

WHEEL BALANCING AND MONITORING SOLUTIONS ON GRINDING MACHINES

MARPOSS

When DITTEL was founded in 1959, it was involved with the development and series production of avionic components and power electronics. The company is now active in the fields of balancing and monitoring technologies. We provide our customers with individual advice in order to make their businesses more successful, covering topics from planning to training. We also pick up trends in our customers' markets and, in turn, develop new products in close co-operation with our customers. And ultimately, our network of highly effective alliances, industrial partners, university and research facilities, working groups and industrial associations, all serve to benefit you, the customer. Since the beginning DITTEL stands for precision, quality and reliability.

Since July 2012 Dittel Messtechnik GmbH is a part of Marposs S.P.A. and customer can now profit from the worldwide network of Marposs, present in 25 countries with sales offices and after sales service centers.

Marposs, established in 1952 by Mario Possati, is the leader supplier of precision instruments for dimensional and geometrical measurement of mechanical parts in the shop floor environment: gauges and control systems for machine tools, manual and automatic systems for manufacturing and assembly lines, hardware and software for data collection and process analysis, non destructive testing equipment and leak test systems, with particular reference to components of car engine, transmission and injection. The Headquarters and the main plant are located in Bentivoglio (BO-Italy).



Dittel - Landsberg am Lech (Germany)



Marposs - Bentivoglio (BO - Italy)

Using wheel balancer and sensors for monitoring, controlling grinding applications and dressing processes, the efficiency and safety of your grinding and combi-machines will increase. The wide range of balancing heads and sensors can be applied to grinding machines for internal or external grinding, centerless grinding, surface grinding, gear or tool grinding, resolving the most disparate application problems. Monitoring processes are essential when using CBN and diamond grinding wheels.

Depending on the type of grinding machines, for new machines or in case of retrofit on used ones, we have different possible applications for Balancing and Acoustic Emission Monitoring Systems in combination with Measuring system, touch probes and other monitoring systems (e.g. force, power, vibration, displacement, etc.).



Balancing & Process Monitoring



Measuring





Probing

Type of Grinding machine	Balancing	Acoustic Monitoring	Other Monitoring	Probing	Gauging
O.D. Grinders					
I.D. Grinders					
Centerless Grinders					
Tool Grinders					
Surface Grinders					
Double Disk Grinders					
Honing & Microfinishing	•				
Gear-Grinding-Worm	•				•

Functions	Sensitron 6	P1dAE
WB Chanel	-	-
Planes	-	-
AE-Input	2	2
AE Chanel	1	2
Balancing Algorithm	-	-
Spectrum	-	-
Pre-Balancing (in combination with a balancing		
head)	-	-
Manual Balancing	-	-
Acoustic Emission & Crash		
Envelope	-	-
Interface PC Software	static I/O	static I/O / RS232
Interface Visualisation		
Display		
Remote control	-	-
Functions	DS6000	DS7000
	FILER	
WB channel	1	2
Planes	1 or 2	2
AE-Input	1 or 4	4
AE channel	1	2
Balancing Algorithm	Trial & Error	deterministic
Spectrum	•	-
Pre-Balancing	•	in combination with P6000
(in combination with a balancing head)		
Manual balancing	•	•
Acoustic Emission & Crash	•	•
Envelope	•	in combinatiion with AE6000
Interface	I/O or Profibus	I/O or Profibus
PC Software 1001	Ethernet oder PS232	Ethernet
Remote control		

P1dWB	DS5000
1	1 or 2
1	1
1 (integrated in Wheel Balancer)	4
Trial & Error	1 Trial & Frror
-	
static I/O / RS232	static I/O
-	(Option: WinControl for 32 Bit Systems)
-	RS232
P7	Blú
2	2
1 or 2	1 or 2
2 or 4	2
Z Trial & Error	2 Trial & Error
•	•
•	•
static I/O and Profibus / Profinet	Profibus / Profinet
MHIS	Blú
Ethernet, RS232	Ethernet / HDMI
	5

Unbalance & Balancing

Balancing systems are based on a highly precise mechanical balancing head and a well-established balancing strategy. The use of balancing systems ensures that unbalances are detected early and dealt with in time. This in turn provides our customers with a constantly high level of workpiece quality and long machine and tool life.



Why should the grinding wheel to be balanced:

Optimally balanced grinding wheels and drive elements are essential for consistent high workpiece quality and increase the service life of the grinding wheel and the life of the grinding spindle. Setup times will be minimized.

Unbalance - results from?

Each body fixed on a rotating axis has imbalances that manifest themselves as vibrations or oscillation and noise.

Unbalances occur whenever the material is not distributed symmetrically of rotating bodies. Especially at high speeds this results in increased wear of vibrations. The unbalance can be either static or dynamic form. In most cases, both forms occur simultaneously.

How works balancing on grinding machines?

Through the ramp-up of the spindle and the rotation of the grinding wheel this will generate an unbalance which brings the grinding wheel to oscillate.

Even slight unbalances of the wheel or as well the clamping of flange will generate centrifugal forces specially for high rpm.

The vibration pick up will shown the vibration in μ m/ sec, and the balancing system will be detected and processed. The wheel will be balanced by adjusting the attaced masses (manual with weights or electromechanical with balancing head), as a kind of counterweight.

The balancing operation will repeated as soon as a new unbalance (set limit) is detected by the vibration sensor, or the grinding wheel is changed / renewed.

Benefits

the constant unbalance monitoring and continuous balancing or rebalancing leads to:

- desired workpiece surfaces (without chattermarks and wavy quality)
- low wearing of the spindle bearing
- prevents material fatique and prevent failure function of important parts
- machine & spindle downtime will shortened
- low erosion of grinding wheels
- and less dressing operations
- Machine and user are better protected



Trial & Error - Deterministic

Primarily developed for use on high precision grinding machines, the electronics enable detection, evaluation and monitoring of the unbalance on the spindles or unbalance of grinding wheels. Fast and precise compensation is peformed by a contactless balancing system - fully automated and at operating speed.

A distinction is made between the "Trial & Error" balancing method and the "deterministic" balancing method.

When using the 2-planel automatic balancing, the unbalance is measured and corrected on two levels, thus reducing the dynamic imbalance.

Trial & Error Balancing

By using the compensation masses on the balancing head, the system recognizes whether the masses are moving in the right direction and thus remove the unbalance.

In automaticmode the electronic will move the weights full-automaticly until the system reach the turn-off threshold or balance the wheel.



Plane 1

Plane 2

Deterministic Balancing

New balancing method with precalculation of the weight position of the balancing heads for targeted unbalance compensation.

Thanks to special electronics in the balancing head, the position of the weights can be transmitted by the DS7000 device.

This allows targeted possiblities to move the balancing weights - while the spindle stop or under rotation.





Pre-Balancing Systems

Unbalance is on machine tools the most common source of vibrations. Balancing of the tool holder and the spindle can be of great help. The unbalance on a pre-defined plane is detected during a pre-balancing cycle and subsequently compensated fixing or moving balancing weights on calculated position on the rotating table.

The electronics suggests the best balancing weight to be used out of a freely programmable weights' table. For the spread angular method the unbalance will be compensated while moving the weights on a 360° scale.

The fixed positions algorithm inside the P6000 units is used to determine the best positions out of a maximum of 24 in which to fix two or three weights. The electronics offers also a continuous monitoring function of the vibration level of the rotating table.

The DS6000 electronic can be programmed, used and its functions visualized through the machine control unit or any Windows based PC. The signals can be exchanged to and from the machine via a Profibus or static I/Os connection.



Automatic Balancing Systems

The mechanical balancing system for the detection, counterbalancing and compensation of unbalances consists of a balancing head, a highly precise acceleration pick-up and the electronic module. Depending on the design of the balancing head it is possible to integrate an Acoustic Emission sensor. So the extension of the system by an Acoustic Emission Module due to modular design is easily made. This further optimizes the overall performance.

Electromechanical balancing heads can be mounted either in or, using customer designed flanges, on the end of the grinding spindle. The balancing heads are compact, cover a wide range of balancing capacities and are suitable for high RPMs. Signals and power are transmitted without physical contact, eliminating the need for virtually all system maintenance. Acoustic emission sensors can be integrated into the balancing head, significantly increasing the range of functions - and the benefits to the customer.



WB electronic unit		1 Plane	2 Plane
Automatic Balancing	Mechanical Trial & Error Mechanical Deterministic Hydro	P1dWB M5100M (M5100MA*) M6000** P7WB (P7 WB/AE*) Blú H6000**	2x M6000** P7WB (P7WB/AE*) Blú M7002 (MA7002)
Pre balancing		M5100 Software DS6000 Licence Key-Pre- Balancing	DS6000 Licence Key-Pre Balancing

* Also as special hardware type with integrated AE function available

Transmission system for balancing heads (FT)



Retractable contacts (FTR)

The contacts which transmit power to the balancing head are normally open and rre only closed during the balancing cycle. The retractable contacts provide maintenance-free performance, and a long life.

No Acoustic Emission signal detactable.



Attached transmitter (AT)

The attached transmitter is directly connected to the balancer. The signal transmission will be contactless. Easy to mount and with acoustic emission sensor and integrated RPM sensor possible.



Non-Contact Power Transmission (CT / CG)

The inductive power transmission will be directly mounted on the balancer. The contactless tranmission is maintenance free and could get with an integrated rpm-sensor as well.

The balancing head can be equipped with integrated AE-sensor.

Electromechanical balancing heads - Flange Type (FT)

Applications:

For all grinding machines without automatic quick change

Advantages:

- Suitable for retrofitting
- RPMs up to 12,000 1/min
- Easy to assemble
- Compact design
- No maintenance
- AE sensor can be integrated



Flange type balancers (FT) are installed in front of the grinding wheel, outside the spindle. FT balancers are usually used on simple and economical grinding machines, without automatic grinding wheel change. They are very easy to install and therefore ideal for retrofitting and can be fitted with an acoustic sensor to check the grinding process.

			Maximum RPM			
Model	Out. Diam. Ø [mm]	Capacity max. [cmg]	Retraction (FTR)	Contactless/GAP (CG)		Attached Transmissi- on (AT)
					Electronic	
			Marposs*	Marposs*	Dittel**	Dittel**
FT 50	50	320	-	-	12000	-
FT 70	70	550	-	-	11000	10000
FT 80	80	800	4000	10000	10000	10000
FT102	102	2.300	3000	5500	5500	5500
FT122	122	4.400	2000	4000	4000	4000
FT142	142	7.400	1700	2000	2000	2000

* Marposs Transmission System is suitable for interconnection with P1dWB, P7, Blú systems

** Dittel Transmission System is suitable for interconnection with all 5000 and 6000 systems



Electromechanical balancing heads - Spindle Type (ST)

Applications:

For all grinding machines with a frontal spindleboring

Advantages:

- Balancing head in the centre of imbalance
- RPMs up to 30,000 1/min
- Minimum interference
- No maintenance
- AE sensor can be integrated
- Non-contact power transmission



			Maximum RPM	
Model	Out. Diam. Ø [mm]	Capacity max. [cmg]	Contactless/GAP (CG)	
			Ele	ectronic
			Marposs*	Dittel**
ST 24	24	25	-	24000
ST 28	28	50	-	20000
ST 30	30	80		30000
ST 32	32	100	-	19000
ST 38	38	400	20000	20000
ST 42	42	640	15000	15000
ST 50	50	1300	10000	10000
ST 55	55	1500	8500	8500
ST 60	60	2200	7500	7500
ST 70	70	3300	6000	6000
ST 81	81	8500	1400	1400

* Marposs Transmission System is suitable for interconnection with P1dWB, P7 and Blú systems ** Dittel Transmission System is suitable for interconnection with all 5000 and 6000 systems

Model	Out. Diam. Ø [mm]	Capacity max. [cmg]	Electronic M7002/MA7002	
				max. RPM
ST 42	42	2x 640	customer made	15000
ST 50	50	2x 1300	customer made	10000
ST 55	55	2x 1500	customer made	8500
ST 60	60	2x 2200	customer made	7500
ST 70	70	2x 3300	customer made	6000



contactless transmission & mounting









Contactless transmission

The contactless transmission could be done on spindle end or directly mounted on the balancer in front of the spindle. The contactless transmission is maintenance free and could be done with an integrated rpm-sensor and Acoustic Emission sensor.



For fixing the balancers into the spindle, there are the possibilities to use a flange mounting system or a clamping flange system to tighten the balancer into the spindle bore.

The multide possibilities of flange design allow to fix the balancer convenient in customer made spindle bore.









P1dWB

The P1dWB is the entry-level system for grinding wheel balancing and process monitoring for grinders.

The P1dWB system can manage a single balancing head, and simultaneously an built-in acoustic sensor (if present) both for FT and ST models. As well as being retro-compatible with the E78 and E82 electronic units, the P1dWB system performs the pre-balancing and the spectral analysis of the imbalance. The data and settings management is rendered safe thanks to the multi-level login function and the quick resolution of the problems is guaranteed by the auto-diagnostic function.

Functions	P1dWB
Channels WB	1
Planes	1
AE-Input	1 (integrated in wheel balancer)
AE Channels	n.a.
Balancing Algorithm	Trial & Error
Spectrum of Vibrations Sensor	•
Pre-Balancing (in combination with WB-Head)	•
Manual Balancing	n.a.
Acoustic Emission & Crash	
Interface	static I/O
PC Software Tool	n.a.
Interface connection	RS232
Display	4,3" LCD touch screen

The P1dWB system meets the modern ergonomics criteria and is completed with a 4.3" touch-screen compatible with hostile environments, typical of mechanical machining.

The P1dWB electronic unit is available in 3 versions: rack, standalone and remote panel and it can be installed outside the machine tool or integrated in the operator panel.

A software tool is supplied, for data backup and restore operations and to facilitate SW updating.

Technical specifications:

- Power supply: 24V DC
- Operator panel: 4.3" touch-screen
- I/O logic interface
- PC connection: RS232



Optionen	Mounting	Module	Transmission system	WB-Head
P1dWB	with DIN-Rail or Mounting Plate	Stand alone or blackbox unit with visualisation on Machine control Rack or cabinet	Retraction CL Trial & Error	FT & ST









DS5000-System

Functions

Spectrum of Vibrations Sensor Pre-Balancing (in combination

Acoustic Emission & Crash

Channels WB

AE Channels

with WB-Head) Manual Balancing

PC Software Tool

Interface connection

Interface

Display

Balancing Algorithm

Planes

AE-Input

The DS5000 combines the monitoring and control electronics needed for electromechanical balancing and the evaluation of data generated by highly senitive acoustic emission sensors, in order to optimize grinding and dressing processes. The device is controlled via the menu displayed on an illuminated, monochrome LCD monitor.

M5100 - System

1 (2)

1

up to 4

1 (2)

Trial & Error

static Interface

WinControl SW

RS232 LCD

Basi	ic f	un	cti	or	IS:

- Fully automatic grinding wheel balancing
- Static interface (digital I/O's) to machine controls
- Field balancing
- Presentation of grinding spindle's frequency spectrum
- Four AE sensors and a voltage sensor can be conntected

- Prolongs the operating life of individual machine components (spindle, grinding wheel etc.)
- Optimization of grinding and dressing process, improving workpiece quality and making the grinding machine more cost efficient



n
AT
FT & ST rror
n AT FT & ST rror



DS6000-System

The M6000 electromechanical balancing control electronics is for use in precision machine tools. The M6000 measures the amount and position of any grinding wheel imbalance. Compensation is performed during grinding breaks using electromechanically adjusted balancing weights - with high precision, contact free and at operating RPMs.

Functions	M6000- System
Channels WB	1
Planes	1 & 2
AE-Input	in combination with AE6000
AE Channels	in combination with AE6000
Balancing Algorithm	Trial & Error
Spectrum of Vibrations Sensor	Software key
Pre-Balancing (in combination with WB-Head)	Software key
Manual Balancing	Software key
Acoustic Emission & Crash	in combination with AE6000
Interface	static Interface & Profibus
PC Software Tool	DSCC SW
Interface connection	RS232 or Ethernet
Display	-

Basic functions:

- Fully automated grinding wheel balancing •
- Profibus and static interface to machine • controls
- Compatible with previous M5000
- Improved balancing strategy
- Series set-up of multiple modules with all parameters

- Optimization of workpiece quality •
- Prolonged operating life of individual machine components (spindle, grinding wheel etc.)
- Grinding machine is more cost efficientefficient •



Optionen	Mounting	Module	Transmission system	WB-Head
M6000 with RS232 M6000 with Ethernet M6001, RS232 for active Vib. Sensor M6001, Ethernet for active Vib. Sensor	with DIN-Rail or Mounting plate	Stand alone Blackbox unit with Visualisation on Windows based machine control or with external Remote control RC6000 / PC6000	CL & AT Trial & Error	FT & ST



DS7000-System

Primarily developed for use on high precision grinding machines, the M7002/ MA7002 units enable detection, evaluation and monitoring of the unbalance on two spindle bearings. Fast and precise compensation is performed by a dual plane external or internal non-contact balancing system - containing electromechanical adjustable compensating weights (balancing heads) fully automatic and at high operating speed.

Functions	M7002- System
Channels WB	2
Planes	2
AE-Input	up to 4
AE Channels	2
Balancing Algorithm	Deterministic
Spectrum of Vibrations Sensor	_
Pre-Balancing (in combination	
with WB-Head)	_
Manual Balancing	in combination with P6001
Acoustic Emission & Crash	
Interface	Profibus
PC Software Tool	USCC
Interface connection	Ethernet
Display	-

Basic functions:

- Predefined, individual adjustable user levels are provided
- combination with DS6000 modules possible
- implement the DITTEL-USCC via Active-X

- The new deterministic balancing algorithm
- Unit controls the balancing heads directly, as well as in stationary position or in rotation.



Optionen	Mounting	Module	Transmission system	WB-Head
M7002 2-Plane Balancing MA7002 2-Plane Balancing with Acoustic Emission	with DIN-Rail or Mounting plate	Stand alone Blackbox unit with Visualisation on machine control	CL Deterministic	ST



Hydro-balancing

Installation options:

- Balancing tank mounted before grinding wheel, nozzle unit mounted in protective cover
- Balancing container mounted behind the grinding wheel, nozzle unit mounted on spindle housing
- Balancing chambers integrated into grinding wheel flange, nozzle unit mounted on wheel housing or protective cover

Applications:

- For all grinding machines with automatic grinding wheel change
- For spindles where a standard balancing head cannot be mounted

Advantages:

- Simply to retrofit
- Flexible design
- RPMs up to 20,000 1/min

The hydro-balancing system can be used on any grinding machine. The imbalance is compensated for by injecting coolant or oil in 3 or 4 balancing chambers, which are integrated into a balancing container or directly into the grinding wheel flange.

The balancing container can be delivered in various designs depending on the specifications of customers' machines. This makes it very easy to retrofit the system on older machines which did not have any integrated automatic balancing system till now.









Chambers Hydro-Ring

Hydro-Tank in front of spindle

Hydro-Tank included in wheel flange

Hydro-Retrofit HBA4000R

The Hydro-balancing system HBA4000R is for retrofit of our worldwide known 19-inch rack mounted units HBA3001 and HBA4000 units.

Primarily developed for use on high precision grinding machines, the HBA4000R enables detection, evaluation and monitroing of unbalance. Fast and precise compensation of the unbalance is performed by means of liquid media (coolant or oil). It is injected by nozzles into a 3- or 4-chamber circular tank, which is mounted to the rotating wheel flange - balancing is done fully automatically, contactfree and at operating speed.



Easy Retrofit with 19-inch rack

H6000

The H6000 hydro-balancing control electronics have been developed especially for use in precision grinding machines not equipped with a balancing system at the centre of the grinding spindle. The H6000 continuously measures the amount and position of any grinding wheel imbalance during breaks in the grinding process and calculates the amount and position of the compensation weight. Cooling lubricant is then injected into one of the chambers of the balancing container - with high precision, contact free, fully automated and at operating RPMs.

Functions	H6000- System	
Channels WB	1	
Planes	1	
AE-Input	in combination with AE6000	
AE Channels	in combination with AE6000	
Balancing Algorithm	Trial & Error	
Spectrum of Vibrations Sensor	Software key	
Pre-Balancing (in combination	Software key	
with WB-Head)	Software key	
Manual Balancing	-	
Acoustic Emission & Crash	in combination with AE6000	
Interface	static Interface & Profibus	
PC Software Tool	DSCC SW	
Interface connection	RS232 or Ethernet	
Display	-	

Basic functions:

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- Grinding wheel balancing is fully automated:
- Profibus and static interface to machine controls
- Improved balancing strategy
- Series set-up of multiple modules with all parameters

Additional functions:

- Field balancing
- Presentation of grinding spindle's frequency spectrum
- Also for retrofit with external remote control

- Optimization of workpiece quality
- Prolonged operating life of individual machine components (spindle, grinding wheel etc.)
- Grinding machine is more cost efficient



Optionen	Mounting	Module	Transmission	Balancing medium
H6000 with RS232 H6000 with Ethernet H6001, RS232 for active Vib. Sensor H6001, Ethernet for active Vib. Sensor	with DIN-Rail or Mounting plate	Stand alone Blackbox unit with Visualisation on WindowsR based machine control or with external Remote control RC6000 / PC6000	Nozzle unit Trial & Error	3- / 4- Chamber inside Tank



When removing material from workpiece (e.g. during grinding), a noise acoustic emission is generated in the machine elements that are involved in the process – an emission that consists of measurable frequencies mainly in the ultrasonic range. These frequencies are detected by AE sensors and rapidly analyzed, assessed and visualized by the diagnosis and monitoring systems to determine the current state of workpiece quality, tool wear and the machine itself. Whether a machine breaks down or stays in operation depends to a great extent on knowing about the faults that can arise. The sensors used by the system must therefore meet very high standards. We offer a wide variety of highly sensitive static or rotating AE sensors (with non-contact signal transmission) that can detect even the slightest signal deviation, enabling you to tap into the full production technology potential of your machine tools and to systematically reduce process costs. The outstanding signal-to-noise ratio of AE sensors ensures that your processes are as stable as possible.

Acoustic Emission:

The cutting process also generates vibrations at the point of contact between the tool and the workpiece. These vibrations manifest themselves as sound. The sound waves consist of and transport kinetic energy that changes the stress in the material and, in turn, leads to short-term plastic deformations, shifting and displacements in the nanometer range. The dynamic displacements generate high-frequency vibrations known as acoustic emissions (AE) that can be detected beyond the point of direct contact between tool and workpiece with the aid of the piezo effect, and are measured as changes in electrical potential.

The acoustic emissions (also known as structural noise, depending on the medium in which they are disseminated) are inaudible, ultrasound signals. The electrical signals measured in this way consist of characteristic frequencies and sound amplitudes that are specific to the cutting operations and can therefore be used to monitor the process.





Potential uses



Process optimization

Via powerful software and analyze tools you can optimize your processes and minimize processing time while maintaining the same level of quality.

First detection

By evaluating the AE signal, it is possible to detect the tool or workpiece first contact position to the micrometer, thus reducing non-productive "air grinding" time.

Collision monitoring (Crash Control) Tool collision is detected as quickly as possible, helping to avoid or minimize further damage to the machine.

Process visualization

When the process is visualized on the display, the process technologists are in a position to make conclusions about the course of the process, to observe it and carry out process and error analyses.

Grinding & Dressing Process

Grinding process monitoring close to the action

In order to record the signals as close as possible to the grinding process, it is important to find the right AE sensor for the application. Especially with high speed, it is particularly important to record the Acoustic Emission signals directly on the grinding process in order not to distort the useful signals by other disturbing noises (for example bearing noise).

Depending on the application and machine, we have a wide range of AE sensors in the program that can be installed on or in the spindle. Even if the sensors could not located directly on the grinding spindle, it is possible to record the signals for process monitoring on the tool spindle or with a fluid sensor. There are also suitable sensors for the different dresser and dressing spindles.

Only with a suitable and designed AE sensor for the application, all advantages can be exploited. In order to achieve the best possible process utilization, it is important to detect the first contact between grinding wheel and workpiece, to shorten the grinding time by delivering quickly ("air grinding" reduced) and thus the maximum grinding performance is achieved as quickly as possible. The AE curve, which can also be extended with an envelope, helps you to analyze the process even further. Also avoid major damage on tools or spindles with crash-control monitoring. A collision is detected as quickly as possible and switch off the machine quickly.

Improve your process monitoring and keep an eye on it before anything changes in the grinding process, thus improving process reliability, increasing quality and reducing rejects in your production.







With the envelope function the dressing cycle will be proceed as long as the AE-signal is inside the teached envelope curve

Static AE-Sensor



Types	Dimensions [mm]	Thread/ Fastenings	Non-contact signal transm.	Active preampli- fication possible
S - Sensor	ø 21 x 24.5	M 6		
Mini-S Sensor	ø 15 x 23	M 4		
Mini-S Sensor MAG	ø 21 x 34.5	magnet		
Micro-S-Sensor	ø 8 x 20	M 3		
SF-Sensor	45 x 30 x 17 D 45 x 30 x 15 M	2 x M 5		
Mini-SF-Sensor	29,5 x 20 x 10			
Magnet Sensor	ø 40 x 40	magnet		



Types:

- S-Sensor
- Mini-S Sensor
- SF-Sensor
- Magnetic Sensor
 - Mini-Magnetic Sensor
 - Micro-S Sensor

Applications for example:

- Stationary dressing tools:
- Single point diamond
- Blade type diamond

Appropriate sensor position:

- On the workpiece headstock
- On the tailstock
- On the machine's headstock

Additional functions:

 Monitoring of dressing and grinding processes

- Easy to assemble
- High signal quality





Fluid AE-Sensor

The AE fluid sensor is the latest addition to the company's range of AE sensors for grinding process optimization. The acoustic emission is transmitted in the opposite direction to the flow of coolant from the machine's system (either grinding oil or cooling emulsion). By electrically and acoustically isolating the AE fluid sensor from the machine tool, We have managed to suppress the machine's background noise.



AE-Signal while dressing process with AE-Fluid-Sensor



Signal transmission:

- From the workpiece
- From the tool
- From the workpiece headstock
- From the workpiece holder

- Easy to assemble & suitable for retrofitting
- Unsusceptible to the electromagnetic interference generated by the machine itself
- Connects all AE evaluation systems without additional preamplifier



Rotating AE-Sensor

M- and Mini-M-Sensor:

Applications for example:

Dressing rotating dressing tools:

- Form roller
- Profile roller •

Sensor position:

- On the grinding wheel spindle •
- On the grinding wheel flange •

Additional functions:

Monitoring of dressing and grinding processes

Customer benefits:

- Simple to assemble •
- Measurements on the rotating shaft provide optimal signal to-noise ratio



Micro-M-Sensor:

Applications for example:

Dressing rotating dressing tools:

- Form roller
- Profile roller

Sensor position:

- In the wheel spindle
- In the dresser spindle •

Additional functions:

Monitoring of dressing and • grinding processes

Customer benefits:

Proximity to process and large signal recording area provide high signal quality

Types	Dimensions [mm]	Thread/ Fastenings	Non-contact signal transm.	Active preampli- fication possible	
Mini-M - Rotor	ø 14 x 9.6	M 4	•		E
Mini-M - Stator	ø 20 x 14		Elene -		1
M sensor (rotor)	ø 21 x 14.2 ø 25 x 11,5	M 6	•	٠	
M reciever (stator)	ø 21 x 18 ø 25 x 23		The second	-	
Micro-M Rotor	customer specific	customer specific	The second	Se C	6
Micro-M Stator	customer specific	customer specific			1 million

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Ring-Sensor:

Applications for example:

Dressing rotating dressing tools:

Form roller

Profile roller

Sensor position:

- On the chuck
- On the grinding wheel spindle
- On the grinding wheel flange

Additional functions:

 Monitoring of dressing and grinding processes

Customer benefits:

 Direct contact to dressing or grinding tool ensures highest signal quality





Types	Dimensions [mm]	Thread/ Fastenings	Non-contact signal transm.	Active preampli- fication possible
Ring-Rotor	customer specific	customer specific	•	•
Ring-Stator	customer specific	customer specific	•	







Sensitron 6

The Sensitron6 is an AE evaluation electronics that can help to monitor and stabilize complex grinding processes. The high performance grinding process monitoring and control electronics are easy to integrate into the machine controls where they evaluate the signals detected by the highly sensitive AE sensors. The Sensitron6 reliably detects the initial contact between the grinding tool and workpiece, detects spark-up and automatically changes the feed rates in order to reduce air grinding time without loss of quality. An integrated crash monitoring function within the working space is a useful security measure that can minimize the costs arising due to collisions. One can select the sensors and operate the evaluation electronics either manually via push buttons or fully automatically via the machine controls. The AE signal is displayed on a LED bar graph (with 30 graduations).

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Functions	Sensitron 6
AE-Input	2
AE Channels	1
AE signal view	LED's
Grinding Process control	
Dressing control	
First contact & GAP reduce	
Crash control	
Interface	I/O serial
PC Software Tool	-
Envelope function	-
Interface visualisation	-
Display	LED's



Optionen	Mounting	AE-Signal view	AE-Sensor
Sensitron 6	in Mainframe	Stand alone unit with LED's on front panel	all passive AE-Sensor



S6000

For the automation of grinding- or dressing sequences it is more and more important to optimize the process and safe workpiece quality. The acoustic emission (AE) signal is an ideal and safe quality of criterion for evaluation.

The AE-Signal of the S6000 will be visualizes over optical LED's over the WINDOWS based machine.

Functions	S6000
AE-Input	2
AE Channels	1
AE signal view	LED view
Grinding Process control	
Dressing control	
First contact & GAP reduce	
Crash control	
Interface	I/O & Profibus
PC Software Tool	DSCC
Envelope function	-
Interface visualisation	RS232
Display	-





Optionen	Mounting	AE-Signal view	AE-Sensor
S6000	with DIN-Rail or Mounting plate	Stand alone Blackbox unit with Visualisation on WindowsR based machine control	all AE-Sensor
		or with external	
		Remote control PC6000	



AE6000 Basic

Constantly top quality, automation, increasing of productivity, reduction of downtime - these are the requirements for manufacturing processes. That can be solved with highly sensitive sensors and intelligent evaluation devices.

For grinding or dressing processes, is the AE-signal (Acoustic Emission) a safe and suitable evaluation criterion for this.

The AE6000 Basic impresses with its simple operation, which is fully automatic, controlled by the machine control.



Functions	AE6000 Basic
AE-Input	2
AE Channels	1
AE signal view	optical LED
Grinding Process control	•
Dressing control	•
First contact & GAP reduce	
Crash control	
Interface	9pol. I/O
PC Software Tool	-
Envelope function	-
Interface visualisation	-
Display	-

Optionen	Mounting	AE-Signal view	AE-Sensor
AE6000 Basic	with DIN-Rail or Mounting plate	only via LED on module	all AE-Sensor





P1dAE is an easy to use monitoring system for grinding machines, whose operation is based on checking acoustic signals.

The P1dAE system is able to satisfy various requirements such as the continuous control of the grinding and dressing processes and it can minimise the damages in case of collision in the work area. Up to two acoustic sensors, managed contemporaneously can be connected and there are four logic channels available to analyse the signal. The level of the signal received is checked and it can be read on the graphic display with 4.3" touch screen, compatible with hostile environments, typical of mechanical machining.

P1dAE works at a frequency interval between 4 KHz and 1000 KHz, the auto setup function is used to select the most suitable band width. P1dAE is an autonomous system available in the rack version, for machine cabinet or remote panel.

A SW tool is supplied, for data backup and to restore operations and to facilitate SW updating. The SW tool can also act as the Human Interface if the system is to be used via a personal computer rather than the panel.

Technical specifications:

- Power supply: 24V DC
- Management of two acoustic sensors
 (contemporaneously)
- Bandwidth: up to 1000 KHz
- Auto setup for an improved selection of the bandwidth

Functions	P1dAE
AE-Input	2
AE Channels	1
AE signal view	curve
Grinding Process control	
Dressing control	
First contact & GAP reduce	
Crash control	
Interface	static I/O
PC Software Tool	n.a.
Envelope function	-
Interface visualisation	-
Display	4,3" LCD touch screen



Optionen	Mounting	Module	Signal view	AE-Sensor
P1dAE	with DIN-Rail or Mounting Plate	Stand alone or blackbox unit with visualisation on Machine control Rack or cabinet	AE curve	all AE-Sensor









AE4100-System

The 4100 series is ideal for visualising and monitoring grinding processes on grinding machines where the machine controls are not equipped with their own monitor. The use of acoustic emission systems enables the user to optimize the grinding and dressing process, to reduce air grinding and to monitor for collisions between grinding wheel and workpiece. The entire 4100 series is menu-controlled (in 5 languages) via the displays on an illuminated, monochrome LCD monitor.

The electronics evaluate the data provided by highly sensitive acoustic emission sensors. One can save up to 31 envelopes and their related parameters.

The use of this system helps to optimize grinding and dressing processes and reduce the amount of air grinding. The device is controlled via the menu displayed on an illuminated, monochrome LCD monitor. Dynamic thresholds can be evaluated using the additional envelope monitoring module.

The combined device **AE4100-1P** combines the functions of pre-balancing / Field balancing and process monitoring with each other. On AE4100-1P, a vibration sensor for monitoring the imbalance and up to four AE sensors can be connected.



Functions	AE4100-1	AE4100-1P
AE-Input	2	2
AE Channels	1	1
AE signal view	curve oscilloscope	curve oscilloscope
Grinding Process control	•	
Dressing control	•	
First contact & GAP reduce	•	
Crash control	•	
Interface	static I/Os	statifc I/Os
PC Software Tool	-	-
Envelope function	_*	-
Interface visualisation	-	RS232
Display	LCD	LCD

Optionen	Mounting	AE-Signal view	AE-Sensor
AE4100-11 channel AEAE4100-22 channel AEAE4100-1P **1 channel AE incl. Pre-Balancing function	Stand alone unit, additional (mounting) frames	AE curve on integrated screen	all AE-Sensor



AE6000-System

Automated grinding or dressing processes must run safely and stably, and produce a consistent level of workpiece quality. Process monitoring on the basis of highly sensitive acoustic emission sensors combined with the **AE6000** evalution unit is the ideal solution to improving process stability. This system can be used to reduce air grinding time, to detect first contact, to detect the first cut during touch dressing, dressing monitoring, grinding process monitoring and wheel damage or collision monitoring.

The **DM6000** process monitoring module enables you to evaluate sensor-based and internal control data.

The increased demands placed on the grinding process over the past few years have led to the introduction of new technologies. In order to make full use of a machine's reserves at increasingly high cutting speeds, one must use the appropriate sensors to detect threshold values during the grinding and dressing processes. Should the measured data exceed the tolerances, corrective action can be taken before the process degenerates without intervention on the part of the machine operator.

Internal control data, e.g. torque, is transferred via Profibus to the module where monitoring takes place. The data set for each monitoring strategy can be flexibly allocated to a signal source. AE/Crash, the voltage input and Profibus inputs are treated equally and can be used for envelope monitoring. When using digital drives, even sensorless process monitoring is possible with the aid of internal control data. Feedback to the controls is made via Profibus or static interface.



Functions	AE6000	DM6000	
AE-Input	1 or 4	4	
AE Channels	1	1	
AE signal view	curve oscilloscope	curve oscilloscope	
Grinding Process control			
Dressing control		•	
First contact & GAP reduce			
Crash control	•	•	
Interface	I/O & Profibus	I/O & Profibus	
PC Software Tool	DSCC	DSCC	
Envelope function	Software option	Software option	
Interface visualisation	RS232 or Ethernet	RS232 or Ethernet	
Display	_	-	

Optionen Mounting Module		AE-Signal view	AE-Sensor
AE6000, 4 AE, with RS232 AE6001, 1 AE, with RS232 AE6000, 4 AE, with Ethernet AE6001, 1 AE, with Ethernet	with DIN-RAIL or Mounting plate Stand alone Blackbox unit with Visualisation on Windows based machine control or with external Remote control RC6000* / PC6000	AE curve	all AE-Sensor
DM6000, 4 AE, with RS232 DM6000, 4 AE, with Ethernet	with DIN-RAIL or Mounting plate Stand alone Blackbox unit with Visualisation on Windows based machine control or with external Remote control RC6000* / PC6000	AE curve, Ist/Soll parameters available	AE-Sensor or Profibus Input

DS7000 System

Primarily developed for use on high precision grinding machines, the M7002/ MA7002 units enable detection, evaluation and monitoring of the unbalance on two spindle bearings. Fast and precise compensation is performed by a dual plane external or internal non-contact balancing system - containing electromechanical adjustable compensating weights (balancing heads) fully automatic and at high operating speed.



Functions	M7002- System
Channels WB	2
Planes	2
AE-Input	4
AE Channels	2
Balancing Algorithm	Deterministic
Spectrum of Vibrations Sensor	-
Pre-Balancing (in combination	
with WB-Head)	-
Manual Balancing	
Acoustic Emission & Crash	
Interface	Profibus, USB
PC Software Tool	USCC
Interface connection	Ethernet
Display	-



The new programmed software USCC (UNIFIED SYSTEM CONTROL CENTER visualizes the admitted signals of the M7002/MA7002 and show them on the WINDOWS / LINUX based system.

The comprehensible principle of the new software allows a very fast installation setup and is familiar in its handling.

Optionen	Mounting	Module	Transmission system	WB-Head
M7002 2-Plane Balancing MA7002 2-Plane Balancing with Acoustic Emission	with DIN-Rail or Mounting plate	Stand alone Blackbox unit with Visualisation on machine control	CL Deterministic	ST



P7-System

P7 electronic system is a unique multifunction process control device capable of managing the complete machine tool by means of Pre-Process, In-Process, and Post-Process measurement controls; machine vibration monitoring and automatic wheel balancing; optimizing the working and wheel dressing cycles.

Funktionen	P7- System		
Channels WB	1 or 2		
Planes	1 or 2		
AE-Input	1 or 2		
	(integrated inside WB head)		
AE Channels	2 or 4		
Balancing Algorithm	Trial & Error		
Spectrum of Vibrations Sensor	•		
Pre-Balancing (in combination			
with WB-Head)	•		
Manual Balancing	•		
Acoustic Emission & Crash	•		
Interface	I/O & Profibus		
PC Software Tool	MHIS		
Interface connection	Ethernet or RS232		
Display	7" LCD with key pads		

A properly balanced grinding wheel can improve the surface quality of individual workpieces and extend spindle life. Marposs Wheel Balancer line is the best solution to continuously monitor the grinding wheel condition and compensate the detected imbalance condition of the grinding wheel.

Acoustic technology, to detect subtle changes in sounds produced while grinding, can be used for extremely precise machine control when the wheel is touching the part or the dresser. Acoustic systems are particularly useful for preventing collisions and detecting machine and tool abnormalities, such as chipped grinding wheels and dresser faults.

Optionen	Mounting	Module	Transmission system	WB-Head
P7 WB Wheel balancing P7 SE Monitoring P7 ME Gaging P7 UP UP & Retrofit	Mounting plate	Stand alone Blackbox unit with Visualisation on machine control Rack or Cabinet	Retraction CL	FT & ST
P7 Multifunction				



MHIS

Software Interface Balancing | Process-Control | In-/ Post-Process Measuring

For the integration of the User Interface of its P7 system Marposs proposes a software called M.H.I.S., for installation in the PC of the machine connected to the P7 via RS232 or Ethernet. The software was developed for the Windows-operating system, is an OCX, and thanks to the presence of a dedicated OPC Server allwos the PC/CNC software to share data with the P7.



DSCC

Software Interface

Balancing | Process-Control with AE

The DSCC Software was developed for Windows-based automation systems and easy to integrate. The software is freely programmable on Windows-based user surface and it is possible for applications via programme interface / ActiveX control elements. Intuitive handlinge, integrate online help and its significant reduction of set-up time are one of the benefits. Following languages are available: German, English, French, Italian, Spanish, Czech



With new combination of MHIS-Software and the DSCC-Software is now available one uniform platform. This solution will be a flexible combination for pre- / in- and post-process measuring as well as operating the balancing- and acousticemission systems on the same software surface.



Software integrated with ActivX-elements

Software Feature Balancing

Spectrum

Software option M6000: Spectrum

This function is an aid for the experts to analyse the rotational behaviour of machine spindles and to district between machine conditional unbalance and external disturbances. Performing a Spectrum sweep in a selected speed range generates an onscreen graphical representation of the amplitude of vibration monitored at each RPM range in the form of a curve.

This function can be very useful in diagnosing a machine condition. The function Spectrum will perform an automatic vibration sweep of an internal specified speed (frequency) range.

This happends when the operating speed is exactly or very close to the resonant frequency of the spindle. Such an unbalance can not be compensated with a balance system which leads, in turn, to unsatisfactory grinding results.

The speed range to be evaluated will vary by machine and process. On constant surface speed machines, the minimum and maximum RPM should be determinded. The suggested range to evaluate is from 0.5 times the minimum speed up to at least 2.5 x maximum speed. This range is important because it includes probably all the frequencies which will have harmonic influence on the operating RPM range.

The Spectrum function is a useful tool to find out those critical frequencies or speeds.



Spectrum

Software Feature Process Control

Pre-Balancing

Software option M6000/H6000: Pre-Balancing

During "pre-balancing", the unbalance is measured while the machine is running and compensated by shifting correction weights or by adding defined weights to the wheel clamping flange. The spindle is balanced in one plane, depending on the application.

This software option is additional for the M6000 mechanical balancing module as well as for the Hydro-System H6000.

This function will be used in the first step to prebalance new grinding wheels on the machine. The second step will be the "finely" balance procedure with the electromechanical balancing head.

This solution will be useful for bigger wheels were the capacity of the balancing heads could not obtain.

Spread angle method: unbalance is compensated by shifting two equally heavy weights (sliding blocks) to the calculated positions.



Pre-Balancing: Spread angle method

Fixed position method: unbalance is compensated by adding defined weights (e.g. screws) at specific positions.



Pre-Balancing: fixed position method

Envelope curve

Software option for AE6000/DM6000: envelope curve

envelope curve

The envelope function monitor the process either through time controlled acoustic emission signals and/or voltage inputs. Each over or under crossing of the given envelop produces an error message for the machine control unit. The envelop can adapt itself to changing conditions. That can be achieved after each cycle using fixed limits (dynamic envelop) or manually on the screen using a computer mouse (edit function).



Software option:

envelope recording

In addition the sets can be saved on an external storage medium. The automatic upload of the saved data back into the DM6000 is possible given the machine control unit uses the foreseen Active X software elements.

Software option for DM6000: segmented envelope

Important parts of a complete process (segments) can be taught through the machine control unit. The so saved segments can be individually started by the machine control unit. It is also possible to re-synchronize the time axis of the envelope with the actual monitoring by every new segment start. Doing that allows for the correction of an

envelope monitoring due to a disturbance caused by the axis displacement or change in axis override.



Software option: segmented envelope Time controlled start of each process monitoring segment

Production, sales and service centers

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