PRESSURE SENSOR FOR COMBUSTION ANALYSIS

Data Sheet

ZI31

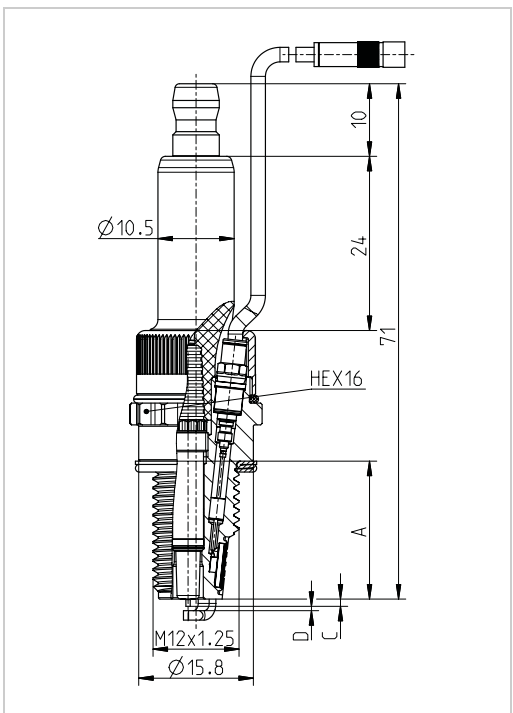
May 2011
AT3377E, Rev. 01

ZI31

BOSCH
in collaboration with AVL

★★ ★ ★ GaPO4

The ZI31 is a spark-plug with integrated pressure sensor. The M12 design has very small eccentricity of the center electrode. This and the high sensitivity of the sensor elements combined with the high stiffness of the spark plug body guarantees excellent measurement performance. The insulator of the spark-plug is developed and manufactured by Bosch. The sensor can be equipped with SDC to make it ready for SDM Sensor Data Management.



Scope of Supply

- Sensor ZI31
- Protection cap
- Piezo-input cable CI31-1 and 2 spare O-rings
- Fitted coupling CC31
- Calibration sheet and documentation
- Operating instructions

Specifications

Measuring range			0 … 200 bar	
Overload			250 bar	
Lifetime	≥		10^8	load cycles
Sensitivity			12 pC/bar	nominal
Linearity	≤	±	0.5%	FSO
Natural frequency	~		130 kHz	
Acceleration sensitivity	≤		0.001 bar/g	axial
Shock resistance	≥		2000 g	
Insulation resistance	≥		10^{13} Ω	at 20 °C
Capacitance			5 pF	
Operating temperature range			-40 … 350 °C	
Thermal sensitivity change	≤	±	0.6%	200 ± 50 °C
Load change drift			5 mbar/ms	max. gradient
Cyclic temperature drift *	≤	±	0.6 bar	
Thermo shock error **				
Δp	≤	±	0.5 bar	
Δp_{mi}	≤	±	1.5%	
Δp_{max}	≤	±	1%	
Temperature of plug-seat	≤		230 °C	permanent
Spark-plug insulator resistivity	≥		$10 \cdot 10^6$ Ω	at 20 °C
Burn off resistance			6 kΩ	at 20 °C
Electric strength	≤		30 kV	permanent
Eccentricity of insulator			1.1 mm	
Thread diameter			M12x1.25	
Cable connection			M3x0.35	negative
Weight			38 grams	without cable
Mounting torque for the spark plug			15 … 25 Nm	

*) at 7 bar IMEP and 1300 rpm, diesel
**) at 9 bar IMEP and 1500 rpm, gasoline

Specification of the spark-plug function

Type	Article	Sealing type	Thread length A*	Heat range	Spark position C	Electrode gap D **	Spare insulator (inner part)
ZI31 YO7CPRT	TIGG1201A.01	flat	12.7 – 19	07	1	0.6	TIBW3591A.01
ZI31 Y3CPRT	TIGG0984A.01	flat	12.7 – 19	3	1	0.6	TIBO7350A.01
ZI31 Y3DPRT	TIGG1252A.01	flat	12.7 – 19	3	3	0.6	TIBW6142A.01
ZI31 Y5DPRT	TIGG0985A.01	flat	12.7 – 19	5	3	0.6	TIBO7351A.01
ZI31 Y5LPRT	TIGG1232A.01	flat	12.7 – 19	5	5	0.6	TIBW6141A.01
ZI31 Y7DPRT	TIGG0986A.01	flat	12.7 – 19	7	3	0.6	TIBO7352A.01
ZI31 Y7LPRT	TIGG0987A.01	flat	12.7 – 19	7	5	0.6	TIBO7353A.01
ZI31 Y3RPRT	TIGG1028A.01	flat	20.2 – 26.5	3	1	0.6	TIBO7350A.01
ZI31 Y3MPRT	TIGG1253A.01	flat	20.2 – 26.5	3	3	0.6	TIBW6142A.01
ZI31 Y5MPRT	TIGG1029A.01	flat	20.2 – 26.5	5	3	0.6	TIBO7351A.01
ZI31 Y5SPRT	TIGG1233A.01	flat	20.2 – 26.5	5	5	0.6	TIBW6141A.01
ZI31 Y7MPRT	TIGG1030A.01	flat	20.2 – 26.5	7	3	0.6	TIBO7352A.01
ZI31 Y7SPRT	TIGG1031A.01	flat	20.2 – 26.5	7	5	0.6	TIBO7353A.01

*) Shorter thread length than 19 mm down to 12 .7 mm and 26 .5 mm down to 20 .2 mm is realized by special distance rings on customer request .
**) Customer specific adaptation possible.

Accessories		
Cables & couplings	CI31, CC31, E124	
Cable-mounting tool	TC31	Art.No. TIWG0215A.01
Box spanner for insulator (inner part)	TT31	Art.No. TIWG0232A.01
Mounting tool for insulator (upper part)	TA31	Art.No. TIWG0231A.01
Box spanner standard shaft	TT24	Art.No. TIWG0234A.01
Box spanner narrow shaft	TT22	Art.No. TIWG0233A.01
Torque wrench for cable	TT02	Art.No. TIWG0117A.01
Torque wrench for sensor	TT18	Art.No. TIWG0209A.01
Sealing gasket	SG33	Art.No. TI0YF0726A.01
T-handle	TT44	Art.No. TIYG1027A.01
Elongation for box spanners	TT43	Art.No. TIYG1026A.01
Mounting paste	SF01	Art.No. TIHK0094A.01

Icons of strength / Measurement Task

	Toughness / knock applications Purpose: Specially designed to withstand under extreme and harsh conditions	Examples: Analysis of knocking combustion, operation under high engine loads, supercharged engines.	
	Precision / thermodynamic analysis Purpose: Very highly accurate measurements for critical thermodynamic analysis.	Examples: Measurements for heat release and friction loss calculations	
	Durability / endurance testing Purpose: Specially designed to withstand under extreme and harsh conditions	Examples: Onboard monitoring of large marine or stationary engines	
	Gallium Orthophosphate GaPO4 Patented unique crystal material.	Today, GaPO4 is by far the best suited piezoelectric material to be used in sensor applications. It has a combination of several unique properties that make it the first choice.	
	Double Shell™ Mechanically decouples the crystals from the housing for premium signal quality.	Due to their high sensitivity, these elements are also susceptible to any other kind of applied pressure which would else cause a misreading of the combustion pressure	
	SDM Sensor Data Management Increasing efficiency due to organized workflow.	SDM guarantees end-to-end automated data transfer and thus ensures errorfree measurements. This solution covers the complete measurement chain running from the sensor to the software.	

Contact Information

AVL List GmbH
Headquarters
Graz-Austria

Phone: +43 316 787-0
E-mail: info@avl.com