



Operating and Service Manual

40T26G40A

Model

10009284

Part Number

Serial Number

EC Declaration of Conformity

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

declare that our product(s);

the Model 40T26G40A 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 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.

SICHERHEITSSYMBOLS

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 hineinschauen. |
|  | Weist auf eine Rahmen- oder Chassis-Anschlussklemme hin. |
|  | Zeigt Wechselstrom an. |
|  | Weist darauf hin, dass dieses Produkt nicht mit Ihrem restlichen Hausmüll entsorgt werden darf. |
|  | Weist darauf hin, dass die markierte Oberfläche und benachbarte Flächen extrem heiße Temperaturen erreichen können und daher nicht angefasst werden sollten. |

SICHERHEITSHINWEISE FÜR DEN AUFBAU DES GERÄTS



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

- Zum Heben und Transport folgen Sie allen in dieser Anleitung angegebenen Anweisungen.
- Platzieren Sie das Gerät auf einer harten, ebenen Oberfläche.
- Verwenden Sie das Gerät nicht in feuchter Umgebung, zum Beispiel in der Nähe einer Spüle oder in einem feuchten Keller.
- Platzieren Sie Ihr Gerät so, dass der Netzschalter leicht zugänglich ist.

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

BEVOR SIE DAS GERÄT ANSCHLIESSEN

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



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

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



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

SYSTEMERDUNG



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

HINWEISE FÜR DEN SICHEREN GEBRAUCH

GEFÄHRLICHE HF-SPANNUNGEN



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

HÖRSCHUTZ

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

WARTUNGSHINWEISE

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

UMGEBUNGSBEDINGUNGEN

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

- Gebrauch in Innenräumen
- Höhe bis zu 2000m
- Temperaturen von 5°C bis 40°C
- Maximale relative Luftfeuchtigkeit 80% bei Temperaturen bis 31°C. Lineare Abnahme auf 50% bei 40°C.
- Netzspannungsschwankungen sollen nicht mehr als $\pm 10\%$ 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 hineinschauen.

HF-ANTENNEN

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

RACK MONTIERBARE TWT-MODELLE

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

HEBEANWEISUNGEN FÜR AR-GERÄTE

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



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

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

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

INSTRUCTIONS POUR UN FONCTIONNEMENT EN TOUTE SÉCURITÉ









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

USAGE PRÉVU

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

SYMBOLES DE SÉCURITÉ

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

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

PRÉCAUTIONS D'INSTALLATION DE L'ÉQUIPEMENT



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

- Respectez toutes les instructions de levage indiquées dans ce document.
- Placez l'équipement sur une surface dure et plane.

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

AVANT LA MISE SOUS TENSION

Votre équipement AR peut disposer de plus d'un câble d'alimentation électrique. Utilisez uniquement un ou des câbles d'alimentation 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 ininterrompue de taille suffisante pour attacher les bornes de câblage, le cordon d'alimentation ou l'ensemble de câbles d'alimentation fourni. **N'UTILISEZ PAS cet équipement si cette protection est affaiblie.**

INSTRUCTIONS POUR UN FONCTIONNEMENT EN TOUTE SÉCURITÉ

TENSIONS RF DANGEREUSES

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



LIMITES ACOUSTIQUES

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

AVERTISSEMENT CONCERNANT L'ENTRETIEN

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

CONDITIONS ENVIRONNEMENTALES

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

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

ÉQUIPEMENT CONTENANT DES LASERS



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

ANTENNES RF

- Cet équipement (antenne ou ensemble antenne) peut être lourd nécessitant deux personnes pour le soulever. Soyez prudent lorsque vous installez ou retirez l'unité. Respectez toutes les instructions concernant l'installation et le levage de l'équipement indiquées dans ce document.

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

MODÈLES TWT MONTÉS SUR BÂTI

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

INSTRUCTIONS DE LEVAGE POUR L'ÉQUIPEMENT AR

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



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

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

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

INSTRUCTIES VOOR VEILIG GEBRUIK


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

BEOOGD GEBRUIK

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

VEILIGHEIDSSYMBOLEN

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

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

VOORZORGSMAATREGELEN BIJ DE INSTALLATIE VAN HET APPARAAT



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

- Respecteer alle tilinstructies die in dit document vermeld zijn.
- Plaats het apparaat op een hard, waterpas oppervlak.
- Gebruik het apparaat niet in een natte omgeving, bijvoorbeeld in de buurt van een gootsteen of in een vochtige kelder.
- Plaats uw apparaat zodanig dat de aan/uit-schakelaar gemakkelijk bereikbaar is.

Revisie 0517

- 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 uitval van veiligheidscrisis's.
- Houd het apparaat uit de buurt van extreem hoge of lage temperaturen om ervoor te zorgen dat het apparaat binnen het gespecificeerde werkbereik wordt gebruikt.
- Bij de installatie van accessoires zoals antennes, directionele koppelingen en terreinsondes, moet u ervoor zorgen dat blootstelling aan gevaarlijke RF-niveaus wordt voorkomen.
- Zorg ervoor dat er niets op de kabels van uw apparaat rust en dat de kabels zich niet op een plaats bevinden, waar er op getrapt kan worden of waar er over gestruikeld kan worden.
- Verplaats de apparatuur voorzichtig; zorg ervoor dat alle zwenkwielen en/of kabels stevig op het systeem zijn aangesloten. Vermijd plotselinge stops en oneffen oppervlakken.

VOOR HET OPZETTEN VAN DE STROOM

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



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

Pas geen netvoedingskabels of stekkers aan. Raadpleeg een bevoegde elektricien of een door AR opgeleide servicemonteur voor aanpassingen van de apparatuur. Respecteer altijd uw lokale/nationale 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-uitgangconnector 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 $\pm 10\%$ 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-ingangsniveau niet, dat in de specificaties is vermeld. Raadpleeg de gebruikershandleiding en het productspecificatieblad om de toepasselijke RF-niveaus te bepalen.
- Een overmatige RF-input kan het apparaat of de connectoren beschadigen en veiligheidsrisico's veroorzaken.
- De RF-spanningen op de antenne-elementen kunnen gevaarlijk zijn tijdens het gebruik. Raak de antenne of elementen niet aan wanneer de RF-ingangconnector 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 tafemodel. Deze modellen die in een rek kunnen worden gemonteerd, kunnen worden geleverd met handgrepen of sledes en handgrepen die aan de voorkant zijn geïnstalleerd. Volg alle tilinstructies in dit document en de installatie-instructies in de gebruikershandleiding van de TWT.

TILINSTRUCTIES VOOR AR-APPARATUUR

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



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

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

- Gebruik alleen het hijsorg (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:

Adjustment, maintenance, or repair of the equipment must be performed only by qualified personnel.



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.



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 (I_w)
 - 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 the AR Worldwide Model 40T26G40A Broadband Microwave Amplifier. The Model 40T26G40A is a 40-watt Ka-band Traveling-Wave Tube Amplifier (TWTA). Refer to the Model Configurations on the data sheet to determine the applicable features of this unit.

1.1 TWTA DESCRIPTION

The amplifier uses a broadband millimeter-wave traveling-wave tube (TWT) to provide 40 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 for bench-top use. The front panel of the rack mountable amplifier is 5.25 inches high, and the overall unit is 25.25 inches deep, excluding the rear-panel connectors. For bench-top use, the amplifier is supplied in an enclosure with integral carrying handles.

Primary power is 99–260 volts, 50–60 Hz, single 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 Worldwide Data Sheet at the end of this section for detailed specifications.

1.4 ACCESSORIES

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

- Directional coupler
 - Antenna
 - Flexible transmission line

Refer to a current AR Worldwide catalogue 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.



40T26G40A

- M1-M12
- 40 Watts CW
- 26.5GHz-40GHz

Features

The Model 40T26G40A is a self contained, forced air cooled, broadband traveling wave tube (TWT) microwave amplifier designed for applications where wide instantaneous bandwidth, high gain and moderate power output are required. A reliable TWT provides a conservative 40 watts minimum at the amplifier output connector. Stated power specifications are at the fundamental frequency.

The amplifier's front panel digital display shows forward and reflected output 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 reflected power warning and remote. Standard features include a built-in IEEE-488 (GPIB) interface, 0dBm input, VSWR protection, gain control, RF output sample port, 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

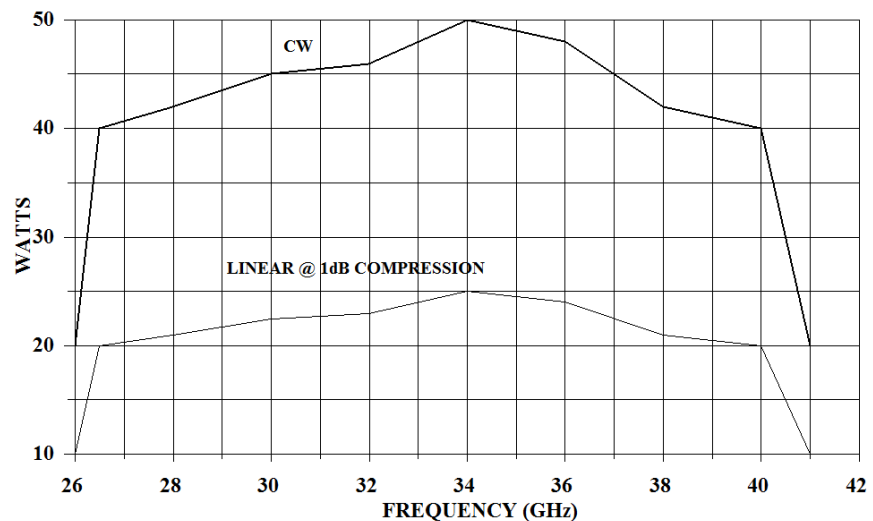
and RF components allow for easy access and repair. Use of a switching mode power supply results in significant weight reduction.

Housed in a stylish contemporary cabinet, this unit is designed for benchtop use but can be removed from the cabinet for rack mounting. The Model 40T26G40A provides readily available RF power for a variety of applications in Test and Measurement, (including EMC RF susceptibility testing), Industrial and University Research and Development, and Service applications. These sub-octave amplifier features moderate harmonic content.

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

Refer to Model Configuration Chart for alternative configurations and special features.

40T26G40A TYPICAL POWER OUTPUT



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

For an applications engineer call: 800.933.8181

www.arworld.us



40T26G40A

- M1-M12
- 40 Watts CW
- 26.5GHz-40GHz

Specifications

POWER (fundamental), CW, @ OUTPUT CONNECTOR: Nominal, 45 watts; Minimum, 40 watts; Linear @ 1dB Compression 10 watts minimum

FLATNESS: ± 8 dB

FREQUENCY RESPONSE: 26.5–40 GHz instantaneously

INPUT FOR RATED OUTPUT: 1.0 milliwatt maximum

GAIN (at maximum setting): 46 dB minimum

GAIN ADJUSTMENT (continuous range): 35 dB minimum

INPUT IMPEDANCE: 50 ohms, VSWR 2.0:1 maximum

OUTPUT IMPEDANCE: 50 ohms, VSWR 2.5:1 typical

MISMATCH TOLERANCE: Output power foldback protection at reflected power exceeding 10 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.

MODULATION CAPABILITY: Will faithfully reproduce AM, FM, or pulse modulation appearing on the input signal. AM peak envelope power limited to specified power.

VIDEO PULSE CAPABILITY (S8V OPTION)

Pulse Width: 0.1 microseconds min.

Pulse Rate (PRF): 10 kHz max

RF Rise and Fall: 30 ns max. (10% to 90%)

Delay: 300 ns max. (pulse input to 90% RF)

PW Distortion: ± 30 ns max.

NOISE POWER DENSITY: Minus 60 dBm/Hz maximum; Minus 70 dBm/Hz (typical)

HARMONIC DISTORTION: Minus 20 dBc maximum; Minus 28 dBc typical

PRIMARY POWER: See Model Configurations

CONNECTORS:

| | |
|---------------------------------|---|
| RF input: | Type K female, rear panel |
| RF output | Type WR-28 waveguide flange, rear panel |
| RF output sample port | Type K female, rear panel |
| GPIB | IEEE-488, rear panel |
| Interlock | DB-15 female, rear panel |
| Video Pulse Input (S8V Option): | Type BNC female, rear panel |

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

WEIGHT: 30 kg, 65 lbs

SIZE (WxHxD): 50.3 x 16.5 x 68.6 cm, 19.8 x 6.5 x 27 in

EXPORT CLASSIFICATION: EAR99

40T26G40A

- M1-M12
- 40 Watts CW
- 26.5GHz-40GHz

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) 48.3 x 13.3 (3U) x 68.6 cm, 19.0 x 5.25 (3U) x 27 in, Subtract approximately 7 kg, 15 lbs, for removal of outer enclosure.
- E2S Slides:** slides installed, add approximately 2 kg, 5 lbs.
- E3H Handles:** Front pull handles installed.
- P Primary Power** must select one primary power from the following options [P1 or P2]:
- P1 99-260 VAC,** 50/60 Hz, single phase, 850VA max.
- P2 400V Europe 360-435 VAC,** 3 phase, WYE (5 wire) 50/60 Hz, 850 VA max. CE marked to comply with EMC European Directive 89/336/EEC for operation inside a shielded room.

- S Special Features:** May select a special feature (extra cost) from the following [(S1R or S3F) and/or S2F and/or S5F and/or S4F]:
- S1R Reflected Power Port:** Type K female connector on rear panel. Forward and reflected sample port calibration data supplied on disk in Excel format at 51 points, evenly spaced over specified frequency response.
- S2F Flatness:** Flatness ± 6 dB max at rated power.
- S3F Reflected power port:** type K female connector on front panel. Forward and reflected sample port calibration data supplied on disk in Excel format at 51 points, evenly spaced over specified frequency response.
- S4F RF input connector:** On front panel, not on rear panel.
- S5F Forward output sample port:** On front panel, not on rear panel.
- S6F RF output connector:** on front panel.
- S7E Ethernet Remote Interface:** removes IEEE-488 interface; RJ-45 connector on rear panel.
- S8V Video Pulse Capability**

| Model Number | Features | | |
|------------------|------------------------------------|----|---------------|
| | E | P | S |
| 40T26G40A | Base model | P1 | - |
| M1 | E1C | P1 | - |
| M2 | E1C & E2S & E3H | P1 | - |
| M3 | See individual Specification Sheet | | |
| M4 | E1C | P1 | S2F |
| M5 | - | P1 | S1R |
| M6 | E1C | P1 | S1R |
| M7 | E1C & E2S & E3H | P1 | S1R |
| M8 | E3H | P1 | S3F, S4F, S5F |
| M9 | E1C & E2S & E3H | P2 | S3F, S5F, S6F |
| M10 | E1C & E2S | P1 | S1R, S2F |
| M11 | E3H | P1 | S2F |
| M12 | E1C, E3H | P1 | S7E, S1R, S8V |

Example: Model number example: Model 40T26G40AM1 would have option E1C, no outer enclosure.

2. THEORY OF OPERATION

2.1 DESIGN OF THE AMPLIFIER

The Model 40T26G40A TWT amplifier consists of four principal subsystems. Two of these subsystems, the microwave power assembly (A28051-002) and the TWT power supply (A22826-352), 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 5.1 for further information about how the parts lists are structured.

The heart of the microprocessor control system is the control head assembly (A27752-300), which consists of the CPU board (A25450-000), the HPA display board (A25425-001), and the data link board (A22488-003). The microprocessor control system supervises the power supply, provides metering display, processes operator front panel inputs, and enables communication with a host computer over the IEEE-488 interface.

The control head is provided with its own power supply and, other than through the IEEE-488 interface bus, is electrically isolated from the amplifier. Communication with the amplifier is via fiber-optic links to the HPA interface assembly (A25444-000).

The TWTA packaging consists of cabinet assembly (A27742-001). The cooling system utilizes a 400 Hz fan with a dedicated 400 Hz power supply (A23692-000).

2.2 DESCRIPTION OF THE RF CIRCUIT

The TWTA consists of two stages of RF amplification: a solid-state preamplifier assembly (E02020-000) and a traveling-wave tube amplifier (E01887-000).

The Type K RF input connector is located on the rear panel. The RF input is fed to the solid-state preamplifier via an input isolator (E20375-000). The solid-state preamplifier's output passes through a voltage-controlled attenuator (E20369-000) to drive the RF input of the TWT. Some units are provided with an RF equalizer (E01462-000) adjusted to achieve the 40T26G40A flatness specification. The RF output of the TWT is WRD-180 waveguide flange. After a transition to WR-28 the output is directed through a waveguide assembly provided with a -30/-30 dB dual-directional coupler. The output WR-28 waveguide flange of the coupler protrudes through the rear panel of the TWTA to function as the TWTA' RF output connector.

The reflected port on the directional coupler is connected to a detector diode, whose output is used for Voltage Standing-Wave Ratio (VSWR) protection by the power supply logic board, for VSWR measurement in the leveling loop, and for reflected power measurement on the HPA interface board. With an optional reverse power sample port on the rear panel, an additional -10 dB coupler is connected to the reverse port of the system's dual directional coupler. The output port of the -10 dB coupler is connected to a detector diode whose output is used on the HPA interface board to measure reflected power and for VSWR foldback and protection. The coupled port of the -10 dB coupler is connected to the reverse power sample port on the rear panel.

The forward port output is split by a -10 dB coupler. The direct output is connected to a detector diode via a pad. The output of the detector diode is used on the HPA interface board to measure forward power. The side port of the coupler is connected to the RF sample port on the rear panel. Its nominal coupling factor is -42 dB, due to approximately 2 dB of additional loss in the cabling.

Amplifier gain is set by the voltage-controlled variable gain attenuator. The control head determines the output of a digital-to-analog converter (DAC) on the HPA interface board. The output of the DAC controls the attenuator's loss.

The emergency bypass board (A24830-001) is mounted behind the front panel. It is provided with a circuit that increases the attenuation so that reflected power is limited to a level on the order of 10 watts. In emergency bypass operation (see section 3.7), the gain control signal is provided locally by means of a potentiometer on the emergency bypass board. The foldback circuits remain on line during emergency bypass operation.

2.3 DESCRIPTION OF THE POWER SUPPLY (A22826-352)

The TWT's power supply is of modular construction. Low-voltage power for logic and control of the entire power supply assembly is provided by the low-voltage power supply module (A23687-001). In addition, this module provides Direct Current (DC) power for the HPA interface and emergency bypass boards. Control logic and TWT protection circuits are contained in the HPA Logic and Control Assembly (A16485-488).

The Heater Power Supply Module (A25963-000) powers the TWT DC heater. In addition, the millimeter wave TWT has a grid modulator (A23684-352).

The high-voltage power supply consists of the following: the Power Factor Correction Module (A23683-100) converts line voltage to DC for the high-voltage switching supply. Switching transistors are on the Power Board Assembly (A23710-000), and switching is controlled by the Pulse Width Modulation (PWM) Board (A10017-488). The high-voltage transformer and rectifiers are contained in the High-Voltage Diode/Capacitor Assembly (A23707-488). The high-voltage DC is filtered in the HV Filter Assembly (A21461-488).

Low-voltage 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 heat sink is cooled by the incoming cabinet air. The Heat Sink/Motherboard Assembly is A23709-000.

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 stand-alone bench-top unit, or it can be installed in a 19-in. rack.

If rack mounting is desired, first remove the amplifier from the cabinet, then install the amplifier in the rack. Optional slide rails for rack mounting are available.

NOTE: 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 the unit's power, RF, and any other interface connectors. On the rear of the unit, remove any screws used to connect the mounting brackets to the amplifier. On the front of the unit, remove the four screws holding 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 that may be used for supplementary support of the rear of the TWTA. 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 the necessary support rails and will facilitate installation and removal of the units.

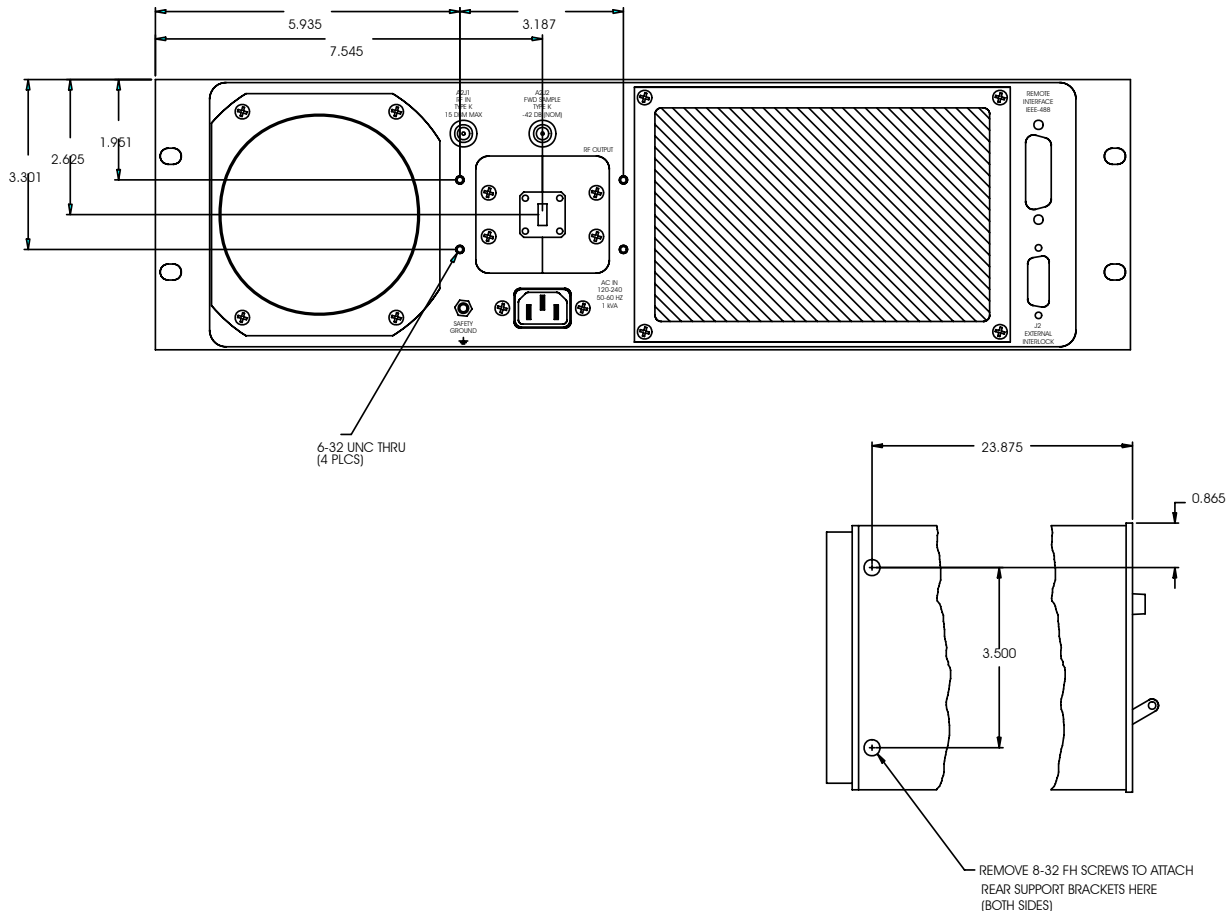


Figure 3-1. Location of Supplementary Threaded Holes for Rear Panel Support

3.2.3 Cooling Requirements

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



CAUTION:

For either bench-top or rack mounting, do not position the TWTA in such a way that the air intake or air outlets are blocked, or that the exhaust flow is directed into the air intake. See section 3.5 for the locations of the air intake and air outlet. If the unit is rack-mounted, make sure that the intake air is 45°C or below. If necessary, fabricate a short duct 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 700 watts when it is in the Operate mode.

3.2.4 AC Line Power Connection

AC line power connection to the TWTA is made at the AC inlet J1, which is a female IEC-320 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 the line cord is 18 gauge.

TWTAs destined for the North American market are provided with a terminated 3-wire cord. It plugs into normal 120 VAC single-phase outlets. The amplifier will operate from any line voltage between 99 and 260 VAC.

3.2.5 RF Output Connection

The RF output is a WR-28 waveguide flat flange. Output flange alignment is critical for proper operation of the amplifier. Use #4 hardware equivalent. Align the two output flanges and secure the mating waveguide, while maintaining flange alignment.



CAUTION:

Never operate the TWTA without a matched output load rated for at least 100 watts, continuous. The TWTA is not provided with an output isolator. Full reflected power may irreparably damage the TWT. Even with no drive, "looping" oscillation can result in RF output high enough to damage the tube if it is operated without a load. The VSWR detection and foldback 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.

If an external isolator is installed at the output of the TWTA, either the isolator should have a load capable of dissipating the full output of the TWTA or the isolator load should be provided with a temperature-sensing switch. The temperature switch should be normally closed, self-resetting, and with a temperature rating such that there is no possibility of damaging the load by overheating before the switch opens. The TWTA may be interlocked with the switch by connecting it between pins 3 and 4 of the external interlock connector (J2). If no external isolator is used, install the factory-supplied connector with the jumper between pins 3 and 4 and pins 10 and 11. See section 3.2.6, **External Interlock Connector**.

3.2.6 External Interlock Connector

The TWTA is provided with an external interlock capability via a 15-pin female 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.

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. When using a bench-top cabinet, the mating connector should be a straight-entry cable type, not a side-entry cable type.

3.2.8 RF Connector

CAUTION:



Many small RF connectors appear to be similar. Pay special attention to use only the proper mating connector for this unit.

3.3 FRONT PANEL FEATURES

Front panel features are shown in Figure 3-2.

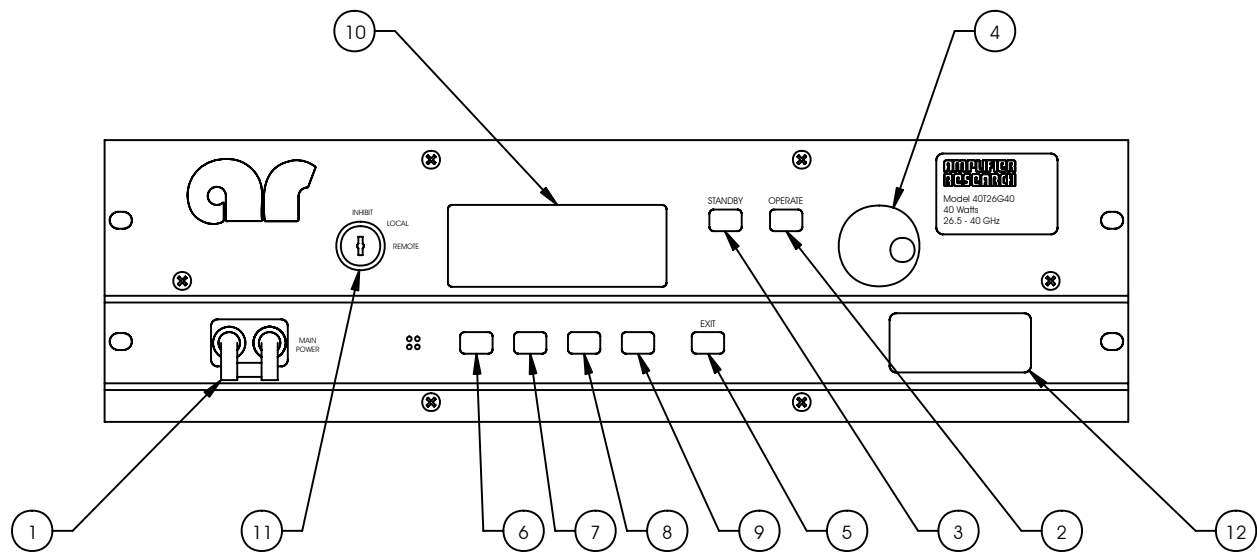


Figure 3-2. TWTA Front Panel

Table 3-1. TWTA Front Panel Features

| Item | Title | Function |
|------|------------------------|--|
| 1 | MAIN POWER | Switchable 7.5 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 TWT beam 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 the operator to inhibit the TWTA, to enable front panel control, or to enable computer control. |
| 12 | Emergency Switch Cover | Provides access to the emergency bypass switches, which permit manual control of the amplifier. |

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. In order 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.

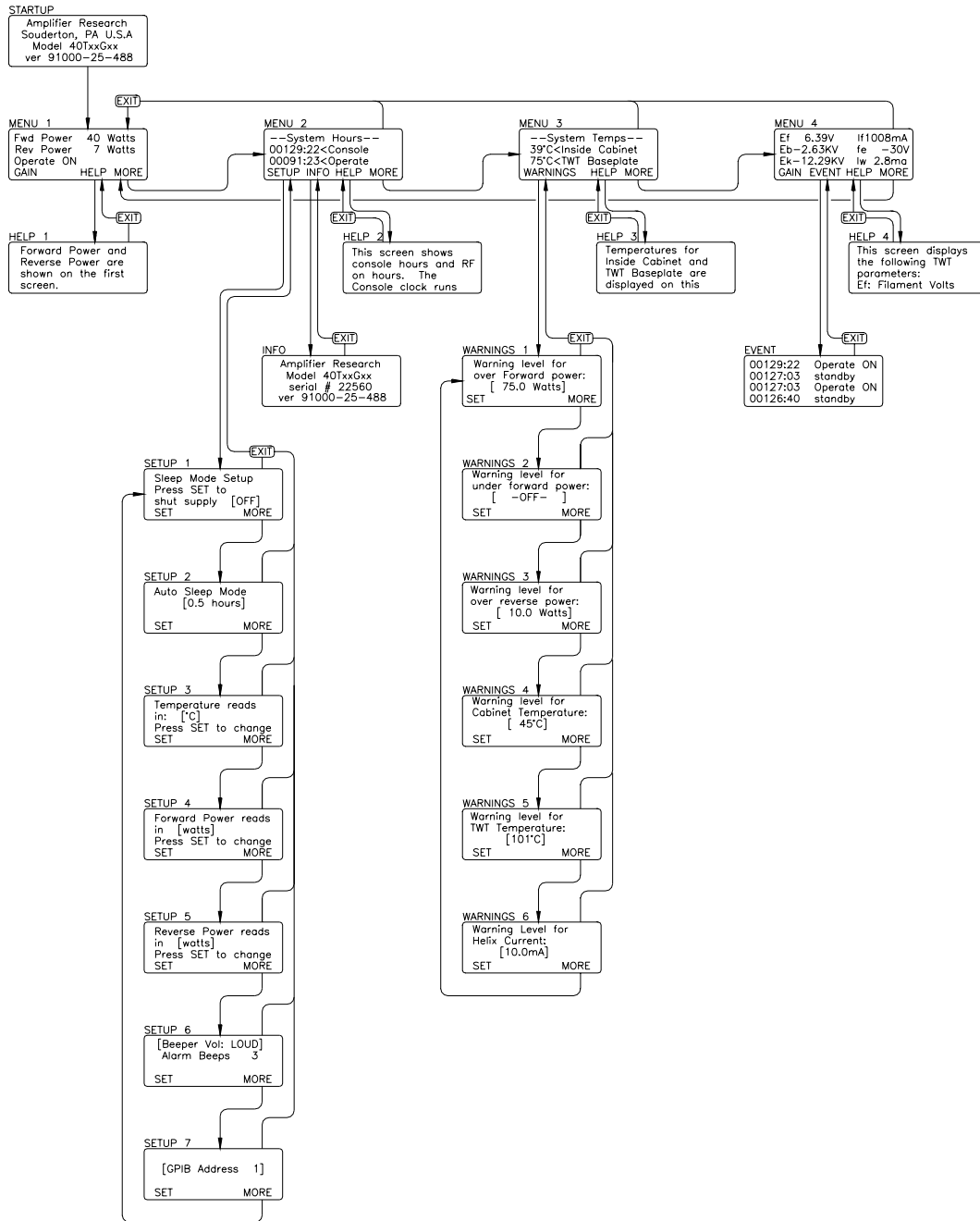


Figure 3-3. TWTA Front Panel Display Screens

Menu screens—The screens at the highest level are called menu screens. There are four 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 4, MORE causes MENU 1 to reappear. In short, MORE permits scrolling through the menu screens. The EXIT key returns the display to MENU 1 from any other menu screen.

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

| Menu | Functions |
|--------|---|
| Menu 1 | Forward power (watts, dBm, or bar graph,) |
| | Reflected power (watts, dBm, or % forward power) |
| | System status (if a latched fault exists, MENU 1 is displayed with the system shutdown message) |
| Menu 2 | Console hours (active when AC power is on) |
| | Operate hours (active when HV is on) |
| Menu 3 | Cabinet temperature (°C or °F) |
| | TWT baseplate temperature (°C or °F) |
| Menu 4 | Heater voltage (Ef) |
| | Heater current (If) |
| | Collector voltage (Eb) |
| | Cathode voltage (Ek) |
| | Helix current (Iw) |

Help Screens—On each of the menu screens, 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.

Setup Screens - From MENU 2, S1 (labeled SETUP) selects the first of several setup screens, SETUP 1. This allows the user to manually shut off the heater power supply and put the HPA into Sleep Mode (see below). Pressing S1 (SET) toggles between On and OFF. Pressing MORE again brings up the SETUP 2 screen, which allows the user to change the Auto Sleep Mode timer setting. Pressing SET will change the timer options in half hour increments from 0.5 to 3.0 hours. Pressing MORE again will save the timer setting and bring up the SETUP 3 screen, which toggles the 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 SETUP 4 screen, which allows a choice of displaying forward power in watts, or in dBm or in bar graph form. Pressing MORE a third time brings up SETUP 5, which allows a choice of watts, dBm, or % of forward power for displaying reverse power. MORE brings up SETUP 6, which allows entering 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. Setup 7 allows the IEEE-488 address to be set. MORE returns you to SETUP 1. EXIT returns you from any of the setup screens to MENU 2.

Sleep Mode - The Sleep Mode feature allows the *user* to selectively shut off the heater module of the power supplies. This can be done manually through the front panel or remotely via the computer interface. This is typically used during extended periods of *remote* operation to improve tube life, by turning off the filaments (Sleep Mode activated). This eliminates excessive STANDBY hours on the TWTs while still permitting remote capability to turn on the amplifier.

To activate Sleep Mode locally:

Press the MORE soft key to get to MENU 2. At MENU 2 press the SETUP soft key to get to SETUP 1. At SETUP 1 press SET to activate Sleep Mode (turn heater and fan off). The system will ask **are you sure?** Press SET again.

After activating the Sleep Mode:

Screen will display **Cooling On** while heaters cool down. **System Off** notifies user that the amplifier is in Sleep Mode

To de-Activate Sleep Mode locally:

Press the ON soft key to de-activate Sleep Mode. Amplifier will return to MENU 1. When de-activating the Sleep Mode the heaters will require approximately a 5 minute heater time delay. Wait the full 5 minutes prior to selecting OPERATE.

For remote activation of Sleep Mode or to set the Auto Sleep Mode timer remotely see Table 3-3 in Section 3.8.

Warnings Screens—From MENU 3, S1 (labeled WARNINGS) selects WARNINGS 1 which allows the operator to enter the maximum forward power. The existing value is between brackets ([]); pressing SET puts arrows (><) around the value, indicating that the adjust knob is active. The effect of the warning set-point is as follows: if the forward power exceeds the set-point, the audible alarm will sound (if configured in SETUP 3). This warning will be repeated every thirty seconds until the over forward power condition is cleared. In addition, a warning message will appear on line 3 (the status line) of MENU 1. If the alarm sounds, the operator should go to MENU 1 to determine the cause.

Pressing more brings up WARNINGS 2, which allows the under forward power set-point to be entered. Adjusting this to the minimum value causes -OFF- to be selected, disabling this alarm.

In WARNINGS 3, the maximum reflected power level is set. Note that these are warning levels at which the beep sounds; the actual maximum reflected power level that generates a system fault is set in hardware in the TWT power supply HPA Logic and Control module (A16485).

MORE brings up WARNINGS 4, which allows input of the maximum cabinet temperature. Entering this parameter is performed as above.

MORE brings up WARNINGS 5, identical to the previous screen except that it deals with the maximum TWT collector block temperature. If either parameter exceeds the set-point, the audible alarm will sound every 30 seconds (if configured), and a warning message will appear on line 3 of MENU 1.

From WARNINGS 5, MORE brings up WARNINGS 6, which permits setting the maximum helix current. Any helix current above this set-point will result in an audible alarm (if configured), repeated every 30 seconds; and a warning message is displayed on the status line of MENU 1.

Pressing MORE again returns display to WARNINGS 1. As before, pressing EXIT from any of the warning screens returns the display to MENU 3.

Info Screen—From MENU 2, S2 (labeled INFO) selects a screen that displays the RF sample port calibration factors at various frequencies across the band. In addition, this screen displays the model number, serial number and firmware revision information that may be required by a service representative when providing technical assistance. The EXIT key returns the display to MENU 2.

Event Screen—From MENU 4, S2 (labeled EVENT) provides a display of events logged by the control system. These events include AC power-up, heater warm-up, change from standby to operate, faults, and resets. The events are stored in a first-in-first-out (FIFO) software buffer that has room for 100 events; as new events are logged, the older ones are discarded.

System Shutdown Screen—In the event of a system shutdown due to a latched fault (i.e., a fault such as body over-current or power low line that requires a reset), the MENU screen is replaced by a screen indicating the nature of the fault. Soft-key S4 (labeled OK) is implemented as a reset key; pressing S4 brings back the MENU screens. Line 3 of MENU 1, which normally displays the operational state of the TWTA, is used as a fault display line until the fault is cleared. When the fault clears the system will automatically resume the standby state and high voltage on will be enabled once again.

Factory Service Screens—A number of screens intended for factory service and calibration are behind passwords and are not accessible to the user.

System Malfunction Screens—A number of screens are reserved to display error messages. These messages are not normally seen and indicate a malfunction of the TWTA. System malfunction messages include the following:

- Database corrupt
- Communication failure
- Cannot restore
- CU line voltage too low to operate. System shutdown

If one of these messages appears, shut off the TWTA and contact an authorized service representative before proceeding further.



CAUTION:

Attempting to operate the TWTA despite control unit problems may result in loss of the static Random Access Memory (RAM) database and calibration information.

3.5 REAR PANEL FEATURES

Rear panel features are shown in Figure 3-4.

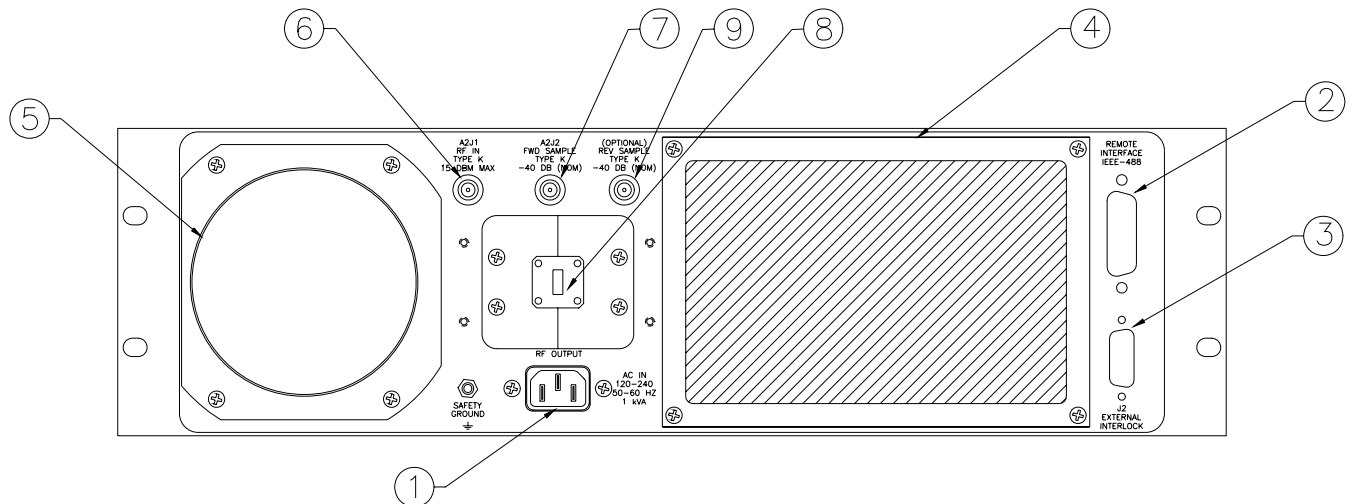


Figure 3-4. TWTA Rear Panel Features

Table 3-2. TWTA Rear Panel Features

| Item | Title | Function |
|------|--------------------|---|
| 1 | AC POWER IN | AC power input connector: IEC-320 connector |
| 2 | IEEE-488 | Remote control connector: 24-pin hermaphrodite |
| 3 | EXTERNAL INTERLOCK | Connector to remote temperature switch protecting the isolator load; D-sub 15-pin female. |
| 4 | — | Cooling air intake |
| 5 | — | Cooling air outlet |
| 6 | RF INPUT | RF Input: Type K female connector |
| 7 | FWD SAMPLE | RF forward power: Type K female connector |
| 8 | RF OUTPUT | RF Output: Type WR-28 waveguide |
| 9 | REV SAMPLE | RF reverse power sample: Type K female connector - OPTIONAL |

3.6 INITIAL TURN ON AND WARM-UP PROCEDURE

Install the TWTA as discussed in section 3.2. Provide an RF generator to the RF input Type K connector, A1J1. Set RF generator level below -50 dBm and set desired frequency in specified range. Connect a load suitable for 100 watts continuous operation to the output waveguide. The load VSWR should be less than 2.0:1 A power meter and suitable attenuators may be connected to the RF sample port A1J2 or optional reverse power sample port. (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 forward / reverse power and the RF sample port forward / reverse power as a function of frequency.

Set the Keylock to LOCAL.

Switch on the MAIN POWER circuit breaker. The fan will operate. The front panel display will show several identification messages and then the MENU 1 screen. The third line will indicate that the heater time delay is active.

Allow the heater warm-up delay to expire. Line three will indicate OFF/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. You will now see the cathode and the collector voltages rise. Verify that the collector and cathode voltages are near nominal. The helix current should be close to the nominal value for no RF drive. Then push MORE or EXIT to go back 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 FWD PWR on the display and power meter (connected to sample port). The forward power bar graph will become active, with maximum length when peak power output is achieved. 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 the input drive level above 0 dBm; input drive levels above +13 dBm may damage the unit. The reflected power level should remain below 10% of the forward power, assuming that the load is properly matched.

An alternate procedure is to pre-set the TWTA gain to 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.

To shut the system down, turn down the RF generator level below -50 dBm and press STANDBY. Allow the TWTA to cool down until the TWT temperature drops below 60°C., then turn off main power

3.7 EMERGENCY BYPASS OPERATION

For reference, see Schematic Diagram No. 10-24830 in section 5.2. The TWTA is provided with a means of operating the amplifier manually if there is a failure of the control module and it is imperative that the amplifier remains on line.



CAUTION:

Emergency bypass operation disables 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 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 solid-state amplifier (SSA) active (RF on) in the left-hand position, and SSA off (RF off) in the right-hand position. There is also a manual control for the gain adjustment; it is a flat, square, single-turn pot (R1).



CAUTION:

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

3.8 REMOTE IEEE-488 OPERATION

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 3-4) | | STATUS=[] |
| RDFLT | Returns system fault code (see Table 3-5) | | flt=[] |
| OPERATE; | Emulates OPERATE push-button | | |
| STANDBY; | Emulate STANDBY push-button | | |
| POWER:OFF; | Emulate STANDBY push-button | | |
| RESET; | Emulates RESET softkey | | |
| RDS/N | Returns serial number | | s/n=[] |
| RDCONHR | Returns console hours | | ConHr=[] |
| RDRFHR | Returns RF hours | | RfHr=[] |
| RDEK | Returns cathode voltage | KV | Ek=[] |
| RDEB | Returns collector voltage | KV | Eb=[] |
| RDEG (or RDEA) | Returns grid (or anode) voltage | V | Eg=[] (Ea=[]) |
| RDEF | Returns heater voltage | V | Ef=[] |
| RDIF | Returns heater current | A | If=[] |
| RDIW | Returns helix current | mA | Iw=[] |
| RDTMPTWTF | Returns TWT temp (°F) | °F | TWTF=[]F |
| RDTMPTWTC | Returns TWT temp (°C) | °C | TWTC=[]C |
| RDTMPPSF | Returns power supply temp (°F) | °F | PSF=[]F |
| RDTMPPSC | Returns power supply temp (°C) | °C | PSC=[]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 | |
| RDPSOTF | Returns power supply overtemp warning setpoint (°F) | °F | PSOTF=[]F |
| SPSOTF | Sets p. s. overtemp warning setpoint (°F) | °F | |
| RDPOTC | Returns p. s. overtemp warning setpoint (°C) | °C | PSOTC=[]C |
| SPSOTC | Sets p. s. 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 3-6) | | Sys=[] |
| RDA | Returns gain | % | A=[] |
| SA | Sets gain | % | |
| RDHTDREM | Returns remaining heater time delay | sec. | HTD=[]s |
| RDPOD | Returns forward power out (dBm) | dBm | Po=[]dBm |
| RDPOW | Returns forward power out (W) | watts | Po=[]W |

| Command | Function | Units | Response format |
|--------------|--|-------|-----------------|
| RDPRD | Returns reverse power out (dBm) | dBm | Pr=[]dBm |
| RDPRW | Returns reverse power out (W) | watts | Pr=[]W |
| RDPOHID | Returns over forward power warning setpoint (dBm) | dBm | Pohi=[]dBm |
| SPOHID | Sets over forward power warning setpoint (dBm) | dBm | |
| RDPOLOD | Returns under forward power warning setpoint (dBm) | dBm | Polo=[]dBm |
| SPOLOD | Sets under forward power warning setpoint (dBm) | dBm | |
| RDPOHIW | Returns over forward power warning setpoint (W) | watts | Pohi=[]W |
| SPOHIW | Sets over forward power warning setpoint (W) | watts | |
| RDPOLOW | Returns under forward power warning setpoint (W) | watts | Polo=[]W |
| SPOLOW | Sets under forward power warning setpoint (W) | watts | |
| RDPRHID | Returns over reverse power warning setpoint (dB) | dBm | Prhi=[]dBm |
| SPPRHID | Sets over reverse power warning setpoint (dBm) | dBm | |
| RDPRHIW | Returns over reverse power warning setpoint (W) | watts | Prhi=[]W |
| SPRHIW | Sets over reverse power warning setpoint (W) | watts | |
| SYSTEM:ON; | Emulates pressing the System ON button from System OFF (Exit Sleep Mode) | | |
| SYSTEM:OFF; | Emulates pressing the Power Save button. (Enter Sleep Mode) | | |
| RDHTRAUTOOFF | Returns heater auto off delay | hours | |
| SHTRAUTOOFF | Sets heater auto off delay (see Table 3-9) | | |
| *IDN?; | Returns the product model number | | [] |
| *STA?; | Returns status string (see Table 3-7) | | [] |
| *STB?; | Returns status string (see Table 3-8) | | [] |

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. |
| 1 | Last command was 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. |
| 51 | Remote system is not ready to accept commands. |
| 60 | Command is not allowed in current system state. |
| 901 | Assert error: invalid table argument* |
| 902 | Assert error: invalid calibration* |

* Please call a service representative if you observe this error.

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 |
| 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 |
| 30 | Grid or anode overvoltage |
| 49 | TWT (software) overtemperature |
| 50 | Cabinet (software) overtemperature |

Table 3-6. Catalog of System State Codes

(The **RDLOGIC** command causes the TWTA to send a string containing an operational state code consisting of 4 ASCII characters representing hex digits. The response is in the form **Sys:[w][x][y][z][eol]** where the hex values of *[w]*, *[x]*, *[y]* and *[z]* are formed as shown below)

| z bit | Meaning |
|--------------|-----------------|
| 0 (LSB) | High voltage on |
| 1 | Transmit on |
| 2 | Remote mode |
| 3 (MSB) | Fault |

| y bit | Meaning |
|--------------|-----------------------------|
| 4 (LSB) | Heater time delay expired |
| 5 | Under forward power warning |
| 6 | Foldback active |
| 7 (MSB) | Inhibit mode |

| x bit | Meaning |
|--------------|------------------|
| 8 (LSB) | External inhibit |
| 9 | Interlock open |
| 10 | (not used) |
| 11 (MSB) | (not used) |

| w bit | Meaning |
|--------------|-------------------|
| 12 (LSB) | (not used) |
| 13 | Sleep Mode Active |
| 14 | (not used) |
| 15 (MSB) | (not used) |

Table 3-7. *STA?; Response Codes

(The command ***STA?;** causes the TWTA to send a string indicative of the current system state)

| *STA?; response | Meaning |
|------------------------|---|
| SLEEP | Sleep Mode active (heater off) |
| WARM-UP | System is in heater time delay. |
| STANDBY | System is ready to allow high voltage on |
| OPERATE | High voltage is on and beam is on |
| FAULT | High voltage is off and system requires reset |

Table 3-8. *STB?; Response Codes

(The command ***STB?**; causes the TWTA to send a string containing an operational state code consisting of 2 ASCII characters representing hex digits. The response is in the form **STATUS:[x][y][eol]** where the hex values of [x] and [y] are formed as shown below)

| y bit | Meaning |
|--------------|--|
| 0 (LSB) | Power status; always 1(power on) |
| 1 | Standby status; 0 if not in standby, 1 if in standby |
| 2 | Operate status; 0 if not in operate, 1 if in operate |
| 3 (MSB) | Fault status; 0 if no fault, 1 if fault exists |

| x bit | Meaning |
|--------------|-------------------------------|
| 4 (LSB) | Mode switch; always 1 (reset) |
| 5 | Blank switch; always 1 (off) |
| 6 | Blank status; always 0 (off) |
| 7 (MSB) | Not used; always 0 |

Table 3-9. Catalog of Heater Auto Off Time Delay Codes

| Argument | Meaning |
|-----------------|-------------------------------------|
| 0 | 0.5 hour heater auto off time delay |
| 1 | 1.0 hour heater auto off time delay |
| 2 | 1.5 hour heater auto off time delay |
| 3 | 2.0 hour heater auto off time delay |
| 4 | 2.5 hour heater auto off time delay |
| 5 | 3.0 hour heater auto off time delay |

Command syntax is in this form:

<command mnemonic> <parameter> <carriage return>

where:

<command mnemonic> consists of one of any valid command found in Table 3-3;

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

<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 usually not returned; see Table 3-3 for the units.

If remote is not enabled, set commands and commands to the system logic (i.e., OPERATE; or STANDBY; 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 a command was processed.

A small sample program that can send commands and receive the strings returned by the TWTA is included in section 5.5. 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 AR Worldwide TWTAs.

Storage: TWTAs, 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 TWTAs 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: TWTAs 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 TWTAs readies the unit for operation. In this mode the filaments are on but the high voltage is off. TWTAs 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....**, 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 AR Worldwide Service for additional assistance. (See **Explanation of....**, below)

Noise Power Density (NPD): TWTAs 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 TWTAs. The noise may surprise users new to TWTAs 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 $[-76 \text{ dBm/Hz} + 10 (\log 4 \times 10^9) \text{ BW factor} = -76 + 96 =] +20$ 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 as 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 Model 40T26G40A TWTA does not require routine scheduled maintenance. The unit's only moving parts are the switches, the relays, and the blower. Preventive maintenance is recommended in section 4.3.

It is recommended that, whenever possible, the TWTA should be returned to the factory for repair. However, since limited logic schematics and partial parts information are supplied in this manual (see 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 the unit is unplugged and 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. If you are 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.

- Remove the 12 screws that secure the lower cover and the 12 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 removed, check for loose wires, components, or fasteners.

Reassemble in the reverse order.

4.4 TROUBLESHOOTING

Table 4-1. Model 40T26G40A TWTA Troubleshooting Guide

| Symptom | Possible cause |
|--|---|
| TWT or power supply overtemperature | Air inlet filter 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, EPROM pins are bent, 64-conductor ribbon cable is defective. |
| Control module datalink failure error 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 reviewing 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 re-assembly. 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 High-Voltage Diode/Capacitor Assembly (A23707-488), the High-Voltage Filter Assembly (A21461-488), and the Heater Supply (A25963-000) are encapsulated modules and are therefore not repairable. Contact an authorized service representative if replacement modules are needed.

5. TECHNICAL DOCUMENTATION

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, only documentation pertaining to the highest levels of the system and to system control logic is included.

5.1 TOP LEVEL BUILD TREE

| | | |
|---------------|------------|---|
| | A28050-352 | HPA 40W KA 26.5-40GHZ FOR MEC-5496 |
| 1A1 | A22826-352 | HV POWER SUPPLY FOR MEC-5496 |
| 1A1A1 | A23709-000 | HEAT SINK/MOTHER BOARD ASSY |
| 1A1A2 | A23687-001 | LOW VOLTAGE POWER SUPPLY MODULE |
| 1A1A3 | A16485-488 | HPA LOGIC AND CONTROL MODULE FOR 40K, 40KA |
| 1A1A4 | A23683-100 | POWER FACTOR MODULE (500W) |
| 1A1A4L4 | A09006-000 | PFC INDUCTOR FOR 100VAC-255VAC |
| 1A1A5 | A23710-000 | POWER ASSEMBLY FOR 100WKU |
| 1A1A5L1, L1A | A09007-000 | INDUCTOR FOR BUCK REGULATOR |
| 1A1A5T1 (E42) | A09402-000 | XFMR,GATE DRIVE (HAND WOUND) |
| 1A1A5T2 (E41) | A09403-000 | XFMR,GATE DRIVE (HAND WOUND) |
| 1A1A6 | A23707-488 | HV DIODE/CAP ASSY FOR TWT MEC 5488 |
| 1A1A6T1 | A09586-000 | HV XFMR FOR TWT MEC 5488 |
| 1A1A7 | A21461-488 | HV FILTER FOR TWT MEC-5488 |
| 1A1A7 | A21461-352 | HV FILTER FOR TWT MEC-5496 |
| 1A1A8 | A23684-352 | GRID MODULATOR FOR MEC-5496 (-1100V BIAS, 0V TO |
| 1A1A8A1 | A23686-110 | FE HV BOARD -1100V BIAS, PULSE TOP ADJUSTABLE |
| 1A1A8A1T1 | A09227-064 | REFERENCE SUPPLY XFMR |
| 1A1A8A1T2 | A09228-000 | FEEDBACK XFMR,HAND WOUND |
| 1A1A8A1T3 | A09595-110 | -1100V BIAS SUPPLY XFMR |
| 1A1A8A1T4-T5 | A09230-000 | XFMR,GATE DRIVE (HAND WOUND) |
| 1A1A8A1T6 | A09598-064 | TOP AND AUXILIARY SUPPLY XFMR |
| 1A1A8A2 | A16486-064 | MODULATOR'S CONTROL BOARD FOR TWT3864C |
| 1A1A9 | A25963-000 | HEATER MODULE,MM WAVE |
| 1A1A9T1 | A09409-000 | XFMR,HEATER FEEDBACK |
| 1A1A9T2 | A09408-000 | XFMR,HEATER POWER |
| 1A1A10 | A10017-352 | PWM BD FOR TWT MEC-5496 -12.7KV |
| 1A1A10 | A10017-488 | PWM BD FOR TWT MEC-5493E |
| 1A1A11 | A25391-488 | FACTORY SELECT PARTS FOR TWT MEC-5493E |
| 1A2 | A28051-002 | MICROWAVE POWER ASSEMBLY, KA BAND, 40 WATT |
| 1A3 | A27752-300 | AR TWTA CONTROL ASSY |
| 1A3A1 | A25450-000 | CPU BOARD W/POWERFAIL (20MHZ) |
| 1A3A2 | A25425-001 | HPA DISPLAY BOARD |
| 1A3A3 | A22488-003 | GPIB INTERFACE BOARD, 3U TWT PRODUCTS |
| 1A4 | A25444-000 | HPA INTERFACE BOARD (PLASTIC FIBERS) |
| 1A4U15 | A31346-000 | DAC REPLACEMENT BOARD FOR U00725. DUAL |
| 1A5 | A24830-001 | EMERGENCY BYPASS BOARD |
| 1A6 | A23692-000 | INSULATED FAN DRIVER |
| 1A6T1 | A09594-000 | FAN DRIVER TRANSFORMER |
| 1A9 | A28052-000 | WIRING KIT, 40W K/KA BAND |
| 1A10 | A27742-001 | LOW PROFILE CABINET ASSY, K AND KA-BAND |
| 1A10A1 | A31297-001 | CABINET KIT, K AND KA-BAND |

5.2 SCHEMATICS

| | |
|--------------|-------------------------------------|
| 10-16485-000 | HPA Logic and Control (A16485-000) |
| 10-24830-000 | Emergency Bypass Board (A24830-001) |
| 10-25444-000 | HPA Interface (A25444-000) |
| 10-28050-352 | HPA 40T Series (A28050-352) |

5.3 PARTS LISTS

| | |
|------------|--|
| A16485-000 | HPA logic and control assembly |
| A22826-352 | Power supply for Teledyne TWT |
| A24830-001 | Emergency bypass board (for reflected foldback) |
| A25444-000 | HPA interface |
| A28050-352 | HPA 40W 26.5-40 GHz (AR) |
| A28051-002 | Microwave power assembly, Ka-band, 40 watt Teledyne tube |
| A28052-000 | Wiring kit for 40T series K/Ka TWTA |

5.3.1 Parts List, HPA Logic and Control Module, A16485-000

| REF. DESIG. | ETM P/N | DESCRIPTION | QUANTITY |
|--|------------|--|----------|
| | B16485-000 | HPA LOGIC AND CONTROL BOARD | 1 |
| C11 | C16333-000 | CAP,33MF,25V,AERL,(NICHICON UVX1E330M) | 1 |
| C2, C5, C15, C58 | C31028-000 | CAP,1000PF,200VDC,10%,CER,1% FAILURE,(KEMET CKR05 SERIES W/"V" OPTION) | 4 |
| C3, C9, C10, C13, C14, C17, C19, C21, C22, C27, C28, C30, C31, C33, C36, C46 | C31032-000 | CAP,0.01MF,200VDC,10%,CER,1% FAILURE,(KEMET CKR06 SERIES W/"V" OPTION) | 16 |
| C61 | C31033-000 | CAP,0.022MF,100VDC,10%,CER,1% FAILURE,(KEMET CKR06B223K W/V OPTION) | 1 |
| C24, C60 | C31036-000 | CAP,0.1MF,100VDC,10%,CER,1% FAILURE,(KEMET CKR06 SERIES W/"V" OPTION) | 2 |
| C1, C4, C6, C7, C16, C18, C25, C26, C32, C34, C37, C38, C39, C40, C41, C43, C44, C45, C48, C49 | C31040-000 | CAP,1MF,50VDC,10%,CER,1% FAILURE,(KEMET CKR06 SERIES W/"V" OPTION) | 20 |
| D16, D23, D31 | D10965-000 | ZENER,15V,(DIODES INC 1N965B) | 3 |
| D1, D3, D4, D5, D7, D8, D9, D10, D11, D12, D13, D17, D18, D19, D21, D22, D25, D26, D28, D30, D35, D37, D36 | D14454-000 | DIODE,AXIAL,(MOTOROLA 1N4454) | 24 |
| | D14733-000 | ZENER,5.1V,1W,10%,AXIAL,(MOTOROLA 1N4733) | 1 |
| | F00010-000 | WASHER,#2,LOCK,SST | 3 |
| | F10086-000 | PHP,2-56 X 3/16SST | 3 |
| J2 | J10370-000 | CONN,37 PIN,MALE,D-SUB,PCB RIGHT ANGLE, (AMP 747252-4) | 1 |
| | J18075-000 | MALE SCREW LOCK,FOR D SUBMIN CONN,(AMP 205817-1) | 1 |
| J4, J5 | J18086-000 | CONN,,SMA,JACK RECEPTACLE,RIGHT ANGLE,0- 18GHZ,PC MOUNT [JOHNSON COMPONENTS 142- 0701-301] | 2 |
| J1 | N25003-000 | HYPERTRONICS CONN,29 PIN MALE RIGHT ANGLE,(CUT ENDS) | 1 |
| Q2 | Q22907-000 | TRANSISTOR,PNP,2N2907A,TO-18 | 1 |
| R1, R9, R19, R37, R44, R50 | R00100-000 | RES,10 OHM,1/4W,5%,CC,(A/B RC07GF100J) | 6 |
| R4, R20, R27, R29 | R01100-000 | RES,100 OHM,1/4W,5%,CC,(A/B RC07GF101J) | 4 |
| R5, R17, R18, R28, R34, R45, R49, R53, R54, R59, R71, R88 | R02100-000 | RES,1K,1/4W,5%,CC,(A/B RC07GF102J) | 12 |
| R6 | R02270-000 | RES,2.7K,1/4W,5%,CC,(A/B RC07GF272J) | 1 |
| R30, R31, R36 | R02470-000 | RES,4.7K,1/4W,5%,CC,(A/B RC07GF472J) | 3 |
| R86, R87 | R02510-000 | RES,5.1K,1/4W,5%,CC,(A/B RC07GF512J) | 2 |
| R75 | R02560-000 | RES,5.6K,1/4W,5%,CC,(A/B RC07GF562J) | 1 |
| R38, R77, R90 | R03100-000 | RES,10K,1/4W,5%,CC,(A/B RC07GF103J) | 3 |
| R32 | R03470-000 | RES,47K,1/4W,5%,CC,(A/B RC07GF473J) | 1 |
| R35 | R05820-000 | RES,8.2M,1/4W,5%,CC,(A/B RC07GF825J) | 1 |
| R13, R14 | R10002-000 | TRIMPOT,5K,1/2W,10%,CERMET,20T,SIDE ADJ,(BOURNS 3296X-1-502) | 2 |
| R76 | R21499-000 | RES,4.99K,1/2W,1%,MF,100PPM,(DALE RN55D) | 1 |
| R10 | R21523-000 | RES,5.23K,1/2W,1%,MF,100PPM,(DALE RN55D) | 1 |
| R16 | R21866-000 | RES,8.66K,1/2W,1%,MF,100PPM,(DALE RN55D) | 1 |
| R52, R73 | R21887-000 | RES,8.87K,1/2W,1%,MF,100PPM,(DALE RN55D) | 2 |
| R67 | R21953-000 | RES,9.53K,1/2W,1%,MF,100PPM,(DALE RN55D) | 1 |

| REF. DESIG. | ETM P/N | DESCRIPTION | QUANTITY |
|--------------------|------------|--|----------|
| R47, R48 | R22200-000 | RES,20K,1/2W,1%,MF,100PPM,(DALE RN55D) | 2 |
| R79, R80 | R22470-000 | RES,47K,1/2W,1%,MF,100PPM,(DALE RN55D) | 2 |
| R42, R60, R61, R89 | R23100-000 | RES,100K,1/2W,1%,MF,100PPM,(DALE RN55D) | 4 |
| R33, R55 | R23698-000 | RES,698K,1/2W,1%,MF,100PPM,(DALE RN55D) | 2 |
| R41 | R23750-000 | RES,750K,1/2W,1%,MF,100PPM,(DALE RN55D) | 1 |
| R21 | R23845-000 | RES,845K,1/2W,1%,MF,100PPM,(DALE RN55D) | 1 |
| R66 | R23953-000 | RES,953K,1/2W,1%,MF,100PPM,(DALE RN55D) | 1 |
| R12, R15 | R32020-000 | TRIMPOT,10K,1/2W,10%,CERMET,20T,SIDE ADJ,(BECKMAN 67X) | 2 |
| U4, U5, U6 | U02390-000 | IC,QUAD COMPARATOR,(NAT LM139J) | 3 |
| U7 | U03240-000 | IC,LOW POWER OP AMP,(NAT LM324) | 1 |
| U9 | U10070-000 | REFERENCE,PRECISION 10V [LINEAR TECH LT1031DCH] | 1 |
| U8 | U17805-000 | IC,5V REGULATOR,TO-220,(NAT LM340T-5.0) | 1 |
| U1, U2, U3 | U20148-000 | IC,HEX INVERTER,SCHMIDTT TRIGGER,(74HC14) (SSD) | 3 |
| RP8 | U30106-000 | IC,10K,RES NETWORK,6 PIN,SIP (DALE MSP06A-01- 103G) | 1 |
| RP1-2, RP5-7, RP9 | U30410-000 | IC,10K,2%,0.40A,10 PIN,ISOLATED RESISTORS (DALE MSP10C-03-103G OR BOURNS 4610H-102- 103) | 6 |
| RP4 | U31020-000 | IC,1K RES NETWORK,SIP,(BECKMAN L061C102G) | 1 |
| W3-W8 | W12200-000 | WIRE, 22 AWG, BLU, 600V, TEFLON, (BELDEN 83006) | 6 |

5.3.2 Parts List, HV Power Supply for TWT 6193A4/D4, A22826-352

| REF. DESIG. | ETM P/N | DESCRIPTION | QUANTITY |
|-------------|------------|---|----------|
| A10 | A10017-488 | PWM BD FOR TWT MEC-5493E | 1 |
| A3 | A16485-488 | HPA LOGIC AND CONTROL MODULE FOR 40K, 40KA | 1 |
| A7 | A21461-488 | HV FILTER FOR TWT MEC-5488 | 1 |
| A4 | A23683-100 | POWER FACTOR MODULE (500W) | 1 |
| A8 | A23684-352 | GRID MODULATOR FOR MEC-5496 (-1100V BIAS, 0V TO -50V ADJUSTABLE PULSE TOP) | 1 |
| A2 | A23687-001 | LOW VOLTAGE POWER SUPPLY MODULE | 1 |
| A6 | A23707-488 | HV DIODE/CAP ASSY FOR TWT MEC 5488 | 1 |
| A1 | A23709-000 | HEAT SINK/MOTHER BOARD ASSY | 1 |
| A5 | A23710-000 | POWER ASSEMBLY FOR 100WKU | 1 |
| A11 | A25391-488 | FACTORY SELECT PARTS FOR TWT MEC-5493E | 1 |
| A9 | A25963-000 | HEATER MODULE,MM WAVE | 1 |

5.3.3 Parts List, Emergency Bypass Board, A24830-001

| REF. DESIG. | ETM P/N | DESCRIPTION | QUANTITY |
|--------------------------|------------|--|----------|
| | B24830-000 | EMERGENCY BYPASS BOARD | 1 |
| C3-C5 | C04105-000 | CAP,0.1MF,100V,20%,MON,(KEMET C331C104M1R5CA) | 3 |
| C6 | C30010-000 | CAP,10MF,35V,TANT,RADIAL,(NEMCO TB10-35K1) | 1 |
| C2 | C31028-000 | CAP,1000PF,200VDC,10%,CER,1% FAILURE,(KEMET CKR05 SERIES W/"V" OPTION) | 1 |
| C1 | C31032-000 | CAP,0.01MF,200VDC,10%,CER,1% FAILURE,(KEMET CKR06 SERIES W/"V" OPTION) | 1 |
| C7 | C31040-000 | CAP,1MF,50VDC,10%,CER,1% FAILURE,(KEMET CKR06 SERIES W/"V" OPTION) | 1 |
| D1, D2 | D14454-000 | DIODE,AXIAL,(MOTOROLA 1N4454) | 2 |
| D3, D4 | D14733-000 | ZENER,5.1V,1W,10%,AXIAL,(MOTOROLA 1N4733) | 2 |
| I2, I3 | I10066-000 | LED,RED,HIGH EFFICIENCY,HIGH BRIGHTNESS | 2 |
| I1, I4 | I10096-000 | LED,GREEN,DIFFUSED,T1-3/4 (XC55G) | 2 |
| TP2 | J16212-000 | TEST JACK,RED,VERTICAL,(EF JOHNSON 105-0852-001) | 1 |
| TP3 | J16213-000 | TEST JACK,ORANGE,VERTICAL,(EF JOHNSON 105-0856-001) | 1 |
| J2 | J18086-000 | CONN,,SMA,JACK RECEPTACLE,RIGHT ANGLE,0-18GHZ,PC MOUNT [JOHNSON COMPONENTS 142-0701-301] | 1 |
| J1 | J18180-000 | CONN,D-SUB,15 PIN,MALE,STRAIGHT,PCB MOUNT (POSITRONIC MD15M3000) | 1 |
| Q1-Q3 | Q22222-000 | TRANSISTOR,NPN,2N2222A,TO-18 | 3 |
| Q4, Q5 | Q22907-000 | TRANSISTOR,PNP,2N2907A,TO-18 | 2 |
| R18, R23 | R01100-000 | RES,100 OHM,1/4W,5%,CC,(A/B RC07GF101J) | 2 |
| R21 | R01150-000 | RES,150 OHM,1/4W,5%,CC,(A/B RC07GF151J) | 1 |
| R19 | R02100-000 | RES,1K,1/4W,5%,CC,(A/B RC07GF102J) | 1 |
| R3, R5, R7 | R02220-000 | RES,2.2K,1/4W,5%,CC,(A/B RC07GF222J) | 3 |
| R22 | R02330-000 | RES,3.3K,1/4W,5%,CC,(A/B RC07GF332J) | 1 |
| R16, R17 | R02470-000 | RES,4.7K,1/4W,5%,CC,(A/B RC07GF472J) | 2 |
| R24 | R02510-000 | RES,5.1K,1/4W,5%,CC,(A/B RC07GF512J) | 1 |
| R4, R6, R8, R9, R13, R15 | R03100-000 | RES,10K,1/4W,5%,CC,(A/B RC07GF103J) | 6 |
| R1 | R12107-000 | TRIMPOT,1K,1/2W,10%,CERMET,1T,SIDE ADJ,(BECKMAN 72XL) | 1 |
| R20 | R20267-000 | RES,267 OHM,1/2W,1%,MF,100PPM,(DALE RN55D) | 1 |
| R10, R11, R12 | R23100-000 | RES,100K,1/2W,1%,MF,100PPM,(DALE RN55D) | 3 |
| R2 | R30074-000 | TRIMPOT,1K,1/2W,10%,CERMET,100PPM,20T,TOP ADJ,(BECKMAN 67W) | 1 |
| S2, S3 | S22004-000 | SWITCH,TOGGLE,DPDT,PC MNT,(AUGAT MTA-206N-PC) | 2 |
| S1 | S22010-000 | SWITCH,TOGGLE,4PDT,ON-NONE-ON,125V @ 6A,(AUGAT MTA-406N-PC) | 1 |
| U2 | U11458-000 | IC,DUAL OP AMP,(NAT LM1458CN) | 1 |
| U1 | U17805-000 | IC,5V REGULATOR,TO-220,(NAT LM340T-5.0) | 1 |

5.3.4 Parts List, HPA Interface Board (Plastic), A25444-000

| REF. DESIG. | ETM P/N | DESCRIPTION | QUANTITY |
|---|------------|---|----------|
| | B25444-000 | HPA INTERFACE BOARD | 1 |
| C161 | C03105-000 | CAP,0.01MF,100V,CER,10%,RADIAL,(AVX SR201C103KAA) | 1 |
| C171 | C04223-000 | CAP,0.22MF,35V,TANT,RADIAL, [JAMCO 33507] | 1 |
| C20, C32, C100 | C05153-000 | CAP,1.5MF,35V,TANT,RADIAL,(JAMECO TM1.5/35) | 4 |
| C129, C163 | C05223-000 | CAP,2.2MF,35V,10%,SOLID SEALED TANT,RADIAL,(SPRAGUE 199D225X9035BA1) | 2 |
| C80, C81, C164 | C06103-000 | CAP,10MF,25V,20%,SOLID TANT,RADIAL,(AVX TAP106M025HSB) | 3 |
| C15 | C06220-000 | CAP,22MF,16V,SOLID TANT,RADIAL,(AVX TAP226K016SCS) | 1 |
| C99 | C16103-000 | CAP,10MF,35V,AERL,(NICHICON UVX1V100) | 1 |
| C101 | C17222-000 | CAP,220MF,16V,AERL,(ILL CAP 227RAR016A) | 1 |
| C47, C67 | C17224-000 | CAP,220MF,50V,AERL,(ILL CAP 227RAR050A) | 2 |
| C44, C168, C169 | C30066-000 | CAP 47 MF, 35V, SOLID TANT. RADIAL, (KEMET T356M476K035AS) | 3 |
| C165, C166, C6, C7, C9, C13, C16, C39, | C31016-000 | CAP,100PF,200VDC,10%,CER,1% FAILURE,(KEMET CKR05 SERIES W/"V" OPTION) | 10 |
| 10, 11, 22, 23, 24, 25, 26, 28, 30, 33, 35, 40, 41, 42, 48, 49, 50, 51, 53, 62, 63, 64, 65, 70, 71, 73, 77, 79, 83, 85, 87, 88, 89, 91, 94, 96, 97, 98, 102, 103, 105, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 121, 125, 132, 167, | C31036-000 | CAP,0.1MF,100VDC,10%,CER,1% FAILURE,(KEMET CKR06 SERIES W/"V" OPTION) | 61 |
| C12, C14, C21, C27, C29, C31, C34, C36, C38, C17, C18, C19, C37, C54, C55, C56, C57, C58, C59, C60, C61, C118, C119, C120, C122, C123, C124, C133, C46, C52, C66, C68, C72, C75, C82, C84, C86, C90, C92, C93, C95, C104, C106, | C31040-000 | CAP,1MF,50VDC,10%,CER,1% FAILURE,(KEMET CKR06 SERIES W/"V" OPTION) | 44 |
| D8, D10-D16, D18-D19 | D14007-000 | DIODE,1000V,1A,AXIAL,(MOTOROLA 1N4007) | 10 |
| D1-D7 | D14454-000 | DIODE,AXIAL,(MOTOROLA 1N4454) | 7 |
| D9, D17 | D14733-000 | ZENER,5.1V,1W,10%,AXIAL,(MOTOROLA 1N4733) | 2 |
| I1 | I10074-000 | LED,GREEN,ALGAAS,NON-DIFFUSED,(HEWLETT PACKARD HLMP-1540) | 1 |
| J5 | J10021-000 | HEADER,2 PIN,MALE,RIGHT ANGLE,SERIES 7478 (MOLEX 22-05-3021) | 1 |
| J1 | J10371-000 | D-SUB,37 PIN MALE,PCB MOUNT,STRAIGHT (POSITRONICS MD37M3S000) | 1 |
| XU17 | J14161-000 | SKT,DIP,16 PIN,MACH SLEEVES,(AUGAT 516-AG11D) | 1 |
| XU26 | J14202-000 | SKT,DIP,20 PIN,MACH SLEEVES,(SAMTEC ICA-320-SGT) | 1 |
| XU15 | J14281-000 | SKT,DIP,28 PIN,MACH SLEEVES,(SAMTEC ICA-628-SGT) | 1 |
| TP0 | J16210-000 | TEST JACK,BLACK,VERTICAL,(EF JOHNSON 105-0853-001) | 1 |
| TP1 | J16211-000 | TEST JACK,BROWN,VERTICAL,(EF JOHNSON 105-0858-001) | 1 |
| TP2 | J16212-000 | TEST JACK,RED,VERTICAL,(EF JOHNSON 105-0852-001) | 1 |
| TP3 | J16213-000 | TEST JACK,ORANGE,VERTICAL,(EF JOHNSON 105-0856-001) | 1 |
| TP4 | J16214-000 | TEST JACK,YELLOW,VERTICAL,(EF JOHNSON 105- | 1 |

| REF. DESIG. | ETM P/N | DESCRIPTION | QUANTITY |
|--|------------|--|----------|
| | | 0857-001) | |
| TP5 | J16215-000 | TEST JACK, GREEN, VERTICAL, (EF JOHNSON 105-0854-001) | 1 |
| TP6 | J16216-000 | TEST JACK, BLUE, VERTICAL, (EF JOHNSON 105-0860-001) | 1 |
| J4 | J18167-000 | D-SUB, 37 PIN, FEMALE, PCB MOUNT, RIGHT ANGLE (AMP 745784-4) | 1 |
| J3 | J18180-000 | CONN, D-SUB, 15 PIN, MALE, STRAIGHT, PCB MOUNT (POSITRONIC MD15M3000) | 1 |
| J2 | J31013-000 | CONN, D-SUB, 25 PIN, MALE, RIGHT ANGLE, PCB MOUNT, [AMP 747238-4] | 1 |
| XJ1-XJ4 | J31014-000 | SPRING LATCH KIT, D-SUB, (AMPHENOL 17-529) | 4 |
| K1-K6 | K02009-000 | RELAY, DPDT, 5VDC, 125V @ 0.5A / 30VDC @ 1A CONTACTS, PCB TERMINALS, SEALED (OMRON G6H-2-DC5) | 6 |
| L1-L4 | L00200-000 | WIDE BAND CHOKE, (VK200 10/3B FERROXCUBE) | 4 |
| Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8 | Q22222-000 | TRANSISTOR, NPN, 2N2222A, TO-18 | 8 |
| R2 | R01220-000 | RES, 220 OHM, 1/4W, 5%, CC, (A/B RC07GF221J) | 1 |
| R41 | R01680-000 | RES, 680 OHM, 1/4W, 5%, CC, (A/B RC07GF681J) | 1 |
| R1 | R04200-000 | RES, 200K, 1/4W, 5%, CC, (A/B RC07GF204J) | 1 |
| R4, R7 | R05820-000 | RES, 8.2M, 1/4W, 5%, CC, (A/B RC07GF825J) | 2 |
| R6, R8, R58 | R20100-000 | RES, 100 OHM, 1/2W, 1%, MF, 100PPM, (DALE RN55D) | 3 |
| R57 | R20200-000 | RES, 200 OHM, 1/2W, 1%, MF, 100PPM, (DALE RN55D) | 1 |
| R11 | R20243-000 | RES, 243 OHM, 1/2W, 1%, MF, 100PPM, (DALE RN55D) | 1 |
| R16 | R20845-000 | RES, 845 OHM, 1/2W, 1%, MF, 100PPM, (DALE RN55D) | 1 |
| R59 | R22332-000 | RES, 33.2K, 1/2W, 1%, MF, 100PPM, (DALE RN55D) | 1 |
| R3, R5 | R30071-000 | TRIMPOT, 10K, 1/2W, 10%, CERMET, 100PPM, 20T, TOP ADJ, (BECKMAN 67W) | 2 |
| R9, R12, R15, R22, R35, R36, R40, R44, | R30103-000 | RES, 10K, 1/8W, 1%, MF, AXIAL, 100PPM, (DALE CMF-50 / RN50C1002F) | 9 |
| R17, R19, R20, R21, R23, R25, R28, R31, R42, R43, R46, R18 | R30140-000 | RES, 1K, 1/8W, 1%, MF, 50PPM, (DALE RN50C) | 12 |
| R13, R14, R24, R26, R27, R29, R32, R37, R38, R39, R47 | R31164-000 | RES, 100K, 1/20W, 1%, FILM, AXIAL, 100PPM, MIL, (DALE RN50C1003F) | 11 |
| U7, U8 | U00027-000 | IC, ULTRA LOW NOISE PRECISION OP AMP, (ANALOG DEVICES OP27GP) | 2 |
| U26 | U00029-000 | CONVERTER, NO OIL, 16BIT, A TO D, SERIAL OUT, [BURR-BROWN ADS7809PB, PB], [ANALOG DEVICES AD977CN] | 1 |
| U17 | U00524-000 | IC, INSTRUMENTATION AMP, (ANALOG DEVICES AD524A) (SSD) | 1 |
| U15 | U00725-000 | IC, DUAL 16 BIT DIGITAL TO ANALOG CONVERTER, (BURR-BROWN DAC-725) (SSD) | 1 |
| U1 | U03171-000 | IC, ADJUSTABLE VOLTAGE REGULATOR, 15W, 1.5A, TO-220, (NAT LM317T) | 1 |
| U9, U10, U18 | U04090-000 | IC, 4CH ANALOG MULTIPLEXER, (DATEL MXD-409) | 3 |
| DP2, DP4, DP5, DP8, DP9 | U08010-000 | IC, 8 COMMON CATHODE CLAMPING DIODES, 9 PIN SIP, (ROHM DAN801) | 5 |
| DP1, DP3, DP6, DP7, DP10 | U08011-000 | IC, 8 COMMON ANODE CLAMPING DIODES, 9PIN SIP, (ROHM DAP801) | 5 |
| U27 | U11165-000 | IC, 6.5536MHZ CLOCK OSCILLATOR, 1/2 SIZE, (ECLIPTEK EC1100HS-6.5536MHZ) (SSD) | 1 |
| U40 | U11528-000 | IC, VERSALINK TRANSMITTER, HORIZONTAL, (200UM FIBER) (HEWLETT PACKARD HFBR-1528) | 1 |
| U54 | U12521-000 | IC, FIBER OPTIC RECEIVER, HORIZONTAL, (HP HFBR-2521) (SSD) | 1 |

| REF. DESIG. | ETM P/N | DESCRIPTION | QUANTITY |
|----------------------------------|------------|---|----------|
| U36 | U17545-000 | DRIVER,OIL,DS75451N,DUAL AND,[NATIONAL SEMICONDUCTOR DS75451N] | 1 |
| U6, U19, U34, U39, U60 | U20148-000 | IC,HEX INVERTER,SCHMIDTT TRIGGER,(74HC14) (SSD) | 5 |
| U42 | U20730-000 | IC,DUAL J-K FLIP FLOP W/RESET,(7473) (SSD) | 1 |
| U51 | U21328-000 | IC,QUAD 2 INPUT NAND,SCHMIDTT TRIGGER,(74HC132) (SSD) | 1 |
| U52 | U21388-000 | IC,3 TO 8 DECODER/DEMULPLEXER, INVERTING,(74HC138) (SSD) | 1 |
| U32 | U21536-000 | IC,DUAL 4 INPUT DIGTAL MULTIPLEXER,(74F153) (SSD) | 1 |
| U35 | U22598-000 | IC,8 BIT ADDRESSABLE LATCH W/RESET,(74HC259) (SSD) | 1 |
| U47 | U23909-000 | IC,DUAL 4 BIT BINARY/BIQUINARY COUNTER (74HCT390) (SSD) | 1 |
| U41, U48 | U24018-000 | IC,JOHNSON DECADE COUNTER W/10 DECODED OUTPUTS,(74HC4017) (SSD) | 2 |
| U45 | U24138-000 | IC,8 BIT BINARY DOWN COUNTER,(74HC40103) (SSD) | 1 |
| U43 | U26889-000 | IC,8 BIT MAGNITUDE COMPARATOR,(74HCT688) (SSD) | 1 |
| U22, U24, U57 | U28008-000 | IC,QUAD 2 INPUT AND,(74HC08) (SSD) | 3 |
| U4, U49, U58 | U28032-000 | IC,QUAD 2 INPUT OR,(74HC32) (SSD) | 3 |
| U44, U46 | U28040-000 | IC,12 BIT DECADE COUNTER,(74HCT4040) (SSD) | 2 |
| U5, U13, U14, U23, U25, U33, U50 | U28074-000 | IC,DUAL D FLIP FLOP W/RESET,(74HC74) (SSD) | 7 |
| U2 | U28123-000 | IC,DUAL RETRIGGERABLE 1-SHOT,(74HC123) (SSD) | 1 |
| U31, U53 | U28164-000 | IC,8 BIT SERIAL IN PARALLEL OUT SHIFT REGISTER,(74HC164) (SSD) | 2 |
| U3, U12, U28, U37, U38 | U28165-000 | IC,8 BIT PARALLEL IN SERIAL OUT SHIFT REGISTER,(74HC165) (SSD) | 5 |
| RP6 | U32001-000 | IC,1K FEED-THROUGH RES NETWORK,16 PIN DIP,(A/B 316B102) | 1 |
| RP1-RP5 | U32103-000 | IC,10K FEED-THROUGH RES NETWORK,16 PIN DIP,(A/B 316B103) | 5 |
| U56 | U40008-000 | REGULATOR,OIL,5V,100MA,TO-92,[MOTOROLA MC78L05ABP] | 1 |
| U55 | U40012-000 | FLIP-FLOP,OCTAL D-TYPE LATCH WITH RESET,[NATIONAL MM74HC273N] | 1 |

5.3.5 Parts List, HPA 40W 26.5-40GHZ (AR) A28050-352

| REF. DESIG. | ETM P/N | DESCRIPTION | QUANTITY |
|--------------------|----------------|---|-----------------|
| A1 | A22826-352 | HV POWER SUPPLY FOR MEC-5496 | 1 |
| A6 | A23692-000 | INSULATED FAN DRIVER | 1 |
| A5 | A24830-001 | EMERGENCY BYPASS BOARD | 1 |
| A4 | A25444-000 | HPA INTERFACE BOARD (PLASTIC FIBERS) | 1 |
| A10 | A27742-001 | LOW PROFILE CABINET ASSY, K AND KA-BAND | 1 |
| A3 | A27752-300 | AR TWTA CONTROL ASSY | 1 |
| A2 | A28051-002 | MICROWAVE POWER ASSEMBLY, KA BAND, 40 WATT TWT WITH BAND EDGES ENHANCED | 1 |
| A9 | A28052-000 | WIRING KIT, 40W K/KA BAND | 1 |

5.3.6 Parts List, Microwave Power Assembly, KA, A28051-002

| REF. DESIG. | ETM P/N | DESCRIPTION | QUANTITY |
|-------------|------------|---|----------|
| | E00988-000 | WR-28 TO COAX ADAPTOR, UG 599/U TO K, 2.9 MM WAVE GUIDE FEMALE, [APOLLO, 16064-1] | 2 |
| | E01149-000 | WAVEGUIDE FLANGE GASKET, WR-28, [MDC # 68028-141] | 1 |
| A4 | E01462-000 | EQUALIZER, FIXED GAIN, 26.5-40 GHZ,M/F CONNECTORS, [MICROTEST INC. EQ105] | 1 |
| A5 | E01887-000 | TWT, 26.5-40.0 GHZ, 40 WATTS CW [MEC, 5496] | 1 |
| | E01928-000 | TRANSITION WRD-180 TO WR-28,(MDC, E01928) | 1 |
| | E02000-000 | WRD-180 TO K(2.9 MM) FEMALE ADAPTOR, [QUINSTAR, QWA-180S 29F] | 1 |
| A3 | E02020-000 | 26.5-40 GHZ SSPA, 18DBM, 20 DB GAIN,(NO ATTEN.),[KMIC TBD] | 1 |
| A6 | E08109-000 | WR-28 OUTPUT ARM,[APOLLO PER E08109] | 1 |
| | E20130-000 | ADAPTER,SMA MALE TO SMA FEMALE,RIGHT ANGLE (SV MICROWAVE, 2994-6002SF (SST FINISH)) | 1 |
| D1, D2 | E20316-000 | DETECTOR,ZERO BIAS SCHOTTKY,40 GHZ,POS OUTPUT,(KRYTAR 303AK (P)) | 2 |
| J1, J2 | E20318-000 | K PANEL ADAPTOR,JACK-JACK,(ANRITSU K232B) | 2 |
| W1-W6 | E20319-000 | CABLE ASSY 30 GHZ,K-MALE TO K-MALE,8LONG,(ASTROLAB MINIBEND K-8) | 6 |
| A7 | E20365-000 | DIRECTIONAL COUPLER, 10 DB, 26.5-40 GHZ, TYPE K,[KRYTAR 184010K] | 1 |
| A2 | E20369-000 | VOLTAGE CONTROLLED ATTEN, 26.5-40 GHZ,0-35DB,WR-28, 0-5 VDC CONTROL VOLTAGE,[QUINSTAR QAV2802CB] | 1 |
| A1 | E20375-000 | COAXIAL ISOLATOR, 1.4:1 VSWR, KA BAND 26.5-40 GHZ,[DITOM DF3797] | 1 |
| | E21002-000 | ADAPTER,K(M)-K(M),(ANRITSU,K220B) | 1 |
| | E21003-000 | ADAPTER,K(F)-K(F),(ANRITSU,K222B) | 1 |
| | E21005-000 | ATTENUATOR,3DB,(ANRITSU,43KC-3) | 1 |
| A8 | E21007-000 | ATTENUATOR,10DB,(ANRITSU,43KC-10) | 1 |
| | H32492-000 | EMI SHIELDING, SELF-ADHESIVE, ULTRA-SOFT, 0.25X0.025 THK, 16 LENGTHS,[INSTRUMENT SPECIALTIES 0098-05] | 1 |
| P34 | J00033-000 | CONN,FEMALE 3 PIN,.063,(MOLEX 03-06-1032) | 1 |
| | J01021-000 | CONN,MALE 2 PIN .063,(MOLEX 03-06-2023) | 1 |
| P33 | J01031-000 | CONN,MALE 3 PIN,.063,(MOLEX 03-06-2032) | 1 |
| | J18160-000 | CONN,1 PIN,FEMALE,20KV,10A,0.180 DIA. LEAD,[CONNECTRONICS 11039-02] | 4 |
| | J31076-000 | CONNECTOR,20 KV,24LEAD;LEAD COLOR RED,(CONNECTRONICS 10539-02) | 1 |
| | N27737-000 | WR-28 WAVEGUIDE PLATE | 2 |
| | N27750-000 | ATTENUATOR CLAMP,K-BAND | 1 |
| | N28830-000 | EMI SHIELD STOP BLOCK,WR-28 | 2 |
| | N31524-000 | WR-28 WAVEGUIDE COVER PLATE | 1 |

5.3.7 Parts List, Wiring Kit, 40W K/KA Band, 28052-000

| REF. DESIG. | ETM P/N | DESCRIPTION | QUANTITY |
|------------------|------------|--|----------|
| A12 | E00765-000 | P.S.,85-264VAC,47-440HZ TO 5VDC & 3.0A,(KEPCO FAW 5-3K/CA 24) | 1 |
| A11 | E00850-000 | AC FILTER,IEC INPUT,250V,7A,(FILTER CONCEPT LF7C) | 1 |
| B1 | E01120-000 | FAN, 11000 RPM, 400HZ, MODEL 1284DH, [AMETEK 010182 MODIFIED PER DRAWING] | 1 |
| | E30147-020 | RIBBON CABLE, 28 AWG, D-SUB 37 PIN FEMALE TO D-SUB 37 PIN FEMALE,[DICAR PER ETM 30147] | 1 |
| XF1 | H14012-000 | FUSE HOLDER,(BUSSMAN HTB-44I) | 1 |
| | H15031-000 | SILPAD,BERGUIST 1009-104 | 1 |
| P30 | J00010-000 | CONN,1 PIN,FEMALE,(MOLEX 03-09-1011) | 1 |
| P14 | J00020-000 | CONN,PIN & SOCKET,2 PIN,FEM,(MOLEX 03-09-1027) | 1 |
| P10, P12 | J00021-000 | CONN,FEMALE 2 PIN .063,(MOLEX 03-06-1023) | 2 |
| P27 | J00023-000 | CONN,HOUSING,FEMALE,02 PIN,(MOLEX 5197-N 10-01-3026) | 1 |
| P16 | J00025-000 | HOUSING,2 PIN,FEMALE,0.1 SPACING,7880 SERIES,(MOLEX 10-11-2023) | 1 |
| P31 | J00033-000 | CONN,FEMALE 3 PIN,.063,(MOLEX 03-06-1032) | 1 |
| P28 | J00034-000 | CONN,HOUSING,FEMALE,03 PIN,(MOLEX 5197-N 10-01-3036) | 1 |
| P15 | J00046-000 | CONN,HOUSING,FEMALE,4 PIN,0.1SPACING,7880 SERIES,(MOLEX 10-11-2043) | 1 |
| P29 | J01010-000 | CONN,1 PIN,MALE,250V (MOLEX 03-09-2011) | 1 |
| J1 | J01020-000 | CONN,PIN & SOCKET,2 PIN,MALE,(MOLEX 03-09-2021) | 1 |
| P11, P13 | J01021-000 | CONN,MALE 2 PIN .063,(MOLEX 03-06-2023) | 2 |
| P32 | J01031-000 | CONN,MALE 3 PIN,.063,(MOLEX 03-06-20332) | 1 |
| XP14, XP30 | J03000-000 | TERMINAL,PIN & SOCKET TYPE,PIN,FEM,CRIMP,(MOLEX 02-09-1118) | 3 |
| XP11, XP13, XP32 | J03013-000 | CONN,PIN MALE,.063,(MOLEX 002-06-2103) | 7 |
| XJ1 | J04000-000 | TERMINAL,PIN & SOCKET TYPE,MALE,CRIMP,(MOLEX 02-09-2118) | 2 |
| XP10, XP12, XP31 | J04013-000 | CONN,PIN FEMALE .063,(MOLEX 002-06-1103) | 7 |
| XP15, XP16 | J04014-000 | TERMINAL PIN HIGH PRESSURE MOLEX 7879 SERIES [MOLEX 08-50-0005] (FOR SERIES 7880 HOUSING 10-11-XXXX) | 6 |
| XP27, XP28 | J04015-000 | PIN,TERMINAL FOR HOUSING CONNECTOR 5.08MM,(MOLEX 5194 SERIES 08-70-1030) | 5 |
| | J10264-000 | CONN,FEM SOCKET,26 PIN,IDC MASS TERMINATION,(THOMAS & BETTS 609-2601M) | 1 |
| | J11240-000 | CONN,RIBBON,24 PIN,FEMALE,1A CONTACTS,BLUE,[3M 3549-1000-SR-3448-61] | 1 |
| P1 | J12031-000 | CONN,D-SUB,FEMALE,3 PIN,#8 AWG,PLUG,HI POWER [ITT CANNON DAM-3W3S] | 1 |
| P9 | J12091-000 | CONN,D-SUB,9 PIN,FEMALE,CRIMP (ITT CANNON DEU-9S) | 1 |
| P2, P3 | J12250-000 | CONN,D-SUB,25 PIN,FEMALE,CRIMP | 2 |
| XP1 | J18054-000 | CONTACT,FEMALE,HI PWR,20 AMP,UP TO 12AWG WIRE,[ITT CANNON DM53744-6] | 2 |
| | J18075-000 | MALE SCREW LOCK,FOR D SUBMIN CONN,(AMP 205817-1) | 2 |
| P20-P26 | J18124-000 | CONN,SMA MALE SOLDER ATTACHMENT FOR RG188,(PASTERNAK PE4036) | 7 |
| J2 | J18176-000 | CONN,D-SUB,15 PIN,FEMALE,CRIMP,(ITT CANNON DAU-15S) | 1 |

Model 40T26G40A

| | | | |
|--------|------------|---|----|
| XJ2 | J18184-000 | D-SUB,15 PIN MALE,CRIMP (ITT CANNON DAU-15P) | 1 |
| P4 | J31011-000 | D-SUB,37 PIN,MALE,CRIMP,5A,20 AWG (ITT CANNON DCU-37P) | 1 |
| P7, P8 | J31012-000 | CONN,D-SUB,15 PIN,FEMALE,RIBBON CABLE,W/STRAIN RELIEF,PLASTIC,[AMPHENOL 841-17-DAFR-B15S] | 2 |
| | J31014-000 | SPRING LATCH KIT,D-SUB,(AMPHENOL 17-529) | 8 |
| | N22925-000 | MODIFIED KNOB,1/4 SHAFT | 1 |
| | N24841-000 | PANEL SWITCH SPACER | 2 |
| S2, S3 | S25002-000 | SWITCH,PUSHBUTTON,SPDT,SAFETY DOOR INTERLOCK,DEFEATABLE,(MICRO SWITCH 3AC6) | 2 |
| S1 | S26030-000 | C/B,2 POLE,7.5A(AIRPAX IEGH-11-1-61-7.5-C-21-V) | 1 |
| S4 | S32074-000 | SWITCH,KEYLOCK,1 POLE,3 POS, SHORTING, THROW,(ILLINOIS LOCK HD5161 AACCM-100-090-041G)WITH KEY E100 | 1 |
| U1, U2 | U00052-000 | PRECISION CELSIUS TEMP SENSOR, TO-220 [NATIONAL LM35DT] | 2 |
| | W01880-000 | WIRE,26 AWG,COAXIAL,RG-188A/U,900V (BELDEN 83269) | 8 |
| | W11400-000 | WIRE,14 AWG,600V,BLUE,(ALPHA 5859) | 8 |
| | W11800-000 | WIRE,18 AWG,BLUE,(BELDEN 83009) | 4 |
| | W12200-000 | WIRE, 22 AWG, BLU, 600V, TEFLON, (BELDEN 83006) | 8 |
| | W21600-000 | POWER CORD,3 COND,16 AWG,125V,13A,10 FEET,3 PIN MALE TO 3 PIN FEMALE IEC 320-C133 (BELDEN 17503) | 1 |
| | W23700-000 | CABLE,RIBBON,37 COND,28 AWG,STRANDED,[AMP 1-57040-8] | 12 |
| W1, W2 | W30020-000 | CABLE,FIBER OPTIC,1000UM POF, (HP HFBR-3504) | 3 |
| | W30064-000 | CABLE ASSY,IEEE-488,ONE HERMAPHRODITE CONNECTOR,ONE STRAIGHT,1 METER,(ICS 105710) | 1 |
| | Y20012-000 | FAN,FINGER GUARD,(ETRI 12001-43) | 1 |
| F1 | Z20020-000 | FUSE,2A,250V,3AG,SB,(LITTELFUSE 313.002) | 1 |
| | Z31022-000 | SURGE ARRESTOR,(CPCLARE AC240L) | 1 |

5.5 SAMPLE PROGRAM FOR IEEE-488 COMMUNICATION

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1000 ! *****
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.

