SF_6 & Dry Air Electronic multi-parameter transmitter

APPLICATIONS

- Moisture monitoring of air or gas (SF6)
- Multi-parameter measurement available:
  -Pressure
  -Temperature
  -Density
  -ppmV
  -Relativity Humidity
  -Dew point temperature
- Suitable for indoor or outdoor
- Industrial, medical or aerospace fields
- HV substation, HV circuit breaker
- Suitable also for new Green Gas like Dry Air

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.
PPMV moisture calculation is based on measurement of three physical data: relative humidity HR%, pressure mbar and temperature °K.
Our sensor has two integrated sensing elements able to read at the same time, all the parameters which are converted by the ASIC into equivalent ppmV unit.

HIGHLIGHTS

- Wide range measurement of moisture content 50 to 2000 ppmV
- Patented polymer die chemically resistant depending on gas and exposition
- Excellent long term stability
- Factory calibration by laser trimming
- Low drift temperature compensated
- 14 bit ASIC core digital Uprocessor
- Double primary sensing element on combined printed board
- Internal digital I2C communications for safe and error free link
- Dry contacts for low and alarm set points (optional)
- Visual indication by powerless flag indicator (information kept even without energy)
- Analogue output 4 to 20mA loop powered or digital Modbus RTU RS 485

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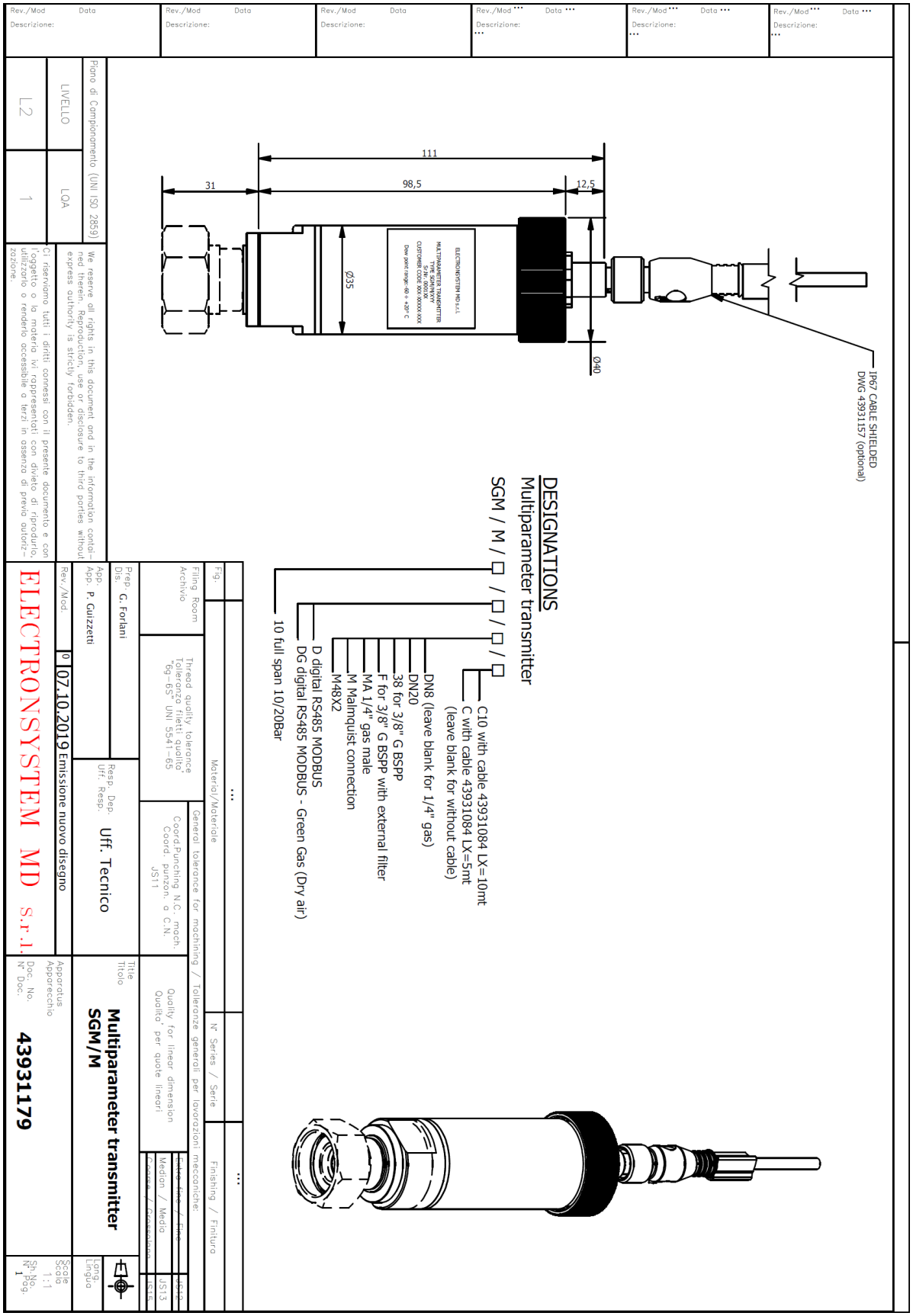
SF_6 & Dry Air Electronic multi-parameter transmitter



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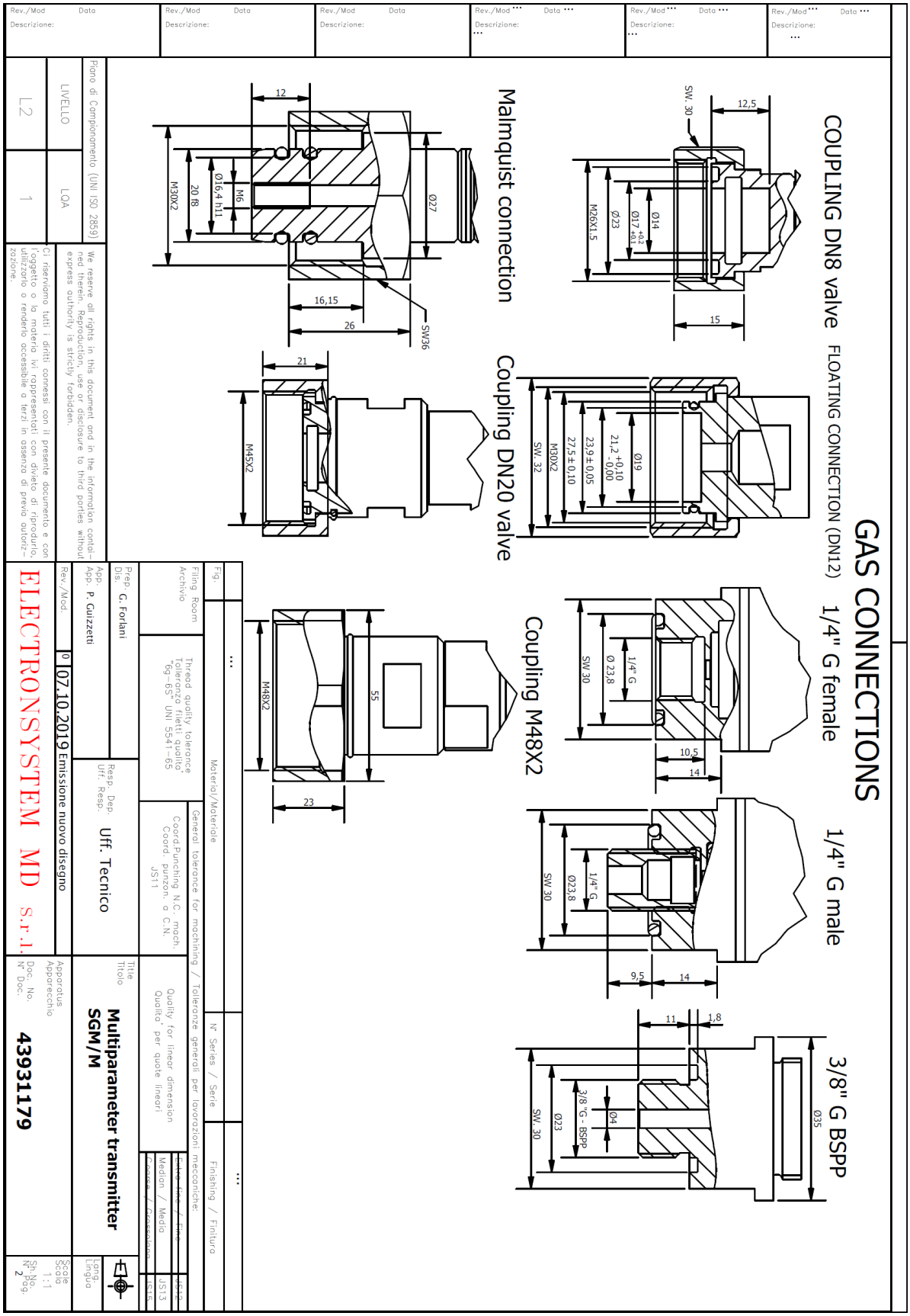
SF_6 & Dry Air Electronic multi-parameter transmitter



SF_6 & Dry Air Electronic multi-parameter transmitter

TECHNICAL FEATURES:
DESCRIPTION:
MULTIPARAMETER SENSOR

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 digital version:
2.1.1 Output signal : RTU MODBUS RS485 (see diagram 2)
2.1.2 Data protocol: baudrate 19200, databits 8, parity even, stopbit 1
2.1.3 Input voltage : 15 to 30 Vdc
2.1.4 Current Consumption : 10mA typ. / 15mA max.
2.2 Common electrical data:
2.2.1 Input protection : overvoltage supressor and reverse voltage diode
2.2.2 Response time moisture sensor: 1 min. from dry to wet point
2.2.3 Equilibrium time moisture sensor: 5 to 48 hours
2.2.4 Calibration moisture sensor: laser trimmed, low drift digital asic core
2.2.5 Long term Stability: ± 0,1% ppmV / year
2.2.6 Accuracy: equivalent to ± 3°C Atm. (PPMv vs Tdew reference chart on p. 6) (check ppmV vs Tdew chart)
2.2.7 Isolation: max 250Vac 50Hz against mass
2.2.8 Resistance of insulation: >10MΩohm
2.2.9 Terminal block : circular shielded M12x1 connector
2.2.10 Consumption : <10mA

3 Measurement range and performance
3.1 Digital output
3.1.1 Absolute pressure [mbar ABS], 0 to 19999 (Accuracy : < ±1% @ T=0÷40°C (±0.3%/10°C extended temp. range)
3.1.2 Temperature [C°], -40 to +80 (±0.5°C@20°C; ±3° C)
*3.1.3 Equivalent pressure [mbar ABS], 0 to 19999 (Accuracy : < ±1% @ T=0÷40°C (±0.3%/10°C extended temp. range)
3.1.4 SF6 density [g/L], 0 to 66 (±1)
3.1.5 Dry air density [g/L], 0 to 12 (±0.25)
3.1.6 Relative humidity [HR%], 0 to 100 (±2%)0.5% FSO@20°C;
**3.1.7 Dew point temp [°C], -60 to +30 (±3)
3.1.8 Dew point temp @ atmospheric p [°C], -60 to +30
3.1.9 Moisture content [ppmV], 0 to 2000 (±50)

* see diagram 3 (isochores, no measurent in liquid phase)
** se diagram 4

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: 20 bar ABS - overpressure up to 30 bar

6 Environmetal conditions:
Operating temperature:
Standard : -40°C to +70°C
Transport and storage : -40°C to 85°C
Relative humidity 3 to 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
6.2 Measured gases: SF6, SF6/N2 MIX, AIR

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 Pressure BAR
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

Rev./Mod Data
Descrizione:

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

Fig.
Material/Materiale
N° Series / Serie
Finishing / Finitura
Filing Room Archivio
Thread quality tolerance Tolleranzo filetti, qualita' "6g-6S" UNI 5541-65
General tolerance for machining / Tolleranze generali per lavorazioni meccaniche:
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 / Grossolana JS15
Prep. Dis. G. Forlani
App. App. P. Guizzetti
Resp. Dep. Uff. Resp. Uff. Tecnico
Rev./Mod. 0 07.10.2019 Emissione nuovo disegno
Title Titolo **Multiparameter transmitter SGM/M**
Apparatus Apparecchio
Doc. No. N° Doc. **43931179**
Scale Scala 1:1
Sh No. N° Fog. 3
Long Lingua
ELECTRONSYSTEM MD S.r.l.
we reserve the rights to modify the drawing without notice

All specs are subject to change without notice

SF_6 & Dry Air Electronic multi-parameter transmitter

DIAGRAM 1: TABLE OF TELEGRAM

Registry	Information	Type	Function
Reg_0	ID_slave	Unsigned Int	Read/Write
Reg_1	Absolute pressure [mbar abs]	Unsigned Int	Read only
Reg_2	Temperature [°C/10]	Signed Int	Read only
Reg_3	Equivalent pressure [mbar abs]	Unsigned Int	Read only
Reg_4	SF6 Density [g/l /10]	Unsigned Int	Read only
Reg_5	Relative humidity HR.Read [%/10]	Unsigned Int	Read only
Reg_6	Dewpoint Temp [°C/10]	Signed Int	Read only
Reg_7	Dewpoint Temp. @ atmospheric P [°C/10]	Signed Int	Read only
Reg_8	Moisture content volume [ppmV]	Unsigned Int	Read only
Reg_9	Moisture content weight [ppmW]	Unsigned Int	Read only
Reg_10	Firmware release	Unsigned Int	Read only
Reg_11	Parity	Unsigned Int	Read/Write
Reg_12	Dry Air Density [g/l /100]	Unsigned Int	Read only
Reg_13	N2 Density [g/l /100]	Unsigned Int	Read Only
Reg_100-109	Product code	Hex/Ascii	Read only
Reg_110-119	Company Brand	Hex/Ascii	Read only

Registry	Description	Value [bit]	Unit value
0	ID slave	131	131
1	Absolute pressure [mbar abs]	987	987
2	Temperature [°C]	197	19,7
3	Equivalent pressure [mbar abs]	981	981
4	SF6 Density [g/l]	597	59,7
5	Relative humidity HR [°]	294	29,4
6	Dewpoint Temp [°C]	-57	-5,7
7	Dewpoint Temp. @ atmospheric P [°C]	-30	-3,0
8	Moisture content volume [ppmV]	500	500
9	Moisture content weight [ppmW]	59	59
10	FW release	304	304
11	Parity*	0	0
12	Dry Air Density [g/l]	117	1,17
13	N2 Density [g/l]	113	1,13
100-109	Product code**	--	SGM/M/D
110-119	Company Brand***	--	Electronsystem_MD

* Parity configuration

Value	Set	Note
0	8,E,1	8bit, Even parity, 1bit stop
1	8,O,1	8 bit, Odd parity, 1bit stop
2	8,N,1	8bit, Null parity, 1bit stop
3	8,N,2	8bit, Null parity, 2bit stop

** Product Code

Registry	Hex Value	Characters
100	0x4753	"G","S"
101	0x2F4D	"/","M"
102	0x2F4D	"/","M"
103	0x0044	"NUL","D"
104	0x0000	"NUL","NUL"
105	0x0000	"NUL","NUL"
106	0x0000	"NUL","NUL"
107	0x0000	"NUL","NUL"
108	0x0000	"NUL","NUL"
109	0x0000	"NUL","NUL"

Data readable only after new specific poll

*** Company Brand

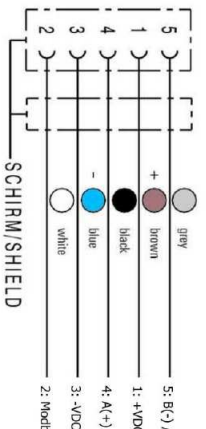
Registry	Hex Value	Characters
110	0x6C45	"l","E"
111	0x6365	"c","e"
112	0x7274	"r","t"
113	0x6E6F	"n","o"
114	0x7973	"y","s"
115	0x7473	"t","s"
116	0x6D65	"m","e"
117	0x4D3F	"M",""
118	0x0044	"NUL","D"
119	0x0000	"NUL","NUL"

Data readable only after new specific poll

Protocol settings

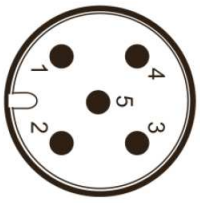
ADDRESS 131 default
Protocol Modbus RTU
Speed 19200 Baud
Data 8 bit
Parity Even parity
Stop 1 bit stop
Scan rate 50ms
Response time out 500ms
Delay 200ms

Wiring 43931157 (optional)

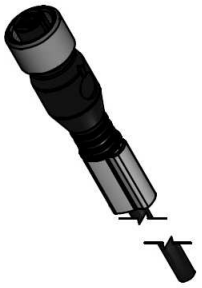


TERMINAL BLOCK

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



View on sensor plug



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

Rev./Mod | Data | Descrizione:

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

Filing Room / Archivio

Thread quality, tolerance / Tolleranza filetti, qualità "6g-6G" UNI 5541-65

Generali tolerance for machining / Tolleranze generali per lavorazioni meccaniche:
Coord.Punching N.C., mach. / Coord. punzon. o C.N. JS11

Quality for linear dimension / Qualità per quote lineari
Median / Media JS13
Coarse / Grossolana JS15

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

Rev./Mod		
0	07.10.2019	: Emissione nuovo disegno

Title / Titolo: **Multiparameter transmitter SGM/M**

Apparatus / Apparecchio: **43931179**
Doc. No. / N° Doc.:

Lang. / Lingua

Scale / Scala 1:1
Sh.No. / N° Sh. 1
Pag. 4

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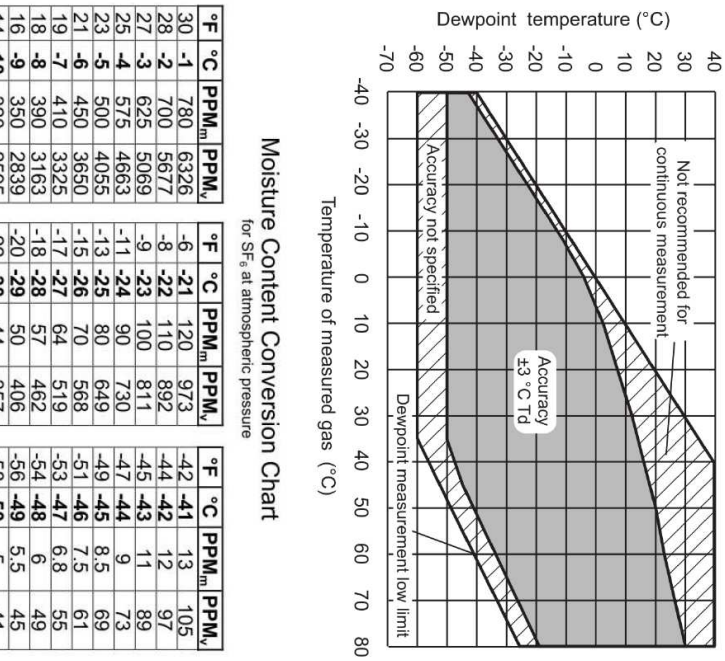
SF_6 & Dry Air Electronic multi-parameter transmitter

DIAGRAM 2: DEW POINT MEASUREMENT ACCURACY

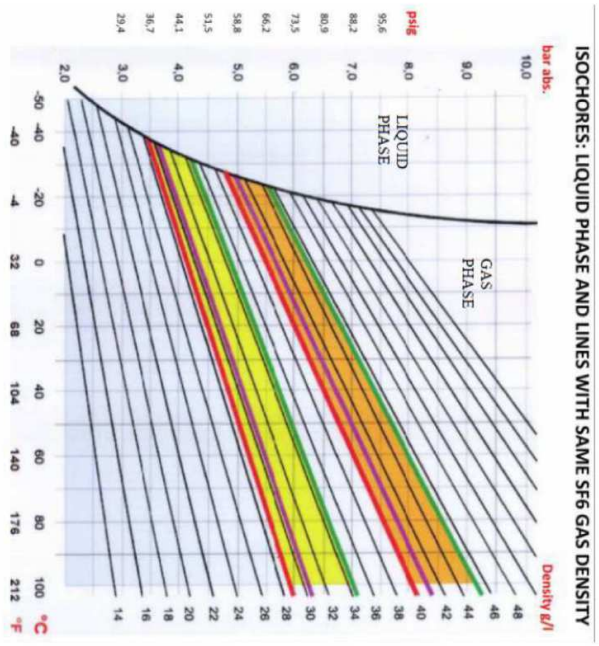


Moisture Content Conversion Chart

for SF_6 at atmospheric pressure

°F	°C	PPM_m	PPM_v	°F	°C	PPM_m	PPM_v	°F	°C	PPM_m	PPM_v
30	-1	780	6326	-6	-21	120	973	-42	-41	13	105
28	-2	700	5677	-8	-22	110	892	-44	-42	12	97
27	-3	625	5069	-9	-23	100	811	-45	-43	11	89
25	-4	575	4663	-11	-24	90	730	-47	-44	9	73
23	-5	500	4055	-13	-25	80	649	-49	-45	8.5	69
21	-6	450	3650	-15	-26	70	568	-51	-46	7.5	61
19	-7	410	3325	-17	-27	64	519	-53	-47	6.8	55
18	-8	390	3163	-18	-28	57	462	-54	-48	6	49
16	-9	350	2839	-20	-29	50	406	-56	-49	5.5	45
14	-10	320	2595	-22	-30	44	357	-58	-50	5	41
12	-11	290	2352	-24	-31	40	324	-60	-51	4.2	34
10	-12	260	2109	-26	-32	36	292	-62	-52	4	32
9	-13	240	1946	-27	-33	32	260	-63	-53	3.5	28
7	-14	220	1784	-29	-34	29	235	-65	-54	3	24
5	-15	200	1622	-31	-35	27	219	-67	-55	2.5	20
3	-16	185	1500	-33	-36	24	195	-69	-56	2.3	19
1	-17	175	1419	-35	-37	22	178	-71	-57	2	16
0	-18	150	1217	-36	-38	19	154	-72	-58	1.7	14
-2	-19	145	1176	-38	-39	17	138	-74	-59	1.5	12
-4	-20	135	1095	-40	-40	15	122	-76	-60	1.3	11

DIAGRAM 3: ISOCHORES



Rev./Mod Data Descrizione:

Piano di Campionamento (UNI ISO 2859)

LIVELLO	LQA
L2	1

Fig.
Filing Room / Archivio
Material / Materiale
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Thread quality tolerance "Tolleranza filetti qualità" "6g-6G" UNI 5541-65
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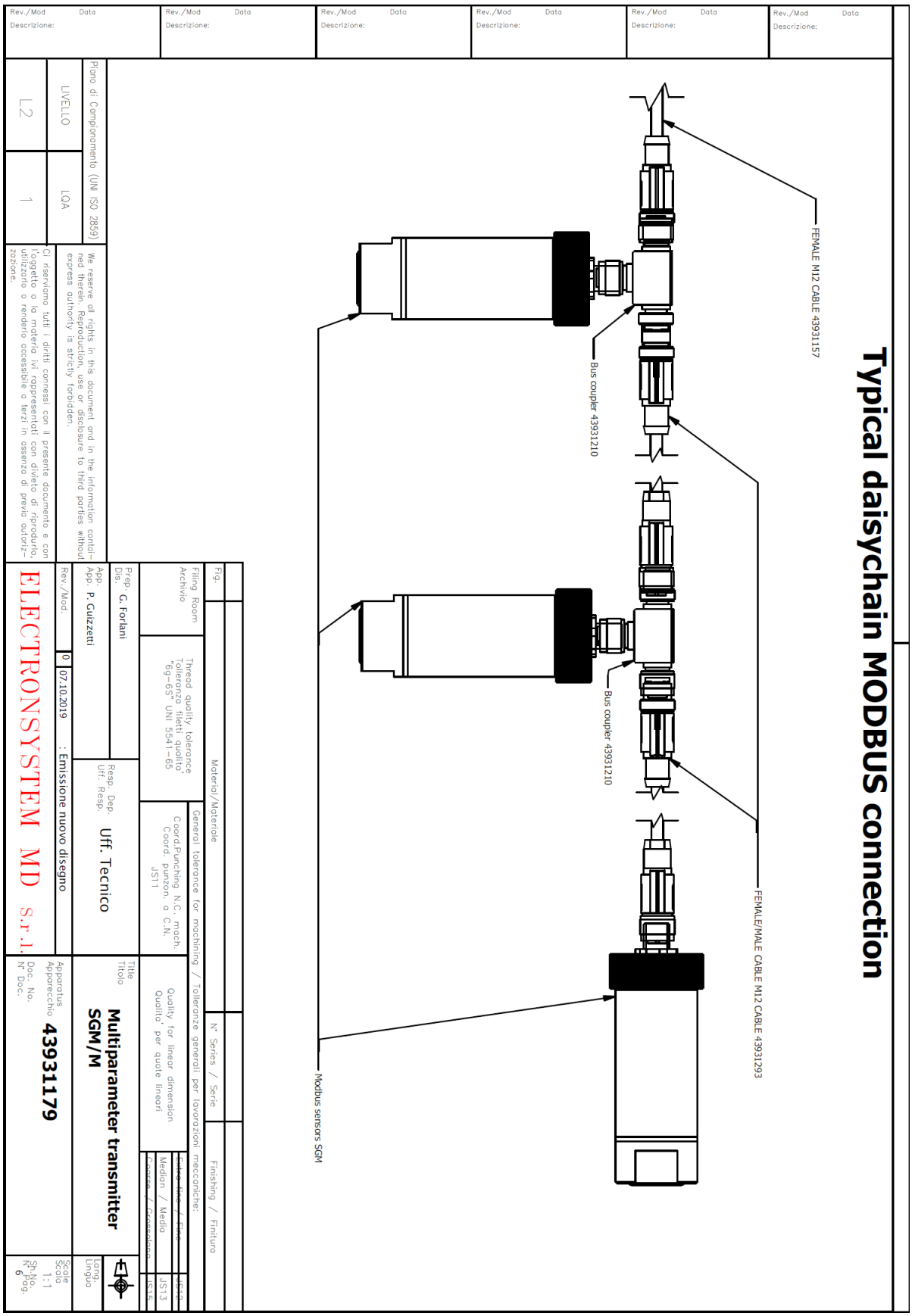
SF_6 & Dry Air Electronic multi-parameter transmitter



STORAGE

If the device 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 to +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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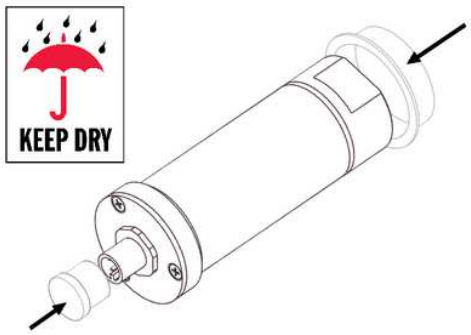
WARNINGS

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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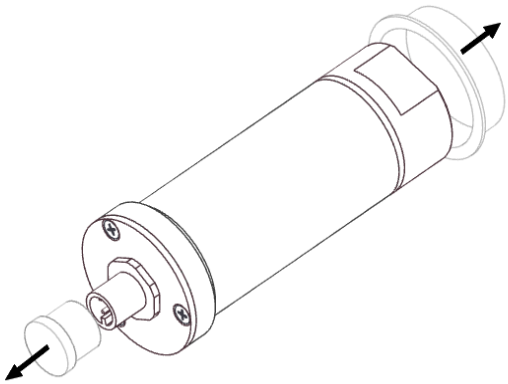
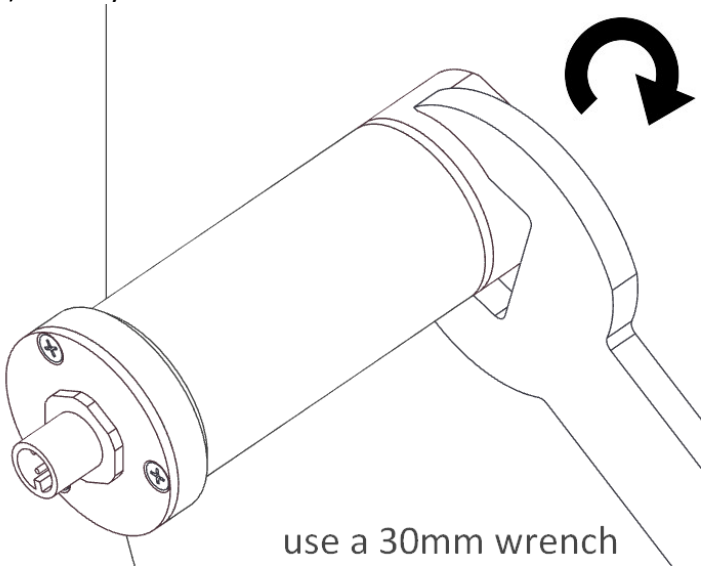
INSTALLATION

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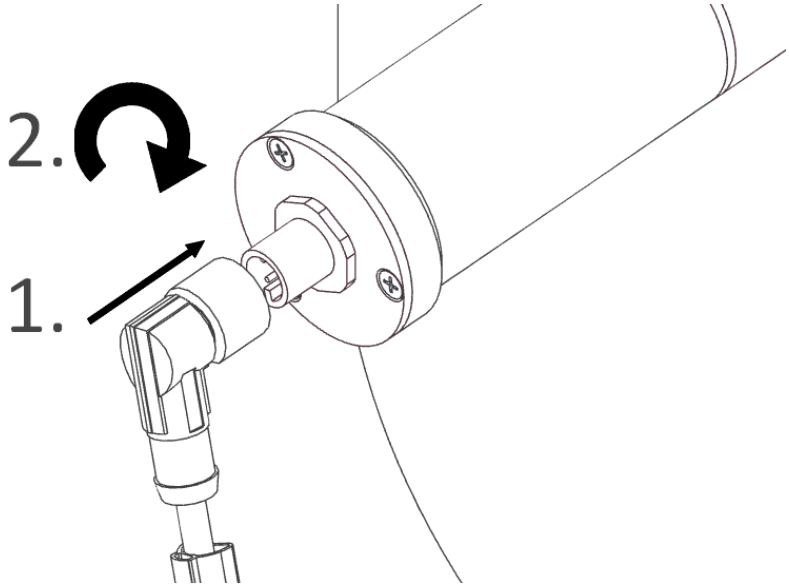
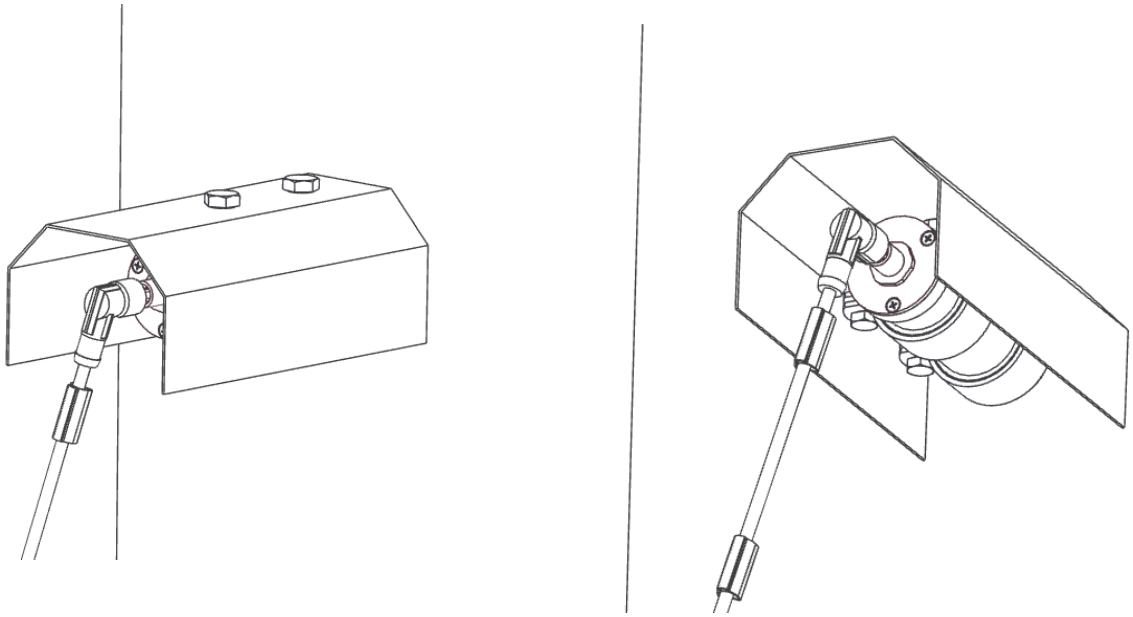
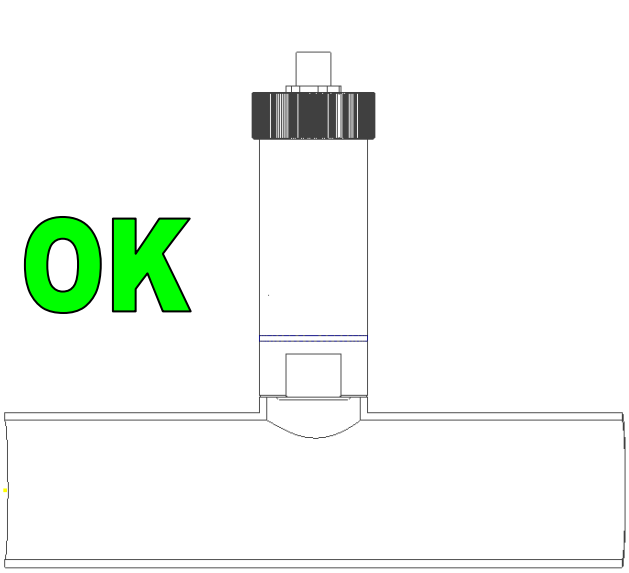
3. Connect proper circular wiring into the output port checking the correct polarization of the connector then turn firmly the rotating crown of the cable.
   Use a cable with a suitable outdoor IP67 connector for your installation (straight or angled)

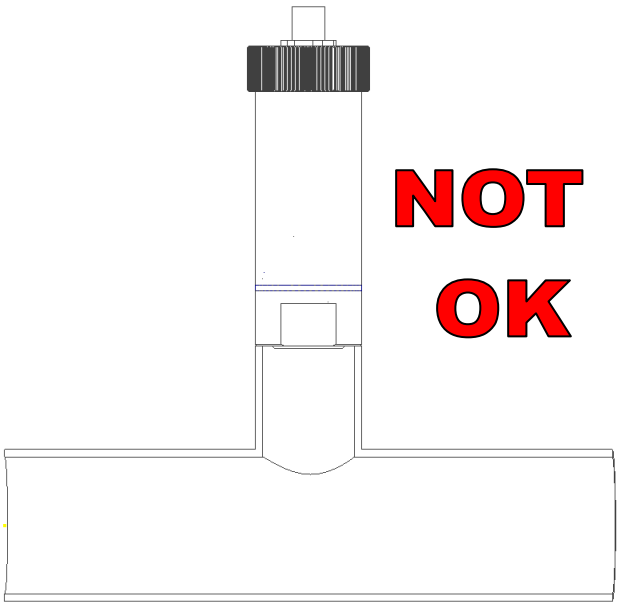


4. In case the weather shield is needed (optional), can be added to the transmitter by fitting the two rubber clamps on the body of transmitter and tightening to assure it can remain in place.
   Assure that the stainless roof completely cover the transmitter and the cable connection.



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





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 Moisture Indicator code SGM/MI/x ?
A: The sensor read relative humidity, temperature and pressure and converts into ppmV unit

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 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 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 Tdew is desired and only ppmV is known or measured ?
A: To convert ppmV (or ppmW) to Tdew pressure of tank need to be known.
For general purpose indication please check tables below.

Simplified table for quick conversion to ppmV

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SF_6 & Dry Air Electronic multi-parameter transmitter

ppmV	Ptank [bar abs]																
Dewpoint temperature [°C]	1	1,25	1,5	1,75	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	10,8	8,6	7,2	6,2	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	15,1	12,1	10,1	8,6	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	20,9	16,8	14,0	12,0	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	28,8	23,1	19,2	16,5	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	39,4	31,5	26,3	22,5	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	53,5	42,8	35,6	30,5	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	72,1	57,7	48,0	41,2	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	96,5	77,2	64,4	55,2	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	128,5	102,8	85,7	73,4	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	170,0	136,0	113,3	97,1	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	223,6	178,9	149,0	127,7	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	292,4	233,9	194,9	167,1	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	380,3	304,2	253,5	217,3	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	492,0	393,6	328,0	281,1	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	633,3	506,6	422,1	361,8	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	811,0	648,7	540,5	463,3	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	1033,7	826,8	688,9	590,4	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	1311,2	1048,7	873,8	748,9	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	1655,8	1324,2	1103,3	945,5	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	2081,8	1664,7	1386,9	1188,5	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	2606,3	2084,0	1736,0	1487,7	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	3249,6	2598,0	2164,0	1854,3	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	4035,6	3225,9	2686,8	2302,1	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	4992,7	3990,2	3322,9	2846,9	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	6154,1	4917,2	4094,3	3507,4	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	7558,9	6038,0	5026,6	4305,4	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	9253,0	7388,8	6149,7	5266,6	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	11290,2	9011,8	7498,6	6420,5	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	13733,6	10956,8	9114,0	7801,8	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	16657,0	13281,3	11043,3	9450,8	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	20147,1	16053,0	13341,8	11414,1	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	24306,0	19350,7	16073,8	13745,9	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	29253,6	23266,7	19314,0	16509,3	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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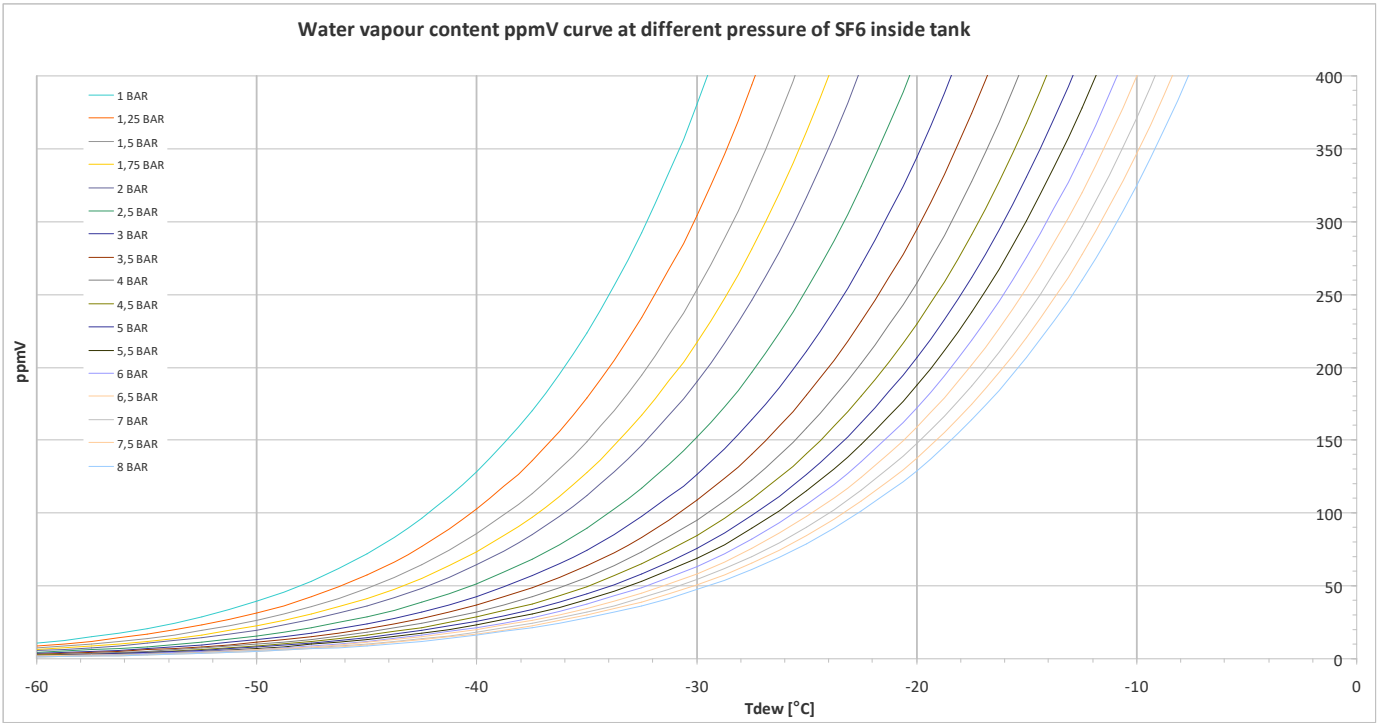

Calculations have been simplified for an easier reading.

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