English

Operating Manual

Universal Isolating Amplifier
TV125M / ST125M

Companies / Brands of GHM

TELEMETRIE & AUTOMATION
IMTRON
Martens
HONSBERG
GREISINGER

www.ghm-messtechnik.de

Save for later reference.

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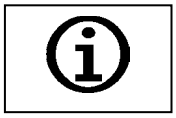
1 Intended use (areas of application)



Refer to the chapter 'Product description' for detailed specifications for the area of application.
The operational safety of the device is only assured when used as intended in accordance with the specifications in the operating manual.
Intervention beyond the actions described in the operating manual may only be carried out by personnel authorised by the manufacturer for safety and warranty reasons. Conversions or modifications made on one's own authority are expressly prohibited.
Application-specific dangers can emanate from this device when used improperly or not as intended.

Only device versions TV125M-Ex, TV125MP-Ex, ST125M-Ex and ST125MP-Ex are permitted for use as operating equipment for connection of intrinsically safe sensors, installed in Zones 0 or 1 and/or 20 or 21.
All safety-relevant characteristic data must be observed in this connection.

The approval for all intrinsically safe operating equipment is voided if it has been previously connected to non-intrinsically safe power circuit, because compliance with the safety-relevant characteristic data cannot be 100% guaranteed there.
Therefore, a safety test must be conducted by the manufacturer before later use as an intrinsically safe operating device.

The device TV125MP-00, ST125MP-00 and all other versions of the series TV****-Ex and ST****-Ex can be installed in the explosion-prone Zone 2 under the following conditions:
- Installation in a clean environment in a conductive, earthed housing (switch cabinet) with a minimum protection rating of IP54.
- Disconnection of connecting terminals only takes place in the de-energised state

Basic standards: EN 60079-0 and EN 60079-15.

General safety instructions, use
This operating manual must be kept in a location such that qualified personnel can refer to it at all times.
Any processes described in this operating manual may only be carried out by trained, qualified personnel who are authorised by the owner and wearing protective clothing.

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1.1 Safety signs and symbols

Warning notices are identified in this document as described under Table 1:

	Warning! This symbol warns of imminent danger which can result in death, severe bodily injury, or severe property damage in case of non-observance.
	Attention! This symbol warns of potential dangers or harmful situations which can cause damage to the device or to the environment in case of non-observance.
	Note! This symbol indicates processes which can have a direct influence on operation or can trigger an unforeseen reaction in case of non-observance.

1.2 Safety instructions

Read the product description before commissioning the device. Ensure that there are no limitations for use of the product for the relevant applications.
The owner is responsible for ensuring the fault-free operation of the device. The owner is obligated to ensure compliance and to observe the required work and safety measures of the current applicable regulations for the entire duration of use.

1.3 Product liability and warranty

Exclusion of liability:
The contents of the operating manual have been checked to ensure conformity with the described device. However, deviations cannot be entirely ruled out. Therefore, we cannot assume any guarantee for complete conformity. The specifications in this document are checked regularly and any necessary corrections are incorporated into subsequent versions. This document is subject to technical changes. In addition, all claims are based on the valid 'Standard Terms for the Supply of Products and Services of the Electrical Industry'.

GHM Messtechnik cannot inspect or repair any devices without the required form having been filled in completely (see page 20).

1.4 Standards and directives

Conformity
Low Voltage Directive 2014/35/EU
Testing standard EN 61010-1: 2010

EMC Directive 2014/30/EU
Testing standard EN 61326-1: 2013
EN 61326-3-1: 2008, amended 2009

ATEX- Directive 2014/34/EU
Testing standard EN 60079-0: 2012 + A11 : 2013,
EN 60079-11: 2012,
EN 60079-15: 2011

Funktionale Sicherheit
Testing standard EN 61508-1..5: 2011
SN 29500: 2013

2 Product description

Isolating amplifiers of the series TV/ST125 are suitable for potential isolation and for conversion of unit signals - optionally in explosion-prone environments. The universal configuration of the input, output and internal power supply by means of a wide-range mains adapter limits the number of models to a few versions. The auxiliary voltage supply can be optionally provided by means of a mounting rail bus connector.

The input measuring range can be switched between 0..20 mA and 4..20 mA and/or 0..10 V and 2..10 V on the front side via a DIP switch. The output measuring range can be configured between 0..20 mA and 4..20 mA and/or 0..10 V and 2..10 V on the front side via a DIP switch.

With the microprocessor-controlled measurement recording, undercutting and exceeding of measuring ranges are detected and communicated via a two-colour status LED on the front side. Then the output is set to a defined starting value and/or end value.

The starting value and the end value of the measuring range can be adjusted with the two trimmers on the front side.

The device version ST125 provides an additional transmitter feed for external 2, 3-wire sensors.

The devices can also be used in the explosion-prone Zone 2 if they are installed in a suitable housing.
Use in systems with functional safety SIL2 is also possible.

2.1 Scope of delivery

- TV125 or ST125
- This operating manual

2.2 Functional principle

The input signals are amplified in the input stage, the amplitudes are limited and the band is limited with an analogue filter of the third order. The filtered signal is digitalised by the analogue-digital converter of the microprocessor with a resolution of 14 bits. After scaling and a measuring range check, the signal is transmitted by means of pulse width modulation via an optocoupler to the output stage.
The output stage converts the PWM signal to a proportional analogue value which is then output via the output. The output current and/or output voltage are limited to a defined starting value and/or end value. The three circuits: Input, output and auxiliary voltage are galvanically isolated with amplified isolation.

2.3 Block circuit diagram

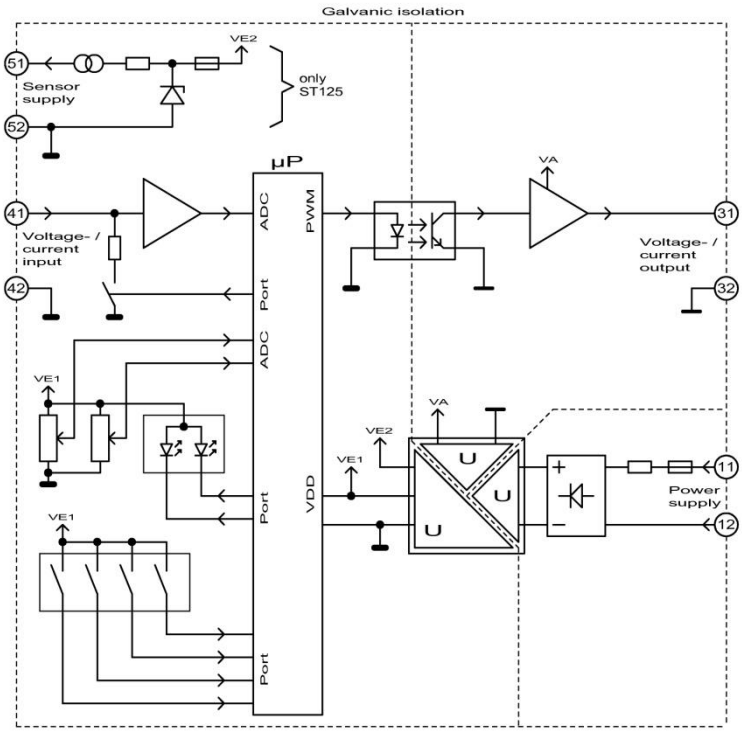


Fig. 1: Block circuit diagram

2.4 Type plate

The type plate contains the most important identification data

- Type and article designation
- Technical data
- Serial number / bar code

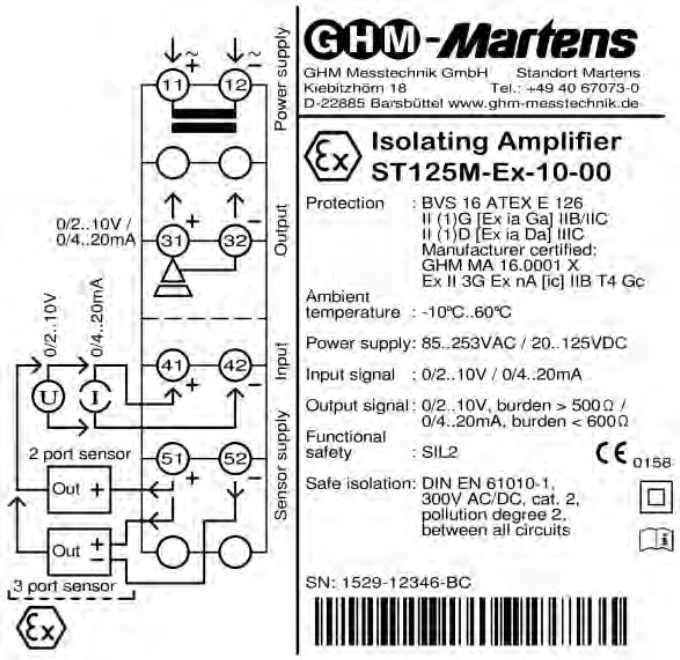
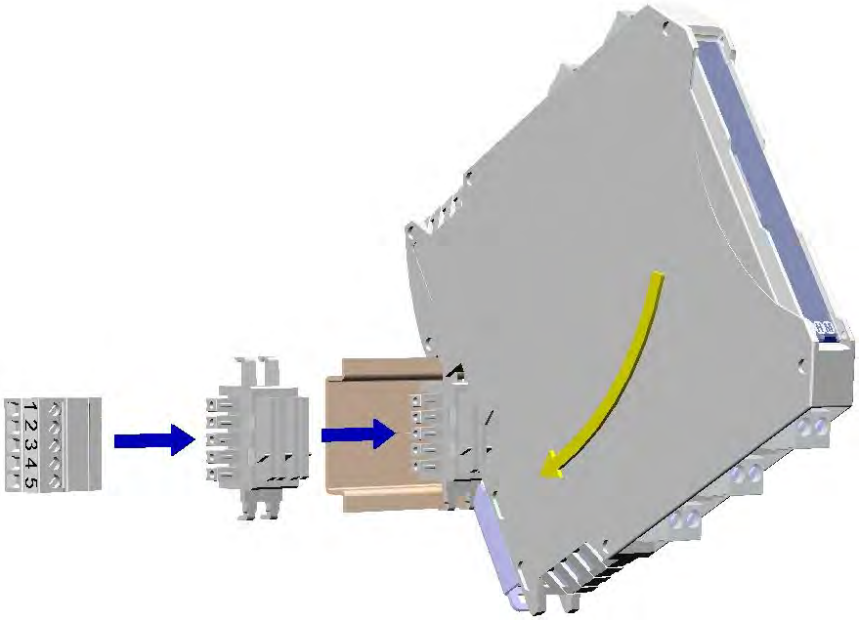
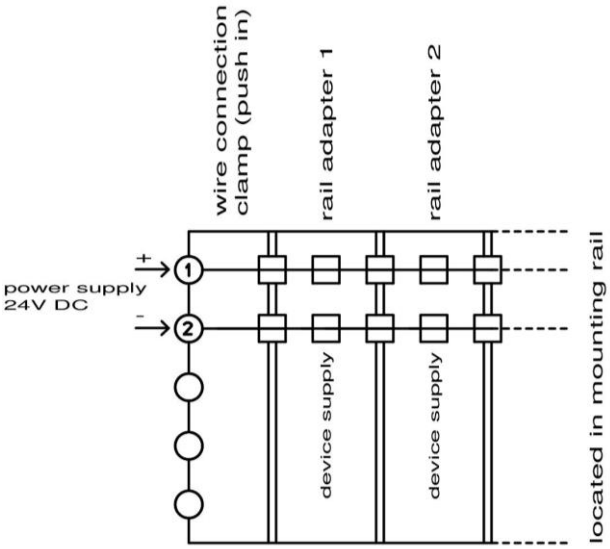


Fig. 2: Type plate

2.5 PowerRail mounting rail bus

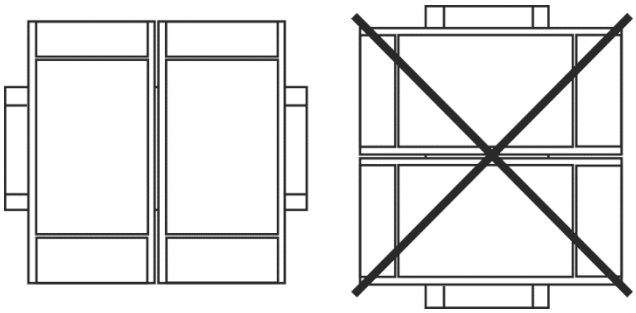
The auxiliary voltage supply of multiple devices can be combined and made easier with a bus system in the mounting rail (TS35).
An appropriate version is available for the entire MP series or GHM rail bus devices in a 12.5mm-wide housing.
A stackable bus adapter is connected to the mounting rail before installing the device to be supplied.
An adapter is required for each device for this purpose. Supply of the bus takes place via a plug-in terminal strip.
The supply terminals 11 and 12 on the upper side of the device are omitted device version TV/ST125MP provided for this purpose.





3 Assembly and installation

3.1 Mechanical assembly



Mounting rail assembly TS35, EN 60715

Gapless installation of several devices is only permitted with horizontally installed mounting rails.
The devices can be installed in Ex Zone 2 within an earthed, conductive housing (switch cabinet) with protection rating IP54.

3.2 Electrical installation

The device may only be installed by an electrician. Compliance with the national and international regulations for installation of electrical and electronic systems applicable in the respective country of use is mandatory.

Voltage supply in accordance with EN 60664-1.

SIL 2 requires an EMC-adequate installation, according to EN 60204-1 (for example)

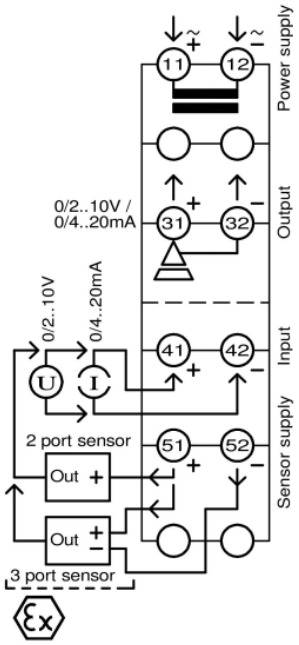
Connection of the auxiliary voltage takes place at connections 11 and 12 of the plug-in terminal strip.

Terminals 41 and 42 are intended for the input and terminals 51 and 52 are for the transmitter feed.

The active analogue output is provided at terminals 31 and 32.

Three are two DIP switches in the front panel for configuration of the input measuring range and the output range. The starting value and the end value of the measuring range can be adjusted with the two trimmers on the front side.

3.3 Connection diagram



Auxiliary voltage: 85..253 VAC / 20..125 VDC
or 24 VDC +/- 15 %

Output: 0/2..10V or 0/4..20 mA

Input: 0/2..10 V or 0/4..20 mA

Transmitter feed (only ST125):

Fig. 3: Connection diagram

4 Controls, functional description, output, transmitter feed

4.1 Controls, functional description

← Status LED

← TR2

← S1: On ⟷ Off
← S2: On ⟷ Off
← S3: On ⟷ Off
← S4: On ⟷ Off

← TR1

Fig. 4: Front panel

Status LED	Message
Green LED illumi-nates	Operating voltage connected
Red and green LEDs blink	See Table 7: Status messages
Red LED illuminates	See Table 7: Status messages

Tab. 2: Status LED

Trimmer	Adjustment
TR1	Starting value
TR2	End value

Tab. 3: Trimmer

DIP switches	On	Off
S1	Input configuration as voltage input	Input configuration as current input
S2	Output configuration as voltage output	Output configuration as current output

Tab. 4: DIP switches S1 and S2

DIP switches	On	Off
S3	Input configuration: S1 = On: 0..10 V, S1 = Off: 0..20 mA	Input configuration: S1 = On: 2..10 V, S1 = Off: 4..20 mA
S4	Output configuration: S2 = On: 0..10 V, S2 = Off: 0..20 mA	Output configuration: S2 = On: 2..10 V, S2 = Off: 4..20 mA

Tab. 5: DIP switches S3 and S4

Configuration	S1	S2	S3	S4	Input	Output
1	Off	Off	Off	Off	4..20 mA	4..20 mA
2	Off	Off	Off	On	4..20 mA	0..20 mA
3	Off	Off	On	Off	0..20 mA	4..20 mA
4	Off	Off	On	On	0..20 mA	0..20 mA
5	Off	On	Off	Off	4..20 mA	2..10 V
6	Off	On	Off	On	4..20 mA	0..10 V
7	Off	On	On	Off	0..20 mA	2..10 V
8	Off	On	On	On	0..20 mA	0..10 V
9	On	Off	Off	Off	2..10 V	4..20 mA
10	On	Off	Off	On	2..10 V	0..20 mA
11	On	Off	On	Off	0..10 V	4..20 mA
12	On	Off	On	On	0..10 V	0..20 mA
13	On	On	Off	Off	2..10 V	2..10 V
14	On	On	Off	On	2..10 V	0..10 V
15	On	On	On	Off	0..10 V	2..10 V
16	On	On	On	On	0..10 V	0..10 V

Tab. 6: DIP switches, configuration

4.2 Status LED

In error-free operation the front-side two-colour status LED illuminates green. When there is an error, the status LED issues a blinking sequence consisting of a specific number of green and red light pulses:

Error circuit	Blinking sequence		Cause
	Green	Red	
System	0	1	Electronic defect
Auxiliary voltage	1	6	Supply voltage of the processor is too low
	1	7	Auxiliary voltage < 18V
Input	2	1	Undermodulation (< -0.3mA / -0.15V or < 3.7mA / 1.85V)
	2	2	Overmodulation (> 20.8mA or > 10.4V)
Output	3	1	Undermodulation (< -0.2mA / -0.1V or < 3.8mA / 1.9V)
	3	2	Overmodulation (> 20.5mA or > 10.25V)

Tab. 7: Status messages

4.3 Output

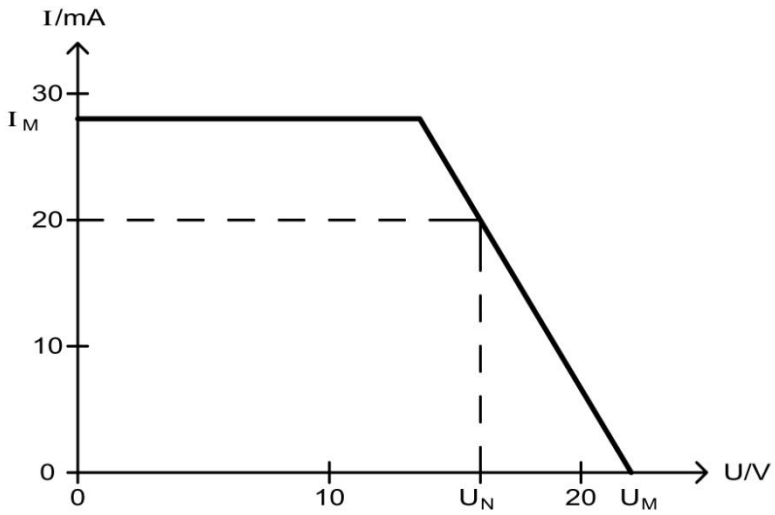
Behaviour of the output when a range is undercut and exceeded:

Output	Modulation range	Undermodulation	Overmodulation
0..10 V	-0,1..10.25 V linear	-0,2 V	10.5 V
2..10 V	1.9..10.25 V linear	1.8 V	10.5 V
0..20 mA	-0,2..20.5 mA linear	-0,4 mA	21 mA
4..20 mA	3.8..20.5 mA linear	3.6 mA	21 mA

Tab. 8: Modulation range

4.4 Transmitter feed (only ST125)

Characteristic curve and output data (terminals 50 and 51):



U_N > 15 V,
I_N = 20 mA,
R_i = 300 Ω,
U_M = approx. 23,5 V,
I_M = approx. 28 mA,
U_0 = 25.9 V,
I_0 = 92,6 mA,
P_0 = 598 mW

Fig. 5: Transmitter feed, characteristic curve

5 Commissioning, maintenance and service

5.1 Commissioning

1. Ensure that the connections have been made as indicated in the connection diagram and the auxiliary voltage is correct.
2. When connecting operating equipment from explosion-prone areas, ensure that the device version has the appropriate approval.
3. When installing the isolating amplifier in Zone 2, the device must be installed in a switch cabinet with protection rating IP54.
4. Make sure that the terminals are firmly screwed in.
5. After switching on the auxiliary power, check to ensure the correct configuration.

Note:
After the auxiliary voltage is connected, a check of the device function takes place according to the requirement for functional safety.
The device is ready for operation after approx. 3 seconds.

The functional test also includes a load test of the auxiliary voltage. The device is subjected to the equivalent of a maximum load for a period of 2 seconds, i.e. a short-circuited sensor supply and an output current of 21 mA at the output. The load is only simulated, which means the sensor supply is not short-circuited internally and the output current of the output is 0 mA.

5.2 Maintenance

Housing:
No cleaning or maintenance is required when operated as intended.

5.3 Service

Service of the device is only possible in the factory.

6 Technical data

Explosion protection
Device with intrinsically safe input, zone 0/1
(TV125M*-Ex…, ST125M*-Ex…)

Gas	:	II (1) G [Ex ia Ga] IIC/IIB [1)]
Staub	:	II (1) D [Ex ia Da] IIIC [1)]
		[1)] Zertifikat BVS 16 ATEX E 126
Installation in Zone 2	:	II 3 G Ex nA [ic] IIB T4 Gc [2)]
		[2)] Manufacturer's certificate, usage conditions on page 3

Device versions without intrinsically safe input
(TV125MP-00…, ST125MP-00…)

Installation in Zone 2	:	II 3 G Ex nA IIB T4 Gc [3)]
(ATEX ignition protection type "n")		[3)] Manufacturer's certificate, usage conditions on page 3

6.1 Parameters

6.1.1 Device <u>without</u> intrinsically safe input

All versions
<u>Input terminal (Power supply):</u>
Terminals 11(+) and 12 (-) or PowerRail connector (option **125MP)

Maximum Voltage	U_M	AC 253 V DC 125 V
TV125M-Ex and ST125M-Ex		
Power supply	U	AC 85...253 V (47...63 Hz) DC 20...125 V
Input-Power	P	< 4 VA
TV125MP-Ex and ST125MP-Ex		
Power supply	U	DC 24 V (+/- 15%)
Input- Power	P	< 2 W

All versions
<u>Output terminal</u>
Terminals 31 (+) and 32 (-)

Signals output-voltage	U	< 30 V
Signals output-current	I	< 22 mA
Maximum Voltage	U_M	AC 253 V DC 125 V

6.1.2 Device with intrinsically safe input

All versions

Input terminal (Input):
Terminals 41 (+) and 42 (-)

Output-voltage	U_0	27,6 V
Output-current	I_0	1,3 mA
Output-power	P_0	9,6 mW
(Characteristic curve trapezoidal)		
Input-voltage	U_i	26 V
Input-current	I_i	113 mA
Input-power	P_i	660 mW
Max. internal capacity	C_i	1 nF
Max. internal inductivity	L_i	240 nH
Max. external capacity IIB /IIIC	C_o	667 nF
Max. external capacity IIC	C_o	85 nF
Max. external inductivity IIB /IIIC	L_0	200 mH
Max. external inductivity IIC	L_0	100 mH

ST125M-Ex and ST125MP-Ex, only

Input terminal (Power supply):
Terminals 51(+) and 52(-)

Output-voltage	U_0	25,9 V
Output-current	I_0	92,6 mA
Output-power	P_0	598 mW
(Characteristic curve trapezoidal)		
Max. internal capacity	C_i	1 nF
Max. internal inductivity	L_i	240 nH
Max. external capacity IIB /IIIC	C_o	769 nF
Max. external capacity IIC	C_o	99 nF
Max. external inductivity IIB /IIIC	L_0	8 mH
Max. external inductivity IIC	L_0	2 mH

6.1.3 Additional data for all device types

Rated voltage	: 253 V AC, 125 V DC according to EN 60079-11. 300 V AC/DC according to EN 61010-1 With overvoltage Category 2 and Degree of Contamination 2 between all circuits. Safe separation with amplified isolation.
Test voltage (input / output / auxillary energy)	: 3 kV AC
Working temperature	: -10…60 °C
Storage temperature	: -20…80 °C
Relaitve air humidity	: 10 … 90 % (no condensation)
Input	: Current or voltage input, switchable
Voltage Input	: 0…10 V or 2…10 V, switchable R_i = 30 kΩ. Max. overload 26 V DC.
Current Input	: 0…20 mA or 4…20 mA switchable. R_i = 51 Ω. Max. overload 113 mA.
Measuring span	: adjustable ± 2 %
Zeropoint	: adjustable ± 2 %
Transmitter feed (ST125, only)	
Rated voltage at 20 mA output current	: > 15 V terminals 51, 52. > 14 V terminals 51, 41. R_i = 300 Ω. See characteristic curve on page 12.
Output	: Current or voltage input, switchable
Voltage Output	: 0…10 V or 2…10 V switchable, Load > 500 Ω.
Current Output	: 0…20 mA or 4…20 mA switchable, Load < 600 Ω.
Step response T_{90}	: 40ms
Standard error	: < 0,2 % of the end value
Temperature coefficient	: < 0,01 % / K

Housing

Material	: Polyamide (PA) 6.6, UL94V-0
Colour	: Light grey
Installation width	: 12.5 mm
Dimensions (HxD)	: 108 x 114 mm
Weight	: 91 g
Protection rating	: Housing IP 30, terminals IP 20 BGV A3
Connection type	: Screw terminals, plug-in with wire protection, 0.2..2.5mm², AWG 24..14. Wire stripping length: 8 mm.
Assembly	: Mounting rail assembly TS35, EN 60715
Functional safety	: SIL2 (parameters in accordance with EN 61508 and SN 29500) for input types 4...20 mA or 2...10 V and output types 4...20 mA and 2...10 V
Device type	: B
HFT	: 0
Error signalling	: Output 0 V repective 0 mA
Reaction time	: Normal function → error : 40 ms Error →Normal function : 1 s (self resetting)

Device	PFH	DC	SFF	PFDavg.		
				1 yrs.	2 yrs.	2,5 yrs.
TV125M	7,26E-07	93,7 %	96,5 %	3,18E-03	6,36E-03	7,95E-03
TV125MP	6,95E-07	93,5 %	96,4 %	3,05E-03	6,09E-03	7,62E-03
ST125M	8,04E-07	94,4 %	96,9 %	3,52E-03	7,04E-03	8,80E-03
ST125MP	7,73E-07	94,2 %	96,7 %	3,39E-03	6,77E-03	8,47E-03

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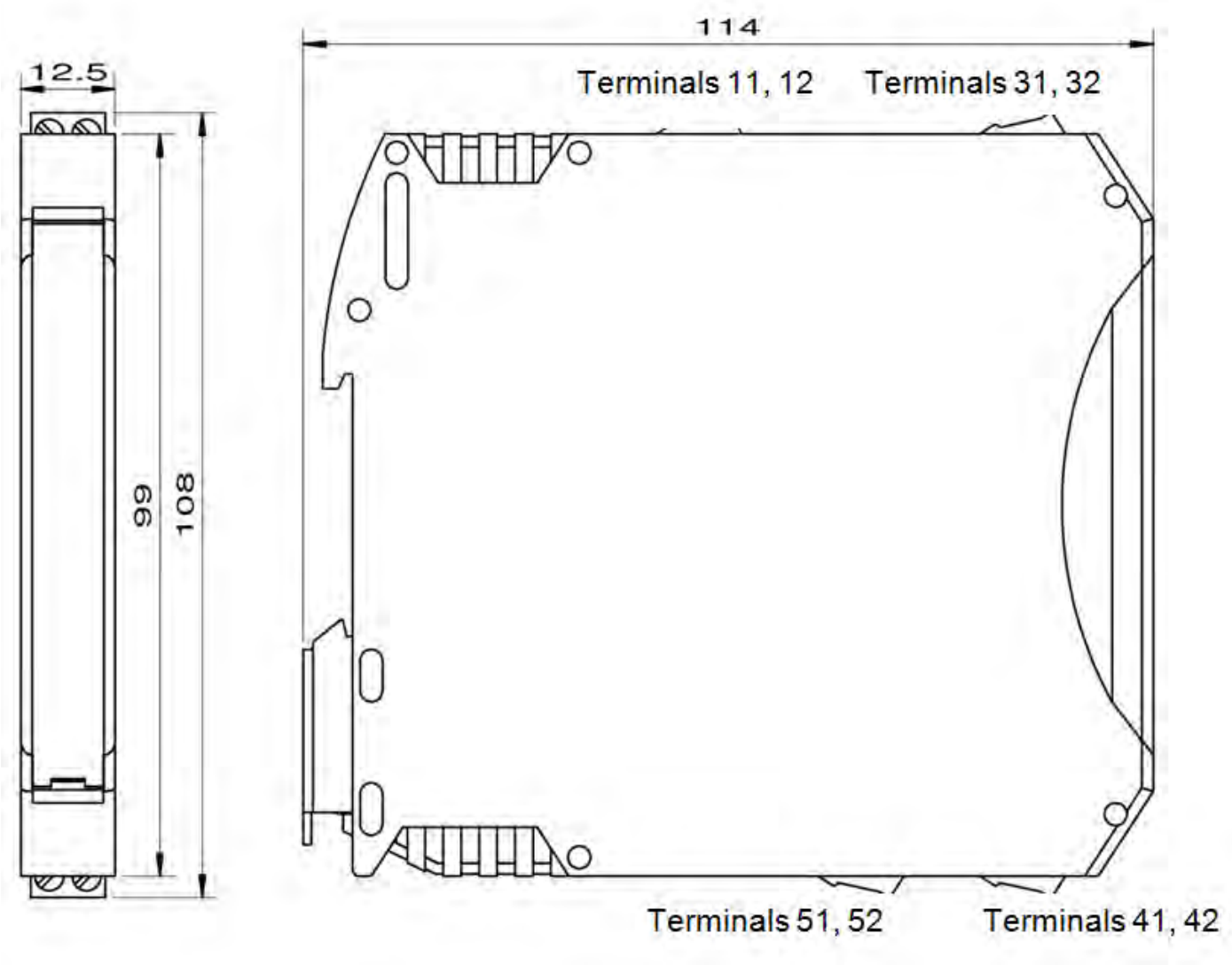
6.2 Mechanical design / dimensions



7 Order key

1. [ ] - 2. [ ] - 3. [ ] - 4. [ ]

1.	**Device version**	
	TV125M	Wide-range mains adapter
	TV125MP	Mounting rail bus connection *), Auxiliary voltage 24 V DC +/- 15%
	ST125M	Transmitter feed, Wide-range mains adapter
	ST125MP	Transmitter feed, Mounting rail bus connection *), Auxiliary voltage 24 V DC +/- 15%
2.	**Explosion protection**	
	00	no intrinsically safe input and no intrinsically safe transmitter feed. The devices TV125MP and ST125MP may be installed in zone 2 according to ATEX- ignition protection type "n"
	Ex	**In case of installing the devices out of the ex-zone**: Input and transmitter feed are intrinsically safe in accordance to ignition protection type "ia" for zones 0 and 20. The devices TV125MP and ST125MP may be installed in zone 2 according to ATEX- ignition protection type "ic"
3.	**Input**	
	10	0/2..10 V / 0/4..20 mA
4.	**Options**	
	00	No options
	01	Push-in terminals (plug-in)

- *) see separate Power Rail information sheet

8 Device transport and storage

Gentle and tension-free packaging of the housing must be ensured for transport (no machine wrapping of the package).
The device must be stored in the environmental conditions specified in the technical data.

9 Return to manufacturer

The legal regulations for environmental protection and our personnel require that devices which are sent back which have come into contact with liquid are handled without risk to people or the environment.
If you send a device back to us for inspection or repair, we must request that you strictly observe the following requirements:
On the GHM homepage under 'Downloads/forms' a return shipment form can be downloaded.
The repair can be performed quickly and without call-back questions if:

1. a filled-in form is provided for each device,
2. the device has been cleaned and packaging which prevents damage to the device is used, and
3. a safety data sheet for the measuring medium is affixed to the outside of the package, if the device has come into contact with a critical substance.

10 Disposal

Separation by material and recycling of device components and packaging must take place when the device is disposed of. The valid legal regulations and directives applicable at the time must be observed.
The device may not be disposed of with household waste. If the device should be disposed of, return it to us with the return shipment form under section 8 filled in. We will then arrange for the proper disposal.

11 Imprint

GHM Messtechnik GmbH
Standort Martens, Kiebitzhörn 18, 22885 Barsbüttel, Germany
Managing Director: Günther Oehler
Registered office: Schloßstr. 6, 88453 Erolzheim / Germany,
Amtsgericht Ulm, Commercial Register Section B 730462

12 EC Certificate of conformity

... professionelle Messtechnik „MADE IN GERMANY"

CE

EU-KONFORMITÄTSERKLÄRUNG
EU-DECLARATION OF CONFORMITY

GHM Messtechnik GmbH Standort Martens, Kiebitzhörn 18, 22885 Barsbüttel, Germany

Dokument-Nr. / Monat Jahr:
Document-No. / Month Year: **3098 / 09.2016**

Wir erklären hiermit als Hersteller in alleiniger Verantwortung, dass die folgenden Produkte konform sind mit den Schutzzielen der Richtlinie des Europäischen Parlaments:
We declare as manufacturer herewith under our sole responsibility that the following products are in compliance with the protection requirements defined in the European Council directives:

Produktbezeichnung:
Product identifier: **TV125M-Ex / TV125MP-Ex**
ST125M-Ex / ST125MP-Ex

Produktbeschreibung:
Product description: **Speisetrenner / Trennverstärker**
Isolating signal converter

Die Produkte entsprechen den folgenden Europäischen Richtlinien:
The products conforms to following European Directives.

Richtlinien / *Directives*		Angewandte harmonisierte Normen oder angeführte technische Normen *Applied harmonized standards or mentioned technical specifications*
2014/30/EU	EMV Richtlinie / *EMC Directive*	EN 61326-1:2013 EN 61326-3-1:2008 + Cor.:2009
2014/35/EU	Niederspannungsrichtlinie / *Low Voltage Directive*	EN 61010-1:2010
2011/65/EU	RoHS / *RoHS*	EN 50581:2012
2014/34/EU	ATEX-Richtlinie / *ATEX Directive*	EN 60079-0:2012 + A11:2013 EN 60079-11:2012 EN 60079-15:2010

Diese Erklärung wird verantwortlich für den Hersteller abgegeben durch:
The manufacturer is responsible for the declaration released by

Michael Wulf
Standortleiter
Business unit manager

Barsbüttel, 12. September 2016

Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Harmonisierungsrechtsvorschriften, beinhaltet jedoch keine Zusicherung von Eigenschaften.
This declaration certifies the agreement with the harmonization legislation mentioned, contained however no warranty of characteristics.

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... professionelle Messtechnik „MADE IN GERMANY"

CE

EU-KONFORMITÄTSERKLÄRUNG
EU-DECLARATION OF CONFORMITY

GHM Messtechnik GmbH Standort Martens, Kiebitzhörn 18, 22885 Barsbüttel, Germany

Dokument-Nr. / Monat.Jahr:
Document-No. / Month.Year: **3043 / 04.2016**

Wir erklären hiermit als Hersteller in alleiniger Verantwortung, dass die folgenden Produkte konform sind mit den Schutzzielen der Richtlinie des Europäischen Parlaments:
We declare as manufacturer herewith under our sole responsibility that the following products are in compliance with the protection requirements defined in the European Council directives:

Produktbezeichnung:
Product identifier: **TV125M-00 / TV125MP-00**
ST125M-00 / ST125MP-00

Produktbeschreibung:
Product description: **Universal-Trennverstärker**
Isolating signal converter

Die Produkte entsprechen den folgenden Europäischen Richtlinien:
The products conforms to following European Directives:

Richtlinien / *Directives*	
2014/30/EU	EMV Richtlinie / *EMC Directive*
2014/35/EU	Niederspannungsrichtlinie / *Low Voltage Directive*
2011/65/EU	RoHS / *RoHS*

Angewandte harmonisierte Normen oder angeführte technische Normen:
Applied harmonized standards or mentioned technical specifications:

Harmonisierte Normen / *harmonized standards*	
EN 61326-1:2013	Allgemeine EMV-Anforderungen / *General EMC requirements*
EN 61010-1:2010	Sicherheit (Niederspannungsrichtlinie) / *Safety (Low Voltage Directive)*
EN 50581:2012	Beschränkung der gefährlichen Stoffe / *Restriction of hazardous substances*

Diese Erklärung wird verantwortlich für den Hersteller abgegeben durch:
The manufacturer is responsible for the declaration released by:

Michael Wulf

Standortleiter
Business unit manager

Barsbüttel, 26. Mai 2016

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