GAS DENSITY CONTROLLER
Type GDCXXX

Revision Q of 23 January 2018

High-Accuracy SF_6 Gauge and Sensor

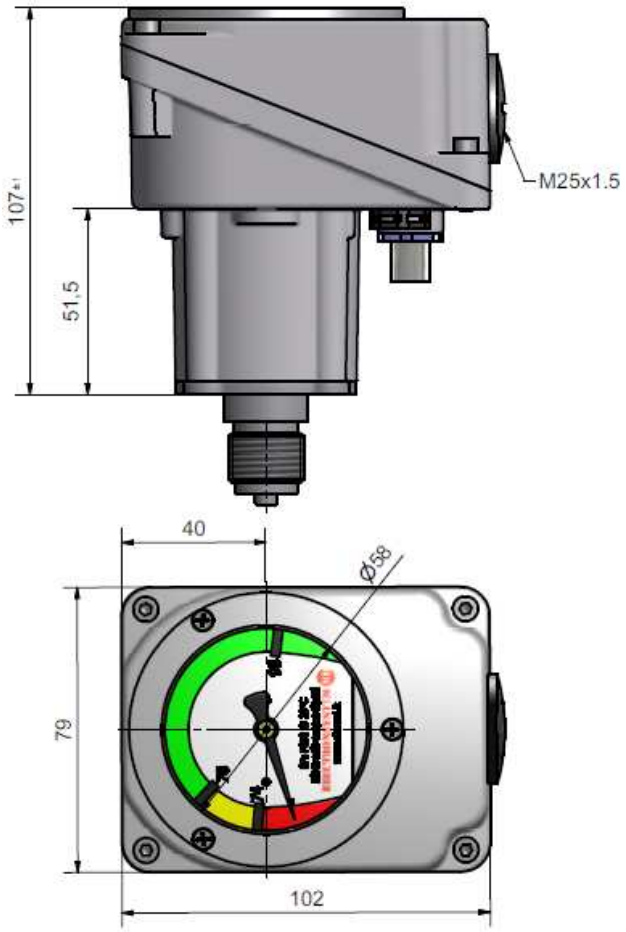
Based on long term experience from over 100,000 density switch installations, GDC was developed to match HV manufacturer demands for quality, reliability and cost.

APPLICATIONS

- High Voltage Circuit Breakers
- Circuit Switchers
- GIS Substations
- Gas insulated High Voltage Bushing
- GIL sections

BASIC FUNCTIONS

- Visual indication of density level
- Uses reference chamber principle for ultimate stability and repeatability
- Up to four independent contacts with decreasing or increasing thresholds



FEATURES & BENEFITS

- Able to follow the Isochor even in liquid phase of SF6, that means no false alarm in low temperature
- Ability to calibrate a Self-diagnosis contact to check leakage in reference volume
- No contact bouncing
- Shock proof
- Designed for outdoor installation
- Maintenance free
- Available with continuous monitoring analog output signal for remote monitoring and totalization of fugitive SF_6 emissions and SF_6 refill maintenance forecasting.

TECHNICAL DETAILS

1 Materials:

1.1 Housing material : EN AB-46100 powder coated RAL9006
1.2 Pressure connection material : AL 6082 anodized / AISI303 / BRASS
1.3 Bellows material : AISI316L
1.4 Viewing glass material : polycarbonate glass, UV and ozone resistant
1.5 Inner o.rings material : EPDM70 peroxide cured (customer compound on request)
1.6 Pointer material : aluminium
1.7 Cable connection material: on request
1.8 Conformity to 2002/95/CE (RoHS)

2 Electrical contacts data:

2.1 Contact execution: micro switch
2.2 Contact material: pure silver
Withstand voltage:
2kV, 50Hz for: connections against earth
1kV, 50Hz over opened contacts
2.4 Minimum capacity of microswitch contacts: see table A
2.5 Electrical connection with encoded plug-in terminal block with screw connection (marked with terminal numbers) up to 2.5 mm^2 finely stranded conductor with cable end sleeve.
2.6 Thread for cable gland : M25x1.5
2.7 Life time :
mechanical > 10^7 operations
electrical > 50000 operations
2.8 Electrical connection between cover and case in order to ensure the same potential
2.9 Bounce-free type
2.10 Impedance in open state > 1MΩ

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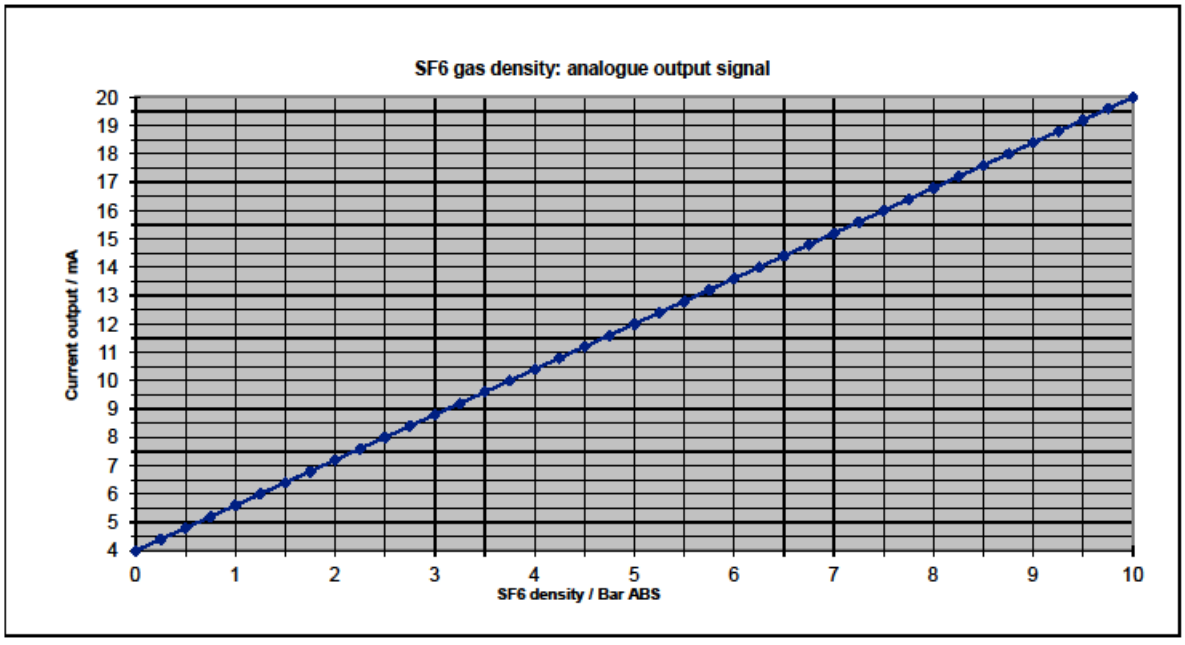
3 Electrical data of sensors

3.1 Electrical data analog version

3.1.1 Output signal : 4 - 20 mA 2 wires system
3.1.2 Input voltage : 15-30Vdc
3.1.3 Rload: Rin< 250 ohm
3.1.4 Input protection : overvoltage surpressor and reverse voltage diode
3.1.5 Response time : < 1000 msec.
3.1.6 Output range: 0 - 10 bar abs
3.1.7 Resolution : < 0.1% of full scale
3.1.8 Stability : < 0.3% of full scale per year
3.1.9 Accuracy : <±1% @ -20÷50°C (±0.1%/10°Cextended temp. range)
3.1.10 Isolation: max 250VAc / Vdc with varistor
3.1.11 Terminal block : see diagram 1, max allowable cross section 2,5mm^2
3.1.12 Gas condensation: measurement of SF6 in liquid phase is not allowed (see isochores diagram 3)



3.2 **Electrical data digital version:**

3.2.1 Output signal : RTU MODBUS RS485
3.2.2 Input voltage : 15-30Vdc
3.2.3 Input protection : overvoltage supressor and reverse voltage diode
3.2.4 Time resolution/ sampling rate: >100 sample/min
3.2.5 Resolution : < 0.1% of full scale
3.2.6 Stability : < 0.3% of full scale per year
3.2.7 Accuracy : <±1% @ -20÷50°C (±0.1%/10°Cextended temp. range)
3.2.8 Isolation: max 250VAc / Vdc with varistor
3.2.9 Diagnostic: continuous watchdog of health sensor state
3.2.10 Terminal block : see diagram 2,
max allowable cross section 2,5mm^2 (switch 1 - 2 - 3)
max allowable cross section 0,5mm^2 (digital output sensor)
3.2.11 Gas condensation: measurement of SF6 liquid phase is not allowed (see isochores diagram)

Table of telegram

Address	Information	Type	Function
Add_0	ID_slave	Unsigned Int	Read/Write
Add_1	Pressure.Read [mbar ABS]	Unsigned Int	Read only
Add_2	Temperature.Read [°K/10]	Signed Int	Read only
Add_3	Density SF6.Read [mbar ABS @20°C]	Unsigned Int	Read only
Add_4	Firmware release	Signed Int	Read only

Protocol settings	
ADDRESS	127 default
Protocol	Modbus RTU
Speed	19200 Baud
Data	8 bit
Parity	Even parity
Stop	1 bit stop

4 Electromagnetic withstand:

4.1 EN61000-6-4 INDUSTRIAL ENVIRONMENT EMISSION
4.2 EN55011 CLASSB Radiated
4.3 EN61000-6-2 INDUSTRIAL ENVIRONMENT IMMUNITY
4.4 EN61000-4-2: 4kV/8kV , Electrostatic Discharge
4.5 EN61000-4-3: 10V/m , Radio Frequency Electromagnetic Field
4.6 EN61000-4-4: analog version 4kV CM, digital version 2kV CM, Fast Transient
4.7 EN61000-4-5: analog version 4kV , digital version 0,5kV CM 0,5kV DM, Surge
4.8 EN61000-4-6: 10V , Conducted disturbance
4.9 CE conformity EN 50081-2, EN 50082-2

5 Working conditions:

5.1 Mechanical stresses:
Shockproof 50G on 3 axis
Shockproof : 10.000 operations on HV breaker
5.2 Max allowable pressure: 16 bar ABS
5.3 Shock and vibration, tested in according to IEC60068-2-6 and IEC60068-2-7

6.1 Environmental conditions:

Operating temperature:
Standard : -40°C to +85°C (low temperature version on request)
Transport and storage : -60°C to 85°C
Relative air humidity in yearly average <80%, occasionally 100%
Altitude: insensible to ambient pressure
6.2 The original design assures insulation of the reference chamber, protections from rain and direct sun are available.
6.3 Environmental test according to:

- IEC 60068-2-1 - EN 60068-2-1: Cold
- IEC 60068-2-2 -EN 60068-2-2: Dry heat
- IEC 60068-2-30 - EN 60068-2-30: Damp heat, cyclic
- IEC 60068-2-78 – EN 60068-2-78 : Damp heat, steady state

6.4 Gas Media: SF6, other medias such as N2/SF6 are allowable
6.5 Corrosion class :EN 60068-2-52 Environmental testing part2 – Test –:test kb salt test cyclic
6.6 Protection degree (DIN EN 60529): IP65

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7 Temperature compensation by filled reference bellow

7.1 Setting level for monitoring of reference chamber leakage is available.
7.2 Reference chamber volume protected by direct impact of sun.
7.3 Accuracy with strong irradiation by protection cover (optional)

8 Scaled indicator

8.1 Working range of the display : between the lowest switching level and the filling pressure
8.2 Main scale (temperature compensated)
8.2.1 Display tolerance : ±1.6% end of scale
8.2.2 Deviation by temperature influence : ±0.1 bar at limit temperature
8.2.3 Instrument dial according to the version
8.2.4 Instrument dial and indicator UV resistant

9 Switching levels

9.1 Up to 4 setting levels
9.2 Switching tolerance (Hysteresis) <0.2 bar
9.3 Accuracy at calibration point @ 20°C: ± 10kPa (other on request)
9.4 Tolerance of the isocore< ±0.10 bar
9.5 Switching compensated from -40°C to +85°C(low temperature version on request)
9.6 Switching points factory calibrated
9.7 Switching point for self autodiagnosys on request

10 Leakage rate

10.1 Leakage rate of the reference volume < $5x10^{-10}$mbar x l/s.
10.2 Leakage rate of the bellows : < $1x10^{-9}$mbar x l/s.
10.3 Leakage test with helium gas

11 Weight : ≈ 800 gr

12 Equipped with a GORE membrane vent to prevent the condensation

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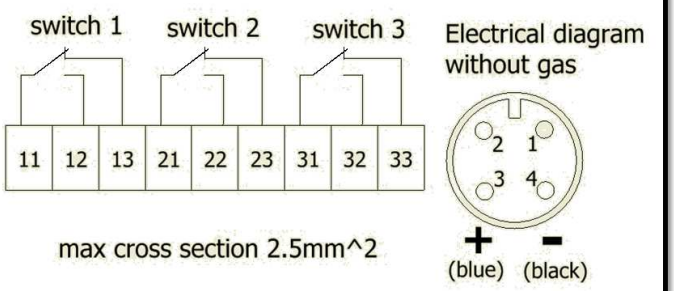
High-Accuracy SF_6 Gauge and Sensor

DIAGRAM 1: ANALOG SENSOR



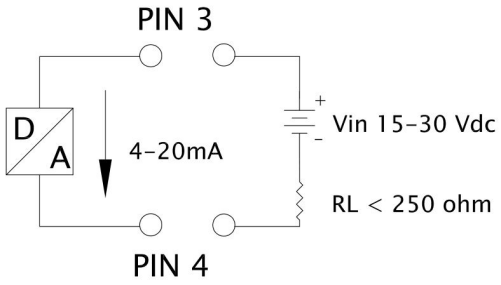


DIAGRAM 2: DIGITAL SENSOR

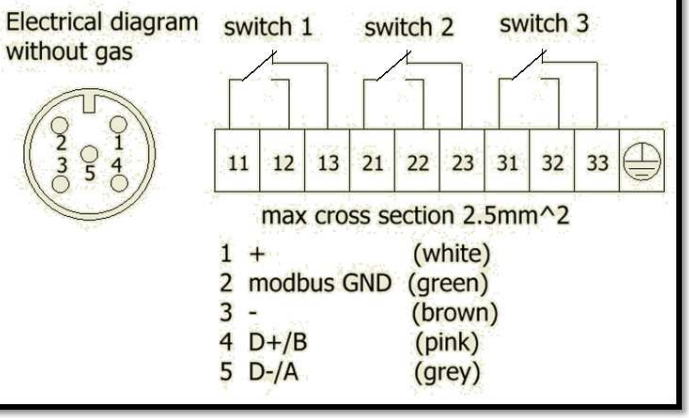


DIAGRAM 3: MECHANICAL SENSOR

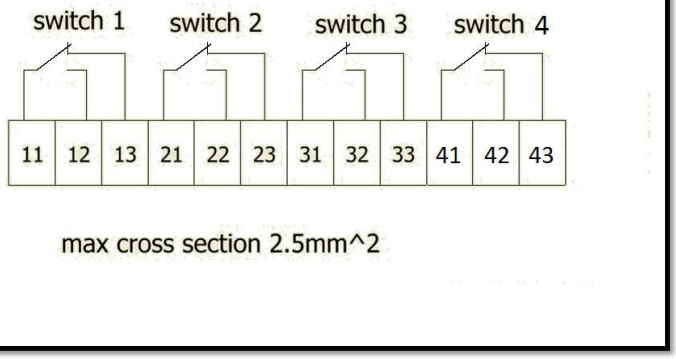
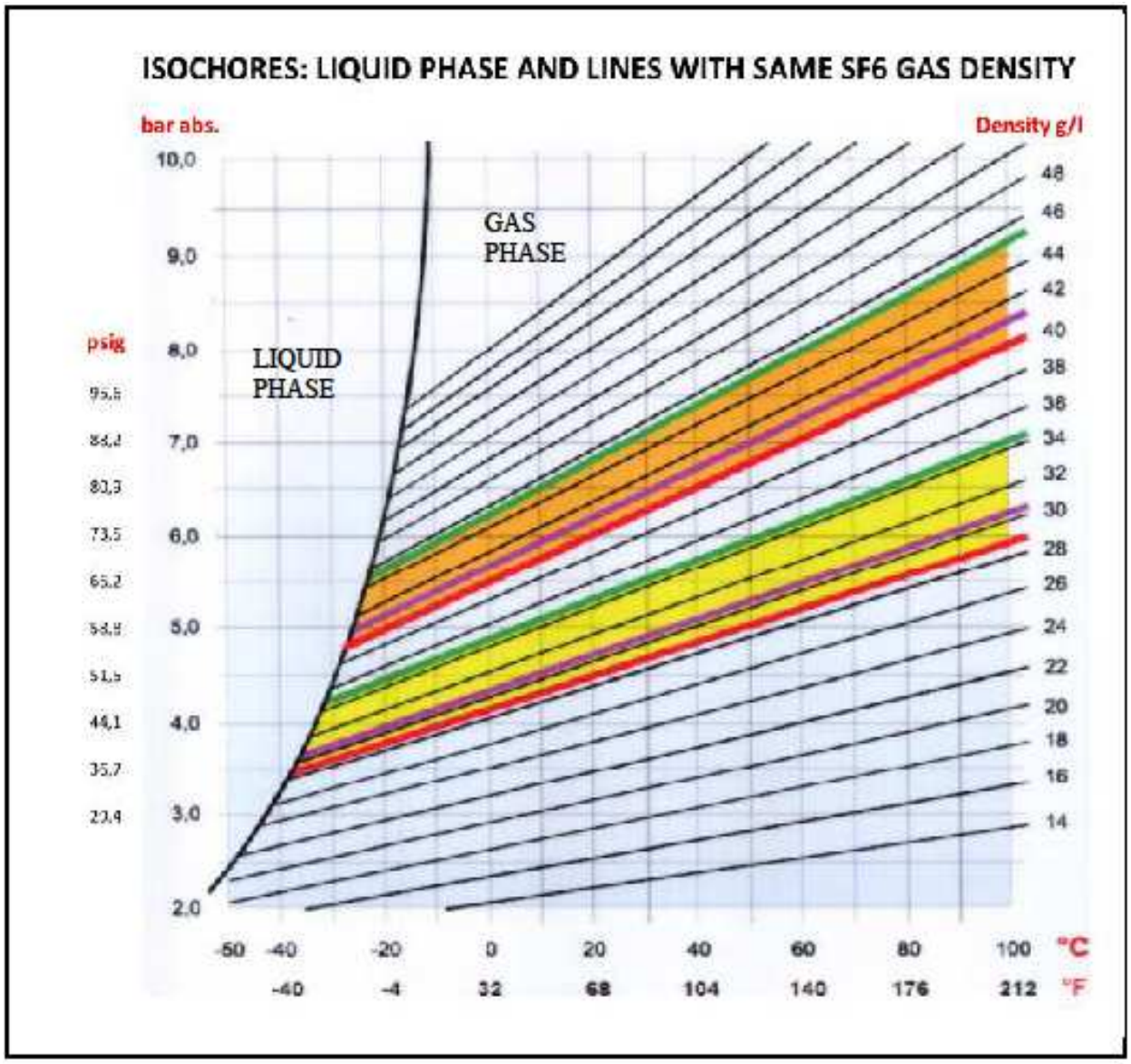


TABLE "A"

Rated voltage -15...+10% (V)	VDC	250	110
2.4.2 capacity (a)	I (R)	0.25A	0.50A
2.4.2 capacity (a)	I (L/R= 40ms)	0.10A	0.20A

DIAGRAM 3



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. ElectronsystemMD work in partnership with its customers in designing customized executions in order to meet specific requirements, please contact us.

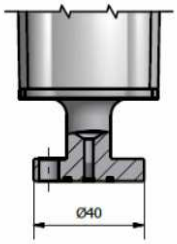
High-Accuracy SF_6 Gauge and Sensor

Features to be defined for GDCXXX X X

Gas connections

A

B



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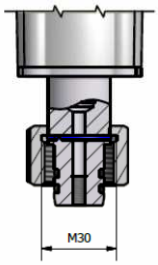

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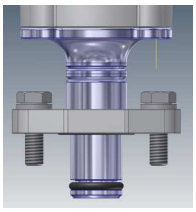

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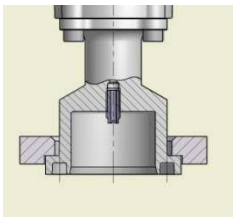

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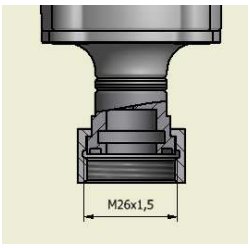

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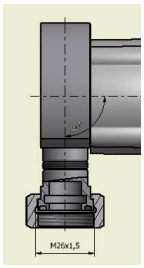
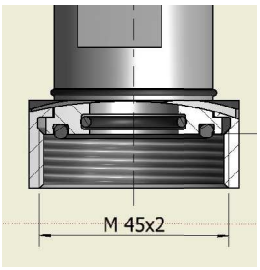


L

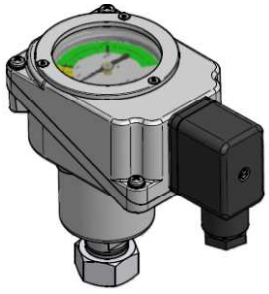
M



Other connections on request

Sun / Rain protections

N (none)



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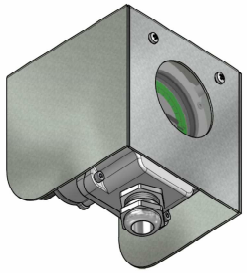

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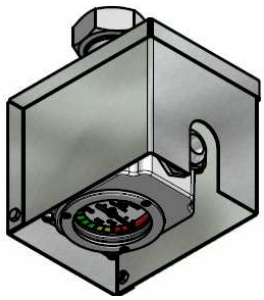

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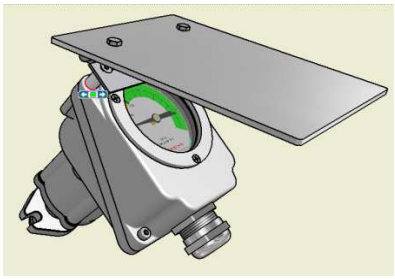
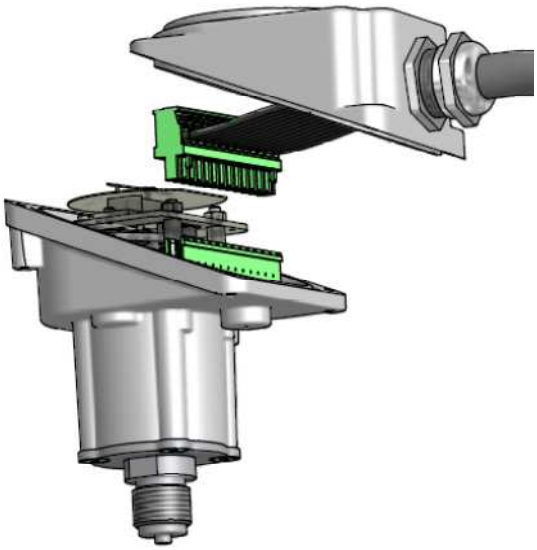


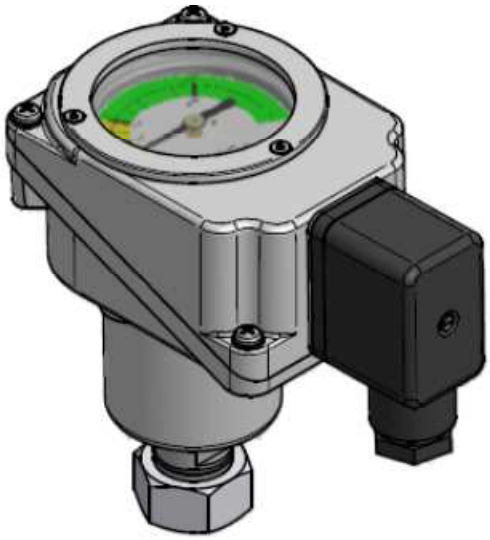
Other protections on request

High-Accuracy SF_6 Gauge and Sensor

Electrical Connection for GDC / GDHC



I: Internal electrical connection with encoded plug-in terminal block



P: Universal plug connector 6 poles + ground

Ordering information (according to above described features):

Code: **GDC**

Number of contacts from 1 to 4 = [X]

Internal variant for calibration values = [XX]

Gas connection: A ,B … = [X]

Sun/rain protection: N or O or V or T= [X]

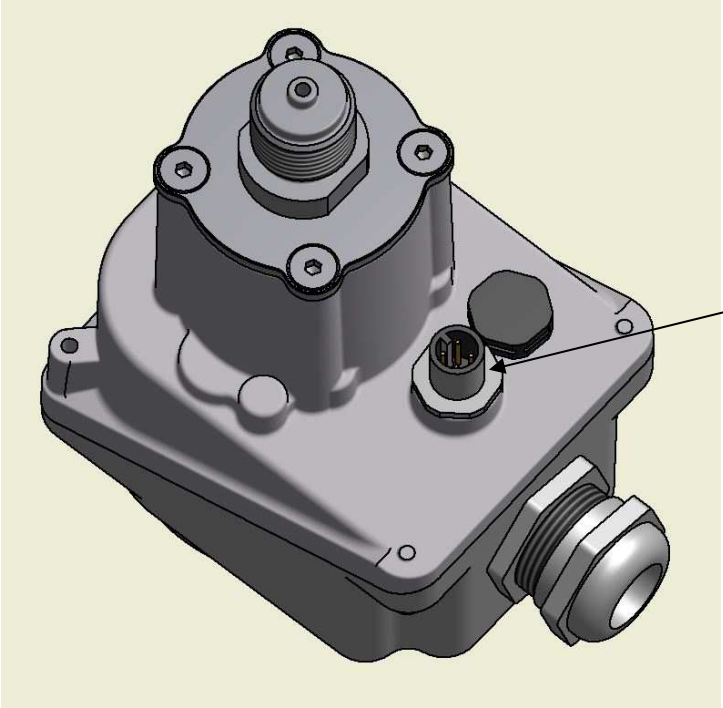
Electrical connection : P or I [X]

Without dial: /W [X]

Only for Low Temperature add: /LT [X]

High-Accuracy SF_6 Gauge and Sensor

Electronic Connection for GDHC:



Electronic connection:
Circular M12 Connector IP67

A: Electronic output analogic 4÷20mA

Or

D: Electronic output digital

HYBRID VERSION:

Code: **GDHC**

Number of contacts from 1 to 4 = [X]

Internal variant for calibration values = [XX]

Gas connection: A ,B … = [X]

Sun/rain protection: N or O or V or T= [X]

Electrical connection : P or I [X]

Electrical output analogic 4÷20mA : /A [X]

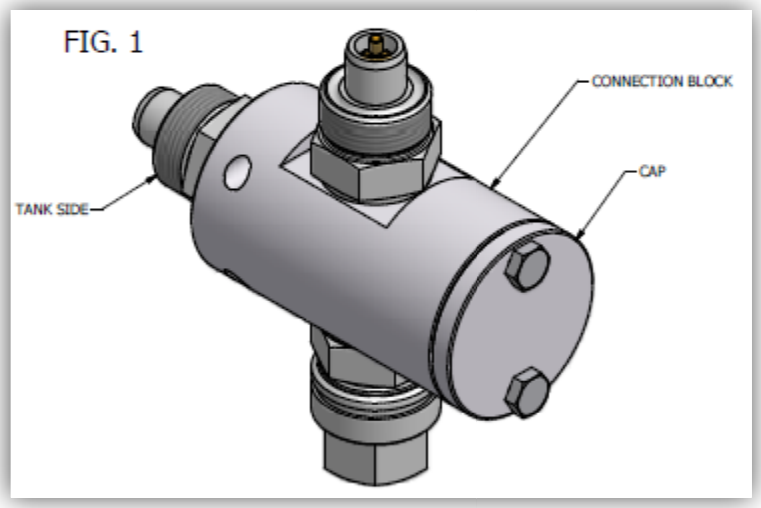
Electrical output digital: /D [X]

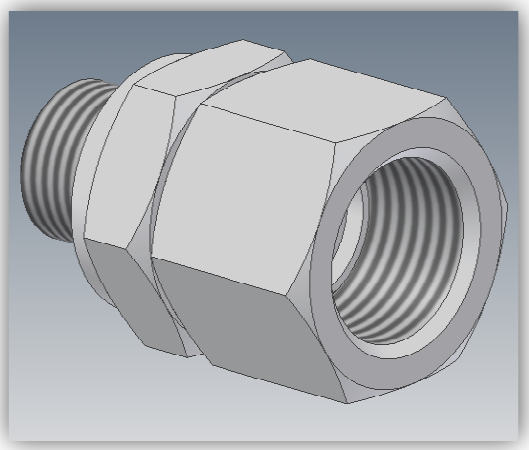
Without dial: /W [X]

Only for Low Temperature add: /LT [X]

Accessories for GDCXXX X X

Connection kit fit for refilling and on service test **Valve: VALV6275**





ASSEMBLY/DISASSEMBLY INSTRUCTIONS

- Turn off control voltage
- Remove cover by unscrewing 4 screws (fig.1)
- Release slide-in contacts (fig.2)
- Assemble cable gland on the cover (fig.3)
- Cable the wires according to wiring-diagram (fig.3)
- Close cover by 4 screws

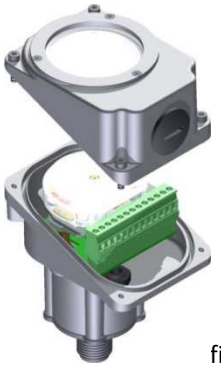


fig.1

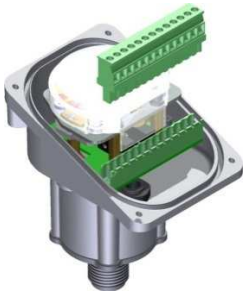


fig.2

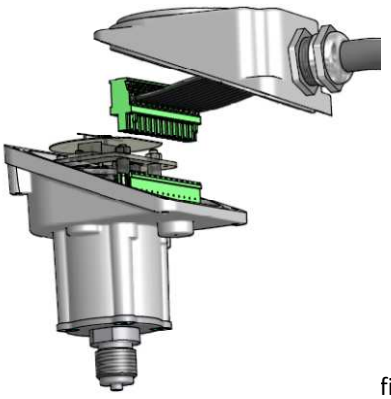


fig.3