MKS PICO™

Mass Spectrometer-Based Helium Leak Detector

Operating Manual

Sniffer Model

Vacuum Model

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Leak Detector Safety Information

Symbols Used in This Instruction Manual

Definitions of WARNING, CAUTION, and NOTE messages used throughout the manual.

Warning		**The WARNING sign denotes a hazard to personnel. It calls attention to a procedure, practice, condition, or the like, which, if not correctly performed or adhered to, could result in injury to personnel.**
Caution		**The CAUTION sign denotes a hazard to equipment. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of all or part of the product.**
Note		**The NOTE sign denotes important information. It calls attention to a procedure, practice, condition, or the like, which is essential to highlight.**

Symbols That May Be Found on the Unit

The following table describes symbols that may be found on the unit.

Table 1: Definition of Symbols Found on the Unit

On (Supply) IEC 417, No. 5007	 Off (Supply) IEC 417, No. 5008	 Earth (ground) IEC 417, No. 5017	 Protective Earth (ground) IEC 417, No. 5019
 Frame or Chassis IEC 417, No. 5020	 Equipotentiality IEC 417, No. 5021	 Direct Current IEC 417, No. 5031	 Alternating Current IEC 417, No. 5032
 Both Direct and Alternating Current IEC 417, No. 5033-a	 Class II Equipment IEC 417, No. 5172-a	 Three Phase Alternating Current IEC 617-2, No. 020206	
 Caution (refer to accompanying documents) ISO 3864, No. B.3.1	 Caution, Risk of Electric Shock ISO 3864, No. B.3.6	 Caution, Hot Surface IEC 417, No. 5041	

Safety Procedures and Precautions

Observe the following general safety precautions during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of intended use of the instrument and may impair the protection provided by the equipment. MKS Instruments, Inc. assumes no liability for the customer's failure to comply with these requirements.

SERVICE BY QUALIFIED PERSONNEL ONLY

Operating personnel must not attempt component replacement and internal adjustments. Only qualified service personnel may perform any service.

DANGER ARISING FROM LOSS OF GROUND

Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulating) can render an electrical shock.

GROUND AND USE PROPER ELECTRICAL FITTINGS

Dangerous voltages are contained within this instrument. All electrical fittings and cables must be of the type specified, and in good condition. All electrical fittings must be properly connected.

USE THE PROPER POWER CORD

Use only a power cord that is in good condition and which meets the input power requirements specified in the manual.

Use only a detachable cord set with conductors that have a cross-sectional area equal to or greater than 0.75 mm^2. A qualified agency (such as VDE, Semko, or SEV) should approve the power cable.

USE THE PROPER POWER SOURCE

This product is intended to operate from a power source that does not apply more voltage between the supply conductors, or between either of the supply conductors and ground, than that specified in the manual.

USE THE PROPER FUSE

Use only a fuse of the correct type, voltage rating, and current rating, as specified for your product.

USE CAUTION WHEN OPERATING WITH HAZARDOUS MATERIALS

If hazardous materials are used, observe the proper safety precautions, completely purge the instrument when necessary, and ensure that the material used is compatible with the materials in this product, including any sealing materials.

DO NOT OPERATE IN AN EXPLOSIVE ENVIRONMENT

To avoid explosion, do not operate this product in an explosive environment unless it has been specifically certified for such operation.

USE PROPER FITTINGS AND TIGHTENING PROCEDURES

All instrument fittings must be consistent with instrument specifications, and compatible with the intended use of the instrument. Assemble and tighten fittings according to manufacturer's directions.

CHECK FOR LEAK-TIGHT FITTINGS

Carefully check all vacuum component connections to the instrument to ensure leak-tight installation.

OPERATE AT SAFE INLET PRESSURES

Never operate at pressures higher than the rated maximum pressure (refer to the product specifications for the maximum allowable pressure).

KEEP THE UNIT FREE OF CONTAMINANTS

Do not allow contaminants to enter the unit before or during use. Contamination such as dust, dirt, lint, glass chips, and metal chips may permanently damage the unit or contaminate the process.

ALLOW THE UNIT TO WARM UP

If the unit is used to control dangerous gases, they should not be applied before the unit has completely warmed up. Use a positive shutoff valve to ensure that no erroneous flow can occur during warm up.

AVOID EXPLOSIVE GAS MIXTURES

Do not use this, or any other gauge with a hot filament, explosive gas mixtures, or flammable gases that could form explosive gas mixtures in air. If the filament or control circuit fails the filament could ignite the mixture. With some gas mixtures, an exothermic catalytic reaction could occur at the filament, causing ignition of the gas.

TAKE PRECAUTIONS TO AVOID POTENTIAL EXPLOSIONS

Precautions must be taken to avoid explosion due to overpressure during backfill operations. If any thermal conductivity gauge is calibrated for air/nitrogen, the measured pressure may vary considerably as a function of true pressure for other gases. Pressure indications above 100 Torr should not be used when backfilling. In a system filled with a pressurized source, install a safety relief valve or rupture disk to limit pressure to safe limits.

HIGH VOLTAGE DANGER

High voltage is present in the instrument when it is turned on.

Informations relatives à la sécurité

Symboles utilisés dans ce manuel d'utilisation

Définitions des indications AVERTISSEMENT, ATTENTION, et REMARQUE utilisées dans ce manuel.

Avertissement		**L'indication AVERTISSEMENT signale un danger pour le personnel. Elle attire l'attention sur une procédure, une pratique, une condition, ou toute autre situation présentant un risque d'accident pour le personnel, en cas d'exécution incorrecte ou de non respect des consignes.**
Attention		**L'indication ATTENTION signale un danger pour l'appareil. Elle attire l'attention sur une procédure d'exploitation, une pratique, ou toute autre situation, présentant un risque d'endommagement ou de destruction d'une partie ou de la totalité de l'appareil, en cas d'exécution incorrecte ou de non respect des consignes.**
Remarque		L'indication REMARQUE signale une information importante. Elle attire l'attention sur une procédure, une pratique, une condition, ou toute autre situation, présentant un intérêt particulier.

Symboles apparaissant sur l'unité

Le tableau suivant décrit les symboles pouvant apparaître sur l'unité.

Tableau 2: Définition des symboles apparaissant sur l'unité

Marche (sous tension) IEC 417, No.5007	 Arrêt (hors tension) IEC 417, No.5008	 Terre (masse) IEC 417, No.5017	 Terre de protection (masse) IEC 417, No.5019
 Masse IEC 417, No.5020	 Equipotentialité IEC 417, No.5021	 Courant continu IEC 417, No.5031	 Courant alternatif IEC 417, No.5032
 Courant continu et alternatif IEC 417, No.5033-a	 Matériel de classe II IEC 417, No.5172-a	 Courant alternatif triphasé IEC 617-2, No.020206	
 Attention : se reporter à la documentation ISO 3864, No.B.3.1	 Attention : risque de choc électrique ISO 3864, No.B.3.6	 Attention : surface brûlante IEC 417, No.5041	

Mesures de sécurité et précautions

Prendre les précautions générales de sécurité suivantes pendant toutes les phases d'exploitation de cet appareil. Le non respect des ces précautions ou des avertissements contenus dans ce manuel constitue une violation des normes de sécurité relatives à l'utilisation de l'appareil et peut diminuer la protection fournie par l'appareil. MKS Instruments, Inc. n'assume aucune responsabilité concernant le non respect des consignes par les clients.

DÉPANNAGE UNIQUEMENT PAR DU PERSONNEL QUALIFIÉ

Le personnel d'exploitation ne doit pas essayer de remplacer des composants ou de faire des réglages internes. Tout dépannage doit être uniquement effectué par du personnel qualifié.

DANGER LIÉ Á UN DÉFAUT DE LA PRISE DE TERRE

En cas de défaut de la connexion protectrice à la prise de terre, toutes les pièces conductrices accessibles (y compris les boutons et les contrôles qui peuvent sembler isolés) peuvent provoquer un choc électrique.

MISE Á LA TERRE ET UTILISATION D'ÉQUIPEMENTS ÉLECTRIQUES APPROPRIÉS

Cet appareil contient des tensions dangereuses. Tous les équipements électriques et les câbles doivent être du type spécifié et en bon état. Tous les équipements électriques doivent être correctement branchés et mis à la terre.

UTILISATION D'UN CORDON ÉLECTRIQUE APPROPRIÉ

Utiliser uniquement un cordon électrique en bon état et conforme aux exigences de puissance d'entrée spécifiées dans le manuel.

Utiliser uniquement un cordon d'alimentation amovible avec des fils électriques ayant une section supérieure ou égale à 0,75 mm^2. Le cordon d'alimentation doit être approuvé par un organisme qualifié tel que VDE, Semko, ou SEV.

UTILISATION D'UNE ALIMENTATION ÉLECTRIQUE APPROPRIÉE

Cet appareil est conçu pour fonctionner à l'aide d'une alimentation dont la tension entre les fils d'alimentation, ou entre les fils d'alimentation et le fil de terre n'est pas supérieure à celle qui est spécifiée dans le manuel.

UTILISATION D'UN FUSIBLE APPROPRIÉ

Utiliser uniquement un fusible du type approprié, avec la tension nominale et le courant nominal spécifiés pour l'appareil.

PRÉCAUTION EN CAS D'UTILISATION AVEC DES PRODUITS DANGEREUX

Si des produits dangereux sont utilisés, respecter les mesures de précaution appropriées, purger complètement l'appareil quand cela est nécessaire, et s'assurer que les produits utilisés sont compatibles avec les composants de cet appareil, y compris les matériaux d'étanchéité.

PAS D'EXPLOITATION DANS UN ENVIRONNEMENT EXPLOSIF

Pour éviter toute explosion, ne pas utiliser cet appareil dans un environnement explosif, sauf en cas d'homologation spécifique pour une telle exploitation.

UTILISATION D'ÉQUIPEMENTS APPROPRIÉS ET PROCÉDURES DE SERRAGE

Tous les équipements de l'appareil doivent être cohérents avec ses spécifications, et compatibles avec l'utilisation prévue de l'appareil. Assembler et serrer les équipements conformément aux directives du fabricant.

VÉRIFICATION DE L'ÉTANCHÉITÉ DES CONNEXIONS

Vérifier attentivement toutes les connexions des composants pour le vide afin de garantir l'étanchéité de l'installation.

EXPLOITATION AVEC DES PRESSIONS D'ENTRÉE NON DANGEREUSES

Ne jamais utiliser des pressions supérieures à la pression nominale maximum (se reporter aux spécifications de l'unité pour la pression maximum admissible).

MAINTIEN DE L'UNITÉ À L'ABRI DES CONTAMINATIONS

Ne pas laisser des produits contaminants pénétrer dans l'unité avant ou pendant l'utilisation. Des produits contaminants tels que des poussières et des fragments de tissu, de glace et de métal peuvent endommager l'unité d'une manière permanente ou contaminer le processus.

RESPECT DU TEMPS D'ÉCHAUFFEMENT

Si l'unité est utilisée pour contrôler des gaz dangereux, ceux-ci ne doivent pas être appliqués avant l'échauffement complet de l'unité. Utiliser une valve de fermeture positive afin de garantir qu'aucun flux ne se produise par erreur pendant l'échauffement.

ÉVITEMENT DES MÉLANGES DE GAZ EXPLOSIFS

Ne pas utiliser cet appareil, ou toute autre jauge avec un filament brûlant, avec des mélanges de gaz explosifs ou avec des gaz inflammables pouvant former des mélanges explosifs dans l'air. En cas de panne du filament ou du circuit de contrôle, le filament peut enflammer le mélange. Avec certains mélanges de gaz, une réaction catalytique exothermique peut se produire au niveau du filament et provoquer l'inflammation des gaz.

PRÉCAUTIONS Á PRENDRE POUR ÉVITER LES EXPLOSIONS POTENTIELLES

Il faut prendre des précautions pour éviter les explosions liées à la surpression pendant les opérations de remplissage. Si une jauge de conductivité thermique est calibrée pour un mélange air/azote, la pression mesurée peut varier considérablement en tant que fonction de la véritable pression pour d'autres gaz. Les indications de pression supérieures à 100 Torr ne doivent pas être utilisées pendant les remplissages. Avec un système rempli à l'aide d'une source pressurisée, installer une valve de décharge de sécurité ou un disque de rupture pour maintenir la pression dans des limites non dangereuses.

DANGER DE HAUTE TENSION

Une haute tension est présente dans l'appareil quand il est mis en marche.

Sicherheitshinweise

In dieser Betriebsanleitung vorkommende Symbole

Bedeutung der mit WARNUNG!, VORSICHT! und HINWEIS gekennzeichneten Absätze in dieser Betriebsanleitung.

Warnung! 

Das Symbol WARNUNG! weist auf eine Gefahr für das Bedienpersonal hin. Es macht auf einen Arbeitsablauf, eine Arbeitsweise, einen Zustand oder eine sonstige Gegebenheit aufmerksam, deren unsachgemäße Ausführung bzw. ungenügende Berücksichtigung zu Verletzungen führen kann.

Vorsicht! 

Das Symbol VORSICHT! weist auf eine Gefahr für das Gerät hin. Es macht auf einen Bedienungsablauf, eine Arbeitsweise oder eine sonstige Gegebenheit aufmerksam, deren unsachgemäße Ausführung bzw. ungenügende Berücksichtigung zu einer Beschädigung oder Zerstörung des Gerätes oder von Teilen des Gerätes führen kann.

Hinweis 

Das Symbol HINWEIS macht auf wichtige Informationen bezüglich eines Arbeitsablaufs, einer Arbeitsweise, eines Zustands oder einer sonstige Gegebenheit aufmerksam.

Erklärung der am Gerät angebrachten Symbole

Nachstehender Tabelle sind die Bedeutungen der Symbole zu entnehmen, die am Gerät angebracht sein können.

Tabelle 3: Bedeutung der am Gerät angebrachten Symbole

Ein (Energie) IEC 417, No.5007	 Aus (Energie) IEC 417, No.5008	 Erdanschluß IEC 417, No.5017	 Schutzleiteranschluß IEC 417, No.5019
 Masseanschluß IEC 417, No.5020	Aquipotential-anschluß IEC 417, No.5021	 Gleichstrom IEC 417, No.5031	 Wechselstrom IEC 417, No.5032
 Gleich- oder Wechselstrom IEC 417, No.5033-a	 Durchgängige doppelte oder verstärkte Isolierung IEC 417, No.5172-a	Dreileiter-Wechselstrom (Drehstrom) IEC 617-2, No.020206	
 Warnung vor einer Gefahrenstelle (Achtung, Dokumentation beachten) ISO 3864, No.B.3.1	 Warnung vor gefährlicher elektrischer Spannung ISO 3864, No.B.3.6	 Höhere Temperatur an leicht zugänglichen Teilen IEC 417, No.5041	

Sicherheitsvorschriften und Vorsichtsmaßnahmen

Folgende allgemeine Sicherheitsvorschriften sind während allen Betriebsphasen dieses Instruments zu befolgen. Eine Mißachtung der Sicherheitsvorschriften und sonstiger Warnhinweise in dieser Betriebsanleitung verletzt die für dieses Instrument und seine Bedienung geltenden Sicherheitsstandards, und kann die Schutzvorrichtungen an diesem Gerät wirkungslos machen. MKS Instruments, Inc. haftet nicht für Mißachtung dieser Sicherheitsvorschriften seitens des Kunden.

Wartung nur durch qualifizierte Fachleute!

Das Auswechseln von Komponenten und das Vornehmen von internen Einstellungen darf nur von qualifizierten Fachleuten durchgeführt werden, niemals vom Bedienpersonal.

Gefährdung durch Verlust der Erdung!

Sollte die Schutzerdung unterbrochen werden, besteht an sämtlichen stromleitenden Teilen die Gefahr eines elektrischen Schlages. Dies gilt auch für Knöpfe und andere Bedienelemente, die dem Anschein nach isoliert sind.

Einwandfreie elektrische Komponenten verwenden!

In diesem Instrument liegen gefährliche Spannungen an. Alle verwendeten elektrischen Bauteile und Kabel müssen dem vorgeschriebenen Typ entsprechen und sich in einwandfreiem Zustand befinden. Alle elektrischen Komponenten sind vorschriftsmäßig anzuschließen.

Das richtige Netzkabel verwenden!

Das Netzkabel muß sich in einwandfreiem Zustand befinden und den in der Betriebsanleitung genannten Leistungswerten entsprechen.

Das Netzkabel muß abnehmbar sein. Der Querschnitt der einzelnen Leiter darf nicht weniger als 0,75 mm^2 betragen. Das Netzkabel sollte das Gütesiegel einer namhaften Prüfanstalt wie etwa VDE, Semko oder SEV tragen.

Korrekte Stromquelle verwenden!

Dieses Produkt ist nur für solche Stromquellen vorgesehen, deren zwischen den Leitern bzw. zwischen Leiter und Masseleiter anliegende Spannungen den in dieser Betriebsanleitung angegebenen Wert nicht überschreiten.

Korrekte Sicherung verwenden!

Es ist eine Sicherung zu verwenden, deren Typ, Nennspannung und Nennstromstärke den Angaben für dieses Produkt entsprechen.

Vorsicht beim Arbeiten mit gefährlichen Stoffen!

Wenn gefährliche Stoffe verwendet werden, muß der Bediener die entsprechenden Sicherheitsvorschriften genauestens einhalten, das Instrument, falls erforderlich, vollständig ausblasen, sowie sicherstellen, daß der Gefahrstoff die am Gerät verwendeten Materialien, insbesondere Dichtungen, nicht angreift.

Gerät nicht zusammen mit explosiven Stoffen, Gasen oder Dämpfen benutzen!

Um der Gefahr einer Explosion vorzubeugen, darf dieses Gerät niemals zusammen mit (oder in der Nähe von) explosiven Stoffen aller Art eingesetzt werden, sofern es nicht ausdrücklich für diesen Zweck zugelassen ist.

Anweisungen zum Installieren der Armaturen

Alle Anschlußstücke und Armaturenteile müssen mit der Gerätespezifikation übereinstimmen, und mit dem geplanten Einsatz des Instrumentes kompatibel sein. Der Einbau, insbesondere das Anziehen und Abdichten, muß gemäß den Anweisungen des Herstellers vorgenommen werden.

Verbindungen auf Undichtigkeiten prüfen!

Überprüfen Sie sorgfältig alle Verbindungen der Vakuumkomponenten auf undichte Stellen.

Gerät nur unter zulässigen Anschlußdrücken betreiben!

Betreiben Sie das Instrument niemals unter Drücken, die den maximal zulässigen Druck (siehe Produktspezifikationen) übersteigen.

Verunreinigungen im Gerät vermeiden!

Stellen Sie sicher, daß Verunreinigungen jeglicher Art weder vor dem Einsatz noch während des Betriebs in das Instrumenteninnere gelangen können. Staub- und Schmutzpartikel, Glassplitter oder Metallspäne können das Gerät dauerhaft beschädigen oder Prozeß und Meßwerte verfälschen.

Geräteeinheit auf Arbeitstemperatur bringen!

Wird das Gerät zur Analyse gefährlicher Gase verwendet, so dürfen diese nur nach Abschluß des Anwärmvorgangs zugeführt werden. Um das versehentliche Fließen von Gas während der Aufheizperiode zu verhindern, sollte ein Anlaßventil (positiv) eingebaut werden.

Explosive Gasgemische vermeiden!

Verwenden Sie weder dieses Instrument noch andere Meßgeräte mit Glüh- oder Heizfäden jemals zusammen mit explosiven Gasgemischen oder mit brennbaren Gasen, welche zusammen mit Luft ein explosives Gemisch erzeugen würden. Sollten Heizfaden oder Steuerstromkreise versagen, könnte der Heizfaden das Gemisch entzünden. Bestimmte Gemische können zudem eine exotherme (wärmefreisetzende) Reaktion am Heizfaden auslösen, welche wiederum das Gas entzünden könnte.

Vorsichtsmaßnahmen zum Vermeiden von Explosionen

Beim Hinterfüllen muß auf folgendes geachtet werden, um eine Explosion aufgrund von Überdruck zu vermeiden: Bei Luft/Stickstoff-kalibrierten Wärmeleitungsmessern kann der gemessene Druck als Funktion des wahren Drucks anderer Gase sehr stark variieren. Bei Druckanzeigen über 100 Torr sollte kein Hinterfüllen durchgeführt werden. Systeme, die über eine unter Druck stehende Quelle gefüllt werden, sollten mit einem Sicherheitsventil oder einer Berstscheibe ausgestattet werden, um den Druck in sicheren Grenzen zu halten.

Vorsicht Hochspannung!

Wenn eingeschaltet, steht das Gerät unter Hochspannung.

Medidas de seguridad

Símbolos usados en este manual de instrucciones

Definiciones de los mensajes de advertencia, precaución y de las notas usados en el manual.

Advertencia		**El símbolo de advertencia indica la posibilidad de que se produzcan daños personales. Pone de relieve un procedimiento, práctica, estado, etc. que en caso de no realizarse u observarse correctamente puede causar daños personales.**
Precaución		**El símbolo de precaución indica la posibilidad de producir daños al equipo. Pone de relieve un procedimiento operativo, práctica, estado, etc. que en caso de no realizarse u observarse correctamente puede causar daños o la destrucción total o parcial del equipo.**
Nota		El símbolo de notas indica información de importancia. Este símbolo pone de relieve un procedimiento, práctica o condición cuyo conocimiento es esencial destacar.

Símbolos hallados en la unidad

La tabla siguiente contiene los símbolos que puede hallar en la unidad.

Tabla 4: Definición de los símbolos hallados en la unidad

Encendido (alimentación eléctrica) IEC 417, N° 5007	 Apagado (alimentación eléctrica) IEC 417, N° 5008	 Puesta a tierra IEC 417, N° 5017	 Protección a tierra IEC 417, N° 5019
 Caja o chasis IEC 417, N° 5020	 Equipotencialidad IEC 417, N° 5021	 Corriente continua IEC 417, N° 5031	 Corriente alterna IEC 417, N° 5032
 Corriente continua y alterna IEC 417, N° 5033-a	 Equipo de clase II IEC 417, N° 5172-a	Corriente alterna trifásica IEC 617-2, N° 020206	
 Precaución. Consulte los documentos adjuntos ISO 3864, N° B.3.1	 Precaución. Riesgo de descarga eléctrica ISO 3864, N° B.3.6	 Precaución. Superficie caliente IEC 417, N° 5041	

Procedimientos y precauciones de seguridad

Las precauciones generales de seguridad descritas a continuación deben observarse durante todas las etapas de funcionamiento del instrumento. La falta de cumplimiento de dichas precauciones o de las advertencias específicas a las que se hace referencia en el manual, constituye una violación de las normas de seguridad establecidas para el uso previsto del instrumento y podría anular la protección proporcionada por el equipo. Si el cliente no cumple dichas precauciones y advertencias, MKS Instruments, Inc. no asume responsabilidad legal alguna.

LAS REPARACIONES DEBEN SER EFECTUADAS ÚNICAMENTE POR TÉCNICOS AUTORIZADOS

Los operarios no deben intentar reemplazar los componentes o realizar tareas de ajuste en el interior del instrumento. Las tareas de mantenimiento o reparación deben ser realizadas únicamente por personal autorizado.

PELIGRO POR PÉRDIDA DE LA CONEXIÓN A TIERRA

Si se pierde la conexión a tierra de protección, todas las piezas conductoras a las que se tiene acceso (incluidas las perillas y controles que parezcan estar aislados) pueden producir descargas eléctricas.

USE ACCESORIOS ELÉCTRICOS ADECUADOS Y CONÉCTELOS A TIERRA

Este instrumento funciona con voltajes peligrosos. Todos los accesorios y cables eléctricos deben ser del tipo especificado y mantenerse en buenas condiciones. Todos los accesorios eléctricos deben estar conectados adecuadamente.

USE UN CABLE ELÉCTRICO ADECUADO

Use únicamente un cable eléctrico que se encuentre en buenas condiciones y que cumpla los requisitos de alimentación de entrada indicados en el manual.

Use únicamente un cable desmontable con conductores que tengan un área de sección transversal equivalente o superior a 0,75mm². El cable eléctrico debe estar aprobado por una entidad autorizada tal como VDE, Semko o SEV.

USE UNA FUENTE DE ALIMENTACIÓN ELÉCTRICA ADECUADA

Este instrumento debe tener una fuente de alimentación eléctrica que no suministre un voltaje superior al especificado en el manual entre los conductores de suministro o entre cualquiera de los conductores de suministro y la conexión a tierra.

USE UN FUSIBLE ADECUADO

Use únicamente un fusible del tipo, tensión nominal y capacidad nominal de corriente adecuados y especificados para el instrumento.

TENGA CUIDADO CUANDO TRABAJE CON MATERIALES TÓXICOS

Cuando se utilicen materiales tóxicos, tome las medidas de seguridad necesarias, purgue totalmente el instrumento cuando sea necesario y compruebe que el material utilizado sea compatible con los materiales del equipo e inclusive, con los materiales de sellado.

NO HAGA FUNCIONAR EL INSTRUMENTO EN ENTORNOS CON RIESGO DE EXPLOSIÓN

Para evitar que se produzcan explosiones, no haga funcionar este instrumento en un ambiente con riesgo de explosiones, excepto cuando el mismo haya sido certificado específicamente para tal uso.

USE ACCESORIOS ADECUADOS Y REALICE CORRECTAMENTE LOS PROCEDIMIENTOS DE AJUSTE

Todos los accesorios del instrumento deben cumplir las especificaciones del mismo y ser compatibles con el uso que se debe dar al instrumento. Arme y ajuste los accesorios de acuerdo con las instrucciones del fabricante.

COMPRUEBE QUE LAS CONEXIONES SEAN A PRUEBA DE FUGAS

Inspeccione cuidadosamente las conexiones de los componentes de vacío para comprobar que hayan sido instalados a prueba de fugas.

HAGA FUNCIONAR EL INSTRUMENTO CON PRESIONES DE ENTRADA SEGURAS

No haga funcionar nunca el instrumento con presiones superiores a la máxima presión nominal (en las especificaciones del instrumento hallará la presión máxima permitida).

MANTENGA LA UNIDAD LIBRE DE CONTAMINANTES

No permita el ingreso de contaminantes en la unidad antes o durante su uso. Los productos contaminantes tales como polvo, suciedad, pelusa, lascas de vidrio o virutas de metal pueden dañar irreparablemente la unidad o contaminar el proceso.

PERMITA QUE LA UNIDAD SE CALIENTE

Si se utiliza la unidad para controlar gases peligrosos, no libere los gases hasta que la unidad termine de calentarse. Use una válvula de cierre positivo para impedir todo flujo no deseado durante el período de calentamiento.

EVITE MEZCLAS DE GASES EXPLOSIVOS

No utilice éste ni ningún otro calibrador de hilo caliente con mezclas de gases peligrosos o inflamables que puedan formar mezclas de gases explosivos en el aire. Si se producen fallas en el filamento o el circuito de control, el filamento pueden encender la mezcla. Algunas mezclas de gases pueden generar una reacción catalítica exotérmica en el filamento y originar de este modo el encendido del gas.

TOME MEDIDAS PARA EVITAR EXPLOSIONES

Es necesario tomar las medidas necesarias para evitar explosiones originadas por sobrepresión durante las operaciones de relleno. Si se calibra cualquiera de los calibradores de conductividad térmica para aire/nitrógeno, la presión obtenida puede variar considerablemente en función de la verdadera presión para otros gases. No se debe utilizar presiones superiores a 100 Torrs durante el relleno. Cuando se llena un sistema con una fuente presurizada, instale una válvula o disco de seguridad para mantener la presión dentro de los límites de seguridad.

PELIGRO DE ALTO VOLTAJE

Cuando se enciende el instrumento hay alto voltaje presente.

Chapter One: Overview

General Information

Congratulations on your purchase of the MKS PICO™ mass spectrometer-based helium leak detector.

The PICO incorporates advanced technology in the area of mass spectrometry and vacuum technology (patents pending) to provide fast, contamination free, leak detection.

Two different models of the PICO Helium Leak detector are available, a dedicated sniffing model and a vacuum model. The PICO sniffing style helium leak detector, detects leaks from pressurized lines with a minimum detectable leak rate of 1 x 10^{-7} atm-cm^3/s. The PICO vacuum style leak detector can detect leaks to 1x 10^{-10} atm-cm^3/s in vacuum systems.

The leak detector incorporates both visual and audible indication that a leak has been detected. The instrument is extremely easy to operate and locates leaks precisely and without uncertainty. Minimal maintenance is required and the instrument can withstand dirty environments without adversely effecting the mass spectrometer or vacuum pumps.

Figure 1: MKS Mass Spectrometer-Based Helium Leak Detector

Description of Main Components

The Helium Leak Detector consists of the following modules:

Vacuum System The vacuum system consists of a turbo-molecular pump (TMP) and backing scroll pump. The turbo pump utilizes advanced technology (patent pending) to achieve vacuum levels required by the mass spectrometer to operate. The backing scroll pump is connected to the turbo pump and lowers the pressure to acceptable levels in which the turbo pump can operate.

Mass Spectrometer The leak detector uses an advanced ion trap mass spectrometry (patent pending) to measure helium levels introduced to the leak detector.

User Interface The touch screen display is the primary interface between the instrument and the operator. An RS232 output option is available that allows the user to download the leak test data to a computer.

Sample Probe *(Not shown)* A three meter sampling probe on the sniffer model provides means of drawing the sample from the atmosphere to the mass spectrometer is standard. Five and six meter long sampling probe options are also available on the sniffer model. A sniffing option is available on the vacuum version with three or six meter long probes.

Theory of Operation

Mass Spectrometer Basics

Traditional Mass spectrometers have the following components

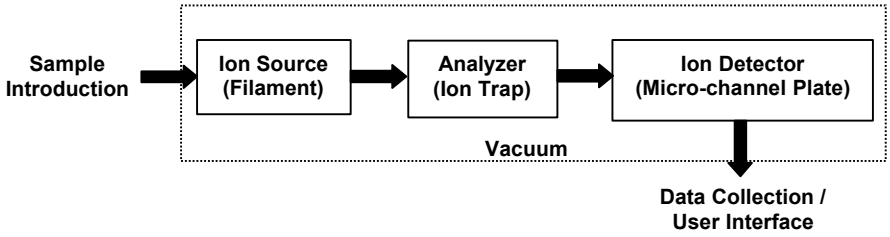

Figure 2: Mass Spectrometer Block Diagram

1. *Sample Introduction:* How the test gas enters the PICO product.
   - ✍ Vacuum Version: KF16 Test Port
   - ✍ Sniffer Version: Sniffing Probe & Tube
2. *Ionization Source:* A filament is used as the Ion source. The filament emits electrons when heated. Helium atoms become ionized by the electrons from the ionization source. The PICO has a dual filament design, one filament is used while the other is present as a backup. In the event of a filament failure, the backup filament is automatically activated and the user is alerted by a message on the display screen.
3. *Analyzer:* Ion trap technology is used. Gas phase ions are sorted in the trap according to mass-to-charge ratio. Helium ions are sent to the Ion Detector for measurement, other unwanted elements are discarded.
4. *Ion Detector*: A micro-channel plate (MCP) design is utilized to measure the helium concentration.
5. *Data Collection/User Interface:* Numerical and graphical indication of leak rate, audio alarm, and graphical trending of the leak rate are how the leak rate is communicated to the user.

Counter-flow Helium Leak Detection

The PICO Helium Leak detector uses a counter-flow detection method for helium detection. The helium gas is introduced between the Scroll Pump and Turbo-pump (see Figures 2 & 3 below). When the helium reaches the branch between the two pumps, the lower pressure of the turbo-pump draws the lighter gas as well as some of the heavier gases into the turbo-pump.

The turbo-pump has a large compression capacity for high molecule gases and pumps those out to the exhaust. Light gases, like helium, do not pump well in turbo-pumps and flow in a different "counter-flow" direction to the lower pressure Ion Trap cavity.

In the ion trap cavity the helium gas is collected and is measured by the ion trap mass spectrometer. By utilizing this technique, unwanted heavy gases are minimized in the ion trap helping to keep the sensor clean for better detector sensitivity.

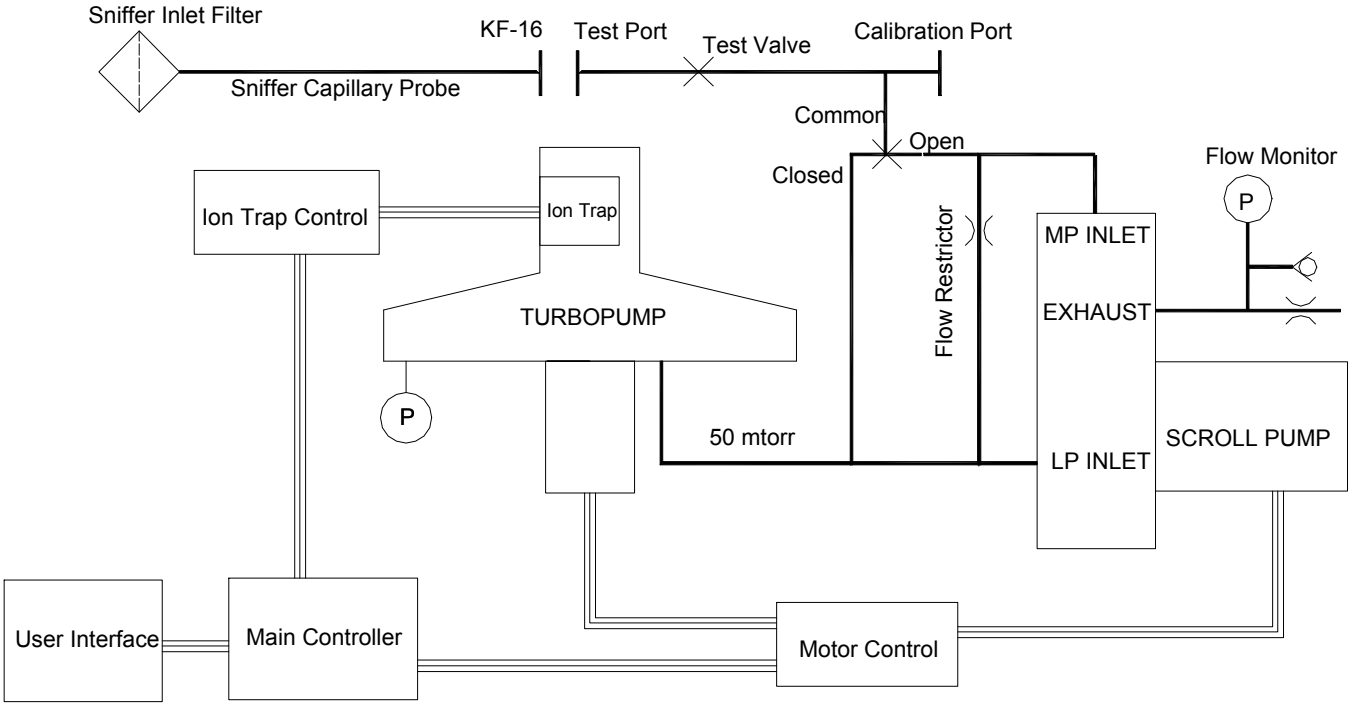

Figure 3: Vacuum System Block Diagram

(Shows Auxiliary Probe connection)

MP = medium pressure

LP = low pressure

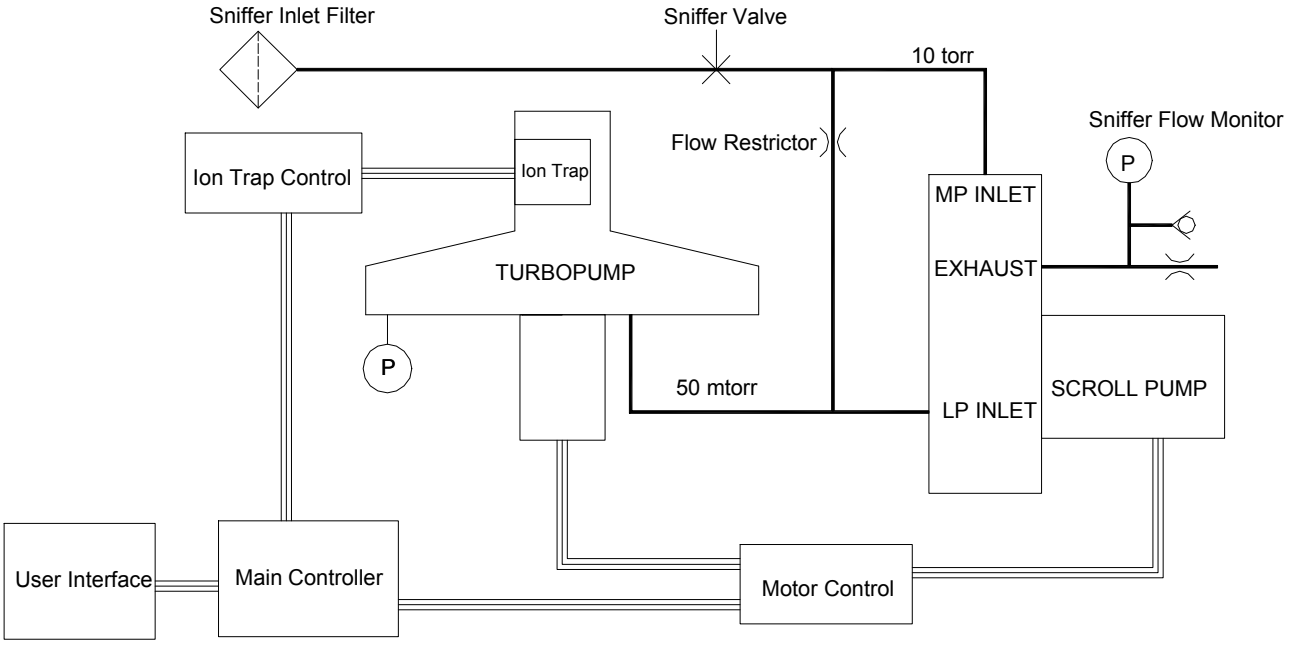

Figure 4: Sniffer System Block Diagram

Leak Rate Unit Conversions:

Common leak rate units and their conversion to atm*cm^3/s also designated as atm*cc/s

Leak Rate Units	atm*cm^3/s
1 mbar*l/s =	0.987
1 torr*l/s =	1.316
1 atm*cm^3/s =	1
1 Pa*m^3/s =	9.87
1 lusec	1.32 x 10^{-3}
1 atm*ft^3/min =	4.72 x 10^{2}
1 gramme per year = (Freon 12)	6.32 x 10^{-6}

Table 5: Leak Rate Conversions

How this Manual is Organized

This manual provides instructions on how to set up, operate, and maintain the PICO™ leak detector.

Before turning on and operating the leak detector, carefully read and familiarize you with all precautionary notes in the *Safety Messages and Procedures* section at the front of this manual. In addition, observe and obey all WARNING and CAUTION notes provided throughout the manual.

Chapter One: General Information (this chapter)
Introduces the product and describes the organization of the manual.

Vacuum Model:

Chapter Two: Getting Started – Vacuum Model
Explains how to unpack and set up the vacuum model for helium leak detecting.

Chapter Three: Operation – Vacuum Model
Describes the standard operating procedures of the unit. The chapter explains how to operate the instrument and provides a detailed description of the display screens. The section also outlines a typical helium leak detection test.

Sniffer Model:

Chapter Four: Getting Started – Sniffer Model
Explains how to unpack and set up the instrument for helium leak detecting.

Chapter Five: Operation – Sniffer Model
Describes the standard operating procedures of the unit. The chapter explains how to operate the instrument and provides a detailed description of the display screens. The section also outlines a typical helium leak detection test.

Appendix A: Product Specifications – Vacuum Model, *MSVA*
Lists the vacuum model instrument specifications.

Appendix B: Model Code Explanation – Vacuum Model, MSVA
Describes the vacuum model codes.

Appendix C: Product Specifications – Sniffer Model, *MSSA*
Lists the sniffer model instrument specifications.

Appendix D: Model Code Explanation – Sniffer Model, MSSA
Describes the sniffer model codes.

Appendix E: Battery Option
Describes the battery option details for sniffer model.

Appendix F: RS232 Output Option
Describes the RS232 output option for both vacuum & sniffer models

Appendix G: Trouble Shooting Guide
Provides suggestions for trouble shooting problems

Customer Support

Please call the MKS Service Department with any questions regarding the operation, maintenance, troubleshooting, etc of the Leak Detector.

Warning  **All returns to MKS Instruments must be free of harmful, corrosive, radioactive, or toxic materials.**

Chapter Two: Getting Started – Vacuum Model, MSVA

Unpacking the PICO™ Vacuum Leak Detector

MKS carefully packed the PICO™ Leak Detector so that it will reach you in perfect operating order. Upon receiving the unit, however, check for defects, cracks, broken or crimped tubing, etc., to be certain damage did not occur during shipment.

Note Do *not* discard any packing materials. Retain all pieces of the shipping container, as received, for possible return.

If you find any damage, notify your carrier and MKS immediately. If it is necessary to return the unit to MKS, call the MKS Service Department for assistance.

Warning Do not remove the base unit from foam by holding the handheld display. This may cause the plastic enclosure to break. Remove unit by handle on top of unit and by placing hand under manifold.

Figure 5: Vacuum Model Unpacking Recommendation

Unpacking Checklist

Standard Equipment:

- PICO™ Leak detector
- Switching power supply with cord
- Carrying Case
- Operating manual (this manual)

Optional Equipment: (in carrying case if purchased)

- Calibrated Leak Standard
- Auxiliary Sniffer Probe (with Sniffer Option)
  - Package of 25 probe filters

Dimensions

Note All dimensions are listed in inches with millimeters referenced in parentheses.

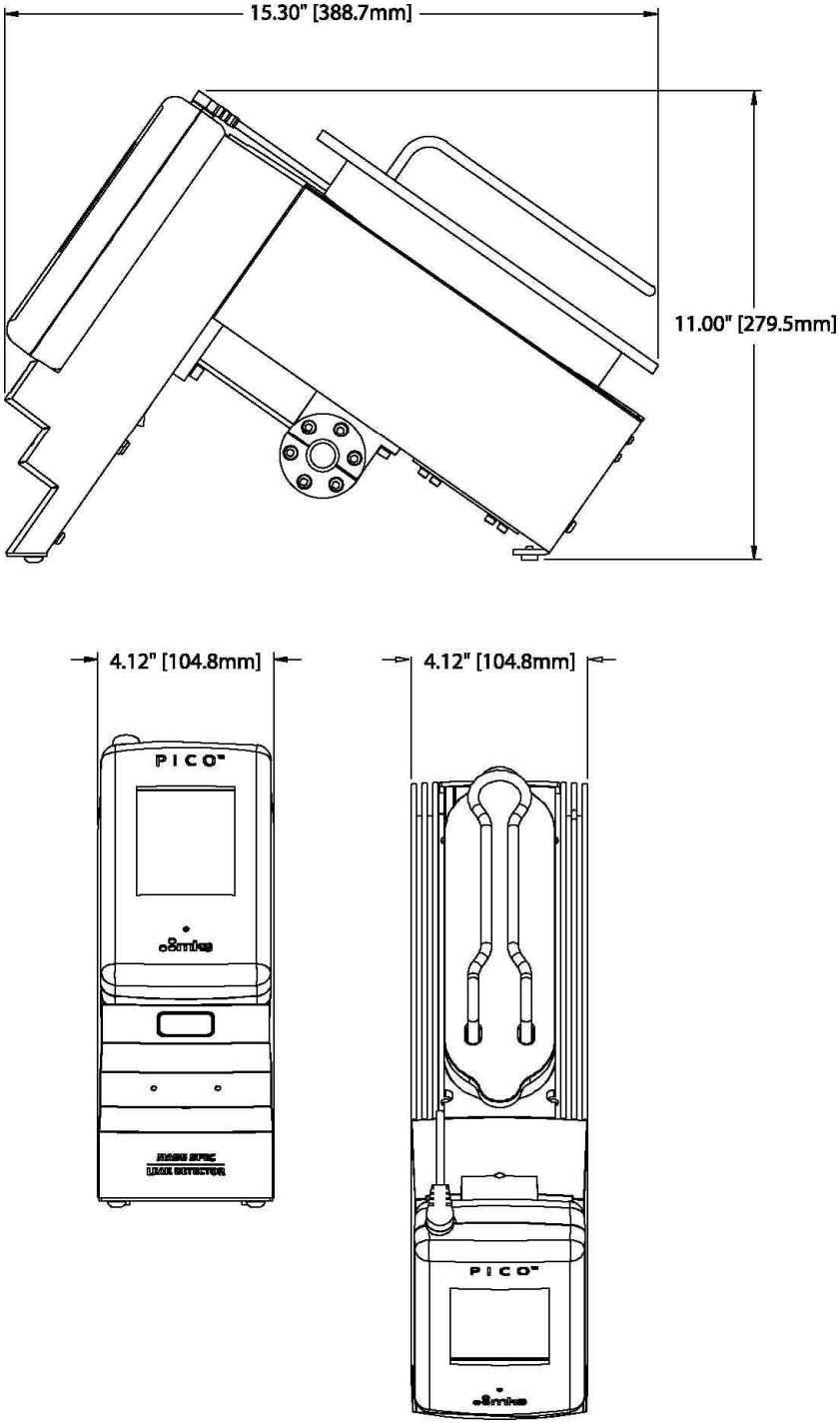

Figure 6: Dimensions, Vacuum Model

Chapter Three: Operation - Vacuum Model, MSVA

Setup and Operating Instructions

Warning  **Please reference this manual for important safety and operational instructions**

Setup – Standard Vacuum Operation

1. Place the instrument on a flat, stable surface.

2. Connect the appropriate end of the switching power supply (with cord) to the power inlet receptacle on the instrument. Connect the other end to the nearest 100-220 VAC-wall receptacle.

3. Connect an appropriate length bellows between the PICO™ KF16 test port and the vacuum system test port.

4. Open the valve on the calibrated leak (counter clockwise). If a calibrated leak is not installed on the Calibration port, be sure that the port is capped with a KF-16 blank.

5. Place the POWER switch in the ON position

6. You will now see the STARTUP screen.

7. Press the START VACUUM button with your finger on the touch screen display. You will hear the pumps begin to operate and the ready light will blink slowly during this period.

   After a warm-up period of approximately five (5) min, the PICO™ will be ready for leak testing (Leak Test button appears). A blinking Ready light indicates the unit is not in Leak Test mode. The Test Valve is closed at this point.

   At the beginning of the warm-up, the Pico will attempt to pump out the volume attached to the Test Port. One minute into the warm-up period, the Pico will decide whether or not it will be able to pump out the volume.

   - If it is able, the PICO will leave the Test Valve open for the remainder of the warm-up period.
   - If it is not making sufficient progress pumping out the test port volume, it will close the Test Valve and continue bringing the pumping system up to operating speed. The user must now pump out the bellows volume using the system being leak tested.

Note  **As the PICO warms up, the vacuum system will make some sounds due to motors accelerating, valves actuating, etc. This is normal.**

Warning

Before pressing the Leak Test button, assure the pressure in the bellows is < 500mTorr. This can be accomplished by slowly opening the foreline test valve of your vacuum system & pumping down the volume.

8. Press the LEAK TEST button. The PICO now does a self-check to assure the pressure in the bellows is below 500mTorr. This process takes 25 seconds and will be indicated on the display screen. The Ready light will only be solid when the unit is ready to conduct a leak test.

9. If the Pico vacuum leak detector experiences a catastrophic, sudden, vent to atmosphere, it will display a PUMPING SYSTEM FAULT message. To clear the error, turn the main power switch off for several seconds, then reapply power and press the START VACUUM button.

Warning

The Pico Vacuum leak detector is intended to operate with test port pressures between 1 and 500 mTorr. If you are using the Pico to leak check a high vacuum system (10 e-4 or lower), always connect the Pico to the foreline of the vacuum system, not directly to the high vacuum chamber.

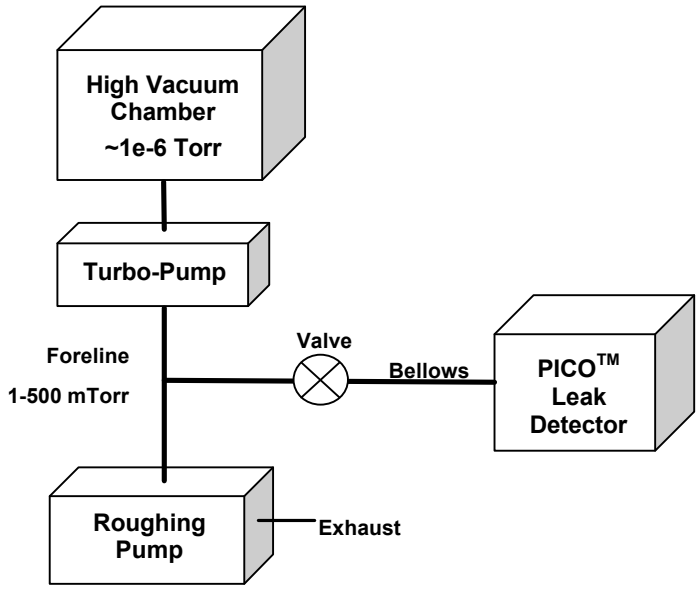

Figure 7: Required connection to high vacuum system

Setup – Sniffer Option on Vacuum

1. Place the instrument on a flat, sturdy surface.
2. Connect the appropriate end of the switching power supply (with cord) to the power inlet receptacle on the instrument Connect the other end to the nearest 100-220 VAC-wall receptacle.
3. Place the POWER switch in the ON position
4. You will now see the STARTUP screen.
5. Make sure that Auxiliary Probe is attached to the Test Port of the PICO unit.

6. Press the START SNIFFER button (located below START VACUUM button) with your finger on the touch screen display. You will hear the pumps begin to operate for a period of approximately five (5) min.

Note

As the PICO warms up, the vacuum system will make some sounds due to motors accelerating, valves actuating, etc. This is normal.

7. After the instrument has properly warmed up, press the LEAK TEST button with your finger to begin leak testing. You will now see the Leak Test screen. You are now ready to perform a leak test.

Figure 8: Start Screen w/ Sniffer Option

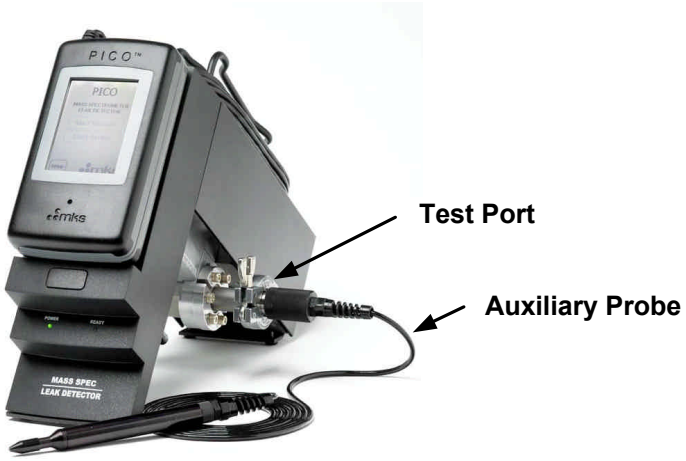

Figure 9: Vacuum Unit w/ Auxiliary Probe Attached

Status Indicators ("Power" and "Ready")

There are two indicator LED's located on the front of the instrument, labeled "Power" and "Ready." The "Power" indicator, when solid (not blinking), alerts the user that power is applied to the leak detector and the power switch is in the ON position.

The "Ready" indicator LED blinks when the unit is warming up or in the startup, standby, setup, or calibrate modes. This indicates the leak detector is NOT ready to perform a leak test. The leak detector is ready to perform a leak test ONLY when the "Ready" indicator is solid (not blinking). The "Ready" indicator will flash rapidly when an error has occurred with the PICO™ and the display screen will highlight the proper diagnostic message.

Description of Display Screens

This section outlines the steps for operating the PICO™ leak detector via the user-interface.

Setup Screen

Factory Setting

The following factory setting is displayed on the Setup screen:

GAS Displays “He” corresponding to Helium.

User Selectable Settings

The following settings displayed on the Setup screen are user selectable.

UNITS Leak rate units. The user has several preprogrammed units available for display, including: atm-cm3/s, Pa m3/s, mbar-l/s, torr-l/s

TIME RESPONSE The user can select:

- NORMAL recommended for general leak detection providing rapid detection of leaks
- FAST very short response time, increases background noise affect on reading
- SLOW best for detecting very small leaks (1 e-9 or 1 e-10 atm*cc/sec range). Reduces background noise level through increased averaging. Recommended setting for Zero Mode operation.

The factory default is NORMAL.

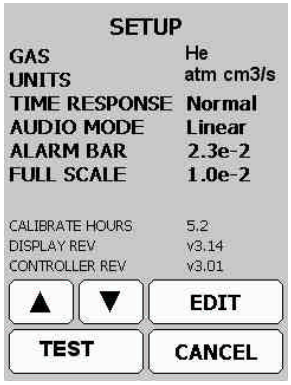

Figure 10: Setup Screen

AUDIO MODE Three options are available:

- LINEAR provides a repetitive audio indication of leak rate. Frequency of the beeps increases (more beeps per second) as the leak rate increase.
- ALARM provides an audible alarm once the leak rate has exceeded the alarm bar threshold.
- OFF disables the audible alarm.

ALARM BAR Allows user to select alarm threshold.

FULL SCALE Allows user to select the upper range of leak rate displayed.

Standby Screen

The flashing message, "Warming Up," becomes "Leak Test" when the unit is ready for a leak test.

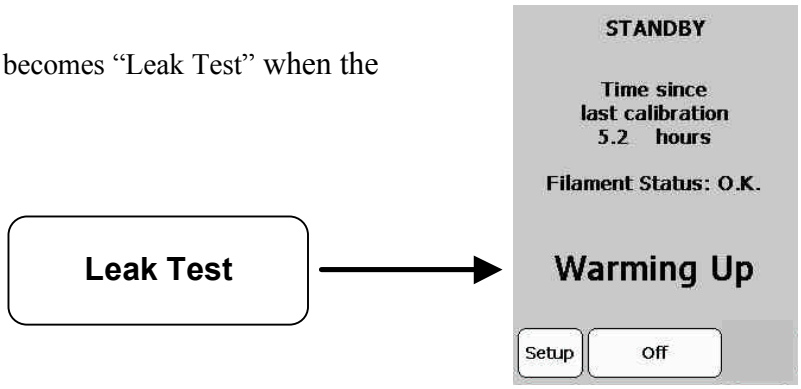

Figure 11: Standby Screen

Setup Shortcut to the Setup screen.

Off Shortcut to the Startup screen, pumps turned off.

Leak Test Screen

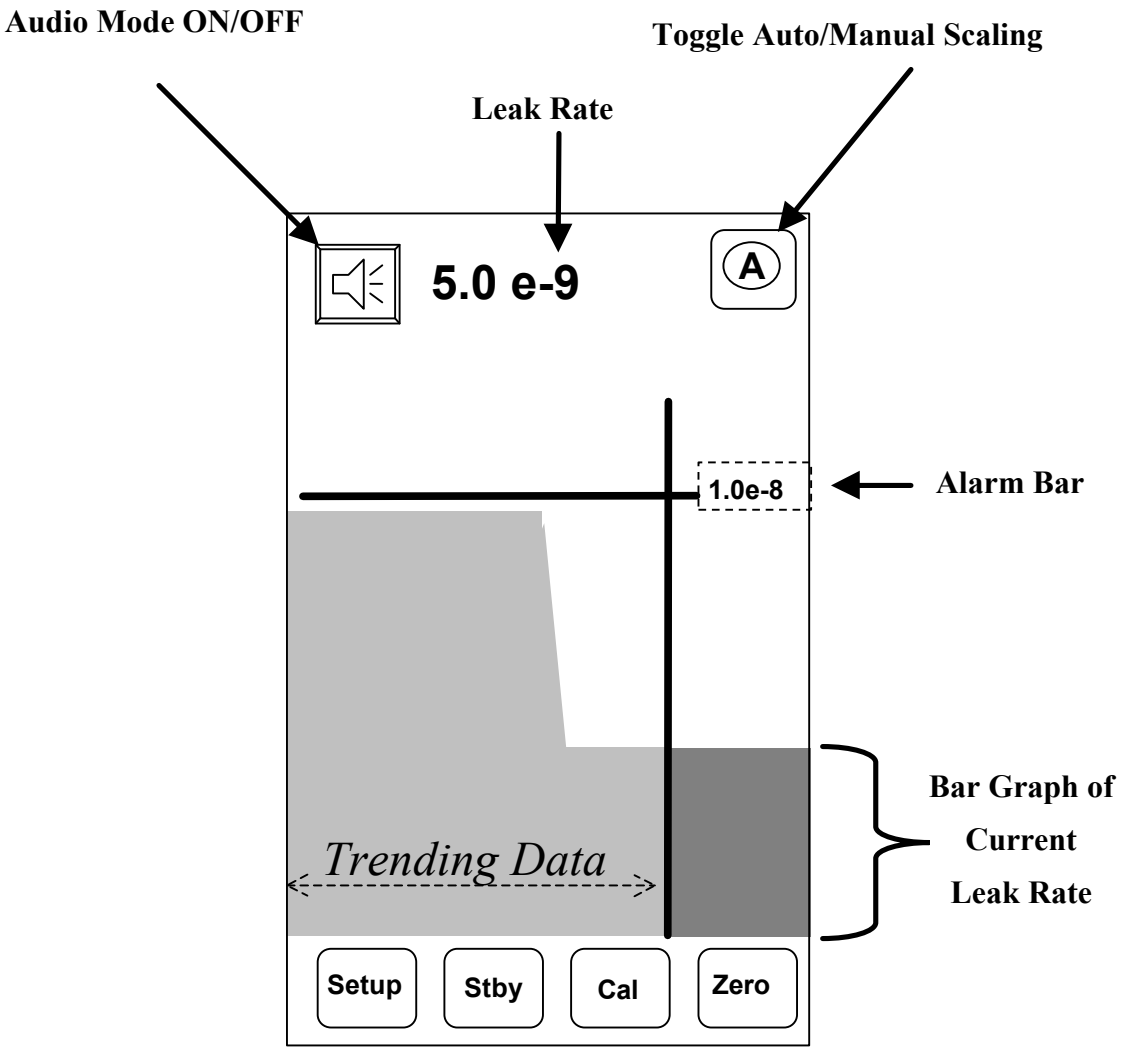

Figure 12: Leak Test Screen

Setup **Stby** **Cal** Shortcuts to the Setup, Standby, and Calibrate screens.

Zero Compensates for background Helium levels. Press this button only when readings are stable and excessive helium backgrounds are not present.

Calibrating the PICO Helium Leak Detector

In order to assure the PICO™ Helium Leak Detector is correctly adjusted to detect helium, a calibration should be performed on a periodic basis with an external Helium Leak Standard (HLS).

Note In the case of the Vacuum with Sniffer Option, **both operating modes need to be calibrated separately** (different HLS's are required).

Note For Calibration when operating the Sniffer Option of the Vacuum PICO,

See Chapter 5 – Sniffer Mode Calibration for instructions

MSVA, Standard Vacuum Model Calibration

The calibration process on the PICO vacuum model involves mounting the inlet flange of the HLS to the calibrate port of the leak detector and pressing a series of buttons to adjust the reading to match the HLS's stated specified leak rate (reference standard).

During calibration the test port valve closes to isolate the system. If the HLS is attached to the wrong port, calibration will not be possible.

It is important to calibrate the PICO with a HLS that has at least **2 x 10^{-8} atm cm^3/s leak rate.** The HLS must be at least twice the background leak rate for calibration to occur.

It is recommended that the unit be run at least 15 minutes to allow pumping system to fully stabilize and at the approximate test pressure conditions for best calibration.

Step 1: Calibrating the PICO – Vacuum Operation

In the LEAK TEST Screen, press the CAL button. You are now in the CALIBRATE routine of the instrument. At this point you will be guided through a series of steps to calibrate the PICO™ . These steps will take you through the following activities

Input leak rate value from HLS.

Measure background Helium levels.

Measure Helium leak rate from HLS and adjust calibration of PICO if necessary.

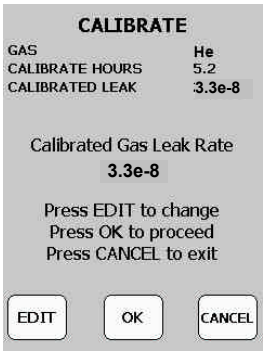

Figure 13: Calibrating the PICO Vacuum Model

Step 2: Setting the Helium Leak Standard (HLS Value)

Compare the "Calibrated Gas Leak Rate" with the leak rate indicated on the HLS. If identical, Press OK.

If the values are not identical, press EDIT to change the value on the display screen. Using the arrows, adjust the numerical values and press ACCEPT.

Please note this step will only have to be performed once, the value will now be stored in memory.

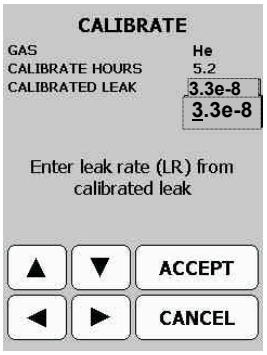

Figure 14: Setting the Helium Leak Standard (HLS Value)

Step 3: Collecting a Background Helium Sample

Once the "Calibrated Gas Leak Rate" is entered, press OK.

Next, close the valve on the HLS to collect a representative background reading of helium in the system. Press OK when the reading is stable.

The display will now flash the message "Collecting Background Sample, Please Wait."

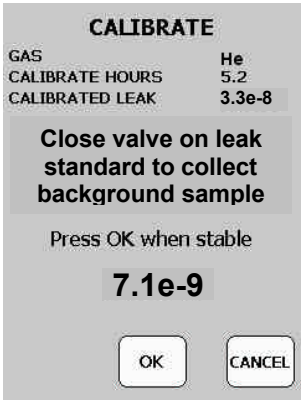

Figure 15: Collecting a Background Helium Sample Setup

Step 4: Collecting a Sample from the HLS

Open the valve on the HLS to collect a representative HLS sample.

Note It is normal to see a "peak" of helium immediately after the valve to the HLS is opened. The size of this peak depends on the length of time the valve has been closed.

Press OK when the reading is stable.

The display will now flash the message "Collecting Calibrated Leak Sample, Please Wait."

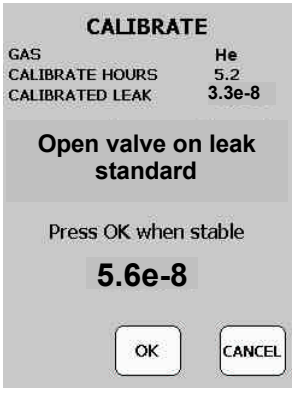

Figure 16: Collecting a Sample from the HLS Setup

Step 5: Calibrate Bar

If the PICO is within calibration, the display will alert the user that no adjustment is necessary.

If calibration is required, you will see the following text on the display. With the HLS valve still open, adjust the calibrate bar until the rate reads the value indicated on the screen (3.6 e-8 in the example below) by using the left or right arrows. Assure the reading is stable and press OK when the values are equal.

Note: The indicated value on the screen will not equal the calibrated leak value. The background level determined in step 3 has been compensated for in this value making it higher.

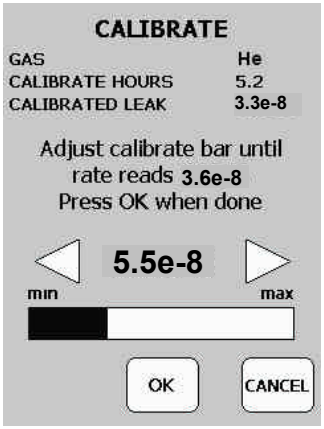

Figure 17: Calibrate Bar

Step 6: Verifying Calibration

Press OK and follow the instructions on the display to verify the calibration.

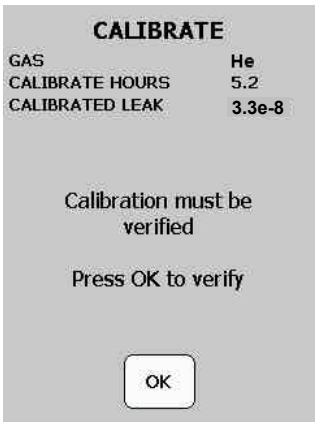

Figure 18: Verifying Calibration

These calibration steps will be repeated if the verified leak rate value does not match the leak rate value the user entered.

Chapter Four: Getting Started – Sniffer Model, MSSA

Unpacking the PICO™ Sniffer Leak Detector

MKS carefully packed the PICO™ Leak Detector so that it will reach you in perfect operating order. Upon receiving the unit, however, check for defects, cracks, broken or crimped tubing, etc., to be certain damage did not occur during shipment.

Note  Do *not* discard any packing materials. Retain all pieces of the shipping container, as received, for possible return.

If you find any damage, notify your carrier and MKS immediately. If it is necessary to return the unit to MKS, call the MKS Service Department for assistance.

Unpacking Checklist

Standard Equipment:

- ✍ PICO™ Leak detector (includes base unit with sniffing probe, attached)
- ✍ Switching power supply with cord
- ✍ Package of 25 probe filters
- ✍ Carrying Case
- ✍ Operating manual (this manual)

Optional Equipment: (in carrying case if purchased)

- ✍ (4) Rechargeable Batteries – if battery option purchased, see Appendix E
- ✍ Battery Charger w/ Cord - – if battery option purchased, see Appendix E
- ✍ Calibrated Leak Standard

Dimensions

Note All dimensions are listed in inches with millimeters referenced in parentheses.

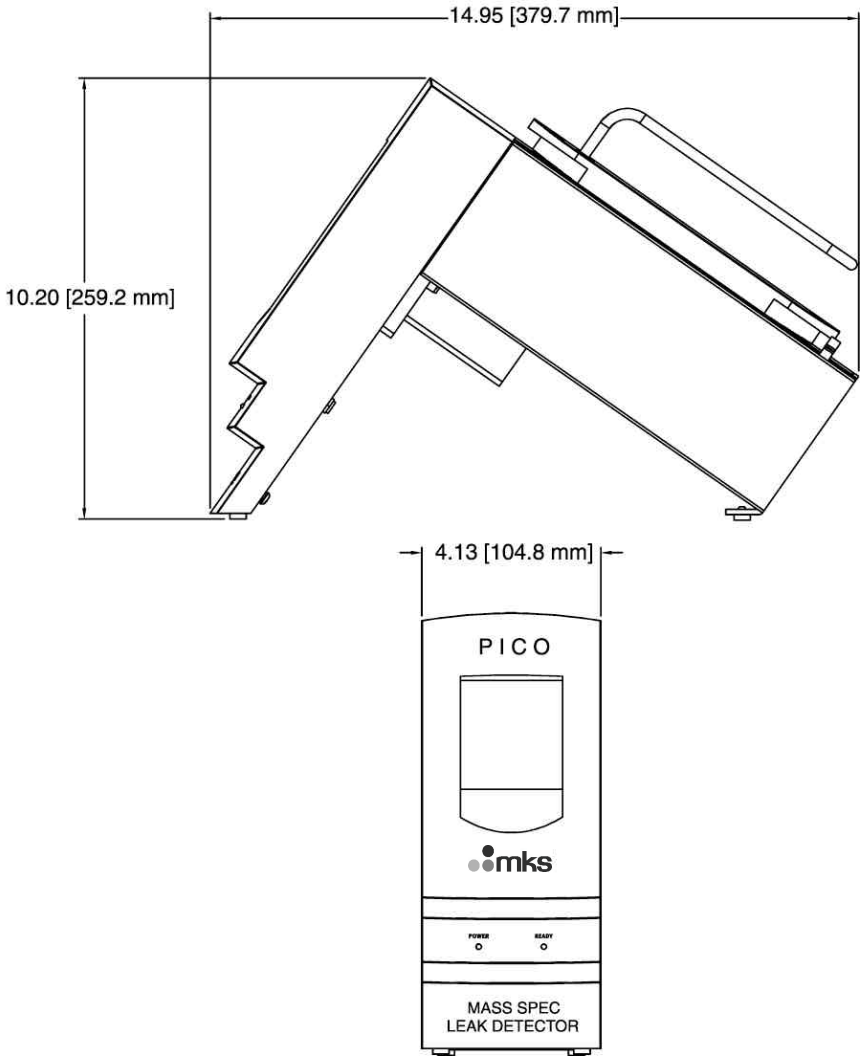

Figure 19: Dimensions, Sniffer Model

Chapter Five: Operation - Sniffer Model, MSSA

Setup and Operating Instructions

Setup – Standard AC Connection

8. Place the instrument on a flat, sturdy surface.
9. Connect the appropriate end of the switching power supply (with cord) to the power inlet receptacle on the instrument Connect the other end to the nearest 100-220 VAC-wall receptacle.
10. Place the POWER switch in the ON position
11. You will now see the STARTUP screen.
12. Press the START SNIFFER button with your finger on the touch screen display. You will hear the pumps begin to operate for a period of approximately five (5) mins.

Note  As the PICO warms up, the vacuum system will make some sounds due to motors accelerating, valves actuating, etc. This is normal.

13. After the instrument has properly warmed up, press the LEAK TEST button with your finger to begin leak testing. You will now see the Leak Test screen. You are now ready to perform a leak test.

Setup – Battery Option Connection

Note  Batteries are shipped in a partially charged state (approximately 40%). It is recommended to charge one set of batteries to the full state prior to use. See Appendix C for battery charging details.

Note  The PICO Helium Leak Detector with Battery Option installed is delivered in the carrying case with the power connector disconnected for shipping purposes. Connect the power connector before attempting operation.

1. Insert a battery in each of the two battery slots on the PICO Helium Leak Detector. For both batteries, the connector should be facing down as the battery is inserted into the slot. Both batteries are required for the PICO to operate.
2. To check the charge condition of a battery, press firmly on the white circle by the charge indicator on the battery.

INDICATOR	*CHARGE STATE*
No lights	Completely discharged
1 red light	0-25%
1 red, 1 green	26-50%
1 red, 2 green	50-75%
1 red, 3 green	76-100%

Table 6: Battery Charge Indicator Status

3. Turn the switch at the top of the rear of the PICO ON. A green light will illuminate if both batteries are properly inserted. If this green light flashes, there is approximately 5 minutes of battery life remaining.
4. Place the POWER switch in the ON position
5. You will now see the STARTUP screen.
6. Press the START button with your finger on the touch screen display. You will hear the pumps begin to operate for a period of approximately five (5) mins.

Note As the PICO warms up, the vacuum system will make some sounds due to motors accelerating, valves actuating, etc. This is normal.

14. After the instrument has properly warmed up, press the LEAK TEST button with your finger to begin leak testing. You will now see the Leak Test screen. You are now ready to perform a leak test.

See Appendix C for additional Battery Option information.

Status Indicators ("Power" and "Ready")

There are two indicator LED's located on the front of the instrument, labeled "Power" and "Ready." The "Power" indicator, when solid (not blinking), alerts the user that power is applied to the leak detector and the power switch is in the ON position.

The "Ready" indicator LED blinks when the unit is warming up or in the startup, standby, setup, or calibrate modes. This indicates the leak detector is NOT ready to perform a leak test. The leak detector is ready to perform a leak test ONLY when the "Ready" indicator is solid (not blinking). The "Ready" indicator will flash rapidly when an error has occurred with the PICO™ and the display screen will highlight the proper diagnostic message.

Description of Display Screens

This section outlines the steps for operating the PICO™ leak detector via the user-interface.

Setup Screen

Factory Setting

The following factory setting is displayed on the Setup screen:

GAS Displays "He" corresponding to Helium.

User Selectable Settings

The following settings displayed on the Setup screen are user selectable.

UNITS Leak rate units. The user has several preprogrammed units available for display, including: atm cm3/s, Pa m3/s, mbar-l/s, torr-l/s

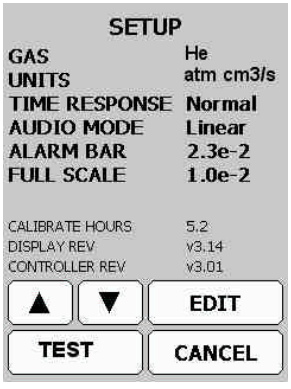

Figure 20: Setup Screen

TIME RESPONSE — The user can select:

NORMAL	recommended for general leak detection providing rapid detection of leaks
FAST	very short response time, increases background noise affect on reading
SLOW	best for detecting very small leaks (1 e-9 or 1 e-10 atm*cc/sec range). Reduces background noise level through increased averaging. Recommended setting for Zero Mode operation.

The factory default is NORMAL.

AUDIO MODE — Three options are available:

LINEAR	provides a repetitive audio indication of leak rate. Frequency of the beeps increases (more beeps per second) as the leak rate increase.
ALARM	provides an audible alarm once the leak rate has exceeded the alarm bar threshold.
OFF	disables the audible alarm.

ALARM BAR — Allows user to select alarm threshold.

FULL SCALE — Allows user to select the upper range of leak rate displayed.

Standby Screen

The flashing message, "Warming Up," becomes "Leak Test" when the unit is ready for a leak test.

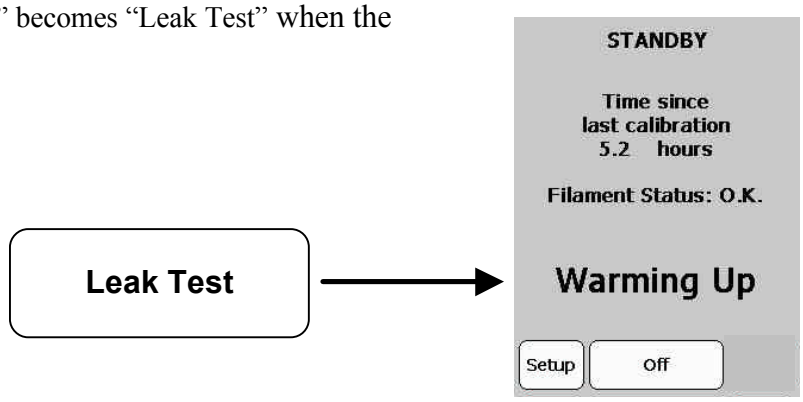

Figure 21: Standby Screen

Setup Shortcut to the Setup screen .

Off Shortcut to the Startup screen, pumps turned off.

Leak Test Screen

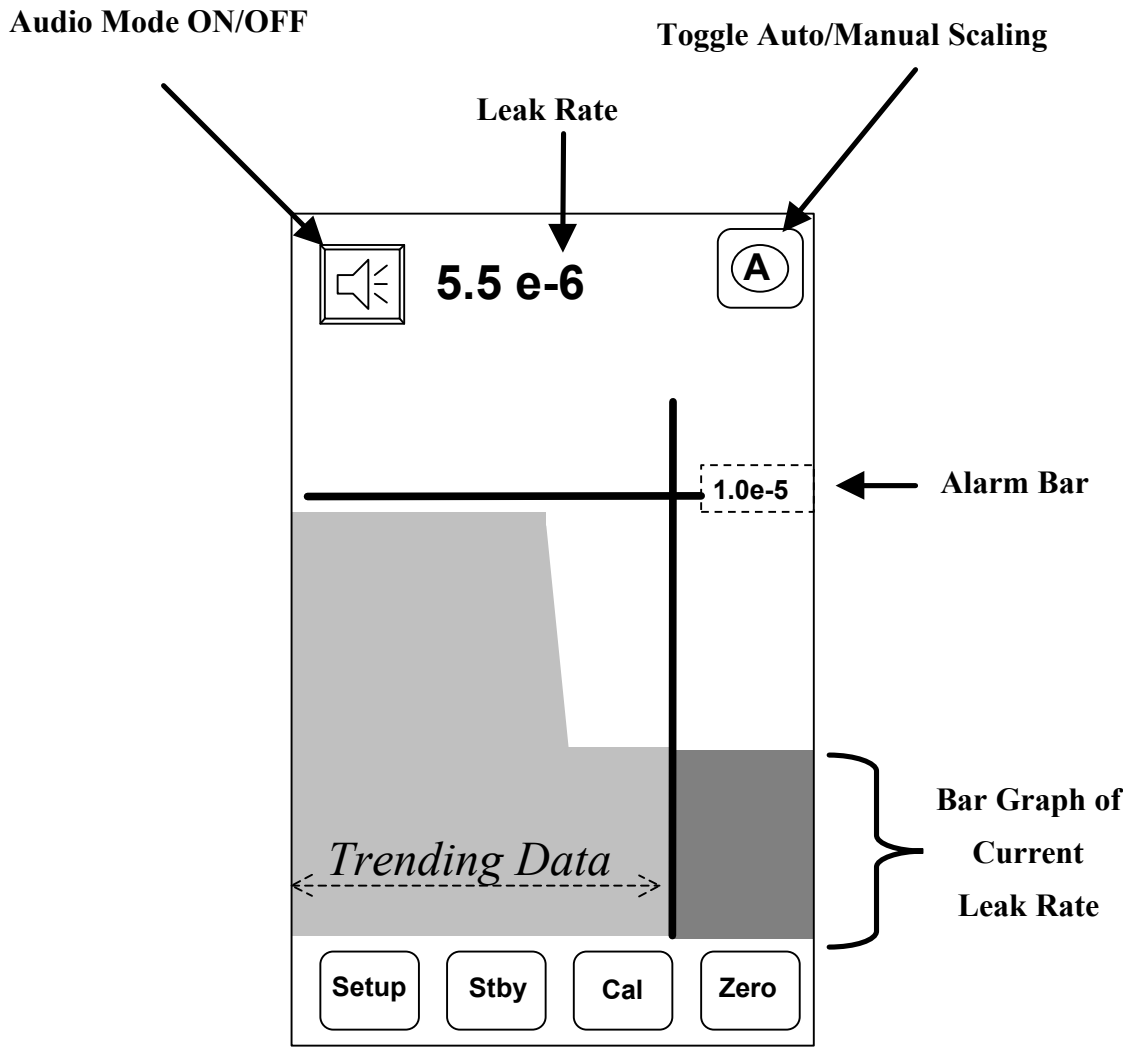

Figure 22: Standby Screen

Setup **Stby** **Cal** Shortcuts to the Setup, Standby, and Calibrate screens.

Zero Compensates for background Helium levels. Press this button only when readings are stable and excessive helium backgrounds are not present.

Calibrating the PICO Helium Leak Detector

In order to assure the PICO™ Helium Leak Detector is correctly adjusted to detect helium, a calibration should be performed on a periodic basis with an external Helium Leak Standard (HLS).

MSSA, Sniffer Model & Vacuum Sniffer Option Calibration

This simple process involves placing the sniffing probe of the leak detector at the inlet of the HLS and pressing a series of buttons to adjust the reading to match the HLS's stated specified leak rate (reference standard).

The following procedure should be performed in a location that has very low background helium in the atmosphere (i.e. a location where helium gas is not normally vented to atmosphere). It is important to calibrate the PICO with a HLS that has at least **2 x 10^{-5} atm cm^3/s leak rate.**

Step 1: Calibrating the PICO – Sniffer Model & Option

In the LEAK TEST Screen, press the CAL button. You are now in the CALIBRATE routine of the instrument. At this point you will be guided through a series of steps to calibrate the PICO™ . These steps will take you through the following activities

Input leak rate value from HLS.

Measure background Helium levels.

Measure Helium leak rate from HLS and adjust calibration of PICO if necessary.

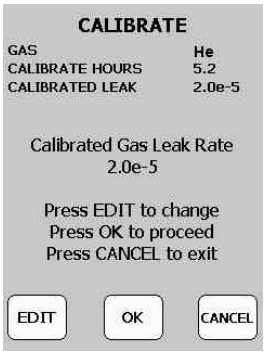

Figure 23: Calibrating the PICO, Sniffer Model & Option

Step 2: Setting the Helium Leak Standard (HLS Value)

Compare the "Calibrated Gas Leak Rate" with the leak rate indicated on the HLS. If identical. Press OK.

If the values are not identical, press EDIT to change the value on the display screen. Using the arrows, adjust the numerical values and press ACCEPT.

Please note this step will only have to be performed once the value will now be stored in memory.

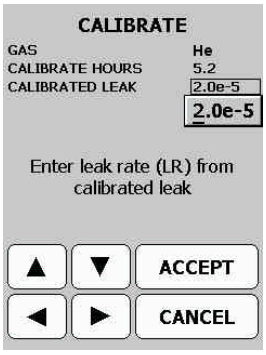

Figure 24: Setting the Helium Leak Standard (HLS Value)

Step 3: Collecting a Background Helium Sample

Once the "Calibrated Gas Leak Rate" is entered, press OK. Next, position the sniffing probe of the PICO away from HLS to collect a representative background reading of helium. Press OK when the reading is stable.

The display will now flash the message "Collecting Background Sample, Please Wait."

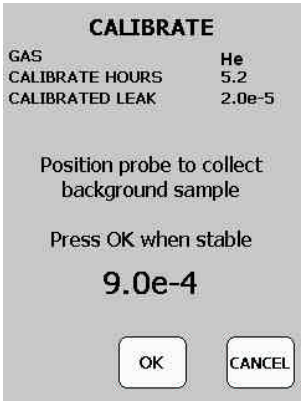

Figure 25: Collecting a Background Helium Sample

Step 4: Collecting a Sample from the HLS

Insert the sniffing probe of the PICO directly at the HLS to collect a representative HLS sample. Press OK when the reading is stable without removing probe from HLS.

The display will now flash the message "Collecting Calibrated Leak Sample, Please Wait."

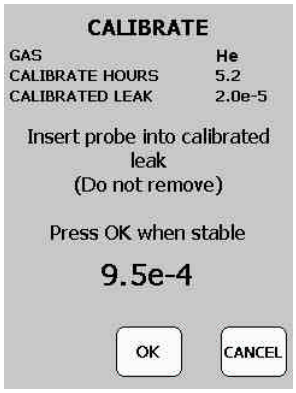

Figure 26: Collecting a Sample from the HLS

Step 5: Calibrate Bar

If the PICO is within calibration, the display will alert the user that no adjustment is necessary.

If calibration is required, you will see the following text on the display.

With the probe inserted in the HLS, adjust the calibrate bar until the rate reads the value indicated on the screen (2.3 e-5 in the example below) by using the left or right arrows. Assure the reading is stable and press OK when the values are equal.

Note: The indicated value on the screen will not equal the calibrated leak value. The background level determined in step 3 has been compensated for in this value making it higher.

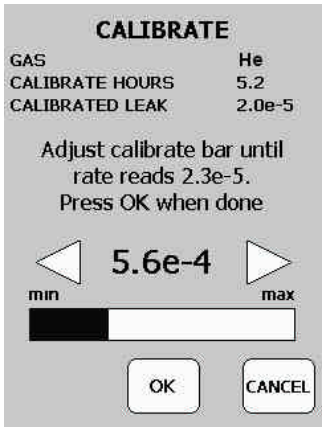

Figure 27: Calibrate Bar

Step 6: Verifying Calibration

Press OK and follow the instructions on the display to verify the calibration.

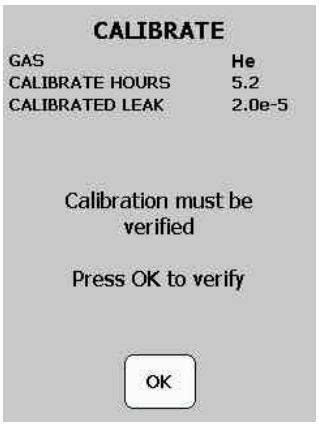

Figure 28: Verifying Calibration

These calibration steps will be repeated if the verified leak rate value does not match the leak rate value the user entered.

Appendix A: Vacuum Model Specifications - MSVA

Standard Product Specifications

Apply to all MSVA Helium Gas models unless otherwise noted. See Appendix B for specific model code descriptions.

Gas Library	Helium
Theory of Operation	Ion Trap Mass Spectrometer
Lowest Detectable Leak Rate (AVS 2.1, ISO 3550)	1 x 10^{-10} atm cc/s
Response Time (63% of steady state)	0.6 seconds (normal response setting)
Inlet Test Pressure Range:	1 - 500mTorr
Connection	Test Port: KF16 on PICO Calibration Port: KF16 on PICO; to connect a calibrated helium leak standard
Vacuum System	Integral turbomolecular and scroll pump
Pumping Speed at Inlet	0.4 liters/min
Maximum pump out volume on test port	100 cc in 5 minutes
User Interface	Removable display with 15 ft of interconnecting cable to base unit. Audible alarm and graphical trending
Zero Function	Allows user to subtract background helium levels
Cold Start to Ready Time	5 minutes
Leak Test Valve	Incorporated in leak test port to protect the leak detector from high-pressure conditions. Leak test valve is closed at all times other than leak test mode. This valve does not isolate the calibration port from the PICO sampling system at any time. Ready Light Condition — Test Valve Condition Flashing — Close Solid — Open
Ambient Temperature	+10 to +45 C
Power	110-240 VAC
Weight	8 Kg

Sniffer Option on MSVA- Differences

Apply to all MSVA Helium Gas Sniffer Option selections. See Appendix B for specific model code descriptions.

Lowest Detectable Leak Rate	1 x 10^{-7} atm cm^{-3}/s
Input Pressure	Atmospheric
Auxiliary Probe	Three (3) meter, or Six (6) meter

Appendix B: Vacuum Model Code Explanation

Model Code Description

The MKS model code identifies the configuration of your instrument. The current available model codes for the vacuum model leak detector are:

- **MSVAHE160000** Basic Vacuum PICO Model, KF16 Fitting
- **MSVAHE260000** Vacuum PICO Model with Sniffer Option, 3 meter probe, KF16 Fitting
- **MSVAHE360000** Vacuum PICO Model with Sniffer Option, 6 meter probe, KF16 Fitting
- **MSVAHE16D000** Basic Vacuum Pico Model with RS232 Output Option
- **MSVAHE26D000** Vacuum PICO Model with Sniffer and RS232 Output Options, 3m probe, KF16 Fitting
- **MSVAHE36D000** Vacuum PICO Model with Sniffer and RS232 Output Options, 6m probe, KF16 Fitting

The different vacuum model configurations are defined by the table below.

Please contact your local MKS representative or visit www.mksinst.com for the latest PICO™ product offerings.

Vacuum Model Code Table

Model Code

MSVA AA B C D E F G

Basic Model

Gas Measured

HE = Helium

Sniffer Option

1 = Standard Vacuum

2 = Combo Vacuum/Sniffer w/ 3m Probe

3 = Combo Vacuum/Sniffer w/ 6m Probe

Vacuum Fitting Interface

6 = KF16

Interface

0 = None

D = RS232 Output, 9-Pin D-Sub

Display

0 = Standard w/ 16’ Cable

Future Option (1)

0 = None

Future Option (2)

0 = None

Appendix C: Sniffer Model Specifications – MSSA

Standard Product Specifications

Apply to all MSSA Helium Gas models unless otherwise noted. See Appendix D for specific model code descriptions.

Gas Library	Helium
Theory of Operation	Mass Spectrometry
Lowest Detectable Leak Rate	1×10^{-7} atm cm^3/s
Input Pressure	Atmospheric
Probe	Three (3) meter
Vacuum System	Integral turbo-molecular and scroll pump
User Interface	Audible alarm and graphical trending
Zero Function	Allows user to subtract background gases
Ambient Temperature	+10 to +45 deg C
Power	110-240 VAC
Weight	8 Kg

Appendix D: Sniffer Model Code Explanation

Model Code Description

The MKS model code identifies the configuration of your instrument. The currently available model codes for the dedicated sniffing leak detectors are:

- **MSSAHE3S0000** Sniffer PICO Model, 3 meter probe
- **MSSAHE3SD000** Sniffer PICO Model, 3 meter probe, RS232 Output Option
- **MSSAHE3S00B1** Sniffer PICO Model, 3 meter probe, Battery Option
- **MSSAHE3SD0B1** Sniffer PICO Model, 3 meter probe, RS232 Output and Battery Options
- **MSSAHE5S0000** Sniffer PICO Model, 5 meter probe
- **MSSAHE5SD000** Sniffer PICO Model, 5 meter probe, RS232 Output Option
- **MSSAHE5S00B1** Sniffer PICO Model, 5 meter probe, Battery Option
- **MSSAHE5SD0B1** Sniffer PICO Model, 5 meter probe, RS232 Output and Battery Options
- **MSSAHE6S0000** Sniffer PICO Model, 6 meter probe
- **MSSAHE6SD000** Sniffer PICO Model, 6 meter probe, RS232 Output Option
- **MSSAHE6S00B1** Sniffer PICO Model, 6 meter probe, Battery Option
- **MSSAHE6SD0B1** Sniffer PICO Model, 6 meter probe, RS232 Output and Battery Options

The different sniffer model configurations are defined by the table below.

Please contact your local MKS representative or visit www.mksinst.com for the latest PICO™ product offerings.

Sniffer Model Code Table

Model Code

MSSA AA BB C D EE

Basic Model

Gas Measured

HE = Helium

Probe Option

3S = Standard Probe, 3 m long

5S = Standard Probe, 5 m long

6S = Standard Probe, 6 m long

Interface

0 = None

D = RS232 Output, 9-Pin D-Sub

Future Option

0 = None

Battery Option

00 = None

B1 = Battery Option

Appendix E: Battery Option

Product Specifications

Applies to all PICO Helium Leak Detectors with the Battery Option installed**.**

Battery Life:	3 hrs
Battery Charge Time:	5.5 hours total time for two batteries, sequential charging
Battery Type:	Lithium Ion
Electrical Power Requirements : (Battery Charger)	90-250 VAC, 47-63 Hz, 65 watts maximum
Operating temperature: Max: (Battery Charger) Recommended:	0°C to 50°C 5°C to 40°C
Temperature Protection:	Over-heat control on battery and circuit; halts service if hot
Approvals (Battery Charger) :	UL/CSA/CE

Warning 

Please reference user manual for important safety and operational instructions. Note any additional safety information marked on the batteries or the charger.

Caution 

Do not block ventilation slots on the charger. Charge only approved battery packs. Keep away from moisture.

Note 

Batteries are shipped in a partially charged state (approximately 40%). It is recommended to charge one set of batteries to the full state prior to use.

Note 

The PICO Helium Leak Detector with Battery Option installed is delivered in the carrying case with the power connector disconnected for shipping purposes. Connect the power connector before attempting operation.

Instructions for setting up the PICO Leak Detector for battery operation in contained in Chapter 4 of this manual.

To Recharge Batteries Using Separate Battery Charger:

1. Plug the power supply into an outlet and insert plug end of the power cable into the DC power jack on the charger. See photo below.

Figure 29: Battery Charger

2. Insert two batteries into the charger.

3. The LED will illuminate to indicate the status of the battery as follows.

4. The charger will charge one battery at a time, with the total time required for both batteries being approximately 5.5 hours. If both batteries are loaded at once, the right battery will charge first, then the left battery. The following chart indicates the status during the charging process, as indicated by the LED under each charging bay.

LED	*STATUS*
OFF	No battery detected
Green Flashing	Fast Charger
Green Solid	Fully Charged
Yellow Flashing	Recalibrating
Yellow / Green alternating	Recalibrated
Yellow Solid	Standby
Red Flashing	Error

Table 7: Battery LED Status

To Recalibrate the Lithium Ion Batteries:

1) Periodically, the battery indicator will need to be recalibrated to accurately reflect the actual charge state of the battery. To do this, place the battery in the left position of the charger, and press the calibrate button. This process will cycle the battery through multiple charge and discharge cycles, and will take 15 hours. The frequency that a battery will need to be recalibrated will depend on multiple factors, such as type of use and temperature, but should be between 3 and 6 months.

Appendix F: RS232 Output Option

Description:

This addendum contains information essential to the operation of the MKS PICO? Mass Spectrometer-Based Helium Leak Detector when using the RS232 Output Option. The RS232 output allows the user to record the detected leak rates into a PC, either immediately while the leak detector is operating or after the operation is complete and the data is downloaded from a log.

Specifications:

- EIA-232 Standards for Serial Communication have been followed for this system.
- The RS232 signal is opto-isolated to 3000 VDC min.

Setup and Operation:

- **Cabling Requirements**
  - The cable connecting the PICO unit to the computer recording the data must be a straight through conducting cable suitable for serial communication.
  - !! Do not use a Null Modem cable.
  - A maximum cable length of 50 feet is recommended per EIA-232 standards
    - ✍ Lengths up to150 feet can be used, but lower data transmission rates (Baud Rate) must be used.

The RS232 Cable is to be connected to the 9-pin D-Sub Connector labeled with RS232 on the PICO unit shown in the figure below. The other end of the connector should be attached to the appropriate COM port of the computer receiving the data.

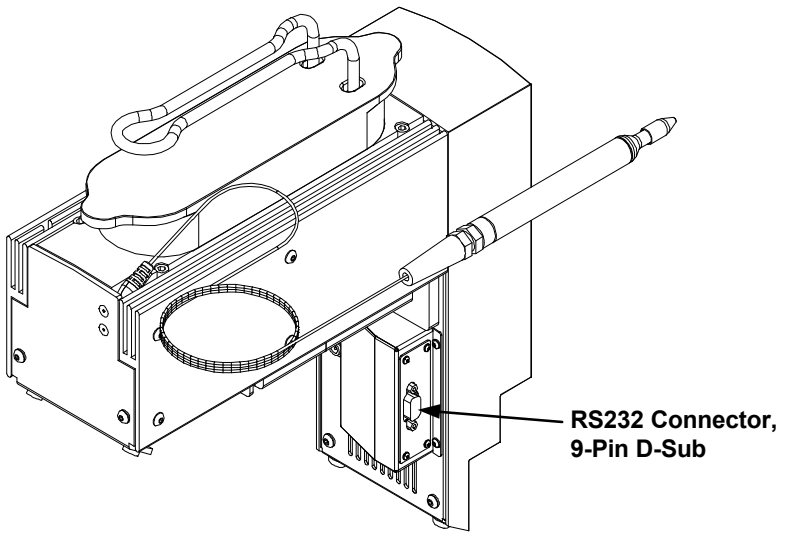

Figure 30: RS232 Output Port Location

- RS232 Signal Connections:

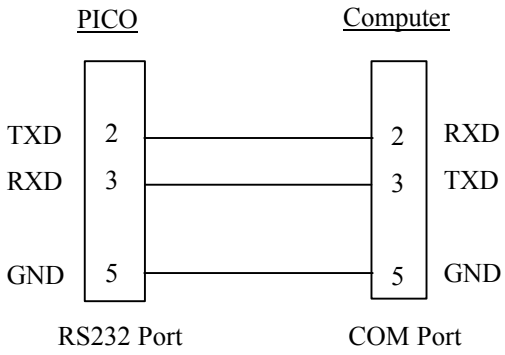

Figure 31: RS232 D-Sub Pin Connections

? Logging Setup Screen

The detector has a screen that allows the user to select all the configuration options, and to output the logged data, if any. The screen is similar to that of the Setup screen, with the selections on the left and the options to the right. This screen is called from the Setup screen, using a new "Logging" button that is inserted between the Return and Cancel buttons as shown below. The "Logging" button is only active when not editing an entry on the Setup screen.

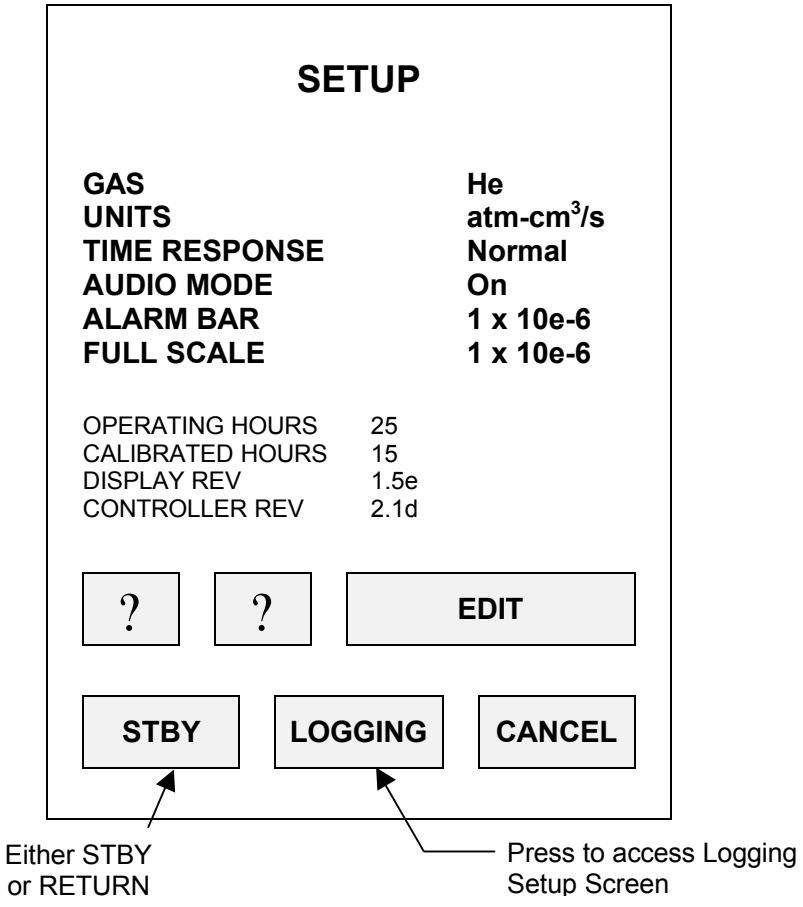

Figure 32: Set-up Screen w/ Logging Option

When the logging button is selected in the setup screen the following Logging Setup screen appears.

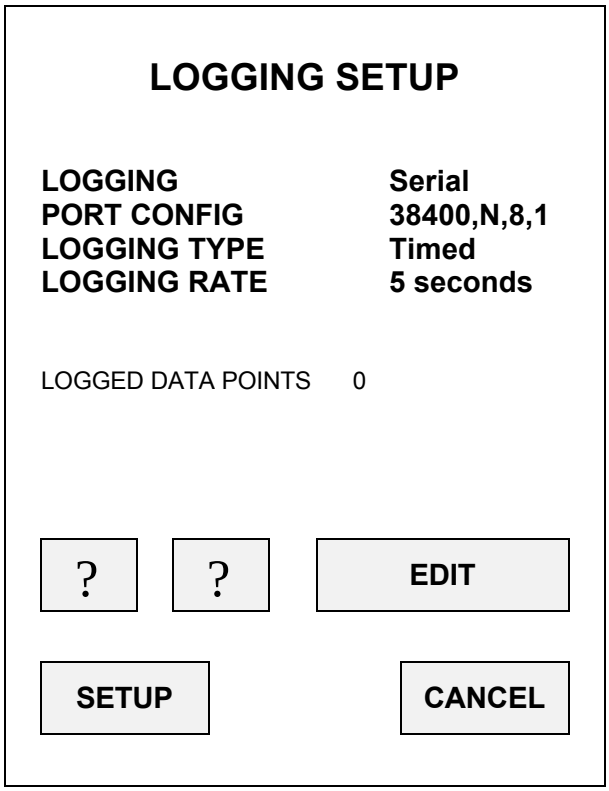

Figure 33: Logging Setup Screen

The editing of the data is performed the same way as on the Setup screen:

- ?? buttons to select the entry
- starting an edit of the entry using the 'Edit' button
  - ?? buttons used to enter data (appear below ?? buttons when needed), or
  - ?? arrow buttons to select menu entry
- saving the entry using the 'Save' button (Edit button changes to Save when editing)
- cancel an edit using the 'Cancel' button.

? Configuration Settings

The detector's configuration determines how and when the data will be output:

Item	Options
Logging:	**Off/Serial/File**
Port Config:	**1200-38400,E/O/N, 7/8**
Logging Type:	**Timed/Alarm**
Logging Rate:	**1- 60 seconds, 1- 99 minutes**

Table 8: RS232 Configuration Setting Options

- **Logging:**
  - ✍ **Off** : No serial output is transmitted or recorded.
  - ✍ **Serial:** The leak detector will output the data immediately to the serial port. As long as **Serial** is selected, the detector will output the data when in Test or Calibration modes. Each time the Test or Calibration mode is entered, the header is output.
  - ✍ **File**: The leak detector will log the data for later retrieval. As long as **File** is selected, the detector will log the data when in Test or Calibration modes. Each time the Test or Calibration mode is entered, the header is logged.

    Note: ***In file mode, the data is stored in temporary memory. Any cycling of power or a selection to clear the data erases the data in the memory.***

- **Port Config:**

  The serial port can be configured for a variety of baud rates, parity bits and data size. These port configuration settings must match between the PICO unit and the computer or the output data will be lost in transit. *No hardware handshaking is utilized.*

  - ✍ Baud rate options: 1200, 2400, 4800, 9600, 19200, and 38400
  - ✍ Parity bit options: Even (E), Odd (O), or None (N)
  - ✍ Data Bits: 7 or 8

- **Logging Type:**
  - ✍ **Timed**: the peak value since the last output is output/logged at fixed intervals selected by the user via the logging rate parameter
  - ✍ **Alarm**: the peak value is output/logged when it has exceeded the configured Alarm Level.

- **Logging Rate:**
  - ✍ The rate can be configured to be 1 to 60 seconds (in 1 second increments) or 1 to 99 minutes (in 1 minute increments). Setting the logging rate to a value > 59 with the seconds selected will default to 1 min rate (e.g. setting the value to 90 sec will default to 1 min on the display once the change is saved). Minute must be selected to obtain logging rates > 1 minute.

Data Output Format

The data format of the output stream contains three pieces (header, leak rate data, and errors), defined as follows:

? The header is displayed each time the Test or Calibrate mode is entered, or the data is output from a log:

MKS PICO Leak Detector
Mode: Sniffer
Gas Measured: He
Units: xxxxx
Last calibration: xx hours
Alarm Threshold: xxxxx
Logging Type: Timed/Alarm
Logging Rate: 1-60 seconds, 1-10 minutes
Saved: Yes/No

- "Yes" in the Saved line means that the File mode was used.
- "No" in the Saved line indicates that Serial mode was used.

? After output of the header data, the leak rate is output based on the configuration (time, alarm, or logged):

x.xx e – x [units] [(cal), (zero)]

- [units] value is whatever is configured in the Setup screen at the time the output is logged (i.e., 'atm cm3/s')

- [cal, zero] data indicates if the output was during the calibration mode '(cal)' or if zeroing was in force '(zero)'. During normal leak test mode, no indicator is appended to the end of the output.

? An error output/log is generated if an error is detected while in the Test/Calibrate modes, with the error message output/logged before the output/log is stopped.

Any changes to the configuration that affect the way the data is logged (Logging Type or Logging Rate) will result in a new header being inserted in the data output/log stream.

Downloading the Data

The data is output in ASCII-readable format.

? The data can easily be recorded on "Hyper-terminal" located on most standard PCs.
? Access Hyperterminal on most PCs that are running MS Windows by selecting the following menu string:

Start ? **Programs** ? **Accessories** ? **Communications** ? **Hyperterminal**

? Set the Hyperterminal settings to the appropriate COM port and Port Config selected on the PICO unit. These settings must match or else the data will not be downloaded correctly and the data lost.
? Hyperterminal defaults to a 500 line backscroll buffer before overwriting data.
- If planning to record more data points change the buffer setting:
  - ? select **Properties** (far right button in hyperterminal menu bar)
    - ? select the **Settings** tab
      - ? edit **Backscroll Buffer Lines** entry to desired value

? **Transferring data from Hyperterminal to MS Excel for viewing and graphing:**
(the steps below were conducted in Windows 2000, other operating system versions may require a different sequence of steps)

- Select **Edit** ? **Select All** from Hyperterminal once data has been recorded
- Select **Edit** ? **Copy** from Hyperterminal
- Open a Notepad or Wordpad text window from **Start** ? **Programs** ? **Accessories** from MS Windows.
- Select **Edit** ? **Paste** from the Notepad or Wordpad top menu. This converts the Hyperterminal data to a text format.
- Select **Edit** ? **Select All** from the Notepad or Wordpad top menu
- Select **Edit** ? **Copy** from the Notepad or Wordpad top menu
- Open MS Excel. Highlight first cell in column A and select **Edit** ? **Paste**
- Select column A. The entire column should be selected
- Select **Data** ? **Text to Columns** from top menu. A popup menu appears
  - Make sure **Delimited** is selected then select the **Next** button
  - In the next screen, check off **Space** as the only delimeter. This will separate the numbers for plotting, then select the **Next** button.
  - In next screen just select the **Finish** button.

The data is now in an Excel format that can be easily plotted. The header information has also been delimited into separate cells because the entire data set was selected prior to the "Text to Columns" step. Only the desired data can be selected for delimiting from "Text to Columns", but if multiple headers and sets of data are present, this process will have to be done multiple times by selecting each data set separately.

Logging – "Filed" Data

Logged data collected while in "File" mode is output in the same format as the immediate type of data and is requested by selecting the "Send Data" button on the Logging Setup screen. The "Send Data" and "Clear" buttons shown below only appear if data is stored. If File mode is selected and no data points have been stored yet, the buttons are not visible.

After storing data points, selecting the "Send Data" button causes the entire contents of the logged data to be output at one time.

Selecting the "Clear" button on this screen will clear the entire contents of the logged data.

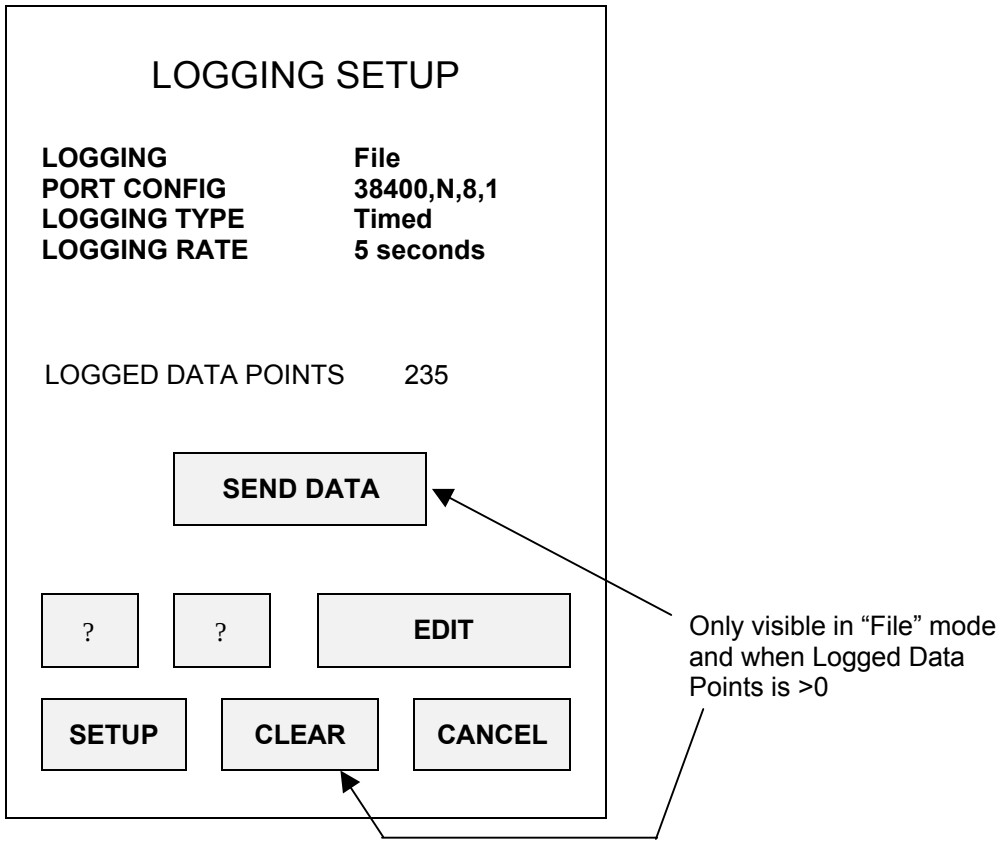

Figure 34: Logged Data View

Note: ***In file mode, the data is stored in temporary memory. Any cycling of power or a selection to clear the data erases the data in the memory.***

Logged Data Capacity:

The logged data stored while in "File" mode uses a first-in-first-out (FIFO) operation, where the oldest reading is lost if the buffer is full and new data needs to be logged.

The following table indicates the amount of recording/logging time and consumed memory for different interval settings and length:

Interval	Log Time	Memory
1 sec	1 hour	90 Kbytes
5 sec	1 hour	18 Kbytes

Table 9: Logging Time/Memory Comparison

With a minimum of 16 Mbyte of RAM within the display unit, at 1 sec log intervals approximately

- 177 hours of log time
- 640,000 lines of data

Appendix G: Trouble Shooting Guide

This addendum contains information for trouble shooting the MKS PICO? Mass Spectrometer-Based Helium Leak Detector. This guide should help solve many of the problems the user is likely to encounter.

Model Codes: S = Sniffer SB = Sniffer with Battery Option
V = Vacuum VS = Vacuum with Sniffer Option
A = All models D = RS232 Output Option

#	Model	Problem	Potential Cause	Action
1	**A**	**Unit takes more than 5 minutes to get into leak check mode** o "Warming Up" on display means: a) Turbo is not up to speed or b) Internal high vacuum is not low enough to turn on the ion trap	1) Unit has been in storage a long time 2) Excess moisture condensed in unit during storage 3) Defective Unit	1) & 2) Let the unit run for several hours or overnight to clean out pumping system 3) Defective Unit – Return to factory for service if running the unit overnight does not help.
2	**A**	**"Pump System Timeout" displayed after 12 minutes**	1) Unit has been in storage a long time or excess moisture has condensed in unit during storage	1) Press "Reset" o If "Warming Up" reappears, see Problem # 1 above o If "Leak Check" button appears, system is ready to use.
3	**A**	**"Vacuum Subsystem Fault" displayed**	1) Sudden loss of vacuum at any time 2) Calibration port that is leaking 3) Vacuum leak in the PICO pumping system 4) Operation in a magnetic field of >50 gauss	1) Correct cause of vacuum loss and retry testing 2) Install calibrated leak or Cap and retry testing 3) Return unit to MKS Service Center 4) Remove from magnetic field.

#	Model	Problem	Potential Cause	Action
4	**V**	**"Test System Pressure High – Test Valve Closed" system fault displayed after pressing Leak Check button**	1) For typical connection setup with a bellows and valve, during Standby (where Leak Check button is visible) the pressure at the test port may rise to >500 mTorr over time in the trapped volume between vacuum system valve & the PICO test valve. 2) Test port is at a pressure greater than 500 mTorr	1) Shut unit off, go through the startup sequence, and go into leak mode immediately after 5 min warm-up (prevents pressure rise in trapped volume 2) Pump test volume/bellows down to < 500 mTorr with another pump
5	**V**	**"Test System Pressure High – Test Valve Closed" system fault displayed while in Leak Check mode after suddenly venting test port to atmosphere**	1) User error or vacuum connection failure on customer's test system	1) Press RESET. System will do one of two things. a) System goes into Standby & can be placed back into leak test mode once vacuum integrity of system is restored b) Vacuum system shuts down & then restarts unit – says "Warming Up", then "Vacuum Subsystem Fault" displayed. Once vacuum integrity of system is verified. Shut PICO off & restart. If "Vacuum Subsystem Fault" persists after several tries, pump system may have failed – Return unit to MKS Service Center.
6	**V, VS**	**"Cal Port Open - Cap or Install Leak" message** o Occurs approx. 30 seconds after selecting Start Vacuum or Start Sniffer in initial screen	1) Blank off cap or calibrated leak standard is missing from Cal Port causing the scroll pump to be vented to atmosphere	1) Install blank or calibrated leak on calibration port of vacuum manifold and restart.

#	Model	Problem	Potential Cause	Action
7	**VS**	**"Foreline Pressure High" system fault displayed after pressing Leak Check button**	1) Test port is open while in Sniffer mode – Auxiliary Probe not attached.	1) Press reset & attach Auxiliary Probe to test port of PICO
8	**S, VS**	**"Low Flow Alarm" displayed on Screen** o Sniffer flow is blocked or restricted	1) Probe tip filter clogged 2) Probe cable damaged	1) Replace filter – see instructions after this table 2) Sniffer unit – Return to MKS Service center for probe cable replacement Sniffer Option on Vacuum unit – Replace auxiliary probe with new one.
9	**A**	**"Filament Failure Switching to Reserve"** o Unit has a pair of filaments on the filament header. When one fails, the system switches over to the other filament. o The backup filament can last as long as the primary filament, so the unit can be run for an extended period of time with the backup	1) Primary filament failed, backup in use	1) Contact MKS Service center for options, including: o Schedule to send the unit to a MKS Service Center for filament replacement o Schedule an MKS Service tech to replace filaments on sight o Obtain instructions and parts for replacement by the user – only recommended for experienced users
10	**SB**	**No power on Battery Unit**	1) Power cord not connected (Unit shipped with cord disconnected) 2) One of the two power switches, or both are not turned on 3) Batteries are dead. Switch is on but light on back of battery unit is off. o ON = Power o Blinking = 15 mins left o OFF = No Power	1) Connect power cord to power connector on PICO 2) Switch both power switches on. PICO main switch and battery switch near probe clip. 3) Each battery has a charge indicator on it, remove battery and check charge. Recharge if drained.

#	Model	Problem	Potential Cause	Action
11	**V**	**Sensitivity of PICO is lower than specification**	1) PICO is attached to a system where the test port pressure is lower than 1 mTorr	1) See Chapter 3, Figure 7 for correct mounting of the PICO to a high vacuum system
12	**D**	**RS232 output data is not being received by the computer**	1) Serial communication parameters are incorrect 2) Serial Cable is not connected 3) Data logging mode set to FILE	1) See Appendix F for correct communication parameters 2) Connect cable 3) In Logging Setup screen o Set Logging to Serial for continuous output and return to leak test mode OR o If the unit was set up in FILE mode, select the SEND DATA button to send the data to the computer See Appendix F for details
13	**D**	**FILED output data has disappeared from the unit**	1) Power was cycled on/off o Data is stored in active memory, power cycling will erase filed data 2) Data already sent to computer - sent data is removed from memory	1) Download data to a computer prior to cycling power 2) Check computer
14	**V**	**When calibrating, no change between indications when valve on calibrated leak is opened or closed**	1) Calibrated leak is attached to test port rather than cal port o test valve is closed during calibration to avoid introduction of variables so calibrated leak is blocked if mounted to test port	1) Move calibrated leak to calibration port.

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