

TGA - Top Gauge Absolute

ABSOLUTE GAUGES FOR THE IN-PROCESS MEASURING
OF DIAMETER ON CYLINDRICAL GRINDING MACHINE



Top Gauge Absolute (TGA) helps to improve precision and efficiency in the manufacturing processes, through an accurate measuring of the diameters of workpieces. Its outstanding performance, in fact, combines one of the Balance Systems' milestones "TG200 gauge head" with the state-of-the-art of mechatronic solutions that earn a quick measuring process along an high accuracy level.

Top Gauge Absolute measures all diameters within its measurement range, with pre/in/post-process cycle, without the need to zero it on the single diameter.

Features

- 2 simultaneous measuring process; availability in combination with the measurement of the axial position (active or passive flagging)
- 32 part programs
- Measuring of smooth and interrupted surfaces
- In-process roundness and shape analysis
- 6 commands to control the infeed
- Thermal compensation
- Remote programming

Benefits

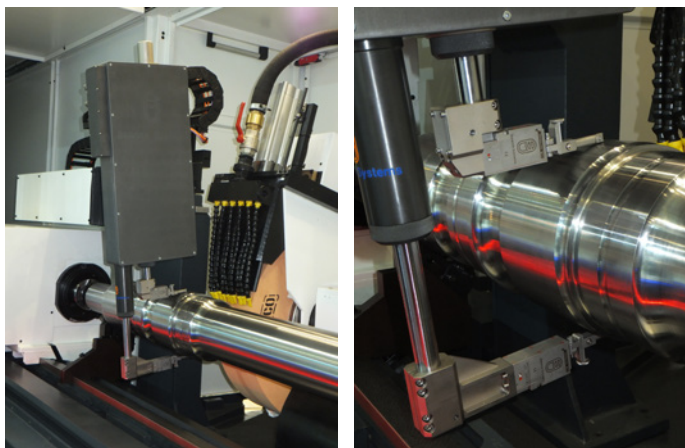
- Allows productions to be stable and consistent and with tight tolerances
- Compensates for grinding wheel wear
- Increases productivity
- Can be implemented both on new and existing machines in the field (retrofitting)
- Easy to use
- Does not require surveillance

The needs

The machining on cylindrical grinder is typically the last operation which is done on a workpiece with diameters that requiring tight dimensional and geometric tolerances. In this phase, the control of the diameters is a crucial operation of the manufacturing process in both timeliness and accuracy of the measurements, even to the overall costs.

In the mass production, the workpiece measuring control is automatically performed in the machine tool by means of high-precision gauges, each one zeroed on a specific master. Thanks to this process a constant quality and a high productivity are obtained, as times and costs of setup marginally affect on the single piece.

In working with small or single part batches, the control of the diameters is manually carried out either directly in the working space of the grinding machine or bringing the workpiece in the metrology room. This classic approach takes time that dramatically reduces the productivity of the manufacturing process and introduces a high risk of scrap parts generating.



Mode of operation

The measure of the diameter is obtained by combining the reading of an linear encoder with two high-precision gauge heads which are kept in contact with the piece. The two gauge heads are brought to the measuring position by a servo-mechanism. Once a diameter is finished, the heads are moved or to a resting position or in the most convenient position for the measurement of the next diameter. The moving speed of these heads is programmed in relation to their position with respect to the diameter to be measured and the phase of the work cycle.

In order to avoid damages coming from a possible collision, the contact between each head and the piece is continuously monitored and the advancement is stopped if the contact occurs outside the planned diameter.

According to the removal rate and to the type of the surface, the gauge heads are continuously adapted to the optimal measuring position.

Solution

In order to increase the productivity of the grinding machine, ensuring a consistent high quality of production, either for single parts or small batch sizes, Balance Systems proposes the absolute automatic gauges, directly installed into grinding machine, of the line Top Gauge Absolute.

Top Gauge Absolute measures, with pre, in and post process cycles, all diameters within its measurement range, without the need to zero it on the single diameter.

Only it is requested a periodic and automatic calibration cycle on a master, preferably fitted in the machine working area.

The product line Top Gauge Absolute includes several models to meet the measurement needs of pieces with various sizes: from small automotive shafts to large rolling mills.

The acquisition of the measurement is carried out continuously on diameters with surfaces both smooth and interrupted, with the same speed, accuracy and precision of the traditional in-process gauges.

In this way, the removal speed of the grinder can be optimized in connection to the real size of the diameter being worked and its final size obtained, in any situation, regardless of the wear of the grinding wheel and of the thermal deviation.

Moreover, the information on the roundness allows the operator to take a prompt action to investigate and remove the causes of the process variation.

The Top Gauge Absolute consists of a pressurized case protected to withstand the harmful actions of the coolant. It can be brought from the rest position to the measuring position, and vice versa, by translation or by rotation.

Typical mode of use of the gauge can be:

- **“Auto-size”** automatic measurement directly requested by NCU
- **“Go-to”** closing at a nominal size set by NCU
- **“Part-Program”** multi-diameter measure combined with a part program automatically selected by NCU.

Each part-program allows the definition of the reference size, the measuring mode, the type of surface and the limits for the control of the feed rates

The value of the dimension is available for NCU at each stage of the measurement process.

Configuration

TGA family includes several ranges of operation, each one can be programmed according to the specific requirements of the application. The high precision TGA measuring heads are fully managed in automatic mode by the multi-function modular system VM25.

The VM25 can be integrated with the grinding machine NCU/PLC thanks to several available protocols and interfaces:

- Digital I/O
- DP Profibus
- Profinet

The VM25 control unit is provided with a panel with color display as well as a VM25 HMI software application for PC ®Windows. Both of them can be used by the operator to configure the application through menu and to manually control the entire device.

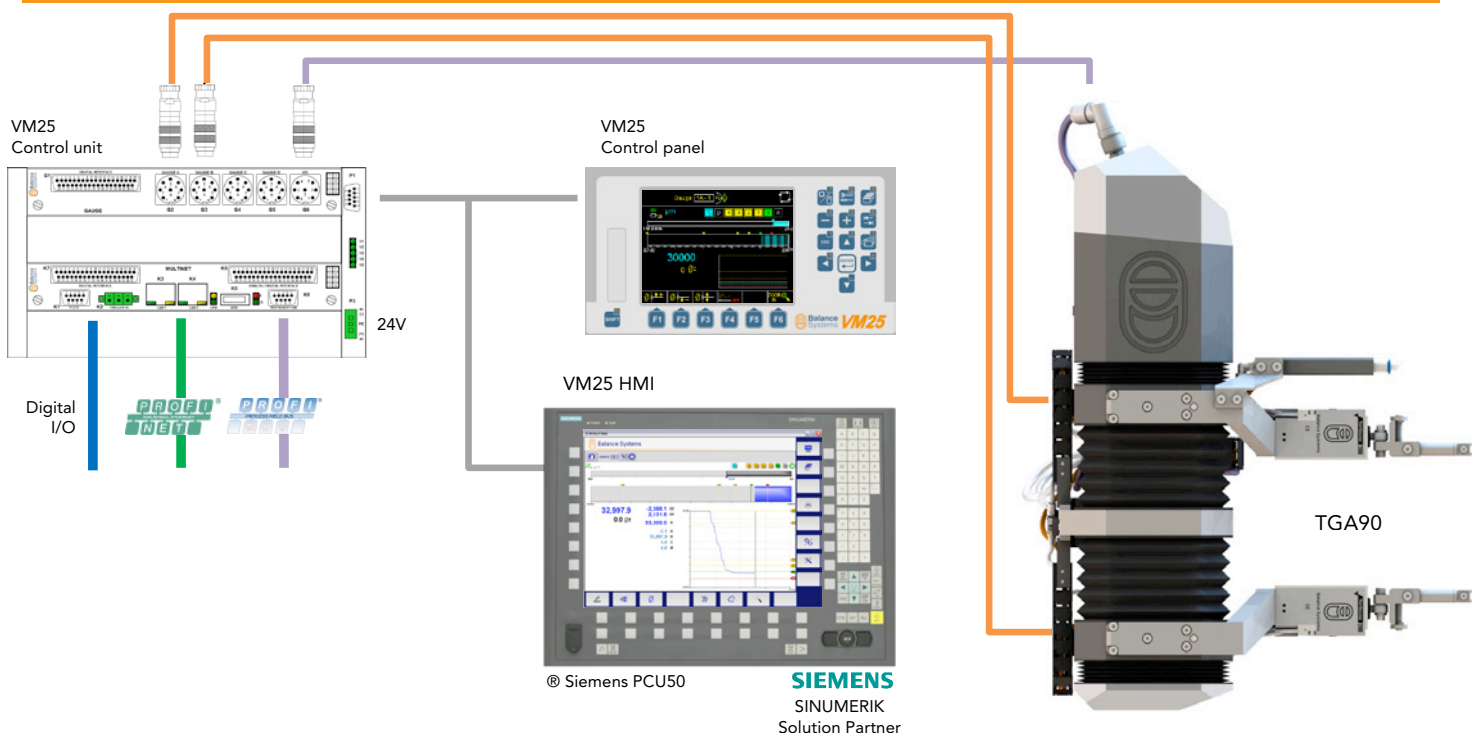
The PC ®Windows VM25 HMI software package includes graphic libraries allowing the integration of the user panel into the HMI application of the machine OEM.

The control unit VM25 can integrate, at any time, additional functions, in order to complete the application in the machine:

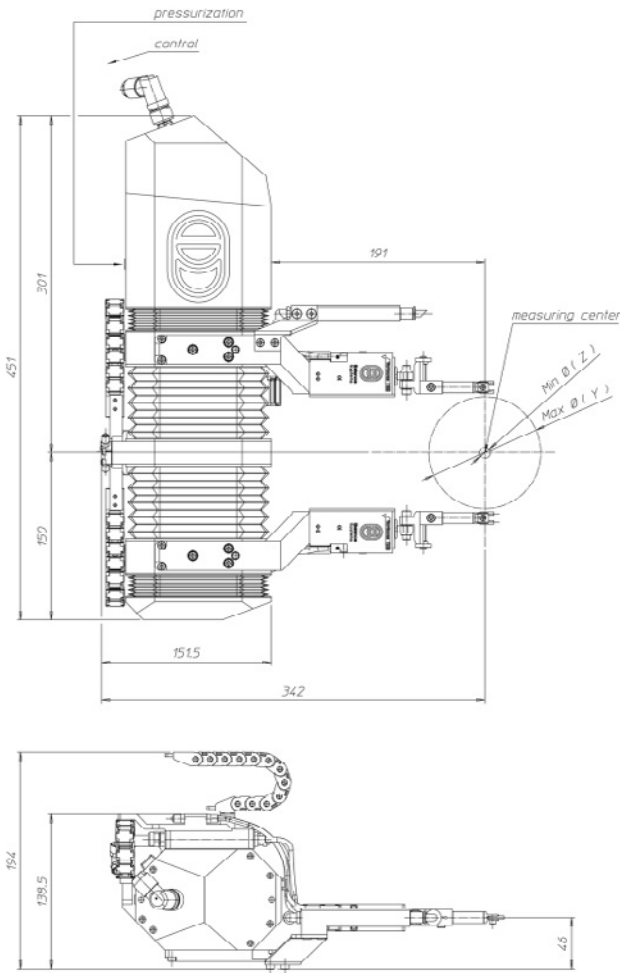
- Automatic balancing of the grinding spindle on 1 and 2 plane (ABSOLUTE BALANCER ®)
- Manual pre-balancing of the grinding spindle on 1 and 2 plane
- Control of the wheel-piece contact (e.g. “gap” for air gap elimination and “crash” for collision detection), with acoustic emission and power sensors
- Control of the wheel-dressing profile, with acoustic emission sensors
- Pre-in-post process control of diameters and axial thicknesses, using gauge heads (Top Gauge 200) with a dedicated master to each measure, on stationary or rotating parts with continuous and interrupted surface
- Active and passive axial positioning of the work piece
- In-post process roundness and shape analysis

The standard package includes the software application “VM25 Service” (for PC ®Windows). This allows local as well as remote maintenance for operations like parameters backup, restore and software updating.

Typical application diagram

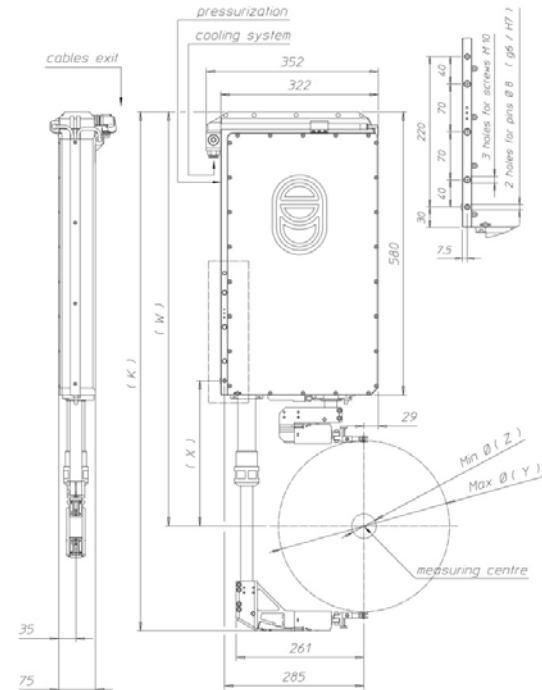


Layout of the TGA90 model



Layout of the TGA200, TGA300, TGA400... models

Example of layout of the TGA300 model



TGA300 Measuring range [mm]	Z [mm]	Y [mm]	X [mm]	W [mm]	K [mm]
10-310	10	310	300	850	1050
50-350	50	350	300	850	1070
100-400	100	400	350	900	1145
150-450	150	450	350	900	1170

Technical data	TGA90	TGA200	TGA300	TGA400	TGA700
Range [mm]	90	200	300	400	700
Measurable Ømin [mm]	4	10	10	50	200
Measurable Ømax [mm]	120	250	450	550	1000
Repeatability in 2σ [µm]	1	1,5	2	2,5	4
Weight [kg]	7,5	27	32	42	80
Measurable surfaces	Smooth or interrupted diameter				
Working temperature [°C]	0° - 50°				
Protection degree (IEC 6059)	IP67				
Power supply [V-A]	24 Vdc ±20% - 3A				
No. of part-programs	32				
No. of commands feed-rate control	6 (Roughing, Finishing, Super-finishing, Dwell, End of cycle, Under-size alert)				
Field bus	Profibus DP / Profinet – real time control, remote programming, data monitoring				



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