



WEB TENSION MEASUREMENT, SENSORS AND PROCESSING OF MEASURED VALUES

EFFECTIVE PROCESS MANAGEMENT AND ANALYSIS

COMPETENCE AND PRECISION

In recent years, the speed with which materials are manufactured, printed, coated, wrapped and cut has increased many times over. These largely automatic, recipe-controlled processes run without manual intervention.

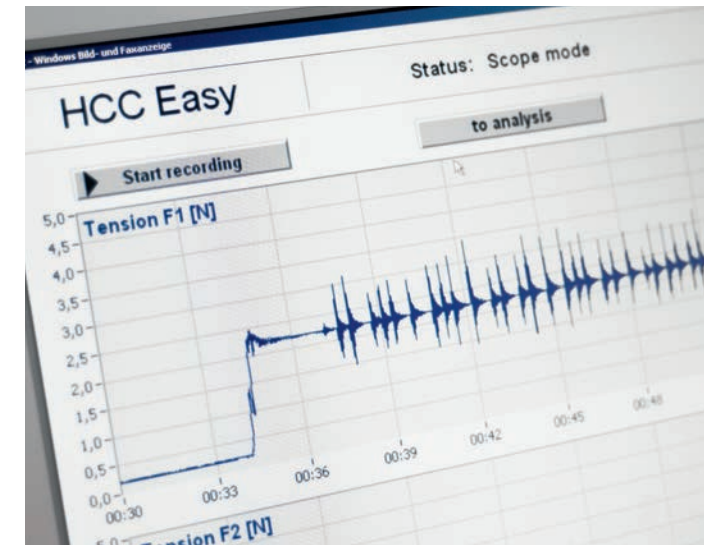
Therefore, web tension measurement is of essence. Accurate measurement results are obtained when guide rollers and web tension sensors are precisely matched.

THIS BROCHURE PROVIDES INFORMATION ON THE FOLLOWING SUBJECTS:

INOMETA	4
Sensor Roller General Information	7
SWA Sensor Rollers	10
CSW Cantilever Sensor Roller	12
CLS Cantilever Load Sensor	14
Sensors	16
RMA Radial Force Sensor	16
WTS Web Tension Sensor	18
RFS Tension Force Sensor	20
Measuring Amplifier	22
Tensiotron® TS 503	22
Tensiotron® TS 62I	24
Tensiotron® TSA 723	28
Individual Solutions and Special Applications	30
Theory of Web Tension Measuring Technology	32

STABILITY AND PROFITABILITY IN ALL PRODUCTION PROCESSES

INOMETA Rollers offers complete products from a single source. INOMETA, pressure cylinders and bridge adapters are in use wherever web materials are produced, wrapped, cut, printed or processed. All products made by INOMETA are specifically designed and manufactured for their diverse applications. Therefore, their distinguishing characteristics are absolute precision, optimized technical design and perfectly customized surfaces. Innovative solutions in the web tensile force measurement technology which lead to a further increase in profitability in all production and processing activities round out INOMETA's product range.



Innovative product ideas and awareness of quality ensure success.



Expert advice and thoughtful planning are hallmarks of INOMETA.

Interdisciplinary Competence for Rollers and Sensors

INOMETA has been cooperating with the Honigmann company for more than ten years. Combined with Honigmann's precise measurement technology, high-quality web guide rollers made by INOMETA ensure unique accuracy and stability for your web tension measurement tasks.

Experienced Project Management

With their know-how and experience, our experts offer reliable and secure support in all process-specific questions. For each respective application, they help select ideally suited INOMETA rollers, cylinders and measurement technology.

Our experienced project managers provide support for the development and production of each product from the quotation phase through to delivery. In the process, they ensure functionality and quality.

Specific Production Methods with Assured Quality

We have high-performance machinery and use specific manufacturing methods. This allows us to offer a wide range of products with many fields of applications for our customers. We use ultramodern CNC lathes and automatic lathes as well as grinding and finishing machines to produce our products. The high quality of our products is owed to continuous improvement and optimization of our production methods and processes.

About the Company

INOMETA is a market leader in the development, production and distribution of web guiding, sensor and functional rollers, printing sleeves and adapters, technical tubes, functional surfaces, and technical winding cores. Our main focus is lightweight design, using aluminium and carbon fiber composite materials to increase productivity and the associated added value.

Our company is certified acc. to the ISO 9001 quality management system. Independent experts regularly review our processes according to strict quality criteria. This ensures the high quality of our products.

PRECISE, SAFE, STABLE

WEB TENSION MEASURING TECHNOLOGY AND ROLLERS ARE INSEPARABLE

Combined with Honigmann's precise measurement technology, high-quality web guide rollers made by INOMETA ensure unique accuracy and stability. To this end, special INOMETA sensor rollers with integrated web tensile force measuring unit and amplifier technology provide smooth web transport and precise web tensions.



The SWA sensor roller is the tried and tested basic model.

SENSOR ROLLERS WITH INTEGRATED WEB TENSION FORCE MEASUREMENT TECHNOLOGY

Type and Specification Key for Sensor Roller Definition

Our type and specification key is designed to facilitate communication between INOMETA and its customers. Rollers can be precisely defined without drawings.

	TYPE	D	L	a	A	BEARING	D	G
example	BA	120	01750	050	01850	1206	20	12
Sensor Roller nominal load 400 N, Aluminium								

roller with bearings inside	TYPE	BA						
diameter 120 mm	D	120						
roller length 1,750 mm	L	1,750						
journal length 50 mm	a	50						
overall length	A	1,850						
low friction bearings	DIN	1206						
journal diameter 20 mm	D	20						
fastening thread M12	G	12						

	TYPE	D	L	a	A	BEARING	D	G
the same roller, but hard anodized	BA	120	01750	050	01850	1206	20	12
Sensor Roller nominal load 400 N, Aluminium, hard anodized								

GENERAL TECHNICAL DATA

MATERIALS		
standard	roller tube	AlMgSi 0.5
	base	AlCuMgPb
	shaft / journal	C45
	housing	C45
alternative	optional materials, e. g. stainless steel or CFRP	



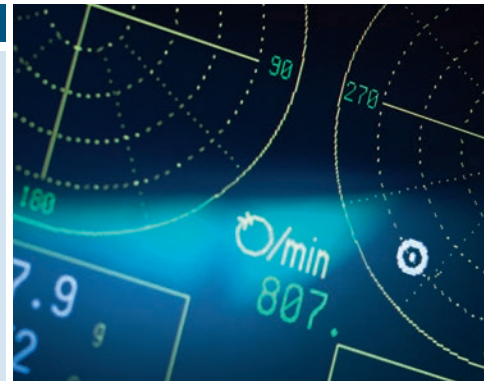
BEARINGS	
standard	Conventional fixed and a floating bearing assembly with contact-free labyrinth seal. low friction bearings with special high viscosity lubricant, bearing clearance and permanent lubrication for heavy-duty use through speed and temperature up to 120 °C
alternative	customer-specific bearing and lubrication systems



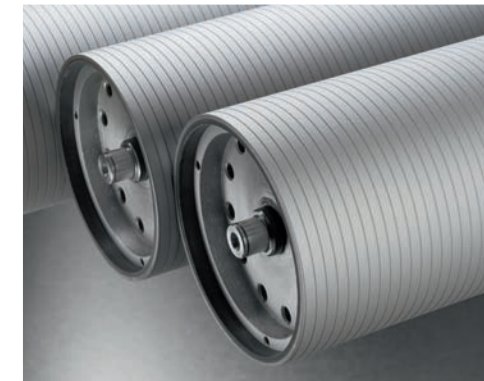
TOLERANCES			
standard	roller length	L	h13
	overall length	A	h8
	journal diameter	d	h8
	concentricity	for L > 1,000	< 35 µm/m
		for L ≤ 1,000	< 35 µm
cylindricity	for L > 1,000	< 35 µm/m	
	for L ≤ 1,000	< 35 µm	
alternative	on request		



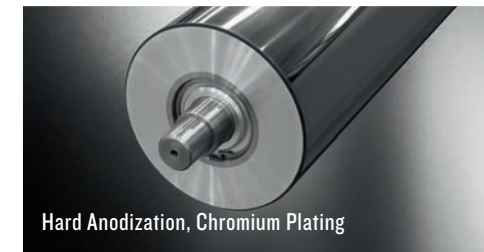
BALANCING	
standard	dynamically precision-balanced acc. to DIN ISO 1940 for 300 m/min balance quality G = 2.5 or 6.3
alternative	fine-balanced with balance quality G = 1 or elastic/dynamic balancing (third level)



SURFACE FINISH



STRUCTURE
Surface structures support material guiding; e. g. spiral-groove surfaces have a spreading effect and rhombic-groove surfaces prevent air cushions between material web and roller.



COATING
By choosing the right surface, the characteristics of the roller can be tailored to the specific requirements of your process. With thermally sprayed PROTEK coatings, you can define wear protection, non-stick and/or traction properties. However, hard anodizing, chromium plating or rubber coating are also possible.

SURFACES					
STRUCTURE		ROUGHNESS DEPTH		COATING	
standard	cylindric, polished	standard	Aluminium, ground Rz 6 – 8 µm	standard	without coating
alternative	application-oriented, e. g. spiral grooved, grooved, concave/convex, structured	alternative	defined surfaces between Rz 0,1 µm and Rz 200 µm	alternative	hard anodization, chrome, elastomers, PROTEK ceramic coating, PROTEK non-stick coating, PROTEK hard metal coating



SIMPLE TO SETUP

SENSOR ROLLER SWA FOR WEB TENSION MEASUREMENT

Without changing the design, the SWA Sensor Roller with integrated web tension measurement can be installed just like a standard web guide roller. The Sensor Roller then fulfills two functions, one being web tensile force measurement, the other being to guide the material web. The SWA Sensor Roller comes ready-to-install. The labor-intensive installation of individual electronic and/or mechanical components by the customer is no longer necessary.

Special Features

- ready-to-install, no need to have the customer install a score of components
- effective overload protection with mechanical stops
- single-sided connecting cable
- proofed web guiding roller technology
- low friction bearings with permanent lubrication
- dynamically precision-balanced acc. to DIN ISO 1940

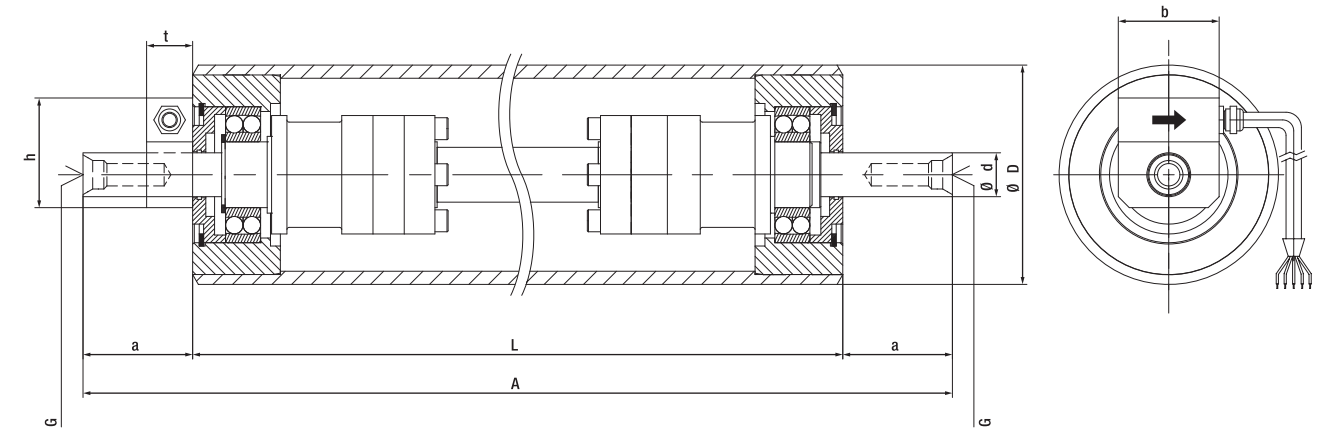


The arrow indicates the measurement direction.

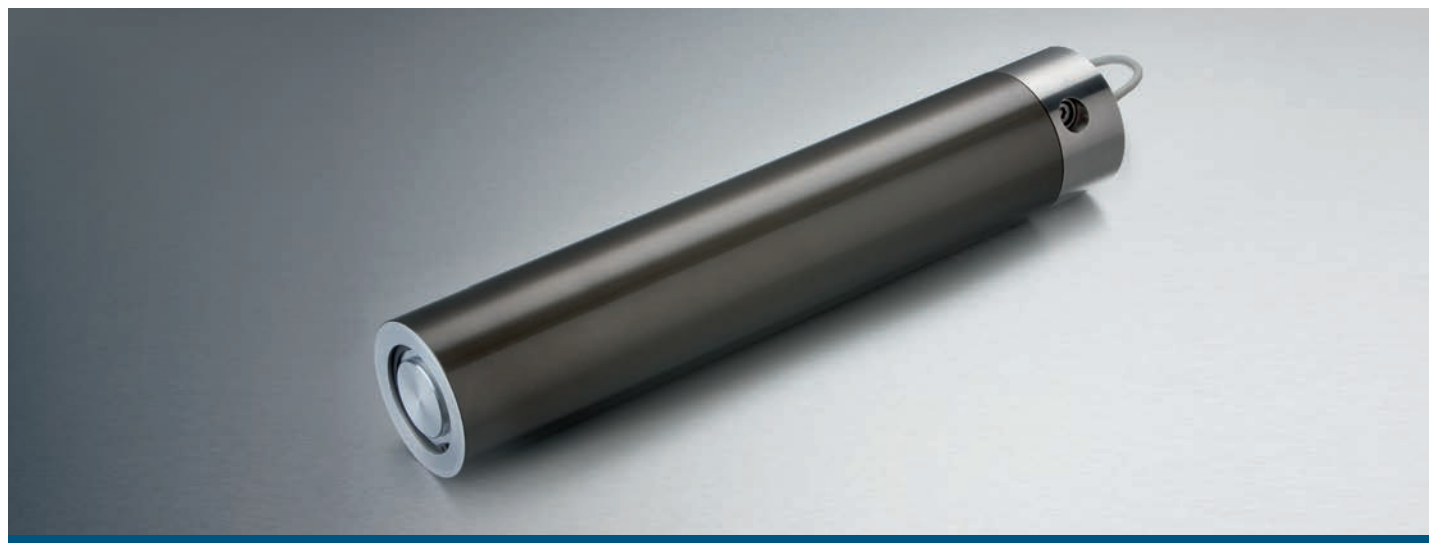
TECHNICAL DATA

The SWA Sensor Roller is specially designed for each case of application. The materials (Aluminium, Steel or CFRP), roller dimensions, surface refinements and nominal loads are selected in close consultation with our customers.

The following standard technical data are used as basis for this dialog:



SWA SENSOR SIZE		1	2	3
nominal measuring range (F_N)	[N]	0–200 to 0–3,000	0–400 to 0–6,000	0–600 to 0–10,000
nominal value	[mV/V]		1.5	
accuracy class	[%]		0.2	
roller diameter D_{min}	[mm]	≥ 80	≥ 100	≥ 120
roller diameter D	[mm]		optional	
roller length L	[mm]		optional	
journal length a , standard	[mm]	50	80	80
journal diameter d	[mm]	20	30	40
low friction bearing acc. to DIN 625		1206	1208	22210
fastening thread		M12	M16	M20
input/output resistance	[Ω]	175	175	
CONNECTION BOX				
height h	[mm]	50	60	72
breadth b	[mm]	46	56	68
depth t	[mm]	21	25.5	27
nominal temperature range	[$^{\circ}C$]		+5 ... +50	
working temperature range	[$^{\circ}C$]		-10 ... +70	
storage temperature range	[$^{\circ}C$]		-30 ... +70	
reference temperature	[$^{\circ}C$]		+23	
protection class			IP50	
TC of zero point	[%/10 $^{\circ}C$]		< ± 0.1	
TC of characteristic value	[%/10 $^{\circ}C$]		< ± 0.15	
linear output signal up to	[% F_N]		approx. 150	
overload protection starting at	[% F_N]		approx. 180	
overload-protected	[% F_N]		> 300 to 500 depending on nominal measuring range	
typ. deflection at nominal load	[mm]		0.07	



COMPACT AND STABLE

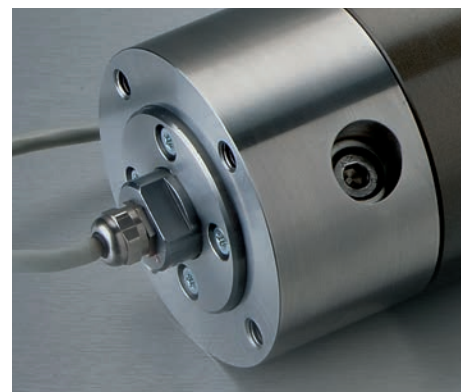
CSW CANTILEVER SENSOR ROLLER FOR WEB TENSION MEASUREMENT

The Cantilever Sensor Roller has a double sided force measurement unit which allows for asymmetrical loading.

A stable stator structure ensures high measuring accuracy and an outstanding vibration damping behavior.

Special Features

- simple, one-sided fastening via threaded holes
- integrated direction adjuster allows for precise fine-tuning of the measurement axis position even after the sensor roller has been installed in the machine
- precise; as the measuring accuracy of the Sensor Roller does not depend on the force introduction point (i. e. the measuring cell of the Sensor Roller operates independently of the lever arm)
- easy-running bearings with permanent lubrication
- fixed and floating bearing assembly with contact-free labyrinth seals
- dynamically precision-balanced acc. to DIN ISO 1940
- robust - effective overload protection with mechanical stops
- customer-specific dimensions and nominal measuring force can be selected
- high stability
- low vibration level

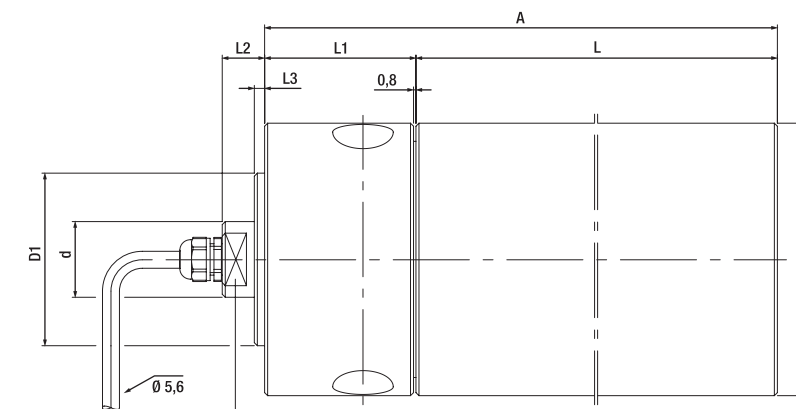


Attachment area of the CSW

TECHNICAL DATA

The CSW Sensor Roller is specially designed for each case of application. The materials (Aluminium, Steel or CFRP), roller dimensions, surface refinements and nominal loads are selected in close consultation with our customers.

The following standard technical data are used as basis for this dialog:



CSW SENSOR SIZE		1	2	3	4	5
nominal measuring range (F _N)	[N]	0-50 to 0-600		0-50 to 0-600		0-100 to 0-5,000
nominal value	[mV/V]	1.5		1.5		1.5
accuracy class	[%]	0.2		0.2		0.2
roller diameter D _{min}	[mm]	≥ 80		≥ 100		≥ 160
roller diameter D	[mm]	80	90	100	120	160 200 220
roller length L	[mm]	240 ... 1,100				
journal diameter D	[mm]	80	90	100	120	160 200 220
centering shoulder D1	[mm]	32	57	65	75	100 125 140
connection d	[mm]	25	25	35	35	40 50 60
length L1	[mm]	45	50	56	67	90 110 121
length L2	[mm]	14	14	16	20	25 30 35
length L3	[mm]	3.4	3.4	4	5	6 8 10
input/output resistance	[Ω]	175				
nominal temperature range	[°C]	+5 ... +50				
working temperature range	[°C]	-10 ... +70				
storage temperature range	[°C]	-30 ... +70				
reference temperature	[°C]	+23				
protection class		IP50				
TC of zero point	[%/10 °C]	< ± 0.1				
TC of characteristic value	[%/10 °C]	< ± 0.15				
linear output signal up to	[% F _N]	approx. 130				
overload protection starting at	[% F _N]	approx. 150				
overload-protected	[% F _N]	> 300 to 500 depending on nominal measuring range				
typ. deflection at nominal load	[mm]	0.07				



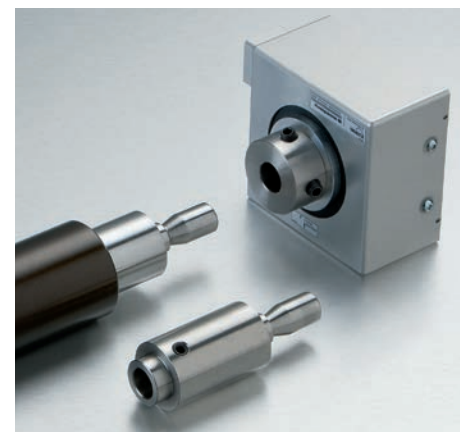
FLEXIBLE AND DYNAMIC

CLS CANTILEVER LOAD SENSOR

The CLS measuring system is specially designed for each case of application. The choice is yours: a complete system, i. e. sensor and roller, or just the sensor. On request, rollers made of CFRP, aluminum or high-quality functional coatings are supplied. The sensor has the highest overload capacity even with small nominal loads. The robust design makes extremely high roller speeds possible.

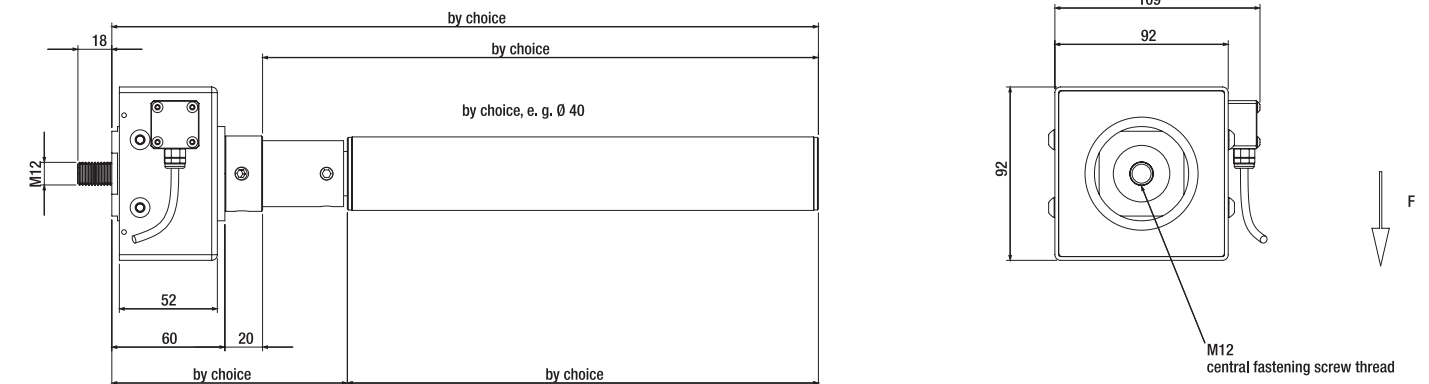
Special Features

- use of very small roller diameters, e. g. 30 mm
- single-sided flange mounting (front and rear side)
- various mounting possibilities
 - journal mounting
 - shaft mounting
 - flange mounting
- measuring cell with dust protection encapsulation
- effective overload protection with mechanical stops
- precise; as the measurement is independent of the lever arm and does not depend on the force introduction point
- customer-specific dimensions and measurement ranges
- proofed web guiding roller technology
- low friction bearings with permanent lubrication
- dynamically precision-balanced acc. to DIN ISO 1940
- roller body can be made with customer-specific surface structures and coatings



Rollers can either have an adapter or be directly connected.

TECHNICAL DATA



CANTILEVER-LOAD-SENSOR CLS

nominal measuring range (F_N)	[N]	0–20 to 0–4,000
size	BG1 ... BG5	size and nominal load are adapted to specific tasks in cooperation with the customer
nominal value	[mV/V]	1.0
sensitivity tolerance	[%]	< ± 0.2
accuracy class		0.5
max. excitation voltage	[V]	12
supply reference voltage	[V]	10
input resistance	[Ω]	350 ± 3
output resistance	[Ω]	350 ± 1
insulating resistance	[GΩ]	> 10
nominal temperature range	[°C]	+5 ... +50, option: –10 ... +70
working temperature range	[°C]	–10 ... +70
storage temperature range	[°C]	–30 ... +70
reference temperature	[°C]	+23
temperature influence per 10 °C		
– on zero point	[% F_N]	< ± 0.1
– on calibration	[% F_N]	< ± 0.15
creepage over 30 minutes	[% F_N]	< ± 0.05
linear output signal up to	[% F_N]	approx. 120
mech. overload protection effective at	[% F_N]	approx. 130
overload-protected ¹	[% F_N]	500 ... 1,000 depending on nominal measuring range
max. safe side load ¹	[% F_N]	300 ... 500 depending on nominal measuring range
dimensions		depending on size and design
weight		depending on size and design
connection cable		robust, flexible, shielded, 4 x 0.25 mm ² , overall Ø 5.6 mm, 3 m long, open-ended with ferrules, special sheathing
protection class		IP50

¹radial force without higher-level bending/pull-out torque



PRECISE AND COMPACT

RMA RADIAL FORCE SENSOR

Clearly defined and setpoint controlled web tensions are a prerequisite for high product quality and minimal downtime.

The compact RMA sensors are designed as roller journal and have the dual function of measuring the web tensile force and holding the measuring roller. This sensor can be supplied in the standard model shown here, or in various other solutions with customer-specific design details.

Special Features

- for inside mounted deflection rollers without continuous shaft
- compact design with flanged connections
- direct, radial force transmission
- compact, robust and virtually universal in application

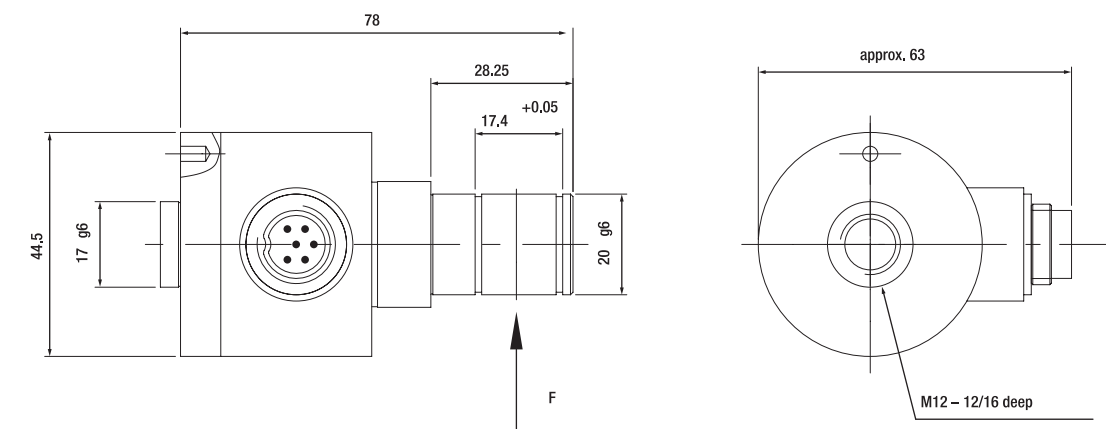
Special Models

- for non-standard nominal measuring forces
- sensor housing and measuring cell made of rustproof stainless steel, suited to use in moist areas
- extended temperature range



Sensor with Relubrication (Optional)

TECHNICAL DATA



RMA RADIAL FORCE SENSOR

nominal measuring range (F_N)	[N]	0–100; 0–300; 0–600; 0–1,200; 0–2,000
nominal value	[mV/V]	1.0
sensitivity tolerance	[%]	$< \pm 0.2$
accuracy class		0.2
combined fault	[% F_N]	$< \pm 0.2$
max. excitation voltage	[V]	12
supply reference voltage	[V]	4.5
input resistance	[Ω]	350 ± 3
output resistance	[Ω]	350 ± 2
insulating resistance	[G_{Ω}]	> 5

nominal temperature range	[$^{\circ}C$]	0 ... +50
working temperature range	[$^{\circ}C$]	-10 ... +70
storage temperature range	[$^{\circ}C$]	-30 ... +90
reference temperature	[$^{\circ}C$]	+23

temperature influence per 10 K

– on zero point (TC0)	[% F_N]	$< \pm 0.1$
– on calibration (TCC)	[% F_N]	$< \pm 0.2$
creepage over 30 minutes	[% F_N]	$< \pm 0.1$
relative reversibility error	[% F_N]	$< \pm 0.2$
working load	[% F_N]	300
maximum load	[% F_N]	400
breaking load	[% F_N]	> 500
max. safe side load	[% F_N]	300
max. perm. dyn. load (DIN 50100)	[% F_N]	50
max. perm. axial torsional moment	[Nm]	35
deflection at nominal load	[mm]	$< 0,04$
natural frequency of sensor	[kHz]	> 2

weight	[g]	approx. 450
surface protection		bronzed
protection class		IP50



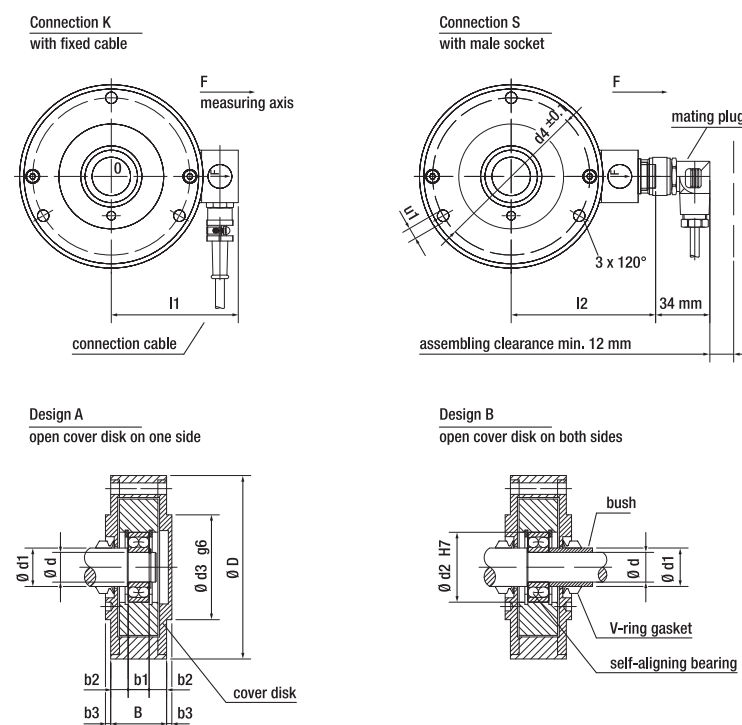
CONVENTIONAL AND PRECISE

WTS WEB TENSION SENSOR

The tensile force measurement determines the radially directed forces of both measuring roller bearings. In this context, the compact WTS sensors fulfill two tasks, one being web tensile force measurement, the other holding the measuring roller.

Special Features

- compact design with flanged connections
- direct, radial force transmission
- easy installation with various installation options, such as inner or outer flange attachment
- high permissible operating speed of the measuring rollers due to large spring constants of the measurement transducer
- overload protection with mechanical stops
- high degree of precision and long-time stability



TECHNICAL DATA

WTS WEB TENSION SENSOR		
nominal measuring range (F_N)	[N]	0–100 to 0–5,000
nominal value	[mV/V]	1.0
sensitivity tolerance	[%]	< ± 0.2
accuracy class		0.1
max. excitation voltage	[V]	12
supply reference voltage	[V]	10
input resistance	[Ω]	350 ± 3
output resistance	[Ω]	350 ± 1
insulating resistance	[GΩ]	> 10
nominal temperature range	[°C]	+5 ... +50
working temperature range	[°C]	–10 ... +70
storage temperature range	[°C]	–30 ... +90
reference temperature	[°C]	+23
temperature influence per 10 K		
– on zero point (TC0)	[% F_N]	< ± 0.1
– on calibration (TCC)	[% F_N]	< ± 0.15
creepage over 30 minutes	[% F_N]	< ± 0.05
linear output signal up to	[% F_N]	approx. 150
overload protection starting at	[% F_N]	180
overload-protected	[% F_N]	400 ... 800 depending on nominal measuring range
deflection at nominal load	[mm]	< 0.10 mm (± 20%)
protection class		IP50

SIZE	NOMINAL LOAD / NOMINAL MEASURING RANGE								
1	100	200	500	1,000	–	–	–	–	–
2	–	200	500	1,000	2,000	–	–	–	–
3	–	–	500	1,000	2,000	3,000	4,000	–	–
4	–	–	–	1,000	2,000	3,000	4,000	5,000	8,000

SIZE	MOUNTING DIMENSIONS [mm]												
	d	d1	d2	d3	d4	D	b1	b2	b3	B	l1	l2	l
1	12	16	32	60	90	105	10	11	3	32	73	87	6.6
	15	20	35	60	90	105	11	10,5	3	32	73	87	6.6
2	17	22	40	60	90	105	12	10	3	32	73	87	6.6
	20	25	47	70	105	125	14	13	4	40	83	97	6.6
3	25	32	52	70	105	125	15	12,5	4	40	83	97	6.6
	30	40	72	105	125	175	19	19	4	57	109	123	9
4	35	45	80	100	150	175	21	18	4	57	109	123	9
	40	50	90	130	190	225	23	22	4	67	130	144	11
	45	60	100	130	190	225	25	21	4	67	130	144	11



SENSITIVE AND ACCURATE

RFS TENSION FORCE SENSOR

The special design of these sensors provides all degrees of freedom for easy integration and installation.

The measurement principle is based on the evaluation of radial forces which are transmitted to the sensor via bearing journal.

Special Features

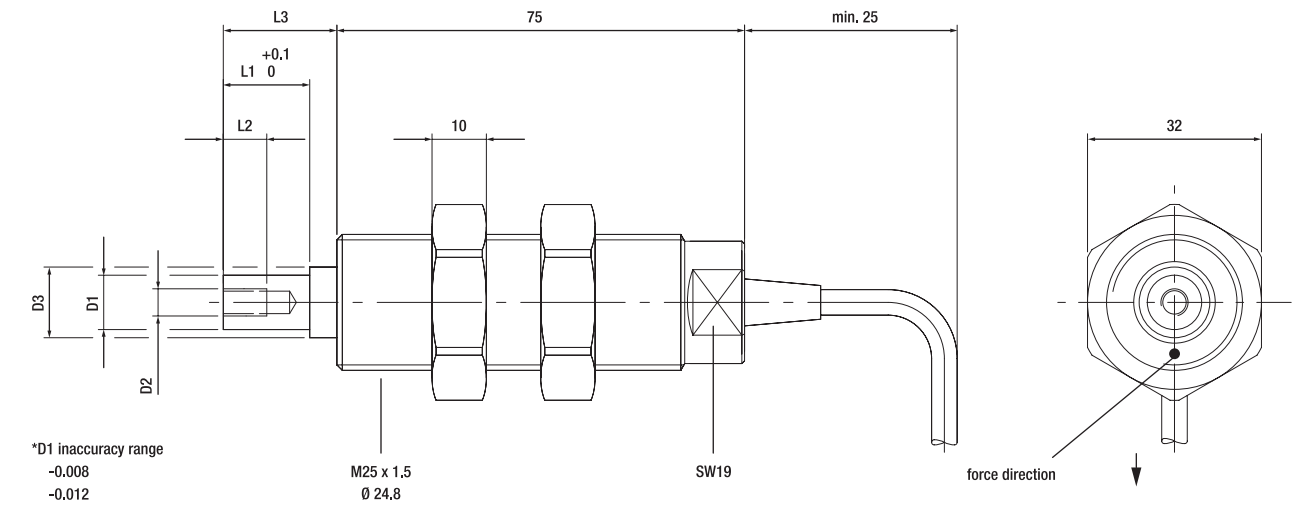
- direct, radial force transmission
- the counter-attachment allows precise alignment of the measurement axis
- high permissible operating speed of the measuring rollers due to large spring constant of the sensor
- robust, effective overload protection with mechanical stops
- high degree of precision and long-time stability
- customer-specific design possible
- smallest measurement ranges available, e. g. 0–2 N



Even miniature sizes of the RFS are available.

DIMENSIONS AND TECHNICAL DATA

On request, we can supply special versions of this sensor type.



NOMINAL LOAD / NOMINAL MEASURING RANGE [N]						JOURNAL [mm]		
2	5	10	20	30	40	5	8	10
50	60	100	200	300	400	–	8	10
500	600	1,000	–	–	–	–	–	10

RFS TENSION FORCE SENSOR		MOUNTING DIMENSIONS [mm]
nominal measuring range (F_N)	[N]	0–2 to 0–1,000
nominal value	[mV/V]	1.5
sensitivity tolerance	[%]	< ± 0.2
accuracy class		0.1
max. excitation voltage	[V]	12
supply reference voltage	[V]	10
input resistance	[Ω]	350 ± 3
output resistance	[Ω]	350 ± 1
insulating resistance	[GΩ]	> 10
nominal temperature range	[°C]	+5 ... +50
working temperature range	[°C]	–10 ... +70
reference temperature	[°C]	+23
linear output signal up to	[% FN]	125
overload protection starting at	[% FN]	140
overload-protected	[% FN]	400 ... 800 depending on nominal measuring range
deflection at nominal load	[mm]	< 0.17 mm (± 20 %)
protection class		IP50



COMPACTNESS AND LONG-TERM STABILITY

TENSOTRON® TS 503

The compact Tensiotron® TS 503 measuring amplifier is designed for universal tensile force measuring use.

Excellent long-term and temperature stability and high measuring accuracy are guaranteed by ultramodern electronics.

This high-quality TS 503 measuring amplifier has an extremely compact design and is easy to install.

Special Features

- Slim-Line module housing for mounting rail installation – only 12.5 mm width
- high noise immunity and operational reliability for use in rough industrial operation
- direct input power supply of 24V DC
 - reverse polarity protected
 - LED operational status indicator
- highly stable bridge voltage to power the sensor
- signal amplification and zero point setting via trimming potentiometer
- screw clamp connections
- output signal configuration via DIP switch:
 - voltage 0 ... ± 10 V or
 - current 0/4 ... 20 mA, unipolar or bipolar



Cable Connection via Screw Clamps

TECHNICAL DATA

TENSOTRON® TS 503

type	module housing for mounting rail installation	
accuracy class	0.1	
connectable sensors:		
SG full bridge	[Ω]	permissible supply impedance ≥ 150
bridge supply	[V DC]	$10 \pm 0.5\%$
nominal amplification G_{nom}		667
nominal measuring range U_{sig}	[mV]	± 15
calibration range w/ ref. to G_{nom}	[%]	50 ... 100 ... 500
adjusting range zero point at G_{nom}	[% FS]	approx. ± 70
input impedance	[Ω]	10^{10}
cutoff frequency (–3 dB)	[Hz]	approx. 55
output signal switchable via DIP switch		
– voltage output (factory default settings)	[V]	0 ... ± 10, max. 10 mA
– current output	[mA]	0 ... ± 20, permissible load 0 ... 500 W
– current output	[mA]	0 ... + 20, permissible load 0 ... 500 W
– current output	[mA]	4 ... + 20, permissible load 0 ... 500 W
nominal temperature range	[°C]	0 ... +60
working temperature range	[°C]	0 ... +60
storage temperature range	[°C]	–25 ... +75
temperature influence per 10 °C		
– on zero point at MA output	[mV]	< 10 (with G_{nom})
– on calibration	[% FS]	< 0.05
supply voltage	[V DC]	20 ... 28
power consumption	[W]	max. 2.5
measuring amplifier connection		screw clamps for flexible line 0.14 ... 2.5 mm ²
dimensions (L x W x H)	[mm]	114.5 x 99 x 12.5
weight	[g]	approx. 100
assembly		snap-on assembly on DIN top-hat rails

Explanation of abbreviations: SG = strain gauge, FS = Full Scale, U_{sig} = input signal voltage, G_{nom} = nominal amplification



TEMPERATURE AND LONG-TERM STABILITY

TENSOTRON® TS 621

The compact TENSOTRON® TS 621 measuring amplifier is designed for universal tensile force measuring use.

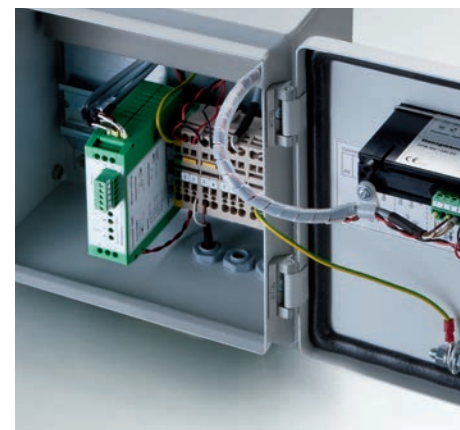
Excellent long-term and temperature stability and high measuring accuracy are guaranteed by ultramodern electronics.

The galvanic isolation, a pluggable sensor connection and various options are the hallmarks of the high-quality

TS 621 measuring amplifier.

Special Features

- high noise immunity and operational reliability for use in rough industrial operation
- direct input power supply of 24V DC, reverse polarity protected, with
 - wide input voltage range 19 ... 36 V DC, LED operational status indicator
 - with integrated DC/DC converter for galvanic isolation of power supply and measuring circuit, as it is very important to avoid ground loops in conjunction with downstream electronic units.
- highly stable bridge voltage to power the sensor
- coarse and fine adjustment for zero point and signal amplification settings
- connection of power supply and output signals via screw clamps
- sensor connection via Phoenix MINI COMBICON connector
- 2/I adapter connector available as accessory (direct parallel connection of two sensors at MA)
- standard version: voltage output 0 ... ± 10 V with optional additional output:
 - Option D second voltage output, with active low-pass filter
 - Option X second voltage output, with 2-/3-/4-/5-fold additional amplification
 - Option A current output 0/4 ... 20 mA, unipolar or bipolar



TS 621 installed in housing for field mounting.

TECHNICAL DATA

TENSOTRON® TS 621

type	module housing for mounting rail installation	
accuracy class	0.1	
connectable sensors:		
SG full bridge	[Ω]	permissible supply impedance ≥ 150
bridge supply	[V DC]	10 ± 0.5 %
– w/ ref. to mass (GND)	[V DC]	± 5
nominal amplification G_{nom}		667
nominal measuring range U_{sig}	[mV]	± 15
calibration range w/ ref. to G_{nom}	[%]	38 ... 100 ... 580
adjusting range zero point at G_{nom}		
– fine approx. % FS ± 20	[% FS]	approx. ± 20
– coarse approx. % FS ± 60	[% FS]	approx. ± 60
input impedance	[Ω]	10^{10}
cutoff frequency (–3 dB)	[Hz]	approx. 70
output signal switchable via DIP switch		
– voltage output V_{out} (with $G_{nom} \cdot U_{sig}$)	[V]	0 ... ± 10, max. 10 mA
nominal temperature range	[°C]	0 ... +60
working temperature range	[°C]	0 ... +60
storage temperature range	[°C]	–25 ... +75
temperature influence per 10 °C		
– on zero point at MA output	[mV]	< 10 (with G_{nom})
– on calibration	[% FS]	< 0.05
supply voltage	[V DC]	19 ... 36
power consumption	[W]	max. 3 galvanic isolation with DC/DC converter
measuring amplifier connection	screw clamps for flexible line 0.2 ... 2.5 mm ²	
sensor connection	connector with screw clamps for flexible line 0.08 ... 1.5 mm ²	
dimensions (L x W x H)	[mm]	80 x 25 x 95
weight	[g]	approx. 100
assembly	snap-on assembly on DIN top-hat rails	

Explanation of abbreviations: SG = strain gauge, FS = Full Scale, f_c = cutoff frequency, MA = measuring amplifier, U_{sig} = input signal voltage, G_{nom} = nominal amplification, V_{out} = standard voltage output, V_{out}^* = optional, amplified voltage output, V_{dout} = optional, damped voltage output

TECHNICAL DATA ADDITIONAL OPTIONS

Other options can be flexibly adapted for specific applications and individually manufactured on additional circuit boards.

TS 621-D

Option D, second voltage output, filtered with fifth-order Bessel low-pass filter

cutoff frequency adjustable via DIP switch

TS 621-D		
V _{dout}	[V]	0 ... ± 10, max. 10 mA
fifth-order Bessel low-pass filter	[Hz]	f _c = 0.5 / 5 / 10 / 20

TS 621-X

Option X, second voltage output, with 2-/3-/4-/5-fold additional amplification

amplification factor X adjustable via DIP switch

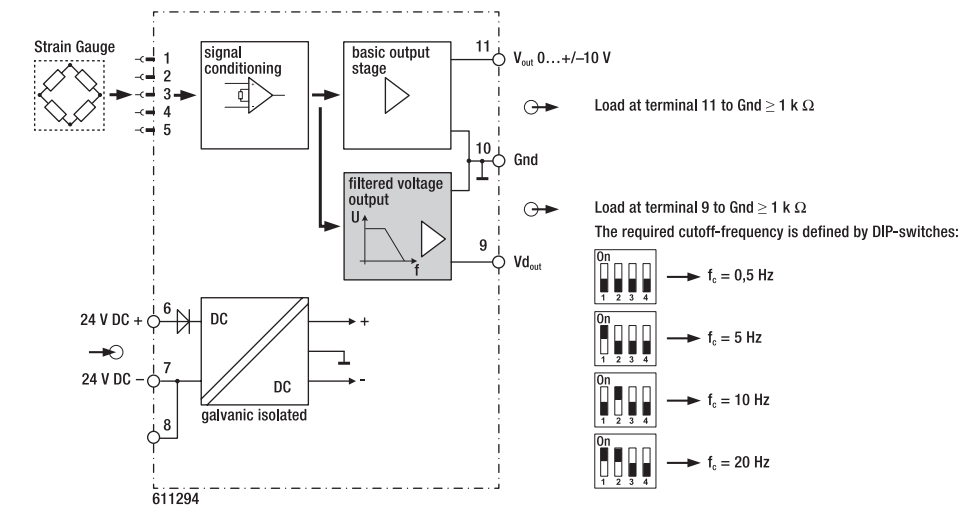
TS 621-X		
V _{out} * = X · V _{out} (f _c = 25 Hz)	[V]	V _{out} * = 2 / 3 / 4 / 5 · V _{out}
working range V _{out} *	[V]	0 ... ± 10, max. 10 mA

TS 621-A

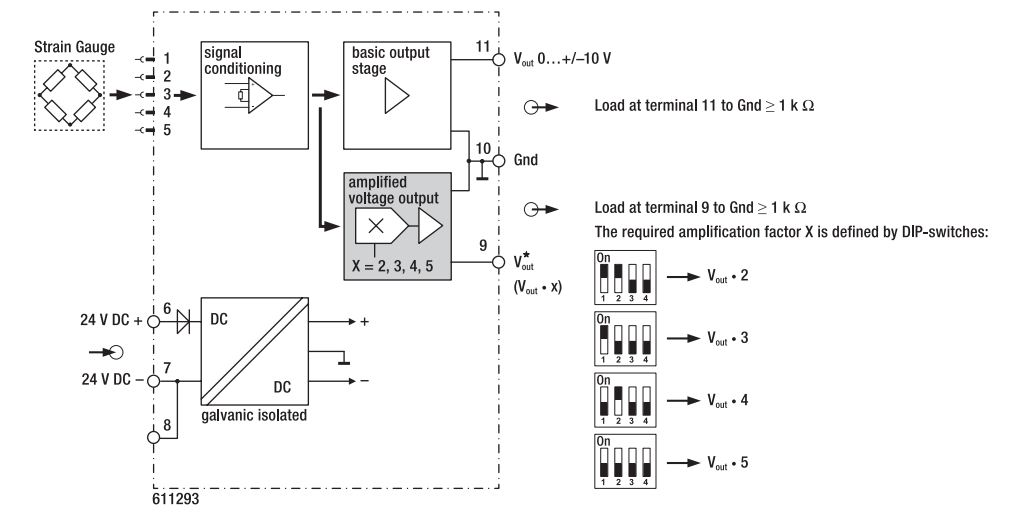
Option A, current output parallel to voltage output, output signal form adjustable via DIP switches

TS 621-A		
bipolar	[mA]	0 ... ± 20, permissible load 0 ... 500 Ω
unipolar	[mA]	0 ... + 20, permissible load 0 ... 500 Ω
unipolar	[mA]	4 ... + 20, permissible load 0 ... 500 Ω

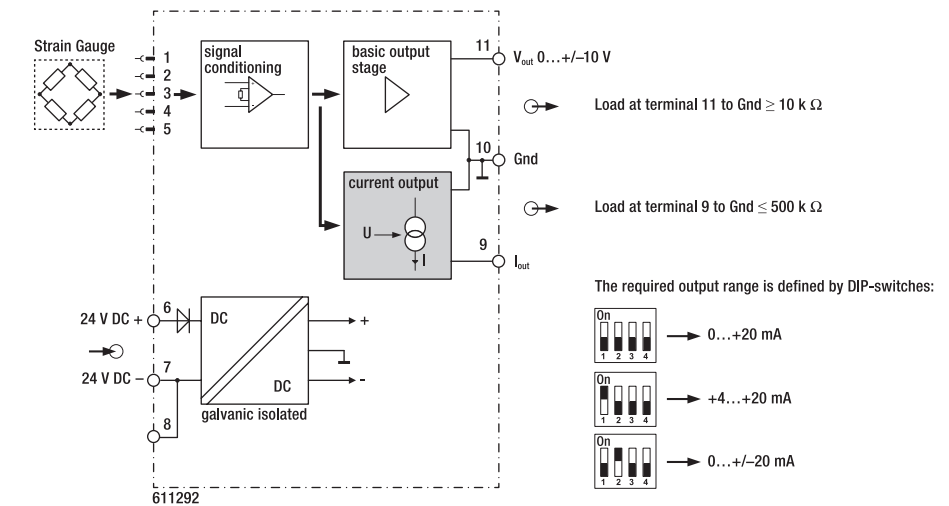
TS 621-D



TS 621-X



TS 621-A





SMALL AND POWERFUL

TENSOTRON® TSA 723

The TSA 723 miniature measuring amplifier has a compact and rugged design. The housing is designed for top hat rail mounting and easily fits into the arrangement of rail-mounted terminals in a control cabinet. The measuring amplifier is available without rail mounting adapter for mounting with double-sided adhesive tape or for use in labs. An optional 2/I adapter connector is available as accessory for direct parallel connection of two sensors.

Special Features

- very small-sized design
- robust aluminium housing
- all connections plugged for easy wiring
- imprinted terminal assignment
- 24 V DC power supply, reverse polarity protected
- available with voltage output 0 ... ± 10 V or current output 0 ... 20 mA or 4 ... 20 mA



TSA 723 with 2/I Adapter Connector

TECHNICAL DATA

TENSOTRON® TSA 723

type	robust aluminium housing	
connectable sensors	SG full bridge	
permissible supply impedance	Ω	175 ... 1,000
accuracy class	0.1	
bridge supply	V DC	10
nominal amplification G_{nom}	667	
nominal measuring range U_{sig}	mV	± 15 (corr. to 1.5 mV/V with 10 V bridge supply)
adjusting range calibration (CAL)	% FN	85 ... 100 ... 500
adjusting range zero point (ZERO)	% FN	± 45
cutoff frequency f_c (-3 dB)	Hz	approx. 70
output		
- voltage output (standard)	V	0 ... ± 10, max. 1 mA
- current output 0 - 20 (optional)	mA	0 ... 20, permissible load 100 ... 300 W
- current output 4 - 20 (optional)	mA	4 ... 20, permissible load 100 ... 300 W
nominal temperature range	°C	0 ... +50
working temperature range	°C	-10 ... +70
storage temperature range	°C	-30 ... +75
temperature influence per 10 K		
- on zero point		
on amplifier output	mV	< 10
- on calibration	% ¹	< 0.05
supply voltage	V DC	20 ... 28
current consumption (350 W bridge, no load)	mA	approx. 36
connections	connectors with screw clamps for flexible lines 0.08 ... 1.5 mm ²	
dimensions	see dimensional drawing	
weight	g	approx. 40

¹ Full Scale

FLEXIBLE, FAST AND SOLUTION-ORIENTED

INDIVIDUAL SOLUTIONS AND SPECIAL APPLICATIONS

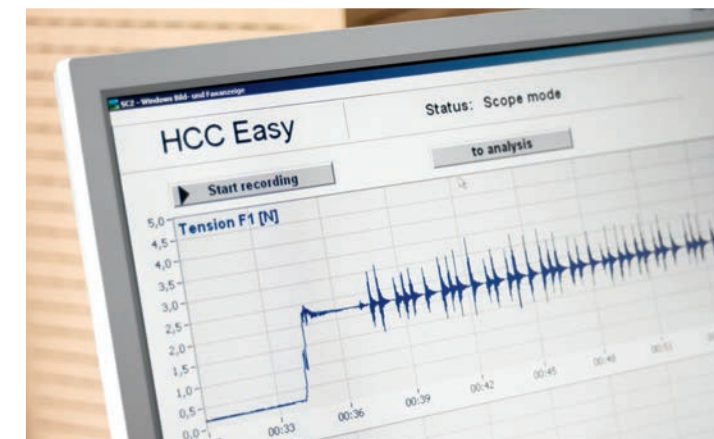


MEASURING AMPLIFIER

For field mounting, we offer prewired measuring amplifier stations, also incl. display.

MOBILE WEB TENSION MEASUREMENT

For quick web tension measurements of papermaking machine covering materials, e. g. felt and wire mesh, as well as cloth or fabric. Unique design features allow not only the measurement of static and dynamic web tension, but also the measurement of the longitudinal and transverse direction.

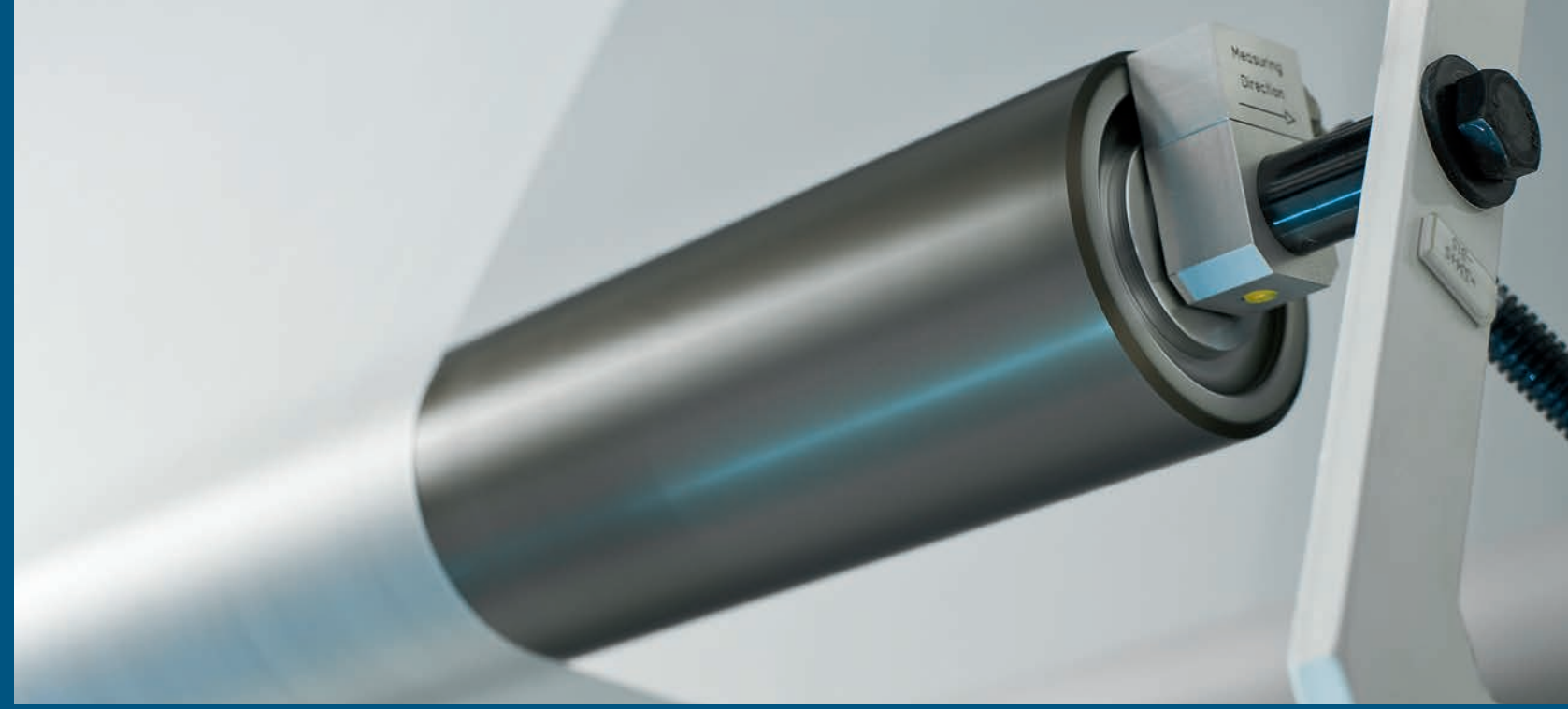


MEASUREMENT DATA LOGGING AND PROCESSING

Complete hard- and software packages used to collect and analyze analog signals. Configuration and operation are very clear and easy. The software was specially designed for tensile force measuring. Without special knowledge, the user can record, save and analyze tensile force signals. HCC-Easy is a high-end professional system with a powerful range of functions. The unique feature of this uncomplicated software is its ease of use.

THE BASIS OF SUITABILITY FOR PRACTICAL APPLICATIONS

THEORY OF WEB TENSION MEASURING TECHNOLOGY



CALCULATION OF NOMINAL MEASURING RANGE

Forces and Angles

When determining nominal measuring range, the maximum forces acting at the sensor bearings are decisive. This is the result of the largest occurring web tensile force, the diverting geometry and the net weight of the measuring roller. With measuring rollers that have sensors on both ends, web tension force and force of gravity affect bearings equally (Figure 1).

Parallelogram of Forces

The resulting F_R is calculated using web tensile force F_T and angle of contact α :

$$F_R = 2 \times F_T \times \sin \alpha / 2$$

To achieve a sufficient measurement accuracy, we recommend an angle of contact between 20° and 180° (Figure 2).

The resulting F_R will only provide the effective measuring force F_{EM} if the sensor and the measurement axis is precisely aligned with the force axis defined by the diverting geometry. If the sensor and its measurement axis are not precisely aligned with the force axis, then the effective measuring force F_{EM} needs to be calculated using the resulting force F_R and the deviation angle β (Figure 3)

$$F_{EM} = F_R \cdot \cos \beta$$

Nominal Measuring Range and Net Weight

The measuring roller's force of gravity F_G needs to be taken into account when determining the nominal measuring force, particularly when dealing with small nominal loads (Figure 4). The force component F_C of the vertically attacking force of gravity F_G which attacks in the direction of the sensor measurement axis is added (signed – and taking force directions into account) to the effective measuring force F_{EM} .

$$F_C = F_G \cdot \cos \mu$$

With a deviation angle of $\mu = 90^\circ$, the factor $\cos \mu$ becomes zero, and a force component F_C which acts in the sensor measurement axis does not occur (Figure 5). This fact can be put to use, especially if e. g. the output signal and – in consequence – the resolution would be degraded due to an unfavorable ratio of effective measuring force F_{EM} and force of gravity F_G .

The sum of effective measuring force F_{EM} and force component F_C may not be larger than the nominal measuring range (F_N) of the sensor.

$$F_{EM} + F_C < F_N > F_G$$

The weight force of the measuring roller causes a sensor signal which is electronically compensated at the measuring amplifier through a zero-point adjustment, so that the signal for the effective measuring force is always available as display or output value.

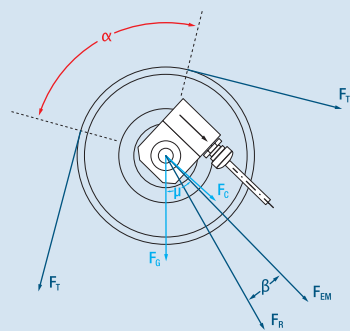


Figure 1:
Forces Acting at the Sensor Roller

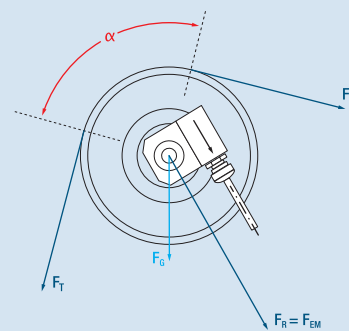


Figure 2:
Measurement = Force Axis

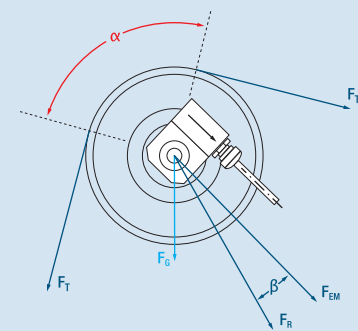


Figure 3:
Deviation of Measurement Axis from Force Axis

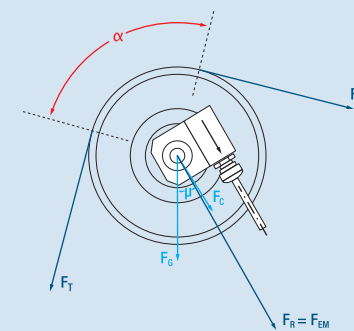


Figure 4:
 F_{EM} and F_C are added up

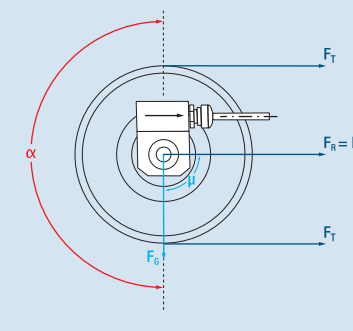


Bild 5:
 $\mu = 90^\circ$, $\mu \cos m = 0$, $F_C = 0$



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