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User Manual

E-TD-R1, E-TD-R2
gas concentration measuring
infrared remote transmitters

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CONTENTS

1. PURPOSE

Concentration measurement of carbonic hydrogens with low carbon atomic numbers (aeriform or liquid but easily volatile at given temperature), or carbon dioxide, and transfer of measured data to the processing equipment.

2. APPLICATION FIELD

In zones 1 or zones, classified as easier, according to standard MSZ EN 60079-10-1:2021 in application group II, for explosion dangerous mediums generated by gases, vapors or mists in category 2 or even easier.

Concentration measurement of flammable or explosion hazardous materials according to the MSZ EN 60079-29-1:2017 in range of 0…100 LFL% (LEL%), and 0…100 % (v/v), in addition, measuring the concentration of carbon-dioxide in several possible measurement ranges.

It is destined in such institutions, where application of sensors with other measuring principles is not possible in certain circumstances, because of their non-suitable poisoning resistance or high cross-sensitivity.

3. MAIN FEATURES

→ *Explosion safe protection according to ATEX*

→ *Robust construction installable in industrial environment*

→ *Versions available for free airflow or sampling from tubing*

→ *Reliable infrared measuring principle*

→ *Selective measurement between materials with different infrared absorption*

→ *It cannot be damaged in case of concentrations significantly exceeding the measuring range*

→ *No need for oxigen for the operation*

→ *It will not become unsensitive by the effect of other materials poisoning sensors, operating on other principles*

→ *4…20 mA analogue and RS485 digital outputs with MODBUS/RTU protocol*

→ *Extended operating temperature range, temperature measurement and temperature compensation*

→ *It can be configured and calibrated without disassembling by means of a computer*

→ *Compared to sensor operating on other measuring principles, less frequent maintenance is sufficient*

→ *Hungarian development and production, easily accessible service*

4. TYPE VERSIONS

E-TD-R1

Free air flow version, constructed for gas concentration measurement in the near the transmitter.

E-TD-R2

Tube connected version. With sampling system constructed for gas concentration measurement of aeriform mediums led via tubing to the equipment.

The listed models can also be made with alloyed steel or tin bronze sinter filter. In the case of tin bronze sinter filters, the type designation is supplemented with the letter "B" (E-TD-R1B, E-TD-R2B)

5. CONSTRUCTION AND OPERATION

The remote transmitter is a gas concentration measuring device based on absorption of light. Its operation is based on that some aeriform materials show absorption properties in infrared band. The amount of absorption depends on concentration. Its operation occurs without chemical reaction and the most sensitive parts necessary for measurement do not even contact with the material to be measured.

The transmitter is constructed with a small size case. On the casing there are a detector head and a gland, and also a plate-foot is screwed to it to help mounting. In the inside of casing there is a series terminal and a signal processing electronic unit.

The transmitter measures the concentration in the detector head. The aeriform medium gets into the detector head via a sinter filter by diffusion method.

The sinter filter ensures, together with other technical solutions applied in the transmitter, that the transmitter cannot become ignition source in explosive medium.

There are an infrared radiation source and a sensor placed in the detector head in certain distance to each other for the concentration measurement. The absorption occurs between them. The concentration i.e. the absorption affects the intensity of infrared radiation getting to the detector. The detector gives a signal proportional with the intensity of infrared radiation. From this signal the processor controlled electronics calculates and transfers the value of gas concentration to other signal processing devices. The transfer of measured results occurs in the form of standard analogue and digital signal.

Since the different materials produce absorptions in different bands, the remote transmitter is capable for selective measurement in a specific band, relating to the material to be measured.

6. CONNECTING POINTS

6.1. Mechanical connecting points

In case of transmitter E-TD-R2 on the detector head there are two mechanical conneting points in order to onnect the tubes of sampling system. The placement and dimensions of them can be found in the relevant technical drawings and the technical data.

6.2. Electric connecting points

The electric connecting points of transmitters E-TD-R1 and E-TD-R2 can be found in attached technical drawings, according to the following:

8.	*GND (white wire):*	*Cable shielding connecting point*
9.	*+U (red wire):*	*Power supply positive pole*
10.	*GND (white wire):*	*Power supply negative pole*
11	*4…20: (yellow wire):*	*4…20 mA analogue current output*
12.	*485 A (grey wire):*	*RS485 digital output point „A”*
13.	*485 B (brown wire):*	*RS485 digital output point „B”*

7. INSTALLATION

7.1. Conditions

The transmitter can only be installed in such places where the technical parameters of transmitter can satisfy the relevant requirements.

It is forbidden, for example, to install the transmitter in Zone 0 or under surface in mines in explosion dangerous areas.

Furthermore, it is not allowed to expose the remote transmitter to ambient temperatures lower or higher than the allowed ones, radiating heat, not alowed pressure range, acidic chemicals, and vibrating effects.

7.2. Placement

The installation place of transmitter is determined by the the design documentation related to the institution (where the transmitter should be installed). During submission of design documentation the prescriptions of transmitter user manual shall be taken into account.
It is also very important to be aware of zone classification of the institution, the zone map, the density relative to air of danger causing material, the vapor density and the exact place of their sources (even during making the design documentation, or also in absance of design documentation).

Other aspecst also taken into account at placement of remote transmitter:

The remote transmitter is suitable to be installed onto both vertical and horizontal surfaces. They are operable mounted at any angle but in version of free air-flow (in case of type E-TD-R1, where the sinter filter can also be seen) the detector head shall face to downward. In this case less dust can accumulate on the filter and the water cannot remain on it. In case of free-airflow version the transmitter must be placed in such place where the material to be measured can accumulate most possibly, (for example floor level or at the bottom of service pit 30 cm over it, in case of solvents with much more higher vapor density than that of the air).

The transmitter considered as point sensing transmitter in free airflow version. The extent of area supervised by the transmitter mainly depends on the geometrical features of the institution and the physical properties of the material to be measured. The transmitter is not capable to measure such material which is not in touch with the transmitter therefore care should be taken during selecting the installation locations and the quantity of transmitters. The area covered by the transmitter is the highest if it is not placed on a wall surface at the edge of the area, but for example in the inside of the area on a column.

In case of version of tubed sampling (E-TD-R2) it is recommended to place the transmitter in such place where the sampling tube can be minimal. At this version because of the forced flow and the closed system, the installation height and position are irrelevant and the covered are cannot be interpreted either.

The are no free handling units on the transmitter and it can also be calibrated without dismounting it , there is no need to ensure big free space around it. At the same time it is necessary to dismantle it during installation and can also be necessary later for maintenance purpose, so we should calculate with the space requirement of those not very frequent jobs.

The transmitter should be placed in a way that no outer damaging mechanical effect could be exerted on the transmitter itself or its cabling. In case any danger of outer mechanical effects is real some additional protecting methods shall be applied that cannot affect its proper operation.

During selection of installation site the spaces liable for water dripping or splashing shall be avoided and if necessary the dirtying of sinter filters must be hindered. If the transmitter E-TD-R1 is placed in a room which is cleaned with water jet cleaning, the detector head must be protected against this effect.

7.3. Cabling

For transmitter cable only cables of specified cross section and wire diameter in shielded or armored construction can be used.
The transmitter is capable to accept one single cable without distribution box. The cable must be fastened in the near the transmitter to avoid mechanical overload of the transmitter.

Accesibility should be secured for electrical works at the end of transmitter cable outside the zone (for example at the connected processing unit) for the time of putting into operation and maintenance works.

The transmitter cable must always be identified for the placement inside the institute by technological mark or manufacturing number of transmitter.
Sufficient length of cable shall be left at cutting to dimension for connectability. The loop resistance of cable cannot be higher that that of specified in the technical data, taking into account the electrical parameters of processing unit.

The transmitter can be cabled in different ways according to aplication aspects.

In the event only the analogue 4…20 mA output is used , it is sufficient to use a shielded cable of 3-wires as minimum.

In case of also using RS485 digital communication output, minimum 5-wire shielded cable is needed. In case of long cable lengths it may be necessary to choose shielded cables with twisted pairs.

If the transmitter is required to be stringed onto an existing RS485 bus sytem the cable branching also shall be solved.

A surge arrester must be installed in the transmitter cable if:

- *the transmitter is to be connected to a DC network (e.g. it will be connected to an existing RS485 polling system that also provides 24V power supply) and overvoltage protection is not provided*
- *the transmitter cable reaches the transmitter through an outdoor section*
- *the electrical equipment (signal processing equipment), which connected to the transmitter is installed outdoors*
- *longer than 30 m transmitter cable must be use, and there is a risk of overvoltage*

8. PUTTING INTO OPERATION

The condition of putting into operation is the suitably installed transmitter according to Chapter 7 and operability of connected processing unit.

Putting into operation means connecting, switching-on and control of proper operation with measuring gas on site. The putting into operation is carried out by the manufaturer or service contracted with the manufacturer against payment. If the manufacturer supplied the remote transmitter along with the processing unit the putting into operation is carried out for both (in this case the central unit and the transmitter together comprises one unit).

If the transmittrer is connected to foreign processing unit the putting into operation does not include the checking of proper operation of foreign equipment. Anyway it is recommended to schedule the putting into operation in a way that in order to observe also the operation of other device controlled by the measuring results of all the transmitters, to avoid later occasional errors and disputes.

The putting into operation occurs by computer managed diagnostics program.

Certain operating settings can be modified during putting into operation (for example if the trasnsmitter shall be matched to interrogating system with MODBUS protocol and different communication speed or different interrogation address should be set compared with the manufatured ones, or the measured results should be made more accurate)

During putting into operation (and later maintenace) the computer and the transmitter can be connected together by hardware key. This connection can be created at the end of transmitter cable located outside the zone.

A protocol is made about putting into operation by diagnostics program which is signed by the maintaining person the customer or his representative. The protocol includes all the main settings of transmitter.

If the conditions are not ensured for putting into operation by the customer at a specified time, the putting into operation fails by the error of customer. In that case the cost of it is covered by the customer.

Attention! The switching on the transmitter is not considered as putting into operation without using the necessary diagnostics program, therefore the technical conditions of guarantee are not considered as fulfilled from the part of the manufacturer.

9. CONDITIONS OF SAFE OPERATION

The condition of safe operation is the observation of prescriptions relevant to installation (Chapter 7) and putting into operation (Chapter 8.).

The transmitter can be connected to such electrical equipment (processing unit)that has reinforced insulation to network voltage or it has grounded output that cannot generate exceeding of limits that are specified in the technical data.

The transmitter power voltage may not exceed 50 V even in case of failure of connected processing unit, otherwise the explosion proof protection of the transmitter is not secured.

The transmitter can be connected only with shielded cable, otherwise electromagnetic compatibility (EMC) problems may occur, that can generate false measured value, unjustified error signal or function loss.

The transmitter can be opened in explosion dangerous areas only in voltage free state. The opening of detector head cover is only allowed in voltage-free condition, after 1 minute waiting time (loosening also considered as opening).

In case of transmitter E-TD-R2, it is not allowed to convey medium of extra temperature or pressure through sampling system to the detector head.

No modification on transmitter is allowed without prior permission of the manufacturer!

10. OPERATION

10.1. Tasks during operation

The operator must observe the transmitter operation continuously at least by taking attention on its error signal. In case of error signal or the measuring results demonstrate evidence of failures the regultions of Chapter 14 must be taken into account.

The damaged transmitter shall be taken out from operation without delay and also regulations of Chapter 14 are relevant.

In case of free airflow type (E-TD-R1), such operating conditions may occur that the proper protection of transmitter cannot be ensured in other way and for example water can get onto the sinter filter during water jet cleaning. In this case the transmitter (or at least the detector head) shall be covered watertightly before cleaning and this extra protection shall be removed after completing the cleaning.

In case the transmitter is connected to tubed sampling system (E-TD-R2) the control and continuous keeping of suitable gas flow is mandatory 10… 30 l/h. In other case it may occur that the transmitter will measure only the gas stagnated in the tubing. A suitable filter system also should be inserted into the tubing that conveys the sampled medium, in the event of existence of solid dirt or moisture. The control and maintenance with justified frequency of the aforementioned is the task of the operator.

Attention! The sampling system may not cause the exceed of pressure range indicated in technical data!

10.2. Cleaning

The casing of transmitter can be cleaned if necessary, but no water or other cleansing agent can get onto the sinter filter or its inside. For cleaning such inactive materials or cleansing agents can be used that cannot cause electrostatic charging, or any damage of the transmitter, do not attack the cover material and can make the inscriptions illegible.

The cleaning or repair of extremely dirty transmitter or if it has received moisture, the repair and maintenance of it is the task of maintaining staff.

11. ABBREVIATIONS INDICATED ON REMOTE TRANSMITTERS

CE - *European suitability marking; it is manufactured according to the European Union directives and standards, subject to relevant evaluation processes*

1418 - identification number of attesting company involved in the manufacturing phase;

Ex - *marking of explosion protection;*

II - application group; it can be used in areas endangered by explosion dangerous materials except in mines

2 - 2nd category; it ensures high protection level in such areas where explosion capable medium is possibly generated. The explosion safe protection methods operate in such a way that they ensure suitable safety level even in case of probable operating errors or dangerous operating conditions

G - gas; to explosion capable mediums generated by existence of gases, vapors or mists
Ex - marking; the transmitter comply with following requirements of protection

db: flameproof enclosure

eb: increased safety

mb: equipment protection by encapsulation

IIC - gas group; the transmitter can also be used in areas endangered by elements of hydrogen group

Gb - equipment protection level (EPL)

T6 - temperature class; the surface temperature of transmitter cannot exceed 85°C.

BKI *14 ATEX 0005 X - marking of attesting institute, year of issue of the certificate, serial number of certificate*

⚠ *At proper use of transmitters the prescriptions of manual shall be taken into account. At least 1 min opening (waiting) time shall be kept before opening of sensing heads, after their switch-off.*

12. TECHNICAL DATA

Sensing method:	*Dual wavelength NDIR (non dispersive infrared)*
Protection mark:	*Ⓔx II 2G Ex db eb mb IIC T6 Gb*
Ambient temperature:	*-20 °C ... +65 °C*
Allowed vapor content:	*0 RH% ... 95 RH%, not condensing*
Allowed preassure [(1)]:	*900 hPa ... 1100 hPa*
Perceptible materials, measuring ranges, life time:	*According to Chart 1.*
Respons time [(2)]	*According to Chart 1. (t_{50} < 20 s, t_{90} < 60 s)*
Inaccuracy [(3)]:	*< ± 3 %*
Power voltage:	*9.5 V DC ... 28 V DC*
Power consumption:	*P < 0.9 W (mean value)*
Warm-up time:	*t < 1 minute (in clean air after switch-on output current continuously reduced from 25 mA , set in to the measured value after being stabilized)*
Temperature measurement:	*Yes (measured value appears only on RS485 output)*
Temperature compensation:	*Yes*
Features of RS485-digital output	
Communication protocol:	*MODBUS / RTU*
Communication speed:	*9600 … 57600, configurable*
Logical address:	*1…247, configurable*
Data reading-out:	*Holding register*
Address and format of measured concentration:	*40001, measuring figure without decimal point (resolution according to actual configuration setting)*
Address and format of measured temperature:	*40002, measuring figure without decimal point (resolution 0.1 ^{o}C)*
Address and format of opertion of self-error signal:	*40003 (0 = operation, 1 = self-error)*
Features of 4…20 mA analogue output	
Highest closing resistance:	*R = 140 Ω (if loop resistance is 0 Ω)*
Highest output current:	*I = 25 mA*
Output current in error state:	*I < 0.1 mA*

Cable needed to connection of transmitter:

3-wired shielded, to 4…20 mA output,

5-wired shielded to RS48 output or,

3 x 2wires (twisted pair) shielded to RS485 output for higher distances

Highest cable loop resistance: *Rh = 20 Ω / at 24 V power supply*
Rh = 10 Ω / at 12 V power supply

Connectable cable diameter [4]: *8-12 mm with reducing ring,*
12-17 mm without reducing ring

Connectable wire cross section [4]: *0,5 mm^2 ... 2,5 mm^2, twisted or solid*

Calibration method: *Controlled by computer based diagnostics program, it is also possible remotely via the cable*

Ingress protection, dimensions, size of connectable sampling pipes, weight: *According to Chart 2.*

Chart No1.

			E-TD-R1 E-TD-R2		***E-TD-R1B E-TD-R2B***	
Material [5]	*Measuring range*	*Life time [6]*	t_{50}	t_{90}	t_{50}	t_{90}
Methyl-alcohol	*0…100 LFL%*	*> 40000 hour*	*11 s*	*28.5 s*	*10 s*	*27.5 s*
Ethyl-alcohol	*0…100 LFL%*	*> 40000 hour*	*13.5 s*	*33 s*	*12 s*	*31 s*
Propane-butane	*0…100 LFL%*	*> 40000 hour*	*14 s*	*42 s*	*13 s*	*34.5 s*
Pentane	*0…100 LFL%*	*> 40000 hour*	*15 s*	*46.5 s*	*15 s*	*42 s*
Hexane	*0…100 LFL%*	*> 40000 hour*	*15.5 s*	*55 s*	*15 s*	*43 s*
Heptane	*0…100 LFL%*	*> 40000 hour*	*19.5 s*	*58.5 s*	*17.5 s*	*52 s*
Carbon-dioxide	*0…5 % (v/v)*	*> 100000 hour*	*14.5 s*	*36 s*	*13.5 s*	*34 s*
Carbon-dioxide	*0…20 % (v/v)*	*> 100000 hour*	*14.5 s*	*36 s*	*13.5 s*	*34 s*
Carbon-dioxide	*0…50 % (v/v)*	*> 100000 hour*	*14.5 s*	*36 s*	*13.5 s*	*34 s*
Carbon-dioxide	*0…100 % (v/v)*	*> 100000 hour*	*14.5 s*	*36 s*	*13.5 s*	*34 s*

Chart No2.

	E-TD-R1 ***E-TD-R1B***	***E-TD-R2*** ***E-TD-R2B***
Protection (MSZ EN 60529)	*IP54*	*IP66*
Dimensions [7]	*102.5 x 144 x 129 mm* *102.5 x 144 x 108 mm*	*102.5 x 144 x 151 mm* *102.5 x 144 x 130 mm*
Connectable sampling pipes	-	*Ø 6/4 mm*
Weight	*approx. 0.99 kg*	*approx. 1.05 kg*

Remarks:

(1) The transmitter is not pressure compensated. The pressure dependence of the sensitivity ~ 1 Rel.% / 10 hPa.

(2) The response times E-TD-R1 and E-TD-R1B types measured with gases at a flow rate of 10 l/h, determined measuring attachment, and in the case of solvent vapors in an air mixing chamber. In the case of E-TD-R2, E-TD-R2B types, measured at a flow rate of 10 l/h.

(3) Measured at the upper measurement limit, with medium level ambient parameters, and regular, use depending maintenance.

(4) The technical data of connected signal-processing unit must be observed when selecting cables and cross-sections.

(5) The transmitters can also be used to detect some other material.

(6) Data not applicable to sinter filters clogged due to contamination. It can be extended by replacing parts.

(7) Depending on the application of the mounting plate

13. GUARANTEE

Műszer Automatika Ltd. undertakes guarantee of 1 year in case of proper use. Condition of guarantee is the full observation of presriptions relating to the installation, putting into operation, safe operation and maintenance. The guarantee period can be extended by ***further 2 years,*** *if the operator or his/her representative concludes a scheduled maintenance contract with the manufacturer's service for 3 years after date of installation.*

Attention!

Switching-on and operation of transmitter wirhout using diagnostics program is not considered as putting into operation and it may generate guarantee loss.

The guarantee refers to failures originated from the manufacture. Damages occured during shipping, storing, installation or occured during the use or happened because of not observing prescriptions included in the manual are not covered.

14. SERVICE, MAINTENANCE

The gas concentration measuring transmitter is a device serving for safety according to its function and application fields. The prevention of any accidents endangering human life, material properties, environment caused by an explosion or its consequences may depend on its proper operation. In any case this safety device is only capable to recognize and prevent the evolving danger situation in time if its technical state allows it. To upkeep this technical state is served by the regular maintenances. Maintenance should be performed from putting into operation depending on the use every ***3 to 12 months****, even in case of faultless operation.*

The maintenance is at the cost of the customer except for the occasional guarantee covered repairs.

The maintenance is carried out by computer managed diagnostics program. It comprises general technical status survey, checking of proper operation of transmitter, setting control and trouble shooting if needed. Upon request during maintenance some settings can also be modified. Printed maintenance protocol is made about maintenance by means of diagnostics program which includes all the important settings of transmitter.

Attention!

Tthe apparatus cannot be put into operation and maintained without using the necessary diagnostics program.

During operation of transmitter trouble shooting is also possible for occasional failures in spite of having made maintenance or missed maintenance. The trouble shooting can be initiated at the manufacturer or its contracted partner.

In this case the following should be indicated:

- name of institution where the transmitter is located,

- manufacturing number,

- exact place of installation,

- error feature exactly specified,

- name at accessibility of contact person of operator or repair claiming party.