1001-10.000 Watt	70 dB

Falls andere elektrische oder elektronische Geräte gleichzeitig mit dem Gerät betrieben werden, kann es zu Beeinflussungen kommen. Da das Gerät zur Erzeugung von Hochfrequenzenergie dient ist es daher auch unbedingt notwendig, daß der Benutzer die Sicherheitsvorschriften in der Bedienungsanleitung liest und einhält.

Il est de la responsabilité de l'utilisateur de cet équipement d'assurer la protection électromagnétique, le filtrage et l'isolation nécessaires, afin de se conformer à la directive 2014/30/EU concernant la C.E.M. Par conséquent, cet équipement doit être mis en fonctionnement dans une enceinte d'atténuation suffisante pour satisfaire aux spécifications d'émissivité et de susceptibilité. Pour une utilisation conforme, les niveaux d'atténuation minimums suivants sont suggérés en fonction de la puissance de sortie de l'équipement:

Puissance de sortie	Atténuation minimum de l'enceinte
100 Watts	50 dB
101 à 1.000 Watts	60 dB
1.001 à 10.000 Watts	70 dB

Puisque cet équipement est destiné à générer de forts niveaux R.F., il est essentiel que l'utilisateur se conforme aux instructions de sécurité indiquées dans ce manuel. Tout autre équipement en fonctionnement dans la cage de Faraday peut-être perturbé par 1'amplificateur.

INSTRUCTIONS FOR SAFE OPERATION

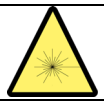
Observe the following safety guidelines to help ensure your own personal safety and to help protect your equipment and working environment from potential damage.

INTENDED USE

This equipment is intended for general laboratory use in generating, controlling, and measuring levels of electromagnetic Radio Frequency (RF) energy. Ensure that the device is operated in a location which will control the radiated energy and will not cause injury or violate regulatory levels of electromagnetic interference.

SAFETY SYMBOLS

These symbols may appear in your user manual or on equipment.

	This symbol is marked on the equipment when it is necessary for the user to refer to the manual for important safety information. The caution symbol denotes a potential hazard. Attention must be given to the statement to prevent damage, destruction, or harm.
	Dangerous voltages are present. Use extreme care.
	Indicates a terminal intended for connection to an external conductor for protection against electrical shock in case of a fault, or the terminal of a protective earth (ground) electrode.
	Indicates invisible laser radiation–do not view directly with optical instruments.
	Indicates frame or chassis ground connection terminal.
	Indicates alternating current.
	Indicates this product must not be disposed of with your other household waste.
	Indicates that the marked surface and adjacent surfaces can attain temperatures that may be hot to the touch.

EQUIPMENT SETUP PRECAUTIONS

Review the user manual and become familiar with all safety markings and instructions. Protection provided by the equipment may be impaired if used in a manner not specified by AR RF/Microwave Instrumentation (AR).

- Follow all lifting instructions specified in this document.
- Place the equipment on a hard, level surface.
- Do not use the equipment in a wet environment, for example, near a sink, or in a wet basement.
- Position your equipment so that the power switch is easily accessible.
- Leave 10.2 cm (4 in) minimum of clearance on all vented sides of the equipment to permit the airflow required for proper ventilation. Do not restrict airflow into the equipment by blocking any vents or air intakes. Restricting airflow can result in damage to the equipment, intermittent shut-downs or safety hazards.
- Keep equipment away from extremely hot or cold temperatures to ensure that it is used within the specified operating range.
- While installing accessories such as antennas, directional couplers and field probes, take care to avoid any exposure to hazardous RF levels.
- Ensure that nothing rests on your equipment's cables and that the cables are not located where they can be stepped on or tripped over.
- Move equipment with care; ensure that all casters and/or cables are firmly connected to the system. Avoid sudden stops and uneven surfaces.

BEFORE APPLYING POWER

Your AR equipment may have more than one power supply cable. Use only approved power cable(s). If you have not been provided with a power cable for the equipment or for any AC-powered option intended for the equipment, purchase a power cable that is approved for use in your country. The power cable must be rated for the equipment and for the voltage and current marked on the equipment's electrical ratings label.

Incorrectly installing or using an incompatible line voltage may increase the risk of fire or other hazards. To help prevent electric shock, plug the equipment and peripheral power cables into properly grounded electrical outlets. These cables are equipped with three-prong plugs to help ensure proper grounding. Do not use adapter plugs or remove the grounding prong from a cable.

Do not modify power cables or plugs. Consult a licensed electrician or AR trained service technician for equipment modifications. Always follow your local/national wiring rules.

Do not operate the equipment if there is physical damage, missing hardware, or missing panels.

SAFETY GROUND

This equipment is provided with a protective earth terminal. The mains power source to the equipment must supply an uninterrupted safety ground of sufficient size to attach wiring terminals, power cord, or supplied power cord set. ***DO NOT USE this equipment if this protection is impaired.***

INSTRUCTIONS FOR SAFE OPERATION

HAZARDOUS RF VOLTAGES

The RF voltages on the center pin of an RF output connector can be hazardous. The RF output connector should be connected to a load before AC power is applied to the equipment. Do not come into contact with the center pin of the RF output connector or accessories connected to it. Place the equipment in a non-operating condition before disconnecting or connecting the load to the RF output connector.

ACOUSTIC LIMITATIONS

If equipment noise exceeds 80dB, ear protection is required.

MAINTENANCE CAUTION

Adjustment, maintenance, or repair of the equipment must be performed only by qualified personnel. Hazardous energy may be present while protective covers are removed from the equipment even if disconnected from the power source. Contact may result in personal injury. Replacement fuses are required to be of specific type and current rating.

ENVIRONMENTAL CONDITIONS

Unless otherwise stated on the product specification sheet, this equipment is designed to be safe under the following environmental conditions:

- Indoor use
- Altitude up to 2000m
- Temperature of 5°C to 40°C
- Maximum relative humidity 80% for temperatures up to 31°C. Decreasing linearly to 50% at 40°C.
- Main supply voltage fluctuations not to exceed ± 10% of the nominal voltage or minimum and maximum autoranging values.
- Pollution degree 2: Normally non-conductive with occasional condensation. While the equipment will not cause hazardous condition over this environmental range, its performance may vary.

EQUIPMENT CONTAINING LASERS

AR Field Probes (FL/PL Series) and Field Analyzers (FA Series) are Class 1 laser products containing embedded Class 4 lasers. Under normal use, the laser radiation is completely contained within the fiber optic cables and poses no threat of exposure. Safety interlocks ensure that the laser is not activated unless the cables are properly connected. Always exercise caution when using or maintaining laser products. Do not view directly with optical instruments.

RF ANTENNAS

- This equipment (antenna or antenna assembly) may be heavy, requiring two persons to lift. Use caution when installing or removing unit. Follow all equipment setup and lifting instructions specified in this document.
- Ensure connectors are appropriate for intended operation. Connectors are specified in the user manual and product specification sheet.
- Do not exceed the maximum RF input level stated in the specifications. Refer to the user manual and product specification sheet to determine the applicable RF levels.
- Excessive RF input could damage the equipment or connectors, causing safety hazards.
- When in operation, the RF voltages on the antenna elements can be hazardous. Do not come into contact with the antenna or elements when the RF input connector is connected to a live RF source.
- To avoid injury to personnel and accidental damage to power amplifier or antenna, disable the RF output of power amplifier before connecting or disconnecting the input connection to the antenna.
- Perform periodic inspections of antenna and field probe systems to verify calibration due date, proper operation, and overall condition of equipment.

RACK MOUNTED TWT MODELS

Some TWT models are supplied without the removable enclosure offered for benchtop use. These rack-mountable models may be supplied with either carry handles or slides and front handles installed. Follow all lifting instructions specified in this document and installation instructions supplied in the TWT user manual.

LIFTING INSTRUCTIONS FOR AR EQUIPMENT

Because most products must be handled during distribution, assembly and use, the risk of serious injury due to unsafe product handling should be a fundamental consideration of every user. An authoritative guideline for eliminating unwarranted risk of injury caused by lifting is provided by the NIOSH Work Practices (Publication #94-110) available at:

https://www.cdc.gov/niosh/docs/94-110/pdfs/94-110.pdf.

In general, observe the following guidelines for lifting a weight of 50 lb or more:

- Use lifting eye (for floor standing) or side handles (table top) to lift unit only.
- Use equipment of adequate capacity to lift and support unit.
- If using forklift to move unit, be sure forks are long enough to extend beyond the side of the unit.
- For additional information, follow the link specified above.

HINWEISE FÜR DEN SICHEREN GEBRAUCH

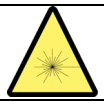
Bitte beachten Sie die folgenden Hinweise zum Schutz Ihrer persönlichen Sicherheit und um Ihre Ausrüstung und Ihren Arbeitsplatz vor möglichen Schäden zu bewahren.

VORGESEHENE VERWENDUNG

Dieses Gerät ist für den allgemeinen Einsatz im Labor bestimmt. Es dient der Erzeugung, Steuerung und Messung von elektromagnetischer Hochfrequenzenergie (RF). Stellen Sie sicher, dass das Gerät an einem Ort in Betrieb genommen wird, an dem die abgestrahlte Energie gesteuert werden kann, so dass niemand Schaden erfährt und elektromagnetische Störungen vermieden werden.

SICHERHEITSSYMBOLE

Einige dieser Symbole befinden sich sowohl in der Bedienungsanleitung als auch auf dem Gerät selbst.

	Dieses Symbol befindet sich auf dem Gerät und weist darauf hin, dass der Nutzer an dieser Stelle wichtige Sicherheitsinformationen in der Bedienungsanleitung studieren soll. Das Warnsymbol weist auf eine mögliche Gefahr hin. Zur Vermeidung von Personen- oder Sachschäden gilt es, die Hinweise zu beachten.
	Gefährliche elektrische Spannungen sind vorhanden. Höchste Vorsicht ist geboten.
	Weist darauf hin, dass an dieser Stelle eine Klemme für den Anschluss an einen Außenleiter anzubringen ist, zum Schutz vor einem Stromschlag oder im Fall einer auftretenden Störung, oder dass eine Klemme anzubringen ist, die als schützende Erdungselektrode fungiert.
	Zeigt unsichtbare Laserstrahlung an –nicht direkt hineinsehen.
	Weist auf eine Rahmen- oder Chassis-Anschlussklemme hin.
	Zeigt Wechselstrom an.
	Weist darauf hin, dass dieses Produkt nicht mit Ihrem restlichen Hausmüll entsorgt werden darf.
	Weist darauf hin, dass die markierte Oberfläche und benachbarte Flächen extrem heiße Temperaturen erreichen können und daher nicht angefasst werden sollten.

SICHERHEITSHINWEISE FÜR DEN AUFBAU DES GERÄTS

Lesen Sie die Bedienungsanleitung aufmerksam durch und machen Sie sich mit allen Sicherheitsmarkierungen und Anweisungen vertraut. Die Sicherheit kann beeinträchtigt sein, falls das Gerät in einer anderen Weise verwendet wird, als von der AR RF/Microwave Instrumentation (AR) vorgegeben ist.

- Zum Heben und Transport folgen Sie allen in dieser Anleitung angegebenen Anweisungen.
- Platzieren Sie das Gerät auf einer harten, ebenen Oberfläche.
- Verwenden Sie das Gerät nicht in feuchter Umgebung, zum Beispiel in der Nähe einer Spüle oder in einem feuchten Keller.
- Platzieren Sie Ihr Gerät so, dass der Netzschalter leicht zugänglich ist.
- Halten Sie einen Mindestabstand von 10,2 cm (4 in) auf allen belüfteten Seiten des Geräts ein, um eine ausreichende Luftzirkulation zu gewährleisten. Beeinträchtigen Sie den Luftstrom des Geräts nicht, indem Sie Lüftungsöffnungen oder den Lufteinlass blockieren. Wird der Luftstrom eingeschränkt, kann dies zu Schäden am Gerät, periodischen Abschaltungen und anderen Gefahren führen.
- Halten Sie das Gerät von extrem heißen oder kalten Temperaturen fern, um sicherzustellen, dass es nur in dem vorgeschriebenen Bedienungsbereich verwendet wird.
- Achten Sie beim Installieren von Zubehör wie Antennen, Richtungskupplungen und Feldsonden darauf, dass sie keinen gefährlichen HF-Werten ausgesetzt sind.
- Stellen Sie sicher, dass nichts auf den Kabeln Ihres Geräts steht. Bringen Sie die Kabel so an, dass niemand darauf treten oder darüber stolpern kann.
- Seien Sie vorsichtig, wenn Sie das Gerät bewegen. Achten Sie darauf, dass alle Rollen und/oder Kabel fest mit dem System verbunden sind. Vermeiden Sie plötzliche Stopps und Oberflächen, die nicht eben sind.

BEVOR SIE DAS GERÄT ANSCHLIESSEN

Ihre AR-Ausrüstung hat möglicherweise mehr als ein Stromversorgungskabel. Verwenden Sie nur zugelassene Stromkabel. Falls Sie kein Stromkabel oder AC-Netzkabel für dieses Gerät haben, kaufen Sie ein Stromkabel, das für den Einsatz in Ihrem Land zugelassen ist. Das Stromkabel muss für das Gerät, die Spannung und den Strom, die auf dem elektrischen Kennzeichnungsetikett des Geräts markiert sind, zugelassen sein.

Bei einer fehlerhaften Installation oder falls eine Netzspannung verwendet wird, die nicht mit dem Gerät kompatibel ist, erhöht sich die Brandgefahr. Auch andere Gefahren können auftreten. Um einen Stromschlag zu verhindern, schließen Sie das Gerät und die peripheren Stromkabel an ordnungsgemäß geerdete Steckdosen an. Die Kabel sind mit dreipoligen Steckern ausgestattet, um eine korrekte Erdung zu gewährleisten. Verwenden Sie keine Adapter. Entfernen sie niemals die Erdungsstange eines Kabels.

Modifizieren Sie niemals die Stromkabel oder Stecker. Konsultieren Sie einen lizenzierten Elektriker oder AR-ausgebildeten Servicetechniker, falls Veränderungen am Gerät durchgeführt werden müssen. Halten Sie sich stets an die nationalen/örtlichen Verdrahtungsregeln.

Schalten Sie das Gerät nicht ein, falls es äußerlich beschädigt ist oder Hardware-Teile oder Konsolen fehlen.

SYSTEMERDUNG

Dieses Gerät ist mit einer Schutzerdklemme ausgestattet. Die Netzstromquelle muss dem Gerät eine ununterbrochene Systemerdung von ausreichender Größe zur Verfügung stellen, damit Kabelklemmen, Netzkabel oder mitgeliefertes Netzkabel ordentlich befestigt werden können. *VERWENDEN SIE DIESES GERÄT NICHT, wenn dieser Schutz beeinträchtigt ist.*

HINWEISE FÜR DEN SICHEREN GEBRAUCH

GEFÄHRLICHE HF-SPANNUNGEN

Die HF-Spannungen am mittleren Pin eines HF-Ausgangsanschlusses können gefährlich sein. Der HF-Ausgangsanschluss sollte an eine Last angeschlossen werden, bevor das Gerät ans Stromnetz angeschlossen wird. Kommen Sie nicht mit dem Mittelstift des HF-Ausgangsanschlusses oder dem damit verbundenen Zubehör in Kontakt. Bevor Sie die Last vom HF-Ausgang trennen oder diese anschließen, stellen Sie das Gerät in einen nicht betriebsfähigen Zustand.

HÖRSCHUTZ

Sollten die Geräusche, die das Gerät verursacht, 80dB überschreiten, ist Gehörschutz erforderlich.

WARTUNGSHINWEISE

Einstellung, Wartung oder Reparaturen der Ausrüstung dürfen nur von qualifizierten Fachleuten durchgeführt werden. Gefährliche Spannungen können auftreten, wenn Schutzabdeckungen vom Gerät entfernt werden, auch wenn es nicht an die Stromquelle angeschlossen ist. Kontakt kann zu Verletzungen führen. Es können nur bestimmte Ersatzsicherungen mit speziellem Nennstrom verwendet werden.

UMGEBUNGSBEDINGUNGEN

Sofern auf dem Produktspezifikations-Blatt nichts anderes angegeben ist, ist dieses Gerät unter folgenden Bedingungen sicher einsetzbar:

- Gebrauch in Innenräumen
- Höhe bis zu 2000m
- Temperaturen von 5°C bis 40°C
- Maximale relative Luftfeuchtigkeit 80% bei Temperaturen bis 31°C. Lineare Abnahme auf 50% bei 40°C.
- Netzspannungsschwankungen sollen nicht mehr als ± 10% der Nennspannung oder der minimal und maximal eingestellten Werte betragen.
- Verschmutzungsgrad 2: Normalerweise nichtleitfähige Verschmutzung mit gelegentlicher Kondensation. Das Gerät wird bei Einsatz in diesem Bereich keine Gefahr verursachen, die Leistung kann dennoch variieren.

LASER-INFORMATION

AR - Feldsonden (FL/PL-Serie) und Feldanalysatoren (FA-Serie) sind Laserprodukte der Klasse 1 mit eingebetteten Klasse-4-Lasern. Bei normalem Gebrauch kann der Laserstrahlung nicht aus den Glasfaserkabel herausdringen. Sicherheitsverriegelungen sorgen dafür, dass der Laser nur aktiviert wird, wenn die Kabel richtig angeschlossen sind. Lassen Sie stets Vorsicht walten bei der Verwendung oder Wartung von Laserprodukten. Niemals direkt hineinsehen.

HF-ANTENNEN

- Die Ausrüstung (Antenne oder Antennenmontage) ist mitunter schwer. Die Montage erfordert daher oft zwei Personen. Folgen Sie allen in diesem Dokument angegebenen Anweisungen zur Anbringung.
- Stellen Sie sicher, dass alle Anschlüsse für den beabsichtigten Betrieb geeignet sind. Informationen zu den Anschlüssen erhalten Sie im Benutzerhandbuch und im Produktspezifikationsblatt.
- Überschreiten Sie nicht den in Spezifikationen angegebenen maximalen HF-Eingangspegel. Informationen zum geeigneten HF-Pegel erhalten Sie im Benutzerhandbuch und im Produktspezifikationsblatt.
- Ein übermäßiger HF-Eingang könnte das Gerät oder die Anschlüsse beschädigen, was zu Sicherheitsrisiken führt.
- Im Betrieb können die HF-Spannungen an den Antennenelementen gefährlich sein. Kommen Sie nicht mit der Antenne oder Antennenelementen in Kontakt, wenn der HF-Eingang an eine live-HF-Quelle angeschlossen ist.
- Um Verletzungen an Personen, am Leistungsverstärker oder der Antenne zu vermeiden, deaktivieren Sie den HF-Ausgang des Leistungsverstärkers, bevor sie die Eingangsverbindung an die Antenne anschließen oder trennen.
- Kontrollieren Sie die Antennen und die Feldsonde regelmäßig, um die nächstfällige Kalibrierung, den ordnungsgemäßen Betrieb und den Gesamtzustand der Ausrüstung zu überprüfen.

RACK MONTIERBARE TWT-MODELLE

Einige TWT-Modelle kommen ohne die abnehmbare Überdachung, die zur Verwendung als Tischgerät dient. Diese rack-montierbaren Modelle verfügen entweder über installierte Tragegriffe oder Rutschflächen. Befolgen Sie alle in diesem Dokument angegebenen Hebehinweise sowie die Installationsanweisungen in der TWT-Bedienungsanleitung.

HEBEANWEISUNGEN FÜR AR-GERÄTE

Die meisten Geräte müssen während des Versands, der Montage und des Gebrauchs transportiert werden. Jeder Nutzer sollte sich über das Risiko von schweren Verletzungen durch unsachgemäße Produkthandhabung bewusst sein. Leitlinien zur Beseitigung von vermeidbaren Verletzungsrisikos, die beim Heben entstehen können, werden in den NIOSH-Arbeitspraktiken (Veröffentlichung # 94-110) zur Verfügung gestellt:

https://www.cdc.gov/niosh/docs/94-110/pdfs/94-110.pdf.

Beachten folgende, allgemeine Richtlinien zum Heben eines Gewichts von 50 Pfund oder mehr:

- Verwenden Sie zum Heben der Einheit eine Hebeöse (für Platzierung auf dem Boden) oder Seitengriffe (für Platzierung auf einer Arbeitsplatte).
- Verwenden Sie Geräte mit ausreichender Kapazität zum Heben und Stützen.
- Falls Sie einen Gabelstapler verwenden, achten Sie darauf, dass die Gabeln lange genug sind und über die Seiten der Einheit hinausreichen.
- Für weitere Informationen folgen Sie dem oben angegebenen Link.

INSTRUCTIONS POUR UN FONCTIONNEMENT EN TOUTE SÉCURITÉ

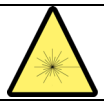
Respectez les consignes de sécurité suivantes pour veiller à votre propre sécurité et vous aider à protéger votre équipement et votre milieu de travail de dommages potentiels.

USAGE PRÉVU

Cet équipement est prévu pour un usage général en laboratoire afin de générer, contrôler et mesurer les niveaux d'énergie de radiofréquence (RF) électromagnétique. Assurez-vous que l'appareil est utilisé dans un endroit qui contrôlera l'énergie rayonnante et ne causera pas de blessure, ni ne violera les niveaux réglementaires d'interférence électromagnétique.

SYMBOLES DE SÉCURITÉ

Ces symboles peuvent apparaître dans votre manuel d'utilisation ou sur l'équipement.

	Ce symbole est apposé sur l'équipement lorsque l'utilisateur doit se référer au manuel pour des informations importantes concernant la sécurité. Le symbole de mise en garde indique un danger potentiel. Vous devez accorder une attention à la déclaration pour éviter tout dommage, destruction ou blessure.
	Présence de tensions dangereuses, soyez très prudent.
	Indique une borne de connexion d'un conducteur externe pour une protection contre l'électrocution en cas de défaillance ou la borne d'une électrode de mise à la terre de protection.
	Indique un rayonnement laser invisible – ne regardez pas directement avec des instruments optiques.
	Indique la borne de connexion de la mise à la terre du cadre ou du châssis.
	Indique un courant alternatif.
	Indique que ce produit ne doit pas être jeté avec vos autres déchets ménagers.
	Indique que la surface marquée et les surfaces adjacentes peuvent atteindre des températures qui risquent d'être chaudes au toucher.

PRÉCAUTIONS D'INSTALLATION DE L'ÉQUIPEMENT

Lisez le manuel d'utilisateur et familiarisez-vous avec tous les marquages et consignes de sécurité. La protection fournie par l'équipement peut être affaiblie s'il est utilisé d'une manière non indiquée par AR RF/instrumentation à hyperfréquence (AR).

- Respectez toutes les instructions de levage indiquées dans ce document.
- Placez l'équipement sur une surface dure et plane.
- N'utilisez pas l'équipement dans un environnement humide, par exemple près d'un lavabo, ou dans un sous-sol humide.
- Positionnez votre équipement de sorte que l'interrupteur d'alimentation soit facilement accessible.
- Laissez un espace minimal de 10,2 cm (4 in) de tous les côtés ventilés de l'équipement pour permettre le flux d'air nécessaire à une bonne ventilation. Ne limitez pas le flux d'air allant dans l'équipement en bloquant tout évent ou entrée d'air. La restriction du flux d'air peut endommager l'équipement, causer des coupures intermittentes ou des dangers pour la sécurité.
- Tenez l'équipement à l'écart de températures extrêmement chaudes ou froides pour veiller à ce qu'il soit utilisé dans la plage de fonctionnement indiquée.
- Lorsque vous installez des accessoires tels que des antennes, des coupleurs directionnels et des sondes de champ, prenez soin d'éviter toute exposition à des niveaux RF dangereux.
- Assurez-vous que rien n'est posé sur les câbles de votre équipement et que les câbles ne se trouvent pas à des endroits où l'on peut marcher dessus ou trébucher.
- Déplacez l'équipement avec soin ; veillez à ce que tous les câbles et/ou roulettes soient solidement raccordés au système. Évitez les arrêts brusques et les surfaces irrégulières.

AVANT LA MISE SOUS TENSION

Votre équipement AR peut disposer de plus d'un câble d'alimentation électrique. Utilisez uniquement un ou des câbles d'alimentation approuves. Si un câble d'alimentation ne vous a pas été fourni avec l'équipement ou pour toute option alimentée en courant alternatif prévue pour l'équipement, achetez un câble d'alimentation qui est approuvé pour être utilisé dans votre pays. Le câble d'alimentation doit être prévu pour l'équipement et pour le courant et la tension indiqués sur l'étiquette de classement électrique de l'équipement.

Installer ou utiliser de façon incorrecte une tension de ligne incompatible peut augmenter le risque d'incendie ou d'autres dangers. Pour aider à éviter toute électrocution, branchez l'équipement et les câbles d'alimentation périphériques dans des prises électriques correctement mises à la terre. Ces câbles sont équipés de prises à trois broches pour veiller à une bonne mise à la terre. N'utilisez pas d'adapteur de prise, ni ne retirez la broche de mise à la terre d'un câble.

Ne modifiez pas les câbles ou les prises d'alimentation. Consultez un électricien agréé ou un technicien d'entretien AR qualifié pour les modifications d'équipement. Respectez toujours les règles locales/nationales de câblage.

N'utilisez pas l'équipement s'il est physiquement endommagé ou s'il manque des pièces ou des panneaux.

MISE À LA TERRE DE SÉCURITÉ

Cet équipement est fourni avec une borne de mise à la terre de protection. La source d'alimentation secteur à l'équipement doit fournir une mise à la terre de sécurité ininterrompue de taille suffisante pour attacher les bornes de câblage, le cordon d'alimentation ou l'ensemble de câbles d'alimentation fourni. ***N'UTILISEZ PAS cet équipement si cette protection est affaiblie.***

INSTRUCTIONS POUR UN FONCTIONNEMENT EN TOUTE SÉCURITÉ

TENSIONS RF DANGEREUSES

Les tensions RF sur la broche centrale d'un connecteur de sortie RF peuvent être dangereuses. Le connecteur de sortie RF doit être connecté à une charge avant que l'équipement ne reçoive l'alimentation en courant alternatif. N'entrez pas en contact avec la broche centrale du connecteur de sortie RF ou des accessoires raccordés à celle-ci. L'équipement doit être dans un état de non fonctionnement avant de déconnecter ou de connecter la charge au connecteur de sortie RF.

LIMITES ACOUSTIQUES

Si le bruit de l'équipement dépasse 80dB, une protection auditive est nécessaire.

AVERTISSEMENT CONCERNANT L'ENTRETIEN

Le réglage, l'entretien ou la réparation de l'équipement doivent être effectués uniquement par un personnel qualifié. Une énergie dangereuse peut être présente lorsque les couvercles de protection sont retirés de l'équipement, même si celui-ci est déconnecté de la source d'alimentation. Un contact peut causer des blessures. Les fusibles de remplacement doivent être d'un type et courant nominal spécifiques.

CONDITIONS ENVIRONNEMENTALES

Sauf mention contraire sur la fiche signalétique du produit, cet équipement est conçu pour être sécuritaire dans les conditions environnementales suivantes :

- Utilisation à l'intérieur
- Altitude jusqu'à 2000 m
- Température de 5°C à 40°C
- Humidité relative maximale de 80 % pour les températures jusqu'à 31°C. Décroissance linéaire à 50 % à 40°C.
- Les fluctuations de tension d'alimentation principale ne doivent pas dépasser ± 10 % de la tension nominale ou des valeurs d'autoréglage minimales et maximales.
- Degré de pollution 2 : Normalement non conducteur avec une condensation occasionnelle. Bien que l'équipement ne cause pas de condition dangereuse dans cette gamme environnementale, sa performance peut varier.

ÉQUIPEMENT CONTENANT DES LASERS

Les sondes de champ AR (série FL/PL) et les analyseurs de champ (série FA) sont des produits laser de classe 1 contenant des lasers intégrés de classe 4. Lors d'une utilisation normale, le rayonnement laser est entièrement contenu dans les câbles à fibres optiques et ne pose aucun risque d'exposition. Des verrouillages de sécurité veillent à ce que le laser ne soit pas activé à moins que les câbles ne soient correctement raccordés. Soyez toujours prudent lorsque vous utilisez ou entretenez des produits laser. Ne regardez pas directement avec des instruments optiques.

ANTENNES RF

- Cet équipement (antenne ou ensemble antenne) peut être lourd nécessitant deux personnes pour le soulever. Soyez prudent lorsque vous installez ou retirez l'unité. Respectez toutes les instructions concernant l'installation et le levage de l'équipement indiquées dans ce document.
- Assurez-vous que les connecteurs sont appropriés pour l'utilisation prévue. Les connecteurs sont indiqués dans le manuel d'utilisation et la fiche signalétique du produit.
- Ne dépassez pas le niveau d'entrée RF maximal indiqué dans les spécifications. Référez-vous au manuel d'utilisation et à la fiche signalétique du produit pour déterminer les niveaux RF applicables.
- Une entrée RF excessive pourrait endommager l'équipement ou les connecteurs causant des dangers pour la sécurité.
- Lorsque l'équipement fonctionne, les tensions RF sur les éléments de l'antenne peuvent être dangereuses. N'entrez pas en contact avec l'antenne ou les éléments lorsque le connecteur d'entrée RF est connecté à une source RF active.
- Pour éviter que le personnel ne se blesse et que l'amplificateur de puissance ou l'antenne ne soit endommagé, désactivez la sortie RF de l'amplificateur de puissance avant de brancher ou débrancher la connexion d'entrée à l'antenne.
- Effectuez des inspections périodiques de l'antenne et des systèmes de sondes de champ pour vérifier la date d'échéance de la calibration, le bon fonctionnement et l'état global de l'équipement.

MODÈLES TWT MONTÉS SUR BÂTI

Certains modèles TWT sont fournis sans le boîtier amovible proposé pour l'utilisation sur un plan de travail. Ces modèles montés sur bâti peuvent être fournis avec des poignées de transport ou des coulisses et poignées frontales. Respectez toutes les instructions de levage indiquées dans ce document et les instructions d'installation fournies dans le manuel d'utilisation TWT.

INSTRUCTIONS DE LEVAGE POUR L'ÉQUIPEMENT AR

Comme la plupart des produits doivent être manipulés pendant la distribution, l'assemblage et l'utilisation, le risque de blessures graves en raison d'une manipulation dangereuse du produit doit être une considération fondamentale pour chaque utilisateur. Une directive faisant autorité pour éliminer le risque injustifié de blessures causées par le levage est fournie par les méthodes de travail de NIOSH (publication n° 94-110) disponibles sur :

https://www.cdc.gov/niosh/docs/94-110/pdfs/94-110.pdf.

De façon générale, respectez les directives suivantes pour lever un poids de 50 lb (22 kg) ou plus :

- Utilisez uniquement l'anneau de levage (si posé au sol) ou les poignées latérales (si sur la table) pour soulever l'unité.
- Utilisez un équipement de capacité adéquate pour soulever et supporter l'unité.
- Si vous utilisez un chariot élévateur pour déplacer l'unité, assurez-vous que les fourches sont assez longues pour s'étendre au-delà du côté de l'unité.
- Pour plus d'informations, suivez le lien indiqué ci-dessus.

INSTRUCTIES VOOR VEILIG GEBRUIK

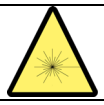
Neem de volgende veiligheidsrichtlijnen in acht om uw persoonlijke veiligheid te helpen waarborgen en uw apparaat en werkomgeving tegen mogelijke schade te beschermen.

BEOOGD GEBRUIK

Dit apparaat is bedoeld voor algemeen laboratoriumgebruik bij het genereren, regelen en meten van niveaus van elektromagnetische radiofrequentie(RF)-energie. Zorg ervoor dat het apparaat wordt gebruikt op een locatie die de uitgestraalde energie controleert, geen letsel veroorzaakt of de reglementaire niveaus van elektromagnetische interferentie schendt.

VEILIGHEIDSSYMBOLEN

Deze symbolen kunnen in uw gebruikershandleiding of op uw apparaat verschijnen.

	Dit symbool staat op het apparaat als de gebruiker de handleiding moet raadplegen voor belangrijke veiligheidsinformatie. Het waarschuwingssymbool geeft een mogelijk gevaar aan. Er moet aandacht worden besteed aan de verklaring om schade, vernietiging of letsel te voorkomen.
	Er zijn gevaarlijke elektrische spanningen aanwezig. Wees uiterst voorzichtig.
	Wijst op een terminal aan die bedoeld is voor aansluiting op een externe geleider voor bescherming tegen elektrische schokken in het geval van een storing, of de terminal van een veiligheidselektrode (aarding).
	Wijst op een onzichtbare laserstraling - bekijk niet rechtstreeks met optische instrumenten.
	Wijst op het frame of het chassis van de aardingsterminal.
	Wijst op wisselstroom.
	Geeft aan dat dit product niet bij het huishoudelijk afval mag worden weggegooid.
	Geeft aan dat het gemarkeerde oppervlak en de aangrenzende oppervlakken temperaturen kunnen bereiken, die warm aanvoelen.

VOORZORGSMAATREGELEN BIJ DE INSTALLATIE VAN HET APPARAAT

Raadpleeg de gebruikershandleiding en leer alle veiligheidsmarkeringen en -instructies kennen. De bescherming die door het apparaat wordt geboden, kan worden belemmerd bij gebruik op een manier die niet wordt vermeld door AR RF/Microwave Instrumentation (AR).

- Respecteer alle tilinstructies die in dit document vermeld zijn.
- Plaats het apparaat op een hard, waterpas oppervlak.
- Gebruik het apparaat niet in een natte omgeving, bijvoorbeeld in de buurt van een gootsteen of in een vochtige kelder.
- Plaats uw apparaat zodanig dat de aan/uit-schakelaar gemakkelijk bereikbaar is.
- Laat een vrije ruimte van 10,2 cm (4 inch) aan alle geventileerde zijden van het apparaat om de luchtstroom die nodig is voor goede ventilatie mogelijk te maken. Belemmer de luchtstroom in het apparaat niet door ventilatieopeningen of luchtinlaten te blokkeren. Het belemmeren van de luchtstroom kan leiden tot schade aan het apparaat, onregelmatige uitvallen of veiligheidsrisico's.
- Houd het apparaat uit de buurt van extreem hoge of lage temperaturen om ervoor te zorgen dat het apparaat binnen het gespecificeerde werkbereik wordt gebruikt.
- Bij de installatie van accessoires zoals antennes, directionele koppelingen en terreinsondes, moet u ervoor zorgen dat blootstelling aan gevaarlijke RF-niveaus wordt voorkomen.
- Zorg ervoor dat er niets op de kabels van uw apparaat rust en dat de kabels zich niet op een plaats bevinden, waar er op getrapt kan worden of waar er over gestruikeld kan worden.
- Verplaats de apparatuur voorzichtig; zorg ervoor dat alle zwenkwielen en/of kabels stevig op het systeem zijn aangesloten. Vermijd plotselinge stops en oneffen oppervlakken.

VOOR HET OPZETTEN VAN DE STROOM

Uw AR-apparatuur kan meer dan een netvoedingskabel bezitten. Gebruik alleen goedgekeurde netvoedingskabel(s). Koopt een netvoedingskabel die is goedgekeurd voor gebruik in uw land als u geen netvoedingskabel hebt ontvangen voor de apparatuur of voor een door wisselstroom aangedreven optie, die bedoeld is voor de apparatuur. De netvoedingskabel moet geschikt zijn voor het apparaat en voor de spanning en stroomsterkte die op het label met de elektrische classificatie van het apparaat staat vermeld.

Het verkeerd installeren of gebruiken van een incompatibele netspanning kan het risico op brand of andere gevaren verhogen. Sluit het apparaat en de perifere netvoedingskabels aan op geaarde stopcontacten om elektrische schokken te helpen voorkomen. Deze kabels zijn uitgerust met driepolige stekkers om voor een goede aarding te zorgen. Gebruik geen adapterstekkers of verwijder de aardingspen van een kabel niet.

Pas geen netvoedingskabels of stekkers aan. Raadpleeg een bevoegde elektricien of een door AR opgeleide servicemonteur voor aanpassingen van de apparatuur. Respecteer altijd uw lokale/nationale bedradingsreglementering.

Gebruik de apparatuur niet als er sprake is van fysieke schade, ontbrekende hardware of ontbrekende panelen.

AARDING

Deze apparatuur is voorzien van een beschermende aardingsterminal. De stroombron van de apparatuur moet een ononderbroken veiligheidsaarding van voldoende grootte leveren om de aansluitklemmen, de netvoedingskabel of de meegeleverde netvoedingskabelset aan te sluiten. ***GEBRUIK dit apparaat NIET als deze bescherming is beschadigd.***

INSTRUCTIES VOOR VEILIG GEBRUIK

GEVAARLIJKE RF-SPANNINGEN

De RF-spanning op de middelste pin van een RF-outputconnector kan gevaarlijk zijn. De RF-uitgangsconnector moet op een massa worden aangesloten voordat er wisselstroom op het apparaat wordt geplaatst. Raak de middelste pin van de RF-outputconnector of de accessoires die erop zijn aangesloten, niet aan. Plaats het apparaat in een niet-werkende staat voordat u de massa loskoppelt of verbindt met de RF-outputconnector.

AKOESTISCHE BEPERKINGEN

Als het geluid van het apparaat 80dB overschrijdt, is gehoorbescherming vereist.

ONDERHOUD WAARSCHUWING

Aanpassing, onderhoud of reparatie van de apparatuur mag alleen worden uitgevoerd door gekwalificeerd personeel. Er kan gevaarlijke energie aanwezig zijn terwijl beschermende afdekkingen van de apparatuur worden verwijderd, zelfs als deze van de stroombron is losgekoppeld. Contact kan tot persoonlijk letsel leiden. Wisselzekeringen moeten van het hetzelfde type en dezelfde stroomsterkte zijn.

OMGEVINGSVOORWAARDEN

Tenzij anders op het productspecificatieblad is vermeld, is dit apparaat ontworpen om veilig te zijn onder de volgende omgevingsomstandigheden:

- Binnengebruik
- Hoogte tot 2000 m
- Temperatuur van 5 °C to 40 °C
- Maximale relatieve vochtigheid 80% voor temperaturen tot 31 °C. Lineair afnemend tot 50% bij 40 °C.
- Schommelingen in de netspanning mogen niet groter zijn dan ± 10% van de nominale spanning of minimum en maximum autobereikwaarden.
- Vervuilingsgraad 2: Normaal niet-geleidend met incidentele condensatie. Hoewel het apparaat geen gevaarlijke toestand veroorzaakt boven dit omgevingsbereik, kunnen de prestaties variëren.

APPARAAT DAT LASERS BEVAT

AR-terreinsondes (FL/PL-serie) en terreinanalysatoren (FA-serie) zijn laserproducten van klasse 1 met ingesloten klasse 4-lasers. Bij normaal gebruik is de laserstraling volledig vervat in de glasvezelkabels en vormt ze geen bedreiging voor blootstelling. Veiligheidsvergrendelingen zorgen ervoor dat de laser niet wordt geactiveerd, tenzij de kabels correct zijn aangesloten. Wees altijd voorzichtig bij het gebruik of het onderhoud van laserproducten. Bekijk niet rechtstreeks met optische instrumenten.

RF-ANTENNES

- Dit apparaat (antenne of antenne-set) kan zwaar zijn, waardoor er twee personen nodig zijn om het op te tillen. Wees voorzichtig bij het installeren of verwijderen van het apparaat. Respecteer alle instructies voor het instellen en optillen van de apparatuur, die in dit document worden vermeld.
- Zorg ervoor dat de connectoren geschikt zijn voor de beoogde werking. De connectoren worden gespecificeerd in de gebruikershandleiding en in het productspecificatieblad.
- Overschrijd het maximale RF-ingangsniveau niet, dat in de specificaties is vermeld. Raadpleeg de gebruikershandleiding en het productspecificatieblad om de toepasselijke RF-niveaus te bepalen.
- Een overmatige RF-input kan het apparaat of de connectoren beschadigen en veiligheidsrisico's veroorzaken.
- De RF-spanningen op de antenne-elementen kunnen gevaarlijk zijn tijdens het gebruik. Raak de antenne of elementen niet aan wanneer de RF-ingangsconnector is aangesloten op een actieve RF-bron.
- Om persoonlijk letsel en onopzettelijke schade aan de vermogensversterker of antenne te voorkomen, schakelt u de RF-output van de vermogensversterker uit voordat u de inputaansluiting op de antenne aansluit of loskoppelt.
- Voer periodieke inspecties uit van de antenne- en terreinsondesystemen om de vervaldatum van de kalibratie, de juiste werking en de algehele conditie van de apparatuur te controleren.

IN EEN REK GEMONTEERDE TWT-MODELLEN

Sommige TWT-modellen worden geleverd zonder de verwijderbare behuizing die wordt aangeboden voor gebruik als tafelmodel. Deze modellen die in een rek kunnen worden gemonteerd, kunnen worden geleverd met handgrepen of sledes en handgrepen die aan de voorkant zijn geïnstalleerd. Volg alle tilinstructies in dit document en de installatie-instructies in de gebruikershandleiding van de TWT.

TILINSTRUCTIES VOOR AR-APPARATUUR

Omdat de meeste producten tijdens de distributie, de assemblage en het gebruik moeten worden behandeld, moet het risico op ernstig letsel als gevolg van een onveilige behandeling van het product een fundamentele overweging voor elke gebruiker zijn. Een gezaghebbende richtlijn voor het elimineren van ongerechtvaardigd risico op letsel veroorzaakt door tillen, wordt aangeboden door de NIOSH-Work Practices (publicatie # 94-110) en is beschikbaar op:

https://www.cdc.gov/niosh/docs/94-110/pdfs/94-110.pdf.

Neem in het algemeen de volgende richtlijnen in acht voor het optillen van een gewicht van 25 kg of meer:

- Gebruik alleen het hijsoog (vloermodel) of de zijhandgrepen (tafelmodel) om de eenheid op te tillen.
- Gebruik apparatuur met voldoende capaciteit om de eenheid op te tillen en te ondersteunen.
- Als u een vorkheftruck gebruikt om de eenheid te verplaatsen, zorg er dan voor dat de vorken lang genoeg zijn om tot voorbij de zijkant van het eenheid uit te steken.
- Volg de link hierboven voor meer informatie.

SAFETY SUMMARY

The following general safety precautions must be observed during all phases of operation and maintenance of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Boonton Electronics assumes no liability for the customer's failure to comply with these requirements.

DO NOT OPERATE THE INSTRUMENT IN AN EXPLOSIVE ATMOSPHERE

Do not operate the instrument in the presence of flammable gases or fumes.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with the power cable connected. Under certain conditions dangerous voltages may exist even though the power cable was removed, therefore; always disconnect power and discharge circuits before touching them.

DO NOT SERVICE OR ADJUST ALONE

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT

Do not install substitute parts or perform any unauthorized modifications on the instrument. Return the instrument to Boonton Electronics for repair to ensure that the safety features are maintained.

SAFETY SYMBOLS

This safety requirement symbol has been adopted by the International Electro-technical Commission, Document 66 (Central Office) 3, Paragraph 5.3, which directs that an instrument be so labeled if, for the correct use of the instrument, it is necessary to refer to the instruction manual. In this case it is recommended that reference be made to the instruction manual when connecting the instrument to the signal source and USB host.

The CAUTION symbol denotes a hazard. It calls attention to an operational procedure, practice or instruction that, if not followed, could result in damage to or destruction of part or all of the instrument and accessories. Do not proceed beyond a CAUTION symbol until its conditions are fully understood and met.

The NOTE symbol is used to mark information which should be read. This information can be very useful to the operator in dealing with the subjects covered in this section.

The HINT symbol is used to identify additional comments which are outside of the normal format of the manual, however can give the user additional information about the subject.

TABLE OF CONTENTS

1. GENERAL INFORMATION

The user manual provides the information needed to install, operate and maintain the AR PSP Series Wideband USB Power Sensors, Pulse.

Chapter 1 is an introduction to the manual and the instrument. Throughout the manual, the designation PSP Series includes models PSP001 to PSP005.

1.1 ORGANIZATION

The manual is organized into seven chapters, as follows:

Chapter 1 - General Information presents summary descriptions of the instrument and its principal features, accessories and options. Also included are specifications for the instrument.

Chapter 2 – Hardware Installation provides instructions for unpacking the instrument, setting it up for operation, connecting power and signal cables, and initial power-up.

Chapter 3 - Getting Started describes the operation of Power Sensor and the PulsewARe software.

Chapter 4 - Remote Programming explains the command set and procedures for operating the instrument remotely.

Chapter 5 – Making Measurements provides definitions for key terms used in this manual and on the GUI displays as well as methodologies used to calculate automated pulse, marker and statistical measurements.

Chapter 6 - Maintenance includes procedures for installing software and verifying fault-free operation.

1.2 DESCRIPTION

The PSP Series sets the standard for fast RF power measurements. This modular product line offers speed and accuracy never before seen in a USB form factor. The new line includes 6, 18 and 40 GHz models, and is designed for measurement of wideband modulated signals.

The PSP Series power sensors turn your PC or laptop, using a standard USB 2.0 port, into a state of the art peak power analyzer without the need for any other instrument. Power measurements from the PSP Series can be displayed on your computer or can be integrated into a test system with a set of user-defined software functions.

The PSP Series include the models PSP001 through PSP005 wideband USB peak power sensors. Collectively they cover a frequency range of 50 MHz to 40 GHz. Offering broad band measurements with rise times from 3 ns, 100ps time resolution and video bandwidths of 195 MHz the PSP Series enables rapid pulse integrity determinations. Effective sampling rate up to 100x faster than conventional power meters so finer waveform details are visible. Capture over/undershoot, droop, edge delay and skew timing, ringing, rise/fall transition times.

The PSP Series power sensors have exceptional trigger stability of less than 100 ps trigger jitter regardless of the trigger source which yields much greater waveform detail because a stable trigger point yields a stable waveform. Using dedicated trigger circuitry rather than software-based triggering provides precise timestamping of relative trigger-to-sample delay. This precision permits the use of random interleaved sampling (RIS) for repetitive waveforms with resulting effective sampling rate of 10 GS/s which permits accurate, direct measurement of fast timing events without requiring interpolation between samples.

Power processing provides power integrity measurements because every pulse is analyzed and none are discarded. Trace acquisition, averaging and envelope times are drastically reduced resulting in simultaneous analysis of average, peak and minimum power.

The PSP Series Wideband USB peak power sensors are supported by AR PulsewARe, a Windows-based software package that provides control and readout of the sensors. It is an easy to use program that provides both time and statistical domain views of power waveforms with variable peak hold and persistence views. Power measurements are supported using automated pulse and statistical measurements, power level and timing markers. The GUI application is easily configured with dockable or floating windows and measurement tables that can be edited to show only the measurements of interest.

The PSP Series sensors are ideal for manufacturing, design, research, and service in commercial and military applications such as telecommunications, avionics, RADAR, and medical systems. They are the instrument of choice for fast, accurate and highly reliable RF power measurements, equally suitable for product development, compliance testing, and site monitoring applications.

1.3 ARCHITECTURE

The Sensor functions as an ultra-fast, calibrated power measurement tool, which acquires and computes the instantaneous, average and peak RF power of a wideband modulated RF signal. The internal A/D converter operates at up to 100Msamples/second, and a digital signal processor carries out the work required to form the digital samples into a correctly scaled and calibrated trace on the display. Figure 1.1 shows a block diagram of the peak power sensor.

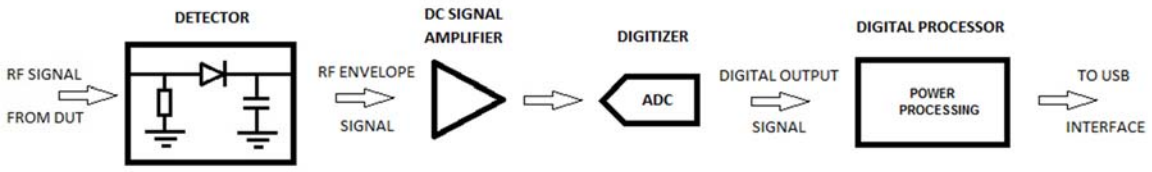


Figure 1-1 PSP Series Block Diagram

The first and most critical stage of a peak power sensor is the detector, which removes the RF carrier signal and outputs the amplitude of the modulating signal. The width of the detector's video bandwidth dictates the sensor's ability to track the power envelope of the RF signal. The picture on the left in Figure 1-2 below shows how a detector with insufficient bandwidth is unable to faithfully track the signal's envelope, therefore affecting the accuracy of the power measurement. The detector on the right has sufficient video bandwidth in order to track the envelope accurately. The fast detectors used in peak power sensors are by their nature non-linear, so shaping procedures within the digital processor must be used in order to linearize their response. When measuring instantaneous peak power, a high sample rate is important in order to ensure that no information is lost. The PSP Series has a sample rate of 100MHz, enabling capture and analysis of power versus time waveforms at very high resolution.

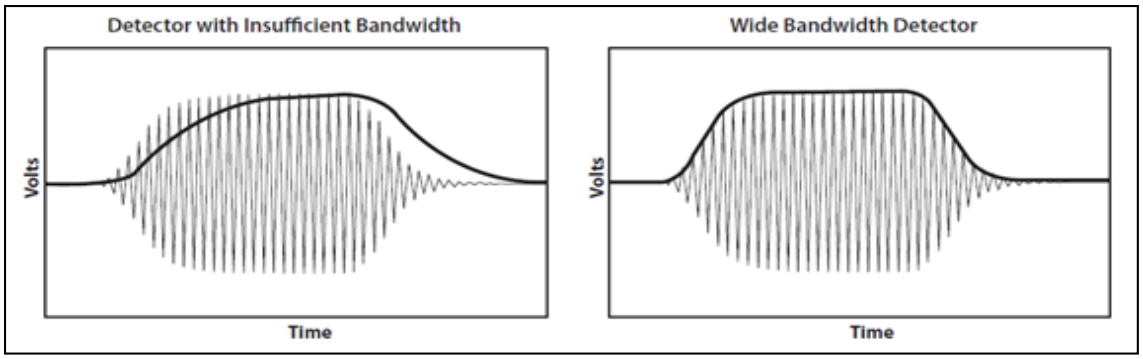


Figure 1-2 Detector Envelope Tracking Response

1.4 PSP SERIES FEATURES

Features	Benefits
Power Processing By combining a dedicated acquisition engine, hardware trigger, deep sample memory, and a real-time optimized parallel processing architecture, the PSP Series achieves sustained acquisition speeds exceeding 100,000 triggered sweeps per second.	Power processing ensures that no signal information is missed due to the "snapshot" approach employed by traditional power meters and USB sensors where processing and re-arm latency can range from 10 to 300 milliseconds for typical triggered pulse measurements. Gap-free gated and continuous statistical analysis can be performed concurrently at a sustained 100 MSPS.
High Sample Rate Continuous sample rate is 100 MSPS, with a 10 GSPS effective sample rate and 100 picosecond time resolution for repetitive signals.	The high sample rate is more than one hundred times faster than most existing USB power sensors, and enables exceptional trigger stability and waveform fidelity when characterizing complex modulation and pulsed signals.
Advanced triggering features The PSP Series can be triggered on the internal RF or an external TTL signal. It includes trigger holdoff, which delays the re-arming of the trigger when multiple trigger events are available.	Multiple trigger sources allow greater measurement flexibility. Trigger Delay/offset for precision propagation measurements. Trigger holdoff is useful when working with signals with multiple trigger events such as packetized communications.
Excellent Trigger stability Trigger with less than 100 ps trigger jitter.	Better measurement uniformity especially when making multi-channel measurements.
High Video Bandwidth The PSP Series has a video bandwidth of up to 195MHz for spread-spectrum signals and measures rise times as fast as 3ns.	High video bandwidth enables the analysis of both very short bursts and very broadband signals including timing, average power and crest factor measurements.
Simultaneous Display of Average and Envelope Power Trace view may be configured to show the average power trace overlaid on a shaded representation of the peak-to-peak RF envelope.	Get the total picture of power by seeing the minimum, peak, and average power all at the same time.
Automatic Measurements Power displays complemented by fully customizable automatic measurement parameters along with user settable markers and reference levels.	Fully characterize measurements with numeric measurement parameters, markers, and reference levels. Customizable measurements let you show only the desired parameters.
Statistical analysis Display a signal's statistical power distribution using complementary cumulative distribution function (CCDF) graphs.	The 100 MSPS sustained statistical acquisition rate enables statistical analysis vital for showing dynamic effects such as RF compression and analyzing modern multi-carrier communications systems.
Support of Multi-Channel Analysis Data from up to eight sensors can be displayed and measured on a common computer.	Simultaneous analysis of input/output and multi-channel measurements, showing functional relationships.
Compact Size, Rugged Construction The PSP Series sensors are compact and rugged, with all-metal construction.	Portable form factor makes it easy to integrate into a system. Rugged construction helps guarantee long life, durability and reliability.
Stable Calibration PSP Series sensors are factory calibrated and require no routine calibration before or during use.	Quicker measurement with minimum downtime due to lack of routine calibration.
Very flexible set-up and system integration	Small size, universal USB connection, multi-channel compatibility, and no need for routine calibration make it an ideal system instrument.

PSP Series

Power Sensor-Pulse

- PSP001-PSP005
- 50MHz-40GHz
- PSP102
- 4kHz-6GHz

Features

PSP Series USB pulse power sensors turn your PC or laptop, using a standard USB 2.0 port, into a power analyzer without the need for any other instrument. Power measurements from the PSP Series can be displayed on the PC or can be integrated into a test system with a set of user-defined software functions. A Status LED on the sensor provides indication of the operational state for diagnostic purposes.

Multiple models of PSP power sensors are available to accommodate a wide array of test applications and modulation types. With choices of frequency coverage and pulse capability, the PSP series of sensors provide models to satisfy most any modulation measurement requirement, with no gaps in signal acquisition, and zero measurement latency, far surpassing conventional power meters.

The PSP power sensors incorporate a unique parallel processing methodology that performs the multi-step process of RF power measurement at incredible, unmatched speeds. While conventional power meters and USB sensors perform steps serially, resulting in long re-arm times and missed data, PSP sensors capture, display and measure every pulse, glitch and detail with no gaps in data and zero latency.

Combining these characteristics with pulse profiling, capture and measure of pulsed, CW and modulated signals, multi-channel capabilities and documentation tools, PSP power sensors are the ideal instrument for fast, accurate and reliable RF power measurements.

Processing in real time provides greater power integrity measurements because every pulse is analyzed and none are discarded. Trace acquisition, averaging and envelope times are drastically reduced resulting in simultaneous analysis of average, maximum and minimum Power.

PSP pulse power sensors are supported by both AR's emcware® software and PulsewARe. PulsewARe is a Windows-based software package that provides control and readout of the sensors. They provide both time and statistical domain views of power waveforms with variable peak hold and persistence views. Power measurements are supported using automated pulse and statistical measurements, power level and timing markers. The GUI application is easily configured with dockable or floating windows and measurement tables that can be edited to show only the measurements of interest.

PSP sensors are ideal for manufacturing, design, research, and service in commercial and military applications such as telecommunications, avionics, RADAR, and medical systems. They provide fast, accurate and reliable RF power measurements, suitable for product development, compliance testing, and site monitoring applications.

The export classification for this equipment is EAR99. These commodities, technology or software are controlled for export in accordance with the U.S. Export Administration Regulations. Diversion contrary to U.S. law is prohibited

AR RF/Microwave Instrumentation
160 School House Rd
Souderton, PA 18964
215-723-8181

For an applications engineer call:800.933.8181

www.arworld.us

PSP Series

Power Sensor-Pulse

- PSP001–PSP005
- 50MHz–40GHz
- PSP102
- 4kHz–6GHz

General Specifications–PSP001–PSP005

Sampling Techniques: Real-time/Equivalent Time/Statistical Sampling

Continuous sample rate: 100 MHz

Effective sample rate: 10 GHz

Time Resolution: 100 ps

Statistical Analysis: Continuous or gated CCDF

Statistical Speed: 100M points/sec

Trigger Sources: Internal or External TTL

External Trigger in/out: TTL in (slave) or out (master), SMB connector

Minimum Trigger Width: 10 ns

Maximum Trigger Frequency: 50 MHz

Trigger Jitter: 0.1 ns rms

Trace Acquisition Speed: 100K sweeps/second

Measurement Speed:
100K meas/sec (buffered mode)
over USB 800 meas/sec (continuous)

Trigger Modes: Auto, Normal, Single, Free run

Trigger Arming: Continuous, Trigger Holdoff, Frame (gap) Holdoff

Remote Connectivity: USB 2.0, type B connector

Command Protocol: IVI-C and IVI-Com

Maximum Input Power: 200mW avg, 1W for 1us peak

Size (LxWxH): 145 x 43 x 43 mm (5.7 x 1.7 x 1.7 in)

Weight: 363 grams/0.8 lbs.

Power Consumption: 2.5W max (USB high power device)

Operating Temperature: 0 to 55°C

Storage Temperature: -40 to 70°C

Export Classification: EAR99

Included Accessories:

USB Cable: A-B Locking, 1.8m (6 ft)

External Trigger Multi I/O Cable: SMB-BNC

Trigger Sync Cable: SMB-SMB

Model Configurations–PSP001-PSP005

Specifications	PSP001	PSP002	PSP003	PSP004	PSP005
RF Frequency Range	50 MHz to 6 GHz	50 MHz to 18 GHz	50 MHz to 40 GHz	50 MHz to 18 GHz	50 MHz to 40 GHz
Average Dynamic Range	-60 to+20 dBm	-34 to +20 dBm	-34 to +20 dBm	-50 to +20 dBm	-50 to +20 dBm
Pulse Dynamic Range	-50 to +20 dBm	-24 to +20 dBm	-24 to +20 dBm	-40 to +20 dBm	-40 to +20 dBm
Internal Trigger Range	-38 to +20 dBm	-10 to +20 dBm	-10 to +20 dBm	-27 to +20 dBm	-27 to +20 dBm
Risetime (fast/slow)	3 ns/<10 µs	5 ns/<10 µs	5 ns/<10 µs	<100 ns/<10 µs	<100 ns/<10 µs
Video Bandwidth	195 MHz/350 kHz	70 MHz/350kHz	70 MHz/350 kHz	6 MHz/350 kHz	6 MHz/350 kHz
Single-shot Bandwidth	35 MHz	35 MHz	35 MHz	6 MHz	6 MHz
RF Input	Type N, 50 ohm	Type N, 50 ohm	2.92 mm, 50 ohm	Type N, 50 ohm	2.92 mm, 50 ohm
VSWR	1.25 (0.05-6 GHz)	1.15 (.05-2.0 GHz) 1.28 (2.0-16 GHz) 1.34 (16-18 GHz)	1.25 (.05-4.0 GHz) 1.65 (4-38 GHz) 2.00 (38-40 GHz)	1.15 (.5-2.0 GHz) 1.20 (2.0-6.0 GHz) 1.28 (6.0-16 GHz) 1.34 (16-18 GHz)	1.15 (.05-2.0 GHz) 1.65 (4.0-38 GHz) 2.00 (38-40 GHz)

PSP Series

Power Sensor-Pulse

- PSP001–PSP005
- 50MHz–40GHz
- PSP102
- 4kHz–6GHz

General Specifications–PSP102

Sampling Techniques: Real-time/Equivalent Time

Continuous sample rate: 25 MSPS

Effective sample rate: 1 GSPS

Time Resolution: 1 ns

Trigger Sources: Internal or External TTL

External Trigger in/out: TTL in (slave) or out (master)

Minimum Trigger Width: 4 μs

Maximum Trigger Frequency: 120 kHz

Trigger Jitter: 1 ns rms; 20 ns rms (external)

Trace Acquisition Speed: >30k sweeps/second

Measurement Speed:
100K meas/sec (buffered mode)
over USB 1000 meas/sec (continuous)

Trigger Modes: Auto, Normal, Single, Free run

Trigger Arming: Continuous, Trigger Holdoff, Frame (gap) Holdoff

Remote Connectivity: USB 2.0, type B connector

Command Protocol: IVI-C and IVI-Com

Maximum Input Power: 200mW avg, 1W for 1μs peak

Size (LxWxH): 145 x 43 x 43 mm (5.6 x 1.7 x 1.7 in)

Weight: 363 grams/0.8 lbs.

Power Consumption: 2.0W max (USB high power device)

Operating Temperature: 0 to 55°C

Storage Temperature: -40 to 70°C

Export Classification: EAR99

Included Accessories:

USB Cable: A-B Locking, 1.8m (6 ft)

External Trigger Multi I/O Cable: SMB-BNC

Trigger Sync Cable: SMB-SMB

Model Configurations–PSP102

Specifications	PSP102
RF Frequency Range	4 kHz to 6 GHz
Average Dynamic Range	-60 to +20 dBm
Pulse Dynamic Range	-45 to +20 dBm
Internal Trigger Range	-40 to +20 dBm
Risetime (fast/standard)	2 μs/1 ms
Video Bandwidth (high/std)*	175 kHz/350 Hz
RF Input	Type N, 50 Ohm
VSWR	1.15 (0.01-2.0 GHz) 1.20 (2.0-6 GHz)

* In High sensitivity mode, the PSP sensor changes to standard bandwidth mode automatically-video bandwidth changes to 350Hz.
At frequencies <10MHz, the PSP sensor changes to high sensitivity mode automatically.

2. Hardware Installation

This section contains unpacking and repacking instructions, power requirements, connection descriptions and preliminary checkout procedures.

2.1 UNPACKING & REPACKING

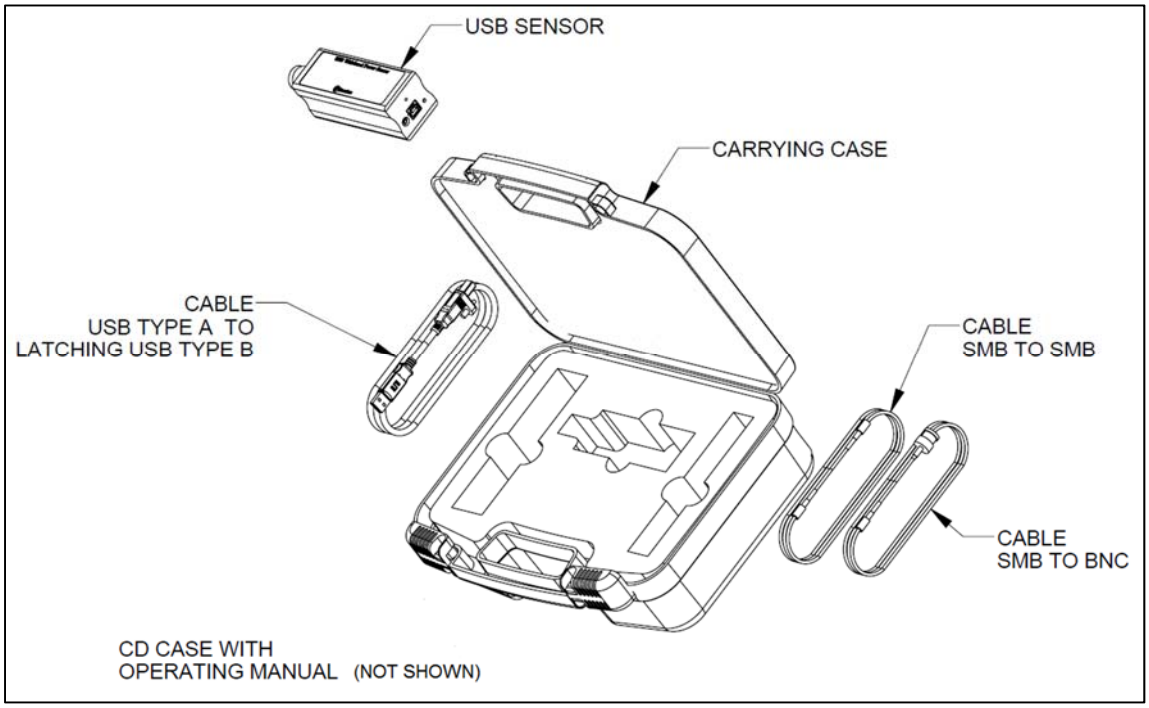


Figure 2-1 PSP Series Sensor kit contents

The PSP Series Wideband USB Power Sensor, Pulse is shipped complete and is ready to use upon receipt.

NOTE: *Save the packing material and container to ship the instrument, if necessary. If the original materials (or suitable substitute) are not available, contact AR to purchase replacements. Store materials in a cool, dry environment.*

Before you start, make sure you have the following items in your PSP series USB Power Sensor package as shown in Figure 2-1.

1. PSP Series Wideband USB Power Sensor-Pulse
2. USB Type-A Cable (6 ft)
3. External Trigger Multi-I/O Cable (SMB to BNC)
4. Trigger Sync Cable (SMB to SMB) for triggering multiple sensors
5. CD containing link to AR PulsewARe Software

If any of these items are missing or damaged, then please contact your local representative immediately and refer to **Contact and Support** section of this guide.

2.2 INSTALLING PULSEWARE SOFTWARE

This section describes the installation and use of AR PulsewARe software for PSP series wideband USB sensors. Before you start, check your PC for software compatibility.

CAUTION: *Do not connect the power sensor to your PC until you have installed the AR PulsewARe software.*

The AR PulsewARe software requires the following minimum computer characteristics:

- Windows XP SP3 and above
- 512 MB RAM
- 1 GHz Processor
- USB Port (2.0 or greater)

2.2.1 Procedure

To install the AR PulsewARe software, follow these steps:

1. PulsewARe installation **.zip** file package can be downloaded from the AR website in the Downloads section.

2. Extract the zip file and run the **pulsewAReLauncher.exe** with admin permissions. Depending on windows OS system configuration and installed software, you may need to click through and accept multiple installation notifications, windows security warnings, and prompts.

3. Now the PulsewARe software installation wizard will appear. Click through to license agreement, read, and accept to continue with the installation process.

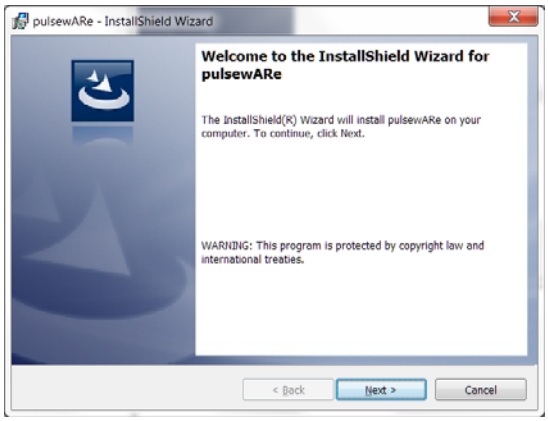


Figure 2-3

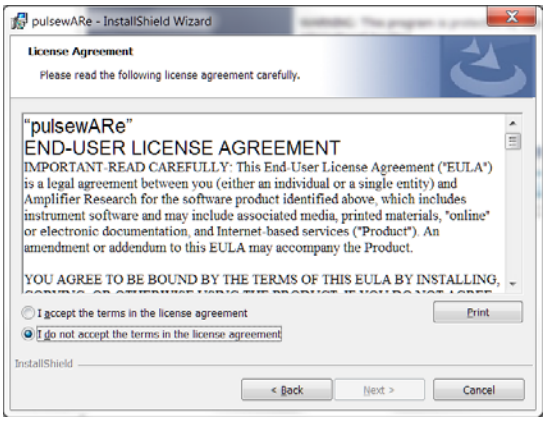


Figure 2-4

4. By default, the main software application will be installed as shown below. Click **Install** to continue.

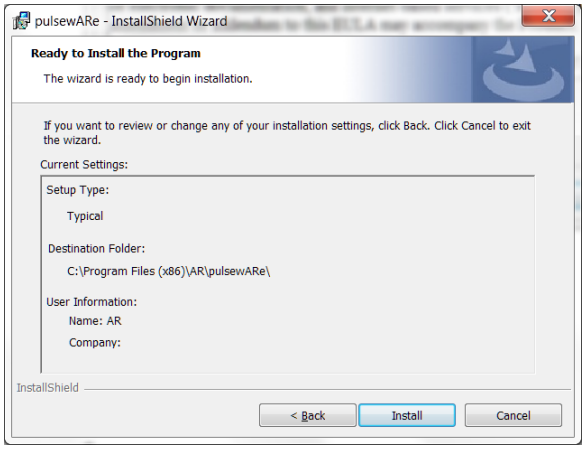


Figure 2-5

5. During installation, the progress will be shown as seen below.

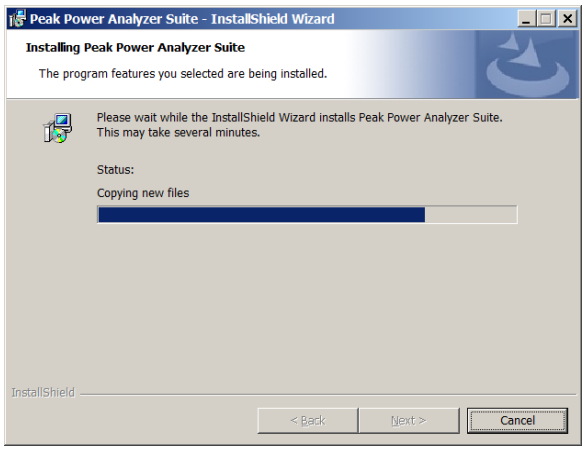


Figure 2-6

6. Once the installation is done successfully, click **Finish** to exit the wizard.

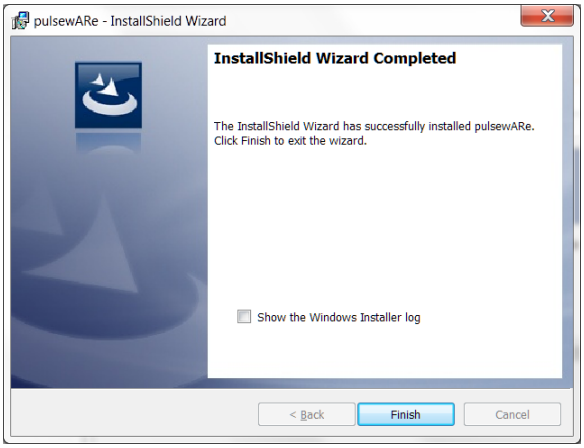


Figure 2-7

2.3 SENSOR CONNECTIONS

The end panel of the PSP Series Power sensor shown below, has two connectors and the **Status** LED. The center connector is a USB Type B receptacle used to connect the PSP Series power sensor to the host computer. The connector labeled **Multi I/O** is an SMB plug and can serve as a trigger input, status output, or as a trigger synchronization interconnect when multiple PSP Series sensors are used.

Connect the PSP Series USB sensor to your PC through the supplied USB cable. Note that the cable should be secured to the sensor using the captive screw on the USB plug. The power sensor is USB 2.0 compatible. It is recommended that you use the USB cable supplied with your sensor.

Connect USB Sensor to RF Source. All PSP-series sensor models are equipped with either a precision Type-N male RF connector or a precision, 2.92 mm male RF connector. Connect the sensor to the RF signal to be measured.

Figure 2-8

CAUTION: *Do not rotate the body of the sensor when connecting the sensor to a unit under test (UUT). To avoid internal sensor damage, connect and disconnect the sensor by turning the metal nut only.*

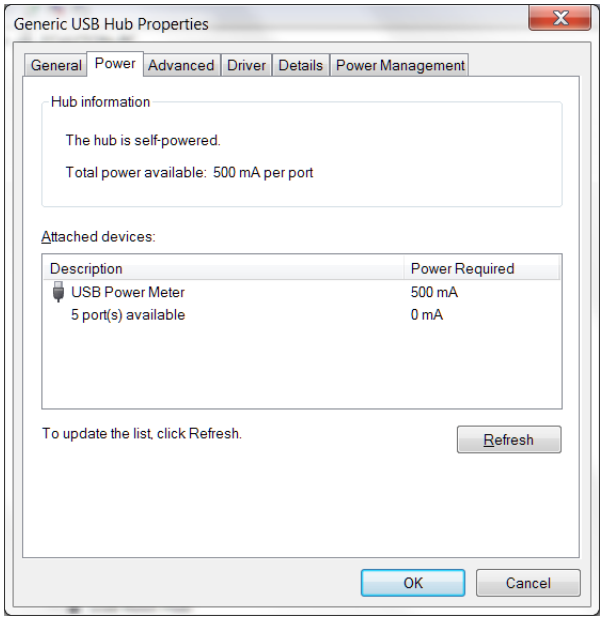
CAUTION: *Ensure that you do not apply any excessive force on the sensor once it has been connected.*

CAUTION: *Do not apply RF power levels greater than +20 dBm to the RF input of the sensor.*

2.4 POWER REQUIREMENTS

The PSP Series sensors require 2.5 Watts at 5 Volts, this is supplied via a USB port. The PSP Series MUST be connected to a USB 2.0 port that is able to supply the full 500mA.

NOTE: *Usually a USB 2.0 port is capable of supplying 500 mA current through its port. When an unpowered USB hub is used (sometimes the hub is internal), available current may need to be shared between connected devices.*



To assess the available power, on the USB 2.0 port the PSP Series sensor is connected to, open the host computer's **Device Manager>USB Controllers>Generic USB Hub** and then right click and check the properties windows under **Power** tab. See figure at right for a Windows Power Dialog example.

Figure 2-9

2.5 STATUS LED CODES

The end panel, shown in Section 2.3, includes a Status LED. The color and flash pattern indicates the sensor's status as described on the label on the side panel shown below.

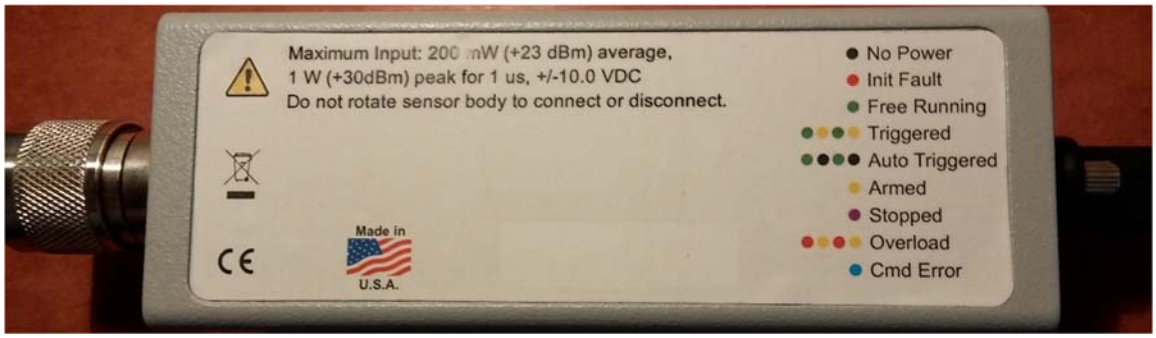


Figure 2-10. The information label on the side of the PSP Series sensor contains information on the maximum power levels the device can handle and the meaning of the various status LED flash patterns.

The PSP Series Power Sensor is now ready to operate as described in Chapter 3, **Getting Started**.

3. Getting Started

This chapter will introduce the PSP Series Wideband USB Peak Power Sensor, and will discuss basic connection and operation.

3.1 CONNECTING THE PSP SERIES SENSOR

Following unpacking and software installation discussed in Chapter 2 of this guide, a sensor device can be connected to the USB port of the PC.

Connect the sensor to the USB port before starting pulsewARe. The first time the sensor is connected, there will be a one-time driver file installation. Wait until you see an automatic device detection message and Windows OS installs the driver file. Note, older operating system may behave differently.

3.2 INTRODUCTION TO AR PULSEWARE SOFTWARE

Once you have installed the software and connected the PSP Series sensor to the PC, you are ready to make measurements using the AR PulsewARe software application.

Open pulsewARe from the **AR** group in the Windows Start Menu or by double clicking on the desktop icon.

A splash screen will welcome you to the application.

Figure 3-1. The AR PulsewARe splash screen.

Under **Available Resources**, a pop-up box will appear as below with the list of connected devices name and hardware information. The initial view of the AR PulsewARe software is shown in Figure 3-2.

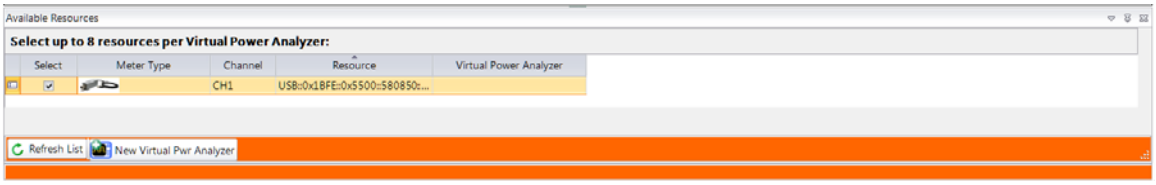


Figure 3-2 The Available Resources box shows connected devices

In the Available Resources window, check the **Select** box for the connected sensor(s), then click ***New Virtual Pwr Analyzer***. This will launch a new Virtual Power Analyzer instance containing trace and control windows. If you have a RF signal connected already to the USB sensor, the measured signal's waveform will appear in the trace window.

A Virtual Power Analyzer is analogous to a benchtop RF Peak Power Analyzer with one or more sensors connected. Time and trigger controls are typically common to all sensors within a Virtual Power Analyzer, while channel-specific controls are available for most other settings. This offers users the familiar, multi-channel approach common to power meters and oscilloscopes.

When independent control of timebase-related settings is desired, it is possible to open multiple Virtual Power Analyzers, each with their own full set of controls.

3.3 DOCKING WINDOWS

AR pulsewARe uses dockable windows to allow the user to arrange the various windows in the configuration of their choice. You can drag a docked window by clicking its title bar. This action enables you to move the window to a different docked position or undock it.

To dock tool windows:

1. Click the tool window you want to dock.

2. Drag the window toward the middle of the software main window.

3. A guide diamond will appear with four arrows pointing toward the four sides of the main window.

4. When the tool window you are dragging reaches the location where you want to dock it, move the pointer over the corresponding portion of the guide diamond. The designated area is shaded blue.

5. To dock the window in the position indicated, release the mouse button. Note that docked windows can be overlapped. By selecting individual tabs, it is possible to resize each tool windows and can be repositioned as below picture.

6. Alternatively, you can dock a tool window to a portion of one of the side walls of the software by dragging it to the side until you see a secondary guide diamond. Click one of the four arrows to dock the tool window to that portion of the side wall.

NOTE: *Each of the tool windows is highlighted as a rectangular box to be positioned by dragging in any direction within the main window. You can always rearrange these tool windows as you prefer to see them within your main software window.*

3.4 MAIN APPLICATION

The main application window is divided into several major sections and dockable windows depending on the type of measurement selection. These windows can be arranged easily by docking and undocking within the main application display area.

3.4.1 Available Resources Window

Sensors can be selected from the **Available Resources** window as shown previously in Figure 3.2. A description for each connected resource will indicate the hardware version, model and channel information including alias. User can select up to eight resources per Virtual Power Analyzer. Following resource selection, click on **New Virtual Pwr Analyzer** and a new Virtual Power Analyzer instance will open with a default configuration suitable for pulse measurements.

3.4.2 The Main Toolbar

Each Virtual Power Analyzer displays a Main Toolbar at the top of its window which hosts shortcuts to commonly used functions and measurements. The Main Toolbar is shown grouped; individual groups can be dragged to re-order or compact the toolbar.

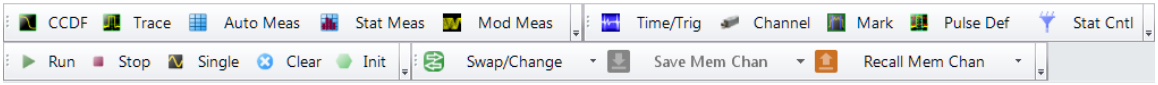


Figure 3-3. Main Toolbar Controls

3.4.3 Trace View Window

In order to display a pulse measurement, users must select the Trace icon from the Main Toolbar.

The Channel settings and Time/Trig settings related to pulse measurement can be selected from Main Toolbar and can be applied to the measurement.

The AR pulsewARe application allows the user to directly enter numeric values for most settings in the Channel Control and Time/Trigger windows. For many of the controls, additional methods such as increment/decrement or preset buttons are available.

3.4.3.1 Trace Pan and Zoom

The mouse can be used to select a zoom area to view detail in an area of interest on the displayed waveform. The highlighted dragged rectangular area indicates the minimum area that will be shown when the zoom operation completes.

Horizontal pan or zoom adjusts the timebase (within preset values) and the trigger delay to highlight an area of interest without vertical rescaling.

The user can also directly pan or zoom to waveform areas of interest by selecting any option from the lower toolbar of the trace window. Available options for zoom/pan control are: Horizontal & Vertical, Horizontal, Pan and None with Undo and Redo selections.

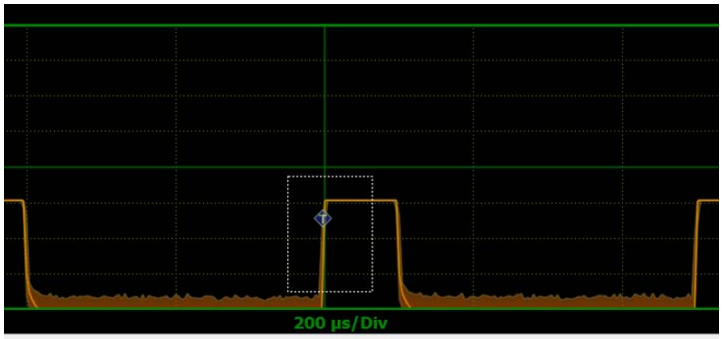


Figure 3-4. Clicking on the Trace View display and dragging will open a zoom box, releasing the mouse button will result in the trace being expanded to show the area contained in the zoom box

3.4.3.2 AutoSet

The Auto Set button below the trace window attempts to configure level scaling, trigger level and timing for a "best fit" display based upon amplitude and timing of the applied signal. All other parameters are set back to defaults. If the AutoSet process fails, all settings are left untouched.

3.4.3.3 Trace Data Export

Any trace window can be exported, and saved or printed as a PDF or CSV document by selecting the Export button from the lower toolbar of the trace window. An exported trace file can easily be imported into a spreadsheet or other report file or documentation.

3.4.4 Channel Control Window

Select the Channel icon and a dockable sidebar will appear on the right hand side of the main application window by default. This allows you to change all related settings to control one or more sensor channels. Channel control setting is defined by several parameters as listed below.

Channel: Select one or all channels (for multi-channels) via the drop down list. Selecting the **All** permits simultaneous update on all measurement channels (up to 8) for most settings.

Units: Selects dBm, Watts or Volts measurement units. Selection affects displayed text, measurements, and trace.

Vert Scale/Center: Sets vertical amplitude scaling and centering of the displayed waveform. These settings affect only the trace display.

Sensor Enabled: Enable or disable individual connected sensors.

Trace Avg: Sets number of acquired sweeps averaged together for displayed trace in pulse/triggered modes. Useful for noisy signals.

Mod Filter/Filter Mode: Sets manual or automatic filter integration time window for measurements in modulated (non-triggered) acquisition modes.

Peak Hold Mode/Decay Count: Sets peak hold duration (# of sweeps). Tracks Trace Avg setting or may be independent.

Video BW: Selects sensor video bandwidth, high or low.

Frequency: Sets measurement frequency for the applied RF signal.

Cal&Corrections: Offset compensates reading for external gain/loss.

Zeroing and Fixed cal: Sensor zeroing and fixed calibration can be performed by selecting each specific button.

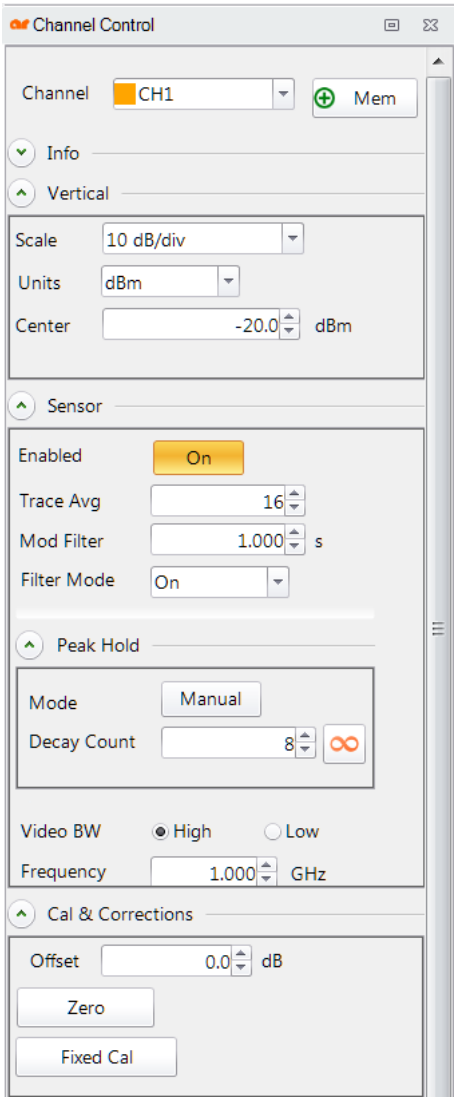


Figure 3-5. Channel Control Menu

3.4.5 Time/Trigger Settings Window

By selecting the Time/Trig icon you will be able to customize all related settings for both timebase and trigger of a pulse signal.

Timebase: Acquisition time in seconds per division. PSP peak power meters use a fixed grid of 10 divisions for the sweep extents. Settings are in a 1-2-5 sequence. Consult series specifications for timebase range.

Trigger Delay: Trigger delay can be adjusted by manually entering a numerical value into the field or using the up-down arrow keys. Click the **0** icon to reset the trigger delay to zero seconds.

Trigger Position: Trigger position can be changed by entering numerical values into the **Divisions** field, clicking the scroll arrows, dragging the slide control, or by clicking the L/M/R (Left/Middle/Right) indicators.

Trigger Source: Several trigger modes are available for each trigger source under **Trigger Control** section. Multiple trigger sources are available under the drop down list including both **Internal** and **External** selection.

Trigger Mode: Select Normal, Auto, AutoLevel or Free run.

Trigger Level: Sets trigger level when trigger source is INT and trigger mode is Auto or Normal.

Slope: Select rising or falling edge triggering.

Holdoff: Sets trigger holdoff time and selects between Normal or Gap holdoff mode.

Trigger Skew Adjustment: This feature allows the user to adjust the skew for internal trigger with master trigger output, and also external and slave triggers. Skew adjustments allows to calibrate out trigger delay between sensors so the user can measure propagation delay of the DUT from input to output. Manual skew adjustments can be made by entering the skew value in the numeric entry field. The button to the right of each skew adjustment is the Auto-Skew button which allows automatic adjustment of the skew.

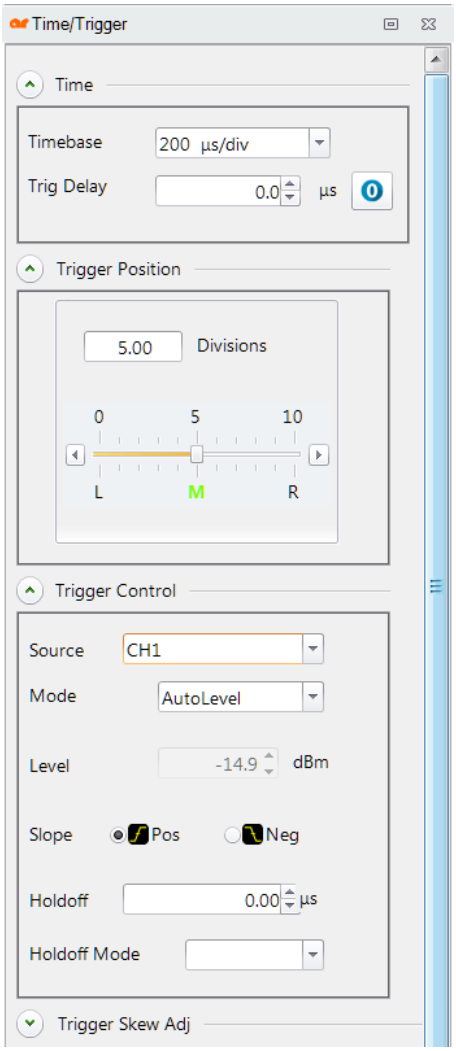


Figure 3-6 Time/Trigger Menu

3.4.6 Marker Settings Window

Clicking the Mark button will open a window to control settings for time markers and amplitude reference lines of a pulse signal.

Markers: Time Marker position settings will allow you to change both marker 1 and marker 2 time positions by using either arrow keys or entering numerical values into the field. It will also display the time delta value between the two markers.

Reference Lines: Also known as Horizontal Markers, can be enabled by selecting On/Off button for each individual channel. Once enabled, users may select several options for automatic amplitude tracking from the Tracking drop down list: Off, Markers, TopBottom, DistalMesial and DistalProximal. Two reference lines can be set by using up/down arrow keys. Horizontal markers are useful to determine the difference with regard to loss.

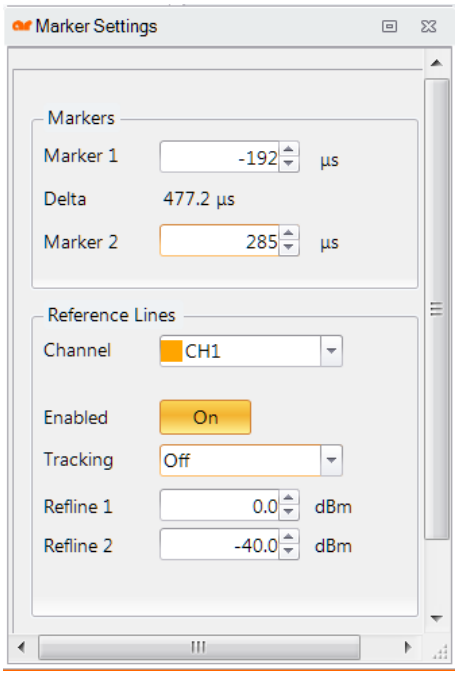


Figure 3-7 Marker Settings Menu

3.4.7 Pulse Definitions Window

Pulse Thresholds: Pulse definition setting allows user to define distal, mesial and proximal values for pulse thresholds. It is also possible to change pulse unit from watts to volts.

Pulse Gate: Pulse start and end gate can be changed both numerically and by changing up/down arrow keys.

Chapter 5 contains a detailed description of each pulse threshold level and the pulse measurement process.

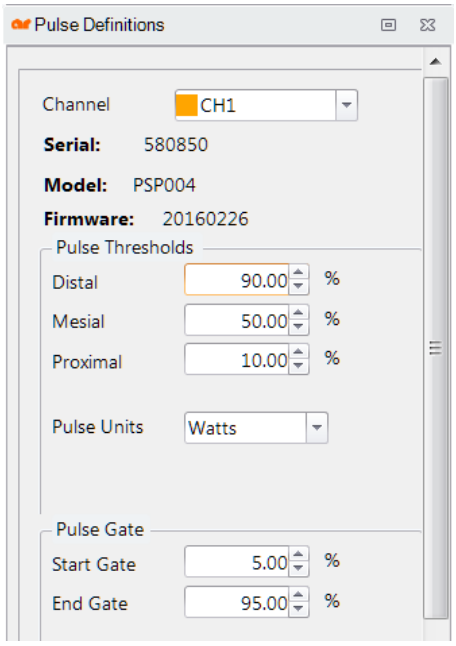


Figure 3-8 Pulse Definitions Menu

3.4.8 Automatic Measurements Window

Selecting Auto Meas icon will allow you to display a tabulated field with a list of parameters for RF pulse measurements including marker measurements.

NOTE: All field parameters are customizable, can be edited or deleted from the list. The whole table can be copied and pasted into a spreadsheet in order to make any custom report file along with captured screenshots by selecting export button as provided by the software.

3.4.8.1 Customize Field Parameters

All field parameters under automatic measurement are customizable, can be edited or deleted from the list by selecting individual parameter fields and then by using *right click* button of the mouse.

3.4.8.2 Export or Copy Field Parameters

The whole automatic table or individual parameter field can be copied and then pasted into a simple spreadsheet or document in order to make a custom report file along with captured screenshots provided by the application.

3.4.9 Graph Settings Window

Selecting the Graph Settings icon allows the user to customize data and trace colors for each measurement channel, and enable or disable trace display features such as **Average**, **Envelope**, **Maximum**, **Minimum** and **Persistence**. It is also possible to adjust marker color, background, grid colors and more under **Graph Colors** section of the display settings.

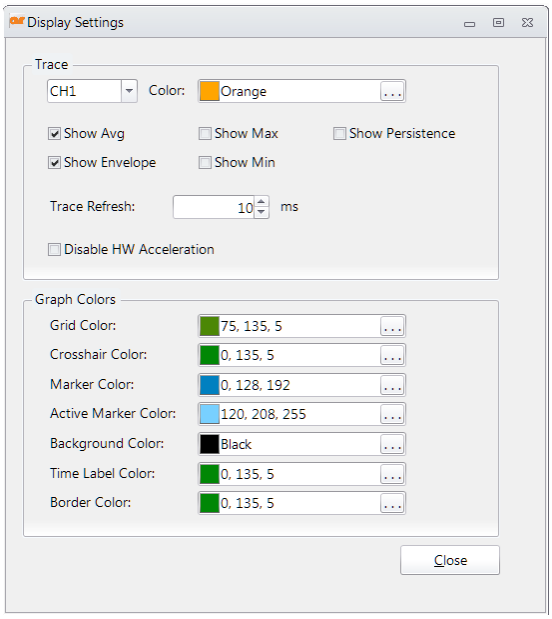


Figure 3-9. Use Display Settings to customize the display.

3.4.10 CCDF View Window

For statistical measurements, select the CCDF icon from menu bar to view a CCDF graph. The sidebar on the CCDF screen allows adjustment of horizontal scale, horizontal offset, cursor type, cursor position and dB offset. The user can also enable/disable capture or reset the statistical data acquisition.

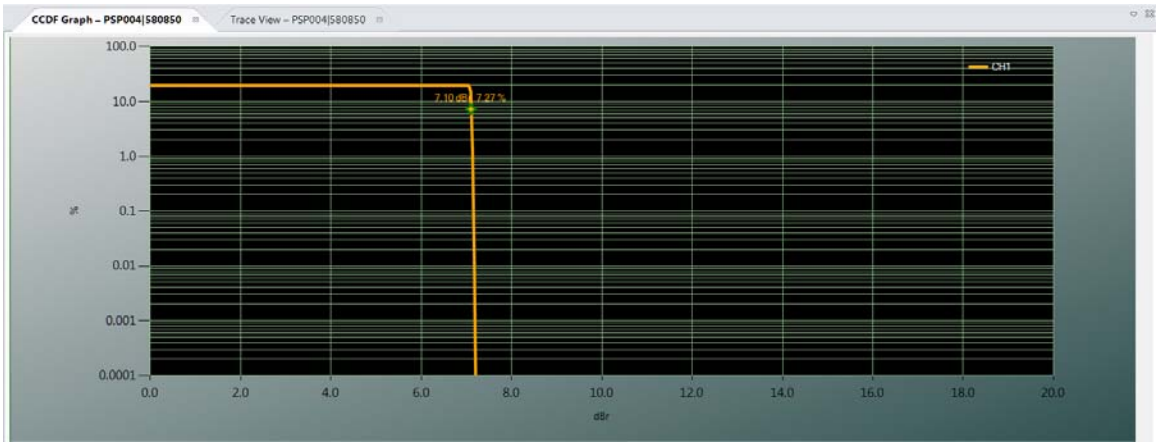
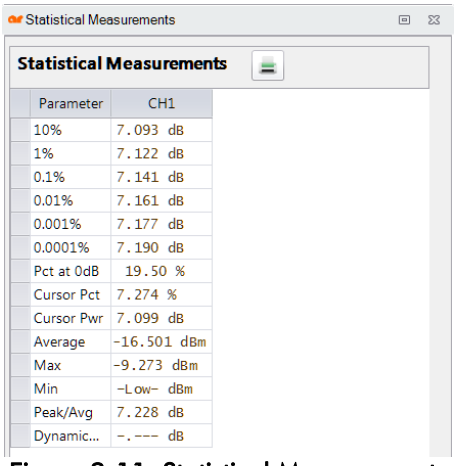


Figure 3-10. Complementary Cumulative Distribution Function (CCDF) graph is selected by pressing the CCDF button on the Main Toolbar

3.4.11 Statistical Measurements Window

By selecting Stat Meas icon, a tabulated list of statistical measurements will be displayed. Here is an example parameters text display for statistical measurements.



Parameter	CH1
10%	7.093 dB
1%	7.122 dB
0.1%	7.141 dB
0.01%	7.161 dB
0.001%	7.177 dB
0.0001%	7.190 dB
Pct at 0dB	19.50 %
Cursor Pct	7.274 %
Cursor Pwr	7.099 dB
Average	-16.501 dBm
Max	-9.273 dBm
Min	-Low- dBm
Peak/Avg	7.228 dB
Dynamic...	-.--- dB

Figure 3-11 Statistical Measurements Window

4. Remote Programming

4.1 INTRODUCTION

The PSP Series USB Power Sensor may be remote controlled by end users using an IVI (Interchangeable Virtual Instruments) driver. The IVI driver can be used by many programming environments and languages including C/C++, Visual Basic, Visual C#, LabVIEW, MATLAB, and others. This driver provides an Application Program Interface (API) which permits user applications to access power sensor control and measurement functions via a C DLL (Dynamic Link Library) or COM (Common Object Module) interface. Additionally, a .NET wrapper and MATLAB wrapper are available for convenience. For more information, please contact AR for assistance.

For more information on IVI drivers, please consult:

http://www.ivifoundation.org/about/Overview.aspx

4.2 COMMUNICATION OVERVIEW

User software interfaces with the sensor via IVI driver. Settings and measurements can be set and queried using functions and properties defined in the IVI driver programming manual. The IVI driver communicates with the sensor using low level calls to Microsoft's Windows USB driver (WinUSB). WinUSB then sends and receives proprietary binary commands and responses from the sensor.

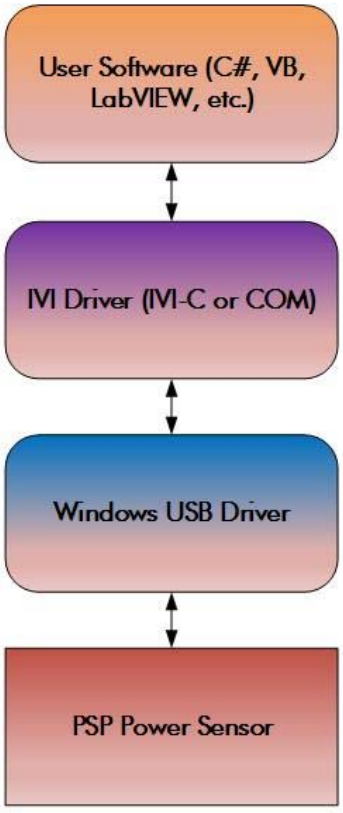


Fig 4.1 PSP Communication Data Flow

5. Making Measurements

5.1 PULSE MEASUREMENTS

5.1.1 Pulse Definitions

IEEE Std 181™-2011 IEEE Standard for Transitions, Pulses, and Related Waveforms, provides fundamental definitions for general use in time domain pulse technology. Several key terms defined in the standard are reproduced in this subsection, which also defines the terms appearing in the PSP Series text mode display of automatic measurement results.

5.1.2 Standard IEEE Pulse

The key terms defined by the IEEE standard are abstracted and summarized below. These terms are referenced to the standard pulse illustrated in Figure 5-1.

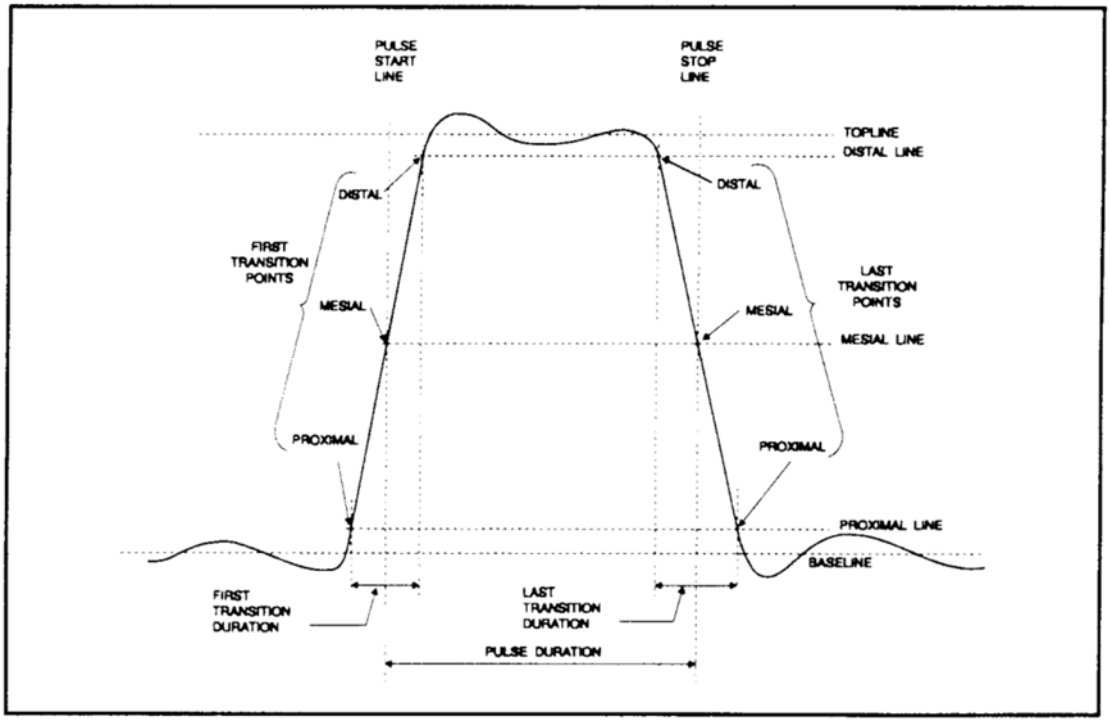


Figure 5-1 IEEE Standard Pulse (IEEE Std 181™-2011)

NOTE: IEEE Std 194™-1977 IEEE Standard for Pulse Terms and Definitions has been superseded by IEEE Std 181™-2003 and -2011. Many of the terms used below have been deprecated by the IEEE. However, these terms are widely used in the industry and familiar to users of power meters. For this reason, they are retained.

Table 5-1 Pulse Measurement Amplitude Threshold Terms

TERM	DEFINITION
Base Line	The two portions of a pulse waveform which represent the first nominal state from which a pulse departs and to which it ultimately returns.
Top Line	The portion of a pulse waveform which represents the second nominal state of a pulse.
First Transition	The major transition of a pulse waveform between the base line and the top line (commonly called the rising edge).
Last Transition	The major transition of a pulse waveform between the top of the pulse and the base line. (Commonly called the falling edge.)
Proximal Line	A magnitude reference line located near the base of a pulse at a specified percentage (normally 10%) of pulse magnitude.
Distal Line	A magnitude reference line located near the top of a pulse at a specified percentage (normally 90%) of pulse magnitude.
Mesial Line	A magnitude reference line located in the middle of a pulse at a specified percentage (normally 50%) of pulse magnitude

5.1.3 Automatic Pulse Measurements

The PSP Series Wideband power sensor and PulsewARe application or API automatically analyzes the waveform data in the buffers and calculates key waveform parameters. The calculated values are displayed in Auto Meas window.

Table 5-2 summarizes the automatic field parameters available. Note that the Pulse Measurements can be edited and customized. Amplitude related parameters will be displayed in the same units as selected in the Channel Control Window.

Table 5-2. Automatic Measurement Parameters

Field Label	Parameter	Definition
Width	Pulse Width	The interval between the first and second signal crossings of the mesial line.
Rise	Risetime	The rising edge time interval from the first crossing of the proximal line to the first crossing of the distal line.
Fall	Falltime	The falling edge time interval from the last crossing of the distal line to the last crossing of the proximal line.
Period	Pulse Period	The time interval between two successive rising edges or two successive falling edges. (Reciprocal of the Pulse Repetition Frequency)
PRF	Pulse Repetition Frequency	The number of cycles of a repetitive signal that take place in one second.
Duty	Duty Cycle	The ratio of the pulse on-time to off-time.
Offtime	Off-time	The time a repetitive pulse is off. (Equal to the pulse period minus the pulse width).
WavAv	Waveform Average Power	Waveform Average Power
PulsAv	Pulse Average On Power	The average "on" power level across the pulse width, defined by the intersection of the pulse rising and falling edges with the mesial line, and offset by the StartGate and EndGate settings.
PulsPk	Pulse Peak Power	The maximum power level of the captured waveform
OvrSht	Overshoot	Leading edge overshoot (The difference between the maximum amplitude of the overshoot and the top line).
Droop	Pulse Droop	Rise or Droop in amplitude between the start and end of the pulse, as defined by the StartGate and EndGate settings.

Field Label	Parameter	Definition
Top	IEEE Pulse Top Amplitude	The amplitude of the top line. (See IEEE definitions)
Bot	IEEE Pulse Bottom Amplitude	The amplitude of the base line. (See IEEE definitions)
EdgDly	Edge Delay	The delay time relative to the trigger of the first onscreen mesial level transition of either polarity. The Edge Delay value will be negative if the mesial transition occurs before the trigger event, and positive if it occurs after the trigger event.
Skew	Channel-to-Channel Skew	The time between the mesial level of a pulse on Channel 1 and a pulse on Channel 2. The pulse can be the power or trigger signal.

5.1.4 Automatic Pulse Measurement Criteria

Automatic measurements are made on repetitive signals that meet the following conditions:

- Amplitude. The difference between the top and bottom signal amplitudes must exceed 6 dB to calculate waveform timing parameters (pulse width, period, duty cycle). The top-to-bottom amplitude difference must exceed 13 dB to measure rise and falltime.

- Timing. In order to measure pulse repetition frequency and duty cycle, there must be at least three signal transitions. The interval between the first and third transition must be at least 1/5 of a division (1/50 of the screen width). For best accuracy on rise and falltime measurements, the timebase should be set so the transition interval is at least one- half division on the display.

5.1.5 Automatic Pulse Measurement Sequence

The automatic measurement process analyzes the captured signal data in the following sequence:

1. Approximately 500 samples of the waveform (equivalent to one screen width) are scanned to determine the maximum and minimum sample amplitudes.
2. The difference between the maximum and minimum sample values is calculated and stored as the Signal Amplitude.
3. The Transition Threshold is computed as one-half the sum of the maximum and minimum sample amplitudes.

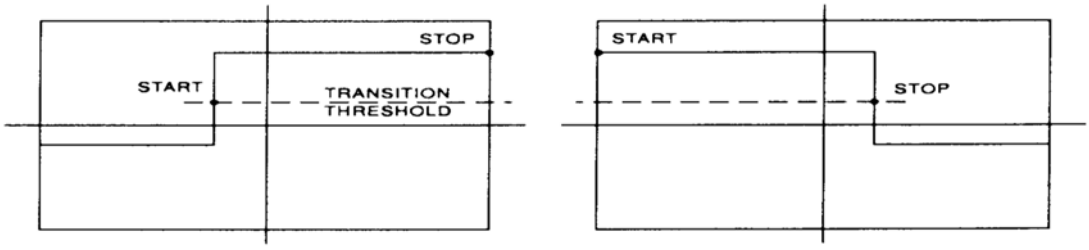


Figure 5-2 Step Waveforms

4. The processor locates each crossing of the Transition Threshold.

5. Starting at the left edge of the screen, the processor classifies each Transition threshold crossing according to whether it is positive-going (– +) or negative-going (+ –). Because the signal is repetitive, only three transitions are needed to classify the waveform, as shown in Table 5-3:

Table 5-3 Waveform Classification Types

Type	Edge Sequence	Description
0	none	No crossings detected
1	Not used	
2	+ –	One falling edge
3	– +	One rising edge
4	+ – +	One falling, followed by one rising edge
5	– + –	One rising, followed by one falling edge
6	+ – + –	Two falling edges
7	– + – +	Two rising edges

6. If the signal is Type 0, (No crossings detected) no measurements can be performed and the routine is terminated, pending the next reload of the data buffers.

7. The process locates the bottom amplitude (baseline) using the IEEE histogram method. A histogram is generated for all samples in the lowest 12.8 dB range of sample values. The range is subdivided into 64 power levels of 0.2 dB each. The histogram is scanned to locate the power level with the maximum number of crossings. This level is designated the baseline amplitude. If two or more power histograms contain equal counts, the lower is selected.

8. The process follows a similar procedure to locate the top amplitude (top line). The power range for the top histogram is 5 dB and the resolution is 0.02 dB, resulting in 250 levels. The level-crossing histogram is computed for a single pulse, using the samples which exceed the transition threshold. If only one transition exists in the buffer (Types 2 and 3), the process uses the samples that lie between the edge of the screen and the transition threshold as shown in Figure 5-2.

9. The process establishes the proximal, mesial, and distal levels as a percentage of the difference between top amplitude and bottom amplitude power. The percentage can be calculated on a power or voltage basis. The proximal, mesial, and distal threshold values are user settable from 1% to 99%, with the restriction that the proximal < mesial < distal. Normally, these values will be set to 10%, 50% and 90%, respectively.

10. The process determines horizontal position, in pixels, at which the signal crosses the mesial value. This is done to a resolution of 0.1 pixel, or 1/5000 of the screen width. Ordinarily, the sample values do not fall precisely on the mesial line, and it is necessary to interpolate between the two nearest samples to determine where the mesial crossing occurred. This process is illustrated in the example shown in Figure 5-3.

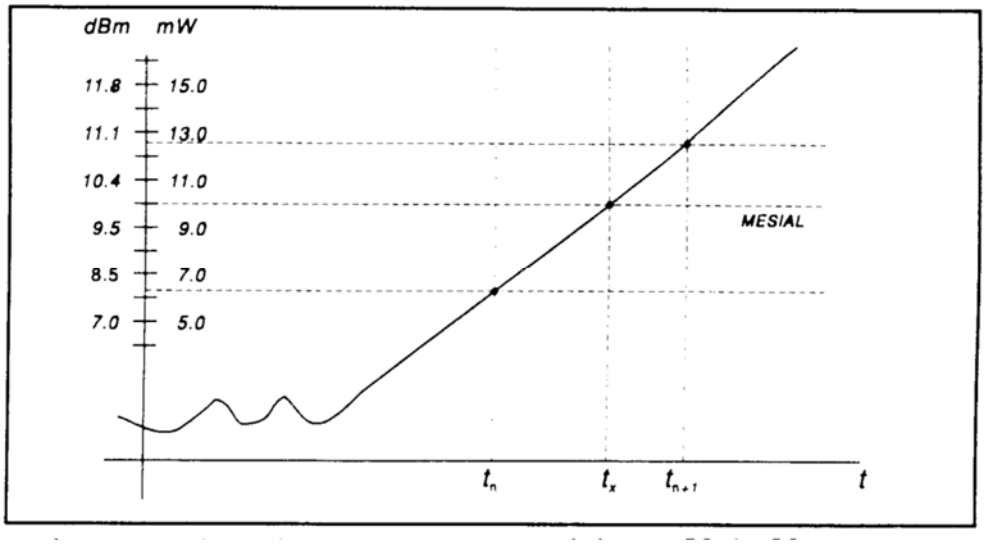


Figure 5-3 Time Interpolation example

Item	dBm	mW
Mesial value	10.0	10.0
Sample n	8.0	6.3
Sample n+1	11.0	12.6

The interpolated crossing time, t_x, is calculated as follows:

$$tx = t_n + \frac{Pmes - Pn}{Pn+1 - Pn}$$

where P is in watts and n is the number of the sampling interval, referenced to the trigger event.
For this example:

$$tx = t_n + \frac{10.0 - 6.3}{12.6 - 6.3}$$

$$= t_n + 0.6$$

11. The processor computes the rise and/or falltimes of waveforms that meet the following conditions:

    a) The waveform must have at least one usable edge (Types 2 through 7, as shown in Table 5-3)

    b) The signal peak must be at least 13 dB greater than the minimum sample value.

    The risetime is defined as the time between the proximal and distal crossings (– +).

    The falltime is defined as the time between the distal and proximal crossings (+ –).

    If no samples lie between the proximal and distal values for either edge (rise or fall), the risetime for that edge is set to 0 seconds.

12. The processor calculates the output values according to the following definitions:

    a) Pulse Width Interval between rising and falling edge mesial points

    b) Risetime See Step 11

    c) Falltime See Step 11

    d) Period Cycle time between successive mesial points of the same polarity

    e) Pulse Repetition Frequency Reciprocal of Period

    f) Duty Cycle Pulse Width/Period

    g) Off-time (Period) - (Pulse Width)

    h) Peak Power Maximum sample value between StartGate time and EndGate time (See Step 1)

    i) Pulse Power Average power between StartGate time and EndGate time

    j) Overshoot (Peak Power) - (Top Amplitude)

    k) Average Power See Step 13

    l) Top Amplitude See Step 8

    m) Bottom Amplitude See Step 7

    n) Droop between StartGate time and EndGate time

    o) Skew See Step 14

5.2 MARKER MEASUREMENTS

Table 5-4 summarizes the Marker Measurements available. Note that the Marker Measurements can be edited and customized. Amplitude related measurements will be displayed in the same units as selected in the Channel Control window.

Table 5-4 Marker Measurements

Field Labelt	Parameter	Definition
MkAvg	Marker Average	Average power over marker interval
MkMin	Marker Minimum	Minimum instantaneous power over marker interval
MkMax	Marker Maximum	Maximum instantaneous power over marker interval
MkMaxF	Marker Maximum Filtered	Maximum average (filtered) power over marker interval
MkMinF	Marker Minimum Filtered	Minimum average (filtered) power over marker interval
MkPk2A	Marker Peak to Average	Peak-to-Average power ratio over marker interval
Mk1Lvl	Marker 1 Level	Average power at marker 1
Mk2Lvl	Marker 2 Level	Average power at marker 2
MkMaxAv	Marker Max Interval Average	Highest value of average-between-markers
MkMinAv	Marker Min Interval Average	Lowest value of average-between-markers
Mk1Min	Marker 1 Minimum	Minimum power or voltage at the Marker 1
Mk1Max	Marker 1 Maximum	Maximum power or voltage at the Marker 1
Mk2Min	Marker 2 Minimum	Minimum power or voltage at the Marker 2
Mk2Max	Marker 2 Maximum	Maximum power or voltage at the Marker 2
MkRatio	Marker Ratio	Ratio of Marker 1 to Marker 2
MkDelta	Marker Amplitude Difference	Amplitude difference between Marker 1 and Marker 2
MkRDelta	Marker Reverse Difference	Amplitude difference between Marker 2 and Marker 1
MkRRatio	Marker Reverse Ratio	Ratio of Marker 2 to Marker 1
Mk1Time	Marker 1 Time	Time at Marker 1
Mk2Time	Marker 2 Time	Time at Marker 2
MkTimeDelt	Marker Time Difference	Time Difference between Marker 1 and Marker 2

5.2.1 Average Power Over a Time Interval

13. The average power of the signal over a time interval is computed by:

a) Summing the power values at each point within the interval

b) Dividing the sum by the number of points

This process is used to calculate Pulse Power, Average Power and the average power between markers.

Since each point represents the power over a finite time interval, the endpoints are handled separately to avoid spreading the interval by one-half pixel at each end of the interval (See Figure 5-4). For the interval in Figure 5-4, the average power is given by:

$$P_{ave} = \tfrac{1}{2}(P_0 + P_n) + \frac{1}{(n-1)} \sum_{n=1}^{n-1} P_n$$

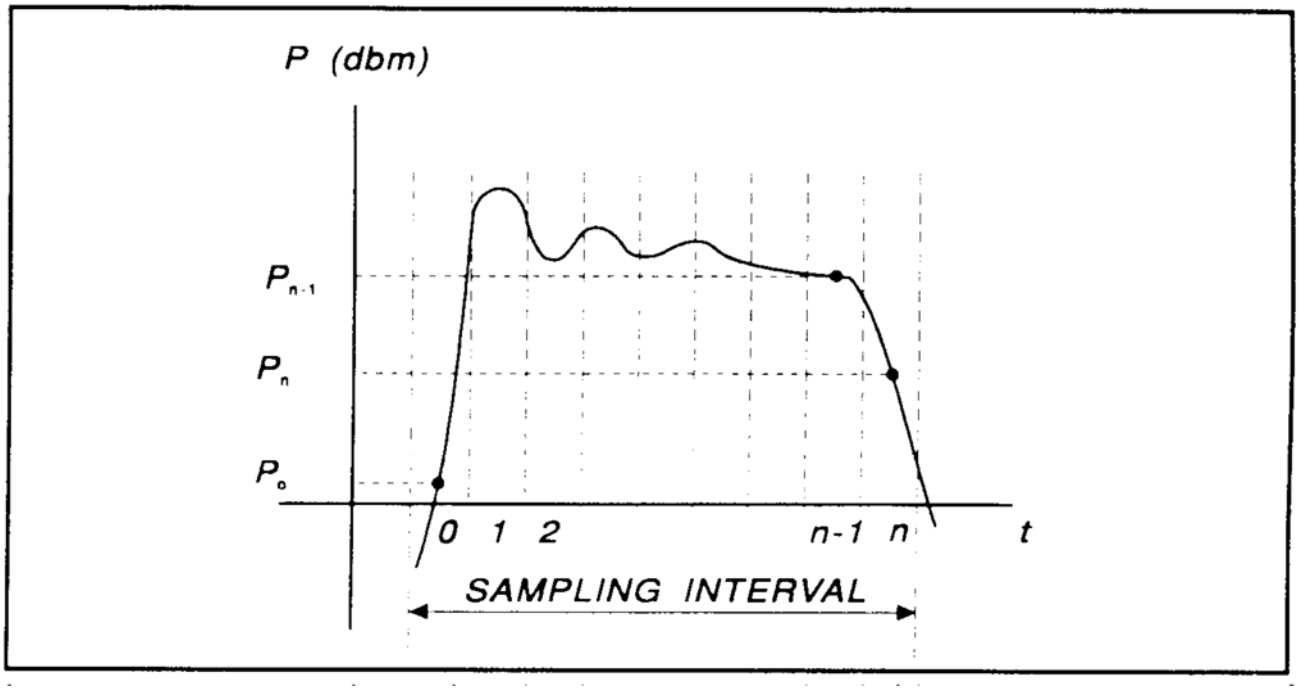


Figure 5-4 Sampling Intervals

14. To compute channel-to-channel Skew, the processor calculates the delay between the two measurement channels. The time reference for each channel is established by the first signal crossing (starting from the left edge of the screen) which passes through the mesial level (or 50% point in trigger view). The signal excursion must be at least 6 dB.

5.3 AUTOMATIC STATISTICAL MEASUREMENTS

Statistical Measurements based on the CCDF Graph are summarized in Table 5-5.

Table 5-5 Automatic Statistical Measurements

Field Label	Parameter	Definition
10%	Power at 10% probability	Peak to average power corresponding to 10% probability
1%	Power at 1% probability	Peak to average power corresponding to 1% probability
0.1%	Power at 0.1% probability	Peak to average power corresponding to 0.1% probability
0.01%	Power at 0.01% probability	Peak to average power corresponding to 0.01% probability
0.001%	Power at 0.001% probability	Peak to average power corresponding to 0.001% probability
0.0001%	Power at 0.0001% probability	Peak to average power corresponding to 0.0001% probability
Pct at 0 dB	Probability (percent) at 0 dB	Probability corresponding to 0 dB on the CCDF Graph
Cursor Pct	Cursor Probability (percent)	Probability at the Cursor Position on the CCDF Graph
Cursor Pwr	Cursor Power	Peak to average power at the Cursor position on the CCDF Graph
Average	Average	The unweighted average of all power samples occurring since acquisition started
Max	Maximum	The highest power sample occurring since acquisition was started
Min	Minimum	The lowest power sample occurring since acquisition was started
Peak/Avg	Peak /Average Ratio	The ratio (in dB) of the Peak Power to the Average Power
Dynamic Range	Dynamic Range	The ratio (in dB) of the Peak Power to the Minimum Power

6. Maintenance

This section presents procedures for maintaining the PSP Series Wideband USB Peak Power Sensor.

6.1 SAFETY RECOMMENDATION.

Although the PSP Series has been designed in accordance with international safety standards, general safety precautions must be observed during all phases of operation and maintenance. Failure to comply with the precautions listed in the Safety Summary located in the front of this manual could result in serious injury or performance issues. Service and adjustments should be performed only by qualified service personnel.

Below is the safety recommendation for the PSP Series USB Power sensor:

- Only rotate the connector nut, DO NOT use the sensor body or device to tighten the connector.
- Do not overtighten the RF connector.
- Do not use a connector with deformed threads, or a bent or broken conductor.
- Do not touch mating-plane surfaces with oily, or wax-like non-conductive substances.
- Do not apply a lateral force to the center conductor.

6.2 CLEANING

Painted surfaces and the RF connector can be cleaned very carefully with a mild cleaning solution (a solution of pure isopropyl or ethyl alcohol) but make sure to keep in mind its flammable nature. Also you can use a clean, water- dampened cloth to clean the body of the PSP Series USB power sensor.

CAUTION: When cleaning the USB power sensor, do not allow any liquid to enter into the device. Avoid using chemical cleaning agents which can damage painted or plastic surfaces.

6.3 INSPECTION AND PERFORMANCE VERIFICATION

If a PSP Series power sensor malfunctions, perform a visual inspection of the instrument. Inspect for signs of damage caused by excessive shock, vibration or overheating. Inspect for broken or damaged connection port at sensor head, or accumulations of dust or other

foreign matter. Correct any problems you discover and verify basic functionality with AR PulsewARe.

If the malfunction persists, contact AR for service.

6.4 CONNECTOR CARE

The most common cause of power sensor problems is excess input power. Applying power exceeding the labeled damage levels will damage the sensing elements such that its voltage versus power relationships are changed, resulting in erroneous power readings. The other most common cause of power sensor problems is damaged connectors. Connections should be tightened with the proper torque wrench applied to the coupling nut only. Any attempt to torque or un-torque a connection using the body of the power sensor may result in either connector damage, or in the connector becoming unthreaded from the body.

The following handling precautions must be observed to prevent connector damage when using PSP Series USB power sensors.

- Keep connectors clean and protect using the plastic end caps provided with each sensor.
- Inspect connectors regularly and look for metal debris, scratches or dents.
- Clean contact surface and threads with clean, dry compressed air.
- Align connectors first and only rotate the connector nut.
- Always follow MIL-C-39012 standards for making a connection
- A MIL-C-39012 or precision type "N" connector is recommended for the RF line signal source connection.
- After proper alignment, rotate the connector nut by hand to connect or disconnect the connector of the sensor from a signal source.
- If the connector nut is not equipped with a hex, it should be hand tightened only.
- Do not over-tighten the connector by using the sensor body for additional leverage.
- Avoid mechanical shock.
- Avoid applying excessive power.
- Observe proper ESD (electrostatic discharges) precautions.

Warranty

WARRANTIES: LIMITATION OF LIABILITY

Seller warrants (i) that seller has title to the goods sold and (ii) that Amplifiers (all parts excluding traveling wave and vacuum tubes), Antennas, field monitors, field probes, field analyzers, field analyzer processor units, system controllers, system interlock, power meters, leak detectors, RF conducted probes, RF conducted clamps, Multi-tone, EMI receiver systems, RF down converters, RF conducted immunity systems, conducted immunity accessories, radiated immunity test systems, safety meters, safety sensor heads, tripods, directional couplers, waveguide adapters, termination loads, load attenuators, impedance stabilization networks, and coaxial cables will be free from defects in material and workmanship for a period of three (3) years from date of shipment shown on AR RF/Microwave Instrumentation invoice.

All modules, used in the amplifiers for the 1-6 GHz, 4-18 GHz, 6-18 GHz, all HPM products, and other applications, are hermetically-sealed. This sealing process protects the internal hybrid circuitry from humidity that could compromise the long term reliability of the product. These modules are not field-repairable and should *never* be opened outside of AR's Microelectronics Lab. The modules in these product lines have a security label on two sides of the modules between the housing and lid/cover. If the security label is removed and or cut, the warranty of the module will be voided.

Vacuum tubes in the 'L' series amplifiers, traveling-wave tubes in TWT amplifiers, and power heads will be free from defects in material and workmanship for a period of one (1) year.

Contact AR RF/Microwave Instrumentation for warranty information regarding items not listed.

Seller's sole responsibility in fulfilling these warranties shall be to repair or replace any goods which do not conform to the foregoing warranties or, at seller's option, to give buyer credit for defective goods. The warranty is valid only when used in the country specified at time of order. Warranty service must be obtained from the repair facility designated at that time. If warranty service is not available in the country where the equipment is to be used, it must be returned to AR RF/Microwave Instrumentation. Warranty service will be provided only for defective goods which are returned within the warranty period, freight costs prepaid to AR RF/Microwave Instrumentation or its designated repair facility.

There are no other warranties, express or implied, including any warranty of merchantability or fitness. Seller shall not be responsible for any incidental or consequential damages arising from any breach of warranty.

No person other than an officer of Amplifier Research Corporation, has any authority to bind seller to any affirmation, representation or warranty except as specifically included in the preceding terms and conditions.

Rev 1216