ME78x/MEP78x datasheet

FLUSH DIAPHRAGM, PIEZORESISTIVE CERAMIC PRESSURE TRANSDUCER

Metallux ME78x and MEP78x pressure sensors are made with a ceramic baseplate and a flush diaphragm and they work following the piezoresistive principle. The Wheatstone bridge is screen printed on one side of the flush ceramic diaphragm, which is in turn glued to the sensor's body. The bridge faces the inside where a cavity is made. Signal conditioning electronics is directly integrated on the ceramic to generate 0.5...4.5 V ratiometric output (ME780) or I^2C output with pressure and temperature information (ME782). Calibration performed electronically with the on-board ASIC and it can be performed in bar (ME78x) or in psi (MEP78x).
Electronics provides offset and span correction when the temperature changes. Zero correction software to compensate offset shift due to final customer assembly available on request. This allows good precision and long-term stability.
The Metallux ME78x family meets EMC requirements. The ASIC EEPROM stores production lot specific data for sensor traceability and it allows custom calibration.
Due to the excellent chemical resistance of the Al_2O_3 ceramic, the ME78x sensors are suitable for nearly all aggressive media.
Metallux ME78x are patented sensors.

FEATURES

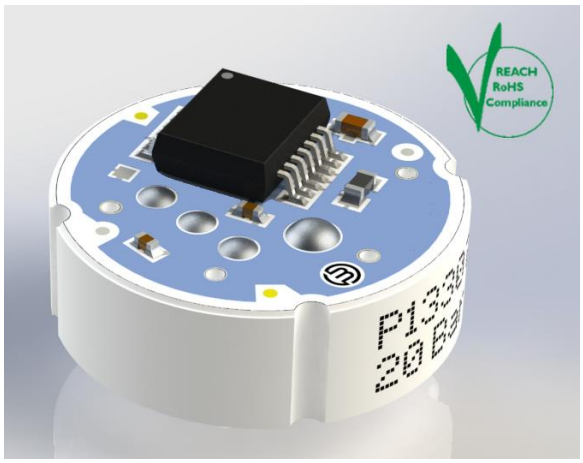
Excellent resistance to corrosion and abrasion

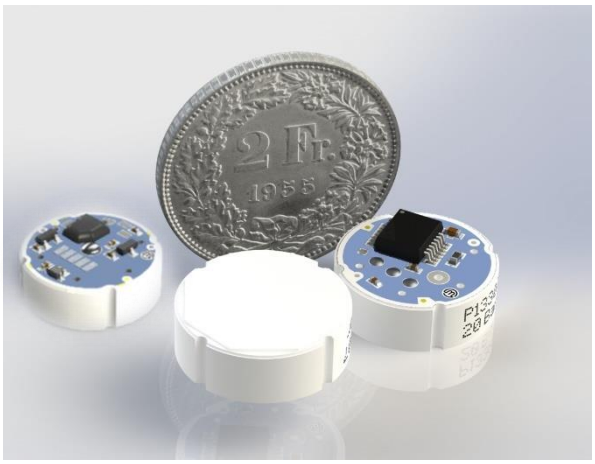
Fully integrated signal conditioning

EMC compliant

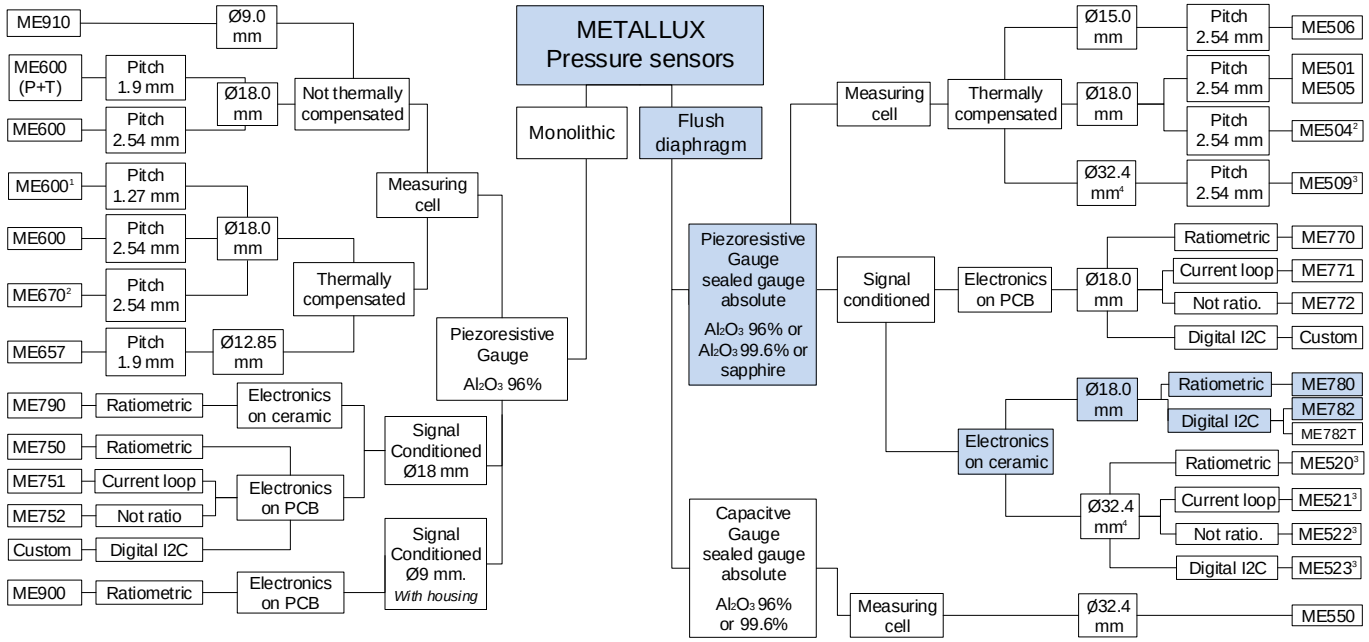
Thermally compensated

Zero stress mounting software





Pressure sensors family tree



[1] Also available in not thermally compensated version
[2] Digitally trimmed offset, also available not thermally compensated
[3] Not available with sapphire diaphragm.
[4] Suitable for low pressure range (≤1 bar)

Technical characteristics

Parameters	Units	ME780	ME782
Output	-	Ratiometric	Digital I²C
Output range	-	0.5...4.5 [V]	Pres: 5...95% of 15bits (output register address: 0x78) Temp: 10...90% of 15 bits (-40...125°C)
Sensor type	-	Flush diaphragm, absolute (A), gauge (R) or sealed gauge (S)	
Technology	-	Piezoresistive with electronic signal conditioning	
Diaph. material	-	Ceramic Al_2O_3 96%, 99.6% or sapphire	
Weight	g	≤ 9 (excluding connections)	
Response time	ms	≤ 5	
Supply voltage	VDC	4.5...5.5	3.3 or 5.0 (depending on calibration settings)
Max current[1]	mA	6 (R_{LOAD} ≥ 2 kΩ)	4.5
Operating temp.	°C	-25...+125 (-13 °F...+257 °F)	-25...+105 (-13 °F...+221 °F)
Storage temp.	°C	-40...+135 (-40 °F...+275 °F)	-40...+125 (-40 °F...+257 °F)
Compliant with	-	Reach, RoHS, Conflict Minerals free	
EMC/ESD[2] compliances	-	Electrostatic discharge immunity IEC/EN61000-4-2(2009) Radiated EM field immunity IEC/EN 61000-4-3(2006) Elect. fast transient (burst) immunity EN 61326-1 (2013) Surge immunity Not applicable Conducted RF immunity IEC/EN 61000-4-6(2014)	Electrostatic discharge immunity IEC/EN61000-4-2(2009) Radiated EM field immunity IEC/EN 61000-4-3(2006) [2] Elect. fast transient (burst) immunity Not applicable [3] Surge immunity Not applicable Conducted RF immunity EN 61326-1 (2013)

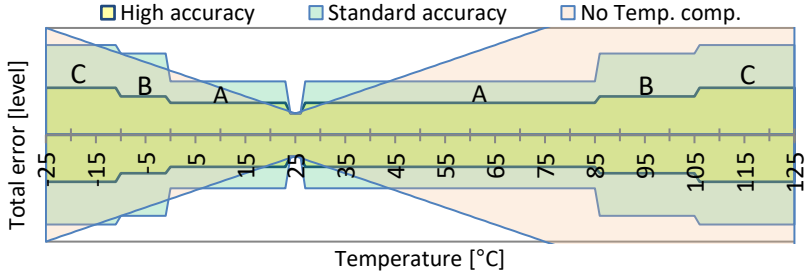
Pressure ranges			ME78x											
Nominal Pressure[4]	ME	bar	0.5	1	2	5	10	20	50	100	200	250	400	600
	MEP	*psi*[4]	*7.5*	*15*	*30*	*100*	*150*	*400*	1000	*1500*	*3000*	*4000*	*5000*	*8500*
Overload pressure		bar	1	2	4	10	15	35	100	150	350	350	500	750
		psi	*15*	*29*	*58*	*145*	*217*	*507*	1450	*2175*	*5075*	*5075*	*7250*	*10875*
Burst pressure		bar	2	3	6	*15*	*25*	*65*	120	200	500	500	650	950
		psi	*29*	*43*	*87*	*217*	*362*	*942*	1740	*2900*	*7250*	*7250*	*9425*	*13775*
Vacuum capability		bar	-0.1	-0.5	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
		psi	*-1.5*	*-7.3*	*-14.5*	*-14.5*	*-14.5*	*-14.5*	-14.5	*-14.5*	*-14.5*	*-14.5*	*-14.5*	*-14.5*
Pressure type		-	R	A/R/S	A/R/S	A/R/S	A/R/S	A/R/S	A/R/S	S	S	S	S	S
Sensor thickness		mm	6.15	6.17	6.23	6.30	6.35	6.55	6.70	6.70	7.05	7.05	7.32	7.55
		in	*0.242*	*0.243*	*0.245*	*0.248*	*0.250*	*0.258*	*0.263*	*0.263*	*0.278*	*0.278*	*0.288*	*0.297*

Accuracy [6] [%FS]		Calibration with high accuracy											
25°C	(77 °F)	1.5	1.0										1.5
A) 0...85 °C	(32...185°F)	1.5				1.4		1.6	1.8	2.4			2.8
B)-10...105°C	(14...221°F)	1.8				1.7		1.8	3.2	2.6			3.2
C)-25...125°C	(-13...257°F)	2.2				2.0		2.2	3.5	3.1			3.5
Accuracy [6] [%FS]		**Calibration with standard accuracy**											
25°C	(77 °F)	1.5	1.0										1.5
A) 0...85 °C	(32...185°F)	2.5				2.4		2.6	2.8	3.4			3.8
B)-10...105°C	(14...221°F)	3.8				3.7		3.8	4.2	4.6			4.6
C)-25...125°C	(-13...257°F)	4.2				4.0		4.2	4.5	5.5			5.5
Accuracy [6] [%FS]		**Calibration without thermal compensation**											
25°C	(77 °F)	1.5	1.0										1.5
-25...125°C	(-13...257°F)	Max ± 0.08 %FS/K (Ceramic cell thermal offset shift + thermal span shift) + Accuracy at 25°C											

Unless indicated, all data are based on a reference temperature of 25°C and a power supply of 5 VDC.

1. During calibration or auto-zero, current consumption is < 30 mA.
2. Tested by splicing the wires to a shielded cable All EMC/ESD. All EMI tests are performed inside grounded Metallux housing.
3. The standard is not applicable with a harness shorter than 3 m. Metallux does not recommend having connection wires longer than 30 cm.
4. Pressure ranges not listed in the technical chart have performances of the nearest listed pressure range. Contact us for customization.
5. Psi values are not the exact conversion of bar value. PSI ranges are defined to cover different standard values.
6. Accuracy includes room temperature error of non-linearity, hysteresis and non-repeatability, offset and span deviation PLUS thermal span shift and thermal offset shift. Accuracy calculation is performed in Metallux housings; accuracy excludes temperature hysteresis which primarily depends on mechanical conditions (housing, o-ring, etc) of actual application.

Total error band (full range) Only for error trend - Not in scale



Example of ME782 read out: .066E3529066E..

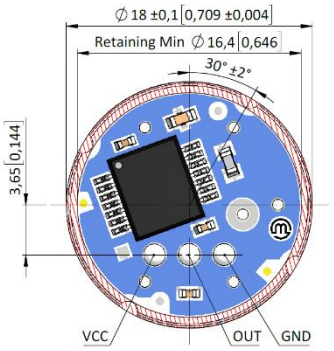
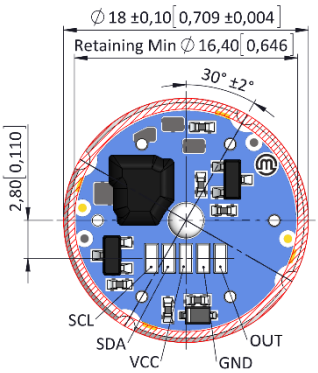
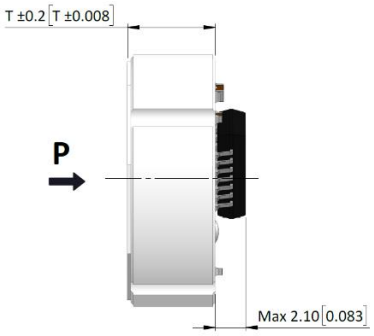
(Red = Pres. in hex – Green = Temp. in Hex – Black = Extra info)

$$P[bar] = \frac{P_{dec}}{32767} * \left(\frac{P_{max} - P_{min}}{B_p - A_p}\right) + \left[P_{min} - A_p\left(\frac{P_{max} - P_{min}}{B_p - A_p}\right)\right]$$

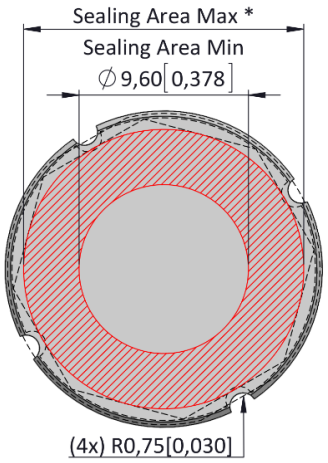
$$T\,[°C] = \frac{T_{dec}}{32767} * \left(\frac{T_{max} - T_{min}}{B_T - A_T}\right) + \left[T_{min} - A_T\left(\frac{T_{max} - T_{min}}{B_T - A_T}\right)\right]$$

P_{dec}= Decimal raw value of pressure (output of ASIC)
T_{dec}= Decimal raw value of temperature (output of ASIC)
P_{max}/P_{min}= Maximum/minimum pressure value in bar (depend by the pressure range of the sensor)
T_{max}/T_{min}= Maximum/minimum temperature value in °C (T_{max}=125°C and T_{min} = -40°C)
A_P = 0.05 B_P = 0.95 A_T = 0.10 B_T = 0.90

Mechanical drawings

ME780 Top View	ME782 Top View	ME78x Side View
		
ME780: 3x Pads ∅1.6 [0.063] Pitch = 2,54 [0,10]	ME782: 5x Pads 0,8 x 2,0 [0,031 x 0.0787] Pitch = 1,27 [0,05]	T = Sensor thickness (see page 2)

Bottom View (0.5…50 bar – 7.5…1000 psi)



*Sealing area max.	
Round	∅ 15,7[0,618]
Octagonal	∅ 14,7[0,579]

Diaphragm shape

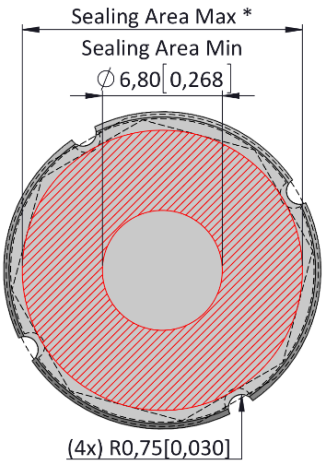
ROUND

ME	-	MEP
0.5 bar	-	7.5 psi
1 bar	-	15 psi
2 bar	-	30 psi

OCTAGONAL

ME	-	MEP
5 bar	-	100 psi
10 bar	-	150 psi
16 bar	-	300 psi
20 bar	-	400 psi
50 bar	-	1000 psi

Bottom View (100…600 bar – 1500…8500 psi)



*Sealing area max.	
Round	∅ 15,7[0,618]
Octagonal	∅ 14,7[0,579]

Diaphragm shape

OCTAGONAL

ME	-	MEP
100 bar	-	1500 psi
200 bar	-	3000 psi
250 bar	-	4000 psi
400 bar	-	5000 psi

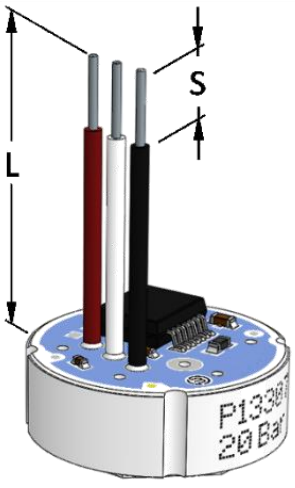
ROUND

ME	-	MEP
600 bar	-	8500 psi

All quotes are in mm [inch] – General tolerance ISO 2768-1 M

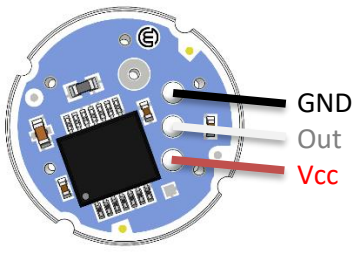
Electrical terminations

ME780: type 0, wires L = 50.8 mm

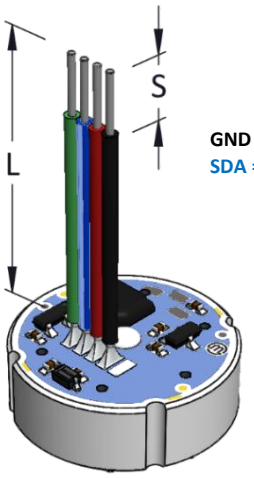


Wire section : 0.09mm²
Cable length: L = 50.8 ± 2 [2 ± 0.08]
Stripping length: S = 5.0 ± 0.5 [0.2 ± 0.02]

GND = Ground [black]
Out = Output Voltage [white]
Vcc = Power Supply [red]

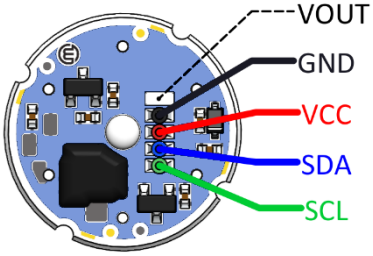


ME782: type 0, wires L= 50.8 mm



Wire section : 0.09mm²
Cable length: L = 50.8 ± 2 [2 ± 0.08]
Stripping length: S = 5.0 ± 0.5 [0.2 ± 0.02]
Op. Temp: -25°C...+105°C (-13 °F...221 °F)

GND = Ground [black] **VCC = Power Supply [red]**
SDA = Serial Data [blue] **SCL= Serial Clock [green]**



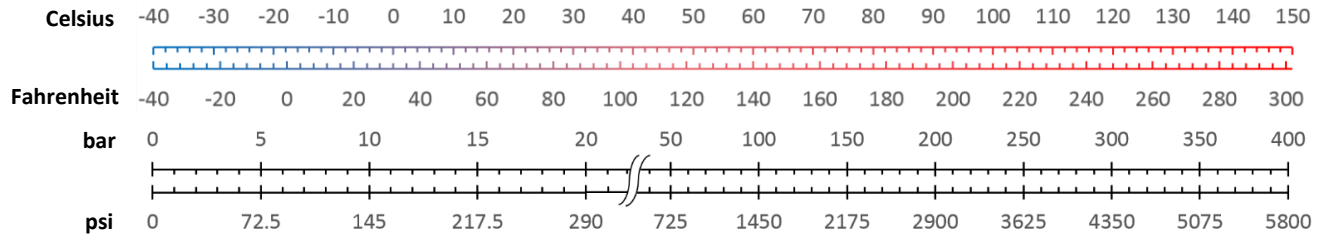
All quotes are in mm [inch] – General tolerance ISO 2768-1 M

Ordering code

	ME	_	78	_	_	_ _ _	_	_	_	_	_	_
Pressure unit												
	bar				blank							
	psi				P							
Output signal												
	Ratiometric		0.5...4.5 [V]		0							
	Digital I²C		5%...95% 15-bit ADC		2							
Sensor Type												
	Absolute					A						
	Gauge					R						
	Sealed gauge					S						
Pressure range												
	ME		MEP			ME – MEP						
	0...0.5 bar	or	0...7.5 psi	[-/R/]		0p5 – 7p5						
	0...1bar	or	0...15psi	[A/R/S]		001 – 015						
	0...2 bar	or	0...30 psi	[A/R/S]		002 – 030						
	0...5 bar	or	0...100 psi	[A/R/S]		005 – 100						
	0...10 bar	or	0...150 psi	[A/R/S]		010 – 150						
	0...20 bar	or	0...400 psi	[A/R/S]		020 – 400						
	0...50 bar	or	0...1000 psi	[A/R/S]		050 – 1k0						
	0...100 bar	or	0...1500 psi	[-/-/S]		100 – 1k5						
	0...200 bar	or	0...3000 psi	[-/-/S]		200 – 3k0						
	0...250 bar	or	0...4000 psi	[-/-/S]		250 – 4k0						
	0...400 bar	or	0...5000 psi	[-/-/S]		400 – 5k0						
	0...600 bar	or	0...8500 psi	[-/-/S]		600 – 8k5						
	Others on request (enquiry for customization)					999 – 999						
Calibration												
	High accuracy						0					
	Standard accuracy						1					
	No temperature compensation* (calibration done at room temperature)						2					
	Not calibrated, not compensated (electrical test only)						3					
	Others on request (enquiry for customization)						9					
Termination type												
	Wires 50.8 mm							0				
	Tinned pads							1				
	Others on request (enquiry for customization)							9				
Power Supply												
	5 V								0			
	3.3 V (Only ME782)								1			
Diaphragm type												
	Ceramic Al_2O_3 96.0% purity									0		
	Different purity on request (Al_2O_3 99.6%, sapphire...)									9		
Venting hole pipe												
	Without										0	
	Venting pipe on request (Metal pipe Ø1.2 mm, for gauge sensor only)										9	
Coating												
	Standard conformal coating											Blank
	Parylene or other coating (enquiry for customization)											Custom

* *ME782 temperature output is not available with this calibration option. Temperature signal is available only with high/standard accuracy.*

Conversion tools



To be disposed of according to local regulations (OTRif 16 02 97 for Switzerland, CER 16 02 16 for European Union)