



TRM-IR

Instructions for Use



WARNING

Strictly follow the Instructions for Use.

Model overview

The TRM-IR platform is a single modular analyzer configured at the factory for one target gas and one measuring range. Order by selecting the model code below.

Model selection

Model	Component	Range, mg/m3	Range, ppm
TRM-IR-SF6-1000	SF6	0...6000	0...1000
TRM-IR-SF6-2000	SF6	0...12000	0...2000
TRM-IR-R134a-1000	R-134a	0...4240	0...1000
TRM-IR-R125-1000	R-125	0...4990	0...1000
TRM-IR-R22-1000	R-22	0...3600	0...1000
TRM-IR-R227-1000	R-227ea	0...7070	0...1000
TRM-IR-CUSTOM	On request	On request	On request

Measured gases and ranges

Measured component	Range, mg/m3	Range, ppm
Sulphur hexafluoride (SF6)	0-6000 / 0-12000	0-1000 / 0-2000
1,1,1,2-tetrafluoroethane (R-134a)	0-4240 / 0-8480	0-1000 / 0-2000
Pentafluoroethane (R-125)	0-4990 / 0-9980	0-1000 / 0-2000
Chlorodifluoromethane (R-22)	0-3600 / 0-7200	0-1000 / 0-2000
1,1,2-trichlorotrifluoroethane (R-113)	0-7790 / 0-15580	0-1000 / 0-2000
Dichlorodifluoromethane (R-12)	0-251 / 0-503	0-50 / 0-100
Heptafluoropropane (R-227ea)	0-7070 / 0-35350	0-1000 / 0-5000
Refrigerant blend R-407c	0-3583 / 0-7165	0-1000 / 0-2000
Other component	On request	On request

ppm values are volumetric (v/v), converted at 20 C and 101.3 kPa. Two measuring ranges are available per component; the analyzer is factory-configured to the ordered range.

Notes on measured gases

SF6 - primary application: working-zone monitoring of gas-insulated switchgear (GIS) and leak detection in electrical substations.

Refrigerants (R-134a, R-125, R-22, R-227ea and blends) - monitoring in industrial and cold-storage rooms; each is factory-calibrated to its own linearised characteristic.

The IR sensor is insensitive to other gases and operates in oxygen-free and oxygen-rich atmospheres; high gas concentration does not disable the sensor.

Every analyzer ships with a documented calibration traceable to national metrology standards.

Contents

1	For your safety	2	9	Calibration	7
1.1	Maintenance	2	9.1	Possible Ways of Calibration for TRM-IR	7
1.2	Accessories	2	9.2	Dependence of Calibration on Ambient Pressure	7
1.3	Safe coupling	2	9.3	Preparing Calibration	8
1.4	Definitions of alert icons	2	9.4	Calibration Using the Magnetic Wand	8
2	Intended use	2	9.5	Zero point calibration	8
3	Functional description	2	9.6	Span calibration	8
3.1	Device marking	2	9.7	Calibration via TREMON Toolbox software	8
3.2	General information for installation	2	10	Device disposal	9
3.3	Restrictions on the installation	2	11	Troubleshooting	9
3.4	Electrical installation	3	12	Modbus RTU RS485 Protocol	9
3.5	Pin Out TRM-IR	3	12.1	Communication settings	9
4	Accessories	5	12.2	Modbus registers	9
4.1	Connection cable	5	13	Technical data	10
4.2	Mounting	5	14	Terms and approvals	11
4.3	Calibration adapter	5	15	Dimensions	12
4.4	USB PC adapter	5	15.1	Drilling template	12
5	Commissioning	6	16	Description of design	12
5.1	Setting the slave address	6	16.1	Functional principle	12
6	Calibration Range Limits	6			
7	Beam Path Warning	6			
7.1	Status indicator	6			
8	Maintenance	6			
8.1	Cuvette cleaning	7			

1. For your safety

Strictly follow the Instructions for Use. For any purpose of the gas analyzer use, it is necessary to fully follow the "Operation Manual" attached to the device.

1.1 Maintenance

Only trained and competent personnel are permitted to inspect, repair and service the product as detailed in these Instructions for Use. Further maintenance work that is not detailed in these Instructions for Use must only be carried out by TREMON or personnel qualified by TREMON. TREMON recommend a TREMON service contract for all maintenance activities.

1.2 Accessories

Use only genuine TREMON spare parts and accessories, or the proper functioning of the product may be impaired.

1.3 Safe coupling

Electrical connections to devices which are not listed in these Instructions for Use should only be made following consultation with the respective manufacturers or an expert. Do not use faulty or incomplete products, and do not modify the product. The appropriate regulations must be observed at all times when carrying out repairs on these devices or components.

1.4 Definitions of alert icons

The following alert icons are used in this document to provide and highlight areas of the associated text that require a greater awareness by the user. A definition of the meaning of each icon is as follows:



CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in physical injury, or damage to the product or environment. It may also be used to alert against unsafe practices.



NOTICE

Indicates additional information on how to use the product.

2. Intended use

TRM-IR gas analyser is intended for continuous monitoring of the concentration of gases containing SF6 in the atmosphere.

3. Functional description

- Optical gas analyzer for SF6 monitoring. Optical 2-beam technology ensures utmost signal stability for all models over long periods? compensation for possible contamination and dust of the optical cell

- The housing for the device consists of robust, non corroding aluminum and is suitable for indoor or outdoor applications
- Segment LED 4-digit concentration indicator displays current measurements or error code in case of breakdown.

The device allows to quickly and easily calibrate the zero point and sensitivity. A magnetic tool is used to perform the corresponding calibration functions. The TREMON Toolbox software contains linearized characteristics for SF6, allows to remotely set zero on the device, and will receive comprehensive information about the current state of the gas analyzer and its settings.

3.1 Device marking

- TRM-IR: Model
- name Conditions of use
- Supply parameters
- Temperature of maintenance
- Year of production Serial
- number



TREMON · TRM-IR-SF6-1000 · 0...1000 ppm

Power: 24 V DC, 2 W
Operating temperature: -40 .. +60 °C
Year of manufacture:
Serial number:



Tremon Solutions
Havensingel 100, 5611 VT Eindhoven, The Netherlands
www.tremon.nl | sales@tremon.nl

3.2 General information for the installation

Only trained and competent personnel are permitted to install TRM-IR. The selection of a suitable mounting location is crucial for the effectiveness and performance of the entire system. Considerable thought must be given to accessibility for required maintenance activities.

3.3 Restrictions on the installation

- Select the mounting location to achieve the maximum detection effect.
Free air circulation around the gas analyzer must not be hampered. The mounting location of the gas transmitter must be selected as near as possible to the location of the possible leakage place.
- To control gases heavier than air (SF6), the gas analyzer should be installed at a height of 15 cm from the floor. The selection of a suitable mounting location is crucial for the effectiveness and performance of the entire system. Considerable thought must be given to the details of the particular application (e.g., potential leaks, air movements/flows accessibility for required maintenance activities).



NOTICE

Water and/or dirt on the optical surface areas may trip a warning or fault.

The device is suited for wall, and floor assembly.
Use the supplied drilling template for mounting on a wall.
The mounting surface should be even and free of sharp edges.

3.4 Electrical installation

Electrical installation to be done only by qualified professional observing all applicable regulations. When installing the cabling, observe national regulations for the separation of mains, low voltage and control current circuits.

- Installation using three or more wire cable 0.5 mm² to 2.5 mm²
- Shielded wire, shield braiding with an average coverage of ≥80 %.
- Shielding connection: Recommended only at the central device
- The power conductors must have a sufficiently low resistance to ensure the correct supply voltage at the gas analyzer
- The length of the wire cable from the device to the junction box should be minimal and not exceed 1 meter in multidrop mode.



CAUTION

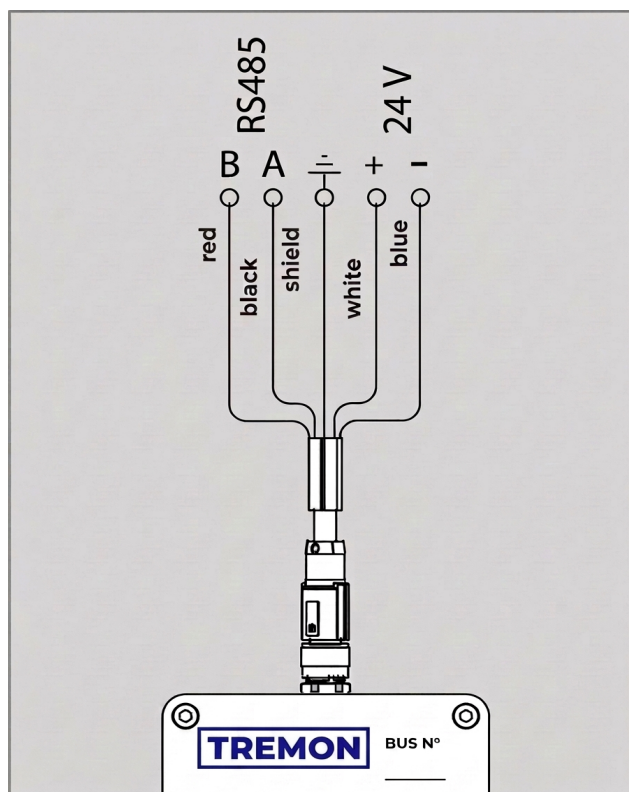
Do not connect the device to the power supply before the wiring is complete and has been tested. This could damage the device.

3.5 Pin Out TREMON

IR.

of connection leads to gas analyzer

- white** = + 24 V (DC supply power consumption max. 2 W)
- blue** = – (common reference potential)
- black** = A (RS485 interface)
- red** = B (RS485 interface)
- shield** = ground.



1. Check the electrical installation to ensure that all conductors have been correctly connected.
2. Do not shorten the white connection lead when the serial interface is not in use except where corresponding terminals are available in the junction box. In this case, shorten the white connection lead and connect it to a free terminal. Make sure that unused conductors will not contact any part of the housing or other conductors.
3. Secure the connection leads within the junction box mechanically.

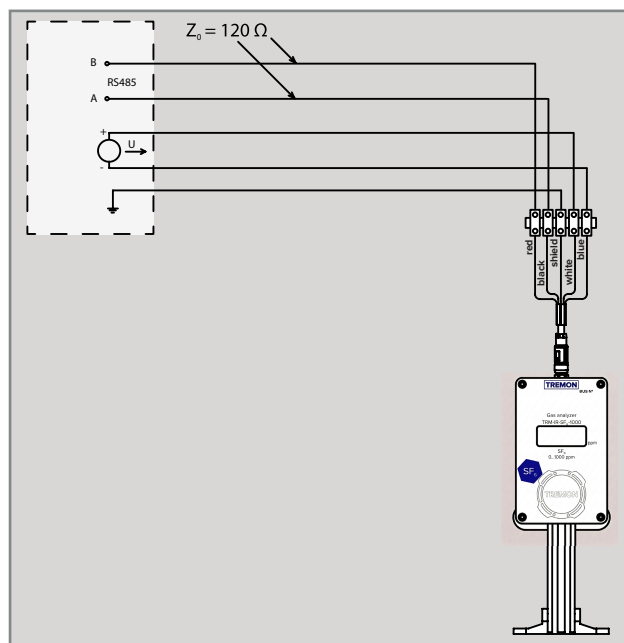


NOTICE

You have to use identical conductors of the same diameter and type for multi-wire connection. Maximally two conductors per terminal.

Each gas analyzer must first be put into operation separately. All gas analyzers which are scheduled for a multidrop line should be configured using a different «Polling Address» in the range from «1» to «255». It is best to assign sequential polling addresses, starting with «1».

Single detector installation



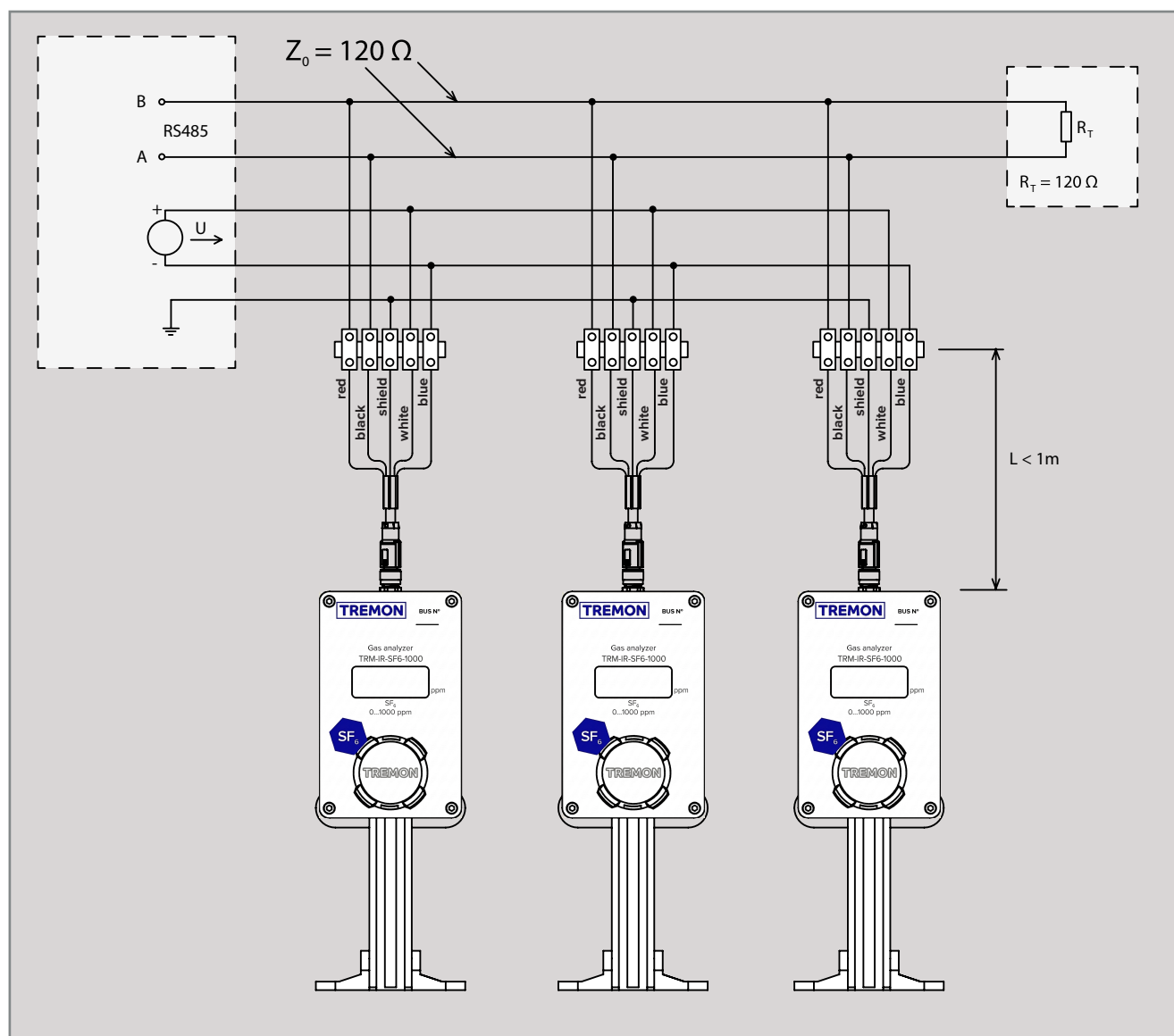
NOTICE

In case of a direct connection of the gas analyzer, the length of the line from the device to the junction box is not regulated.

Regarding the multidrop connection, the cable length from the device to the junction box is limited to 1 meter.

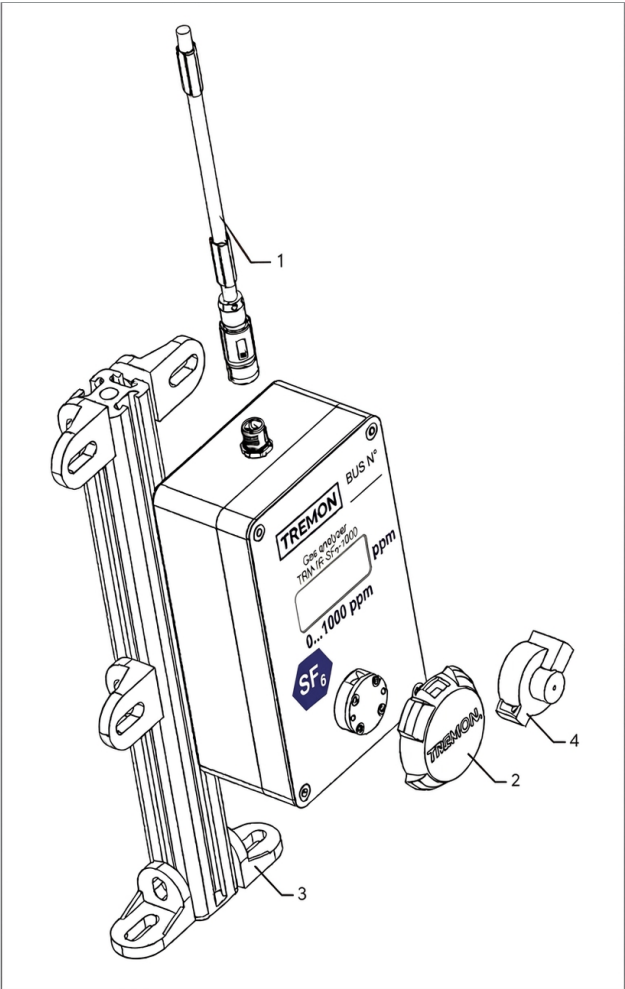
«Slave Address:» configuration. See the TREMON Toolbox operation manual. Depending on the power supply and line length, a maximum of 112 gas analyzers can be connected to 1 line. The diagram below shows a multidrop system with RS485 communication and one (central) power supply and a control unit. The impedance of the digital line cable is 120 Ohms.

Multidrop installation



4. Accessories

Overview of Accessories for the TRM-IR gas analyzer.



Overview of Accessories for the TRM-IR gas analyzer:

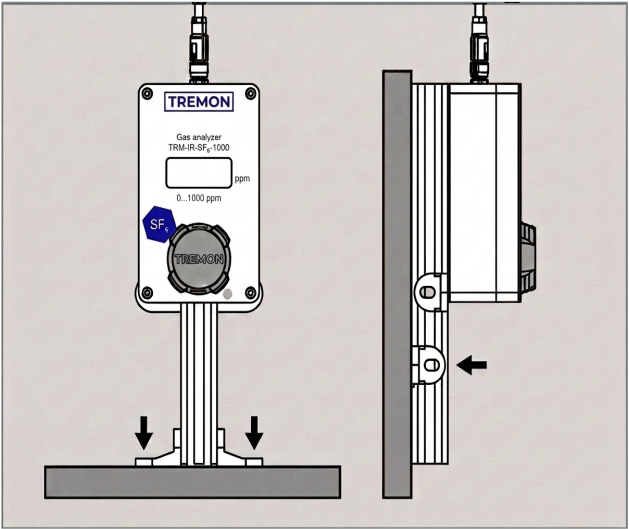
1	Connection cable	TRM-0601
2	Splash guard	TRM-0602
3	Mounting set	TRM-0603
4	Calibration adapter	TRM-0604
-	USB PC adapter	TRM-0605
-	Magnetic Wand	TRM-0606

4.1 Connection cable

The cable is intended to connect the gas analyzer to the junction box or directly to the controller.

4.2 Mounting

The mounting set is suited for mounting the gas analyzer to flat and curved surfaces.



4.3 Calibration adapter

The calibration adapter is designed to calibrate a gas analyzer

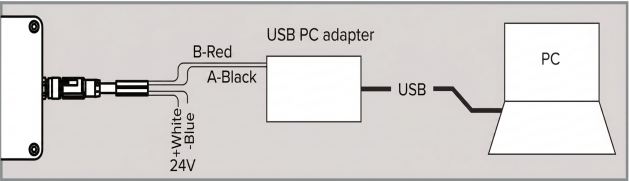


NOTICE

In the case of strong wind (wind speeds greater than 30 m/s, 11 Beaufort) there is a risk of test gas mixing with the ambient air. This may lead to incorrect calibration gas concentrations.

4.4 USB PC adapter

USB PC adapter - for communication of the gas analyzer TRM-IR with TREMON Toolbox software.



5. Commissioning

The device has been factory-calibrated, so after finishing the electrical and mechanical installation, the device is ready to operate. To avoid false alarms, the alarm activation in the central device has to be disabled.

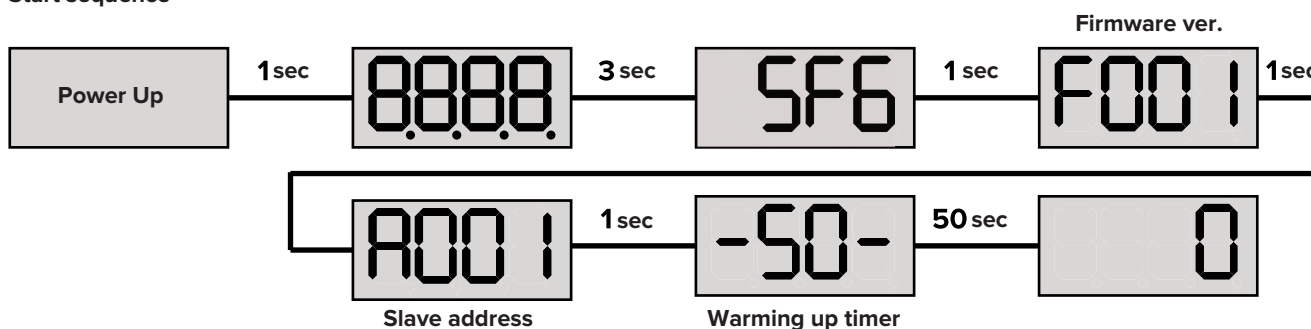
Supply the system with power. The gas analyzer runs an internal self-test during which the status indicator's lights flash for 50 seconds. We recommend checking if the factory-preset calibration and configuration match with the intended use of the gas transmitter. Due to national regulations, it may be necessary to run a calibration of the zero-point and the sensitivity (span).

After installation, we recommend checking the measured value output within the configured measuring range (to the full-scale deflection) as well as checking if all relevant alarms are triggered. Enable the alarm activation in the central device to put the system back to normal operating mode.

5.1 Setting the slave address

During the gas analyzer start, the current firmware version and slave address are displayed. The address can be changed, if necessary. The settings described above are performed using the TREMON Toolbox through the RS485 interface.

Start sequence



6. Calibration Range Limits

When calibrating with magnetic wand (order code TRM-0606), the gas analyzer displays the name of the calibrated point:

- null - zero calibration
- span - span calibration
- done - procedure completed successfully

This information is provided in the form of flashing words on the segment indicator. As a successful result of the procedure for the zero point and sensitivity calibration, the indicator will signal the word «done» for 1 second. Calibration can also be done using the TREMON Toolbox program, see "Calibration using the TREMON Toolbox program"



NOTICE

TRM-IR indicate faults on the display and in the corresponding modbus register. In case of several faults, display will indicate error messages one by one 1 second for each.

7. Beam Path Warning

Although the gas analyzer is equipped with effective facilities to protect the optic, in rugged environments the beam path may be subject to contamination over time. For this purpose, the beam block warning can be activated. In case the light intensity at the input of the optical measurement module falls below a critical value due to increasing contamination so that the stability of the measurement signal can no longer be guaranteed - the beam path warning has been activated. Measurement of the current gas concentration continues in the background upon reaching 70% of the maximum contamination level and stops when the threshold exceeds 70%, since the reliability of the measurements drops significantly.

7.1 Status indicator

TRM-IR is equipped with a seven segment red LED display.



NOTICE

Gas transmitters with splash guard must be regularly checked for contamination of the splash guard. Any contamination may cause an increase of the measured value response time. In case of contamination: Clean splash guard, replace if necessary.

8. Maintenance

While commissioning

- During the automatic self-test, check the function of the yellow and green status lights.
- Check zero-point calibration.
- Check RS 485 communication.
- Check measuring value output and alarm activation by applying suitable test gas.

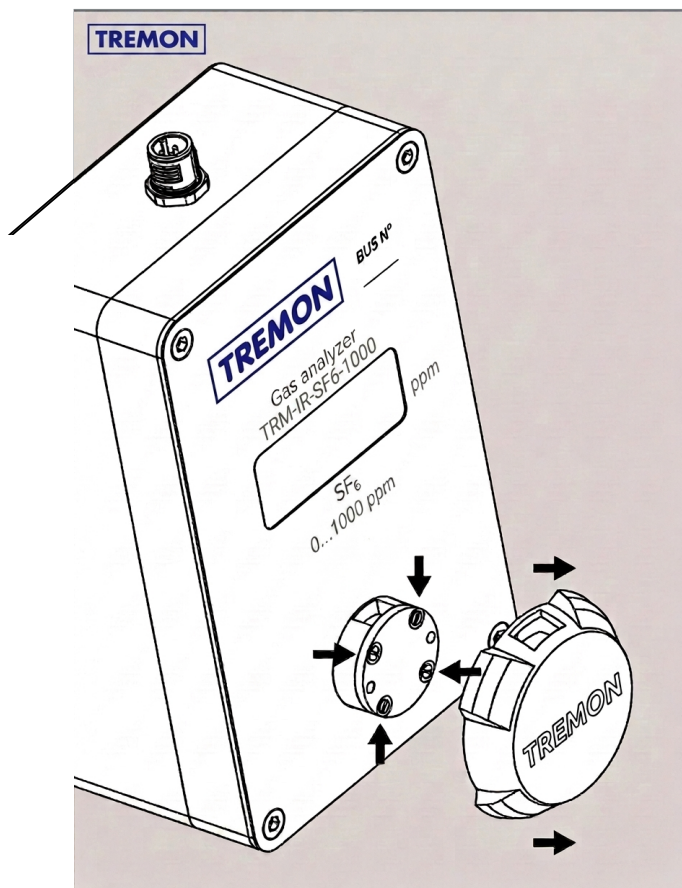
At regular intervals

To be determined by the persons responsible for the gas detection system. Every 12 months:

- Check the zero-point and sensitivity calibration (if necessary, temporarily disable the alarm activation in the central device and re-activate it afterwards).
- Check signal transmission to central device and alarm activation.
- Inspection by competent personnel. We strongly recommend that a service contract be signed for handling repairs and maintenance.

8.1 Cuvette cleaning

- 1 Unplug the power cable from the gas analyzer.
- 2 Remove the splash guard.
- 3 Unscrew the 4 screws on the mirror (see the illustration)
- 4 Check optical surface areas (mirror 1 and window 2) and other accessories for contamination, clean with water or alcohol
- 5 Carefully dry with absorbent cotton or a smooth cloth.
- 6 Install the splash guard and when required any other accessories to the gas analyzer.
- 7 Turn on the power of the gas analyzer
- 8 Calibrate the device



CAUTION

Do not scratch the mirror or window!
Completely remove all cleaning agents!
Do not use sharp tools like scrapers or screwdrivers!

9. Calibration

The IR has been factory-calibrated for SF6. It can be useful and necessary to renew or to check the calibration. Observe national instructions and regulations, if applicable. The gas transmitter requires a 2-point calibration: A zero-point calibration and a sensitivity calibration at a suitable point within the measuring range (span calibration). Always use calibration adapter TREMON (device no. TRM-0604). Zero gas free of measurement gas must basically be used for zeropoint calibration. TREMON recommends to use clean compressed air or nitrogen. If calibration is performed using ambient air (fresh gas calibration), make sure that no measured gas and no other hydrocarbons are in the ambient air during calibration. The sensitivity calibration can be performed with gas from the device's internal gas library. In an ideal state of affairs (which is however not essential), the calibration gas is identical with the measured gas.



CAUTION

The gas analyzer is factory-preset to a calibration gas concentration for the sensitivity calibration. Perform the sensitivity calibration with this concentration; otherwise, the risk of getting higher measuring errors during operation increases. The calibration gas concentration can also be found on the configuration label and – if necessary – the calibration value can be changed using the TREMON Toolbox software, see “TREMON Toolbox software”.

9.1 Possible Ways of Calibration for TRM-IR

- Locally using the magnetic wand (part no. TRM-0606). Using the TREMON
- Toolbox software.

9.2 Dependence of Calibration on Ambient

The gas transmitter provides a measurement signal which depends on the partial pressure of the gas component to be measured. Variations of atmospheric pressure, or of absolute pressure in dependence of the altitude of the site of operation, cause variations of the partial pressure. P_i = current pressure in the measuring cuvette

$$\text{value} = \text{measured} \times P_i / 1013$$

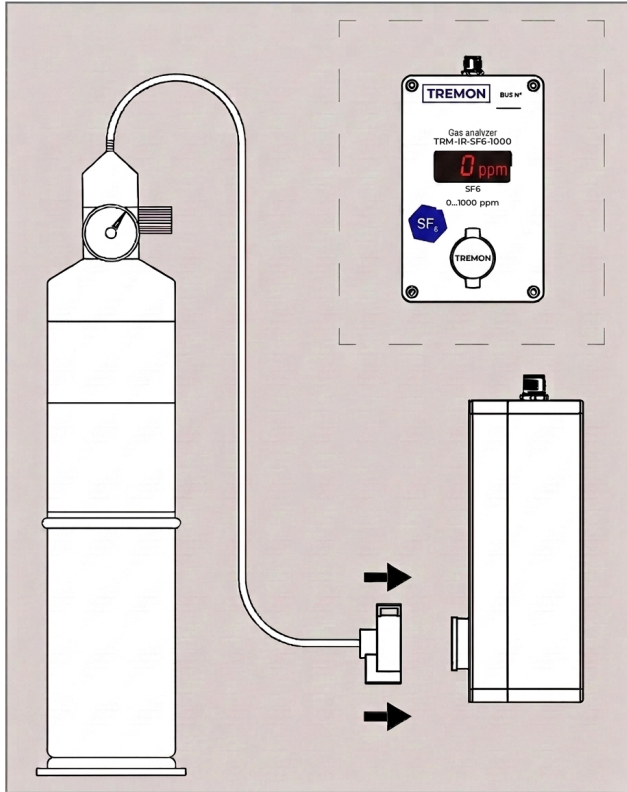
Example: If the gas analyzer has been calibrated under normal air pressure 1013 mBar, a pressure change to 900 mBar would result in the following change of measured value:

$$5000 \text{ mg/m}^3 \times 900 / 1013 = 4400 \text{ mg/m}^3$$

In ppm (SF6: 6000 mg/m³ = 1000 ppm):
833 ppm x 900 / 1013 = 733 ppm

9.3 Preparing Calibration

- 1 Provide calibration gas
- 2 Remove the splash guard
- 3 Mount the TREMON calibration adapter on a cuvette.
- 4 Connect the hose (diameter 6 mm) for calibration gas feed directly to the adapter.



9.4 Calibration Using the Magnetic Wand

The calibration can be performed directly at the gas analyzer using the magnetic wand (part no. TRM-0606):

- 1 The gas transmitter has the marks on two opposite sides - on the left below and on the top of the display on the right side
- 2 For calibration, place the magnetic wand onto the respective mark for 1 second and remove it
- 3 The display will mark the selected point: zero or span.
- 4 Place the magnetic wand on the mark again
- 5 After successful calibration, the display will show the message «done».



NOTICE

Always first calibrate the zero-point before the sensitivity (span).

Calibration may be aborted at any time. Do not place the magnetic wand at the selected mark. After 7 seconds, the selection of the calibrated mark will be canceled and you will be able to start the procedure again.

9.5 Zero point calibration

- Connect the calibration adapter to the device
- Feed nitrogen or synthetic air with at least 0.5 L/min onto the sensor
- Purge the cuvette with nitrogen or synthetic gas for 10-15 seconds
- Place the magnetic wand within onto the mark » 0 « and the zero message will appear
- Remove the magnetic wand
- Place the magnetic wand within onto the mark » 0 « one more time and then remove it
- The display will show the message «done» for 1 second
- Shut off the air feed

9.6 Span calibration

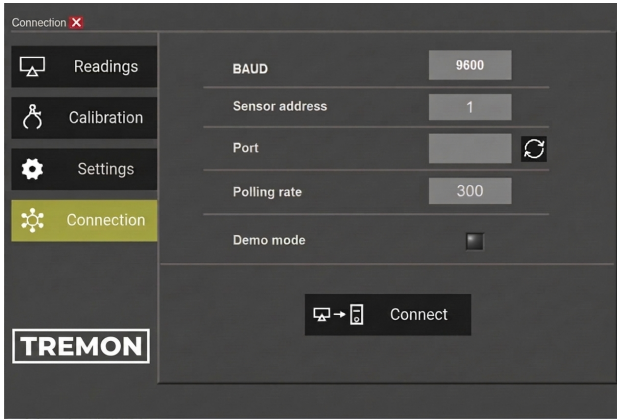
- Feed the calibration gas corresponding to the device configuration at least 0.5 L/min to the sensor.
- Feed gas for at least 30 seconds
- Place the magnetic wand within onto the mark »S« and then remove it
- Place the magnetic wand within onto the mark »S« once again and then remove it
- Shut off the gas feed
- Remove the calibration adapter
- Mount the splash guard

9.7 Calibration via TREMON Toolbox software

The TREMON toolbox software is a calibration and configuration software and is available on request. The software allows for the complete calibration of the TREMON IR gas analyzer. For detailed information refer to the Instructions for Use of TREMON Toolbox (available on tremon.nl website in «downloads» section

- Install TREMON RunTime and TREMON Toolbox on your PC
- Connect the USB PC adapter and install the driver software, if necessary (enclosed with the TREMON Toolbox software). Carry out the electrical connections. Provide power supply for the gas transmitter to be calibrated. Run TREMON Toolbox software. In the start screen of the software, click the communication port selection window
- Set the address of the configured device
- Click the «Connect» button
- After establishing communication with the device, select Calibration (to calibrate the zero point and the span) or Settings (to set the device address on the network and saving the log of the indications)

Communication via RS485 interface allows you to communicate with the gas analyzer via longer distances



10. Device disposal



EU-wide regulations governing the disposal of electric and electronic appliances which have been defined in the EU Directive 2002/96/EC and in national laws have been effective from August 2005 and apply to this device. Common household appliances can be disposed of using special collecting and recycling facilities. However, as this device has not been registered for household usage, it must not be disposed of through these means. The device can be returned to your national TREMON Sales Organization for disposal. Please do not hesitate to contact the above if you have any further questions on this issue.

11. Troubleshooting

The gas analyzer constantly runs self test for numerous internal functions. The device will indicate the error code on the display in the case of malfunction.

Cause

- **Display does not working**
 - Check 24V power supply. Polarity.
- **The device reboots cyclically**
 - Check the voltage drop. ($U > 16V$)
 - Check the electrical contacts
- **Err0 ... Err3**
 - Contact service
- **Err4**
 - Clean the optical surfaces
- **Err5**
 - Contact service



NOTICE

If the malfunction cannot be resolved onsite, contact TREMON Service to clarify further actions.

12.1 Communication settings

- Slave address 1 ... 255
- Baud rate 9600
- Parity none
- Stop bit 1
- Length 8 bit
- 2-wire RS485

12.2 Register map

Address	Discription
● 1	gas concentration
● 2	Error code
	○ B00000001 Channel 1 fault
	○ B00000010 Channel 2 fault
	○ B00000100 IR source fault
	○ B00001000 EEPROM fault
	○ B00010000 Beam blocked
	○ B00100000 Heater fault
● 11	Slave address
● 13	Zero calibration
● 14	Span calibration
● 40	Firmware version
● 594	Reboot

12. Modbus RTU

Devices work as slave Modbus-RTU. PLC values polling is carried out by the corresponding function code (see also Modbus specification). System supports the following commands:

0x03: Read Holding Registers

13. Technical data

Functional principle	Double-compensated infrared absorption, 2-beam technology
Supply voltage	24 V DC (21.6 – 26.4 V)
Power consumption	Maximum power with heater on - 2 W
Communication	RS-485 (protected to 75 V) / Modbus RTU
Measuring range	0...1000 ppm (1)
Lower detection limit	2% of full scale
Accuracy	10%
Warm up time	60 s
Response time	10 s
Dimensions	160 x 100 x 60 mm
Protection Class	IP67
Weight	1 kg
Housing	powder coated Aluminium
Environmental conditions	–40 – +60 °C, 906 – 1070 mBar, humidity 0 – 100%
Storage conditions	0 – +60 °C, 906 – 1070 mBar, humidity 0 – 100% non-condensing

(1) Measuring range depends on the ordered model. Full ranges (per datasheet):

Model / component	Range, mg/m ³	Range, ppm
TRM-IR-SF6 (SF6)	0...6000 / 0...12000	0...1000 / 0...2000
TRM-IR-R134a (R-134a)	0...4240 / 0...8480	0...1000 / 0...2000
TRM-IR-R125 (R-125)	0...4990 / 0...9980	0...1000 / 0...2000
TRM-IR-R22 (R-22)	0...3600 / 0...7200	0...1000 / 0...2000
TRM-IR (R-113)	0...7790 / 0...15580	0...1000 / 0...2000
TRM-IR (R-12)	0...251 / 0...503	0...50 / 0...100
TRM-IR-R227 (R-227ea)	0...7070 / 0...35350	0...1000 / 0...5000
TRM-IR (R-407c)	0...3583 / 0...7165	0...1000 / 0...2000
TRM-IR-CUSTOM (other)	On request	On request

ppm values are volumetric (v/v) at 20 °C and 101.3 kPa; two ranges available per component, factory-set to the ordered range.

14. Terms and approvals

Conformity

Declaration of conformity and calibration certificate are supplied with each instrument and are available on request.

Protection class

IP67 (higher ingress protection available on request).

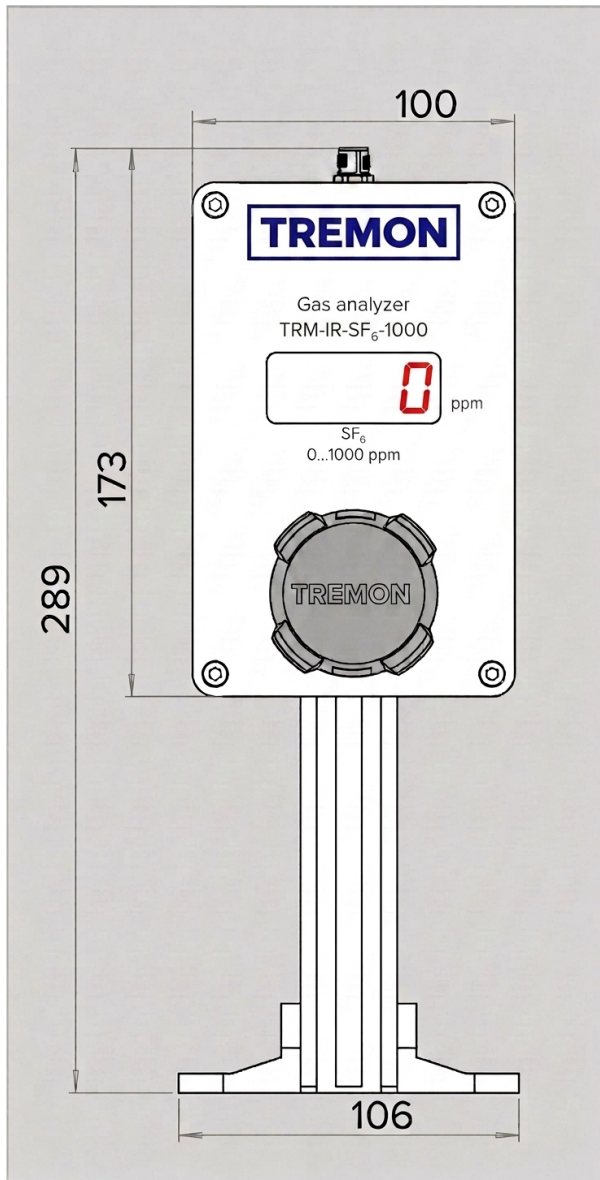
Electromagnetic compatibility

Designed and tested to IEC 61000-4 series immunity requirements for industrial electromagnetic environments.

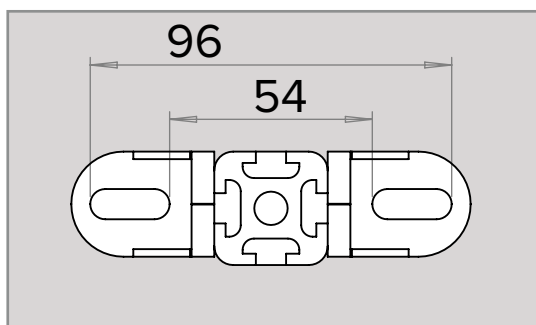
Calibration

Traceable to national metrology standards; recommended recalibration interval 1 year.

15. Dimensions



15.1 Drilling template



16. Description of design

- TRM-IR is a measurement tool to measure the concentration of SF₆ in the atmosphere according to the principle of absorption of infrared radiation.
- The infrared technology differs from other sensing technologies by:
 - Clarity of reading for concentrations
 - Reduced maintenance efforts (due to increased long term stability)
 - Fault safety
 - Insensitivity against flow velocity
 - Insensitivity against polymerising and corrosive substances and catalyst poisons
 - Unlimited measuring sensitivity in oxygen deficient and oxygen-free mixtures
 - No proof of other gases.
- The microprocessor technology allows to:
 - Detection of device faults and warning via status indicator and digitally
 - Special calibration mode for suppressing the alarm triggering in the central device during maintenance
 - One-man calibration
 - Temperature compensation
 - Freely selectable measuring range

16.1 Functional principle

The ambient air to be monitored gets into the measuring cuvette by diffusion, supported by a thermally generated suction through the splash guard («chimney effect»). Thermal sensors located directly at the optocouplers compensate for signal deviations due to temperature changes. The radiation emerges from the stainless steel housing through a sapphire window and passes through the measuring cuvette twice. The mirror reflects the radiation which is guided into the optic module and to the detectors. The measuring cuvette is heated to avoid condensation of the atmospheric humidity. The zero-point stability is ensured by a reference detector which compensates for the effects of contamination of mirror and window as well as potential variations of intensity of the infrared radiation source. The combination of these compensation processes provides optimum signal stability.



Tremon Solutions
Havensingel 100, 5611 VT Eindhoven, The Netherlands
sales@tremon.nl
www.tremon.nl
KVK 95114289 / BTW-ID NL005130552B15

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