MPS4164/ MPS4164TCU

Miniature Analog Pressure Scanner

FEATURES

- New valve design provides „isolate-purge“
- On board sensor excitation
- 40kHz data output
- Double-isolated, ultra-stable pressure sensors
- Direct legacy compatibility with ZOC series scanners
- Removable input headers
- Upgradable to Ethernet MPS4264 standard

The MPS4164 analog miniature pressure scanner is an extremely compact 64 channel pressure scanner. It has been designed from the ground up with size, accuracy and functionality in mind. Each MPS4164 module incorporates 64 individual silicon pressure sensors, calibration valving, a high-speed multiplexer (45kHz) and an instrumentation amplifier. Simply, it accepts up to 64 individual pneumatic pressure inputs and converts them to high level electronic signals. It boasts a small footprint, a rugged isolate-purge calibration valve, extremely stable and repeatable pressure sensors and a wealth of other innovative features.

The MPS4164 is designed around a core sensor pack that uses a custom packaged, ultra-stable sensor. Scanivalve engineers evaluated known causes of non-repeatability in piezoresistive pressure transducers. Designing a double isolation method of bonding the sensors to the base substrates (patent pending) minimizes the mechanical influences of assembly and thermal expansion. This process dramatically improves the stability and the resulting accuracy of the sensors.

A brand new valve has been designed that fully isolates the sensors from purge pressure and provides long term, maintenance free operation. Not only is the valve design an improvement over legacy products, but two different valve actuation options are available. The „standard“ (CPx) actuation uses opposing 65psi control pressures to shift the valve into whichever state is desired. The new „Normal Px“ (NPx) option uses a spring to default the valve into measurement mode and 120psi to shift it into calibrate mode.

APPLICATIONS

The MPS4164 electronic pressure scanning module is specifically designed for use in wind tunnel and flight tests where operational conditions are very space constrained and pressures do not exceed 50 psi. It is ideal for use inside small supersonic wind tunnel models.

The very low pressure ranges offered and small size also make it an ideal fit for wind engineering applications where the measurement pressures are very low. In high channel count systems, the lower cost-per channel makes it an affordable solution.

It may be mounted in any position so the pressure sensors may be close coupled to the pressure sources to be measured. Removable headers allow for easy installation and removal without breaking the pneumatic lines.

The MPS4164 module is designed to be used in conjunction with Scanivalve model ERAD4000 Re-mote A/D or model DSM4000 Digital Service Mod-ule. Each MPS4164 pressure scanner incorporates an embedded RTD to monitor the temperature of the pressure sensors. The ERAD4000 communicates via Ethernet. The DSM4000 communicates via Ethernet, RS-232, or ARINC 429.

ISO 9001:2015 CERTIFIED
### LEGACY COMPATIBILITY

The MPS4164 was designed specifically to replace the legacy ZOC series of pressure scanners. This MPS can directly replace a ZOC33 64-channel analog scanner. It can be a drop-in replacement for the ZOC33 or can be used to expand an existing ZOC33 system.

The electrical interface of the MPS4164 is exactly the same as a ZOC scanner. The electrical connector is the same meaning it operates using existing cabling and hardware infrastructure. Firmware in the DSM4000 and the ERAD4000 can be easily field-updated to support the MPS4164*. An integrated TEDs ID chip in the MPS4164 supports automatic system configuration at system power-up.

The pneumatic interface and valve logic of the MPS4164 is also the same as a ZOC scanner. In the „CPx“ configuration, the MPS4164 operates 65psi control pressures with the same control logic as a ZOC33. This allows single logic operation in mixed ZOC/MPS4164 system.

While directly legacy compatible with the ZOC scanners, the MPS4164 offers many feature upgrades. Overall sensor performance is improved, the operating temperature is extended, the scanner is physically smaller and the MPS valve includes full „isolate-purge“ functionality.

*DSM4000 firmware V2.16 and ERAD4000 firmware V2.19 and later fully support MPS4164

### IMPROVED SENSORS, IMPROVED ACCURACY

The primary focus of the MPS4164 was to improve the unit’s overall accuracy across the entire temperature range. Scanivalve worked directly with a leading sensor designer to create a custom sensor package specifically for the MPS series of scanners. This design uses two layers of RTV to isolate the pressure sensor from mechanical influences like those caused by thermal expansion or assembly. Piezoresistive sensors also change greatly in span and zero over temperature so we placed eight individual RTDs in very close proximity to the sensors. Combined with the design placing the sensors in an aluminum housing in the center of the module to prevent rapid temperature changes, these RTDs allow us to accurately correct for any change in the sensor’s behavior due to temperature.
### PNEUMATIC CALIBRATION VALVE

The valve design is a sliding-type valve. An aluminum shuttle, populated with self-lubricating O-rings cycles back and forth between two positions to achieve each of the pneumatic states. The“bearing plate” between the sliding O-rings and the aluminum stationary portion of the valve is a proprietary compound that is extremely low friction. The O-rings are supported completely to prevent any deformation during a state change. The valve shuttle is supported on ball bearings to provide minimal friction and maximum support. This design allows for low actuation force and minimal “stiction”- meaning the actuation force does not noticeably increase after long periods of dormancy. Samples of the valve design were tested to over 1,000,000 cycles without maintenance.

Existing pressure scanners require outside pneumatic pressure as a force to switch the valve logic. In most applications, this “control pressure” must be continuously supplied to the scanner to maintain the desired valve state. The MPS4164 offers a unique option with a valve that defaults to the “measurement” mode, allowing sample pressures to be read without any outside pneumatic control pressure. This option, called “Normal Px,” is another way the MPS4164 simplifies system architecture.

An optical valve position sensor has been integrated allowing the valve state to be queried with a simple software command.

### EXAMPLE WIND TUNNEL SYSTEM ARCHITECTURE

Shown using ERAD4000 mounted in the test article. Alternate system configuration uses DSM4000 installed under the test section or in the control room.
### SPECIFICATIONS (FOR MPS4164 VERSION)

**Inputs (Px):**
- 0.042” [1.067mm] OD (standard)
- 0.031” [0.787mm] OD (optional)

**Inputs (Cal, Ref, CTL, Prg):**
- 0.063” [1.600mm] OD

**Full Scale Ranges:**
- 4 inH₂O, 8 inH₂O, 1psid, 5psid, 15psid
  - [995.4Pa, 1990.7Pa, 6.89kPa, 34.5kPa, 103.4kPa]

**Accuracy:**
- 4 inH₂O: 0.20%FS
- 8 inH₂O: 0.15%FS
- 1psid: 0.08%FS
- 5psid: 0.08%FS
- 15psid: 0.08%FS

**Overpressure Capability:**
- 4 inH₂O: 25x
- 8 inH₂O: 15x
- 1psid: 10x
- 5psid: 10x
- 15psid: 5x

**Media Compatibility:**
- Gases compatible with silicon, silicone, aluminum, and Buna-N

**Maximum Reference Pressure:** 50 psig (345kPa)

**Maximum Environment Pressure:** 100 psia (690kPa absolute)

**Minimum Environment Pressure:** 0.5 psia (3.45kPa absolute)

**Shock & Vibration:** MIL-STD-810G, Category 24

**Scan Rate:** 40kHz (standalone)

**Power Requirements:**
- +15Vdc @ 120mA
- -15Vdc @ 30mA

**Control Pressure Requirements:**
- 65psi (CPx)
- 120psi (NPx)

**Electrical Connector:** 15 pin MDM 15SL2P

**Weight:** 6.59oz [186.9g]

**Operating Temperature:** 0°C to 70°C

**Storage Temperature:** 0°C to 80°C

### DIMENSIONS (FOR MPS4164 VERSION) INCHES [mm]

[Diagram of specifications and dimensions]

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The information provided herein is to the best of our knowledge true and accurate, it is provided for guidance only. All specifications are subject to change without prior notification.

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MPS4164TCU
Thermal Control Unit

**FEATURES**

- Maintains a stable temperature environment for MPS4164 series analog pressure scanners
- For use with MPS4164/64CPx and MPS4164/64NPx models
- Quick disconnects for electrical and pneumatic I/O
- Rugged IP-54 rated aluminum case

The MPS (Miniature Pressure Scanner) line of Thermal Control Units is designed to provide a controlled temperature environment for MPS4164 series electronic pressure scanners. The MPS4164 pressure scanners incorporate temperature compensated piezoresistive pressure sensors which must remain in a controlled temperature environment to provide the most accurate pressure measurement. All MPS4164TCU’s include a rugged anodized aluminum enclosure, pneumatic connectors, mating pneumatic connector, a single electrical/data connector, and breakout cable with flying leads.

The MPS4164TCU offers an optional heater circuit for use in environments as cold as -60°C. This heater circuit utilizes two 20 watt heaters to keep the MPS4164 scanner within its temperature compensated range (0-70°C). Exceeding the compensated temperature range can induce errors in the pressure measurements.

For higher temperature applications (60-125°C) the Cooling Kit variant of the MPS4164TCU is required. The cooling kit variant contains the same heater circuit as the heater only MPS4164TCU variant. With the addition of the cooling kit, the MPS4164TCU can keep the MPS in the compensated range while the environmental temperatures range from -60°C to 125°C. Approximately 3.0 CFM of 23°C cooling air is required to properly cool the MPS while subject to the 125°C environment.

The electrical connector is a 19 contact Bendix PT series connector which provides module power, heater power, and analog addressing. The pneumatic connector is a Scanivalve 70MPS series connector. These features make for easy use and adaptability when implementing the MPS4164TCU into a complex system.

**APPLICATIONS**

Thermal Control Units are most commonly utilized in flight test, automotive, wind turbine, wind tunnel, and engine test applications where temperatures tend to vary and are often extreme.

Thermal Control Units may also be used anywhere a stable temperature environment is not available for MPS pressure scanners. Although the environmental temperatures are within the compensated range of the scanner, a Thermal Control Unit can be used to improve measurement accuracy and limit any effects from temperature.

Thermal Control Units also provide a ruggedized enclosure to protect the scanner’s components from moisture, dust, debris, and other contaminants that could harm the scanner.
SPECIFICATIONS

**Mechanical Capacity:**
MPS4164/64CPx
MPS4164/64NPx

**Case Material:**
6063 Anodized Aluminum

**Operating Temperature Range:**
-60°C to +125°C*

**Pneumatic I/O:**
70 Port connector with 0.063" tubulations (standard)
or 70 Port connector with 0.040" tubulations** (optional)

**Electrical I/O:**
PT06A-14-19P

**Heater Rating:**
Two 20 watt heaters

**Power Required:**
Without heater: ±15Vdc @120mA
With heater option: 20-30Vdc, 45W

**Cooling Air Required (125°C Environment):** 3.0 CFM

**Temperature Sense:** 4 wire RTD

**Mounting Position:** Any

**Ingress Protection:** IP-54 rating

**Shock and Vibration:** MIL-STD-810G Category 24

**Weight:**
(Including MPS Scanner and connector)
MPS4164TCU-1 1.97 lbs (.89 kg)
MPS4164TCU-2 1.77 lbs (.80 kg)
MPS4164TCU-3 1.62 lbs (.73 kg)

**Minimum Environmental Pressure:**
MPS4164TCU 0.5psia

ORDERING INFORMATION

MPS4164TCU-X
Where X is:
-1 MPS4164TCU with Cooling Kit and Heater
-2 MPS4164TCU with Heater Only
-3 MPS4164TCU no Heater or Cooling Kit

*Scanivalve recommends use of the MPS4164TCU with Cooling Kit in environments above 60°C. 3.0 CFM of 23°C cooling air is required at 125°C.
**Px inputs are 0.040” tubulations. CAL, REF, CALCTL, PXCTRL and PURGE are 0.063” tubulations

DIMENSIONS INCHES [mm]