# ELECTRIC CYLINDERS AND PRESSES
## Series SA
**with press-forces of up to 100kN**

# The electromechanical system

**Stroke, speed, force, precision and life cycle are the most important characteristics of the system**

The cylinder consists basically of a motor and a spindle screw, with a nut running along it.

Our spindle screw uses planetary roller technology (the finest at the state of the art) housed inside a sturdy tubular structure.

The motor is controlled by a servo drive, controlled by electronics designed and built in house.

# The benefits of the system

Being a press and not just a linear actuator, there are built-in sensors that enable the complete and accurate control of the pressing operations.

The physical dimensions controlled are force and position, The force is measured by a load cell and the position is detected by an absolute encoder.

SA presses are used where it is necessary to control the production process

in real time for all pieces manufactured, in order to ensure that there are zero defects.

**• Active control of the process**
The movements are constantly controlled in terms of acceleration, speed and height.

**• Stopping point precision**
Active position control allows extreme precision of the stopping point.
With the additional possibility of introducing a micrometric external position transducer.

**• Clean**
Requires no pneumatic and/or hydraulic powering.

**• Low management cost**
Energy is consumed during the processing phase only.
Reduced maintenance costs.

**• Flexible application**
Possibility to program even the most complex work cycles.
All the working parameters are memorised and independent of the operator's skill.

**• High reliability**
The planetary roller screw and the best mechanical choices guarantee exceptional duration in time, even in severe working conditions.

**• Cycle time**
The possibility to reduce the working stroke guarantees a short cycle time.

# The Components

The supply always comprises ALL the components required for the correct operation of the system, without other expensive additions.
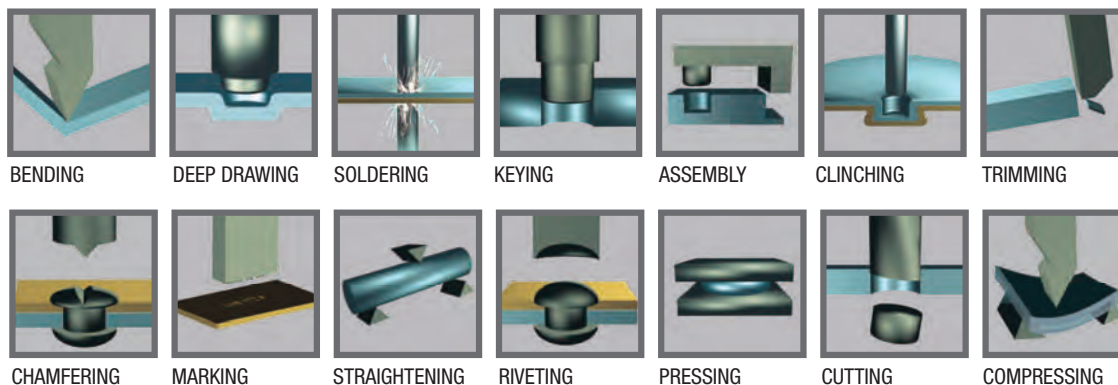It also guarantees maximum performance.

Servo drive

**Press-Right** System

**SA** Cylinder

All the cables connecting the three components

## SA Electric Cylinders are used in various industrial processes, like:

BENDING    DEEP DRAWING    SOLDERING    KEYING    ASSEMBLY    CLINCHING    TRIMMING

CHAMFERING    MARKING    STRAIGHTENING    RIVETING    PRESSING    CUTTING    COMPRESSING
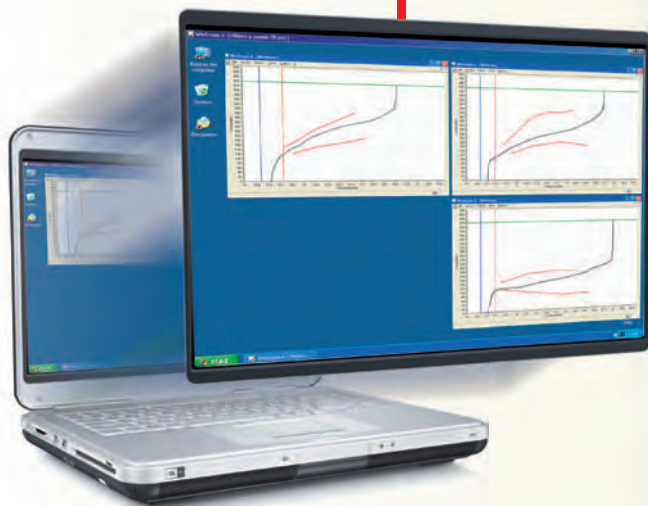
# The command and control chain

## The synergy between servo-drive and electronics is essential.

The control system has been designed specifically for pressing operations and employs all the experience of Alfamatic in this sector, dating back to 1992.
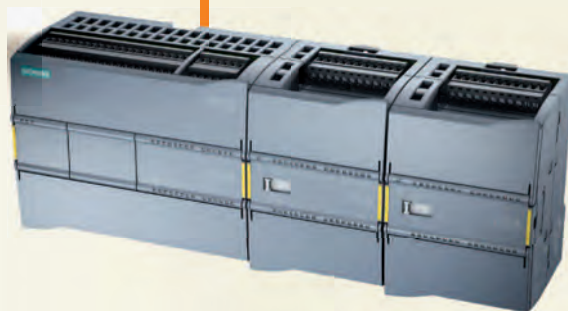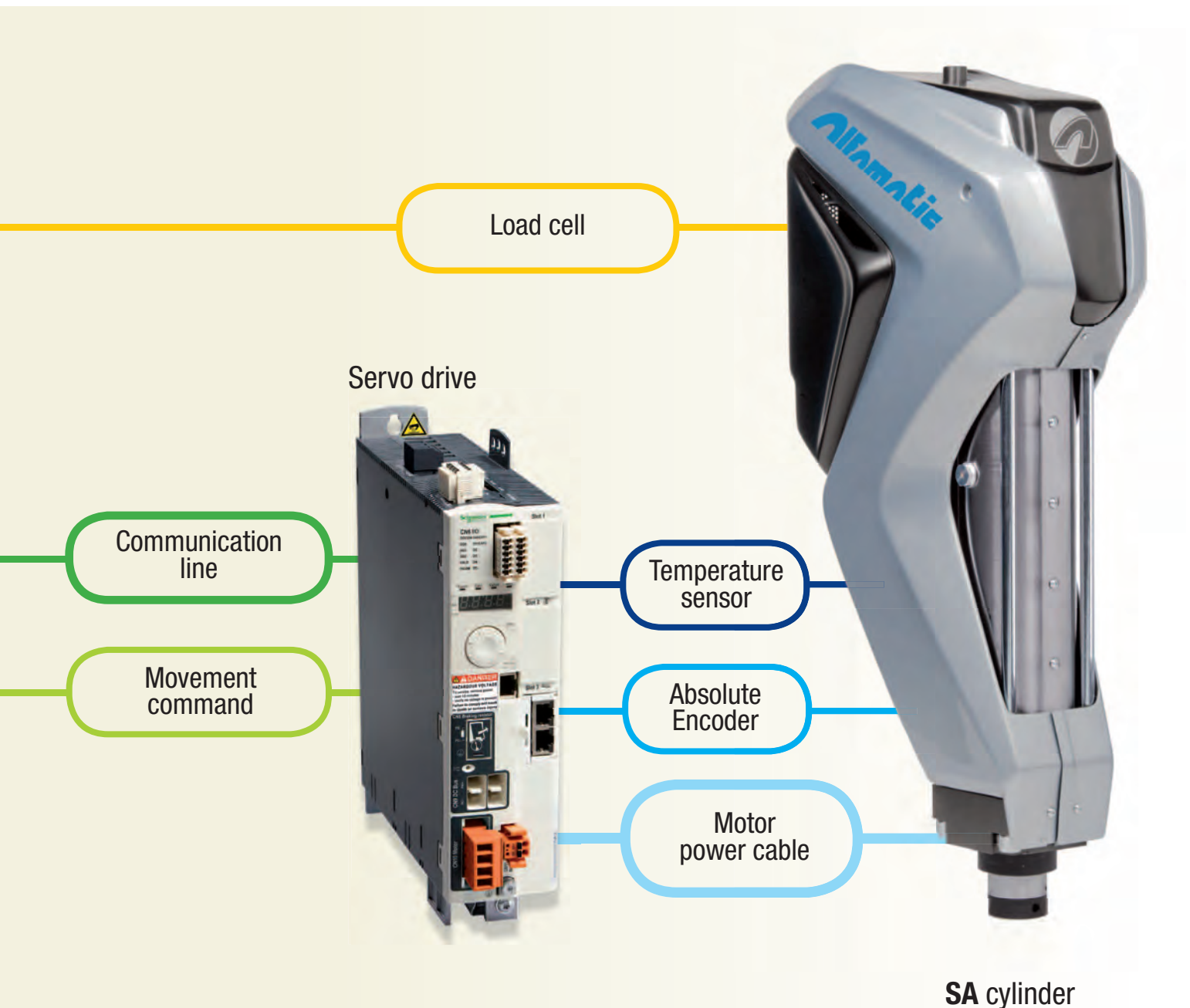
Tool
**Press-Right**

Software **WinScope**®

**PLC**

For machine manufacturers, Alfamatic supplies an installation kit complete with press structure and electrical cabinet. See page 19

Alfamatic also offers a series of complete and certified pressing stations in a variety of configurations (with a c-frame structure, with a two or four-column structure, with an electromechanical rotary table, etc.)

Load cell

Servo drive

Communication
line

Movement
command

Temperature
sensor

Absolute
Encoder

Motor
power cable

**SA** cylinder

**Press-Right**
It controls the force and instantaneous position of the cylinder in real time.
It shows the working curve and checks that it stays within pre-set parameters

**Servo drive**
It drives the brushless motor of the cylinder and controls the position of the piston-rod. The standard version of the system is in safety category 4. This is made possible by the interruption, at every cycle, of the power supply to the servo drive.
This guarantees maximum safety in pressing applications.

**SA cylinder**
A planetary roller nut on a spindle screw converts the rotary motion of the motor into linear motion.
The cylinder houses a load cell and an absolute encoder, for measuring the force and the position of the piston-rod in the cylinder.

# The Cylinder and its components

## Transmission group

Made up of drive and conduct pulleys, connected by an inclined teeth belt.

The fine pitch of the roller screw allows the assembly without speed reducer, benefiting reliability, noise and performance.

The special inclined teeth belt guarantees:
• silence
• low vibrations

## Load cell built-into the actuator

This works in compression and in traction, and is based on strain gauge technology. It guarantees the following advantages:
• improved linearity and precision in the measurement of static and dynamic forces
• precision with every force profile
• increased immunity to electromagnetic disturbance.

## Chromium-plated piston-rod

The cylinder piston-rod is chromium-plated internally and externally, with substantial reduction of the radial clearance and improved resistance to wear and tear

## Brushless motor with absolute encoder

The best solution for:
• torque curves
• no maintenance
• dimension-to-power ratio

The absolute encoder keeps the cylinder position constantly in the memory
(NO zero search):
the cylinder is immediately ready to go.

## Planetary roller screw

Designed specifically to resist high loads for millions of circles, this is the best choice for heavy-duty press applications.
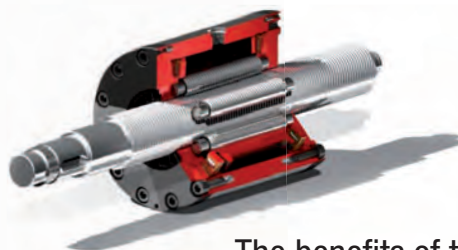
## The benefits of the planetary roller screw:

• improved durability, even under harsh conditions of use.
• improved shock resistance
• reduced external dimensions

# Press-Right

Press-Right is a measurement system that provides 100% quality control on the manufacturing process.

Interfaced to a position transducer and a force transducer, it continuously monitors the position/force curve and verifies that it stays within a specifically positioned continuous control range. The system architecture is based on a multiprocessor for data monitoring and analysis and is connected directly to the sensors. The instrument actively controls the movement of the motor, promptly controlling the force and position values.
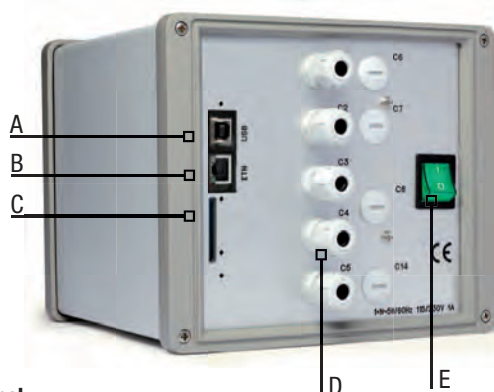
**Rear panel**

A - USB connection

B - Ethernet connection

C - SD memory slot

D - direct connections to the sensors and utilities

E - on/off switch

**(D) SD memory card**

An SD memory card allows to memorise the working curves, which can then be displayed and analysed using WinScope software. The program is included in the supply package. The instrument also has an internal memory, able to store more than one hundred different types of process.

**(E) I/O operation**

The instrument can be managed using simple ON/OFF digital signals and it is easy to integrate with any controller.

# Servo drive

To drive the brushless motor of the cylinder and have an extremely high performance it is necessary to feed the phases, taking into consideration the angular position of the shaft. This job is performed by the servo drive.

The servo drive also controls the position of the cylinder, preventing movements beyond the maximum stroke. The configuration and the various regulations of the servo drive are programmed in the factory by Alfamatic. The movement is fully controlled by the Press-Right instrument. No special skills or abilities are required for the configuration of the servo drive, hugely simplifying the use of the Alfamatic system.

# Production management and control

The SA system regulates the cylinder speed in real time, using the force and position transducers for feedback.

The continuous regulation of the speed with feedback from the force transducer makes it possible to reach the required force in the best way: the speed is reduced only when the force measured during pressing approaches the required value.

This reduces the cycle time and the real force applied does not significantly exceed that required.

The SA system architecture also makes it possible to maintain the force constant for a specific time, correcting the cylinder position constantly.

The cylinder will be drawn back if the force increases beyond the required value and will be moved forward if the force drops below the required value.

The continuous regulation of speed with feedback from a precision position transducer gives the SA system the capacity to bring the cylinder to a required position in just one movement, with micrometric precision.

The cylinder will reach the stopping point at a speed close to zero, stopping exactly where required.

There is no need to correct the position with subsequent movements requiring several stops and restarts in the same pressing operation.
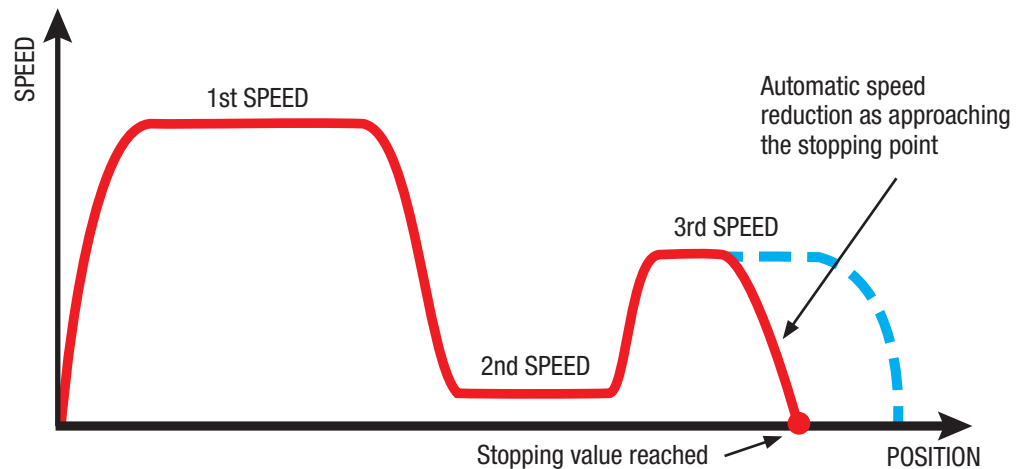
The elimination of the intermediate stops prevents the sticking during the assembly of the pieces.

The possibility of using an additional linear displacement probe solves positioning problems in the best way, with values directly detected on the piece.

The cylinder speed follows a profile divided into three sections, with three different speeds.

The cylinderis moved without interruption, accelerating or decelerating between one section to the next.

The most useful profile in pressing consists in approaching to the piece at high speed, following the main pressing at medium speed, and ending it with force feedback for precise stopping.

The profile used for general movements has a single very high speed.

There are applications in which it is useful to have a first section with a lower speed, while picking up the piece with loading tongs for example.

It could also be necessary, when inserting a piece, to complete the last section of the movement at a very slow speed in order to avoid dangerous collisions.

A work procedure can require a phase in which it is necessary to measure the position of the piece before deciding how to proceed in the next phase; in this case, the profile will have a first approach at high speed and a very slow second section for the precise measurement of the point of contact with the piece.

The point of contact can be identified by measuring the force when impacting the piece, or using an electrical contact.

Another example of profile is the one used in typical imprinting operations in the manufacture of watertight metal valves. In this case, the profile will have a first high-speed section to approach the piece quickly, a very slow second section to measure the point of contact to the piece and a third section for the actual imprinting.

The profile is directly parameterised in the instrument, so the PLC is not responsible for this (no operator panel and no extra programming required).

The ease with which it is possible to regulate a complex profile, setting just a few values, makes it easy to achieve an optimal working cycle for every application.
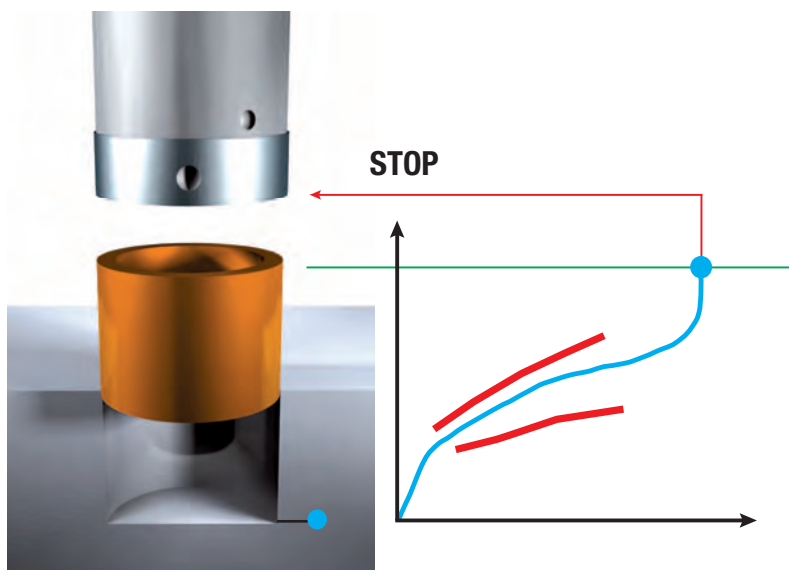
**STOP**

## Management of the cylinder stopping point

When a determined force and/or stroke value is reached, the stop and return of the press are commanded.

P1
P2
P3
P4

P1
P2
P3
P4
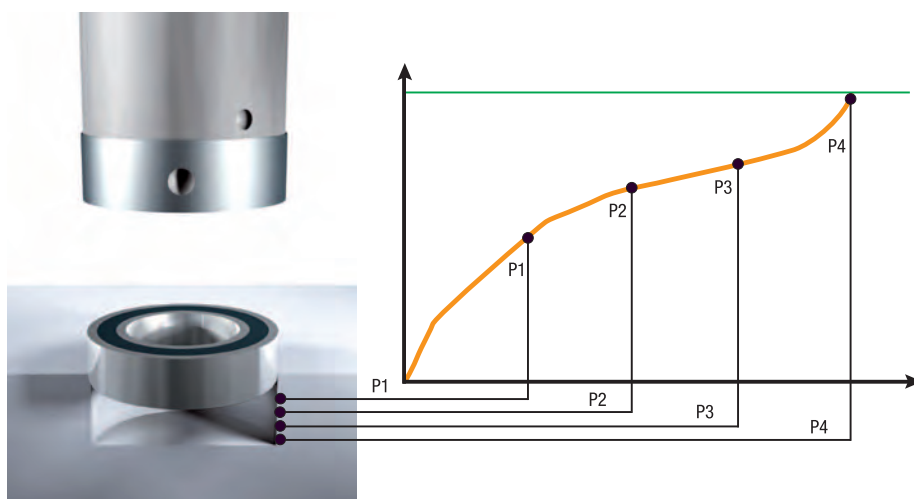
## Pressing interference control

During the entire pressing operation, the interference between the two pieces to be assembled is checked.

## Control band

The continuous band system guarantees control of every point of the press curve.

This prevents all the uncertainties deriving from the use of discreet windows which leave some areas uncontrolled.

The bundled software also allows the automatic creation of the band, based on sample curves.
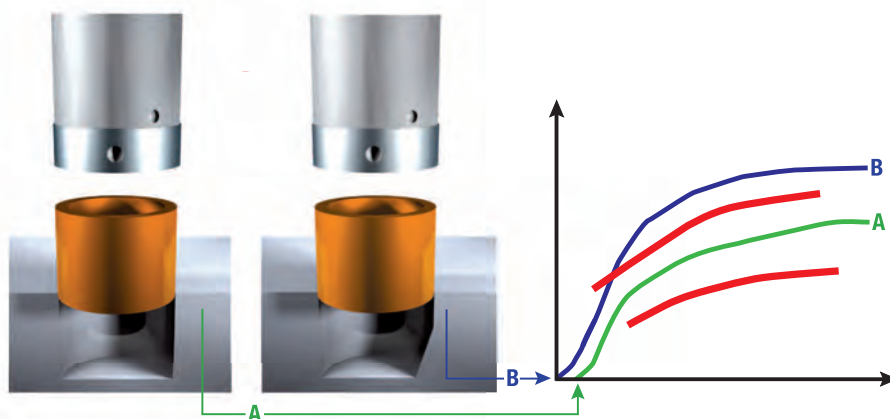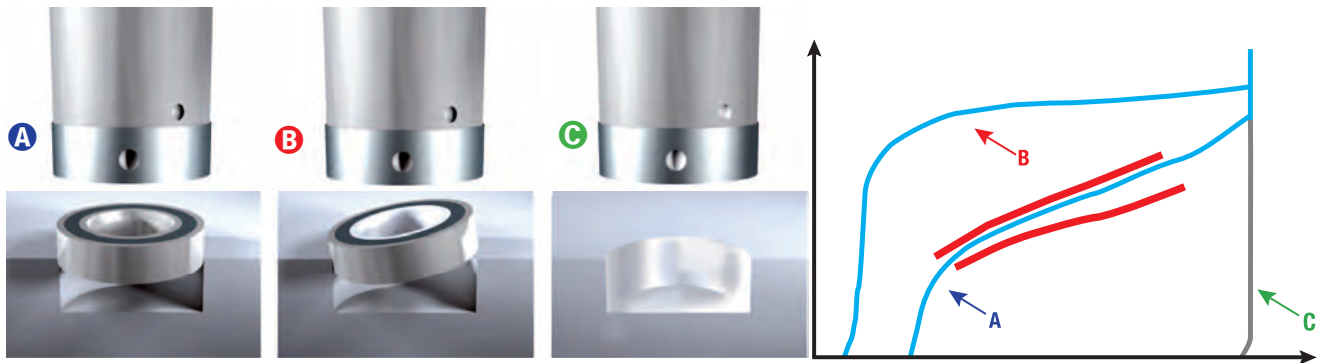
## Geometric check on the piece using the continuous band

Any geometric errors of the piece are highlighted by non-compliant press curves.

B
A

B
A

## Check of presence and correct positioning of the piece

**A** correctly positioned piece
**B** incorrectly positioned piece
**C** piece not inserted in the relative housing

Example of positioning and relative press curves



## Non-destructive measurement

For large and expensive parts. The cycle stops whenever the monitoring curve goes outside the tolerance band.
As the check takes place in real time, it preserves the integrity of the piece.
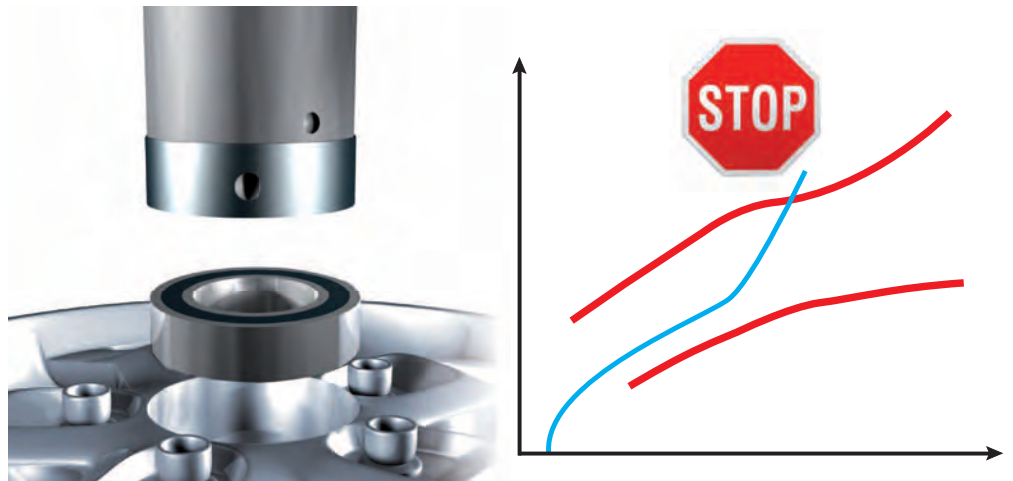


## Check on elastic elements

From the curve measured, it is possible to determine the correspondence of the elastic element with the project specifications.



## Determining fracture values

The active check on the position allows precise measurement of force and height values at the time of fracture.

## Stopping and holding the programmed force value

Thanks to the feedback of the closed loop force value, the force is held constant, automatically and continually correcting the cylinder position.

## Correcting the structure deformation

The instrument continuously calculates the real position of the cylinder, taking into account the deformation of the loaded structure.

## Relative position

The working parameters can be automatically set referring to the contract point between the tool and the piece, regardless of the dimensional tolerances.
Using a micrometric probe, this possibility is particularly useful for high-precision imprinting cycles.

## Checking the contact point

Checking the contact point allows the interruption of the cycles, should the piece be missing or poorly positioned.

## External micrometric probe

The use of an external probe allows micrometric precise measurement of the real position of the tool compared to a reference point on the piece.

This eliminates all the imprecisions due to clearances and deformations of the structure.

Thanks to the peculiarity of the system, it is possible to regulate the cylinder speed in real time, reaching a programmed position at zero speed.

This prevents successive positionings by approximation which, in addition to requiring long times, involve the subsequent stopping and restarting of the cylinder, with the risk of the piece getting stuck all the time.

**Phase 1**
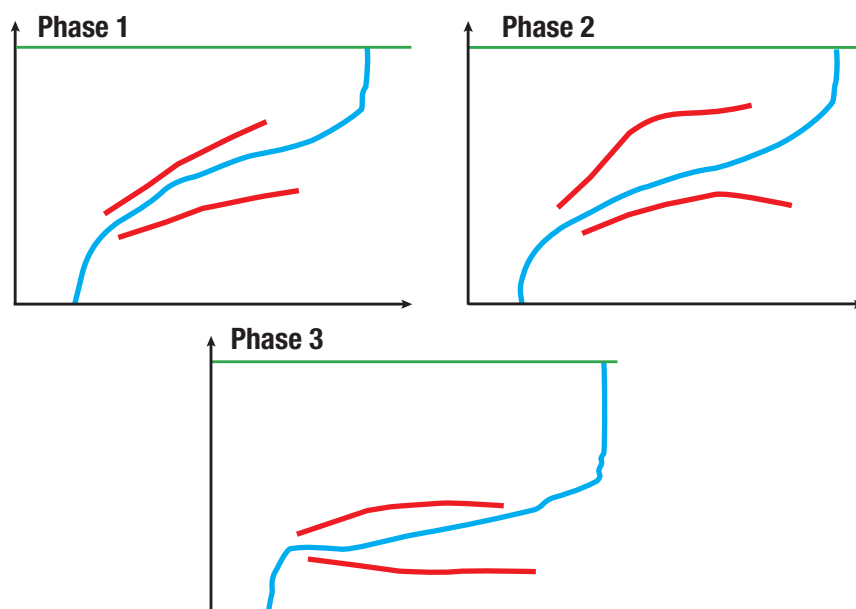
**Phase 2**

**Phase 3**

## Management of work by phases

The instrument makes it possible to breakdown every job into several phases (up to four), automatically managing the selection of the correct parameters for every phase.
The phases can be used for a single job with several cycles (e.g.: the insertion of a bush with subsequent chamfering) or for several jobs linked together by a single piece (e.g.: the sequential pressing of several bearings on a drive shaft).

# WinScope® software

The SA with Press-Right is a stand-alone system and does not require the use of a computer. The programming and control functions are performed by the instrument in a clear and simple way.
However, the occasional or continuing use of a computer connected to the instrument can add some functions to the system.
The WinScope® programme is supplied for this purpose.

## Programming
WinScope® makes the programming of the tool easier, Values can be set by numeric entry of the values or by dragging the objects inside the graph displayed.

## Central management
WinScope®, it is possible to simultaneously monitor, control, programming and archiving of the data of several presses from a single computer.

## IP communication
The interface, with a supervision and data archiving software, is simplified thanks to simple commands and the IP protocol.

## Curve analysis
WinScope® offers superior view and analysis of the press curves and their control parameters.

## Tracking
It is possible to track the history of the single pieces produced. The data measured is archived by WinScope® along with the piece code which can be entered manually, reading the barcode/Data Matrix, or automatically on the PLC.
As well as reading, the printing of a Data Matrix on a label to associate with the piece processed is also allowed.
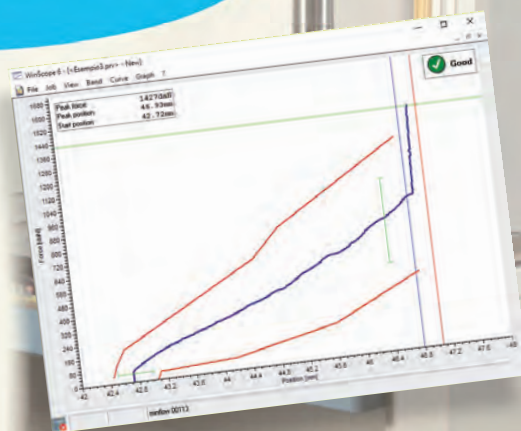
## Automatic determination of the control parameters

Available in manual or statistic method, with envelope of the minimum values and definition of the mean curve.

mean curve from envelope of several working curves **A**

control band generated by assigning a determined tolerance to the mean curve of point A. **B**
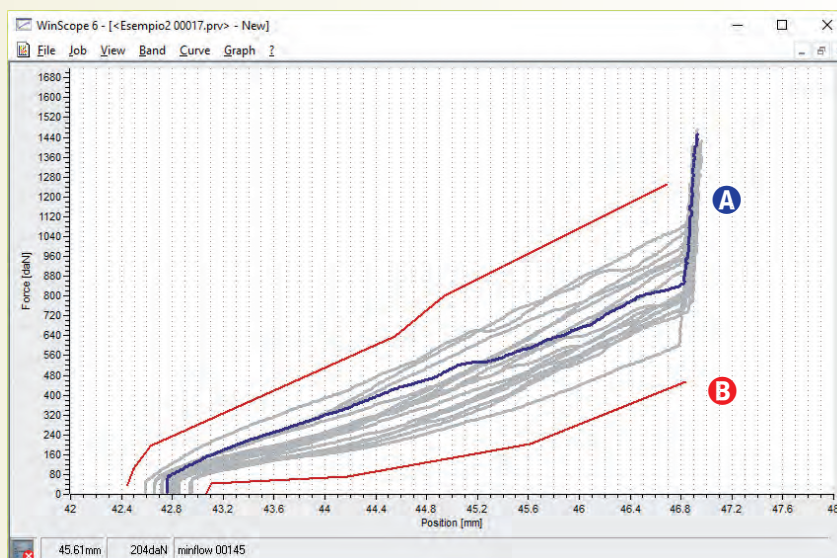


## Statistical analysis

The software incorporates a powerful statistical analysis function of production (with calculation of CP/CPK, means, variances, etc.)
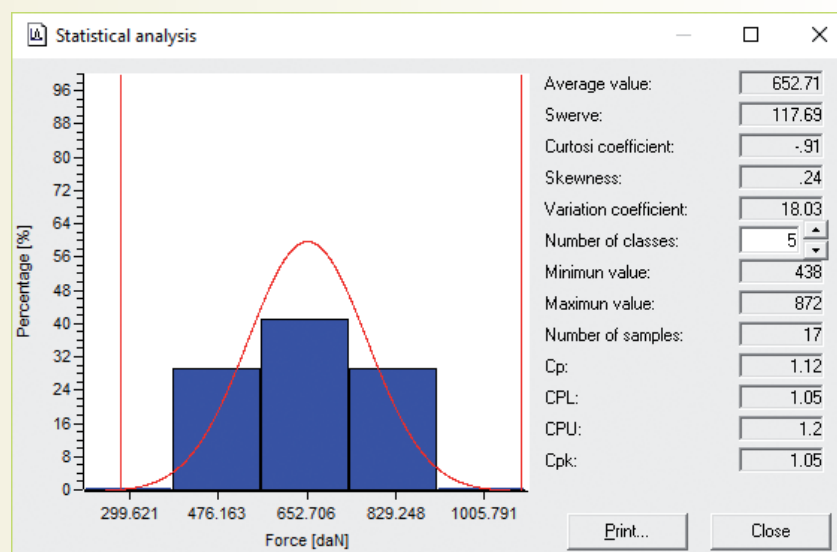


### Storaging curves
Press curves can be saved for further analysis, individually or superimposing an entire family.

### Database
As well as saving single curves, it is possible to archive the values measured in a database.

### Printing
Another function of WinScope® is the possibility to connect a standard printer for graphs printouts.

**13**

# The range of Actuators

Models SA10 and SA25 use the same structure, sized for the model with the highest force.

The force and the maximum speed of the cylinder depend on the different transmission ratio.

This allows the subsequent transformation of model SA10 into SA25 and vice versa.

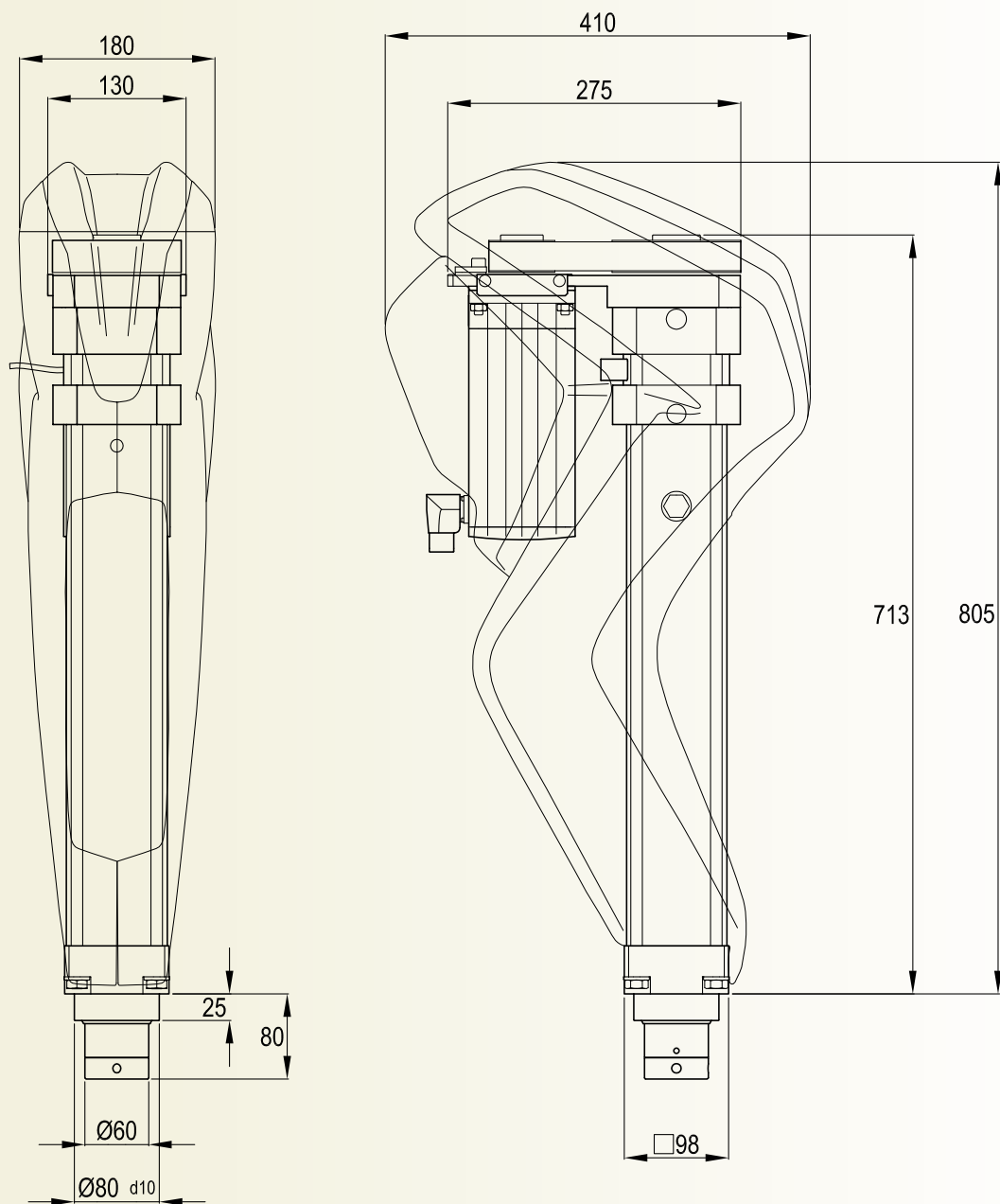The operation involves only the replacement of the load cell and the transmission group.

## Model SA10 - SA25



## Technical features

|  | SA10 | SA25 |
|---|---|---|
| Maximum force | 10 kN | 25 kN |
| Maximum speed | 250 mm/s | 140 mm/s |
| Repeatability with a constant load | ±0,01mm | |
| Precision of force measured | 0,5% F.S. | |
| Stroke | 290 mm | |
| Absorbed power | 2 kW | |
| Installed power | 3 kW | |
| Voltage | 400V three-phase 50Hz | |
| Weight | 45 kg | |
| Ambient temperature | 10...40 °C | |
| Relative air humidity | 90% (no condensation allowed) | |
| Precision of the anti-rotation system | 0.7° | |

180

130

410

275

713

805

25

80

Ø60

Ø80 d10

□98

n°8-M8x1.25

37

86
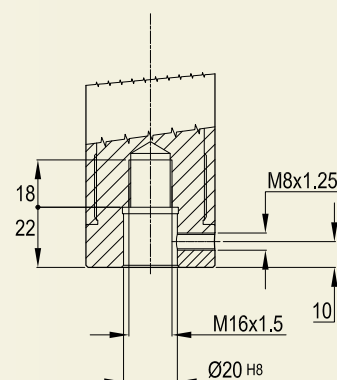
## Fixing data **SA10** - **SA25**

| Screw | M8x1.25 |
|---|---|
| Minimum length screwed | 20 mm |
| Hole depth | 30 mm |
| Tightening torque | 40 Nm |
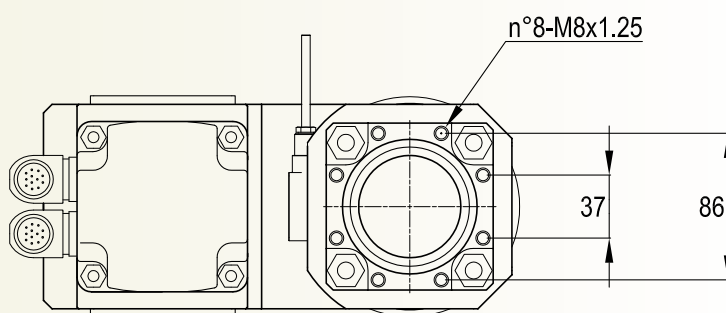
# The range of Actuators

Models SA50, SA70 and SA100 use the same structure, sized for the model with the highest force.

The force and the maximum speed of the cylinder depend on the different transmission ratio.

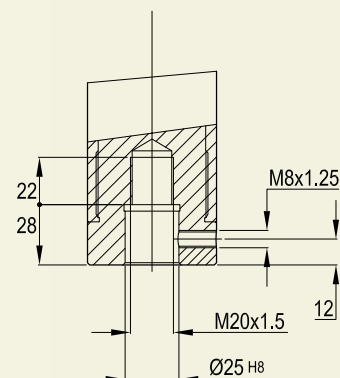This allows the modification of the press characteristics after purchase.

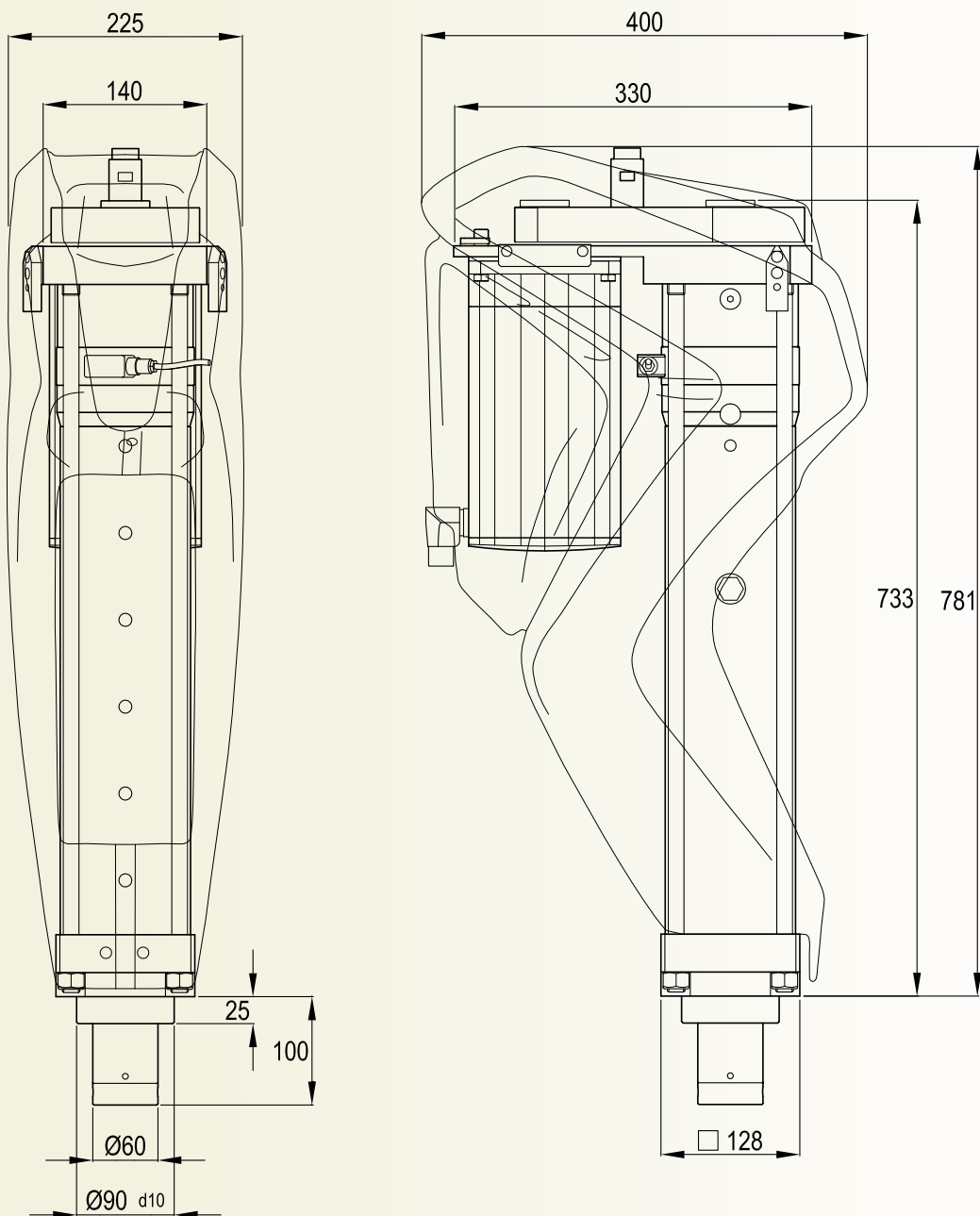The operation involves only the replacement of the transmission group.

## Technical features

| | SA50 | SA70 | SA100 |
|---|---|---|---|
| Maximum force | 50 kN | 70 kN | 100 kN |
| Maximum speed | 250 mm/s | 200 mm/s | 100 mm/s |
| Repeatability with a constant load | ±0,01mm | ±0,01mm | ±0,01mm |
| Precision of force measured | 1% F.S. | 0,7% F.S. | 0,5% F.S. |
| Stroke | 250 mm | | |
| Absorbed power | 5 kW | | |
| Installed power | 6 kW | | |
| Voltage | 400V three-phase 50Hz | | |
| Weight | 75 kg | | |
| Ambient temperature | 10...40 °C | | |
| Relative air humidity | 90% (no condensation allowed) | | |
| Precision of the anti-rotation system | 0.7° | | |

22
28
M8x1.25
M20x1.5
12
Ø25 H8

225

140

25

100

Ø60

Ø90 d10

400

330

733  781

☐ 128

n°8-M12x1.75

40  108

## Fixing data SA50 - SA70 - SA100

| Screw | M12x1.75 |
|---|---|
| Minimum length screwed | 20 mm |
| Hole depth | 30 mm |
| Tightening torque | 40 Nm |
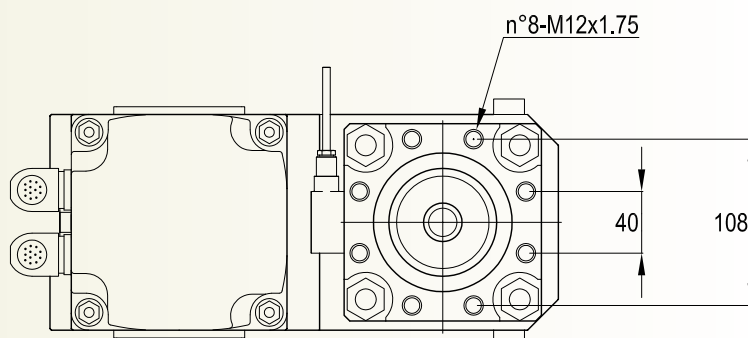
# Accessories

## Female/male adapter
## Code **CS**

Adapting interface for the standard rod (from female thread to male thread).
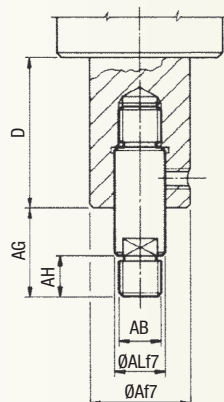
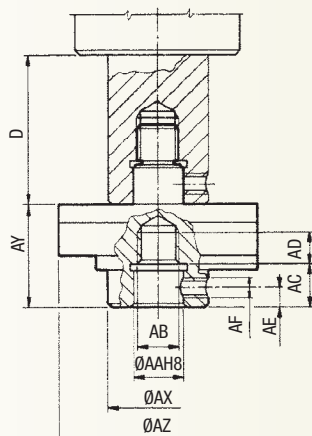| Series | **SA10** | **SA25** | **SA50** | **SA70** | **SA100** |
|---|---|---|---|---|---|
| Af7 | 60 | | | 60 | |
| D | 55 | | | 75 | |
| AL | 20 | | | 25 | |
| AB | M16x1,5 | | | M20x1,5 | |
| AH | 16 | | | 20 | |
| AG | 33 | | | 38 | |

## Tool holder
## Code **RS**

Provides connection to a possible mould with four fastening holes.
To be installed jointly with the part code CS (female/male adapter).
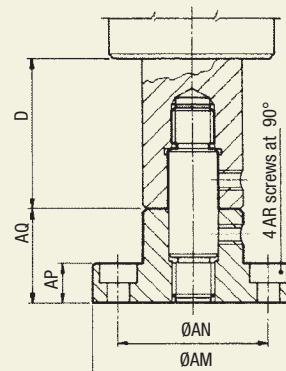
| Series | **SA10** | **SA25** | **SA50** | **SA70** | **SA100** |
|---|---|---|---|---|---|
| D | 55 | | | 75 | |
| AQ | 35 | | | 40 | |
| AP | 15 | | | 20 | |
| AM | 78 | | | 98 | |
| AN | 60 | | | 78 | |
| AR | M8 | | | M8 | |

## External load cell
## Code **TC4**

The use of an external load cell makes it possible to obtain force measurements to a precision of 0.2% F.S.

| Series | **SA10** | **SA25** | **SA50** | **SA70** | **SA100** |
|---|---|---|---|---|---|
| D | 55 | | | 75 | |
| AY | 75 | | | 85 | |
| AZ | 100 | | | 127 | |
| AX | 60 | | | 60 | |
| AA | 20 | | | 25 | |
| AB | M16x1,5 | | | M20x1,5 | |
| AF | M8x1,5 | | | M8x1,25 | |
| AE | 10 | | | 12 | |
| AC | 22 | | | 28 | |
| AD | 18 | | | 22 | |

## Micrometric probe
## Code **GT2**

The use of an external probe makes it possible to measure the position of the tool in relation to a reference point on the piece, with micrometric precision.
See page 11

Table for selecting the right size

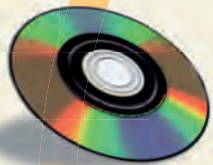| Type | | | | | | | | | | | | | | | | | SPEED mm/s |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SA100** | | | | | | | | | | | | | | | | | 100 |
| **SA70** | | | | | | | | | | | | | | | | | 200 |
| **SA50** | | | | | | | | | | | | | | | | | 250 |
| **SA25** | | | | | | | | | | | | | | | | | 140 |
| **SA10** | | | | | | | | | | | | | | | | | 250 |
| **PA5*** | | | | | | | | | | | | | | | | | 250 |
| **PA2*** | | | | | | | | | | | | | | | | | 250 |
| kN | 0.1 | 0.25 | 0.5 | 0.7 | 1 | 1.5 | 2 | 2.5 | 3.5 | 5 | 7 | 10 | 20 | 25 | 50 | 70 | 100 |

\* See specific catalogue for Series PA

# The system, ready for the installation on production lines.

**SA** cylinder

Instrument
**Press-Right**

**WinScope®**
Software

Alfamatic offers a KIT ready to fit into
pressing stations.

In addition to the command and control
chain (consisting of cylinder, motor, servo
drive, Press-Right instrument and cables)
the main C-structure, made of monolithic
steel, is supplied with the electrical system
housed in a pre-wired cabinet.

The C-structure is also available with
special dimensions to customer
specifications.

Main
C-structure

All the cables connecting
the three components

Electrical system in a cabinet,
complete with servo drive

Available catalogues:

PNEUMO-HYDRAULIC PRESSES

MANUALLY OPERATED PNEUMO-HYDRAULIC PRESSES

PRESSING PROCESS CONTROL SYSTEMS

SERIES AP/AX POWER GROUPS

SERIES PK POWER GROUPS

PRESSURE BOOSTERS

ELECTRIC CYLINDERS

ELECTRIC PRESSES

SPECIAL PRESSES

Technical data and pictures may change without

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