# MKS Type T3PIA
# Pendulum Valve
# With Analog/TTL Interface

## Instruction Manual

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# WARRANTY

Type T3PIA Pendulum Valve with Analog/TTL Interface

MKS Instruments, Inc. (MKS) warrants that for one (1) year from the date of shipment the equipment described above (the “equipment”) manufactured by MKS shall be free from defects in materials and workmanship.

For the period commencing with the date of shipment of this equipment and ending one (1) year later, MKS will, at its option, either repair or replace any part which is defective in materials or workmanship without charge to the purchaser. The foregoing shall constitute the exclusive and sole remedy of the purchaser for any breach of MKS of this warranty.

The purchaser, before returning any equipment covered by this warranty, which is asserted to be defective by the purchaser, shall make specific written arrangements with respect to the responsibility for shipping the equipment and handling any other incidental charges with the MKS Sales Representative or distributor from which the equipment was purchased or, in the case of a direct purchase from MKS, with the MKS home office in Andover, Massachusetts, USA.

This warranty does not apply to any equipment which has not been installed and used in accordance with the specifications recommended by MKS for the proper and normal use of the equipment. MKS shall not be liable under any circumstances for indirect, special, consequential, or incidental damages in connection with, or arising out of, the sale, performance, or use of the equipment covered by this warranty.

MKS recommends that all MKS pressure and flow products be calibrated periodically (typically) every 6 to 12 months) to ensure accurate readings. When a product is returned to MKS for this periodic re-calibration it is considered normal preventative maintenance not covered by any warranty.

THIS WARRANTY IS IN LIEU OF ALL OTHER RELEVANT WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY AND THE IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, AND ANY WARRANTY AGAINST INFRINGEMENT OF ANY PATENT.

# MKS Type T3PIA
# Pendulum Valve
# With Analog/TTL Interface

*Printed in the United States of America*

US Patent 6,089,537 and other Patents Pending



Firmware version: 01.02

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# Valve Safety Information

## Symbols Used in This Instruction Manual

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

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

## Symbols Found on the Unit

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

**Table 1: Definition of Symbols Found on the Unit**

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

## Safety Procedures and Precautions

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

**Warning** **Moving parts in the valve create a risk of personal injury until the valve is securely incorporated into a system. To avoid injury, keep all body parts away from any valve opening.**

1. **Do not insert objects into openings where contact with moving parts is possible.**
2. **Isolate the valve from any electrical or pneumatic power supply before handling the valve.**

**DO NOT SUBSTITUTE PARTS OR MODIFY VALVE**

Do not install substitute parts or perform any unauthorized modification to the valve. Return the valve to an MKS Calibration and Service Center for service and repair to ensure that all safety features are maintained.

**SERVICE BY QUALIFIED PERSONNEL ONLY**

Operating personnel must not attempt component replacement and internal adjustments. Qualified service personnel must perform any service only.

**USE CAUTION WHEN OPERATING WITH HAZARDOUS MATERIALS**

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

**PURGE THE VALVE**

After installing the unit, or before removing it from a system, purge the unit completely with a clean, dry gas to eliminate all traces of the previously used flow material.

**USE PROPER PROCEDURES WHEN PURGING**

This valve must be purged under a ventilation hood and gloves must be worn for protection.

**DO NOT OPERATE IN AN EXPLOSIVE ENVIRONMENT**

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

**USE PROPER FITTINGS AND TIGHTENING PROCEDURES**

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

**CHECK FOR LEAK-TIGHT FITTINGS**

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

**OPERATE AT SAFE INLET PRESSURES**

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

**INSTALL A SUITABLE BURST DISC**

When operating from a pressurized gas source, install a suitable burst disc in the vacuum system to prevent system explosion should the system pressure rise.

**KEEP THE UNIT FREE OF CONTAMINANTS**

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

**KEEP AWAY FROM VALVE OPENING**

Keep fingers, other body parts, and other materials away from the valve opening when the valve is in operation.

# Sicherheitshinweise für das Ventil

## In dieser Betriebsanleitung vorkommende Symbole

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

| | |
|---|---|
| **Warnung!** | **Das Symbol WARNUNG! weist auf eine Gefahr für das Bedienpersonal hin. Es macht auf einen Arbeitsablauf, eine Arbeitsweise, einen Zustand oder eine sonstige Gegebenheit aufmerksam, deren unsachgemäße Ausführung bzw. ungenügende Berücksichtigung zu Verletzungen führen kann.** |
| **Vorsicht!** | **Das Symbol VORSICHT! weist auf eine Gefahr für das Gerät hin. Es macht auf einen Bedienungsablauf, eine Arbeitsweise oder eine sonstige Gegebenheit aufmerksam, deren unsachgemäße Ausführung bzw. ungenügende Berücksichtigung zu einer Beschädigung oder Zerstörung des Gerätes oder von Teilen des Gerätes führen kann.** |
| **Hinweis** | Das Symbol HINWEIS macht auf wichtige Informationen bezüglich eines Arbeitsablaufs, einer Arbeitsweise, eines Zustands oder einer sonstige Gegebenheit aufmerksam. |

## Erklärung der am Gerät angebrachten Symbole

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

**Tabelle 2: Bedeutung der am Gerät angebrachten Symbole**

| | | | |
|---|---|---|---|
| Ein (Energie)<br>IEC 417, No.5007 | Aus (Energie)<br>IEC 417, No.5008 | Erdanschluss<br>IEC 417, No.5017 | Schutzleiteranschluss<br>IEC 417, No.5019 |
| Masseanschluss<br>IEC 417, No.5020 | Aquipotentialanschluss<br>IEC 417, No.5021 | Gleichstrom<br>IEC 417, No.5031 | Wechselstrom<br>IEC 417, No.5032 |
| Gleich- oder Wechselstrom<br>IEC 417, No.5033-a | Durchgängige doppelte oder verstärkte Isolierung<br>IEC 417, No.5172-a | Dreileiter-Wechselstrom (Drehstrom)<br>IEC 617-2, No.020206 | Vorsicht: Quetschgefahr für die Hand<br>ISO 3864 |
| Warnung vor einer Gefahrenstelle (Achtung, Dokumentation beachten)<br>ISO 3864, No.B.3.1 | Warnung vor gefährlicher elektrischer Spannung<br>ISO 3864, No.B.3.6 | Höhere Temperatur an leicht zugänglichen Teilen<br>IEC 417, No.5041 | Vorsicht: Federspannung<br>ISO 3864 |

## Sicherheitsvorschriften und Vorsichtsmaßnahmen

**Folgende allgemeine Sicherheitsvorschriften sind während allen Betriebsphasen dieses Gerätes zu befolgen. Eine Missachtung der Sicherheitsvorschriften und sonstiger Warnhinweise in dieser**

**Betriebsanleitung verletzt die für dieses Gerät und seine Bedienung geltenden Sicherheitsstandards, und kann die Schutzvorrichtungen an diesem Gerät wirkungslos machen. MKS Instruments, Inc. haftet nicht für Missachtung dieser Sicherheitsvorschriften seitens des Kunden.**

**Warnung** **Solange das Ventil nicht fest in ein System eingebaut ist, besteht Verletzungsgefahr aufgrund von beweglichen Teilen. Daher Finger und andere Körperteile unbedingt von allen Ventilöffnungen fernhalten.**

1. **Niemals Fremdkörper in Öffnungen einführen, in denen ein Kontakt mit beweglichen Teilen möglich ist.**
2. **Das Ventil vor dem Hantieren stets von allen elektrischen und pneumatischen Kraftquellen trennen.**

**Niemals Teile austauschen oder Änderungen am Ventil vornehmen!**
Ersetzen Sie keine Teile mit baugleichen oder ähnlichen Teilen, und nehmen Sie keine eigenmächtigen Änderungen am Ventil vor. Schicken Sie das Ventil zwecks Wartung und Reparatur an den MKS-Kalibrierungs- und -Kundendienst ein. Nur so wird sichergestellt, daß alle Schutzvorrichtungen voll funktionsfähig bleiben.

**Wartung nur durch qualifizierte Fachleute!**
Das Auswechseln von Komponenten und das Vornehmen von internen Einstellungen darf nur von qualifizierten Fachleuten durchgeführt werden, niemals vom Bedienpersonal.

**Vorsicht beim Arbeiten mit gefährlichen Stoffen!**
Wenn gefährliche Stoffe verwendet werden, muß der Bediener die entsprechenden Sicherheitsvorschriften genauestens einhalten, das Ventil, falls erforderlich, vollständig spülen, sowie sicherstellen, daß der Gefahrstoff die von ihm benetzten, im Ventil verwendeten Materialien, insbesondere Dichtungen, nicht angreift.

**Spülen des Ventils mit Gas!**
Nach dem Installieren oder vor dem Ausbau aus einem System muß das Ventil unter Einsatz eines reinen Trockengases vollständig gespült werden, um alle Rückstände des Vorgängermediums zu entfernen.

**Anweisungen zum Spülen des Ventils!**
Das Ventil darf nur unter einer Ablufthaube gespült werden. Schutzhandschuhe sind zu tragen.

**Nicht zusammmen mit explosiven Stoffen, Gasen oder Dämpfen benutzen!**
Um der Gefahr einer Explosion vorzubeugen, darf dieses Produkt niemals zusammen mit explosiven Stoffe aller Art eingesetzt werden, sofern es nicht ausdrücklich für diesen Zweck zugelassen ist.

**Anweisungen zum Installieren der Armaturen!**
Alle Ventilanschlußstücke und Armaturenteile müssen mit den Ventilspezifikationen übereinstimmen, und mit dem geplanten Einsatz des Ventils kompatibel sein. Der Einbau, insbesondere das Anziehen und Abdichten, muß gemäß den Anweisungen des Herstellers vorgenommen werden.

**Ventil auf Undichtigkeiten prüfen!**
Überprüfen Sie sorgfältig alle Verbindungen auf undichte Stellen.

**Nur unter zulässigen Anschlußdrücken betreiben!**
Betreiben Sie das Ventil niemals unter Drücken, die den maximal zulässigen Druck (siehe Produktspezifikationen) übersteigen.

**Geeignete Berstscheibe installieren!**
Wenn mit einer unter Druck stehenden Gasquelle gearbeitet wird, sollte eine geeignete Berstscheibe in das Vakuumsystem installiert werden, um eine Explosionsgefahr aufgrund von steigendem Systemdruck zu vermeiden.

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

**Hände weg von der Ventilöffnung!**
Körperteile, insbesondere Finger, sowie Fremdobjekte während des Betriebes von der Ventilöffnung fernhalten.

# Informations de sécurité relatives au manomètre

## Symboles utilisés dans ce manuel d'utilisation

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

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

## Symboles figurant sur l'unité

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

**Tableau 3: Définition des symboles sur l'unité**

| | | | |
|---|---|---|---|
| Marche (sous tension)<br>IEC 417, No.5007 | Arrêt (hors tension)<br>IEC 417, No.5008 | Terre (masse)<br>IEC 417, No.5017 | Terre de protection (masse)<br>IEC 417, No.5019 |
| Masse<br>IEC 417, No.5020 | Equipotentialité<br>IEC 417, No.5021 | Courant continu<br>IEC 417, No.5031 | Courant alternatif<br>IEC 417, No.5032 |
| Courant continu et alternatif<br>IEC 417, No.5033-a | Matériel de classe II<br>IEC 417, No.5172-a | 3~<br>Courant alternatif triphasé<br>IEC 617-2, No.020206 | Attention : Danger d'écrasement de la main<br>ISO 3864 |
| Attention : se reporter à la documentation<br>ISO 3864, No.B.3.1 | Attention : risque de choc électrique<br>ISO 3864, No.B.3.6 | Attention : surface brûlante<br>IEC 417, No.5041 | Attention : Ce dispositif est à ressort<br>ISO 3864 |

## Mesures de sécurité et précautions

**Observer les précautions générales de sécurité suivantes pendant toutes les phases d'exploitation de cet appareil. Le non-respect des ces précautions ou des avertissements du manuel constitue une violation des normes de sécurité relatives à l'utilisation de l'appareil et peut compromettre la protection assurée**

**par l'appareil. MKS Instruments, Inc. rejette toute responsabilité en cas de non-respect des consignes par les clients.**

**Avertissement** **Les pièces mobiles de la valve peuvent être une cause d'accident tant que la valve n'est pas solidement incorporée dans un système. Pour éviter tout accident, tenir toute partie du corps à distance de toute ouverture de la valve.**

1. **Ne pas insérer des objets dans les ouvertures où le contact avec des pièces mobiles est possible.**
2. **Isoler la valve de toute source d'alimentation électrique ou pneumatique pendant la manipulation de la valve.**

#### PAS DE SUBSTITUTION DE PIÈCES OU DE MODIFICATION DE LA VALVE

Ne pas installer des pièces de substitution ou effectuer des modifications non autorisées sur la valve. Renvoyer la valve à un centre de service et de calibrage MKS pour tout dépannage ou réparation afin de garantir le l'intégrité des dispositifs de sécurité.

#### DÉPANNAGE UNIQUEMENT PAR DU PERSONNEL QUALIFIÉ

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

#### PRÉCAUTION EN CAS D'UTILISATION AVEC DES PRODUITS DANGEREUX

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

#### PURGE DE LA VALVE

Après l'installation de l'unité, ou avant son enlèvement d'un système, purger l'unité complètement avec un gaz propre et sec afin d'éliminer toute trace du produit de flux utilisé précédemment.

#### UTILISATION DES PROCÉDURES APPROPRIÉES POUR LA PURGE

Cette valve doit être purgée sous une hotte de ventilation, et il faut porter des gants de protection.

#### PAS D'EXPLOITATION DANS UN ENVIRONNEMENT EXPLOSIF

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

#### UTILISATION D'ÉQUIPEMENTS APPROPRIÉS ET PROCÉDURES DE SERRAGE

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

#### VÉRIFICATION DE L'ÉTANCHÉITÉ DES CONNEXIONS

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

#### EXPLOITATION AVEC DES PRESSIONS D'ENTRÉE NON DANGEREUSES

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

#### INSTALLATION D'UN DISQUE D'ÉCHAPPEMENT ADAPTÉ

En cas d'exploitation avec une source de gaz pressurisé, installer un disque d'échappement adapté dans le système à vide afin d'éviter une explosion du système en cas d'augmentation de la pression.

#### MAINTIEN DE L'UNITÉ À L'ABRI DES CONTAMINATIONS

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

#### PRÉCAUTION AVEC L'OUVERTURE DE LA VALVE

Éviter tout contact des mains, toute autre partie du corps, ou tout autre matériel avec l'ouverture de la valve quand celle-ci est en fonctionnement.

# Medidas de seguridad del manómetro

## Símbolos usados en este manual de instrucciones

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

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

## Símbolos hallados en la unidad

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

**Tabla 4: Definición de los símbolos hallados en la unidad**

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

## Procedimientos y precauciones de seguridad

**Las medidas generales de seguridad descritas a continuación deben observarse durante todas las etapas de funcionamiento del instrumento. La falta de cumplimiento de dichas medidas de seguridad o de las advertencias específicas a las que se hace referencia en otras partes de este manual, constituye una violación de las normas de seguridad establecidas para el uso previsto del instrumento y podría anular**

**la protección proporcionada por el equipo. Si el cliente no cumple dichas precauciones y advertencias, MKS Instruments, Inc. no asume responsabilidad legal alguna.**

**Advertencia** **Hasta que la válvula sea incorporada en forma segura al sistema, las piezas en movimiento presentes en la misma pueden causar daños personales. Para evitarlo, mantenga todo el cuerpo alejado de la abertura de válvula.**

1. **No introduzca por las aberturas objetos que puedan entrar en contacto con piezas en movimiento.**
2. **Antes de tocar la válvula, aíslela de toda fuente de alimentación neumática o eléctrica.**

#### NO UTILICE PIEZAS NO ORIGINALES O MODIFIQUE LA VÁLVULA

No instale piezas que no sean originales o modifique la válvula sin autorización. Para asegurar el correcto funcionamiento de todos los dispositivos de seguridad, envíe la válvula al Centro de servicio y calibración de MKS toda vez que sea necesario efectuar reparaciones o tareas de mantenimiento.

#### LAS REPARACIONES DEBEN SER EFECTUADAS ÚNICAMENTE POR TÉCNICOS AUTORIZADOS

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

#### TENGA CUIDADO CUANDO TRABAJE CON MATERIALES TÓXICOS

Cuando se utilicen materiales tóxicos, los operarios deberán cumplir las medidas de seguridad correspondientes, purgar totalmente la válvula cuando sea necesario y comprobar que el material utilizado sea compatible con los materiales humedecidos del instrumento e inclusive, con los materiales de sellado.

#### PURGUE LA VÁLVULA

Una vez instalada la unidad o antes de retirarla del sistema, purgue completamente la unidad con gas limpio y seco para eliminar todo resto de la sustancia líquida empleada anteriormente.

#### USE PROCEDIMIENTOS ADECUADOS PARA REALIZAR LA PURGA

La válvula debe purgarse debajo de una campana de ventilación y deben utilizarse guantes protectores.

#### NO HAGA FUNCIONAR LA VÁLVULA EN UN AMBIENTE CON RIESGO DE EXPLOSIONES

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

#### USE ACCESORIOS ADECUADOS Y REALICE CORRECTAMENTE LOS PROCEDIMIENTOS DE AJUSTE

Todos los accesorios de la válvula deben cumplir las especificaciones de la misma y ser compatibles con el uso que se debe dar a la válvula. Arme y ajuste los accesorios de acuerdo con las instrucciones del fabricante.

#### COMPRUEBE QUE LAS CONEXIONES SEAN A PRUEBA DE FUGAS

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

#### HAGA FUNCIONAR LA VÁLVULA CON PRESIONES DE ENTRADA SEGURAS

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

#### INSTALE UNA CÁPSULA DE SEGURIDAD ADECUADA

Cuando el instrumento funcione con una fuente de gas presurizado, instale una cápsula de seguridad adecuada en el sistema de vacío para evitar que se produzcan explosiones cuando suba la presión del sistema.

#### MANTENGA LA UNIDAD LIBRE DE CONTAMINANTES

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

#### MANTÉNGASE ALEJADO DE LA ABERTURA DE LA VÁLVULA

Cuando la válvula esté funcionando, mantenga los dedos, otras partes del cuerpo y otros materiales alejados de la abertura.

# Chapter One: General Information

## Introduction

The MKS Type T3P Throttle Valve is designed for use in downstream pressure control applications.

The T3P unit consists of a throttling isolation valve with an electronic housing attached to the motor plate, a microprocessor, driver circuits which eliminate the need for a separate controller box, the RS-232 serial communications interface, and analog outputs that reflect pressure or valve position. The valve is controlled by using digital values sent through the serial network.

The operation of the controller is based on a digital pressure/position control algorithm that directs the valve to the proper position for either pressure or position control. The pressure or position setpoint is sent as a digital serial command. The T3P unit reads the pressure signal used for control applications directly from an MKS Baratron pressure transducer. All of the unit's operational settings are controlled using the serial communication protocol.

When the T3P controller is turned off or experiences an unexpected power loss, all calibration constants are saved in non-volatile memory.

Protection from RF interference and noisy electrical environments is increased by the use of a metal case, by internal design elements, and by the use of surge and ESD suppression networks and RFI filtering on all inputs and outputs. The T3P unit meets the testing standards required for the European CE Mark when used with an overall metal braided shielded cable, properly grounded at both ends.

### Definitions

**Table 5: Definitions**

| Term | Description |
|---|---|
| Full Scale (FS) Range | The defined 100% value of an attribute, in its assigned units |
| Sccm | Standard cubic centimeters per minute |
| Setpoint | The pressure value to which the device is controlling the flow of gas |
| Slm | Standard liters per minute |
| Trip Point | An alarm or warning level |

## How This Manual is Organized

This manual is designed to provide instructions on how to set up, install, and operate a Type T3P unit.

**Before installing your Type T3P unit in a system and/or operating it, carefully read and familiarize yourself with all precautionary notes in the *Safety Messages and Procedures* section at the front of this manual. In addition, observe and obey all WARNING and CAUTION notes provided throughout the manual.**

Chapter One, *General Information*, (this chapter) introduces the product and describes the organization of the manual.

Chapter Two, *Installation*, explains the environmental requirements and describes how to mount the instrument in your system. This chapter provides setup and installation procedures.

Chapter Three, *Product Overview*, gives a brief description of the instrument and its functionality.

Chapter Four, *Analog/TTL Operation*, describes how to operate the instrument, including how to select the digital input functions, how to set the analog set point inputs, how to select the digital output functions, and how to use RS-232 commands with an analog T3P/B.

Chapter Five, *Maintenance and Troubleshooting*, lists any maintenance required to keep the instrument in good working condition, and provides a checklist for reference should the instrument malfunction.

Appendix A, *Product Specifications*, lists the specifications of the instrument.

Appendix B, *Model Code Explanation*, describes the model code used to order the instrument.

Appendix C, *Dimensions*, contains line drawings of the various sizes of the T3P Analog/TTL.

## Customer Support

Standard maintenance and repair services are available at all of our regional MKS Calibration and Service Centers, listed on the back cover. In addition, MKS accepts the instruments of other manufacturers for recalibration using the Primary and Transfer Standard calibration equipment located at all of our regional service centers.

Should any difficulties arise in the use of your Type T3P instrument, or to obtain information about companion products MKS offers, contact any authorized MKS Calibration and Service Center. If it is necessary to return the instrument to MKS, please obtain an ERA Number (Equipment Return Authorization Number) from the MKS Calibration and Service Center before shipping. The ERA Number expedites handling and ensures proper servicing of your instrument.

Please refer to the inside of the back cover of this manual for a list of MKS Calibration and Service Centers.

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

# Chapter Two: Installation

## Unpacking the Type T3P Unit

MKS has carefully packed the Type T3P unit so that it will reach you in perfect operating order. Upon receiving the unit, however, you should check for defects, cracks, broken connectors, etc., to be certain that damage has not occurred during shipment.

**Note** Do *not* discard any packing materials until you have completed your inspection and are sure the unit arrived safely.

If you find any damage, notify your carrier and MKS immediately. If it is necessary to return the unit to MKS, obtain an ERA Number (Equipment Return Authorization Number) from the MKS Service Center before shipping. Please refer to the inside of the back cover of this manual for a list of MKS Calibration and Service Centers.

**Caution** **Only qualified individuals should perform the installation and any user adjustments. They must comply with all the necessary ESD and handling precautions while installing and adjusting the instrument. Proper handling is essential when working with all highly sensitive precision electronic instruments.**

### Unpacking Checklist

*Standard Equipment:*

- Type T3P Unit
- *Type T3PIA Pendulum Valve With Analog/TTL Interface Instruction Manual* (this book)
- *MKS Type T3BIA/T3PIA Valves with RS-232 Interface Supplement*, MKS p/n 134414-P1
  You will need the *Supplement* to perform the installation using the procedures provided in this manual.

## Interface Cables

**Note** An overall metal braided, shielded cable, properly grounded at both ends, is required to meet CE Mark specifications.

## Generic Shielded Cable Description

MKS offers a full line of cables for all MKS equipment. Should you choose to manufacture your own cables, follow the guidelines listed below:

1. The cable must have an overall metal *braided* shield, covering all wires. Neither aluminum foil nor spiral shielding will be as effective; using either may nullify regulatory compliance.
2. The connectors must have a metal case with direct contact to the cable shield on the whole circumference of the cable. The inductance of a flying lead or wire from the shield to the connector will seriously degrade the shield's effectiveness. Ground the shield to the connector before its internal wires exit.
3. With very few exceptions, the connector(s) must make good contact to the controller's case (ground). "Good contact" is about 0.01 ohms and the ground should surround all wires. Contact to ground at just one point may not suffice.
4. For shielded cables with flying leads at one or both ends. It is important to ground the shield at each such end *before* the wires exit. Make this ground with absolute minimum length. Refer to Figures 1 and 2. (A ¼-inch piece of #22 wire may be undesirably long since it has approximately 5 nH of inductance, equivalent to 31 ohms at 1000 MHz). After picking up the braid ground, keep wires and braid flat against the case. With very few exceptions, grounded metal covers are not required over terminal strips. If one is required, it will be stated in the Declaration of Conformity.
5. In selecting the appropriate type and wire size for cables, consider:
   A. Voltage ratings.
   B. Cumulative $I^2R$ heating of all the conductors (keep them safely cool).
   C. IR drop of the conductors, so that adequate power or signal voltage gets to the controller.
   D. Capacitance and inductance of cables that handle fast signals (such as data lines or stepper motor drive cables).
   E. Some cables may need internal shielding from specific wires to others.

***Example 1: Preferred Method to Connect Cable***
*(shown on a transducer)*

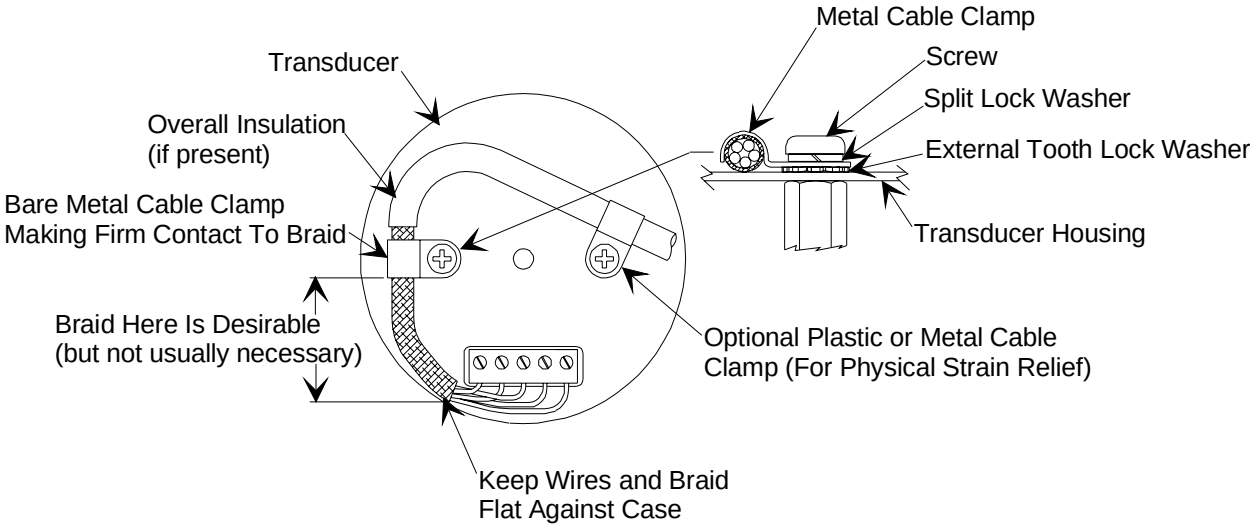



**Figure 1: Preferred Method To Connect an Overall Metal Braided Shielded Cable**

***Example 2: Alternate Method to Connect Cable***
*(shown on a transducer)*

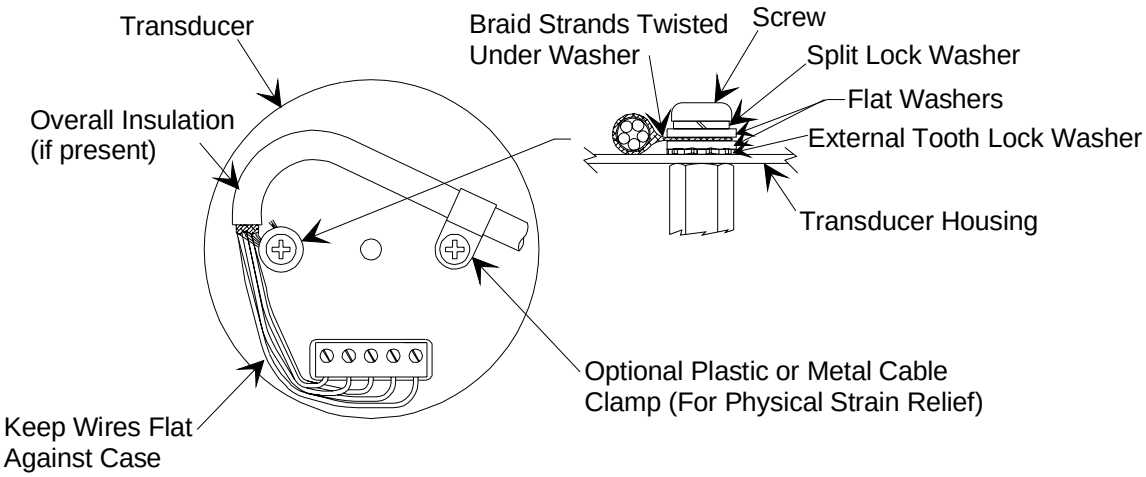



**Figure 2: Alternate Method To Connect an Overall Metal Braided Shielded Cable**

*Use this method when cable clamp is not available.*

## Product Location and Requirements

### Ambient Operating Temperature

The acceptable ambient operating temperature range for the T3P unit is 20° to 40° C.

### Power Requirements

#### *T3P Controller*

The T3P requires an input voltage of 24.0 VDC @ 2 Amp. If using heated pressure transducers and the power is to be supplied for these from the valve, then their power requirements must be added to the valve power requirements listed above. The T3P can supply up to 750 mA maximum (combined High and Low sensors) for heated pressure transducers. The input voltage is provided by the power connector. Refer to Table 14, page 22 for more information.

**Note** In order to utilize the battery backup function of the T3P Controller, power must be supplied to the Controller for a minimum of 2 hours to fully charge the batteries. Failure to adequately charge the batteries may result in incomplete shutdown of the T3P upon power loss.

#### *Analog Pressure Transducer*

An analog pressure transducer requires ±15 VDC ±5%, supplied by an external power source or from the valve. The transducer is connected to the T3P unit using an appropriate interface cable. Contact the MKS Engineering Department for cable information.

When using an analog transducer, the power is received through the T3P power connector and is passed on to the transducer through the Sensor connector. Both connectors are located on the top of the T3P unit (refer to Figure 13, page 32). Refer to Table 11, page 20, for the Auxiliary connector pin out, and Table 12, page 21, and Table 13, page 22, for the Analog Sensor connector pin out.

# Setup

## Mounting Instructions

The T3P unit can be mounted in a vacuum exhaust line with the proper fittings and connectors. For best pressure control, locate the pressure transducer and the T3P as close as practical to the process chamber. This minimizes the time constants associated with these items.

**Caution** **Use tubing that is less than 6 inches long and no less that ¼ inch in diameter to connect the transducer and chamber. If the distance must exceed 6 inches, use a larger diameter tubing to compensate for conductance loss.**

A typical system configuration is shown in Figure 3:

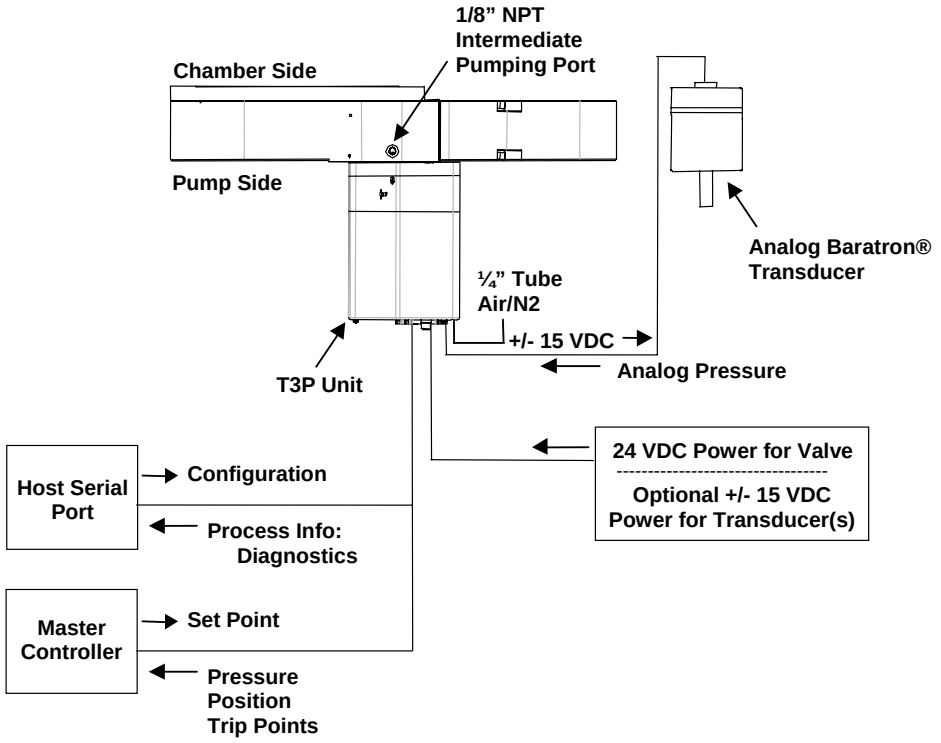



**Figure 3: Typical System Configuration**

## Installation into the Vacuum System

### *Tightening Torque for Mounting Screws on Flanges*

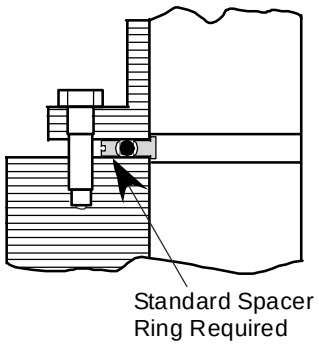
- Mounting with the Centering Ring and Spacer Ring

  Tighten mounting screws of the flanges uniformly in crosswise order. Observe the maximum torque levels in the following table. Higher tightening torques deform the valve body and can lead to an improper function of the valve.

**Note** A standard spacer ring is required.

**Table 6: Maximum Torque Levels When Mounting With the Centering Ring and Spacer Ring**

| Nominal Size | | Max. Tightening Torque (Nm) | | Max. Tightening Torque (lbf-ft) | |
|---|---|---|---|---|---|
| mm | inch | ISO-F | JIS | ISO-F | JIS |
| 320 | 12 | N/A | 17-20 | N/A | 13-15 |
| 250 | 10 | 17-20 | 17-20 | 13-15 | 13-15 |
| 200 | 8 | 13-15 | 13-15 | 9-11 | 9-11 |
| 160 | 6 | 13-15 | N/A | 9-11 | N/A |
| 100 | 4 | 8-10 | N/A | 6-8 | N/A |
| Verify that the depth of the mounting screws is maximum 1X thread diameter. | | | | | |

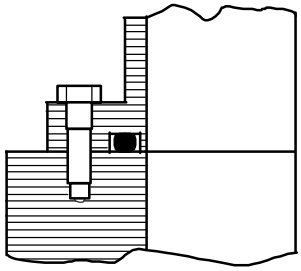



- Mounting with the O-Ring in Groove

  Tighten mounting screws of the flanges uniformly in crosswise order. Observe the maximum torque levels in the following table. Higher tightening torques deform the valve body and can lead to an improper function of the valve.

**Table 7: Maximum Torque Levels When Mounting with the O-Ring in Groove**

| Nominal Size | | Max. Tightening Torque (Nm) | | Max. Tightening Torque (lbf-ft) | |
|---|---|---|---|---|---|
| mm | inch | ISO-F | JIS | ISO-F | JIS |
| 320 | 12 | N/A | 65-70 | N/A | 48-52 |
| 250 | 10 | 35-40 | 65-70 | 26-30 | 48-52 |
| 200 | 8 | 35-40 | 35-40 | 26-30 | 26-30 |
| 160 | 6 | 35-40 | N/A | 26-30 | N/A |
| 100 | 4 | 20-23 | N/A | 15-17 | N/A |
| Verify that the depth of the mounting screws is maximum 1X thread diameter. | | | | | |

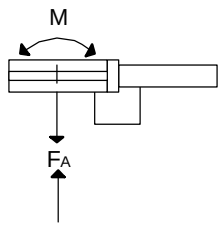


### *Admissible Forces*

Forces from evacuating the system, from the weight of other components, and from baking can lead to deformation and malfunctioning of the valve. Stress has to be relieved by suitable means, e.g. bellows sections.

**Table 8: Admissible Forces**

| Nominal Size | | Axial tensile or compression force (FA) | | Bending moment (M) | |
|---|---|---|---|---|---|
| mm | inch | N | lbf | Nm | lbf-ft |
| 320 | 12 | 3000 | 660 | 120 | 90 |
| 250 | 10 | 2500 | 550 | 100 | 75 |
| 200 | 8 | 2000 | 440 | 80 | 60 |
| 160 | 6 | 2000 | 440 | 80 | 60 |
| 100 | 4 | 1000 | 220 | 40 | 30 |
| For a combination of both forces (FA and M) the values are invalid.<br>Verify that the depth of the mounting screws is maximum 1X thread diameter. | | | | | |



### *Mounting Screw Length*

**Note** The maximum screw penetration into the valve mounting flange is equal to the nominal screw diameter. The use of screws exceeding this depth may result in improper flange preload and/or damage to the valve.

**Table 9: Mounting Screw Length**

| Nominal Size | | Screw Quantity X Diameter | |
|---|---|---|---|
| mm | inch | ISO-F | JIS |
| 320 | 12 | NA | 12 X M12 |
| 250 | 10 | 12 X M10 | 12 X M12 |
| 200 | 8 | 12 X M10 | 8 X M12 |
| 160 | 6 | 8 X M10 | 8 X M10 |
| 100 | 4 | 8 X M8 | NA |

### *Installation Procedure*

1. Install the control valve on the vacuum chamber. Chamber mounting side is indicated on the outline drawing and is the side opposite the motor.
2. Connect compressed air: Connections are for 1/4” tube
   Use only clean, dry air or N2
   Compressed air pressure (refer to Table 10 below)
   Connect compressed air to controller connection “AIR/N2 INPUT”
3. Connect the heating device (see *Heater Specifications* in *Appendix A: Product Specifications*).
4. Option: Connect vacuum line to intermediate pumping port (1/8” NPT) rotary shaft seals.

**Table 10: Required Air Pressure Based on Valve Size**

| Valve Size | | Compressed Air Pressure |
|---|---|---|
| mm | inch | psig |
| 320 | 12 | 75-100 |
| 250 | 10 | 65-100 |
| 200 | 8 | 55-100 |
| 160 | 6 | 55-100 |
| 100 | 4 | 55-100 |

## Setup Procedures

The following is a brief overview of the key steps that should be followed in order to achieve optimal initial performance of the T3P Valve. Detailed descriptions of items can be found in other sections of this manual. Configuring each of these items properly on start up is highly recommended.

### 1. Physical Installation Checklist:

- Preferred installation is horizontal, motor down
- Do not exceed maximum external mounting loads
- Consider clearance for removing cover for maintenance items
  - — Fan clearance
  - — Battery panel access
- Torque requirements for flange

### 2. Interface Checklist

- Power (+24V)
- Communications (RS-232, DeviceNet, Analog/TTL)
- Air pressure (refer to Table 10, page 16)
- Transducer for high pressure range (default if using one transducer)
- Transducer for low pressure range
- Heater power connectors (if using heater option)
- Interlock jumper (Aux IO, 25 pin, pin 22-24)

### 3. Front Panel Setup

- RS-232 baud rate, stop bits, parity (if applicable)
- DeviceNet MAC address and baud rate (if applicable)

### 4. Valve Configuration Setup via RS-232 or DeviceNet

- Configure valve via software interface for transducer(s)
  - — Transducer for high pressure range
  - — Full scale range
  - — Crossover pressure (between low and high range)
  - — Full scale voltage
  - — PID or Model Based Control

  IF using PID Control:
  - — Tuning parameters: Gain and Phase (Lead)

  If using Model Based Control:
  - — Default Pump Speed Curve is intended for a broad range of applications, however the LEARN function can be used to get the best control with a particular system
  - — Chamber Volume is required for an optimal Pump Speed Learn
  - — Perform Pump Speed Learn

The following parameters have default values that work for most applications, however they can be adjusted. It is highly recommended that the following values only be adjusted after a Pump Speed LEARN function has been conducted.

- System Tau
- Flow Observer Tau
- Trajectory Tau
- Trajectory shape
- Pump Speed Pedestal
- Speed Up option

### 5. Output Configurations

- Process alarms (relays)
- Encoder

## Electrical Information

### Connectors

The T3P throttle valve controller has four connectors located on its top panel (refer to Figure 4):

- 25-pin Female Type “D” Auxiliary Connector
- 15-pin Female Type “D” Analog (High) Sensor Connector
- 15-pin Female Type “D” Analog (Low) Sensor Connector
- 9-pin Male Type “D” Power Connector

**Caution** **To prevent damage from electrostatic discharge (ESD) to the sensitive connector pins, they must be covered with an ESD protective cover when not in use.**

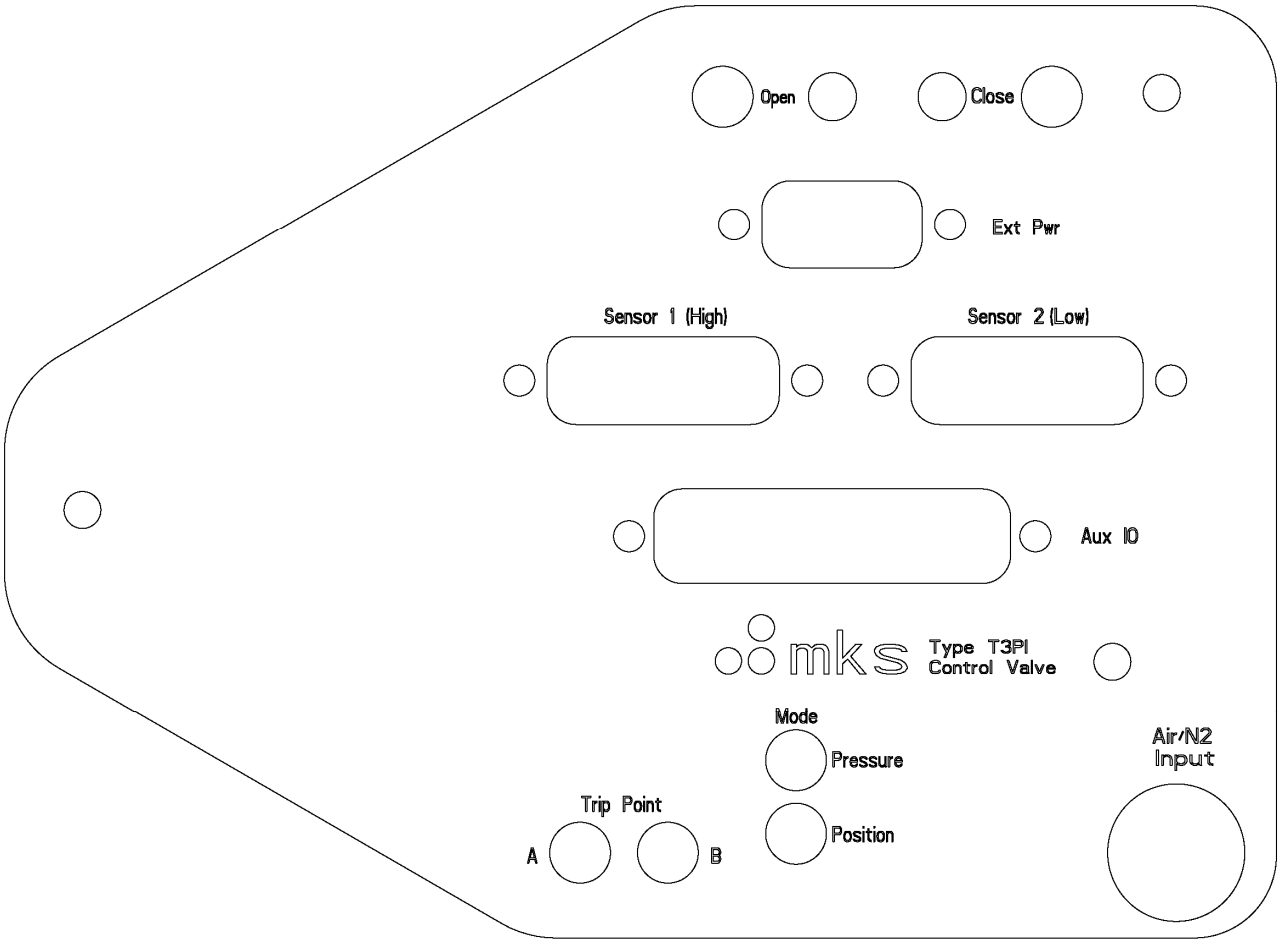



**Figure 4: Top Panel of the T3P Unit**

### *Auxiliary Connector*

The 25-pin female Type “D” Auxiliary connector provides access to the alarm relay outputs for use with an analog transducer.

**Table 11: Auxiliary Connector Pin Out**

| Pin Number | Description |
|---|---|
| 1 | Reserved |
| 2 | Reserved |
| 3 | Valve Open Command (DIN) |
| 4 | Valve Close Command (DIN) |
| 5 | Pressure/Position Mode Command (DIN) |
| 6 | PID/ST Mode Command (DIN) |
| 7 | LEARN Valve (DIN) |
| 8 | LEARN Conductance (DIN) |
| 9 | Analog Setpoint Input (+) |
| 10 | Analog Setpoint Input (-) |
| 11 | Pressure Output (AOut) |
| 12 | Position Output (AOut) |
| 13 | Analog Ground |
| 14 | Relay A – N.O. |
| 15 | Relay A – N.C. |
| 16 | Relay A – Common |
| 17 | Relay B – N.O. |
| 18 | Relay B – N.C. |
| 19 | Relay B – Common |
| 20 | Valve Open Status (D Out) |
| 21 | Valve Closed Status (D Out) |
| 22 | Interlock (TTL input) |
| 23 | Remote Zero Command (TTL input) |
| 24 | Digital Ground |
| 25 | Chassis Ground |

### *Analog Sensor Connector*

The two 15-pin female Type “D” Analog Sensor connectors provide access to the power and pressure input pins for use with analog Baratron sensors.

**Table 12: Analog Sensor 1 (High) Connector Pin Out**

| Pin Number | Description |
|---|---|
| 1 | No Connection |
| 2 | Pressure Input Signal (+) |
| 3 | No Connection |
| 4 | No Connection |
| 5 | Sensor Power Return |
| 6 | -15 V Power Output |
| 7 | +15 V Power Output |
| 8 | No Connection |
| 9 | No Connection |
| 10 | No Connection |
| 11 | No Connection |
| 12 | Pressure Signal Input (-) |
| 13 | No Connection |
| 14 | +24 Volt Power Output |
| 15 | Chassis Ground |

**Table 13: Analog Sensor 2 (Low) Connector Pin Out**

| Pin Number | Description |
|---|---|
| 1 | No Connection |
| 2 | Pressure Input Signal (+) |
| 3 | No Connection |
| 4 | No Connection |
| 5 | Sensor Power Return |
| 6 | -15 V Power Output |
| 7 | +15 V Power Output |
| 8 | No Connection |
| 9 | No Connection |
| 10 | No Connection |
| 11 | No Connection |
| 12 | Pressure Signal Input (-) |
| 13 | No Connection |
| 14 | +24 Volt Power Output |
| 15 | Chassis Ground |

***Power Connector***

The 9-pin male Type “D” Power connector provides power to the valve.

**Table 14: Power Connector Pin Out**

| Pin Number | Description |
|---|---|
| 1 | + 24 V Power Input |
| 2 | + 24 V Power Input |
| 3 | 24 V Return |
| 4 | 24 V Return |
| 5 | +15 V Auxiliary Power Input (for gauges) |
| 6 | 15 V Return |
| 7 | -15 V Auxiliary Power Input (for gauges) |
| 8 | (Reserved) |
| 9 | Chassis Ground |

## Startup

### Power Up

At power up, your instrument performs checks on its communications link and internal diagnostic checks of the EEPROM and RAM. The results of these checks are indicated by the color (green or red) and condition (solid or flashing) of the status LEDs on top of the unit (refer to Figure 13. page 32). Refer to page 33 for more information on the status LEDs.

When you apply power to your device, the following LED sequence occurs:

1. The Position Status LED flashes one time from GREEN to RED, for approximately 0.25 seconds each, and then turns GREEN.
2. The Pressure Status LED flashes one time from GREEN to RED, for approximately 0.25 seconds each, and then turns OFF.
3. The Position Status LED illuminates solid GREEN when the initialization is complete.

   After initialization, the LEDs will change to indicate the current status. This will vary depending on the previous settings.

**Note** If the power up LED sequence does not function properly, contact MKS for assistance.

### Warm Up Time

After installation and power up, your T3P controller requires less than 1 minute to warm up. The Heater System, if installed, requires approximately 4 hours.

### Maximum Differential Pressure

During pressure control (throttling) observe the following maximum differential pressures.

**Table 15: Differential Pressure**

| Nominal Size | | Maximum Throttling Differential Pressure |
|---|---|---|
| mm | inch | Torr |
| 320 | 12 | 3.75 |
| 250 | 10 | 5 |
| 200 | 8 | 5 |
| 160 | 6 | 20 |
| 100 | 4 | 40 |

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# Chapter Three: Product Overview

**Note** Before continuing with the information in this chapter, be sure to have worked through all descriptions and procedures in Chapter Two.

## General Information

The T3P consists of a throttle valve, a microprocessor, an RS-232 communications interface, analog inputs for pressure or position control, and analog outputs that reflect the pressure or valve position.

### Valve Safety

MKS products are designed and tested to provide the highest degree of safety attainable. To use your MKS valve safely, you must always conform to the following instructions:

- Refer to Chapter Two for directions on installation and operation of the valve.

**Warning** **The moving parts in the valve create a risk of personal injury until the valve is securely incorporated into a system. To avoid injury keep all objects away from any valve opening.**

- Do not insert objects into openings where contact with moving parts is possible.
- Isolate the equipment from any electrical or pneumatic power supply before handling the valve.

## Control Mode

The T3P controls pressure in a vacuum system using either Pressure or Position control.

Parameters for the control modes are adjusted and viewed via digital communications.

In *Pressure Control*, the T3P unit moves the valve in order to maintain a desired pressure (the setpoint). The controller uses either a Model Based or a Proportional, Integral, and Derivative (PID) algorithm to determine the valve position and make position adjustments. With Model Based, the control algorithm uses the current pressure, position, and setpoint readings to calculate the next valve position during each control cycle. With PID, the setpoint uses two parameters—the phase and gain—to optimize the response from setpoint to setpoint. Although there are default values for these parameters, you should adjust the values for optimum control (refer to *Tuning the Controller* in the *MKS Type T3BIA/T3PIA Valves with RS-232 Interface Supplement*, for more information). The feedback is an analog pressure signal. This signal is normally 0 to 10 Volts, but the zero and full-scale voltages can be adapted to individual applications.

In *Position Control*, the T3P unit moves the valve to a desired position (the setpoint). In this mode, the valve is moved to the desired setpoint but no feedback signal is generated. It is not necessary for the controller to make adjustments once the valve reaches its setpoint.

### Model Based Pressure Control

The T3P controls the chamber pressure by utilizing a Model Based Control technique. The valve position is adjusted at each control cycle to regulate the valve conductance and, thus, the chamber pressure itself. An accurate knowledge of the system parameters is required for the optimal operation of the pressure controller. These parameters include the chamber volume and the valve conductance.

### LEARN Function

The purpose of the LEARN function is to obtain the chamber pump speed versus valve position using the real operating conditions of sensor type, chamber volume, inlet flow, and pumping system. The LEARN function should be executed prior to normal valve operation. The LEARN function is generally required only once during initial setup/installation. The sequence of steps required to LEARN the valve is as follows:

1. Enter the chamber volume in liters utilizing the valve software interface. An approximate value for volume may be used provided the volume estimator is turned on (see the following step).
2. Determine appropriate setting for the volume estimator:
   a. If you are confident of the actual chamber volume entered, turn off the volume estimator.
   b. If you are unsure of the actual chamber volume, turn on the volume estimator. The volume estimator will determine the volume during the system learn and use this volume for pressure control.
3. Set correct pressure transducer ranges. Refer to the *MKS Type T3BIA/T3PIA Valves with RS-232 Interface Supplement*, as necessary.
4. Obtain the recommended learn flow setting from the valve software.
5. Turn on flow to the desired rate for the duration of the LEARN test.
6. Enter the actual flow rate that is being used.
7. Start the LEARN function.

The flow rate should remain constant until the LEARN function is completed. The LEARN function moves the valve over a set of non-uniformly distributed positions and records the pressure data from the valve high channel transducer. The typical duration of the LEARN function execution is less than 45 seconds. The pressure data versus time resembles Figure 5. If the actual flow is significantly lower than the recommended flow (dotted line), the accuracy of the obtained chamber pump speed may be insufficient. If the actual flow is much higher than the recommended flow (dashed line), the pressure transducer saturation may occur. This will result in incorrect pump speed curve and will negatively affect the quality of pressure control.

Adjust the flow, if necessary, and rerun the system learn starting with Step 5 above.

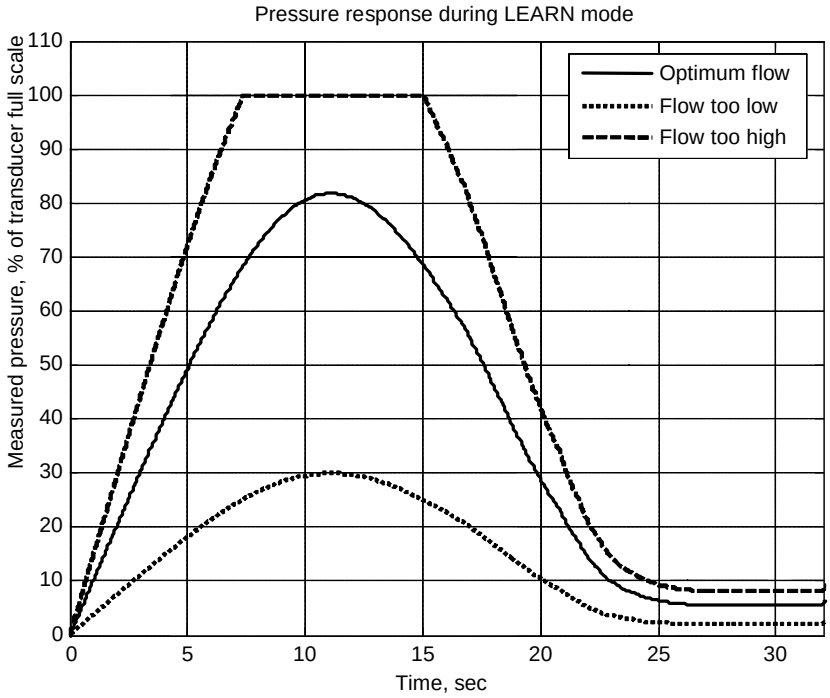



**Figure 5: Typical Pressure Response in LEARN Mode**

The typical chamber pump speed versus valve position is shown in Figure 6.

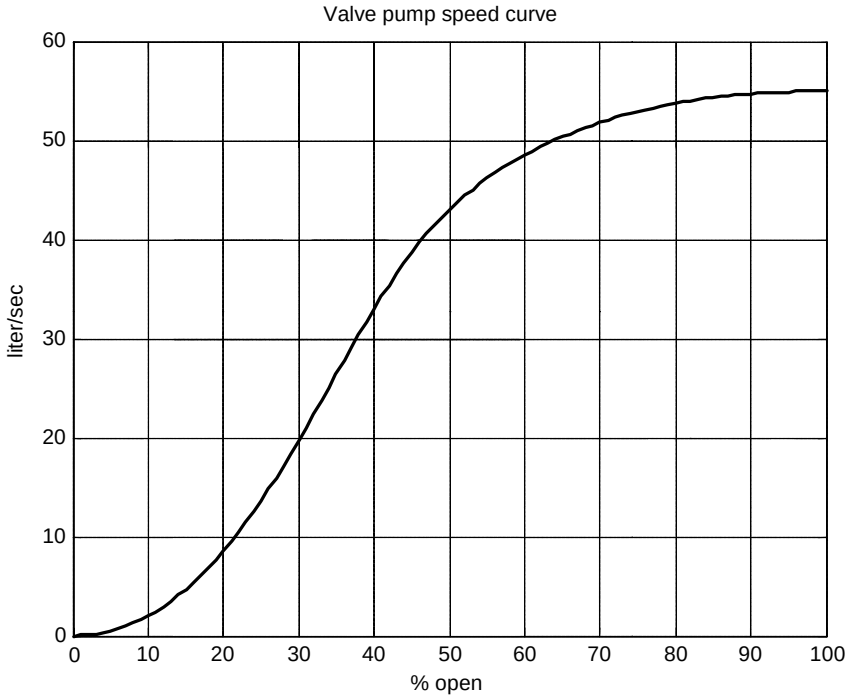



**Figure 6. Typical Chamber Pump Speed Curve**

Refer to the *MKS Type T3BIA/T3PIA Valves with RS-232 Interface Supplement* for more information on how to learn the system.

## Phase and Gain

The T3P unit uses a PID compensator to control pressure in a vacuum system. When a new pressure setpoint is commanded, the unit responds by changing the pressure smoothly to the desired value. If the pressure is slow to change or oscillates, the PID compensator must be re-tuned. The phase and gain values can be manually adjusted to provide the best response to the setpoint. By careful adjustment of each value, it is possible to achieve optimum control throughout a wide range of pressure regions.

### *Phase*

The phase provides a control signal that is proportional to the change in the error signal. The error signal is the difference between the actual pressure and the setpoint. The phase is responsible for controlling how quickly the pressure responds to a change in setpoint. A large phase generally results in a faster response to setpoint. However, if the phase is too large, the system will be slow in responding to setpoint and, in some cases, may oscillate around the setpoint (refer to Figure 7). If the phase is too small, the pressure will overshoot and then oscillate around the setpoint before settling in (refer to Figure 8).

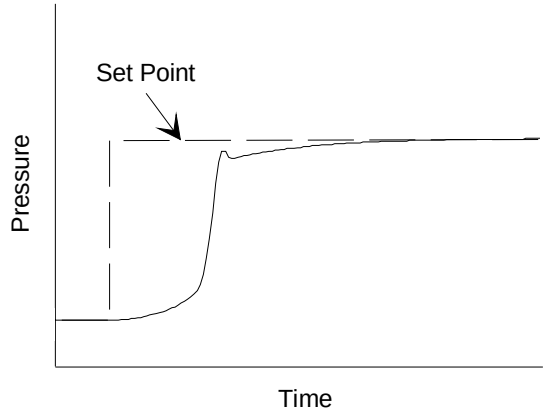



**Figure 7: Phase Set Too High**

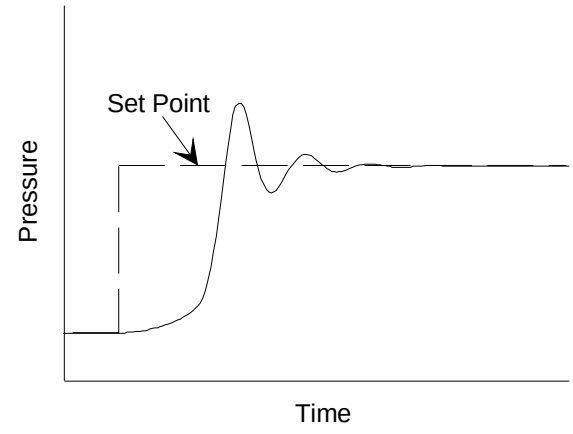



**Figure 8: Phase Set Too Low**

### *Gain*

The gain provides a control signal that is proportional to the error signal. The gain allows the controller to track the setpoint with minimal steady state error. The highest possible gain setting produces the best pressure control. A high gain setting generally results in a faster response to setpoint, and the best rejection of disturbances such as changes in flow rate or noise in the system. However, if the gain is too large, the pressure will overshoot the setpoint before settling in (refer to Figure 9). If the gain is too small, the pressure will respond slowly to a setpoint change (refer to Figure 10) or a change in flow rate.

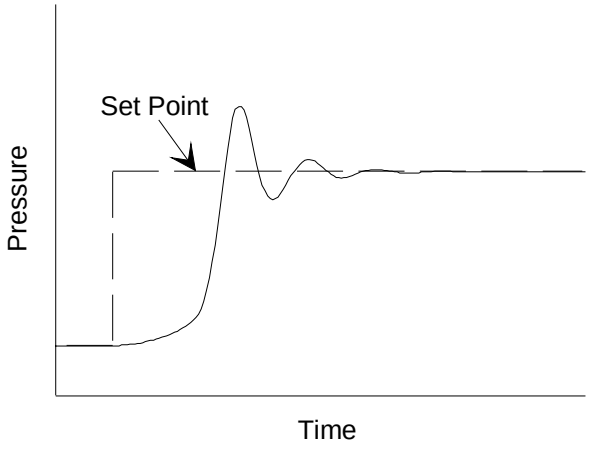



**Figure 9: Gain Set Too High**

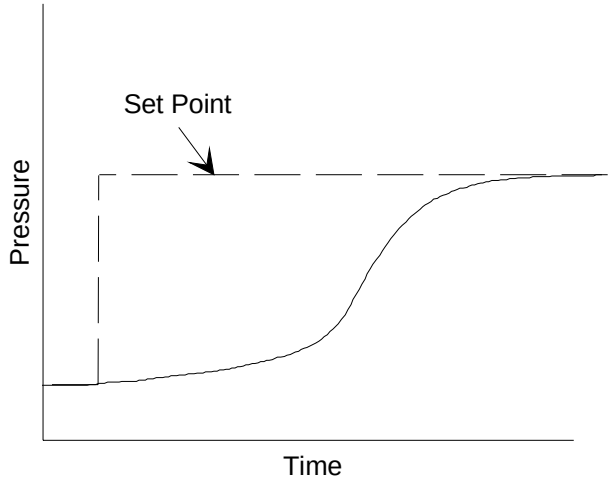



**Figure 10: Gain Set Too Low**

## Trip Points

The T3P has four software trip points. The trip points are adjustable using digital communication commands, such that when the pressure rises above or below the specified trip point value, the corresponding trip point changes state.

The four trip points can be configured to monitor either the pressure value or the valve position; any combination is acceptable (refer to *Trip Point Source* in the *MKS Type T3BIA/T3PIA Valves with RS-232 Interface Supplement* for more information). In addition, two of the trip points can be mapped to hardware relays through the Auxiliary connector (refer to *Discrete Output Source* in the *MKS Type T3BIA/T3PIA Valves with RS-232 Interface Supplement* for more information). Refer to Table 11, page 20, for the Auxiliary connector pin out.

### Trip Point Hysteresis

Hysteresis is built into the operation of the trip points to help compensate for the noise inherent in all systems. Without hysteresis, the noise may cause the trip points to repeatedly switch states, a condition known as "relay chatter." Hysteresis is set as a percentage of the current trip point value. The default hysteresis value of 10% can be adjusted with a digital command (refer to *Trip Point Hysteresis* in the *MKS Type T3BIA/T3PIA Valves with RS-232 Interface Supplement* for more information).

Setting the hysteresis too high creates a *deadband* around the trip point. The deadband prevents the trip point from responding to changes in the pressure signal around the trip point. Ideally, the hysteresis should be close to, but not less than, the peak-to-peak noise. This setting will provide maximum immunity from relay chatter while providing the best possible accuracy. It may take some trial and error efforts to determine the smallest hysteresis setting appropriate for your system.

### Trip Point Delay

The trip point delay defines the amount of time a trip point alarm condition must exist before the trip point status attribute reports an ON condition. If the trip point condition exists for a time period that is less than the specified trip point delay, the trip point status attribute remains OFF. The trip point delay is illustrated in Figures 11 and 12, page 31.

The trip point delay can be set from 0 to 10,000 msec; the default value is 0. Different trip point delay values can be set for the trip point(s) (refer to *Trip Point Alarm Delay* in the *MKS Type T3BIA/T3PIA Valves with RS-232 Interface Supplement*).

### Trip Point Direction

The trip point polarity, or direction, defines the direction of pressure change that will energize the trip point. The direction of the trip points can be adjusted with a digital command, as described in *Trip Point Direction* in the *MKS Type T3BIA/T3PIA Valves with RS-232 Interface Supplement.*

The initial direction for all of the trip points is "low." The trip point is energized and the trip point LED illuminates as the pressure falls *below* the specified trip point value. The trip point is not de-energized and the LED is not cleared until the pressure rises above the value defined by the corresponding trip point hysteresis, as shown in Figure 11.

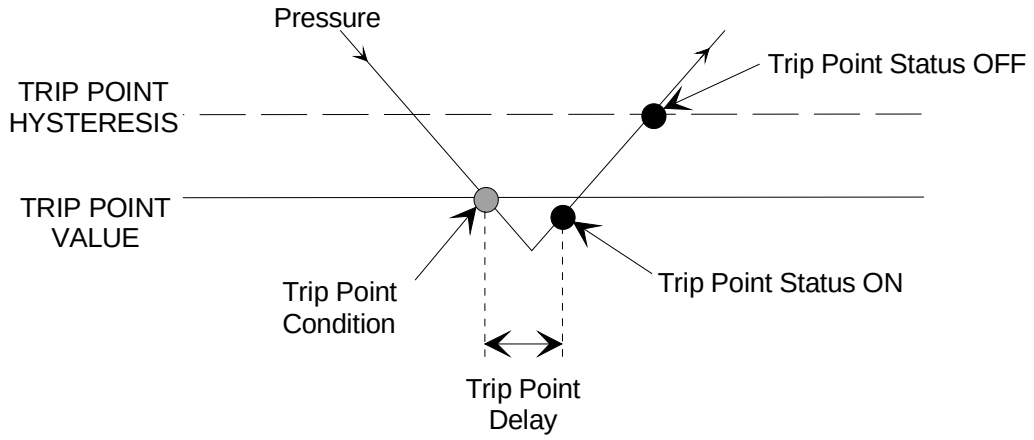



**Figure 11: Trip Point Direction Set Low**

The direction for any of the trip points can be changed to "high." The trip point is energized and the trip point LED illuminates as the pressure rises *above* the specified trip point value. The trip point is not de-energized and the LED is not cleared until the pressure falls below the value defined by the corresponding trip point hysteresis, as shown in Figure 12.

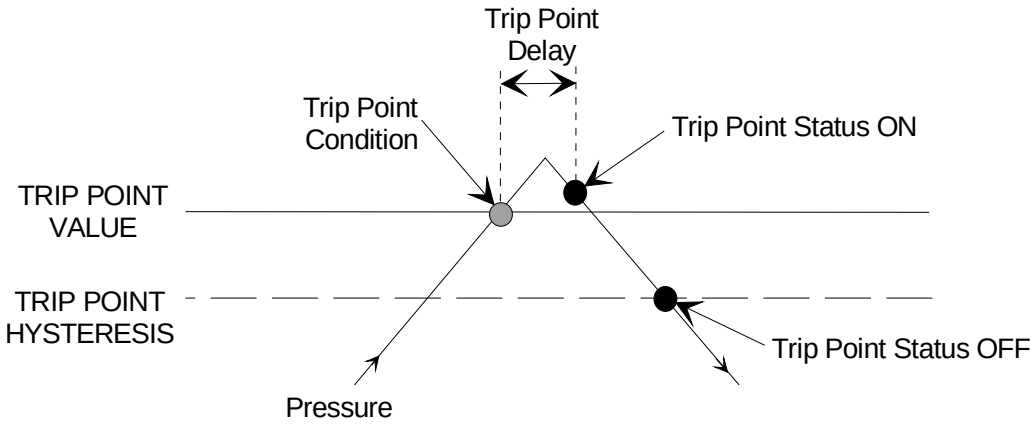



**Figure 12: Trip Point Direction Set High**

## Top Panel Components

The top panel of the T3P is shown in Figure 13.

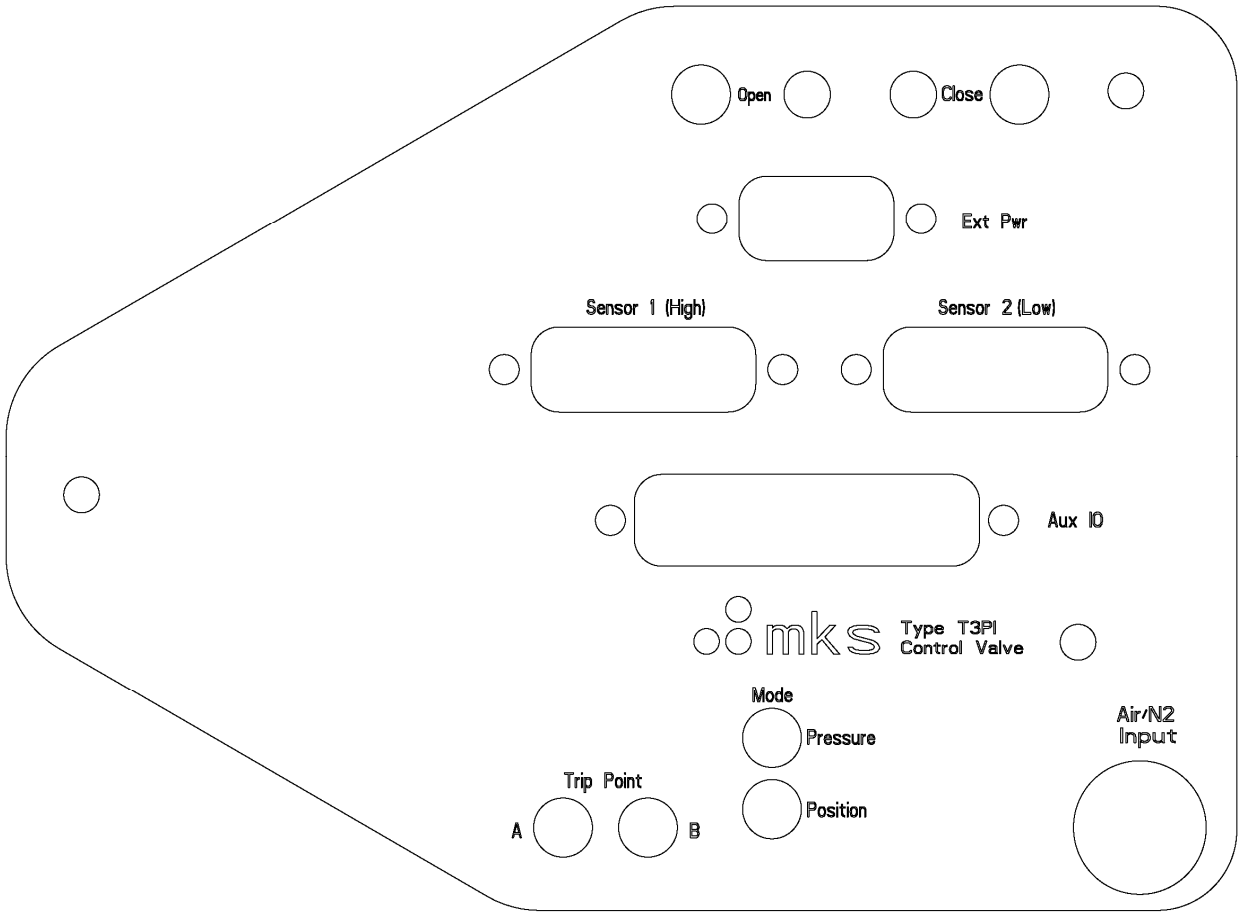



**Figure 13: Top Panel of the T3P Unit**

### Analog Sensor Connectors

The two 15-pin female Type “D” Analog Sensor connectors provide access to the power and pressure input pins for use with analog Baratron sensors. Refer to Table 12, page 21, and Table 13, page 22, for the Analog Sensor connector pin out.

### Auxiliary Connector

The 25-pin female Type “D” Auxiliary connector provides access to the alarm relay outputs for use with an analog sensor and provides an interface for the RS-232 serial communication. Refer to Table 11, page 20, for the Auxiliary connector pin out.

### Power Connector

The 9-pin male Type “D” power connector provides power entry to the valve. Refer to Table 14, page 22, for connector pin out. The +24V power is to operate the valve and the +/-15V is an option to power the analog sensors directly.

### Valve Position Indicator LEDs

The OPEN indicator light, located to the left of the manual valve switch, illuminates red when the valve is fully open. The CLOSE indicator light is located to the right of the manual switch and illuminates red when the valve is in the fully closed position.

### Manual Valve Switches

These push button style switches allow you to manually drive the valve to the open or closed position.

### Trip Point Indicator LEDs

These LEDs illuminate green when a trip point is energized.

#### *Position Status LED*

The Position Status LED illuminates a solid green when the device is in Position Control Mode. If interlock is not enabled, the Position Status LED illuminates a solid red. The Position Status LED illuminates a solid red/green when the device is learning valve steps.

**Table 16: Position Status LED Indicators**

| LED State | Meaning |
|---|---|
| Solid Green | Position Control Mode |
| Flashing Green | — |
| Solid Red | Unrecoverable fault |
| Flashing Red | Interlock not enabled |
| Off | No power, if Pressure Status LED also off |
| Red/Green | Learning valve steps |

#### *Pressure Status LED*

The Pressure Status LED illuminates a solid green when the device is in Pressure Control Mode (Model Based). The LED flashes green when the device is in Pressure Control Mode (PID). If a fault condition is detected, the Pressure Status LED illuminates a solid red. If there is no power, the Pressure Status LED (and Position Status LED) is off. The Pressure Status LED illuminates red/green when the device is learning conductance.

**Table 17: Pressure Status LED Indicators**

| LED State | Meaning |
|---|---|
| Solid Green | Pressure Control Mode (Model Based) |
| Flashing Green | Pressure Control Mode (PID) |
| Solid Red | Unrecoverable fault |
| Flashing Red | Interlock not enabled |
| OFF | No power, if Position Status LED also off |
| Red/Green | Learning conductance |

## Labels

There are two labels on the T3P.

### Pump Label

The pump label, shown in Figure 14, indicates which side of the valve should be oriented toward the high vacuum pump during installation.

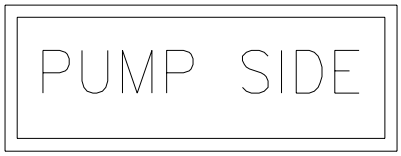



**Figure 14: Pump Label**

### Serial Number Label

The serial number label lists the serial number, product model code, full-scale range, and calibration gas for your device. The label also displays the CE mark signifying compliance with the European CE regulations.


**Figure 15: Serial Number Label**

The options for your controller are identified in the model code when you order the unit. Refer to Appendix B, *Model Code Explanation*, for more information.

# Chapter Four: Analog/TTL Operation

## General Information

Digital *inputs* and *outputs* are designed to interface with low power TTL and CMOS logic families. They also include additional components to protect against damage from ESD or transient voltages.

## Selecting the Digital Input Functions

The specific function of each digital input is listed in Table 18. To select an input function, pull the appropriate input pin to a TTL low level (0 to 0.8 Volts) for a minimum of 50 milliseconds.

The TTL low signal is "level sensitive" meaning that once the signal is held low, the T3 unit may take up to 50 milliseconds to recognize the command. The line must be held low *continuously* for the T3 unit to use the selected parameters. Once the signal goes high, the controller will default back to the state associated with the high signal within 50 milliseconds.

When the input is brought high (+2.4 to +5 Volts), any lower priority functions that have been selected will be activated, even if they were previously suppressed.

Refer to Table 11, *Auxiliary Connector Pin Out*, on page 20 for the complete Interface connector pin out.

**Table 18: Digital Input Functions**

| I/O Pin No. | State | Digital Input Function |
|---|---|---|
| 3 | Low | Open the valve |
| | High | No function |
| 4 | Low | Close the valve |
| | High | No function |
| 5 | Low | Analog set point to *position* |
| | High | Analog set point to *pressure* (default) |
| 6 | Low | PID |
| | High | Model based |
| 7 | Low | Learn Valve Steps |
| | High | No function |
| 8 | Low | Learn System Conductance |
| | High | No function |
| 22 | Low | Disable Interlock |
| | High | No function |
| 23 | Low | Remote Zero Command |
| | High | No function |

## Setting the Analog Set Point Inputs

The analog set point inputs, (+) set point and (-) set point (pins 9 and 10 respectively on the Interface connector) are fully differential. The (-) set point must be connected to a ground to work correctly, and it is recommended that it be connected to ground at the source of the set point signal. If suitable ground is not available at source of set point, connect pin 10 to pin 13.

## Selecting the Digital Output Functions

**Table 19: Digital Output Functions**

| I/O Pin No. | State | Digital Output Function |
|---|---|---|
| 20 | Low | Valve is open |
| | High | Valve is not open |
| 21 | Low | Valve is closed |
| | High | Valve is not closed |

## Using RS-232 Commands with an Analog T3P

RS-232 settings are:

- baud rate for an Analog T3P is 19,200
- 8 data bits
- None parity
- 1 stop bit

The RS-232 should be used for configuration or to read parameters, but not to directly control the valve.

If the T3P is to be **operated** via RS-232, the device must be reconfigured from Analog mode to Serial mode. Please consult MKS Applications for assistance.

### How Analog Inputs and RS-232 Commands Interact

Consider this example:

The valve is being held closed via a TTL Valve Close signal and the valve is closed.

An RS-232 serial command is sent to Open the valve.

The RS-232 signal is processed, and the valve is instructed to open.

Approximately 50 msec later, the TTL Valve Close signal is read again and the valve is instructed to move closed.

Refer to the *MKS Type T3BIA/T3PIA Valves with RS-232 Interface Supplement* for the complete list and description of serial commands.

# Chapter Five: Maintenance and Troubleshooting

## General Information

In general, the T3P requires no maintenance other than proper installation and operation. If the controller fails to operate properly upon receipt, check for shipping damage and check the cables for correct continuity. Any damage should be reported to the carrier and MKS Instruments immediately.

If it is necessary to return the unit to MKS for service, obtain an ERA Number (Equipment Return Authorization Number) from any MKS Calibration and Service center before shipping. Please refer to the inside back cover of this manual for a list of MKS Calibration and Service Centers.

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

## Maintenance

Periodically check for wear on the cables and inspect the enclosure for visible signs of damage.

### Cleaning the Unit

Periodically wipe down the unit with a damp cloth.

## Preventive Maintenance

### Disassembly of Gate and Seal Ring

The T3P Pendulum Analog/TTL valve has a serial communication interface to the tool computer.

The procedure for the maintenance of the pendulum is performed by activating commands on the *Pendulum Maintenance Mode Screen* on the tool computer.

The tool computer *Pendulum Maintenance Mode Screen* must contain the following 6 commands (see the software command reference in Table 23, page 42, to program the commands):

"Select Position Control Mode"

"Move Gate to 50 Percent Position"

"Move Gate to 100 Percent Position"

"Learn Valve"

"Close Valve"

"Select Pressure Control Mode"

1. Close (seal) the valve (valve is now at 0 percent position).
2. Vent both the chamber and pump sides of the valve.

**Warning** **The moving parts in the valve create a risk of personal injury until the valve is securely incorporated into a system. To avoid injury keep all objects away from any valve opening.**

3. Loosen the valve cover screws (4) and remove the cover. Refer to Figure 16.

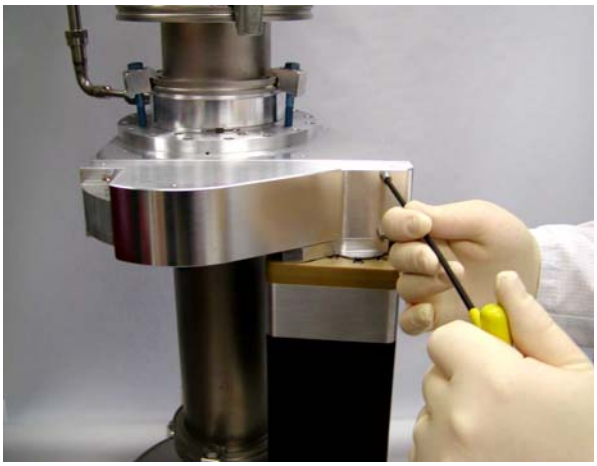


**Figure 16: Four (4) Valve Cover Screws**

4. Select the *Pendulum Maintenance Mode Screen* on the tool computer.
5. At the *Pendulum Maintenance Mode Screen*, select the "**Select Position Control Mode**" command.
6. At the *Pendulum Maintenance Mode Screen*, select the "**Move Gate to 50 Percent Position**" command. (This will move the gate to the 50% position and allow access to the bolt(s) holding in the gate.)
7. Observe the bolt(s) attaching the gate to the main shaft. If there is only one bolt, skip to Step 8. Otherwise, loosen the outer bolt with a ½" open end wrench. The outer bolt is the bolt located farthest from the centerline of the valve bore.
8. At the *Pendulum Maintenance Mode Screen*, select the "**Move Gate to 100 Percent Position**" command. (This will move the gate to the 100%, full open, position and allow access to the bolt(s) holding in the gate.)
9. Loosen the remaining bolt attaching the gate to the main shaft (using a ½" open end wrench). Refer to Figure 17.

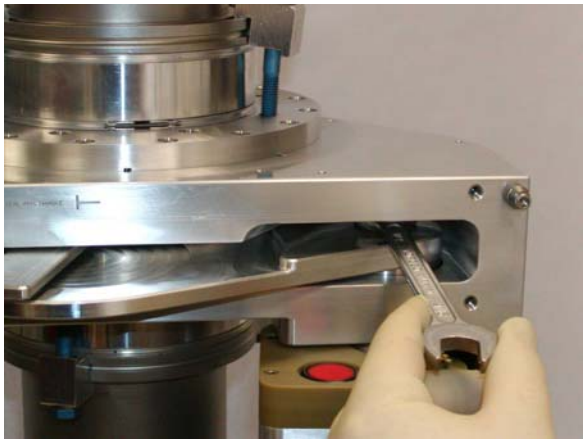


**Figure 17: Gate Bolt**

10. Remove the gate.

11. With one hand, depress and hold in the MAINTENANCE button. (This will move the seal ring into a position that allows it to be unlocked.)

**Note** The software looks for the MAINTENANCE button only if the valve is in position mode AND the valve is at 100 percent.

12. While keeping the maintenance button depressed, unlock the seal ring by moving the handle in the indicated direction on the handle. Refer to Figure 18

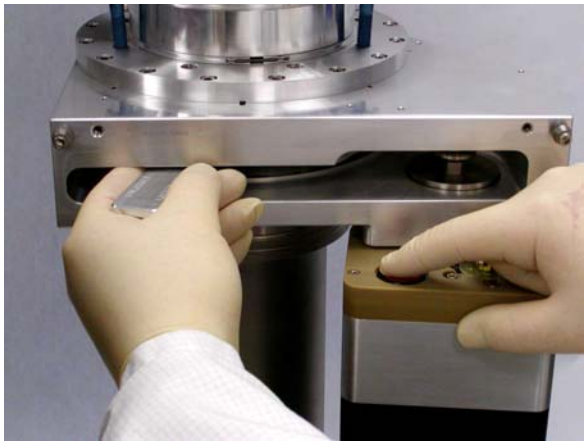


**Figure 18: Handle**

13. Release the MAINTENANCE button.
14. Remove the seal ring.

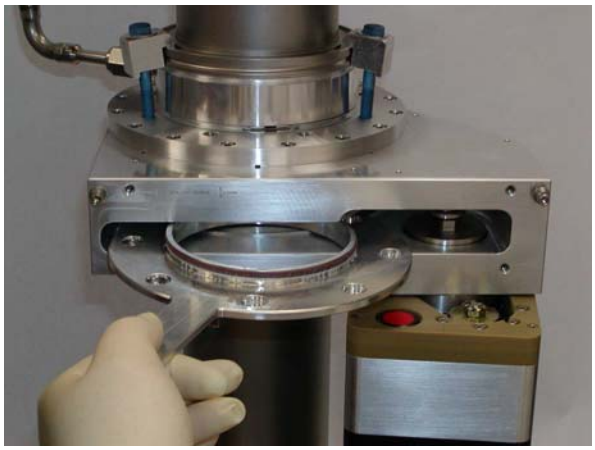


**Figure 19: Seal Ring Removal**

### Cleaning and Seal Replacement

1. Clean the valve parts and replace seals on the seal ring as required.
2. Install the seal ring face o-ring without grease.
3. Lubricate the radial groove of the seal ring. Pay attention that the following quantity of grease is distributed constant on the whole circumference. Refer to Figure 20.

**Figure 20: Lubricating O-Ring Groove**

**Table 20: Seal Ring Quantity of Grease**

| Nominal Size | | Quantity of Grease |
|---|---|---|
| mm | inch | ml |
| 320 | 12 | 0.5 |
| 250 | 10 | 0.4 |
| 200 | 8 | 0.3 |
| 160 | 6 | 0.25 |
| 100 | 4 | 0.2 |

4. Lubricate the o-ring with the following quantity of grease.

**Table 21: O-Ring Quantity of Grease**

| Nominal Size | | Quantity of Grease |
|---|---|---|
| mm | inch | ml |
| 320 | 12 | 0.3 |
| 250 | 10 | 0.25 |
| 200 | 8 | 0.2 |
| 160 | 6 | 0.15 |
| 100 | 4 | 0.1 |

5. Install the o-ring.

### Reassembly

1. Insert the seal ring into the valve body so it is approximately centered within the valve bore and the handle is located approximately as indicated on the body. Refer to Figure 21.

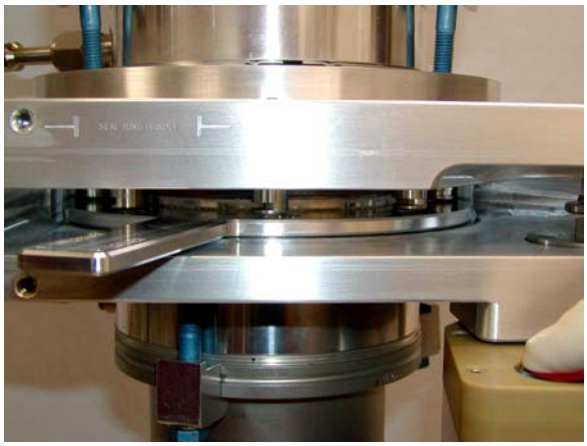


**Figure 21: Seal Ring in Valve Body**

*2.* With one hand, hold in the MAINTENANCE button. *(This will move the locking pins into a position that allows the seal ring to be locked.)*

**Note** The software looks for the MAINTENANCE button only if the valve is in position mode AND the valve is at 100 percent.

3. While keeping the MAINTENANCE button depressed, align the seal ring with the locking pins in the body and lock the seal ring by moving the handle in the indicated direction on the handle.
4. Release the MAINTENANCE button.
5. Install the gate and tighten the bolt. The bolt(s) that attach the gate to the shaft are to be torqued to 175 lbf-in (20 Nm). Make sure the gate is fully engaged on the shaft before tightening. For gates with two bolts, only one bolt will be accessible; tighten this bolt only.
6. At the *Pendulum Maintenance Mode Screen,* select the "**Move Gate to 50 Percent Position**" command. *(This will move the gate to the 50% position and allow access to the outer bolt (if applicable) holding in the gate.)*
7. If the valve has two bolts, tighten the outer bolt now.
8. If this valve is controlled via DeviceNet or Analog/TTL, at the *Pendulum Maintenance Mode Screen,* select the "**Learn Valve**" command.
9. If, and only if, this valve is controlled via an analog/TTL I/O interface, change the "Control Mode" on the top of the valve enclosure to the "Learn Valve" position.
10. The Learn Valve sequence will take approximately 1 minute.
11. Install the valve cover and tighten the screws to the following torque.

**Table 22: Valve Cover Screw Torque**

| Nominal Size | | Maximum Torque | |
|---|---|---|---|
| mm | inch | Nm | lbf-in |
| 160-320 | 6-12 | 6 | 50 |
| 100 | 4 | 4 | 35 |

12. If, and only if, this valve is controlled via an analog/TTL I/O interface, change the "Control Mode" on the top of the valve to the "Run" position.
13. If this valve is controlled via DeviceNet or Analog/TTL, at the *Pendulum Maintenance Mode Screen*, select the "**Close Valve**" command.
14. If, and only if, this valve is controlled via an analog/TTL I/O interface, depress the "Close" switch on the top of the valve.
15. At the *Pendulum Maintenance Mode Screen*, select the "**Select Pressure Control Mode**" command.

## Software Commands

**Table 23: Software Command Reference**

| Command | Analog/TTL I/O |
|---|---|
| "Select Position Control Mode" | Select position control mode by setting the logic level on the AUX I/O connector pin 5 LOW |
| "Move Gate to 50 Percent Position" | Set the analog set point signal on the AUX I/O connector pin 9 to 5.00 Volts and pin 10 to 0.00 Volts |
| "Move Gate to 100 Percent Position" | Set the analog set point signal on the AUX I/O connector pin 9 to 10.00 Volts and pin 10 to 0.00 Volts |
| "Learn Valve" | Connect pin 7 to LOW |
| "Close Valve" | Connect pin 4 to LOW |
| "Select Pressure Control Mode" | Select position control mode by setting the logic level on the AUX I/O connector pin 5 HIGH |

## Replacing the Battery

The T3P comes equipped with a battery. This battery is used to close the valve in the event of power loss. The battery is trickle charged when the T3P is powered. Use the following procedure to change the battery (MKS p/n 137182-P1).

1. Ensure that the vacuum system is in a state where the power can be removed from the T3P.
2. Remove power.
3. Locate the fan cover plate on the electronics enclosure of the T3P.
4. Remove the 4 Phillips head screws holding this cover in place. See Figure 22.

**Figure 22: Removing Phillips Head Screws**

5. Allow the cover, with the fan attached, to gently hang in place.
6. Remove the battery pack connector from the PC board.
7. Remove the battery pack from the unit.

**Figure 23: Removing Battery Pack from Device**

8. Reverse the procedure to install the new battery pack.
9. Torque the 4 Phillips head screws to 15 lbf-in.

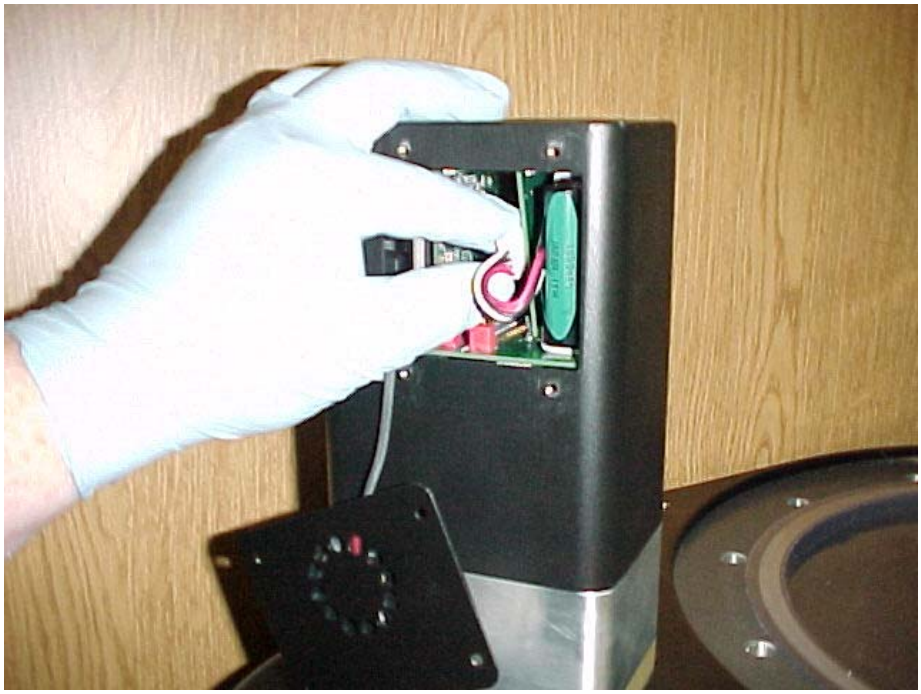


**Figure 24: Installing the New Battery Pack**

## Troubleshooting

The following sections contain basic information for identifying and solving problems with your device. MKS also offers standard maintenance and repair services, including recalibration at the MKS Regional Calibration and Service Centers.

### General

| Symptom | Root Cause | Correction |
|---|---|---|
| During hard close, closed conductance fails spec (<10-5 atm*cc/sec He). | O-rings on seal ring damaged or worn. | Replace o-rings on seal ring using procedure described in this manual. |
| Valve does not open. | Insufficient air pressure. | Increase pneumatic air pressure. Refer to Table 10, page 16. |
| | Missing interlock on 25 pin DI/DO connector, pins 22 to 24. | Connect pin 22 to 24, or verify external interlock wiring. |
| | Pressure differential across gate too high (see *Maximum Differential Pressure*, page 23). | Adjust operating conditions to stay within maximum differential pressure specification of the valve. |
| | No 24V power is present at the valve terminals. | Verify 24V power is applied to the valve. |
| | Failed solenoid valve. | MKS Repair to replace. |
| | Defective valve. | Return to MKS repair facility. |
| Valve does not close. | Insufficient air pressure. | Increase pneumatic air pressure. Refer to Table 10, page 16. |
| | Missing interlock on 25 pin DI/DO connector, pins 22 to 24. | Connect pin 22 to 24, or verify external interlock wiring. |
| | Pressure differential across gate too high (see *Maximum Differential Pressure*, page 23). | Adjust operating conditions to stay within maximum differential pressure specification of the valve. |
| | No 24V power is present at the valve terminals. | Verify 24V power is applied to the valve. |
| | Failed solenoid valve. | MKS Repair to replace. |
| | Defective valve. | Return to MKS repair facility. |
| Valve does not close when power is removed. | Battery not sufficiently charged. | Valve should remain powered for 2 hours to ensure fully charged batteries. |
| | Battery needs to be replaced. | Order replacement battery and follow procedure for replacing (see *Replacing the Battery*, page 42). |
| Valve fails to control pressure. Pressure reported by valve is FS. | Sensor disconnected. | Reconnect sensor. |
| Valve fails to control pressure. Pressure reported by valve is low or zero. | Manometer not powered. | Verify power to manometer. |

| Symptom | Root Cause | Correction |
|---|---|---|
| Poor pressure control—oscillating. | Tuning parameters are improper. | If using PID Mode, optimize Gain and Phase values (see *Phase and Gain*, page 28).<br>If using Model Based mode, re-learn the Pump Speed Curve (see *LEARN Function*, page 26). |
| Poor pressure control. Indicated pressure is too high or low (Control offset). | Ground connections have too high impedance. | Using MKS valve GUI, determine if control offset is tuning or system ground offset. |
| | Tuning parameters are improper. | Tuning parameters need optimization. |
| Poor pressure control in a specific pressure range. | Crossover point not correct. | Configure crossover pressure for installed manometers. |
| Valve reports negative pressure. | Manometer not zeroed. | Zero manometer. |
| | Manometer does not have power. | Verify power to manometer. |
| Valve reports unexpected pressure. | Manometer Full Scale setup not correct. | Configure valve for correct manometer range (see the *MKS Type T3BIA/T3PIA Valves with RS-232 Interface Supplement*). |
| | Voltage range for manometer not correct. | |
| Pump Speed Learn does not work | Manometer needs to be plugged in high range for Pump Speed Learn to be performed. | Plug manometer in high range. |

### Communications

| Symptom | Root Cause | Correction |
|---|---|---|
| Analog/TTL communications fail. | Incorrect settings or bad cable. | Verify baud rate, data bits, parity, and CR-LF.<br>Verify cable wiring. |
| DeviceNet communications fail. | Incorrect settings or lack of network power. | Verify MAC address and baud rate. Verify network power. |

# Appendix A: Product Specifications

## Digital Communication Specifications

| | |
|---|---|
| Connector | 25-pin, type 'D', female |
| Data Bits, Parity, Stop Bits Switch | 8 Data bits, no parity, 1 stop bit, 19,200 baud rate |
| Maximum Cable Length | 50 ft. |
| Response Time | < 20 msec (typical) |

## Electrical Specifications

| | |
|---|---|
| CE Compliance | |
| Electromagnetic Compatibility[1] | Meets Directive 2004/108/EEC |
| Product Safety Requirements | Meets Directive 92/59/EEC |
| Machinery Directive | Meets Directive 89/392/EEC |
| Low-Voltage Requirements | Meets Directive 73/23/EEC |
| Installation Category | II, according to EN 61010-1 |
| Pollution Degree | 2, according to IEC 664 |
| Connectors | |
| Auxiliary | 25-Pin Female Type "D" |
| Analog Sensors | 15-Pin Female Type "D" |
| Power | 9-Pin Male Type "D" |
| Power Requirements | 24.0 VDC @ 3 Amp (2 Amps for the motor drive and up to 750 mAmps for the pressure sensor gauges) |
| Signal Inputs | |
| Pressure | 0 to +10 VDC |
| Analog Set Point | 0 to +10 VDC |
| TTL | Valve open and valve close, Pressure/Position, Learn Valve, Learn Conductance, Interlock, Remote Zero |
| Signal Output | |
| Analog | Pressure out, position out |
| TTL | Valve Open, Close status |
| Open Collectors | Alarms; 2, rated for 30 VDC @ 250 mA maximum (levels and assignment to position, pressure, set point via software) |

## Environmental Specifications

| | |
|---|---|
| Ambient Operating Temperature Range | 20° to 40° C |
| Operating Humidity Range | 0 to 95% RH, non-condensing |
| Storage Temperature Range | -20° to 80° C |

[1] An overall metal braided shielded cable, properly grounded at both ends, is required during use.

### Performance Specifications

| | |
|---|---|
| Control Range | |
| Pressure Control | 0.5 to 100% of sensor range |
| Position Control | 0° to 50° for 100 mm<br>0° to 65° for 160 mm<br>0° to 68° for 200 mm<br>0° to 75° for 250 and 320 mm |
| resolution | 0.0058° for all valve sizes |
| Controller Repeatability | ±0.1% of FS |

### Heater Specifications

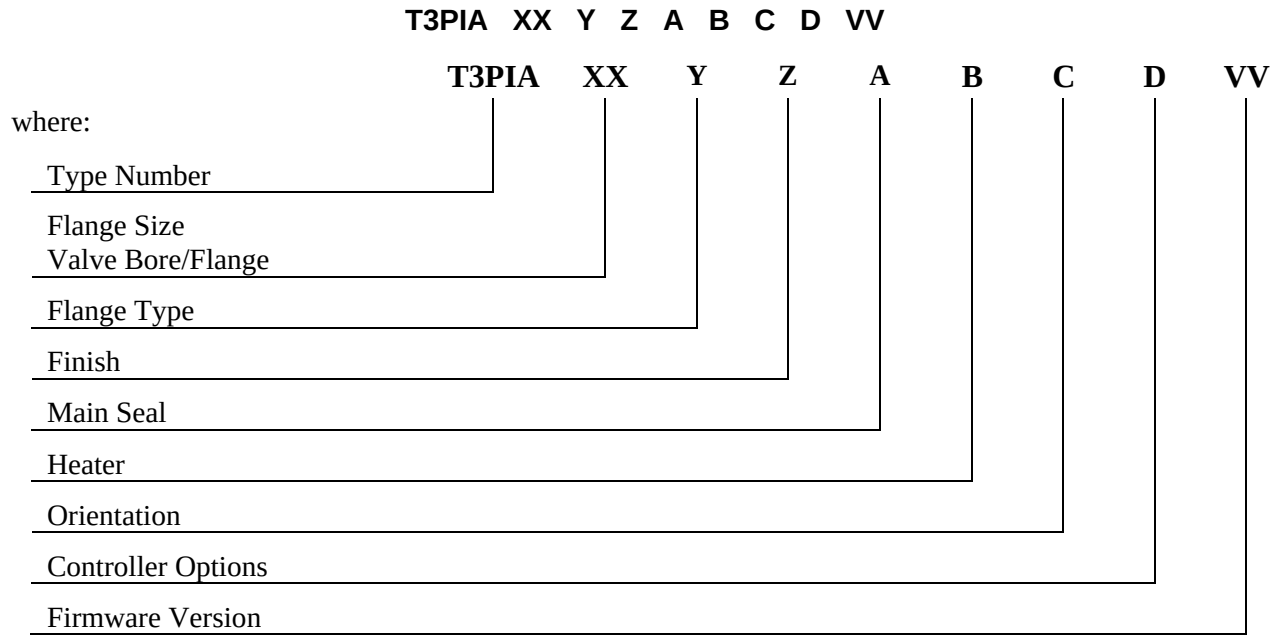
| | |
|---|---|
| Heating Method | Cartridge Heater |
| Heating Voltage | 100 or 240 VAC; selected in model number |
| Temperature Control | Electronic temperature controller on heater line cord.<br>LED display indicates heater status. When on, the heater is +/- 20 degrees of the setpoint temperature. |
| Heater Temperature | Set at factory based on model code. |
| Over Temperature Protection | Manual reset thermal switch on valve. |
| Mains Protection | This device is protected by an individual fuse located in the power plug (100 to 120 VAC devices only).<br>10 Amp 250 VAC for flange size 100-320 mm<br>MKS assumes no responsibility if the supplied plug is removed. |
| For heater operation using 200 to 240 VAC, the heater power cable is not terminated.<br>It is the responsibility of the end user to properly terminate and fuse. | |
| Wire Assignment | Black: Line (120 VAC or 220 VAC)<br>White: Neutral (120 VAC) or Line (220 VAC)<br>Green: Ground |
| Suggested Fuse Ratings for 200 to 240 VAC Use | Flange Size: 100 mm (4") 10 Amp 250 VAC<br>160 mm (6") 10 Amp 250 VAC<br>200 mm (8") 10 Amp 250 VAC<br>250 mm (10") 5 Amp 250 VAC<br>320 mm (12") 5 Amp 250 VAC<br>Use a VDE approved fuse or equivalent. |

Due to continuing research and development activities, these product specifications are subject to change without notice.

# Appendix B: Model Code Explanation

## Model Code

The options for your T3P are identified in the model code when you order the unit. The model code is identified as follows.




***Type Number (T3PIA)***

This designates the model number of the instrument.

***Flange Size (XX)***

| Model Number | Ordering Code |
|---|---|
| 100 mm | 10 |
| 160 mm | 16 |
| 200 mm | 20 |
| 250 mm | 25 |
| 320 mm | 32 |

***Flange Type (Y)***

| Model Number | Ordering Code |
|---|---|
| ISO | 0 |
| JIS | 1 |

***Finish (Z)***

| Model Number | Ordering Code |
|---|---|
| None | 0 |
| Anodize | 1 |

***Main Seal (A)***

| Model Number | Ordering Code |
|---|---|
| Viton | V |
| Chemraz E38 | C |
| Kalrez 8085 | K |

***Heater (B)***

| Model Number | Ordering Code |
|---|---|
| None | A |
| 95° C @ 115 VAC | C |
| 95° C @ 230 VAC | D |
| 105° C @ 115 VAC | E |
| 105° C @ 230 VAC | F |
| 120° C @ 115 VAC | H |
| 120° C @ 230 VAC | J |

***Orientation (C)***

Spring to close, seal opposite motor and:

| Model Number | Ordering Code |
|---|---|
| Counter Clockwise Close, Horizontal | F |
| Counter Clockwise Close, Vertical | P* |
| Clockwise Close, Horizontal | B |
| Clockwise Close, Vertical | K* |
| * Not available for 320 mm flange size. | |

***Controller Options (D)***

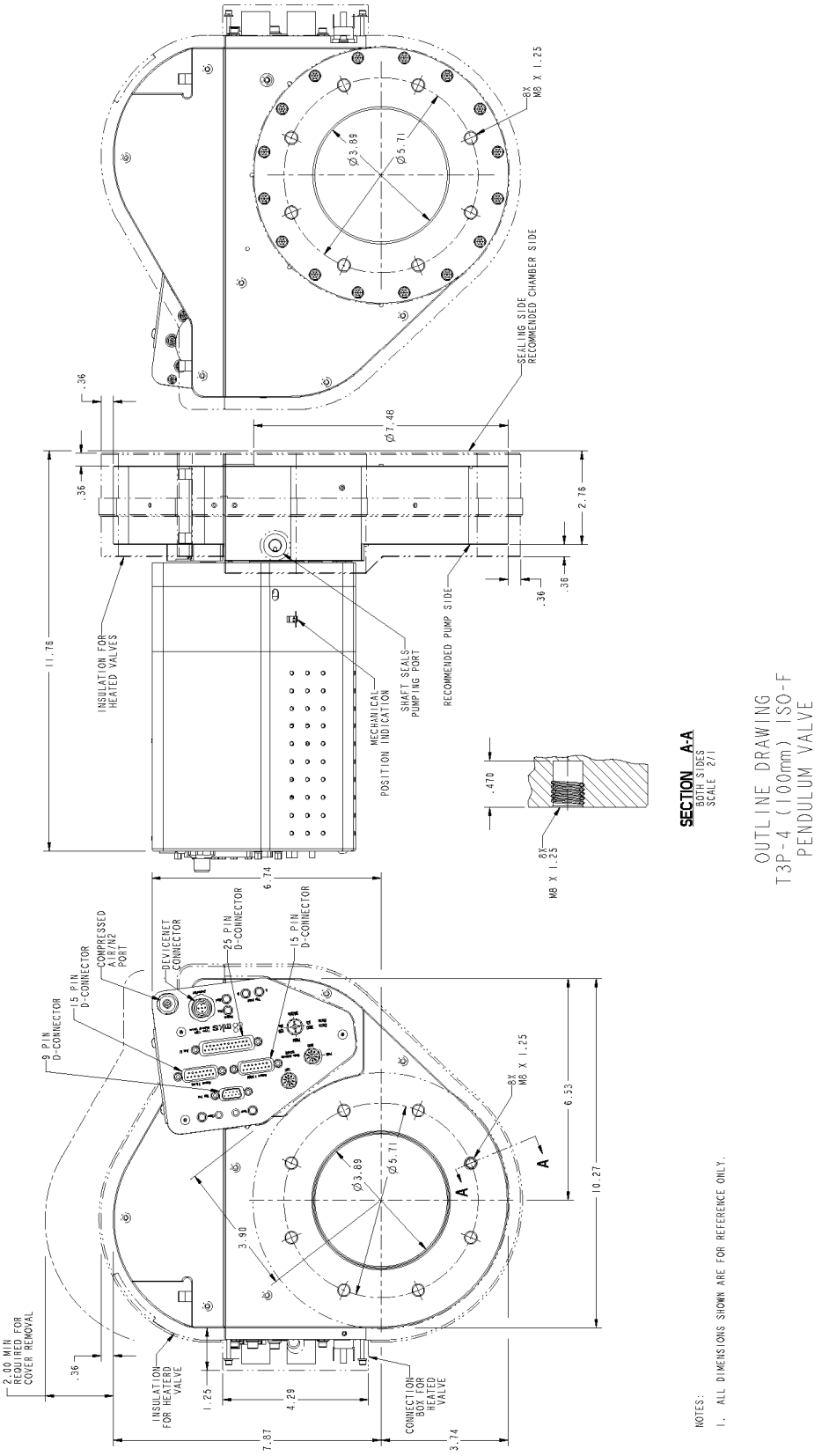
| Model Number | Ordering Code |
|---|---|
| DeviceNet | D |
| RS-232 | R |
| TTL/Analog | T |

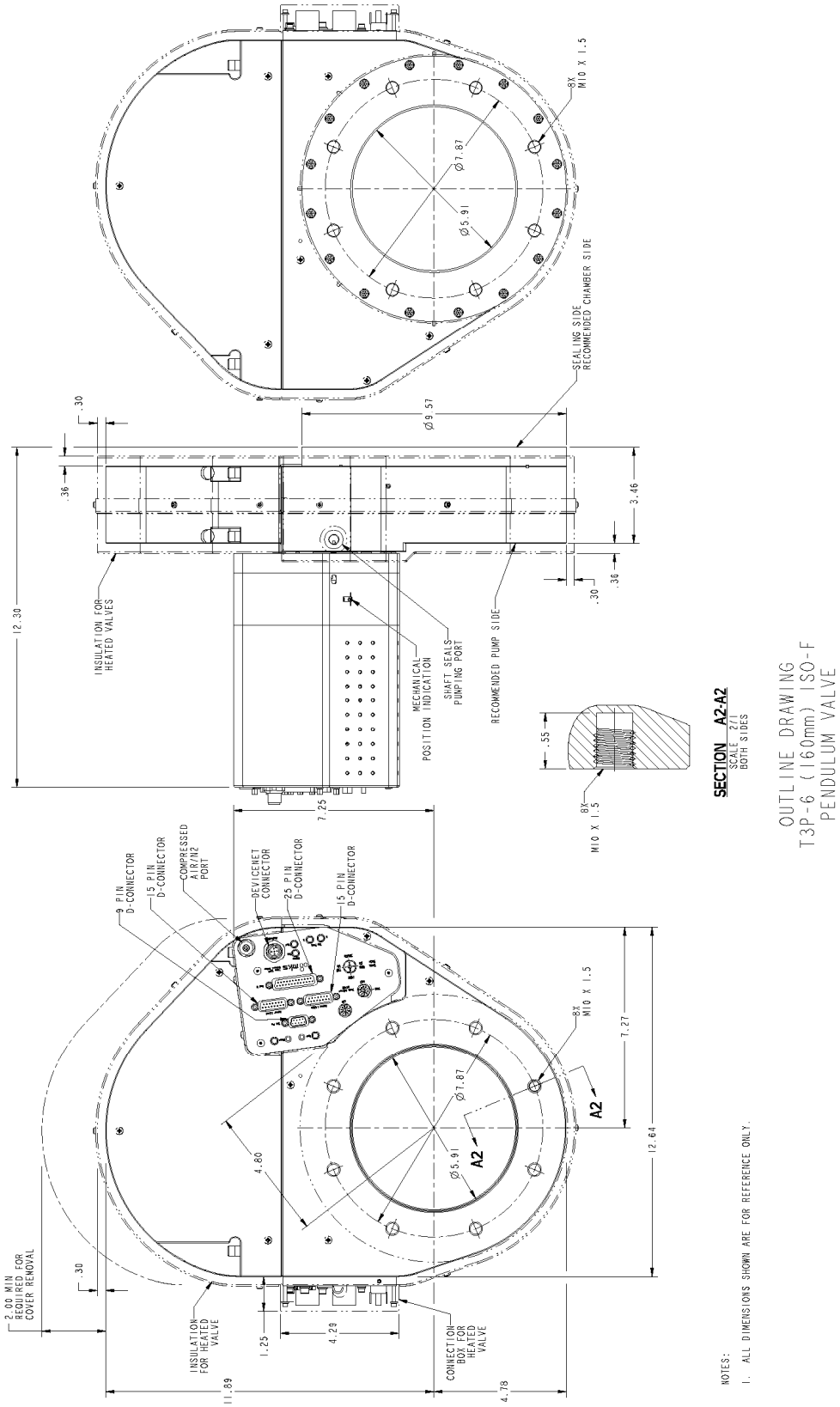
***Firmware Revision (VV)***

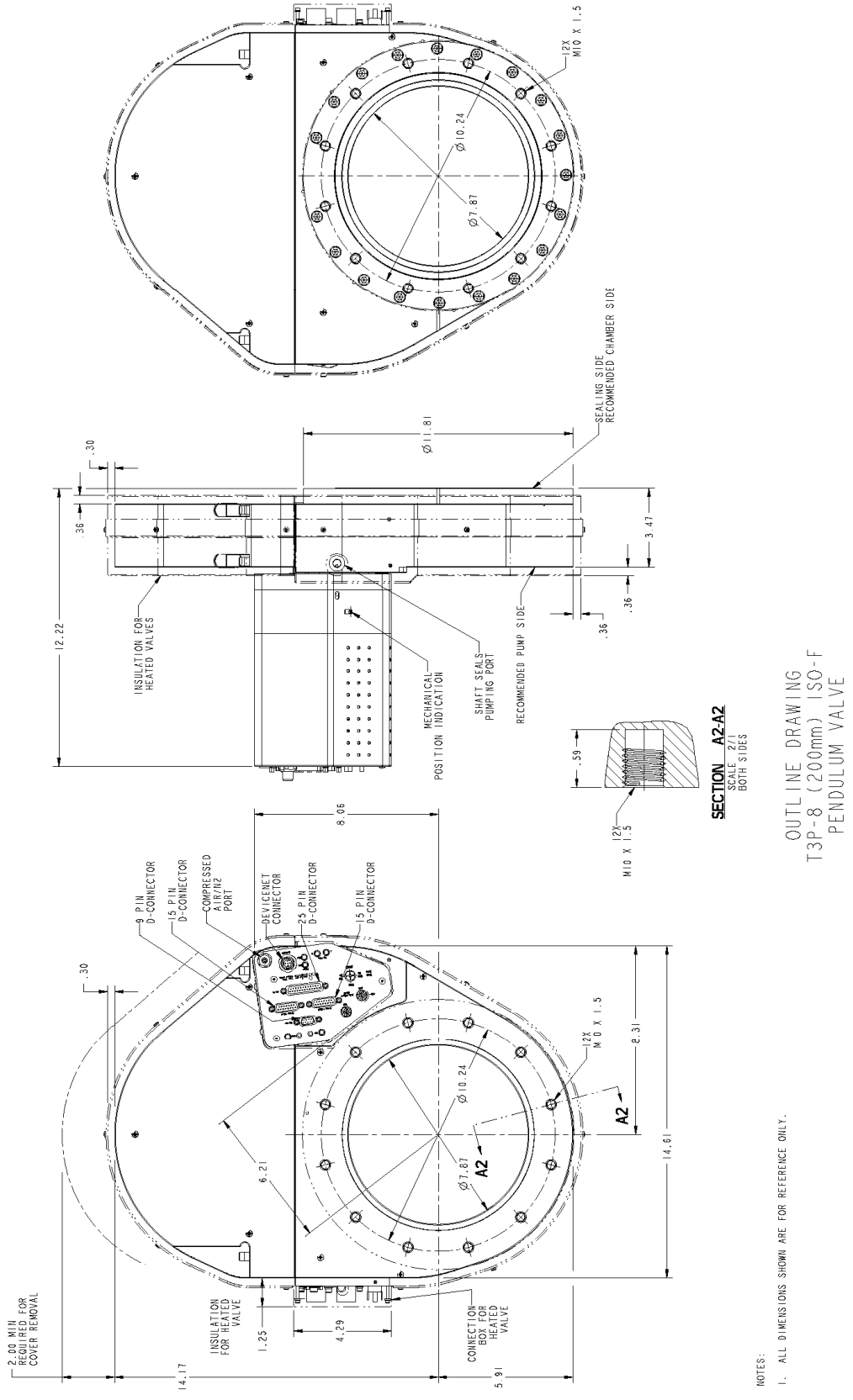
The revision of firmware installed in your unit is indicated by a two-character code.

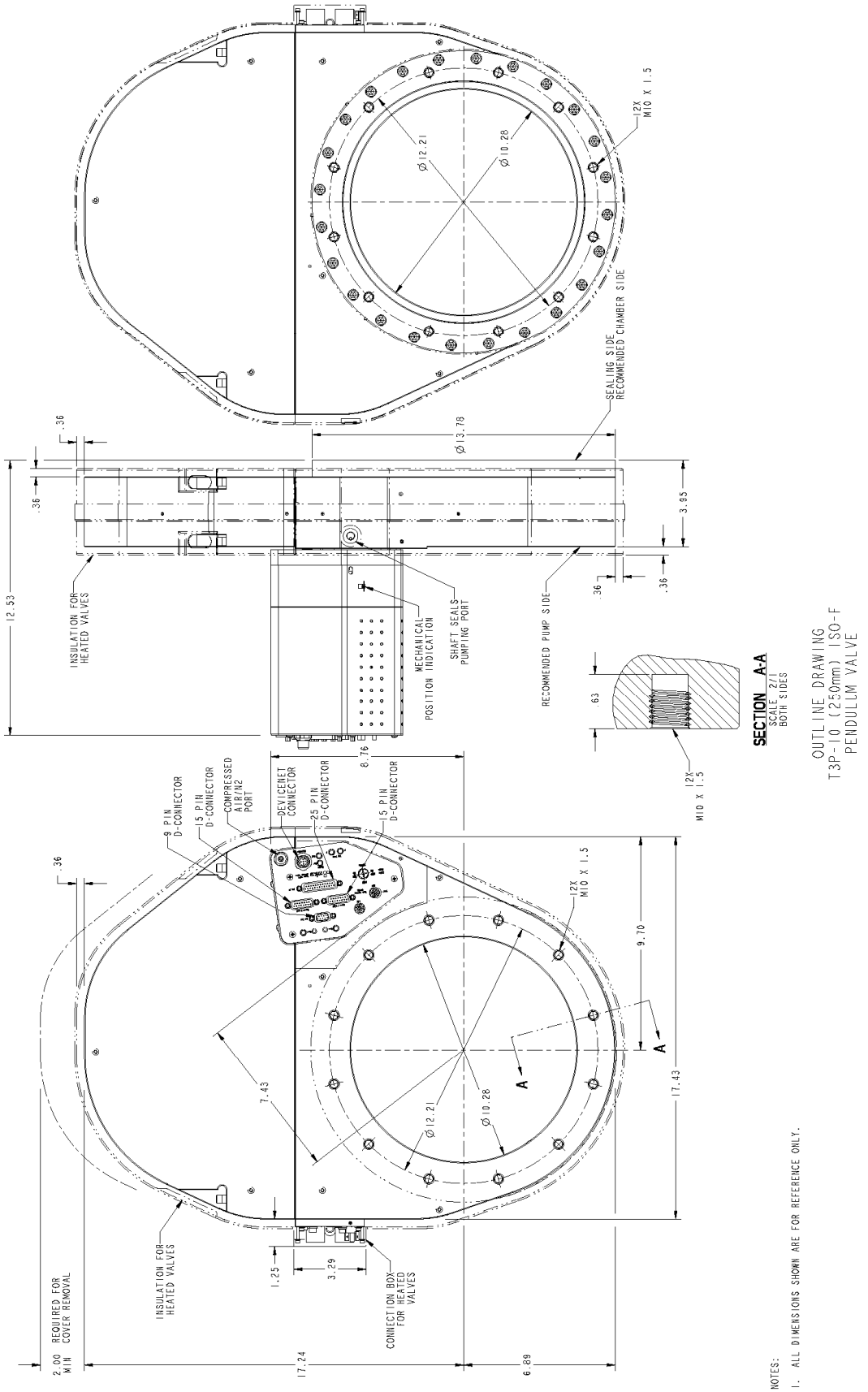
# Appendix C: Dimensions

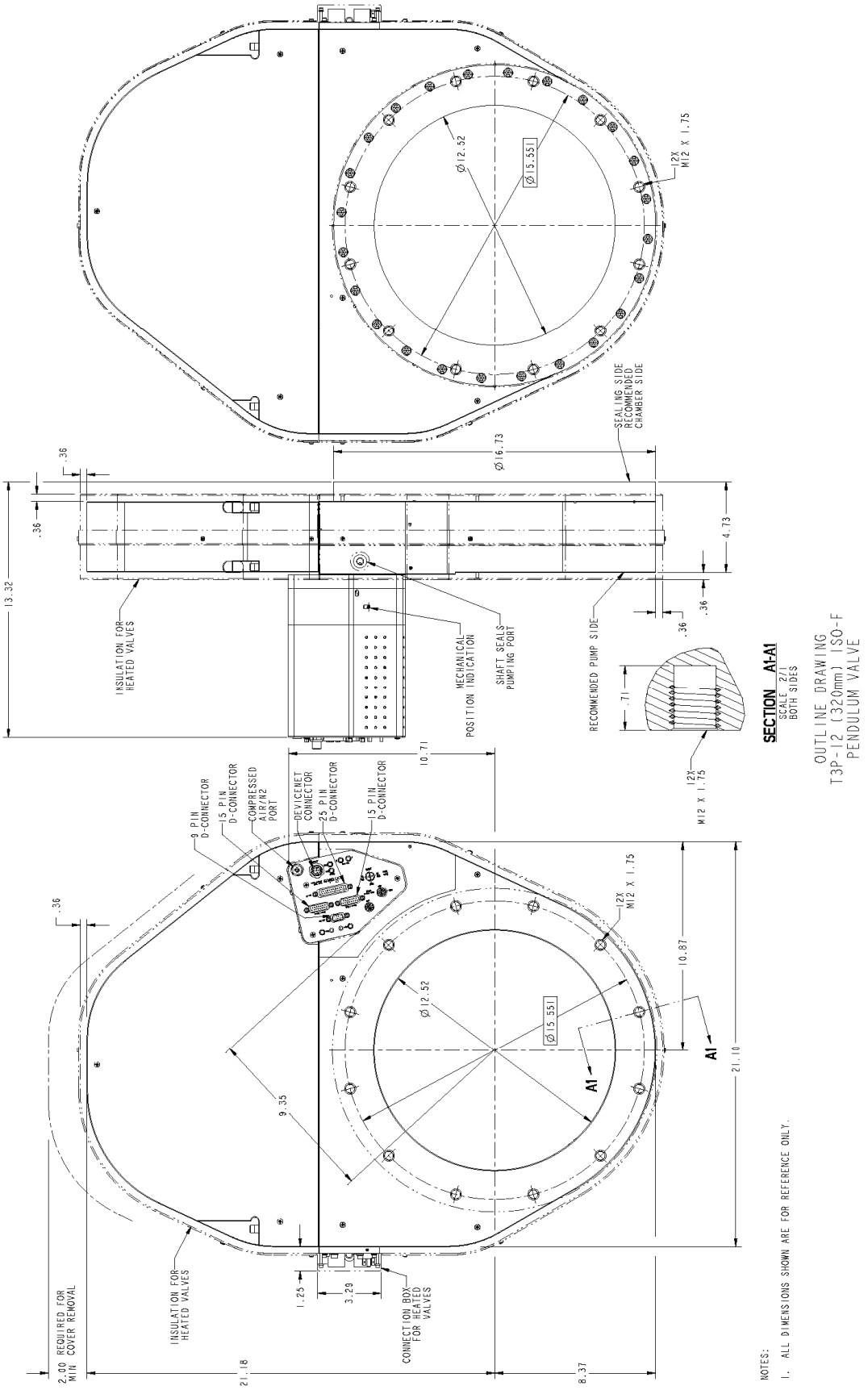
**Note** All dimensions are listed in inches with millimeters referenced in parentheses. All dimensions are for reference only.

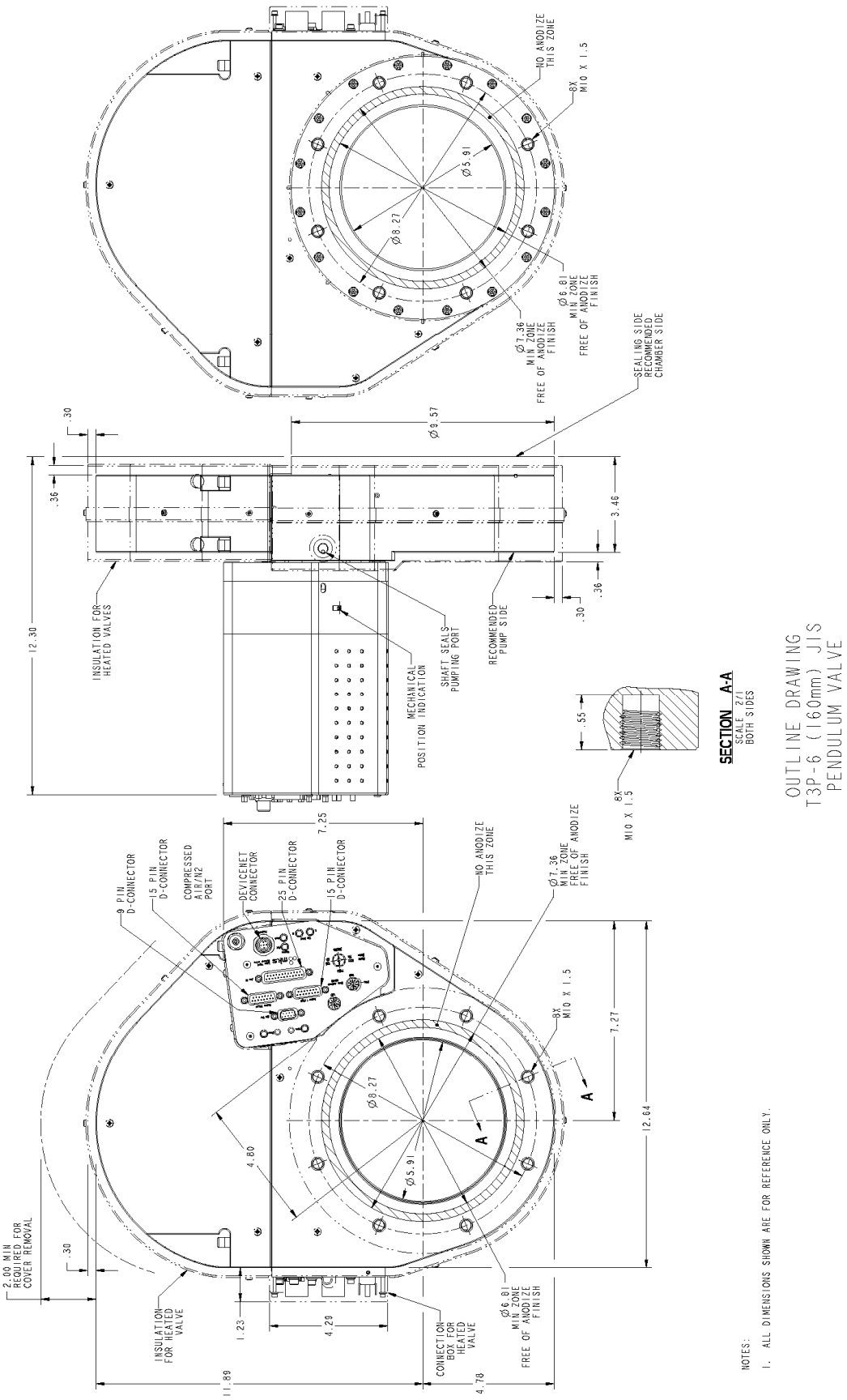

8X M8 X 1.25
Ø3.89
Ø5.71
SEALING SIDE
RECOMMENDED CHAMBER SIDE
.36
Ø7.48
.36
2.76
.36
.36
11.76
INSULATION FOR HEATED VALVES
MECHANICAL POSITION INDICATION
SHAFT SEALS PUMPING PORT
RECOMMENDED PUMP SIDE
.470
8X M8 X 1.25
SECTION A-A
BOTH SIDES
SCALE 2/1
6.74
DEVICENET CONNECTOR
25 PIN D-CONNECTOR
15 PIN D-CONNECTOR
COMPRESSED AIR/N2 PORT
9 PIN D-CONNECTOR
15 PIN D-CONNECTOR
8X M8 X 1.25
6.53
10.27
A
A
Ø3.89
Ø5.71
3.90
2.00 MIN REQUIRED FOR COVER REMOVAL
.36
INSULATION FOR HEATERD VALVE
1.25
4.29
7.87
CONNECTION BOX FOR HEATED VALVE
3.74
OUTLINE DRAWING
T3P-4 (100mm) ISO-F
PENDULUM VALVE
NOTES:
1. ALL DIMENSIONS SHOWN ARE FOR REFERENCE ONLY.


OUTLINE DRAWING
T3P-6 (160mm) ISO-F
PENDULUM VALVE
SECTION A2-A2
SCALE 2/1
BOTH SIDES
NOTES:
1. ALL DIMENSIONS SHOWN ARE FOR REFERENCE ONLY.
SEALING SIDE
RECOMMENDED CHAMBER SIDE
RECOMMENDED PUMP SIDE
INSULATION FOR HEATED VALVES
MECHANICAL POSITION INDICATION
SHAFT SEALS PUMPING PORT
9 PIN D-CONNECTOR
15 PIN D-CONNECTOR
COMPRESSED AIR/N2 PORT
DEVICENET CONNECTOR
25 PIN D-CONNECTOR
15 PIN D-CONNECTOR
8X M10 X 1.5
2.00 MIN REQUIRED FOR COVER REMOVAL
INSULATION FOR HEATED VALVE
CONNECTION BOX FOR HEATED VALVE
Ø9.57
Ø7.87
Ø5.91
12.30
11.89
12.64
7.27
7.25
4.80
4.78
4.29
3.46
1.25
.55
.36
.30


12X M10 X 1.5
Ø10.24
Ø7.87
SEALING SIDE RECOMMENDED CHAMBER SIDE
Ø11.81
.30
.36
3.47
.36
.36
12.22
INSULATION FOR HEATED VALVES
MECHANICAL POSITION INDICATION
SHAFT SEALS PUMPING PORT
RECOMMENDED PUMP SIDE
SECTION A2-A2
SCALE 2/1
BOTH SIDES
.59
12X M10 X 1.5
8.06
9 PIN D-CONNECTOR
15 PIN D-CONNECTOR
COMPRESSED AIR/N2 PORT
DEVICENET CONNECTOR
25 PIN D-CONNECTOR
15 PIN D-CONNECTOR
.30
12X M10 X 1.5
8.31
A2
Ø10.24
A2
Ø7.87
6.21
14.61
2.00 MIN REQUIRED FOR COVER REMOVAL
INSULATION FOR HEATED VALVE
1.25
4.29
CONNECTION BOX FOR HEATED VALVE
14.17
5.91
OUTLINE DRAWING
T3P-8 (200mm) ISO-F
PENDULUM VALVE
NOTES:
1. ALL DIMENSIONS SHOWN ARE FOR REFERENCE ONLY.

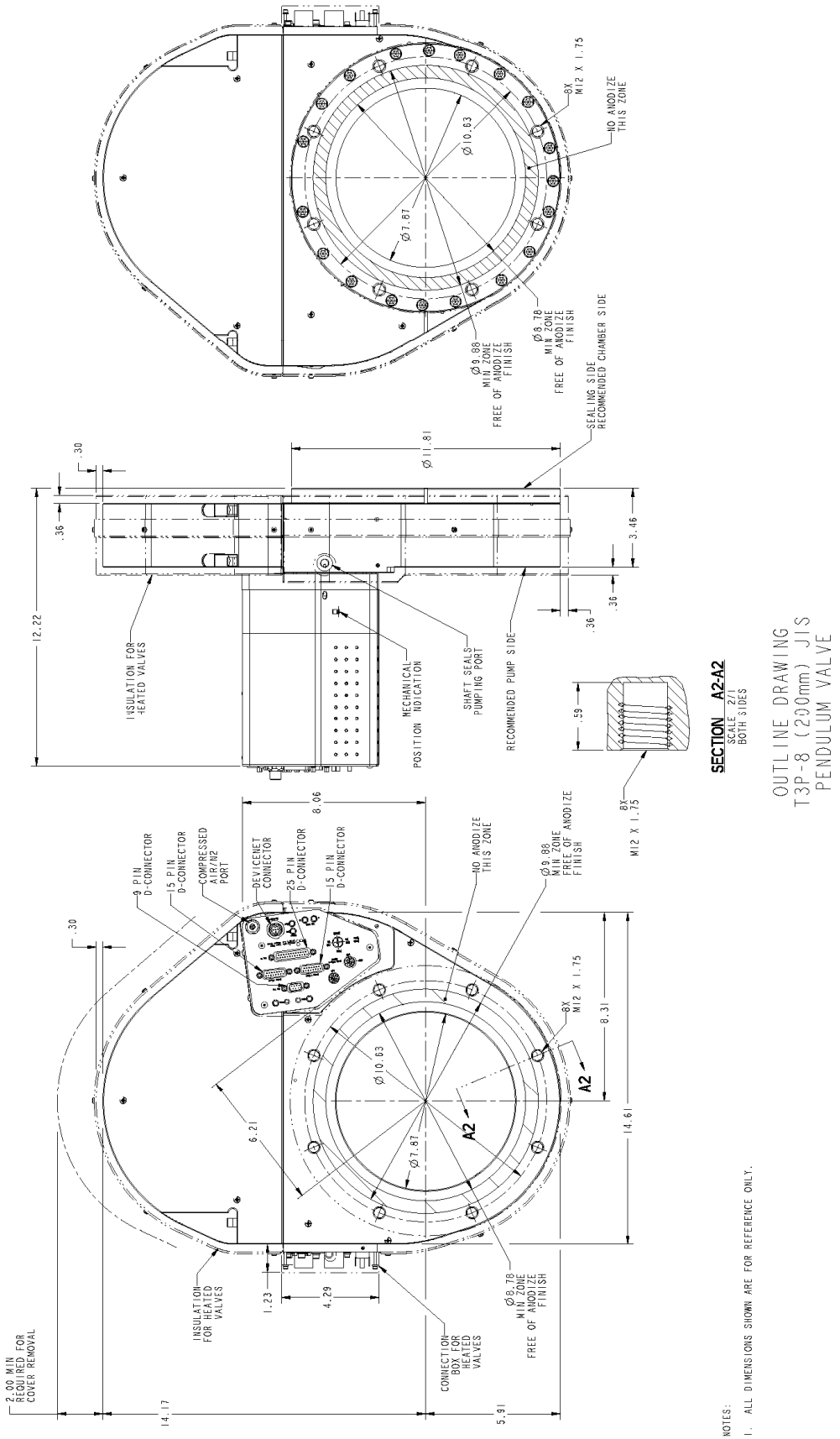

12X M10 X 1.5
Ø12.21
Ø10.28
SEALING SIDE
RECOMMENDED CHAMBER SIDE
Ø13.78
.36
.36
3.95
12.53
INSULATION FOR HEATED VALVES
MECHANICAL POSITION INDICATION
SHAFT SEALS PUMPING PORT
RECOMMENDED PUMP SIDE
.36
.36
63
12X M10 X 1.5
SECTION A-A
SCALE 2/1
BOTH SIDES
8.76
9 PIN D-CONNECTOR
15 PIN D-CONNECTOR
COMPRESSED AIR/N2 PORT
DEVICENET CONNECTOR
25 PIN D-CONNECTOR
15 PIN D-CONNECTOR
.36
12X M10 X 1.5
9.70
A
A
7.43
Ø12.21
Ø10.28
17.43
INSULATION FOR HEATED VALVES
1.25
3.29
CONNECTION BOX FOR HEATED VALVES
2.00 REQUIRED FOR MIN COVER REMOVAL
17.24
6.89
NOTES:
1. ALL DIMENSIONS SHOWN ARE FOR REFERENCE ONLY.
OUTLINE DRAWING
T3P-10 (250mm) ISO-F
PENDULUM VALVE

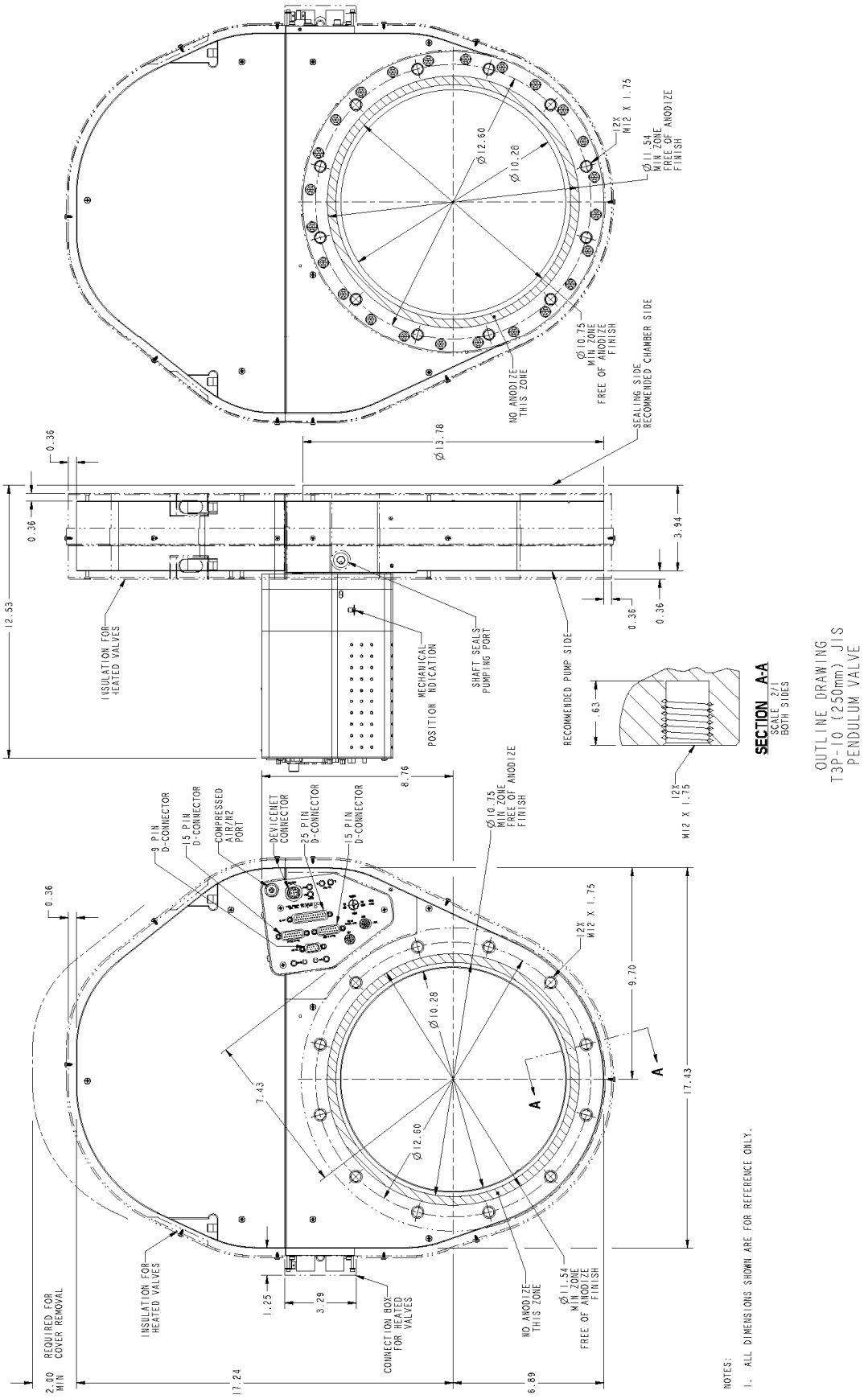

Ø12.52
Ø15.551
12X M12 X 1.75
SEALING SIDE RECOMMENDED CHAMBER SIDE
Ø16.73
.36
.36
13.32
4.73
.36
.36
INSULATION FOR HEATED VALVES
MECHANICAL POSITION INDICATION
SHAFT SEALS PUMPING PORT
RECOMMENDED PUMP SIDE
.71
10.71
12X M12 X 1.75
SECTION A1-A1
SCALE 2/1
BOTH SIDES
OUTLINE DRAWING
T3P-12 (320mm) ISO-F
PENDULUM VALVE
9 PIN D-CONNECTOR
15 PIN D-CONNECTOR
COMPRESSED AIR/N2 PORT
DEVICENET CONNECTOR
25 PIN D-CONNECTOR
15 PIN D-CONNECTOR
12X M12 X 1.75
10.87
21.10
A1
A1
9.35
1.25
3.28
INSULATION FOR HEATED VALVES
CONNECTION BOX FOR HEATED VALVES
2.00 REQUIRED FOR MIN COVER REMOVAL
21.18
8.37
NOTES:
1. ALL DIMENSIONS SHOWN ARE FOR REFERENCE ONLY.

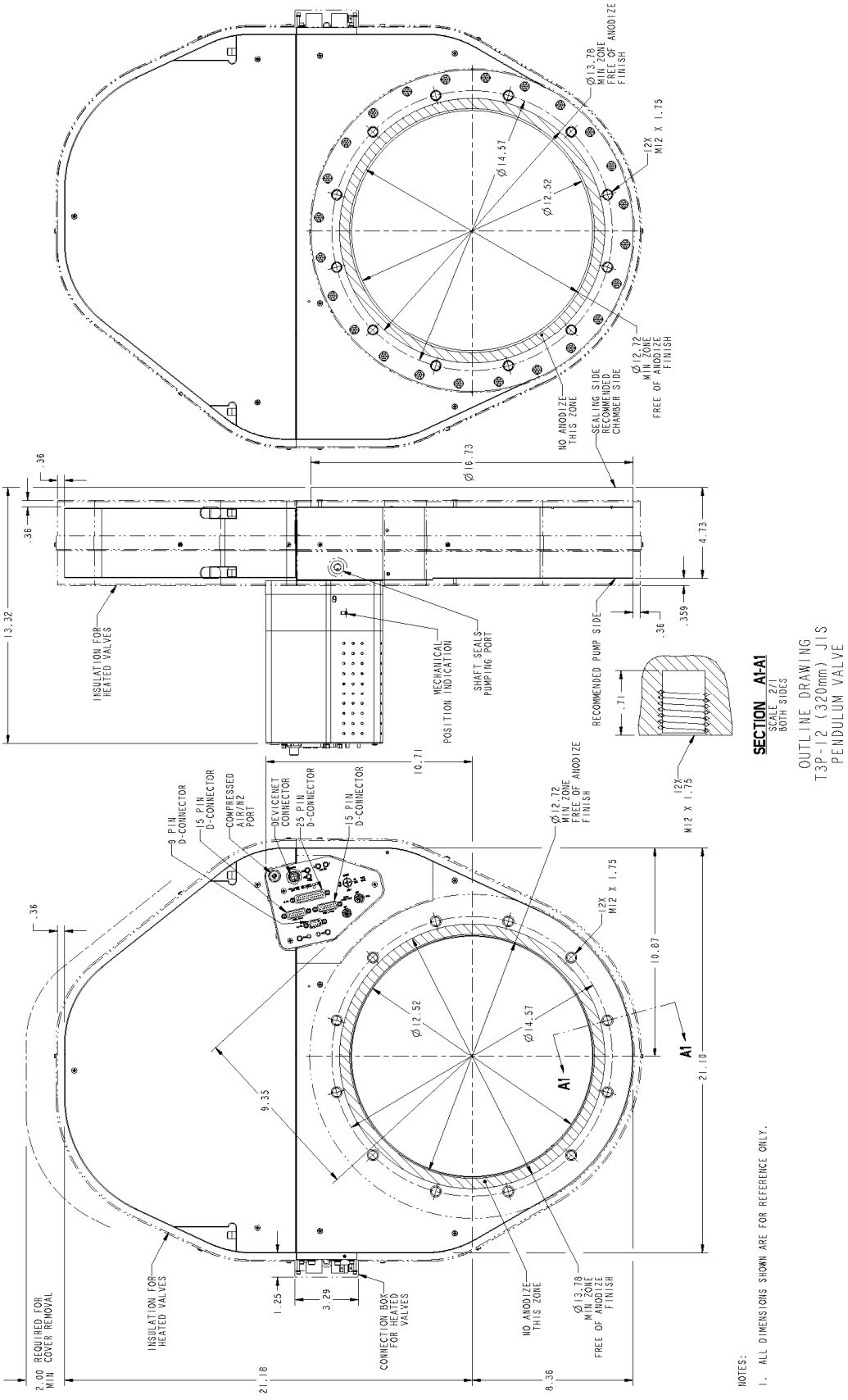



OUTLINE DRAWING
T3P-6 (160mm) JIS
PENDULUM VALVE

NOTES:
1. ALL DIMENSIONS SHOWN ARE FOR REFERENCE ONLY.


8X M12 X 1.75
NO ANODIZE THIS ZONE
Ø10.63
Ø7.87
Ø9.88 MIN ZONE FREE OF ANODIZE FINISH
Ø9.78 MIN ZONE FREE OF ANODIZE FINISH
SEALING SIDE RECOMMENDED CHAMBER SIDE
Ø11.81
.30
.36
12.22
3.46
.36
INSULATION FOR HEATED VALVES
MECHANICAL POSITION INDICATION
SHAFT SEALS PUMPING PORT
RECOMMENDED PUMP SIDE
.59
8X M12 X 1.75
SECTION A2-A2
SCALE 2/1
BOTH SIDES
9 PIN D-CONNECTOR
15 PIN D-CONNECTOR
COMPRESSED AIR/N2 PORT
DEVICENET CONNECTOR
25 PIN D-CONNECTOR
15 PIN D-CONNECTOR
8.06
NO ANODIZE THIS ZONE
Ø9.88 MIN ZONE FREE OF ANODIZE FINISH
8X M12 X 1.75
8.31
A2
A2
Ø10.63
Ø7.87
6.21
14.61
1.23
4.29
INSULATION FOR HEATED VALVES
CONNECTION BOX FOR HEATED VALVES
Ø8.78 MIN ZONE FREE OF ANODIZE FINISH
2.80 MIN REQUIRED FOR COVER REMOVAL
14.17
5.91
OUTLINE DRAWING
T3P-8 (200mm) JIS
PENDULUM VALVE
NOTES:
1. ALL DIMENSIONS SHOWN ARE FOR REFERENCE ONLY.


OUTLINE DRAWING
T3P-10 (250mm) JIS
PENDULUM VALVE
SECTION A-A
SCALE 2/1
BOTH SIDES
NOTES:
1. ALL DIMENSIONS SHOWN ARE FOR REFERENCE ONLY.
SEALING SIDE
RECOMMENDED CHAMBER SIDE
RECOMMENDED PUMP SIDE
NO ANODIZE THIS ZONE
INSULATION FOR HEATED VALVES
MECHANICAL POSITION INDICATION
SHAFT SEALS PUMPING PORT
CONNECTION BOX FOR HEATED VALVES
REQUIRED FOR COVER REMOVAL
9 PIN D-CONNECTOR
15 PIN D-CONNECTOR
COMPRESSED AIR/N2 PORT
DEVICENET CONNECTOR
25 PIN D-CONNECTOR
12X M12 X 1.75
Ø11.54 MIN ZONE FREE OF ANODIZE FINISH
Ø10.75 MIN ZONE FREE OF ANODIZE FINISH
Ø12.60
Ø10.28
Ø13.78
12.53
17.24
17.43
9.70
8.76
7.43
6.89
3.94
3.29
2.00 MIN
1.25
0.36
63


Ø13.78
MIN ZONE
FREE OF ANODIZE
FINISH
12X
M12 X 1.75
Ø14.57
Ø12.52
Ø12.72
MIN ZONE
FREE OF ANODIZE
FINISH
NO ANODIZE
THIS ZONE
SEALING SIDE
RECOMMENDED
CHAMBER SIDE
Ø16.73
.36
.36
13.32
4.73
.36
.359
INSULATION FOR
HEATED VALVES
MECHANICAL
POSITION INDICATION
SHAFT SEALS
PUMPING PORT
RECOMMENDED PUMP SIDE
.71
10.71
9 PIN
D-CONNECTOR
15 PIN
D-CONNECTOR
COMPRESSED
AIR/N2
PORT
DEVICENET
CONNECTOR
25 PIN
D-CONNECTOR
15 PIN
D-CONNECTOR
Ø12.72
MIN ZONE
FREE OF ANODIZE
FINISH
12X
M12 X 1.75
10.87
21.10
A1
A1
9.35
.36
2.00 REQUIRED FOR
MIN COVER REMOVAL
INSULATION FOR
HEATED VALVES
1.25
3.29
CONNECTION BOX
FOR HEATED
VALVES
NO ANODIZE
THIS ZONE
Ø13.78
MIN ZONE
FREE OF ANODIZE
FINISH
21.18
8.36
SECTION A1-A1
SCALE 2/1
BOTH SIDES
OUTLINE DRAWING
T3P-12 (320mm) JIS
PENDULUM VALVE
NOTES:
1. ALL DIMENSIONS SHOWN ARE FOR REFERENCE ONLY.

# Index