



M9100 PRESSURE TRANSDUCER

- **Microfused Technology**
- **One-piece stainless steel pressure port**
- **Low profile package**
- **Enhanced EMC/RFI rejection**
- **Reverse polarity protected**
- **Rugged connector**

Features

- Pressure ranges to 700bar (10,000 psi)
- -40°C to +125°C operating temperature
- $\pm 0.25\%$ accuracy (FSO)
- $\pm 2\%$ total error band
- 5X rated burst pressure
- ISO11452 compliant EMC performance
- Optional snubber

Applications

- Hydraulic systems
- Construction vehicles and equipment
- Agricultural vehicles & machines
- Hydrostatic transmissions
- Hydrostatic brakes
- Hydraulic cylinders
- Lift equipment
- Compressed gas storage

TE Connectivity's (TE) M9100 hydraulic transducer measures fluid pressures up to 700 bar in extreme conditions. Based on strain gage technology, the sensor provides durability and excellent performance in the presence of high temperatures and high levels of vibrations. An innovative snubber design ensures durability against pressure spikes and is available with select standard configurations. With its simple design the M9100 is less prone to errors and maintenance is reduced to a minimum. The robust package ensures reliable sensor operation while submerged in water or in contact with harsh media.

System design-in is eased by the excellent EMI/EMC performance of the M9100. The sensor withstands nearby electrical noise and can be installed next to EMI emitting components. Furthermore, a high level of electrical protection to the power supply makes the sensor more robust to poor power supply control and reduces the risk of system issues.

With a 27 mm hex and low vertical profile (down to 50 mm), the M9100 hydraulic transducer is designed for durable connection systems by including a TE Deutsch DT type connector. The transducer ensures performance in the extreme conditions found in the hydraulic systems that are part of off-road vehicles, construction, and industrial equipment.

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Absolute Maximum Ratings⁽¹⁾

| Parameter | Symbol | Min | Typ | Max | Units | Notes/Conditions |
|--------------------------|--------------------|-----|-----|---------|-------|---|
| Supply voltage | V _{dd} | | | 28 | V | |
| Reverse voltage | | | | 16 | V | |
| Output short circuit | | | | | | |
| Storage temperature | T _s | -50 | | 140 | °C | |
| Applied Pressure (proof) | P _{proof} | | | 2X | Rated | |
| Applied Pressure (burst) | P _{burst} | | | 5X | Rated | Or 20kpsi (1379 bar), whichever is less |
| ESD | | | | 8 15 | kV | ISO10605 (contact) ISO10605 (air) |

⁽¹⁾Maximum limits the device will withstand without change to performance or physical damage

Standard Pressure Ranges (gauge)

| PSI | Bar |
|--------|-----|
| 500 | 40 |
| 1000 | 50 |
| 1500 | 100 |
| 3000 | 200 |
| 5000 | 400 |
| 7500 | 500 |
| 10,000 | 700 |

Electrical Specifications

(Unless otherwise specified, all parameters are measured at 25°C @ 5.0V applied)

| Parameter | Symbol | Min | Typ | Max | Units | Notes/Conditions |
|---------------------------------------|-----------------|------|-----|------|-------|------------------|
| Supply voltage (V _{supply}) | V _{dd} | 4.75 | | 5.25 | V | |
| Operating current | I _{dd} | 4.0 | | 10.0 | mA | |
| Output rise time | T _r | | 1.0 | | ms | 10% to 90% |
| Output load resistance | R _o | 5000 | | | Ω | |
| Insulation resistance ⁽¹⁾ | | 10 | | | MΩ | @500VDC |
| Bandwidth | | | 1.0 | | kHz | |

⁽¹⁾Between sensor body and any pin in the connector

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Operating Specifications

(Unless otherwise specified, all parameters are measured at 25°C @ 5.0V applied)

| Parameter | Symbol | Min | Typ | Max | Units | Notes/Conditions |
|---------------------------------|--------|-------|-----|--------------|-------|--------------------------------|
| Full scale span ⁽¹⁾ | | 0.5 | | 4.5 | V | Ratiometric to V _{dd} |
| Accuracy ⁽²⁾ | | -0.25 | | 0.25 | %Span | BFSL |
| Total error band ⁽³⁾ | TEB | | | ±1.0 ±2.0 | %Span | 0 to 100°C <0°C or >100°C |
| Cycle life | | 10M | | | | 0 to full scale cycles |
| Long term stability | | -0.25 | | +0.25 | %Span | per year |
| Weight | | | 56 | | grams | |

⁽¹⁾Span is ratiometric to power supply voltage. Output saturation is 4.7V (high) and 0.3V (low)

⁽²⁾Combined linearity, hysteresis, repeatability

⁽³⁾Total error band (TEB) includes accuracy, thermal, span, and zero errors over compensated temperature range

Environmental Specifications

(Unless otherwise specified, all parameters are measured at 25°C @ 5.0V applied)

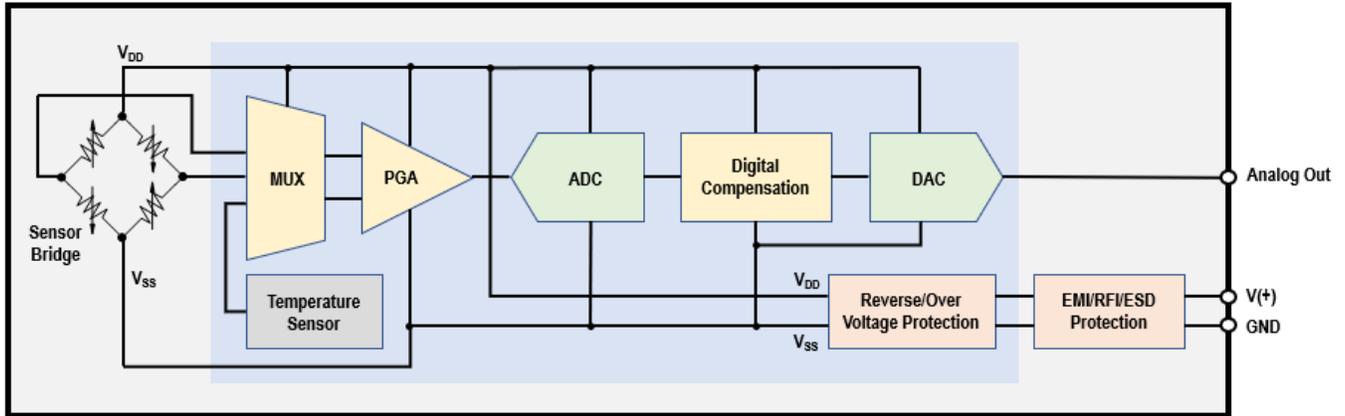
| Parameter | Symbol | Min | Typ | Max | Units | Notes/Conditions |
|-----------------------------|----------------|---|-----|-----|-------|------------------|
| Operating temperature range | T _o | -40 | | 125 | °C | |
| Storage temperature | T _s | -50 | | 140 | °C | |
| Ambient humidity | | 0 | | 95 | %RH | Non-condensing |
| Ingress protection | IP | IP69/IP6K9K | | | | ISO 20653 |
| Media compatibility | | Wetted surface and snubber are 17-4PH stainless steel Hex area is 304 stainless steel. Connector housing is Polyetherimide (PEI) | | | | |

Agency Certifications and Approvals

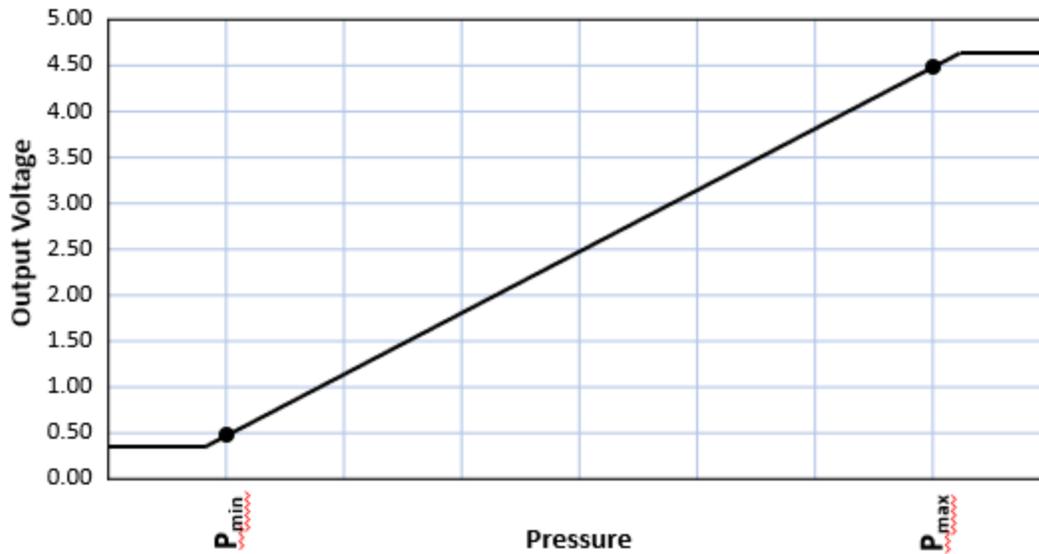
| Evaluation Parameter | Reference Standard |
|--|--|
| RoHS | RoHS 2 Compliant (Directive 2011/65/EU) |
| Conducted RF emission – voltage method | CISPR 25, Edition 03 0.15 – 108MHz, Class 5 |
| Conducted transient susceptibility on signal leads | ISO 7637-3 CCC Method: ±200V ICC Method: Level IV (±6V) |
| Radiated emission – component ALSE method | CISPR 25, Edition 03 150kHz – 3.0GHz, Class 5 |
| Radiated susceptibility | ISO 11452-2 200 – 3000MHz, Level IV, 100V/m |
| BCI | ISO 11452-4 90kHz – 400MHz, Level IV, 200mA |
| Immunity to electrostatic discharge | ISO 10605 8kV Direct/15kV Air Discharge |
| Low frequency magnetic fields | ISO 11452-8 0 Hz (DC): 25MT 15Hz – 150kHz, Level IV 1000A/m |

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Block Diagram



Pressure Transfer Function

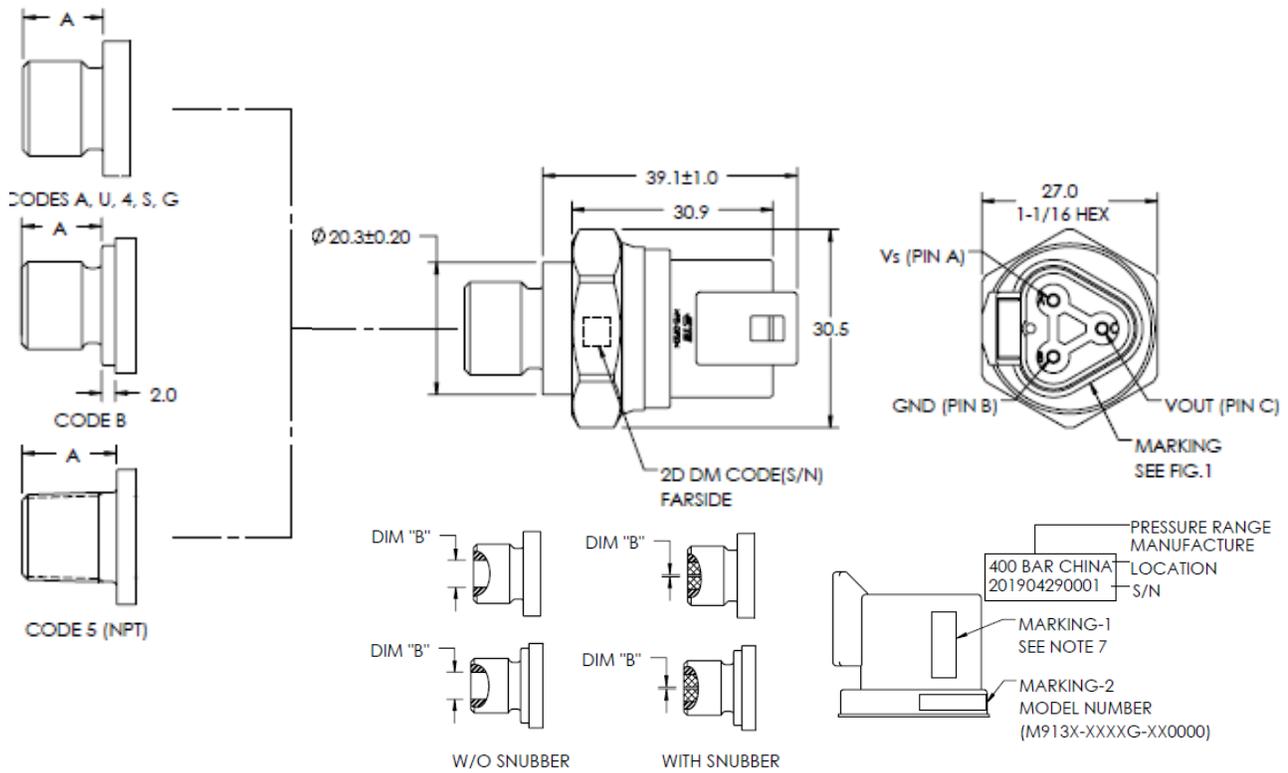


$$V_{out} = \left[\frac{0.8}{(P_{max} - P_{min})} \times (P_{app} - P_{min}) + 0.1 \right] \times V_{dd}$$

- V_{out} - Output Voltage
- P_{max} - Maximum Rated Pressure
- P_{min} - Minimum Rated Pressure
- P_{app} - Applied Pressure
- V_{dd} - Power Supply Voltage

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Outline Drawing and Connections



Snubber Option

Marking Detail

Pressure Port Details

| Code | Port | | Dim "A" (mm) | Mating Geometry | Torque (N-m) | Snubber Option | DIM "B" (mm) | |
|------|-------------|-----------------|--------------|------------------|-------------------------|----------------|--------------|---------|
| | | | | | | | No Snubber | Snubber |
| A | 9/16-18 UNF | SAE J1926-2 | 12.0 | SAE J1926-1 | 30-35 | Yes | 6.6 | 0.5 |
| 4 | 7/16-20 UNF | | 11.0 | | 15-20 | No | 4.5 | - |
| B | G1/4 | JIS B2351 | 12.0 | JIS B2351 Type O | 30-35 | Yes | 6.6 | 0.5 |
| U | G1/4 | DIN 3852-E | 12.0 | DIN 3852-2 | 30-35 | No | 4.5 | - |
| S | M12x1.5 | ISO 6149-2 | 11.0 | ISO 6192-1 | 25-30 | No | 4.5 | - |
| G | M14x1.5 | | 11.0 | | 30-35 | No | 4.5 | - |
| 5 | 1/4-18 NPT | SAE J514 140139 | 14.2 | SAE J514 140139 | 2-3 TFFT ⁽¹⁾ | No | 4.5 | - |

⁽¹⁾TFFT – Turns From Finger Tight

Connector Details

| Sensor Connector | Mating Connector | Sensor Contact Plating |
|------------------|------------------|------------------------------|
| DT04-3P | DT06-3S | 0.4 μm Au over 1.3-3.0 μm Ni |

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Harsh Environment Protections and Fault Diagnostics

The M9100 pressure transducer can be exposed to a variety of aggressive environments and conditions in normal operation and is designed to survive them without affecting the sensor performance. M9100 physical protective features include:

- **17-4PH stainless steel pressure port and 304 stainless hex area** – Protects against hostile/corrosive media, and chemical attacks from the environment.
- **Polyetherimide connector housing** – Thermoplastic that is compatible with many hydraulic and environmental fluids and has excellent high temperature performance.
- **IP69/IP6K9K design and construction** – The transducer resists dust, dirt, sand, debris, resistant to submersion up to a maximum depth of 1.5m underwater for a period of up to thirty minutes and resists high pressure wash and steam.
- **Sealed Connectors** – TE Deutsch connector options are designed for harsh environments and meets IP68 and IP6K9K certifications.
- **Snubber** – Restricts the magnitude of pressure spikes present in some hydraulic systems (optional for some port versions).

The M9100 is also designed to withstand unusual electrical anomalies that may occur. These protective features include:

- **Power supply overvoltage** – The transducer is designed to operate from a 5 VDC power source but will survive an overvoltage of up to 28 VDC without damage.
- **Reverse polarity protection** – The transducer will survive reversed power supply voltages up to 16 VDC without damage.
- **Shorted analog output** – The transducer output can be shorted to either V(+) or GND for an indefinite period of time without damage.

The transducer electronics is designed with fault detection and diagnostic features. A fault is indicated when the analog output goes to either 0.0V or becomes a high impedance output. Both results are outside of the normal expected output from the sensor (0.5 – 4.5V) and can be easily detected by the application electronics. In some cases, the fault can be cleared by removing and re-applying power to the transducer. If this doesn't clear the fault, the transducer should be replaced. Faulty transducers cannot be repaired in the field. Table below shows the faults and the analog output level they generate.

Diagnostic Faults

| Fault | Description | Sensor output |
|-------------------|---|---------------------------------|
| Overvoltage | Power supply voltage exceeds operating limit | High impedance |
| Reverse voltage | Power supply connections reversed | High impedance |
| Output shorted | Output line shorted to Vdd or GND | Voltage of the short connection |
| V(+) loss | (+) power line disconnected | 0.0V |
| GND loss | (-) or ground line disconnected | 0.0V |
| Application fault | Failure of the MEMS sense element | 0.0V |
| Firmware fault | Errors in code driving internal digital functions | 0.0V |
| Hardware fault | Mechanical failure of the ASIC chip or wiring | 0.0V |

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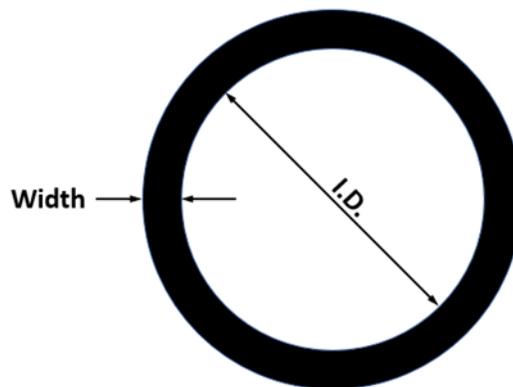
Installation Instructions and Cautions

Proper installation and operation will be achieved when these guidelines are followed:

- Ensure the sensor is properly aligned to the mating threaded port before engaging. Off-axis alignment could result in cross threading and damage to the sensor as it's rotated into the port.
- Transducers can be installed by either spanner wrench or deep socket. Torque values provided are for reference only. Actual torque depends on mating port material, surface finish, lubrication, and sealing mechanism. Calibration and/or zero point may shift if the sensor is over-torqued. Check for zero shift after installation.
- Do not apply torque to the connector housing or back end area of the transducer.
- To ensure proper environmental sealing and electrical connections when using a mating connector, follow the manufacturer's installation guidelines.
- Some versions of the M9100 use an o-ring to seal the port. Ensure an o-ring of proper dimensions is used. Attach the o-ring carefully to avoid cuts in the o-ring material from contact with the threads. Installation tools are commercially available to help avoid o-ring damage.

O-Ring Details

| Port Type | Applicable Standard | Reference Dimensions (mm) | |
|-------------|---------------------|---------------------------|-------|
| | | I.D. | Width |
| 9/16-18 UNF | SAE J1926-2 | 11.9 | 1.98 |
| 7/16-20 UNF | SAE J1926-2 | 8.92 | 1.83 |
| G1/4 (JIS) | JIS B2351 | 10.8 | 2.4 |
| G1/4 (DIN) | DIN 3852-E | 10.8 | 2.4 |
| M12x1.5 | ISO 6149-2 | 9.3 | 2.2 |
| M14x1.5 | ISO 6149-2 | 11.3 | 2.2 |



O-ring Dimensions

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Ordering Information

Part Number
M91 x x – 0000 G – x x0000

Output Signal

| Code | Output |
|------|-------------|
| 3 | 0.5 to 4.5V |

Connector

| Code | Type |
|------|-----------------|
| A | DT04-3P W/O Key |

Pressure Range

| PSI | BAR |
|------|------|
| 500P | 040B |
| 01KP | 050B |
| 1K5P | 100B |
| 03KP | 200B |
| 05KP | 400B |
| 7K5P | 500B |
| 10KP | 700B |

Pressure Type

| | |
|---|-------|
| G | Gauge |
|---|-------|

Port Material

| | |
|---|------------------|
| 0 | 17-4PH Stainless |
| 1 | 17-4PH w/snubber |

Pressure Port

| Code | Type |
|------|----------------------------------|
| A | 9/16-18 UNF, SAE J1926-2, Male |
| 4 | 7/16-20 UNF, SAE J1926-2, Male |
| B | G1/4, JIS B2351, Male |
| U | G1/4, DIN 3852-E, Male |
| S | M12x1.5, ISO 6149-2, Male |
| G | M14x1.5, ISO 6149-2, Male |
| 5 | 1/4-18 NPT SAE J514 140139, Male |

Pressure range and pressure port can be configured for custom OEM requirements. Contact factory for details.