IMTRON
Member of GHM GROUP

SIGNAL CONDITIONING
& DATA ACQUISITION
TSA MODULES

Analogue measuring technology – at its best! Precision in real time.

Signal conditioning with know-how.

Editorial. Specialists by competence.

Dear readers,

Anyone looking to lead in the global competition must be able to respond to changing demands with sophisticated and technically advanced products. Consequently, improved methods of validation of product characteristics are indispensable. This is where innovative measuring technology plays a key role.

For decades, the Imtron Center of Competence of the GHM GROUP has been delivering test stand measuring technology to the widest range of applications areas, including the development departments of automotive manufacturers and suppliers.

With our measuring technology, we record almost every variable to be measured and provide a better overview of development and production. Regardless of whether it involves the monitoring of slowly changing variables, such as temperature, or rapidly changing signals, such as speed or vibrations, all data is recorded with chronological synchronisation.

We would like to offer you a comprehensive overview of our signal conditioning systems in this brochure. We can also work with you to developed a tailored solution for your specific requirements.

Harald Feuerer | Imtron Location Manager | Member of Management

Pure analogue technology: precise and fast. Measuring technology – at its best!

The sensory organ of modern production.

To not only sharpen them, but also adapt them to rapidly changing production cycles, is one of the most important challenges for efficient industrial production. The Imtron Center of Competence GHM GROUP supplies your production with innovative measuring systems that operate with precision and extraordinary speed.

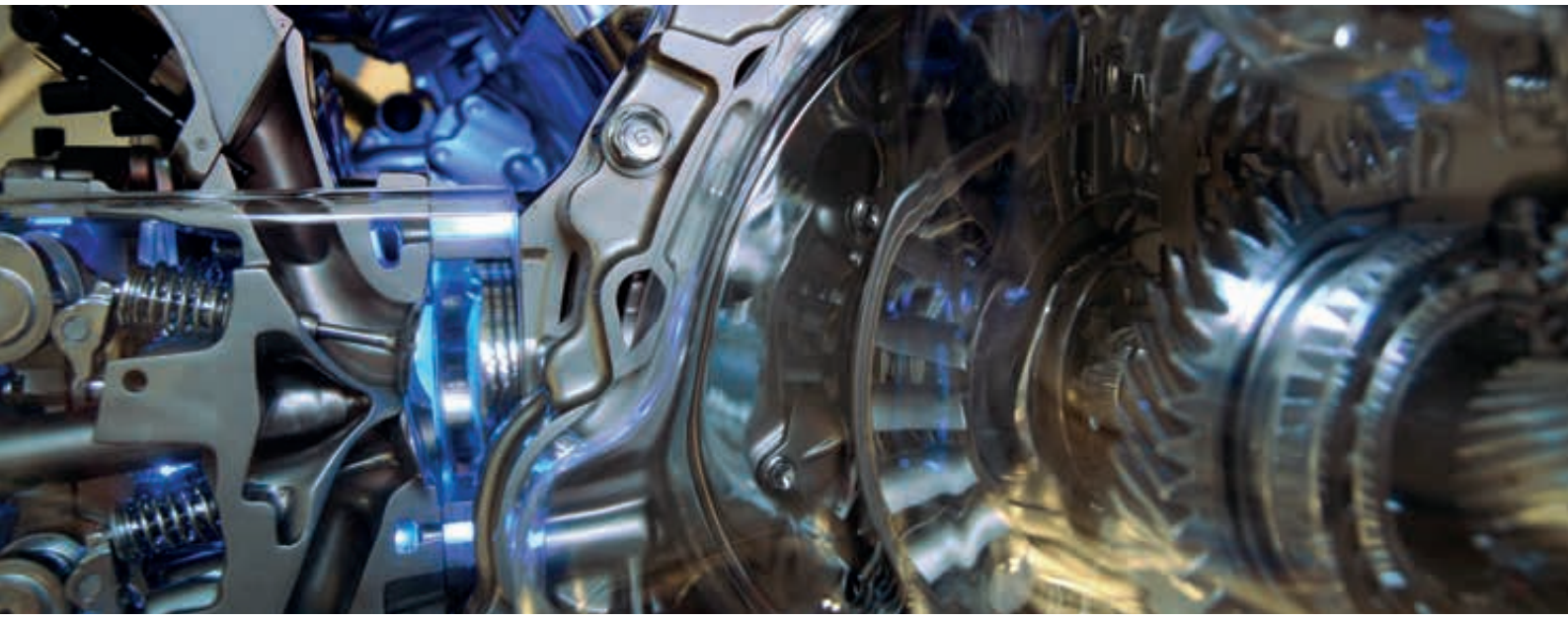
Signal conditioning

The detection and evaluation of the widest-ranging sensor values are prerequisite for a successful production and the smooth operation of devices, machinery and systems. In order to meet this requirement, high-quality signal preparation is required in many areas of application.

With our extensive expertise in signal conditioning and data recording gathered over decades, we have earned the trust of our renowned customers.

With the highest quality, innovative strength, outstanding service and continuous updating and improvement of our measuring technology, we offer first-class products and solutions.

This can apply to a test stand with several hundred channels or a laboratory measuring station with only a few channels. Our widely diversified product assortment offers the optimal solution for every area of application.



GHMGROUP
Specialists by Competence.

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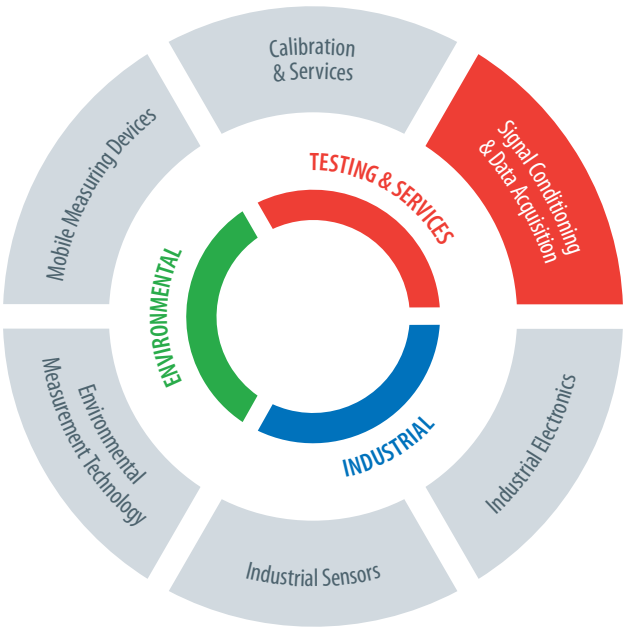


Purely analogue.

Signal conditioning – Precision in real time.

Signal conditioning across a wide front

Analogue signal conditioning is a time-tested method for processing, filtering, amplifying and galvanically isolating sensor data in high quality.

Whether in test stands for the automotive industry or in status monitoring in machine and plant construction, precise, secure and fast measurement data acquisition and high signal processing quality are always in demand.

The long-term stability of technology without reliance on software ensures smooth signal preparation of nearly every analogue sensor signal.

The TSA series of devices meets with demand with sophisticated, precise analogue technology. TSA is the designation for analogue rail modules and describes the design and technology of our devices.

Advantages of the TSA series

- **Cost reduction**
  Signal conditioning and galvanic isolation in one device, a separator isolator is unnecessary
- **High signal quality**
  Flexible interference suppression with replaceable filter modules
- **Speed**
  Limit frequencies of up to 30 kHz possible
- **Precision**
  High precision and long-term stability
- **Special requests**
  Tailored measuring ranges possible, even in small quantities
- **Service-friendly**
  Plug-in connection terminals ensure easy installation and quick replacement
- **User-friendly**
  No software necessary, easy commissioning
- **From a single provider**
  Modules available for all analogue sensor signals

TSA series. Uncompromising quality. Purely analogue signal conditioning.

Measuring transducers and isolating amplifiers

Not every signal can be forwarded "one-to-one" from downstream devices. Therefore, some signals must be adapted according to the use. This is the strength of analogue technology. Isolating amplifiers and measuring transducers with galvanically isolated circuits provide signals in the right form and help to suppress interfering influences within a system. The TSA series is distinguished by the following features and advantages.

- High-precision isolating amplifiers for suppression of interference and prevention of earth loops
- Pre-configured modules ensure quicker commissioning without programming work
- Galvanic isolation of power and signal electronics provides protection of downstream electronics
- High signal bandwidths of up to 30 kHz and power outputs of up to 200 mA are possible
- Outstanding for use in measurement applications with very low ripple of < 2 mVpp and an accuracy of 0.1 %
- Subsequent module adaptations in applications with plug-in filters
- Processing of standard signals
- Simple assembly on a carrier rail and simple wiring with interchangeable plug connector
- High-precision measuring transducers with integrated signal conditioning of a variety of different sensors such as DMS, potentiometers, Pt100, thermocouples, ICP and voltage and current signals

Challenging applications.
Signal conditioning.

Test stands for machine construction and the automotive industry

Acquisition of sensor signals in test stands – preparation and conversion of specific sensor signals into standard signals which are transmitted to superordinate test stand control and data acquisition units. Various filters depending on the area of application and sensor type are used to guarantee a high signal quality and eliminate interfering effects.

Status monitoring of machines and systems

Monitoring of status changes, e.g. safe detection of forces or vibrations arising on machines and plants and delivery to superordinate control for analysis and optimisation of processes.

Monitoring of wind turbines

Monitoring of forces and vibrations on moving parts, such as rotor blades or generators. Undesired frequency ranges are exited with implementation of specific parameters, such as the rotational speed of the rotor, and an optimal operating state is guaranteed.

Actuation of servo valves

Quickly reaction control modules are needed for activation of the servo valves required in a hydraulic application. The TSA modules operate autarkically and without time delay and can assume direct control of valves with a driver current of up to 200 mA.

TSA series. Purely analogue.

The Imtron Center of Competence has mastered this field for many years. Our modules can convert nearly any analogue sensor signal into standards signals that can then be processed, for instance, in a control unit for data acquisition in real time.

In order to prevent damage to systems or assemblies and guarantee high signal quality, inputs and outputs are galvanically from each other and the supply voltage and signals are filtered.

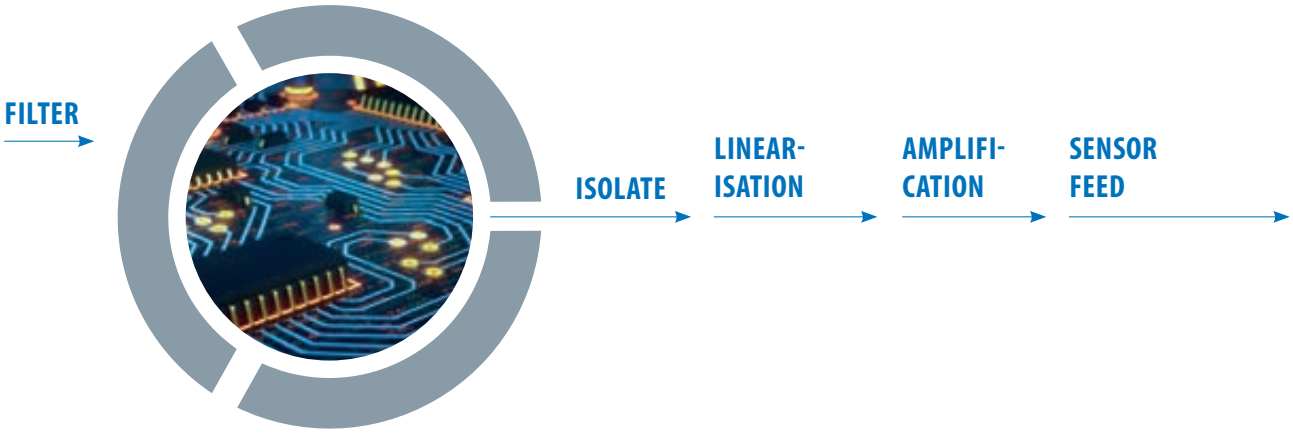
Tried and tested approach

The sensor signals are prepared, filtered and galvanically isolated by means of 3-way isolation with the signal conditioning modules of the TSA series. Interfering signals are suppressed and the signal quality is improved significantly with the interchangeable filter modules. Moreover, in addition to the preparation of signals, the TSA modules are simultaneously responsible for the feed to the sensor and the galvanic isolation between input and output signal and the voltage supply. The electronic components of the devices are protected from condensation in changing climatic conditions with a special coating on the printed circuit board. Therefore, the TSA modules are ideally suited for use for testing even in the most difficult conditions and remain cost-effective, because they combine signal conditioning and galvanically isolating amplifiers in a single device.

The signal conditioning suppresses interfering influences even in environments with electromagnetic interfering fields in automated measuring and control circuits, as well as for the protection of control units and AD converter cards.

Customised adaptations in every respect can also be implemented (such as measuring range, amplification factor, sensor feed, etc.).

TSA modules. Precise measurements in real time.



Flexible filters. Avoid interfering signals.

Various analogue plug-in filters are available for the TSA series devices.

Various frequencies between 1 Hz and 30 kHz and various filter characteristics are available. The filters can be designed as low-pass (standard), high-pass, band-pass or band-elimination. Therefore, the modules can be modified and used flexibly for numerous applications.

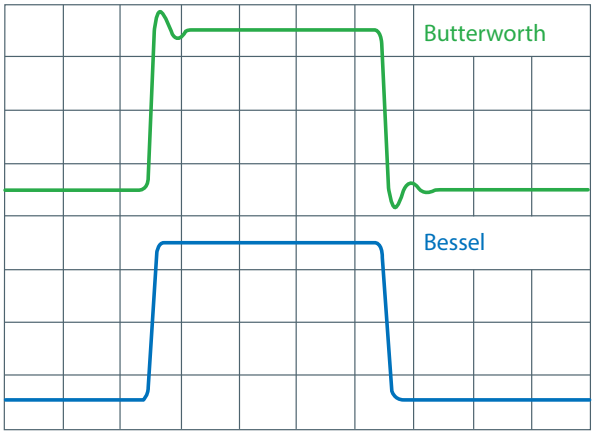
- **Low pass filter**
  Frequencies above the limit frequency are removed; only the lower frequencies pass through
- **High pass filter**
  Frequencies below the limit frequency are removed; only the higher frequencies pass through
- **Band pass**
  Frequencies above or below a defined frequency band are removed
- **Band stop**
  Frequencies within a defined frequency band are removed (e.g. for 50 Hz humming, frequency band 49 .. 51 Hz)

Order of a filter

The order of a filter describes the amplification reduction (attenuation and edge steepness) of frequencies above or below the respective limit frequency of the filter. Filters of a higher order can be created with connection of filters of a lower order in a series.

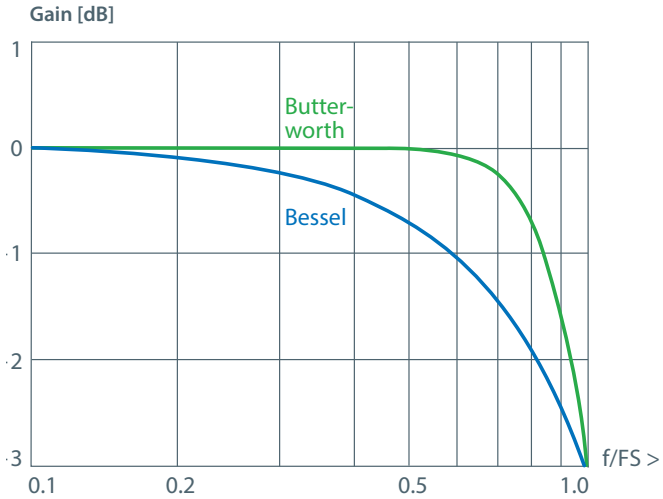
Filter basics. Filter characteristics.

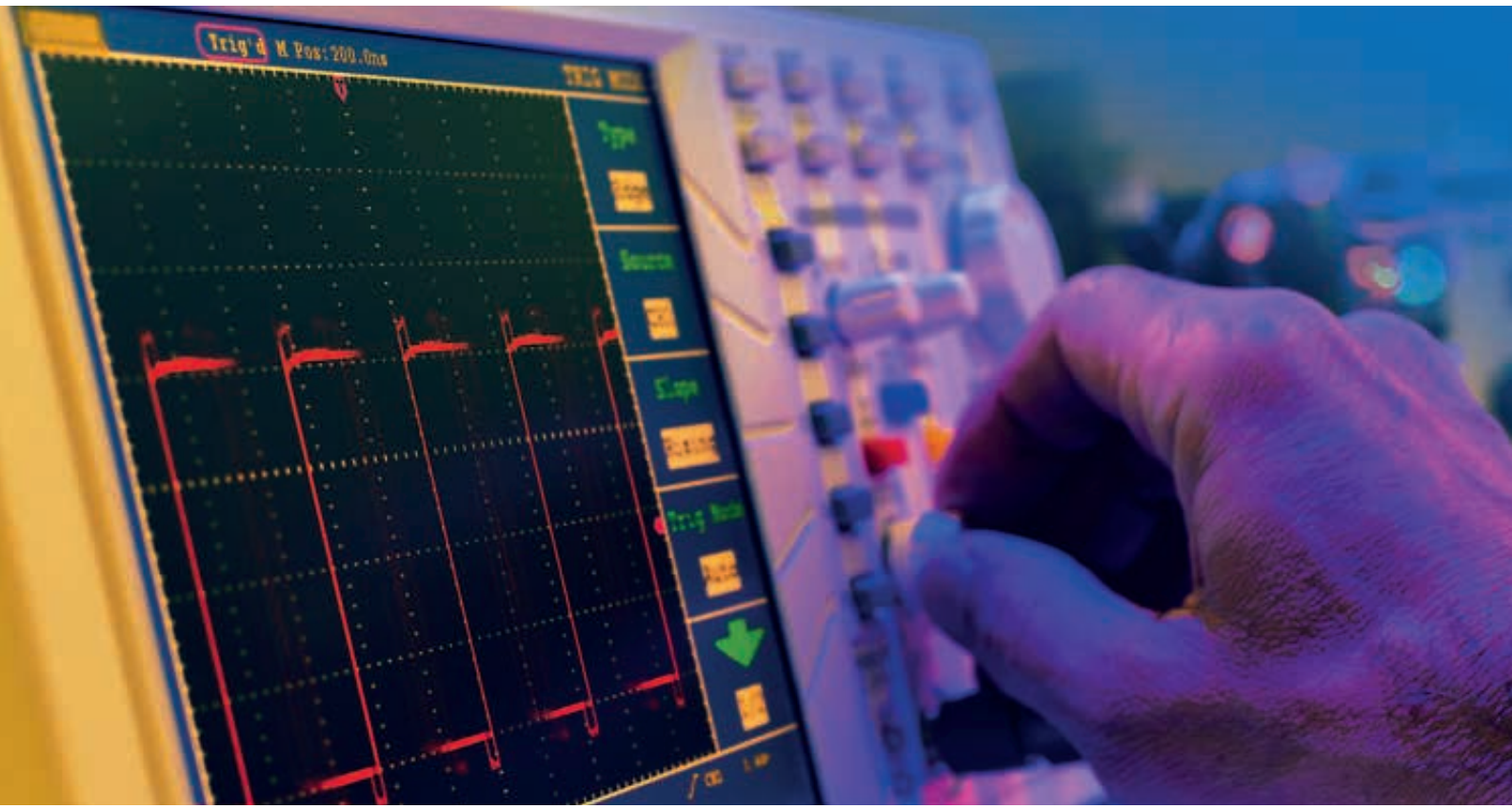
1



Channel #1: 5 V/div. Time basis: 2 ms/div.
Channel #2: 5 V/div. Low-pass: Fg = 1 kHz

2





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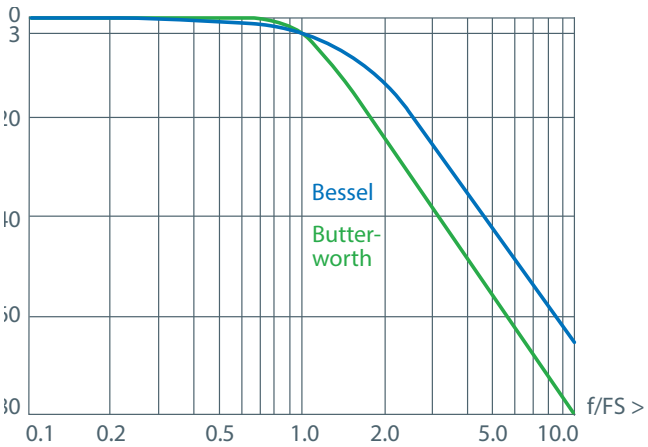


Figure 1:
For steep-edged signals, such as rectangles, Bessel is the better choice, because it has a minimal effect on the signal.

Figure 2:
Butterworth has an overshoot for steep signal edges, which can reach 11 % with filters of the 4th order. Bessel filters of the 4th order only oscillate 0.8 %, but do not isolate as sharply as at the transition from the passing range to the suppression range.

Figure 3:
The isolating effect of a filter increases in steepness at the transition from the passing range to the suppression range. In this case, Butterworth is clearly better than Bessel.

Technology. Basic configuration.

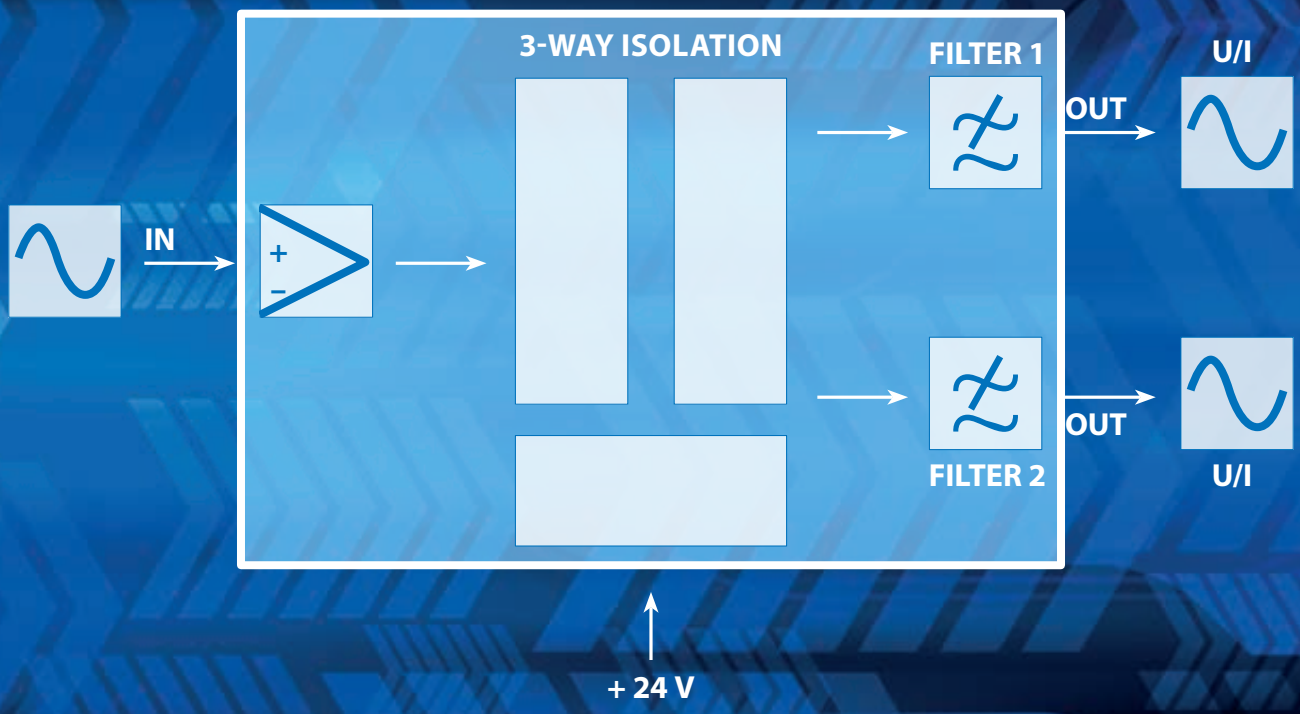
Basic configuration – example

The modules are designed for potential-free signal conversion and conditioning in automation and measuring technology. Each of the modules has 3-way isolation and offers flexible interference suppression with plug-in filters. They are designed as Butterworth or Bessel filters of the 4th order. Other orders and filter characteristics can be implemented on request.

With potential isolation and filter characteristics, the modules are especially well-suited for suppression of interfering influences in measuring and control circuits, for galvanic isolation of power and signal circuits, as well as for prevention of earth loops.

With a ripple of < 2 mVpp and a precision of 0.1 %, the modules are also suited extremely well for technical measurement applications.

The standard supply voltage is 24 V DC. An optional 12 V version is also available. The modules have plug-in connections for simple connection. The standard module width is 22.5 mm. The carrier rail design enables different TSA modules to be pushed on from the side, plugged in from above and locked without major effort as analogue plug & play units.



Product overview. Selection matrix.

The following overview should help you choose the right module for your application.

MODULE	TSA-FIL	TSA-FIL2-2	TSA-DMS	TSA-POTI	TSA-DC	TSA-PT100	TSA-TC	TSA-ICP	TSA-ICP2-2	TSA-PWR	TSA-RMS	TSA-IF	TSA-MATH
SIGNAL INPUT													
VOLTAGE	●	●			●					●	●		●
CURRENT	●	●			●					●	●		
DMS			●								●		
POTI				●									
PT100						●							
THERMO-COUPLES							●						
ICP®/ IEPE								●	●		●		
SPEED, PULSE												●	
STANDARD SIGNAL OUTPUT VOLTAGE OR CURRENT													
PLUG-IN FILTER	●	●	●	●	●	●	●	●	●	●	●		●
±10 V/ 0 .. 10 V	●/○	●/○	●/○	●/○	●/○	●/○	●/○	●/○	●/○	●/○	●/○		●/○
±20 MA 0/4 .. 20 MA	●/○	●/○	●/○	●/○	●/○	●/○	●/○	●/○	●/○				●/○
±200 MA 0 .. 200 MA										●/○			
TTL												●	

● Standard | ●/○ Standard / Alternative (combinations on request).
Subject to errors and changes.

TSA series. Standard modules.

From the standard to the speciality

The TSA modules offer the possibility of signal conditioning of standard signals and specific sensor signals. 3-way potential isolation takes place between signal input and output, as well as the supply voltage. The signals are also filter and a separate filter slot is provided for each output.

Technical features:

- Detection of: Voltage, current, DMS bridges, potentiometers, Pt100, thermocouples, ICP® / IEPE sensors
- Conversion of sensor signals to standard signals
- 3-way isolation
- Signal filtering can be adapted on commissioning by replacement
- Amplification and linearisation
- Sensor feed and bridge extension
- Optional second output with dedicated filter

Advantages:

- High-quality analogue signal conditioning
- High precision and speed
- Flexible filtering
- High bandwidth
- Optional second output for signal duplication

Standard modules. Overview.

MODULE	TSA-FIL	TSA-DMS	TSA-POTI	TSA-DC
AREA OF APPLICATION	Conditioning of standard signals	Conditioning of signals from DMS bridges	Conditioning of signals from potentiometers	Conditioning of AC/DC voltage signals
INPUT	0 .. 10 V/ ± 10 V 0/4 .. 20 mA / ± 20 mA	DMS bridges 4-/6-wire Full / 15half bridge Bridge resistances 120 .. 1 k possible	Potentiometer 3-/5-wire 350 .. 1000 Ohm	AC/DC voltage 0.1 .. 10 V
OUTPUT	0 .. 10 V / ± 10 V 0/4 .. 20 mA / ± 20 mA	0 .. 10 V / ± 10 V 0/4 .. 20 mA / ± 20 mA	0 .. 10 V / ± 10 V 0/4 .. 20 mA / ± 20 mA	0 .. 10 V / ± 10 V 0/4 .. 20 mA / ± 20 mA
ACCURACY	0.1 %	0.1 %	0.1 %	0.1 %
SENSOR FEED	–	5 V DC, customer-specific up to 10 V possible	5 V DC	–

MODULE	TSA-PT100	TSA-TC	TSA-ICP
AREA OF APPLICATION	Conditioning of signals from Pt100 sensors	Conditioning of signals from potentiometers	Conditioning of signals from ICP®/ IEPE sensors
INPUT	Pt100 4-wire	Thermocouple, type J, K, R, T	ICP sensors
OUTPUT	0 .. 10 V / ± 10 V 0/4 .. 20 mA / ± 20 mA	0 .. 10 V / ± 10 V 0/4 .. 20 mA / ± 20 mA	0 .. 10 V / ± 10 V 0/4 .. 20 mA / ± 20 mA
ACCURACY	0.2 %	0.2 %	0.1 %
SENSOR FEED	Constant current 1 mA	Compensation ± 0,5 °C	Constant current 4 mA

COMMON FEATURES OF THE TSA MODULES	
FILTER	Interchangeable filter modules; Bessel or Butterworth filters of the 4th or 8th order, limit frequency 1 Hz .. 30 kHz
ACCURACY	0.1 % of the measurement range end value
LOW-NOISE	Ripple < 2 mVpp
ISOLATION	3-way isolation
SUPPLY VOLTAGE	24 V DC ± 10 %
INPUT	Standard signals; sensor-specific signals
OUTPUT	2 outputs (2nd output via additional filter module); 0 .. 10 V/ ± 10 V; 0/4 .. 20 mA/ ± 20 mA; combinations possible

TSA series. Two-channel modules.

These modules basically offer the identical functions as the various standard modules with respect to signal conditioning of standard and specific sensor signals. The additional second output can be used for integration with PLC systems. It also permits connection of display units or end devices used for data acquisition. The incoming signals can be filtered and provided in a separate filter slot for each output. The two outputs can be operated with different filter characteristics.

Two-channel modules. Overview.

MODULE	TSA-FIL2-2	TSA-ICP2-2
AREA OF APPLICATION	Conditioning of standard signals	Conditioning of signals from ICP® / IEPE sensors
INPUT	0 .. 10 V / ± 10 V; 0/4 .. 20 mA / ± 20 mA	ICP sensors
OUTPUT	0 .. 10 V / ± 10 V; 0/4 .. 20 mA / ± 20 mA	0 .. 10 V/ ± 10 V; 0/4 .. 20 mA / ± 20 mA
ACCURACY	0.1 %	0.1 %
SENSOR FEED	–	Constant current 4 mA

COMMON FEATURES	
FILTER	Interchangeable filter modules per channel (Bessel or Butterworth filter: 4th or 8th order) Limit frequency: 1 Hz .. 30 kHz
ACCURACY	0.1 %
LOW-NOISE	Ripple < 2 mV_{pp}
ISOLATION	3-way isolation
SUPPLY VOLTAGE	24 V DC ± 10 %
	Mounting rail or front terminal
INPUT	2 inputs for standard signals or sensor-specific signals
OUTPUT	2 outputs; 0 .. 10 V / ± 10 V; 0/4 .. 20 mA / ± 20 mA; combinations possible

Two-channel isolating amplifier for ICP® / IEPE sensors

Technical features:

- Signal conditioning of highly sensitive Piezo electrical acceleration sensors
- 3-way isolation
- Replaceable filter modules for each channel
- Switchable amplification
- Integrated sensor feed
- Disengageable AC coupling
- Power supply via T-bus or front terminal

Two-channel isolating amplifier for standard signals

Technical features:

- Signal condition and conversion of standard signals
- 3-way isolation
- Replaceable filter modules for each channel
- Power supply via T-bus or front terminal

Advantages of two-channel isolating amplifiers:

- Space-saving 2-channel amplifier
- Independently configurable channels for maximum flexibility

TSA-ICP2-2

TSA-FIL2-2

TSA series. MATH, RMS and IF special modules.

Mathematical modules

Technical features:

- Mean value formation (TSA-RMS) of signals of voltage transmitters, DMS bridges, potentiometers, Piezo electric sensors and standard signals
- Mathematical linking (addition, subtraction, multiplication [power], division) of two voltage signals (TSA-MATH)

Advantages:

- Signal conditioning and mathematical preparation in one module and in real

Conversion of pulse signals to TTL

Technical features:

- Pulse formation of signals from pulse transmitters to TTL output

Advantages:

- Pulse formation with up to 3 channels in one module
- Optional open-collector output

MATH, RMS and IF special modules. Overview.

These TSA special modules calculate and link their input signal synchronously.

MODULE	TSA-RMS	TSA-MATH	TSA-IF
AREA OF APPLICATION	Signal conditioning and RMS formation	Linking of two voltage signals	Potential-free pulse formation
INPUT	Depending on the type; standard signals, DC, DMS, ICP/IEPE, potentiometer	0.06/ 0.15/ 10/ 20 V	Frequency (DC): 0 .. 50 kHz Voltage: 100 mV_{pp} .. 60 V_{pp}
OUTPUT	±10 V 0 .. 7.07 V (RMS)	0 .. 10 V/ ±10 V; 0/4 .. 20 mA / ±20 mA	TTL 5 V DC; Optional: Open collector
ACCURACY	0.1 %/ 2 % (RMS)	0.1 %	
SENSOR FEED	Integrated, depending on sensor type		

Mathematical modules

TSA-RMS
TSA-Math

Conversion of pulse signals to TTL

TSA-IF

TSA series. TSA-PWR special module.

Actuation of servo valves

Quickly reaction control modules are necessary for activation of the servo valves required in a hydraulic application.

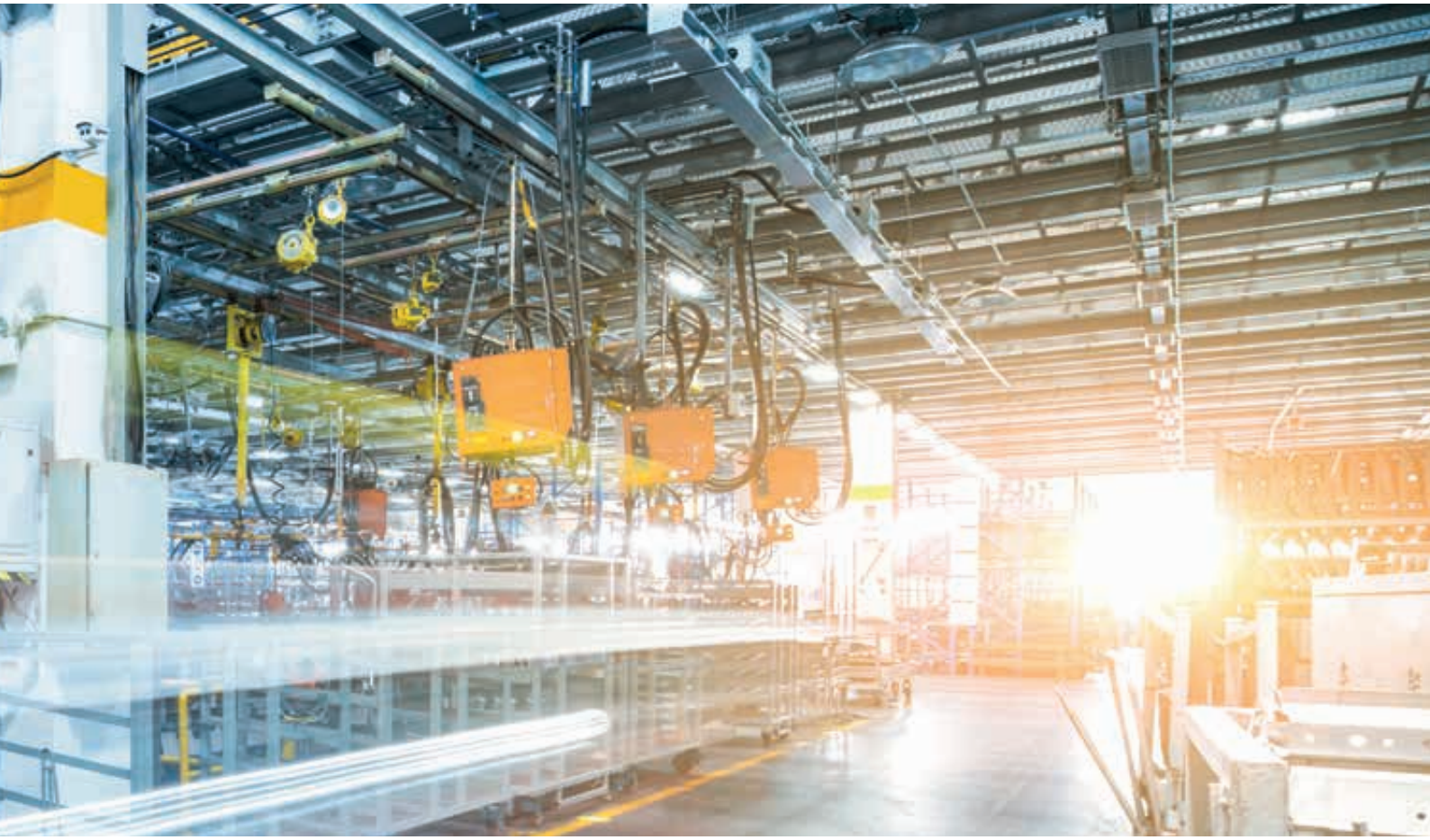
The signals of the control unit must be converted from standard signals into signals with higher power, because many servo valves require more than the 20 mA provided by the control unit.

Technical features:

- Basic equipment as standard modules
- Actuation of consumers with up to 200 mA/2 W with standard signal input

Advantages:

- Quick and local actuation of consumers with standard signals
- Quick and interference-free actuation with integrated filter technology
- Autarkic and local



TSA-PWR special module. Overview.

MODULE	TSA-PWR
AREA OF APPLICATION	Actuation of consumers with up to 200 mA
SUPPLY VOLTAGE	24 V DC ±10 %
	Mounting rail or front terminal
INPUT	0 .. 1 0 V / ±10 V; 0/4 .. 20 mA / ±20 mA
OUTPUT	up to ±200 mA; ±10 V (up to 200 mA / 2 W)
ACCURACY	0.1 %

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- Numerous certified partners

Europe

- 12 locations, including sales centers
- 5 production locations and specialized sales locations

Americas

- Subsidiary in São Paulo
- Qualified partners

Africa

- Subsidiary in Johannesburg
- Reliable partners

Your ideas and requests are our inspiration.
Challenge us.

The GHM Messtechnik GmbH Group was founded in 2009. However, the history of the traditional brands that are bundled under the umbrella brand goes back much further. In its current formation as the GHM GROUP, the enterprise is still obligated to the shared philosophy of the founders: Absolute customer orientation, speed, and first-class product quality!

Innovation with method: An increasing number of tasks in terms of the global economy and in technology reach the limits of feasibility and beyond. We meet this challenge with a broad-based enterprise structure

The Centers of Competence under the umbrella of the GHM GROUP cover a wide range of market-specific solutions for all important areas of application with their respective areas of expertise.

With the GHM GROUP our customers benefit from over 200 years of combined experience. With this expertise, our engineers at the various "Centers of Competence" are quickly and flexibly in a position to develop solutions that meet the specific requirements of our customers and are in-line with market demand.

It is an advantage of our enterprise, which is unrivalled.

GHMGROUP
Specialists by Competence.

GREISINGER	HONSBERG	Martens	IMTRON	DeltaOHM	VAL.CO
Center of Competence Portable Measuring Devices	**Center of Competence** Industrial Sensors	**Center of Competence** Industrial Electronics	**Center of Competence** Signal-Conditioning and Data Acquisition	**Center of Competence** Environmental Measuring Technology & Meteorology	**Center of Competence** Industrial Sensors

INDUSTRIAL

- Sensors for a variety of process variables such as temperature, flow, level and pressure
- Transmitters and isolators for various input/ output variables
- Indicators and controllers in various formats and performance classes

ENVIRONMENTAL

- Measuring stations for climate and environmental data with the connection to cloud-systems
- Mobile measurement technology for climate, water and gas analysis

TESTING & SERVICES

- Test bench measurement technology wit up to 40,000 measurement in the secondary
- Stationary and mobile systems for universal use
- Modular systems for individual adaption to the process needs

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07 / 2019 / en