

ClampOn DSP Leak Monitor

DIGITAL SIGNAL PROCESSING

INDONESIA DISTRIBUTOR



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ClampOn DSP Leak Monitor Ex ia version.

ADVANTAGES

- **Easy to install**
- **Non-intrusive**
- **Real time measurement**
- **Retrofit-installable with no prod. shutdown**

BACKGROUND

A leak in an oil or gas flow line is a highly dangerous situation – upstream as well as downstream, so it is extremely important for the operator to be warned about any leak immediately should it occur. A leak in a flow line, valve, flange or any other component can compromise safety and may also lead to a shutdown at the production stage or down-stream at a refinery or terminal. A product leak normally has a very low flow-rate, which is determined by the size of the defect, the properties of the fluid and the pressure differential. The ClampOn

DSP Leak Monitor has been developed with the aim of offering a product that can quantify a leak through a closed valve. Reasons for installing a ClampOn DSP Leak Monitor are plentiful:

- Reduced loss to flare
- Monitoring of internal valve leak rate
- Improved maintenance planning
- Prevention of leak to atmosphere

OPERATING PRINCIPLE

The basic theory is that a leak creates a very high-frequency noise that can be monitored by an ultrasonic sensor. In a «non-leak» situation the ultrasonic pattern will be stable, but when a leak occurs the signature will change drastically. The ClampOn DSP Leak Monitor is based on the ClampOn Ultrasonic Intelligent Sensor technology platform. The instrument's ability to monitor signal at multiple frequency, combined with extreme sensitivity enables it to distin-



Subsea version of the ClampOn DSP Leak Monitor.

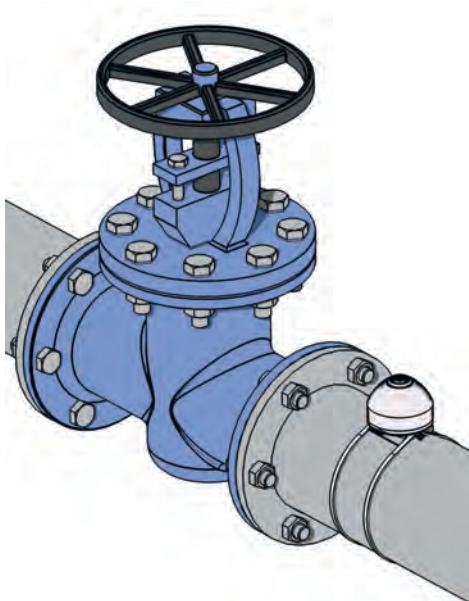
guish and eliminates background noise unrelated to leakages so that the “hiss” from a leak can be monitored and the operator warned when a leak is present. The ClampOn DSP Leak Monitor detects small and medium leaks or flow-throughs, even with low differential pressure over the measuring point on pipes and valves.

INSTALLATION

The ClampOn DSP Leak Monitor, based on our patented Ultrasonic Intelligent Sensor technology, is available in topside and subsea versions. The sensor is easy to install and operate. It's non-intrusive design and clever clamp-on mounting fixtures makes it an effortless job to install, both at yard and in the field for retrofit systems. Installation point is on or next to the area/valve of interest.

The sensor body is made from of stainless steel for topside units and titanium for subsea units, and is clamped to the location (valve, flange or pipe) to be monitored. The topside units are certified to Ex ia IIB, or Ex d IIC, pipe wall temperatures from -40 to +125 oC (257 oF). An unlimited number of sensors can be connected to a single computer for real-time measurements.

The signal from the sensors can be interfaced directly with any type of Main Control System, and can even communicate as a ModBus Slave with any ModBus Master unit.



Placement of sensor; on the valve itself or as close as possible on the pipe.



ClampOn DSP Leak Monitor Ex d version

KEY SPECIFICATIONS

• Method of operation	Passive acoustics (ultrasonic)
• Processing	Intelligent DSP electronics inside sensor unit
• Method of installation	Non-intrusive, clamped to pipe surface
• Minimum detectable leakage	Gas: dP>1 bar, min. leakage rate 0.1 l/min Liquid: dP>3 bar, min. leakage rate 0.1 l/min (depending on delta pressure [dP] over the leakage point)
• Repeatability	Better than 1%
• Interface options	RS485 (ASCII, binary, ModBus RTU), 4-20mA
• Two-way communication	Yes
• Software upgrading	Yes
• Ambient temperature	-50 °C to +85 °C (Ex d)
•	-40 °C to +60 °C (Ex i)
• Flow regimes	Oil, gas, water, multiphase
• Diagnostic features	Intelligent "health check"
• Ingress protection	IP66/IP68 (1 meter for 24 hours) in accordance with IEC 60529
• Housing material	Stainless Steel 316L
• Dimensions	112 mm x 132mm [4.4 in x 5.2 in] (Ex d)
• Ex approval	Ex d / Ex i
• Power Consumption	Max 2.2 W

All specifications are subject to change without notice



ULTRASONIC INTELLIGENT SENSORS

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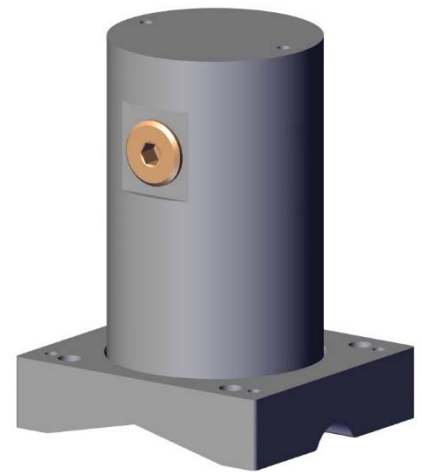
Instrument datasheet

ClampOn DSP Leak Monitor



1	General	Note
1.1	Model name	ClampOn DSP Leak Monitor
1.2	Model number	TSE.DS2I.SA00.A10
1.3	Explosion protection principle	Intrinsically safe, Ex i
1.4	Serial number	YY-MM-XXXXX, unique for each unit 1

2	Physical	
2.1	Dimensions (ø × h)	80 mm × 144 mm [3.1 in × 5.7 in]
2.2	Enclosure material	Stainless steel 316L
2.3	Enclosure protective coating	None, not certified with any type of coatings
2.4	Weight (sensor only)	2.2 kg [4.9 lb]
2.5	Weight (with mounting bracket)	3.2 kg [7.1 lb]
2.6	Ambient temperature	See "Approvals & certification"
2.7	Ingress protection	IP66/IP68 (1 meter for 24 hours), in accordance with IEC 60529
2.8	Equipment marking	Metallised polyester certification label Stainless steel tag plate where applicable
2.9	Cable entry configuration	1 off M20 × 1.5 ISO metric fitted with Ex blanking element by default 2
2.10	Cable gland	None by default 2
2.11	Cable length and type	None by default 2



3	Electrical	Note
3.1	Rated voltage (from a safety barrier), U_{dc}	24 V 3
3.2	Power consumption (typical/maximum), sensor + safety barrier (PSD 1001C)	1.9 W/ 2.2 W
3.3	Electronics platform/generation	ClampOn DSP II
3.4	Microprocessor	600 MIPS
3.5	Non-volatile memory	8 MB
3.6	Vibration accelerometer	3-axis MEMS 4

4	Operation	
4.1	Manner of operation	Real-time measurement
4.2	Unit of measurement	Raw value 9
4.3	Technology	Passive ultrasonic using piezoelectric transducer
4.4	Processing	DSP in sensor unit
4.5	Calibration	All sensors are calibrated to a master signal at factory
4.6	Design life	25 years
4.7	Repeatability	Better than 1 %
4.8	Flow conditions	Oil, water, gas, multiphase
4.9	Minimum detectable leakage	Liquid: dP >3 bar [44 psi], gas: dP >1 bar [15 psi] 5
4.10	Pipe/valve material	All steel alloys 6

5	Signal	7
5.1	Signal types (galvanically isolated)	RS-485 and 4-20 mA 3
5.2	RS-485 (half duplex) protocol	Modbus RTU or proprietary DSP 8, 9
5.3	RS-485 baud rate	2.4 kbps to 115.2 kbps
5.4	4-20 mA (passive, sink), 4-wire	Configurable raw value range up to 5 000 000. Default 0 to 500 000 8, 9

6	Installation	
6.1	Mounting	Mounting bracket clamped to pipe/valve by non-invasive, non-intrusive stainless steel clamping bands, or welded to pipe/valve surface. Sensor screws into the mounting bracket 6, 10
6.2	Terminal block connection data	0.5 mm ² to 1.5 mm ² [AWG 20 to AWG 16] conductor (stranded) cross section with ferrule with plastic sleeve

Instrument datasheet

ClampOn DSP Leak Monitor



7 Approvals & certification			13
7.1	Hazardous area location approval	Zone 0, 1, 2 for ATEX/IECEx installations and Zone 0, 1, 2 or Division 1 for cULus (NEC/CEC) installations	
7.2	ATEX certificate	Presafe 17 ATEX 9492X	12
7.3	ATEX marking	Ex II 1 G Ex ia IIB T4 Ga $-40^{\circ}\text{C} \leq T_{\text{amb}} \leq +60^{\circ}\text{C}$	
7.4	ATEX ambient temperature range	$-40^{\circ}\text{C} \leq T_{\text{amb}} \leq +60^{\circ}\text{C}$	11
7.5	IECEx certificate	IECEx PRE 17.0009X	12
7.6	IECEx marking	Ex ia IIB T4 Ga $-40^{\circ}\text{C} \leq T_{\text{amb}} \leq +60^{\circ}\text{C}$	
7.7	IECEx ambient temperature range	$-40^{\circ}\text{C} \leq T_{\text{amb}} \leq +60^{\circ}\text{C}$	11
7.8	cULus file number	E354507	12
7.9	cULus marking	Class I Division 1 Groups C, D T4 Class I Zone 0 AEx ia IIB T4 Ga Class I Zone 0 Ex ia IIB T4 Ga	
7.10	cULus ambient temperature range	$-40^{\circ}\text{C} \leq T_{\text{amb}} \leq +60^{\circ}\text{C}$	11
7.11	CE marking in conformance with	2014/34/EU (ATEX Directive) and 2014/30/EU (EMC Directive)	

Notes

1. Serial number breakdown: yy (year of manufacture), mm (month of manufacture), xxxxx (unique electronics ID).
2. Various solutions available.
3. Irrespective of whether in a hazardous or non-hazardous area, all signal and power connections to and from the sensor must be via certified safety barriers with intrinsically safe outputs in accordance with the Ex certificates' electrical data. Only use certified safety barriers supplied or recommended by ClampOn.
4. For vibration measurement details, see instrument datasheet addendum. Vibration output is optional and not activated in instrument by default.
5. Minimum leakage rate is 0.1 l/min [0.026 gal/min], depending on delta pressure (dP) across the leakage point.
6. Sensor waveguide must have metal-to-metal contact with the pipe/valve surface.
7. Factory configurable software parameters via RS-485 interface. May also be configured in-field by ClampOn authorised personnel.
8. 4-20 mA only recommended for raw value trending. ClampOn recommends digital (Modbus RTU or DSP) output to enable leak calculation.
9. Sensor's UOM is raw value. To calculate leak rate (l/min), send sensor raw value, (live) inlet pressure and valve status to a PC or PAC programmed with fluid type, valve type and inlet ID.
10. Mounting bracket available in stainless steel (standard), carbon steel or duplex. Clamping bands available in stainless steel or Inconel.
11. The ambient temperature (T_{amb}) marked on the equipment refers to the temperature of the surroundings, irrespective of any external source of heating, such as process temperature (T_{pipe}), or direct sunlight. Equipment is certified for process temperature $\leq +125^{\circ}\text{C}$. If there is a risk the ambient temperature of the surroundings will exceed T_{amb} , steps must be taken to mitigate this risk, such as installing a sunshade, insulating the pipe, or moving the equipment to another location.
12. See certificate and/or installation instructions for electrical parameters (for IS calculations), and specific conditions of use.
13. The sensor may not be marked with all certificates at the same time.

Instrument Datasheet

DSP Leak Monitor Ex d

1	General	Note
1.1	Model description	DSP Leak Monitor
1.2	Explosion protection principle	Flameproof enclosure, Ex d
1.3	Part number	Various depending on model type and mechanical configuration
1.4	Serial number	YY-MM-XXXX, unique for each unit 1

2	Physical	
2.1	Dimensions (ø x h)	112 mm x 132 mm [4.4 in x 5.2 in]
2.2	Enclosure material	Stainless steel 316L
2.3	Enclosure protective coating	None, not certified with any type of coatings
2.4	Weight (sensor only)	4 kg [8.8 lb]
2.5	Weight (with mounting bracket)	4.5 kg [9.9 lb]
2.6	Ambient temperature	See "Approvals & certification"
2.7	Ingress protection	IP66/IP68 (1 meter for 24 hours), in accordance with IEC 60529
2.8	NEMA enclosure type	Type 4X
2.9	Equipment marking	Stainless steel 316 marking plate on top of enclosure showing product name, part number, serial number, certification, and, if applicable tag number and client information
2.10	Cable entry configuration	2 off M25x1.5 ISO metric: one entry fitted with Ex certified blanking element, one entry fitted with M25 x M20 Ex thread adaptor and Ex cable gland 2, 3
2.11	Cable gland	Hawke 501/453/UNIV A M20 2, 3
2.12	Cable length and type	10 m, RFOU(c) S2/S6, 4x2x0.75 mm ² , grey 2, 13



3	Electrical	Note
3.1	Power input	12 VDC to 28 VDC (electronics equipped with inverse polarity and transient protection)
3.2	Power consumption (typical/maximum)	1.2 W @24 VDC/1.2 W @28 VDC
3.3	Electronics platform/generation	ClampOn DSP II
3.4	Microprocessor	600 MIPS
3.5	Non-volatile memory	8 MB
3.6	Diagnostic features (with software)	Internal self-testing of analogue filters, amplifiers, and flash memory

4	Operation	
4.1	Manner of operation	Real-time measurement
4.2	Unit of measurement	Raw value 8
4.3	Technology	Passive ultrasonic
4.4	Processing	DSP in sensor unit
4.5	Calibration	All sensors are calibrated to a master signal at factory
4.6	Repeatability	Better than 1 %
4.7	Flow conditions	Oil, water, gas, multiphase
4.8	Minimum detectable leakage	Liquid: dP >3 bar [44 psi], gas: dP >1 bar [15 psi] 4
4.9	Pipe/valve material	All steel alloys 6

5	Signal	
5.1	RS-485 (half duplex) protocol	Modbus RTU or proprietary DSP 5, 7, 8
5.2	RS-485 baud rate	2.4 kbps to 115.2 kbps 5
5.3	4-20 mA (passive, sink), 4-wire	Configurable raw value range up to 5 000 000. Default 0 to 500 000 5, 7, 8

6	Installation	
6.1	Mounting	Mounting bracket clamped to pipe/valve by non-invasive, non-intrusive stainless steel clamping bands, or welded to pipe/valve surface. Collar nut secures sensor in mounting bracket 9
6.2	Conductor (stranded) wire cross section	0.25 mm ² to 0.75 mm ² [AWG 24 to AWG 18] with ferrule with plastic sleeve

Instrument Datasheet

DSP Leak Monitor Ex d



7 Approvals & certification			14
7.1	Hazardous area location approval	Zone 1, 2 for ATEX/IECEx, and Zone 1, 2 and Division 2 for cUL _{US} (NEC/CEC)	
7.2	ATEX marking	Ex II 2 G Ex db IIB T5 Gb -50 °C ≤ T _{amb} ≤ +85 °C	10
7.3	ATEX certificate	DEMKO 13 ATEX 1336551X	12
7.4	ATEX ambient temperature range	-50 °C ≤ T _{amb} ≤ +85 °C	
7.5	IECEx marking	Ex db IIB T5 Gb -50 °C ≤ T _{amb} ≤ +85 °C	10
7.6	IECEx certificate	IECEx ULD 13.0010X	12
7.7	IECEx ambient temperature range	-50 °C ≤ T _{amb} ≤ +85 °C	
7.8	cUL _{US} marking	Class I, Zone 1, AEx d IIB T5 Ex d IIB T5 Gb	11
7.9	cUL _{US} file number	E363818	
7.10	cUL _{US} ambient temperature range	-50 °C ≤ T _{amb} ≤ +85 °C	
7.11	CE marking in conformance with	2014/34/EU (ATEX Directive) and 2014/30/EU (EMC Directive)	

Notes

1. Serial number breakdown: yy (year of manufacture), mm (month of manufacture), xxxxx (unique electronics ID).
2. Various solutions available.
3. For cUL_{US} installations, the sensor can be fitted with any type of plug/adaptor/cable gland provided they are suitably rated to maintain the type of protection. In addition all components utilized (cable included) on the sensor must be "UL Listed and Recognized" and listed in the "virtual" catalogue, the Online Certifications Directory.
4. Minimum detectable leakage rate is 0.1 l/min [0.026 gal/min], depending on delta pressure (dP) across the leakage point.
5. Factory configurable software parameters. May also be configured in-field by ClampOn authorised personnel.
6. Sensor must have metal-to-metal contact with the pipe/valve surface.
7. 4-20 mA only recommended for raw value trending. ClampOn recommends digital (Modbus RTU or DSP) output to enable leak calculation.
8. Sensor's UOM is raw value. To calculate leak rate (l/min), send sensor raw value, (live) inlet pressure and valve status to a PC or PAC programmed with fluid type, valve type and inlet ID.
9. Mounting bracket in stainless steel (standard), carbon steel or duplex. Clamping bands available in stainless steel or Inconel.
10. Temperature class is given at maximum ambient temperature (including any external source of heating, typically process temperature, where applicable).
11. Suitable for use in (and additionally marked) Class I, Division 2, Group C T5 as per UL 60079-0 (6th Edition) Clause 29.12.2DV.
12. See certificate and/or installation instructions for specific conditions of use.
13. 10 m cable as standard. Sensor supplied with cable pre-terminated in sensor by ClampOn, with flying lead at the other end.
14. The sensor may not be marked with all certificates at the same time.