M9100
PRESSURE TRANSDUCER

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

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.

Features

- Pressure ranges to 700bar (10,000 psi)
- -40°C to +125°C operating temperature
- ±0.25% accuracy (FSO)
- ±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

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

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

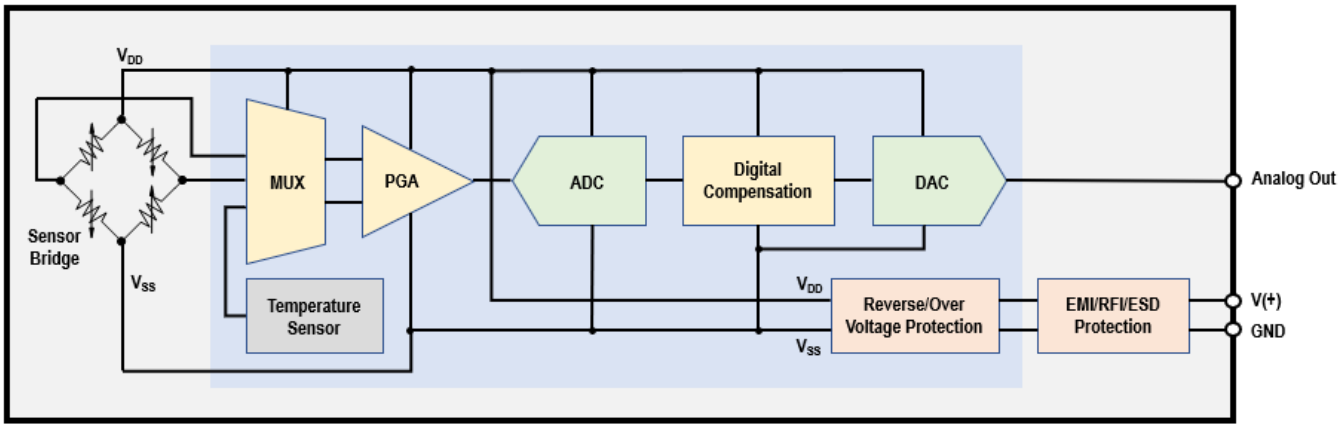
(Unless otherwise specified, all parameters are measured at 25°C @ 5.0V applied)

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)				

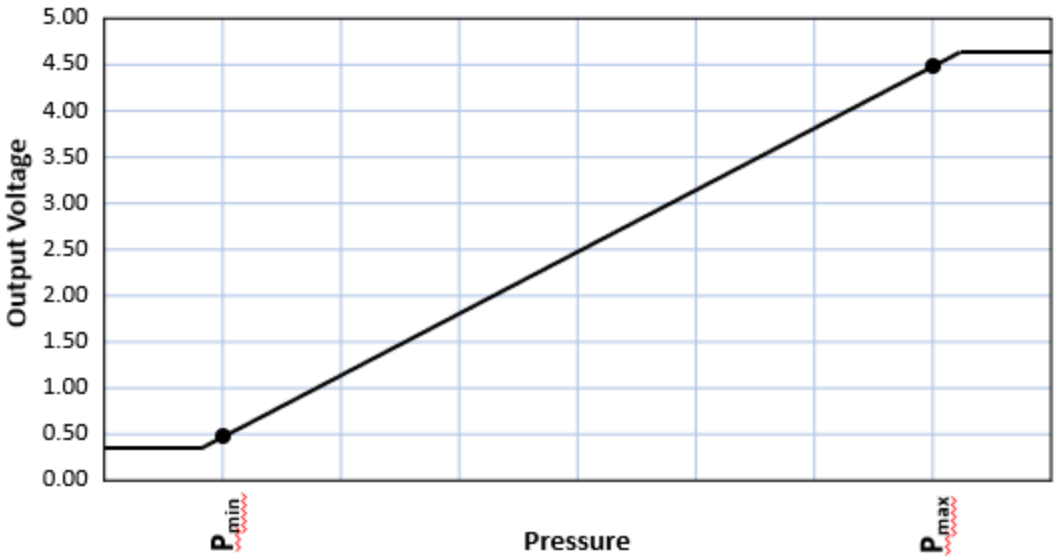
Agency Certifications and Approvals

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

Block Diagram



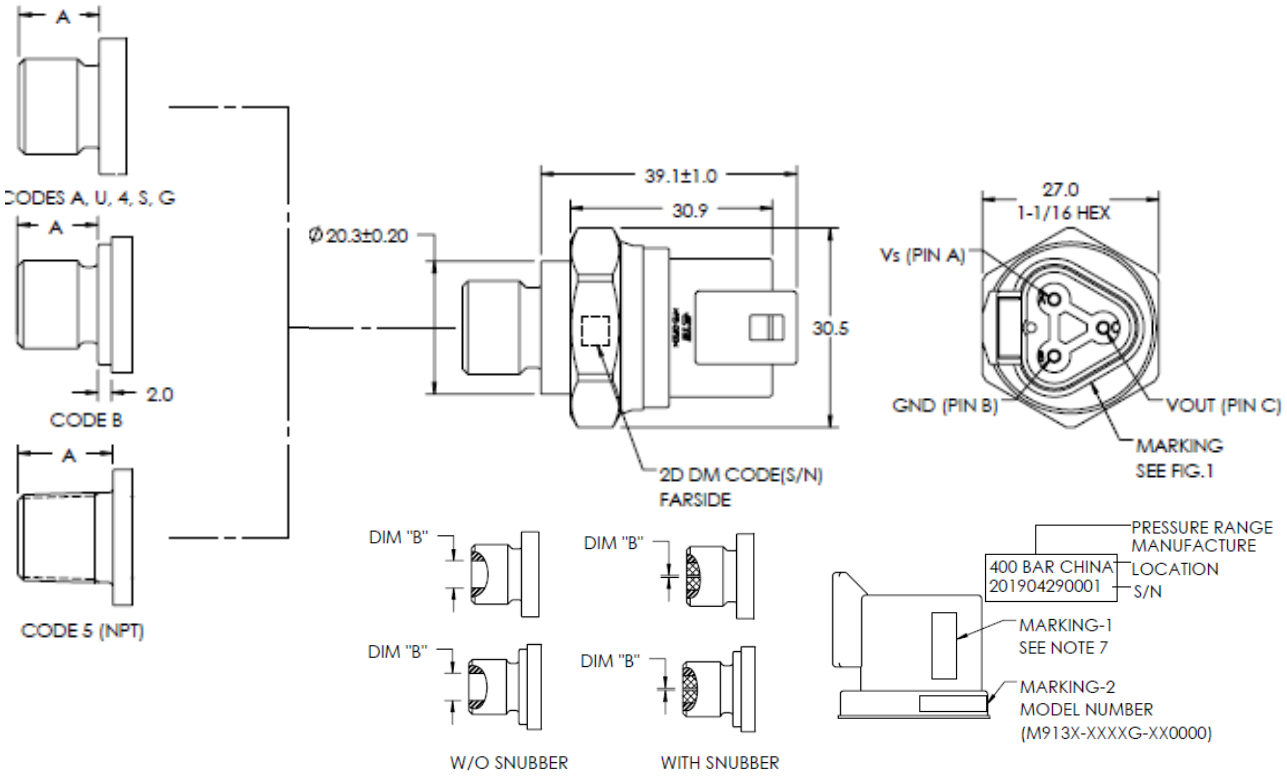
Pressure Transfer Function



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

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

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

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

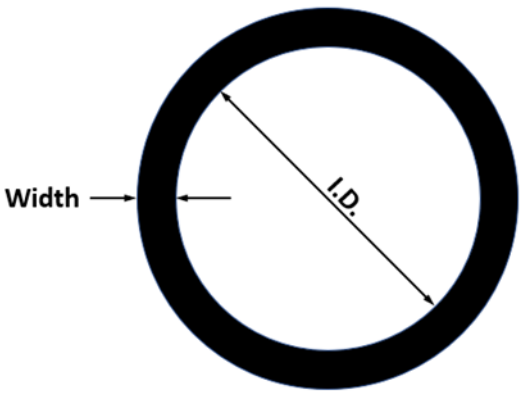
Installation Instructions and Cautions

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

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.