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COMPANY BACKGROUND

„From a bold idea to a fully developed piece of engineering“

Grünwald GmbH is renowned for its standard of high quality and continuous product development in the field of control and measuring engineering.

Our foundation is based on an experienced staff, state of the art production procedures, optimized internal processes, high quality raw materials, and certified quality control.

We distribute our German manufactured products worldwide.

Experience is our greatest strength. Customer feedback feeds our innovations and product development. Our products provide the highest level of durability, reliability, and accuracy under the harshest conditions in the industry – even in explosive environments found in the mining industry.

„Experience creates confidence“

Founded in 1976, our company was based in Remscheid, Germany. Our company quickly grew, building a reputation for our ability to supply high quality measurement products using a high level of innovation.

In 2001 Grünwald was purchased by Mr. Lothar Schnickmann and Mr. Michael Wolf and new management was established. The company then relocated to Hamm, Germany, where it experienced further growth and market presence.

Our new location also provided us with greater manufacturing capability and enabled us to service our customer base more efficiently.

Today our customers recognize us as an innovative, yet flexible partner, who can quickly and reliably meet their flow and measurement product needs throughout the world.

We design and manufacture measuring and control equipment, such as Volume Flow, Temperature, Pressure and Level measuring devices, as well as Control units and temperature switches for use in explosive environments and all other mining applications.



1976	Founded in Remscheid, Germany	
2001	Company purchased by Lothar Schnickmann and Michael Wolf Cooperation with Distributor in Poland	
2002	Initial relocation and expansion into Hamm commenced	
2003	Certification to ATEX 94/9/EC	
2004	Completion of relocation of the whole company to Hamm	
2006	Certification to DIN EN ISO 9001:2000 Certification to IECEx	 
2008	Production capabilities expanded Cooperation with Distributor in Canada Cooperation with Distributor in Slovenia Cooperation with Distributor in South Africa Cooperation with Distributor in Turkey	
2009	Certification to DIN EN ISO 9001:2008 Cooperation with Distributor in China	
2010	Certification GOST and RTN for Russia Cooperation with Distributor in Russia Cooperation with Distributor in the USA	
2012	Certification MA for China Cooperation with Distributor in Czech Republic	
2014	Certification IECEx for Australia	
2015	Certification MSHA for USA Cooperation with Distributor in Australia	
2016	Certification EAC Ex for Russia Certification to ATEX 2014/34/EU	 
2018	Certification to DIN EN ISO 9001:2015	
2019	Cooperation with Distributor in Vietnam Cooperation with Distributor in Iran	
2020	Change Sales Strategy in Poland by local representatives Cooperation with Distributor in India	
2021	Certification EAC Ex for Russia	
2022	Certification MA for China	

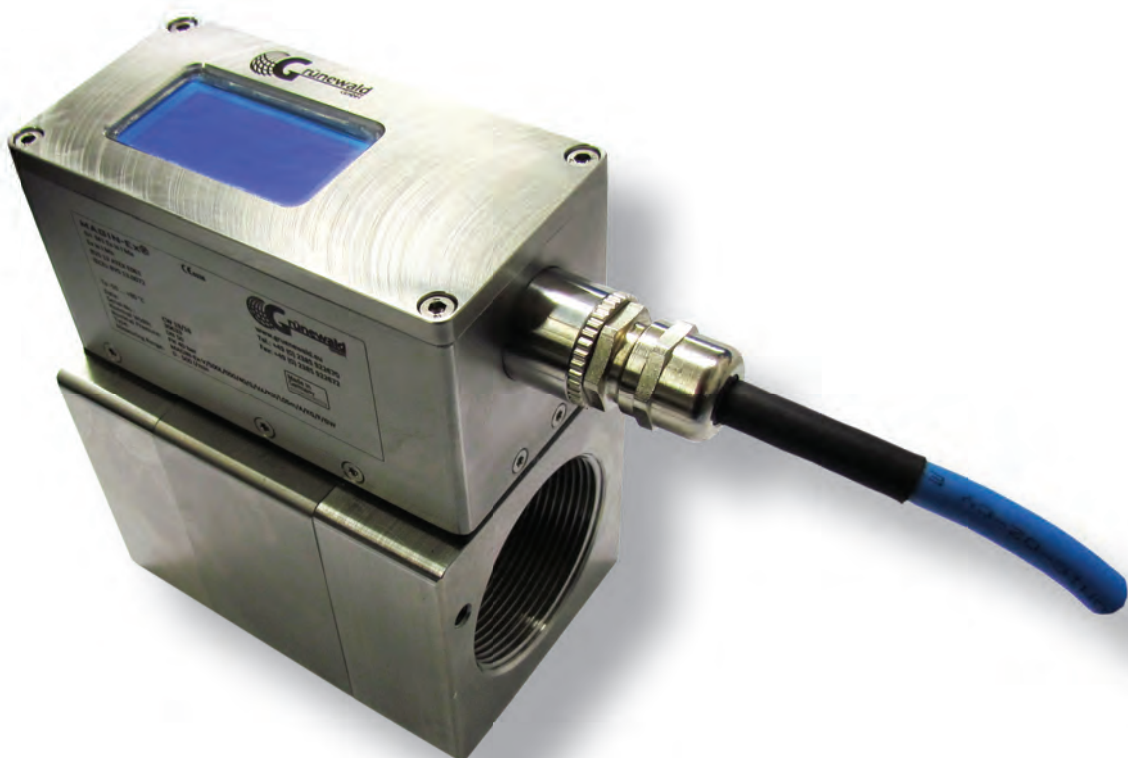
VOLUME FLOW MEASURING INSTRUMENTS TYPE *MAGIN-EX*[®]

The *MAGIN-EX*[®] series is designed for volume flow measurement, which can be integrated with further measurements such as pressure and / or temperature. To increase the fail-safety, safety-relevant circuits are redundantly designed.



The development was based on state-of-the-art technologies, both in the field of electronics and mechanical design, with the aim of offering a modern and highly-technical measuring instrument for underground mining applications. Due to the used processor electronics, high measuring accuracies and fast reaction times, as well as in conjunction with the mechanical design, a great variety of configurations can be realized. This allows you to assemble your individual measuring device for your application.

With the magnetic-inductive measuring method, no mechanical components are used for the measurement recording, so that a high failure safety against e.g. pollution in the liquid is reached. According to Faraday's law of induction, a voltage is induced into the medium to be measured, which moves in a magnetic field, by means of two coils. This induced voltage behaves logarithmically to the flow rate and is fed to the electronics via two laterally arranged measuring electrodes. The flow volume is then calculated over the nominal width. The direction of flow is not relevant for these volume flowmeters.



A prerequisite for this measuring principle is the use of conductive media, such as for example water or liquids with water. Oil can not be measured with the **MAGIN-EX**[®]. There is the **SMALL-EX**[®] **VISCOFLOW** for use in pure oil by use of gear-wheels inside.

The measuring instruments are designed for use under very rough and difficult ambient conditions and withstand very high mechanical loads due to their extremely solid construction and the stainless steel housing. They are designed for use in filled systems with liquid media.

In the field of the electrical connection, connectors of different designs as well as cable connections are available in variable lengths. If you prefer a connector or a specific standard connector, we can check the usability. An intrinsically safe 12 V power supply is required as auxiliary energy.



MAGIN-EX® The measuring instruments of the **MAGIN-EX®** series can also be equipped with further measurements in addition to the volume flow measurement. On the one hand, an internal pressure measurement and / or temperature measurement can be supplemented. All 3 measurements are displayed on the display and transferred to the controller (PLC). On the other hand, an external temperature sensor can be connected, the measured values of which are also displayed on the display and transmitted to the controller (PLC). The cooling capacity and heat output ($Q = m \times c \times \Delta T$) can be evaluated by the internal and external temperature measurement in a cooling system. This measured value is shown in the display and transmitted.

For the volumetric flow measurement there is an additional sum function, whereby the measured volume flow is added up and displayed on the display. It is possible to change the display via buttons in the housing, e.g. the measuring units or further data.

A backlit, graphic display is used, which allows up to 4 measured values to be displayed. Furthermore, it is also possible to display values not only in German, English and Polish, but also in Chinese. The language can be changed on the device itself.



The measuring device is available as a compact version or as a stepped version. In the stepped version, the display unit is connected to the measuring body by means of a cable and thus allows the display to be installed in a user-friendly position.

With the signal transmission, different output signals are available. A frequency output signal 5-15 Hz can be selected as an active or passive variant, as well as current output signals with 0-20 mA or 4-20 mA or voltage output up to max. 10 volts. Furthermore, the CANBus system is available as a digital output signal.

The measuring device can also be equipped with boundary values which the user can set on the device on site. When the set lower or upper limit value is reached, a 0/1 signal from the measuring device is transmitted to the control unit (PLC).

Marking:

Version	Group 1 (Mining)		Group 2 (Chemical)	
	ATEX	IECEX	ATEX	IECEX
Frequency output Current output Voltage output Boundary Values	Ex I M1 Ex ia I Ma	Ex ia I Ma	Ex II 2G Ex ia IIA T4 Gb	Ex ia IIA T4 Gb
CAN-Bus Devices with stepped sensors	Ex I M2 Ex ia [ib] I Mb	Ex ia [ib] I Mb	Ex II 2G Ex ia [ib] IIA T4 Gb	Ex ia [ib] IIA T4 Gb

Certifications:

BVS 13 ATEX E 061

IECEX BVS 13.0072



Environmental Temperature:

-50 bis +80 °C (-58 bis +176 °F)

IN PROGRESS



TECHNICAL DETAILS

Housing Material:	Stainless Steel
Gauge Accuracy:	± 0.5 % in range of 10 % - 100 % of measuring end-value (higher accuracy on request)
Medium:	Water
Illuminated Display:	optional
Display:	l/min ; m ³ /h ; gpm (other units on request)
Output Signal:	5 – 15Hz 0/4 – 20mA * – **V (max. 10 V DC, at min. 7.5V power supply) CAN-Bus Customized output signals with intermediate ranges configurable on request
Nominal Voltage:	12V DC (7.5 – 14.0 V DC) 3-wire technology

Output signal		without Display	with Display
Frequency	5 - 15 Hz	120 mA	140 mA
Current	0 - 20 mA	120 - 140 mA	140 - 160 mA
Current	4 - 20 mA	124 - 140 mA	144 - 160 mA
Voltage	* - ** V	120 mA	140 mA
CAN-Bus		140 mA	160 mA

The manufacturer reserves the right to modify, due to technical progress the instrument and all of its components while acknowledging the normative and certified guidelines.



Metric System			
Nominal Width (DN) (mm)	Nominal Pressure (PN) (bar)	Mechanical Connection	max. Measuring Range
20	40 / 100 / 200	G ¾" / Staple lock	0 - 120 l/min
25	40 / 100 / 200	G 1" / Staple lock	0 - 150 l/min
32	40 / 100 / 200	G 1¼" / Staple lock	0 - 250 l/min
40	40 / 100 / 200	G 1½" / Staple lock	0 - 300 l/min
50	40 / 100 / 200	G 2" / Staple lock	0 - 400 l/min
50	16 / 40 / 63 / 160	Flange	0 - 60 m³/h
65	16 / 40 / 63 / 160	Flange	0 - 80 m³/h
80	16 / 40 / 63 / 160	Flange	0 - 100 m³/h
100	16 / 40 / 63 / 160	Flange	0 - 120 m³/h
150	16 / 40 / 63 / 160	Flange	0 - 200 m³/h
200	16 / 40 / 63 / 160	Flange	0 - 400 m³/h
250	16 / 40 / 63 / 160	Flange	0 - 500 m³/h
300	16 / 40 / 63 / 160	Flange	0 - 600 m³/h

Imperial System			
Nominal Width (DN) (inch)	Nominal Pressure (PN) (psi)	Mechanical Connection	max. Measuring Range
0.75	600 / 1500 / 3000 / 6000	G ¾" / Staple lock	0 - 30 gpm
1.00	600 / 1500 / 3000 / 6000	G 1" / Staple lock	0 - 40 gpm
1.25	600 / 1500 / 3000 / 6000	G 1¼" / Staple lock	0 - 70 gpm
1.50	600 / 1500 / 3000 / 6000	G 1½" / Staple lock	0 - 80 gpm
2.00	600 / 1500 / 3000 / 6000	G 2" / Staple lock	0 - 110 gpm
2.50	250 / 600 / 950 / 2400	Flange	0 - 180 gpm
2.00	250 / 600 / 950 / 2400	Flange	0 - 270 gpm
3.00	250 / 600 / 950 / 2400	Flange	0 - 440 gpm
4.00	250 / 600 / 950 / 2400	Flange	0 - 530 gpm
6.00	250 / 600 / 950 / 2400	Flange	0 - 880 gpm
8.00	250 / 600 / 950 / 2400	Flange	0 - 1760 gpm
10.00	250 / 600 / 950 / 2400	Flange	0 - 2200 gpm
12.00	250 / 600 / 950 / 2400	Flange	0 - 2600 gpm

Measuring ranges above apply to water medium.

Other measuring ranges, nominal width, nominal pressure, media and connection types on request.

MODEL KEY

M A G I N - E X - V / * / * * / * * * * / * * * * / * * * * / * * * * / * * / * * / * * / * * / * * / * * / * * / * * / * * / * * / * * / * * / * * / * *

Main Measurement	Additional Measurement	Nominal Voltage	Measuring Range	Unit	Additional Measuring		Nominal Width	Nominal Pressure	Mechanical Connection	Electrodes Material	Functional Safety	Electrical Connection	Display	Sensors Adjustment	Port
					Measuring Range	Unit									
V [Volume Flow]	P [Pressure] T [Temperature internal] T2 [Temperature external]	12 [12V DC] E12 [12V DC external]	*** [0..***]	L [l/min] cbm [cbm/h] gpm [gpm] % [%] *** [Special]	Pressure	Pressure	020 [DN20]	*** [PN*** bar]	G [BSP Female Thread]	TI [Titanium]	SI [Functional Safety SIL/PL]	B [PROMOS BN41...AT] H [Harting]	A [with display]	KG [Compact Instrument]	S0 [0-20 mA]
						mb [mbar]	025 [DN25]								S4 [4-20 mA]
						MPa [MPa]	032 [DN32]								S... [*..* mA]
						*** [0..***]	040 [DN40]								U... [*..* V max. 10V]
						psi [psi]	050 [DN50]								F [5-15 Hz]
						% [%]	080 [DN80]								F*** [*..* Hz]
						*** [Special]	100 [DN100]								FA [5-15 Hz active]
						Temperature	150 [DN150]								F***A [*..* Hz active]
						*** [0..***]	200 [DN200]								*** [Special]
						*...* [-*..*] Measuring Range with negative Temperature	250 [DN250]								GW [Contact for Boundary values]
						C [°C]	300 [DN300]								C [CAN-Bus]
						F [°F]	*** [DN***]								
						K [°K]	*** [Special]								
						% [%]									
						*** [Special]									

Examples: MAGIN-Ex-V/P/T/12/100L/40b/40C/025/40/G/TI/KSI/H/A/KG/S4
MAGIN-Ex-V/P/T/12/200cbm/40b/60C/150/40/F/TI/KSI/H/A/KG/S4
MAGIN-Ex-V/P/T/12/250L/40b/40C/032/40/G/TI/KSI/H/KA/KG/S4

Other types, connections, measuring ranges, etc. on request.

The manufacturer reserves the right to modify, due to technical progress the instrument and all of its components while acknowledging the normative and certified guidelines.

MEASURING INSTRUMENTS TYPE *SMALL-EX*[®]

SMALL-EX[®] devices are intrinsically safe measuring instruments for various measurements like volume flow or level measuring of liquid media as well as pressure or temperature measuring.

Based on this standard the measuring instrument series includes a differential pressure measurement, inclinometer, force control unit as well as a patented temperature measuring system f.e. for the usage at conveyor belt systems.



The instruments are suitable for use under very harsh and challenging environments and maintain high mechanical loads because of the solid design by the stainless steel housing.

Through processor-technology, a higher measuring accuracy and a faster response time can be achieved. All measurements can be equipped with or without a display. A self-illuminated display is used which considerably improves the readability.

For a better opportunity to use the measuring instrument can be designed with a stepped sensor. The sensor is in a separate housing and is connected with a cable to the evaluating unit which can be equipped with a display.

In the area of transmission reading several output signals are available. You can choose between 5 to 15 Hz, 0 to 20 mA as well as 4 to 20 mA or a voltage up to 10 V, at a power supply of min. 7.5 V DC. These signals are transmitted as analogous signals. The output signals can be customized and configured based upon customer requirements, e.g. 0.5 - 4.5 V, 6 - 14.5 Hz, 2 - 15 mA, In addition we offer this measuring instrument also with a CAN-BUS option.

As electrical connection are different approved connectors or a cable connection in variable length available. If you favour a connector or use a specific standard-connector, we can check the applicability.

The measuring instrument series is available in 12 Volt as well as 16 Volt (3-wire-technology) and also in 24 Volt (2-wire-technology). As a separate version the power supply and the output signal can be occurred via 2 separate cables (E12 or E16).



The **SMALL-EX**[®] Measuring Instrument series is approved for the usage in underground intrinsically safe measurement systems for various countries. Besides the ATEX-certification for Europe the measuring instruments have the certifications for Australia (IECEX), Russia (EAC Ex) and USA (MSHA). The certification for China (MA) and India (DGMS) is in progress.

In order to meet even difficult operating conditions, these measuring devices are suitable for use in environmental temperature ranges from -50 ° C to +100 ° C (-58 ° F to +212 ° F) for group 1 as well as -50 ° C to + 80 ° C (-58 ° F to +176 ° F) for Group 2.

With regard to reliability and failure safety, the measuring devices have a safety integration level (SIL) 2 as well as a performance level (PL) c.

Marking:

Version	Group 1 (Mining)		
	ATEX	IECEX	EAC Ex
2-wire ; 24 Volt (without plugable stepped sensor)	⊕ I M1 Ex ia I Ma	Ex ia I Ma	PO Ex ia I X
3-wire ; 12 / 16 Volt frequency output current output voltage output	⊕ I M1 Ex ia I Ma	Ex ia I Ma	PO Ex ia I X
3-wire ; 12 / 16 Volt CAN-Bus	⊕ I M1 Ex ib I Mb	Ex ib I Mb	PO Ex ia I X

Version	Group 2 (Chemical)	
	ATEX	IECEX
2-wire ; 24 Volt (without plugable stepped sensor)	⊕ II 1/2 G Ex ia IIC T4/T6 Ga/Gb	Ex ia IIC T4/T6 Ga/Gb

Certifications:

BVS 06 ATEX E 005 X
 IECEX BVS 09.0056X
 IECEX TSA 13.0023X
 MSHA 18-ISA 150004-0
 TC RU C-DE.MH062.B.03774



IN PROGRESS

Environmental Temperature: -50 to +100 °C (-58 to +212 °F)
 at Group 1

-50 to +80 °C (-58 to +176 °F)
 at Group 2



VOLUME FLOW MEASURING INSTRUMENTS TYPE *SMALL-EX*[®]

SMALL-EX[®] Measuring Instruments are intrinsically safe flow volume measuring instruments. They can be equipped with integrated pressure and/or temperature measuring sensors.



The measuring instruments are designed for use in filled systems with water or emulsion. Depending on the design or application, the measuring instruments can be designed for system pressures up to 400 bar. For flow measurement of oil we designed the instrument-series *SMALL-EX*[®] *VISCOFLOW*.

The volume flow measuring instruments can be optionally equipped with a self-illuminated display. For versions with integrated pressure or temperature measurement, up to 3 displays are installed.

For a better opportunity to use the measuring instrument can be designed with a stepped sensor. The sensor is in a separate housing and is connected with a cable to the evaluating unit which can be equipped with a display.

At the volume flow measuring instruments **SMALL-EX[®]** the be measured liquid medium flows through a defined housing bore and set the turbine in motion. The turbine is equipped with five sealed magnet. These magnetic fieds are reported by an inductive, non-contact sensor to the electronics and evaluated there. The flow direction is not relevant for these volume flow measuring instruments.



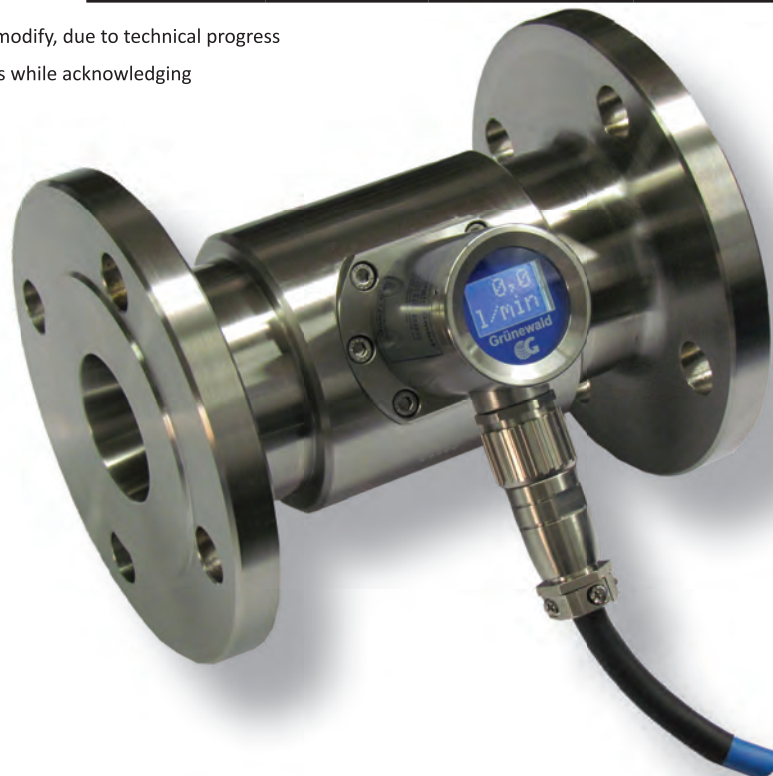
SMALL-EX[®] A variety of mechanical connections are available, such as different threads, staple lock, flange, Victaulic-system or SAE-flange. Due to the construction of the nominal widths DN20 to DN32 several instruments of this size can be mounted together to built a unit.

TECHNICAL DETAILS

Housing Material:	Stainless Steel	
Gauge Accuracy:	± 0.5 % from end-value (higher accuracy on request)	
Medium:	filtered water as well as emulsion	
Illuminated display:	optional	
Display:	l/min ; m ³ /h ; gpm ; l/sec (other units on request)	
Output Signal:	5 – 15Hz	
	0/4 – 20mA	
	* – **V (max. 10 V DC, at min. 7.5V power supply)	
	CAN-Bus	
	Customized output signals with intermediate ranges configurable on request	
Nominal Voltage:	12V DC (7.5 – 14.0 V DC)	3-wire technology
	16V DC (9.6 – 16.1 V DC)	3-wire technology
	24V DC (14 – 26.6 V DC)	2-wire technology

Nominal current per measuring system:		Output signal	without Display	with Display
Frequency	5 - 15 Hz		13 mA	23 mA
Current	0 - 20 mA		13 - 33 mA	23 - 43 mA
Current	4 - 20 mA		17 - 33 mA	27 - 43 mA
Voltage	* - ** V		17 mA	27 mA
CAN-Bus			30 mA	40 mA

The manufacturer reserves the right to modify, due to technical progress the instrument and all of its components while acknowledging the normative and certified guidelines.



Metric System			
Nominal Width (DN) (mm)	Nominal Pressure (PN) (bar)	Mechanical Connection	max. Measuring Range
20	40 / 100 / 200 / 400	G ¾" / Staple lock / Victaulic / SAE	0 - 120 l/min
25	40 / 100 / 200 / 400	G 1" / Staple lock / Victaulic / SAE	0 - 150 l/min
32	40 / 100 / 200 / 400	G 1¼" / Staple lock / Victaulic / SAE	0 - 250 l/min
40	40 / 100 / 200 / 400	G 1½" / Staple lock / Victaulic / SAE	0 - 300 l/min
50	40 / 100 / 200 / 400	G 2" / Staple lock / Victaulic / SAE	0 - 400 l/min
50	16 / 40 / 63 / 160	Flange / Victaulic / SAE	0 - 60 m³/h
65	16 / 40 / 63 / 160	Flange / Victaulic / SAE	0 - 80 m³/h
80	16 / 40 / 63 / 160	Flange / Victaulic / SAE	0 - 100 m³/h
100	16 / 40 / 63 / 160	Flange / Victaulic / SAE	0 - 120 m³/h
150	16 / 40 / 63 / 160	Flange / Victaulic	0 - 200 m³/h
200	16 / 40 / 63 / 160	Flange / Victaulic	0 - 400 m³/h
250	16 / 40 / 63 / 160	Flange / Victaulic	0 - 500 m³/h
300	16 / 40 / 63 / 160	Flange / Victaulic	0 - 600 m³/h

Imperial System			
Nominal Width (DN) (inch)	Nominal Pressure (PN) (psi)	Mechanical Connection	max. Measuring Range
0.75	600 / 1500 / 3000 / 5800	G ¾" / Staple lock / Victaulic / SAE	0 - 30 gpm
1.00	600 / 1500 / 3000 / 5800	G 1" / Staple lock / Victaulic / SAE	0 - 40 gpm
1.25	600 / 1500 / 3000 / 5800	G 1¼" / Staple lock / Victaulic / SAE	0 - 70 gpm
1.50	600 / 1500 / 3000 / 5800	G 1½" / Staple lock / Victaulic / SAE	0 - 80 gpm
2.00	600 / 1500 / 3000 / 5800	G 2" / Staple lock / Victaulic / SAE	0 - 110 gpm
2.00	250 / 600 / 950 / 2400	Flange / Victaulic / SAE	0 - 270 gpm
2.50	250 / 600 / 950 / 2400	Flange / Victaulic / SAE	0 - 360 gpm
3.00	250 / 600 / 950 / 2400	Flange / Victaulic / SAE	0 - 440 gpm
4.00	250 / 600 / 950 / 2400	Flange / Victaulic / SAE	0 - 530 gpm
6.00	250 / 600 / 950 / 2400	Flange / Victaulic	0 - 880 gpm
8.00	250 / 600 / 950 / 2400	Flange / Victaulic	0 - 1760 gpm
10.00	250 / 600 / 950 / 2400	Flange / Victaulic	0 - 2200 gpm
12.00	250 / 600 / 950 / 2400	Flange / Victaulic	0 - 2600 gpm

Measuring ranges above apply to water medium.
Other measuring ranges, nominal width, nominal pressure, media and connection types on request.



MODEL KEY

SMALL-V / ** / ** / ** * * * * / ** * * / ** * * / ** * * / ** * * / ** * * / ** * * / ** * * / ** * * / ** * * / ** * * / ** * *

Measuring mode	Design	Nominal Voltage	Measuring Range	Unit	Nominal Width	Nominal Pressure	Additional Measuring	Mechanical Connection	Electrical Connection	Display	Sensors Adjustment	Port 1	Port 2	Port 3
V [Volume Flow]	RG [Round-Instrument]	12 [12V DC]	*** [0-***]	L [l/min]	*** [DN***]	*** [PN*** bar]	**C [0-** °C]	G [BSP Female Thread]	B [PROMOS BN41..AT]	A [with display]	KG [Compact-Instrument]	SI0 [0-20 mA]	F [5-15 Hz]	C [CAN-Bus]
		E12 [12V DC external]		cbm [cbm/h]				**F [0-** °F]						
		16 [16V DC]		G [gpm]		p*** [PN*** psi]	**b [0-** bar]	F [Flange]	S [Souriau]	KA [without display]	AS...m [stepped sensor with length in m]	SI... [*... mA]		
		E16 [16V DC external]		% [%]		**p [0-** psi]	**M [0-** MPa]	AF [ANSI Flange]	M12 [M12-connector]			U... [*... V max. 10V]		
				*				O [Staple lock]	L...m [cable with length in m]					
				[special]				VI [Victaulic]	** [System **]					
								SAE [SAE Flange]	** [Special]					
V [Volume Flow]	RG [Round-Instrument]	24 [24V DC]	*** [0-***]	L [l/min]	*** [DN***]	*** [PN*** bar]	**C [0-** °C]	G [BSP Female Thread]	H [Harting]	KA [without display]	KG [Compact-Instrument]	SI4 [4-20 mA]	-	-
				cbm [cbm/h]				**F [0-** °F]						
				G [gpm]		p*** [PN*** psi]	**b [0-** bar]	F [Flange]	M12 [M12-connector]		AS...m [stepped sensor with length in m]			
				% [%]		**p [0-** psi]	**M [0-** MPa]	AF [ANSI Flange]	L...m [cable with length in m]					
				*				O [Staple lock]	** [System **]					
				[special]				VI [Victaulic]						
								SAE [SAE Flange]	** [Special]					

Examples: SMALL-V/RG/12/120L/025/40/O/H/A/KG/SI4
 SMALL-V/RG/E12/400cbm/200/40/F/BL05m/A/AS10m/U1-10V
 SMALL-V/RG/12/400L/032/100/100b/80C/G/L03m/KA/KG/C

Other types, connections, measuring ranges, etc. on request.

VOLUME FLOW MEASURING INSTRUMENTS TYPE *SMALL-EX*[®]

VISCOFLOW

SMALL-EX[®] Measuring Instruments are intrinsically safe volume flow measuring instruments for pure oil. In the volume flow measuring instrument is an arrangement of gears, whose revolutions are counted by a impulse sensor. They can be equipped with integrated pressure and/or temperature measuring sensors.



The volume flow will be transmitted as an analogous signal with a signal range of 5-15 Hz, 0/4-20 mA, 0-10 V (max. 10 V DC; at a power supply of min. 7.5 V DC) or CAN-Bus. Also possible is a „pulse output“, up to max. 1kHz at which the volume can be counted because a defined amount of oil flows through the device per pulse.

The volume flow measuring instrument for oil can be used as an instantaneous display of liters per minute or impulse output as „counting“. The oil is passed through gear-wheels so per count, a defined amount of oil flows. Thus, the instrument is independent of viscosities or temperatures. This value will be transmitted via an arbitrary signal and also optionally displayed in the illuminated display on site.

This measuring instrument can be used e.g. in hydraulic systems up to 400 bar for measurement of pump performance or (the impulse version) for displacement measurement of hydraulic cylinders.

TECHNICAL DETAILS

Housing Material:	Stainless Steel / spheroidal cast iron	
Gauge Accuracy:	± 0.5 % from end-value (higher accuracy on request)	
Medium:	pure oil	
Illuminated display:	optional	
Display:	l/min ; m ³ /h ; gpm ; l/sec (other units on request)	
Output Signal:	5 – 15Hz	
	0/4 – 20mA	
	* – **V (max. 10 V DC, at min. 7.5V power supply)	
	pulse output up to 1 kHz	
	CAN-Bus	
	Customized output signals with intermediate ranges configurable on request	
Nominal Voltage:	12V DC (7.5 – 14.0 V DC)	3-wire technology
	16V DC (9.6 – 16.1 V DC)	3-wire technology
	24V DC (14 – 26.6 V DC)	2-wire technology

Nominal current per measuring system:	Output Signal		without Display	with Display
	Frequency	5 - 15 Hz	16 mA	26 mA
	Current	0 - 20 mA	16 - 36 mA	26 - 46 mA
	Current	4 - 20 mA	20 - 36 mA	30 - 46 mA
	Voltage	* - ** V	20 mA	30 mA
	CAN-Bus		33 mA	43 mA

The manufacturer reserves the right to modify, due to technical progress the instrument and all of its components while acknowledging the normative and certified guidelines.



Metric System			
Nominal Width (DN) (mm)	Nominal Pressure (PN) (bar)	Mechanical Connection	max. Measuring Range
10	400	G 3/8" BSP / Staple lock	0,16 - 16 l/min
12	400	G 1/2" BSP / Staple lock	0,2 - 30 l/min
15	400	G 1/2" BSP / Staple lock	0,3 - 60 l/min
20	315	1" SAE-Flange	0,6 - 100 l/min
25	315	1" SAE-Flange	1 - 160 l/min

Imperial System			
Nominal Width (DN) (inch)	Nominal Pressure (PN) (psi)	Mechanical Connection	max. Measuring Range
0.40	5800	G 3/8" BSP / Staple lock	0.04 - 4 gpm
0.50	5800	G 1/2" BSP / Staple lock	0.05 - 8 gpm
0.60	5800	G 1/2" BSP / Staple lock	0.08 - 16 gpm
0.75	4550	1" SAE-Flange	0.16 - 26 gpm
1.00	4550	1" SAE-Flange	0.26 - 42 gpm

Other measuring ranges, nominal width, nominal pressure, media and connection types on request.

The manufacturer reserves the right to modify, due to technical progress the instrument and all of its components while acknowledging the normative and certified guidelines.



MODEL KEY

S M A L L - V / * * / * * / * * * * * * / * * * / * * * / * * * / * * / * * / * * / * * / * * / * * / * * / * * / *

Measuring mode	Design	Nominal Voltage	Measuring Range	Unit	Nominal Width	Nominal Pressure	Additional Measuring	Mechanical Connection	Electrical Connection	Display	Sensors Adjustment	Port 1	Port 2	Port 3
V [Volume Flow]	RG [Round-Instrument]	12 [12V DC]	*** [0-***]	L [l/min]	*** [DN***]	*** [PN*** bar]	**C [0-*** °C]	VG [BSP Female Thread]	B [PROMOS BN41...AT]	A [with display]	KG [Compact-Instrument]	S10 [0-20 mA]	F [5-15 Hz]	C [CAN-Bus]
		E12 [12V DC external]		cbm [cbm/h]			**F [0-*** °F]		H [Harting]					
		16 [16V DC]		G [gpm]		p*** [PN*** psi]	**b [0-*** bar]	VO [Staple lock]	M12 [M12-connector]	KA [without display]	AS...m [stepped sensor with length in m]	SI... [*... mA]	F*	
		E16 [16V DC external]		% [%]		**p [0-*** psi]	**M [0-*** MPa]	V** [special]	L...m [cable with length in m]			U... [*... V max. 10V]		
				*					** [System **]					
V [Volume Flow]	RG [Round-Instrument]	24 [24V DC]	*** [0-***]	L [l/min]	*** [DN***]	*** [PN*** bar]	**C [0-*** °C]	VG [BSP Female Thread]	H [Harting]	KA [without display]	KG [Compact-Instrument]	S14 [4-20 mA]	-	-
				cbm [cbm/h]			**F [0-*** °F]		S [Souriau]					
				G [gpm]		p*** [PN*** psi]	**b [0-*** bar]	VO [Staple lock]	M12 [M12-connector]		AS...m [stepped sensor with length in m]			
				% [%]		**p [0-*** psi]	**M [0-*** MPa]	V** [special]	L...m [cable with length in m]					
				*					** [System **]					

Examples: SMALL-V/RG/12/16L/010/400/VG/L03m/A/KG/F

SMALL-V/RG/16/70L/020/315/250b/VO/H/KA/KG/SI4

Other types, connections, measuring ranges, etc. on request.

The manufacturer reserves the right to modify, due to technical progress the instrument and all of its components while acknowledging the normative and certified guidelines.

LEVEL MEASURING INSTRUMENTS TYPE *SMALL-EX*[®]

The level measuring instrument is used for level measuring of fluid mediums in tanks or receptacles without inner pressure. The measuring instrument also can be equipped with integrated temperature measuring.

They are designed for use in filled systems with fluid medium. The gauge accuracy depends on the temperature of the medium and the viscosity. These parameters are each compensated.



At the bottom end of the instrument with or without tube, a piezo-resistive pressure transducer is mounted. Using this construction, any tank or receptacle of any size or depth can be checked and measured.

The level measuring can be carried out either by a probe tube, which is inserted into the tank or receptacle from the top or from the side or as screw-in instrument without probe tube to measure at the bottom of the tank or receptacle. Customized to the application, variants are available with a straight probe tube as well as a 75 ° or 90 ° bent probe tube.

A variety of mechanical connections are available, such as different threads or flange.



The measuring instrument can optional be equipped with an illuminated LCD-display. For more comfortable use the measuring instrument can be designed with a stepped sensor. The sensor is in a separate housing and is connected with a cable to the evaluating unit which can be equipped with a display. Level measuring instruments with a flange connection can be designed with a display turned 90° to the front.

If the level measuring instrument is equipped with an integrated temperature measuring, both values can be displayed alternately in a time interval where both measurement signals are continuously transmitted to the control system.

The version with a probe tube has a measuring range amount min. 300 mm and max. 1200 mm according to construction. Furthermore, a capillary tube up to max. 20 m is available.



MEASURING RANGE

0 up to 20 m

0 up to 65.6 ft

Any measuring range within the maximum ranges can be selected, as for example 0-450 mm, 0-970 mm, 0-22 ft, etc.

LEVEL MEASURING IN TANKS WITHOUT CONSTANT PRESSURE EQUALIZATION, UP TO 1 BAR

This specialized level measuring device has been developed especially for the use in pressurized tanks. Two pressure sensors separately monitor the level and the internal pressure of the tank ensuring an exact measurement independent of the internal pressure that may be inside of the tank up to a maximum of 1 bar.



A pressure sensor is installed at the top of the device and evaluates the level of liquid in the tank. On tanks that have an internal pressure fluctuations (e.g., poor ventilation or fluid back flow), over-pressurization may take place that will affect the measurement.. To compensate for this, a second pressure sensor monitors the internal tank air pressure and calculates this internally. The internal communication through the data BUS calculates both measured values and a precise measuring result, independent of the surrounding pressure is transferred to the device.

Using this measuring method, it is possible to achieve precise measurements under heavy duty operation. Susceptible mechanics are excluded.

TECHNICAL DETAILS

Housing Material:	Stainless Steel	
Construction:	with probe tube made of stainless steel or as a screw-in instrument without probe tube for measuring at the bottom of the receptacle	
Sensor:	piezo-resistive pressure transducer with temperature compensation	
Mechanical Connection:	G $\frac{1}{2}$ A ; G $\frac{3}{4}$ A	Construction without probe tube
	G1 $\frac{1}{4}$ A ; G2 A ; Flange	Construction with probe tube
	(other connections on request)	
Gauge Accuracy:	± 0.5 % from end-value (higher accuracy on request) ± 0.5 cm for level measuring in tanks without constant pressure equalization	
Medium:	fluid medium, e.g. water, emulsion, oil	
Illuminated display:	optional	
Display:	mm ; m ; % ; ft (other units on request)	
Output Signal:	5 – 15Hz 0/4 – 20mA * – **V (max. 10 V DC, at min. 7.5V power supply) CAN-Bus Customized output signals with intermediate ranges configurable on request	
Nominal Voltage:	12V DC (7.5 – 14.0 V DC)	3-wire technology
	16V DC (9.6 – 16.1 V DC)	3-wire technology
	24V DC (14 – 26.6 V DC)	2-wire technology

Nominal current per measuring system:	Output Signal		without Display	with Display
	Frequency	5 - 15 Hz	10 mA	20 mA
	Current	0 - 20 mA	10 - 30 mA	20 - 40 mA
	Current	4 - 20 mA	14 - 30 mA	24 - 40 mA
	Voltage	* - ** V	14 mA	24 mA
	CAN-Bus		27 mA	37 mA

For level measuring in tanks without constant pressure equalization:

Nominal current per measuring system:	Output Signal		without Display	with Display
	Frequency	5 - 15 Hz	54 mA	64 mA
	Current	0 - 20 mA	54 - 74 mA	64 - 84 mA
	Current	4 - 20 mA	58 - 74 mA	68 - 84 mA
	Voltage	* - ** V	58 mA	68 mA
	CAN-Bus		54 mA	64 mA

MODEL KEY

SMALL-N / ** / ** / *** ** / *** / ** / *** / ** / ** / ** / ** / ** / **

Measuring mode	Design	Nominal Voltage	Measuring Range	Unit	Additional Measuring	Mechanical Connection	Electrical Connection	Display	Sensors Adjustment	Port 1	Port 2	Port 3
N [Level]	RG [Round-Instrument]	12 [12V DC]	*** [0-***]	mm [mm construction with probe tube]	**C [0-** °C for construction with internal temperature measuring]	construction with probe tube G [BSP male thread]	B [PROMOS BN41..AT]	A [with display]	KG [Compact-Instrument]	SIO [0-20 mA]	F [5-15 Hz]	C [CAN-Bus]
		E12 [12V DC external]		mb [mm construction without probe tube]		**F [0-** °F for construction with internal temperature measuring]	F [flange]					
		16 [16V DC]		m [m]		construction without probe tube	M12 [M12-connector]	KA [without display]	AS...m [stepped sensor with length in m]	SI... [*..** mA]		
		E16 [16V DC external]		ft [ft]	D [measurement in tanks without constant pressure equalisation]	G2 [G 1/2 A BSP]	L...m [cable with length in m]		U... [*..** V max. 10V]			
				% [%]		G3 [G 3/4 A BSP]	** [System **]					
				* [special]		** [special]						
N [Level]	RG [Round-Instrument]	24 [24V DC]	*** [0-***]	mm [mm construction with probe tube]	**C [0-** °C for construction with internal temperature measuring]	construction with probe tube G [BSP male thread]	H [Harting]	KA [without display]	KG [Compact-Instrument]	SI4 [4-20 mA]	-	-
				mb [mm construction without probe tube]		**F [0-** °F for construction with internal temperature measuring]	F [flange]					
				m [m]		construction without probe tube	M12 [M12-connector]		AS...m [stepped sensor with length in m]			
				ft [ft]		G2 [G 1/2 A BSP]	L...m [cable with length in m]					
				% [%]		G3 [G 3/4 A BSP]	** [System **]					
				* [special]		** [special]						

Examples: SMALL-N/RG/12/300mm/G/B/A/AS08m/S4/C
 SMALL-N/RG/12/50mb/G3/L10m/KA/KG/S4
 SMALL-N/RG/12/160mb/G2/H/A/KG/F
 SMALL-N/RG/12/350mm/60C/G/L10m/A/KG/S4
 SMALL-N/RG/12/500mm/D/80C/F/L10m/A/KG/S4

Other types, connections, measuring ranges, etc. on request.

The manufacturer reserves the right to modify, due to technical progress the instrument and all of its components while acknowledging the normative and certified guidelines.

PRESSURE MEASURING INSTRUMENTS TYPE *SMALL-EX*[®]

SMALL-EX[®] Measuring Instruments are intrinsically safe pressure measuring instruments. They can be used in any mounting position for fluid and gaseous media. The pressure is measured with an integrated piezo-resistive transducer with temperature compensation.



The Round-Design instruments can optional be equipped with a self-illuminated display. The In-Line-Design is not available with a display. For more comfortable use the measuring instrument can be designed with a stepped sensor. The sensor is in a separate housing and is connected with a cable to the evaluating unit which can be equipped with a display.

A variety of mechanical connections are available, such as different threads or staple lock.

DESIGN

The *SMALL-EX*[®]-Measuring instrument housings are made of stainless steel enabling a greater mechanical capacity, and the small units can be used in just about any environment.

ROUND-DESIGN



IN-LINE-DESIGN





PRESSURE RANGES

0 up to 1000 bar

0 up to 14500 psi

0 up to 100 MPa

Any measuring range within the maximum pressure ranges can be selected, as for example 0 - 52.5 bar, 0 - 450 bar, 0 - 3000 psi, 0 - 15 MPa, etc.

As special version the measuring instrument can also be designed for the measurement of vacuum (-1.0 to +1.0 bar).



TECHNICAL DETAILS

Housing Material:	Stainless Steel	
Sensor:	piezo-resistive pressure transducer with temperature compensation	
Gauge Accuracy:	± 0.5 % from end-value (higher accuracy on request)	
Medium:	fluid and gaseous medium	
Illuminated display:	optional	
Display:	mbar ; bar ; Pa ; kPa ; MPa ; psi ; t (other units on request)	
Output Signal:	5 – 15Hz	
	0/4 – 20mA	
	* – **V (max. 10 V DC, at min. 7.5V power supply)	
	CAN-Bus	
	Customized output signals with intermediate ranges configurable on request	
Nominal Voltage:	12V DC (7.5 – 14.0 V DC)	3-wire technology
	16V DC (9.6 – 16.1 V DC)	3-wire technology
	24V DC (14 – 26.6 V DC)	2-wire technology

Nominal current per measuring system:	Output Signal	without Display	with Display
	Frequency 5 - 15 Hz	10 mA	20 mA
	Current 0 - 20 mA	10 - 30 mA	20 - 40 mA
	Current 4 - 20 mA	14 - 30 mA	24 - 40 mA
	Voltage * - ** V	14 mA	24 mA
	CAN-Bus	27 mA	37 mA

The manufacturer reserves the right to modify, due to technical progress the instrument and all of its components while acknowledging the normative and certified guidelines.

MODEL KEY

SMALL-P / ** / ** / *** * / ** / ** / ** / ** / ** / ** / *

Measuring mode	Design	Nominal Voltage	Measuring Range	Unit	Mechanical Connection	Electrical Connection	Display	Sensors Adjustment	Port 1	Port 2	Port 3
P [Pressure]	RG [Round-Instrument]	12 [12V DC] E12 [12V DC external] 16 [16V DC] E16 [16V DC external]	*** [0-***]	mb [mbar] b [bar] p [psi] M [MPa]	G1 [G 1/4 A BSP] G2 [G 1/2 A BSP] G3 [G 3/4 A BSP] O [staple lock]	B [PROMOS BN41..AT] H [Harting] S [Souriau] M12 [M12-connector] L...m [cable with length in m] ** [System **]	A [with display] KA [without display]	KG [Compact-Instrument] AS...m [stepped sensor with length in m]	SI0 [0-20 mA] SI4 [4-20 mA] SI... [*..** mA] U... [*..** V max. 10V]	F [5-15 Hz]	C [CAN-Bus]
	IL [In-Line-Instrument]	12 [12V DC] 16 [16V DC]		** [special] ** [special]	** [special]	- [no display possible] ** [System **]	- [no stepped sensor possible]				
P [Pressure]	RG [Round-Instrument]	24 [24V DC]	*** [0-***]	mb [mbar] b [bar] p [psi] M [MPa]	G1 [G 1/4 A BSP] G2 [G 1/2 A BSP] G3 [G 3/4 A BSP] O [staple lock]	H [Harting] S [Souriau] M12 [M12-connector] L...m [cable with length in m] ** [System **]	KA [without display]	KG [Compact-Instrument] AS...m [stepped sensor with length in m]	SI4 [4-20 mA]	-	-
	IL [In-Line-Instrument]			** [special] ** [special]	** [special]	- [no display possible] ** [System **]	- [no stepped sensor possible]				

Examples: SMALL-P/RG/12/60b/O/H/A/AS05m/SI4/C
SMALL-P/RG/E12/1000p/O/HL10m/A/KG/SI4
SMALL-P/IL/12/40M/G1/B/U1-10V

Other types, connections, measuring ranges, etc. on request.

DIFFERENTIAL PRESSURE MEASURING INSTRUMENTS TYPE *SMALL-Ex*[®]

The differential pressure measuring instrument is designed for liquid and gaseous media and can be mounted in any position. The pressure is measured with an integrated piezo-resistive transducer with temperature compensation.

It is possible to carry out the differential pressure measuring instrument in different versions. The standard-version consists of the pressure measuring instrument without a display and a pressure measuring instrument with a display. This display shows the differential pressure between the two measuring points and transmit it to the control system.

The special version consists of two pressure measuring instruments with display. One display shows the differential pressure between the two measuring points and transmit it to the control system. The other display shows the system pressure of the set measurement point and also transmitted to the control system.



PRESSURE RANGE

System Pressure: 0 up to 600 bar

0 up to 8700 psi

0 up to 60 MPa

Measuring Range: 0 up to 50 bar

0 up to 725 psi

0 up to 5 MPa

Any measuring range within the maximum pressure ranges can be selected, as for example 0-3 bar, 0-20 bar, 0-300 psi, 0-2.5 MPa, etc.

TECHNICAL DETAILS

Housing Material:	Stainless Steel	
Sensor:	piezo-resistive pressure transducer with temperature compensation	
Gauge Accuracy:	± 1.0 % from end-value (higher accuracy on request)	
Medium:	fluid and gaseous medium	
Illuminated display:	optional	
Display:	mbar ; bar ; Pa ; kPa ; MPa ; psi (other units on request)	
Output Signal:	5 – 15Hz 0/4 – 20mA * – **V (max. 10 V DC, at min. 7.5V power supply) CAN-Bus Customized output signals with intermediate ranges configurable on request	
Nominal Voltage:	12V DC (7.5 – 14.0 V DC)	3-wire technology
	16V DC (9.6 – 16.1 V DC)	3-wire technology

Nominal current per measuring system:	Output Signal	without Display	with 1 Display	with 2 Displays
	Frequency 5 - 15 Hz	54 mA	64 mA	74 mA
	Current 0 - 20 mA	54 - 74 mA	64 - 84 mA	74 - 114 mA
	Current 4 - 20 mA	58 - 74 mA	68 - 84 mA	78 - 114 mA
	Voltage * - ** V	58 mA	68 mA	82 mA
	CAN-Bus	54 mA	64 mA	74 mA

The manufacturer reserves the right to modify, due to technical progress the instrument and all of its components while acknowledging the normative and certified guidelines.



MODEL KEY

S M A L L - P / * * / * * / * * * * / * * * * * * / * * / * * / * / * * / * * / * * / * / *

Measuring mode	Design	Nominal Voltage	System pressure		Differential pressure		Mechanical Connection	Electrical Connection	Display	Sensors Adjustment	Port 1	Port 2	Port 3	
			Measuring Range	Unit	Measuring Range	Unit								
P [Pressure]	RG [Round-Instrument]	12 [12V DC]	*** [0-***]	mb [mbar]	*** [0-***]	mbD [mbar]	G1 [G 1/4 A BSP]	B [PROMOS BN41..AT]	A [with display for differential pressure]	KG [Compact-Instrument]	SI0 [0-20 mA]	F [5-15 Hz]	C [CAN-Bus]	
		E12 [12V DC external]		b [bar]		bD [bar]	G2 [G 1/2 A BSP]							H [Harting]
		16 [16V DC]		p [psi]		pD [psi]	G3 [G 3/4 A BSP]							S [Souriau]
		E16 [16V DC external]		M [MPa]		MD [MPa]	O [staple lock]							M12 [M12-connector]
				** [special]		**D [special]	** [special]							L...m [cable with length in m]
								KA [without display]	AS...m [stepped sensor with length in m]	SI...- [*..** mA]				
								** [System **]		U...- [*..** V max. 10V]				

Examples: SMALL-P/RG/12/350b/20bD/O/HL10m/2A/SI4/C
 SMALL-P/RG/E12/10M/1MD/G2/L05m/A/KG/F
 SMALL-P/RG/16/1000p/200pD/G1/2A/AS10m/U1-10V

Other types, connections, measuring ranges, etc. on request.

The manufacturer reserves the right to modify, due to technical progress the instrument and all of its components while acknowledging the normative and certified guidelines.



TEMPERATURE MEASURING INSTRUMENTS TYPE *SMALL-EX*[®]

SMALL-Ex[®] Measuring Instruments are intrinsically safe temperature measuring instruments or as a special version for use as a thermo switch. They can be mounted and used in any position. They are designed for use in systems with fluid or gaseous medium as well as surfaces. Temperature measurement occurs via a Pt1000 Resistance sensor, which is installed in the housing.



The Round-Design instruments can optional be equipped with an illuminated LCD-display. The In-Line-Design is not available with a display. For more comfortable use the measuring instrument can be designed with a stepped sensor. The sensor is in a separate housing and is connected with a cable to the evaluating unit which can be equipped with a display. In addition, we offer a special version for the use as thermo switch for example at conveyor belt systems.

The mechanical connection can be occur by a variable adjustable stainless steel compression fitting with a thread in a variety of sizes or mounting flanges.

When used in systems with a pressure of more than 100 bar, the use of an additional protection tube is necessary.

TEMPERATURE RANGE

max. -10 to +100 °C

max. +14 to +212 °F

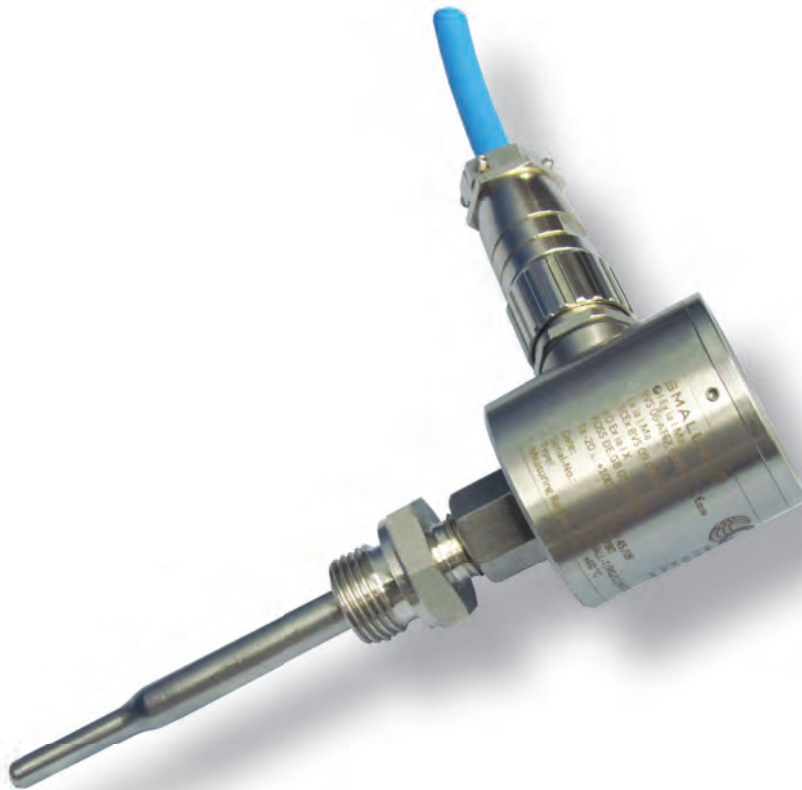
Any measuring range within the maximum temperature ranges can be selected, as for example 0 - 55.5 °C, -10 - 70 °C, 32 - 140 °F, etc.

As special version the measuring ranges can be expanded up to 200 °C for round-design instruments with stepped sensor.

DESIGN

The *SMALL-EX*[®]-Measuring instrument housings are made of stainless steel enabling a greater mechanical capacity, and the small units can be used in just about any environment.

ROUND-DESIGN



IN-LINE-DESIGN



TECHNICAL DETAILS

Housing Material:	Stainless Steel	
Sensor:	Pt1000 - Resistance Sensor	
Gauge Accuracy:	± 1.0 % from end-value (higher accuracy on request)	
Medium:	fluid and gaseous medium, as well as surfaces	
Illuminated display:	optional	
Display:	± °C ; ± °F (other units on request)	
Output Signal:	5 – 15Hz	
	0/4 – 20mA	
	* – **V (max. 10 V DC, at min. 7.5V power supply)	
	CAN-Bus	
	Customized output signals with intermediate ranges configurable on request	
Nominal Voltage:	12V DC (7.5 – 14.0 V DC)	3-wire technology
	16V DC (9.6 – 16.1 V DC)	3-wire technology
	24V DC (14 – 26.6 V DC)	2-wire technology

Nominal current per measuring system:	Output Signal		without Display	with Display
	Frequency	5 - 15 Hz	10 mA	20 mA
Current	0 - 20 mA	10 - 30 mA	20 - 40 mA	
Current	4 - 20 mA	14 - 30 mA	24 - 40 mA	
Voltage	* - ** V	14 mA	24 mA	
CAN-Bus		27 mA	41 mA	

The manufacturer reserves the right to modify, due to technical progress the instrument and all of its components while acknowledging the normative and certified guidelines.



MODEL KEY

SMALL-T / ** / ** / *** * / ** / *** / ** / ** / ** / ** / ** / ** / **

Measuring mode	Design	Nominal Voltage	Measuring Range	Unit	Mechanical Connection	Probe Length	Electrical Connection	Display	Sensors Adjustment	Port 1	Port 2	Port 3		
T [Temperature]	RG [Round-Instrument]	12 [12V DC]	*** [0-***]	C [°C]	G2 [G 1/2 A BSP]	50 [50 mm]	B [PROMOS BN41..AT]	A [with display]	KG [Compact-Instrument]	SIO [0-20 mA]	F [5-15 Hz]	C [CAN-Bus]		
		E12 [12V DC external]					H [Harting]						KA [without display]	AS...m [stepped sensor with length in m]
	16 [16V DC]	F [flange]					150 [150 mm]	M12 [M12-connector]	-				-	SI4 [4-20 mA]
	E16 [16V DC external]	** [special]					200 [200 mm]	L...m [cable with length in m]						SI... [*..** mA]
T [Temperature]	RG [Round-Instrument]	12 [12V DC]	*** [0-***]	F [°F]	F [flange]	150 [150 mm]	H [Harting]	KA [without display]	KG [Compact-Instrument]	SI4 [4-20 mA]	-	-		
		16 [16V DC]					S [Souriau]						AS...m [stepped sensor with length in m]	
	24 [24V DC]	** [special]					200 [200 mm]	M12 [M12-connector]	-				-	SI4 [4-20 mA]
	IL [In-Line-Instrument]	** [special]					*** [*** mm]	L...m [cable with length in m]						SI4 [4-20 mA]

Examples: SMALL-T/RG/12/60C/G2/100/H/A/KG/F
 SMALL-T/RG/12/80C/G2/150/B/A/AS05m/SI4/C
 SMALL-T/IL/12/80C/G2/100/L05m/U1-10V

Other types, connections, measuring ranges, etc. on request.

The manufacturer reserves the right to modify, due to technical progress the instrument and all of its components while acknowledging the normative and certified guidelines.

THERMO SWITCH TYPE *SMALL-EX*[®]

The temperature monitoring type *SMALL-EX*[®] are suitable for use under very harsh and challenging environments designed and maintain high mechanical loads because of the solid design by the stainless steel housing. They are designed for use e.g. at conveyor belt systems, as a bearing-temperature monitoring or as a monitoring of oil temperature or coolant.



A variety of mechanical connections are available, such as different threads or flange. As electrical connection are different approved connectors or a cable connection in variable length available. If you favour a connector or use a specific standard-connector, we can check the applicability.

The measuring instrument can be equipped with an illuminated display for easy temperature detection on site.

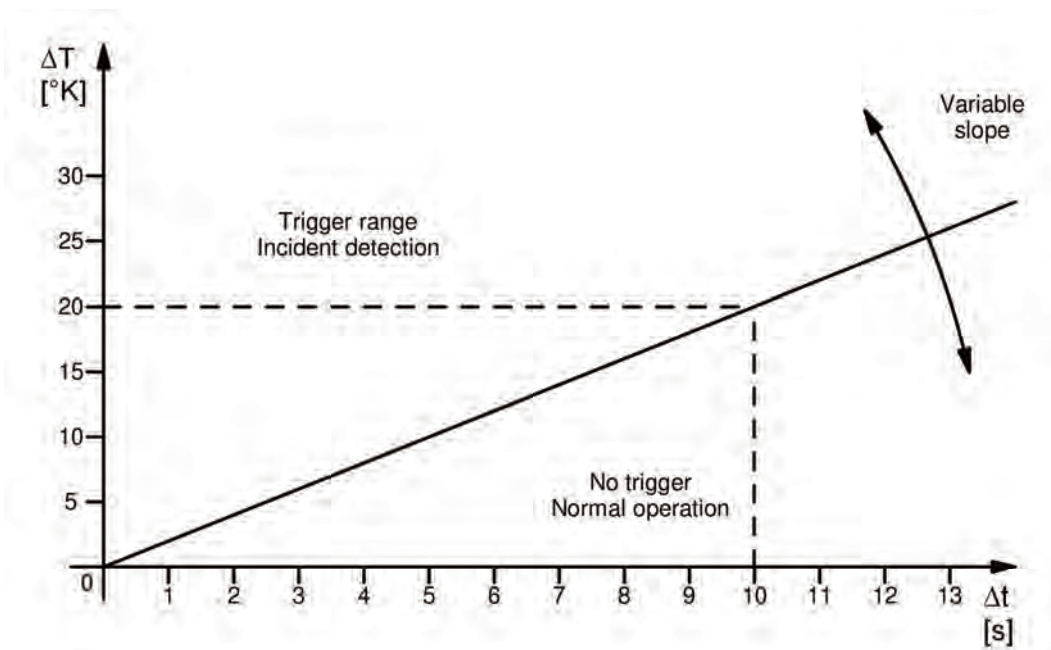


A patented variant of the **SMALL-EX[®]** measuring instrument detects the temperature flank and compares this with the temperature gradients which are stored by the manufacturer such as those at a belt start-up at the cheek of a conveyor belt. For this version the level of the environmental temperature is irrelevant to the detection and does not affect the evaluation.

Patent-No: DE 10 2009 033 009 (02.07.2009)



With this temperature switch, a differential temperature of 20 ° K and a difference time of 10 seconds are usually set. This means that when the temperature changes more than 20 ° K within less than 10 seconds, a slanting of the conveyor belt is detected. As long as the temperature rise is not exceeded and the time is not missed at the same time, the system is in normal operation.



At normal operating the instrument sends a constant signal of e.g. 5 mA (or 7 Hz). If the temperature increases above the normal operating temperature, e.g. a 19 mA (or 14 Hz) signal is sent. The recognition of the danger occurs in the instrument, not in the control system. Furthermore, a warning temperature (e.g. 40 °C) with e.g. 12 mA (or 10 Hz) and a maximum temperature (e.g. 60 °C) with e.g. 17 mA (or 13 Hz) will be transmitted. These values are variable and can be set beforehand.

To ensure the safety switch, the instrument occurs a self-test which occurs discretely by restarting the instrument, by a set time interval for an alternating signal of e.g. 9 mA (or 9Hz) and 15 mA (or 12 Hz) transmitted. This self-test occurs at every restart and can be triggered manually on site or externally.

Moreover, a further variant of monitoring and transmitting is possible. In normal operating the instrument sends a „1“ signal. If the dangerous temperature rise for the system is detected, the instrument sends a „0“ signal.

On demand the self-test can be done out from outside by a magnetic switch or the measuring instrument can be acknowledged if the limit value has been exceeded.

TECHNICAL DETAILS

Housing Material:	Stainless Steel		
Sensor:	Pt1000 - Resistance Sensor		
Gauge Accuracy:	± 1.0 % from end-value (higher accuracy on request)		
Medium:	fluid and gaseous medium, as well as surfaces		
Illuminated display:	optional		
Display:	± °C ; ± °F (other units on request)		
Output Signal:	Hz		
	mA		
	Customized output signals with intermediate ranges configurable on request		
Nominal Voltage:	12V DC (7.5 – 14.0 V DC)	3-wire technology	
	16V DC (9.6 – 16.1 V DC)	3-wire technology	

Nominal current pro measuring system:	Output Signal		without Display	with Display
	Frequency	Hz	10 mA	20 mA
	Current	mA	10 - 30 mA	20 - 40 mA

The manufacturer reserves the right to modify, due to technical progress the instrument and all of its components while acknowledging the normative and certified guidelines.

TEMPERATURE RANGE

max. -10 to +100 °C

max. +14 to +212 °F

Any measuring range within the maximum temperature ranges can be selected, as for example 0 - 55.5 °C, -10 - 70 °C, 32 - 140 °F, etc.

As special version the measuring ranges can be expanded up to 200 °C for round-design instruments with stepped sensor.

MODEL KEY

SMALL-TS / ** / ** / *** * / ** / *** / ** / ** / ** / ** / *

Measuring mode	Design	Nominal Voltage	Measuring Range	Unit	Mechanical Connection	Probe Length	Electrical Connection	Display	Sensors Adjustment	Port 1	Port 2	
TS [Thermo Switch]	RG [Round-Instrument]	12 [12V DC]	*** [0-***]	C [°C]	G2 [G 1/2 A]	50 [50 mm]	B [PROMOS BN41..AT]	A [with display]	KG [Compact-Instrument]	SI* [mA]	F* [Hz]	
		E12 [12V DC external]				F [°F]	100 [100 mm]					H [Harting]
		16 [16V DC]				F [flange]	150 [150 mm]					S [Souriau]
		E16 [16V DC external]				** [special]	200 [200 mm]					M12 [M12-connector]
						** [special]	*** [*** mm]					L...m [cable with length in m]
				** [System **]	KA [without display]	AS...m [stepped sensor with length in m]						

Examples: SMALL-TS/RG/12/60C/F/B/A/KG/F*

SMALL-TS/RG/12/100C/G2/L05m/KA/SI*

Other types, connections, measuring ranges, etc. on request.

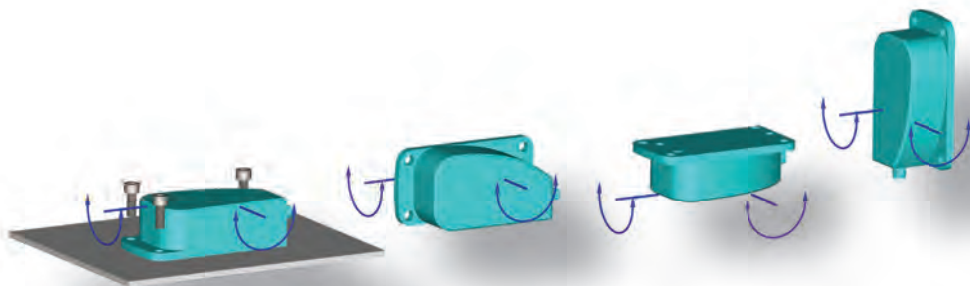
The manufacturer reserves the right to modify, due to technical progress the instrument and all of its components while acknowledging the normative and certified guidelines.



INCLINOMETER INSTRUMENTS TYPE *SMALL-EX*[®]



The series **SMALL-EX**[®] Inclinometer is an instrument to measure angles of slope f.e. on machines. It is designed to be used on mining machines such as roadheaders, shearers, drilling machines, continuous minders and others. The device is perfect for use in rough and hard environments and because of the solid construction and stainless-steel housing, it is robust enough to cope.



As an option, the device can be equipped with one illuminated display per movement axis.



Of course the device of the **SMALL-EX**[®] series is also available with different connectors, a specific measuring range and different output signals. If you prefer a special connector, we will gladly check the usability.

The measuring instrument is optionally equipped with a 1- or 2-axis measurement and can be operated up to max. +/- 70° with a resolution of 0.1°.

TECHNICAL DETAILS

Housing Material:	Stainless Steel	
Sensor:	capacitive liquid sensor	
Gauge Accuracy:	± 1.0 % from end-value (higher accuracy on request)	
Illuminated display:	optional	
Display:	° (Degree) or % (Percent) (other units on request)	
Output Signal:	5 – 15Hz	
	0/4 – 20mA	
	* – **V (max. 10 V DC, at min. 7.5V power supply)	
	CAN-Bus	
	Customized output signals with intermediate ranges configurable on request	
Nominal Voltage:	12V DC (7.5 – 14.0 V DC)	3-wire technology
	16V DC (9.6 – 16.1 V DC)	3-wire technology
	24V DC (14 – 26.6 V DC)	2-wire technology

Nominal current per measuring system:

Output Signal		1-Axis		2-Axis	
		without display	with 1 display	without displays	with 2 displays
Frequency	5 - 15 Hz	11 mA	21 mA	22 mA	42 mA
Current	0 - 20 mA	11 - 31 mA	21 - 41 mA	22 - 62 mA	42 - 82 mA
Current	4 - 20 mA	15 - 31 mA	25 - 41 mA	30 - 62 mA	50 - 82 mA
Voltage	* - ** V	16 mA	26 mA	32 mA	52 mA
CAN-Bus		28 mA	38 mA	56 mA	76 mA

The manufacturer reserves the right to modify, due to technical progress the instrument and all of its components while acknowledging the normative and certified guidelines.

MODEL KEY

SMALL-TS / ** / ** / ** * ** / * / * ** / * ** / * ** / * ** / * ** / * ** / *

Measuring Mode	Design	Nominal Voltage	X-Axis		Y-Axis		Mechanical Connection	Electrical Connection	Display	Sensors Adjustment	Port 1	Port 2	Port 3
			Measuring Range	Unit	Measuring Range	Unit							
TS [Inclinometer]	RG [Round-Instrument]	12 [12V DC]		° [Degree]	° [Degree]		B [PROMOS BN41..AT]				SI0 [0-20 mA]		
		E12 [12V DC external]	*** [+/-***]	% [Percent]	*** [+/-***]	% [Percent]	F [Flange]	H [Harting]	A [with display]	KG [Compact-Instrument]	SI4 [4-20 mA]		
		16 [16V DC]		** [Special]	** [Special]	** [Special]	** [Special]	S [Souriau]	KA [without display]	AS...m [stepped sensor with length in m]	SI... [*..** mA]	F [5-15 Hz]	C [CAN-Bus]
		E16 [16V DC external]					L...m [cable with length in m]				U... [*..** V max. 10V]		
						** [System **]							
TS [Inclinometer]	RG [Round-Instrument]	24 [24V DC]	*** [+/-***]	° [Degree]	° [Degree]		H [Harting]						
				% [Percent]	% [Percent]		S [Souriau]		KG [Compact-Instrument]				
				** [Special]	** [Special]	** [Special]	F [Flange]	M12 [M12-connector]	KA [without display]	AS...m [stepped sensor with length in m]	SI4 [4-20 mA]	-	-
							** [Special]	L...m [cable with length in m]					
						** [System **]							

Examples: SMALL-TS/RG/12/X70Y70/F/M12L03m/KA/KG/C
 SMALL-TS/RG/24/X40Y40/F/M12L10m/KA/KG/SI4
 SMALL-TS/RG/12/X70/F/M12L10m/KA/KG/SI4
 SMALL-TS/RG/12/X70Y70/F/M12L10m/A/KG/SI4

Other types, connections, measuring ranges, etc. on request.

The manufacturer reserves the right to modify, due to technical progress the instrument and all of its components while acknowledging the normative and certified guidelines.

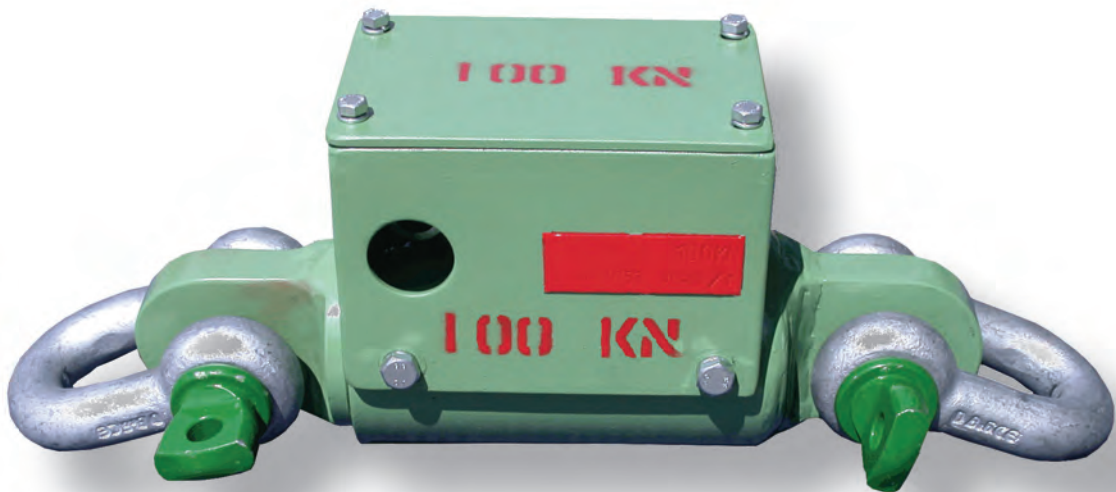
FORCE CONTROL UNIT

WITH INTEGRATED PRESSURE MEASURING INSTRUMENT TYPE *SMALL-EX*[®]

The measuring system is constructed for force control monitoring (conveyor belt systems/energy trains). Two measuring units can be utilized to monitor belt tracking on conveyor belt drive systems.

The force control unit utilizes the *SMALL-EX*[®] measuring system, which is integrated into the force control unit and is capable of accurately measuring forces up to 20 tons (kN).

In the area of transmission reading several output signals are available. You can choose between 5 to 15 Hz, 0 to 20 mA as well as 4 to 20 mA or a voltage up to 10 V, at a power supply of min. 7.5 V DC. These signals are transmitted as analogous signals. In addition we offer this measuring instrument also with a CAN-BUS option.



MEASURING RANGE

0 up to 20 t (kN)

Any measuring range within the maximum ranges can be selected, as for example 0-3 t, 0-15 t, etc.

TECHNICAL DETAILS

Housing Material:	Steel	
Gauge Accuracy:	± 0.5 % from end-value	
Dimensions:	Outer dimensions without shackles	
	L = approx. 450 mm x W = approx. 460 mm ; D = approx. 220 mm	
Weight:	approx. 25 kg	
Display:	t (other units on request)	
Output Signal:	5 – 15Hz	
	0/4 – 20mA	
	* – **V (max. 10 V DC, at min. 7.5V power supply)	
	CAN-Bus	
	Customized output signals with intermediate ranges configurable on request	
Nominal Voltage:	12V DC (7.5 – 14.0 V DC)	3-wire technology
	16V DC (9.6 – 16.1 V DC)	3-wire technology
	24V DC (14 – 26.6 V DC)	2-wire technology

Nominal current per measuring system:	Output Signal		without Display	with Display
	Frequency	5 - 15 Hz	10 mA	20 mA
	Current	0 - 20 mA	10 - 30 mA	20 - 40 mA
	Current	4 - 20 mA	14 - 30 mA	24 - 40 mA
	Voltage	* - ** V	14 mA	24 mA
	CAN-Bus		27 mA	37 mA

The manufacturer reserves the right to modify, due to technical progress the instrument and all of its components while acknowledging the normative and certified guidelines.

PRESSURE MEASURING INSTRUMENTS TYPE *SIMPL-EX*[®]

The *SIMPL-EX*[®] pressure measuring instruments are made for use at shield supports. Based on the simple construction with high robustness it is available with individual customers equipment at a very low price level. An individual mass product build to the highest standards.



Through the usage of a state of the art technology in the field of electronics, which is based on the proven electronics of the measuring instrument series *SMALL-EX*[®], a processor is used for evaluating the signals instead of conventional potentiometers. The calibration occurs by a specially developed software. Due to this fact a high measuring accuracy and repeatability can be achieved. The usage of the measuring instruments at different temperatures do not affect the measuring values. Another advantage of the electronic and the solid construction, which is completely made of stainless steel, is the high vibration resistance. Increase the interaction of experience, electronics and construction as well as the use of high quality components and materials, the operational reliability are significant and thus ideally suited for use in very rough and tough environments such as water or hydraulic systems.

Select your required electrical connection as well as output signal, your mechanical connection and your measuring range.

As electrical connection various connectors f.e. SKK24, Harting, Hirschmann or a cable gland with cable to choice. If you prefer a different connector or a specific standard connector, we can check the usability. Regarding the output signals, a current output (0-20 mA or 4-20 mA) or a voltage output (max. 10 V DC) can be selected. Also, we may include threads such as G1/2A, NPT, Staple lock and various other mechanical connections. You will receive your individual measuring instrument or a replacement device for your system.

TECHNICAL DETAILS

Housing Material:	Stainless Steel	
Sensor:	piezo-resistive pressure transducer with temperature compensation	
Gauge Accuracy:	± 2.0 % from end-value (higher accuracy on request)	
Medium:	fluid and gaseous medium	
Output Signal:	0/4 – 20mA * – **V (max. 10 V DC, at min. 7.5V power supply) Customized output signals with intermediate ranges configurable on request	
Nominal Voltage:	12V DC (7.5 – 14.0 V DC)	3-wire technology
	16V DC (9.6 – 16.1 V DC)	3-wire technology

Nominal current pro measuring system:	Output Signal		Nominal Current	
	Current	0 - 20 mA	Current	9 - 29mA
	Current	4 - 20 mA	Current	13 - 29 mA
	Voltage	* - ** V	Current	9 mA

PRESSURE RANGES

- 0 up to 1000 bar
- 0 up to 14500 psi
- 0 up to 100 MPa

Any measuring range within the maximum pressure ranges can be selected, as for example 0 - 52.5 bar, 0 - 450 bar, 0 - 3000 psi, 0 - 15 MPa, etc.

The manufacturer reserves the right to modify, due to technical progress the instrument and all of its components while acknowledging the normative and certified guidelines.



Marking:  I M1 Ex ia I Ma
Ex ia I Ma



Certifications: IBExU 13 ATEX 1110
IECEX IBE 13.0039

IN PROGRESS

Environmental Temperature: -50 to +100 °C (-58 to +212 °F)



MODEL KEY

SIMPL-EX-P / ** / *** * / ** / ** / ***

Measuring Mode	Nominal Voltage	Measuring Range	Unit	Mechanical Connection	Electrical Connection	Port
P [Pressure]	12 [12V DC] 16 [16V DC]	*** [0-***]	mb [mbar]	G1 [G 1/4 A BSP]	S24 [SKK24-connector]	SI0 [0-20 mA] SI4 [4-20 mA] SI... [*..** mA] U... [*..** V max. 10V]
			b [bar]	G2 [G 1/2 A BSP]	M12 [M12 Sensor-connector]	
			p [psi]	G3 [G 3/4 A BSP]	H [Harting]	
			M [MPa]	O [Staple lock]	S [Souriau]	
			** [Special]	** [Special]	L...m [cable with length in m]	
				V [Valve connector]		
					** [System **]	

Examples: SIMPL-Ex-P/12/600b/O/S24/U0,5-4,5V

SIMPL-Ex-P/12/600b/O/V/SI4

SIMPL-Ex-P/12/450b/G2/M12/SI4

Other types, connections, measuring ranges, etc. on request.

The manufacturer reserves the right to modify, due to technical progress the instrument and all of its components while acknowledging the normative and certified guidelines.



FLOW INDICATOR TYPE *DA* AND *DAK*

The intrinsically safe flow indicator type *DA* and type *DAK* can be mounted in any position and monitors the flow of water as well as emulsion in closed a filled system. The volume flow will be shown as analogous display.

The flow indicator type *DA* is for monitoring use only, whereas the flow indicator type *DAK* has a contact boundary switch integrated for monitoring. Inside of the massive brass housing, a contact breaker is fitted to the volume dial. The lower and upper boundaries can be externally adjusted over the whole range of the dial using the key, which is delivered with the unit.

In addition, the flow indicator can be equipped with different electrical wirings and connections, e.g. with resistors for cable monitoring.



Marking: ⓧ I M2 Ex ia I Mb
 PO Ex ia I X



Certifications: DMT 03 ATEX E 080
 TC RU C-DE.MIO62.B.03774



Environmental Temperature: -20 to +60 °C (-4 to +140 °F)

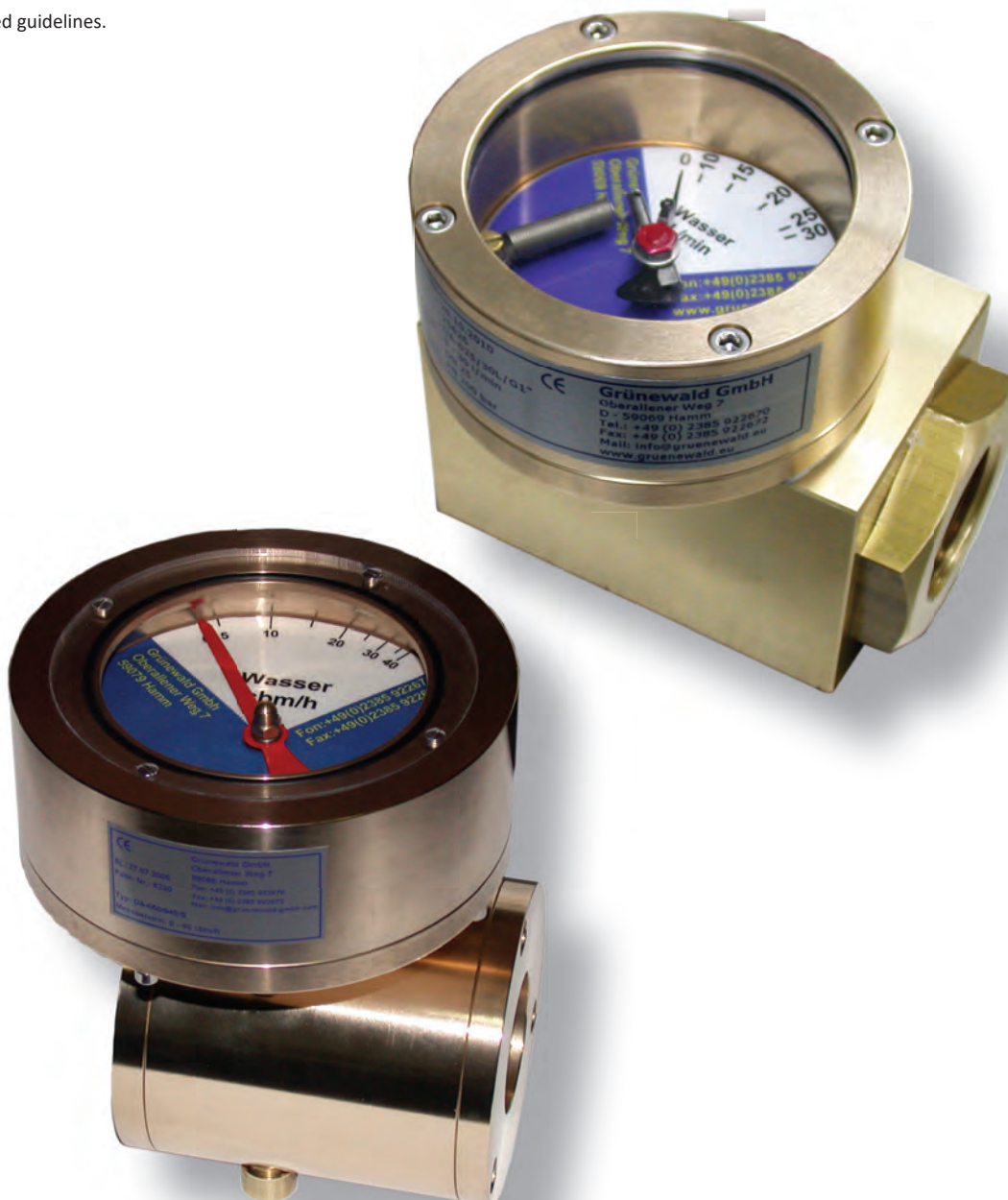
IN PROGRESS



TECHNICAL DETAILS

Housing Material:	Brass MS58 / Red Brass RG7	
Gauge Accuracy:	± 3.0 % from end-value	
Medium:	water as well as emulsion	
Display:	l/min ; m ³ /h ; gpm (other units on request)	
Nominal Voltage:	0 - 24 V DC	
Circuit Durability:	2.0 A	at 0 - 12 V
	1.0 A	at 12 - 24 V

The manufacturer reserves the right to modify, due to technical progress the regulating valve and all of its components while acknowledging the normative and certified guidelines.



Metric System			
Nominal Width (DN) (mm)	Nominal Pressure (PN) (bar)	Mechanical Connections	max. Measuring Range
25	200	G 1" BSP Female Thread / Staple lock	0 - 120 l/min
32	100	G 1¼" BSP Female Thread / Staple lock	0 - 300 l/min
50	40	G 2" BSP Female Thread / Staple lock / Sandwich	0 - 60 m³/h
80	40	Sandwich	0 - 100 m³/h
100	40	Sandwich	0 - 150 m³/h
150	40	Sandwich	0 - 400 m³/h
200	40	Sandwich	0 - 600 m³/h

Imperial System			
Nominal Width (DN) (inch)	Nominal Pressure (PN) (psi)	Mechanical Connections	max. Measuring Range
1.00	2900	G 1" BSP Female Thread / Staple lock	0 - 30 gpm
1.25	1450	G 1¼" BSP Female Thread / Staple lock	0 - 80 gpm
2.00	580	G 2" BSP Female Thread / Staple lock / Sandwich	0 - 260 gpm
3.00	580	Sandwich	0 - 440 gpm
4.00	580	Sandwich	0 - 660 gpm
6.00	580	Sandwich	0 - 1760 gpm
8.00	580	Sandwich	0 - 2640 gpm

Measuring ranges above apply to water medium.

Other measuring ranges, nominal width, nominal pressure, media and connection types on request.

The manufacturer reserves the right to modify, due to technical progress the instrument and all of its components while acknowledging the normative and certified guidelines.



MODEL KEY

DA - *** / *** ** / **

DAK - *** / *** ** / ** / ** / ** / *

Nominal Width	Measuring Range	Unit	Mechanical Connection	Electrical Connection	Control Form
*** [DN***]	*** [0-***]	L [l/min] cbm [cbm/h] G [gpm] % [%] * [special]	G** [BSP Female Thread] O [staple lock] S [Sandwich] ** [special]	E** [Insertion through fixed wire max. 30 m] P [PROMOS BN41...AT] H [Harting] S [Souriau] ** [System **]	N [without circuit] E [Resistor circuit] D [Light emitting diode/LED] DD [Anti parallel diode] P [PROMOS-circuit] S [Siemens end element]

Examples:

- DAK-025/120L/G1"/E10/N
- DAK-025/50L/G1"/P/P
- DA-080/100cbm/O
- DAK-150/180cbm/S/E03/DD
- DAK-032/200L/G1¼"/SF/E
- DA-050/40cbm/G2"

Other types, connections, measuring ranges, etc. on request.

The manufacturer reserves the right to modify, due to technical progress the instrument and all of its components while acknowledging the normative and certified guidelines.

FORERUNNER MEASURING INSTRUMENT SERIES

Through our many years of development and production of measuring equipment for use in explosion-proof areas specifically for the mining industry, there are measuring instrument series that we no longer apply and develop further. Some of the current measuring instrument series based on the forerunner series and benefit from the experience.

Regulating Valve type RV



Volume flow measuring instrument type SMALL-Ex MicroFlow



Volume flow measuring instrument type UNI



Volume flow measuring instrument type DFM



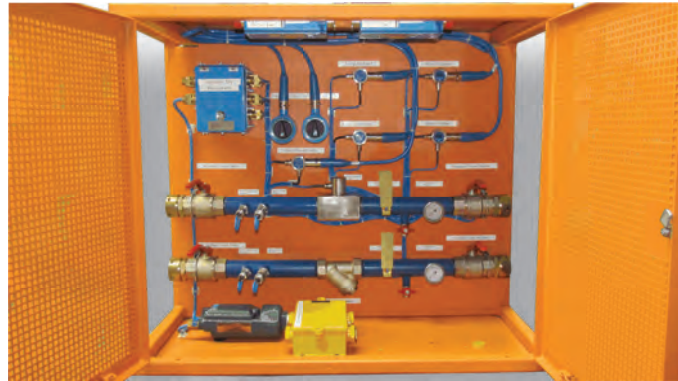
Thermo Switch type TS



ITEMS MADE TO ORDER

We manufacture individual measuring devices and measuring units, as well as monitoring and control units especially for customer requirements. We specialize in the area of explosion protection as well as the non-explosion area. However, we also produce our equipment for other areas of deployment. Some examples of our individual measuring systems are as follows:

Cooling Monitoring Unit DN50



Cooling Monitoring Unit DN100



High-water alarm with external testing facility



AGENCIES



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