119895-P1
Rev B, 3/98
Instruction Manual

MKS Type 41A, 42A, 51A, and 52A Mini Vacuum Pressure Switch

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WARRANTY

Type 41A, 42A, 51A, and 52A Equipment

MKS Instruments, Inc. (**MKS**) warrants that for two years from the date of shipment the equipment described above (the "equipment") manufactured by **MKS** shall be free from defects in materials and workmanship and will correctly perform all date-related operations, including without limitation accepting data entry, sequencing, sorting, comparing, and reporting, regardless of the date the operation is performed or the date involved in the operation, provided that, if the equipment exchanges data or is otherwise used with equipment, software, or other products of others, such products of others themselves correctly perform all date-related operations and store and transmit dates and date-related data in a format compatible with **MKS** equipment. THIS WARRANTY IS **MKS'** SOLE WARRANTY CONCERNING DATE-RELATED OPERATIONS.

For the period commencing with the date of shipment of this equipment and ending two years later, **MKS** will, at its option, either repair or replace any part which is defective in materials or workmanship or with respect to the date-related operations warranty without charge to the purchaser. The foregoing shall constitute the exclusive and sole remedy of the purchaser for any breach by **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.

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MKS Type 41A, 42A, 51A, and 52A Mini Vacuum Pressure Switch

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Safety Information

Symbols Used in This Instruction Manual

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

Warning 

The WARNING sign denotes a hazard. 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.

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 ll equipment IEC 417, No.5172-a	 Three phase alternating current IEC 617-2 No.020206	
 Caution, refer to accompanying documents ISO 3864, No.B.3.1	 Caution, risk of electric shock ISO 3864, No.B.3.6	 Caution, hot surface IEC 417, No.5041	

Table 1: Definition of Symbols Found on the Unit

Safety Procedures and Precautions

The following general safety precautions must be observed 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.

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT

Do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument 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 remove instrument covers. Component replacement and internal adjustments must be made by qualified service personnel only.

USE CAUTION WHEN OPERATING WITH HAZARDOUS MATERIALS

If hazardous materials are used, users must take responsibility to observe the proper safety precautions, completely purge the instrument when necessary, and ensure that the material used is compatible with sealing materials.

DO NOT OPERATE IN EXPLOSIVE ATMOSPHERES

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

USE PROPER FITTINGS AND TIGHTENING PROCEDURES

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

CHECK FOR LEAK-TIGHT FITTINGS

Before proceeding to instrument setup, carefully check all plumbing connections to the instrument to ensure leak-tight installation.

OPERATE AT SAFE INLET PRESSURES

This unit should never be operated 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, a suitable burst disc should be installed in the vacuum system to prevent system explosion should the system pressure rise.

KEEP THE UNIT FREE OF CONTAMINANTS

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

Chapter One: General Information

Introduction

The MKS Type 41A/42A/51A/52A Mini Vacuum Pressure Switch is based on the proven Type 700/800 Series mini Baratron® capacitance manometer technology. The small footprint of the 41/42/51/52 pressure switch makes it ideal for applications with limited space. The switches are available in a single-ended or flow-through configuration, using either an absolute or gage transducer. Table 2 lists the various configurations available. Table 3 lists the features available on the single-ended (41 and 51) and flow-through versions (42 and 52).

Description of the 41/42/51/52 Mini Vacuum Pressure Switch	
Model Type	**Description**
41	Single-Ended Gage Transducer
51	Single-Ended Absolute Transducer
42	Flow-Through Gage Transducer
52	Flow-Through Absolute Transducer

Table 2: Description of the 41/42/51/52 Mini Vacuum Pressure Switch

Configuration Options of the Single-Ended and Flow-Through Versions		
Feature	**Single-Ended (41 and 51)**	**Flow-Through (42 and 52)**
Connector	9-pin Type “D” or flying leads	9-pin Type “D” or flying leads
Fittings	4-VCR fixed male, ¼” NPT male, ⅛” NPT male, or KF-16	Swagelok® 4-VCR fixed male
Full Scale Range	10 Torr to 25000 Torr (500 psi)	1000 Torr (≈20 psi) to 500 psi

Table 3: Configuration Options of the Single-Ended and Flow-Through Versions

The pressure switch output signal changes state when the measured pressure crosses a trip point pressure value. The trip point pressure value is selected at the time the unit is ordered and the value set at the factory. The trip point direction, whether to trip when the pressure rises above or drops below the trip point value, is also defined when the unit is ordered. The pressure switch arrives fully configured so all you need to do is install it into your system.

How This Manual is Organized

This manual is designed to provide instructions on how to set up, install, and operate a Type 41/42/51/52 unit.

Before installing your 41/42/51/52 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.

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

Chapter Four, *Operation,* describes how to use the instrument and explains all the functions and features.

Chapter Five, *Maintenance,* lists any maintenance required to keep the instrument in good working condition.

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

Appendix B, *Model Code Explanation,* describes the model code.

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 41/42/51/52 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 free of harmful, corrosive, radioactive, or toxic materials.**

Chapter Two: Installation

How To Unpack the Type 41/42/51/52 Unit

MKS has carefully packed the Type 41/42/51/52 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 41/42/51/52 Unit
- Type 41/42/51/52 Instruction Manual (this book)

Optional Equipment:

- Electrical Connector Accessories Kit - XXA-K1 where XX designates your specific model (contains a mate for the electrical connector)
- Interface cable CB41S-1

Product Location and Requirements

- Ambient Operating Temperature: 0° to 50° C (32° to 122° F)
- Ventilation requirements include sufficient air circulation
- Storage Temperature Range: -20° to +80° C (-4° to 176° F)
- Input power: 10 to 20 VDC @ 35 mA maximum or 20 to 30 VDC @ 30 mA maximum

Setup

Dimensions of the Single-Ended Units

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

The dimensions of single-ended units depend upon the full scale range of the unit. High pressure units have a full scale range of 50 psi through 500 psi (2600 Torr through 25000 Torr). Low pressure units have a full scale range of 10 through 1200 Torr.

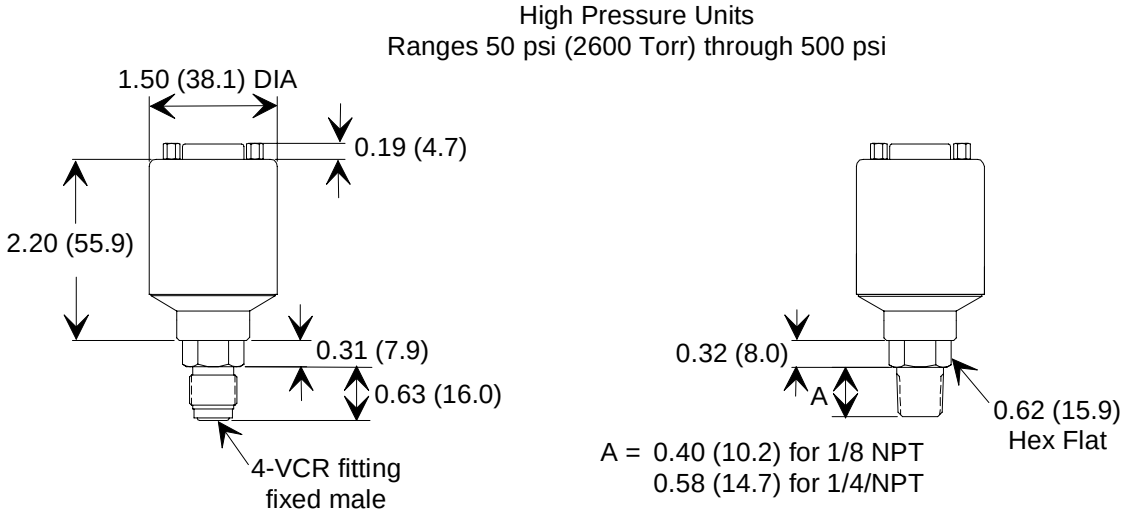

Figure 1: Dimensions of High Pressure Single-Ended Units

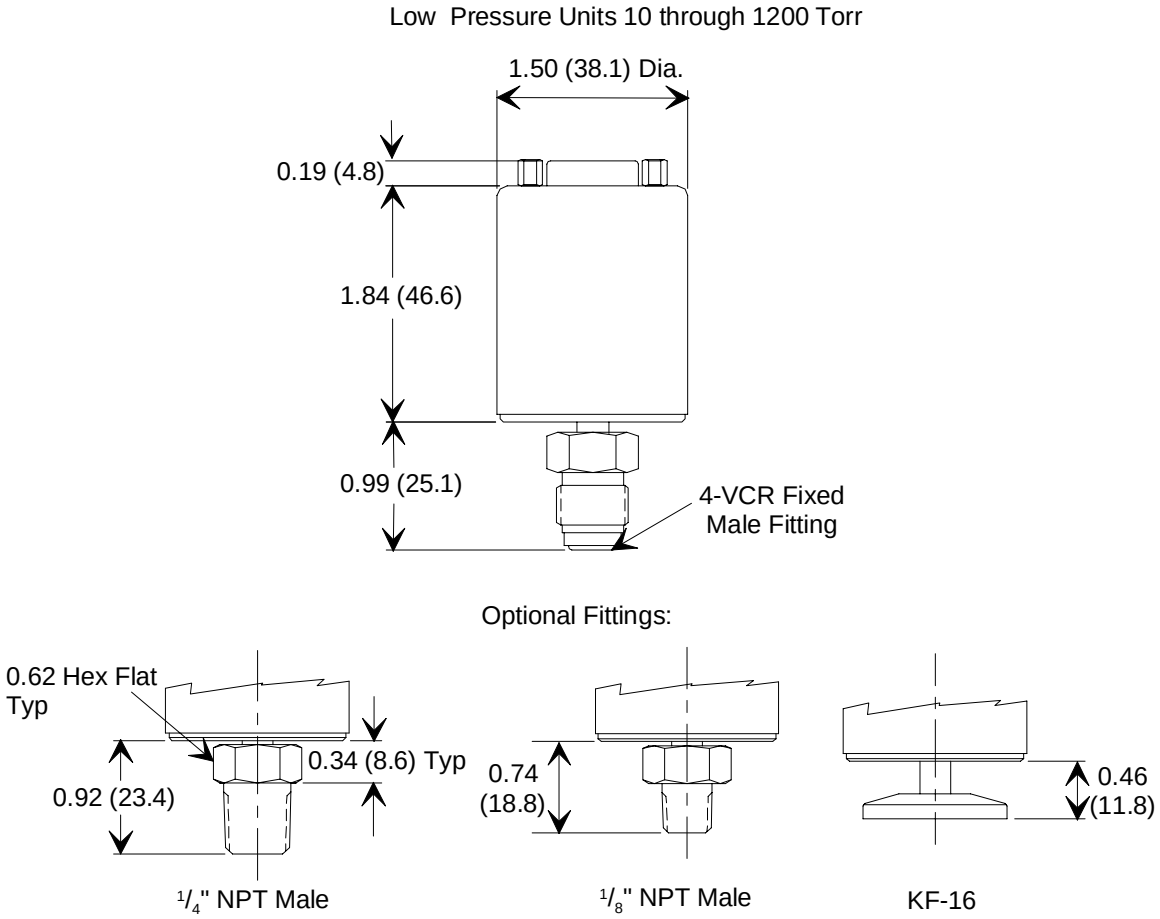

Figure 2: Dimensions of Low Pressure Single-Ended Units

Dimensions of the Flow-Through Units

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

The dimensions of the flow-through version are the same for high and low pressure units.

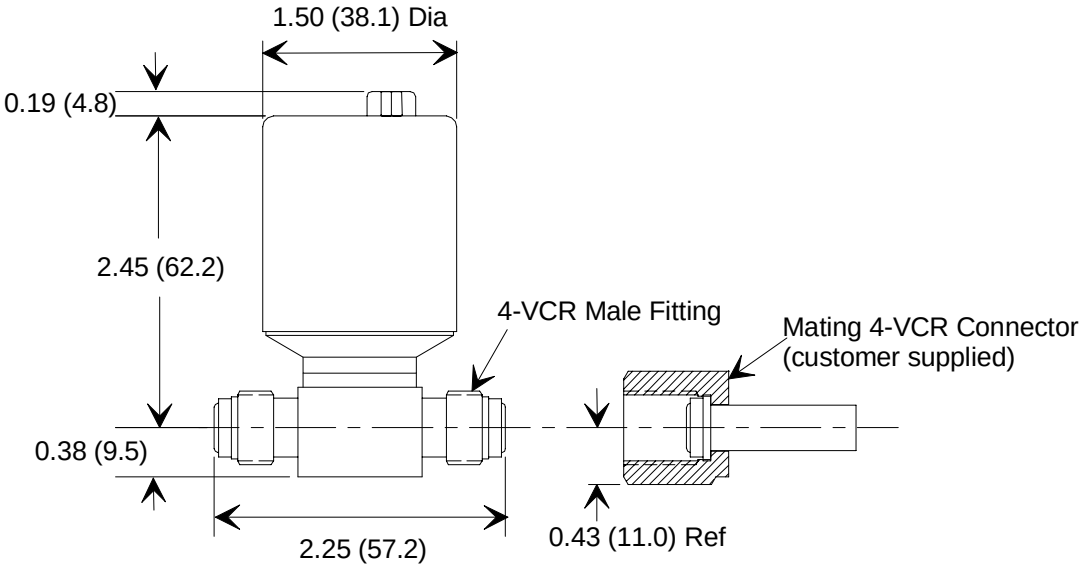

Figure 3: Dimensions of Flow-Through Units

Mounting

The 41/42/51/52 switch can be mounted in any orientation with the exception of the low pressure units (< 20 psi FS). If the full scale pressure of the unit is less than 20 psi *and* the unit may be exposed to particulates, mount the unit with the connector up. This will allow any foreign matter entering the unit to fall away from the sensing diaphragm. Material on the diaphragm may cause a zero shift and reduce the unit's switch point accuracy.

Electrical Information

The 41/42/51/52 switches require an external power supply capable of supplying either 10 to 20 VDC @ 35 mA maximum or 20 to 30 VDC @ 30 mA maximum.

Type "D" Connector

The pressure switch is available with a 9-pin male Type "D" connector. The connector pinout is listed in Table 4.

Pinout of the 9-Pin Type "D" Connector	
Pin Number	**Assignment**
1	Power Return (-)
2	Power Input (+)
3	Relay Normally Open Contact
4	Relay Common
5	Relay Normally Closed Contact
6	Reserved
7	Reserved
8	Reserved
9	Chassis Ground

Table 4: Pinout of the 9-Pin Type "D" Connector

Note The "Reserved" pin assignment refers to a pin with an internal connection that may be assigned a function in the future.

Flying Leads Connector

The flying leads connector has 2 foot long cable with six (6) leads. The color assignments are listed in Table 5.

Pinout of the Flying Leads Connector	
Wire	**Assignment**
Red	Power Input (+)
Black	Power Return (-)
Green	Relay Normally Open Contact
White	Relay Common
Orange	Relay Normally Closed Contact
Bare Wire	Shield (Drain)

Table 5: Pinout of the Flying Leads Connector

Trip Point Relay

The trip point relay is a single pole, double throw switch, one normally open (NO), one normally closed (NC) form "C" relay with contacts rated from 0.1 to 1 ampere, resistive. When the relay is energized the normally open (NO) contacts will close. The action of the trip point, whether it is energized above or below the trip point, is specified when the unit is ordered. Refer to *Appendix B: Model Code Explanation*, page 31, to determine the trip point action from the model code of the unit. In addition, the serial number label, shown in Figure 7, page 17, lists the trip point action.

Interface Cables

As of January 1, 1996, all products shipped to the European Community must comply with the EMC Directive 89/336/EEC, which covers radio frequency emissions and immunity tests. MKS products that meet these requirements are identified by application of the CE Mark.

Note

1. An overall metal braided shielded cable, properly grounded at both ends, is required to meet CE specifications.
2. To order an overall metal braided shielded cable, add an "S" after the cable type designation. For example, to order an overall metal braided shielded cable, for a 41/42/51/52 unit, use part number CB41S-1.

Connecting a Pressure Switch with a Type "D" Connector

The interface cable, CB41S-1, has a 9-pin female Type "D" connector (to attach to the pressure switch) on one end and 2 foot flying leads (6 wire) on the other end. Use the flying leads end of the cable to connect to your system. To ensure CE compliance, you must properly ground the flying leads by connecting the shield (drain) lead to the main ground on your system. Refer to Figure 4, page 15, to identify the shield (drain) lead.

Connecting a Pressure Switch with a Flying Leads Cable

When connecting a pressure switch equipped with a flying leads cable, you must connect the bare metal shield (drain) wire to the main ground on your system to achieve CE compliance. Refer to Figure 4, page 15, to identify the shield (drain) lead.

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 which has direct contact to the cable's shield on the whole circumference of the cable. The inductance of a flying lead or wire from the shield to the connector will degrade the shield's effectiveness. The shield should be grounded to the connector before its internal wires exit.

3. With very few exceptions, the connector(s) must make good contact to the device'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 at each such end, to ground the shield *before* the wires exit. Make this ground with absolute minimum length. (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's 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 or in the instruction manual.

5. In selecting the appropriate type and wire size for cables, consider:
   A. The voltage ratings;
   B. The cumulative I^2R heating of all the conductors (keep them safely cool);
   C. The IR drop of the conductors, so that adequate power or signal voltage gets to the device;
   D. The capacitance and inductance of cables which are handling fast signals, (such as data lines or stepper motor drive cables); and
   E. That some cables may need internal shielding from specific wires to others; please see the instruction manual for details regarding this matter.

Special Consideration for the Ground Connection

If you choose to make your own cable you must properly ground the cable on both ends to ensure electromagnetic integrity and compliance with CE regulations. Figure 4 identifies the components of a cable designed to connect to a Type “D” connector on the pressure switch.

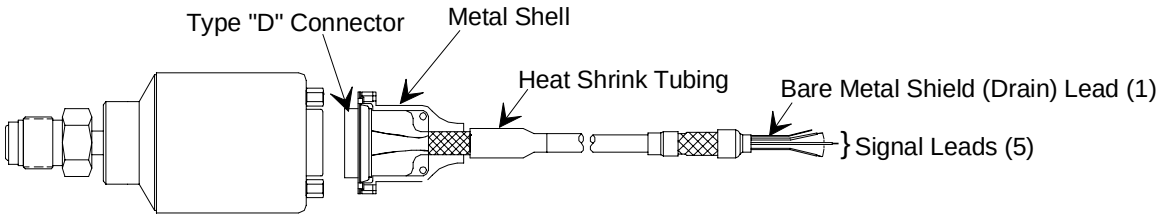

Figure 4: Components of a Cable to Connect to a Type “D” Connector

On the connector end of the cable, Figure 5 shows how the metal braided shield is folded back over itself to expose the wires. Then the metal shell of the connector is clamped over the metal braided shield to form a good contact point.

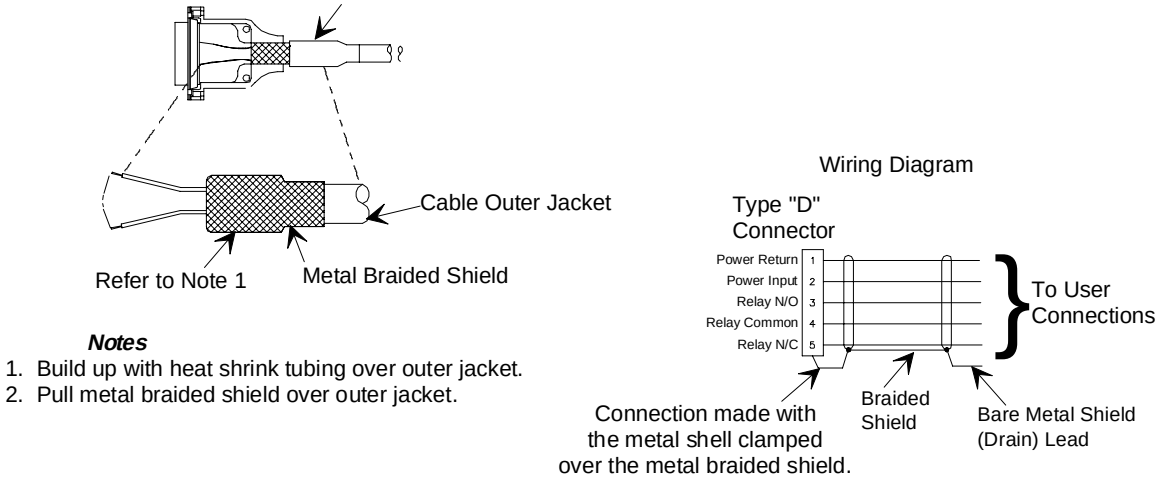

Figure 5: Expanded View of the Cable

At the flying leads end of the cable, connect the shield (drain) lead to the main ground of your system using the shortest length of shield (drain) lead possible.

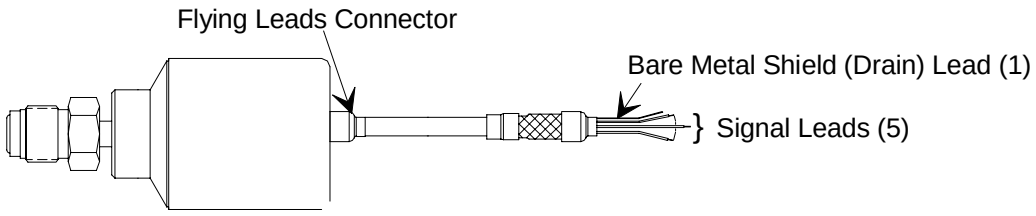

Figure 6: Flying Leads Connector

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Chapter Three: Overview

General Information

The 41/42/51/52 pressure switch output is represented by a change of state of relay contacts to indicate when the pressure of the system exceeds a factory set pressure value.

Note The trip point pressure value cannot be changed in the field.

Labels

The mini-pressure switch has two identification labels; a serial number label and a trip point action label.

Serial Number Label

Every mini pressure switch carries a serial number label, as shown in Figure 7.

Figure 7: Serial Number Label

The serial number label lists the input requirement, the full scale range, the trip point, and the action of the trip point relay. In addition, it displays the “CE” symbol to denote compliance with the CE directive.

Trip Point Label

Each mini-pressure switch also carries a label to identify the action of the trip point. The trip point action is set at the factory to energize when the pressure is either above or below the trip point.

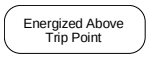

Figure 8: Trip Point Label

Sensor

The variable capacitance sensor consists of a pressure inlet tube (port) connected to a small chamber in the transducer body. One wall of this chamber is a metal diaphragm. The front side of the diaphragm is exposed to the gas whose pressure is to be measured. The back, or *reference* side of the diaphragm faces a rigidly mounted ceramic disc containing two electrodes. The diaphragm in the single-ended version is positioned opposite the inlet port. The diaphragm on the flow-through version is positioned above the gas stream. Figure 1 page 8, and Figure 2, page 9, show the design of the single-ended version; and Figure 3, page 10, shows the design of the flow-through version.

The reference side of the absolute version (Type 51 or 52) is permanently evacuated below the resolution of the instrument and its vacuum is maintained with a chemical getter system. The reference side of the gage version (Type 41 or 42) is open to the atmosphere. Since its pressure should not be altered, there is no connector on the reference side.

The diaphragm deflects with changing pressure (force per unit area) independently of the gas type or composition of the measured gas. This deflection causes an imbalance of the sensor electrode capacitances since the distance to the diaphragm is now different for each electrode. Using a precision constant frequency oscillator for excitation, the imbalance of capacitances is converted to a DC voltage representative of pressure and is supplied as one input to a comparator circuit. The circuit compares the pressure signal to the factory set trip point signal and appropriately activates a relay when the two signals differ. The form C relay contacts are available on the Type “D” connector or the flying leads cable so you can connect the pressure switch into your system.

Trip Point Value

The trip point pressure is designated at the time the unit is ordered and *cannot* be changed in the field.

Caution  **The trip point value is NOT ADJUSTABLE. Before operating the switch, ensure that the range of pressure for the system is appropriate for the particular 41/42/51/52 switch.**

The trip point pressure value must be in the same pressure units as the full scale range. For example, you cannot order a 1000 Torr full scale unit with a trip point of 14.7 psia; you must specify the trip point as 760 Torr.

How The Full Scale Range Affects Trip Point Accuracy

The accuracy of the pressure switch (reacting to the trip point) depends on the full scale range of the unit. Therefore, you should order the *lowest* full scale range switch that will measure the trip point value. For example, if you need a trip point of 50 Torr, a 100 Torr full scale range will provide a trip point accuracy of 0.5 Torr. The switch will trip between 49.5 and 50.5 Torr. However, a 1000 Torr full scale switch with the same 50 Torr trip point will provide a trip point accuracy of only 5 Torr. Therefore the switch will trip between 45 and 55 Torr.

Method of Operation

The 41/42/51/52 pressure switch changes the state of a relay when the pressure crosses the trip point pressure. The pressure switch is set at the factory in one of two settings:

Relay energizes when the pressure *rises above* the trip point pressure

or

Relay energizes when the pressure *drops below* the trip point pressure

Note The action of the switch (whether the relay is energized when the pressure rises above or drops below the trip point pressure) cannot be changed in the field.

The trip point signal is available on the connector as shown in Table 6. (For complete connector assignments, refer to Table 4, page 11, and Table 5, page 12.)

Trip Point Signals		
Pin Number	**Flying Lead Color**	**Assignment**
3	Green	Relay Normally Open Contact
4	White	Relay Common
5	Orange	Relay Normally Closed Contact

Table 6: Trip Point Signals

Units Set to Energize *Above* the Trip Point Pressure

When the measured pressure is below the trip point value, the relay is in its normal state; the normally open contact is open and the normally closed contact is closed. When the pressure rises above the trip point value, the relay changes to its tripped state; the normally open contact closes and the normally closed contact opens.

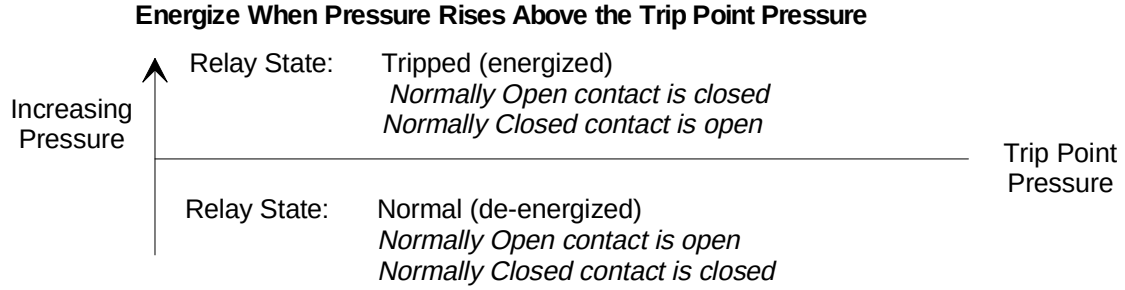

Figure 9: Trip Point Set to Energize Above the Trip Point Pressure

Units Set to Energize *Below* the Trip Point Pressure

When the measured pressure is above the trip point value, the relay is in its normal state; the normally open contact is open and the normally closed contact is closed. When the pressure falls below the trip point value, the relay changes to its tripped state; the normally open contact closes and the normally closed contact opens.

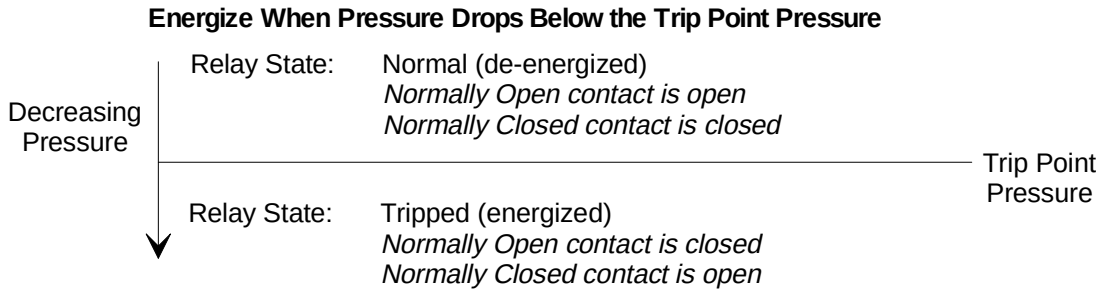

Figure 10: Trip Point Set to Energize Below the Trip Point Pressure

Hysteresis

Hysteresis is built into the operation of the trip point to help compensate for the noise inherent in all systems. Without hysteresis, noise may cause the relay to repeatedly switch states, a condition known as "relay chatter." The hysteresis is set at the factory for 0.25% of full scale; it cannot be adjusted.

How A Gage Switch Works

The 41 and 42 gage pressure switches can measure pressure both above and below atmospheric pressure (that is both positive and negative pressure). A gage pressure switch can be used as an atmospheric switch; one that references the trip point pressure to current atmospheric pressure. For example, a gage pressure switch with a 100 psi full scale range, enables you to set the trip point value at 15 psi above atmospheric pressure (2 atmospheres). Therefore, even though atmospheric pressure may fluctuate around 760 Torr (in most places) the switch would always change when the pressure exceeded 15 psi above *current* atmospheric pressure. This switch would require a "normal calibration" since the trip point pressure is above atmospheric pressure. In the model code the full scale range would be "12P" to designate pressure units of psi with a normal calibration. The trip point pressure would be "015."

Reverse Calibration Switch

In some instances you may need to reference atmospheric pressure yet set the trip point value somewhat below atmospheric pressure. For example, using a 100 Torr Type 41 gage pressure switch, you may need to set the trip point pressure 10 Torr *below* atmospheric pressure. This switch would require a "reverse calibration" since the trip point is set below atmospheric pressure. The choice of a reverse calibration is selected in the model code, in the "Full Scale Range" section. In our example, the full scale range would be "12D" where the "D" designates the pressure units of Torr with a reverse calibration. The trip point pressure, specified in the last three digits of the model code, is defined as the value below atmospheric pressure. In our example, the trip point pressure would be "010." Refer to *Appendix B: Model Code Explanation*, page 31, for a complete description of the model code.

Atmospheric Switch

Some processes operate in a vacuum yet require the switch to change at atmospheric pressure. A gage switch with a reverse calibration can achieve this effect. A typical configuration may have a full scale range of 10 Torr or "11D" with a trip point set to atmospheric pressure (000). This switch would trip whenever the measured pressure reached atmospheric pressure.

Chapter Four: Operation

How To Use the Pressure Switch

There are no user adjustments on the pressure switch.

1. Connect the relay outputs.
2. Connect power to the switch.
3. Apply power to the switch.

Caution  **The trip point value is NOT ADJUSTABLE. Before operating the switch, ensure that the range of pressure for the system is appropriate for the particular 41/42/51/52 switch.**

4. Allow at least 15 minutes for the pressure switch to warm up.

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Chapter Five: Maintenance

General

The 41/42/51/52 pressure switch requires no regular maintenance. However, periodically check for wear on the cables and inspect the enclosure for visible signs of damage.

Repair

Should you encounter difficulty using the 41/42/51/52 switch, 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 free of harmful, corrosive, radioactive, or toxic materials.**

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Appendix A: Product Specifications

Performance Specifications

Accuracy (of trip point)[1]	±0.5% of Full Scale + temperature coefficient
CE Compliance[2] Electromagnetic Compatibility	EMC Directive 89/336/EEC
Leak Integrity (internal to external)	$< 10^{-9}$ scc/sec He
Relay Rating	0.1 to 1.0 Amp resistive @ 30 VDC
Temperature Coefficient	±0.07% of Full Scale/° C
Time Response	≤ 20 milliseconds
Trip Point Deadband	3% of Full Scale
Trip Point Value	User defined; set at the factory (not adjustable)

[1] Includes non-repeatability, noise, humidity effects, and resolution.

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

Physical Specifications

Burst Pressure	10 times full scale or 90 psia, whichever is greater
Connector	9-pin Type “D” or flying leads
Description	
41	Single-Ended gage unit
42	Flow-Through gage unit
51	Single-Ended absolute unit
52	Flow-Through absolute unit
Dimensions	
Flow-Through	1.5” diameter (2.25 port to port) x 2.45” to centerline of ports 38.1 mm diameter (57.2 mm port to port) x 62.2 mm
Single-Ended	1.5” diameter x 2.20” (excluding port) 38.1 mm diameter x 55.9 mm
Fittings	
Flow-Through	4-VCR, fixed male
Single-Ended	4-VCR, fixed male, ¼” NPT, ⅛” NPT, NW-16-KF
Full Scale Ranges	
41 Single-Ended Gage	10 through 25000 Torr (500 psi)
42 Flow-Through Gage	10 through 25000 Torr (500 psi)
51 Single-Ended Absolute	1000 through 25,000 Torr (19.3 through 500 psi)
52 Flow-Through Absolute	1000 through 25,000 Torr (19.3 through 500 psi)
Internal Volume	
Flow-Through	6.6 cc
Single-Ended	3.3 cc
Overpressure (without damage)	45 psia or 2 times the pressure rating (whichever is greater)
Weight	
Flow-Through	12 oz. (0.34 kg)
Single-Ended	10 oz. (0.28 kg)
Wetted Material	825 Incoloy, Inconel® and 316 SST for low range units

Electrical Specifications

Input Power	10 to 20 VDC @ 35 mA maximum or 20 to 30 VDC @ 30 mA maximum
Relay	Single pole, double throw switch, one normally open (NO), one normally closed (NC) form “C” relay
Relay Contact Rating	1.0 A resistive at 30 VDC

Environmental Specifications

Operating Temperature Range	0° to 50° C (32° to 122° F)
Storage Humidity Range	25 to 70% relative humidity, non-condensing
Storage Temperature Range	-20° to +80° C (-4° to 176° F)

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

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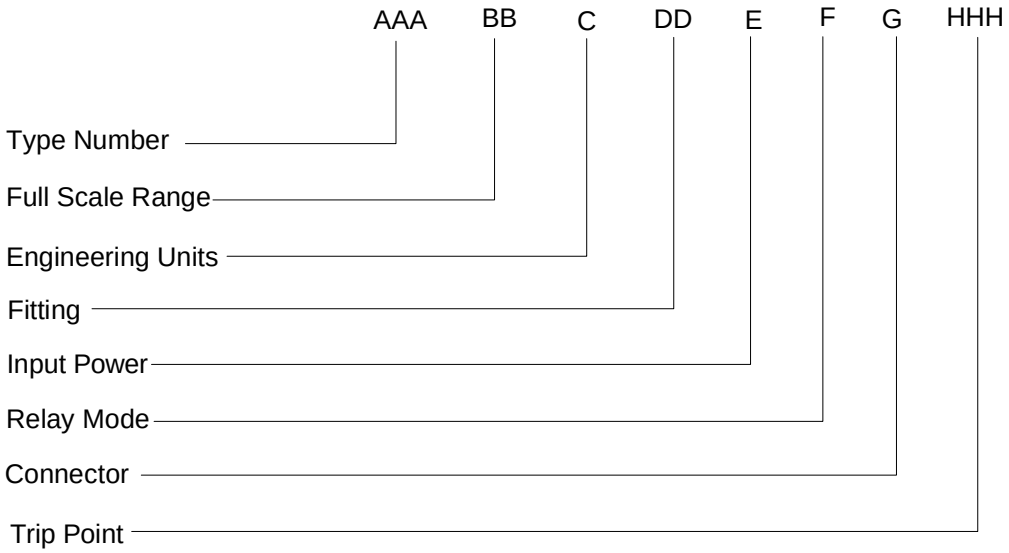
Appendix B: Model Code Explanation

Model Code

The options of your 41/42/51/52 switch are identified in the model code when you order the unit. The model code is identified as follows:

AAA BB C DD E F G HHH

where:



Type Number (AAA)

This designates the model number of the instrument.

Type Number and Description	Ordering Code
41A Single-Ended Gage Unit	41A
42A Flow-Through Gage Unit	42A
51A Single-Ended Absolute Unit	51A
52A Flow-Through Absolute Unit	52A

Full Scale Range and Units (BB and C)

The full scale range is indicated by a two digit code (BB) and the engineering units have a one letter code (C). Consult Applications Engineering for other engineering units.

Full Scale Ranges		
Value	**Comments**	**Ordering Code**
10 Torr	Type 41/51 only	11T
30 Torr	Type 41/51 only	31T
100 Torr	Type 41/51 only	12T
500 Torr	Type 41/51 only	52T
1000 Torr (19.3 psi)		13T
20 psi		21P
50 psi (2585 psi)		51P
100 psi		12P
250 psi		RDP
500 psi		52P

Examples: The designation of a full scale range of 100 Torr is “12T”; 500 Torr is “52T”; 1000 Torr is “13T”; and 100 psi is “12P.”

Full Scale Range for Reverse Calibration Only (Types 41 and 42 only)		
Value	**Comments**	**Ordering Code**
10 Torr	Type 41 only	11D
30 Torr	Type 41 only	31D
100 Torr	Type 41 only	12D
500 Torr	Type 41 only	52D
1000 Torr		13D
20 psi		21P
50 psi		51C
100 psi		12C
250 psi		RDC
500 psi		52C

Examples: The designation of a full scale range reverse calibration unit of 100 Torr is “12D”; 500 Torr is “52D”; 1000 Torr is “13D”; and 100 psi is “12C.”

Fittings (DD)

Four types of fittings are available, designated by a two letter code.

Single Ended Fitting Options (Type 41/51)	**Ordering Code**
Swagelok 4-VCR fixed male	CA
NW-16-KF (1200 Torr maximum)	GA
1/8" NPT, male	FE
¼" NPT, male	FB
Flow-Through Fitting Option (Type 42/52)	**Ordering Code**
Swagelok 4-VCR fixed male	CH

Input Power (E)

The input/output power is designated by a single number code.

Input Power	**Ordering Code**
10 to 20 VDC	1
20 to 30 VDC	2

Relay Mode (F)

The relay mode (whether the relay is energized when the pressure rises above or drops below the trip point value) is specified by a single letter code (F).

Trip Point Direction	**Ordering Code**
Energize when pressure rises above the trip point	A
Energize when pressure drops below the trip point	B

Connector (G)

Two types of connectors are available, indicated by a single letter code.

Connector	**Ordering Code**
9-pin male Type "D"	A
Flying Leads	F

Trip Point Value (HHH)

The trip point value is designated by a three digit code. The trip point must be designated in the same pressure units as the full scale range. For example, a 1000 Torr full scale unit with a trip point of "760" indicates the standard atmospheric pressure of 760 Torr. For a 100 Torr unit, with a 50 Torr trip point, enter "050." For reverse calibration, list the trip point as a value below atmosphere. Consult the factory if your trip point cannot be specified by three digits.

Trip Point Value	**Ordering Code**
Three digit value (001 through 999) ***exception***: 1000 Torr = 1KT	3 digit value

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