



rf/microwave instrumentation

Operating and Service Manual

6900TP2G4M10

Model

10042909

Part Number

Serial Number



rf/microwave instrumentation

EC Declaration of Conformity

We: Amplifier Research
160 School House Road
Souderton, PA. 18964

declare that our product(s);

the Model 6900TP2G4 series RF amplifiers

to which this declaration relates is in compliance with the following European directives:

Low Voltage Directive: 2014/35/EU

EMC Directive: 2014/30/EU

Supplementary Information:

Safety : EN 60215-1:1989

EN 61010-1:2010

EMC: EN 61000-6-2:2005, EN61000-6-4:2007

Year Mark Applied: 2016

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directives and Standards.

Authorized officer of the company:

Patricia Thrasher
Manager Quality & Service

Instructions for European EMC Conformity

WARNING

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.

ACHTUNG

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 Störfestigkeitsspezifikation 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.

AVERTISSEMENT

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 l'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

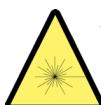
Adjustment, maintenance, or repair of the equipment must be performed only by qualified personnel. Hazardous energy may be present while protective covers are removed from the equipment even if disconnected from the power source. Contact may result in personal injury. Replacement fuses are required to 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 $\pm 10\%$ 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 Konsole fehlen.

SYSTEMERDUNG



Dieses Gerät ist mit einer Schutzerdungsklemme ausgestattet. Die Netzstromquelle muss dem Gerät eine ununterbrochene Systemerdung von ausreichender Größe zur Verfügung stellen, damit Kabelklemmen, Netzkabel oder mitgeliefertes Netzteil 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-Eingangspiegel. 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 approuvés. 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'adaptateur 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 interrompue 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 $\pm 10\%$ 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.

EQUIPEMENT 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 entretez 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 waarschuwingsymbool 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.

VOORZORGSMATREGELEN 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 zwenkwielden 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). Koop 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 aardingspennen 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 bedravingsreglementering.



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

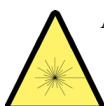
Aanpassing, onderhoud of reparatie van de apparatuur mag alleen worden uitgevoerd door gekwalificeerd personeel. Er kan gevaarlijke energie aanwezig zijn terwijl beschermende afdekkingen van de apparatuur worden verwijderd, zelfs als deze van de stroombron is losgekoppeld. Contact kan tot persoonlijk 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.
- Vervuilinggraad 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-ingangs niveau 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 tijlinstructies in dit document en de installatie-instructies in de gebruikershandleiding van de TWT.

TIJLINSTRUCTIES 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.

ADDITIONAL WARNINGS & NOTES



WARNING:

This equipment operates at potentially lethal voltages. Only trained, qualified personnel should operate, maintain, or service it.

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.



CAUTION:

Only qualified personnel must perform adjustment, maintenance, or repair of the equipment.



CAUTION:

Replacement fuses are required to be of specific type and current rating.



CAUTION:

The information in this document was obtained from reliable sources and was believed to be accurate at the time of publication. Since subsequent modifications to the machine may have been made, use this information only as a guide. Carefully compare the unit's actual configuration and operation to the descriptions in this manual before you undertake to operate, service, or modify this machine. Any variance or modification should be noted, dated, and initialed in the discrepant part of all manuals on hand for future reference. If you have technical or editorial comments you wish to make to the manufacturer, please write them on photocopies of the relevant sheets.

NOTE: The contents of this document are the property of the manufacturer and this document is delivered on the express condition that it not be disclosed, reproduced in whole or in part, or used for manufacture for anyone other than the manufacturer without its written consent, and that no right is granted to disclose or so use any information in this document.

ADDENDUM

This addendum is applicable to and is only for use with TWTA models that are supplied:

- without the outer cabinet
- without the outer cabinet, with carry handles
- without the outer cabinet - supplied with slides and front handles installed

Refer to the Model Specification sheet in the manual to determine the applicability to a specific model.

MODELS SUPPLIED WITHOUT THE OUTER CABINET

Some models are supplied without the removable enclosure offered for bench top use. These models may be rack mounted as described in Section 3.2, **Installation**.

MODELS SUPPLIED WITHOUT THE OUTER CABINET – SUPPLIED WITH CARRY HANDLES

Some models are supplied without the removable enclosure offered for bench top use and supplied with added carry handles on each side, and with pull handles on the front. When installing the unit in a rack, the side mounted carry handles may be used to position the unit. Before sliding the unit into the rack, lower the carry handles against the side of the unit so that the handles will clear the rack rails.

CAUTION:



Do not use front mount handles to carry unit.

Front handles are for use in sliding the unit out of a rack. Before pulling unit, remove front rack mounting screws and disconnect all connectors from the rear of the unit.

CAUTION:



This unit is heavy, requiring two persons to lift. Use caution when installing or removing unit.

MODELS SUPPLIED WITHOUT THE OUTER CABINET - SUPPLIED WITH SLIDES AND FRONT HANDLES INSTALLED

Some models are supplied without the removable enclosure for bench top use, and are supplied with front handles and slides for rack mounting. Intended for 19 inch wide rack mounting, the slides are suitable for a rack with 24 through 32 inch frame depth. Use of slides permits installation of multiple units without the 1 $\frac{3}{4}$ inch separation between units as described in Section 3.2, **Installation**.



CAUTION:

Do not use front mount handles to carry unit.

Front handles are for use in sliding the unit out of a rack. Before pulling unit, remove front rack mounting screws and disconnect all connectors from the rear of the unit.

The slide detents will latch in the forward position of the unit. Depress the two detents to return the unit to the rack, or to release the slides for removal of the unit.



CAUTION:

This unit is heavy, requiring two persons to lift. Use caution when installing or removing unit.

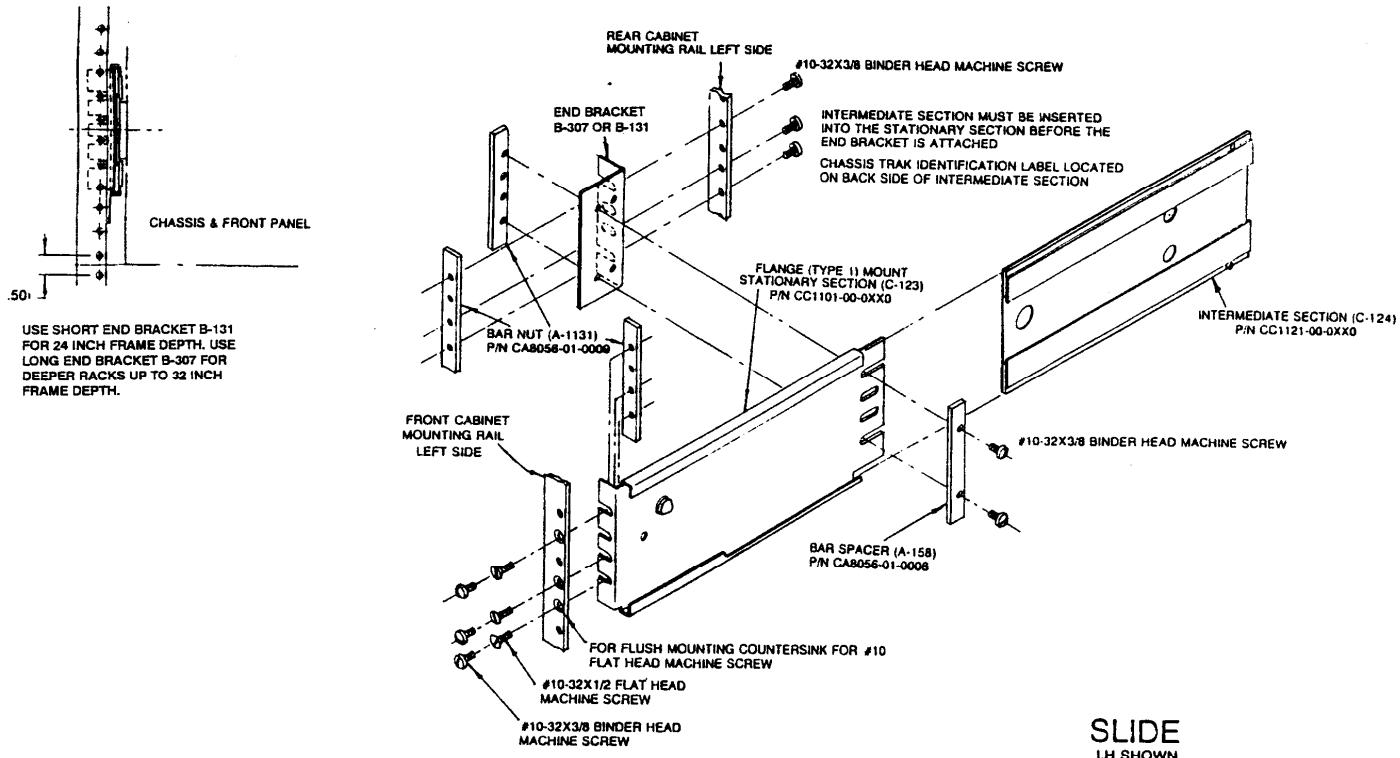


CAUTION:

Before installing or pulling unit from rack, check that rack is firmly anchored and will not tilt forward when slides are extended.

SLIDE ASSEMBLY INSTALLATION GUIDE

A slide assembly installation guide follows. Installers should check that the rack is sufficiently stable so that it will not tilt forward when slides are extended.



PART NUMBERS SHOWN ON THIS SHEET ARE GENERAL DEVICES PART NUMBERS.

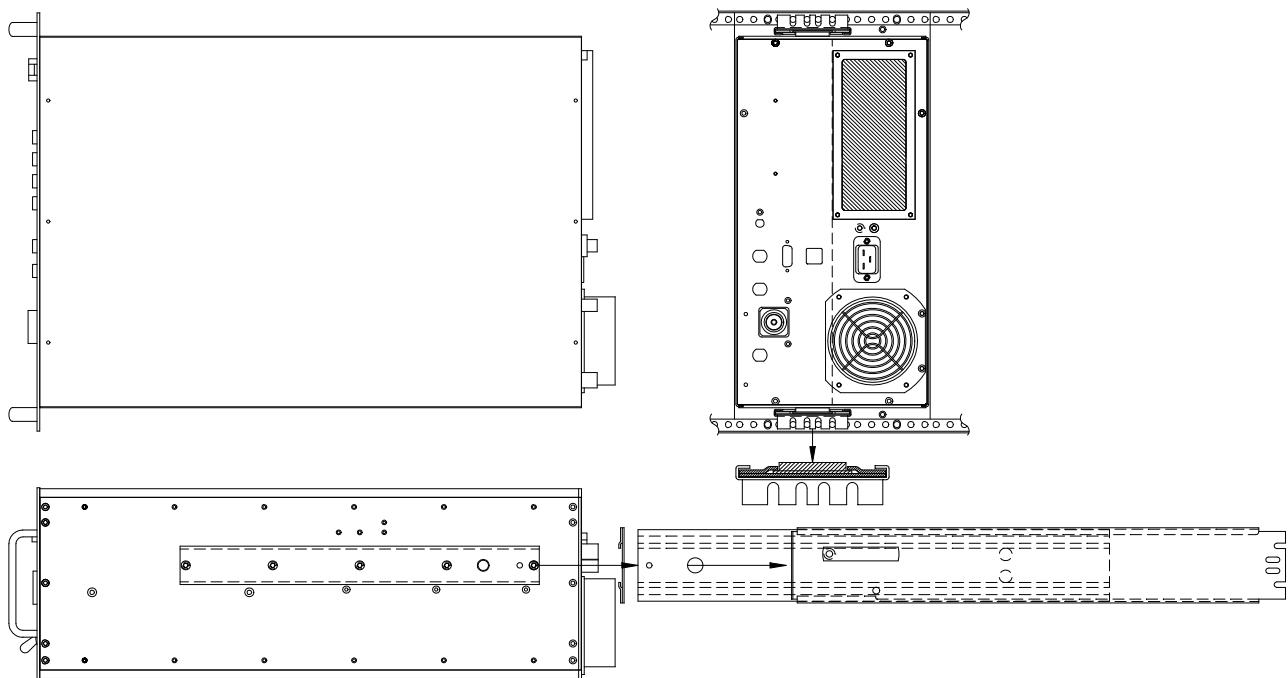
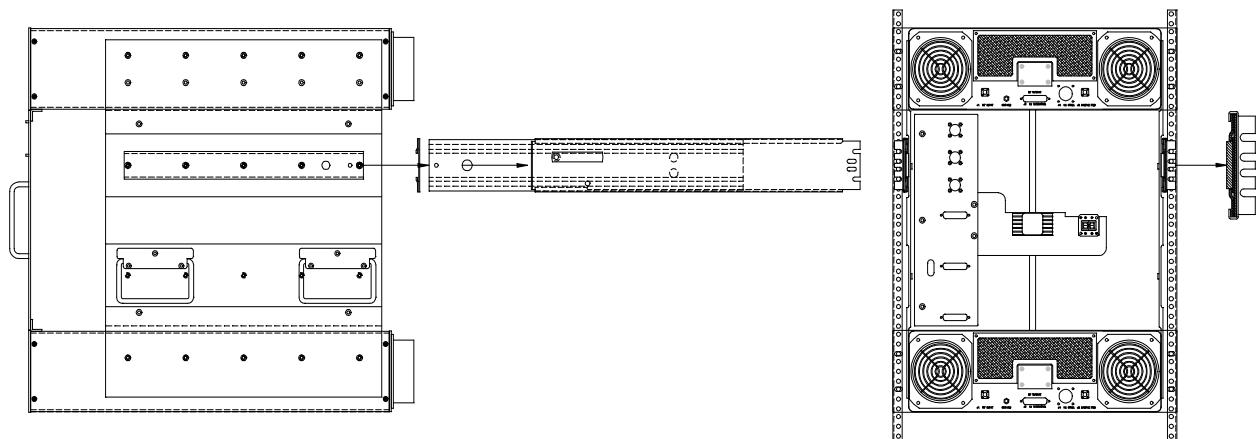
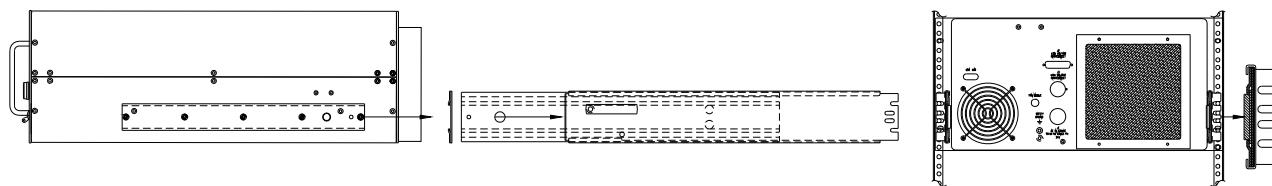


Illustration of Typical TWTA Slide Assembly



Suggested Periodic Maintenance for TWT Amplifiers

1. Keep monthly log of the voltages, currents and temperatures as shown on Menus. Also record Date, "Console" and "Operate" hours. Take readings in Operate mode with the gain at zero (0%) percent. Leave unit in Operate mode for 20 minutes (Max Duty if Pulsed Unit), and then record data. Review the log to identify trends and contact factory if required.
2. Keep monthly log of performance with active RF. At mid-band frequency, with Gain set to 100%, apply RF drive that will provide rated power. This will help indicate if the gain or power is changing and if the traveling wave tube or pre-amp needs service. Record the following:
 - a. RF Drive Level
 - b. Forward Power
 - c. Reverse Power
 - d. Body Current (Iw)
 - e. Sample Port Power reading (if possible).
3. Remove air intake filter and clean using compressed air and/or vacuum cleaner.
4. Ensure air inlet and outlet are unobstructed.
5. Check that AC Input connections are secure. Make sure the AC cable is not damaged or deteriorated.
6. Check that both input and output RF connections (waveguide or coax) are connected tightly and un-damaged.

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1. DESCRIPTION AND SPECIFICATIONS

This manual provides operating, interfacing and selected service information pertinent to AR Model 6900TP2G4M10 Broadband Microwave Amplifier. This Model is a 6900 watt broadband S-band traveling-wave tube amplifier (TWTA). This manual supports models offering additional special features. Refer to the model specification sheet to determine the applicable features of these units.

1.1 TWTA DESCRIPTION

The amplifier uses two power-combined broadband traveling-wave tubes (TWTs) to provide 6900 watts minimum output over the TWT amplifier's full bandwidth. The amplifier is well suited for susceptibility and general laboratory testing where instantaneous bandwidth and high gain are required.

The amplifier is completely self-contained and packaged for standard 19-inch rack mounting or bench top use. The front panel of the rack mountable amplifier is 17.5 inches (10U) high, and the overall unit is 35.5 inches deep, including the rear-panel connectors and vent housing. For bench top use, the amplifier is supplied in an enclosure with integral carrying handles.

Primary power is 190-260 volts 50-60 Hz, three phase. An efficient switching power supply design provides minimum power consumption. A fast regulation control loop and a high degree of filtering ensure performance within specifications over a wide range of operating conditions. The amplifier is fully enclosed, and the upper and lower panels of the rack mountable amplifier are interlocked to reduce the likelihood of accidental contact with high voltage.

1.2 SUGGESTED APPLICATIONS

- RF Susceptibility testing
- Antenna and component testing
- Equipment calibration
- General laboratory instrumentation

1.3 SPECIFICATIONS

Refer to the AR Data Sheet at the end of this section for detailed specifications.

1.4 ACCESSORIES

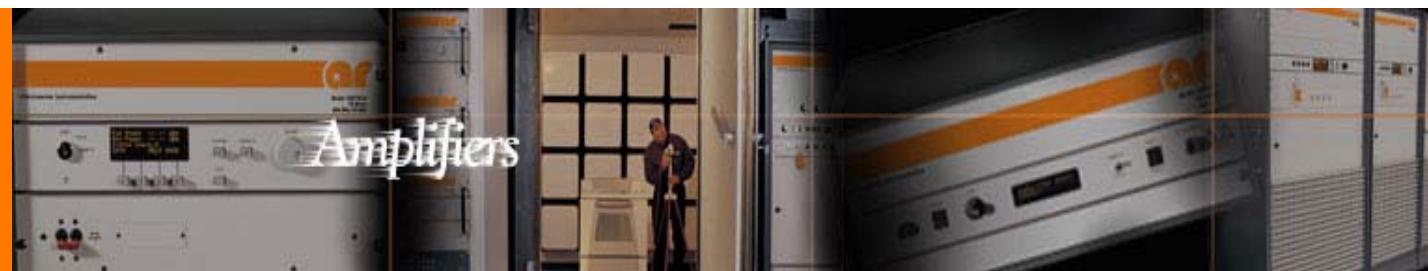
AR offers a number of accessories for use with this amplifier including:

- Directional coupler
- Antenna
- Flexible transmission line

Refer to a current AR catalog for Microwave Accessories.

1.5 TEST DATA SHEET

A Test Data Sheet for a specific unit is prepared at the time of manufacture and is included with the unit's copy of this manual.



Amplifiers

6900TP2G4

- Pulse Amplifier
- M1-M11
- 6900 Watts
- 2GHz-4GHz

Features

The Model 6900TP2G4 is a self contained, forced air cooled, broadband traveling wave tube (TWT) microwave amplifier system designed for pulse applications at low to moderate duty factors where instantaneous bandwidth and high gain are required. Reliable TWT subsystems provide a conservative 6900 watts minimum peak RF pulse power at the amplifier output connector. Stated power specifications are at the fundamental frequency.

The amplifier's front panel digital display shows forward and reflected average power output or forward and reflected peak power, plus extensive system status information accessed through a series of menus via soft keys. Status indicators include power on, warm-up, standby, operate, faults, excess average or peak reflected power warning and remote. Standard features include a built-in IEEE-488 (GPIB) interface, 0dBm input, TTL Gating, VSWR protection, gain control, RF output sample ports, auto sleep, plus monitoring of TWT helix current, cathode voltage, collector voltage, heater current, heater voltage, baseplate temperature and cabinet temperature. Modular design of the power supply and RF

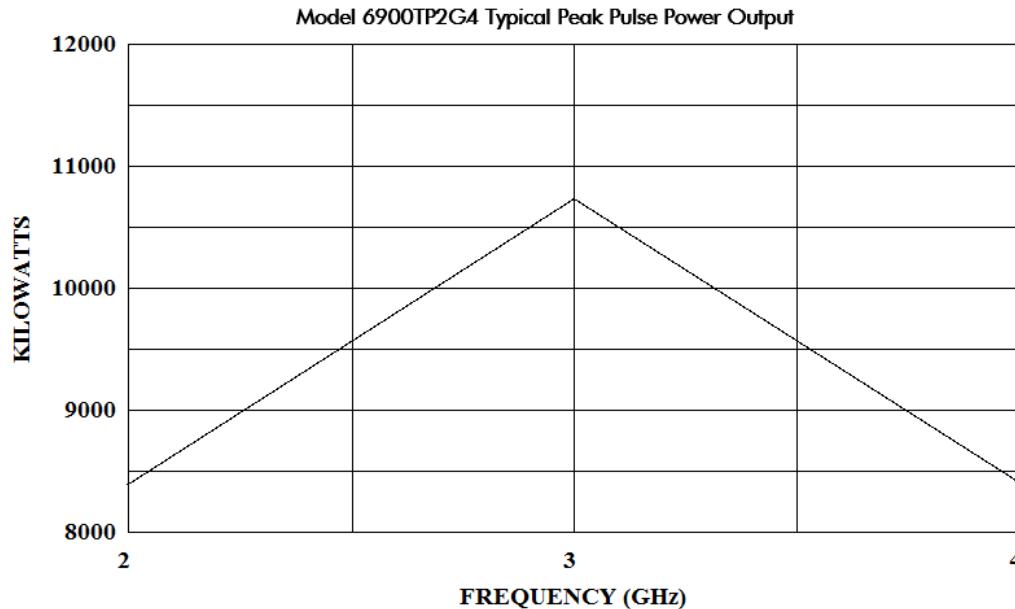
components allow for easy access and repair. Use of switching mode power supplies results in significant weight reduction.

The rated power is developed by efficiently power combining the outputs from two 4500 watts (nominal) pulse TWTs that are factory matched in gain and phase, resulting in an excellent combination of wide instantaneous bandwidth with improved harmonic levels.

Housed in a stylish contemporary cabinet, the amplifier provides readily available pulsed RF power for a variety of applications in Test and Measurement, (including EMC RF pulse susceptibility testing), Industrial and University Research and Development, and Service applications. AR also offers a broad range of amplifiers for CW (Continuous Wave) applications.

The export classification for this equipment is 3A999.d. 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.

See Model Configurations for alternative packaging and prime power selection.



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6900TP2G4

- Pulse Amplifier
- M1-M11
- 6900 Watts
- 2GHz-4GHz

Specifications

POWER (Fundamental), Peak Pulse, @ Output: Nominal, 9000 watts; Minimum, 6900 watts

FLATNESS: ±8 dB maximum, ±4 dB at rated power

FREQUENCY RESPONSE: 2-4 GHz

INPUT FOR RATED OUTPUT: 1.0 milliwatt maximum

GAIN (at maximum setting): 68 dB minimum

GAIN ADJUSTMENT (continuous range): 35 dB minimum

INPUT IMPEDANCE: 50 ohms, VSWR 2.5:1 maximum

OUTPUT IMPEDANCE: 50 ohms, VSWR 2.5:1 typical

MISMATCH TOLERANCE: Output pulse width foldback protection at peak reflected power exceeding 4000 watts. Will operate without damage or oscillation with any magnitude and phase of source and load impedance. May oscillate with unshielded open due to coupling to input. Should not be tested with connector off.

PULSE CAPABILITY:

Pulse Width	0.2 – 50 microseconds.
Pulse Rate (PRF)	100 kHz maximum
Duty Cycle	4% maximum.
RF Rise and Fall	70 ns max (10% to 90%).
Delay	500 ns maximum from pulse input to RF 90%
Pulse Width Distortion	±50 ns maximum (50% points of output pulse width compared to 50% points of input pulse width)
Pulse Off Isolation	80 dB minimum, 90 dB typical
Pulse Input	TTL level, 50 ohm nominal termination

Model Configurations

E Package Alternatives. May select an alternative from the following [E1C or (E1C and E2S) and/or E3H]:

E1C Cabinet: Without outer enclosure for rack mounting, size (W x H x D) 49 x 44.3 (10U) x 86 cm, 19 x 17.44 (10U) x 33.9 in., Subtract approximately 16 kg, 35 lbs, for removal of outer enclosure.

E2S Slides: slides installed, add approximately 5 kg, 10 lbs.

E3H Handles: Front pull handles installed.

P Prime Power: Must select one primary power from the following [P1 or P2]

P1 208V, US: 208 VAC ± 10%, 3 phase, delta (4 wire) 50/60 Hz, 5 KVA maximum

P2 400V, Europe: 360-435 VAC, 3 phase, WYE (5 wire) 50/60 Hz, 5 KVA maximum. CE marked to comply with EMC European Directive 89/336/EEC for operation inside a shielded room.

P3 190-260VAC single phase, 50/60Hz, 5kVa max

NOISE POWER DENSITY:

(pulse on) Minus 55 dBm/Hz (maximum); Minus 84 dBm/Hz (typical)

(pulse off) Minus 140 dBm/Hz (typical)

HARMONIC DISTORTION: Minus 15 dBc maximum

PRIMARY POWER: See Model Configurations

CONNECTORS:

RF input: Type N female on rear panel

RF output: Type DIN 7-16 female on rear panel

RF output sample ports (forward and reflected):

Type N female on rear panel

Pulse input: Type BNC female on rear panel

GPIB: IEEE-488 female on rear panel

Interlock: DB-15 female on rear panel

COOLING: Forced air (self contained fans), air entry and exit in rear.

SIZE (W x H x D): 50.3 x 48 x 89 cm, 19.8 x 19 x 35 in

WEIGHT (approximate): 121 kg, 265 lbs

EXPORT CLASSIFICATION: 3A999.d

Model No.	Features	
	E	P
6900TP2G4	Base model	P1
M1	E1C	P1
M2	E3H	P1
M3	E1C & E3H	P1
M4	E1C & E2S	P1
M5	E1C & E2S & E3H	P1
M6	–	P3
M7	E1C	P3
M8	E3H	P3
M9	E1C & E3H	P3
M10	E1C & E2S	P3
M11	E1C & E2S & E3H	P3

Model number example: Model 6900TP2G4M2 would have option E3H front pull handles installed.

2. THEORY OF OPERATION

2.1 DESIGN OF THE AMPLIFIER

The AR Model 6900TP2G4M10 Amplifier consists of four principal subsystems. Two of these subsystems, the microwave power assembly (A33066-001) and the power supply for MEC-3102 tube (A33068-001) are discussed in Sections 2.2 and 2.3, respectively.

The other two subsystems are the microprocessor control system and the TWTA packaging. These both consist of a number of subassemblies. See the build tree in Section 5 for further information about how the TWTA is structured.

The heart of the microprocessor control system is the control head assembly (A26946-001), which consists of the CPU Board (A25450-000) and the GPIB/LINK Transceiver Board A22488-013. The microprocessor control system supervises the power supply and RF gain controls, processes operator front panel input, and enables communication with a host computer over the IEEE-488 interface. Communication from the front panel is through the HPA display board (A22700-900).

The control head is provided with its own power supply and is electrically isolated from the amplifier. Communication with the amplifier is via fiber optic links and the HPA interface assembly (A25444-001).

The TWTA packaging consists of a cabinet assembly A33318-001, a cooling system utilizing three 400Hz fans and various chassis wiring components.

2.2 DESCRIPTION OF THE RF ASSEMBLY

The TWT amplifier consists of two stages of RF amplification: one stage of solid state pre-amp with fixed gain (E02592-000) and a traveling-wave tube (E02594-000).

The Type N RF input connector is located on the rear panel. The RF input is fed to the input connector on the solid-state pre-amp via a Type SMA coaxial cable. The solid state pre-amp's output is passed thru a hybrid coupler which then connects to the RF input of the TWTS. The RF output of the TWT is a Type-SC coaxial. The output of each TWT is fed into a combiner (E03195-000) to power combine the two TWTS. The combiner has two directional couplers that are used for metering the forward and reflected power. The output of the combiner is a Type DIN 7-16 output located on the rear of the unit.

The reflected port on the directional coupler is connected to a detector diode, whose output is used for VSWR protection by the power supply logic & control module. It is also used on the machine interface board for conversion from analog to digital for use by the control head to display reflected power.

One forward port on the directional coupler is likewise connected to a detector diode, whose output is used on the machine interface board for conversion from analog to digital for use by the control head to display forward power.

The reflected port output is split using a -10dB coupler (SMA-type) and fed directly to the RF sample port on the rear panel (Type-N, normally -60dB).

Amplifier gain is determined by the fixed gain solid state pre-amp (SSPA). The emergency bypass board mounted behind the front panel is provided with a circuit for control head bypass in the event of a failure.

2.3 DESCRIPTION OF THE POWER SUPPLY

The TWT power supply is of modular construction. All modules are connected through a motherboard, and are very easy to replace. This makes maintenance fast and easy.

Low Voltage Module: AC / DC converter which generates the +15VDC/-15VDC/+5VDC needed for house-keeping.

Logic and Control Module: This module controls the power supply, monitors all the voltages and currents of the unit, and provides protection for the power supply and the TWT.

Input Filter Module: The input filter module is a AC to DC converter. It gets power from the power source three phase 190-260V AC, and converts it to 280V DC, 3000W. It has low line ripple inrush limited and phase protection.

Phase & Post Power Converter: The post and phase module, consists of the following:

- Fixed frequency resonant regulator and converter
- A linear regulator (Post Regulator)

The resonant converter operates at fixed frequency of 66kHz, at a power level of 2500W. It converts the incoming 280VDC into a sine wave, using a resonant tank. (resonant inductor and capacitor). That waveform is driving the primary of the high voltage transformer which generates the cathode and collector voltages. The cathode voltage is tightly regulated by the post regulator, which compensates for the output capacitor droop during the pulse.

High Voltage Rectifier and XFMR Module, 8kW: This module contains the high voltage transformer and the high voltage rectifiers. The voltage waveform at the transformer primary is amplified by the transformer, and rectified by the diodes to generate the cathode and collector voltages.

8kW High Voltage Filter: This module contains the high voltage capacitors for the cathode and the collector voltages. This module filters the ripple from the high voltage rectifiers, monitors the cathode and collector voltages, and sends a feedback signal to the post regulator.

Tank Module: The tank module contains a resonant inductor. It works with resonant capacitor (in the post and phase module) together to force the current from square wave to be sine wave, and drive it into the primary of the high voltage transformer.

Storage Capacitor Assembly: This module contains high voltage capacitors, which store the energy needed to keep the cathode voltage well regulated during the pulse. Since the main regulator loop cannot respond during the pulse, the energy is taken from the caps, and the post regulator compensates for the capacitors droop, to keep the cathode tightly regulated.

The Heater Power Supply Module powers the TWT DC heater. It uses +15VDC input and provides isolated -6.3 VDC at cathode potential.

The Grid Module controls whether the TWT is ON or OFF. It generates two floating voltages at cathode potential (one positive with respect to cathode= TWT ON, and one negative with respect to cathode =TWT OFF). It switches its output between those voltages, at a rate of up to 20kHz, controlled by the TTL drive at its input.

Interconnects between the power supply modules are through a motherboard. It is installed in a finned heat sink assembly to which the modules are bolted. The incoming cabinet air, boosted by a 400Hz fan, cools the heat sink.

2.4 DESCRIPTION OF ELECTRONIC CROWBAR

Because the charge in the Cathode voltage capacitor storage module exceeds the maximum energy which can be safely dissipated during a TWT tube arc, the amplifier is provided with an electronic crowbar which can shunt the stored energy through a resistor network rather than through the TWT in the event of anomalous tube behavior.

Two conditions cause the electronic crowbar to fire: an “unauthorized” pulse (a pulse that occurs in the absence of a high on the pulse gate), or an “authorized” pulse accompanied by excessive helix current. An unauthorized pulse may result from a number of abnormalities, including a TWT tube arc or a modulator glitch. The high helix current condition may result from a high pulse top voltage, excessive RF drive, or a tube arc within a pulse.

The electronic crowbar system consists of two subsystems, the Pulse Monitor Board (A30750-000) and the Crowbar Driver Board (A30655-000). The Pulse Monitor Board is responsible for making the decision to fire the crowbar, and the Crowbar Driver Board contains the triggered spark gap switch and the trigger circuitry.

2.4.1 Pulse Monitor Board

The Pulse Monitor Board senses TWT pulses by means of a Hall-effect current sensor applied to the cathode voltage (E_k) and heater (E_f) leads to the TWTs. Any beam current in excess of half an ampere or so results in a detected pulse signal. In 3 to 5 microseconds this signal will cause a crowbar fire output from the board unless it is masked by an “authorizing” pulse.

The “authorizing” pulse is created when all the following conditions prevail:

- The crowbar driver board is charged up and ready to fire
- A pulse gate signal is received
- High voltage power supply is turned on
- RF ON is selected
- No waveguide arc is detected
- Pulse gate is not over pulse width
- Pulse gate is not overduty
- Body current is within safe limits

When all the above conditions are met, the detected beam pulse is masked, and the crowbar will not fire during the pulse.

If either over pulse width or over-duty is detected, the pulse enable signal to the modulator is interrupted and a warning is displayed on the front panel display.

2.4.2 Crowbar Driver Board

The Crowbar Driver Board contains the actual crowbar switch, which is a triggered gas gap between the cathode supply and ground. The gap has a self-breakdown voltage of 20KV and will not fire when cathode voltage is applied to it unless triggered by a high voltage pulse to its trigger electrode.

The driver board contains a 300 VDC supply which charges a storage capacitor. When this capacitor is fully charged, the driver board signals the logic board that it is ready to fire the crowbar.

If a crowbar fire signal is received, a triac is turned on, dumping the charge in the storage capacitor into a 30:1 step-up trigger transformer. The transformer's secondary is wired to the triggered gap trigger electrode.

When the spark gap fires, its series resistance is reduced to a few milliohms, and a large discharge current quickly dumps the energy stored in the capacitor bank. The output resistors in the cathode supply have much more impedance than the ignited spark gap, and as a result, most of the stored energy is dissipated by these resistors. The actual energy dumped into the spark gap is low, so that the gap can fire repeatedly with no significant deterioration.

3. OPERATION

3.1 WARNINGS AND CAUTIONS

Throughout this manual, the symbol:



WARNING:

indicates that a hazard exists that may result in personal injury or loss of life.



CAUTION:

indicates that failure to follow procedures may result in damage to the equipment.



WARNING: DANGER - High Voltage Present:

Electrical equipment in this TWTA generates and stores high-voltage energy that can result in fatal electrocution. Do not operate the TWTA with covers or the front panel removed.

Service work must be performed only by technicians thoroughly familiar with the high-voltages present in microwave tube amplifiers in general, and with this equipment in particular.

Never handle the TWT leads or the high-voltage connectors unless the unit has been unplugged and it has been positively established that the high-voltage filter capacitors have been discharged to a *known* safe level.



WARNING: Safety Ground

Improper grounding of this equipment can result in electric shock. The TWTA must be operated only with a line cord with a safety ground wire. It is the user's responsibility to ascertain that the power connector is properly wired and that the power outlet is grounded.



WARNING: Explosive Atmosphere

To avoid explosion, never operate this TWTA in an explosive atmosphere. This equipment is not certified for operation in an explosive atmosphere.

3.2 INSTALLATION

3.2.1 Unpacking

Upon receiving the TWTA, unpack the unit and inspect it for obvious signs of external damage. If damage is observed, notify the carrier and contact an authorized service representative.

Save and store the shipping container in case the unit needs to be returned in the future for calibration or repair.

3.2.2 Mounting

The TWTA may be operated as a standalone bench top unit or it may be installed in a 19" rack.

If rack mounting is desired, first remove the amplifier from the cabinet, then install the amplifier in the rack.

CAUTION:



Due to the weight of the unit, the removal of the amplifier from the cabinet or rack is a two-person operation.

Before removal disconnect power, RF, and any other interface connectors. On the rear of the unit, remove the six screws used to connect brackets to amplifier. On the front of the unit, remove the four screws holding each the front panel to the cabinet. Carefully slide the amplifier out of the front of the cabinet.

CAUTION:



Never rack mount the TWTA using the front panel alone. The chassis is likely to be damaged unless its weight is supported. Bottom support rails must be provided in a rack mount configuration.

See Figure 3-1 for the locations of threaded holes on the bottom half of the TWTA chassis, which may be used for supplementary support of the TWTA.

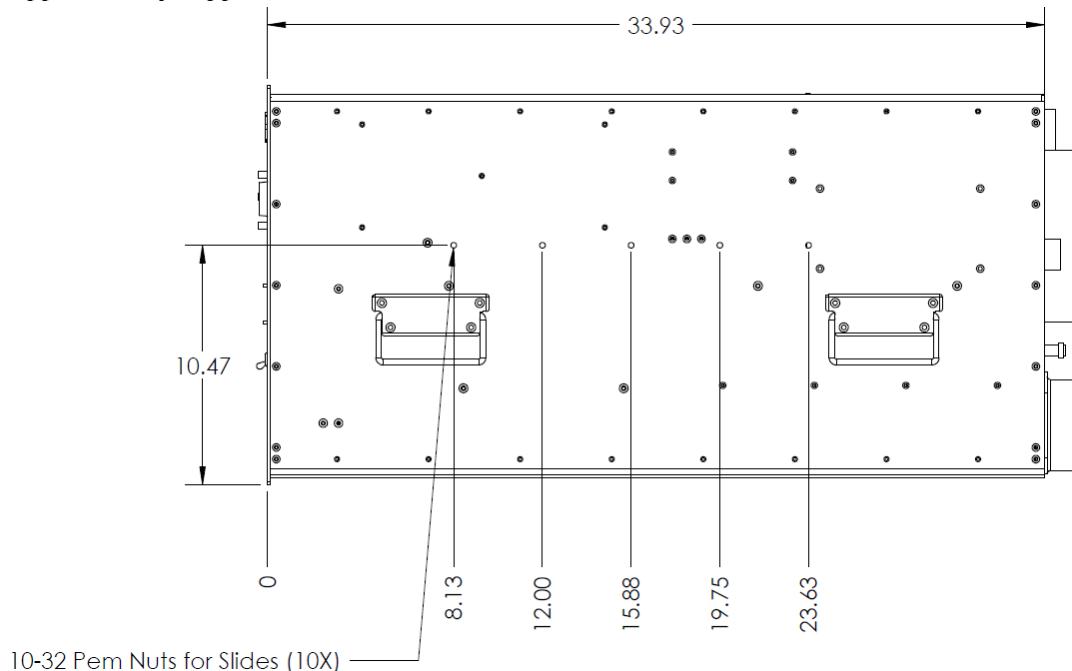


Figure 3-1. Rack Mounting Configuration

If bottom supports are used for rack mount installation of multiple units, the amplifiers should be separated vertically by at least 1 3/4 inches. This will allow room for necessary support rails and facilitate installation and removal of the units.

3.2.3 Cooling Requirements

The TWTA is provided with two cooling fans. It is important that air movement around the rear of the unit be unobstructed.



CAUTION:

For either bench or rack mounting, do not position the TWTA in such a way that the air intakes or outlets are blocked, or that the exhaust flows are directed into the intakes. See Paragraph 3.5 for location of air intakes and air outlets. If the unit is rack mounted, make sure that the intake air is 45°C or below. If necessary, fabricate short ducts to direct the hot exhaust air out of the rack enclosure. Great care must be taken to minimize any flow restrictions. Avoid mounting heat-producing equipment in the same rack, especially below the TWTA. Failure to provide adequate cooling can result in the unit's shutting down from over temperature conditions.

The TWTA dissipates approximately 3300 watts when in the Operate mode.

3.2.4 AC Line Power Connections

AC line power connection to the TWTA is made at the AC inlet J1, which is a male, 20A, MS3102A22-22P connector. A line cord suitable for the type of AC outlet used, and consistent with local electrical codes, must be obtained to mate with J1. Minimum wire size for line cord is 14 gauge.

NOTE: Mating connector provided.

A 4 wire line cord must be obtained and terminated with a plug to a 208 volt, three-phase source as follows:

	MS3102A22-22P	Function
	A	Phase A
	B	Phase B
	C	Phase C
	D	Safety Ground



WARNING: Safety Ground

Improper grounding of this equipment can result in electric shock. The TWTA must be operated only with a line cord with a safety ground wire. It is the user's responsibility to ascertain that the power connector is properly wired and that the power outlet is grounded.



CAUTION:

Main supply voltage fluctuation not to exceed $\pm 10\%$ of the nominal voltage.

3.2.5 RF Output Connections

The RF output connector is Type DIN 7-16.



CAUTION:

Never operate the TWTA without a matched output load rated for at least 15,000 peak and 1,000 watt average. Full reflected power may irreparably damage the TWTs. The over reverse power detection circuit is provided to protect the tube from *progressive* failure or mismatch of the output load; it should not be relied on for protection from the absence of a load.

3.2.6 External Interlock Connector

The TWTA is provided with an external interlock capability via a 15-pin D-Sub connector, J2. To enable the high voltage power supply, it is necessary to provide continuity between J2 pins 3 and 4. If the amplifier shuts down because the interlock was opened, it will be necessary to reset the system to return to standby (see *System shutdown screen* in Section 3.4). There is an internal jumper between J2 pins 1 and 2; a continuity check through these pins can be used to verify the presence of the amplifier in the instrumentation system. Users may adopt this interlock feature to disable the RF output for either equipment protection or as a backup for personnel protection. Wiring details are shown below and the location of the connector is shown on Figure 3-3.

Pin	Title	Function
1	INTERNAL JUMPER	Internal jumper from pin 1 to pin 2
2.	INTERNAL JUMPER	Internal jumper from pin 1 to pin 2
3.	EXTERNAL INTERLOCK SUPPLY	Disables High Voltage power supply in continuity is opened from pin 3 to pin 4.
4.	EXTERNAL INTERLOCK RETURN	Disables High Voltage power supply in continuity is opened from pin 3 to pin 4.
5-9.	NOT USED	
10.	INHIBIT SUPPLY	Disables RF power output if continuity is opened from pin 10 to pin 15.
11-14	NOT USED	
15	INHIBIT RETURN	Disables RF power output if continuity is opened from pin 10 to pin 15.



CAUTION:

Do not rely on the external interlock for personnel protection. The intent of the external interlock feature is to disable the RF output for equipment protection. Use proper operating and safety procedures to insure that power is removed for personnel safety.

3.2.7 External IEEE-488 Connector

The TWTA is provided with a standard IEEE-488 connector on the rear panel. If the TWTA is mounted in a bench-top cabinet, the mating connector should be a straight-entry cable type, not a side-entry type.

3.3 FRONT PANEL FEATURES

Refer to Figure 3-2 below.

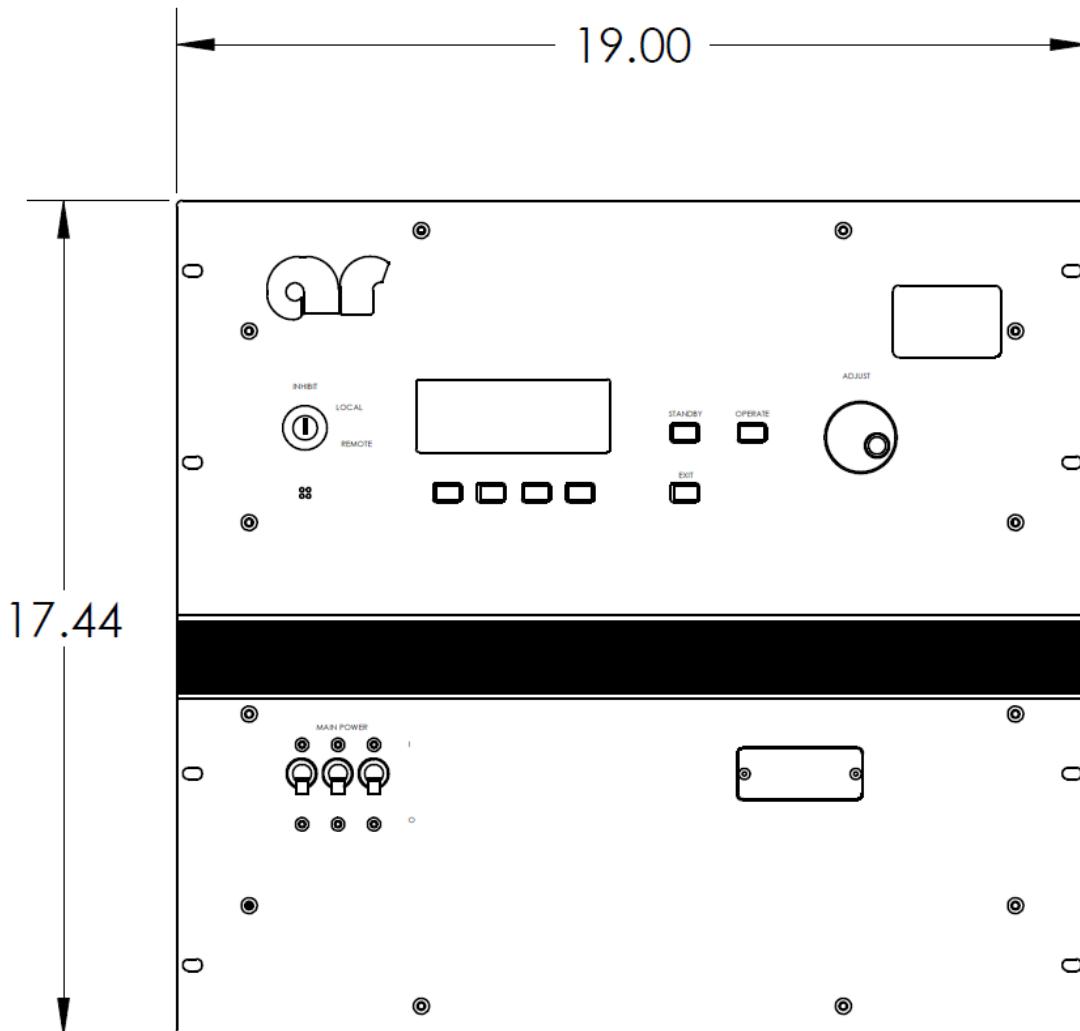


Figure 3-2. Front Panel Features

Table 3-1. Front Panel Features

Item	Title	Function
1	MAIN POWER	Switchable 16 A. circuit breaker; connects primary power to power supplies.
2.	OPERATE	Push-button; turns on high voltage and SSA when all faults and heater delay are cleared.
3.	STANDBY	Push-button; shuts off SSA and turns off high voltage.
4.	ADJUST	Rotary knob used as an input device to change values of a variety of parameters.
5.	EXIT	Push-button; terminates various menu selection routines and returns to the previous menu level.
6-9.	S1...S4	Soft Key push-buttons; various menu selection functions.
10.	Display	Displays numerous parameter values and fault messages.
11.	Keylock Switch	Allows operator to inhibit the TWTA, to enable front panel control, or to enable computer control.

3.4 FRONT PANEL DISPLAY AND SOFT KEYS

The purpose of the front panel display is to permit the operator to access extensive information about the condition and operation of the TWTA. To accomplish this, a number of informational screens are programmed. It is important for the operator to be able to select the screen with the required information. Screen selection is accomplished by pressing an appropriate soft key or by pressing the EXIT key. When a soft key is active, its function is displayed on the bottom line of the display. Figure 3-3 provides a “roadmap” for navigating between the screens.

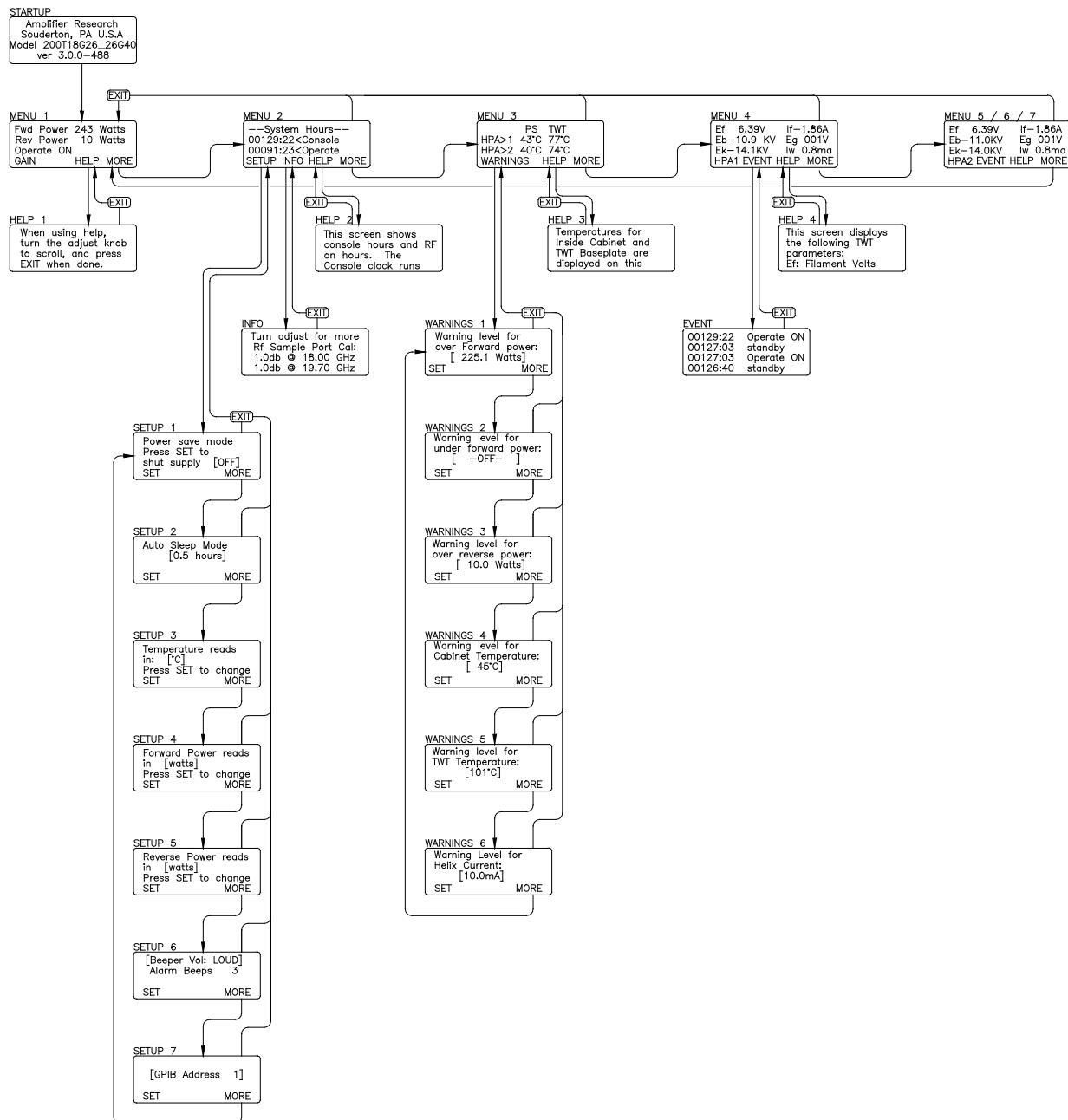


Figure 3-3. Front Panel Display Screens

Menu screens: The screens at the highest level are called menu screens. There are seven menu screens. At power on, the MENU 1 screen is displayed. Each of the menu screens has the soft key S4 labeled MORE. The MORE key (S4) causes the next menu screen to appear. From MENU 7, MORE causes MENU 1 to reappear. In short, MORE permits scrolling through the menu screens. The EXIT key returns display to MENU 1 from any other menu screen.

The menu screens display system status and parameter levels. They are configured as follows:

MENU 1	Forward power (watts, dBm or bar graph)
	Reverse power (watts or dBm)
	System status (if a latched fault exists, MENU 1 is displayed with the system shutdown message)
MENU 2	Forward power adv (bar graph, watts or dB)
	Reflected power adv (watts or dB)
	System Status
MENU 3	- System Hours -
	Console hours (active when main power circuit breaker is on, represents TWT filament hours)
	Operate hours (active when HV is on)
MENU 4	- System Temps -
	TWT 1 baseplate temperature (°C or °F)
	TWT 2 baseplate temperature (°C or °F)
MENU 5	Heater voltage (Ef)
	Heater current (If)
	Collector voltage (Eb),
	Cathode voltage (Eg)
	Helix current (Iw)
	Grid voltage (eg)

Help Screens-S3: On each of the menu screens 1, 2, 3 and 4, soft key S3 is labeled HELP. If S3 is selected, a message describing the functions of that screen will be displayed. Use the ADJUST knob to scroll through the message. The EXIT key will return you to the screen from which the help screen was called.

MENU 1: Shows forward and reverse power in watts, dBm, or bar graph. The reverse power may also be displayed as a percentage of forward power. Use the setup screens (described later) to change display units. Pressing S1 (GAIN) allows you to adjust the gain while monitoring its effect on output power. The third line of this screen normally shows operating status, but changes to helix current when GAIN is selected for adjustment, and will be overwritten by a message if a fault occurs..

Setup Screens Menu 2 - Labeled SETUP selects the first of six setup screens.

SETUP 1: toggles Auto Cycle On/OFF and Remote. Pressing S1 (SET) changes the selection. The setting displayed when the screen is exited will be retained.

Pressing MORE brings up the next screen, SETUP 2.

Auto Cycle: When primary power is restored after an interruption, the system will return to the On state that existed before the interruption. For example, if the TWTA is at RF On, and Auto Cycle is selected, it will automatically recycle the amplifier to turn RF On after a primary power interruption.

The control system will warn you at power up if Auto cycle is enabled. To cancel, simply press either the RF Off or Standby key.

Remote: When Remote is off, a device connected to the TWTA computer interface may monitor the amplifier's status but may not control the Operate , Standby , RF Off or RF On, or Reset keys. When Remote is On, the external device has full control of the amplifier for safety reasons. Pressing the RF Off or Standby keys cancels the Remote mode, and causes the system to revert to local control.

SETUP 2 toggles display of temperature parameters between Fahrenheit and Celsius degrees. Pressing S1 (SET) changes the selection. The setting displayed when the screen is exited will be retained. Pressing MORE again brings up the next screen, SETUP 3.

SETUP 3 allows a choice of displaying forward power in stripchart form, or in dBm or watts. Pressing MORE again brings up the next screen, SETUP 4.

SETUP 4 allows a choice of dBm or watts for displaying reflected power. Pressing MORE again brings up the next screen, SETUP 5.

SETUP 5 toggles the desired number of alarm beeps and the desired beep volume. S1 (SET) toggles between parameters, and the adjust knob is used to enter the data. Pressing MORE again brings up the next screen, SETUP 6.

SETUP 6 allows the IEEE-488 address to be set. Pressing MORE again returns you to SETUP 1. EXIT returns you from any of the setup screens to MENU 2.

3.5 REAR PANEL FEATURES

See Figure 3-4 below.

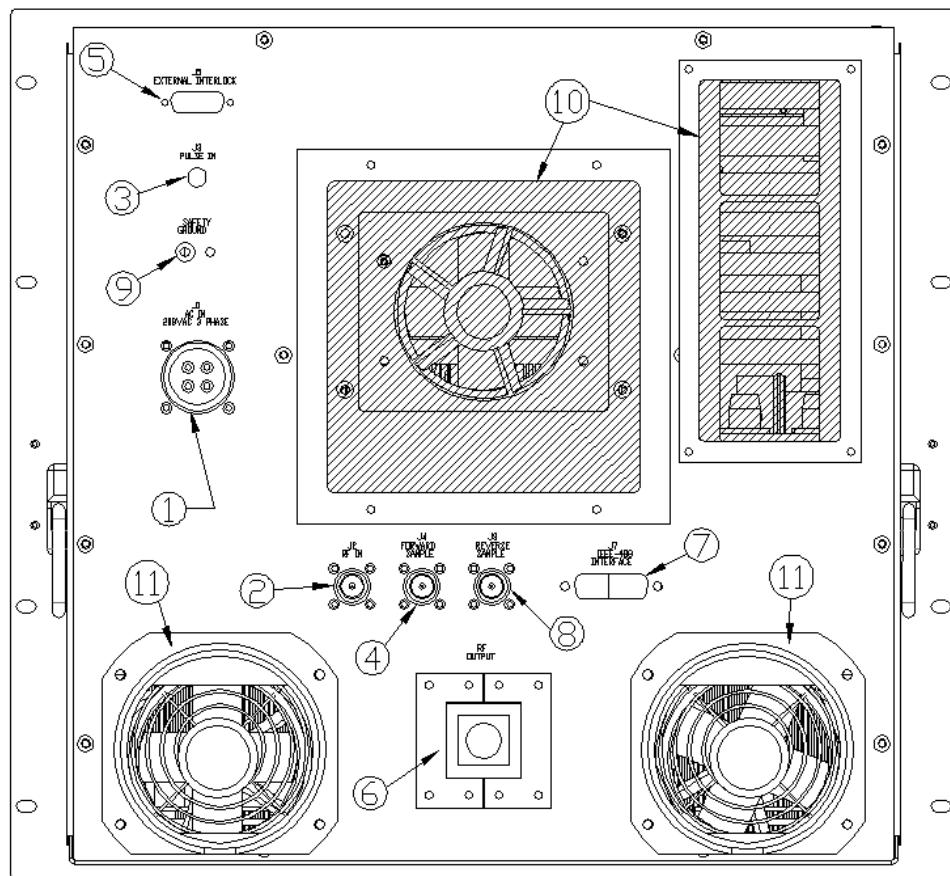


Figure 3-4. Rear Panel Features

Table 3-2. Rear Panel Features

Item	Title	Function
1.	AC POWER IN	AC power input connector: MS3102A22-22P mates with MS3106F22-22S
2.	RF IN	RF Input: Type-N female
3.	PULSE GATE INPUT	Modulator pulse inhibit input (TTL): BNC female
4.	RF FORWARD SAMPLE	RF forward sample: Type-N female
5.	EXTERNAL INTERLOCK	Connector for remote interlock and inhibit functions: D-sub 15-pin female
6.	RF OUT	RF Output Signal 68.4 dBm Min
7.	IEEE-488 INTERFACE	Remote control connector: IEEE-488 24 pin hermaphrodite
8.	RF REVERSE SAMPLE	RF reverse sample, Type-N Female
9.	SAFETY GROUND	Safety Ground, threaded stud
10.	AIR INLET	-
11.	AIR OUTLET	-

3.6 INITIAL TURN ON AND WARM-UP PROCEDURE

Before applying power, verify that the equipment line voltage is compatible with the TWTA.

Install the TWTA as discussed in Section 3.2. Provide an RF generator to the RF input Type N connector J3. Set RF generator level below -20 dBm and set desired frequency in specified range. Connect a load suitable for 1000 watts continuous operation to the RF output connector (20,000 watts peak). The load VSWR should be less than 2.0:1. A power meter and suitable attenuators may be connected to the RF sample port (rear panel). (Refer to RF sample port calibration factors on the rear of the unit or on the *Info* screen in MENU 2). These show the relation between the amplifier output power and the RF sample port power as a function of frequency. When only the power of the fundamental frequency is to be measured and when operating near rated power use filters, a frequency selective receiver, or a spectrum analyzer to reduce the harmonic content of the measured level.

Switch on the MAIN POWER circuit breaker. The fans will operate. The front panel display will show several identification messages and then MENU 1 screen. The third line will indicate the heater time delay is active. Allow the heater warm-up delay to expire. Line three will indicate STANDBY / READY.

Push S4 (MORE) three times to go to MENU 4. Verify that the heater voltage and current are near their nominal levels. The values of these parameters at the time the TWTA left the factory are logged on the test data sheet.

Push the OPERATE push-button. Stay in Menu Screen 4. You will now see the cathode and collector voltages rise. Verify that the collector and cathode voltages are near nominal. The values of these parameters at the time the TWTA left the factory are logged on the test data sheet.

Set Gain to 0%. Push OPERATE, check the helix current (Iw). The helix current should be close to the nominal value for no RF drive. The value of this parameter at the time the TWTA left the factory is logged on the test data sheet.

Push S4 (MORE) or EXIT to get to Menu 1.

Set the TWTA gain to maximum. Adjust the RF generator to slowly increase the RF drive toward 0 dBm to reach the desired forward power on the display and power meter (connected to the forward sample port). The forward power display will become active, with a maximum reading when peak power output is achieved.

An alternate procedure is to pre-set the gain to a minimum, set the RF generator to 0 dBm and then slowly increase the TWTA gain to set the desired RF output level.

Observe that the helix current is sensitive to the RF drive level of the TWT. It is at a minimum with no RF drive. The helix currents with no drive and with rated RF output mid-band are logged on the test data sheet. The value of the helix current is a good qualitative indicator of RF drive present.

Best performance is obtained when the input RF drive is set at or just below the level which causes peak power output. Do not set input drive above 10 dBm

CAUTION:



Input drive above +20 dBm may damage the unit.

The reverse (reflected) power level should remain below 10% of the forward power, assuming that the output is properly matched.

To shut the system down, push STANDBY. Allow the TWTA to cool down until the TWT temperature drops below 50°C, then turn off main power. Menu 1 displays **COOL-DOWN** until the TWT temperature is within 15°C of the cabinet temperature.

3.7 EMERGENCY BYPASS

The TWTA is provided with a means of operating the amplifier manually in the event that there is a failure of the control module and it is imperative that the amplifier remain on line.



CAUTION:

Emergency bypass operation disables external interlock and certain protective and diagnostic features. For this reason, the emergency bypass mode of operation should be used only when the control unit fails and when it is essential to remain on line.

To access the manual controls, remove the two 4-40 screws securing the Emergency switch cover plate on the front panel. Emergency bypass mode is selected by pushing the left-hand switch (S1) to the left. The center switch (S2) toggles between high voltage on (left) and high voltage off (right). The right-hand switch (S3) selects between beam on (left) and beam off (right). There is a manual control for the gain adjustment as well. This is a flat, square single-turn pot (R1).



CAUTION:

Do not adjust 20-turn pot R11; its function is to set the foldback VSWR level, and it is calibrated at the factory.

3.8 IEEE-488 COMMUNICATION

The TWTA is provided with an IEEE-488 interface that permits remote emulation of OPERATE, STANDBY, and RESET push-buttons as well as access to parameter measurements, system faults, and control unit status. The following tables summarize the commands and the return codes.

Table 3-3. Catalog of IEEE-488 Commands

Command	Function	Units	Response format
RDSTAT	Returns status code of processing of previous command (see Table 5)		STATUS=[]
RDFLT	Returns system fault code (see Table 6)		flt=[]
PWR-ON	Emulates OPERATE push-button		
PWR-OFF	Emulate STANDBY push-button		
XMIT-ON	Emulate RF ON push-button		
XMIT-OFF	Emulate RF OFF push-button		
SYSTEM-ON	Places unit in Sleep Mode		
SYSTEM-OFF	Returns unit from Sleep Mode		
RESET	Emulates RESET softkey		
RDS/N	Returns serial number		s/n=[]
RDCONHR	Returns console hours		ConHr=[]
RDCONMN	Returns console minutes		ConMn=[]
RDRFHR	Returns RF hours		RfHr=[]
RDRFMN	Returns RF minutes		RfMn=[]
RDEK	Returns cathode voltage	KV	Ek=[]
RDEB	Returns collector voltage	KV	Eb=[]
RDEG	Return grid voltage	V	Eg=[]
RDEF	Returns heater voltage	V	Ef=[]
RDIF	Returns heater current	A	If=[]
RDIW	Returns helix current	mA	Iw=[]
RDTMPTWTF	Returns TWT 1 temp (°F)	°F	TWT1F=[]F
RDTMPTWTC	Returns TWT 1 temp (°C)	°C	TWT1C=[]C
RDTMPTWT2F	Returns TWT 2 temp (°F)	°F	TWT2F=[]F
RDTMPTWT2C	Returns TWT 2 temp (°C)	°C	TWT2C=[]C
RDTWTOTF	Returns TWT overtemp warning setpoint (°F)	°F	TWTOTF=[]F
STWTOTF	Sets TWT overtemp warning setpoint (°F)	°F	
RDTWTOTC	Returns TWT overtemp warning setpoint (°C)	°C	TWTOTC=[]C
STWTOTC	Sets TWT overtemp warning setpoint (°C)	°C	
RDIWOC	Returns helix overcurrent warning setpoint	mA	IwOC=[]
SIWOC	Sets helix overcurrent warning setpoint	mA	
RDLOGIC	Returns logic state code (see Table 7)		Sys=[]
RDA	Returns gain	%	A=[]
SA	Sets gain	%	
RDHTDREM	Returns remaining heater time delay	sec.	HTD=[]s
RDPODP	Returns Peak forward power out (dBm)	dBm	Po=[]dBm Pk
RDPOWP	Returns Peak forward power out (W)	watts	Po=[]W Pk

Command	Function	Units	Response format
RDPRDP	Returns Peak reverse power out (dBm)	dBm	Pr=[]dBm Pk
RDPRWP	Returns Peak reverse power out (W)	watts	Pr=[]W Pk
RDPOHIDP	Returns Peak over forward power warning setpoint (dBm)	dBm	Pohi=[]dBm Pk
SPOHIDP	Sets Peak over forward power warning setpoint (dBm)	dBm	
RDPOLODP	Returns Peak under forward power warning setpoint (dBm)	dBm	Polo=[]dBm Pk
SPOLODP	Sets Peak under forward power warning setpoint (dBm)	dBm	
RDPOHIWP	Returns Peak over forward power warning setpoint (W)	watts	Pohi=[]W Pk
SPOHIWP	Sets Peak over forward power warning setpoint (W)	watts	
RDPOLOWP	Returns Peak under forward power warning setpoint (W)	watts	Polo=[]W Pk
SPOLOWP	Sets Peak under forward power warning setpoint (W)	watts	
RDPRHIDP	Returns Peak over reverse power warning setpoint (dB)	dBm	Prhi=[]dBm Pk
SPRHIDP	Sets Peak over reverse power warning setpoint (dBm)	dBm	
RDPRHIWP	Returns Peak over reverse power warning setpoint (W)	watts	Prhi=[]W Pk
SPRHIPW	Sets Peak over reverse power warning setpoint (W)	watts	
RDPOD	Returns forward power out (dBm)	dBm	Po=[]dBm Avg
RDPOW	Returns forward power out (W)	watts	Po=[]W Avg
RDPRD	Returns reverse power out (dBm)	dBm	Pr=[]dBm Avg
RDPRW	Returns reverse power out (W)	watts	Pr=[]W Avg
RDMMSG	Message displayed on front panel		
RDFLTMSG	Read fault or warning message on screen		
RDFLOG *	Read event log * 0 to 99 Event Number		

Table 3-4: Catalog of Status Codes

(The **RDSTAT** command causes the TWTA to return a string in the form **STATUS=[code]**, where **[code]** is an ASCII number whose meaning is given below)

Status Code	Meaning
0	No command was given or last command was successful.
1	Last command is successful.
2	Last command is in process.
3	Last command failed to complete. Time-out.
10	Last command failed. Invalid command.
11	Last command failed. Data was unparseable.
20	Last set command failed. Data was beyond high limit.
21	Last set command failed. Data was beyond low limit.
22	Last set command failed. Data was out of range
23	Last set command failed. Data was wrong polarity
50	Last command failed. Local system does not have remote enabled.

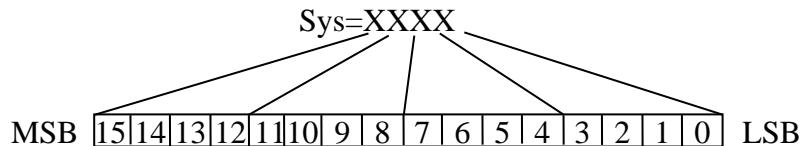
Table 3-5: Catalog of Fault Codes

(The **RDFLT** command causes the TWTA to return a string in the form **flt=[code]**, where **[code]** is an ASCII number whose meaning is given below)

Fault Code	Meaning
0	No fault
7	System Fault
8	FIL Not Ready
9	Low Line
10	Cathode overvoltage
11	Body overcurrent
12	Cathode undervoltage
13	VSWR TWT
14	SSPA Over Temperature
15	Collector undervoltage
16	Inverter fault
17	Internal interlock open
18	Tube arc
19	TWT (hardware) overtemperature
20	Cabinet (hardware) overtemperature
22	External inhibit
23	Over reverse power
25	Over Duty
26	Panel open
28	Over Pulse Width

Table 3-6: Catalog of System State Codes

(The **RDLOGIC** command causes the TWTA to return a string in the form **Sys=[code]**, where **[code]** consists of 4 hexadecimal numbers encoded in their binary values as follows)



Bit	Meaning if high
0 (LSB)	High voltage on
1	Transmit on
2	Remote mode
3	Fault
4	Heater time delay expired
5	Under forward power warning
6	No surge enabled
7	Auto Recycle enabled
8	External inhibit
9	External interlock
10	Foldback Active
11	Power on
12	Standby Ready
13	RF Off Ready
14	ALC enabled (if installed)
15 (MSB)	Panel Open

Command syntax is in this form:

<command mnemonic> <parameter> <carriage return>

where;

<command mnemonic> consists of one of any valid command found in Table 4.

<parameter> (as applicable) consists of one ASCII "space" character followed by a number.

<carriage return> consists of an ASCII carriage return.

All commands are case sensitive.

The system will return parameter values, fault codes, and status codes regardless of whether remote is enabled. The parameter value is returned as a string of 20 characters or less, consisting of a label, "=", and a value. For example, outputting the command RDEF to the TWTA would result in the TWTA sending back the string "Ef=6.03" (assuming the heater voltage is 6.03 volts). Units are not returned; see table 3 for the units.

If remote is not enabled, set commands and commands to the system logic (i. e., PWR-ON, PWR-OFF, XMIT-ON, XMIT-OFF or RESET;) will not be accepted.

It is recommended that the RDSTAT command be used to provide the host program with a report on how the previous command was processed.

A small sample program that can send commands and receive the strings returned by the TWTA is included, see Section 5.4. It is written in Hewlett-Packard's "Rocky Mountain" BASIC. The program assumes that the IEEE-488 bus is at address 7 and that the address of the TWTA is 01.

Remote operation is determined by the application (software) program in the system controller. This application program will aid the user in generating the Command Codes and displaying/monitoring the Status Codes. Consult the application program users instructions for Remote operation procedure.

The application program should issue only one string at a time. After each functional command is issued the status should be checked to ensure that the command has been properly executed. The application program should allow sufficient time for the function to be completed before checking the status.

The application program should facilitate checking the status just prior to issuing a command - since the status could have been changed by a fault condition of the amplifier or by operator activation of the amplifier. Periodic checking of the status is also recommended.

3.9 TWTA GENERAL CONSIDERATIONS

This section is intended to offer some guidelines regarding operation, storage and use of Amplifier Research TWTA's.

Storage: TWTA's, as with other electronic equipment, are best stored in a benign environment at reasonably constant temperature. Service life is not improved by periodic operation.

Availability: For critical missions, and after long periods of storage, it is recommended that TWTA operation be checked sufficiently in advance of the mission to permit repair if required. Though service life is not improved by periodic operation, users experiencing amplifier trip due to body over current may benefit by

periodically operating a unit with high voltage and grid on, but no rf drive. Such operation for about one hour on a weekly basis should effectively reduce nuisance tripping. Since the cathode structure has finite life, extended periods of non-functional operation of TWTA's is not recommended. An alternate approach, if periodic trip off has been observed, is to operate the unit without rf input for 1-2 hours before planned functional operation, resetting the unit after occasional trip off.

Cooling during Operate Mode: AR TWTA's have their air outlets and inlets on the rear panels. It is important to prevent the heated air, which is expelled from the TWTA's air outlets, from being recycled into the air inlets. Applications should have a clearance behind the TWTA of at least two feet for single bench top units and at least three feet for the higher power units, or the heated air should be ducted away.

Operation in Standby Mode: Standby mode for TWTA's readies the unit for operation. In this mode the filaments are on but the high voltage is off. TWTA's should not be left in this Standby mode for extended periods. Where practical, operational procedures should limit the time on Standby mode to less than approximately one hour. (See *Explanation of Limiting the Time in Standby mode....*, below)

Operate Turn on: When selecting the Operate mode, when high voltage is first turned on, there may be some internal TWT arcing which can cause protective circuits to deselect the Operate mode, thereby returning the unit to the Standby mode. There may be a report of body over-current fault. In either case, if there is no other contraindication, the Operate mode may be selected again. This procedure may be repeated, if needed up to 25 times, until the Operate mode is actually set. If this condition persists, contact Amplifier Research Service for additional assistance. (See *Explanation of Limiting the Time in Standby mode....*, below)

Noise Power Density (NPD): TWTA's produce rf noise over their operating frequency range, as specified by the Noise Power Density (NPD). This noise is significantly higher than the noise produced by typical solid state amplifiers, and is inherent in present TWTA's. The noise may surprise users new to TWTA's when it accumulates and results in a significant indication in a broadband measurement device – such as a power meter or field probe. The error produced by this indication is not significant when operating near rated TWTA power levels, but may cause difficulty when trying to operate high power TWTA's at low output power levels.

For example, consider a hypothetical typical NPD of -76 dBm/Hz , from a 4 GHz bandwidth amplifier. A broadband detector might see the NPD as $[-76 \text{ dBm/Hz} + 10 (\log 4 \times 10^9) \text{ BW factor} = -76 + 96 =] +20 \text{ dBm}$, or 0.1 watts. This power is insignificant for a user operating at 200 watts (+53 dBm), but may be very noticeable to a user trying to operate below 1 watt (+30 dBm). [One watt is 0.5% of (23dB below) rated power for a 200-watt amplifier.] A field probe user who obtains a 200 V/M field with 200 watts, may see a field as high as $[53 \text{ dBm} - 20 \text{ dBm} = 33 \text{ dB below } 200 \text{ V/M} =] 4.5 \text{ V/M}$ due to this hypothetical NPD.

For these applications the use of a lower power amplifier is highly recommended, especially when considering safety issues. Alternatively, additional power loss in the form of an added high power microwave attenuator, or preferably an increased space loss for radiated fields, may be used to lower the noise received by the broadband measurement device.

Explanation of Limiting the Time in Standby mode and of Repeated Operate Selection.

Traveling wave tubes tend to get “gassy” if they are left in a Standby mode for extended periods of time. In this Standby mode, the heater (filament) is on but there is no high voltage applied to the collector (or high voltage is applied to the collector but the grid is off). This is the normal state after a tube's warm up time, just prior to entering the Operate mode.

In this state the cathode end of the TWT is heating up but the electron “beam” is off. In other words, there is no cathode current. As the cathode heats up, gas trapped in the structure of the tube can be released, thus corrupting the vacuum of the tube. If the tube become too “gassy”, arcing may occur when the high voltage is

fully applied in the Operate mode. Another possible failure mode is a body over-current fault when the beam is turned on and the tube is “gassy”.

Occasional arcing is normal for a TWT. The support components are designed to handle this, protecting both the TWT and its support circuitry. However, if the tube arcs two or three times in rapid succession, or worse yet repeatedly, a fault will be sensed that will shut the high voltage off, thus removing the unit from Operate status. The remedy usually recommended is to repeat the selection of the Operate mode until the unit remains in Operate. It has been found that most of the faults that can be cleared by this method will be cleared within 25 attempts to enter the Operate mode.

Once the tube is operating normally, gas will continue to evolve at a slow enough rate that the TWTA will not fault. This happens because the gas in the tube will interact with the beam and become ionized. As the electrons in the beam hit the gas molecules they ionize the gas, at which point it is accelerated into the collector structure and “buried” deep enough so that it ceases to be a problem.

To preclude this gassing problem, and thus reduce the need for repeating the Operate selection, it is recommended that the time in Standby be limited – to about one hour. Extended periods in Standby may result in an inability to clear the fault by this method. In this case, service measures may be needed to correct the unit. Thus, users should reduce the likelihood of occurrence of this problem by limiting the amount of time in the Standby mode.

The service measures involve pulsing of the tube beam current and gradually increasing the duty of the pulsing until the unit will operate continuously. Note that a similar condition can exist for tubes with grids when the TWTA is in the Operate mode (high voltage is on) but gating (control) input is set so that the grid turns off the TWT beam current. Operational procedures should also limit the time in this mode

4. MAINTENANCE

The TWTA does not require routine scheduled maintenance. The only moving parts are the elements of switches, relays and blowers. Preventive maintenance is recommended in Paragraph 4.3.

The TWTA is basically a factory repairable unit. However, since limited logic schematics and partial parts information is supplied in this manual (Section 5) some user service organizations may choose to perform their own corrective maintenance. **Warnings and Cautions should be observed.**

4.1 SAFETY WARNING



WARNING:

Service work must be performed only by technicians thoroughly familiar with the high voltages present in microwave tube amplifiers in general, and with this equipment in particular.

Never handle the TWT leads or the high-voltage connectors unless it has been positively established that the high-voltage filter capacitors have been discharged to a *known* safe level.



CAUTION:

A malfunctioning power supply can cause damage to the TWT. When troubleshooting the TWTA, remove the TWT and substitute suitable loads to prevent damage to the TWT.

4.2 UNAUTHORIZED REPAIRS



CAUTION:

Unauthorized repairs or modification of this product during the warranty period may void the warranty. In the event that the TWTA malfunctions while it is still under warranty, always contact an authorized service representative.

4.3 PREVENTIVE MAINTENANCE

The RF characteristics and power supply voltages and currents of the TWTA should be logged on a regular basis. Maintenance should be performed if significant deviations from the logged values appear. If the unit is under warranty, contact an authorized service representative if impaired performance is suspected.

If there is accumulated dust on the air intake grill, clean it with dry compressed air. If significant dust has been noted on the air intake grill, it may be desirable to vacuum the dust and debris from inside the enclosure.

To open the enclosure:

1. Remove the amplifier from the cabinet or rack as follows:

NOTE: Due to the weight of the unit, the removal of the amplifier from the cabinet or rack is a two person operation.

Disconnect power, RF, and any other interface connectors. On the rear of the unit, remove any screws used to connect brackets to the amplifier. On the front of the unit, remove the four screws holding the front panel onto the cabinet. Carefully slide the amplifier out of the front of the cabinet.

2. Remove the 6 screws that secure the lower cover and the 6 screws that secure the upper cover. Remove the covers to gain access to the interior of the TWTA.

Vacuum dust and debris from inside the enclosure. Clean dust from the TWTA and its flying leads. Remove any dirt from around the three high voltage connectors. While the cover is off, check for loose wires, components or fasteners.

Reassemble in the reverse order.

4.4 TROUBLESHOOTING

Symptom	Possible cause
TWT or power supply over temperature	Air inlet filter(s) dirty Collector heat sink dirty Inadequate clearance behind TWTA High air inlet temperature Defective blower or power supply
No response when main power turned on	Panel open interlock switch open
Control module display does not come up; unit does not beep when powered up	Shorted or defective control module power supply Control module failure
Control module does not boot	EPROM(s) missing.
Control module datalink failure or Communication Problem error appears	HPA interface failure. Fiberoptic link failure +15 VDC supply failure
Heater power supply does not come up	Defective low voltage power supply module Defective heater power supply module
No high voltage	Open external interlock Keylock switch on INHIBIT or REMOTE Defective high voltage power supply.
Voltages normal, but no RF output, helix current low	No RF input Defective remote control board Defective SSA Gain turned down

After review of the symptoms of the failure, the user may want to check for a loose connector or component especially after rough handling of the unit. Look externally for physical damage and internally for unmated or loose parts.

The service technician should become familiar with the internal mechanical construction to permit correct reassembly. Limited troubleshooting may be conducted, with caution, based on the failure symptom and an understanding of the logic/schematic diagrams.

4.5 NON-REPAIRABLE MODULES

The following modules are encapsulated and not repairable. Contact an authorized service representative if replacement modules are needed.

- A27816-004 Heater Power Supply Module
- A27818-000 Tank Module (No Caps)
- A33176-000 High Voltage Filter Assembly
- A33173-000 High Voltage Rectifier & XFMR Module
- A33186-001 Storage Cap Assembly
- A30493-004 Dual Modulator Module, Pulsed Applications

4.6 RECOMMENDED SPARE PARTS

- A27840-004 Heater Power Supply Module
- A27818-000 Tank Module (No Caps)
- A33176-000 High Voltage Filter Assembly
- A33173-000 High Voltage Rectifier & XFMR Module
- A33186-001 Storage Cap Assembly
- A30493-004 Dual Modulator Module, Pulsed Applications
- A23050-084 HPA Logic and Control Module
- A30467-100 Phase and Post Power Inverter
- A26452-150 Low Voltage Power Supply Module
- A23065-000 Input Filter Module
- A23692-000 Insulated Fan Driver

5. TECHNICAL DOCUMENTATION

NOTE: The purpose of this technical documentation section is to provide a guide to the TWTA for technician-level servicing. It is intended for use by qualified technical personnel who must troubleshoot and repair the TWTA in the field. Such repairs are typically limited to replacement of modules or major components. For this reason, documentation pertaining to the highest levels of the system and to system control logic is included.

5.1 TOP LEVEL BUILD TREE

5.1.1 HPA 83PS, 2 - 4GHZ, A38003-001

Ref Des	Item Number	Item Description
A6,A7,A8	A23692-000	INSULATED FAN DRIVER
A4	A24324-003	HPA SYSTEM CONTROL FRONT PANEL ASSEMBLY
A3	A25444-001	HPA INTERFACE BOARD (200UM GLASS FIBERS)
A18	A26946-001	CONTROL HEAD ENCLOSURE, IEEE-488.
A11	A30493-004	DUAL MODULATOR ASSY, SINGLE CATHODE REFERENCE
A15	A30537-003	HV BREAKOUT BOX, 3 COLLECTORS
A16	A30655-000	CROWBAR DRIVER BOARD, 10-15KV
A13	A30750-000	PULSE MONITOR BOARD
A1	A33066-001	MICROWAVE POWER ASSY, 83PS
A2	A33068-001	POWER SUPPLY FOR MEC-3102 SUPERTUBE
	A33181-001	WIRING KIT, 83PS
A5	A33186-001	STORAGE CAP ASSEMBLY FOR 83PC AND 83PS
	A33318-001	CABINET KIT

5.2 SCHEMATICS

10-38003-001	HPA, 83PS
25-38003-001	RF Block Diagram
10-25444-001	HPA Interface
10-30537-003	HV Breakout Box
10-30655-000	Crowbar Driver Board
10-30750-000	Pulse Control Monitor Board
10-33186-000	Capacitor Bank

5.3 SAMPLE PROGRAM FOR IEEE-488 COMMUNICATION

```
1000 ! **** IEEE-488 COMMUNICATIONS SOFTWARE ****
1010 ! *      IEEE-488 COMMUNICATIONS SOFTWARE      *
1030 ! *      7/24/92   AARON D. MCCLURE          *
1040 ! ****
1041 DIM F$[80]
1042 DIM A$[80]
1050 CLEAR SCREEN
1060 INPUT "INPUT COMMAND TO SEND TO POWER SUPPLY.  EXIT TO QUIT.",A$
1070 IF A$="EXIT" THEN 1130
1080 OUTPUT 701;A$
1090 IF A$[1,2]<>"RD" THEN GOTO 1060
1095 IF A$[1,1]="" THEN GOTO 1100
1100 ENTER 701;F$
1110 PRINT "OUTPUT FROM COMMAND ",A$, " IS ",F$
1120 GOTO 1060
1130 CLEAR SCREEN
1140 END
```


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.

