

3300 INSERTGAGE®

INSTRUCTION MANUAL



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Rev.	Date	Reason
1	11/03/2019	Including points 6, 7,8,9 and 10 - EU Declaration of conformity
2	01/07/2019	Update of the EU Declaration of conformity
3	29/10/2020	Update of the EU Declaration of conformity + modification of the ATEX label CE 0492 becomes CE 2813

1. PRÉSENTATION

The SENSY INSERTGAGE[®] is a new type of sensor with a strain gauge of small dimension (\emptyset 19 mm and length of 26 mm) in stainless steel and air-tight.

Its user-friendliness and easiness of installation distinguish it from conventional load cells: its advantage is that it can be installed into the structure straight away, without having to be taken apart. A simple hole is enough to insert the metallic structure that is being studied. It is no longer necessary to modify or revise the already existing structure* in order to insert a load cell.

Thanks to the use of an appropriate signal conditioner, the INSERTGAGE[®] can be calibrated for reading loads or strains.

 * The resistance of the structure should be checked using the piercing of the 19 mm Ø hole.

1.1. Principle of the INSERTGAGE®

Once a structure is submitted to a load, it is subject to deformation and internal stress. The INSERTGAGE[®] tightly installed into the structure is subject to the same deformations and measures the stress in the material, using the stress concentration phenomenon at the edge of the hole. The load cell uses strain gauges mounted as a complete bridge; in order to measure these stresses. The output signal is thus proportional to the applied load. The whole structure and the INSERTGAGE[®] make up a force transducer whose maximal load is in function of the structure.

1.2. Applications

The INSERTGAGE[®] is used in all structures where it is possible to pierce a 19 mm \emptyset hole without compromising the structural integrity of the installation. The main applications are:

- \rightarrow Weighing of silo, tanks, mixers, reactors,
- \rightarrow Measuring of strains or efforts in structure,
- → Measuring of level
- \rightarrow Detection of threshold
- \rightarrow Verification of distribution of efforts
- \rightarrow ...

1.3. Avantages

- \rightarrow Simple installation with minimum of equipment
- $\rightarrow~$ Measuring of all types of efforts
- \rightarrow Air-tightly closed IP67
- \rightarrow No maintenance
- \rightarrow No moving parts
- \rightarrow Quick implantation
- $\rightarrow~$ SENSY stocks standard and economical product
- \rightarrow Interchangeable
- $\rightarrow\,$ No modification of structure
- \rightarrow Long life expectancy \rightarrow Insensitive to atmospheric aggressions
- \rightarrow Economical to use
- \rightarrow Used with an appropriate interface, the load can easily be seen.
- \rightarrow Same type of load cell for all loads and structures

1.4. User advice

- The INSERTGAGE[®] is a measuring device equipped with gauges mounted as a complete bridge and thermally compensated: the standard version works in a temperature range of -10°C to +45°C.
- The markings on the load cell should be lined up perfectly according to the main direction of the strains to be measured.
- The load cell should be positioned where the effort to be measured is the greatest, and as close as possible to the neutral fibre of the effort or efforts considered as parasites.



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- The piercing hole must be drilled with a tolerance of -0 +0.05 mm.
- Use the SENSY mounting kit to maintain it perpendicular to the axle of the load.
- Follow the installation instructions supplied with the 3300 kit to be able to insert the INSERTGAGE[®] into the structure.
- The installation of the INSERTGAGE[®] must be done so its outline is completely closed. If the two following conditions are respected, the stress
 in the structure are distributed proportionally through the INSERTGAGE[®]:
 - 1) Outline closed all around the insertion
 - 2) Alignment of the INSERTGAGE® axle; either using the direction of the main strains; either using the cutting strain.
- For the alignment, the INSERTGAGE[®] has a positioning mark on the front side and on the whole body.
- Protect the load cell, the hole and the structure against corrosion, using the K3300 protect product supplied with the 3300 installation kit or use another technique.
- Protect the load cell from direct sunlight.
- Make sure the choice of the measured deformation represents the physical scale you want (load, weight, and force).
- The global precision will be much better if an INSERTGAGE[®] is placed in each branch, in which the deformations are distributed (the different feet of a silo for example).
- The principles linked to the weighing apply to the knowledge that any load to be measured (force, weight) must pass thoroughly through the
 devices for which the deformation is being measured (interaction between the scales of the silo, reinforcements, endless screws and any other
 pieces attached to the structure).
- The INSERTGAGE[®] being in steel, the results are better when it is inserted into steel structures. Nevertheless, the results are as good when inserted into other materials (aluminium), but only if the effects linked to the drift of the "zero-point" and due to different thermal dilatations between the INSERTGAGE[®] and the structure can be mastered.
- SENSY S.A. recommends their INDI PAXS indicator model, which is easy and precise to use, allowing multiple adjustments, such as linearity
 correction and various uses of the output signal.
- SENSY S.A. technicians are at your disposal for any other information or technical support.

1.5. Cabling



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1.6. Dimensions



1.7. Technical features

	0.5 – 2 %	2 – 5 %
Excitation	1015 V	1015 V
Input impedance (Ohms)	702 Ω (± 2 Ω)	351 Ω (± 2 Ω)
Output impedance (Ohms)	702 Ω (± 2 Ω)	351 Ω (± 2 Ω)
Insulation resistance (Ohms)	>5000 MΩ	>5000 MΩ
Nominal sensitivity (10 Kg/mm ²)	\pm 1.2 mV/V	\pm 1.2 mV/V
Linearity	< 0.5%	< 0.5%
Hysteresis	< 0.5%	< 0.7%
"zero-point" drift: - specific	< 1 µV/V/10°C	< 2 µV/V/10°C
- installed	< 4 µV/V/10°C (Insertion into steel)	< 7 µV/V/10°C (Insertion into steel)
Functioning temperature	-20° +70°C	-20+ 70°C
Storage temperature	-40° +100°C	-40+ 100°C

1.8. Estimate of the INSERTGAGE® output signal

In order to have a representative signal, the minimal variation of stress in the material must be higher than 10 N/mm²

1.8.1. Compression or tension



Signal in mV/V = $2750 \times \frac{F}{E \times S}$

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2.2. Operational mode

- Draw the axes of the seating holes of the SENSY INSERTGAGE $^{\ensuremath{\mathbb{S}}}$ (Figure 1) 1)
- 2) Adjust the sticky sheet supplied with the kit
- 3) Mark the centre of the 3 piercings







- Dip the end of the 6.5 mm Ø drill in the K3300 LUBRI and pierce the three holes. 4) (mild steel n=1400 tr/min)*
- 5)
- Dip the end of the 13 mm Ø drill in the K3300 LUBRI and pierce the central hole. (mild steel n= 650 tr/min) Clean the surface of the beam and fix the guiding block using the two supplied screws. (*Figure 2*) (metric 6- length: 50 or 60 mm according to 6) width of beam)

Warning: the notch in the guiding block must be turned towards the structure.



- - 7) Pierce the ¾" Ø hole; for this operation, make sure the K3300 LUBRI paste is used frequently for the same piercing, the second purpose of this operation being to get rid of the shavings. Whilst drilling, apply a constant force under a turning speed of 400 tr/min (mild steel). Once the hole has been drilled, move the milling-cutter back and forth several times, to ensure it has been properly pierced. (*Figure 3*)

*Remark: It is possible to place the INSERTGAGE[®] into a tube: in which case, replace the step 4, by drilling with a 5 mm drill and to tap the 2 exterior holes with screw tap M6 ISO.



- 8) Take away the guiding block, clean it correctly and remove all the shavings so the socket can slide into the guiding canon without rubbing.
- 9) Control the diameter of the hole so the front part of the INSERTGAGE[®] enters easily. If this is not the case, repeat operation 7 with a new milling-cutter.
- 10) Clean the piercing correctly and all around it.
- 11) Grease the hole destined to receive the INSERTGAGE® with a generous amount of K3300 PROTECT.
- 12) Pass the INSERTGAGE® cable through the central hole of the guiding block.
- 13) Fix the INSERTGAGE[®] and the guiding block to the structure by positioning the INSERTGAGE[®] correctly and by referring to the arrow on the front side of the load cell (*Figure 4*). Once the guiding block has been tightly fixed to the structure, the load cell should be blocked and not turn any more. Therefore, it is necessary to verify the position of the load cell before fixing the guiding block definitively.



Figure 4

The different positions of the load cell according to the efforts to be measured are at the end of the document.



- 14) Pass the cable inside the pressing plate and fix it to the guiding block using the supplied screws (Metric 6- 30 mm long)
- 15) Pass the cable inside the socket and the pressing plate.
- 16) Tighten the screw in order to insert the 3300 into the structure.
- 17) In order that the centre of the INSERTGAGE[®] coincides with the central axle of the beam, the end of the load cell should be longer than the length X, calculated using the following formula : X=13-(e/2) with e= Thickness of the beam in mm (*Figure 5*)



Note : The pushing socket is designed for a maximum thickness of 26 mm

- 18) If the INSERTGAGE® has been correctly inserted, you can undo the whole installation and clean it properly for any further use.
- 19) Whilst fixing the cable of the INSERTGAGE[®], do not forget to form the "droplet" loop in case the SENSY INSERTGAGE[®] gets wet (rain).
- 20) When several INSERTGAGES[®] are electrically mounted in parallel, make sure that each one of them gives out an increasing signal under increasing load.

In option: SENSY sells a protective casing for the INSERTGAGE® and cable, to avoid any damaging contacts. (Figure 6)



MA-3300 INSERTGAGE_EN.doc









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3. K3300 LUBRI : USER INSTRUCTIONS

Type of product	Paste	
Color	White	
Composition	Mineral oil, solid lubricant, and thickener.	
Characteristics Test	Norm	Result
Penetrability, density Unworked penetrability Density at 20°C	ISO 2137 ISO 2811	250-280 mm/10 1,65 g/ml
<i>Temperature</i> Service temperature range Flash point, open crucible	ISO 2592	-20°C à 1150°C 205°C
Load capacity, anti-usage protection, shell - 4-ball machine Welding load 800N load usage index - Almen-Wieland machine Allowed load	E-life DIN 51 350 P.4 DIN 51 350 P.5	2200 N 1,0 mm 20000 N
<i>Coverage</i> Coverage		28 m²/Kg

Application

The paste should be applied onto the clean work piece or tool with a cloth, brush, or dip the tool. Lubrication should be repeated from time to time, according to requirements.

Storage

5 years

Conserve at room temperature in a non-corrosive environment.

Security orders

Wash hands before eating, drinking or smoking. Avoid eye contact.

Observation

In case of regular and intensive use, ask for the latest security sheet. The given characteristics are average values. The diversity of conditions for actual use and of purposes excludes all guarantee as far as we are concerned, as well as any of the manufacturer's responsibilities and insurances relating to the properties of this product, apart from recommended use and application.

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4. K3300 PROTECT : USER INSTRUCTIONS

Type of product Wax solution

Color	Ttransparent		
Composition	Wax, corrosive inhibi	itor, solvents	
Characteristics Test		Norm	Result
<i>Density</i> Density at 20°C		ISO 2811	0,81 g/ml
<i>Temperature</i> Service temperature range Flash point, closed crucible		ISO 1523	-40+ 120°C 28°C
Anti-corrosive protection Saline mist test Climatic chamber with condensed water		ISO/R 1456 DIN 50 017 KFW	96 h > 50 cycles
Coverage Coverage			39 m²/Kg

Application

The solution should be applied onto the clean area by immersion, pulverising or brushing. Drying time at room temperature: 90 minutes. You can apply several layers of film to reinforce the anti-corrosive protection (dry between layers). Thinner layers can be obtained by diluting with white-spirit. Because K3300 PROTECT is compatible with usual lubricants, most of the time, it is not necessary to eliminate the film before the installation of the machines. If necessary, wash with white-spirit.

Storage

5 years

Conserve at room temperature in a non-corrosive-environment.

Security orders

Contains white spirit poor in aromatic compounds. Light-up point: +28°C Wash hands before eating, drinking or smoking. Avoid eye and skin contact. Keep away from temperatures higher than 50°C (e.g. sunshine) Never spray in direction of flames or incandescent matter. Inflammable.

Observation

In case of regular and intense use, ask for the latest security sheet. The given characteristics are average values. The diversity of conditions for actual use and of purposes excludes all guarantee as far as we are concerned, as well as any of the manufacturer's responsibilities and insurances relating to the properties of this product, apart from recommended use and application.



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5. STATE OF THE ART INSTALLATION OF SENSY INSERTGAGES®

- 1) In order to have a representative signal, the minimal variation of stress in the material must be higher than 10 N/mm² and greater is the variation, better is the precision.
- 2) Ideally, the insertion structure must not be loaded (empty silo).
- 3) Keep the 57,15 mm track centre needed for fitting the kit.
- 4) When piercing, keep a good perpendicularity between the axle of the drill and the surface.
- 5) In order to make the piercing with the milling cutter easier, it is advisable to drill fronts holes until 16mm maximum.
- 6) When using the milling cutter, keep a maximum speed of 400 turns/minute and drill, using the K3300 LUBRI paste and by applying regular pressure.
- 7) After each hole, make sure that the knurling of the INSERTGAGE[®], stops at the entrance of the hole (grip) and that the milling cutter doesn't give any play in the canon.
- 8) During the insertion, make sure the arrow at the front of the load cell points exactly in the direction of the strain you want to measure.



6. USE IN POTENTIALLY EXPLOSIVE ATMOSPHERE (OPTION)

6.1. Intrinsic safety protection

Use of sensors in hazardous zones can only be done with Ex marked sensors, delivered with one or more of the certificates hereunder:

ATEX: ISSeP07ATEX012X

SENSY's load cells which are marked Ex i comply with the following standards:



The use of junction boxes or additional cable lengths must be considered in the choice of protection. The electrical characteristics of the cable being limited (see certification), it is recommended to carefully chose the cable length and avoid any winding of the cable. After having defined all elements, it is mandatory to control if the sensor's output tension is still compatible with the electronic device in use and the requested accuracy. See certificate for the special conditions for safe use.

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7. PERIODIC INSPECTIONS

1. Check output for zero load (annually)

Output signal	Min acceptable	Max acceptable
mV/V / 4 wires	-0.15 mV/V	0.15 mV/V
4-20mA / 2 wires	3 mA	6 mA
4-20mA / 3 wires	3 mA	6 mA
0- 5V / 3 wires	0 V	0.8 V
0- 10V / 3 wires	0 V	0.8 V
1-5V / 3 wires	0.5 V	1.5 V
1 -10V / 3 wires	0.5 V	1.5 V
-10 / 0 / + 10V	-1.5 V	1.5 V

- 2. Make sure that the axle beam has not been knocked (markings) or chemically attacked (some corrosive greases). If points 1 and 2 are not accounted for, just take preventive measures. (annually)
- 3. In case of doubt, reply to the diagnostic questionnaire available on Web: www.sensy.com/support.
- 4. Verify the integrity of the cable.
- 5. After any serious functioning incident, repeat operations 1 to 4.



8. USE FEATURES

(The exact characteristics are systematically given in the control sheet delivered with every load cell and function of the output signal!)

Output signal:		mV/V	4-20 mA	4-20 mA	1-5 V	0-10 V	-100+10 V	RS-232 RS-485
			2 wires	3 wires	3 wires	3 wires	3 wires	
Compensated temp. range					-10+45°C			
Operating temperature range				-	30 +70°C ¹			
Storage temperature range		-50+85°C			-50	.+85°C		
Power supply	(VDC)	5 <u>10</u> 15 ²	9 – 30 ³	13 – 30	13 –	30	15 - 18 ⁴	6 <u>12</u> 18
Load impedance e	(Ω)	NA	≤ 750	≤ 1.000		> 5k		
Nominal sig. range		0 – 12 mV/V	4 - 20 mA	4 - 20 mA	0.1-5 V	0.1-10 V	-100+10 V	
Saturation		> 3 mV/V	> 24 mA	> 24 mA		> 11 V		

 1 Max +60°C for EX-I T4, T6 and C6 options 3 9-28VDC for EX-I C6 options

 2 5 to 12VDC for EX-I T2 GD, EX-I T4 GD and EX-I T6 GD options 4 15 to 27VDC with a 1000 Ω bridge

9. GUARANTEE

The manufacturer's guarantee is applicable as far as mounting recommendations and general use principle, like above described, are respected.

For any particular use, not described in this document, it is mandatory to obtain a prior written agreement from SENSY S.A. for the validity of the guarantee.



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Other capacities and dimensions available on request Other views	
Other capacities and dimensions available on request Other views	
Other views	Dimensions in mr
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Rev: 29-10-20







11. EU DECLARATION OF CONFORMITY

DECLARATION OF CONFORMITY

Manufactured by:

SENSY SA Z.I. Jumet – Allée Centrale B – 6040 JUMET Phone: +32 71 25.82.00 Fax: +32 71 37.09.11 Website: <u>http://www.sensy.com</u>

CONCERNED ITEMS: 3300, see calibration certificate related to model and serial number.

SENSY S.A. certify that the items described here above have been duly designed, manufactured and tested for use in accordance with the essential requirements defined in the European Directives listed here under.

2014/30/EU Electro-Magnetic Compatibility Directive

2011/65/EU Restriction of the use of certain hazardous substances in the electrical and electronic equipment (RoHS) modified by the standard EU/2017/2102

2014/35/EU Safety / low voltage directive

Conception and compliance of this equipment is made according to all of part of the following standards: EN 61326 (2006)

If designed, manufactured and tested safety ref. D-DP SIL3 READY (option):

- see specific and separate certificate according to ISO 13849-1 and/or EN 62061

If designed, manufactured and tested for use in potentially explosive atmospheres (option): - see specific and separate certificate.

Jumet, October 29th, 2020

Augustin DUBOIS Product Development Division

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