inTEST Thermal Solutions
an inTEST Company

41 Hampden Road, Mansfield, MA 02048 U.S.A.
Tel: +1.781.688.2300
www.inTESTthermal.com

Part Number: LM04070

ATS-700 Series, ATS-800 Series
THERMOSTREAM® Temperature Forcing System

Interface and Applications Manual

Revision E
November 2016

Table of Contents

Preface

Notice

Patents have been granted and/or patent applications are pending or are in process of preparation on all our developments.

The material in this manual is for informational purposes and is subject to change without notice.

Temptronic Corporation assumes no responsibility for any errors which may appear in this manual.

To Our Customers

This Manual

The purpose of this manual is to help obtain the greatest return on your investment. inTEST Thermal Solutions suggests that operators, supervisors, and technicians responsible for operating and maintaining this equipment become familiar with the contents of these manuals prior to using the equipment.

This manual instructs how to setup, operate and perform routine maintenance for the ATS-700 & -800 Series *THERMOSTREAM* Systems.

Other Manuals in the Set

Following is the complete list of manuals which make up this information set.

Manual Name	Part Number
ATS-700 & -800 Interface and Applications Manual	LM04070
ATS-700 & -800 Service Manual	LM04080

inTEST Thermal Solutions Support

Introduction

inTEST Thermal Solutions is committed to assisting end users and technicians to maintain operational systems which are highly reliable. inTEST Thermal Solutions offers the following support services.

Customer Training

Formal technical training courses are available. The training courses cover the theory of operation and the maintenance procedures for the System. For further information, contact the inTEST Thermal Solutions Service Department.

Repair Service

Temptronic maintains a fully equipped repair center at the factory plant for warranty and non-warranty repairs. For further information on module and circuit board repairs, our exchange program, and the availability of spare parts, contact the inTEST Thermal Solutions Service Department.

Before returning any module or circuit board for repair, contact the inTEST Thermal Solutions Service Department to obtain a return authorization (RA) number.

Spare Parts

Electrical and mechanical replaceable parts for the System can be obtained through your local inTEST Thermal Solutions representative, or directly from the inTEST Thermal Solutions Service Department. When ordering, be sure to specify the:

- Quantity
- Temptronic part number
- Description
- Reference designation (if any)
- Complete model number and serial number of your system

For your convenience, Spare Parts Kits are available for different levels of service activity.

Technical Support

Contact the inTEST Thermal Solutions Service Department by one of the following means:

inTEST Thermal Solutions Technical Support	
1.800.558.5080	Toll Free Telephone (service calls only)
service@inTESTthermal.com	e-Mail Address
781.688.2302	Service FAX line
781.688.2300	Main Telephone line

ATTENTION

1. Please note that the 1.800 toll free telephone number is dedicated to Service Department calls only. It is not possible to dial this number and to transfer to other departments within inTEST Thermal Solutions.

2. The main telephone number, 781.688.2300, should be used for non-service related calls.

Before You Call

Introduction

You can help us support your machine in timely fashion by having on hand specific information when calling in:

- Software Version
- System Model Number

System Model Number

A modular system design allows the customer to select options or features as desired for a given installation or application.

The System Model Number Designation, printed on the nameplate, reflects the configuration at time of shipment as described below:

System Configuration

ATS - 710 - M - 2

Feature	Code	Description
800 Series US Domestic Systems (60 Hz only) 700 Series International Voltage Configurations (50/60 Hz)		
Arm Assembly	M H T	Mechanical Arm Extended Height Mechanical Arm Turret
Power Configuration	2 3 4 5 6 7 8 9	230-250 VAC, 60 Hz, 30 amp 235-250 VAC, 50 Hz, 30 amp 200-214 VAC, 60 Hz, 30 amp 200-214 VAC, 50 Hz, 30 amp 215-224 VAC, 60 Hz, 30 amp 215-224 VAC, 50 Hz, 30 amp 225-234 VAC, 60 Hz, 30 amp 225-234 VAC, 50 Hz, 30 amp

1

Safety

Chapter Overview

Introduction

This chapter covers all the safety Warnings and Cautions for the *ATS-700 & -800 Series THERMOSTREAM* Systems.

In this Chapter

This Chapter is divided into the following Sections:

Section A: Safety Precautions, Warnings, Cautions

Warnings

WARNING

WARNING: Refer to Accompanying Documentation

Electrical Hazard

WARNING: High Voltage, Electrical Shock Hazard

Hot Surface

WARNING: Hot Surface

Cold Surface

WARNING: Cold Surface

WARNING 1: The locations of potentially dangerous voltages and other hazards such as hot surfaces or cold surfaces or compressed air/gases/vapors at high pressures are identified and labeled on the equipment. Be careful to observe these warnings when installing, operating, maintaining, or servicing the equipment. Observe all warnings given in this manual. Only use the equipment for the intended usages specified by the manufacturer.

WARNING 2: The troubleshooting instructions contained in this manual can involve a possible contact with electrical power at high voltages, compressed air at high pressures, and refrigerants at high or vacuum pressures. These hazards can be injurious or dangerous to life. Do not perform these instructions unless you qualify to do them.

WARNING 3: To avoid shock hazard, the equipment must be grounded with an adequate earth ground per local electrical codes.

WARNING 4: When connecting thermocouple sensors to the Device Under Test (DUT), electrically isolate the sensors to protect operators from contact with any hazardous voltages which could be present at the DUT site.

WARNING 5: Parts inside the thermal head operate at extremely hot and cold temperatures and are dangerous to touch. Do not perform any maintenance inside the thermal head until the system is turned off. Wait until the head parts have reached a safe and stable temperature near ambient.

WARNING 6: Keep your fingers out of the space between the thermal cap on the head and the DUT site during the up/down motion of the system's thermal head.

WARNING 7: Per SEMI S2-93A, energized electrical work (“Hot Work”) is specified by Type as follows:

TYPE	DESCRIPTION (per SEMI S2-93A)	EXPOSURE THRESHOLD
1	Fully de-energized (electrically “cold.”)	n.a.
2	Live circuits, covered or insulated. Work performed at remote location to preclude accidental shock.	n.a.
3	Live circuits exposed. Accidental contact is possible.	<= 30v RMS, 42.2v peak, 240 volt-amps, and 20 Joules
4	Live circuits exposed. Accidental contact is possible.	> 30v RMS, 42.2v peak, 240 volt-amps, and 20 Joules
5	Energized. Measurements & adjustments require physical entry, or equipment configuration does not allow use of clamp-on probes.	n.a.

WARNING 8: Where equipment must be fully de-energized (electrically “cold”) to allow safe entry into the system, the following Lockout/Tagout procedure is required per OSHA 29 CFR 1910: a) For devices with a power cord which “unplugs” from a service receptacle, the end user must supply and tag a Plug lockout shell which completely encloses the plug and prevents accidental reconnection; b) for devices hardwired to the electrical supply, the end user must install and tag a power disconnect switch with a lock out position, or install and tag a circuit breaker with a lock out position, to prevent accidental reconnection.

WARNING 9: To de-energize the system for safe replacement of a module, turn off the ac power (cease operations and power down), then turn off the system’s air pressure supply, then bleed all air from the system by turning on ac power just long enough to exhaust all air from the system. Now disconnect both the main power supply cord and disconnect the air supply line from air supply port fitting on the rear frame module. The only stored energy remaining in the system will then be that within some electrical capacitors. One large capacitor is near the system’s air-chiller compressor. Other large capacitors are in the system’s electrical power supplies.

WARNING 10: If service of the Air Chiller Module is required, only a licensed (and/or EPA Certified) refrigeration service person, authorized by the Temptronic Corporation, is qualified to perform any charging or handling of the refrigerants in the system.

WARNING 11: Under no circumstances (leak testing or any other purpose) is the Air Chiller Module to be charged with any gas at a pressure above 150 psig (10.34 bar).

WARNING 12: The Air Chiller Module acts as a counterbalance for the Thermal Head Assembly. Before removing the Air Chiller Module, make sure the horizontal arm is down on the vertical C-arm at its lower limit, and the thermal head is in next to the horizontal arm and stowed toward the rear of the machine. Use appropriate weight lifting equipment when removing/servicing the Air Chiller module.

WARNING 13: Two persons are required when removing (or installing) the thermal head assembly at the end of the horizontal arm. One person must lift the thermal head assembly by the head’s front handles, using both hands, while the other person loosens (or tightens) the pivot lock.

WARNING 14: To prevent high-pressure ejection of condensate (which may or may not contain injurious substances) when draining moisture from the air filter elements, first turn off the system's air pressure supply, second bleed all air from the system by turning on ac power to the system just long enough to exhaust air in the system, third disconnect the supply line from the air supply port fitting located on the rear panel.

WARNING 15: When cleaning condenser air inlet fins, (access fins by removing front panel) use soft brush and/or vacuum cleaner, taking care not to bend inlet fins; as fins have sharp edges, to prevent getting cut, wear protective gloves and/or do not touch inlet fins directly with fingers.

WARNING 16: Only use the coolants (heat transfer fluids) and refrigerants specified by the manufacturer: they are carefully engineered to be safe for operating personnel, to be friendly to the environment, to operate efficiently, and to not harm the equipment. Do not substitute unauthorized coolants and refrigerants, nor mix (add) in unauthorized coolants or refrigerants: doing so can cause warranties to be voided. Wear protective safety eye glasses, gloves, and apron when filling coolants and refrigerants. Temptronic assumes no liability for damages caused by use of unauthorized coolants and refrigerants.

Cautions

CAUTION

CAUTION: Refer to Accompanying Documentation

Electrical Hazard

CAUTION: High Voltage, Electrical Shock Hazard

Hot Surface

CAUTION: Hot Surface

Cold Surface

CAUTION: Cold Surface

CAUTION 1: Observe the precautions given on the equipment and within this manual to prevent damage to the equipment. Only use the equipment for the intended usages specified by the manufacturer.

CAUTION 2: Unauthorized personnel should not remove from the equipment those panels which are provided for protection and/or cooling and/or require a tool to remove.

CAUTION 3: Use proper handling and packaging procedures for static-sensitive circuit boards. Assume that all circuit boards are the static-sensitive type.

CAUTION 4: Before connecting the equipment to its electrical source, check that the ~ (ac) voltage and frequency to be supplied to the system are correct for those listed on the system's data plate (located on the rear panel of the equipment).

CAUTION 5: Disconnect the system's power cord from its service supply before checking or replacing any back-up batteries.

CAUTION 6: Be very careful to avoid damaging the two thermocouples which go from the Head thermal cutout board into the main air stream through various connector/supports. These thermocouples are very delicate. Do not cut, twist, or bend them as internal connections can be broken.

CAUTION 7: The weight of the Air Chiller Module is about 175 pounds (79.5 kg), and counterbalances (is used to stabilize) the system's frame when the thermal head is extended on the horizontal arm. If removing the Air Chiller module: a) be careful that the system remains stable (upright) after the module is removed, b) use appropriate weight lifting equipment when removing/servicing the Air Chiller module.

CAUTION 8: When removing the flow control board, be extremely careful to avoid flexing the board when disconnecting the inlet and outlet air hoses. Even a slight flexing of the board can damage delicate components and/or wiring on the board.

CAUTION 9: When making the system air connection to the system, hold the AIR INPUT fitting with a second wrench while tightening the barb fitting to prevent the AIR INPUT fitting from rotating in the panel.

CAUTION 10: Use suitable Clean Dry Air (CDA) compressed air supply for the system: a) to prevent premature fouling of the filters/regulator assemblies provided with the system, b) to prevent ice forming from within the cooling module and possibly reducing or obstructing output air flow. Improper air supply quality can cause damage to system internal operating components.

CAUTION 11: Properly use and maintain the provided filters/regulator assemblies. Doing so prevents moisture and/or compressor oils from being introduced into system operating components. If left unchecked, moisture and/or compressor oil can cause damages to the system which are not covered under warranty.

CAUTION 12: To loosen the linear actuator assembly (approximately 3 feet long), first elevate the system high enough to allow the actuator to drop down clear (use a fork lift truck). Then loosen the actuator from the rear of the system. Do not position yourself beneath (it is not necessary to be under) the elevated system.

CAUTION 13: If using a 300° C system, verify that all accessories (e.g. thermal cap, FlexExtender™ hoses, etc. and all test setup components) are properly rated for these temperatures.

Section B: CONSIGNES DE SÉCURITÉ POUR LE PERSONNEL EXPLOITANT

AVERTISSEMENT

WARNING

AVERTISSEMENT: Attention

Electrical Hazard

AVERTISSEMENT: Haute tension

Hot Surface

AVERTISSEMENT: Surface chaude

Cold Surface

AVERTISSEMENT: Surface froide

AVERTISSEMENT 1: Des tensions potentiellement dangereuses ainsi que d'autres risques, tels que la présence de surfaces chaudes ou froides ou d'air comprimé/gaz/vapeurs sous forte pression existent à certains endroits du système. Ceux-ci sont identifiés et signalés sur le matériel. Observer soigneusement ces avertissements durant l'installation, l'exploitation, la maintenance et le dépannage du matériel. Respecter également tous les avertissements énoncés dans ce manuel. Utiliser le matériel uniquement aux fins spécifiées par le fabricant.

AVERTISSEMENT 2: Les instructions de dépannage contenues dans ce manuel peuvent exposer le personnel à des tensions élevées, à de l'air comprimé sous forte pression et à des réfrigérants sous forte pression ou pression négative. Ces dangers peuvent entraîner des blessures graves, voire mortelles. Ne pas exécuter ces instructions si l'on ne dispose pas des qualifications nécessaires.

AVERTISSEMENT 3: Pour éviter tout risque de choc électrique, le matériel doit être mis à la terre en utilisant une prise de terre adéquate, conformément aux codes électriques en vigueur.

AVERTISSEMENT 4: Lors du raccordement des capteurs de thermocouples à l'appareil à tester (DUT), isoler électriquement les capteurs de manière à protéger les opérateurs de toute tension dangereuse pouvant exister au niveau du DUT.

AVERTISSEMENT 5: Les pièces à l'intérieur de la tête thermique fonctionnant à des températures très élevées ou très basses, tout contact avec ces pièces est dangereux. N'effectuer aucune maintenance à l'intérieur de la tête thermique tant que le système n'est pas arrêté. Attendre que la température des pièces de la tête se soit stabilisée aux environs de la température ambiante.

AVERTISSEMENT 6: Pendant la montée ou la descente de la tête thermique du système, ne pas mettre les doigts dans l'espace compris entre le capuchon thermique de la tête et l'appareil à tester.

AVERTISSEMENT 7: Conformément au SEMI S2-93A, les installations électriques sous tension sont spécifiées par type comme suit:

TYPE	DESCRIPTION (per SEMI S2-93A)	EXPOSURE THRESHOLD
1	Hors tension	s.o.
2	Circuits sous tension, protégés ou isolés. Exécution des travaux à distance afin d'éviter tout choc électrique.	s.o.
3	Circuits sous tension exposés. Risque de contact accidentel	<= 30 V efficaces, 42,2 V crête, 240 VA, et 20 J
4	Circuits sous tension exposés. Risque de contact accidentel.	>30 V efficaces, 42,2 V crête, 240 VA, et 20 J
5	Sous tension. Les mesures et les réglages exigent un accès physique aux circuits ou l'agencement de l'équipement ne permet pas l'utilisation de sondes à pince.	s.o.

AVERTISSEMENT 8: Lorsqu'on doit mettre l'équipement hors tension pour pouvoir accéder sans danger aux circuits, l'OSHA 29 CFR 1910 prescrit la procédure de verrouillage et d'étiquetage suivante : a) Dans le cas des appareils comportant un cordon d'alimentation que l'on débranche d'une prise d'alimentation, l'utilisateur final doit fournir et étiqueter un boîtier verrouillable qui enveloppe complètement la prise et empêche tout rebranchement accidentel ; b) Dans le cas des appareils reliés par cordon à l'alimentation électrique, l'utilisateur final doit poser et étiqueter soit un sectionneur à position de verrouillage, soit un disjoncteur à position de verrouillage, afin d'empêcher tout rebranchement accidentel.

AVERTISSEMENT 9: Pour désactiver le système de manière à remplacer un module sans risques, couper l'alimentation alternative (arrêt du fonctionnement et mise hors tension), puis couper l'alimentation pneumatique et purger le système en rétablissant l'alimentation alternative juste le temps nécessaire pour évacuer tout l'air présent. Débrancher alors le cordon d'alimentation principal et déconnecter la conduite d'alimentation pneumatique du raccord d'alimentation pneumatique situé sur le module arrière du châssis. La seule énergie alors présente dans le système est celle emmagasinée dans des condensateurs électriques. Un gros condensateur est situé près du compresseur du refroidisseur d'air du système. D'autres gros condensateurs sont intégrés aux alimentations électriques du système.

AVERTISSEMENT 10: Si l'on doit intervenir sur le module du refroidisseur d'air, seul un dépanneur en réfrigération breveté (et/ou certifié par l'EPA) agréé par Temptronic Corporation est qualifié pour manipuler les réfrigérants et recharger le système.

AVERTISSEMENT 11: En aucun cas (essai d'étanchéité ou toute autre situation) on ne doit charger le module du refroidisseur d'air avec un gaz à une pression supérieure à 10,34 bars.

AVERTISSEMENT 12: Le module de refroidissement d'air sert de contrepoids à la tête thermique. Avant de déposer ce module, s'assurer que le bras horizontal est abaissé au maximum sur le bras vertical en « C » et que la tête thermique est à proximité du bras horizontal et repoussée vers l'arrière de la machine. Utiliser un matériel de levage adéquat pour la dépose et l'entretien du module de refroidissement d'air.

AVERTISSEMENT 13: Deux personnes sont requises pour déposer (ou installer) la tête thermique à l'extrémité du bras horizontal. Une personne soulève la tête thermique en saisissant des deux mains les poignées situées à l'avant de la tête pendant que l'autre personne serre (ou desserre) le dispositif de blocage du pivot.

AVERTISSEMENT 14: Pour éviter une éjection violente du condensat (qui peut ou non contenir des substances nocives) lorsque l'on évacue l'eau accumulée dans les éléments filtrants du filtre à air, procéder comme suit : 1) couper l'alimentation pneumatique du système ; 2) purger complètement le système en le mettant sous tension juste le temps nécessaire pour évacuer tout l'air présent ; 3) déconnecter la conduite d'alimentation pneumatique du raccord d'alimentation pneumatique situé sur le panneau arrière du châssis.

AVERTISSEMENT 15: Lors du nettoyage des ailettes d'admission d'air du condenseur (accessibles en déposant le panneau avant), utiliser une brosse douce et/ou un aspirateur en veillant à ne pas déformer ces ailettes ; les ailettes ayant des bords acérés, porter des gants protecteurs pour ne pas se couper et/ou ne pas toucher les ailettes directement avec les doigts.

AVERTISSEMENT 16: N'utiliser que les liquides de refroidissement (fluides caloporteurs) et les réfrigérants spécifiés par le fabricant : ils sont spécialement conçus pour la sécurité du personnel et la protection de l'environnement et pour offrir un bon rendement d'exploitation et ne pas endommager le matériel. Ne pas leur substituer des liquides de refroidissement ou réfrigérants non autorisés, ni les mélanger avec de tels liquides ou réfrigérants : ceci entraînera une annulation des garanties. Porter des lunettes, des gants et un tablier de protection durant les remplissages avec ces liquides et réfrigérants. Temptronic n'accepte aucune responsabilité en cas de dommages dus à l'emploi de liquides de refroidissement et réfrigérants non autorisés.

ATTENTION

CAUTION

ATTENTION: Attention

Electrical Hazard

AVERTISSEMENT: Haute tension

Hot Surface

AVERTISSEMENT: Surface chaude

Cold Surface

AVERTISSEMENT: Surface froide

ATTENTION 1: Se conformer aux mesures de sécurité figurant sur le matériel et dans ce manuel pour ne pas endommager le matériel. N'utiliser le matériel qu'aux fins spécifiées par le fabricant.

ATTENTION 2: Seul le personnel autorisé est habilité à déposer les panneaux de refroidissement et/ou de protection et/ou ceux dont la dépose exige l'emploi d'un outil.

ATTENTION 3: Respecter les procédures de manutention et d'emballage applicables aux cartes de circuit imprimé sensibles à l'électricité statique. Considérer a priori que toutes les cartes sont sensibles à l'électricité statique

ATTENTION 4: Avant de raccorder le matériel à son alimentation électrique, s'assurer que la tension alternative ~ et la fréquence fournies au système correspondent à celles indiquées sur la plaque signalétique (située sur le panneau arrière).

ATTENTION 5: Débrancher le cordon d'alimentation du système de sa source d'alimentation avant de vérifier ou de remplacer les batteries de secours.

ATTENTION 6: Veiller soigneusement à ne pas endommager les deux thermocouples allant de la découpe thermique de la tête au flux d'air principal par l'intermédiaire de différents supports et connecteurs. Ces thermocouples sont très fragiles. Ne pas les couper, les tordre ou les plier car cela risque de rompre leurs connexions internes.

ATTENTION 7: Le module de refroidissement d'air pèse environ 79,5 kg, et il sert de contrepoids (de stabilisation) au châssis du THERMOSTREAM lorsque la tête thermique est déployée sur le bras horizontal. Si l'on dépose le module de refroidissement d'air : a) veiller à ce que le système reste stable (vertical) une fois le module déposé, b) utiliser un matériel de levage adéquat pour faire la dépose/ l'entretien du module de refroidissement d'air.

ATTENTION 8: Lors de la dépose de la carte de régulation du débit, éviter soigneusement de plier la carte lors du débranchement des tuyaux d'arrivée et de sortie d'air. Une légère flexion de la carte suffit pour endommager ses composants délicats et/ou son câblage.

ATTENTION 9: Lorsque l'on raccorde l'alimentation pneumatique au système, serrer le raccord cannelé tout en agrippant le raccord AIR INPUT (d'ALIMENTATION EN AIR) avec une seconde clé pour éviter qu'il ne tourne dans le panneau.

ATTENTION 10: Utiliser un air comprimé sec et propre (CDA) convenable : a) pour éviter un encrassement prématuré des filtres et détendeurs équipant le système, b) pour éviter tout givrage à l'intérieur du module de refroidissement, susceptible de réduire ou de bloquer même l'écoulement d'air en sortie. Une alimentation pneumatique de qualité inadéquate risque d'endommager les composants internes du système.

ATTENTION 11: Utiliser et entretenir comme il convient les filtres/détendeurs fournis. Ceci protège les composants du système d'une contamination éventuelle par de l'humidité et/ou les huiles de compresseur. Si l'on ne surveille pas la situation, cette humidité et ces huiles de compresseur peuvent endommager le système, les dommages n'étant pas couverts par la garantie.

ATTENTION 12: Pour desserrer l'actionneur linéaire (environ 92 cm de long), relever tout d'abord suffisamment le système pour faire descendre et dégager l'actionneur (utiliser un chariot élévateur). Puis desserrer l'actionneur de l'arrière du système. Ne pas se placer en dessous du système relevé, car cela n'est pas nécessaire.

ATTENTION 13: Si vous utilisez un système de 300 ° C, vérifier que tous les accessoires (par exemple covert thermique, FlexExtender ™ tuyaux, etc, et tous les composants d'installation d'essai) sont de calibre approprié pour ces températures.

Section C: SICHERHEITSHINWEISE FÜR DAS BEDIENPERSONAL

WARNHINWEIS

WARNING

WARNHINWEIS: Bitte die beiliegende Dokumentation beachten

Electrical Hazard

WARNHINWEIS: Hochspannung, Gefahr von elektrischen Schlägen

Hot Surface

WARNHINWEIS: heisse Oberfläche

Cold Surface

WARNHINWEIS: kalte Oberfläche

WARNHINWEIS 1: Potentielle Hochspannungsstellen und andere Gefahrenzonen, wie heiße oder kalte Oberflächen bzw. unter Hochdruck stehende Druckluft, Gase oder Dämpfe, sind am Gerät markiert und mit einer Kurzbeschreibung versehen. Diese Warnungen müssen bei der Installation, beim Betrieb, der Instandhaltung und Wartung des Gerätes genau beachtet werden. Alle im vorliegenden Handbuch gegebenen Sicherheitshinweise müssen beachtet werden. Das Gerät darf nur für die vom Hersteller angegebenen Verwendungszwecke benutzt werden.

WARNHINWEIS 2: Die im vorliegenden Handbuch enthaltenen Anweisungen zur Störungsbehebung können u.U. zum Kontakt mit Hochspannungen, unter Hochdruck stehender Druckluft und unter Hochdruck oder Vakuum stehenden Kältemitteln führen. Dabei können Verletzungs- und Lebensgefahr entstehen. Diese Anweisungen dürfen daher nur von qualifiziertem Personal ausgeführt werden.

WARNHINWEIS 3: Das Gerät muss lokalen Vorschriften entsprechend angemessen geerdet sein, um Elektroschockgefahren zu vermeiden.

WARNHINWEIS 4: Beim Anschluss von Thermoelement-Sensoren an das Testgerät (DUT) sind die Sensoren elektrisch zu isolieren, um die Bediener vor einem Kontakt mit potentiell lebensgefährlichen Spannungen im DUT-Bereich zu schützen.

WARNHINWEIS 5: Im Thermokopf befindliche Teile werden während des Betriebs extrem heiß und kalt; es besteht daher Berührungsgefahr. Wartungsarbeiten im Thermokopf dürfen nur durchgeführt werden, wenn das system ausgeschaltet ist. Warten Sie, bis die Teile im Thermokopf eine sichere und beständige Temperatur nahe der Raumtemperatur erreicht haben.

WARNHINWEIS 6: Während der Auf- und Abbewegung des Thermokopfes des ThermoStreams sind die Finger vom Zwischenraum zwischen der Thermalkappe am Kopf und dem DUT-Bereich fernzuhalten.

WARNHINWEIS 7: Gemäß SEMI S2-93A werden stromführende Elektroarbeiten („Hot Work“) wie folgt nach Typen eingestuft:

TYP	BESCHREIBUNG (gemäß SEMI S2-93A)	AUSSETZUNGS-GRENZE
1	Vollkommen spannungsfrei (elektrisch „kalt“)	Unzutreffend
2	Spannungsführende Leitungen, bedeckt oder isoliert. Fernbetrieb zur Vermeidung von Unfällen.	Unzutreffend
3	Spannungsführende Leitungen, offenliegend. Unfallmöglichkeit.	<= 30V effektiver Mittelwert; 42,2V Spitze; 240 Volt-Amp und 20 Joules
4	Spannungsführende Leitungen, offenliegend. Unfallmöglichkeit.	> 30V effektiver Mittelwert; 42,2V Spitze; 240 Volt-Amp und 20 Joules
5	Stromführend. Messungen und Einstellungen erfordern physikalische Einwirkung, Benutzung von nichtisolierten Kabelklemmen unzulässig.	Unzutreffend

WARNHINWEIS 8: Gerät, das vollkommen spannungsfrei (elektrisch „kalt“) sein muss, um sicheren Zugang zum system zu gewährleisten, erfordert nach den Vorschriften der U.S. Betriebssicherheits- und Gesundheitsbehörde OSHA 29 CFR 1910 folgende Verschluss- und Markierungsvorgänge: a) Für Geräte mit einem Netzkabel, das von einer Steckdose abgezogen werden kann, muss der Endbenutzer eine Steckdose bereitstellen und markieren, die den Stecker vollkommen umschließt und einen versehentlichen Wiederanschluss verhindert; b) Für Geräte mit festverdrahtetem Stromanschluss muss der Endbenutzer einen Unterbrechungsschalter mit einer Verriegelungsposition installieren und markieren bzw. einen Sicherungsautomaten mit einer Verriegelungsposition installieren und markieren, um einen versehentlichen Wiederanschluss zu verhindern.

WARNHINWEIS 9: Um das ThermoStream-system zum sicheren Auswechseln eines Moduls spannungsfrei zu schalten ist die Netzspannung auszuschalten (Betrieb beenden und abschalten), dann die Druckluftversorgung des systems abdrehen; gesamte Luft aus dem system ablassen, indem die Spannung am Gerät so lange eingeschaltet bleibt, dass gesamte Luft aus dem system entweicht. Danach das Netzkabel abziehen und die Luftversorgungsleitung vom Luftversorgungsanschluss an der Rückwand des Rahmens abtrennen. Die einzige im system verbleibende Energie befindet sich jetzt in einigen elektrischen Kondensatoren. Ein großer Kondensator befindet sich in der Nähe des Luftkühlungskompressors. Weitere große Kondensatoren befinden sich in den Stromversorgungseinheiten des systems.

WARNHINWEIS 10: Wartungsarbeiten am Kältemodul dürfen nur von (durch lokale Behörden) lizenzierten Kältetechnikern durchgeführt werden, die von der Temptronic Corporation zu Arbeiten mit Kältemitteln für das ThermoStream-system zugelassen sind.

WARNHINWEIS 11: Auf keinen Fall darf das Kältemodul (zu Dichtheitsprüfungen oder anderen Zwecken) mit einem Gas geladen werden, das unter einem Druck von mehr als 10,34 Bar steht.

WARNHINWEIS 12: Das Kältemodul dient als Gegengewicht für den Thermokopfaufbau. Vor Ausbau des Kältemoduls sicherstellen, dass der Horizontalarm den vertikalen C-Arm als untere Grenze erreicht, und dass der Thermokopf sich neben dem Horizontalarm befindet und zur Rückseite der Maschine weisend verriegelt ist. Angemessene Hebevorrichtungen beim Ausbau bzw. Service des Kältemoduls verwenden.

WARNHINWEIS 13: Zum Ausbau (oder zur Installation) des Thermokopfaufbaus am Ende des Horizontalarms sind zwei Mitarbeiter erforderlich. Einer muss den Thermokopfaufbau an den Griffen an der Vorderseite des Kopfes (mit beiden Händen) anheben, während der andere den Drehverschluss lockert (bzw. anzieht).

WARNHINWEIS 14: Um den Ausstoß von Kondensat (das u.U. Schadstoffe enthält) unter Hochdruck zu vermeiden, wenn Flüssigkeit aus den Luftfilterelementen abgelassen wird, wie folgt vorgehen: Erstens, die Luftdruckversorgung des systems abstellen; zweitens, alle Luft aus dem system ablassen, indem die Wechselspannung zum ThermoStream gerade lange genug bestehen bleibt, um die Luft aus dem system zu evakuieren; drittens, die Luftversorgungsleitung vom Luftversorgungsanschluss an der Rückwand des Rahmens abtrennen.

WARNHINWEIS 15: Zum Reinigen der Lufteinlassrippen am Wärmetauscher eine weiche Bürste bzw. einen Staubsauger verwenden (die Vorderwand abnehmen, um an die Rippen heranzukommen). Vorsichtig vorgehen, damit die Einlassrippen nicht verbogen werden. Die Rippen haben scharfe Kanten. Um Schnittgefahren zu vermeiden, Schutzhandschuhe tragen bzw. die Rippen nicht direkt mit den Fingern berühren.

WARNHINWEIS 16: Nur die vom Hersteller angegebenen Kältemittel verwenden: Diese wurden speziell entwickelt, so dass sie sicher für das Bedienungspersonal, umweltfreundlich, leistungsfähig und unschädlich für das Gerät sind. Nur autorisierte Kältemittel (keinen Ersatz) verwenden bzw. hinzufügen (vermischen): Bestehende Garantien können sonst erlöschen. Beim Einfüllen von Kühl- und Kältemitteln Schutzbrillen, Handschuhe und eine Schürze tragen. Temptronic übernimmt keine Haftung für Schäden, die auf die Verwendung von nicht autorisierten Kühl- und Kältemitteln zurückzuführen sind.

HINWEIS

HINWEIS 1: Die am Gerät und in diesem Handbuch gegebenen Vorsichtsmaßregeln beachten, um Geräteschäden zu vermeiden. Das Gerät darf nur für die vom Hersteller angegebenen Verwendungszwecke benutzt werden.

HINWEIS 2: Schutz- und Kühlabdeckungen sowie Abdeckungen, die mit einem Werkzeug abgenommen werden müssen, dürfen nur von dazu befugtem Personal vom Gerät entfernt werden.

HINWEIS 3: ESD-empfindliche Leiterplatten immer angemessen handhaben und verpacken. Alle Leiterplatten sollten als ESD-empfindlich angesehen werden.

HINWEIS 4: Vor Anschluss des Gerätes an die Stromversorgung sicherstellen, dass die Wechselspannung und Frequenz für das system richtig sind und den auf dem Typenschild (an der Rückwand des Gerätes) angegebenen Werten entsprechen.

HINWEIS 5: Vor Testen oder Auswechseln der Stützbatterien das Netzkabel des systems von der Stromversorgung abziehen.

HINWEIS 6: Äußerst vorsichtig vorgehen, um eine Beschädigung der beiden Thermoelemente zu vermeiden, die von den thermischen Sicherheitsschaltungen des Kopfes durch verschiedene Anschlüsse bzw. Halterungen in den Hauptluftstrom führen. Die Thermoelemente sind sehr empfindlich. Sie dürfen nicht zerschnitten, gedreht oder verbogen werden, weil dabei interne Verbindungen abreißen können.

HINWEIS 7: Das Kältemodul wiegt ca. 79,5 kg und dient als Gegengewicht (zur Stabilisierung) zum Systemrahmen, wenn der Thermokopf mit dem Horizontalarm ausgefahren ist. Beim Herausnehmen des Kältemoduls: a) Vorsichtig sein, damit das system stabil (aufrecht) bleibt, nachdem das Modul entfernt ist; b) zum Abnehmen oder zur Wartung des Kältemoduls angemessene Hebevorrichtungen benutzen.

HINWEIS 8: Beim Entfernen der Platine zur Luftsteuerung sehr vorsichtig vorgehen, um zu vermeiden, dass sie verbogen wird, wenn die Luftein- und Luftauslass-Schläuche entfernt werden. Selbst eine leichte Biegung der Platte kann die empfindlichen Bestandteile bzw. die Verdrahtung der Platine beschädigen.

HINWEIS 9: Beim Anschließen der Druckluft den AIR INPUT- (Lufteinlass-) Anschluss mit einem zweiten Schraubenschlüssel halten, während der Steckanschluss angezogen wird, um zu vermeiden, dass sich der Lufteinlass-Anschluss in der Wand dreht.

HINWEIS 10: Geeignete öl- und partikelfreie Druckluft für das system verwenden, um: a) eine vorzeitige Verschmutzung der mit dem system gelieferten Filter und Regeleinrichtungen und b) eine Eisbildung im Kühlmodul und eine potentielle Behinderung oder Blockierung des Auslass-Luftflusses zu vermeiden. Qualitätsmängel in der Luftversorgung können Schäden an den internen Bestandteilen des systems verursachen.

HINWEIS 11: Die mitgelieferten Filter und Regeleinrichtungen ordnungsgemäß verwenden und instand halten. Auf diese Weise wird verhindert, dass Feuchtigkeit bzw. Kompressoröle in die Bestandteile des systems eindringen. Feuchtigkeit und Kompressoröl können sonst Schäden am system hervorrufen, die von der Garantie ausgeschlossen sind.

HINWEIS 12: Um die (etwa 1 Meter lange) Säule zu lösen, das system zuerst hoch genug heben, so dass die Säule frei nach unten geführt werden kann (einen Gabelstapler benutzen). Dann die Säule vom system ablösen. Dabei nicht unter dem angehobenen system stehen (es besteht keine Notwendigkeit dazu).

HINWEIS 13: Bei Verwendung eines 300 ° C-System sicher, dass alle Zubehörteile (z. B. thermische Kappe, FlexExtender ™ Schläuche, etc. und alle Test-Setup Komponenten) richtig für diese Temperaturen ausgelegt.

Section D: PRECAUCIONES DE SEGURIDAD PARA EL PERSONAL DE OPERACIONES

ADVERTENCIA

WARNING

ADVERTENCIA: Precaución

Electrical Hazard

ADVERTENCIA: Alta tensión

Hot Surface

ADVERTENCIA: Superficie caliente

Cold Surface

ADVERTENCIA: Superficie fría

ADVERTENCIA 1: Los lugares donde existen posibles tensiones peligrosas y otros riesgos tales como superficies calientes o frías o aire comprimido/gases/vapores a altas presiones, están identificados y señalados con rótulos en el equipo. Observe cuidadosamente estas advertencias durante la instalación, operación, mantenimiento o al efectuar reparaciones del equipo. Observe todas las advertencias contenidas en este manual. Use el equipo únicamente para los fines indicados por el fabricante.

ADVERTENCIA 2: Las instrucciones de identificación y solución de problemas contenidas en este manual, pueden causar un posible contacto con energía eléctrica de altas tensiones, aire comprimido y refrigerantes a altas presiones o al vacío. Estos riesgos pueden causar lesiones o poner en peligro la vida. No efectúe esas instrucciones a menos que usted esté calificado para hacerlas.

ADVERTENCIA 3: Para evitar los riesgos de choques eléctricos, el equipo debe estar puesto a tierra con un conector a tierra física adecuado, de acuerdo con los códigos eléctricos locales.

ADVERTENCIA 4: Cuando se están conectando los sensores de termopar al Dispositivo En Prueba (DUT), aísle los sensores eléctricamente para proteger a los operadores del contacto con cualquier tensión peligrosa que podría haber en el sitio del DUT.

ADVERTENCIA 5: Las piezas dentro de la cabeza térmica funcionan a temperaturas extremadamente calientes y frías y son peligrosas al tocarlas. No efectúe ningún mantenimiento dentro de la cabeza térmica hasta que el sistema no haya sido apagado. Espere hasta que las piezas de la cabeza hayan alcanzado una temperatura segura y estable, cerca a la temperatura ambiente.

ADVERTENCIA 6: Durante el movimiento de arriba/abajo de la cabeza térmica del sistema, mantenga sus dedos apartados del espacio entre la tapa térmica de la cabeza y el sitio del DUT (dispositivo en prueba).

ADVERTENCIA 7: Por la norma SEMI S2-93A, el trabajo eléctrico excitado ("Trabajo con corriente"), es especificado por Tipo como sigue:

TIPO	DESCRIPTION (por SEMI S2-93A)	UMBRAL DE EXPOSICION
1	Desexcitado completamente (eléctricamente "frío").	n.a.
2	Circuitos con corriente, forrados o aislados. Trabajo efectuado en lugar remoto para evitar choque accidental.	n.a.
3	Circuitos con corriente expuestos. Contacto accidental posible.	<= 30 V RMS (tensión eficaz), 42,2 V pico, 240 voltio amperios y 20 julios
4	Circuitos con corriente expuestos. Contacto accidental posible.	> 30 V RMS (tensión eficaz), 42,2 V pico, 240 voltio amperios y 20 julios
5	Excitado. Las mediciones y ajustes requieren introducción física, o la configuración del equipo no permite el uso de sondas tipo mordaza.	n.a.

ADVERTENCIA 8: Cuando el equipo tiene que estar completamente desexcitado (eléctricamente "frío"), para permitir la entrada segura dentro del sistema, se debe seguir el siguiente procedimiento de Bloqueo/Marcado con Etiquetas de acuerdo con la norma OSHA 29 CFR 1910: a) Para los dispositivos con cordón eléctrico que se "desenchufa" de un receptáculo de servicio, el usuario final debe proveer y poner una etiqueta en una envoltura de bloqueo del Enchufe que cubra completamente al mismo y evite la reconexión accidental; b) para dispositivos conectados directamente a la alimentación eléctrica, el usuario final deberá instalar y poner una etiqueta en un interruptor de desconexión de la corriente con una posición de desconectado y bloqueado o instalar y poner una etiqueta a un disyuntor con una posición de desconectado y bloqueado, para evitar la reconexión accidental.

ADVERTENCIA 9: Para cortar la corriente del Sistema para el reemplazo seguro de un módulo, desconecte la alimentación de CA (detiene el funcionamiento y corta la corriente), luego desconecte el suministro de presión de aire del Sistema, luego purgue todo el aire del Sistema conectando la alimentación de CA sólo el tiempo suficiente para sacar todo el aire. Ahora desconecte el cordón de alimentación eléctrica principal y la línea de suministro de aire del conector del orificio en el módulo del bastidor posterior. La única energía que queda en el Sistema será la almacenada en algunos condensadores eléctricos. Un condensador grande está situado cerca del compresor del enfriador de aire del Sistema. Otros condensadores grandes están dentro de los suministros de energía eléctrica del Sistema.

ADVERTENCIA 10: Si se necesita hacer alguna reparación del Módulo del Enfriador de Aire, solamente un técnico de refrigeración con licencia (y/o certificado por EPA) y autorizado por Temptronic Corporation estará calificado para efectuar cualquier carga o manipulación de los refrigerantes en el Sistema.

ADVERTENCIA 11: Bajo ninguna circunstancia (prueba de fugas o cualquier otro propósito) se debe cargar el Módulo del Enfriador de Aire con cualquier gas a una presión superior a los 10,34 Bares (150 psig).

ADVERTENCIA 12: El Módulo del Enfriador de Aire actúa como un contrapeso del Conjunto de la Cabeza Térmica. Antes de desmontar el Módulo del Enfriador de Aire, asegúrese de que el brazo horizontal esté bajado sobre el brazo vertical C en su límite más bajo y que la cabeza térmica esté adentro al lado del brazo horizontal y guardada hacia la parte posterior de la máquina. Para desmontar o reparar el Módulo del Enfriador de Aire use un equipo apropiado para levantar pesos.

ADVERTENCIA 13: Para desmontar (o instalar) el conjunto de la cabeza térmica en el extremo del brazo horizontal se necesitan dos personas. Una persona debe levantar el conjunto de la cabeza térmica sujetando con sus dos manos los agarradores frontales de la cabeza, mientras que la otra persona afloja (o aprieta) la traba pivote.

ADVERTENCIA 14: Para evitar la expulsión a alta presión del condensado (que puede contener o no substancias peligrosas), cuando se está drenando la humedad de los elementos del filtro de aire, primero apague el suministro de presión del aire del sistema, segundo purgue todo el aire del Sistema conectando la alimentación de CA justo el tiempo suficiente para sacar todo el aire en el sistema, tercero desconecte la línea de suministro de aire del conector del orificio de suministro de aire situado en el panel posterior.

ADVERTENCIA 15: Cuando se están limpiando las aletas de la entrada de aire del condensador (para tener acceso a las aletas quite la tapa frontal) use una escobilla blanda y/o una aspiradora, teniendo cuidado de no doblar las aletas, debido a que las aletas tienen bordes afilados y para evitar cortarse use guantes protectores y/o no toque las aletas de entrada directamente con los dedos.

ADVERTENCIA 16: Use únicamente los líquidos enfriadores (líquidos de transferencia de calor) y refrigerantes especificados por el fabricante y desarrollados técnicamente para ofrecer seguridad para los operadores, no sean perjudiciales al medio ambiente, funcionen eficientemente y no dañen el equipo. No substituya con enfriadores y refrigerantes no autorizados, ni mezcle (agregar) con los mismos: el hacerlo puede anular las garantías. Cuando está llenando enfriadores y refrigerantes use gafas protectoras de seguridad, guantes y un delantal. Temptronic no asume ninguna responsabilidad por daños causados por el uso de enfriadores y refrigerantes no autorizados.

PRECAUCION

PRECAUCION 1: Observe las precauciones indicadas en el equipo y en este manual, para evitar causar daños al equipo. Use el equipo únicamente para los fines especificados por el fabricante.

PRECAUCION 2: Personal no autorizado no deberá quitar del equipo los paneles de enfriamiento y/o protección, o aquellos que necesitan una herramienta para quitarlos.

PRECAUCION 3: Use los procedimientos correctos para la manipulación y empaque de placas de circuitos sensibles a la estática. Haga de cuenta que todas las placas de circuitos son del tipo sensibles a la estática.

PRECAUCION 4: Antes de conectar el equipo a su fuente de alimentación eléctrica, verifique que la tensión de ~ (CA) y la frecuencia a ser alimentada al sistema son las correctas de acuerdo con las listadas en su placa de datos (ubicada en el panel posterior del equipo).

PRECAUCION 5: Antes de verificar o reemplazar cualesquiera pilas de reserva, desconecte el cordón eléctrico del Sistema de su alimentación de servicio.

PRECAUCION 6: Tenga mucho cuidado para evitar daños a los dos termopares que van desde la placa de cortacircuito térmico de la Cabeza hasta dentro de la corriente de aire principal a través de varios conectores/soportes. Estos termopares son muy delicados. No los corte, retuerza ni doble porque se podrían romper conexiones internas.

PRECAUCION 7: El peso del Módulo del Enfriador de Aire es de aproximadamente 79,5 kg (175 libras) y actúa como contrapeso (para estabilizar) el bastidor del Sistema cuando la cabeza térmica está extendida sobre el brazo horizontal. Si se está desmontando el módulo del Enfriador de Aire: a) tenga cuidado que el sistema permanezca estable (derecho en posición vertical) después que se ha desmontado el módulo, b) para desmontar o reparar el Módulo del Enfriador de Aire use un equipo apropiado para levantar pesos.

PRECAUCION 8: Cuando se está desmontando la placa de control de flujo, tenga mucho cuidado de no doblar la placa al desconectar las mangueras de entrada y salida de aire. Aún una ligera flexión de la placa podría dañar componentes delicados y/o el alambrado de la placa.

PRECAUCION 9: Cuando se está haciendo la conexión de aire al Sistema, sujete el conector de AIR INPUT (entrada de aire) con una segunda llave, mientras está apretando el conector de púa, para evitar que el conector de AIR INPUT gire dentro del panel.

PRECAUCION 10: Use un suministro adecuado de aire comprimido ASL (Aire Seco Limpio) para el Sistema: a) para evitar la obstrucción prematura de los conjuntos de filtros/ regulador provistos con el Sistema, b) para evitar la formación de hielo dentro del módulo de enfriamiento y posiblemente reducir u obstruir el flujo del aire de salida. La calidad inadecuada del suministro de aire puede causar daños a los componentes operativos internos del Sistema.

PRECAUCION 11: Use y mantenga de la forma correcta los conjuntos suministrados de filtros/reguladores. Esto evitará la entrada de humedad y/o aceites del compresor dentro de los componentes operativos del Sistema. Si no se verifica esto, la humedad y/o aceite del compresor puede causar daños al Sistema, los mismos que no están cubiertos por la garantía.

PRECAUCION 12: Para aflojar el conjunto del actuador lineal (aproximadamente 92 cm de largo), primero suba el sistema a la altura necesaria para que el actuador baje sin obstáculos (use un montacargas de horquilla). Luego, afloje el actuador por la parte posterior del sistema. No se coloque debajo (no es necesario estar debajo) del sistema levantado.

PRECAUCION 13: Si se utiliza un sistema de 300 º C, verifique que todos los accesorios (por ejemplo, la tapa térmica, FlexExtender ™ mangueras, etc y todos los componentes de la instalación de prueba) están correctamente clasificados para estas temperaturas.

Section E: Säkerhets Föreskrifter och Varningar, Varsamhet

Varningar

WARNING

Varningar: Varningar

Electrical Hazard

Varningar: Högspänning

Hot Surface

Varningar: Varm yta

Cold Surface

Varningar: Kall yta

VARNING 1: Lokalisering av eventuellt farliga spänningar och andra farligheter som varma ytor eller kalla ytor eller höga tryck om luft/gas/ånga är identifierade av märkningar på utrustningen, enligt symbolerna ovan. Iakttag och lokalisera dessa varningar vid installation, användning och underhåll eller service av utrustningen. Läs och förstå alla varningar skrivna i utrustningens manual. Enbart använd utrustningen för sitt ändamål som specificerats från tillverkaren.

VARNING 2: Före varje försök att utföra underhåll på ATS-XX, försäkra er om att komprimerad luftanslutning och spännings matningen är avslaget. Stäng först av luftanslutningen och låt det uppbyggda lufttrycket i den inbyggda lufttorkaren mynna ut (lufttorkaren behöver tillslagen spänning för att torka ut), därefter stäng av spännings matningen till utrustningen. Utför inte dessa rutiner om inte kvalifikation för ändamålet finnes.

VARNING 3: För att undvika strömstötar, skall utrustningen vara väl jordad genom att varje elektrisk kabel har härför avsedda jordanslutning.

VARNING 4: Vid anslutning av temperatur sensorer till komponent under test (DUT), isolera elektriskt sensorn för att undvika att operatören kommer i kontakt med farliga spänningar som kan finnas på och om testobjektet.

VARNING 5: Delar i det termiska huvudet arbetar i extrema varma och kalla temperaturer och är mycket farligt att vidröra. Utför inget underhåll på eller i det termiska huvudet innan utrustningen helt har stängts av. Vänta tills huvudets delar erhållit en säker temperatur i närhet av rumstemperaturen.

VARNING 6: Vid upp/ner rörelse av temperaturhuvudet på ATS-XX, håll fingrar och föremål utanför den termiska koppen och komponenttest arean.

VARNING 7: I enlighet med SEMI S2-93A, elektriskt laddade arbeten är specificerade per typ enligt nedan.

TYP	BESKRIVNING (enl. SEMI S2-93A)	EXPONERBAR TRÖSKELNIVÅ
1	Fullständigt avslaget. (elektrisk kyla)	n.a.
2	Öppen krets, täckt eller isolerad. Arbete utförs på avstånd för undvikande av elektrisk stöt.	n.a.
3	Öppen krets exponering. Olycksrisk föreligger.	<=30v RMS, 42.2v topp, 240 volt-amp, och 20 svängningar.
4	Öppen krets exponering. Olycksrisk föreligger.	>30v RMS, 42,2v topp, 240 volt-amp, och 20 svängningar.
5	Uppladdad. Mätning och justering kräver fysisk kontakt, eller utrustningens konfiguration tillåter inte användandet av verktyg eller tänger.	n.a.

VARNING 8: Utrustningen måste vara fullständigt avslagen (elektrisk kyla) för att erbjuda ett säkert inträde i utrustningen, följande rutiner bör genomföras enligt OSHA 29 CFR 1910: a). För moduler med en spänningsmatningskabel som bortkopplas från ett spänningsuttag, måste slutanvändaren förse uttaget med tillräckligt skydd att ingen möjlighet finnes att vidröra de spänningsledande kontaktstiften så länge anslutningen vidhålles. b) för moduler som handvirats till elektriska spänningskällor, måste slutanvändaren installera en säkerhetsbrytare (på/av) för möjligheten att frånslaga spänningen eller installera en jordfelsbrytare.

VARNING 9: För att ”urladda” utrustningen för ett säkert utbyte av någon modul, slå först av utrustningens AC matningsspänning (utför SHUT DOWN ifrån menyn), sedan stäng av dess luft tillförsel, och låt systemet ”blöda” all kvarvarande luft genom att åter slå på spänningen tillräckligt länge för att få ut all luft ur systemet. Nu kan man koppla loss både AC anslutning och luft anslutning. Den enda laddade energin som kan finnas i systemet är nu eventuella uppladdade elektriska kondensatorer. En stor kondensator finns i närhet av systemets air-chiller kompressor. En annan stor kondensator finns i systemets spänningsaggregat.

VARNING 10: Om service är nödvändig i utrustningens Air Chiller modul eller kompressor delar, får denna service enbart utföras av ackrediterad (och/eller EPA Certifierad) kylservice personal eller auktoriserad och utbildad från Temptronic Corporation, som är kvalificerad att utföra laddning eller reparation av kylaggregat.

VARNING 11: Under inga omständigheter (läck-test eller annan hantering) får Air Chiller modulen laddas med någon gas eller tryck över 150 psi (10.34 bar).

VARNING 12: Hela Air Chiller modulen utgör en viktbalans för det termiska huvudet och dess arm. Om denna modul måste löstagas, försäkra er om att den horisontala armen är nere på den vertikala C-armen på sitt lägsta läge och det termiska huvudet är bredvid den horisontala armen och låsta intill maskinen. Använd tillgänglig viktlyftutrustning vid urtagning/service av Air Chiller modulen.

VARNING 13: Två personer behövs för borttagning (eller installation) av det termiska huvudet på den horisontala armen. En person måste lyfta huvudet med båda händer medan den andra personen lossar (eller drar åt) dess fästskruvar.

VARNING 14: För att undvika högtrycks utblås eller smällar (vilka kan eller inte oftast täckas av försäkringar) när utrustningens filter skall rengöras, stäng alltid först av lufttillförseln till utrustningen, sedan låt lufttrycket läcka ut genom att sätta på utrustningens PÅ/AV knapp och låt utrustningen vara igång tillräckligt länge tills all luft evakuerats från utrustningen. För det tredje, koppla loss luftanslutningen till utrustningen (SP1) lokaliserad på baksidan av utrustningen.

VARNING 15: Vid rengörning av utrustningens inre filter (kan utföras genom att avtaga skyddskåpan på framsidan av utrustning) använd en mjuk borste och/eller en dammsugare. Var försiktig att inte peta och bända på några delar inom maskinen, det kan vara skarpa kanter och viss skärningsrisk finns. Använd handskar och peta inte med fingrar inuti filtren.

VARNING 16: Använd enbart kylvätska (värme cirkulation) och köldmedier som specificerats av leverantören. Dessa är noggrant utprovade om säkerhet för användare och miljön samt arbetes effektivitet och ej skadliga för utrustningen. Byt inte ut köldmedier mot ospecificerad eller mixad media. Ett sådant handlande täcks inta av garantin. Temptronic har inget ansvar för skador uppkomna genom användning av felaktig köldmedia.

Försiktighet och Varsamhet

VARSAMHET 1: Observera den varsamhet och försiktighet som angives på utrustningen och dess manual för att undvika skador på utrustningen. Använd enbart utrustningen såsom leverantören angivit och specificerat.

VARSAMHET 2: Personal som ej är aktualiserad för ändamålet skall inte avlägsna skydd eller paneler på utrustningen som är avsedda för skydd eller kylning eller är behov av verktyg för borttagande.

VARSAMHET 3: Använd erkänd hantering och packnings rutin för statiskt känsliga kort. Alla elektroniska kort i maskinen är av statisk känslig typ.

VARSAMHET 4: Innan ATS-XX anslutes till elektriskt spänningsuttag, kontrollera att rätt växelspänning (AC) och frekvens (Hz) överensstämmer med specifikationen noterad på utrustningens märkplatta, lokaliserad på baksidan av utrustningen.

VARSAMHET 5: Frikoppla systemets elektriska spänningskabel innan kontroll eller utbyte av back-up batterier genomförs.

VARSAMHET 6: Var mycket försiktig att inte skada de två termistorer som går från det termiska huvudets avbrottskort och ut i munstycket med tempererad luftström genom varierande kopplingar eller uppsättningar. Dessa termistorer är mycket känsliga och får inte böjas, brytas eller kapas från sina kontaktorer.

VARSAMHET 7: Vikten på systemets Air Chiller modul är c:a 79,5 kg (175 lb), och utgör systemets viktbalans när det termiska huvudet är i sitt yttersta läge på den horisontala armen. Om Air Chiller'n måste borttagas: a) försäkra er om att utrustningen förblir stabil (upprätt) efter att modulen avlägsnats, b) använd lyftutrustning vid borttagning/montering av Air Chiller modulen.

VARSAMHET 8: Vid borttagning av kontrollkortet för luftflöde, var extra försiktig att inte bända eller vrida kortet vid borttagning av ingående och utgående luft anslutningar. Även en liten bändning av kortet kan skada dess komponenter och/eller virningar på kortet.

VARSAMHET 9: Var aktsam om att förankra utrustningens luftanslutnings munstycke vid montering och åtdragning av extern luftslang, så att inte munstycket vrides i panelen.

VARSAMHET 10: Använd enbart ren och torr tryckluft (CDA) för systemet: a) för att undvika föroreningar av filter och regulatorer som finns is systemet, b) för att undvika isbildning och frost i utrustningens kylsystem vilket reducerar luftströmmen och dess kapacitet. Dålig luftkvalitet kan skada systemtes ingående komponenter.

VARSAMHET 11: Ansvarsfullt användning och underhåll av ingående filter och regulatorer. Detta minskar föroreningar och/eller kompressor olja att komma in i systemet och orsaka problem. Vid ej utfört underhåll, kan föroreningar och kompressor olja orsaka sådana skador att de inte täcks av garantin.

VARSAMHET 12: För att lossa lyftarmens stång och motor (c:a 90 cm lång), först lyft upp systemet tillräckligt högt för att lyftstången kan falla ner (använd en lyft truck). Sedan lossa enheten från baksidan av systemet. Vistas ej under utrustningen när den är upplyft. (Det är inte nödvändigt att arbeta under ifrån).

VARSAMHET 13: Om du använder en 300 ° C-systemet, kontrollera att alla tillbehör (t.ex. termisk mössa, FlexExtender ™ slangar, etc. och alla test-komponenter inställningar) korrekt klassade för dessa temperaturer.

2

Preparation For Use

Chapter Overview

Introduction

This chapter provides a general overview of the *ATS-700 & -800 Series THERMOSTREAM* Models.

In this Chapter

This Chapter is divided into the following Sections:

Section A: Initial System Setup Checklist

Setup Checklist

STEP	INITIAL SYSTEM SETUP CHECKLIST
1	Receive, unpack, *THERMOSTREAM* System (see Unpacking/Receipt of Shipment, page 2-10).
2	Place system at DUT site, near to Air, Power (see Placement Requirements, page 2-12).
3	Attach Thermal Cap and Shroud (see Attaching the Thermal Cap and Shroud, 14).
4	Insulate DUT site (see Static, Moisture, and Extreme Temperature Protection, page 2-43).
6	Configure input voltage for compressor auto-transformer (see Power Connections and Voltage Requirements, page 2-17).
	Connect system to main Power (see Power Connections and Voltage Requirements, page 2-17).
7	Connect system to facility compressed air (see Air Connections, page 2-26).
8	Connect purge air (see Connecting Purged Air, page 2-29).
9	Press front panel On switch to energize system.
10	Enable "Full" Access (see Chapter 3).
11	Press "Heat/Cool, (Compr. On)" button, let compressor run 1/2 hour to allow refrigerants to separate and to produce full range cold output (see Chapter 3).
12	Check Head & Manipulator (Vertical Stand, Arms) movement: --unlock Vertical Stand lock, test Head up/down switches (see Chapter 3). --test Head up/down software button (see Chapter 3). --unlock, test movement of three locks: arm/Head (see Chapter 3).
13	Test "Flow: On/Off" button (see Chapter 3). --listen to hear quiet "whoosh" as Air Dryer cycles every 60 seconds --with "Flow: On," and "Head: Down," check if air flow from Head output nozzle
14	Attach sensor to DUT: --standard attachment techniques (see Interfacing and Attaching Thermocouples, page 2-32) --alternate attachment techniques (see Non-Standard Thermocouples, page 2-41)
15	Verify main Air sensor (see Chapter 5) and Calibrate main Air sensor if needed (see Chapter 5).
16	Verify DUT mode sensor(s) (see Chapter 5) and Calibrate DUT mode sensor(s) if needed (see Chapter 5).
17	Setup "new" Air mode test, test cycle to Hot, Cold set points (see Chapter 3).
18	Setup "new" DUT mode test, cycle to Hot, Cold set points (see Chapter 3).
19	For remote Host control of the *THERMOSTREAM* System. --interface RS232C, or IEEE-488.2, or MCT cable (Rear Panel I/O Ports, page 2-30). --configure (see Remote Operation, Chapter 4), then test run to Hot, Cold set points
20	Begin normal system operation (see Chapter 3).

Section B: General Information

Overview

In this Section

The following topics are covered in this Section:

Scope of Manual

This manual supports the ATS-700 & -800 *THERMOSTREAM* Series Systems for:

- General and advanced assembly
- Interfacing, interconnecting
- Local and Remote operation parameters for Medium and Full Access
- Routine preventive maintenance.

The THERMOSTREAM System is a programmable temperature control airstream system, used to test and characterize electronic devices in various thermal environments.

The THERMOSTREAM System is controlled by internal microprocessors, and permits either local or remote hosted operation, either attended or unattended. The system can record time/ temperature test performance datalogs.

The THERMOSTREAM System displays the air and DUT (Device-Under-Test) temperatures. It also displays various operator input values, such as: hot, ambient, and cold temperature set points, soak times and cycle data, and further displays system derived operations status data and error message alerts.

Data is displayed in real-time alphanumeric format, to fully inform the operator or test setup engineer.

Related Documentation

Introduction

This manual (LM04070) is one of two used with the ATS-700 & -800 Series *THERMOSTREAM* Systems. This section provides a description of the manuals and other related documentation.

ATS-700 & -800 Series *THERMOSTREAM* Documentation

The following is a list of manuals and other pertinent documentation related to the *ATS-700 & -800 Series THERMOSTREAM* Systems.

NOTE: Data sheets can be downloaded here:

http://intestthermal.com/resources/resource-center/temperature-forcing

Title	Part Number	Description
ATS-710-M *THERMOSTREAM* Datasheet	SL10720	• Datasheet and technical specifications
ATS-710-T *THERMOSTREAM* Datasheet	SL10730	• Datasheet and technical specifications
ATS-730-M *THERMOSTREAM* Datasheet	SL10740	• Datasheet and technical specifications
ATS-730-T *THERMOSTREAM* Datasheet	SL10750	• Datasheet and technical specifications
ATS-750-M *THERMOSTREAM* Datasheet	SL10760	• Datasheet and technical specifications
ATS-770-M *THERMOSTREAM* Datasheet	SL10770	• Datasheet and technical specifications
ATS-810-M *THERMOSTREAM* Datasheet	SL10850	• Datasheet and technical specifications
ATS-810-T *THERMOSTREAM* Datasheet	SL10860	• Datasheet and technical specifications
ATS-830-M *THERMOSTREAM* Datasheet	SL10870	• Datasheet and technical specifications
ATS-830-T *THERMOSTREAM* Datasheet	SL10880	• Datasheet and technical specifications
ATS-850-M *THERMOSTREAM* Datasheet	SL10890	• Datasheet and technical specifications

Title	Part Number	Description
ATS-870-M *THERMOSTREAM* Datasheet	SL10900A	• Datasheet and technical specifications
ATS *THERMOSTREAM* Systems -700 Series Brochure	SL10700	• Brochure for 60Hz only systems describing overview of all models.
ATS *THERMOSTREAM* Systems -800 Series Brochure	SL10710	• Brochure for all 50/60 Hz systems describing overview of all models.

User/Owner Documentation

Introduction

The following section details the owner's warranty and System Specifications for the *THERMOSTREAM* System.

Warranty

A copy of Temptronic Corporation's standard Warranty is available on the inTEST Thermal Solutions website: http://intest-thermal.com/warrantytemptronic.

Specifications

The System Specifications are as published on the data sheet(s) which is (are) included in the front cover pocket of this manual, or inserted immediately at the end of this Manual.

Specifications typically include:

- Temperature range, Air flow, Vacuum
- Environmental, Service features
- Facilities requirements: Power, Dewpoint/humidity
- Air Standards: Supply Pressure, Oil Content, Filtration
- Dimensions

Access Levels

Introduction

This manual explains how to operate the "Medium" and "Full" Access levels functions:

Access Level	*THERMOSTREAM* Functions
BASIC	Run to pre-set set point(s); Load pre-programmed tests. No changes.
MEDIUM	Run to & Change set point(s); Load & Setup tests; Datalog: record new datalogs; review saved datalogs; Temporary changes (no Save)
FULL	Run to set points; Setup tests; Datalog & Print; Assign, change Passwords/Access levels; Configure system; Calibrate sensors; Defrost; Permanent changes: Load, Rename, Save

This manual also explains how to:

- Turn the system on and off (see Chapter 3)
- Move the Head up and down over the Device Under Test (DUT) (see Chapter 3)
- Use the operator control module (OCM) Touch Screen (see Chapter 3).

NOTE: Functions not available in Basic or Medium Access are displayed on the screen "grayed out" (in lighter colors) and do not execute when pressed.

Remote Operation Modes

Introduction

The system provides four I/O's for four different communication interfaces:

- Serial (RS-232)
- Parallel Bus (GPIB) (IEEE-488.2)
- ST/EOT/SFF Interface.
- Ethernet 10/100 baseT

ATTENTION

See Chapter 4, "Remote Interfaces" for detailed instructions and command sets.

Serial RS-232 Interface

An RS232C serial communications interface is factory installed in the *THERMOSTREAM* System at the time of purchase in addition to the standard IEEE-488 interface. In this case, the series communications cable plugs into the RS232C connector on the *THERMOSTREAM* I/O panel.

IEEE (GPIB) Interface

For remote control of the *THERMOSTREAM* System, an IEEE-488 interface is standard for parallel communications with a tester or host computer. The parallel communications cable plugs into the IEEE-488 connector on the *THERMOSTREAM* THERMOSTREAMI/O panel.

ST/EOT/SFF Interface

A limited MCT Standard interface between the *THERMOSTREAM* System and a tester is a standard feature. This interface cable plugs into the ST/EOT/SFF connector on the *THERMOSTREAM* I/O panel.

Interface connections (signals) include the Start-Test (ST) output from the *THERMOSTREAM* System, the End-of-Test (EOT) input from the tester, and the Stop-on-First-Fail (SFF) input from the tester.

Ethernet 10/100 baseT Interface

An Ethernet 10/100 baseT communications interface is factory installed in the *THERMOSTREAM* System at the time of purchase (in addition to the above interfaces). The Ethernet communications cable plugs into the **10/100 BaseT** connector on the *THERMOSTREAM* I/O panel.

Section C: Unpacking/Receipt of Shipment

Overview

In this Section

Receipt of Shipment

Introduction

The *THERMOSTREAM* System is shipped in one large packing carton, on a skid, and can be transported to its location with a single fork-lift. All purchased items are included inside the packing carton. When received, the carton should be examined for any signs of mishandling or damage during shipment.

NOTE: If there are any obvious signs of damage to the packing carton, contact the carrier immediately and do not proceed with the unpacking.

Unpacking Video

Watch the ThermoStream Upacking video on the inTEST Thermal Solutios YouTube page::

https://www.youtube.com/watch?v=xCBDLDwBnJk

Repackaging System

If the system is to be shipped to another location, repackage the system in the original shipping carton, by reversing the order of unpacking.

NOTE: Prior approval is required before shipping the system to a inTEST Thermal Solutions Sales/Service Office, or to the factory.

ATTENTION

IT IS RECOMMENDED THAT A TAG BE ATTACHED TO THE SYSTEM GIVING THE SYSTEM OWNER'S NAME, ADDRESS, TELEPHONE NUMBER, SYSTEM MODEL AND SERIAL NUMBERS, AND THE REASON FOR RETURN.

Section D: Placement Requirements

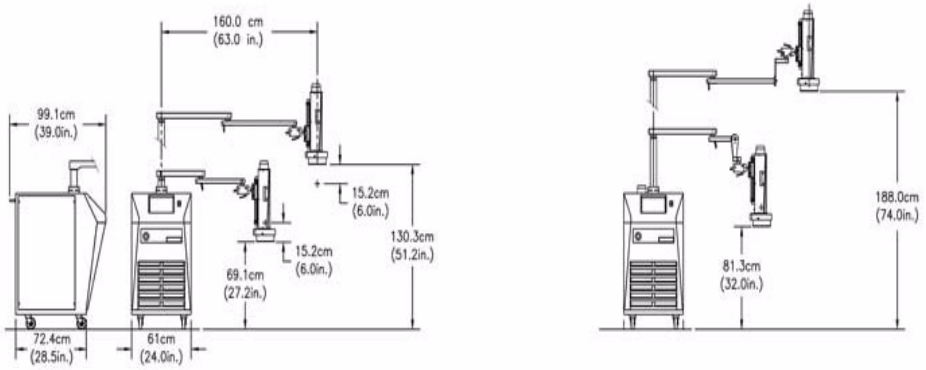
Clearances, Dimensions, Weight

The proposed placement site for the *THERMOSTREAM* System should be one near to necessary ac power and compressed air service interconnections. Also, the proposed site should be near any tester with which the *THERMOSTREAM* System will interface.

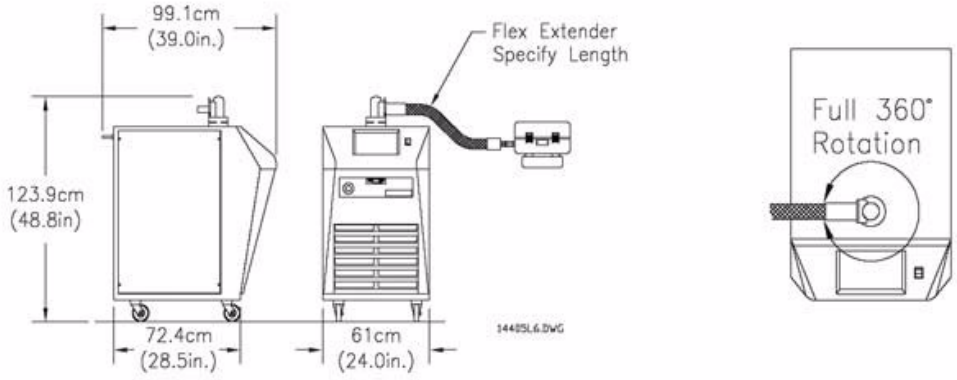
For proper internal ventilation (air intake through front, air exhaust out back) of the *THERMOSTREAM* and to provide for supply connections, the system should be located with an 8-inch minimum clearance, behind the system.

The Clearance, Dimensions, and Weights for each model are listed in the Data Sheet(s) in the back of this Manual.

Dimensions, THERMOSTREAMModels 710M, 730M, 750M, 770M, 810M, 830M, 850M, 870M



Dimensions, THERMOSTREAMM odels 730T, 810T, 830T



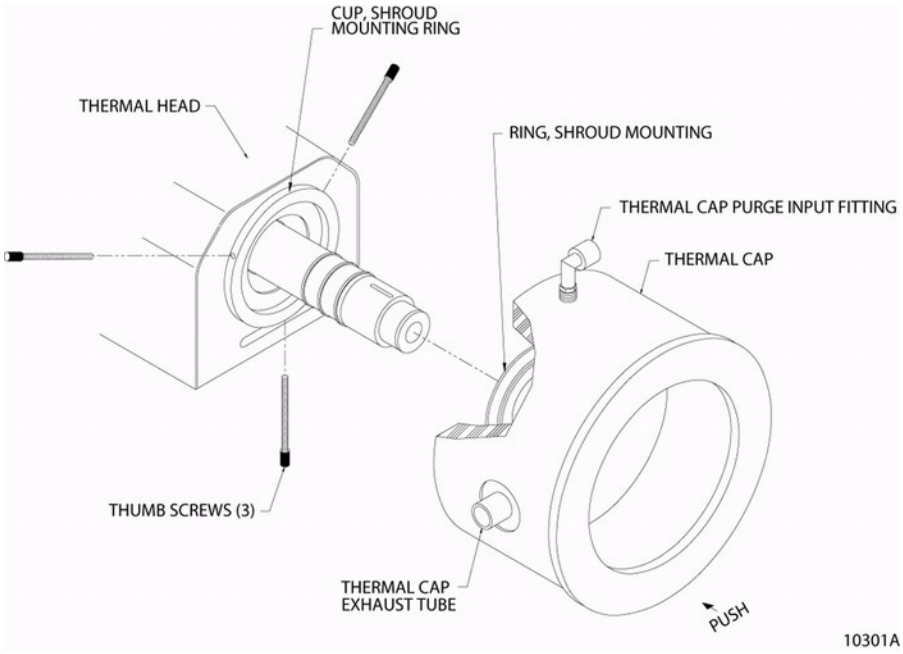
Section E: Attaching the Thermal Cap and Shroud

Introduction

Each system is configured to customer specifications at the time of order and shipped complete. Typically, the required assembling is to attach the thermal cap to the head module.

To attach the standard, transparent thermal cap onto the bottom of the head module, no tools are required. **NOTE**: The same procedure applies for the optional, non-transparent thermal cap.

Thermal Cap

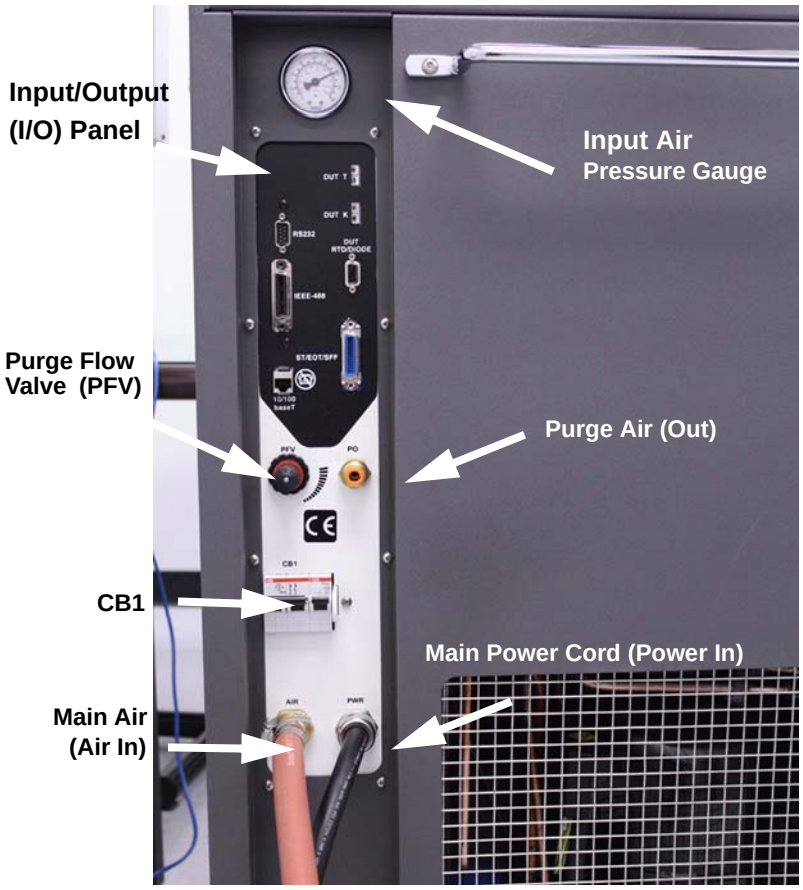


Procedure

Step	Action
1	At initial installation of the *THERMOSTREAM* System, install the three thumbscrews in the mounting ring at the head output. Thumbscrews are packed with the thermal cap in a separate box.
2	Apply upward pressure, twist back and forth, and slip (push) the thermal cap into the mounting ring of the head module.
3	Rotate the thermal cap to locate its exhaust port away from the operator's position, and tighten the three thumbscrews to secure the thermal cap in place.
4	Slip the thermal shroud over the end of the head outlet nozzle to concentrate the air flow around the DUT. Five different shaped shrouds are provided. Use the appropriate shaped one for the type of DUT being tested (additional sizes are available from Temptronic).
5	Attach the purge air hose between the thermal cap purge input fitting and the fitting at the lower rear of the head module.

Section F: Rear Panel, Air and Power Connections

Rear Panel



Descriptions

PART	DESCRIPTION
Input/Output Panel	Interface for an RTD/Diode sensor.
Input Air Pressure Gauge	Monitors the pressure of the compressed air being supplied to the system. This gauge is downline from particulate & coalescing filters.
Purge Flow Valve (PFV)	Used to adjust the flow of the Purge Air Out.
Purge Air Out (PO)	Supplies clean, dry air to the Tester Platform. The purged air is used to protect platform components from moisture related problems. For greater detail, see Connecting Purged Air, page 2-29.
CB1	CB1, a 30 amp circuit breaker, the main power breaker.

PART	DESCRIPTION
Main Air In	The facility's compressed air supply is connected here. For greater detail, see Connecting the Main Air Supply (Compressed Air), page 2-28.
Main Power Cord (Power In)	A 32 amp power cord, approximately 3 meters long. For 60 Hz systems, the power cord is terminated in a standard 230 v plug. For 50 Hz systems, the power cord is not terminated with a plug: attach a plug appropriate to the facility and local electrical power code.

Section G: Power Connections and Voltage Requirements

Overview

In this Section

System Power Requirements

The *THERMOSTREAM* System includes a 32 amp power cord, approximately 3 meters long.

For 60 Hz systems, the power cord is terminated in a standard 230 v plug.

For 50 Hz systems, the power cord may not be terminated with a plug: if necessary, attach a plug appropriate to the facility and local electrical power code.

Power Requirements

The System's model number, serial number and power requirements, are listed on the rear panel name plate.

Verify that your facility's line voltage and frequency matches the requirements listed on the System's rear panel name plate.

INSERT REFERENCE INFO HERE INCLUDING HOW TO READ THE PART # DIGITS.

Nameplate (volts)	Facility Requirements (volts)
208	200 - 214
220	215 - 224
230	225 - 234
243	235 - 250
Nameplate (Hz)	**Facility Requirements (Hz)**
50	48 - 52
60	58 - 62
Nameplate (Amps)	**Facility Requirements (Amps)**
20	20 minimum
30	30 minimum

ATTENTION

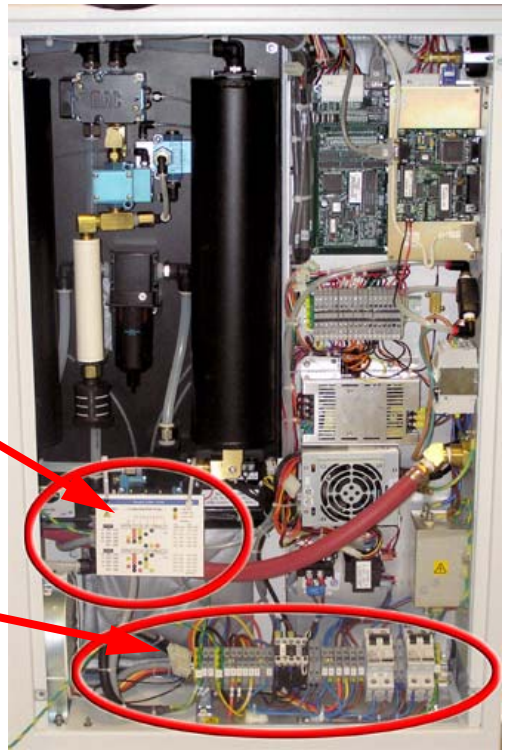
If your Facility power does NOT match the Nameplate, the internal Auto-Transformer will have to be re-configured.

To Re-Configure the Auto Transformer

Electrical Hazard

Only qualified service personnel familiar with the electrical shock hazards present inside the equipment should perform any disassembly or corrective maintenance.

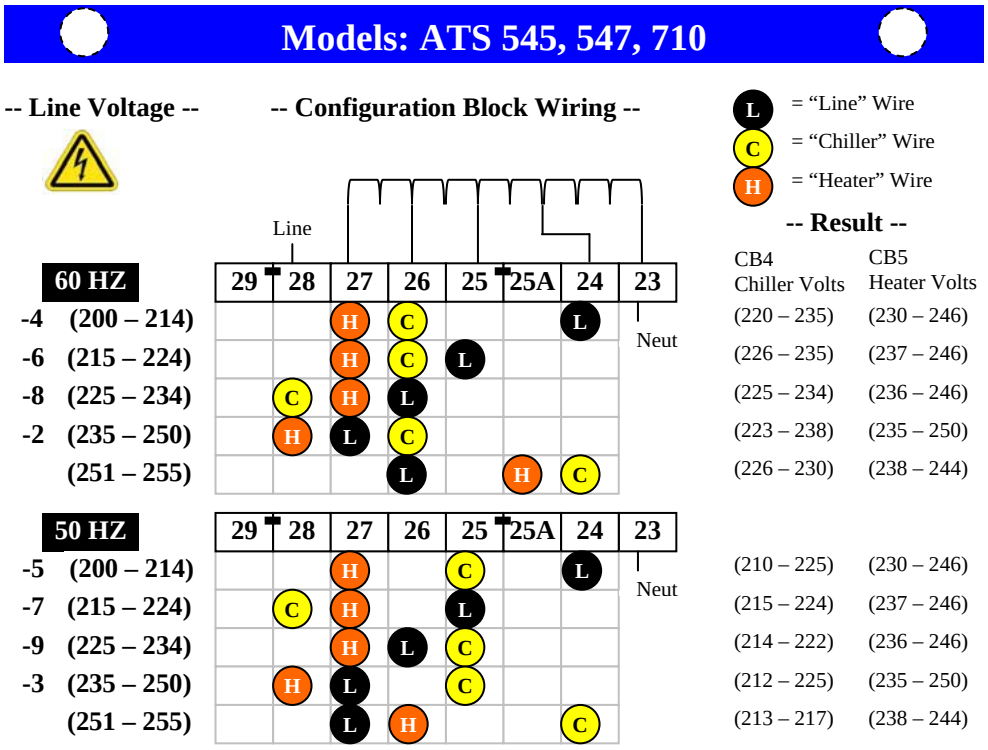
Re-Configure the Transformer

Step	Action
1	Power down the system and disconnect the Main Power cord and Main Air Supply.
2	Remove the right side panel. To remove the panel: 1. Unscrew the four quarter-turn locking screws. 2. Gently pull the panel outward several inches, without damaging the ground wire (which is attached to the panel). 3. Detach the protective ground wire; be careful to reconnect the ground wire upon re-assembly.
3	Locate the High Voltage rail and Voltage Configuration Card: 

Step	Action
4	Use the Voltage Configuration Card to re-configure your system according to your new input line voltage and frequency. 1. On the card's left side, find the Frequency and Voltage that matches your facility power. 2. Configure the "H" (orange), "C" (yellow), and "L" (black) wires in the terminal blocks as shown on the card.
5	Once you have re-configured the Auto Transformer, you **MUST** change the system's rear panel name plate. If needed, contact Temptronic for a new nameplate.

Voltage Configuration Cards

ATS-710 Voltage Configuration Card

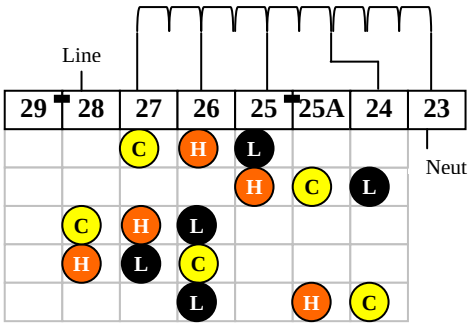


ATS-730, 750, 770 Voltage Configuration Card

Models: ATS 730, 750, 770

-- Line Voltage --

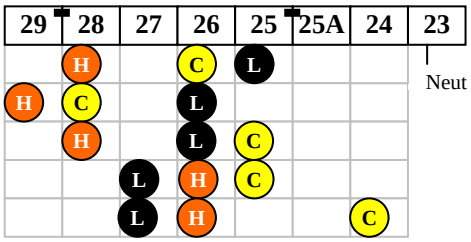
-- Configuration Block Wiring --



L = "Line" Wire
C = "Chiller" Wire
H = "Heater" Wire

-- Result --

60 HZ	CB4 Chiller Volts	CB5 Heater Volts
-4 (200 – 214)	(220 – 235)	(210 – 225)
-6 (215 – 224)	(226 – 235)	(226 – 235)
-8 (225 – 234)	(225 – 234)	(236 – 246)
-2 (235 – 250)	(223 – 238)	(235 – 250)
(251 – 255)	(226 – 230)	(238 – 244)



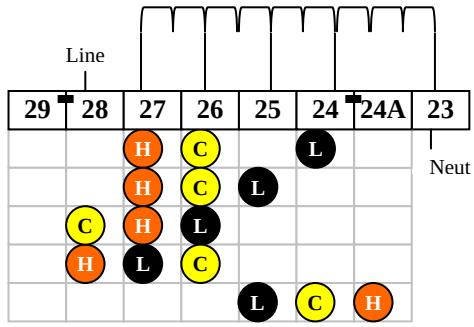
50 HZ	CB4 Chiller Volts	CB5 Heater Volts
-5 (200 – 214)	(210 – 225)	(204 – 214)
-7 (215 – 224)	(215 – 224)	(215 – 224)
-9 (225 – 234)	(214 – 222)	(225 – 234)
-3 (235 – 250)	(212 – 225)	(223 – 238)
(251 – 255)	(213 – 217)	(238 – 244)

ATS-810 Voltage Configuration Card

Models: ATS 645, 647, 810, 820

-- Line Voltage --

-- Configuration Block Wiring --



L = "Line" Wire
C = "Chiller" Wire
H = "Heater" Wire

-- Result --

60 HZ	CB4 Chiller Volts	CB5 Heater Volts
-4 (200 – 214)	(220 – 235)	(230 – 246)
-6 (215 – 224)	(226 – 235)	(237 – 246)
-8 (225 – 234)	(225 – 234)	(236 – 246)
-2 (235 – 250)	(223 – 238)	(235 – 250)
(251 – 255)	(238 – 244)	(238 – 244)

ATS-830, 840, 850 Voltage Configuration Card

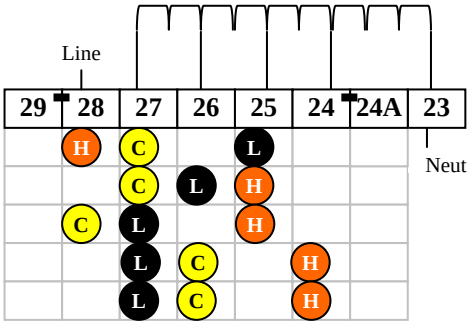
Models: ATS 830, 840, 850

-- Line Voltage --

60 HZ

-4	(200 – 214)
-6	(215 – 224)
-8	(225 – 234)
-2	(235 – 250)
	(251 – 255)

-- Configuration Block Wiring --

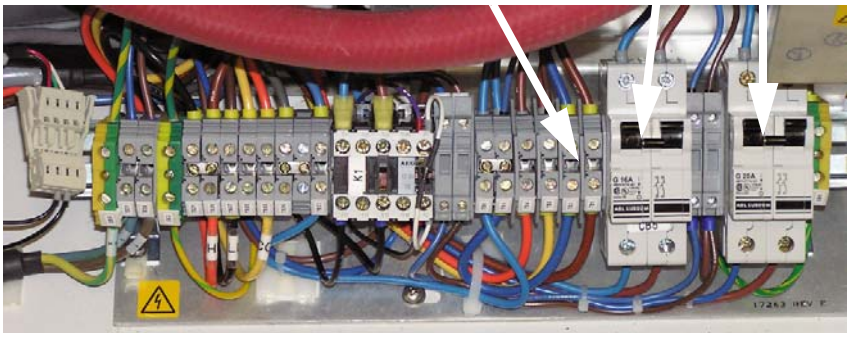


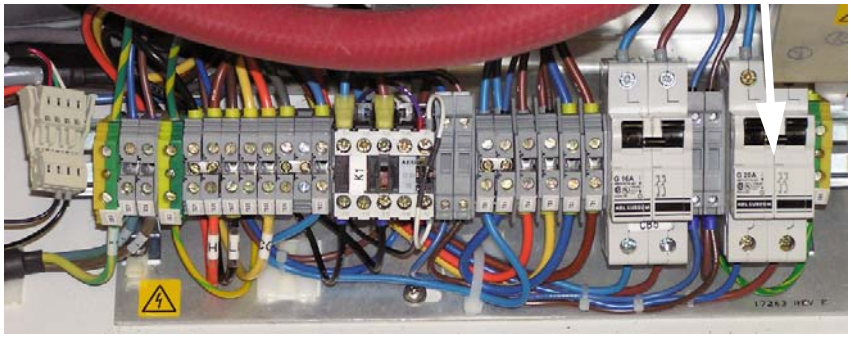
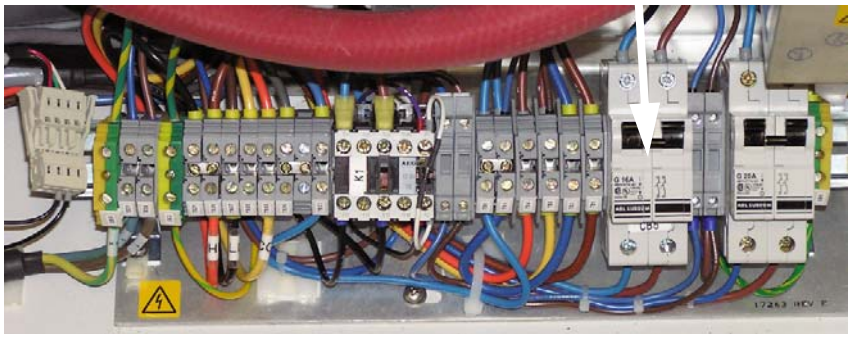
L = "Line" Wire
C = "Chiller" Wire
H = "Heater" Wire

-- Result --

CB4 Chiller Volts	CB5 Heater Volts
(220 – 235)	(200 – 214)
(226 – 235)	(204 – 213)
(225 – 234)	(203 – 211)
(223 – 238)	(200 – 213)
(238 – 244)	(213 – 217)

Testing the New Transformer Configuration

Step	Action
6	Turn BOTH CB4 and CB5 OFF. (downward position is OFF).
7	Plug in Main Power Cord. **DO NOT PRESS THE ON BUTTON ON THE SYSTEM FRONT PANEL. ONLY PLUG IN THE MAIN POWER CORD!**
8	Place CB1 in an ON position (upward position is ON). CB1 is the Main Breaker located on the system's rear panel.
9	Using a volt meter, measure the line voltage across TB1 and TB2. **TB2 and TB1** **CB5** **CB4** 

Step	Action
10	Using a volt meter, measure the Chiller voltage across the top two terminals of CB4. The Chiller voltage should be within the range specified on the right side of the Voltage Configuration Card. **CB4** 
11	Using a volt meter, measure the Heater voltage across the top two terminals of CB5. The Heater voltage should be within the range specified on the right side of the Voltage Configuration Card. **CB5** 
12	Once you have tested the voltages, place CB4 and CB5 into an ON position (upwards position is ON).

Connecting the Main Power

Procedure

CAUTION

CAUTION 3: Before connecting the *THERMOSTREAM* System to its electrical source, check that the ~ (ac) voltage and frequency to be supplied to the *THERMOSTREAM* System are correct for those listed on its data plate (located on system frame, rear panel).

To connect main power:

Step	Action
1	**IMPORTANT**: **at initial setup** check/set auto-transformer, before running: if the facility line voltage differs from that specified on the system rear panel nameplate, then the system **requires the auto-transformer to be configured for correct input voltage**. See Voltage Configuration Cards, page 2-21.
2	Plug the supplied, hardwired, standard, 3 meter long, line cord into a grounded power receptacle which is in accordance to the electrical code(s) of the system's location.
3	Place the rear panel Circuit Breaker (CB1) into the ON (upward) position.
4	After you have verified that the Auto Transformer is properly configured, run system as detailed in Chapter 3.

Section H: Air Connections

Overview

In this Section

Compressed Air Standards

The *THERMOSTREAM* System is supplied with a 3 meter long, 5/8-inch ID braid reinforced, rubber hose and its associated 1/2-inch NPT barb fitting and two hose clamps.

Compressed Air Requirements

Clean, Dry Air	Filtered to 5 micron particulate contamination
Supply Pressure	6.2 to 7.6 BAR (90 to 100 PSIG)
Total Air Flow Required	7.1 I/s to 14.2 l/s (15 to 30 scfm) 11.8 l/s (25 scfm) nominal
Air Supply Temperature	+20 to +25C (+23C nominal)
Operating Temperature	+20 to +28C (+23C nominal)
Humidity	0 - 60% (45% nominal)

Air Dryer

The air dryer is fully integrated into the *THERMOSTREAM* System pneumatics package. To enable air dryer function, simply connect the air supply.

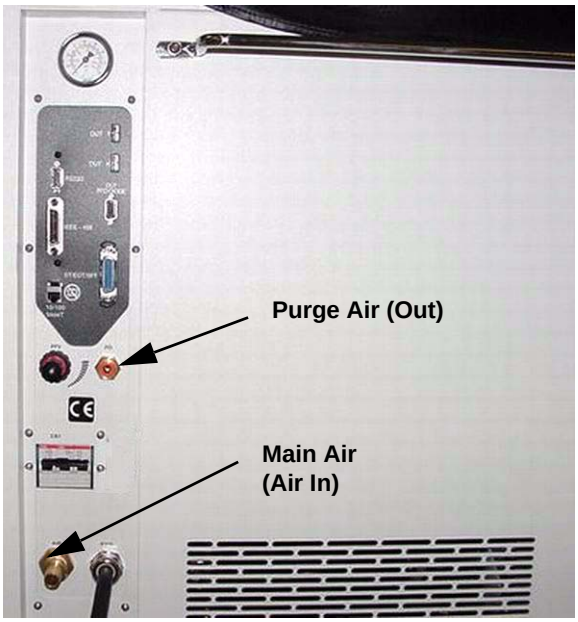
The supply flow must be capable of the specified minimum SCFM: a supply pressure below the minimum results in a reduced performance.

Connecting the Main Air Supply (Compressed Air)

Introduction

The *THERMOSTREAM* System is supplied with a 3 meter long, 5/8-inch ID braid reinforced, rubber air hose, two hose clamps, and two 1/2-inch NPT barb fittings.

Rear Panel, Air Connections



Procedure

To connect the system to a compressed air supply:

Step	Action
1	A 1/2-inch NPT barb fitting is pre-installed at the factory into the system rear panel, marked AIR.
2	Push the air hose over the rear panel AIR barb fitting and secure with a hose clamp (supplied).
3	Connect other end of air hose to the facility compressed air supply and secure with a hose clamp (supplied).
4	The facility air supply should have a dedicated shut off valve to allow the system to be isolated from the air supply without disconnecting the hoses during routine maintenance procedures.

Connecting Purged Air

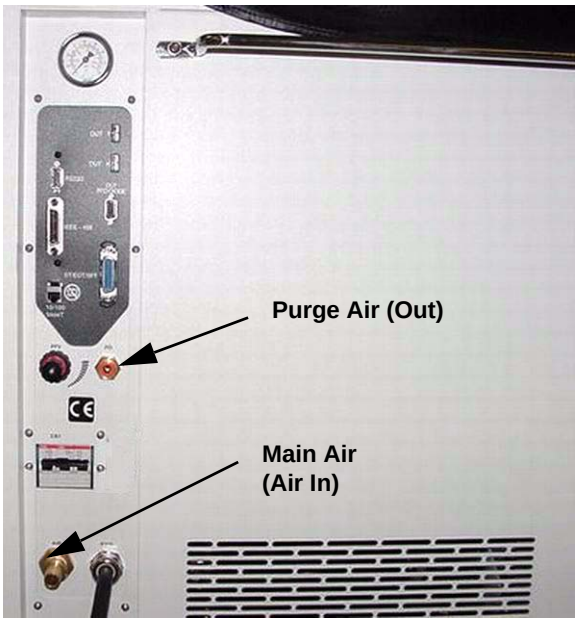
Introduction

To protect the tester platform (test board) and its test cables, socket lead wires and related interconnections from moisture related problems, do the following:

direct dry, ambient, purge air from the system rear panel Purge Out (PO) port as required.

For detail on how to protect the tester site, see Static, Moisture, and Extreme Temperature Protection, page 2-43.

Rear Panel, Air Connections



Procedure

Step	Action
1	Attach the quick disconnect fitting on the end of the supplied purge air hose to the rear panel Purge Out (PO) port.
2	Direct the other end of the purge air hose to the area to be purged.
3	Use the rear panel Purge Flow Valve (PFV) to adjust purge air flow.

Section I: Rear Panel I/O Ports

I/O Ports Overview

Descriptions

PART	DESCRIPTION
RS232C	RS232 Serial Communications I/O port
IEEE-488	IEEE General Purpose Interface Bus (GPIB)
10/100 BaseT	Ethernet Communications I/O port (RJ45) **ATTENTION** This port does NOT accommodate a standard telephone interface (RJ11, RJ12).
DUT T	Interface for a Type T thermocouple
DUT K	Interface for a Type K thermocouple
DUT RTD/Diode	Interface for an RTD/Diode sensor.
ST/EOT/SFF	Start Test/End of Test/Stop First Fail/ Communications port.

PART	DESCRIPTION
Input Air Pressure Gauge	Monitors the pressure of the compressed air being supplied to the system.
Purge Flow Valve (PFV)	Used to adjust the flow of the Purge Air Out.
Purge Air Out (PO)	Supplies clean, dry air to the Tester Platform. The purged air is used to protect platform components from moisture related problems.

Section J: Interfacing and Attaching Thermocouples

Overview

In general, there are two functional modes available in which to operate the *THERMOSTREAM* System. Both modes allow test setup and test running.

The two functional modes are:

Air mode: which uses the main airstream temperature as primary control

DUT mode: an external temperature sensor (thermocouple or RTD) interfaced directly to the DUT monitors DUT temperature and permits DUT tuning. In DUT mode, primary control can be 1) use main air temperature, above, or 2) use the DUT temperature monitored by the external sensor.

A thermocouple and/or RTD sensor can be defined as follows:

Thermocouple: a temperature measurement sensor which consists of two dissimilar metals joined together at one end (a junction) which produces a small thermoelectric voltage when the junction is heated. The change in thermoelectric voltage is interpreted by thermocouple thermometers as a change in temperature.

Resistance Temperature Detector (RTD) sensors operate on the principle of change in electrical resistance in wire as a function of temperature. An RTD probe is an assembly composed of an element (the actual temperature sensing unit), a sheath, lead wire(s), and a termination or connection.

For purposes of this manual, the term “thermocouple” may apply to RTD sensors as well.

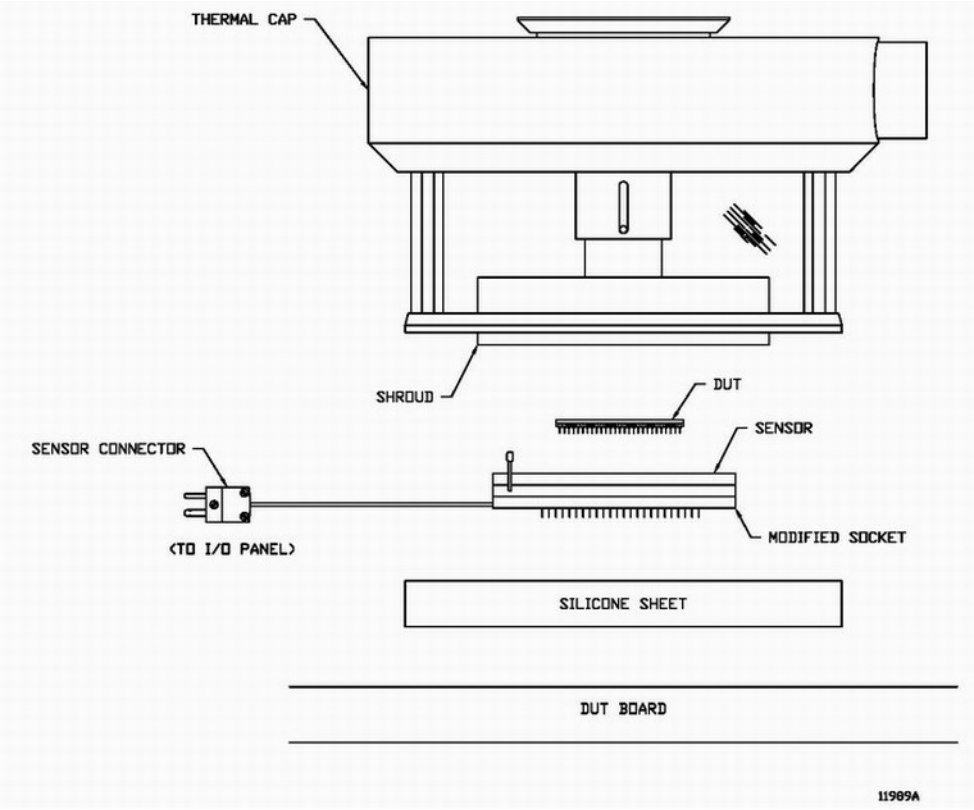
In this Section

Sensor Interface Guidelines

Introduction

The system permits the DUT to be placed within the temperature control loop (see illustration below) by accepting input from an external thermocouple or external RTD temperature sensor.

DUT Test Fixture Interface



Interfacing Guidelines

Follow these **sensor interfacing guidelines**:

1. All materials used in fixturing should be capable of withstanding the total system specified temperature range as listed in the System Specification.
2. The DUT sensor must be located within the test fixture, be in contact with the DUT, and be properly connected to the appropriate Input/Output port. When installing the thermocouple plug at the system I/O Panel port, take care to observe thermocouple connector polarity.
3. The sensor should be durable, be of low mass to retard thermal conductivity, have reasonable surface contact area, and be mounted such that it is thermally isolated from the socket to eliminate heat sinking.
4. The fixturing should ensure repeatable contact with the DUT.
5. The tested device body should not contact the socket body.
6. **Do not ground the sensor:** if the DUT case is grounded, then isolate the sensor by using a material which is electrically nonconductive but is an excellent thermal conductor.
7. Allow only the thermocouple junction to contact the bottom center of the DUT to minimize heatsinking.*

8. Mount the sensor beneath the DUT to shield it from high velocity *THERMOSTREAM* System air.
9. If the sensor is mounted on top of the device and is in the airstream, then time/temperature measurement will not be the required DUT temperature but be some weighted average of both device and air temperatures.
10. Use silicone rubber as an insulated base on which the test socket is centered and mounted; make the base large enough to accommodate the Thermal Cap for proper sealing (see Insulation (Minimizing Heat Conductivity), page 2-47).
11. When modifying the test socket to accept temperature sensors (per the supplied drawings), care should be taken to prevent any stress in the sensor lead wires.

*To interface a specific thermocouple (Type T, Type K) or a RTD/Diode sensor, see the next subsections.

To interface a non-standard sensor, see Non-Standard Thermocouples, page 2-41.

T-Type Sensors

Introduction

Two T-type (Copper/Constantan) thermocouple assemblies are supplied with the system: a disc style and a spring style.

The **disc style assembly** features a circular sensor element to contact the DUT underside.

The **spring style assembly** features a narrow rectangular sensor element mounted on a spring to contact the DUT underside.

The disc style tends to contact a larger DUT surface area than the spring style and is more responsive than the spring style (approximately 2x to 3x faster): it should be used if test speed and device throughput are critical.

The spring style, however, is more rugged than the disc style, and if spring style response time is adequate for the application, then the spring style may be a better choice.

Disc Style

To interface the factory supplied T-type disc style thermocouple, follow these steps in accordance with the Sensor Interface Guidelines, page 2-33.

Install the sensor element on the DUT test socket to contact the DUT when inserted in the socket. See Typical Test Socket (Disc Type), page 2-36.

Plug the connector on the other end of the thermocouple wiring into the “DUT T” port on the system I/O Panel.

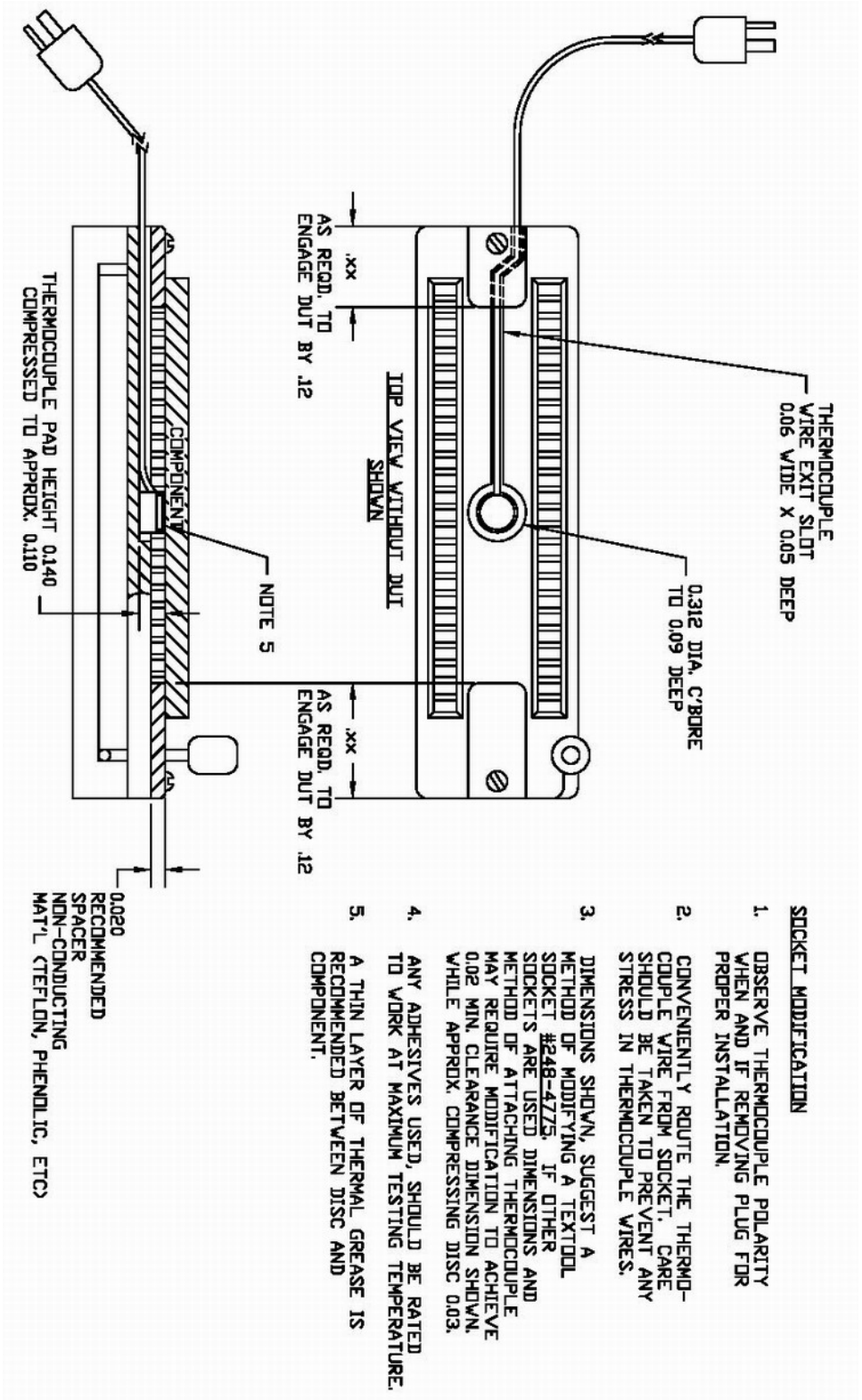
Spring Style

To interface the factory supplied T-type spring style thermocouple, follow these steps in accordance with the Sensor Interface Guidelines, page 2-33.

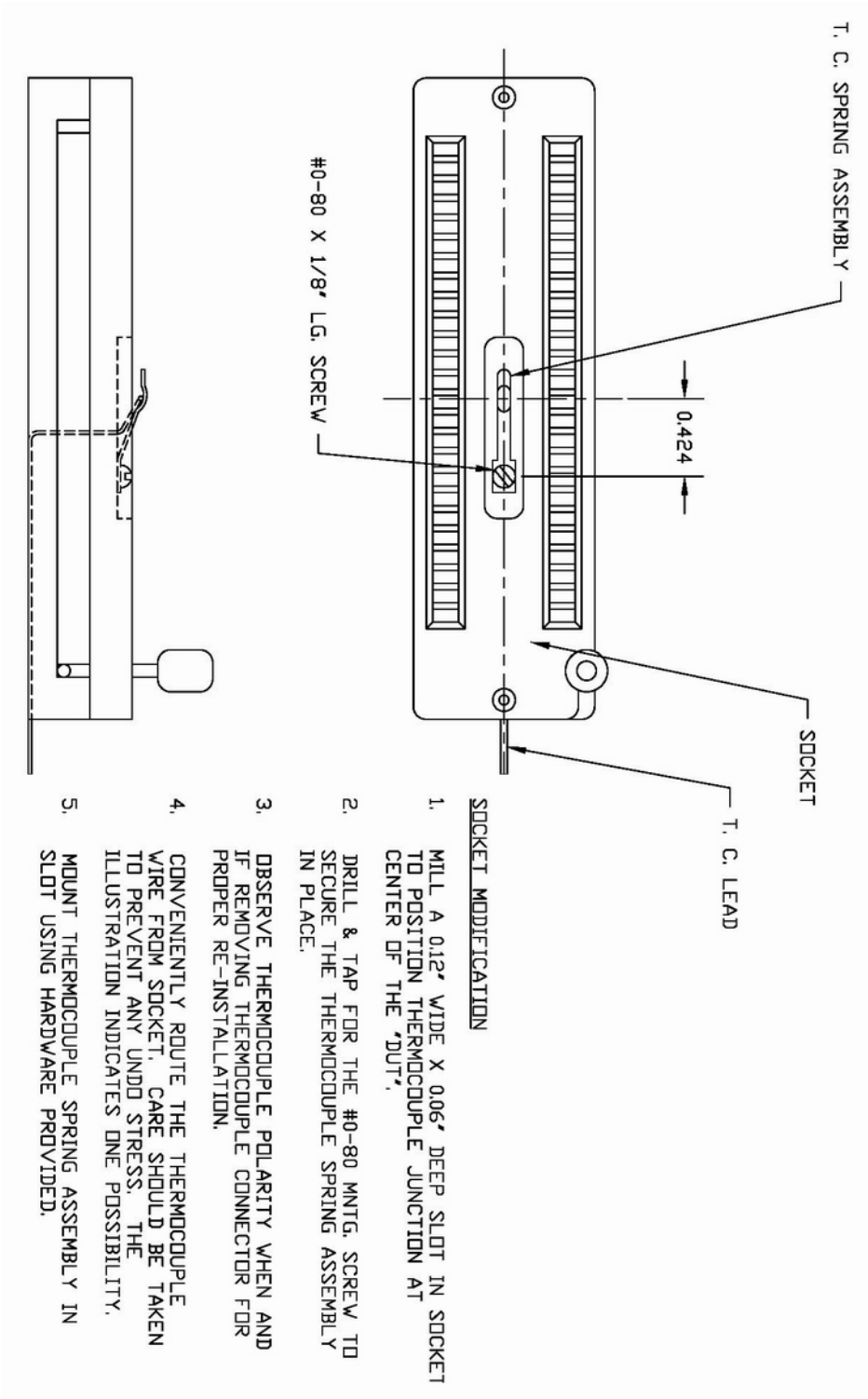
Install the sensor element on the DUT test socket to contact the DUT when inserted in the socket.See Typical Test Socket (Spring Type), page 2-37.

Plug the connector on the other end of the thermocouple wiring into the “DUT T” port on the system I/O Panel.

Typical Test Socket (Disc Type)



Typical Test Socket (Spring Type)



SOCKET MODIFICATION

1. MILL A 0.12" WIDE X 0.06" DEEP SLOT IN SOCKET TO POSITION THERMOCOUPLE JUNCTION AT CENTER OF THE "DUT".
2. DRILL & TAP FOR THE #0-80 MNTG. SCREW TO SECURE THE THERMOCOUPLE SPRING ASSEMBLY IN PLACE.
3. OBSERVE THERMOCOUPLE POLARITY WHEN AND IF REMOVING THERMOCOUPLE CONNECTOR FOR PROPER RE-INSTALLATION.
4. CONVENIENTLY ROUTE THE THERMOCOUPLE WIRE FROM SOCKET. CARE SHOULD BE TAKEN TO PREVENT ANY UNDO STRESS. THE ILLUSTRATION INDICATES ONE POSSIBILITY.
5. MOUNT THERMOCOUPLE SPRING ASSEMBLY IN SLOT USING HARDWARE PROVIDED.

K-Type Sensors

Introduction

To interface an operator supplied K-type (Chromel/Alumel) thermocouple, follow these steps in accordance with the Sensor Interface Guidelines, page 2-33.

1. Install the sensor element according to the detailed instructions supplied by the thermocouple vendor:
   the sensor element must be installed on the DUT test socket to contact the DUT when the DUT is inserted in the socket.
2. See the Drawings referenced for T-type factory supplied thermocouples, above, and follow the concepts therein to modify the test socket.
3. Plug the connector on the other end of the thermocouple wiring into the "DUT K" port on the system I/O Panel.

RTD-Type Sensors

Introduction

To interface an operator supplied RTD Resistance Temperature Detector sensor, follow these steps in accordance with the Sensor Interface Guidelines, page 2-33.

1. Use a 100 ohm RTD with a temperature rating range of -100 °C to 250 °C, minimum.
2. Install the sensor element according to the detailed instructions supplied by the RTD sensor vendor: the sensor element must be installed on the DUT test socket to contact the DUT when the DUT is inserted in the socket.
3. See the Drawings referenced for T-type factory supplied thermocouples, above, and follow the concepts therein to modify the test socket.
4. Plug the connector on the other end of the sensor wiring into the “RTD/Diode” port on the system I/O Panel.

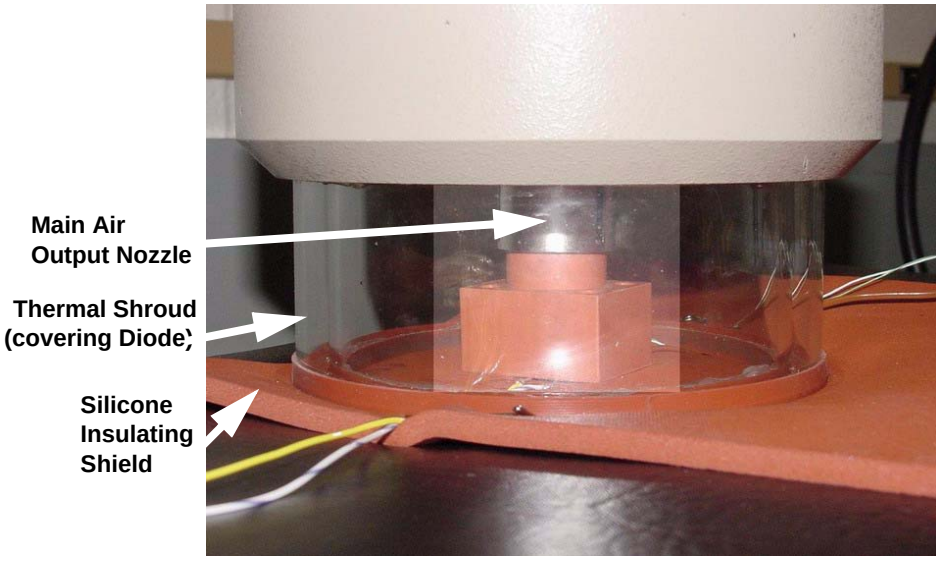
Diode-Type Sensors

Introduction

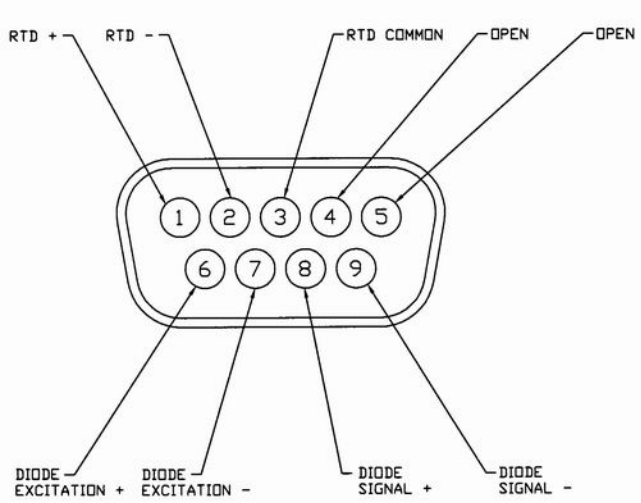
To interface an operator supplied Diode sensor, follow these steps in accordance with the Sensor Interface Guidelines, page 2-33.

1. Use a Diode with a temperature range greater than the desired temperature testing range.
2. Install the sensor element according to the detailed instructions, and/or wiring diagram, supplied by the Diode sensor vendor.
3. Use a thermal shroud to cover the Diode sensor within the Head Thermal Cap.
4. To plug in the connector on the end of the sensor's wiring:
   - jump positive pins 6 and 8 to the Diode's positive anode; and jump negative pins 7 and 9 to the Diode's negative cathode.
5. The diode current is 10 mA (milliamps) fixed.

DUT Diode Sensor (with Shroud and Thermal Cap)



RTD/Diode Pinouts



Non-Standard Thermocouples

Introduction

Proper thermocouple to DUT contact is essential to insure accurate temperature sensing.

If the techniques given above (how to use the factory supplied socket/fixture(s) to attach Type T, Type K, RTD/Diode sensors) are considered "standard" thermocouple and “standard" sensor to DUT attaching techniques, then below are offered "non-standard" or "alternate" techniques: first, how to construct a thermocouple; second, how to attach it.

NOTE: To enable testing, a socket/fixture must still be used, to apply power to the DUT circuits.

To properly construct a Type T thermocouple:

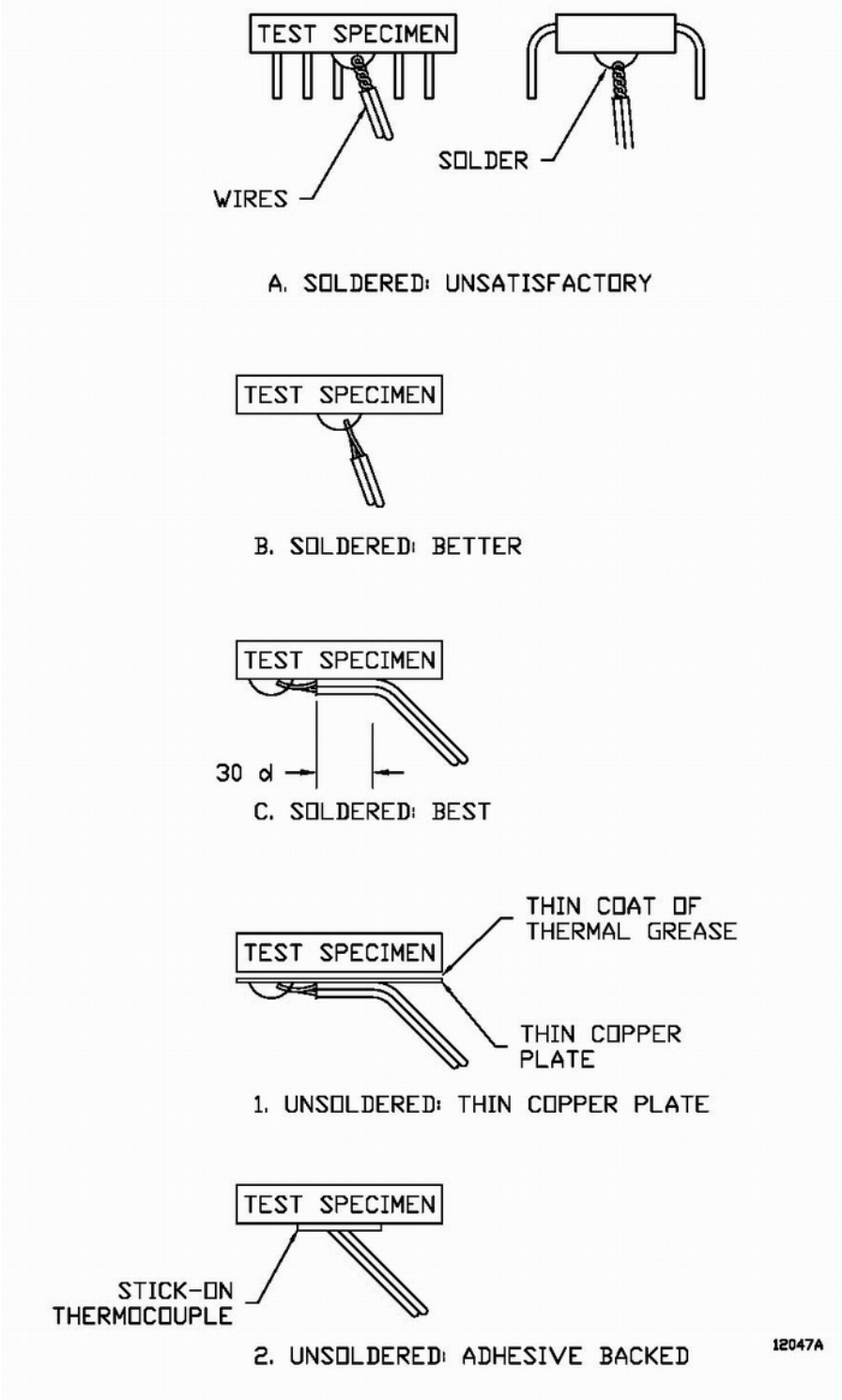
1. Use a small gauge (#26, #28, #30, or #36 gauge) teflon or kapton coated copper-constantan thermocouple wire.
2. Using wire thicker than #36 gauge (0.005 inch / 0.013 mm) conducts excessive heat between the test specimen DUT and the ambient, resulting in inaccurate temperature measurements.
3. Make the thermocouple junction as small as possible.

To properly attach a thermocouple, using alternate techniques:

1. Review the Sensor Interface Guidelines, page 2-33.
2. Follow the table and illustration below.

Alternate Techniques to Attach Thermocouples

Alternate Techniques to Attach Thermocouples	
SOLDERED ATTACHMENT	
A	UNSATISFACTORY: Sensor only contacts solder; no direct sensor to DUT contact
B	BETTER: Sensor directly contacts DUT, but sensor wire is exposed to ambient air
C	BEST: Both sensor junction and sensor wire directly contact DUT; sensor wire to DUT contact should be at least 30 times diameter of sensor wire
UNSOLDERED ATTACHMENT	
1	THIN COPPER PLATE: attached to DUT with thin film of thermal grease
2	ADHESIVE BACKED: sensor "sticks on" to DUT with adhesive


TEST SPECIMEN
SOLDER
WIRES
A. SOLDERED: UNSATISFACTORY
TEST SPECIMEN
B. SOLDERED: BETTER
TEST SPECIMEN
30 d
C. SOLDERED: BEST
THIN COAT OF THERMAL GREASE
TEST SPECIMEN
THIN COPPER PLATE
1. UNSOLDERED: THIN COPPER PLATE
TEST SPECIMEN
STICK-ON THERMOCOUPLE
2. UNSOLDERED: ADHESIVE BACKED
12047A

Section K: Static, Moisture, and Extreme Temperature Protection

Overview

Temperature transition times are dependent on mass, specific heat characteristics, thermal coupling and thermal conduction paths to the DUT, test socket, test leads, and other fixturing features.

This section offers how to optimize test site setup as follows:

1. Protect the test site from the buildup and discharge of static electricity.
2. Prevent moisture infiltration at the DUT/socket and condensation buildup on the tester platform and cables, the latter to prevent icing.
3. Minimize undesired heat transfer at the DUT site to increase test efficiency and protect tester board components from temperature extreme damages.

To use one of Temptronic's standard configured, or application-specific, custom configured thermal test enclosures, see MobileTempTM Series ThermoChambers (page 2-49).

In this Section

Electrostatic Discharge (ESD) Protection

Component damaging static electricity can be generated in the normal course of handling sensitive electronic products, principally when two non-conductive surfaces are either rubbed together or separated. Such an electrostatic discharge (ESD) can also be generated by the discharge of compressed air on inert gases over a surface. Although ESD can be generated at low air jet velocity, ESD is more likely to be generated increasingly at higher, sustained air jet velocities.

The airflows through *THERMOSTREAM* pneumatics have been extensively researched and designed to provide ionically neutral air (free of static charge) at the head air nozzle output onto the DUT test fixture, so long as the guidelines presented in this manual are implemented.

When evaluated with field meters and probes, the electric field, in the vicinity of the temperature controlled air discharged from the *THERMOSTREAM*nozzle, does not indicate the presence of significant or measurable number of charged particles in the jet.

The air flows through the *THERMOSTREAM* System are fully grounded from the air inlet to its air nozzle output. Also, when the optional conductive shroud kit (for interfacing to the DUT) is used with the standard (factory supplied) conductive metal thermal cap, an “ESD Protected Test Environment” is assured.

It is not normally necessary to add air ionizer equipment to the fixture site to provide ionically neutral air.

Note, however, that relative humidity has a significant impact on the generation of static electricity, and that the next topic, “Moisture Protection” is a factor directly related to ESD control.

Moisture Protection

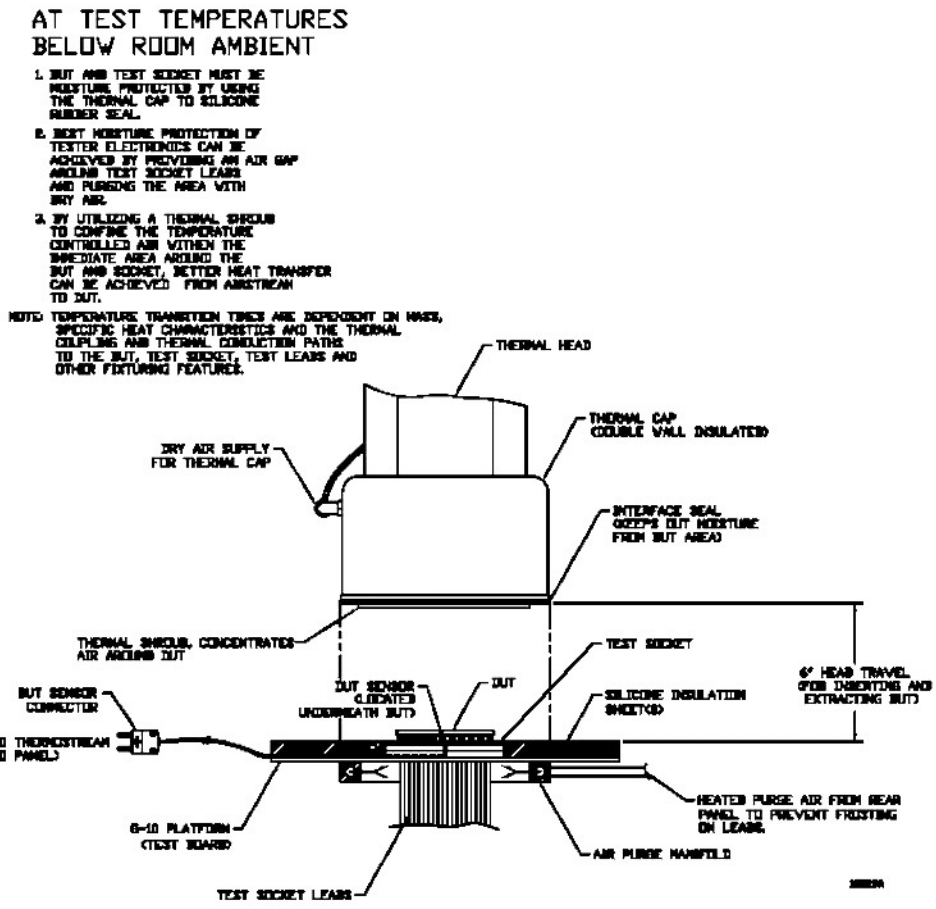
Introduction

With reference to the typical test site, there are two principal areas to protect from moisture:

1. The DUT and the test socket in which the DUT is seated (the area below the thermal cap onto which *THERMOSTREAM* air is directed).
2. The tester platform (test board) and its test cables, socket lead wires and related interconnections (normally exposed to room air temperatures).

See below for how to insulate the DUT and Socket, and how to use purge air for the tester platform area.

Typical Test Site (Head, Cap, Shroud, DUT, Air Purge Manifold)



Insulating the DUT and Socket

Although the pneumatic design and conditioning of the *THERMOSTREAM* System airflows works to deliver dry air to the DUT within or below the thermal cap, it is necessary to provide a tight seal between the lower edge of the thermal cap and the upper surface of the tester platform.

To make a tight seal, install the provided silicone foam insulating material onto the tester platform surface, as is described in Insulation (Minimizing Heat Conductivity), page 2-47.

Air Purging the Tester Platform

Condensation, frost and ice can appear on the tester platform (test board) and its test cables, socket lead wires, and related interconnections, during low temperature testing unless the platform area is properly purged with system-supplied dry air as given below.

For instance, if the tester platform is exposed to ambient room air which has a dew point on the order of 15 °C, and if the *THERMOSTREAM* outlet air is at a low temperature, then thermal conduction and forced convection can cause condensation, frosting and/or icing to appear on the tester cables.

The best way to prevent these conditions is to provide an air gap around the tester platform lead wires and cables and to purge the area with dry air.

The *THERMOSTREAM* System supplies dry purge air from an air purge outlet "PO," located on the frame module back panel, as is the purge flow valve "PFV."

The purge air can be directed to where condensation is to be prevented (see Connecting Purged Air, page 2-29).

At low temperatures, *THERMOSTREAM* airflow has a very low dew point. Since it is very dry, condensation within the thermal cap is not a concern.

Also, Temptronic can provide either standard or custom thermal test enclosures for your test site (see MobileTempTM Series ThermoChambers, page 2-49).

Insulation (Minimizing Heat Conductivity)

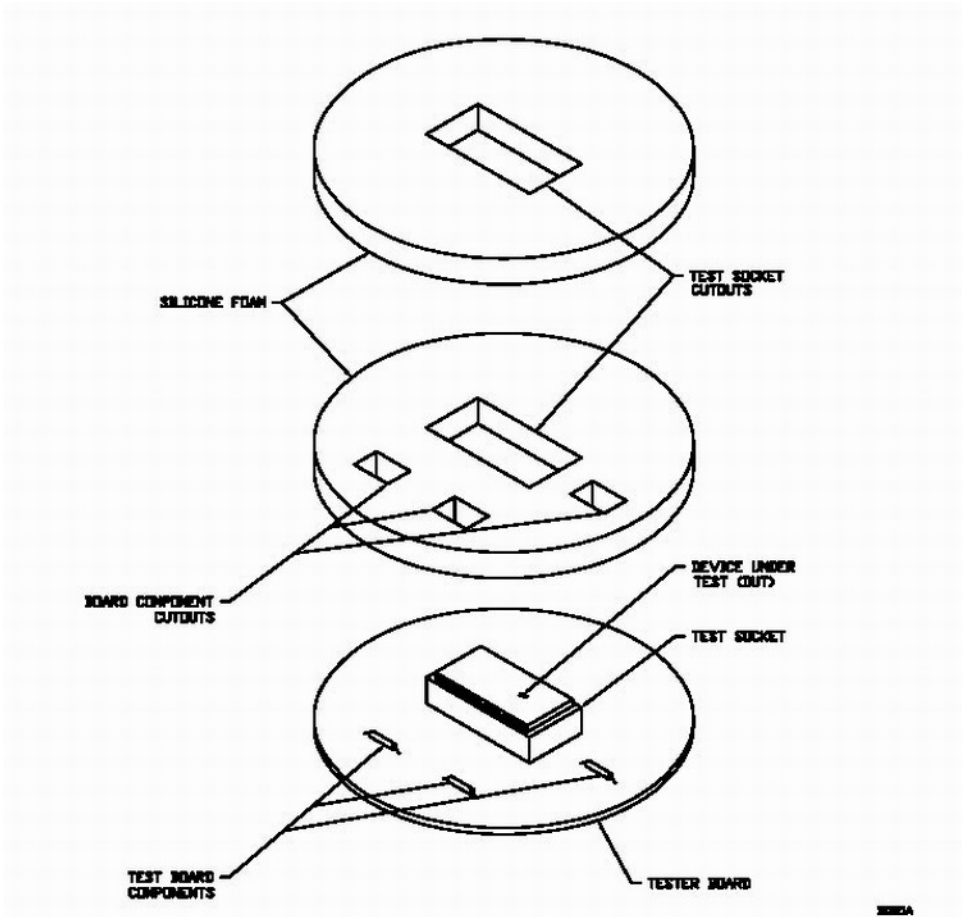
Before the testing of devices is initiated, at either elevated and/or reduced temperatures, the DUT site should be carefully prepared by inserting insulation materials to minimize undesired paths of heat transfer and to reduce moisture inflows to the DUT site:

1. Minimize heat transfer by thermal conductivity from the DUT socket site (within the thermal cap) to the external test equipment to increase efficiency (and reduce moisture infiltration).
2. Protect components on the tester board in the vicinity of the DUT from the temperature extremes of the *THERMOSTREAM* air flow.

As mentioned earlier, utilizing a thermal shroud confines the temperature controlled air within the immediate area around the DUT and socket (see Attaching the Thermal Cap and Shroud, page 2-14).

Temperature transition times, however, are dependent on mass, specific heat characteristics and the thermal coupling and thermal conduction paths to the DUT, test socket, test leads, and other fixturing features. To minimize conductivity, fit and seal insulation materials as given below.

Insulation Kits, Fitting and Sealing



Each *THERMOSTREAM* System is supplied with a standard insulation kit (P/N ZAK40480) which contains three sheets (1/8-, 1/4-, and 1/2-inch thick) of 12-inch square silicone foam material.

The silicone material combines the property of low thermal conductivity with the added feature of elasticity. Cut to fit snugly around a given component configuration, thereby forming a seal to minimize heat transfer.

Should more insulation material be required, an optional insulation kit (P/N SA22450) contains three sheets (1/8-, 1/4-, and 1/2-inch thick) of 18-inch square silicone foam material.

Both of these optional kits come with RTV adhesive. For separate pieces of available foam material and adhesive, contact the inTEST Thermal Solutions Service Department. For convenience, pieces and sheets of the silicone foam may be cemented together with an RTV adhesive.

Section L: MobileTemp™ Series ThermoChambers

ThermoChambers

Temptronic's Mobile Temp™ Systems combine our *THERMOSTREAM* product with our exclusive high speed ThermoChambers™ to offer environmental test systems with the fastest, most uniform temperature control in the industry. These portable, compact packages enable temperature test at the test location and are ideal for small lot qualification, burn-in, temperature cycling, and research & development.

Features of the ThermoChambers include:

- Hood, clamshell, and front load style chambers available
- Detachable Chambers for remote operation at test site
- No LN2 or CO2 required
- -65 to +200C temperature range*
- Fast temperature change rates: up to 30C per minute*
- Superior Temperature Uniformity: +/- 0.5C
- Thermal control to within 0.1C
- Thermocouple ports
- Multiple cable access ports for power and signal lines

3 System Operation

Chapter Overview

Introduction

This chapter contains instructions for front panel (local) operation of the ATS-700 & -800 *Series THERMOSTREAM* Systems for “Medium” and “Full” Access level functions.

Remote system operation is discussed in Chapter 4, Remote Interfaces. Familiarity with front panel operation is recommended before attempting remote operation.

The *THERMOSTREAM* System operates in three modes, each of which allows test setup and test running:

1. **Air mode** (default): uses the main airstream temperature as primary control.

2. **DUT mode**: an external temperature sensor interfaced directly to the DUT monitors DUT temperature and permits DUT tuning. In DUT mode, primary control can be 1) to use main air temperature or 2) to use the DUT temperature monitored by the external sensor.

3. **TC Meter Mode:** controls the temperature of the main air with an offset in order to reach the desired temperature on the DUT. TC Meter Mode allows the user to control the temperature of the DUT without interfacing an external temperature sensor.

In this Chapter

This Chapter is divided into the following Sections:

Section A: Thermal Head and Manipulator

Overview

In this Section

The following topics are covered in this Section:

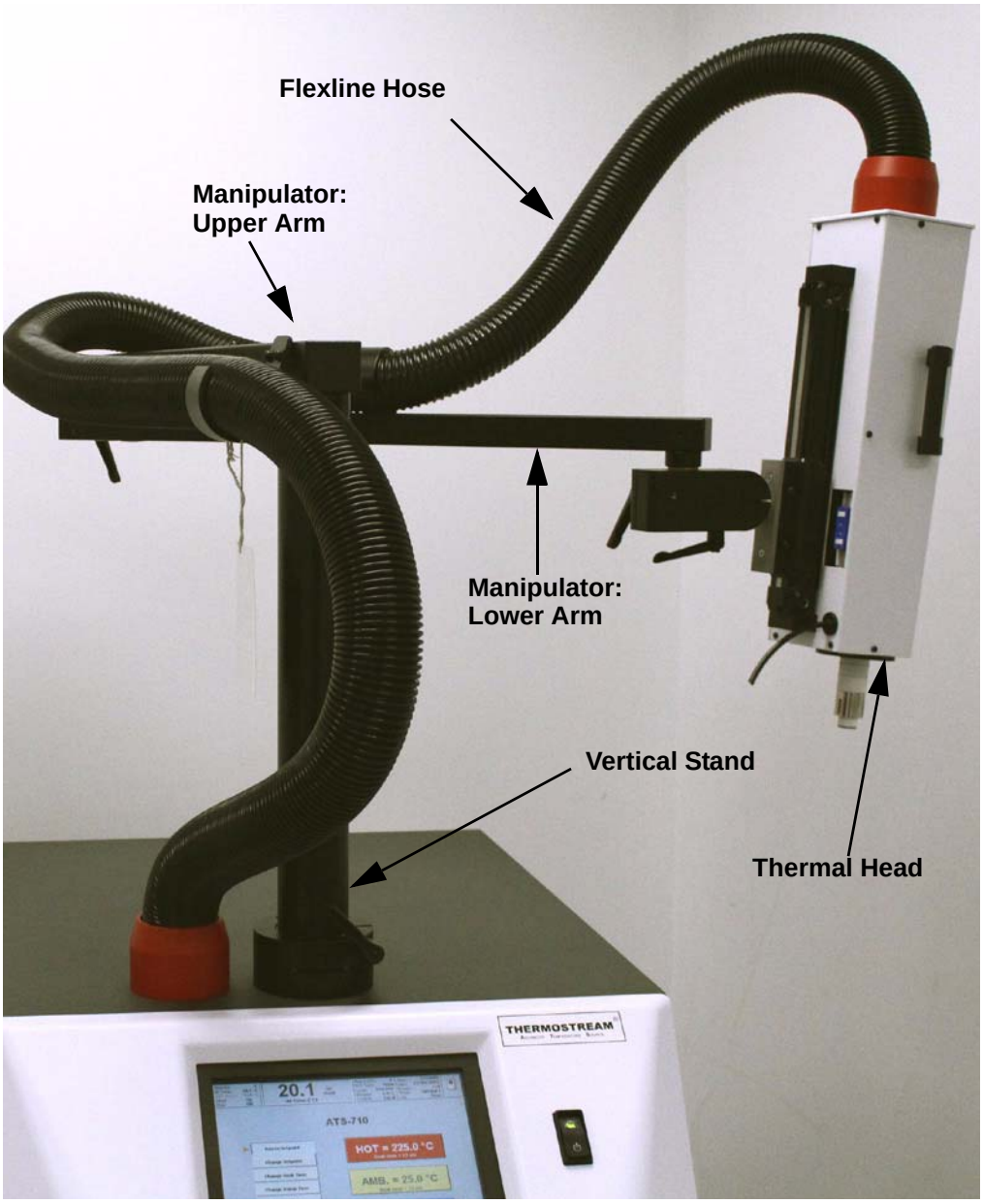
Head and Manipulator Introduction

The Thermal Head is mounted to the manipulator assembly (vertical stand and hinged arm configuration). It allows the Head to be positioned as required near to the DUT site.

The four mechanical locks on the manipulator allow the Head to be pivoted, turned, tilted, and vertically swung. These four types of motion enable the Head to be precisely aligned to the DUT site.

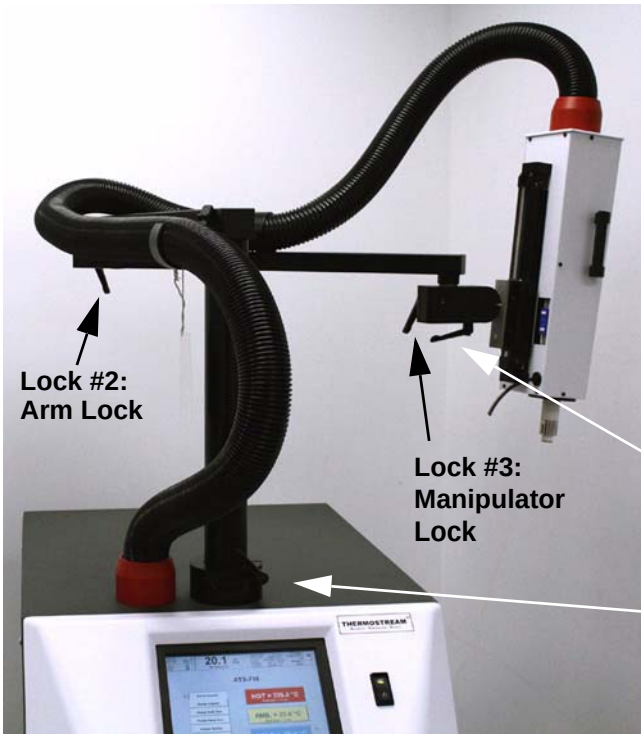
When initially setting up for testing, manually move and adjust the Manipulator and Head. Once the Head is manually positioned over the DUT site, use the electrical up/down controls to facilitate production testing.

Head and Manipulator Detailed



Manipulator Locks

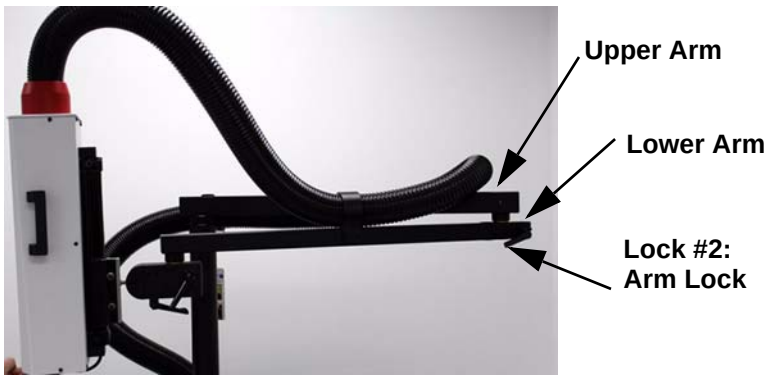
Locks Detailed



Lock#1: Vertical Stand Lock

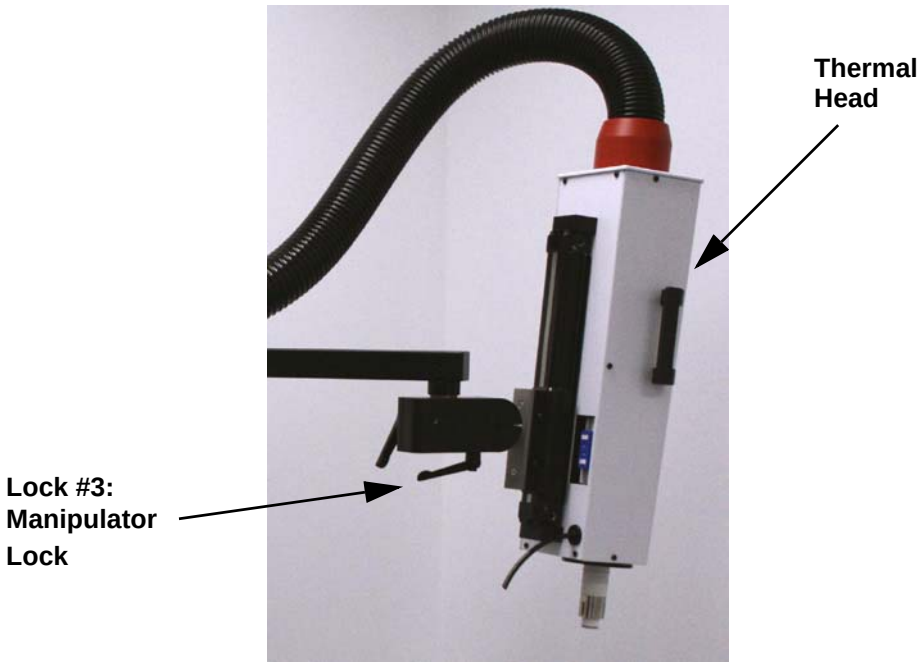
Tighten lock to a) clamp horizontal sweep movement of the manipulator upper arm, and b) to disable the **STAND UP** ↑ and **STAND DOWN** ↓ buttons. When tightened, the Vertical Stand Lock loosens/tightens movement of the vertical stand.

Lock #2: Arm Lock



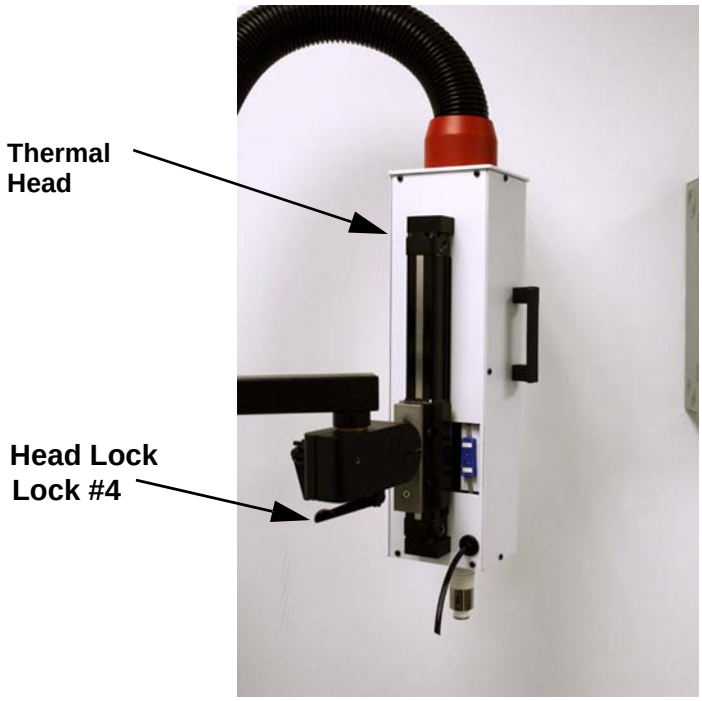
Tighten lock to clamp any horizontal pivot movement of the manipulator lower arm. When tightened, the Arm Lock locks horizontal motion of arm.

Lock #3: Manipulator Lock



Tighten lock to clamp any forward/backward tilting, and/or vertical swinging of the Head. When loosened, the Manipulator Lock allows the thermal head to rotate around mechanical arm.

Lock #4: Head Lock



Tighten lock to clamp any horizontal pivoting (rotating, left to right, right to left) movement of the thermal head with respect to the manipulator. When loosened, the Head Lock allows the thermal head to pivot, tilt, and swivel.

Stand Motion: Up/Down

Introduction

The two directional "**STAND**" switches, up ↑ and down ↓, are located on the Thermal Head. These two switches raise and lower the vertical Stand post for a 16-inch vertical travel. The manipulator assembly (the lower and upper arms) is attached to the Vertical Stand post.

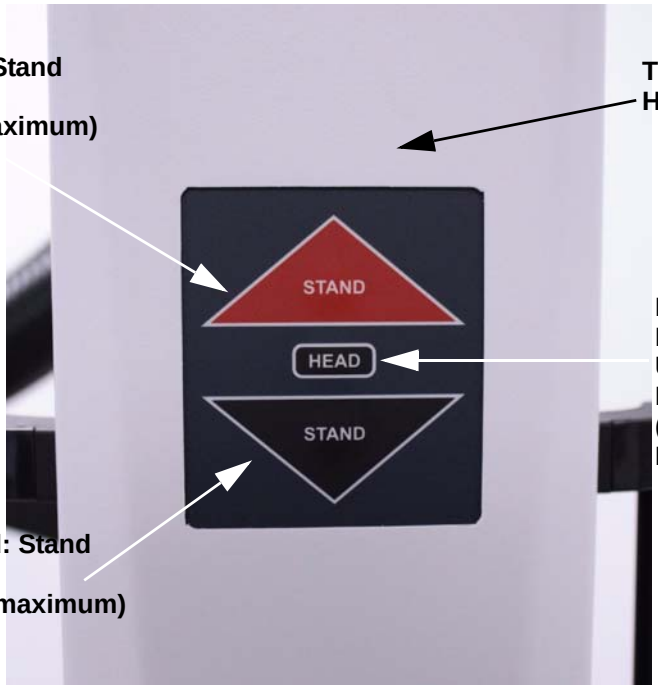
WARNING

WARNING 5: During the up/down motion of the *THERMOSTREAM* head, keep your fingers out of the space between the thermal cap (on the thermal head) and the DUT site.

CAUTION

CAUTION 4: Always hold the handle grips firmly on the head module while positioning the head and or arm.

.

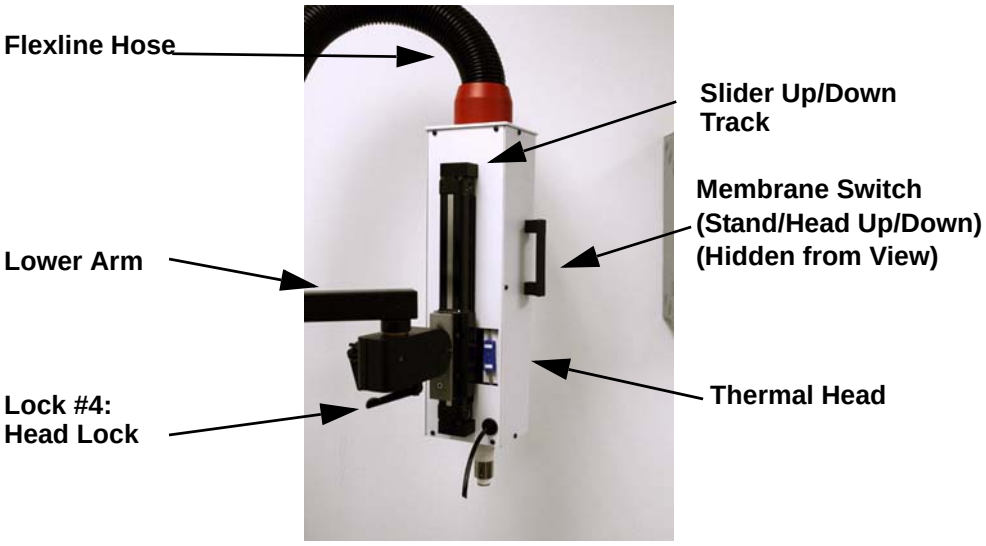


Generally, the manipulator (with the thermal Head in the down position) is lowered until the Head's thermal cap covers the DUT site.

NOTE: When the Vertical Stand Lock is tightened, the STAND up and down buttons are disabled.

Thermal Head Motion

Thermal Head Detailed



WARNING

See **Warning 5** and **Caution 4.**

Position the Head as follows:

The "**HEAD**" membrane switch raises or lowers the Thermal Head for a 6-inch travel:

- The Head moves up/down on a slide, located behind the Thermal Head.
- Pressing the "Head" switch toggles between the up and down 6-inch travel.
- When the Head travels up/down on the slide, this movement is independent of the Vertical Stand; the Stand post is not moved by toggling the "Head" switch.
- If Head up/down is "Locked" (see *Utilities Screen*), then:
  - The "Head" switch is disabled (will not move Head up/down on the slide)
  - To raise/lower entire Head, use "Stand" up/down arrow switches)
  - If, at test start, Head remains up (at the top of the slide), then entire Thermal Head assembly is lowered by using the Stand down arrow switch
  - If, at test end, Head remains lowered over the DUT (Head does not move on the slide), then raise entire Head assembly by using the Stand up arrow switch.

The **Default Motion/Flow** (factory wired) is:

- At test start, Head goes down, air is on.
- At test end, Head goes up, air is off.

To use the *THERMOSTREAM* System software to move the Head up/down, turn flow on/off, and to lock/unlock Head motion, see the *Utilities Screen*.

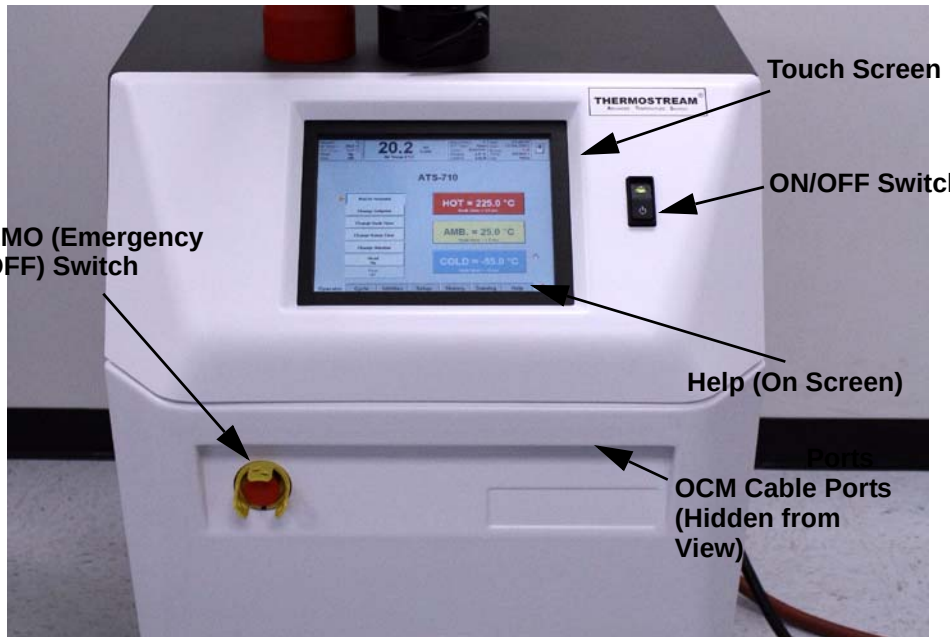
Section B: Operator Control Module (OCM)

Overview

In this Section

The following topics are covered in this Section:

OCM User Interfaces



Descriptions

PART	DESCRIPTION
Touch Screen	An approximately 10.4 inch (diagonal size) color touch screen for operator inputs. This graphical user interface allows non-technical individuals, production operators, and test engineers optimum ease of use with minimum training time. A touch screen LCD allows users local system access to operate, program, setup tests/see test results and calibrate sensors. **To use the touch screen**, place your finger on the display over the desired item and gently touch the screen surface as if pressing a button. A "pointing finger" insertion point indicates the spot being touched. A **gentle touch** is all that is required. Pressing down hard upon the screen surface does not cause the system to respond more quickly (or any differently) than does a gentle touch. If an alphanumeric field is touched, then an alphanumeric “keyboard” is displayed. See Touch Screen Alphanumeric “Keypad”, page 3-12. **DISPLAY:** The display shows the operational status of the *THERMOSTREAM* System. Typical operating menus show the programmed values (set points and soaks), and the resultant current values (Device Under Test (DUT) and *THERMOSTREAM* System temperatures, soak times, and cycle numbers). Additional menus are available for test setups, system configuration and operator maintenance.

PART	DESCRIPTION
OCM Cable Ports	The OCM Cable Ports installed on the system front panel, located within the top panel overhang, consist of ports for a Keyboard, mouse, USB connection (2), and printer. Keyboard Port: a DIN port (recessed and facing down) used to interface a keyboard. Mouse Port: a DIN port (recessed and facing down) used to interface a mouse. USB Port: (2) standard USB ports.
EMO Switch	Press the EMO to trip the back panel Circuit Breaker (CB1) and interrupt the power input to the *THERMOSTREAM* (shutting down the system) System.
Power ON/Off Switch	The system's on/off power switch. The indicator light illuminates when the system is on.
Help (On Screen)	An on-screen "HELP" button located on the lower right of the touch screen.

Touch Screen Alphanumeric “Keypad”

Alphanumeric “Keypad” Detailed

If an alphanumeric field is touched, then an alphanumeric “keypad” is displayed.

ALPHANUMERIC "KEYPAD"
Displayed at the top: the parent screen’s selected field name
Touch the desired character to display that character
Press "CAPS" to toggle between uppercase (capital) and lower case characters
Press the leftward pointing arrow key to delete, leftward, one character at a time
Press Clear ("C" key, below leftward arrow key), to clear all displayed characters
Press "OK" to save the displayed characters into the selected field of the original screen
Press "Cancel" to delete the displayed characters, and exit to the unchanged field of the original screen

Touch Screen Numeric “Keypad”

Numeric “Keypad” Detailed

If a numeric field is touched, then a numeric calculator style "keypad" is displayed.

NUMERIC "KEYPAD"
Displayed at the top: parent screen’s selected field name, its "current value," and the allowed input "limits" (out of range inputs disable the "OK" save key)
Touch the desired number to display that number
Press the +/- key to toggle from positive to minus
Press the leftward pointing arrow key to delete, rightward, one character at a time
Press the "C" (Clear) key to delete all the displayed characters
Press "OK" to save the displayed characters into the selected field of the original screen
Press "Cancel" to delete the displayed characters, and exit to the unchanged field of the original screen

Section C: System Startup and Shutdown

Overview

In this Section

The following topics are covered in this Section:

System Startup

CAUTION

CAUTION 3: Before connecting the *THERMOSTREAM* System to its electrical source, check that the ~ (ac) voltage and frequency to be supplied to the *THERMOSTREAM* are correct for those listed on its data plate (located on system frame, rear panel).

Procedure

Step	Action
1	Plug the ac power cord into a grounded receptacle which conforms to the local electrical code, and check the ac voltage/frequency in accordance to Caution 3, above.
2	To apply power, move breaker CB1 to the upward position (ON).
3	To interrupt power, move the breaker to a downward position (OFF).
4	Breaker CB1 is normally left in the upward (ON) up position.
5	Check that the system is connected to the specified air source and the air is turned on.
6	Check that the Vertical Stand lock is unlocked, to allow Stand/Manipulator Arms to travel up/down and to allow air flow.
7	Toggle the front panel On/Off switch to start operation of the *THERMOSTREAM* System. The ON indicator light illuminates.
8	The *Startup Screen* then displays: "Please wait until the system initializes".hd.
9	The Air Purge Delay (60 seconds) displays. “Please wait until the system initializes ... Air Purge Delay ... XX seconds remaining.
10	The Compressor Delay (60 seconds) displays “Please wait until the system initializes. Compressor delay ... XX seconds remaining.
11	The *THERMOSTREAM* Control Software then boots, displaying functional screens. The *THERMOSTREAM* is ready to use.

Password at Startup

Introduction

The system allows passwords to be assigned which allow access to system functions at three levels: Basic, Medium, Full.

Functions not available in Basic or Medium Access are still displayed on the screen as "grayed out" (in lighter colors) fields and do not execute when pressed.

The password and Access level are input on the *Utilities Screen*.

Access Level	Functions
BASIC	Run to pre-set point(s); Load pre-programmed tests. No changes can be made by BASIC operator.
MEDIUM	Run to & Change set point(s); Load & Setup tests. Datalog: record new datalogs; review saved datalogs. Temporary changes (no Save) can be made by MEDIUM operator.
FULL	Run to set points; Setup tests. Datalog & Print. Assign, change Passwords/Access levels. Configure system; Calibrate sensors. Permanent changes allowed: Load, Rename, Save, Delete.

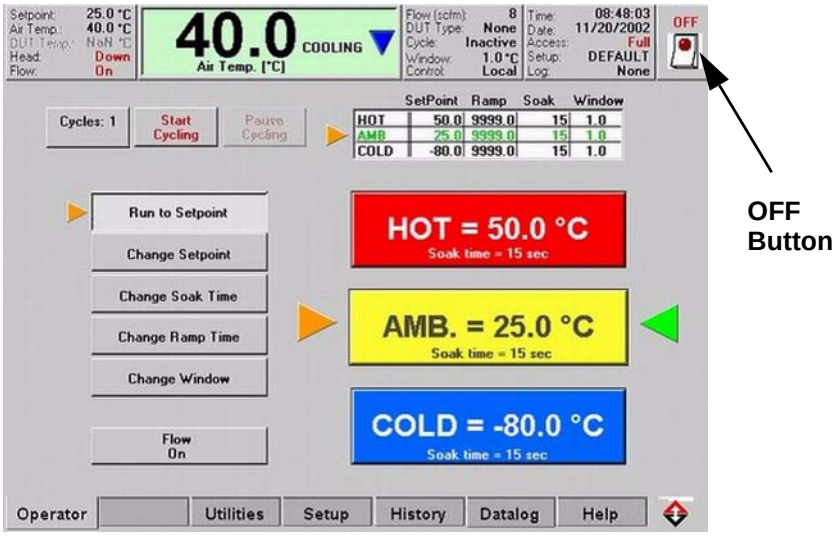
System Shutdown

Introduction

When moving the *THERMOSTREAM* System to a different test location, or when shutting down for an extended period, turn off and disconnect the system from its air supply and its ~ (ac) power source.

Procedure

To shutdown the *THERMOSTREAM* System:

Step	Action
1	Press the front panel ON/OFF Switch to power down the system. OR Press the "OFF" button on the upper right corner of the Status Bar display. 
2	When prompted, "Are you sure you want to shut down the system," press, "OK."
3	The *THERMOSTREAM* Control Software terminates the compressor and other hardware, then the software logs off.

Section D: System Status Screens

Overview

In this Section

System Status Screens include the Status Bar and its corresponding Jumbo Temperature Screen. The Status Bar (and Jumbo Temperature screen) are displayed at the top of all major screens: *Operator, Cycle, Utilities, Setup, History, Datalog.*

For detailed information on the Status Bar or Jumbo Temperature screen, see:

Status Bar

NOTE: Pressing the Status Bar toggles the Jumbo Temperature Screen..

Status Bar Field	Description
Setpoint	The current set point that the system is driving to.
Air Temp.	The main air temperature as measured at the main air nozzle.
DUT Temp.	In Air Mode: is grayed out, N/A is displayed. In DUT Mode: displays the temperature of the DUT sensor. In TC Meter Mode: is grayed out if TC Meter is being used in with the main air sensor OR displays the temperature of the DUT sensor without the offset if TC Meter is being used with a DUT sensor.
Head	Displays the position of the Thermal Head (Up or Down)
Main Temp Display (green in graphic above)	In Air Mode: displays the main air temperature. In DUT Mode: displays the DUT sensor temperature. In TC Meter Mode: displays either the Air Temperature plus offset OR the DUT sensor temperature plus offset. The Main Temp Display also provides information about the temperature transition status (i.e. ramping, soaking, set point, soak time).
Flow (scfm)	Displays the flow rate in either scfm, lt/s, or scfh. (refer to *Setup Screen* to change flow measurement units, scfm is the default). **NOTE**: The Flow (scfm) turns blue when system is automatically reducing airflow.
DUT Type	Displays the type of DUT sensor being used (None; K-Type; T-Type; RTD; Diode).
Cycle	Displays the cycle count.
Window	Displays the band (range) above/below set point, in which the system is "At Temperature." ***Example:*** a 50 °C set point, with 1.0 °C Window, is "At Temp" between 49 to 51 °C.
Control	Displays either Local or Remote for the mode that's being used to control the system. Local is using the front panel touch screen. Remote is using RS232 or GPIB IEEE-488.2, or Ethernet.
Time	Displays the current time.
Date	Displays the current date.
Access	Displays the access level setting of the system. Refer to Password at Startup, page 3-16 for more detail on access levels.
Setup	The name of the active Setup File.

Status Bar Field	Description
Log	The name of the Datalog filename that is presently open **NOTE**: a saved Datalog can be open for viewing, with Datalogging (recording of data) off.
OFF	Press to shutdown the system.
System Timer	Displays the time (hrs:mins:seconds) remaining before the system shuts down automatically. The timer can be configured and turned off in the *Utilities Screen*.

Jumbo Temperature Screens

Jumbo Screen Detailed

Jumbo Temperature Screen
ACCESS JUMBO SCREEN (Air mode, or DUT mode): Press the Status Bar to toggle to the Jumbo Temperature Screen.
EXIT JUMBO SCREEN: Press "Return" Bar, at top of Jumbo Screen, to toggle back to the original screen.
Air Temp °C: (fluctuating) Air temperature, measured at main output nozzle, if in Air mode. Air Temp is a real time, system supplied value.
DUT Temp °C: (fluctuating) DUT temperature, measured at sensor interfaced to DUT, if in DUT mode. DUT Temp is a real time, system supplied value.
Ramp Icons: Displayed at Jumbo Screen bottom: Solid square: system Air Temp (or DUT Temp) is At Temperature Red triangle, pointing up: system Air Temp (or DUT Temp) is heating (ramping higher) Blue triangle, pointing down: system Air Temp (or DUT Temp) is cooling (ramping down) "Flow: OFF" displayed if no main air flow Cycling Icons: empty Circle: transition in circle: "S"oaking in circle: "T"esting in circle: "H"olding (cycling paused)
Off: Click, to display "Are you sure?" prompt; click "OK" to shut down hardware and log off.

Section E: Operator Screen

Operator Screen (Full Access)

Introduction

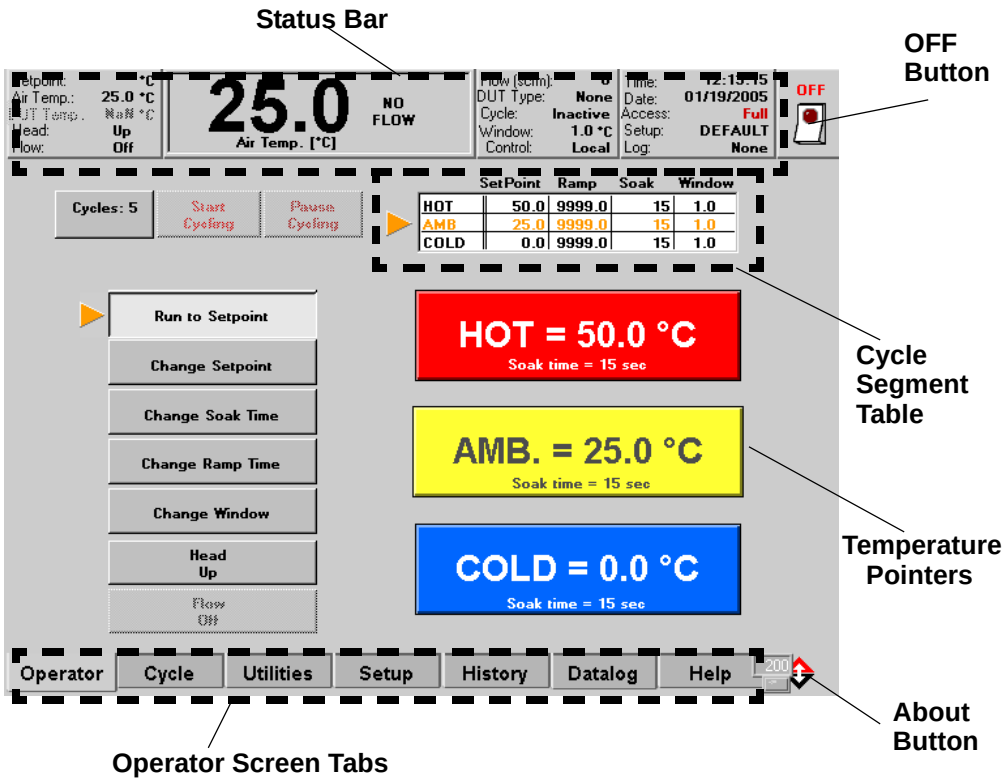
The *Operator Screen* allows the user to:

- Run to three programmed set points (HOT, AMBIENT, COLD)
- Cycle through the three programmable set points
- Change the soak time and ramp time of the three programmable set points.

Operator Screen Detailed

Watch the tutorial video on inTEST Thermal Solution's YouTube Channel:

https://youtu.be/W2OYzQhiLNE?t=2m



Field/Button Descriptions

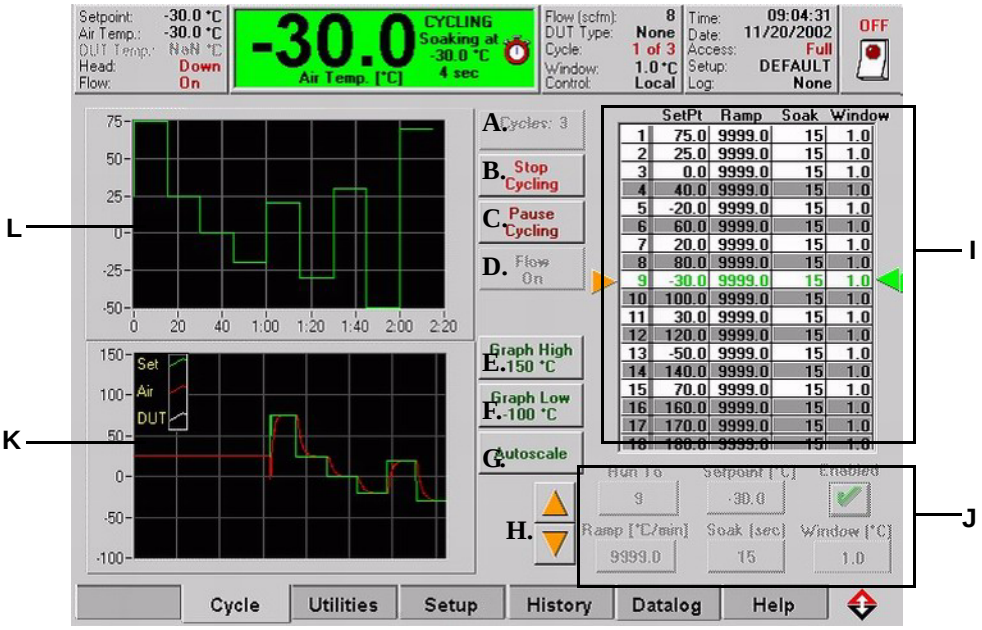
Field/Button	Description
Status Bar	System supplied values and status is displayed at the screen's top. For Greater detail on the Status Bar, see page 3-19.
OFF Button	Press to shutdown the system. For Greater detail on the System Shutdown, see page 3-17.

Field/Button	Description
Cycle Pointer	Appears when the system is cycling. Points to the set point the system is presently cycling to.
Temperature Pointers	Appears when the system is ramping to or at the selected set point. A second “green” pointer appears when the air flow is On.
About Button	Press to display information on the system, including software version.
Operator Screen Tabs	Press to display each of the major screens: *Operator, Cycle, Utilities, Setup, History, Datalog.*
Cycles:1	Press to set the number of cycles. 1 cycle is completed when the system goes through each of the three set points (HOT, COLD, AMBIENT).
Start Cycling	Press to begin the cycling routine. **NOTE:** the Flow must be set to ON for cycling to begin.
Pause Cycling	Press to Pause the cycling routing.
Cycle Segment Table	Displays the profiles of the 3 programmed set points (HOT, AMBIENT, COLD). **NOTE:** the cycle information may be toggled on/off in the *Setup Screen.*
Run to Setpoint	Press Run to set point and then either HOT, COLD, or AMBIENT to run the system to one set point.
Change Setpoint	Press Change set point and then either HOT, COLD, or AMBIENT to change the temperature of the selected set point
Change Soak Time	Press Change Soak Time and then either HOT, COLD, or AMBIENT to change the soak time of the selected set point Soak time is the duration that the system stays (or soaks) at the set point.
Change Ramp Rate	Press Change Ramp Rate and then either HOT, COLD, or AMBIENT to change the ramp rate of the selected set point **NOTE**: a RAMP set to “0” will not allow the system to change (or ramp to) temperature. When cycling, a set point with a RAMP set to “0” will be skipped. A RAMP set to “9999” allows the system to change (or ramp to) temperature at its fastest rate.
Change Window	Press Window and then either HOT, COLD, or AMBIENT to change the window of the selected set point. Window is the range above/below the set point, in which the system is "At Temperature." Example: a 50 °C set point, with 1.0 °C Window is "At Temp" between 49 to 51 °C.
Head Up/Down	Press to toggle the Thermal head up or down.
Flow On	Press to toggle main air flow on or off.

Section F: Cycle Screen

Cycle Screen (Full Access)

Cycle Screen Detailed



Descriptions

Watch the ThermoStream Cycling Tutorial on the inTEST Thermal Solutions YouTube Channel:

https://www.youtube.com/watch?v=PKE9gCmr6Ms

Part	Description
A	**Cycle:1** Press to set the number of cycles
B	**Stop Cycling** Press to stop cycling
C	**Pause Cycling** Press to pause cycling
D	**Flow On** Toggles air Flow On/Off while running to a single set point.
E	**Graph High (°C)** Set vertical (y axis) maximum temperature scale
F	**Graph Low (°C)** Set vertical (y axis) minimum temperature scale
G	**Autoscale** Press to optimize the viewing of the Runtime Graph
H	**Segment Pointer** Press up/down to select a segment in the Cycle Segment Table
I	**Cycle Segment Table** Displays the parameters for the 18 programmable set points

Part	Description
J	**Cycle Segment Parameters** use the various parameter buttons to set the profiles of the 18 segments. The parameters are: **Run to:** Displays the selected segment number (1 - 18) **Setpoint °C:** Press to set the temperature of the selected segment **Enabled:** Press to enable (green check) or disable (red X) the selected segment. **Ramp (°C/min):** Press to set the ramp rate of the selected segment **Soak (sec):** Press to set the soak time of the selected segment Soak time is the duration that the system stays (or soaks) at the set point. **Window (°C):** Press to set the Window of the selected segment Window is the range above/below the set point, in which the system is "At Temperature." Example: a 50 °C set point, with 1.0 °C Window is "At Temp" between 49 to 51 °C.
K	**Runtime Graph** a realtime graph that displays set point, air, and DUT temperatures and times.
L	**Profile Graph** a graphical presentation of the cycle segments. The graph reflects the parameters set in the Cycle Segment Parameters field.

Section G: Utilities Screen

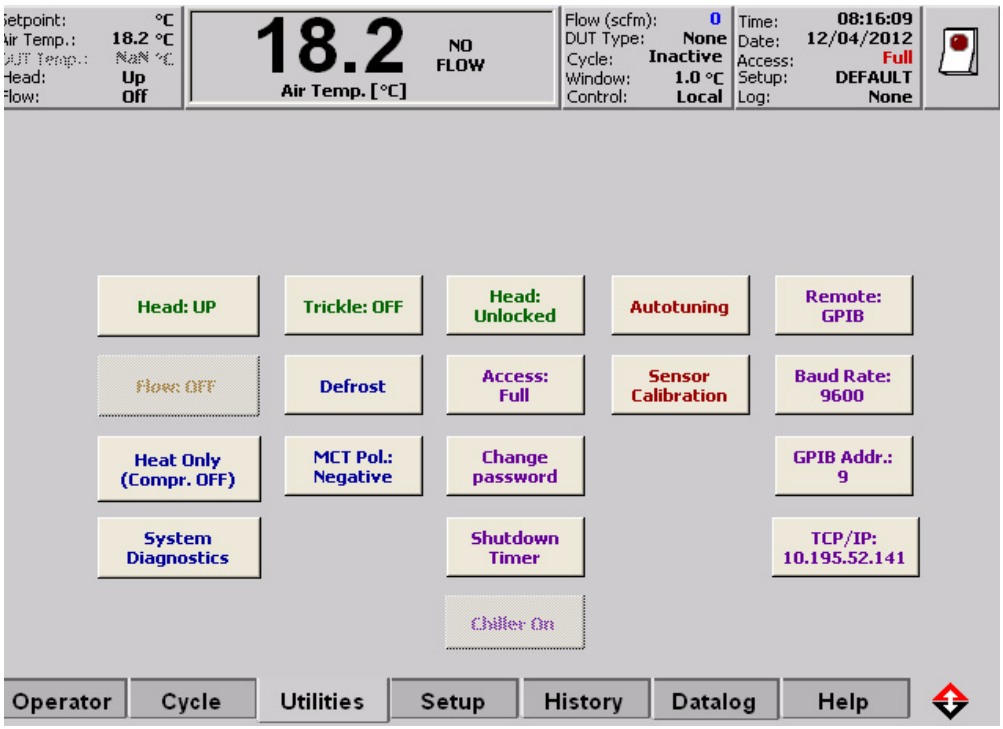
Overview

In this Section

The following topics are covered in this Section:

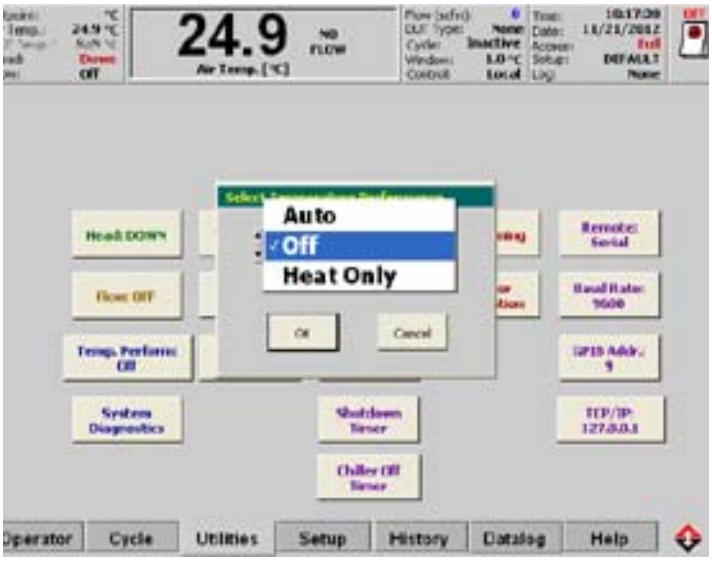
Utilities Screen (Full Access)

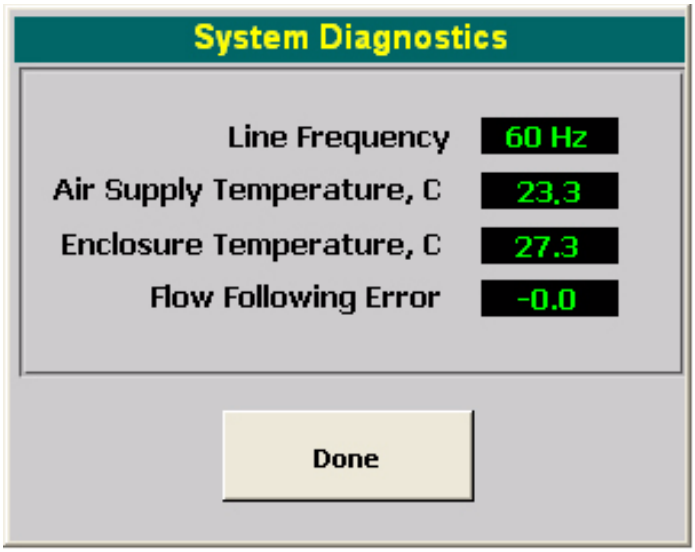
Utilities Screen Detailed



Field/Button Descriptions

Field/Button	Description
Head: UP	Press to toggle Head up/down (unless Head is "Locked")
Flow: OFF	Press to toggle main air Flow on/off. Flow is dependent on the Head Up/Down and if there is an active temperature.
Heat/Cool (Compr. ON/OFF)	Press to toggle the compressor on or off. When the compressor is on, the *THERMOSTREAM* System only operates at or above ambient temperature. **NOTE**: When toggling the compressor from ON to OFF, the compressor startup delay occurs. This is a 60 second delay before the compressor is ready for operation.

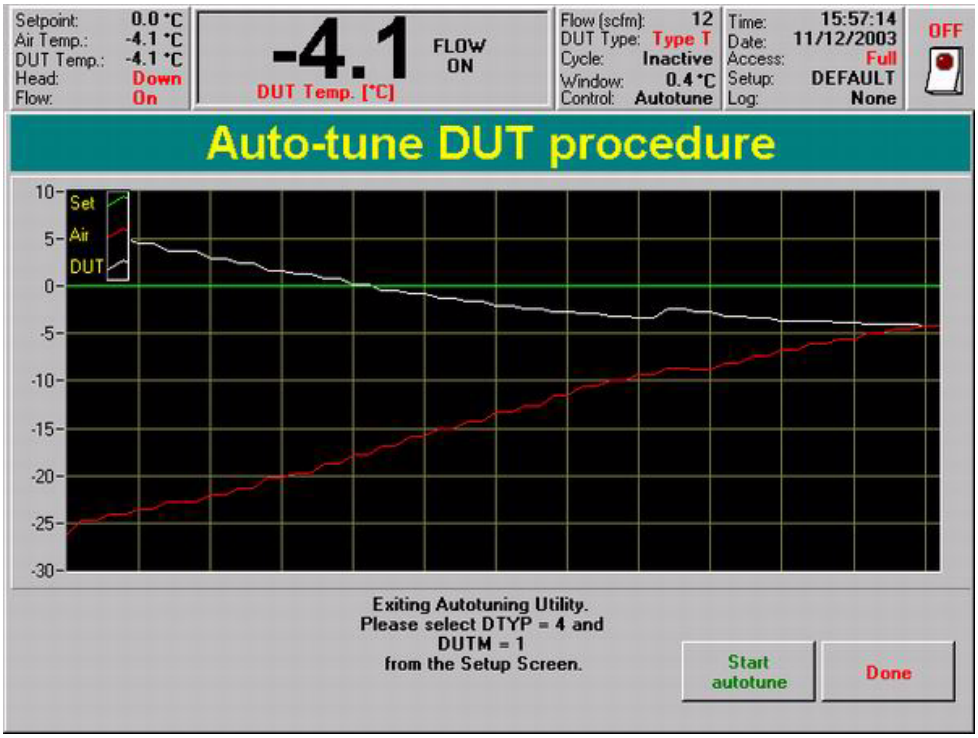
Field/Button	Description
Temp Perform: Auto Off Heat Only	Press to select the Temperature Performance options of the *THERMOSTREAM* System.  **Auto:** (default) Select for highest flow levels possible but with slower transition rates. Still reduces flow rates as needed to achieve set point (300°C at 16 scfm). **Off:** Select to achieve fastest transition rates with larger reductions in flow rates (300°C at 11 scfm). **Heat Only:** Select when only hot set points are required. Shuts off the compressor and only allows the THERMOSTREAM to operate at or above ambient temperature. **NOTE**: when changing from Heat Only back to Auto or Off, the compressor startup delay occurs. There is a 60 second delay before the compressor is ready for operation.

Field/Button	Description
System Diagnostics	Press to access the *System Diagnostics Screen*.  **Line Frequency:** displays the frequency of the facility supplied power. **Air Supply Temperature, C:** displays the temperature of the facility supplied air. **Enclosure Temperature, C:** displays the *THERMOSTREAM* system's internal temperature. **Flow Following Error:** displays the difference between the selected air flow rate (as configured in the *Setup Screen*) and the actual flow rate. If the difference becomes 1 scfm (or greater), this value displays in RED.
Trickle: OFF	Press to toggle Trickle air flow ON/OFF. Trickle bypasses main Air controls. The Trickle Flow keeps flexline hose cold during "head up" or "air off" modes. Keeping the flexline cold allows for quicker hot to cold transition times. **NOTE**: Trickle air flow will be on only if main air flow is off.
(Heated) Defrost	Press to display the Heated Defrost Procedure countdown timer and to enter mode. Refer to page 3-35 for details.
Head: Unlocked	Press to toggle Head either locked/unlocked in the present up/down position: -HEAD UNLOCKED: up/down is enabled. -HEAD LOCKED: Head stays up (or down) until Head is Unlocked **NOTE:** Turret Style Systems should have the "Head: Lock" on.
Change Password	Full Access required to change Password/Access level. Press to display the Change Password, page 3-37.

Field/Button	Description
Shutdown Timer	Press to configure and/or shutdown the system timer. The timer is configurable in minutes (i.e. entering a value of “60” sets the timer and system shutdown to 60 minutes). Entering a value of “0” disables the timer; the system will not automatically shutdown.
Chiller Off Timer	Press to configure and/or shutdown the Chiller Off Timer. The timer is configurable in minutes (e.g. entering a value of “60” sets the timer and chiller system shutdown to 60 minutes). **NOTE**: This is a dynamic button, which reflects the amount of time remaining on the timer. The Chiller timer countdown begins when there is no airflow from the main air nozzle. The chiller and compressor shut off at the end of that countdown. Disabling the Chiller timer does not automatically turn the compressor back on. **Use the Temp. Performance button in the Utilities Screen to turn the chiller back on.**
MCT Pol: Negative	Press to toggle Positive of Negative polarity.
Access: Full	Press to display the Select Access Level Screen, page 3-41. Use this screen to set access levels at Basic, Medium, of Full.
Autotuning	Press to display the Auto-tune DUT Procedure Screen, page 3-32. Use this screen for DUT tuning. DUT tuning allows the operator to enable DUT mode Autotuning, where the system continuously, automatically, successively matches the DUT mass for the best compromise between minimal overshoot and fastest temperature transition time.
Sensor Calibration	Press to display the *Calibration Procedure Screen*. For detailed calibration procedures, see Chapter 5
Load TC Calibration	Press to display the load TC Meter dialog box. The dialog box lists all available TC Meter setup files. **NOTE**: this button is only accessible if *DUT Mode* has been set to *TC Meter Mode* in the Setup Screen (page 3-42).
Load Diode Calibration	Press to display the load Diode dialog box. The dialog box lists all available Diode setup files. **NOTE**: this button is only accessible if *DUT Type* is set to Diode in the Setup Screen (page 3-42).
Remote: GPIB	Press to set Serial, or GPIB for remote interfacing.
Baud Rate: 9600	Press to set baud (300 to 57,600).
GPIB Addr: 9	Press to set General Purpose Interface Bus address: range is 1 to 9 and is settable with the Touch Screen Numeric “Keypad”, page 3-13.
TCP/IP	Displays the system’s dynamic TCP/IP address.

Auto-tune DUT Procedure Screen

Auto-tune DUT Screen Detailed



To access the Auto-Tune Screen

The *Auto-Tune Screen* is accessed from the *Utilities* Screen by pressing the "Autotuning" button.

To use the Auto tuning feature, **the following system parameters must be set:**

1. In the *Setup Screen*, the "DTYP" parameter must be set to "4"
2. In the *Setup Screen*, the "DUT Mode" parameter must be set to DUT
3. In the *Utilities Screen*, the Head parameters must be set to allow for Main Air Flow:

If the Head Up/down parameter...	Then the "Head Lock" parameter...
is set to "UP"	must be set to "Locked"
is set to "Down"	must be set to "Unlocked"

To use the Auto-tune Feature

After all the parameters have been properly set, Press the "Start autotune" Button.

The system continuously, automatically, and successively matches the DUT mass for the best compromise between minimal overshoot and fastest temperature transition time.

NOTE: For fine tuning the DUT, the "Thermal constant" parameter (see Setup Screen (Full Access), page 3-43) may be used in addition to the Auto-tuning feature.

Compressor Startup

Compressor Startup Screen Detailed

Compressor startup Screen Description

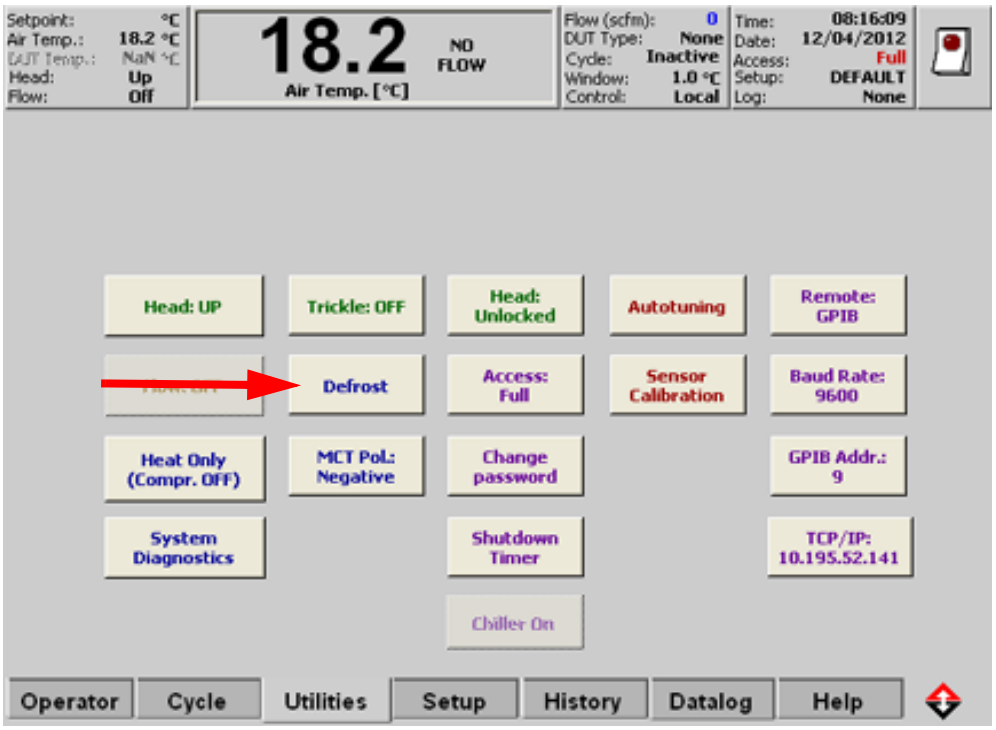
Compressor Startup Screen: Fields, Buttons	
A	TIME LEFT (system supplied, descending counter): displays the time (seconds) remaining until compressor initialization. 60 seconds are required for all models. At 0 seconds, "Heat/Cool" displays on *Utilities Screen*, the compressor is on and the system is ready to drive to hot or cold set points.
B	Press CANCEL to display alert: "Are you sure you wish to cancel the cooling procedure?" Press "OK". This exits *Compressor Startup Screen*, returns to *Utilities Screen.* The system remains in "Heat Only" mode (no cooling, the compressor is off; system is ready to drive to hot set points only).

Heated Defrost Procedure

Heated Defrost Screen

The heated defrost feature allows the ATS-Series Systems to defrost themselves using internal heaters. Wet air supply can lead to moisture in the system. That moisture can freeze up in the internal chiller. Any freeze ups are an indication that the air supply needs to be checked (i.e. the dew point of the air supplied to the *THERMOSTREAM* System is too high.

Older generation *THERMOSTREAM* Systems did not have any heating elements to aid the defrost cycle and would take 24 hours to fully defrost. The heaters allow the ATS-Series Systems to fully defrost in less than two hours. Access the Defrost button through the *Utilities Screen*.



Screen Description

ATTENTION

The defrost procedure turns off the system's compressor. Once the defrost procedure is complete, you must turn the compressor on using the Temp Performance configuration on the *Utilities Screen*.

WARNING

Water ejects out of the main air nozzle during the Defrost Cycle. Over the course of the cycle, up to one quart of water may be expelled from the main air nozzle. Move all components away from the nozzle and if needed, place a bucket or container at the nozzle to collect the water.

Procedure

CAUTION

CAUTION 7: During the cycle, the melt water will eventually be forcibly ejected from the main air output nozzle. Therefore, position the nozzle away from the tester or any other electronic components.

Defrosting permits recovery from a “freeze-up” condition created when moisture in the air supply is allowed to enter the heat exchanger of the air chiller where it condenses and freezes.

A diminishing air flow at the head nozzle for a set value of air flow indicates a freeze-up condition.

When freeze-up occurs, determine what has failed and is allowing moisture to enter the heat exchanger.

Check in this order (see Chapter 5 for detail):

1. **Particle Filter:** empty if necessary
2. **Coalescing Filter:** empty if necessary
3. **Air dryer Post Filter:** empty if necessary
4. Air dryer operation.

When the cycle is initiated:

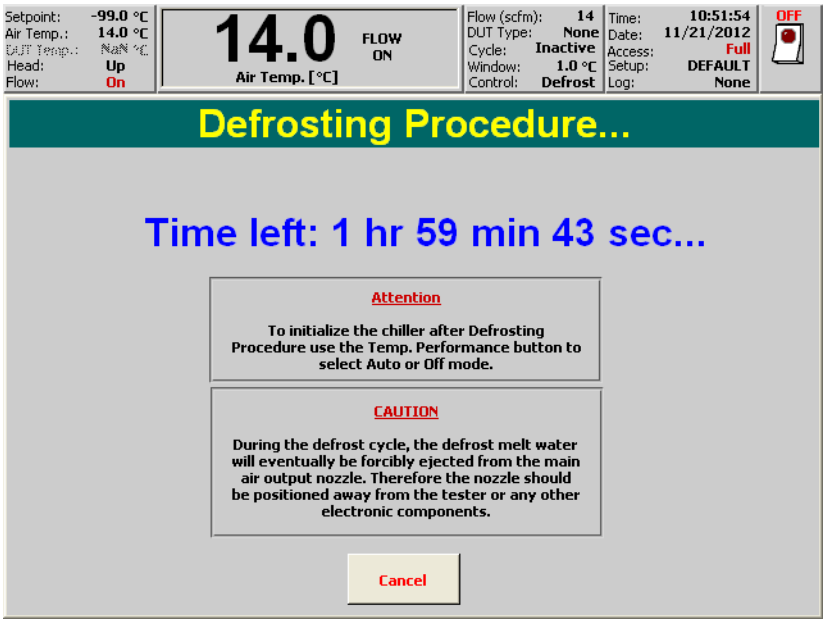
1. The compressor (air chiller module) is turned off.
2. The system will not permit temperature control.
3. The air flow through the system continues to force air through the heat exchanger to aid in defrosting and removing moisture from the heat exchanger.

ATTENTION

Although the cycle can be aborted at any time and the system returned to normal temperature control operation, if the moisture in the heat exchanger is not removed, or if moisture continues to enter the heat exchanger, then the freeze-up reoccurs.

To begin a defrost cycle:

1. In the *Utilities Screen*, press the Defrost button.
2. The Defrost Procedure Screen displays. A two-hour countdown begins.



ATTENTION

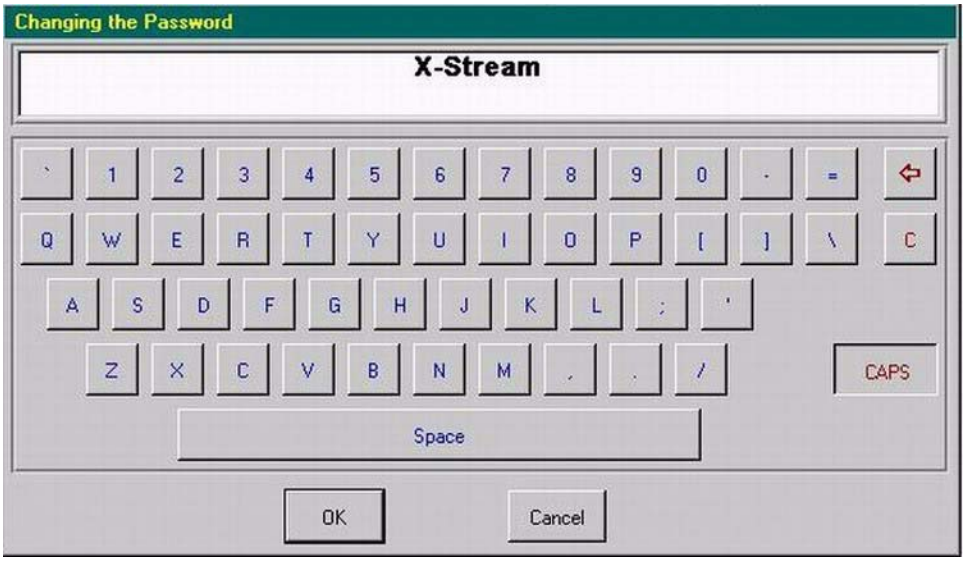
Although the cycle can be aborted at any time and the system returned to normal temperature control operation, if the moisture in the heat exchanger is not removed, or if moisture continues to enter the heat exchanger, then the freeze-up reoccurs.

3. To cancel the Defrosting Procedure at any time, press the Cancel button.

   NOTE: The Defrosting Procedure automatically changes the Temp. Performance setting to Heat Only Mode. To change the system from Heat Only Mode, access the Temp Performance Settings in the *Utilities Screen*.

Change Password

Change Password Screen Detailed



Password Screen Description

ALPHANUMERIC "KEYPAD" Changing the Password
Displayed at the top: the parent screen's selected field name (Changing the Password)
Touch the desired character to display that character
Press "Caps" to toggle between uppercase (capital) and lower case characters
Press the leftward pointing arrow key to delete, leftward, one character at a time
Press Clear ("C" key, below leftward arrow key), to clear all displayed characters
Press "OK" to save the displayed characters into the selected field of the original screen
Press "Cancel" to delete the displayed characters, and exit to the unchanged field of the original screen

Chiller Off Timer

Introduction

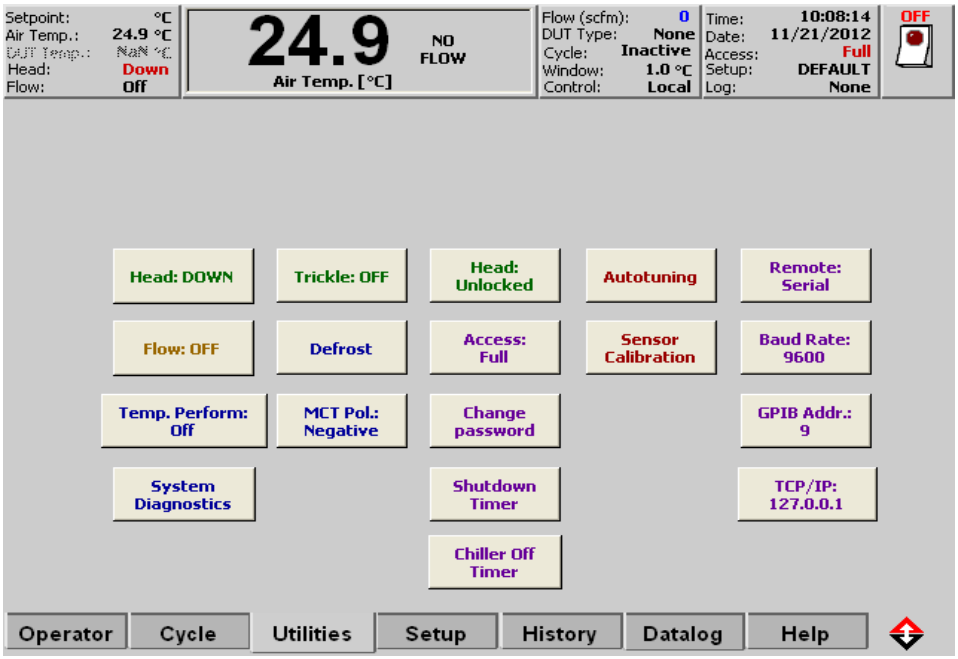
Chiller Off Timer is an ECO-friendly feature of the ATS Systems. Its purpose is to shut off the chiller and compressor if the *THERMOSTREAM* System idles for a designated period of time. Shutting down the chiller and compressor results in significant energy savings.

When the Chiller Off Timer is enabled, the *THERMOSTREAM* System begins a countdown once there is no airflow from the main air nozzle. The chiller and compressor shut off at the end of the count down.

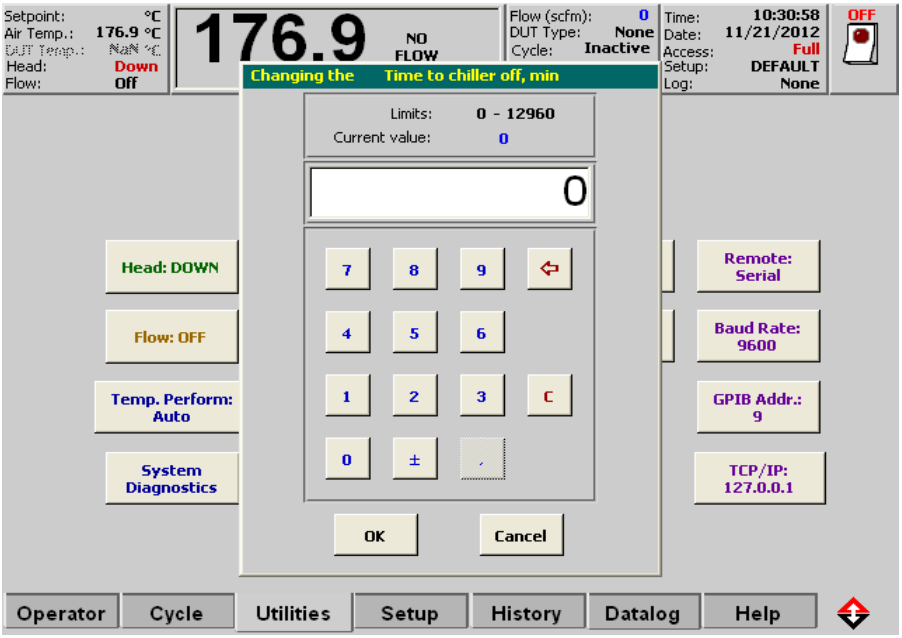
Procedure

To activate the Chiller Off Timer:

1. In the *Utilities Screen*, press the Chiller Off Timer button.



2. The Chiller Off Timer dialogue box displays.



3. The Value of “0” means the Timer is off (or disabled). Enter a value between 1 and 12960 - the number in the Chiller Off Countdown.
4. The Chiller Off Countdown resets any time Flow is turned on.

   Example: The Chiller Countdown is set to 15. After 15 minutes of idle time (i.e. no air flow), the Chiller and Compressor shut off. If Flow was turned on at the minute mark of the countdown, the counter resets to 15 minutes once the system idles again.

5. To turn off or disable the Chiller Off Timer, set the timer to zero (“0”).
   NOTE: this only turns off the Timer. The chiller must still be turned back on for the system to drive to cold temperatures. Use the Temp. Performance settings in the Utilities Screen to turn on the compressor.

Remote Commands for Chiller Off Timer

GTIM can be used to set the Chiller Off Timer. Use the GTIM Command with the desired value to set the timer.

Example:

GTIM 12

Sets the Chiller Off Timer to 12 minutes.

Example:

GTIM?

Use this query to get the status of the GTIM command. The query yields both the setting of the timer and the time remaining on the countdown.

Example:

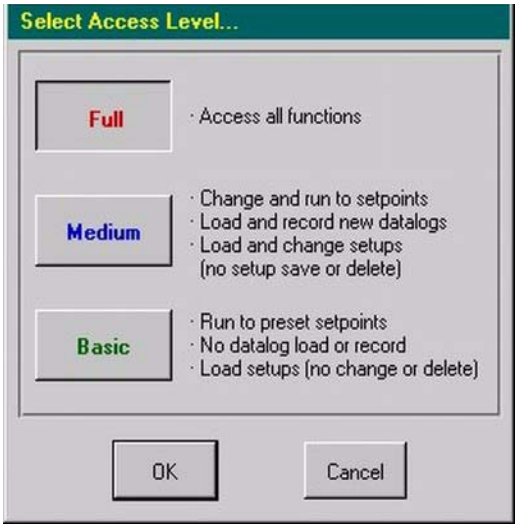
GTIM? 12:9

Means the timer was set to 12 and 9 minutes remain on the countdown.

NOTE: the “COOL 1” command, must be used to turn the compressor back on after the timer is shutoff.

Select Access Level Screen

Access Screen Detailed



Access Screen Description

Access Screen: Full, Medium, Basic
COMMANDS
Press "Cancel" to exit *Access Screen* and return to the *Utilities Screen* without changing the originally installed Access level.
Press "OK" (after pressing one of below Access levels) a) to install the highlighted Access level b) to exit back to the *Utilities Screen.* **NOTE**: Full Access is required to change an Access level (or to assign Passwords).
ACCESS LEVELS (PERMISSIONS)
FULL. Press "Full," then "OK" to assign Full level access: -Access all functions. Assign passwords/access. Configure, calibrate,. -Change, save, delete.
MEDIUM. Press "Medium," then "OK" to assign Medium level access: -Run to set points. Load tests and datalogs. Record new datalogs. -Change, no save, no delete.
BASIC. Press "Basic," then "OK" to assign Basic level access: -Run to pre-set points. Load pre-programmed tests. -No change, no save, no delete.
NOTE: Functions not available in Basic or Medium Access are displayed on the screen "grayed out" (in lighter colors) and do not execute when pressed.

Section H: Setup Screen

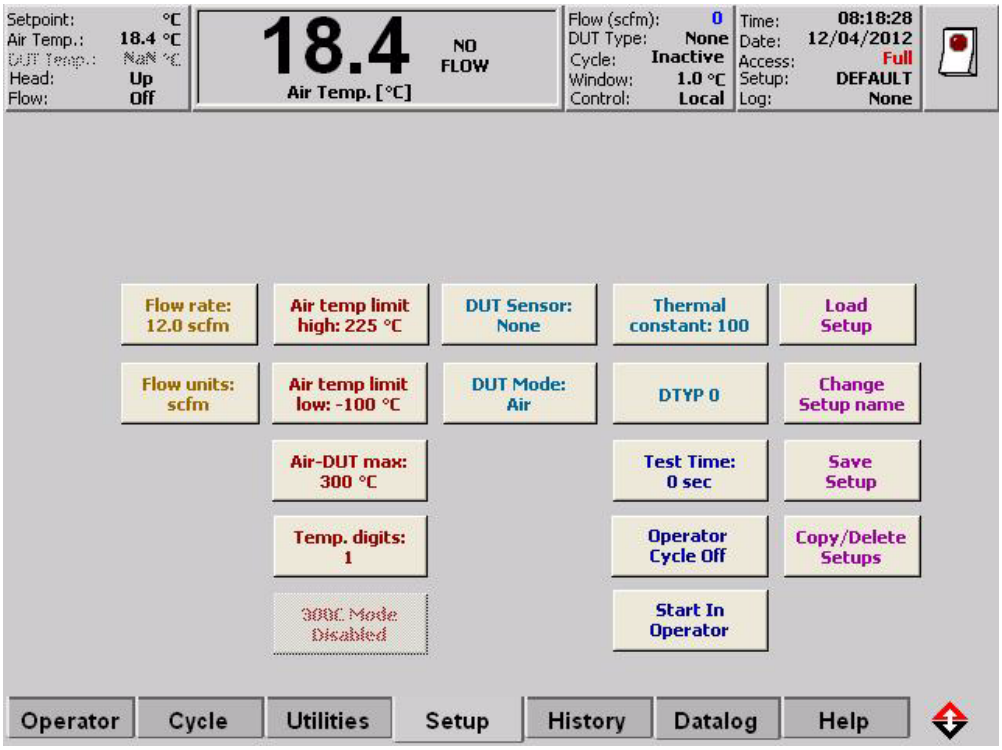
Overview

In this Section

The following topics are covered in this Section:

Setup Screen (Full Access)

Setup Screen Detailed



Field/Button Descriptions

Field/Button	Description
Flow Rate: 12.0 scfm	Flow Rate is the rate at which the air comes out of the main air nozzle Default setting is 12 scfm. Maximum setting is 18 scfm. Press to display the Touch Screen Numeric "Keypad" and set the air flow rate. The rate can be displayed in either standard cubic feet/ minute, or, liters/second.
Flow units: scfm	Press to toggle the air flow as either standard cubic feet/minute, or, liters/second.
Air temp limit high: 225°C	Set the maximum hot air temperature for the system. Default (and maximum) hot air temperature is 225°C or 225°C (ATS-750 only).
Air temp limit low: -100°C	Set the maximum cold air temperature for the system. Default is -150°C.
Temp. digits: 1	Press to toggle temperature displays as either "0" (no decimal point values shown) or "1" (1 decimal point value shown).

Field/Button	Description
300C Mode Enabled (ATS-750)	Press to enable/disable operation at 300°C. Refer to 300° C Mode, page 3-47. **Note**: For safety reasons, the 300C Mode is not programmable remotely. In addition, the high temperature setting is not persistent on Power Off.
DUT Sensor: None	Press to display the Select DUT Sensor Screen (page 3-49).
DUT Mode: Air	Press to select between Air, DUT and TC Meter modes. When DUT is selected, the “DUT Temp” field on the Status Bar becomes active. **NOTE:** DUT mode can only be selected if a DUT type is already chosen in the Select DUT Sensor Screen (page 3-49).
Load Diode Calibration	Press to display the load Diode dialog box. The dialog box lists all available Diode setup files. **NOTE**: this button is only accessible if *DUT Type* is set to Diode in the Setup Screen (page 3-42).
Load TC Calibration	Press to display the load TC Meter dialog box. The dialog box lists all available TC Meter setup files. **NOTE**: this button is only accessible if *DUT Mode* has been set to *TC Meter Mode* in the Setup Screen (page 3-42).
Air-DUT max: 300°C	Allows the operator to set a maximum limit on the difference between the Air and DUT temperatures. The default (and maximum) setting is +300° C. Accepted values are between 10 °C to 300° C in 1 °C increments. When the system is shipped this value is set to 300° C to ensure minimum transition times between temperatures. This maximum temperature differential value is applied symmetrically: either as a positive or negative value, in response to whether DUT temperature is ramping hotter or colder. For example, if a “DUT set point” of 100° C is desired and an "Air-to-DUT max" is set to 10° C, then the air temperature must stay within 10° C of the DUT temperature and gradually bring the DUT to 100 °C.

Field/Button	Description
Thermal constant: 100	Allows the operator to increase or decrease temperature overshoot. Applies to DUT mode for both tuned (Autotuning on) and non-tuned (Autotuning off) test setup files. Accepted values are 20 to 3000 in increments of 1. The thermal constant default setting is 100. Values lower than 100 are for lower mass devices while values higher than 100 are for higher mass devices. Therefore, this number is used as a way of tuning the system to the thermal time response of the user's specific device type, including its socket and/or enclosure. The thermal constant can be set to produce minimum over-shoot, maximum stability, and slower time to set point temperature (i.e. high damping), or, the constant can be set to produce moderate overshoot, moderate stability, and faster time to set point temperature (i.e. low damping). When setting, use this rule of thumb: the larger the DUT thermal constant, the greater the damping; the lower the DUT thermal constant, the smaller the damping.
DTYP 0	Press to Select the DUT Type. there are 5 possible selections: 0-Smallest DUT mass ***Example***: a 28 pin, 350 mil, ceramic or plastic device 1-Larger DUT mass ***Example***: a 32 pin, 400 mil ceramic or plastic device 2-Larger DUT mass ***Example***: a 68 pin PLCC plastic device. 3-Largest DUT mass. use for larger hybrid chips. 4- System Derived. Use this parameter to Auto-tune the DUT. For Detail on the Auto-tune DUT Procedure Screen, see page 3-32. 5- Box use with Temptronic ThermoChambers.

Field/Button	Description
Test Time: 0 sec.	Allows the operator to program a maximum test time. This timer begins automatically at the end of any programmed soak time when the "AT TEMPERATURE" condition is reached and the "start test" signal is given by the system. This is primarily useful when Cycling. Because the system is capable of being coupled with automatic test equipment, utilizing standard "start test" and "end test" signals, this feature can work in two ways: First, it allows simple operation utilizing only the "start test" signal from the system to the host tester. If the "end test" signal is not available from the host tester, or is not used, when the test time has elapsed, the system automatically moves to the next temperature set point in the cycle routine. Second, if the "end test" signal is being used, then this "maximum test time" feature can prevent the system from "hanging up" (interrupting the cycling routine) in the instance of the "end test" signal not being properly received from the host tester. For example, if a cycling routine of 10 temperature set points is setup, each cycle segment with a varying time length, with the longest set point test being 5 seconds, then "Test Time" might be set to 6 seconds. If the "end test" signal is not received by the system, the system still automatically cycles to the next set point after 6 seconds and not "hang up." That particular test, however, would not be logged as completed. To disable or ignore "Test Time," set it to 0 (zero).
Operator Cycle On	Press to toggle the Cycle information on/off on the *Operator Screen.*
Start In Operator	Press to select between the *Operator* and *Cycle Screen* as the default screen at system startup.
Load Setup	Press to display the Select a Setup file Screen (page 3-50) and choose a file to load.
Change Setup name	Press to display the Touch Screen Alphanumeric “Keypad” (page 3-12) and change the name of the present setup.
Save Setup	Press to save present setup. **ATTENTION** If you do not want to overwrite your present setup, change the setup name and then press Save Setup.
Copy/Delete Setups	Press to display the Copy/Delete Setup Screen (page 3-52) and choose a file to copy and/or delete.

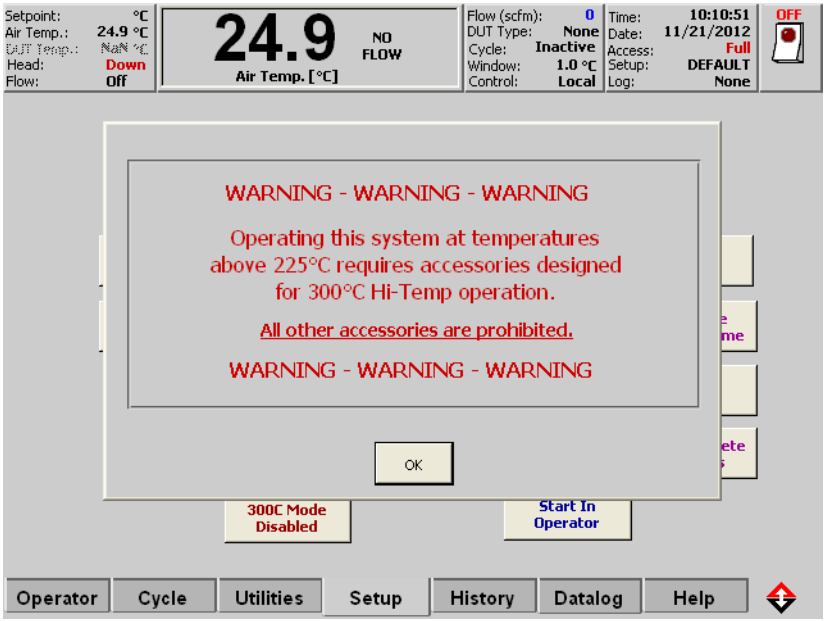
300° C Mode

300° C Warning

The ATS-750 is capable of operating at +300 C. Enable or disable the +300 C Mode in the *Setup Screen*.

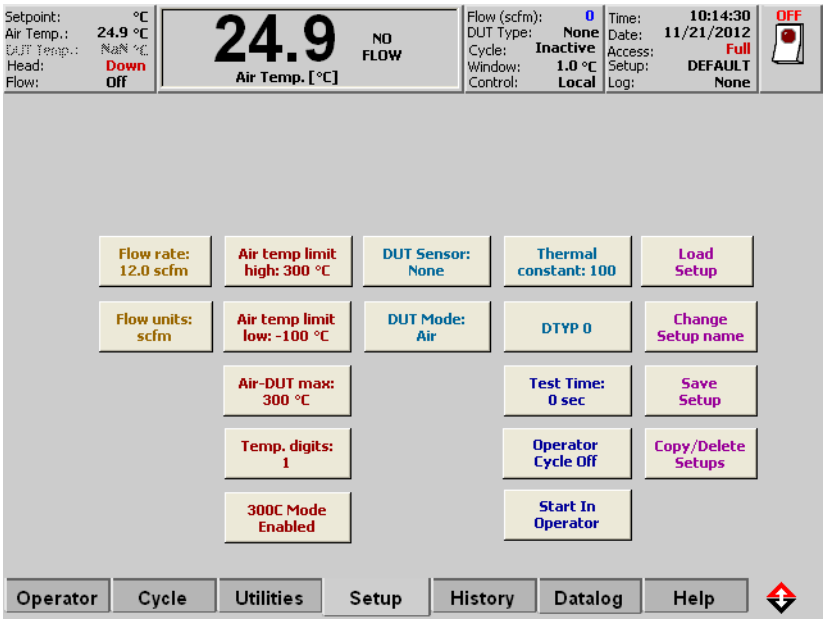
CAUTION

If using a 300° C system, verify that all accessories (e.g. thermal cap, FlexExtender™ hoses, etc. and all test setup components) are properly rated for these temperatures.



NOTE: "There are no remote commands (IEEE, RS232) to enable or disable 300C Mode Operation. For safety reasons, 300C mode can only be enabled/disabled from the system's touch screen panel.

NOTE: When the system is powered down, the 300C Mode will automatically be DISABLED and must be ENABLED again on power up for the system to achieve any set points above +225C.

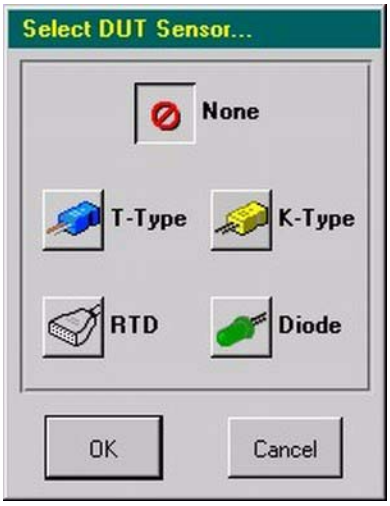


1. In the Setup Screen, the 300C Mode button is set to DISABLED.
2. When you press ENABLE 300C Mode, the display issues a WARNING which you must read and press OK to accept. Enter the required password to initiate 300C Mode. The default password is “enable.”

3. Once 300C Mode is enabled, the ATS-750 automatically changes the system over temperature limit to +305C. Once disabled, the system automatically change the over temperature limit back to the +230C default.
4. To Disable 300C Mode, go to the Utilities screen an press the 300C Mode Enabled button. The button toggles to display 300C Mode Disabled.

Select DUT Sensor Screen

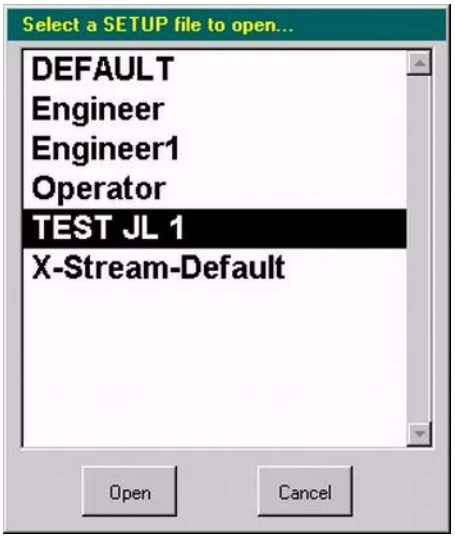
DUT Sensor Screen Detailed



DUT Sensor Screen: None, Type T, K, RTD, Diode
COMMANDS
Press "Cancel" to exit *DUT Sensor Screen*, back to *Setup Screen*, without changing the originally installed mode (Air or DUT).
TO CHANGE "DUT SENSOR First set "DUT MODE" Button to "AIR".
Press "OK:" a) to install the highlighted DUT Type b) to exit back to the *Setup Screen* c) to display the following buttons on the *Setup Screen*: DUT Mode, Air-DUT Max, Thermal Constant, Autotuning. **NOTE**: operating in DUT mode requires an external DUT sensor be interfaced to the DUT.
DUT TYPES
NONE. Press "None," then "OK," to exit to *Setup Screen*: de-selects prior selected DUT mode; enables main Air mode
TYPE T. Press "Type T," then "OK," to select Type T sensor
TYPE K. Press "Type K," then "OK," to select Type K sensor
RTD. Press "RTD," then "OK," to select RTD sensor
DIODE. Press "Diode," then "OK," to select Diode sensor

Select a Setup file Screen

Setup file Screen Detailed



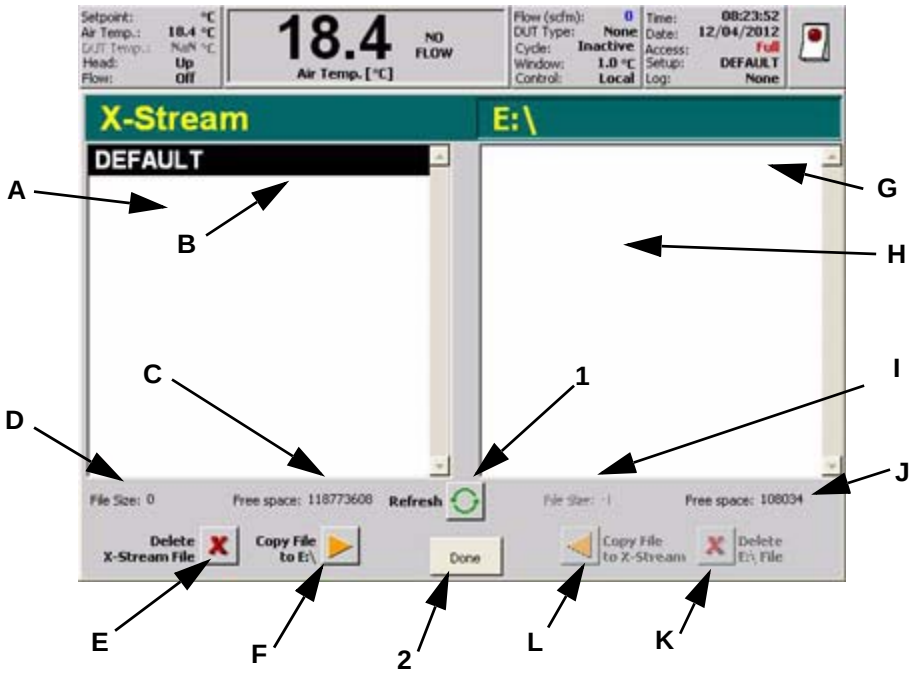
SELECT SETUP SCREEN (Load Saved Setups)
COMMANDS
Press "Cancel" to exit *Select Setup Screen*, back to *Setup Screen* -without changing the originally installed test Setup -does not load (display/enable running) the highlighted Setup.
Press "Open" (displays/enables running) the highlighted setup -loads values of highlighted Setup into *Setup Screen* -Setup segment parameters loaded into, can be run on *Cycle Screen* -If prior datalogged, then Setup can be reviewed on *History Screen* -If not prior datalogged, then "Live" running data can be viewed on *History Screen.*
LOAD SETUP
Press Setup filename to highlight/select Setup, then press "Open" to enable running the Setup
To save a Setup without overwriting the original data, first rename the Setup: see Save Setup, Rename Setup (Prevent Overwriting), page 3-51.

Save Setup, Rename Setup (Prevent Overwriting)

Save, Rename Setups: Prevent Overwriting (Setup Screen)	
FUNCTION	For Air mode and DUT mode. "Save" a test Setup; "Change Setup Name", to prevent overwriting original data.
ACCESS	Press "Setup" *Screen* tab
COMMANDS	**DESCRIPTION**
SAVE SETUP [Caution: Overwriting Data]	Press **Save Setup** to save present test session Setup. If presently open Setup is not new, system then prompts: "Are you sure you want to overwrite the "filename" setup?" To preserve the original Setup: -press "Cancel," -press "Change Setup Name" button to display keypad -enter a new Setup filename, press "OK". Press "Save Setup," at "Are you sure?" prompt, the system displays the newly entered Setup name: press "OK".
CHANGE SETUP NAME	Press **Change Setup Name** to display keypad. Enter new Setup name, press "OK".

Copy/Delete Setup Screen

Setup File Screen Detailed



Setup File Screen Description

Copy/Delete Setups Screen: Fields, Buttons	
1	REFRESH LISTINGS: press to update X-Stream and filenames displayed.
2	DONE: press to exit back to *Setup Screen.*
X-STREAM	
A	Filenames pane (lists all Setup files); use scroll bar to right to scroll list up/down.
B	(Highlighted) Setup filename: press Delete (item "E") or Copy (item "F") to do so.
C	FREE SPACE kilobytes (System Supplied): unused X-Stream memory available.
D	FILE SIZE (kilobytes) (System Supplied): size of Highlighted Setup (see item "B").
E	DELETE X-STREAM FILE: press to delete Highlighted Setup (see item "B").
F	COPY X-STREAM FILE: press to copy Highlighted Setup (item "B") to the file destination.
FILE DESTINATION **NOTE**: If there is no USB storage device in the drive, “No Floppy Inserted” displays. Insert a USB device. Click the refresh button and the E: drive displays.	
G	(Highlighted) Setup filename: press Delete (item "K") or Copy (item "L") to do so.
H	Filenames pane (lists all Setup files); use scroll bar to right to scroll list up/down.
I	FILE SIZE (kilobytes) (System Supplied): size of Highlighted Setup (see item "G").
J	FREE SPACE (kilobytes) (System Supplied): unused memory available.

K	DELETE FILE: press to delete Highlighted Setup (see item "G").
L	COPY FILE: press to copy Highlighted Setup (item "G") to X-Stream.

Section I: History Screen

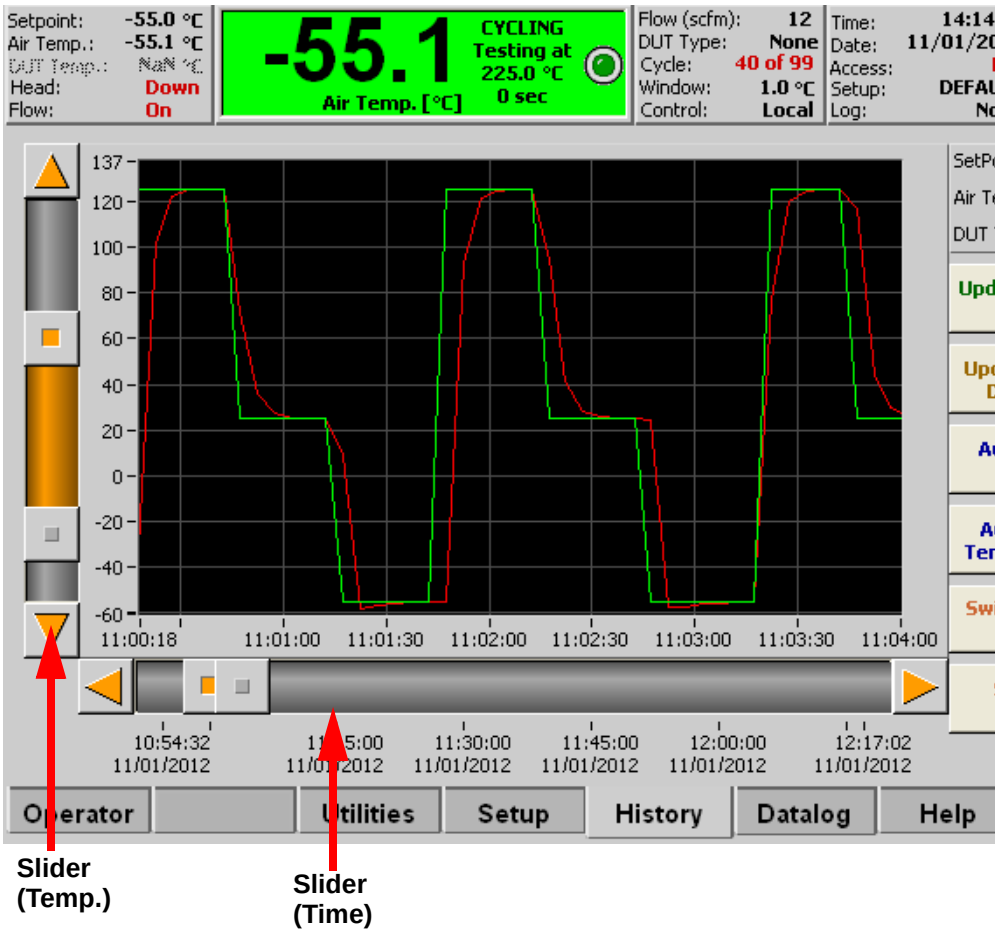
Overview

In this Section

The following topics are covered in this Section:

History Screen (Full Access)

History Screen Detailed



Field/Button Descriptions

Field/Button	Description
Slider (Time)	Use to adjust the view of the horizontal time graph. Click and drag the square slider button across the bar for a rapid adjustment. Use the arrows for fine adjustment.
Slider (Temp.)	Use to adjust the view of the vertical temperature graph. Click and drag the square slider button across the bar for a rapid adjustment. Use the arrows for fine adjustment.

Field/Button	Description
Update every 5s	Press to set the frequency (in seconds) that the History Graph updates. Acceptable values are between 5 and 9999. **NOTE:** “9999” stops the graph from updating.
Update from Datalog	Press **From Datalogging** to update History Graph with time/temp values from the presently loaded Datalog (s). It is NOT necessary to turn "Datalogging On" to Update from a Datalog: only load (open) the Datalog.  **CAUTION** **CAUTION:** if system is running to or at a temperature (not in Idle), then **first rename the original Datalog** before turning "Datalogging On:" this prevents overwriting the original Datalog with the present runtime data.
AutoScale Time	Press to autoscale the History Graph horizontal axis to optimum view.
Autoscale Temperatures	Press to autoscale the History Graph vertical axis to optimum view.
Switch active cursor	Press to toggle Selected Slider button on both the horizontal (x) axis and also toggle the Selected Slider button on the vertical (y) axis.
Sliders Focus/Pan	**PAN**: enables moving both Sliders in sync (dragging one slider moves both sliders equally), and scrolls History Graph. **FOCUS**: enables to drag one Slider independent of the other Slider, and correspondingly scrolls History Graph display.

To Review Live Data

Procedure

1. Begin controlling to temperature(s):
   - run to a set point from either the *Operator* or *Cycle Screen*.
2. Press HISTORY tab to review Live data.
3. Press "Update From Live Data".
4. Press "Autoscale Time".
5. Press "Autoscale Temperature".
   - use Sliders, and Slider Fine Move, to adjust History Graph display.

ATTENTION

"Live" data is unsaved data: when live data memory space full, earliest data is progressively overwritten; if a new Test Setup is run, it progressively overwrites the prior session data (first in data, is first out of the memory).

To Review Saved (Datalogged) Data

Procedure

1. Press DATALOG tab to access *Datalog Screen.*
2. Press "Open Datalog”.
3. Select Datalog Filename.
4. Press "Open".

ATTENTION

It is **NOT** necessary to turn "Datalogging On" to review Datalog data from the *History Screen*: only load (open) the Datalog.

CAUTION

CAUTION: if "Datalogging On" is to be enabled, beware overwriting original data: first rename the original Datalog filename to preserve it.

5. Press HISTORY tab to access *History Screen.*
6. Press "Update From Datalog".
7. Press "Autoscale Time".
8. Press "Autoscale Temperature".
9. Use Sliders and Slider Fine Move to adjust History Graph display.

NOTE: Datalog data is saved data. A live test can be running in the background while a Datalog is reviewed.

Section J: Datalog Screen

Overview

Datalogging is used to record a continuous history of time/temperature responses into memory.

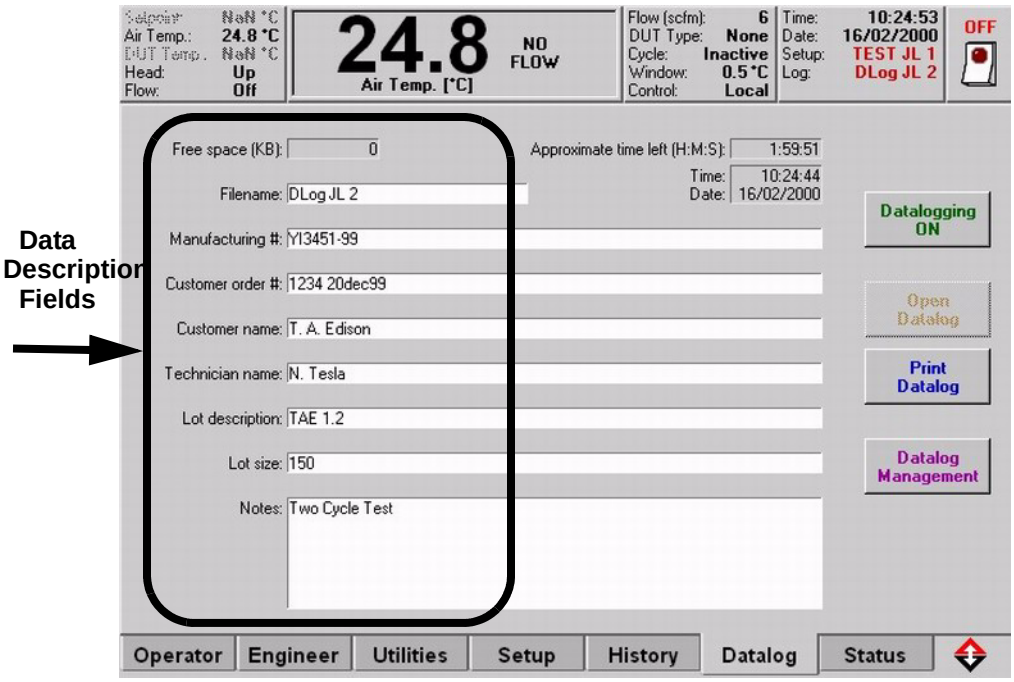
This feature powerfully supports device characterization tests of long duration, freeing the operator from the need to do real-time direct supervision.

In this Section

The following topics are covered in this Section:

Datalog Screen (Full Access)

Datalog Screen Detailed



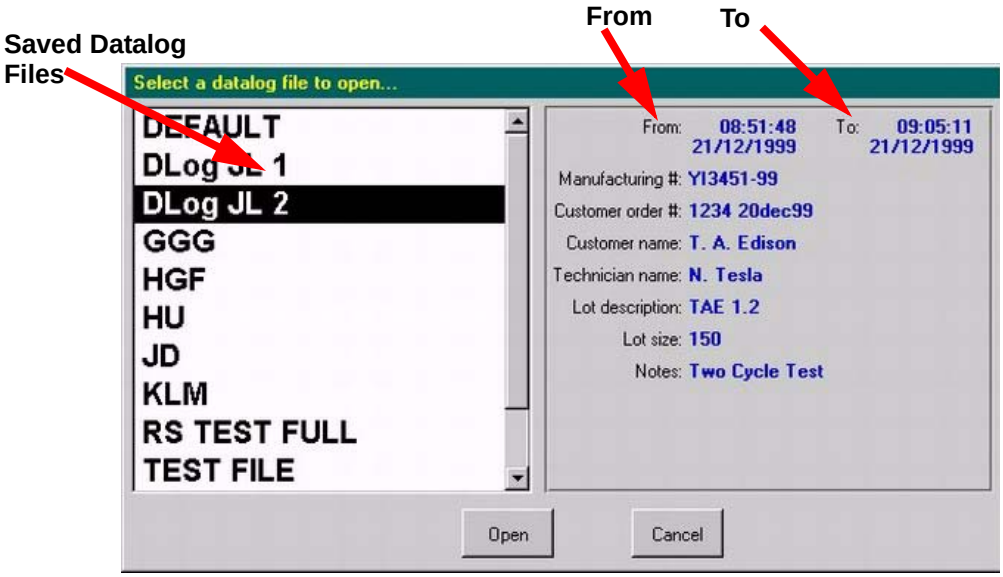
Data Description Fields

Field/Button Descriptions

Field/Button	Description
Datalogging ON	Datalogging On/Off. To **prevent overwriting original file**: press Filename and change the original Filename to new Filename.
Open Datalog	Press to Open and Load saved Datalog files. See Loading a Saved Datalog file, page 3-61.
Print Datalog	Press to Print Datalog (see Printing Datalogs, page 3-65.
Datalog Management	Press to display Copy/Delete a Datalog File (detailed on page 3-62).
Data Field Descriptions	Press within each field to change/edit the information. The fields include: --Manufacturing #; --Customer Order #; --Customer Name --Technician Name; --Lot Description; --Lot Size; --Notes.

Loading a Saved Datalog file

Datalog File Screen Detailed

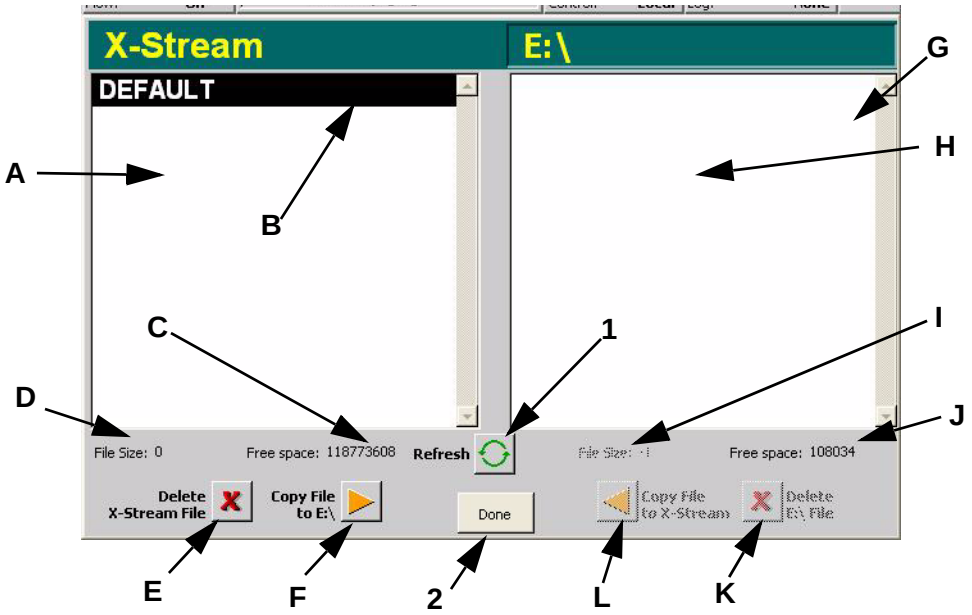


Field/Button Descriptions

Field/Button	Description
Saved Datalog Files	Displays all of the saved Datalog filenames. Press the desired datalog file to highlight it. Once highlighted, press Open to load the file.
From and To	Displays the begin and end times of the highlighted Datalog file.
Open	Press to load the highlighted Datalog file.
Cancel	Press to exit the *Datalog File Screen* and return to the *Datalog Screen*.

Copy/Delete a Datalog File

Copy/Delete Datalog Detailed



Field/Button Descriptions

Copy/Delete Datalogs Screen: Fields, Buttons	
1	REFRESH LISTINGS: press to update X-Stream and filenames listed.
2	DONE: press to exit back to *Datalog Screen.*
X-STREAM	
A	Filenames pane (lists all Datalog files); use scroll bar to right to scroll list up/ down.
B	Highlighted Datalog filename: press Delete (item "E") or Copy (item "F") to do so.
C	FREE SPACE kilobytes (system supplied): unused X-Stream memory available.
D	FILE SIZE (kilobytes) (system supplied): size of Highlighted Datalog (see item "B").
E	DELETE X-STREAM FILE: press to delete Highlighted Datalog (see item "B").
F	COPY X-STREAM FILE: press to copy Highlighted Datalog (item "B") to desired destination.
FILE DESTINATION **NOTE**: If there is no USB storage device in the drive, “No Floppy Inserted” displays. Insert a USB device. Click the refresh button and the E: drive displays.	
G	Highlighted Datalog filename: press Delete (item "K") or Copy (item "L") to do so.
H	Filenames pane (lists all Datalog files); use scroll bar to right to scroll list up/ down.

Copy/Delete Datalogs Screen: Fields, Buttons	
I	FILE SIZE (kilobytes) (system supplied): size of Highlighted Datalog (see item "G").
J	FREE SPACE kilobytes (system supplied): unused memory available.
K	DELETE FILE: press to delete Highlighted Datalog (see item "G").
L	COPY FILE: press to copy Highlighted Datalog (item "G") to XStream.

Convert Data to Tab Delimited File

Introduction

Once a datalog data is saved to a USB drive or other storage device, users may convert the raw data to a tab delimited format for use in Excel or similar tool. An executable file is available from Temptronic.

Procedure

To convert data to tab delimited format:

1. Contact the Service Department for the PG175130; XSDL_TO_ASCII.exe converter.
2. Copy the converter to an empty folder on your computer.
3. Place the previously saved XSDL file (native data log format) into the same folder as the XSDL_TO_ASCII application.

   NOTE: Do not place more than one datalog file into the file with the application.

4. Double-click the XSDL_TO_ASCII.EXE file name to run the application.
5. A new .txt file is created using the same name as the original XSDL file.
   Example: Datalog123.XSDL becomes Datalog123.txt.

Printing Datalogs

To install a Printer to the *THERMOSTREAM* System

Step	Action
1	Shutdown the system. Press "Off" on the *Statusbar Display* to exit *THERMOSTREAM* Control Software. See System Shutdown, page 3-17.
2	Connect the printer cable to the appropriate port on your computer according to the printer manufacturer's instructions. Attach a keyboard and a mouse, if possible, to front panel ports. See OCM User Interfaces “OCM Cable Ports”, page 3-10.
3	Startup the system. Press front panel On-only momentary switch to energize system. See System Startup, page 3-15 if needed.
4	The MicroSoft Windows XP operating system boots.
5	Press Alt-Tab to toggle to the Windows Screen.
6	Select the Start Menu, then, select Printers and Faxes.
7	Plug the power cord of the printer into a wall outlet and turn the printer on. If you are using a Plug and Play printer, Windows detects it and, in many cases, installs it without requiring you to make any selections. The printer is ready to print.
8	If you do not have a Plug and Play printer or if Windows does not recognize your printer, select Add a Printer and follow the Wizard’s prompts.

To print a Datalog

1. Open a Datalog file, see Loading a Saved Datalog file, page 3-61.
2. Press "Print Datalog" on *Datalog Screen*.
3. System prompts "The Datalog has been successfully sent to the printer."

Section K: Setting Up a New Test (Air Mode)

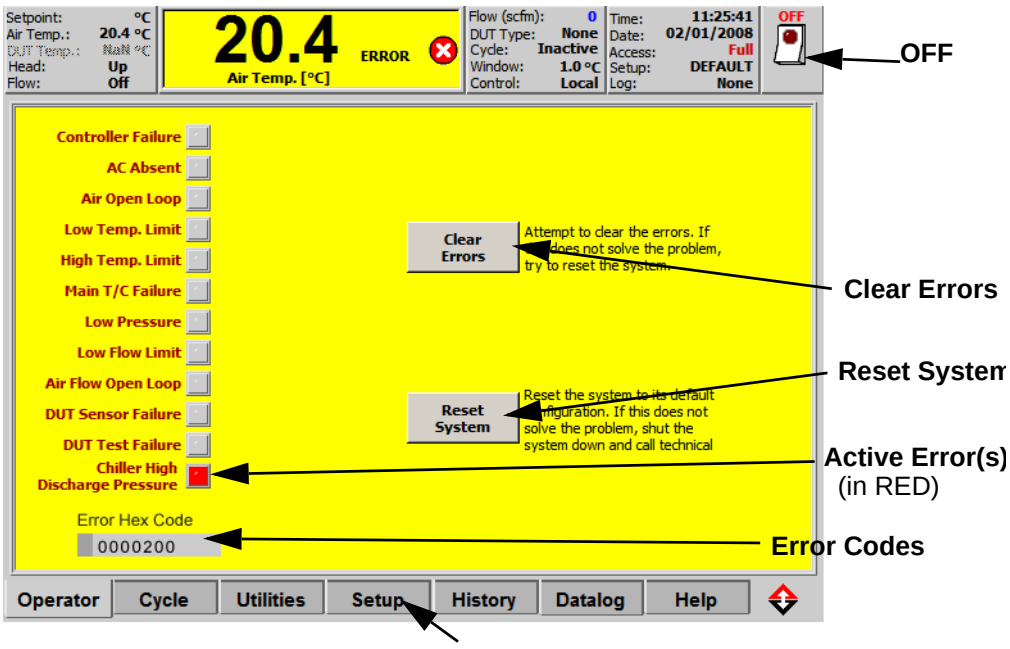
Parameter (default)	AIR MODE: SETUP A "NEW" TEST
UTILITIES SCREEN (See page 3-26)	
1. HEAD: UNLOCKED	enables Default Motion/Flow: test start = head down, flow on; test end = head up, flow off
2. TRICKLE: ON	keeps flexline hose cold in "head up, air off," for quick response to cooling calls
3. HEAT/COOL	compressor is running
SETUP SCREEN (See page 3-42)	
4. FLOW RATE: [5 scfm]	set main Air flow at Head output nozzle
5. FLOW UNITS [scfm]	toggle standard cubic feet/minute (scfm), or, liters/second (l/s)
6. AIR TEMP LIMIT HIGH [+225 °C] (**NOTE**: +300 °C for ATS-750)	set limit on highest air temperature DUT will undergo
7. AIR TEMP LIMIT LOW [-100 °C]	set limit on lowest air temperature DUT will undergo
8. TEMP DIGITS [1]	1 or 0 decimal points displayed: if "1"="53.8 °C"; then "0" rounds to "54 °C"
9. DUT SENSOR NONE	"None" disables prior DUT mode sensors, and enables Air mode
10. TEST TIME: [10 seconds]	begins at end of soak, controls (limits) test time, then next segment starts; can prevent cycling from "hanging up".
CYCLE SCREEN (See page 3-24)	
11. WINDOW [1.0 °C]	set range, per segment, above/below set point, in which system is "At Temp:" a 50 °C set point, with 1.0 °C Window band, is "At Temp" between 49 to 51 °C.
12. CYCLES [1]	set how many times a complete Cycle (all Enabled Segments) runs
13. CYCLE SEGMENTS	set point, RAMP, SOAK, ENABLED
To load (recall) a prior saved Setup, see Select a Setup file Screen, page 3-50.	

Section L: Setting Up a New Test (DUT Mode)

Parameter (default)	AIR MODE: SETUP A "NEW" TEST
UTILITIES SCREEN (See page 3-26)	
1. HEAD: UNLOCKED	enables Default Motion/Flow: test start = head down, flow on; test end = head up, flow off
2. TRICKLE: ON	keeps flexline hose cold in "head up, air off," for quick response to cooling calls
3. HEAT/COOL	compressor is running
SETUP SCREEN (See page 3-42)	
4. FLOW RATE: [5 scfm]	set main Air flow at Head output nozzle
5. FLOW UNITS [scfm]	toggle standard cubic feet/minute (scfm), or, liters/second (l/s)
6. AIR TEMP LIMIT HIGH [+225 °C] (**NOTE**: +300 °C for ATS-750)	set limit on highest air temperature DUT will undergo
7. AIR TEMP LIMIT LOW [-100 °C]	set limit on lowest air temperature DUT will undergo
8. TEMP DIGITS [1]	1 or 0 decimal points displayed: if "1"="53.8 °C"; then "0" rounds to "54 °C"
9. DUT SENSOR T, K, RTD, Diode	select a DUT sensor to enable DUT mode, then install sensor in direct contact to DUT
10. DUT MODE: [Air]	in DUT mode: select “DUT” to set up a DUT Mode test.
11. Air-DUT Max [300°C]	set max limit between Air and DUT temps
12. THERMAL CONSTANT [100]	manually adjust temperature overshoot/undershoot; midrange is "100:" low mass DUTs set <100; high mass set > 100
14. DTYP 0	Set the DUT size from “0” to “4” “0” is the smallest mass DUT “3” is the largest mass DUT “4” is for Auto-tuning the DUT
14. TEST TIME: [10 seconds]	begins at end of soak, controls (limits) test time, then next segment starts; can prevent cycling from "hanging up".
CYCLE SCREEN (See page 3-24)	
15. WINDOW [1.0 °C]	set range, per segment, above/below set point, in which system is "At Temp". a 50 °C set point, with 1.0 °C Window band, is "At Temp" between 49 to 51 °C.
16. CYCLES [1]	set how many times a complete Cycle (all Enabled Segments) runs
17. CYCLE SEGMENTS	set point, RAMP, SOAK, ENABLED
NOTE: To load (recall) a prior saved Setup, see Select a Setup file Screen, page 3-50.	

Section M: Error Messages

Error Screen Detailed



Field/Button Descriptions

Field/Button	Description
OFF	Press to shut Off, see Service Manual or call Service.
Active Error	The active Error(s) are marked in RED and should be resolved in the order they appear (top down).
Clear Error	Press to Clear Errors. If not cleared, press again. If not cleared, Reset system.
Reset System	Press to Reset system to default values installed at initial start up. Only defaults are reset: unsaved data/setups/runtime history is not lost. If no reset executed, then shut system Off.
Screen Tabs	Are disabled until the error is cleared or the system is reset.
• If proper corrective action taken, automatically clears *Error Screen*, or press "Clear Errors" to exit screen. • Some errors clear if the system is shut Off, then wait one minute, then re-start system.	
NOTE: For detailed Error Message Troubleshooting, refer to the *Service Manual*.	

Error Hex Codes

CONTROLLER_FAILURE 0x00000001

AC_ABSENT 0x00000002

AIR_OPEN_LOOP 0x00000004

LOW_TEMP_LIMIT 0x00000008
HIGH_TEMP_LIMIT 0x00000010
MAIN_TC_FAILURE 0x00000020
LOW_AIR_PRESSURE 0x00000040
LOW_FLOW_LIMIT 0x00000080
AIR_FLOW_OPEN_LOOP 0x00000100
DUT_SENSOR_FAILURE 0x00000200
DUT_TEST_FAILURE 0x00000400
CHILLER_HIGH_DISCHARGE_PRESSURE 0x00000800
CJ 0x00001000
SYS_COMM_CHECKSUM 0x00002000
SYS_COMM_OVERRUN 0x00004000
SYS_COMM 0x00008000
MISSING_PROBE_CAL 0x00010000
RESET_FROM_BROWN_OUT 0x00020000
RESET_FROM_WDT 0x00040000
FIRMWARE_NOT_UPDATED_FROM_VB_APP 0x00080000
SYS_DATA_RX_TIMEOUT 0x00100000
TC_T_MAIN_AIR_CAL_BAD 0x00200000
TC_T_DUT_CAL_BAD 0x00400000
TC_K_DUT_CAL_BAD 0x00800000
CONTROLLER_TEMP_LOW 0x01000000
CONTROLLER_TEMP_HIGH 0x02000000
NVM_SET_TO_DEFAULTS 0x04000000
AD_NO_DATA 0x08000000
SYS_COMM_FRAMING 0x10000000
NOT_RELEASED_SOFTWARE 0x20000000
SYS_COMM_SIZE 0x40000000
FLOW_CAL_INPUT_VOLTAGE_BAD 0x80000000

Section N: Set Time, Date

Procedure

To set the system time and/or date, follow these steps:

1. Press “Off” on *Statusbar Display* to exit *THERMOSTREAM* Control Software.
2. Attach a keyboard (and preferably, also attach a mouse) to front panel ports.
3. Press front panel On-only momentary switch to boot (energize) system.
4. Before Windows NT operating system can boot, immediately press and hold down the F2 key to enter BIOS Setup Mode.
5. The *BIOS Setup Main Screen* displays, with the “System Time” field highlighted.
6. Enter new time (hours, minutes, seconds), using “arrow keys” to move between time fields.
7. Use “down arrow” key to access “System Date” field, and enter new date (day, month, year), using “arrow keys” to move between date fields.
8. Press ESC key to exit the BIOS Setup.
9. Press “down arrow” key to select “Save Changes & Exit”.
10. When prompted “Continue,” press Yes (or press ENTER key).
11. System then exits BIOS Setup mode and a normal X-Stream bootup begins: Microsoft Windows NT boots, then the *THERMOSTREAM* Control Software (TSCS) boots. The system is then fully operational.
12. The new time and/or date displays on *Statusbar Display.*

4

Remote Interfaces

Chapter Overview

In this Chapter

This Chapter is divided into the following Sections:

Section A: Remote Interfaces, Overview and Assumptions

Remote Interfaces Overview

The ATS-700 & -800 Series *THERMOSTREAM* Systems have four different communications interfaces: GPIB (IEEE-488.2), Serial (RS-232C), Ethernet (10/100 base T), and a limited MCT hardware interface (ST/EOT/SFF).

- The *THERMOSTREAM* GPIB host interface was designed to be in substantial compliance with IEEE Standard 488.2. Please refer to the IEEE-488.2 standard for command syntax and general programming information.
- The Serial and Ethernet interfaces use the software protocols of the IEEE-488.2 standard. Additional software commands were added to emulate the functionality normally provided by dedicated GPIB control lines.
- The GPIB and Serial interfaces feature complete IEEE-488 service request and serial polling capabilities. The system can be programmed to generate service requests for temperature events (reaching the desired temperature, completing cycling, etc.), System-specific errors (overheat, low air flow, etc.) or IEEE-488 standard errors (command not recognized, etc.).
- This manual provides information specific to the ATS-700 & -800 Series *THERMOSTREAM* Systems and identifies which instructions the System supports.
- For the System to be controlled by a remote Host, the System must first be initialized and be in an operating mode capable of temperature control.
- When the System is being controlled by a remote Host, the “Control” field in the Statusbar reads: “Control: Serial, or, GPIB, or TCP/IP”.

To interface the System to an automated tester station (permit control by a remote prober Host) see:

IEEE-488.2 Interface, page 4-10

Serial Interface, page 4-11

Ethernet 10/100 BaseT Interface, page 4-27

MCT Interface, page 4-30

Software Version 3.2 (or higher)

- Has a remote command interface which is compatible with the Temptronic *TP04000A* and *TP04200A*, but differs from earlier *TP04300A* software versions.
- Multiple commands on a single command line are supported. See Syntax, page 4-6.
- The user may enable *TP04300A* backward compatibility to Ver 1. The communication protocols are different in Ver 1 mode. To run Version 1, see Enable/Disable Version 1 Software, page 4-4.

Software Version 1 compatibility mode

- Only one command or query allowed per command line.
- No command terminators are required. The *THERMOSTREAM* checks the input buffer every 50mSec for data then process what is in the input buffer. This may lead to the *THERMOSTREAM* processing incomplete commands in RS-232 mode.
- Allow a 100 mSec delay between commands.
- The following commands return different values for Version 1: AUXC?, "CYCL?"and "EROR?".
- Remote Command Set (page 4-13) notes the differences in commands between Version 3 and 1 compatibility.

Section B: Enable/Disable Version 1 Software

Refer to Chapter 3 to determine current software version.

Enable Version 1 Software

To enable prior Software Version 1 set "Compatible4000=FALSE" flag, as follows:

CAUTION

When editing the "Compatible4000" setting in \X-Stream.ini, do not change any other settings: doing so can cause the System to not function, or to not function properly.

Step	Action
1	If System is running, then press "OFF" on Statusbar Display to exit *THERMOSTREAM* Control Software (TSCS). If needed, see Chapter 3 for shutdown information.
2	Attach a keyboard, and a mouse, (and, preferably a monitor) to OCM front panel ports. If needed, see Chapter 3 for keyboard, mouse, and monitor connections.
3	Press front panel On switch to energize system.
4	Microsoft Windows operating system begins to boot.
5	When Windows "Desktop" appears press "Start" key (or left-click "Start" button in lower left, in Task Bar displayed at screen bottom).
6	If the *THERMOSTREAM* boots completely, then press "Start" key on keyboard, and continue.
7	In START menu, navigate to PROGRAM, then ACCESSORIES menus, and select (launch) either NOTEPAD or WORDPAD program.
8	In Notepad (or Wordpad) go to FILE, then OPEN, and set drop down menu, "Files of Type," to "All Files".
9	Navigate to, and open the file: "D:\X-Stream\X-Stream.ini.
10	In \X-Stream.ini file, edit "Compatible4000" flag to read **Compatible4000=FALSE** (use uppercase letters in FALSE flag).
11	Press FILE, then SAVE, to save \X-Stream.ini.
12	Press FILE, then OPEN, then select and double click \X-Stream.exe to boot the *THERMOSTREAM* Control Software (TSCS) operating system.
13	Close NotePad (or WordPad): press FILE, then EXIT.
14	If the TSCS is already running, then press "Off" on Statusbar Display to exit the TSCS, and do a normal system startup to reboot and install the new values.
15	The System is now running Version 1 commands.

Disable Version 1 Software

To disable Software Version 1 set "Compatible4000=TRUE" flag.

To exit Version 1, and return to Version 3, navigate to \X-Stream.ini and change the "Compatible4000=FALSE" flag to "Compatible4000=TRUE," save the changed file, then re-boot.
Use the Version 3 commands. See Remote Command Set, page 4-13.

Section C: Syntax

Syntax Overview

For both GPIB (IEEE-488.2) and Serial (RS-232C):

- All message strings to and from the *THERMOSTREAM* consist of ASCII characters.
- Numerical arguments are always sent/received in decimal format as a string of ASCII characters.
- Some numerical arguments consist of a series of binary flags. They are sent as a decimal number equal to the sum of the binary weights of each flag bit that is a “one.”
- Commands with arguments must have a space between the command and the argument.
- Serial (RS-232C) program messages (strings) must be terminated with a line feed. GPIB program messages (strings) may be terminated with a line feed, by setting the EOI line, or both.
- In GPIB mode, response messages from the *THERMOSTREAM* terminate with a line feed character with the EOI line set. In Serial mode, response messages are terminated with a carriage return followed by a line feed.
- Program message unit separators “;” (semicolons) are required to delimit multiple commands or queries in a single program message (string).
- In serial mode, the ! (exclamation point) character acts as the device clear command. It is sent as a single character (no terminator) and should never otherwise appear in a message.
- The System parses commands as explained in Command Processing (page 4-7)

Command Examples

Command Description	Syntax From Host to System	System Returns
Read the current temperature.	TEMP?<LF>	25<LF>
Set the temperature of Profile 1 to 25 °C, the window to 3 °C, the soak time to 15 seconds, and the ramp time to 0.	R1 S1; R1 W3; R1 K15; R1 R0;<LF>	
Read the set point and the current temperature.	SETP?;TEMP?<LF>	25;24.9<LF>

Section D: Command Processing

Command Processing Overview

- The System reads the message into a buffer until a Line Feed <LF> is received (or in GPIB mode, the EOI line is set).
- After the <LF> (or EOI) is received, the System begins to process the commands/queries in the message.
- The System continues until all of the commands/queries in the message string are processed.
- During processing of the message, the System will not transmit data. In GPIB mode, the GPIB hardware handshake lines prevents new data from being received. In Serial mode, because there is no hardware handshaking, new data will be received into the input buffer but will not be acted upon until processing of the current message is completed.
- When the entire message string has been processed, the System transmits the response(s) (separated by semicolons if there was more than one query message unit in the string) to any queries.
- Although commands and queries are typically processed in less than 100 milliseconds, a GPIB bus or Serial Interface timeout interval of 3 seconds is recommended.
- All commands/queries in multiple-command messages are processed sequentially. All program messages are processed sequentially.

Section E: Error Reporting (Software Version 3)

Command and query errors are reported by means of the IEEE-488.2 “standard event status register.” This register may be read with the *ESR? query. For more information, see Remote Command Set on page 4-13, and/or the IEEE-488.2 standard.

- Reading the ESR register also clears it.
- If a command or query error occurs, succeeding program message units in that same string are not processed.
- When initially developing a program, it is recommended that *ESR? queries be liberally interspersed between commands.
- If the response is 0, it indicates that no error exists and the program can safely proceed.
- Once the program has been debugged, some of the *ESR? queries can be removed.

Section F: Maximizing Communications Throughput

- Sending multiple commands separated by semicolons helps to eliminate potential delays in the control program. See Syntax, page 4-6.
- The System processes multiple program message units in the same message without waiting between them.
- For example, the multiple command message:
  SETP 25;LLIM 30;ULIM 90<LF>
  *ESR?<LF>

  executes more quickly than:
  SETP 25<LF>
  LLIM 30<LF>
  ULIM 90<LF>
  *ESR?<LF>

Section G: IEEE-488.2 Interface

Set: Bus Address; Baud 9600

The IEEE-488 interface requires the following settings:

- Address and baud rate are set on the *Utilities* Screen (see Chapter 3 for more information on the *Utilities* Screen).
- Use the “GPIB Address” button to set a unique address for each device on the bus.
- Use the "Baud Rate" button to set 9600 baud. (A baud rate of other than 9600 prevents the user from setting the GPIB address).

Demonstration Program

A “C” Language demonstration program, idemo, illustrates recommended programming practices for the *THERMOSTREAM* .

Idemo is a 32-bit Windows console application.

Source and executable versions of idemo are provided on the *THERMOSTREAM* Interface & Applications Manual CD-ROM (part # LM04070).

ATTENTION

The executable version of idemo requires a National Instruments (NI) GPIB interface card, and the NI-488.2 drivers.

Section H: Serial Interface

Serial Interface Connector

The system I/O panel provides a DB9P (9-pin male) connector with a nonstandard pinout. The *THERMOSTREAM* does not support handshaking. For compatibility with host computers that expect handshaking (such as those computers that were connected to Temptronic *TP04000A* and *TP04200A* Systems), a special cable should be used that connects pin 4 to pin 6, and pin 7 to pin 8, on the host computer side. No connection should be made to those pins on the *THERMOSTREAM* side. Alternatively, if handshaking is disabled on the host, a straight through cable (NOT a null modem) with female connectors on both ends can be used to hook the System up to a PC-compatible host computer.

Pin Number	Function/Signal Level
Shell	Chassis ground
1	DCD - no connection
2	Serial data out from the *THERMOSTREAM*
3	Serial data into the *THERMOSTREAM*
4	DTR - Always high output from the*THERMOSTREAM* (tied to +8 through 3.3K ohms).
5	Signal ground
6	DSR - no connection
7	RTS - always high output from the *THERMOSTREAM* (tied to +8v through 3.3K ohms).
8	CTS - tied to pin 4
9	RI - no connection.

Serial Interface Parameters

The Serial interface parameters, are as follows:

Setting	Parameter
Baud Rate	300, 1200, 2400, 4800, 9600, 19200, 38400, 57600
Data Bits	Fixed at 8
Parity	Fixed at No Parity
Stop Bits	Fixed at One (1)

Demonstration Program

A “C” Language demonstration program, sdemo, illustrates recommended programming practices for the *THERMOSTREAM*.

Sdemo is a 32-bit Windows console application.

Source and executable versions of sdemo are provided on the *THERMOSTREAM* Interface & Applications Manual CD-ROM (part # LM01470).

Section I: Remote Command Set

Remote Commands Overview

In this Section

The following topics are covered in this Section:

IEEE Mandatory Commands

Command	Description
***CLS**	Clear the status (*ESR, TESR) registers.
***ESE**	Set the standard event status enable (mask) register. *ESE nnn -- where nnn is 0 – 255 **NOTE**: See *ESR? for the meaning of each bit in the mask.
***ESE?**	Read the standard event status enable (mask) register.
***ESR?**	Read the standard event status register. bit 7 – power on – not used bit 6 – user request -- not used bit 5 – command error (cme) bit 4 – execution error (exe) bit 3 – device dependent error (dde) bit 2 – query error (qye) bit 1 – request control -- not used bit 0 – operation complete -- not implemented **NOTE**: The above bits are latched, and are automatically cleared when the register is read.
***IDN?**	Returns TEMPTRONIC, ATS-XXX, PG19909X, Ver 5.7.2 -- varies with system models ATS-XXX and software versions.
***RST**	Reset (force) the System to the Cycle screen. **NOTE**: Any device-specific errors are reset. The upper and lower temperature limits and certain other values are reset. set point number 5 becomes the active set point. **NOTE**: After sending this command, wait 4 seconds before sending another command.
<serial poll>	Read the status byte by performing a serial poll. bit 7 – ready bit 6 – request for service (RQS) bit 5 – standard event status (ESB) summary bit bit 4 – message available (MAV) (GPIB only, always 0 for RS-232) bit 3 – temperature event (TESR) summary bit bit 2 – device specific error (EROR) summary bit bit 1 – not used (always 0) bit 0 – not used (always 0) **NOTE**: The “request for service” flag (bit 6) is automatically reset when a serial poll is performed.
***SRE**	Set the service request enable (mask) register. *SRE nnn -- where nnn is 0 – 255 **NOTE**: See <serial poll> for the meaning of each bit in the mask.
***SRE?**	Read the service request enable (mask) register.

Command	Description
***STB?**	Read the status byte. bit 7 - ready bit 6 - master summary status (MSS) bit bit 5 - standard event status (ESB) summary bit bit 4 - message available (MAV) (GPIB only, always 0 for RS-232) bit 3 - temperature event (TESR) summary bit bit 2 - device specific error (EROR) summary bit bit 1 - not used (always 0) bit 0 - not used (always 0)
***TST?**	Self test (dummy, always returns 0, meaning “passed”).
***OPC**	Not implemented
***OPC?**	Not implemented
***WAI**	Not implemented

RS-232C Serial Commands

Command	Description
%GL	Go to local – enables System touch screen controls. **NOTE**: In accordance with the IEEE-488.2 standard, the System still responds to remote commands in when in local mode.
%LL	Local lockout – the System touch screen controls are disabled, and no “Return to local” button appears on the panel.
%RM	Go into remote mode – the System touch screen controls are disabled, but a “Return to local” button appears. **NOTE**: When in remote mode, the touch screen controls will be disabled each time the System receives a command.
%S?	Read the status byte by performing a serial poll. bit 7 – ready bit 6 – request for service (RQS) bit 5 – standard event status (ESB) summary bit bit 4 – message available (MAV) (always 0 for RS-232) bit 3 – temperature event (TESR) summary bit bit 2 – device specific error (EROR) summary bit bit 1 – not used (always 0) bit 0 – not used (always 0) **NOTE**: The “request for service” flag (bit 6) is automatically reset when a serial poll is performed.
!	Device clear – clears the serial communications subsystem. The System echos back the “!” when the command has completed. If the “!” response is not received, the command should be retried. **NOTE**: This command is sent as a single character (no line feed terminator), and should never otherwise appear in a string sent to the System.
^	The System sends a “^” as a service request (SRQ) indicator in serial mode. **NOTE**: The “^” character will never otherwise appear in a response string, and is sent as a single character.

Device Specific Commands

Command	Description
ADMD	Set the air-to-DUT maximum difference. ADMD nnn -- where nnn is 10 - 300 °C in 1 degree increments.
ADMD?	Read the air-to-DUT maximum difference.
AUXC?	Read the auxiliary condition register. **Version 3 software:** bit 10 – reserved bit 9 – reserved bit 8 – Operator screen = 1, Cycle screen = 0 bit 7 – reserved bit 6 – ready for operation = 1, startup sequence = 0 bit 5 – flow on = 1, flow off = 0 bit 4 – DUT mode = 1, air-control mode = 0 bit 3 – heat only mode =1, compressor on =0 bit 2 – head up = 1, head down = 0 bit 1 – reserved bit 0 – reserved **Version 1 software:** bit 17 – HDLK bit 16 – MCTP bit 15 – DTYP bits 12/13/14 – DSNS • 0/ 0 /0 – no DUT sensor present • 0/ 0 /1 – type T thermocouple • 0/ 1/ 0 – type K thermocouple • 0 /1/ 1 – RTD • 1/ 0 /0 – diode bits 10/11 – DUTM • 0/ 0 -- air • 0/ 1 – DUT bit 9 – DLOG bit 8 – CYCP bit 7 – CYCL bit 6 – TRKL bit 5 – COOL bit 4 – FLOW bit 3 – HEAD bit 2 – EROR bit 1 – EMSH bit 0 – N/A

Command	Description
CLER	Clear device-specific (reported by EROR?) errors. **NOTE**: After sending this command, wait 4 seconds before sending another command.
COOL	Turn the compressor on or off. COOL 1 – turn the compressor on COOL 0 – turn the compressor off **NOTE:** There is a delay between the time that the compressor is turned on and the System is ready to operate.
COOL?	Read COOL on/off state.
CYCC	Set the cycle count. CYCC nnnn -- where nnnn is the number (1 - 9999) of cycles to do.
CYCC?	Read the number of cycles to do.
CYCL	Start/stop cycling. CYCL 1 – start CYCL 0 – stop **NOTE**: When all cycles have been completed or when cycling was stopped on failure, it is necessary to send a CYCL 0 command to reset the system.
CYCL?	Read the cycle number (current value if cycling, last value if not). **NOTE**: If Version 1 compatibility mode is enabled, CYCL? returns the number of fully completed cycles.
CYCO	Turn the display of the cycling feature parameters on the operator screen on or off. CYCO 1 – display cycling parameters CYCO 0 – don’t display cycling parameters
CYCO?	Read CYCO on/off state.
CYCP	Pause or restart cycling. CYCP 1 – pause cycling CYCP 0 – restart cycling
CYCP?	Read CYCP pause/run state
DLOG	DLOG “filename” turns on datalogging to the file “filename.” DLOG 0 turns datalogging off. **NOTE**: The file name should be in quotes. **NOTE**: If the file already exists, it will automatically be overwritten.
DLOG?	Return the name of the file if datalogging is active, or “None” if datalogging is off.

Command	Description
DSNS	Set the DUT sensor type. DSNS n -- where n is 0-4 0 – no DUT sensor 1 – type T thermocouple 2 – type K thermocouple 3 – RTD 4 – diode
DSNS?	Read the DUT sensor type.
DSPC?	Return the remaining disk space available for datalogging, in bytes. **NOTE**: The maximum space value returned is limited to 2147483647 bytes (2 Gbytes).
DTYP	Press to Select the DUT Type. there are 5 possible selections: 0-Smallest DUT mass example: a 28 pin, 350 mil, ceramic or plastic device 1-Larger DUT mass example: a 32 pin, 400 mil ceramic or plastic device 2-Larger DUT mass example: a 68 pin PLCC plastic device. 3-Largest DUT mass. use for larger hybrid chips. 4- System Derived. Use this parameter to Auto-tune the DUT 5- Box use with Temptronic ThermoChambers.
DTYP?	Read the setting of DTYP.
DUTC	Set the device thermal constant. DUTC nnn -- where nnn is nominally 100 but can range from 20 - 500. **NOTE**: Use a higher number for a higher mass device, and to reduce the amount of overshoot. A lower number may cause some overshoot, but may also reduce the transition time.
DUTC?	Read the device thermal constant.
DUTM	Turn DUT mode on or off. DUTM 0 -- off (air control) DUTM 1 -- on (DUT control) DUTM 2 -- TC Meter mode
DUTM?	Read DUT mode on/off state. **NOTE**: The DUT mode state also appears as a bit in AUXC?.
EDIT	Enter/leave EDIT mode. EDIT mode allows making changes to the parameters for a particular set point without trying to control at that set point. EDIT 1 – enter edit mode EDIT 0 – leave edit mode

Command	Description
EDIT?	Read the on/off state of EDIT mode.
EROR?	Read the device-specific error register (16 bits). **Version 3 software:** bit 15 – reserved bit 14 – no DUT sensor selected bit 13 – improper software version bit 12 – reserved bit 11 – reserved bit 10 – purge heat failure bit 9 -- flow sensor hardware error bit 8 – DUT open loop bit 7 -- internal error bit 6 – open purge temperature sensor bit 5 – no purge flow bit 4 -- low input air pressure bit 3 -- low flow bit 2 – set point out of range bit 1 -- air open loop bit 0 – overheat **Version 1 software:** bit 12 – DUT sensor failure bit 11 – high flow limit bit 10 – low flow limit bit 9 – low pressure bit 8 – main T/C failure bit 7 – high temperature limit bit 6 – low temperature limit bit 5 – air open loop bit 4 – AC absent bit 3 – controller failure bit 2 – reserved bit 1 – reserved bit 0 - reserved
FLLE	Set the main air flow lower limit. FLLE n – where n is 1 to 5 scfm **NOTE**: THIS VALUE IS IGNORED BY THE SYSTEM. The flow lower limit value is a fixed value.
FLLE?	Read the main air flow lower limit, in scfm.
FLOW	Turn the main nozzle air flow on or off. FLOW 1 – on FLOW 0 – off

Command	Description
FLOW?	Read the setting of FLOW. **NOTE**: The FLOW on/off state also appears as a bit in AUXC?.
FLRE?	Read the measured main nozzle air flow rate, in scfm. **NOTE**: This query and FLWR? are identical.
FLRL?	Read the measured main nozzle air flow rate, in liters/sec.
FLSE	Set the desired main nozzle air flow rate, in English units. FLSE nn – where nn is 5 –18 scfm **NOTE**: The allowable upper limit for FLSE is 2 less than the setting of FLUE, and so may be less than 18.
FLSE?	Read the main nozzle air flow rate setting, in scfm.
FLUE	Set the main nozzle air flow upper limit, in English units. FLUE nn -- where nn is 5 – 20 scfm.
FLUE?	Read the main nozzle air flow upper limit setting, in scfm.
FLWM	Set the main nozzle air flow rate, in English units. FLWM nn – where nn is 5 –18 scfm **NOTE**: This command and FLSE are identical.
FLWM?	Read the desired main nozzle air flow rate setting, in scfm. **NOTE**: This query, and FLSE? are identical.
FLWR?	Read the measured main nozzle air flow rate, in scfm. **NOTE**: This command and FLRE? are identical.
GTIM?	Set the Chiller timer to shutdown the system after *n* minutes where *n* is 0 - 12960. **NOTE:** Setting a value of “0” disables the shut down timer.
GTIM	Queries the time (in minutes) before the timer shuts down the Chiller.
HDLK	Lock the test head in its current position (up or down). HDLK 1 – head locked (prevented from moving) HDLK 0 – head can move up and down
HDLK?	Read the setting of HDLK.
HEAD	Raise or lower the test head (same as STND). HEAD 1 – put head down HEAD 0 – put head up **NOTE**: Sending this command when the head is locked will NOT cause an error, but the head will not actually move.
HEAD?	Read the up/down state of the test head. **NOTE**: The HEAD state also appears as a bit in AUXC?.
LGIN	LGIN “password” remotely logs in a host to the System. **NOTE**: THIS COMMAND IS USED IN TCP/IP MODE ONLY. It is NOT used for IEEE-488.2 or Serial communications modes. **NOTE**: “X-Stream” is the factory-set login password.
LGIN?	Returns “GPIB” if the System is in IEEE-488.2 mode, “Serial” if in serial mode, or “Network” if in TCP/IP mode.

Command	Description
LLIM	Set the lower air temperature limit. LLIM nnn -- where nnn is -150 to +25 °C **NOTE**: LLIM limits the minimum air temperature in both air and DUT control modes. Additionally, an “out of range” error generates if a set point is less than this value.
LLIM?	Read the lower air temperature limit.
LO	If a host is remotely logged in to the System, LO logs it out. **NOTE**: THIS COMMAND IS USED IN TCP/IP MODE ONLY. It is NOT used for IEEE-488.2 or serial communications modes.
LOGOUT	same as “LO” (above).
LRNM	Turn DUT automatic tuning (learning) on or off. LRNM 0 – off (control DUT with current DUT control parameters) LRNM 1 – automatic tuning on NOTE: LRNM 0 is equivalent to DTYP 0. LRNM 1 is equivalent to DTYP 1.
LRNM?	Read the setting of LRNM.
MCTP	Set the MCT interface polarity. MCTP 0 – negative MCTP 1 – positive
MCTP?	Read the setting of MCTP.
NEXT	Step to the next set point during temperature cycling. **NOTE**: Stepping occurs whether or not the device is at temperature. NEXT causes an error if the system is not in cycling mode.
PASS	Change the System password – PASS “password.” **NOTE**: THIS COMMAND IS USED IN TCP/IP MODE ONLY. It is NOT used for IEEE-488.2 or serial communications modes.
PRGT	To maintain compatibility with other Temptronic products, this command is accepted but ignored. PRGT nn - where nn is the purge heat temperature.
RAMP	Set the ramp rate for the currently selected set point, in °C per minute. RAMP nn.n – where nn.n is 0 to 99.9 in 0.1 °C per minute steps. or RAMP nnnn – where nnnn is 100 to 9999 in 1 °C per minute steps.
RAMP?	Read the setting of RAMP.
RMPC	To maintain compatibility with other Temptronic products, this command is accepted but ignored. RMPC 1 RMPC 0
RMPS	Same as RMPC

Command	Description
RSTO	Reset (force) the System to the Operator screen. **NOTE**: Any device-specific errors are reset. The upper and lower temperature limits and certain other values are reset. set point number 1 (Ambient) becomes the active set point. **NOTE**: After sending this command, wait 4 seconds before sending another command.
SETD?	Read the dynamic temperature set point. **NOTE**: This value changes during a temperature ramp to reflect the instantaneous value at the time the query is executed.
SETN	Select a set point to be the current set point. SETN nn -- where n is 0 – 17 when on the Cycle screen. or SETN n – where n is 0 to 2 when on the Operator screen (0=hot, 1=ambient, 2=cold). **NOTE**: Use *RST to reset (force) the System to the Cycle screen. Use RSTO to reset (force) the System to the Operator screen. **NOTE**: SETN arguments 0-17 correspond to the set points numbered 1-18 on the Cycle screen. **NOTE**: Use EDIT to change the parameters for a particular set point without actually controlling temperature at that set point.
SETN?	Read the current set point number.
SETP	Set the currently selected set point's temperature. SETP nnn.n -- where nnn.n is –99.9 to 225.0 °C. **NOTE**: Entering a value greater than ULIM (the upper limit) or less than LLIM (the lower limit) causes an "out of range" error.
SETP?	Read the current temperature set point.
SFIL	SFIL "filename" loads the test setup file with that name. **NOTE**: The file name should be in quotes. **NOTE**: After sending this command, wait 2 seconds before sending another command.
SFIL?	Return the name of the test setup file currently in use.
SFIS	SFIS "filename" saves the current values of the test parameters to a file with that name. **NOTE**: The file name should be in quotes. If it already exists, it will be overwritten. **NOTE**: After sending this command, wait 2 seconds before sending another command.
SOAK	Set the soak time for the currently selected set point. SOAK nnnn – where nnnn is 0 – 9999 seconds.
SOAK?	Read the soak time for the currently selected set point.

Command	Description
SPEN	Enable/disable the use during temperature cycling of the currently selected set point. SPEN 1 – the System uses the set point during temperature cycling. SPEN 0 – the System skips the set point during temperature cycling. **NOTE**: SPEN 0 forces the ramp rate of the selected set point to zero. Setting the ramp rate to zero is another way to cause a set point to be skipped during cycling.
SPEN?	Read the value of SPEN for the currently selected set point.
SRST	Reset (force) the System to the Cycle screen without raising the test head. **NOTE**: Any device-specific errors are reset. The upper and lower temperature limits and certain other values are reset. set point number 5 becomes the active set point. **NOTE**: After sending this command, wait 4 seconds before sending another command.
STIM	Set the shutdown timer to shutdown the system after *n* minutes where *n* is 0 - 12960. **NOTE:** Setting a value of "0" disables the shutdown timer.
STIM?	Queries the time (in minutes) before the timer shuts down the system.
STND	Raise or lower the test head (same as HEAD). STND 1 -- put head down STND 0 -- put head up **NOTE**: Sending this command when the head is locked will NOT cause an error, but the head will not actually move.
TECR?	Read the temperature event condition register. bit 7 – datalogging on bit 6 -- not used bit 5 -- stopped cycling ("stop on fail" signal was received) bit 4 -- end of all cycles bit 3 -- end of one cycle bit 2 -- end of test (test time has elapsed) bit 1 -- not at temperature bit 0 -- at temperature (soak time has elapsed)
TEMP?	Read the system temperature, in 0.1 °C increments. The reading depends on which temperature sensors are being used: In Air Mode: query returns the main air temperature In Dut Mode: query returns the DUT sensor temperature In TC Meter Mode: TC Meter Mode can be used with either the Main Air or DUT sensor. The query returns either the Main Air or DUT sensor temperature plus the offset. Use TMPA? to always return air temperature (without offset), and TMPD? to always return DUT temperature (without offset), regardless of mode.

Command	Description
TESE	Set the temperature event status enable (mask) register. TESE nnn -- where nnn is 0 – 255 **NOTE**: See TESR? for the meaning of each bit in the mask.
TESE?	Read the temperature event status enable (mask) register.
TESR?	Read the temperature event status register bit 7 -- reserved bit 6 -- not used bit 5 -- stopped cycling ("stop on fail" signal was received) bit 4 -- end of all cycles bit 3 -- end of one cycle bit 2 -- end of test (test time has elapsed) bit 1 -- not at temperature bit 0 -- at temperature (soak time has elapsed) **NOTE**: The above bits are latched. They are set when the corresponding bit in the temperature event condition register makes a 0 to 1 transition, and are automatically cleared when the temperature event status register is read.
TMPA?	Read main air temperature, in 0.1 °C increments. **NOTE**: This query always returns the main air nozzle temperature without any offsets whether in Main Air Mode, DUT Mode, or TC Meter Mode.
TMPD?	Read DUT sensor temperature, in 0.1 °C increments. **NOTE**: This query always returns the DUT sensor temperature without any offsets whether in DUT Mode, or TC Meter Mode.
TRKL	Turn trickle flow on/off. TRKL 1 – trickle flow on TRKL 0 – trickle flow off
TRKL?	Read the setting of TRKL.
TTIM	Set the maximum allowable test time. TTIM nnnn -- where nnnn is 0-9999 seconds **NOTE**: Setting a test time prevents the System from staying at one set point forever during cycling if a NEXT command or MCT interface “end of test” pulse is not received.
TTIM?	Read the maximum test time.
ULIM	Set the upper air temperature limit. ULIM nnn -- where nnn is 25 to 225 °C. **NOTE**: ULIM limits the maximum air temperature in both air and DUT control modes. Additionally, an “out of range” error generates if a set point exceeds this value.
ULIM?	Read the upper air temperature limit.

Command	Description
WHAT?	Returns an integer indicating what the system is doing at the time the query is processed. 5 = on Operator screen 6 = on Cycle screen
WNDW	Set the currently selected set point's temperature window. WNDW n.n -- where n.n is 0.1 - 9.9 °C **NOTE**: The window is the maximum positive or negative deviation from the temperature set point allowable for an "at temperature" condition.
WNDW?	Read the currently selected set point's temperature window.

Section J: Ethernet 10/100 BaseT Interface

Ethernet Overview

In this Section

The following topics are covered in this Section:

Ethernet Connector

Introduction

An industry standard RJ-45 port is provided for 10/100 BaseT Ethernet communications. It supports:

- 10 Mb/s and 100 Mb/s operation (N-way auto-negotiation)
- Full duplex capability
- Full duplex flow control per IEEE 802.3x

RJ-45 Connector (Pin Outs)

Pin	Signal
1	Transmit + (positive)
2	Transmit - (negative)
3	Receive + (positive)
4	Not Connected
5	Not Connected
6	Receive - (negative)
7	Not Connected
8	Not Connected

Ethernet Log In/Log Out

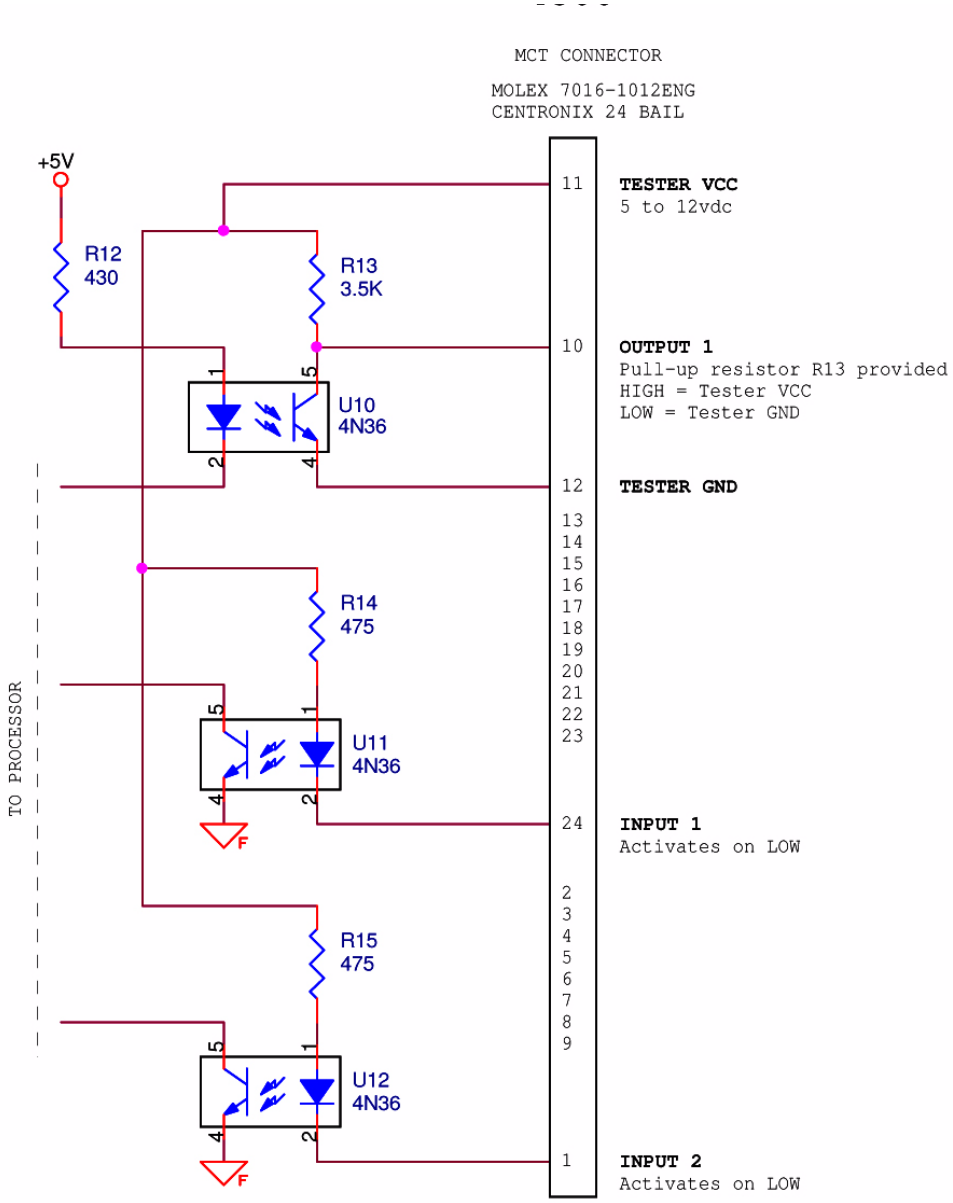
Procedure

To log in / log out, via Ethernet to a fully booted, operational *THERMOSTREAM*, from a remote host:

Step	Action
1	Connect via telnet to the *THERMOSTREAM*'s TCP/IP address, port 40957. The *THERMOSTREAM*'s TCP/IP address can be viewed in the Utilities *Screen*.
2	Terminal type is vt100.
3	Remote host displays: "Welcome to the X-Stream Server client from [IP Address] ###.###.###.### at port ####" one connection is established.
4	**Log in** the remote host to control the *System* via the ethernet connection. At the remote host screen, command prompt, type: LGIN X-Stream. Press Enter key.
5	Remote host displays: "Password correct. Controller now is NETWORK".
6	**NOTE**: "X-Stream" is the factory installed *System* remote login password. If "X-Stream" does not operate, then the remote login password may have been changed by a user. (See the LGIN and PASS commands in Chapter 3).
7	The Command Set given in Remote Command Set (page 4-13) can now be executed from the remote host.
8	The *System Screen* is slightly "grayed" out, "LOGIN" displays in the lower right corner, and in the Status Bar (top of screen), the "Control" field displays "Network."
9	To disable (exit) remote control, **log out** by: 1. typing LO or LOGUT at the remote command prompt. 2. Press the Enter key. 3. Remote screen displays: "Success. Controller now is LOCAL." 4. In the Status Bar, the Control field displays: "Local." **NOTE: LO or LOGUT is** required to free the TCP/ IP port of the *System*. ***RST** sets the controller back to local mode.

Section K: MCT Interface

MCT Interface



This interface has 2 inputs:

- End of Test (EOT)
- Stop On First Fail (SFF),

and one output:

- Start Test (ST).

To set the input/output pulse polarity, use “MCT Polarity: Positive/Negative” on the *Utilities Screen* (see Chapter 3 for more information on the *Utilities* screen.

When the polarity is set to POSITIVE, the minimum required pulse time for each signal is 2 seconds. Anything shorter than 2 seconds will be ignored.

When the polarity is set to NEGATIVE, the minimum required pulse time for each signal is 100ms

MCT Connector, Pin Outs

Pin #	Signals	Functions
1	STOP, FIRST FAIL	An input pulse as short as 100 msec received to signal the *THERMOSTREAM* to abort temperature cycling and to display “DUT Failure” alert.
10	START TEST (READY TO TEST)	An output (120 to 150 msec pulse) from the *THERMOSTREAM* to signal AT TEMP condition.
11	TESTER VCC	+5 to +12 Vdc
12	TESTER GROUND	Ground
24	END OF TEST	An input . Signals the *THERMOSTREAM* to immediately cycle to the next set point.

5 Routine Maintenance

Chapter Overview

In this Chapter

This Chapter is divided into the following Sections:

Section A: Maintenance Log

Introduction

The following log is provided as a suggested long term preventive maintenance schedule. Space has been provided for additional items found useful from actual system performance and experience for each installation.

For short term preventive maintenance, check the filter sight glasses of the pneumatics module for water either daily or weekly (see Drain Moisture from Pneumatics Filter Elements, page 5-6).

Maintenance Log

Maintenance Item	Run Time (thousands of hours)							
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
Air calibration		[]		[]		[]		[]
Pneumatic module filters	[]	#	[]	#	[]	#	[]	#
Air dryer filter(s)	[]	#	[]	#	[]	#	[]	#

[] Check and perform maintenance as required.

Check and replace as indicated.

Section B: Inspection and Cleaning

Introduction

Weekly inspection is recommended for frequently used systems to ensure normal operation with no deterioration in performance.

1. Inspect exposed hoses and cables for cuts and or abrasions; reroute and repair as required.
2. Inspect for free air flow at all ventilated panel areas; remove any restrictions.
3. Inspect for open liquid containers resting on the system; remove when found. The system is not waterproof.
4. Keep the system clean for reliable operation.
5. Clean the display using any commercially available CRT cleaner and a soft lint-free cloth. Do not use any abrasive cleaner or paper towel.
6. Clean the condenser inlet every 3 months or sooner if needed. A dirty condenser inlet reduces the air flow and degrade the cooling performance of the refrigeration unit.

WARNING

WARNING 7: When cleaning condenser air inlet fins, (access by removing front panel) use soft brush and/or vacuum cleaner, taking care not to bend inlet fins; as fins have sharp edges, to prevent getting cut, either wear gloves and/or do not touch inlet fins directly with fingers.

7. Clean the front panel Operator Control Module (OCM) every 6 months or sooner if needed. Use a soft, lint-free cloth or a ball of absorbent cotton, moistened with a mild glass cleaner. Be careful not to get cleaning liquids into the OCM interior. *Do not* use a paper towel; *do not* use enough liquid to drip or run.

Section C: Side Panel and Cover Removal

ATTENTION

No tools are needed to remove or reinstall the panels.

Top, Front Panel Removal

1. Grasp both sides of the top front panel, holding the top panel half way down from top of panel.
2. To unseat the top panel from the four supporting snap-poles, without damaging the On-only switch's connecting wires, gently pull the top front panel straight forward 3 or 4 inches only.
3. Disconnect On-only switch connecting wires by unplugging them from the molex connector.
4. Remove the panel
5. To reinstall the top panel, first replug the On-only switch wires into the molex connector, then align the top panel with the snap poles and reverse the above steps.

Bottom, Front Panel Removal

1. Grasp both sides of the bottom front panel, holding the bottom panel half way down from top of panel.
2. Gently pull the front panel straight forward to unseat it from the snap-poles
3. Remove the panel.
4. To reinstall, align the bottom panel with the snap-poles and reverse the above steps.

Left and Right Side Panel Removal

1. To unseat the left or right side panel, first unscrew the four quarter-turn locking screws, one in each corner.
2. On the right panel only, detach the grounding wire from its lug nut.
3. Remove the panel.
4. To reinstall, reverse the above steps.

Section D: Air Path Maintenance

Overview

Follow this sequence to inspect the air filters to follow the air path:

Particle Filter, Pneumatic Module: a) change element when it is visibly dirty or system is losing air flow; b) regularly (daily or weekly) drain moisture.

Coalescing Filter, Pneumatic Module: a) change element when it is visibly dirty or system is losing air flow; b) regularly (daily or weekly) drain moisture.

Post Filter, Air Dryer Module: change element when it is visibly dirty or system is losing air flow; b) regularly (daily or weekly) drain moisture c) if air dryer is failing, or if water in filter, then the system freezes.

In this Section

The following topics are covered in this Section:

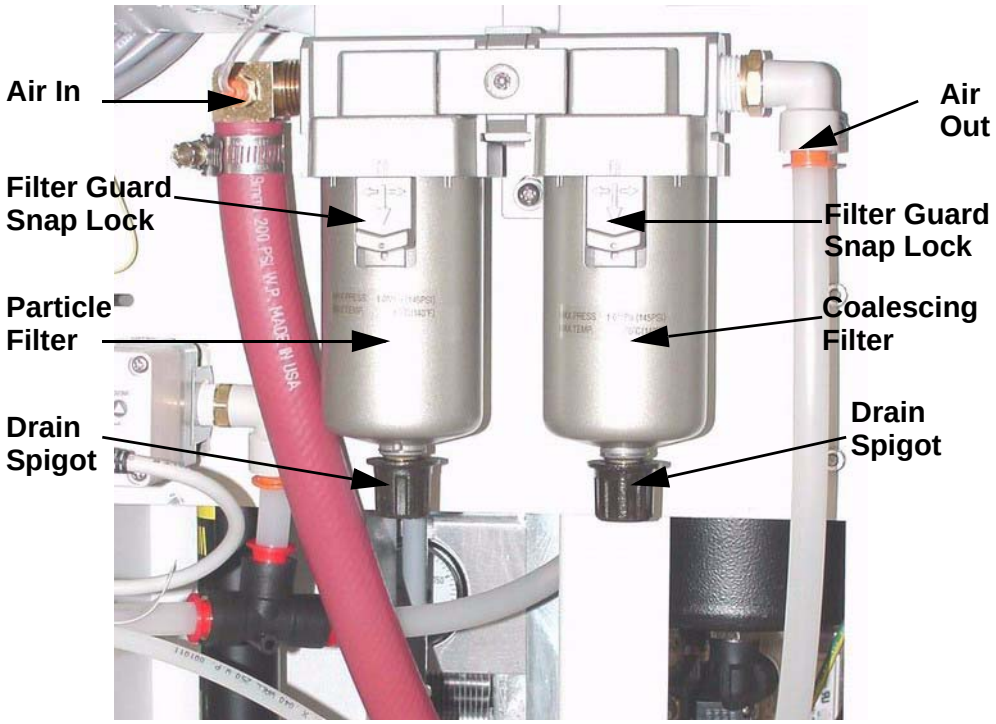
Drain Moisture from Pneumatics Filter Elements

Introduction

At least once a week (daily if system is used during multiple shifts), remove the front panel and follow the procedure below to drain moisture from (bleed) the filter elements.

Failure to drain moisture can result in system freeze up, which restricts air flow, and can render the system inoperable. Although the time required to defrost the system varies, defrosting can take hours (see Heated Defrost Procedure, page 3-34).

Particle and Coalescing Filter detailed



Procedure

WARNING

WARNING 6: To prevent high-pressure ejection of condensate (which may or may not contain injurious substances) when draining moisture from the air filter elements, first turn off the system's air pressure supply, second bleed all air from the system by turning on ac power to the System just long enough to exhaust air in the system, third disconnect the supply line from the air supply port fitting located on the rear panel of the frame module.

Step	Action
1	Remove front panel to access particle/coalescing filters, and/or, remove right side panel to access post air filter.
2	Disconnect air supply and bleed air pressure as given in Warning 6 above.
3	Place container below particle filter drain spigot.

Step	Action
4	Optional: spigot has barb fitting to attach rubber hose; put free end of hose in drainage container.
5	Grasp spigot knob, turn clockwise 1/4 turn to open spigot and drain condensate.
6	Drain until no more fluid comes out.
7	Close spigot: turn counter-clockwise 1/4-turn.
8	If drained condensate is viscous (thick) or highly contaminated with particles, then remove bowls and wipe them clean.

Pneumatics Filter Element Replacement

Filter Replacement Detail

Procedure

Watch the ThermoStream Air Filter Replacement video on the inTEST Thermal Solution's YouTube Channel: https://www.youtube.com/watch?v=w03Mu0O2CdA

To replace the Filter Element, use P/N CS158580.

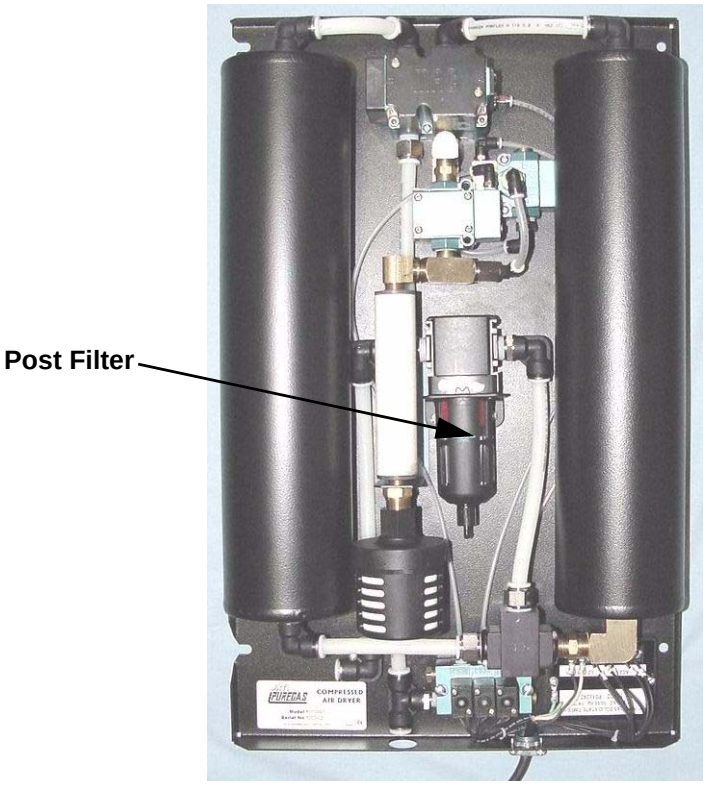
WARNING

WARNINGS 1, 2, 3, 8, 9 in Chapter 1, Safety.

Step	Action
1	Power down the System and disconnect power cord.
2	Disconnect the facility air supply from the System.
3	Remove the filter cover by pressing down and twisting.
4	Unscrew and replace the filter.

Air Dryer: Post Filter Replacement

Post Filter Detailed



Procedure

Watch the ThermoStream Air Filter Replacement video on the inTEST Thermal Solution's YouTube Channel: https://www.youtube.com/watch?v=w03Mu0O2CdA

This video details post filter replacement at the 3:25 mark.

To replace the Filter, use P/N ZZ10110.

WARNING

WARNINGS 1, 2, 3, 8, 9 in Chapter 1, Safety.

Step	Action
1	Power down the System and disconnect power cord.
2	Disconnect the facility air supply from the System.
3	On the filter housing, push up, turn 1/4 turn counterclockwise, and then pull down. This removes the housing and expose the filter element (red).
4	Unscrew the filter element.
5	Replace in the reverse order.

Muffler Replacement

Muffler Detailed

Procedure

To replace the Muffler, use P/N ZZ09300.

WARNING

WARNINGS 1, 2, 3, 8, 9 in Chapter 1, Safety.

Step	Action
1	Power down the System and disconnect power cord.
2	Disconnect the facility air supply from the System.
3	Locate the faulty Air Muffler.
4	Unscrew by hand and discard the Muffler.
5	Screw in the new Muffler. Hand tighten. Do NOT over tighten.

Section E: Verification of DUT, RTD, and Diode Sensors

Overview

In this Section

The following topics are covered in this Section:

DUT Verification Introduction

Verification determines whether or not the System is currently calibrated to standard or if the System needs to be recalibrated.

Before the System is calibrated, or at any time the system calibration is questioned, perform the verification procedure as outlined below.

If periodic verifications show that the calibration performance has stabilized and is well within specifications, then the follow-up calibration procedure is not required.

To ensure an accurate System sensor verification, follow the proper temperature sensing techniques. Contact the Temptronic Service department if you have any questions.

The verification procedure must be performed by a qualified technician. Verify that the instrumentation (external precision temperature Monitor and thermocouple sensor) used to sense the working surface temperature is in calibration. This instrumentation must be calibrated against a primary or transfer standard.

Verification is performed at a high temperature and a low temperature. Verification can also be done at other temperatures (offsets) if desired.

It is **not recommended** to use verification techniques which require inserting the Monitor thermocouple sensor into the main Air “close to, but not touching” the System’s factory installed main Air thermocouple: precisely positioning the Monitor thermocouple is uncertain, and even small variants in Monitor thermocouple siting can skew (cause inaccurate) measurement results and prevent repeatable measurements during current and future verification sessions.

The following Approved Verification procedures use the Monitor or RTD Simulator output, connected in series, as a precise, repeatable, input to the System, and applies to verifying sensor accuracy in main Air, and DUT: T, K, RTD, Diode modes.

Low Temperature Verification

Procedure

Step	Action
1	Access *Setup Screen* and a) set "Air Temp Limit: High" at or above +200.0 °C, and b) set "Air Temp Limit: Low" at or below -60.0 °C, and c) set "DUT Sensor Type" to None (which enables main Air mode, measured by the Type T sensor which is factory installed in the Head.
2	Run System for half an hour at Ambient to allow all components to stabilize at normal operating temperatures before starting verification.
3	To verify main Air, use: a) an external precision temperature Monitor, and b) a T-type thermocouple cable in a “Y” configuration with one male, one female, and one Monitor connector.
4	Access *Utilities Screen* to set "Flow: Off" so that the System is not supplying air flow controlled to a set point (other than minimum constant "Trickle" air flow).
5	To access the main Air T-type thermocouple plug, go to the back of the thermal Head, and snap off the access cover, thereby exposing the plug and jack.
6	Carefully disconnect the main Air thermocouple to avoid bending the plug’s two pins and gently pull the male plug out of the access opening. Disconnecting this plug generates an "Error" prompt on the *Statusbar* (at top of screen).
7	Insert the main Air thermocouple plug which was just disconnected into the female connector of the Monitor "Y" cable. Be aware of the plug’s pin polarity (do not force the wide pin into the narrow slot).
8	Connect the Monitor "Y" cable male plug into the System female receptacle in the Head, again taking care to match pin polarity. Connect the Monitor connector on the "Y" cable into the Monitor. The Monitor is now connected in series between the Head main Air T-type thermocouple and the System.
9	The *Statusbar* "Error" should clear; if System displays *Error Screen*, then press "Clear Error" to exit the *Error Screen*.
10	From the *Setup Screen* make certain "DUT Sensor" is set to "None.”
11	Access *Utilities Screen* to set "Flow: On."
12	Then set the System temperature set point to -60.0 °C and allow System to run until a stable AT TEMPERATURE is indicated within ±1 °C of set point.
13	Read the Monitor (not the System AT TEMPERATURE) and record the Monitor value in the Low Temperature Verification (page 5-13).
14	If the difference between the Monitor and System readings is greater than ±1.0 °C, then **recalibrate the System** as given in Calibration (page 5-20) after restoring the System as follows.

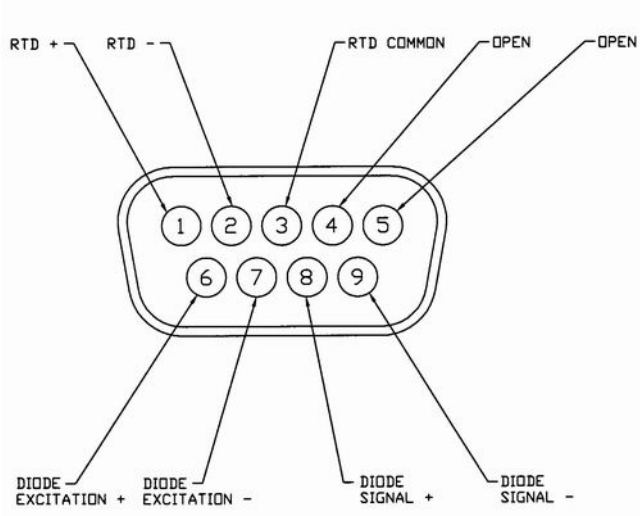
Step	Action
15	To restore the System, access the *Utilities Screen* and set "Flow: Off" which prevents running to a set point; next disconnect the Monitor “Y” cable connectors, which generates an "Error" prompt on the *Statusbar* (at top of screen); reconnect the main Air thermocouple plug into the System female receptacle; the "Error" will not clear automatically; access *Utilities Screen* to set "Flow: On."
16	If the difference between the Monitor and System readings is between (within the range of) ±1.0 °C, then no re-calibration is required. Restore the System as given above (or continue Low Temperature verification with the DUT Modes (T, K, RTD, Diode sensors) below.

Verify DUT “T” or “K” Modes (Low Temp.)

Step	Action
17	Access the *Utilities Screen* and set "Flow" to Off.
18	Set the external precision temperature Monitor output to -60.0 °C.
19	Insert the Monitor male plug into the appropriate sensor port on the System’s rear I/O Panel: if verifying DUT T sensor, then choose the “DUT T” port; if verifying DUT K sensor, then choose “DUT K” port. Be aware of plug pin polarity (do not force the wide pin into the narrow opening).
20	Access the *Setup Screen* and a) set "DUT Sensor" to "T-Type" or "K-Type," and b) **NOTE**: The System defaults to "DUT Mode: Air." If System was preset to "DUT Mode: DUT," then be certain to reset "DUT Mode: Air" to prevent heater damage.
21	This is NOT doing a DUT Mode test setup, where the DUT controls temperature: it is a DUT sensor Verification setup, which procedure will be driven by the Monitor output, interfaced as given above.
22	Allow the System temperature to stabilize, read the DUT temperature displayed on the System, an.d record the System DUT temperature in the Low Temperature Verification (page 5-13).
23	Compare the Monitor temperature set point value to the System displayed DUT temperature. **If the difference between the Monitor and System DUT values is greater than -60.0 ±1.0 °C, then recalibrate the System** as given in Calibration (page 5-20).
24	You may repeat the procedure for the other sensor type, or verify DUT RTD or Diode, or proceed to verify Type T, or Type K, High temperature (High Temperature Verification, page 5-17) or restore the System by disconnecting the temperature Monitor from the System rear I/O panel, and accessing *Utilities Screen* to set "Flow: On."

Verify DUT “RTD” (Low Temp.)

Step	Action
25	Access the *Utilities Screen* and set "Flow" to Off.

Step	Action
26	Use an external Resistance Temperature Detector (RTD) Simulator (or use a decade resistance box) **accurate to .01% of setting,** with a range from 10Ω to 1,111.110Ω, as the **input** to the System, rather than allowing the DUT to control the System, as follows; for RTD connector wiring, see below. 
27	Set the RTD Simulator output for 76.330Ω (which is -60.0 °C on the System).
28	Insert the RTD Simulator male plug into the “DUT RTD/Diode” sensor port on the System rear I/O pane.
29	Access the *Setup Screen* and a) set "DUT Sensor" to "RTD," and b) **NOTE**: The System defaults to "DUT Mode: Air." If System was preset to "DUT Mode: DUT," then be certain to reset "DUT Mode: Air" to prevent heater damage.
30	This is NOT doing a DUT Mode test setup, where the DUT controls temperature: it is a DUT sensor Verification setup, which procedure will be driven by the RTD Simulator output, interfaced as given above.
31	Allow the System temperature to stabilize, read the DUT temperature displayed on the System, and record the System DUT temperature in the Low Temperature Verification (page 5-13).
32	Compare the RTD Simulator temperature set point value to the System displayed DUT temperature. **If the difference between the Simulator and System DUT values is greater than -60.0 ±1.0 °C, then recalibrate the System** as given in Calibration (page 5-20).
33	Proceed to verify Diode, or to High Temperature Verification, page 5-17.

Verify DUT “Diode” (Low Temp.)

Step	Action
34	To verify a Diode sensor, first calibrate the Diode (see Calibration, page 5-20)

Step	Action
35	After calibrating the Diode, then an external Type T or Type K sensor may be interfaced to the Diode and can be read to verify the calibration.
36	Temperature accuracy (the acceptable temperature range above/below set point) varies based on the chosen Diode's linearity.

High Temperature Verification

Procedure

Step	Action
1	Access *Setup Screen* and a) set "Air Temp Limit: High" at or above +200.0 °C, and b) set "Air Temp Limit: Low" at or below -60.0 °C, and c) set "DUT Sensor Type" to None (which enables main Air mode, measured by the Type T sensor which is factory installed in the Head.
2	Run System for half an hour at Ambient to allow all components to stabilize at normal operating temperatures before starting verification.
3	To verify main Air, use a) an external precision temperature Monitor, and b) a T-type thermocouple cable in a “Y” configuration with 1- male, 1 female, and 1 Monitor connector.
4	Access *Utilities Screen* to set "Flow: Off" so System is not supplying air flow controlled to a set point (other than minimum constant "Trickle" air flow).
5	To access the main Air T-type thermocouple plug, go to the back of the thermal Head, and snap off the access cover, thereby exposing the plug and jack.
6	Carefully disconnect the main Air thermocouple to avoid bending the plug’s two pins and gently pull the male plug out of the access opening. Disconnecting this plug generates an "Error" prompt on the *Statusbar* (at top of screen).
7	Insert the main Air thermocouple plug which was just disconnected into the female connector of the Monitor "Y" cable. Be aware of the plug’s pin polarity (do not force the wide pin into the narrow slot).
8	Connect the Monitor "Y" cable male plug into the System female receptacle in the Head, again taking care to match pin polarity. Connect the Monitor connector on the "Y" cable into the Monitor. The Monitor is now connected in series between the Head main Air T-type thermocouple and the System.
9	The *Statusbar* "Error" should clear; if System displays *Error Screen*, then press "Clear Error" to exit the *Error Screen*.
10	From the *Setup Screen* make certain "DUT Sensor" is set to "None.”
11	Access *Utilities Screen* to set "Flow: On."
12	Then set the System temperature set point to +200.0 °C and allow System to run until a stable AT TEMPERATURE is indicated within ±1 °C of set point.
13	Read the Monitor (not the System AT TEMPERATURE) and record the Monitor value in the Low Temperature Verification (page 5-13).
14	If the difference between the Monitor and System readings is greater than ±1.0 °C, then **recalibrate the System (**see Calibration, page 5-20) after restoring the System as follows.
15	To restore the System, access the *Utilities Screen* and set "Flow: Off" which prevents running to a set point; next disconnect the Monitor “Y” cable connectors, which generates an "Error" prompt on the *Statusbar* (at top of screen); reconnect the main Air thermocouple plug into the System female receptacle; the *Statusbar* "Error" clears; access *Utilities Screen* to set "Flow: On."

Step	Action
16	If the difference between the Monitor and System readings is between (within the range of) ±1.0 °C, then no re-calibration is required. Restore the System as given above (or continue High Temperature verification with the DUT Modes (T, K, RTD, Diode sensors) below.

Verify DUT “T” or “K” Modes (High Temp.)

Step	Action
17	Access the *Utilities Screen* and set "Flow" to Off.
18	Set the external precision temperature Monitor output to +200.0 °C.
19	Insert the Monitor male plug into the appropriate sensor port on the System’s rear I/O Panel: if verifying DUT T sensor, then choose the “DUT T” port; if verifying DUT K sensor, then choose “DUT K” port. Be aware of plug pin polarity (do not force the wide pin into the narrow opening).
20	Access the *Setup Screen* and a) set "DUT Sensor" to "T-Type" or "K-Type," and b) **NOTE**: The System defaults to "DUT Mode: Air." If System was preset to "DUT Mode: DUT," then be certain to reset "DUT Mode: Air" to prevent heater damage.
21	This is NOT doing a DUT Mode test setup, where the DUT controls temperature: it is a DUT sensor Verification setup, which procedure will be driven by the Monitor output, interfaced as given above.
22	Allow the System temperature to stabilize, read the DUT temperature displayed on the System, and record the System DUT temperature in the Low Temperature Verification, page 5-13.
23	Compare the Monitor temperature set point value to the System displayed DUT temperature. **If the difference between the Monitor and System DUT values is greater than +200.0 ±1.0 °C, then recalibrate the System** (see Calibration, page 5-20).
24	You may repeat the procedure for the other sensor type, or verify DUT RTD or Diode, or proceed to verify Type T, or Type K, Low temperature or restore the System by disconnecting the temperature Monitor from the System rear I/O panel, and accessing *Utilities Screen* to set "Flow: On."

Verify DUT “RTD” (High Temp.)

Step	Action
25	Access the *Utilities Screen* and set "Flow" to Off.
26	Use an external Resistance Temperature Detector (RTD) Simulator (or use a decade resistance box) **accurate to .01% of setting,** with a range from 10Ω to 1,111.110Ω, as the **input** to the System, rather than allowing the DUT to control the System, as follows; for RTD connector wiring.
27	Set the RTD Simulator output for 175.840Ω (which is +200.0 °C on the System).

Step	Action
28	Insert the RTD Simulator male plug into the “DUT RTD/Diode” sensor port on the System rear I/O panel.
29	Access the *Setup Screen* and a) set "DUT Sensor" to "RTD," and b) **NOTE**: The System defaults to "DUT Mode: Air." If System was preset to "DUT Mode: DUT," then be certain to reset "DUT Mode: Air" to prevent heater damage.
30	This is NOT doing a DUT Mode test setup, where the DUT controls temperature: it is a DUT sensor Verification setup, which procedure will be driven by the RTD Simulator output, interfaced as given above.
31	Allow the System temperature to stabilize, read the DUT temperature displayed on the System, and record the System DUT temperature in the Maintenance Log, page 5-2.
32	Compare the RTD Simulator temperature set point value to the System displayed DUT temperature. **If the difference between the Simulator and System DUT values is greater than +200.0 ±1.0 °C, then recalibrate the System** (see Calibration, page 5-20).
33	Proceed to verify Diode, below, or to Low Temperature verification or restore the System by disconnecting the RTD Simulator from the System rear I/O panel, and accessing *Utilities Screen* to set "Flow: On”.

Verify DUT “Diode” (High Temp.)

Step	Action
34	To verify a Diode sensor, first calibrate the Diode (see Calibration, page 5-20).
35	After calibrating the Diode, then an external Type T or Type K sensor may be interfaced to the Diode and can be read to verify the calibration.
36	Temperature accuracy (the acceptable temperature range above/below set point) varies based on the chosen Diode’s linearity.

Section F: Calibration

Overview

In this Section

The following topics are covered in this Section:

Calibration Introduction

Verification determines whether or not the System is currently calibrated to standard or if the System needs to be recalibrated.

Before the System is calibrated, or any time system calibration is questioned, perform the sensor verification procedures given in Verification of DUT, RTD, and Diode Sensors, page 5-11.

To ensure an accurate System calibration, follow the proper temperature sensing techniques. Contact the Temptronic Service department if you have any questions.

The calibration procedure must be performed by a qualified technician.

Each temperature sensor calibration requires the use of a precision temperature Calibrator instrument.

Verify that the instrumentation (Calibrator and thermocouple sensor) used to sense the working surface temperature is in calibration. This instrumentation must be calibrated against a primary or transfer standard.

The calibration procedure is made easier by system semi-automatic operations directed by selections from a series of System screens which perform calibration at the optimum temperature (offset).

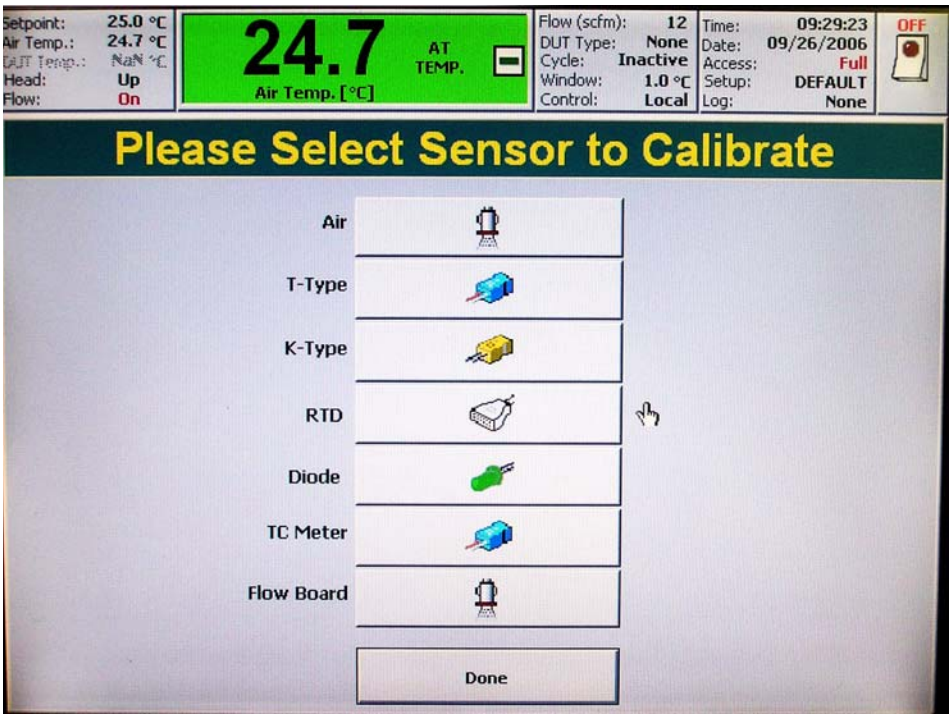
Carefully follow the detailed setup instructions on each System screen.

It is **not recommended** to use calibration techniques which require inserting a sensor into the main Air nozzle. Precisely positioning the sensor within the nozzle is uncertain, and even small variants in the sensor's location can skew (cause inaccurate) measurements and prevent repeatable measurements during current and future verification sessions.

The following Approved Calibration procedures use the Temptronic factory installed "Calibration" software program accessed from the *Utilities Screen* and yield precise, repeatable, calibration measurements to a standard.

Calibration Select Sensor Screen

Calibration Select Sensor Screen Detailed



NOTE: Before entering the Calibration Select Screen, the appropriate DUT type must be selected in the *Utilities* and *Setup* Screens.

Calibration Select Sensor Screen Detailed

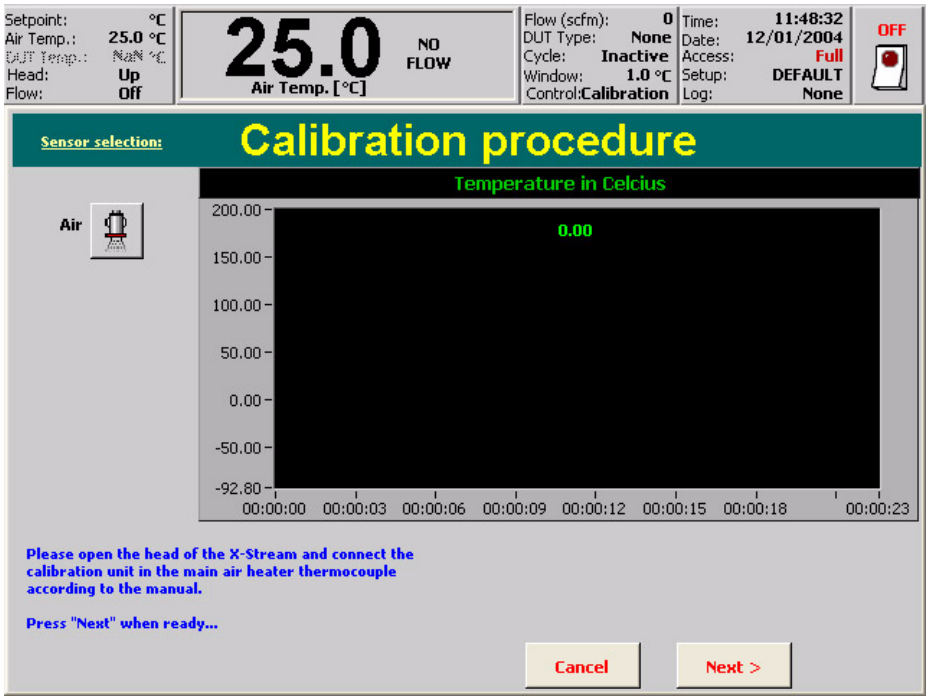
Press **DONE** to exit the Select Sensor Screen.

To continue with the calibration, select the desired sensor type (Air, T-Type, K-Type, RTD, Diode, TC Meter) and proceed as follows:

- Air Sensor Calibration (Air Mode), page 5-23
- Sensor Calibration: Type T, Type K Thermocouples (DUT Mode), page 5-25
- RTD Sensor Calibration (DUT Mode), page 5-32
- RTD Sensor Calibration (DUT Mode), page 5-32
- Diode Sensor Calibration (DUT Mode), page 5-34
- TC Meter Calibration (TC Meter Mode), page 5-36
- Flow Board Calibration, page 5-38

Air Sensor Calibration (Air Mode)

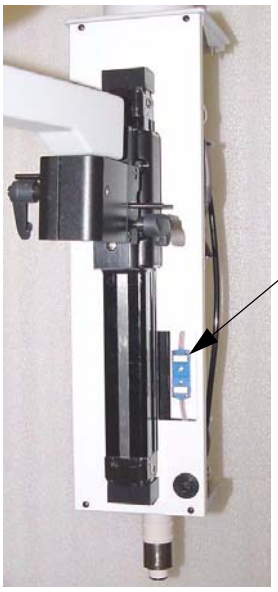
Start Calibrating (Air Sensor)



Procedure

To calibrate the main Air sensor:

Step	Action
1	Run system for half an hour at Ambient to stabilize components at normal operating temperatures.
2	Toggle Head into Up position so System is not supplying main air flow controlled to a set point (other than "Trickle" air flow). **NOTE: Turret Style Systems** should have the “Head: Lock” on. The “Head: Lock” can be toggled on/off in the *Utilities Screen*.
3	Remove the Air sensor access cover on the Head rear.

Step	Action
4	Disconnect the calibration jack (blue) on the rear of the Thermal Head.  **Calibration Jack** Plug a male connector from the Calibrator into the female connector of the Calibration Jack. Take care to observe plug pin polarity. DO NOT use the male connector of the Calibration Jack. **NOTE:** Because the internal head assembly is NOT easily accessible on **Turret Style Systems**, the thermocouple from the calibrator must be interfaced directly with the Watlow Board (J5).
5	Press the *Utilities Screen* tab, then press the "Sensor Calibration" button to display the *Calibration Select Sensor Screen*, then press "Air' to display *Calibrate Air Screen.*
6	Follow the on-screen prompts to set the Low Temperature Calibration Point. Set Calibrator output to -60.0 °C, then press "Next" to display *Calibrate Low Temperature (Air) Screen*. **Allow graph plot to stabilize at low temperature**.
7	Follow the on-screen prompts to set the High Temperature Calibration Point. Set Calibrator output to +200.0 °C, then press "Next" to display *Calibrate High Temperature (Air) Screen*. **Allow graph plot to stabilize at high temperature**.
8	Press "Next" to display *Calibration Done (Air) Screen*, then press "Done" to return to *Utilities Screen.*
9	Optional: use Calibrator to set new set point: see if System runs to the Calibrator set point.
10	Disconnect the Calibrator from the Calibration Jack. Re-connect the male and female ends of the Calibration Jack. Take care to observe plug pin polarity. Reinstall the sensor access cover.

Sensor Calibration: Type T, Type K Thermocouples (DUT Mode)

Introduction to Type T and Type K Thermocouple Calibration

The sensor calibration procedures for Type T and Type K Thermocouples are identical.

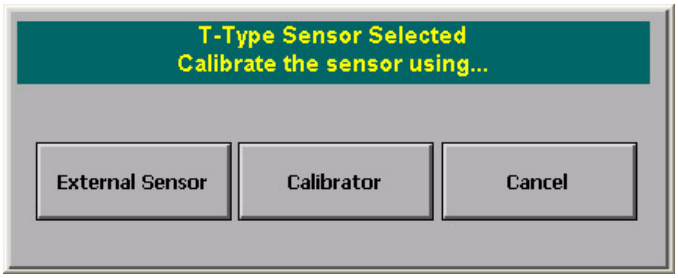
There are two methods for calibrating the sensors:

- **Calibrator**
- **External Sensor**

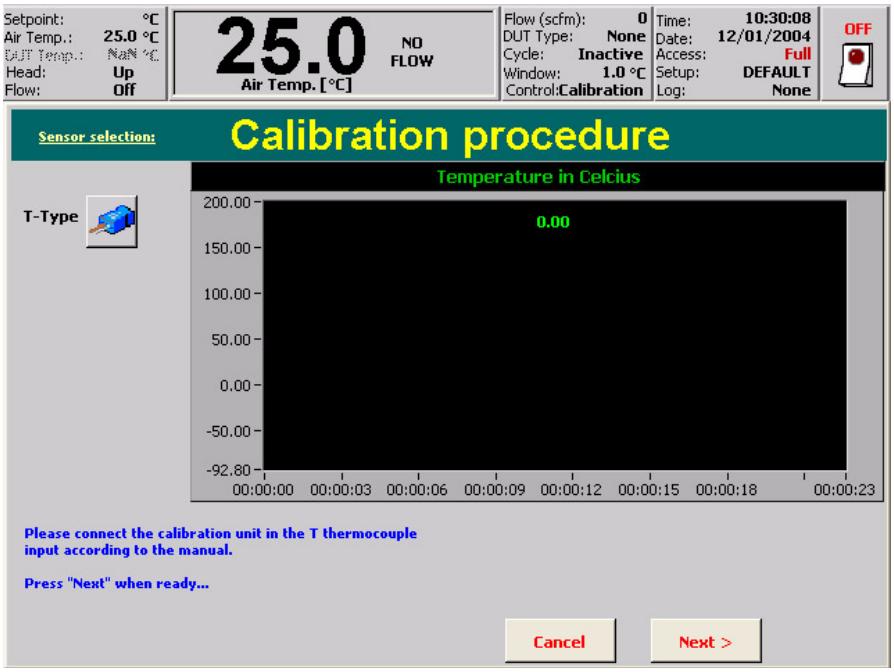
Calibrator is the recommended method. This method uses an external voltage source (or Calibrator) as the primary reference. The Calibrator inputs millivolt values for high and low set points.

External Sensor is used for unique applications. It is recommended that you contact a Temptronic representative before calibrating with this method.
This method uses an external temperature sensor as a primary reference.

Once the Sensor has been chosen from the Calibration Select Sensor Screen, the following dialog box displays as follows.



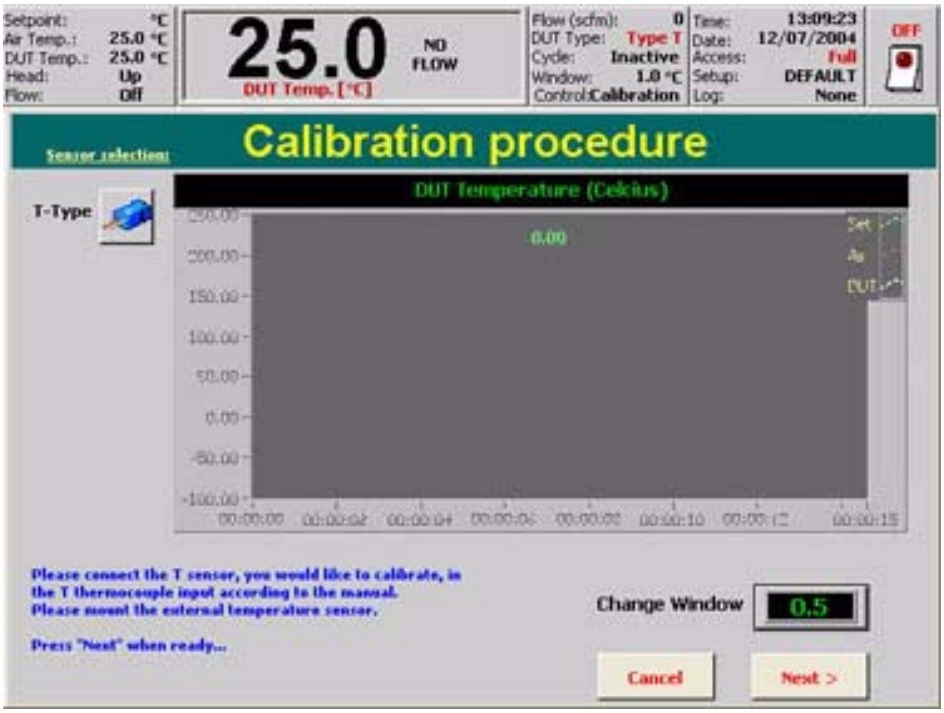
Calibrator Method (Type T, Type K)



To calibrate a the sensor:

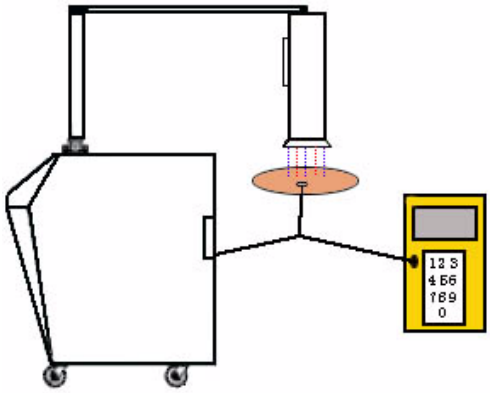
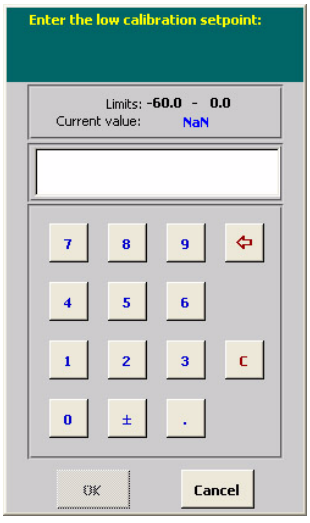
Step	Action
1	Run system for half an hour at Ambient to stabilize components at normal operating temperatures.
2	Toggle Head into Up position so System is not supplying main air flow controlled to a set point (other than "Trickle" air flow). **NOTE: Turret Style Systems** should have the “Head: Lock” on. The “Head: Lock” can be toggled on/off in the *Utilities Screen*.
3	Unplug any external Type T or K sensor from the port on the rear panel I/O. Plug the Calibrator output plug into the appropriate rear panel socket, taking care to observe plug pin polarity.
4	Press the *Utilities Screen* tab, then press the "Sensor Calibration" button to display *Calibration Main Screen*, then press "T-Type” or “K-Type” to display the *Calibration Screen.*
5	Set Calibrator output to the desired Low Calibration point (-60.0 °C), then press "Next" to display *Calibrate Low Temperature Screen*. **Allow graph plot to stabilize at low temperature**.
6	Set Calibrator output to desired high Calibration point (+200.0 °C), then press "Next" to display *Calibrate High Temperature Screen*. **Allow graph plot to stabilize at high temperature**.
7	Press "Next" to display *Calibration Done Screen*, then press "Done" to return to *Utilities Screen*.
8	Unplug the Calibrator output plug from the rear socket, and replug the external sensor into the rear I/O socket, taking care to observe plug pin polarity.

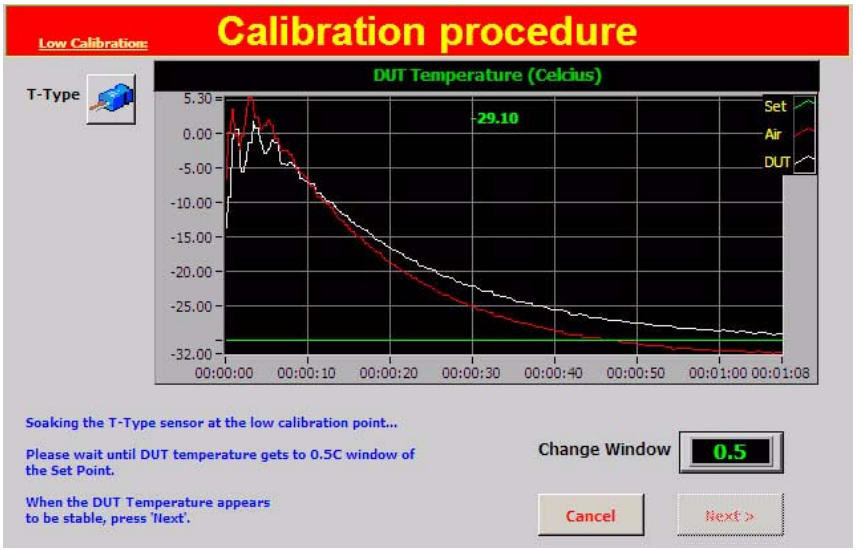
External Sensor Method (Type T, Type K)

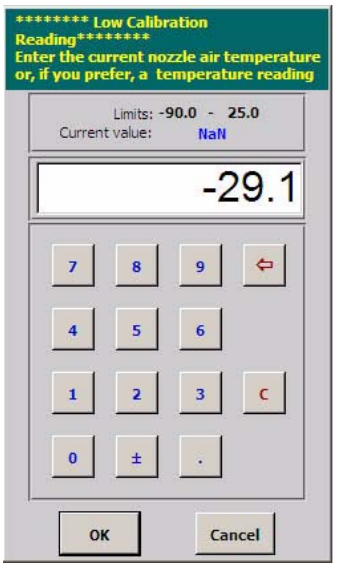
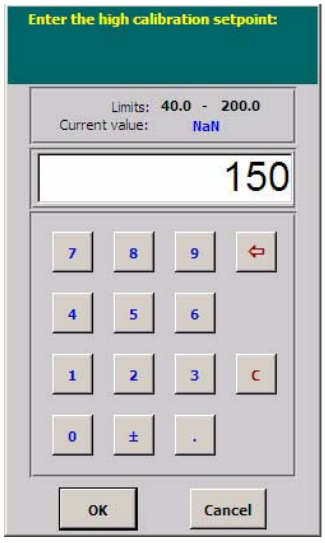


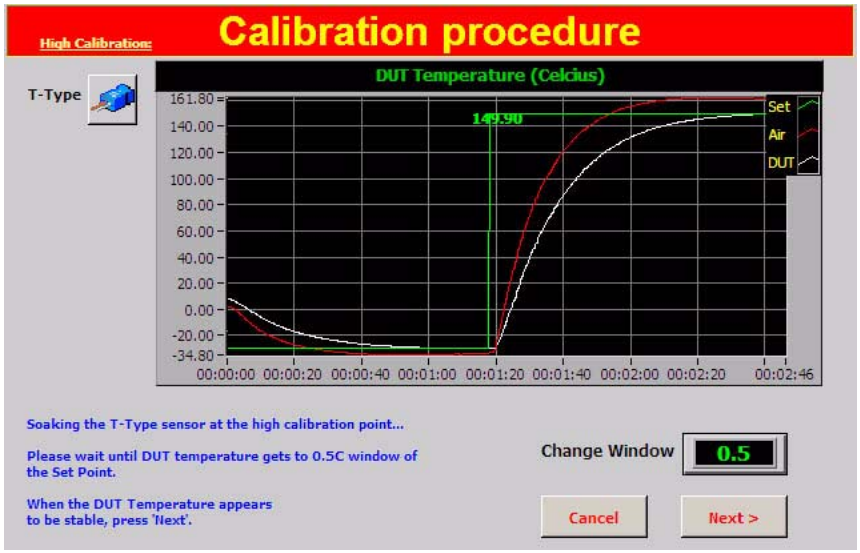
ATTENTION

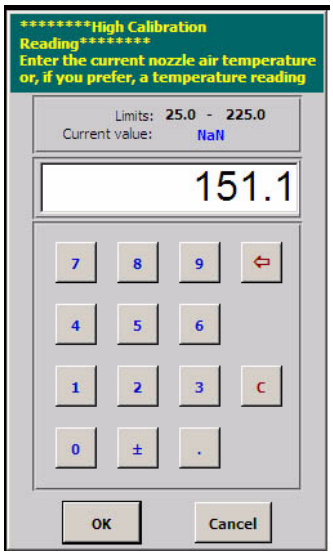
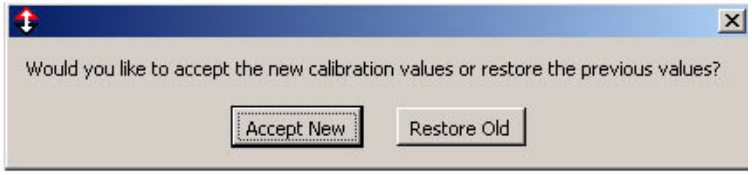
The System must initially be calibrated with the **Calibrator** method before the **External Sensor** method can be used.

Step	Action
1	Run the system for half an hour at Ambient to stabilize components at normal operating temperatures.
2	Toggle Head into Up position so System is not supplying main air flow controlled to a set point (other than "Trickle" air flow). **NOTE: Turret Style Systems** should have the “Head: Lock” on. The “Head: Lock” can be toggled on/off in the *Utilities Screen*.
3	Using a “Y” cable, connect a sensor from the System’s rear I/O port and from an External Calibrator to the Main Air Thermal Cap. **Diagram:** *Y Cable Setup* 
4	Once the sensor has been properly connected, press “NEXT >”.
5	Enter the desired “Low Calibration” set point (between -60.0 and 0.0) and press “OK”. Once “OK” is pressed, the System ramps to the “Low Calibration” set point. 

Step	Action
6	As the System ramps to the Low Calibration set point, progress can be monitored on the Calibration graph: The Green Line - represents the desired set point (-30 in the example below) The Red Line - represents the Main Air Temperature. The Main Air controls the DUT at the desired set point. The White Line - represents the DUT. The DUT (white) eventually matches the set point (Green). The **Change Window** is the range above/below the set point at which the system is "At Temperature". Values between 5.0 and .5 may be entered into the Change Window. The **Next** button becomes available once the temperature has settled within the parameters of the Change Window. Press **NEXT** when the DUT Temperature is within the Change Window and appears stable. 

Step	Action
7	Enter the ***Low Calibration Reading***. The Low Calibration Reading is the temperature that is displayed on the External Meter. In the Example below, -30.0 was the Low Calibration set point, -29.1 was the temperature displayed on the External Meter. Enter the External Meter Reading. Press “OK”. 
8	Enter the desired “High Calibration” set point (between 40.0 and 200.0) and press “OK”. Once “OK” is pressed, the System ramps to the “High Calibration” set point. 

Step	Action
9	As the System ramps to the High Calibration set point, progress can be monitored on the Calibration graph: The Green Line - represents the desired set point (150.0 in the example below) The Red Line - represents the Main Air Temperature. The Main Air controls the DUT at the desired set point. The White Line - represents the DUT. The DUT (white) eventually matches the set point (Green). The **Change Window** is the range above/below the set point at which the system is "At Temperature". Values between 5.0 and .5 may be entered into the Change Window. The **Next** button becomes available once the temperature has settled within the parameters of the Change Window. Press **NEXT** when the DUT Temperature is within the Change Window and appears stable. 

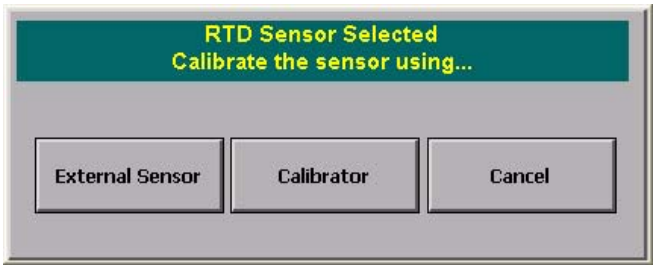
Step	Action
10	Enter the ***High Calibration Reading***. The High Calibration Reading is the temperature that is displayed on the External Meter. In the Example below, 150.0 was the High Calibration set point, 151.1 was the temperature displayed on the External Meter. Enter the External Meter Reading. Press “OK”. 
11	A prompt asks if the user wants to save the calibration values.  Accept the new values or Restore the previous values as desired. The *Main Calibration Screen* displays.

RTD Sensor Calibration (DUT Mode)

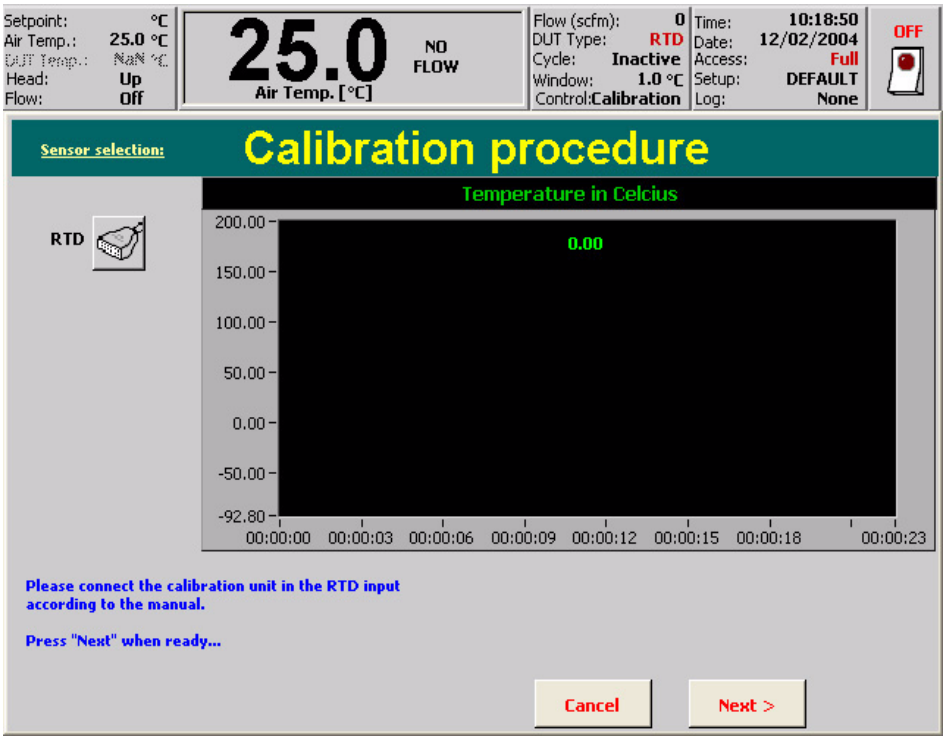
RTD Sensor Calibration Introduction

This calibration method uses an external voltage source (or Calibrator) as the primary reference. The Calibrator inputs millivolt values for high and low set points.

Once the RTD Sensor has been chosen from the Calibration Select Sensor Screen, the following dialog box displays.:



RTD Calibration



To calibrate an RTD sensor:

Step	Action
1	Run system for half an hour at Ambient to stabilize components at normal operating temperatures.
2	Toggle Head into Up position so System is not supplying main air flow controlled to a set point (other than "Trickle" air flow). **NOTE: Turret Style Systems** should have the “Head: Lock” on. The “Head: Lock” can be toggled on/off in the *Utilities Screen*.

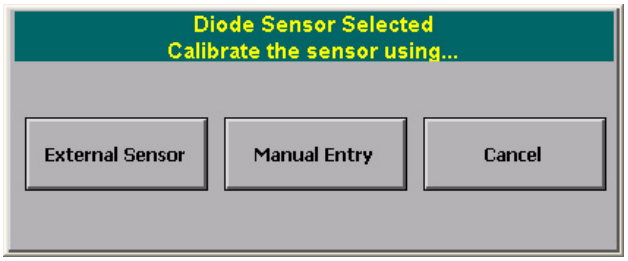
Step	Action
3	Unplug any external RTD sensor plug from the RTD socket on the rear panel I/O, and plug the Calibrator output plug into the RTD rear panel socket, taking care to observe plug pin polarity.
4	Press the *Utilities Screen* tab, then press the "Sensor Calibration" button to display *Calibration Main Screen,* then press "RTD' to display the *Calibrate RTD Screen.*
5	Set Calibrator output to the desired Low Calibration point (-60.0 °C), then press "Next" to display *Calibrate Low Temperature (RTD) Screen*. **Allow graph plot to stabilize at low temperature**.
6	Set Calibrator output to desired high Calibration point (+200.0 °C), then press "Next" to display *Calibrate High Temperature (RTD) Screen*. **Allow graph plot to stabilize at high temperature**.
7	Press "Next" to display *Calibration Done (RTD) Screen*, then press "Done" to return to *Utilities Screen*.
8	Unplug the Calibrator output plug from the rear RTD socket, and replug the external RTD sensor into the rear I/O socket, taking care to observe plug pin polarity.

Diode Sensor Calibration (DUT Mode)

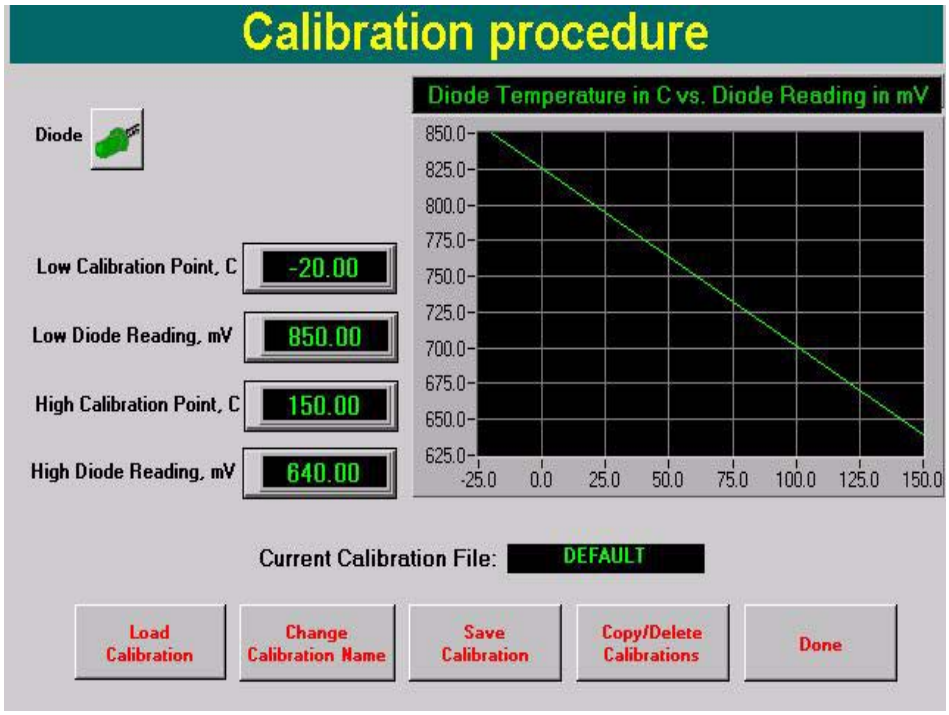
Diode Calibration Introduction

This method requires the Diode Manufacturer's Specifications to be manually entered into the Calibration fields.

Once the Diode has been chosen from the Calibration Select Sensor Screen, the following dialog box displays as follows.



Diode Calibration



Step	Action
1	Press the **Change Calibration Name** button to re-name the calibration file as desired. If you do NOT re-name the Calibration file, overwrite the current Calibration file.
2	In the **Low Calibration Point, C** field, enter the low calibration point. This value is provided by the Diode Manufacturer's Specifications.

Step	Action
3	In the **Low Diode Reading, mv** field, enter the millivolt value of the Diode at the low calibration point. This value is provided by the Diode Manufacturer's Specifications.
4	In the **High Calibration Point, C** field, enter the high calibration point. This value is provided by the Diode Manufacturer's Specifications.
5	In the **High Diode Reading, mv** field, enter the millivolt value of the Diode at the high calibration point. This value is provided by the Diode Manufacturer's Specifications.
6	Press **Save Calibration** and **Done**.
7	The Diode is now calibrated according to the Manufacturer's Specifications.

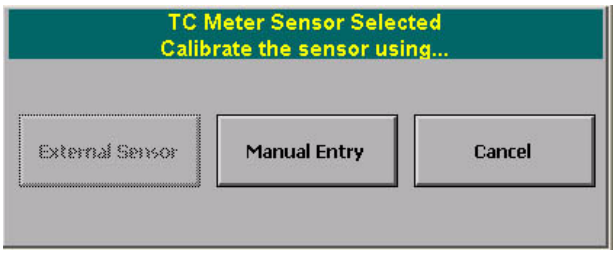
TC Meter Calibration (TC Meter Mode)

TC Meter Calibration Introduction

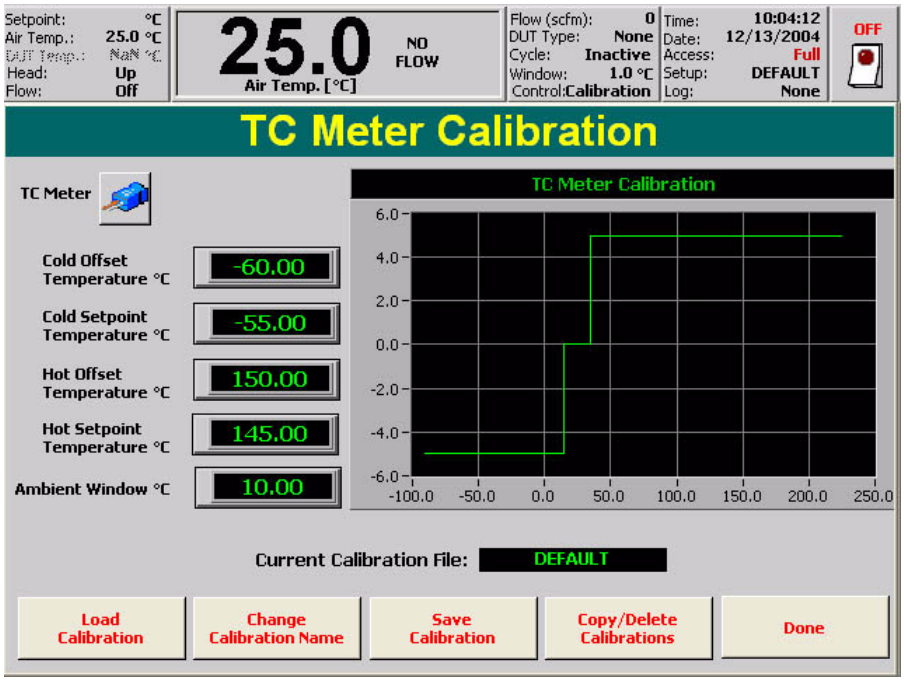
Some Test Setups do not allow an external temperature sensor to be interfaced with the DUT. The TC Meter Mode uses either the Main Air sensor (with offsets) or a DUT sensor (with offsets) to allow the system to achieve a DUT set point without interfacing a DUT sensor. **The operator must characterize their device and know the offsets before using TC Meter Mode**.

This calibration method requires the set points (Low and High) and the known offsets to be manually entered into the Calibration fields.

Once TC Meter Mode has been chosen from the Calibration Select Sensor Screen, the following dialog box displays.:



Manual Method (TC Meter)



Step	Action
1	Press the **Change Calibration Name** button to re-name the calibration file as desired. If you do NOT re-name the Calibration file, overwrite the current Calibration file.

Step	Action
2	Set the **Ambient Window, C** as desired. Ambient is set at 25.0 C (+/- 20.0) The Air temperature and the Calibrated DUT temperature will be the same value when the system is within the Ambient Window.
3	In the **Low Calibration Point, C** field, enter the desired “Low Calibration” set point (between -60.0 and 0.0).
4	In the **Low DUT Calibrated Temperature, C** field, enter the value of the Low Calibration Point + the offset. The offset must be a known (pre-determined value). In the Example above, the **Low Calibration Point, C** is -60.0, the offset is -5.0 and the **Low DUT Calibrated Temperature, C** is -55.0.
5	In the **High Calibration Point, C** field, enter the desired “High Calibration” set point (between 40.0 and 200.0).
6	In the **High DUT Calibrated Temperature, C** field, enter the value of the High Calibration Point + the offset. The offset must be a known (pre-determined value). In the Example above, the **High Calibration Point, C** is 150.0, the offset is -5.0 and the **High DUT Calibrated Temperature, C** is -145.0.
7	Press **Save Calibration** to save the file.
8	Press **Done** to exit the calibration screen

Flow Board Calibration

Introduction

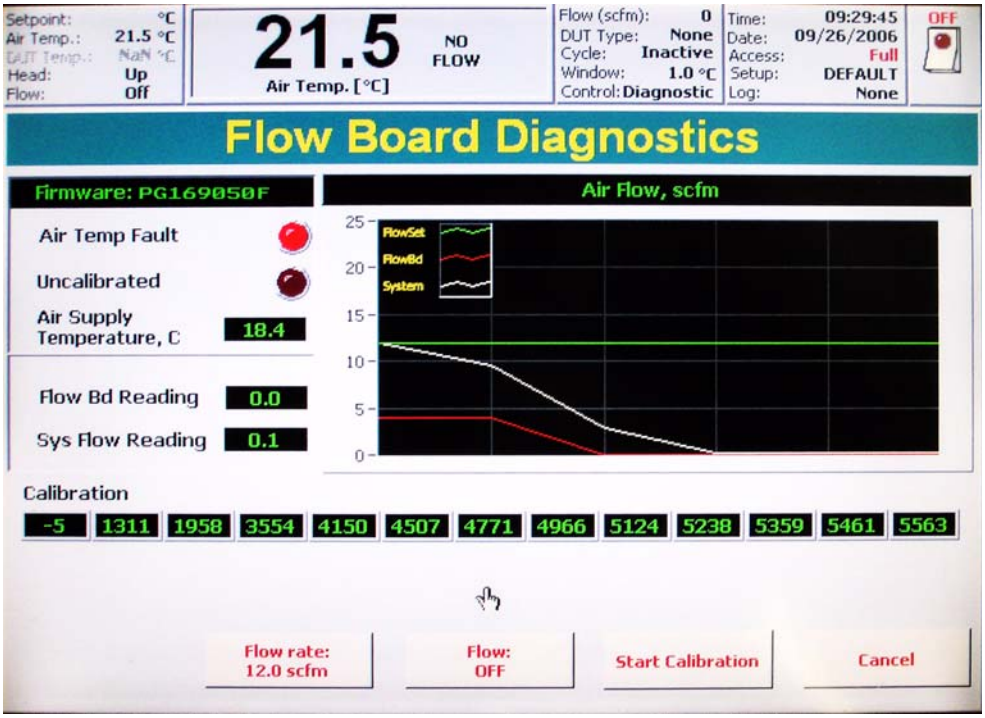
Firmware and Software Required for this Calibration:
Flow Board Firmware: PG169050F or later
AND
OCM Software Version: 5.5.0 release [PG183940A] or later
AND
Watlow Firmware: 5.50 [PG183950A] or later)

WARNING

WARNING: Clean, dry air between 17° and 30° C is required for this calibration procedure. If the dew point of your facility's air is above -45° C (MINUS 45 Degrees Celsius), perform this calibration with the System in "Heat Only" mode.

Flow Board Diagnostics Screen

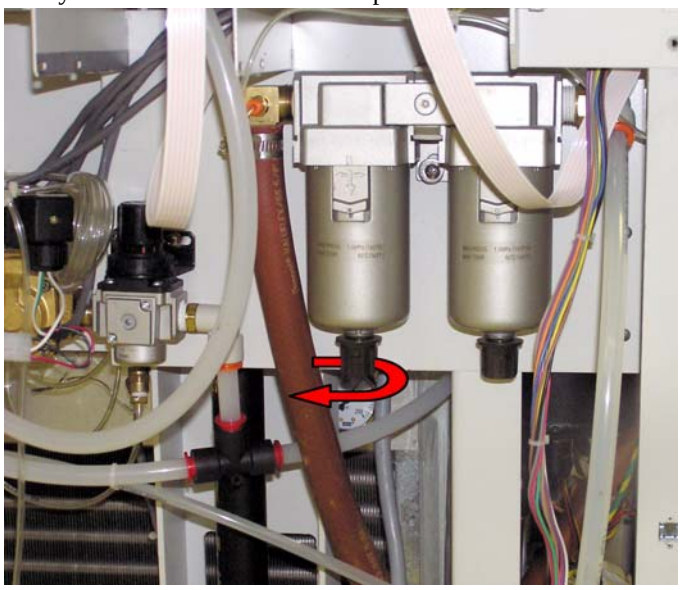
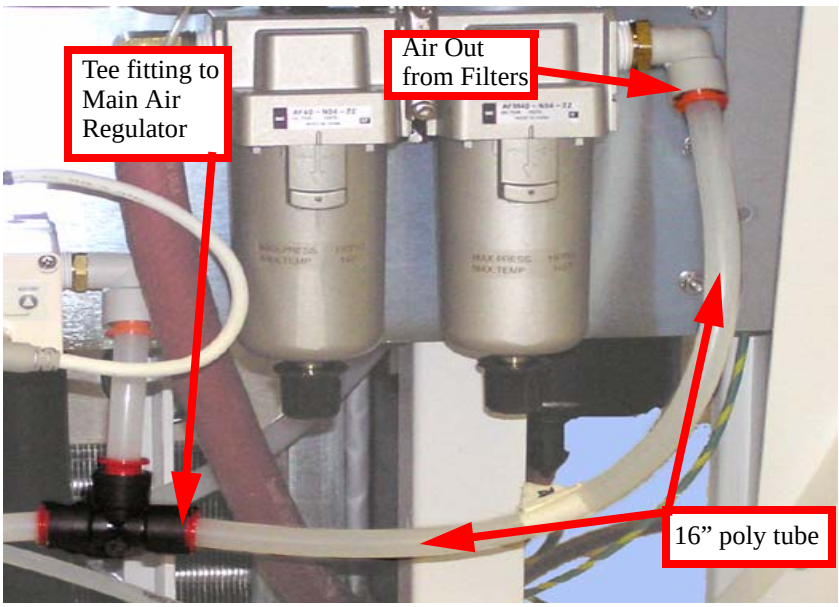
The *Flow Board Diagnostics Screen* displays before the Flow Board Calibration procedure can be started.

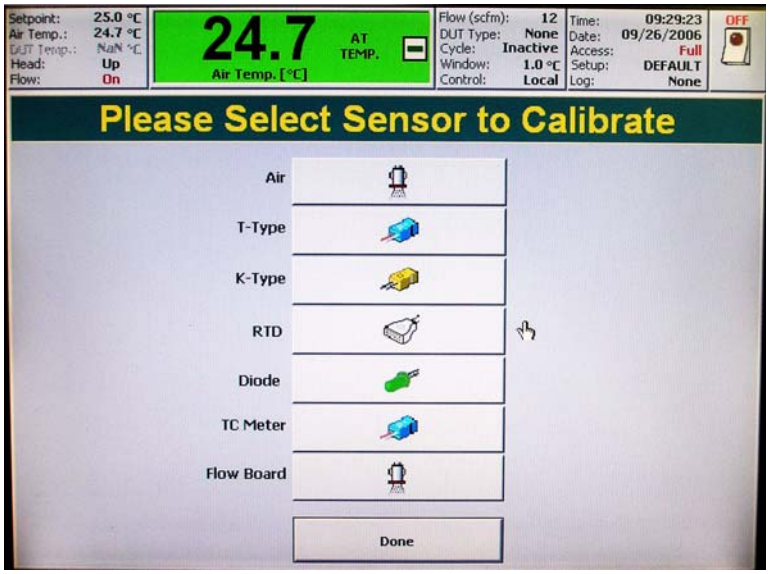
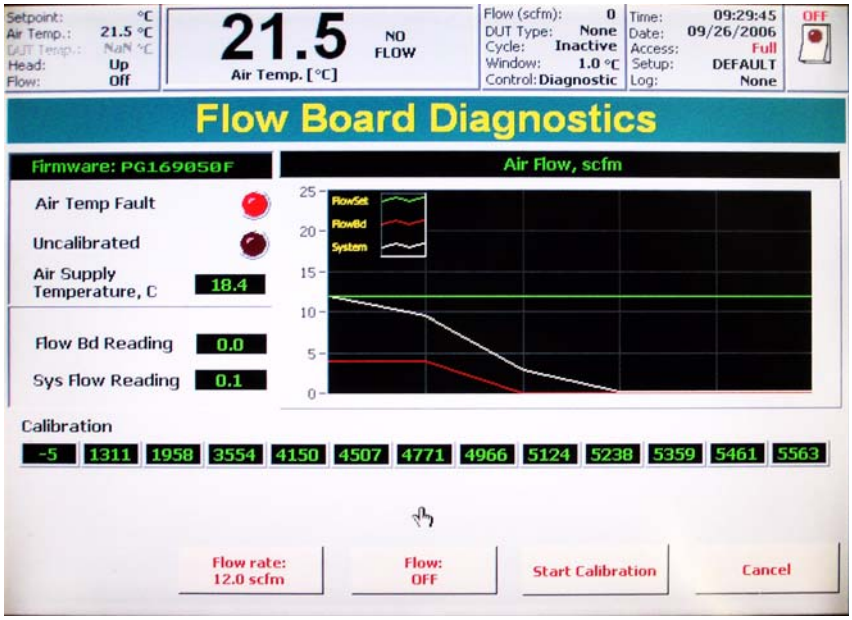


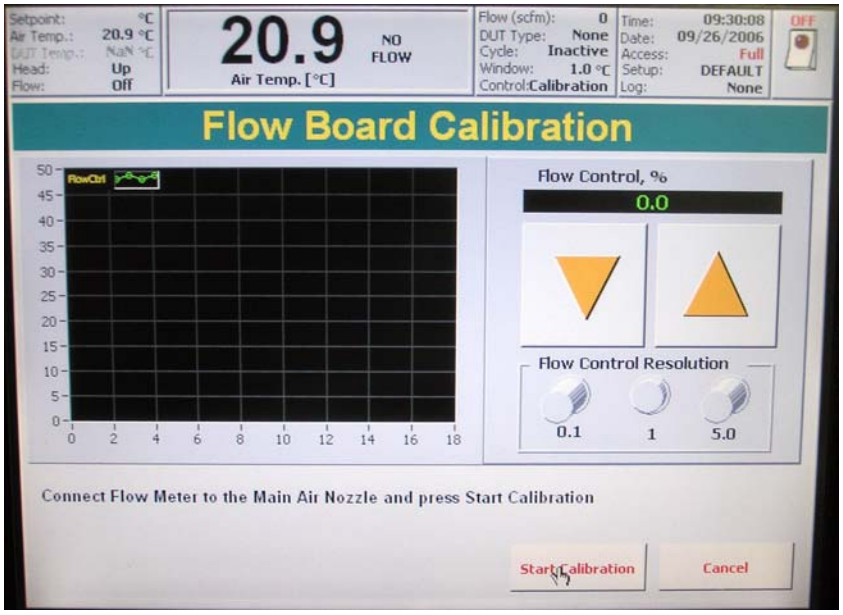
Air Temp Fault: illuminates if the air supply temperature is outside of the acceptable range for calibration (below 17° or above 30° C)
Uncalibrated: illuminates if the flow board is currently in an uncalibrated state
Flow Bd Reading: displays the flow board's air flow reading (scfm)
Sys Flow Reading: displays the system's air flow reading (scfm)

Flow Rate: press to set the system flow rate
Flow On/Off: press to turn the air flow on or off
Start Calibration: press to begin the flow board calibration procedure
Cancel: Press to exit the Flow Board Diagnostics screen

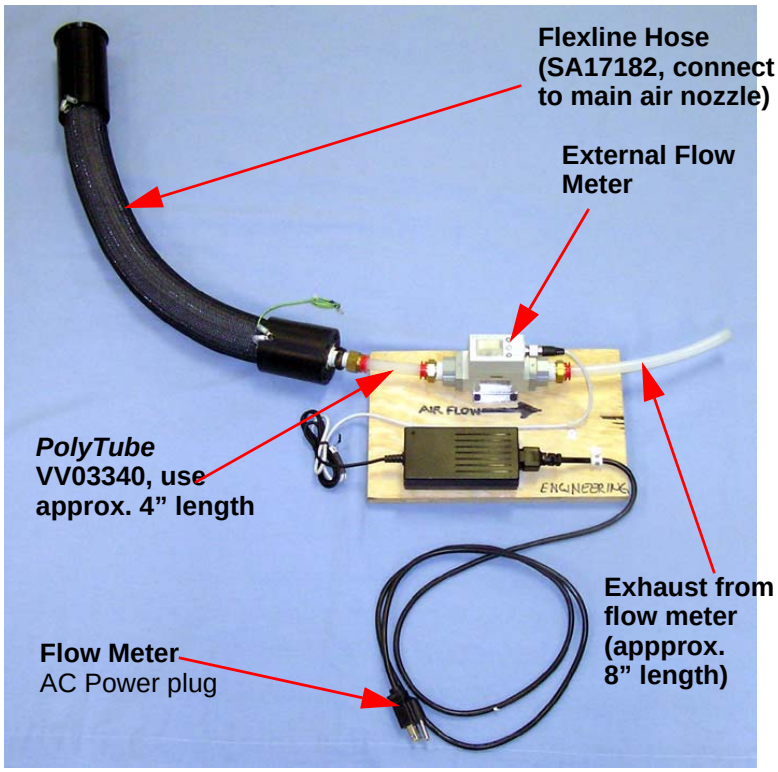
Flow Board Calibration Procedure

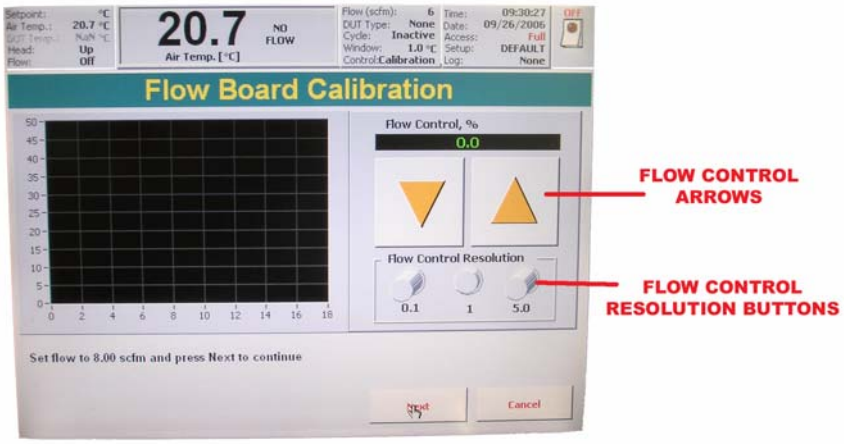
Step	Action
1	Power down the System. Unplug the main power cord and shut off the main air supply.
2	Open the Drain Valves on the Main Air Filters. This relieves air pressure from the system. Close Valves once air pressure has been relieved. 
3	Connect a 16” length of Poly Tube (VV03340) between the Air Out from filters and Tee Fitting to Main Air Regulator (as shown).: 

Step	Action
4	**NOTE!** Before Powering On the System, Be sure that nothing is connected to the Thermal Head (i.e. an external flow meter). Connect Main Air and Power to the *THERMOSTREAM*. Press the power on button and wait for the "air purge delay" to complete during the system startup routine.
5	In the *Utilities Screen*, Set the Trickle Flow to Off.
6	In the *Setup Screen*, Set the flow rate to 12 scfm.
7	In the *Operator's Screen*, set the *THERMOSTREAM* to Ambient temperature (25° C) and run the System to the Ambient temperature.
8	In the *Utilities Screen*, select Sensor Calibration and the following displays: 
9	Select Flow Board in the Sensor Calibration screen. The *Flow Board Diagnostics Screen* displays:  flow diagnostics screen.jpg

Step	Action
10	Press the Start Calibration button and the *Flow Board Calibration Screen* displays as shown below.  **<u>Before Starting the Calibration, connect the external flow meter!</u>**

Step	Action
11	Assemble and Connect an external flow meter to the *ThermoStream's* main air nozzle.



Step	Action
12	Once the external Flow Meter is connected, press Start Calibration in the Flow Board Calibration screen.
13	Follow the on-screen prompts. • Use the Flow Control arrows (and flow control resolution buttons) to adjust the flow rates. • Use the external flow meter to read the flow rates. **NOTE:** The *THERMOSTREAM*'s front panel reads 6 scfm throughout the calibration procedure. You must use the external flow meter to read an accurate flow rate during calibration. • The system requires the following sequence of calibration points (scfm): 8, 10, 0, 4, 6, 8, 10, 12, 14, 16, 18 **NOTE:** By pressing Cancel, you can EXIT the calibration anytime before the last calibration point has been entered (18 scfm). 
14	Once the 18scfm calibration point has been entered, the calibration procedure is finished: Press Done. Press OK when the prompt asks you if you want to quit.
15	Power down the *THERMOSTREAM*. Disconnect main power cable and main air.
16	Open the Drain Valves on the Main Air Filters to bleed out air from the system.
17	Remove the external flow sensor assembly.
18	**ATTENTION** **IMPORTANT!** Remove the 16" Poly-Tube. Re-connect all pneumatics lines to original configuration and close the drain valves.
19	Flow Board Calibration completed.

A

Safety Data Sheets

SDS Overview

Introduction

The Safety Data Sheets (SDS) for storing, handling, or disposing the following fluids used in the System are presented in this Chapter.:

SDS included in this manual		
50Hz Chiller	**60Hz Chiller**	**Air Dryer Desiccants**
POE Oil	POE Oil	Molecular Sieve 4A-50
HFC Refrigerant Blend	HFC Refrigerant Blend	Activated Aluminas

WARNING

WARNING 10: See the Material Safety Data Sheet (Appendix A) for safety precautions when storing, handling, or disposing any coolant fluids.
WARNING 11: Dispose of any new or removed coolant fluid (or handle any related vapor discharge) in accordance with the established policies and procedures for that material.
WARNING 9: If service of the Cooler/Circulator is required, only a licensed refrigeration service person certified by the Temptronic Corporation is qualified to perform any charging or handling of the refrigerants in the System. Service by unqualified persons can cause warranties to be voided.
WARNING 18: Only use the coolants (heat transfer fluids) and refrigerants specified by the manufacturer: they are carefully engineered to be safe for operating personnel, to be friendly to the environment, to operate efficiently, and to not harm the equipment. Do not substitute unauthorized coolants and refrigerants, nor mix (add) in unauthorized coolants or refrigerants: doing so can cause warranties to be voided. Wear protective safety eye glasses, gloves, and apron when filling coolants and refrigerants. Temptronic assumes no liability for damages caused by use of unauthorized coolants and refrigerants.

1. Identification:

Product Name: HFC Refrigerant Blend is a Proprietary Mixture of the following Components

HFC-236-fa Used as a Refrigerant

1,1,1,3,3,3 – Hexafluoropropane
ASHRAE Refrigerant Number Designation: R-236fa

HFC-23 Used as a Refrigerant

Trifluoromethane
ASHRAE Refrigerant Number Designation: R-23

Halocarbon 14 Used as a Refrigerant

Tetrafluoromethane
ASHRAE Refrigerant Number Designation: R-14

Part Numbers: CS168290, CS205430 AND CS208960

Name of Supplier: inTEST Thermal Solutions
Address of Supplier: 41 Hampden Road
Mansfield, MA 02048
Telephone: (781) 688-2300
Fax: (781) 688-2301

U.S Emergency Phone: (800) 424-9300

Int'l. Emergency Phone (collect): (703) 527-3887

Recommended Use: Refrigerant blend for inTEST Thermal chillers

Restrictions on Use: To be used only on inTEST Thermal chillers

2. Hazard(s) Identification:

All hazards regarding the chemical:

Product Hazard Category:

Gases under Pressure	Liquefied Gas
Specific organ toxicity Single exposure	Category 3

Required Label Elements:

Pictograms:

Inhalation:

Low levels of concentration, initial symptoms may include headache, dizziness, nausea, loss of concentration and irritation. High concentrations of vapor is harmful and may cause central nervous system depression with dizziness, cardiac arrhythmia, confusion, incoordination, drowsiness, heart irregularities, unconsciousness or death. Intentional misuse or deliberate inhalation may cause death without warning. Vapor reduces oxygen available for breathing and is heavier than air. Gross overexposure, possibly temporary alteration of the heart's electrical activity with irregular pulse, palpitations or inadequate circulation.

Individuals with preexisting diseases of the central nervous or cardiovascular system may have increased susceptibility to the toxicity of excessive exposures.

Skin Contact:

Immediate effects of overexposure may include: Frostbite and irritation, if liquid or escaping vapors contact the skin.

Eye Contact:

"Frostbite-like" effects and irritation may occur if the liquid or escaping vapors contact the eyes.

Carcinogenicity:

None of the components of this material (HFC refrigerant blend) are listed by IARC, NTP, OSHA, and ACGIH as a carcinogen.

---

2. Composition/Information on Ingredients

Chemical Name	Concentration	CAS Number	EC Number	R	Formula
1,1,1,3,3,3 – Hexafluoropropane (HFC-236fa)		690-39-1			
Methane, Trifluoro- (HFC-23)		75-46-7			
Tetrafluoromethane (Halocarbon 14)		75-73-0			

Note: Total refrigerant weight for CS168290 and CS208960 is 912 grams and for CS205430 is 1256 grams. Individual material amounts have been withheld for proprietary reasons.

---

4. First-Aid Measures:

Contact with skin:

Flush skin with water for at least 15 minutes. Treat for frostbite if necessary by gently warming affected area. Seek medical assistance for frostbite or if irritation is present. Wash contaminated clothing before reuse

Contact with eyes:

Immediately flush eyes with plenty of water for 15 minutes. Call a physician

Inhalation:

Immediately remove to fresh air. Keep person calm. If not breathing, give artificial respiration. If breathing is difficult give oxygen. Call a physician

Ingestion:

Ingestion is not considered a potential route of exposure

Notes to Physicians:

Because of possible disturbances of cardiac rhythm, catecholamine drugs, such as epinephrine, should be used with special caution only in situations of emergency life support.

5. Fire-Fighting Measures:

Extinguishing Techniques:

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Use water spray to cool containers. Wear self-contained breathing apparatus (SCBA). Wear full protective equipment. Water runoff should be contained and neutralized prior to release

Extinguishing Equipment:

Water spray or fog, “alcohol” foam, dry chemical or carbon dioxide

Hazards as a result of the Fire:

Containers may rapture under fire conditions due to high pressure. Decomposition may occur.

Contact of welding or soldering torch flame with high concentrations of refrigerant can result in visible changes in the size and color of torch flame. This flame effect will only occur in concentrations of product well above the recommended the exposure limits, therefore, stop all work and ventilate to disperse refrigerant vapors from the work area before using any open flames.

HFC-23 is not flammable in air at temperatures up to 100 degrees C (212F) at atmospheric pressure. However mixtures HFC-23 with high concentrations of air at elevated pressure and/or temperature can become combustible in the presence of an ignition source. HFC-23 can also become combustible in an oxygen enriched environment (oxygen concentrations greater than that of air).Whether a mixture containing HFC-23 and air, or HFC-23 in an oxygen enriched atmosphere become combustible depends on the inter-relationship of 1) the temperature, 2) the pressure, and 3) the proportion of oxygen in the mixture. In general, this blend should not be allowed to exist with air above atmospheric pressure or at high temperatures; or in an oxygen enriched environment. For example, this blend should not be mixed with air under pressure for leak testing or other purposes.

Vapors are heavier than air and may travel to a source of ignition and flashback. Avoid high temperatures and static charges. Use water spay to cool containers

6. Accidental Release Measures:

Safeguards (personnel):

Evacuate personnel to safe areas. Ventilate area, especially low and enclosed places where vapors may collect.

Protective Equipment:

Review FIRE FIGHTING MEASURES and HANDLING (Personnel) sections before proceeding with clean-up.

Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Clean Up Action:

Ventilate area, especially low or enclosed places where heavy vapors might collect. Remove open flame. Evacuate enclosed spaces until gas is dispersed. Keep upwind.

---

7. Handling and Storage:

Handling:

Avoid breathing vapors or mist. Avoid contact with eyes or skin or clothing. Wash thoroughly after handling. Do not puncture or drop cylinders, expose them to open flame or excessive heat. Follow standard safety precautions for handling and use of compressed gas cylinders. Use with sufficient ventilation to keep employee exposure below recommended limits.

Do not mix with air above atmospheric pressure for leak testing or any other purpose.

Keep away from sparks, flames and hot glowing surfaces

Storage:

Store in a clean, cool, well ventilated dry area of low fire risk and out of direct sunlight. Protect cylinder and its fittings from physical damage as with any gas cylinder

---

8. Exposure Controls/Personal Protection:

Permissible Exposure Limits (PELs):

1,1,1,3,3,3 – Hexafluoropropane	PEL*	1000 PPM	8 & 12 HR TWA
Trifluoromethane	PEL*	1000 PPM	8HR
Tetrafluoromethane	PEL*	None Established	

Engineering Controls:

Normal ventilation for standard manufacturing procedures is generally adequate. Local exhaust should be used when large amounts are released (similar to welding and brazing facilities). Mechanical ventilation should be used in low places.

Personal Protective Equipment (PPE):

Wear impervious clothing, such as gloves, apron, boots, or whole bodysuit as appropriate.

Wear Chemical splash goggles or safety glasses.

Wear NIOSH approved respiratory protection, as appropriate.

---

9. Physical and Chemical Properties:

Characteristics:

HFC-236fa

Specific Gravity	1.370 gm/cc
Vapor Pressure	272.4 kPa @ 25°C (77°C)
Melting Point	-98°C (-144°F)
Freezing Point	-103°C (153°F)
Boiling Point	-1.4°C (29.5°F) @760 mm HG
Form	Liquefied Gas
Color	Colorless

HFC – 23

Appearance / odor	Clear, colorless, liquefied gas with faint ethereal (ether like) odor
Specific gravity	1.15 @ 0/0C
Vapor pressure	686 psig @ 25C / 77F
Vapor density	2.4 (Air =1)
Freezing point	-155C /-247F
Boiling point	-82.1C / -115.8F
Solubility in water	0.1 wt% @ 25C / 77F

Halocarbon 14

Appearance / odor	Clear, colorless, odorless compressed gas
Specific gravity	3.050
Vapor pressure	529 psig @ -45.6C / -50.1F
Vapor density	3.03 (Air = 1)

Freezing point	-186.7C /-304.2 F
Boiling point	-127.9C / -198.2F
Solubility in water	0.0015 wt% @ 25C / 77F

10. Stability and Reactivity:

Stability:

All components in this blend are chemically stable under specified conditions or storage, shipment and or use.

Reactivity:

Conditions to Avoid:

Avoid open flames and high temperatures.

Incompatibility:

Avoid contact with hydrochloric acid, alkali or alkaline earth metals, powdered metals such as aluminum, magnesium, zinc and strong oxidizers since they may react or accelerate decomposition.

Decomposition:

Decomposition products are hazardous. Thermal decomposition of components includes forming hydrochloric and hydrofluoric acids, carbon monoxide, carbon dioxide, chlorine and carbonyl halides

11. Toxicological Information:

CAS. NO 690-39-1 HFC-236fa:

Animal Data:

Inhalation 4hr LC50: >457,000 ppm in rats

Single exposure by inhalation caused narcosis and cardiac sensitization, a potentially fatal disturbance of the heart rhythm associated with a heightened sensitivity to the action of epinephrine: in a cardiac sensitization screening test in dogs exposed to concentrations of 50,000 to 250,000 ppm evidence of sensitization occurred at 150,000 ppm. Repeated exposures caused a reduced startling response in rats.

No other significant toxicological effects were observed. No-Observed-Adverse- Effects- Level (NOAEL): 20,000 ppm.

Developmental studies conducted in rats and rabbits at dose levels of 5000, 20,000 or 50,000 ppm produced no evidence of developmental toxicity. HFC 236fa was not uniquely toxic to the rat or rabbit conceptus. Specific studies to evaluate the effect on female reproductive performance have not been conducted; however, limited information obtained from studies on developmental toxicity do not indicate adverse effects on female reproductive performance. Tests have shown that HFC-236fa does not cause genetic damage in bacterial or mammalian cell cultures. No animal data are available to define carcinogenic effects of HFC-236fa.

CAS. No. 75-46-7 HFC-23

Animal Data:

Inhalation 4 hr LC50:	>663,000 ppm in rats

HFC-23 is untested for skin and eye irritancy, and for animal sensitization.

No animal tests are available to define the carcinogenic hazards of HFC-23. The maternal and developmental NOAEL was 50,000 ppm. It is not considered a unique developmental hazard to the conceptus. There were no developmental or reproductive effects.

Tests have shown that HFC-23 does not produce genetic damage in bacterial or mammalian cell cultures. It has not produced genetic damage in tests on animals

Cas. No. 75-73-0 Halocarbon – 14

Animal Data:

Inhalation 15 Minutes ALC:	895,000 ppm in rats

Effects observed in animals from exposure by inhalation to concentrations of >89%, v/v include central nervous depression and death. Exposure by inhalation at concentrations as high as 22.4% resulted in no observed adverse effects. No animal test reports are available to define carcinogenic, mutagenic, embryotoxic, or reproductive hazards.

---

12. Ecological Information: (*OSHA non-mandatory)

HFC-236fa

Aquatic Toxicity

96 hour LC50 – Zebra Fish:	292/ mg/L
96 hour LC50 – Freshwater Algae:	> 186 mg/L
48 hour LC50 – Daphnia magna:	299 mg/L

HFC-23 and Halocarbon 14

Environmental Stability:

These gases will be dissipated rapidly in well-ventilated areas.

Effects of Material on plants or Animals:

Any adverse effects on animals would be related to adverse effects on the cardiovascular system and to exposure to oxygen – deficient environments. The symptoms experienced by overexposed animals would be similar to those described for exposed humans. No adverse effect is anticipated to occur to plant-life, except for frost produced in presence of rapidly expanding gas.

Effect of Chemical on Aquatic Life:

No Evidence is currently available on the effects of these refrigerants on aquatic life.

---

13. Disposal Considerations: (*OSHA non-mandatory)

Recover into high pressure recovery tank if possible. Dispose of in accordance with federal, state and local regulations.

---

14. Transport Information: (*OSHA non-mandatory)

Proper Shipping Name:	Refrigerant Gas, NOS (1,1,1,3,3,3 – Hexafluoropropane) (Trifluoromethane) (Tetrafluoromethane)
Hazard Class number and Description:	2.2 (Nonflammable Gas)
UN Identification Number:	UN 1078
DOT Label(s) Required:	Nonflammable Gas
Shipping Containers:	Cylinders

---

15. Regulatory Information: (*OSHA non-mandatory)

U.S. Federal Regulations:

Sara / Title III Hazard Categories and list;

HFC-236fa CAS Number 690-39-1

TSCA Inventory Status: Listed

HFC-23 CAS Number 75-46-7

Product Hazard Categories:		**Lists:**	
Acute	Yes	Extremely Hazards Substance	No
Chronic	No	Cercla Hazards Substance	No
Fire	No	Toxic Chemical	No
Reactivity	No		
Pressure	Yes		

Halocarbon 14 **CAS Number 75-73-0**

Product Hazard Categories:		**Lists:**	
Acute	Yes	Extremely Hazards Substance	No
Chronic	No	Cercla Hazards Substance	No
Fire	No	Toxic Chemical	No
Reactivity	No		
Pressure	Yes		

16 Other Information:

NPCA – HMIS Ratings:

HFC – 236fa

Health:	1
Flammability:	0
Reactivity:	1

HFC - 23

Health:	1
Flammability:	0
Reactivity:	1

Halocarbon -14

Health:	1
Flammability:	0
Reactivity:	1

History Revision Block

Rev.	Date	Revision Description	Author	Signature
A	12-10-03	Releasing	B. Kelso	B. Kelso
B	04-20-11	ECO 110325: New address and logo	T. Ryan	T. Ryan
C	02-19-14	ECO 140209: Add two new charge numbers CS205430 and CS205440	B. Kelso	B. Kelso
D	09-17-14	ECO 140914: Standardizing Format	K. Burnell	K. Burnell
E	05-06-15	ECO 150501: Add new charge number CS208960	B. Kelso	B. Kelso
F	10-21-15	ECO 150920: Reformat to SDS template; add Pictograms	B. Kelso	B. Kelso

***Note: Since other Agencies regulate this information, OSHA will not be enforcing Sections 12 through 15 – see (29 CFR 1910.1200(g)(2)).**

SAFETY DATA SHEET PE68 OIL

1. CHEMICAL PRODUCT AND COMPANY INFORMATION

PRODUCT: NATIONAL POLYOLESTER LUBRICANT PE68
PRODUCT CODE: PE68
CHEMICAL NAME/FAMILY: SYNTHETIC ESTER LUBRICATING FLUID
OTHER NAMES: Refrigerant Oil
MANUFACTURER: NATIONAL REFRIGERANTS, INC.
ADDRESS: 11401 Roosevelt Boulevard Phila., Pa. 19154
INFORMATION: 800-262-0012 **EMERGENCY:** 800-424-9300
DATE: 3/2015 **PREPARER:** Matt Callahan

2. HAZARD IDENTIFICATION

CLASSIFICATION: Not classified according to 29 CFR 1910.1200 (2012)

OTHER HAZARDS: SKIN AND EYE CONTACT: Prolonged contact may cause minor skin irritation.

3. COMPOSITION/ INFORMATION ON INGREDIENTS

MATERIAL	CAS NO.	APPROX%	TLV
Pentaerythritol ester of heptanoic and isopentanoic acids	68441-94-1	Proprietary	$5mg^3$ (as a mist)
Mixed pentaerythritol esters of isononionic and heptanoic acids	118685-29-3	Proprietary	$5mg^3$
Antiwear/antioxidant additive	N/A		N/A

4. FIRST AID MEASURES

SKIN CONTACT: In case of skin contact, remove contaminated clothing and wash skin thoroughly with soap and water.

EYE CONTACT: If splashed into eyes, flush with clear water for 15-minutes or until irritation subsides. If irritation persists, call a physician.

INHALATION: Vapor inhalation under ambient conditions is normally not a problem. If overcome by vapor from hot product, immediately remove from exposure and call a physician. If breathing is irregular or has stopped, start

resuscitation; administer oxygen if available. If overexposure is due to oil mist, remove from further exposure until excessive oil mist condition subsides.

INGESTION: If ingested, do not induce vomiting. Call a physician immediately.

5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSITION HAZARDS: N/A

EXTINGUISHING MEDIA: Foam, CO_2, Dry Chemical

SPECIAL FIREFIGHTING INSTRUCTIONS: Use water spray to cool surface of container. Use Self Contained Breathing Apparatus (SCBA), avoid breathing fumes, vapors, or mists. Water may cause frothing.

6. ACCIDENTAL RELEASE MEASURES

PROCEDURES IN CASE OF ACIDENTAL RELEASE, BREAKAGE OR LEAKAGE: Ventilate area. Avoid breathing vapor. Wear appropriate personal protective equipment, including appropriate respiratory protection. Contain spill if possible. Wipe up or absorb on suitable material and shovel up. Prevent entry into sewers and waterways. Avoid contact with skin, eyes or clothing.

7. HANDLING AND STORAGE

HANDLING: Minimum feasible handling temperatures should be maintained. Avoid exposure to heat and flames. Protect against eye and skin contact.

STORAGE: Periods of exposure to high temperatures should be minimized. Water contamination should be avoided. Keep container tightly sealed when not in use Store containers in an upright and secure position to prevent spills and protect against damage.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

GENERAL CONTROL MEASURES

Normal ventilation for standard manufacturing procedures is generally adequate. Local exhaust should be used when large amounts are released. Mechanical ventilation should be used in low places. Keep containers closed when not in use. Do not handle near heat, sparks, flame, or strong oxidants.

PERSONAL PROTECTIVE EQUIPMENT

Butyl gloves should be worn to avoid prolonged or repeated exposure. Chemical splash goggles should be worn as needed to prevent eye contact. Under normal use, no respiratory protection is required when using this chemical.

PERSONAL HYGIENE

Minimize breathing vapor, mist, or fumes. Avoid prolonged contact with skin. Remove contaminated clothing, and launder or dry-clean before reuse. Cleanse skin thoroughly after contact, especially before eating, with waterless hand cleaner followed by soap and water.

EXPOSURE GUIDELINES: ACGIH TLV = 5mg/m3 (as a mist)

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE:	Amber liquid
ODOR:	Slight chemical odor
ODOR THRESHOLD:	Not determined
PH:	Not applicable
MELTING POINT/FREEZING POINT:	N/A
BOILING POINT:	N/A
FLASH POINT: COC TEST METHOD	>270˚C (518˚F)
EVAPORATION RATE:	Not applicable
FLAMMABILITY:	Not applicable
LEL/UEL:	Not evaluated
VAPOR PRESSURE:	N/A
VAPOR DENSITY:	N/A at 77 deg. F (Air = 1)
RELATIVE DENSITY:	0.98 g/cc@20˚C (68˚F)
SOLUBILITY:	Negligible
PARTITION COEFFICIENT	
n-Octanol/water:	Not applicable
AUTO IGNITION TEMPERATURE:	Not determined
DECOMPOSITION TEMPERATURE:	Not determined
VISCOSITY:	72.3 cSt @ 40˚C

10. STABILITY AND REACTIVITY

STABILITY: Material is stable. Avoid open flames and high temperatures.

DECOMPOSITION: This material may decompose if exposed to high temperatures (open flames) producing CO and CO_2.

INCOMPATABILITY: N/A

POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL INFORMATION

PRINCIPLE HEATLH HAZARDS

SKIN CONTACT: In case of skin contact, remove contaminated clothing and wash skin thoroughly with soap and water.

EYE CONTACT: If splashed into eyes, flush with clear water for 15-minutes or until irritation subsides. If irritation persists, call a physician.

INHALATION: Vapor inhalation under ambient conditions is normally not a problem. If overcome by vapor from hot product, immediately remove from exposure and call a physician. If breathing is irregular or has stopped, start resuscitation; administer oxygen if available. If overexposure is due to oil mist, remove from further exposure until excessive oil mist condition subsides.

INGESTION: If ingested, do not induce vomiting. Call a physician immediately.

EXPOSURE LIMIT FOR TOTAL PRODUCT

5mg/m^3 for oil mist in air

CARCINOGENICITY

Not listed as a carcinogen by IARC, NTP, OSHA or ACGIH.

SAFETY PRECAUTIONS

Avoid breathing vapors and prolonged skin exposure. Use with sufficient ventilation to keep exposure below recommended limits.

SIGNS AND SYMPTOMS OF EXPOSURE

None known

12. ECOLOGICAL INFORMATION

- ENVIRONMENTAL TOXICITY -

Freshwater Fish Toxicity	The acute LC50 is > 1000mg/L based on similar materials
Freshwater Invertebrates Toxicity	The acute EC50 is > 1000mg/L based on similar materials
Algal Inhibition	The acute EC50 is > 1000mg/L based on similar materials
Saltwater Fish Toxicity	Not determined
Saltwater Invertebrates Toxicity	Not determined
Bacteria Toxicity	The acute EC50 is > 1000ppm based on similar materials
Miscellaneous Toxicity	Not determined

-ENVIRONMENTAL FATE –

Biodegradation	This product will biodegrade moderately based on OECD 301-type test data for similar products
Bioaccumulation	Less than 1.0% of the components potentially bioconcentrate, based on octanol/water coefficients

Soil Mobility Not determined

13. DISPOSAL CONSIDERATIONS

SPILL, LEAK OR RELEASE

Ventilate area. Do not flush into sewers. Dike spill. Collect on absorbent material and transfer to steel drums for recovery or disposal. Comply with Federal, State and local regulations on reporting releases.

WASTE DISPOSAL

Comply with Federal, State and local regulations

14. TRANSPORATION INFORMATION

***** This product is not regulated by DOT, IMO, ICAO**

DOMESTIC--OTHER THAN AIR (DOT)

PROPER SHIPPING NAME:
UN NUMBER: Not applicable
HAZARD CLASS: Not applicable
DOT LABELS: Not applicable
DOT PLACARD: Not applicable

INTERNATIONAL WATER OR AIR (IMO/ICAO)

PROPER SHIPPING NAME:
UN NUMBER: Not applicable
HAZARD CLASS: Not applicable
IMO/ICAO LABEL: Not applicable

15. REGULATORY INFORMATION

SARA TITLE III INFORMATION (40CFR300)

EXTREMELY HAZARDOUS SUBSTANCES (40CFR355)

MATERIAL	TPQ (LBS)	RQ (LBS)
None listed	N/A	N/A

CERCLA HAZARDOUS SUBSTANCES (40CFR302.4)

MATERIAL	WT%	RQ (LBS)
None listed	N/A	N/A

PRODUCT HAZARD CATAGORIES (SARA TITLE III/SECTIONS 311 & 312)

IMMEDIATE	NO	**DELAYED**	NO
FIRE	NO	**PRESSURE**	NO
REACTIVE	NO	**CHRONIC**	NO

TOXIC SUBSTANCES (SARA TITLE III/SECTION 313 & 40CFR372)

MATERIAL	CAS NO.	WT %
None listed		

16. OTHER INFORMATION

HMIS CODES:

H	F	R	P
1	1	0	-

DISCLAIMER:

INFORMATION AND RECOMMENDATIONS CONTAINED HEREIN ARE BELIEVED TO BE ACCURATE AT THE TIME OF PREPARATION. NO WARRANTY IS MADE CONCERNING THE ACCURACY AND NO LIABILITY SHALL BE MADE FOR CLAIMS FOR USE OR RELIANCE OF THE RECOMMENDATIONS CONTAINED HEREIN

.

SAFETY DATA SHEET

according to 1907/2006/EC, Article 31

MOLECULAR SIEVE 4A

Revision 0

Revision date

1. IDENTIFICATION OF THE SUBSTANCE / PREPARATION AND THE COMPANY

Product name MOLECULAR SIEVE 4A

Company

Elemental Microanalysis Ltd
Hameldown Road
Okehampton Business Park
Exeter Road
Okehampton
Devon EX20 1UB
United Kingdom
info@microanalysis.co.uk
www.microanalysis.co.uk

Telephone +44 (0) 1837 54446

Fax +44 (0) 1837 54544

Emergency telephone number +44 (0) 1837 54446

2. HAZARDS IDENTIFICATION

Main hazards No Significant Hazard.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Hazardous ingredients

	Conc.	CAS	EINECS	Symbols/Risk phrases
Molecular Sieve	90 - 100%	1318-02-1	215-283-8	

4. FIRST AID MEASURES

Skin contact Wash off immediately with plenty of soap and water.

Eye contact Rinse immediately with plenty of water for 15 minutes holding the eyelids open. Seek medical attention if irritation or symptoms persist.

Inhalation Move the exposed person to fresh air.

Ingestion Rinse mouth thoroughly. Seek medical attention if irritation or symptoms persist.

5. FIRE FIGHTING MEASURES

Extinguishing media Use extinguishing media appropriate to the surrounding fire conditions.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions Ensure adequate ventilation of the working area.

Clean up methods Sweep up. Transfer to suitable, labelled containers for disposal. Clean spillage area thoroughly with plenty of water.

MOLECULAR SIEVE 4A

Revision 0
Revision date

7. HANDLING AND STORAGE

Handling Avoid contact with eyes and skin. Ensure adequate ventilation of the working area. Adopt best Manual Handling considerations when handling, carrying and dispensing.

Storage Keep in a cool, dry, well ventilated area. Keep containers tightly closed. Store in correctly labelled containers.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering measures Ensure adequate ventilation of the working area.

Respiratory protection Wear suitable respiratory equipment when necessary.

Hand protection Rubber gloves.

Eye protection Approved safety goggles.

Protective equipment Wear protective clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Description Pellets.

Relative density 2.1 (g/ml)

Melting point >1200°C

10. STABILITY AND REACTIVITY

Stability Stable under normal conditions.

11. TOXICOLOGICAL INFORMATION

Toxicological information

MOLECULAR SIEVE 4A	Oral Rat LD50 = >10000mg/kg
	Dermal Rabbit LD50 = >2000mg/kg

12. ECOLOGICAL INFORMATION

Ecotoxicity

MOLECULAR SIEVE 4A	Fish LC50/96h = >1000mg/L (B rerio) mg/l

13. DISPOSAL CONSIDERATIONS

General information Dispose of in compliance with all local and national regulations.

14. TRANSPORT INFORMATION

Further information The product is not classifed as dangerous for carriage.

15. REGULATORY INFORMATION

Risk phrases No Significant Hazard.

Safety phrases S22 - Do not breathe dust.

16. OTHER INFORMATION

Further information The information supplied in this Safety Data Sheet is designed only as guidance for the safe use, storage and handling of the product. This information is correct to the best of our knowledge and belief at the date of publication however no guarantee is made to its accuracy. This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any other process.

Safety Data Sheet
F200

1. Product and Company Identification

Company
BASF CORPORATION
100 Campus Drive
Florham Park, NJ 07932, USA

24 Hour Emergency Response Information
CHEMTREC: 1-800-424-9300
BASF HOTLINE: 1-800-832-HELP

2. Hazards Identification

Emergency overview

CAUTION:
MAY CAUSE EYE, SKIN AND RESPIRATORY TRACT IRRITATION.
May cause difficulty breathing.
Prolonged or repeated contact may result in dermatitis.
Contact with the eyes or skin may cause mechanical irritation.
Contains material which may indicate/cause the possibility of sensory and pulmonary irritation.
Avoid contact with the skin, eyes and clothing.
Avoid inhalation of dusts.
Use with local exhaust ventilation.
Wear a NIOSH-certified (or equivalent) particulate respirator.
Wear safety glasses with side-shields.
Wear chemical resistant protective gloves.
Wear protective clothing.
Eye wash fountains and safety showers must be easily accessible.

State of matter: solid
Colour: off-white
Odour: odourless

Potential health effects

Primary routes of exposure:
Routes of entry for solids and liquids include eye and skin contact, ingestion and inhalation. Routes of entry for gases include inhalation and eye contact. Skin contact may be a route of entry for liquified gases.

Acute toxicity:
Virtually nontoxic after a single skin contact. Virtually nontoxic by inhalation. Virtually nontoxic after a single ingestion. The product has not been tested. The statement has been derived from the properties of the individual components.

Irritation / corrosion:
Not irritating to the eyes. Not irritating to the skin. Not irritating to the respiratory system. The product has not been tested. The statement has been derived from the properties of the individual components.

Potential environmental effects

Aquatic toxicity:
There is a high probability that the product is not acutely harmful to aquatic organisms. The product has not been tested. The statement has been derived from the properties of the individual components.

Degradation / environmental fate:
Not applicable for inorganic substances.

3. Composition / Information on Ingredients

CAS Number	Content (W/W)	Chemical name
1344-28-1	94.0 - 100.0 %	Aluminum oxide

4. First-Aid Measures

General advice:
Remove contaminated clothing.

If inhaled:
Keep patient calm, remove to fresh air. If necessary, give oxygen. If not breathing, give artificial respiration. Seek medical attention if necessary.

If on skin:
After contact with skin, wash immediately with plenty of water and soap. Consult a doctor if skin irritation persists.

If in eyes:
In case of contact with the eyes, rinse immediately for at least 15 minutes with plenty of water. Immediate medical attention required.

If swallowed:
No hazards anticipated. If large quantities are ingested, seek medical advice.

Note to physician
Treatment: Treat according to symptoms (decontamination, vital functions), no known specific antidote.

5. Fire-Fighting Measures

Flash point: Non-flammable.
Self-ignition temperature: not self-igniting

Additional information:
Use extinguishing measures to suit surroundings.

Hazards during fire-fighting:

No particular hazards known.

Protective equipment for fire-fighting:
Wear self-contained breathing apparatus and chemical-protective clothing.

6. Accidental release measures

Personal precautions:
Use breathing apparatus if exposed to vapours/dust/aerosol. Avoid contact with the skin, eyes and clothing. Use personal protective clothing. Information regarding personal protective measures see, chapter 8.

Environmental precautions:
Prevent spread over a wide area (e.g. by containment or oil barriers). Do not discharge into drains/surface waters/groundwater. Contain contaminated water/firefighting water.

Cleanup:
Vacuum up spilled product. Place into suitable container for disposal.

7. Handling and Storage

Handling

General advice:
Avoid dust formation in confined areas. Avoid contact with the skin, eyes and clothing. Ensure adequate ventilation.

Protection against fire and explosion:
Product is not explosive.

Storage

General advice:
Keep container tightly closed in a cool, well-ventilated place.

Storage incompatibility:
General advice: Segregate from reducing agents.

Storage stability:
Keep container dry.

8. Exposure Controls and Personal Protection

Advice on system design:
Provide local exhaust ventilation to control dust. Provide local exhaust ventilation to maintain recommended P.E.L.

Personal protective equipment

Respiratory protection:
Wear a NIOSH-certified (or equivalent) particulate respirator. Observe OSHA regulations for respirator use (29 CFR 1910.134). Wear appropriate certified respirator when exposure limits may be exceeded.

Hand protection:
Wear chemical resistant protective gloves., Consult with glove manufacturer for testing data.

Eye protection:
Safety glasses with side-shields.

Body protection:
Body protection must be chosen depending on activity and possible exposure, e.g. apron, protecting boots, chemical-protection suit (according to EN 14605 in case of splashes or EN ISO 13982 in case of dust).

General safety and hygiene measures:
No eating, drinking, smoking or tobacco use at the place of work.

9. Physical and Chemical Properties

Form:	solid in various forms
Odour:	odourless
Colour:	off-white

pH value:	9.4 - 10.1	
Melting point:	2,050 °C	
Bulk density:	38.0 - 52 lb/ft3	(68 °F)
Viscosity, dynamic:		not applicable
Solubility in water:		insoluble

10. Stability and Reactivity

Conditions to avoid:
Avoid deposition of dust. Avoid dust formation.

Substances to avoid:
water, reducing agents

Hazardous reactions:
The product is chemically stable.
No hazardous reactions known.

Decomposition products:
Hazardous decomposition products: No hazardous decomposition products known.

Thermal decomposition:
No decomposition if used correctly.

Corrosion to metals:
No corrosive effect on metal.

Oxidizing properties:
not fire-propagating

11. Toxicological information

Acute toxicity

Oral:

Information on: Aluminum oxide
Type of value: LD50
Species: rat
Value: > 5,000 mg/kg (OECD Guideline 401)

Irritation / corrosion:

Skin:

Information on: Aluminum oxide
Species: rabbit
Result: non-irritant
Method: OECD Guideline 404
---

12. Ecological Information

Fish

Acute:
DIN 38412 Part 15 static
Leuciscus idus/LC50 (96 h): > 500 mg/l

The product has not been tested. The statement has been derived from products of a similar structure and composition.

Information on: Aluminum oxide
Acute:
DIN 38412 Part 15 static
Leuciscus idus/LC50 (96 h): > 500 mg/l
The product has not been tested. The statement has been derived from products of a similar structure and composition.

Aquatic invertebrates

Acute:
OECD Guideline 202, part 1 static
Daphnia magna (48 h): > 100 mg/l

Information on: Aluminum oxide
Acute:
OECD Guideline 202, part 1 static
Daphnia magna (48 h): > 100 mg/l

Aquatic plants

Toxicity to aquatic plants:
OECD Guideline 201 static
green algae/No observed effect concentration (72 h): > 100 mg/l

13. Disposal considerations

Waste disposal of substance:
Dispose of in accordance with local authority regulations. Check for possible recycling. Disposal requirements are dependent on the hazard classification and will vary by location and the type of disposal selected. All waste materials should be reviewed to determine the applicable hazards (testing may be necessary).

14. Transport Information

Land transport
USDOT

Not classified as a dangerous good under transport regulations

Sea transport
IMDG

Not classified as a dangerous good under transport regulations

Air transport
IATA/ICAO

Not classified as a dangerous good under transport regulations

15. Regulatory Information

Federal Regulations

Registration status:
Chemical TSCA, US released / listed

OSHA hazard category: ACGIH TLV established;

EPCRA 311/312 (Hazard categories): Acute;

EPCRA 313:

CAS Number	Chemical name
1344-28-1	Aluminum oxide

State regulations

State RTK	CAS Number	Chemical name
MA, NJ, PA	1344-28-1	Aluminum oxide

16. Other Information

NFPA Hazard codes:
Health : 1 Fire: 0 Reactivity: 0 Special:

HMIS III rating
Health: 1 Flammability: 0 Physical hazard: 0

NFPA and HMIS use a numbering scale ranging from 0 to 4 to indicate the degree of hazard. A value of zero means that the substance possesses essentially no hazard; a rating of four indicates extreme danger. Although similar, the two rating systems are intended for different purposes, and use different criteria. The NFPA system was developed to provide an on-the-spot alert to the hazards of a material, and their severity, to emergency responders. The HMIS system was designed to communicate workplace hazard information to employees who handle hazardous chemicals.

BASF supports worldwide Responsible Care® initiatives. We value the health and safety of our employees, customers, suppliers and neighbors, and the protection of the environment. Our commitment to Responsible Care is integral to conducting our business and operating our facilities in a safe and environmentally responsible fashion, supporting our customers and suppliers in ensuring the safe and environmentally sound handling of our products, and minimizing the impact of our operations on society and the environment during production, storage, transport, use and disposal of our products.

Local Contact Information
prod_reg@basf.com

THE DESCRIPTIONS, DESIGNS, DATA, AND INFORMATION FURNISHED BY BASF HEREUNDER ARE GIVEN GRATIS AND BASF ASSUMES NO OBLIGATION OR LIABILITY FOR THE DESCRIPTION, DESIGNS, DATA AND INFORMATION GIVEN OR RESULTS OBTAINED, ALL SUCH BEING GIVEN AND ACCEPTED AT YOUR RISK.
END OF DATA SHEET

Drawings

B

Drawings Overview

In this Appendix

The following drawings and schematics are detailed:

Drawing/Schematic	Drawing #
SYSTEM WIRE DIAGRAM	18207
PNEUMATIC, SCHEM.	14631

Revisions				
Zone	Rev	Description	Date	Approved
		SEE SHEET 1		

HEAD ASSY

HEAD KEYPAD
HEAD UP/DOWN
STAND UP
STAND DOWN
MOMEN
P2 J2
CBL 22 22/5 (GcF)
CBL 23 18/6
CBL 24 24 T-T/C
CBL 25 24 T-T/C
J56 J55 J54 J53
CA8 T-T/C SS SHIETH
P15
+24V CUTOUT 2 (391C) - FUSE BLOW
+24V CUTOUT 1 (356C) - RELAY LATCH OUT
+24V
GND
PC4
HTR CUTOUT BOARD
SCH. 11928
J50 J49
CBL 26 24 K-T/C
CBL 27 24 K-T/C
K4
IN- LOAD
IN+ LOAD
SSR DC/AC
HTR2
200 BLK 14
J66 J58
BLK (LEAD)
G9 G/Y 14
G10 VIO 20
G11 VIO 20
G8 G/Y 14
GRNYEL
#10 STUD HEAD
#10 STUD HEAD COVER

SW3
STAND INTERLOCK CLOSED = LOCKED
SLEEVING
STAND MOTOR
MTR1
CBL 18/2 (p/o mtr)
P18 J18
CBL 7 18/4
CBL 29 CONN 20

J1 I2C
J2 I2C
J12 RS-232
PC3 (43xx)
FLOW BOARD
SCHEMATIC 14790
J11 P11
STAND UP (IN)
STAND DWN (IN)
INHIBIT (IN)
24RET
MTR+ (AOUT)
MTR- (AOUT)
NC
J10 P10
IVCC (+5V)
FREQ OUT
HTR ENABLE (IN)
24RET
J4 P4
MAIN AIR (OUT) +24V
HEAD UP/DWN (OUT) +24V
COMP (OUT) +24V
SHUTDOWN (OUT) +24V
TRICKLE (OUT) +24V
SAFETY (OUT)
J5 P5
24RET
HIGH DISCH PRES (IN)
24RET
LOW AIR PRES (IN)
24RET
HEAD UP/DWN (IN)
J9 P9
FLOW+ (AOUT)
FLOW- (AOUT)
COND
J8 P8
24VAC1
24VAC2
+24V
+12V
-12V
+5V
24VRTN
24VRTN
GND
GND
G12 VIO 18
#8 SCREW DRIVE SHELF
#8 SCREW FLOW SENSOR BLOCK
CBL 15 20/4
CBL 16 20/8
CBL 11 20/2
CBL 1 20/2
CBL 19 20/4
CBL 2 20/4

SW4 (LOW AIR PRES)
SW4
PSW-1A
PSW-1B
J11 P11
CBL 8 20/2
SV3 (TRICKLE AIR)
SV3
CBL 3 20/4
SV1 (HEAD UP/DOWN)
SV1
J10
SV2 (MAIN AIR)
SV2
CBL 4 20/4
OPTIONAL "PURGE W/ MAIN AIR"
SV5 (PURGE CTRL)
SV5 SV5a
STANDARD "PURGE ALL TIME"
SV5b
4300 (ATS 7xx) ONLY
SV4 (ELCTRO AIR PRES REG)
0-10V SIGNAL IN
24VDC PWR
1-5V MONITOR OUT
COM
20/4 (p/o SV4)
Note: Input 0-10V = 0 -130psi
Outout 1-5V = 0 -130psi
4390(ATS730,40,50) COOL/BYPASS VALVE
SV6
BYPASS COOL
J30 P30
SW2 (EMO)
"MOMENTARY"
CBL 5 20/2

4310 (ATS 5xx) ADD ON CABLES
CA1 8 COND RBBN (VIDEO)
CA2 6 COND FLAT (KEYPAD)
CA3 6 COND FLAT (ENCODER)
CA4 __COND (I2C)
CBL 29 24 T-T/C
CBL 30 12/3

4300 (ATS 7xx) ADD ON CABLES
CA5 ETHERNET (VV04910)
CA9 9 COND (RS-232)
CA10 9 COND (RS-232)
CA6 9 COND
NULL MODEM (RS-232)

COMMON LV CABLE BUNDLE
CBL 15 20/4
CBL 16 20/8
CBL 11 20/2
CBL 1 20/2
CBL 8 20/2
CBL 3 20/4
CBL 4 20/4
CBL 7 18/4
CBL 19 20/4
CBL 2 20/4
CBL 5 20/2
CBL 13 20/2
CBL 21 20/4
CBL 6 18/15

G7 GRNYEL 12
#10 STUD LEFT PANEL
#10 STUD FRAME

4310 (ATS 5xx) FRONT PANEL CONTROLS

"MOMENTARY"
"ON" SWITCH
SW1 (4310)
ON
CBL 20 20/4
P1
NOTE 3
6" LCD DISPLAY
DISPLAY BD
ROTARY ENCODER
KEYPAD

4300 (ATS 7xx) FRONT PANEL CONTROLS

"MOMENTARY"
"ON/OFF" SWITCH
SW1 (4300)
ON/OFF
CBL 20 20/4
RECP/SOC PLUG/PINS
J2 P2
TO BE DISCONTINUED
floppy drive
34 pin rbn cbl
J3
OCM1 (SA18248)
CPU/HARD DRIVE
SCH. 18257
P1
POWER
J1
ON/OFF SWITCH
FLOPPY
FLOPPY PWR
KEY BD
MOUSE
USB1
USB2
PRINTER
ETHERNET
COM2
COM3
COM4 (SPARE)
12VDC PWR
VGA
COM1
key bd
mouse
USB1
USB2
printer
TOUCH DISPLAY

CHILLER ASSY (43xx, ATSxxx)

ID WIRE JUMPER
* Only on 4390, ATS730,750,770
TO J2
P2
HI PRESSURE SWITCH CONTACT
CONTROLLER INPUT SIGNALS
COMPRESSOR FAN
GRN/YEL
BLU
BRN
LINE VOLTAGE FROM tb30,31
* DEFROST HEATER
BLU
BLK
LINE VOLTAGE FROM TB40,41
DEFROST HEATER AND WIRES
* Only on ATS7xx

Approvals	Date
Drawn B. ROGAN	11/10/04
Checked	
Checked	
Design B. ROGAN	11/10/04

TEMPTRONIC an inTEST Company

Title: 4300/4310/4390 (ATS) SYSTEM WIRE DIAGRAM

Size: Custom | Document Number: 18207 | Rev: F

Date: | Sheet 2 of 2

Revisions [1]				
Zone	Rev	Description	Date	Approved
	A	INITIAL RELEASE, for -80-90 Streams , ECO 060717 Formerly 17353, Differences include: CB4 to 20A, Added CBL11 & 12 Wiring, Add F3 & F4, Chg F1 and F2 to 0.16A, Chg TB30 and 31, Add TB24A, Chg wires 35, 36, 37 and 38, Add CA6, Del P/J12 from refrigeration cbl, Del Floppy Drive	7/25/06	BR
	B	SWAPPED WIRES 120 AND 121 ON RELAY K8 FOR IMPROVED SHUTDOWN ECO# 061003	9/28/06	BR
	C	SWAPPED F3 AND F4 DESIGNATIONS (WAS REVERSED), ADD NOTES, IMPROVE CLARITY ECO# 061211	12/06/06	BR
	D	DELETED FLICKER BD, ADD NOTE 11, SPLIT DWG INTO 2 "S" SHEETS ECO 081007	1/28/09	BR
	E	ATS upgrade: Add K4, TB40-41, SV6, add Light Tower, Updates notes for "ATS" eco 121101	10-31-12	BR
	F	ATS upgrade: Revise T2 Config Block ECO 121116	11-21-12	BR

4310 (ATS 5xx) BOARD SET

NOTE 2

NOTE 11

PC5
FLICKER BOARD
SCHEMATIC 16995

PC2
4310 MAIN CONTROLLER BOARD
SCHEMATIC 15119

PC2
UNIFIED MAIN CONTROLLER BOARD
SCHEMATIC 19238

CA1 8 COND RBBN (VIDEO)
CA2 6 COND FLAT (KEYPAD)
CA3 6 COND FLAT (ENCODER)
CA4 __COND (I2C)
CBL 15 20/4
CBL 18 20/5
CBL 17 20/4
CBL 11 20/2
CBL 16 20/8
CBL 29 24 T-T/C
CBL 30 12/3

NOTE 6
NOTE 1,6

4300 (ATS 7xx) BOARD SET

PC1
WATLOW CONTROLLER BOARD
SCH NOT AVAILABLE

PC6
IEEE BOARD

CA5 ETHERNET
(VV04910)
CBL 29 24 T-T/C
(AIR T/C)
CA9 9 COND
(RS-232)
CA10 9 COND
(RS-232)

NOTE 1

4300(ATS7xx)
LIGHT TOWER
OPTION

* Wires not included in harness.
The wires are added durring
the install of the light tower

NOTE 4

CBL 15 20/4
CBL 16 20/8
CBL 11 20/2
CBL 21 20/4
CBL 12 20/4
CBL 1 20/2
CBL 8 20/2
CBL 3 20/4
CBL 4 20/4
CBL 7 18/4
CBL 19 20/4
CBL 2 20/4
CBL 5 20/2
CBL 13 20/2
CBL 6 18/15

FOR 4310 ONLY
NOTE 5

R2
2 OHM 25W

CBL 30 10/3
NOTE 10
200-250 VAC
50/60HZ
1 PH
30A

K9
REMOTE TRIP

NOTE 7

AIR PURGE
ASSY

CBL 9 18/2

ATSxxx Wiring
T2 AUTO-TRANSFORMER
230 220 208 200 0

43xx Wiring
T2 AUTO-TRANSFORMER
230 220 208 200 0

T2
TOROIDAL
6.9KVA
ALL TAPS RATED 30A
5% TAPS

T1
25VA

TO
CHILLER
(PRES SW AND ID)

TO
CHILLER
(COMP/FAN)

TO
CHILLER
(DEFROST HEATER)
* Only on ATS730,40,50

See Config Card
NOTE 10

CBL 12 20/4

Approvals	Date
Drawn B. ROGAN	11/10/04
Checked	
Checked	
Design B. ROGAN	11/10/04

TEMPTRONIC
an INTEST Company

Title: 4300/4310/4390 (ATS) SYSTEM WIRE DIAGRAM

Size: Custom | Document Number: 18207 | Rev: F

Date: | Sheet 1 of 2

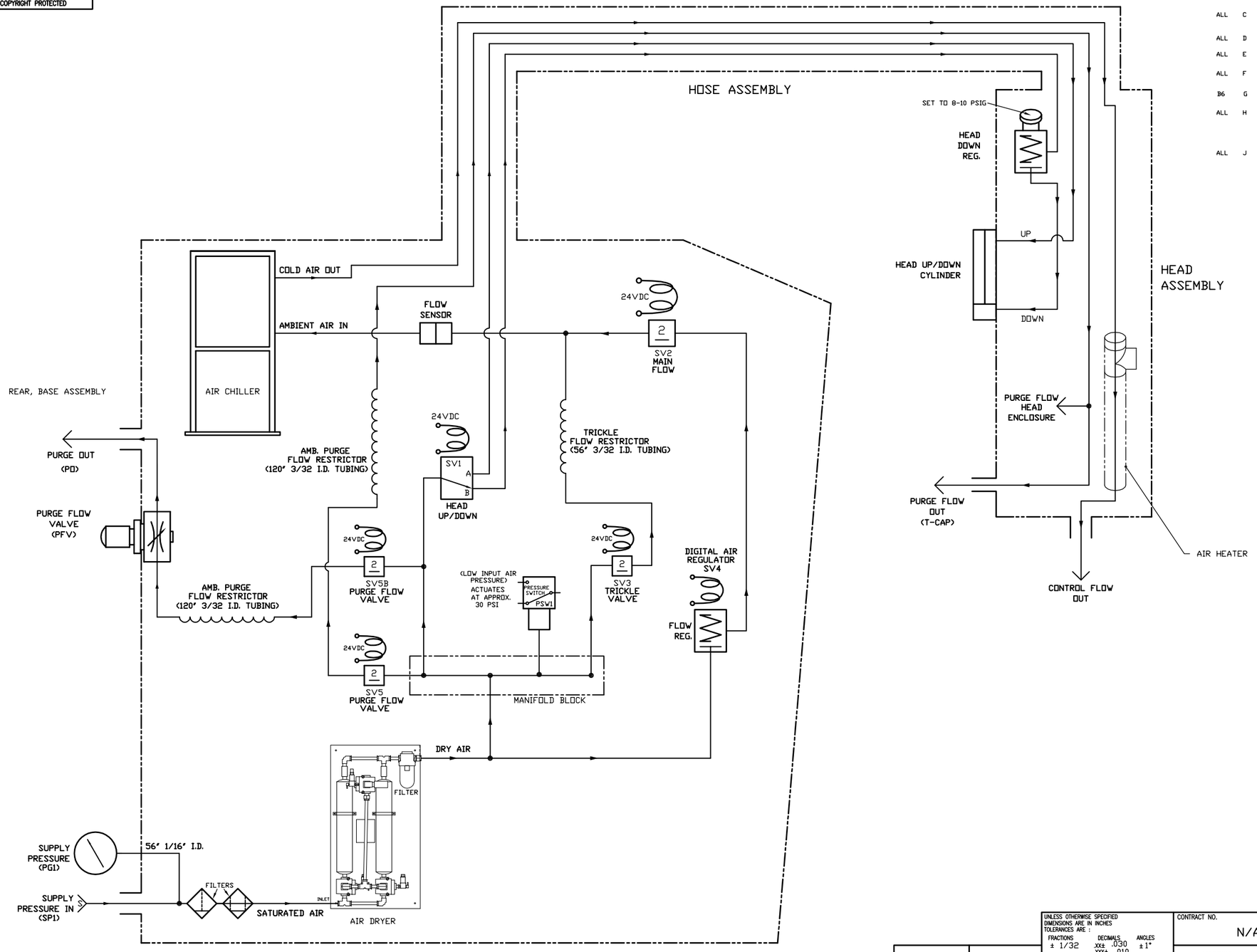
NOTES:

1. FOR A 4310(ATS5xx): J7 CONNECTS TO P7 AND J8 CONNECTS TO P8
2. FOR A 4310(ATS5xx): CBL 29 (MAIN T/C) CONNECTS TO J12
3. FOR A 4310(ATS5xx): CBL 6 (J1) CONNECTS TO P1
4. FOR A 4310(ATS5xx): WIRES 110,111 ARE UNUSED AND TIED TO THE HARNESS
5. FOR A 4310(ATS5xx): K7 IS USED AND WIRED WITH 133,134,132,121 AS SHOWN
   FOR A 4300(ATS7xx): K7 IS NOT USED, WIRES 133,134,132,121 ARE AS SHOWN
6. FOR A 4300(ATS7xx): THE FOLLOWING 4310 CONNECTIONS ARE UNUSED AND TIED TO THE HARNESS: - P18, P1, P2, P4, J7, AND J8
7. FOR A 4300(ATS7xx): WIRE #117 IS UNPLUGGED FROM K8 AND TIED TO THE HARNESS
8. note deleted
9. FOR A 4390(and ATS cf09 chiller): ALL WIRING IS THE SAME AS A 4300 EXCEPT ADDED ARE THE ID JUMPER ACROSS PINS 1,2 OF P2 AND THE SV6 COOL/BYPASS VALVE
10. THE LINE VOLTAGE IS BROKEN INTO THE FOLLOWING RANGES:
    200-214V
    215-224V
    225-234V
    235-250V
    THE AUTO-TRANSFORMER (T2) IS TAPPED TO MATCH THE PARTICULAR LINE VOLTAGE RANGE, FREQUENCY, AND CHILLER TYPE. SEE THE CONFIGURATION CARD INSIDE THE ELCTRICAL BOX FOR THIS INFORMATION.
11. UNITS PRIOR TO 2009 USED THE MAIN BD AND THE FLICKER BOARD (SHOWN IN DASH LINE). THE FLICKER BD WAS DELETED 2009 (ECO 081007).

DWG NO. | SH. | REV.

REVISIONS

ZONE	REV.	DESCRIPTION	DATE	APPROVED
ALL	A	INITIAL RELEASE	05-11-00	
ALL	B	RECONFIGURE HEAD UP/DOWN PLUMBING TO AVOID CONFUSION E.C.O. #14631B	09-20-00	
ALL	C	CHG 'HEATED PURGE OUT' TO 'PURGE OUT' 14631C CHG 'HEATED PURGE FLOW VALVE' TO 'PURGE FLOW VALVE'	04-17-02	Brett Wood
ALL	D	CHANGES PER ECO 14631D	10-30-02	
ALL	E	ADD SV5, RELOCATE PSW1	01-20-04	
ALL	F	REVISED TUBING LENGTHS ECO#051019	10-20-05	
B6	G	ADDED AIR PURGE BYPASS AROUND SV5 PER ECO#060302	02-22-06	
ALL	H	REVISED PER ECO #060819 ADD SOLENOID VALVE SV5B SHOW MANIFOLD BLOCK CONNECTIONS	08-23-06	Brett Wood
ALL	J	REVISED PER ECO #080530 CHG TRICKLE RESTRICTOR FROM 68", TO 56"	05-28-08	Brett Wood



GENERAL NOTES: (UNLESS OTHERWISE SPECIFIED)

	TP04300
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE :
FRACTIONS ± 1/32 DECIMALS .XX± .030 .XXX± .010 ANGLES ±1°

MATERIAL: N/A
FINISH: N/A
DO NOT SCALE DRAWING

CONTRACT NO.: N/A

APPROVALS	DATE
DRAWN: S.PETROVICH	05-11-00
CHECKED	
ISSUED	
DESIGN	

TEMPTRONIC an ATEST Company

PNEUMATIC, SCHEM.
TP04300A

SIZE: D | PSCM NO.: N/A | DWG. NO.: 14631 | REV.: J
SCALE: N/A | SHEET: 1 OF 1

ATS Series to TP04300

C

Backwards Compatibility

Introduction

The ATS-XXX remote interface command set exhibits a high degree of backwards compatibility with that of the TP04300. The differences are listed below:

NOTE: The following commands are different in the ATS-Series.

Commands

Command	Description
*IDN?	Returns TEMPTRONIC, ATS-XXX, PG19909X, Ver 5.7.2 -- varies with system models ATS-XXX and software versions.
GTIM	Sets the Chiller Off Time to XX minutes.
GTIM?	Use this query to get the status of the GTIM command. The query yields both the setting of the timer and the time remaining on the countdown.

D

Application Notes: Advanced Operations

Application Notes Overview

In this Appendix

The following Topics are detailed in this Appendix:

Temperature Control Using the ATS-Series System

The main application of the system is to control the temperature of the Device Under Test (DUT) by varying the temperature of the air stream coming out of the air nozzle. There are three modes of temperature control in the system. They are:

- Air Mode
- DUT Mode
- TC Meter Mode

In Air Mode, the X-Stream controls the temperature of the Air coming out of the air nozzle. The temperature sensor is located in the main air nozzle.

In DUT Mode, the X-Stream controls the temperature of the DUT, which is located under the cap or inside of the test fixture. The temperature sensor is mounted in direct contact with the DUT.

In TC Meter Mode, X-Stream controls the temperature of the air with an offset in order to reach the desired temperature on the DUT. The system can use either the Main Air Sensor or a DUT sensor as a baseline to achieve the DUT temperature.

Air Mode

In Air Mode, the system controls the temperature of the air stream coming out of the main air nozzle. The DUT could be located under the cap or in the test fixture, or simply exposed to the stream of the air at the desired temperature. Using the control panel or via remote interface, the operator can set the desired air temperature and the air reaches the temperature within seconds.

Pros:

- The Air Mode is easy to use.
- Does not require external temperature sensor.
- Fast air temperature changes allow a great flexibility in the test.

Cons:

- The DUT is not guaranteed to reach the desired temperature, because the system is not sensing the DUT temperature, but rather the temperature of the air coming out of the nozzle.
- Because of the test setup’s limitations, the DUT temperature is often different (lower or higher) than the air temperature.
- The soak time has to be verified by the system’s operator to ensure that the DUT reaches the desired test temperature.

DUT Mode

DUT Mode is use for controlling the temperature of the DUT.

Pros:

- Accurate DUT temperature controlling (the DUT is controlled within ±0.1C)

Cons:

- Requires an external temperature sensor (thermocouple, RTD, or diode)

Mounting and Selecting a DUT Temperature Sensor

The temperature sensor has to be in direct contact with the DUT and connected to the back of the system. The system reads the DUT temperature and finds the optimal air temperature to make a faster transition and stabilize the DUT temperature at the set point. To use DUT Mode, connect the DUT sensor and then select the sensor type from the Control Panel.

Understanding the Temperature Control in DUT Mode

In most of the applications the system, performs to the customer's satisfaction by using the factory default settings. However, the operator can modify the test depending on specific needs. The system offers 6 distinct settings to customize and "tweak" the temperature transitions:

- DTYP setting
- Thermal Constant setting
- RAMP rate setting
- Air temperature limit (high and low) setting
- Air to DUT max setting
- Flow rate (scfm) setting

These settings can all be accessed in the *Setup Screen* and saved to a setup file.

DTYP Setting

First, choose the appropriate DUT Type (DTYP) settings. The system is designed to control the temperature of a wide variety of DUTs. Depending on the geometry, size, material, and location of the DUT relative to the air stream, the DUT responds differently to changes in the air temperature.
A larger device takes more power to heat than a smaller device.
A plastic DUT responds differently than a similar sized ceramic DUT.
A DUT under the cap reacts differently than a DUT one foot away in a fixture.
All these factors contribute to determining the DTYP selection. The system offers 5 default presets of temperature control parameters. They are as follows:

DUT Type (DTYP)	Thermal Mass	Example
0	Smallest DUT mass	28 pin, 350 mil, ceramic or plastic device
1	Larger DUT mass	32 pin, 400 mil ceramic or plastic device
2	Even Larger DUT mass	68 pin PLCC plastic device
3	The Largest DUT mass	Larger hybrid chips, Thermal box
4	System Derived (auto-tune)	Thermal fixture, thermal box

Identifying your DUT's DTYP is an important step if you use the DUT mode. DTYP 0 to 3 (see Table above) are factory default temperature control parameters, chosen for optimal transition time and minimal overshoot. DTYP 4 uses system-derived parameters, which can be customized for any application. Please read below about Autotuning and saving DTYP 4 temperature control parameters.

DTYP 0 is the optimal selection if your DUT is a smaller 28 pin, 350-mil device. DUT size and thermal conductivity determine which DTYP setting to use; the larger and less conductive the DUT, the higher DTYP. A 28 pin, 350-mil device made of plastic could be a different DTYP than a 28 pin, 350-mil device made of ceramic because ceramic conducts heat differently than plastic. Another factor to consider is the limitations of the test setup. A thermal box with a longer hose has a transport delay and temperature drop along the length of the hose. A smaller DUT placed within large volume has a delayed response because its environment is a significant heat/cold load on the system.

For special test setups (thermal fixtures and boxes) it is recommended to run the **auto-tune Utility** (in the Utilities Screen). The auto-tune Utility uses a thermal step response to determine both DUT delay time and DUT rise time. The temperature control parameters are calculated using the Ziegler- Nichols step response method. For detail on how to run the auto-tune Utility please refer the manual. The auto-tune Utility produces and stores the temperature control parameters which are unique and optimal for your setup.

Thermal Constant Setting

The second way to affect temperature transitions is to modify the DUT Thermal Constant. Accepted values of the Thermal Constant are 20 to 3000 in increments of 1. The Thermal Constant default is 100: Values lower than 100 are for lower mass devices and values higher than 100 are for higher mass devices. The Thermal Constant can be set to produce minimum over-shoot, maximum stability, and slower time to set point temperature (i.e. high damping), or, the constant can be set to produce moderate overshoot, moderate stability, and faster time to set point temperature (i.e. low damping). When setting, use this rule of thumb: the larger the DUT Thermal Constant setting, the greater the damping; the lower the DUT Thermal Constant setting, the less the damping.

RAMP rate Setting

RAMP rate is the speed (°C/sec) at which the system transitions from one set point to another. A RAMP rate setting of “9999” allows the system to transition (or ramp) as fast as possible; a RAMP rate setting of “0” does not allow the system to transition (or ramp) to that set point - a transition rate of “0” instructs the system to “skip” that set point and move on to the next set point. The system default RAMP rate is “9999” (as fast as possible). Changing to a lower RAMP rate results in a slower transition time, a faster settling time, and a more even temperature distribution throughout the test set up.

Air temp limit (high and low) Setting

Air temp limits are the settable high and low temperature limits of the system. The defaults (and maximums) are +225°C (high temp) (Model ATS-750- maximum +300°C) and -100°C (low temp). Limiting air temperature decreases the transition time but (in the same way as RAMP) helps to eliminate temperature gradient and minimizes settling times and overshoot. Using Air temp limits also prevents any thermal shock or other thermal damage to the Device Under Test.

Air to DUT max Setting

Air to DUT max allows the operator to set a maximum limit on the difference between Air and DUT temperatures. The default (and maximum) setting is +300°C, to allow for the fastest possible transition times. By decreasing the Air to DUT max settings, transition times decrease but allow for smoother, quicker settling times

Flow rate Setting

Flow rate is the rate at which the air comes out of the main air nozzle. Increasing the airflow accelerates the transition time. However, the combination of low air temperatures and extremely high flow rates may not achieve the ultimate cold capabilities of the system.

Temperature Control Troubleshooting

This section describes common problems in the temperature transition and suggests how use the settings in the *Setup Screen* to correct them.

Oscillatory behavior

DUT and air temperatures oscillate around the set point.

- **DTYP** - Try to use a higher DTYP, if you are already at DTYP 3, see the Thermal Constant adjustments (below).
- **Thermal Constant** - Increasing Thermal Constant produces a greater damping; damping oscillations significantly reduces the settling time. Adds stability to a system.
- **Autotuning** - Tune system to your test setup; may still need to adjust the Thermal Constant
- **Air Flow –** increase or decrease the flow rate

Slow Transition Time

DUT temperature slowly reaches or stays at steady state below the set point.

- **DTYP** - Try to use lower DTYP, if you are already at DTYP 0, see the Thermal Mass adjustments
- **Thermal Constant –** Decreasing Thermal Constant reduces damping and makes temperature control more aggressive. Gives you a faster time to reach the set point
- **Air Flow –** increase the flow rate
- **Autotuning** - Tune system to your test setup; may still need to adjust the Thermal Constant

Transition Time is too Fast

DUT temperature changed faster than current application requirements (thermal shock possible).

- **Ramp rate** - Decrease the ramp rate
- **DTYP** - Try to use higher DTYP
- **Thermal Constant –** increase the Thermal Constant
- **Air Max and Min temperature limits –** limit air temperature high and low
- **Air DUT max –** decrease the Air-to-DUT
- **Air Flow –** limit the air flow

Temperature overshoot

DUT Temperature reaches the set point, but overshoots (above or below) the set point.

- **DTYP** - Try to use higher DTYP, if you are already at DTYP 3, see the Thermal Mass adjustments
- **Thermal Constant** - Increasing Thermal Constant reduces overshoot and add stability
- **Ramp rate** - Decrease the ramp rate
- **Air Max and Min temperature limits –** limit air temperature high and low
- **Air DUT max –** decrease the Air-to-DUT
- **Autotuning** - Tune system to your test setup; may still need to adjust the DUTC
- **Air Flow –** limit the air flow

Steady State Error

DUT temperature extremely slow changes or stays at steady state below the set point

- **DTYP** - Try to use lower DTYP, if you are already at DTYP 0, see the Thermal Constant adjustments
- **Thermal Constant –** Decreasing Thermal Constant reduces damping and makes temperature control more aggressive. Gives you a faster time to reach the set point
- **Air Max and Min temperature limits –** increase the limits on air temperature
- **Air DUT max –** increase the Air-to-DUT
- **Autotuning** - Tune system to your test setup; may still need to adjust the Thermal Constant
- **Air Flow –** limit the air flow
- **Verify compressor -** must be ON (i.e. “Heat Only Mode” is not selected in the Utilities Screen)
- **Verify your setup –** if System runs at its max heat/cold power, but fails to reach the set point, check you test setup for leaks
- **Verify temperature sensor** mount and location
- **Refer** to appropriate system specifications

Uneven temperature distribution

This generally occurs with larger DUTs under the thermal cap or in the Thermal Fixtures.

- **Soak time –** increase soak time
- **Air-to-DUT difference –** decrease to slow the transition time
- **Air DUT max** - decrease to slow the transition time
- Experiment with a temperature sensor location

TC Meter Mode

Introduction

Some test setups do not allow an external temperature sensor to be interfaced with the Device Under Test (DUT). The solution to these types of test setups is to thermally characterize the DUT and then use TC Meter Mode to control the DUT with a calibrated offset. The calibrated offset is determined by the DUT characterization and allows for a DUT temperature to be achieved without interfacing a temperature sensor directly at, on, or into the DUT.

It is critical that the DUT characterization is repeatable for TC Meter Mode to be accurate. Any changes in the test setup or DUT characteristics requires a new DUT characterization and new TC Meter calibration.

With TC Meter Mode, users can specify temperatures (i.e. set points) for the DUT, the THERMOSTREAM then controls the DUT at those set points. The THERMOSTREAM operator screens and *Remote Interface Screens* display a calibrated DUT temperature even though no sensor is directly interfaced with the DUT.

Although no sensor is directly interfaced with the DUT in TC Meter Mode, the THERMOSTREAM must still use a sensor as a baseline for calculating the DUT temperature (i.e. a sensor as a baseline PLUS the offset that was determined in characterization). In TC Meter Mode, the THERMOSTREAM can use any of its standard sensors as a baseline sensor. The THERMOSTREAM can operate in Air Mode with the Main Air Sensor or DUT Mode with a T-Type, K-Type, Diode, or RTD sensor. However, the sensor being used as a baseline should remain the same throughout both calibration and DUT testing.

Calibrating TC Meter Mode

For a step-by-step calibration procedure, refer to Chapter 5, TC Meter Calibration (TC Meter Mode).

TC Meter calibration consists of five parameters:

- Cold Offset Temperature ($T_{ColdOffsetTemp}$)
  - the cold baseline temperatures without the offset
- Cold set point Temperature ($T_{ColdSetpoint}$)
  - the cold baseline temperatures PLUS the offset; this is the target temperature for the DUT
- Hot Offset Temperature ($T_{HotOffsetTemp}$)
  - the hot baseline temperatures without the offset
- Hot set point Temperature ($T_{HighCalTemp}$)
  - the cold baseline temperatures PLUS the offset; this is the target temperature for the DUT
- Ambient Window
  - the window between 15°C and 35°C, where the DUT temperature equals to Air temperature.

Calculated DUT temperature will be:

$T_{DUT} = T_{sensor} + (T_{HotSetpoint} - T_{HotOffsetTemp})$	above 15°C to 35°C + Ambient Window
$T_{DUT} = T_{sensor}$	within 15°C to 35°C +/- Ambient Window
$T_{DUT} = T_{sensor} + (T_{ColdSetpoint} - T_{ColdOffsetTemp})$	below 15°C to 35°C + Ambient Window

E

Data Sheets & Specifications

ATS-700 and -800 Series Data Sheets

Data sheets for all ThermoStream models can be downloaded in PDF format at:
http://intestthermal.com/resources/resource-center/temperature-forcing