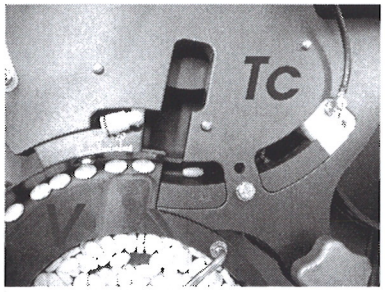
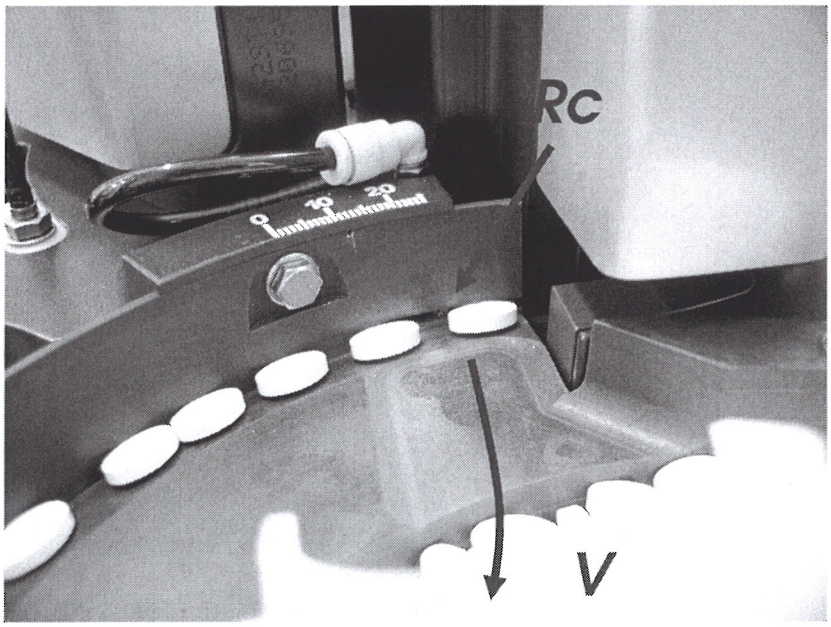
11.2 Tablet dosing system

The end part of the vibrating container ***V*** spiral overlaps with the conveyor drum ***Tc***.
This area has a recirculation air jet ***Rc*** which blows the tablets not for dosing away from the spiral and back in the vibrating container ***V***.

Figure 34 – Detailed view of the inside of the vibrating container.

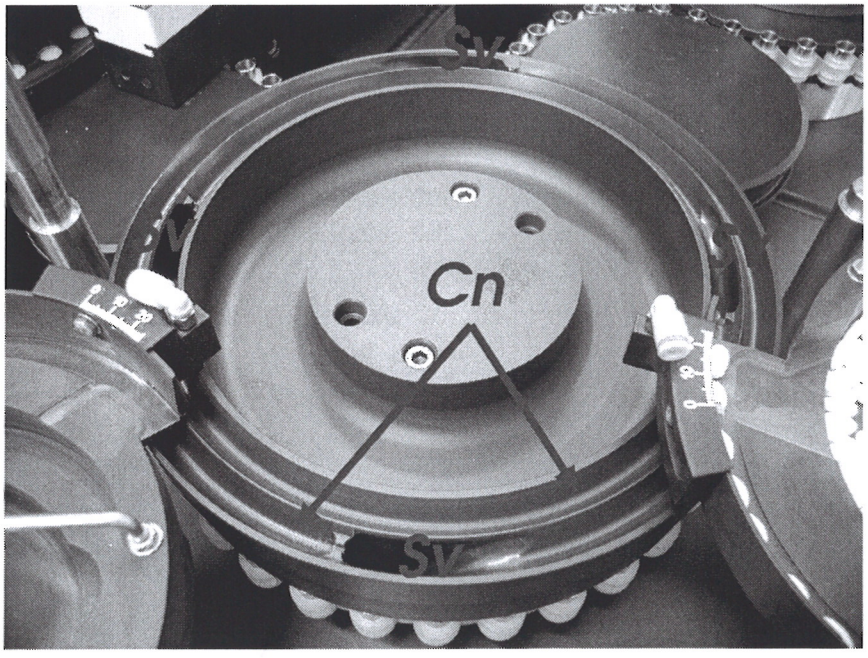




Conveyor drum

The conveyor drum consists of two channels ***Cn*** interrupted by two or four chutes ***Sv*** (depending on the machine speed and the number of elements), for tablet discharge.

Figure 35 – Full view of the conveyor drum.



The alternation of these continuous channels with the chutes divides the conveyor drum into sectors **A** and sectors **B**.

The sectors **A** are represented by the continuous channel areas while the sectors **B** are represented by the chutes.

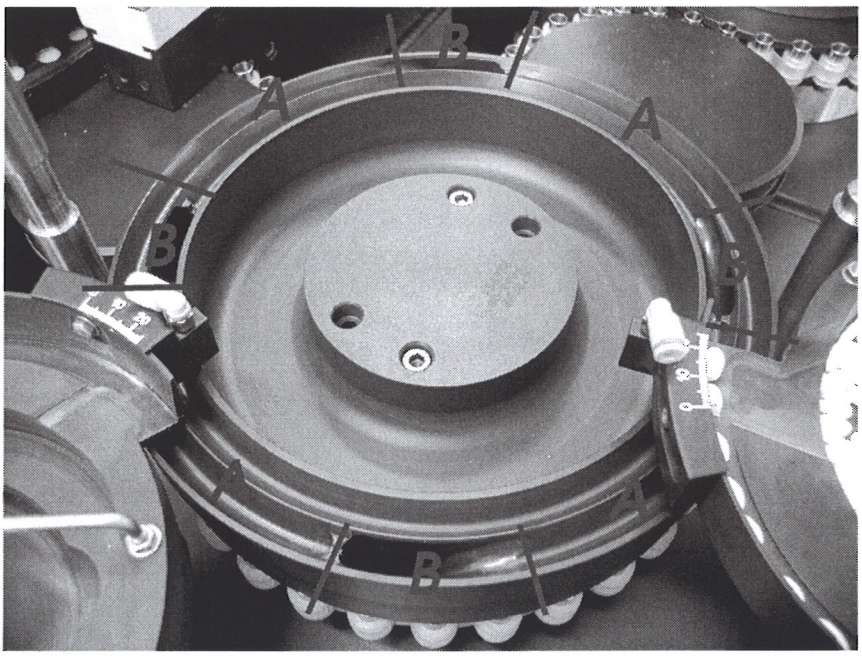


Figure 36 – Highlighting of sectors A and B

The conveyor drum rotates continuously and when it has a sector ***A*** beneath the end part of the vibrating container spiral, this triggers the stage during which one or more tablets are dropped onto the drum.

Tablet dosing and recirculation air jet

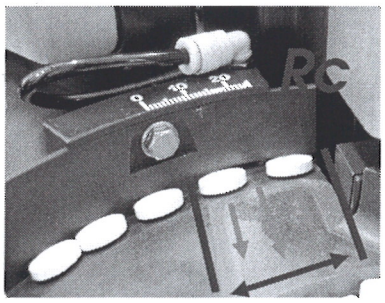


Figure 37 – Detailed view of the recirculation air jet

As soon as sector ***A*** starts, the recirculation air jet ***Rc*** is stopped, allowing the tablets to be transferred to this sector. Once the pre-set number of tablets has been transferred, the laser sensor restores the recirculation air jet ***Rc***.

The correct side positioning of the air jet depends on the tablets used and is adjusted manually by the operator with the aid of the graduated scale.

The tablet selected **Cm** falls onto the conveyor drum continuous channel where a leveller **R** prevents it from being pulled forward by the rotation of the conveyor (see the arrow).

When the next sector **B** arrives close to the leveller, the tablet drops along the chute **Sv** due to the acceleration created by force of gravity and the rotation of the conveyor drum.

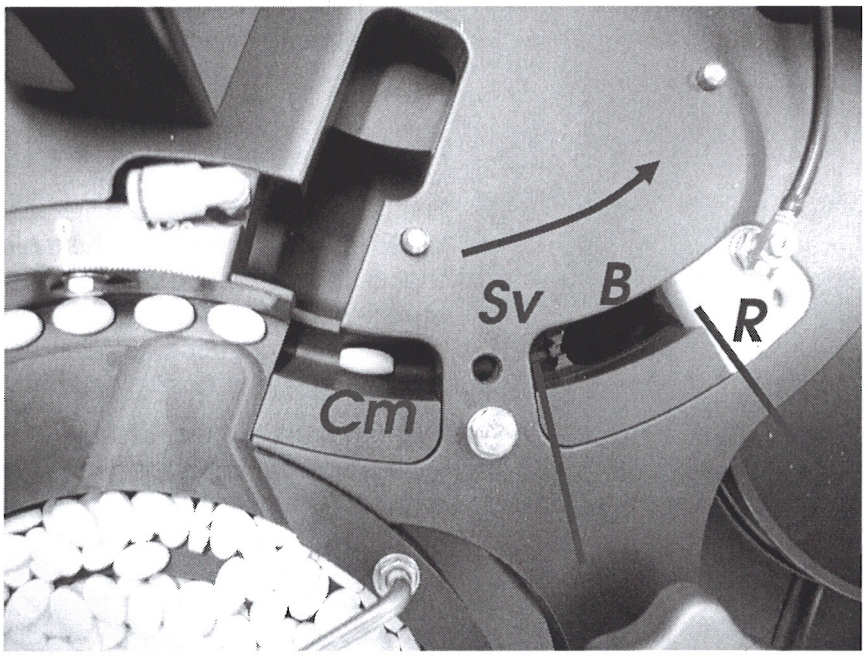


Figure 38 – Part view of the conveyor drum descent area

Tablet descent chute

The parabolic shape of the chute ***Sv*** ensures the correct descent of all types of tablet (lenticular, oblong, etc.).
This particular shape and size is designed to accompany the tablet above the capsule body and to prevent irksome bouncing which might block the tablet or delay the tablet drop process.

At the end of the chute, the tablet, by force of gravity, drops inside the capsule body contained in the conveyor belt bush.

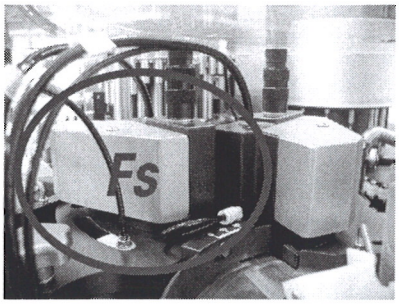
11.3 Dosing control system

The Universal Tablet Unit has a series of devices for accurate control of the various dosing stages and intervention if there are problems.

No tablet dosing

If, for any reason, the tablets are not transferred on the conveyor drum to sector ***A***, the recirculation air jet will still be reset at the end of the sector ***A***.
In this case (no dosing), ***the corresponding capsule is automatically rejected without the machine stopping***

Laser controlling the number of tablets dosed

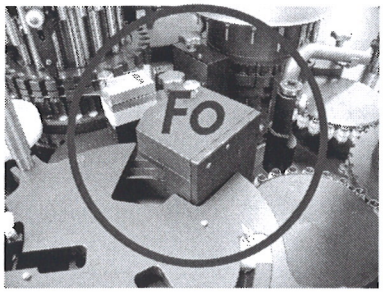


The laser sensor ***Fs*** as well as resetting the recirculation air jet ***Rc*** after the transfer of the tablets on the conveyor drum, checks the passage of the correct number of tablets specified for that particular vibrating container.
In fact, every container can feed one or more tablets, depending on the dosing combinations set.

If an incorrect number of tablets are transferred on the conveyor drum and then dosed, ***the corresponding capsule is automatically rejected without the machine stopping.***

📖 *For further details on the dosing combinations, refer to the dosing combination section in this document.*

Laser controlling for blocked chute



A special laser sensor ***Fo*** checks that the chute is not blocked by one or more tablets that have been dosed.

If the tablets are blocked inside the chute, the blocked chute sensor ***Fo*** commands the ejection of the capsules present on the capsule transfer bush belt in the reject container. The machine stops automatically to allow the operator to clear the blocked chute.

11.4 Unit controlled by means of a PC

The unit is controlled by the capsule filling machine control panel (PC).
Special functions may be used to set the following parameters:

- ***Number of tablets to be dosed per single dosing station***
- ***Dosing combinations***
- ***Production speed***
- ***Use of second dosing station***
  - ***used to optimise the speed by dividing the tablets to be dosed between the two stations***
  - ***used to dose two different tablets in the same capsule***
- ***Vibration container vibration intensity (range)***

Vibration container vibration frequency

The two unit dosing stations are identical but are completely independent in terms of use and adjustments.

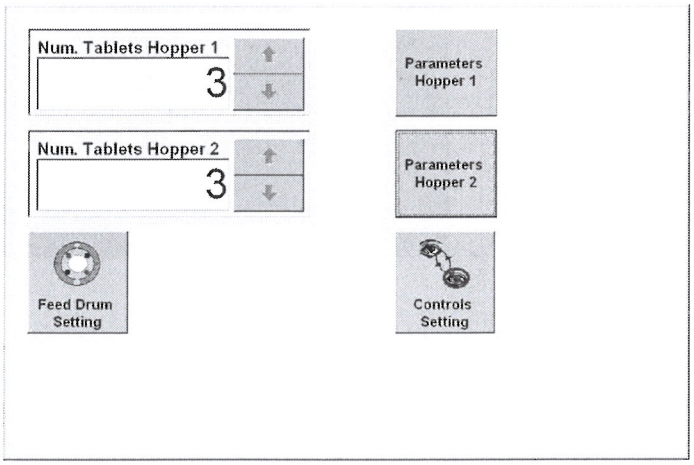


Figure 39 – Example of control panel display: fields for unit operation configuration.

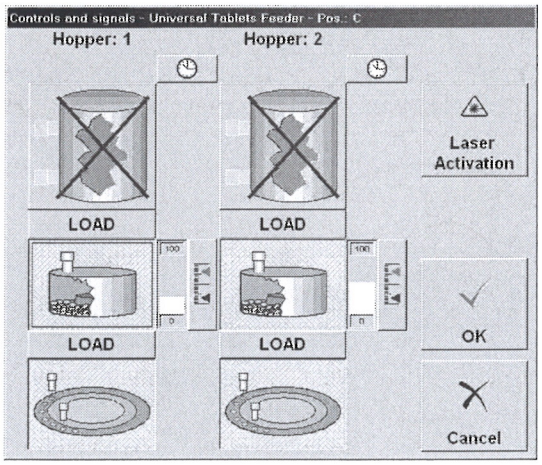


Figure 40 – Example of control panel display: here you can control unit operations, specifically the tablet flow from the hoppers to the conveyor drum.

11.5 Unit dosing combinations

The use of two dosing stations in the universal tablet unit ensures considerable unit versatility.

You can choose from the following:

Different tablets in the two dosing stations (TYPE A conveyor drum)

The **first** station *1* doses one or more tablets of a certain type in the capsule.

The **second** station *2* doses one or more tablets the same or different to station *1*.
In this way the possible dosing combinations are increased, since it is possible to dose two different types of tablet and their combinations. The production speed with four infeed tubes is 12,500 capsules/hour.

TYPE A conveyor drum

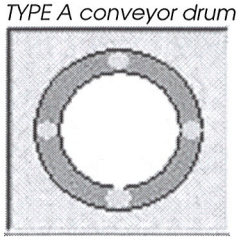
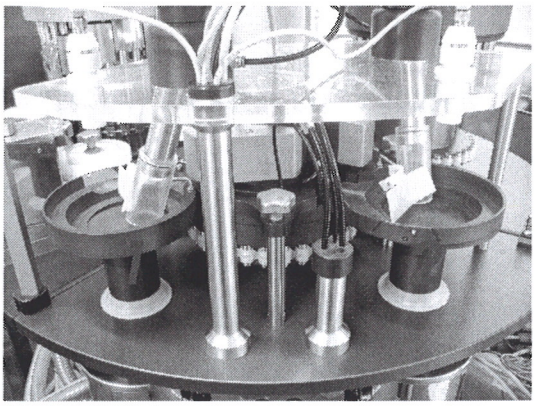


Figure 13 – Use the TYPE A drum conveyor, with both vibrating containers discharging the tablets into the external channel.

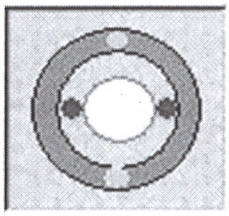


Same tablets in the two dosing stations (TYPE B conveyor drum)

The **first** station *1* doses one or more tablets of a certain type in the capsule.

The **second** station *2* doses the same number of tablets again of the same type as station *1*.
This ensures optimum production speed, with four infeed tubes this is 12,500 capsules/hour.

TYPE B conveyor drum



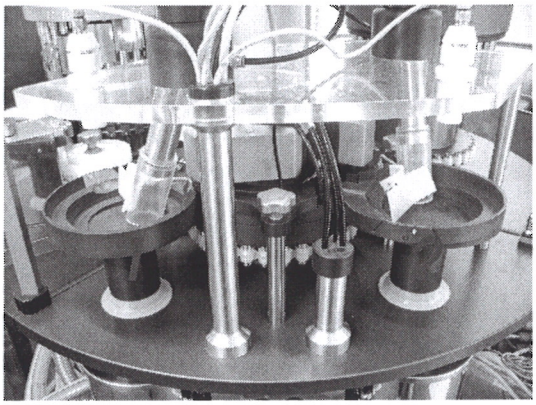


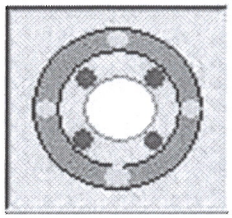
Figure 14 – Use the TYPE B drum conveyor, with the vibrating containers discharging the tablets into the internal and the external channels respectively.

Same tablets in the two dosing stations (TYPE C conveyor drum)

The **first** station *1* doses one or more tablets of a certain type in the capsule.

The **second** station *2* doses the same number of tablets again of the same type as station *1*.
This increases the production speed, with eight infeed tubes this is 25,000 capsules/hour.

TYPE C conveyor drum



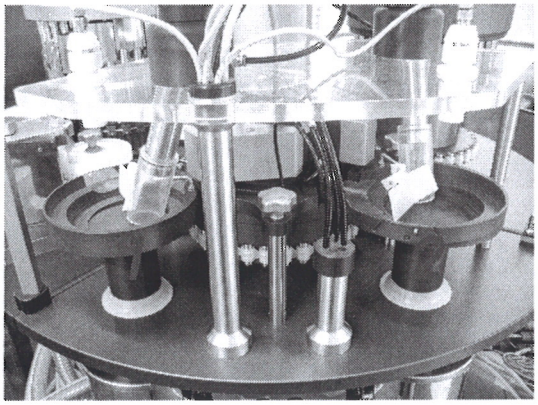


Figure 15 – Use the TYPE C drum conveyor, with the vibrating containers discharging the tablets into the internal and the external channels respectively.

Universal tablet unit dosing combinations

The use of two dosing stations in the universal tablet unit makes it possible to dose identical tablets and different tablets (two types) in various quantities.

DOSING STATION 1	DOSING STATION 2
1 type **A tablet**	1 **type** A tablet
1 type **A tablet**	**More than one** type A tablet
More than one type **A tablet**	**More than one** type A tablet
1 type **A tablet**	1 **type** B tablet
1 type **A tablet**	**More than one** type **B** tablet
More than one type **A tablet**	**More than one** type **B** tablet
Etc...	**Etc...**

11.6 Dosing combinations with other units

The universal tablet dosing unit can operate in combination with another dosing unit envisaged for the PLANETA machine.

2 Universal tablet units

With two universal tablet units installed on the machine, you can dose up to **four** different types of tablet and combine them as required.
As an alternative, again using two universal tablet units installed on the machine, you can dose up to **two** types of tablet but at a production speed twice that obtained by one unit alone.

☞ ***N.B.*** *note that the production speed which can be obtained by one universal tablet unit alone depends on the number, shape, size and dosing combinations of the tablets you wish to dose.*

1 Universal tablet unit + 1 Powder unit

You can dose from **one** to **two different types of tablet** and combine them with **powder.**
In this way, you can obtain a maximum production speed equal to that which can be obtained by the universal tablet unit.

1 Universal tablet unit + 1 Pellet unit

You can dose from **one** to **two different types of tablet** and combine them with two types of **pellets.**
In this way, you can obtain a maximum production speed equal to that which can be obtained by the universal tablet unit.

12. NETT weight control system

*The **NETT** system controls the net weight of the dosed product to ensure total production control (100% of capsules). The system consists of:*

- ***Empty capsule weight control sensor (ECCS)***
- ***Full capsule weight control sensor (FCCS)***
- ***NETT software***
- ***Analytical balance***
- ***Printer (OPTIONAL)***

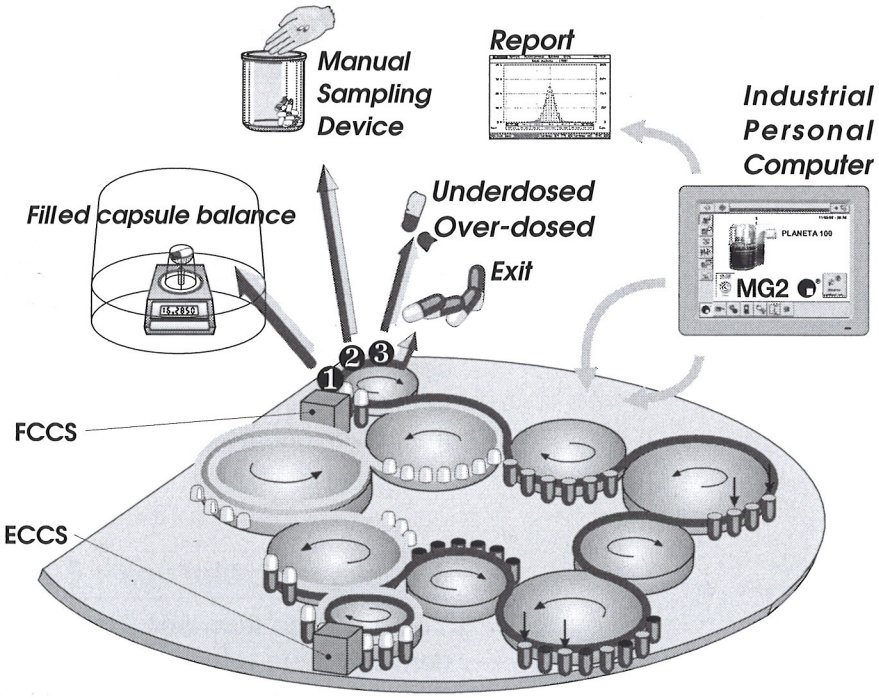


Figure 41 – The drawing shows the NETT weight control system installed on the PLANETA 100.

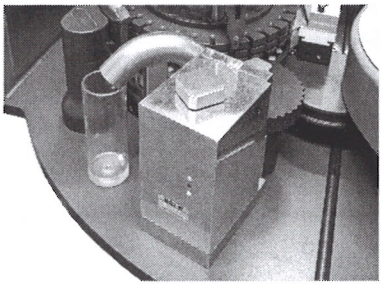
The system determines the net content dosed into each capsule using the difference between gross and tare weight. To calculate tare, the infeed unit, positioned on its capsule infeed transfer wheel, is fitted with a sensor (**ECCS**) that detects each empty capsule.

To calculate gross weight, the capsule outfeed transfer wheel is fitted with a sensor (**FCCS**) that detects each filled capsule.

NETT 100% weight control software

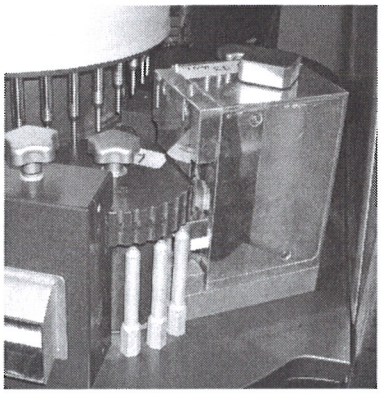
The NETT system software is installed in the industrial PC in the console outside the electrical control unit. By exchanging data with the machine control PC, the software integrates weight control management and machine management functions.

ECCS sensor



The **ECCS empty capsule control sensor** is positioned on the empty capsule transfer unit and weighs each empty capsule (tare).

FCCS sensor



The **FCCS full capsule control sensor** is positioned on the capsule outfeed transfer wheel, and weighs each filled capsule (gross).

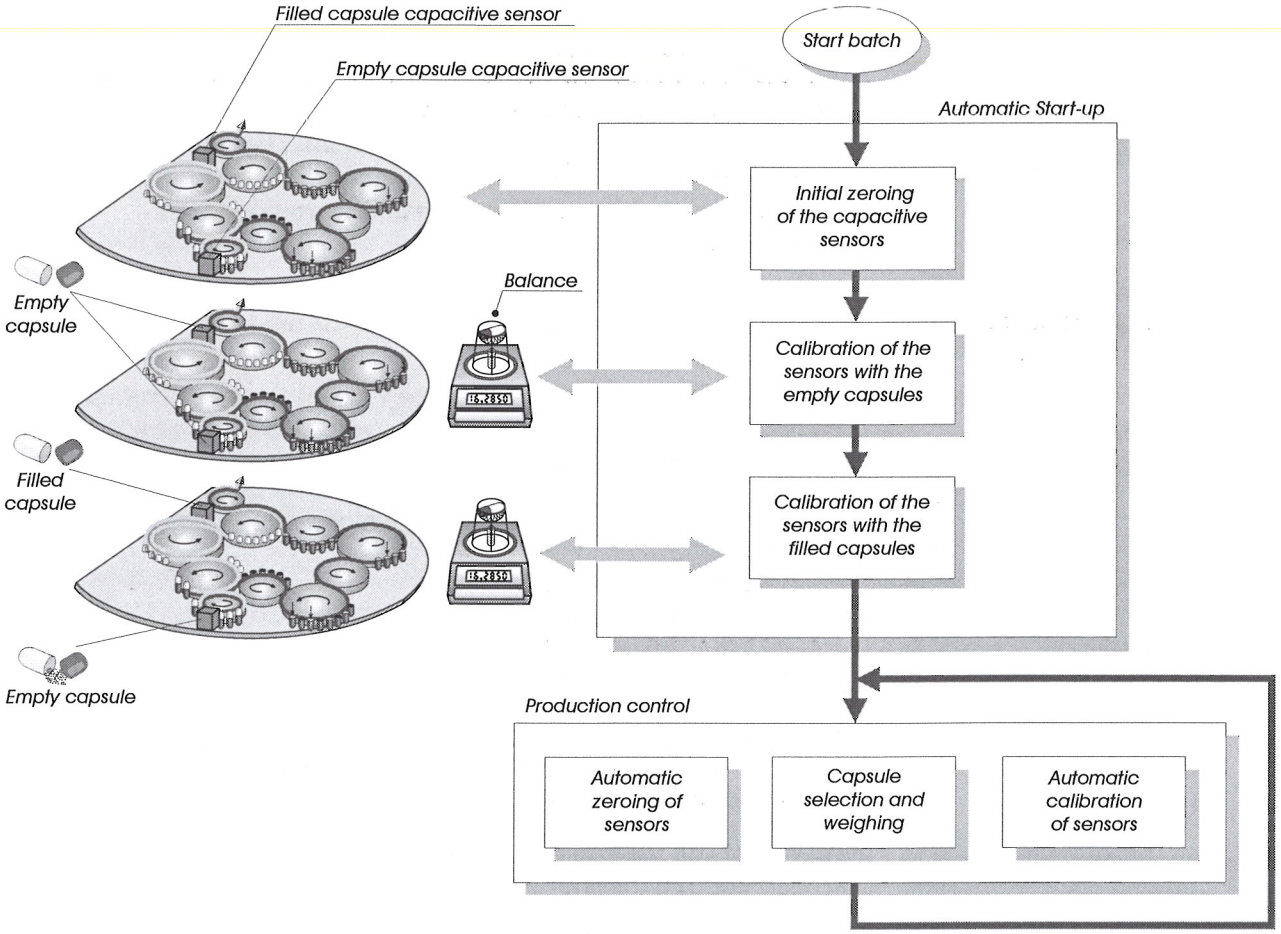
Automatic sensor calibration and zeroing

The system controls sensor functioning to ensure that they remain calibrated. The first test is done on the assumed zero value that the empty capsule sensor detects after the transfer of each capsule.

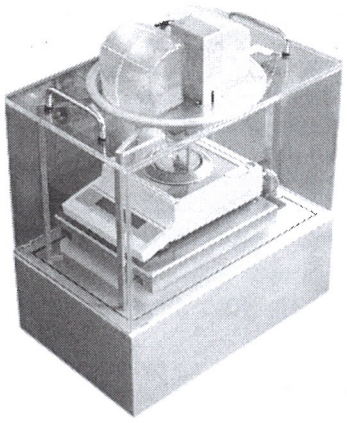
A second, similar test is done using the full capsule sensor.

A third test is done cyclically on the full capsule sensor using the analytical balance which weighs one of the full capsules that has been measured by the sensor.

This operation is described in the following diagram:



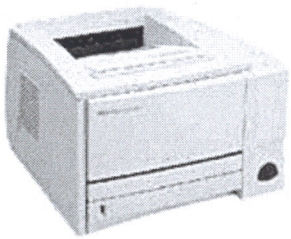
Analytical balance



The system uses the precision balance to weigh a sample of dosed capsules at regular intervals. The system then uses these values to continually calibrate the dosed capsule weight control sensor.

The balance is housed in a protective structure with parts in impact-proof transparent materials to permit visual inspection inside the unit (see photo):
The balance is electrically connected to the capsule filling machine.
A chute transfers the dosed capsules to the balance for weighing. The balance is zeroed between each weighing operation.

Printer



On request the system can be supplied with a printer to enable analysis reports and data to be printed. The printer is located on a support and is connected to the control panel.

Weight control functions

The weight control functions include:

- ***Net weight control of 100% of dosed capsules***
- ***Automatic adjustment of product dosing***
- ***Machine stop***

Net weight control of 100% of dosed capsules

The net weight of the contents dosed into each capsule is calculated by the NETT system using the difference between gross weight and tare.
Capsules whose net weight is outside the set acceptance limits are rejected by the devices on the outfeed disk.

Automatic adjustment of product dosing

Total production control lets you correct any variation in net weight compared to the required one and bring it back within set limits, *practically in real time* and with great precision.

Machine stop

During production the NETT system constantly controls the production cycle thus ensuring more than one level of security.
If the system detects problems that cannot be solved automatically, the machine is stopped and a warning message is displayed on the monitor.

Machine control functions

During lot processing, the system collects data about weight control and machine operation. Data is then exchanged with the PLC controlling the machine to ensure that the production process is monitored and controlled at all levels. Production data are analysed and the results are used to control and adjust machine operation and to monitor and control production quality.
The machine control functions include:

- ***Lot analysis***
- ***Dosator analysis***
- ***Productivity analysis***
- ***Rejected capsule analysis***

Lot analysis

This shows the distribution of net weights detected by the system.

Dosator analysis

This shows the distribution of net weights detected by the system for each dosator installed on the machine.

Productivity analysis

This enables information to be collected concerning machine productivity. For example, for each lot produced by the machine it is possible to discover the number of rejected and accepted capsules.

Rejected capsule analysis

This shows, for each lot produced by the machine, the distribution of net weights outside the external limits.

Operation of NETT system in statistical mode

The system enables the NETT (100%) control to be disabled.
A statistical weight control is enabled as an alternative.

In this mode the weight control system is applied to a sample of dosed capsules.

The sample capsules are picked up and transferred onto the chute which feeds them to the weight control balance.

If this weight is outside the set limits, the capsule is rejected and then ejected into the reject container by an air jet.

If the weight is correct, the capsule is fed to the production container.

Additional system features

The system consists of a series of completely independent components which perform logically distinct functions. Thus the system is fully modular and can be configured to meet the specific requirements of the customer.

The system can be set up for connection to a commercial supervision package. It can also be connected to company networks for remote supervision functions or integration with the company production process.
This means that analysis can be done and reports printed from a remote computer.

Capsule samples can be taken for laboratory analysis.

13. Control system sensors and devices

Correct machine operation is guaranteed by a control system that processes operator commands and simultaneously detects machine data, sending them to the operator.

To do this, the control system uses a network of sensors and actuator devices in the various machine zones involved.

This network of sensors and devices can detect a variety of problems which in part are solved by the machine's automatic operations.

If the automatic operations are unable to solve a problem, the system stops production and displays a fault message.

The control system includes:

- ***Safety devices***
- ***Control devices***
- ***Sensors***
- ***Actuator devices***
- ***Signalling devices***

Safety devices

The line is equipped with several safety devices. These devices assure the operator integrity and isolate the energy forms (e.g. machine stop and/or electrical circuits with dangerous voltage disconnection)

- ***Guards microswitches***
- ***Hood microswitches***
- ***Safety circuit (Pilz)***
- ***Emergency pushbuttons***

Control devices

These process the detected data and make the adjustments necessary to control the production process.

- ***IPC***
- ***PLC***

Detection devices (sensors)

These detect information and problems concerning the functioning of the components on the machine (e.g. capsule missing from a certain phase of the capsule cycle).

Actuators

These enable the operator to correctly check and operate the machine and to properly perform the production processes.

- ***Brushless motors (motor for empty capsule pickup)***
- ***Asynchronous three-phase motors (machine motor, head raise motor)***
- ***D.C. motors (service motors for adjustment functions)***
- ***Solenoid valves (solenoid valves for pneumatic system)***
- ***Relay and contactors***

📖 *Actuator presence and functioning are described in those parts of the manual describing their specific use.*

Signalling devices

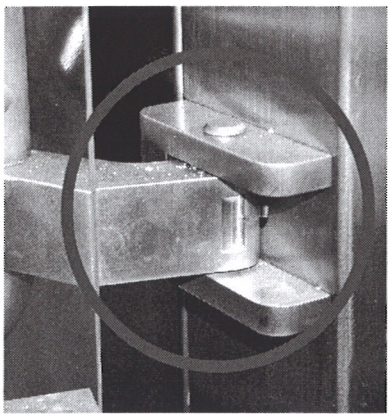
These visual and acoustic devices signal machine working particular conditions.

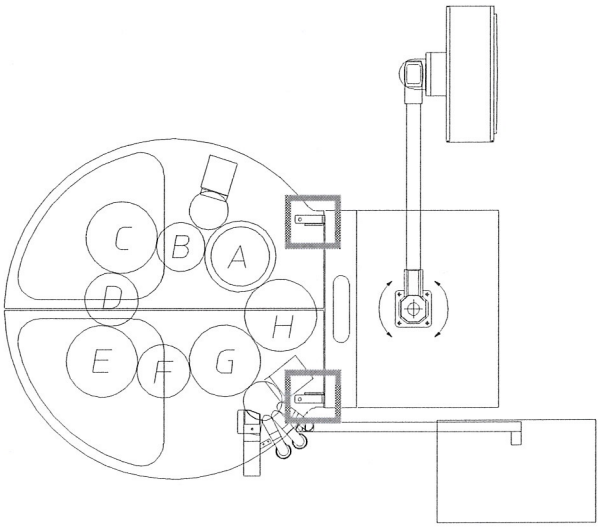
- ***Buzzer***
- ***Signalling beacon***

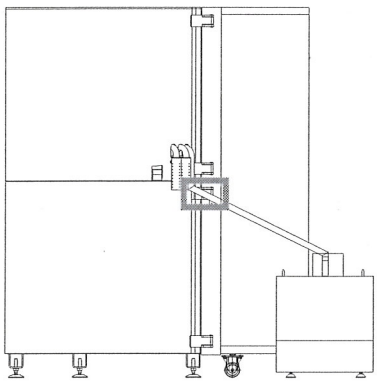
13.1 Safety devices

Guard safety microswitches

Machine protection guards can be opened and are equipped with safety microswitches.





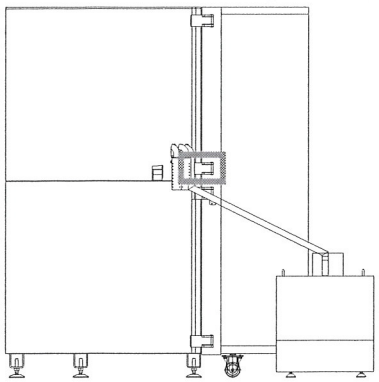


The safety micro-switches cut power supply (main circuit) out of all machine actuators.

Therefore, if guards are opened during machine running, the machine immediately stops and it cannot restart up.

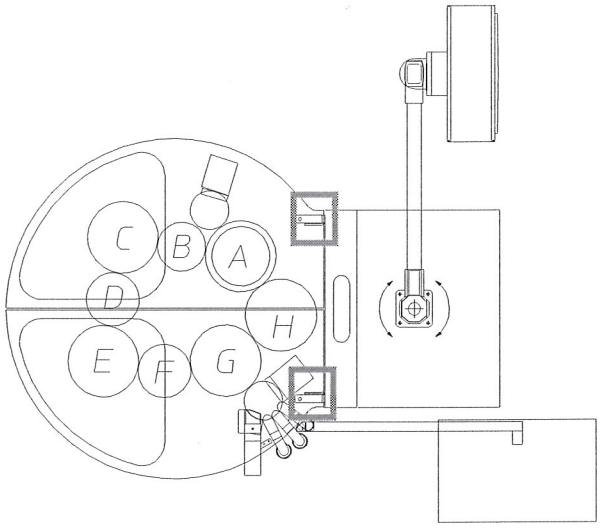
An alarm message is also displayed in these conditions.

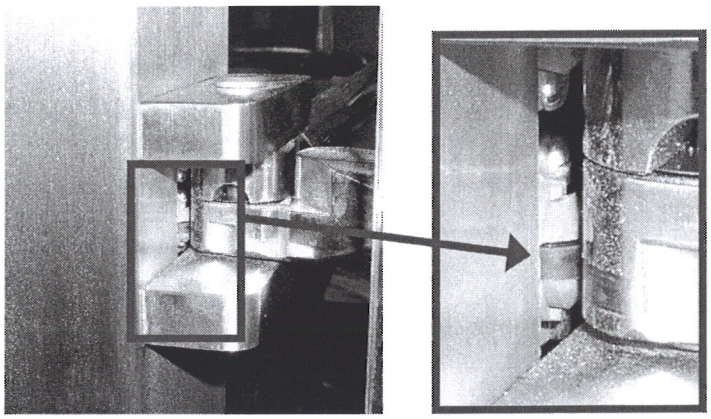
In order to restore power supply, close guards back and re-equip the safety circuit by pressing **RESET** button on the control panel.



Hood safety microswitches

Machine upper part protection hoods can be opened and are equipped with safety microswitches.





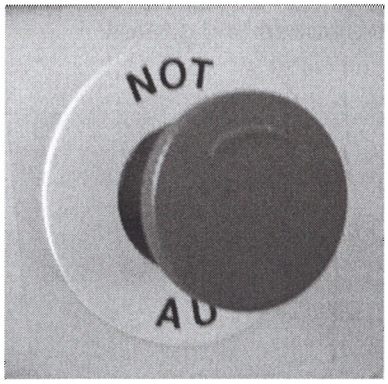
The safety micro-switches cut power supply (main circuit) out of all machine actuators.

Therefore, if hoods are opened during machine running, the machine immediately stops and it cannot restart up.

An alarm message is also displayed in these conditions.

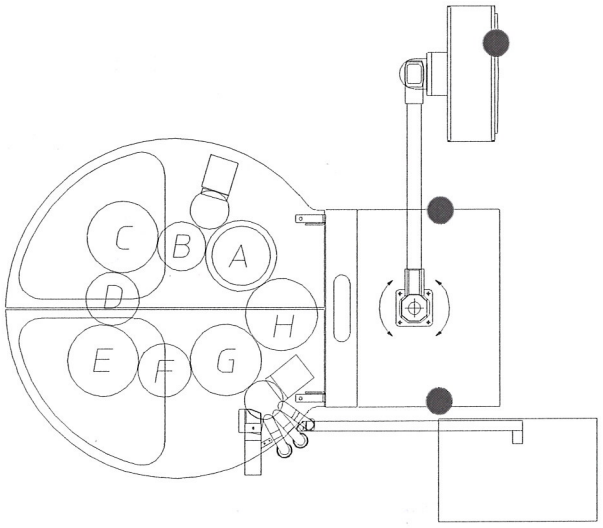
In order to restore power supply, close hoods back and re-equip the safety circuit by pressing **RESET** button on the control panel.

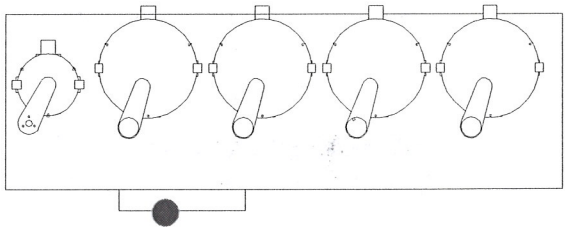
Emergency pushbuttons



Emergency pushbuttons cut power supply (main circuit) out of all machine actuators and services.

- ***2 buttons on the electric cabinet***
- ***1 button on the control panel***
- ***1 button on the service cabinet***

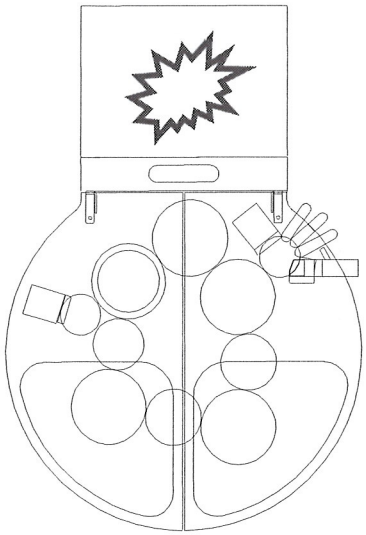




If one of these buttons is pressed, the machine immediately stops (or its restart up is not allowed).

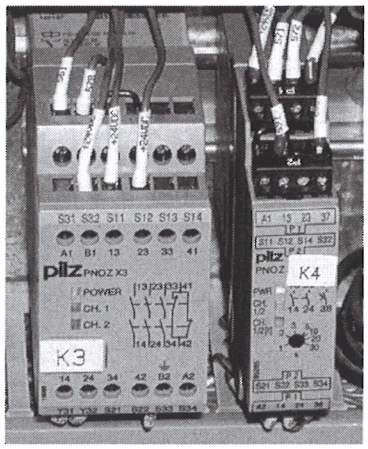
A message is also displayed in these conditions.

In order to restore power supply, release the mushroom button and re-equip the safety circuit by pressing RESET button on the control panel.



Relè di sicurezza (PILZ)

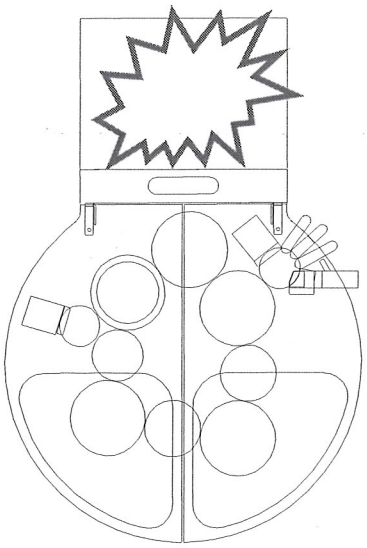
Two safety relays are in the electric cabinet.
One of them controls the emergency circuit (emergency pushbuttons) and the other one controls hoods and guards (hood and guard microswitches).



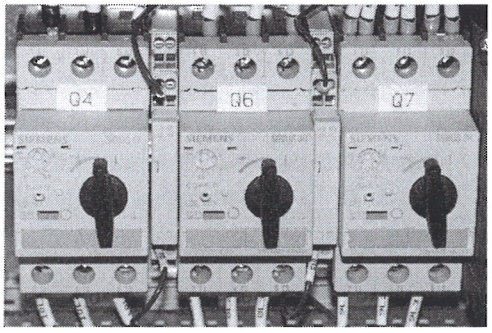
These devices control the signals from micro-switches related and cut-off the circuit.

A message is also displayed in these conditions.
In order to restore safety relays re-enable the circuit and press **RESET** button on the control panel.

Thermomagnetic safety switches



Thermomagnetic safety switches cut power supply (main circuit) out of their actuators, when their absorbed current is above the set value.



If a current overload occurs, the thermomagnetic safety switch is deactivated and causes the immediate energy cut of its actuator.
A message is also displayed in these conditions.
In order to restore the thermomagnetic safety switch working, you must:

1) Check possible overheating, short circuits and the functional condition of its actuator.

2) Re-equip the thermomagnetic safety switch and check again its actuator working.