SF_6 Dew point temperature transmitter

APPLICATIONS

- Moisture monitoring of air or gas (SF6)
- Suitable for indoor or outdoor
- Industrial, medical or aerospace fields

HIGHLIGHTS

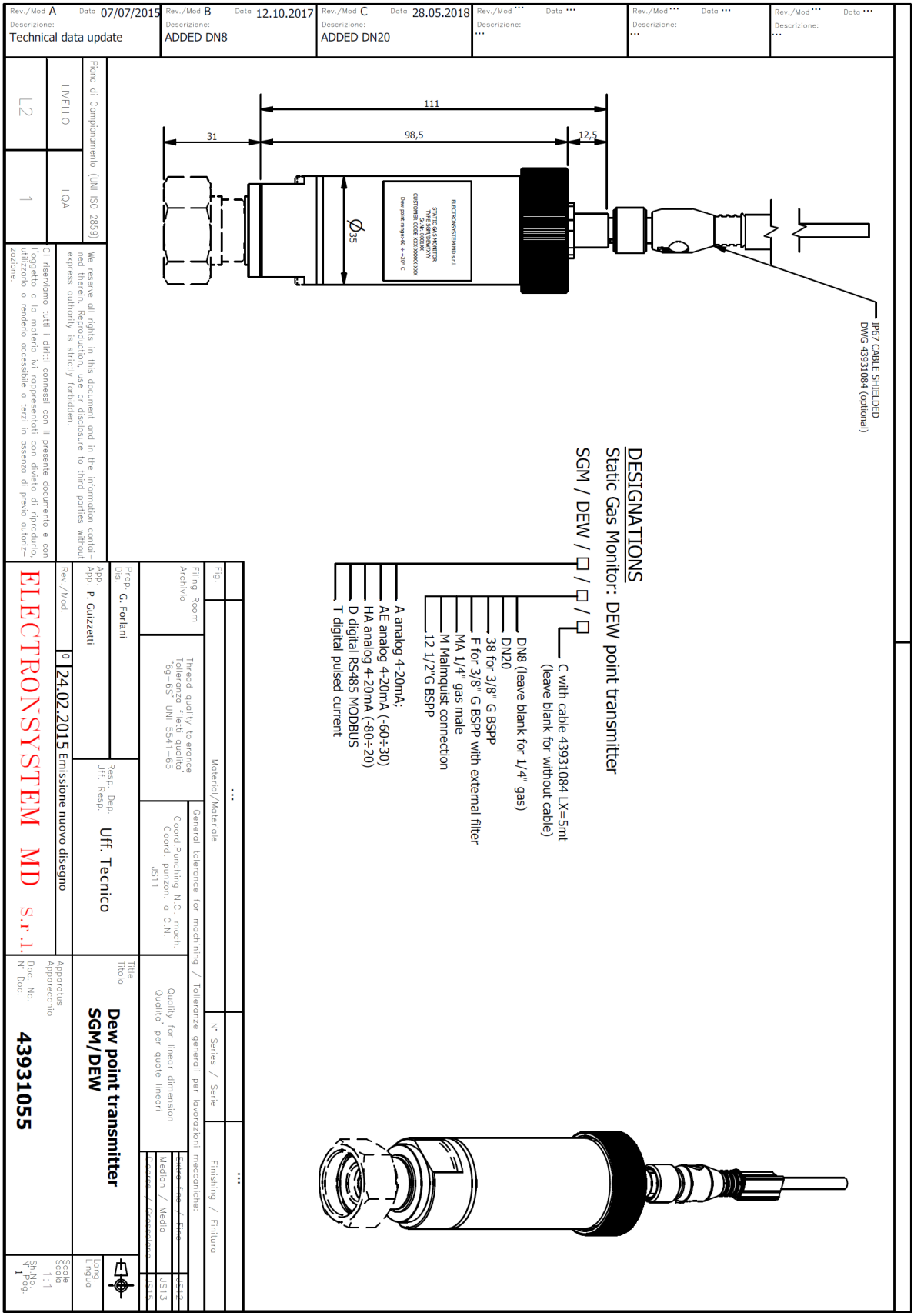
- Wide range measurement of dewpoint
- High accuracy +/- 3°C (+/- 5.4°F)
- Patented polymer die chemically resistant
- Excellent long term stability
- Quick response time
- Factory calibration by laser trimming
- Low drift temperature compensated
- 14 bit ASIC core
- Multiple transmission data output

High voltage circuit breakers commonly used for distribution and transmission are reliable if they are able to operate in steady and controlled conditions.
The use of SF6 as quenching gas is extremely important to guarantee a safe operation during the life of equipment.
But if moisture inside the gas exceed critical limits the properties of insulation of SF6 are no more valid and severe damages can happen to switchgear.
Moisture limits are defined by IEC60480 standard which defines the guidelines for checking and treatment of sulfur hexafluoride (SF6) taken from electrical equipment and specification for its re-use.
The inlet of moisture inside tank can bring, during power switching and arc quenching, to chemical decomposition of SF6 into fluorides.
Fluorides indeed do not reduce good insulating properties of SF6 unless the content of humidity is beyond critical limit: at this stage the byproducts also include the high corrosive HF hydrogen fluoride acid.
In addition to above the content of moisture must be kept under control to guarantee that in very cold climates the water vapor can't condensate creating tracking lines or leakage currents.

Moisture calculation is based on measurement of two physical data: relative humidity HR% and temperature.
Our sensor has an integrated sensing element able to read contemporary both HR and T which are converted by the ASIC into equivalent dew point temperature.

SF_6 Dew point temperature transmitter

Rev./Mod	Data	Descrizione
A	07/07/2015	Technical data update
B	12.10.2017	ADDED DN8
C	28.05.2018	ADDED DN20
...	...	...
...	...	...
...	...	...



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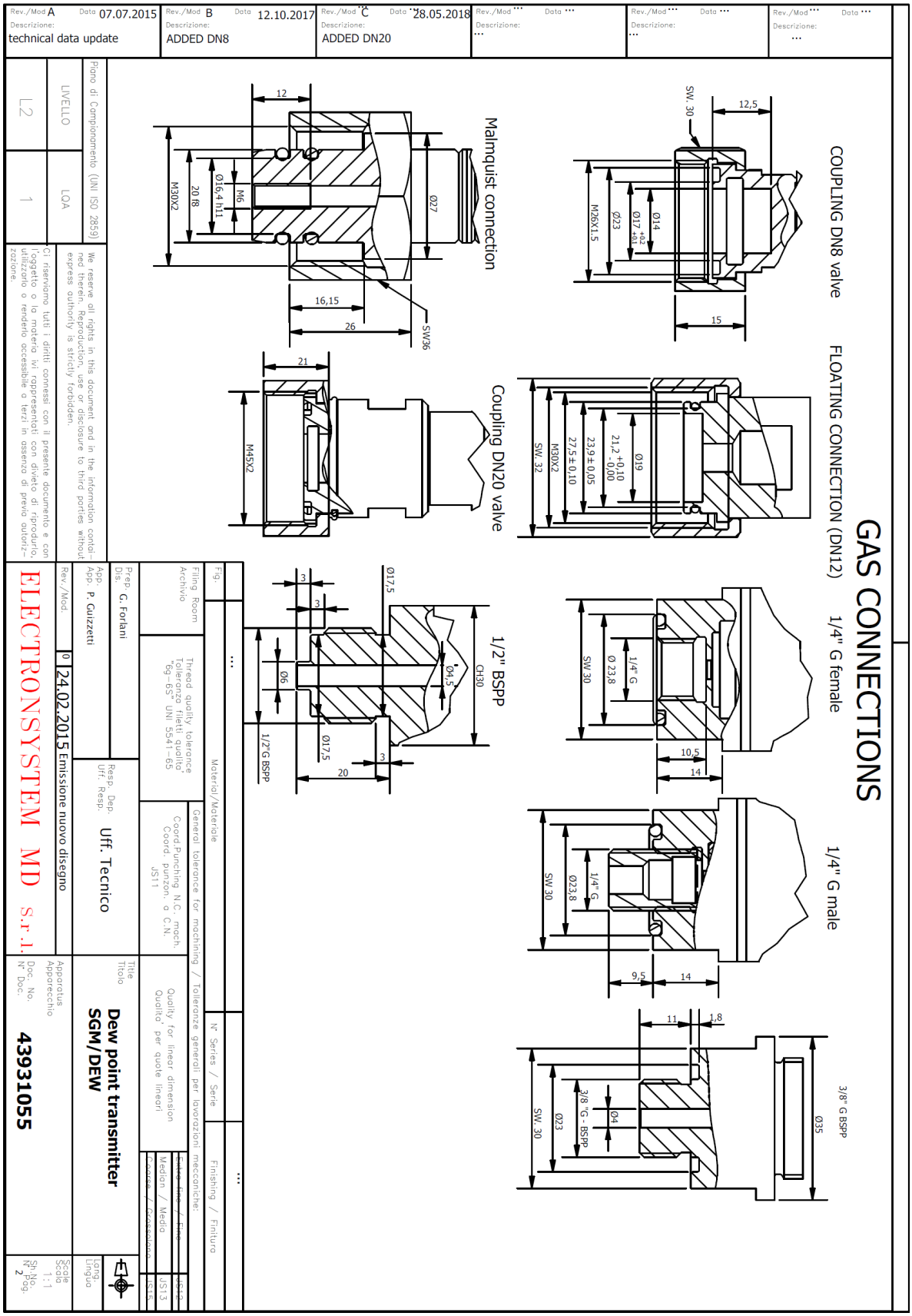
SF_6 Dew point temperature transmitter



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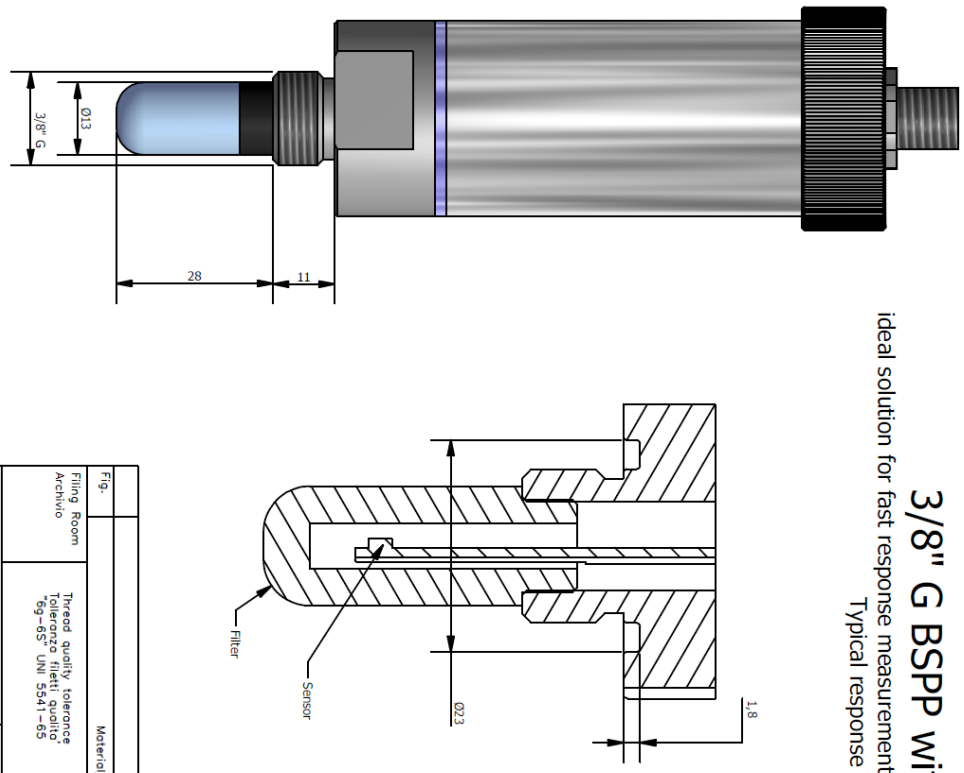
Rev./Mod A	Data 07.07.2015	Rev./Mod B	Data 12.10.2017	Rev./Mod C	Data 28.05.2018	Rev./Mod	Data	Rev./Mod	Data	Rev./Mod	Data
Descrizione: technical data update		Descrizione: ADDED DN8		Descrizione: ADDED DN20		Descrizione:		Descrizione:		Descrizione:	



3/8" G BSPP with external filter

ideal solution for fast response measurement with medical or technical not aggresive gases

Typical response time < 60 second.

LIVELLO	L2	Piano di Campionamento (UNI ISO 2859)	
LQA	1		

Fig.	Material/Materiale	N° Series / Serie	Finishing / Finitura		
Filing Room Archivio	General tolerance for machining / Tolleranze generali per lavorazioni meccaniche:				
Thread quality tolerance "6g-6S" UNI 5541-65 Tolleranza filetti qualita' "6g-6S" UNI 5541-65	Coord.Punching N.C. mach. Coord. punzon. o C.N. JS11	Quality for linear dimension Qualita' per quote lineari	Extra fine / Fine	JS12	
			Median / Media	JS13	
			Coarse / Grossolano	JS15	

Prep. Dis. G. Forlani	App. App. P. Guizzetti	Rev./Mod.			
Resp. Dep. Uff. Resp. Uff. Tecnico		0	24.02.2015	Emissione nuovo disegno	

ELECTRONSYSTEM MD S.r.l.

Title Titolo	Dew point transmitter SGM/DEW	Apparatus Apparecchio	
		Doc. No. N° Doc.	43931055
Long. Lungo		Scale Scala 1:1	Sh. No. N° Pag. 3

SF_6 Dew point temperature transmitter

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TECHNICAL FEATURES:

DESCRIPTION:
DEW POINT TRANSMITTER

1 Materials:
1.1 Housing material : AISI 316
1.2 Inner o.rings material : EPDM70 peroxide cured
1.3 Primary sensing element: Patented polimer chemically resistant
1.4 Cable connection material: aluminium alloy nickel-plated
1.5 Conformity to 2002/95/CE (RoHS), Halogen free

2 Electrical data of sensors
2.1 Electrical data analog version
2.1.1 Output signal : 4 - 20 mA 2 wires loop system (see diagram 1)
2.1.2 Input voltage : 15-30 Vdc
2.1.3 Rload: Rlm< 250 ohm
2.2 Electrical data digital pulsed current version:
2.2.1 Output signal : PWM pulse current (see diagram 2)
2.2.2 Input voltage : 15-30 Vdc
2.2.3 Rload: Rlm< 250 ohm
2.3 Electrical data digital version:
2.3.1 Output signal : RTU MODBUS RS485 (see diagram 3)
2.3.2 Data protocol: baudrate 19200, databits 8, parity even, stopbit 1
2.3.3 Input voltage : 15-30 Vdc
2.3.4 Current Consumption : 10mA typ. / 15mA max.
2.4 Common electrical data:
2.4.4 Input protection : overvoltage supressor and reverse voltage diode
2.4.5 Response time : 1 min. from dry to wet point
2.4.6 Calibration: laser trimmed, low drift digital asic core
2.4.7 Long term Stability: +/- 0,15°C dew point / year
2.4.8 Accuracy : ±3°C -30°<Tdew<+20°, ±4°C -30°<Tdew<-40°, ±5°C -50°<Tdew<-60°
2.4.9 Repeatitivity : ± 1,5°C dew point
2.4.10 Isolation: max 250Vac 50Hz against mass
2.4.11 Resistance of insulation: >10Mohm
2.4.12 Terminal block : circular shielded M12x1 connector (see diagram 4)

3 Output range:
3.1 Dew point: -60 ÷ +20°C
3.2 Temperature: -25 ÷ +60°C *

4 Electromagnetic protection:
4.1 EN61000-4-2: ESD air 15kV
4.2 EN61000-4-3: Radiated immunity AM 10V/m 80...1000MHz, PM 10V/m 900...2700MHz with 10m cord
4.3 EN61000-4-4: Burst 2kV withstand of the communication & power supply interfaces with 10m cord
4.4 EN61000-4-5: Surge 0,5kV withstand on the shield of 10m cord
4.5 EN61000-4-6: Conducted immunity 10V/m
4.6 EN61000-6-4: Radiated disturbances 30MHz-1000MHz class B

5 Working conditions:
5.1 Mechanical stresses:
Shockproof 100G, pulse duration 6ms on 3 axys (IEC EN 60068-2-27:2009)
5.2 Max allowable pressure: 10 bar ABS

6 Environmetal conditions:
Operating temperature:
Standard : -30°C to +70°C
Transport and storage : -30°C to 70°C
Relative humidity 0÷100% HR
Solar radiation: <= 1000 W/mq
Wind: <= 34 m/s
Altitude: <= 2000 m
6.1 Protection degree (DIN EN 60529): IP65; IP67 on request

7 Leakage rate
7.1 Leakage rate : < 1x10^ -9 mbar x l/s.
7.2 Leakage test with helium gas

8 Weight : ≈ 250 gr

9 Primary element features
9.1 Technology: Patented new chemical resistant polymer wafer
9.2 Core chip: ASIC 14bit resolution factory calibrated
9.3 Measurements on chip: combined Relative humidity HR% and Temperature °C
9.4 Protection: integrated filter resistant to dust and chemicals
9.5 Long term stability: 0,15%HR in 5 years ; 2°C in 5 years
9.6 Reliability: MTTF: 9.312.507 hours

* available only for SGM/DEW/T or SGM/DEW/D

Piano di Campionamento (UNI ISO 2859)	
LIVELLO	LQA
L2	1

Fig.
Material/Materiale
N° Series / Serie
Finishing / Finitura
General tolerance for machining / Tolleranze generali per lavorazioni meccaniche:
Filing Room / Archivio
Thread quality tolerance "6g-6S" UNI 5541-65
Coord.Punching N.C. mach. Coord. punzon. a C.N. JS11
Quality for linear dimension / Qualità per quote lineari
Extra finis. / Fine
Medium / Media
Process / Processo
JS13
JS16

Rev./Mod.			
0	24.02.2015	Emissione nuovo disegno	

Prep. Dis. G. Forlani
Appr. Appr. P. Guizzetti
Resp. Dep. Uff. Resp. Uff. Tecnico

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Long. / Lunga

SF_6 Dew point temperature transmitter

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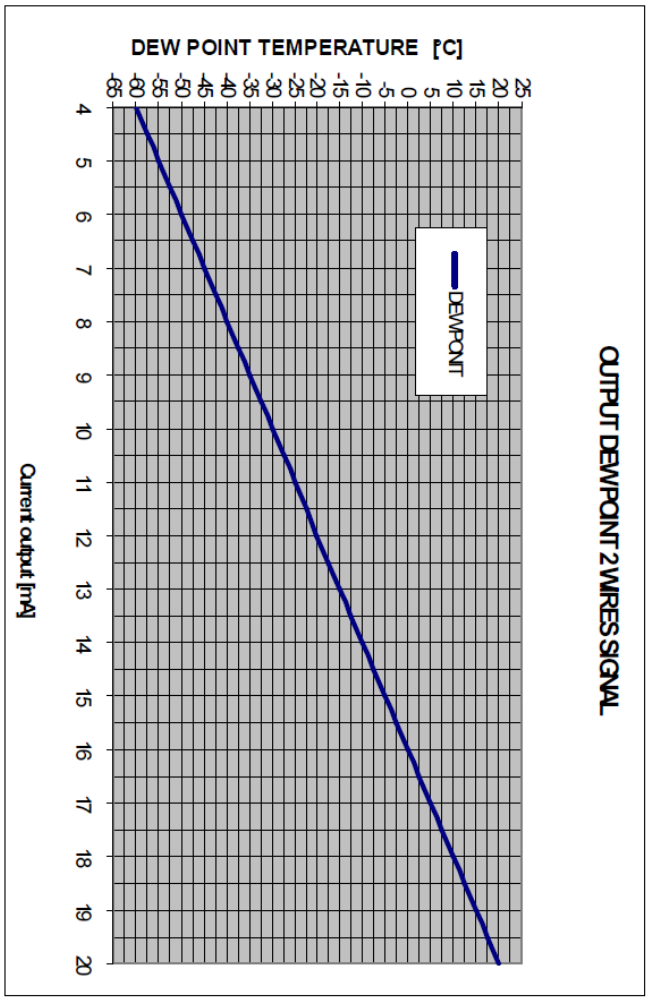
Descrizione: technical data update		Descrizione: ADDED DN8		Descrizione: ADDED DN20		Descrizione:		Descrizione:		Descrizione:	

DIAGRAM 1: ANALOG SENSOR CODE SGM/DEW/A

OUTPUT DEWPOINT 2WRESSIGNAL



Piano di Campionamento (UNI ISO 2859)	
LIVELLO	L2
LQA	1

Fig.	Materiali/Materiale	N° Series / Serie	Finishing / Finitura
Filing Room Archivio	General tolerance for machining / Tolleranze generali per lavorazioni meccaniche:		
Thread quality tolerance Tolleranza filetti qualita' "6g-6S" UNI 5541-65	Coord.Punching N.C. mach. Coord. punzon. a C.N. JS11	Quality for linear dimension Qualita' per quote lineari	Extra fine / Fine JS12 Medium / Medio JS13 Coarse / Grossolano JS15

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Sh. No. / N° Fog. 5

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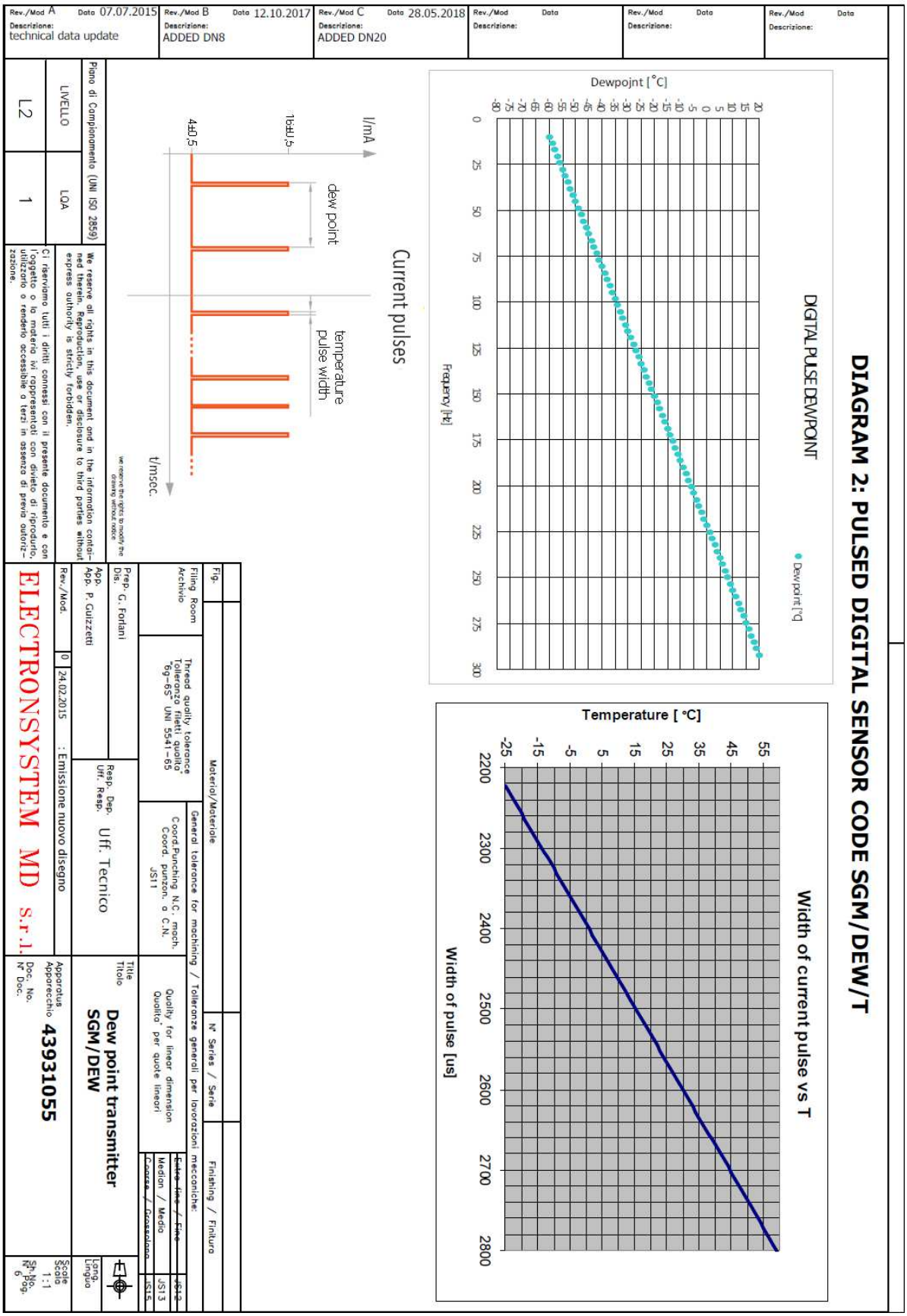
SF_6 Dew point temperature transmitter



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...	...	...
...	...	...
...	...	...

DIAGRAM 3: MODBUS RTU RS485 CODE SGM/DEW/D

Registry	Information	Type	Function
Reg_0	ID_slave	Unsigned Int	Read/Write
Reg_1	Relative humidity HR.Read [%/10]	Unsigned Int	Read only
Reg_2	Temperature.Read [°C/10]	Signed Int	Read only
Reg_3	Temperature Dew point [°C/10]	Signed Int	Read only
Reg_4	Firmware release	Unsigned Int	Read only

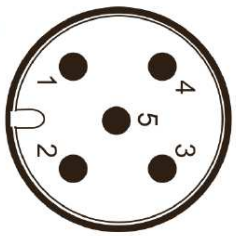
Protocol settings

ADDRESS	128 default
Protocol	Modbus RTU
Speed	19200 Baud
Data	8 bit
Parity	Even parity
Stop	1 bit stop
Scan rate	50ms
Response time out	500ms
Delay	200ms

EXAMPLE:

Registry	bit reading	value	Unit	Description
0	128	128		slave add
1	294	29,4	[%]	relative humidity
2	249	24,9	[°C]	temperature
3	57	5,7	[°C]	dewpoint temperature
4	1	1		FW revision

DIAGRAM 4: TERMINAL BLOCK



View on sensor plug

SGM/DEW/X/A or SGM/DEW/X/T
3: +VDC
4: -VDC

SGM/DEW/X/D:
1: +VDC
2: Modbus Gnd
3: -VDC
4: A(+) / TR (+)
5: B(-) / TR (-)

Piano di Campionamento (UNI ISO 2859)	
LIVELLO	LQA
L2	1

Fig. ... | Material/Materiale | N° Series / Serie | ... | Finishing / Finitura

General tolerance for machining / Tolleranze generali per lavorazioni meccaniche:

Filing Room Archivio

Thread quality, tolerance Tolleranze filetti qualità "6g-6S" UNI 5541-65

Coord.Punching N.C. mach. Coord. punzon. a C.N. JS11

Quality for linear dimension Qualità per quote lineari

Extra fine / Fine JS12
Median / Media JS13
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Rev./Mod. 0 24.02.2015 Emissione nuovo disegno

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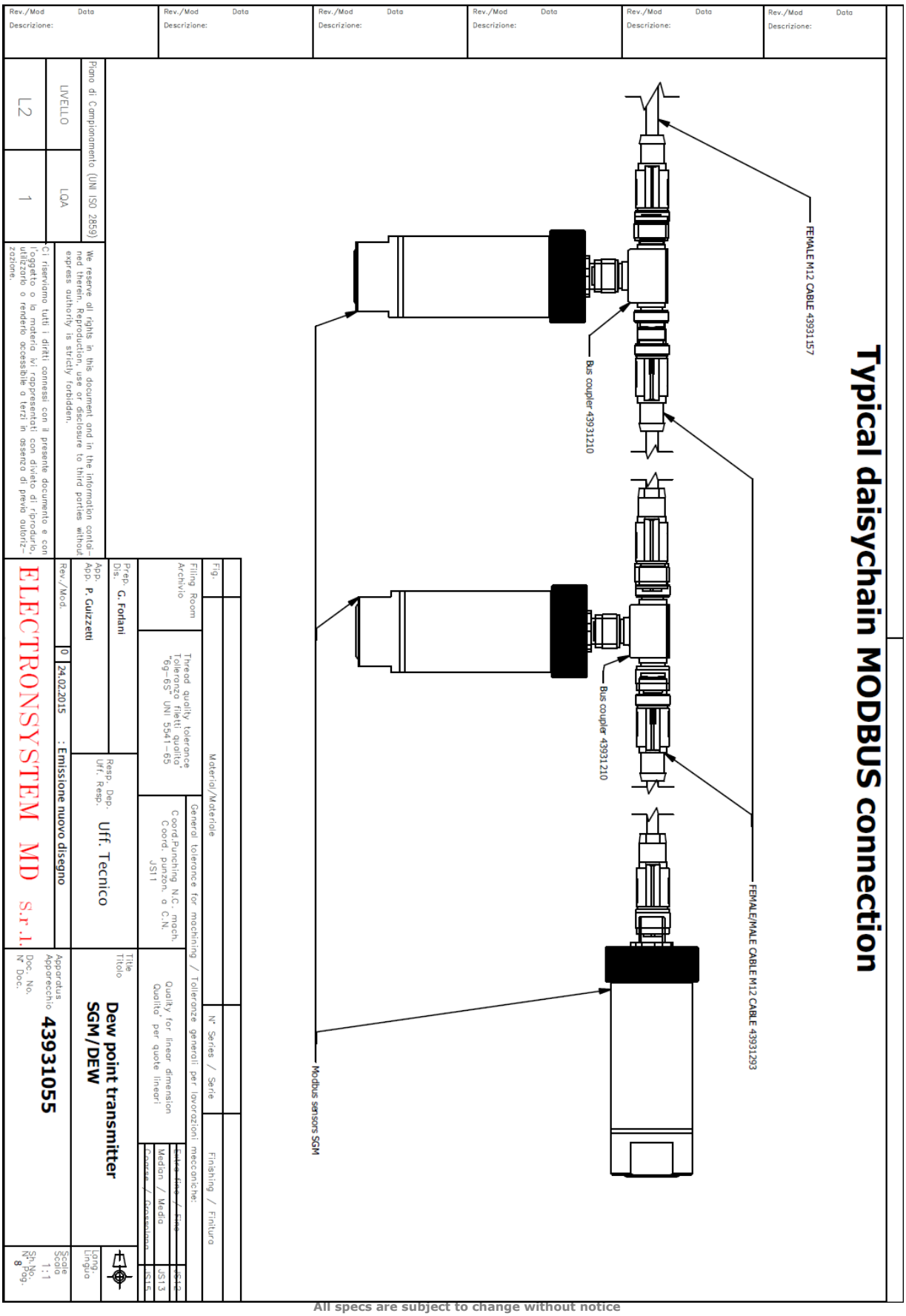
SF_6 Dew point temperature transmitter



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PRECAUTIONARY USE

1. The correct reading of instrument is strongly affected by boundary conditions of moisture environment. Due to this the time to get correct reading can vary a lot from few hours to few days.
2. The suggestion to reduce equilibrium time is to dry the part (including the entire block to which the sensor is connected) before installation or in any case to avoid absolutely exposure to wet gas.
3. Some other brands are quicker to get correct reading but compulsory need a gas flow to work so preventive actions, to avoid SF6 dispersal, must be taken; on the contrary this sensor can work stand alone without gas flow but some more time is hence needed to get correct reading.
4. Do not leave the sensor without protection in standard environment and in case use a green dry gas flow in front on reading element before installation to prevent moisture trapping.

STORAGE

If the complex must be storage before use, please keep dry and repaired.
Do not leave outdoor.
Device is strongly sensitive to humidity hence avoid to store where relative humidity is more than 90%

STORAGE TEMPERATURE: -30°C ÷ +70°C
RELATIVE HUMIDITY: max 90% @ +40°C

MAINTENANCE

Maintenance of transmitter must be done compulsory in factory. We recommend every 5 years to send back transmitter for calibration check and inspection.

WARRANTY

Device is covered by 24 months after installation or max 36 months after delivery.
In case of service the transmitter must be sent back to factory for inspection.

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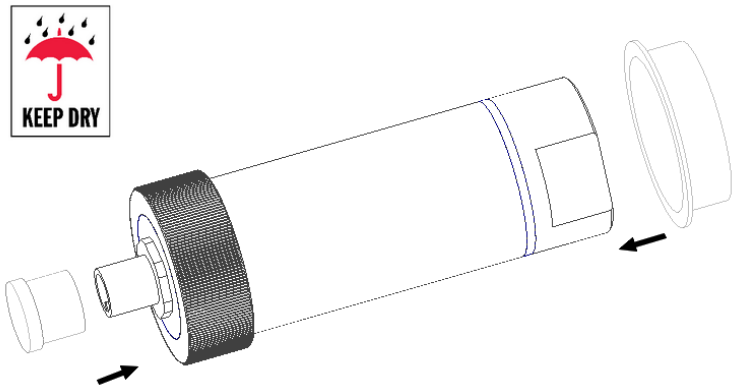
WARNINGS

CAUTION
Do not drop or hit the transmitter. The sensor is fragile and may break from sudden shock.
When transporting the transmitter, use the original shipping box from Electronsystem.

NOTE
Keep the transmitter dry and clean.
Do not remove the transparent transport protection caps before you are ready to install the transmitter.
Uncapped transmitter will absorb environment moisture which will affect the dewpoint measurement and will potentially need weeks to be ready to give reliable signal.



NOTE
Connect the transmitter directly to the main SF_6 gas volume, not behind a sampling line because this is the area where high humidity tends to accumulate.
In any case after first installation the transmitter will have a small amount of moisture inside the connection. In still dry gas it takes a long time until a vapour pressure inside the measurement cell reaches equilibrium with the main gas tank. It is usual for the stabilization of the dewpoint reading to take several days after installation.

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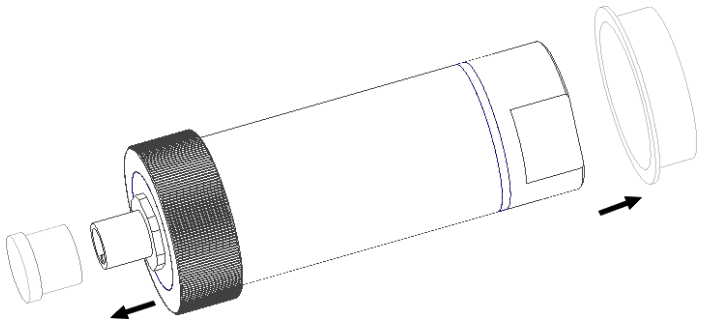
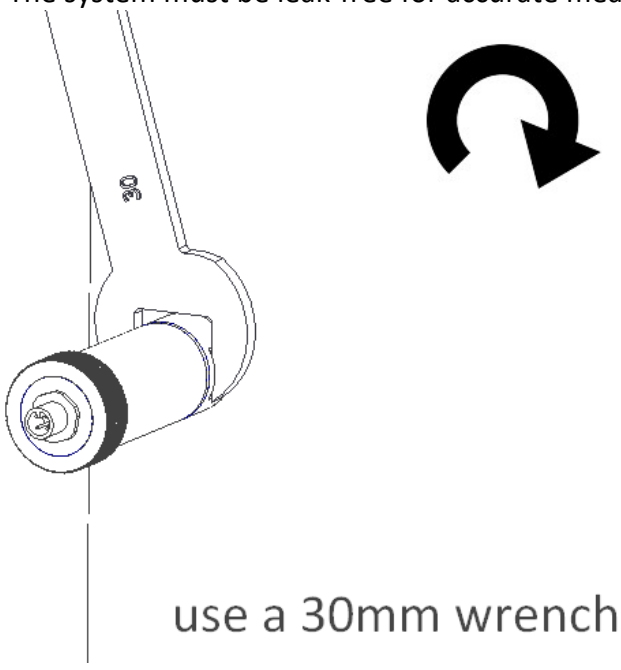
SF_6 Dew point temperature transmitter

INSTALLATION

1. Remove the transparent transport caps when you are ready to install the transmitter. Check o-ring is clean without dust and properly assembled.



2. Install the transmitter to the mechanical coupling and tighten gently by hand. Then use a 30mm wrench to tighten the connection. Use a sufficient force to achieve a tight installation (recommended 10-15Nm) . The system must be leak-free for accurate measurement.



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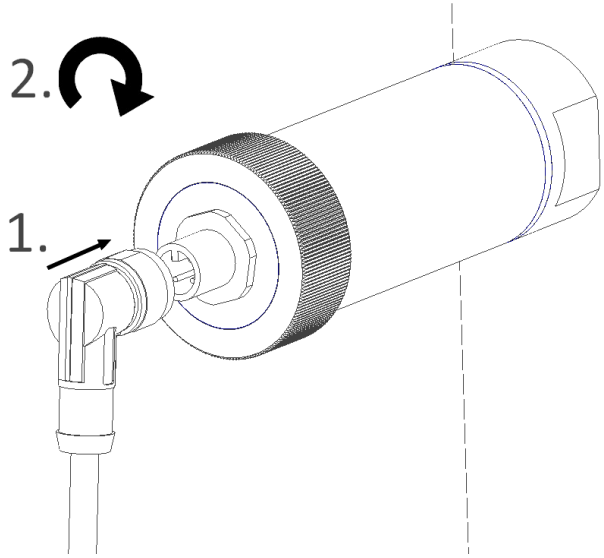
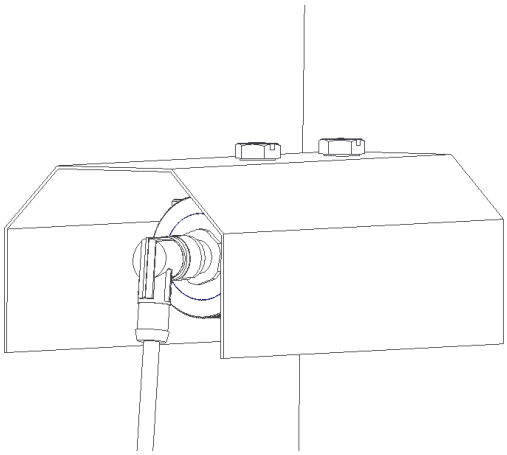
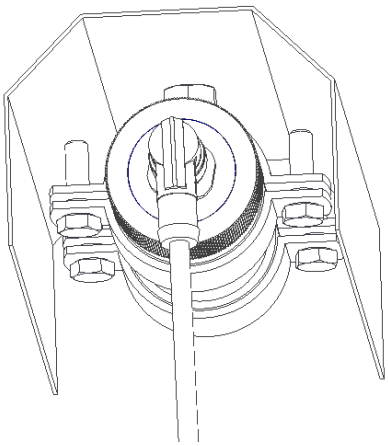
3. Connect proper circular wiring into the output port checking the correct polarization of the connector then turn firmly the rotating crown of the cable.
   Use a cable with a suitable outdoor IP67 connector for your installation (straight or angled)



4. In case the weather shield is needed (optional), can be added to the transmitter by fitting the two rubber clamps on the body of transmitter and tightening to assure it can remain in place.
   Assure that the stainless roof completely cover the transmitter and the cable connection.





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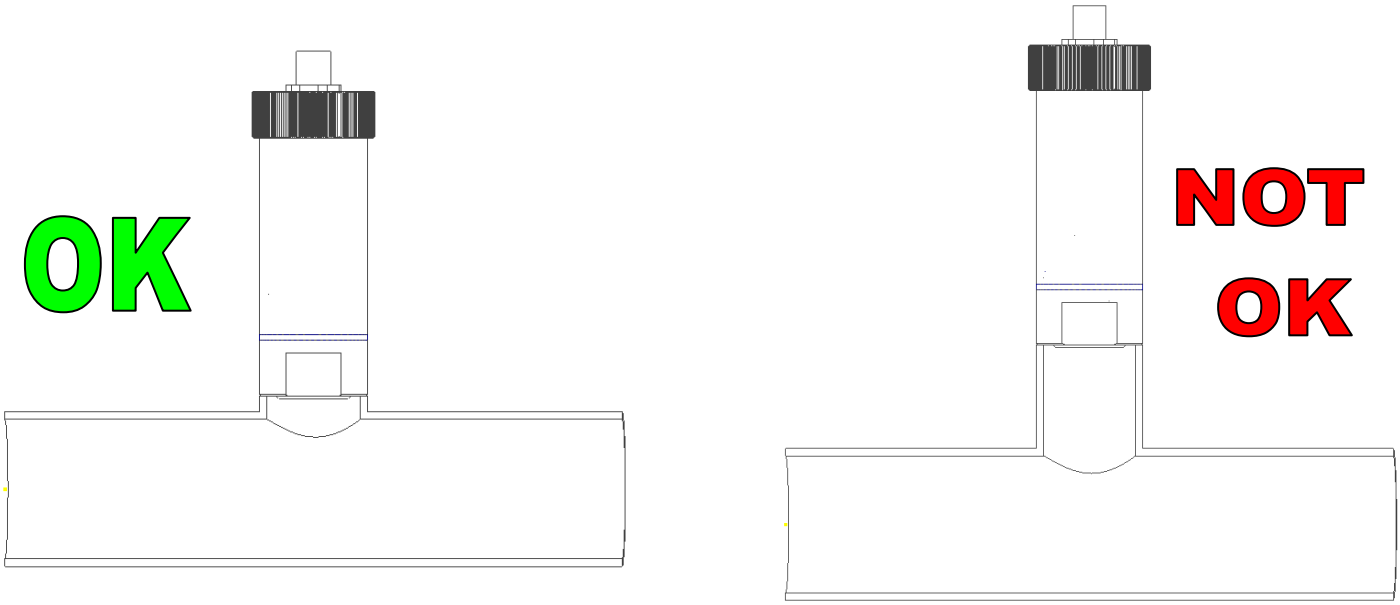
5. Suggested installation hint to avoid inaccurate reading of moisture (Tdew)



The primary element need to breathe to give an accurate response hence if installation is at the end of a thin pipe or far from tank there is no possibility to hydrate or dry; this will cause inaccurate reading unless a flow is guaranteed

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APPLICATION NOTES and FAQ:

Q: What is the physical parameter transmitted by SGM/DEW/x ?
A: The sensor read relative humidity and temperature and converts into dewpoint temperature

Q: What is dewpoint temperature, Tdew ?
A: The temperature (in degrees °C or °F) at which moisture (water vapour) in the gas begins to condense as liquid (droplets or dew) or solid (ice)

Q: What is ppmV ?
A: Moisture volume concentration (parts per million by volume). One million times the ration of the volume of moisture (water vapour) present in the gas to the total volume of the gas (including water vapour).

Q: What is ppmW ?
A: Moisture mass concentration (parts per million by mass).
For SF6 gas, conversion to ppmW=ppmV / 8.1

Q: Is Tdew pressure dependant ?
A: Yes it is strongly dependant. It has no sense to deal with Tdew without indicating also the reference pressure of tank

Q: Is ppmV or ppmW pressure dependant ?
A: No they do not depend on pressure of tank

Q: What if measurement in ppmV is desired and only dewpoint is known or measured ?
A: To convert Tdew to ppmV (or ppmW) pressure of tank need to be known. There are some formulas able to calculate ppmV starting from Tdew and pressure.
For general purpose indication please check tables below.

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Simplified table for quick conversion to ppmV

ppmV	Ptank [bar abs]												
Dewpoint temperature [°C]	2,0	2,5	3,0	3,5	4,0	4,5	5,0	5,5	6,0	6,5	7,0	7,5	8,0
-60	5,4	4,3	3,6	3,1	2,7	2,4	2,2	2,0	1,8	1,7	1,5	1,4	1,4
-57,5	7,6	6,0	5,0	4,3	3,8	3,4	3,0	2,7	2,5	2,3	2,2	2,0	1,9
-55	10,5	8,4	7,0	6,0	5,2	4,7	4,2	3,8	3,5	3,2	3,0	2,8	2,6
-52,5	14,4	11,5	9,6	8,2	7,2	6,4	5,8	5,2	4,8	4,4	4,1	3,8	3,6
-50	19,7	15,8	13,1	11,3	9,8	8,8	7,9	7,2	6,6	6,1	5,6	5,3	4,9
-47,5	26,7	21,4	17,8	15,3	13,4	11,9	10,7	9,7	8,9	8,2	7,6	7,1	6,7
-45	36,0	28,8	24,0	20,6	18,0	16,0	14,4	13,1	12,0	11,1	10,3	9,6	9,0
-42,5	48,3	38,6	32,2	27,6	24,1	21,4	19,3	17,5	16,1	14,8	13,8	12,9	12,1
-40	64,2	51,4	42,8	36,7	32,1	28,5	25,7	23,4	21,4	19,8	18,4	17,1	16,1
-37,5	85,0	68,0	56,7	48,6	42,5	37,8	34,0	30,9	28,3	26,1	24,3	22,7	21,2
-35	111,8	89,4	74,5	63,9	55,9	49,7	44,7	40,6	37,3	34,4	31,9	29,8	27,9
-32,5	146,2	116,9	97,4	83,5	73,1	65,0	58,5	53,2	48,7	45,0	41,8	39,0	36,5
-30	190,1	152,1	126,7	108,6	95,1	84,5	76,0	69,1	63,4	58,5	54,3	50,7	47,5
-27,5	246,0	196,8	164,0	140,5	123,0	109,3	98,4	89,4	82,0	75,7	70,3	65,6	61,5
-25	316,5	253,2	211,0	180,9	158,2	140,7	126,6	115,1	105,5	97,4	90,4	84,4	79,1
-22,5	405,4	324,3	270,2	231,6	202,6	180,1	162,1	147,4	135,1	124,7	115,8	108,1	101,3
-20	516,6	413,2	344,3	295,1	258,2	229,5	206,6	187,8	172,1	158,9	147,5	137,7	129,1
-17,5	655,2	524,1	436,7	374,3	327,5	291,1	262,0	238,1	218,3	201,5	187,1	174,6	163,7
-15	827,2	661,7	551,3	472,5	413,4	367,5	330,7	300,6	275,6	254,4	236,2	220,5	206,7
-12,5	1039,8	831,7	693,0	593,9	519,6	461,9	415,7	377,9	346,4	319,7	296,9	277,1	259,8
-10	1301,5	1040,9	867,3	743,3	650,3	578,0	520,2	472,9	433,4	400,1	371,5	346,7	325,0
-7,5	1622,2	1297,3	1080,9	926,3	810,4	720,3	648,2	589,3	540,1	498,6	462,9	432,1	405,0
-5	2013,7	1610,4	1341,6	1149,7	1005,9	894,0	804,5	731,3	670,3	618,8	574,5	536,2	502,7
-2,5	2490,1	1991,1	1658,7	1421,4	1243,5	1105,2	994,6	904,1	828,7	764,9	710,2	662,8	621,4
0	3067,6	2452,6	2043,0	1750,6	1531,5	1361,1	1224,8	1113,3	1020,5	941,9	874,5	816,2	765,1
2,5	3765,2	3009,9	2507,0	2148,1	1879,1	1669,9	1502,7	1365,9	1251,9	1155,5	1072,9	1001,3	938,7
5	4605,2	3680,8	3065,4	2626,4	2297,3	2041,5	1837,0	1669,7	1530,4	1412,5	1311,5	1223,9	1147,3
7,5	5613,4	4485,7	3735,3	3200,0	2798,9	2487,1	2237,8	2034,0	1864,2	1720,5	1597,4	1490,8	1397,5
10	6820,0	5448,5	4536,3	3885,8	3398,4	3019,7	2716,9	2469,3	2263,0	2088,6	1939,1	1809,6	1696,3
12,5	8259,7	6596,9	5491,3	4703,2	4112,9	3654,2	3287,6	2987,8	2738,2	2527,0	2346,1	2189,3	2052,2
15	9973,1	7962,6	6626,7	5674,7	4961,8	4408,1	3965,5	3603,7	3302,4	3047,6	2829,3	2640,2	2474,8
17,5	12007,1	9582,6	7972,8	6826,1	5967,7	5301,1	4768,5	4333,1	3970,6	3664,0	3401,4	3173,9	2975,0
20	14415,9	11499,6	9564,7	8187,1	7156,4	6356,2	5716,9	5194,5	4759,6	4391,8	4076,9	3804,0	3565,4

Legenda:	
	0 < ppmV < 200
	201 < ppmV < 500
	501 < ppmV < 1000
	ppmV > 1001

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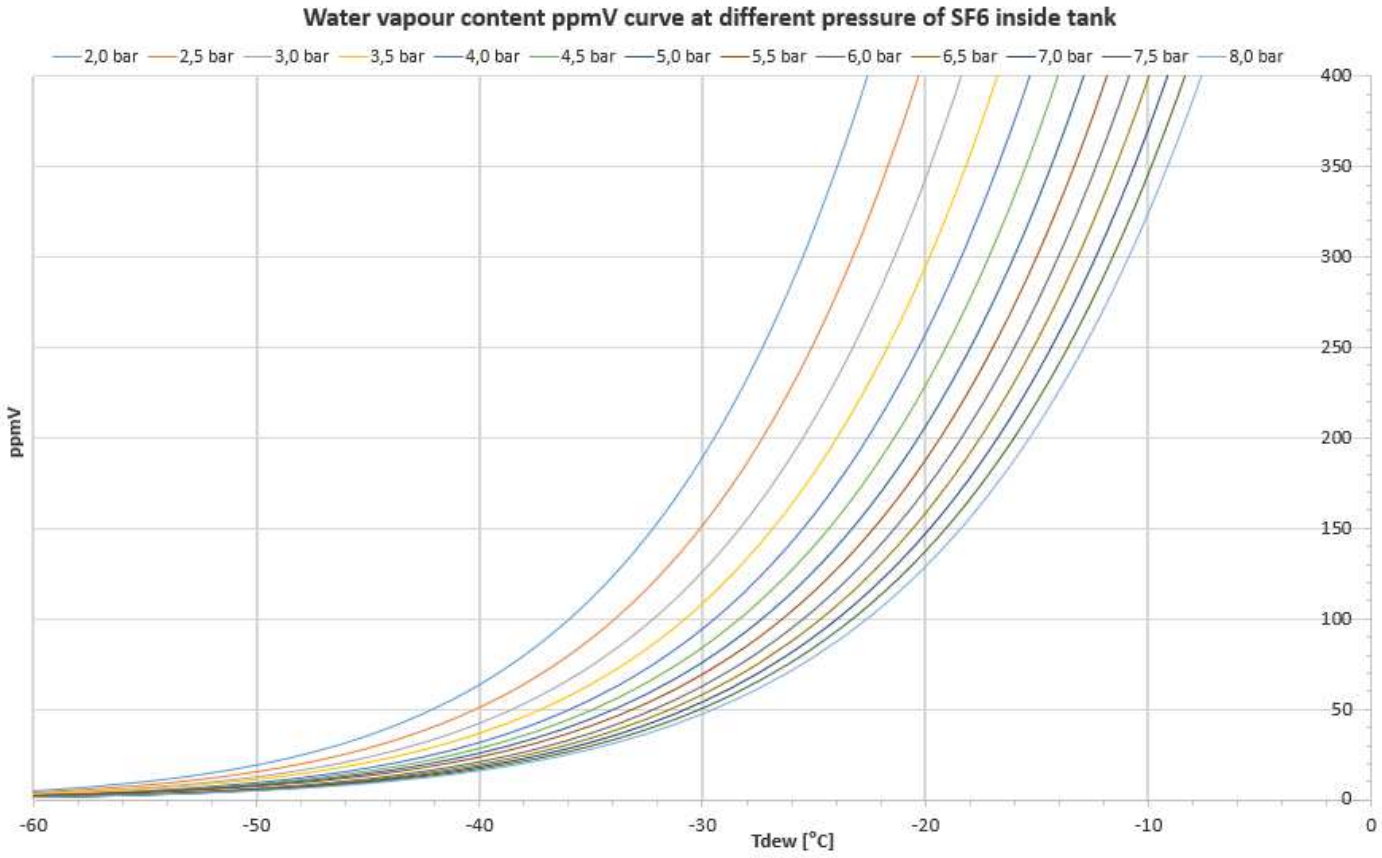
SF_6 Dew point temperature transmitter



Calculations have been simplified for an easier reading.

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