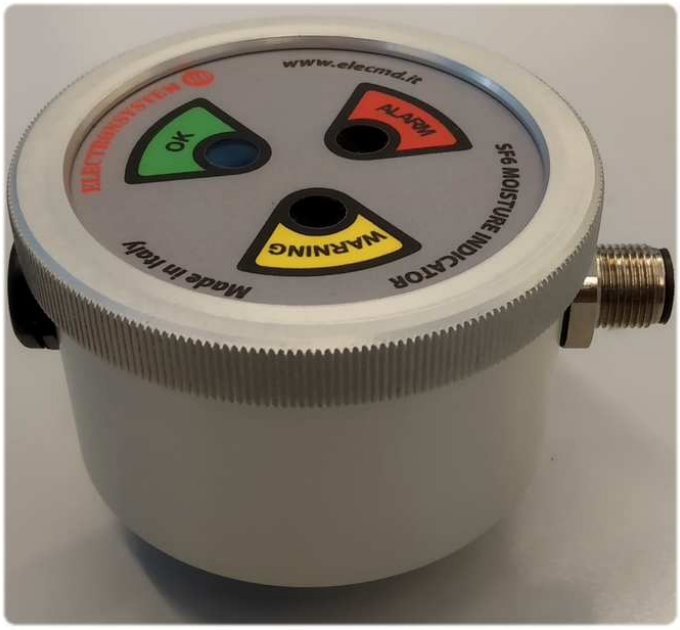
SF_6 Electronic multi-parameter indicator



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

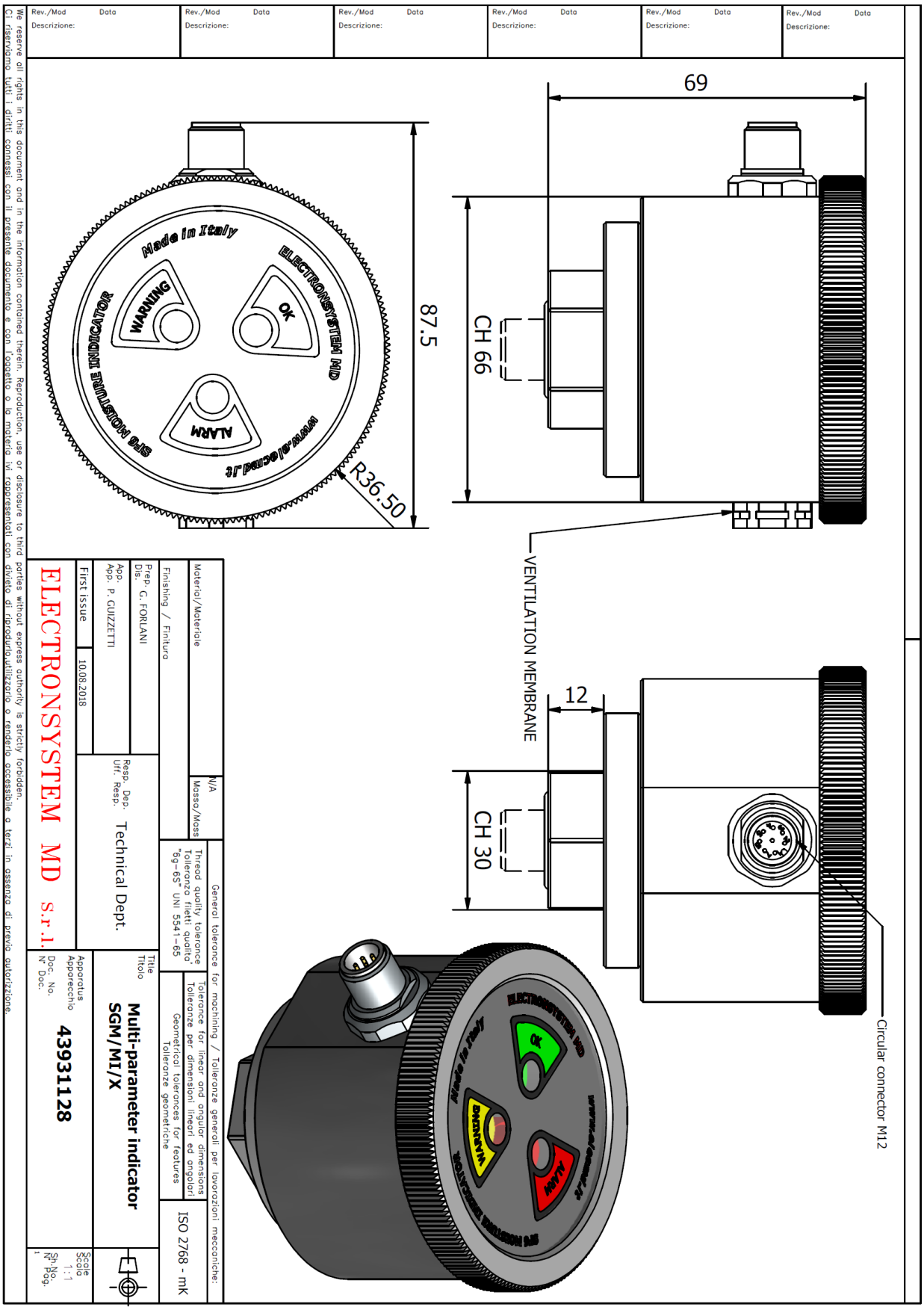
High voltage circuit breakers commonly used for distribution and transmission are reliable if they are able to operate in steady and controlled conditions.
The use of SF6 as quenching gas is extremely important to guarantee a safe operation during the life of equipment.
But if moisture inside the gas 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 an 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

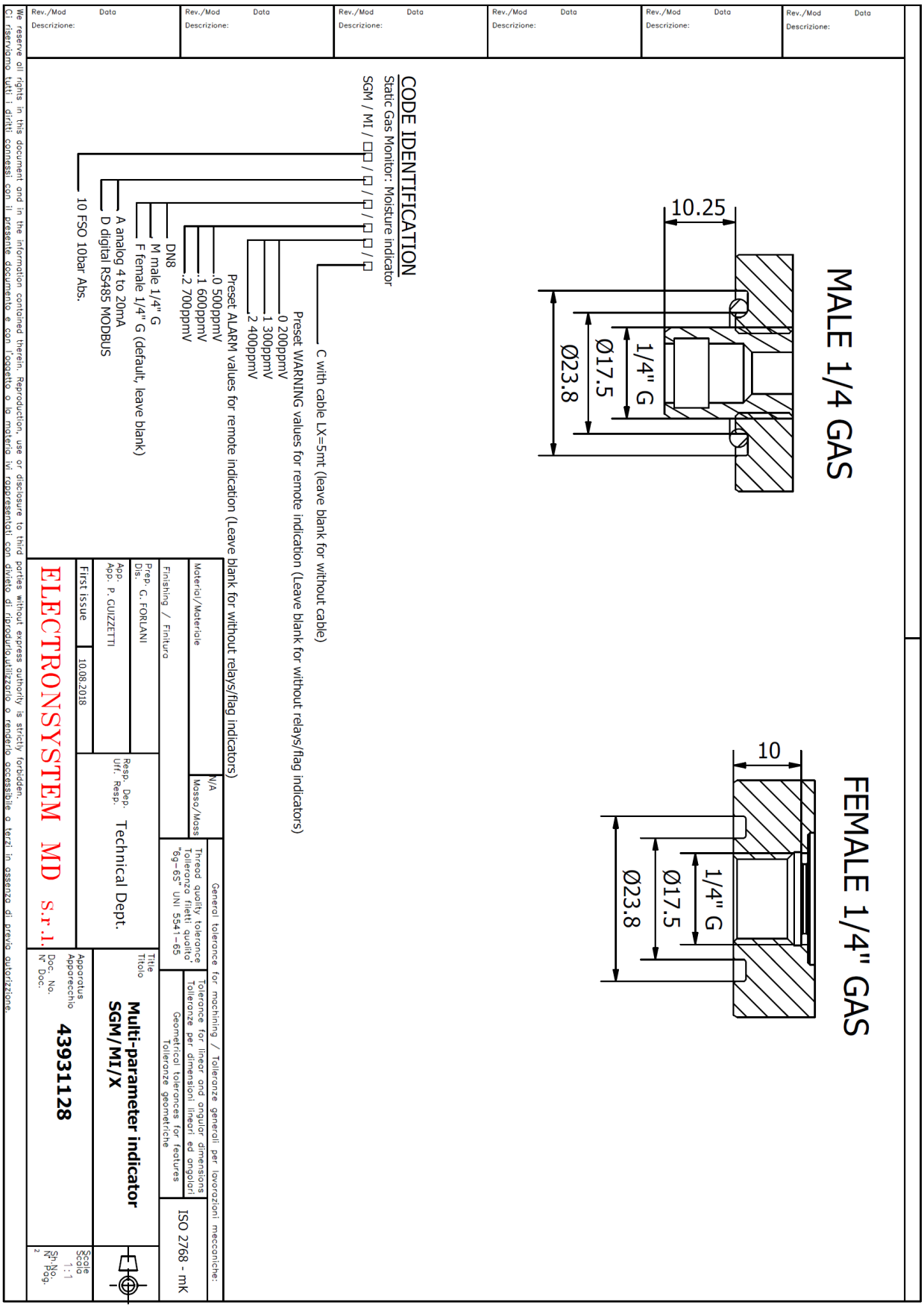
Via Madonna delle Rose, 72 24061 Albano S.Alessandro (BG) ITALY - Phone +39035584000, Fax +39035584099 E-mail: info@elecmd.it Web www.elecmd.it

SF_6 Electronic multi-parameter indicator



All specs are subject to change without notice

SF_6 Electronic multi-parameter indicator



All specs are subject to change without notice

SF_6 Electronic multi-parameter indicator

TECHNICAL FEATURES:

DESCRIPTION:
MOISTURE INDICATOR

1 Materials:
1.1 Housing material : Anodized aluminium 6082 anticorodal
1.2 Inner o.rings material : TIMO70 peroxide cured
1.3 Primary sensing element: Patented polymer chemically resistant
1.4 Cable connection material: aluminium alloy nickel-plated
1.5 Conforms to 2002/95/CE (RoHS), Halogen free

2 Electrical data of sensors
2.1 Electrical data analog version
2.1.1 Output signal : 4 to 20 mA 2 wires loop system (see diagram 1)
2.1.2 Input voltage : 15 to 30 Vdc
2.1.3 Rload: Rin< 250 ohm
2.2 Electrical data digital version:
2.3.1 Output signal : RTU MODBUS RS485 (see diagram 2)
2.3.2 Data protocol: baudrate 19200, databits 8, parity even, stopbit 1
2.3.3 Input voltage : 15 to 30 Vdc
2.3 Output contacts:
2.3.1 1 x dry C.O. contact for alarm
2.3.2 1 x dry C.O. contact for warning
2.3.3 2A 30Vdc, 0.5A 125Vdc (resistive load)
2.3.4 Max switch voltage 220Vdc 125Vac
2.3.5 Max switching current 2A
2.4 Common electrical data:
2.4.1 Input protection : overvoltage supressor and reverse voltage diode
2.4.2 Response time : 1 min. from dry to wet point
2.4.3 Equilibrium time: 5 to 48 hours
2.4.4 Calibration: laser trimmed, low drift digital asic core
2.4.5 Long term Stability: ± 0,1% ppmV / year
2.4.6 Accuracy: equivalent to ± 3°C Atm. (PPMv vs Tdew reference chart on p. 6) (check ppmV vs Tdew chart)
2.4.7 Isolation: max 250Vac 50Hz against mass
2.4.8 Resistance of insulation: >10Mohm
2.4.9 Terminal block : circular shielded M12x1 connector

3 Measurement range and performance
3.1 Analog output
3.1.1 Moisture content [ppmV], 50 to 2000 (±50)
3.2 Digital output
3.2.1 Absolute pressure [mbar ABS], 0 to 9999 (1% FSO)
3.2.2 Temperature [C°], -40 to +80 (±2° C)
*3.2.3 Equivalent pressure [mbar ABS], 0 to 9999 (1% FSO)
3.2.4 SF6 density [g/L], 0 to 66 (±1)
3.2.5 Relative humidity [HR%], 0 to 100 (±1,5%)
**3.2.6 Dew point temp [°C], -60 to +30 (±3)
3.2.7 Dew point temp @ atmospheric p [°C], -60 to +30
3.2.8 Moisture content [ppmV], 0 to 2000 (±50)

* see diagram 3 (isochores, no measurement 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 30G on 3 axys
5.2 Max allowable pressure: 12 bar ABS

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 Pollution Class III IEC 60815, table 1
6.2 Protection degree (DIN EN 60529): IP65; IP67 on request
6.3 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:

Material/Materiale — Massa/Mass
Finishing / Finitura
General tolerance for machining / Tolleranze generali per lavorazioni meccaniche:
Thread quality tolerance / Tolleranza filetti qualita' "6g-6S" UNI 5541-65
Tolerance for linear and angular dimensions / Tolleranze per dimensioni lineari ed angolari
Geometrical tolerances for features / Tolleranze geometriche
ISO 2768 - mK

Prep. G. FORLANI
Dis.
App.
App. P. GUIZZETTI
Resp. Dept. / Uff. Resp. Technical Dept.
First issue 10.08.2018

ELECTRONSYSTEM MD S.r.l.

Title / Titolo: **Multi-parameter indicator SGM/MI/X**
Apparatus / Apparecchio
Doc. No. / N° Doc.: **43931128**
Scale 1:1
Sh. No. / N° Pag. 1

We reserve the rights to modify the drawing without notice

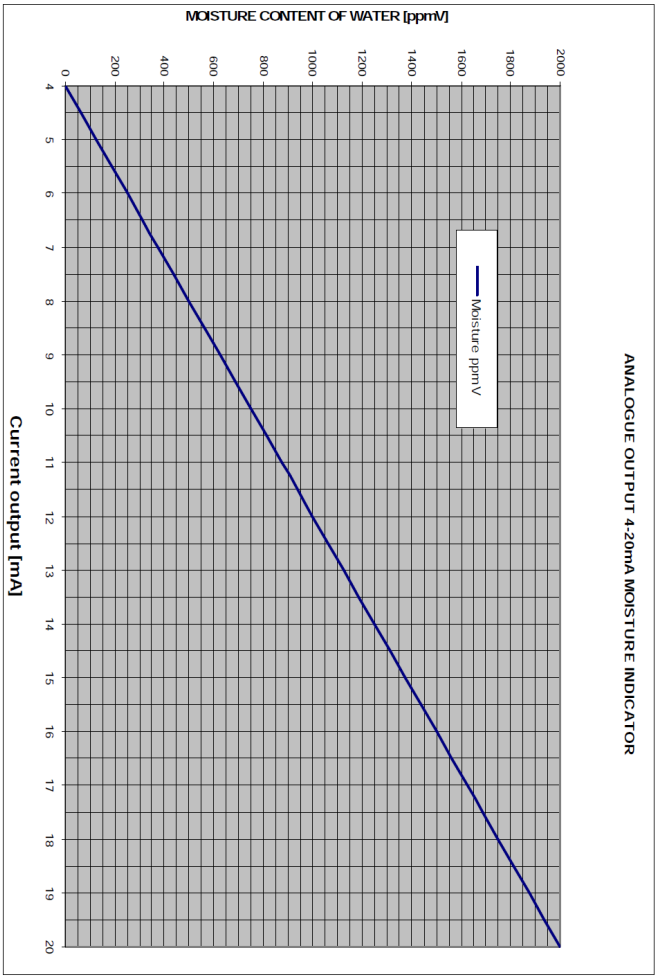
All specs are subject to change without notice

SF_6 Electronic multi-parameter indicator

Rev./Mod	Data	Descrizione:

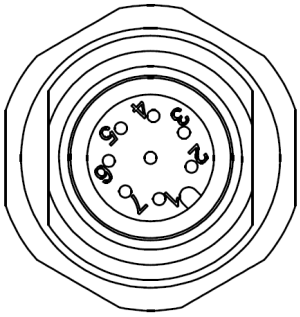
DIAGRAM 1: ANALOG SENSOR

ANALOGUE OUTPUT 4-20mA MOISTURE INDICATOR



TERMINAL BLOCK

SGM/MI/X/A:
1: +VDC
2: -VDC
3: NC alarm
4: C alarm
5: NA alarm
6: NC warning
7: C warning
8: NA warning



Materiali/Materiale	N/A
Finishing / Finitura	Massa/Mass
Thread quality tolerance Tolleranza filetti qualità "6g-6S" UNI 5541-65	General tolerance for machining / Tolleranze generali per lavorazioni meccaniche
Tolerance for linear and angular dimensions Tolleranze per dimensioni lineari ed angolari	
Geometrical tolerances for features Tolleranze geometriche	ISO 2768 - mK

Prep. G. FORLANI Dis.			
App. App. P. GUIZZETTI	Resp. Dep. Uff. Resp.	Technical Dept.	
First issue	10.08.2018		

ELECTRONSYSTEM MD S.r.l.

Title Titolo	Multi-parameter indicator SGM/MI/X	
Apparatus Apparecchio		
Doc. No. N° Doc.	43931128	
Scale Scala 1:1	Sh. No. N° Fog. 4	

All specs are subject to change without notice

SF_6 Electronic multi-parameter indicator

DIAGRAM 2: TABLE OF TELEGRAM

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]	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

Protocol settings

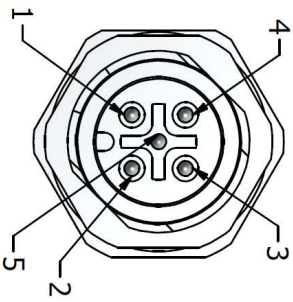
ADDRESS 129 default
Protocol Modbus RTU
Speed 19200 Baud
Data 8 bit
Parity Even parity
Stop 1 bit stop

Example

0	ID slave	129	129
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]	5970	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

TERMINAL BLOCK

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



Rev./Mod Data Descrizione:

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

\\srv2k12\archivi\Electronsystem MD\archivi_cad\Vault elettronica\Disegni\VARIE\Assieme2.iam

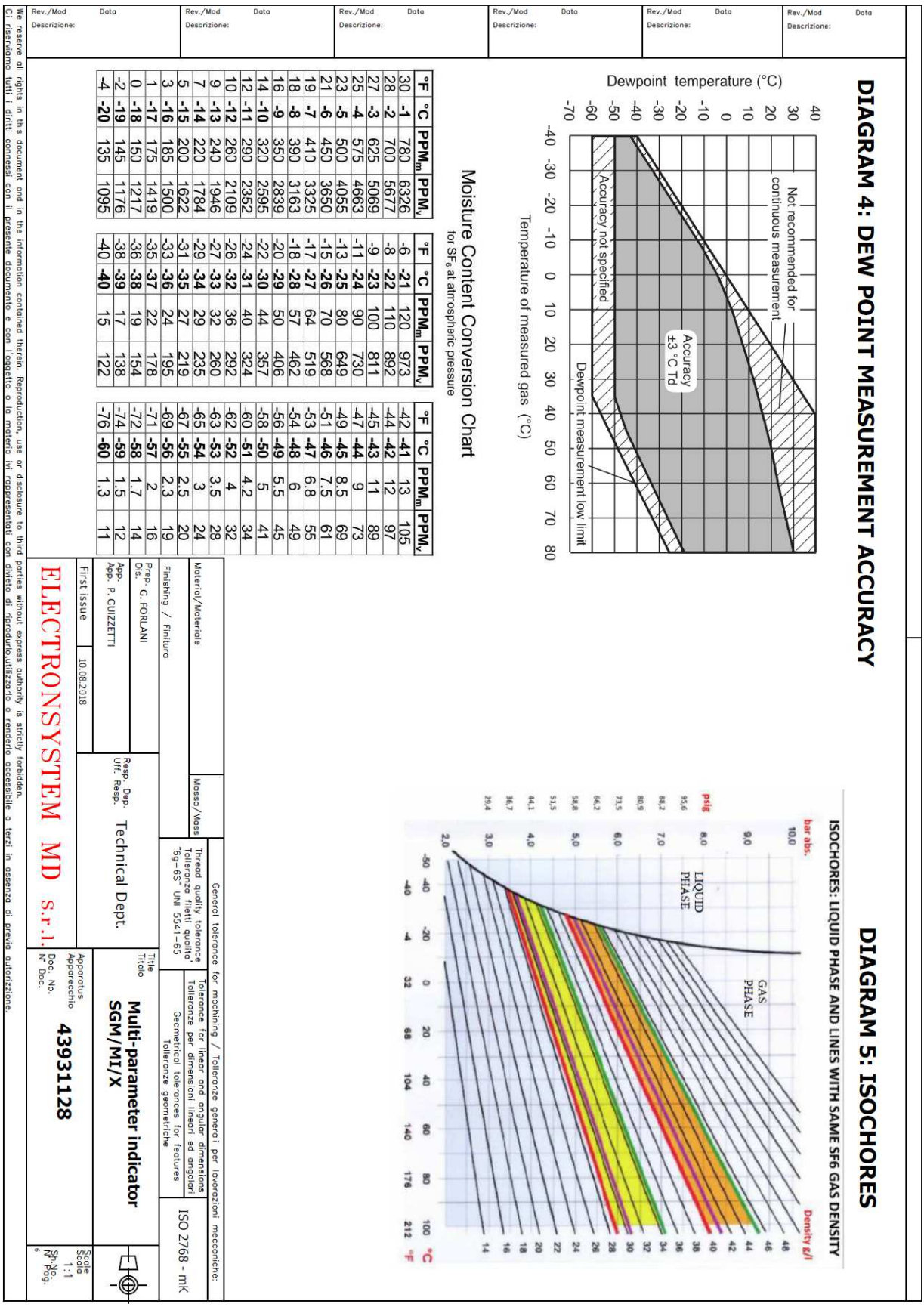
Fig.
Materiali/Materiale
N° Series / Serie
Finishing / Finitura
Filing Room Archivio
Thread quality tolerance Tolleranza filetti qualita' "6g-6G" UNI 5541-65
General tolerance for machining / Tolleranze generali per lavorazioni meccaniche:
Coord.Punching N.C. mach. Coord. punzon. a C.N. JS11
Extra fine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

Prep. Dis. G. Forlani
App. App. P. Giuizzetti
Resp. Dep. Uff. Resp. Uff. Tecnico
Rev./Mod. 10.08.2018 : Emissione nuovo disegno

Title Titolo: **Multi-parameter indicator SGM/MI/X**
Apparatus Apparecchio: **43931128**
Doc. No. N° Doc.
Scale Scala 1:1
Sh. No. N° Fog. 5
Long. Lungo

ELECTRONSYSTEM MD S.r.l.

SF_6 Electronic multi-parameter indicator



°F	°C	PPM_m	PPM_v
30	-1	780	6326
28	-2	700	5677
27	-3	625	5069
25	-4	575	4663
23	-5	500	4055
21	-6	450	3650
19	-7	410	3325
18	-8	390	3163
16	-9	350	2839
14	-10	320	2595
12	-11	290	2352
10	-12	260	2109
9	-13	240	1946
7	-14	220	1784
5	-15	200	1622
3	-16	185	1500
1	-17	175	1419
0	-18	150	1217
-2	-19	145	1176
-4	-20	135	1095

°F	°C	PPM_m	PPM_v
-6	-21	120	973
-8	-22	110	892
-9	-23	100	811
-11	-24	90	730
-13	-25	80	649
-15	-26	70	568
-17	-27	64	519
-18	-28	57	462
-20	-29	50	406
-22	-30	44	357
-24	-31	40	324
-26	-32	36	292
-27	-33	32	260
-29	-34	29	235
-31	-35	27	219
-33	-36	24	195
-35	-37	22	178
-36	-38	19	154
-38	-39	17	138
-40	-40	15	122

°F	°C	PPM_m	PPM_v
-42	-41	13	105
-44	-42	12	97
-45	-43	11	89
-47	-44	9	73
-49	-45	8.5	69
-51	-46	7.5	61
-53	-47	6.8	55
-54	-48	6	49
-56	-49	5.5	45
-58	-50	5	41
-60	-51	4.2	34
-62	-52	4	32
-63	-53	3.5	28
-65	-54	3	24
-67	-55	2.5	20
-69	-56	2.3	19
-71	-57	2	16
-72	-58	1.7	14
-74	-59	1.5	12
-76	-60	1.3	11

All specs are subject to change without notice

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.

Via Madonna delle Rose, 72 24061 Albano S.Alessandro (BG) ITALY - Phone +39035584000, Fax +39035584099 E-mail: info@elecmd.it Web www.elecmd.it

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 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.
We suggest to flush with a dry gas the area surrounding the gas connection to clean and dry the moisture absorbed during stockage in order to reduce response time.

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.

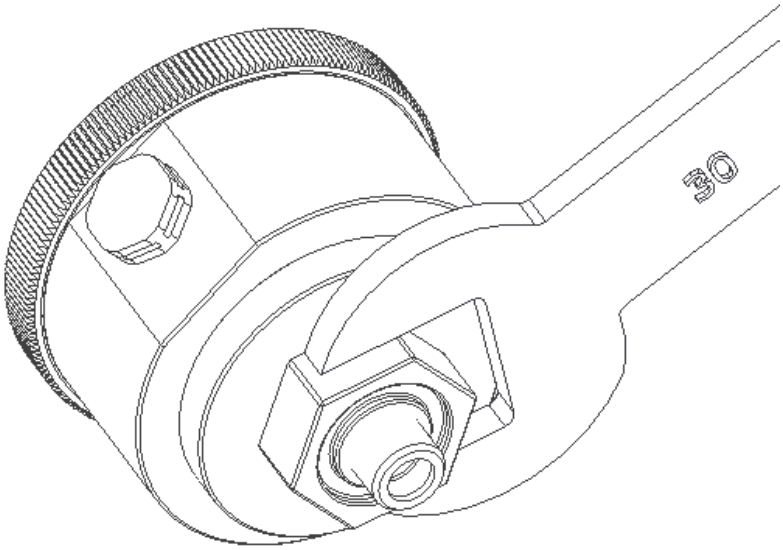
NOTE
The sensor is protected against accidental or occasional chemical attack of measured gas, but in case of long period of operation in contact with aggressive agent or bioproducts we decline responsibility of damage or mis-calibration.

Via Madonna delle Rose, 72 24061 Albano S.Alessandro (BG) ITALY - Phone +39035584000, Fax +39035584099 E-mail: info@elecmd.it Web www.elecmd.it

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 to 15Nm) . The system must be leak-free for accurate measurement.



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)

Via Madonna delle Rose, 72 24061 Albano S.Alessandro (BG) ITALY - Phone +39035584000, Fax +39035584099 E-mail: info@elecmd.it Web www.elecmd.it

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

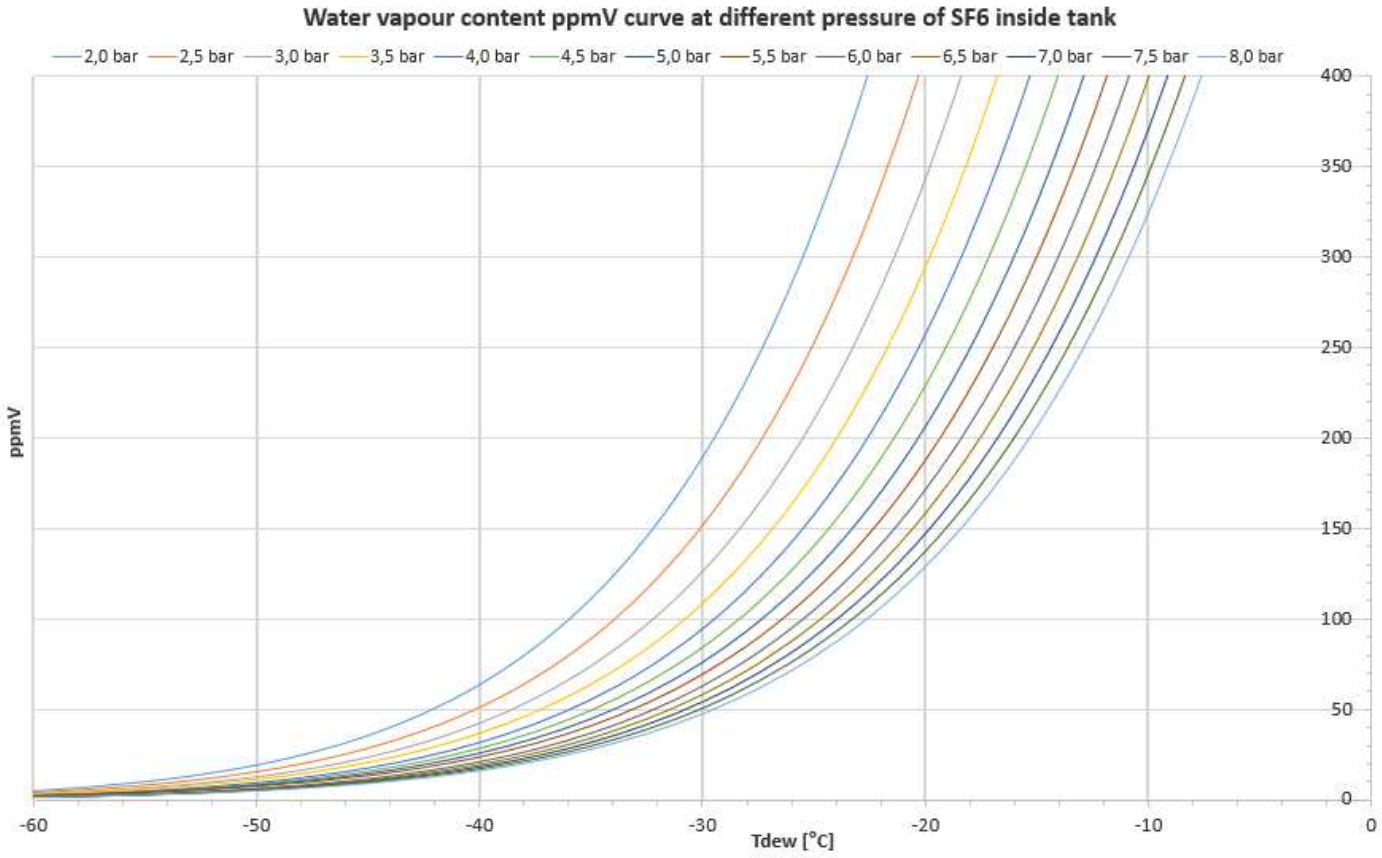
Via Madonna delle Rose, 72 24061 Albano S.Alessandro (BG) ITALY - Phone +39035584000, Fax +39035584099 E-mail: info@elecmd.it Web www.elecmd.it

SF_6 Electronic multi-parameter indicator

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

SF_6 Electronic multi-parameter indicator



Calculations have been simplified for an easier reading.

DISCLAIMER NOTE:

While we provide application assistance it is up to the customer to determine the suitability for its use.

Specification may change without notice.The information we supply is believed to be accurate and reliable as of this printing.
However we assume no responsibility for its use.

The quality of ElectronsystemMD products is guaranteed by a Quality, Safety and Environmental management system certified by DNV according to ISO 9001, ISO 18001 and ISO 14001. Electronsystem MD works in partnership with its customers in designing customized executions in order to meet specific requirements, please contact us.