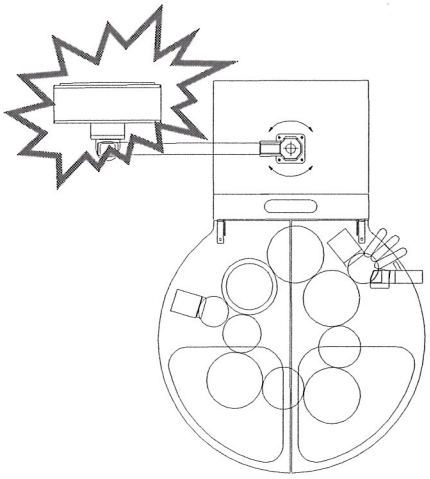
13.2 Control devices



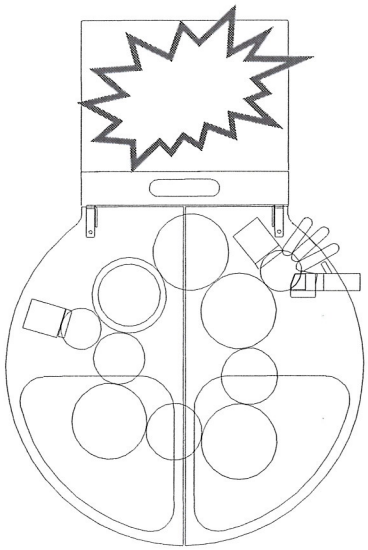
Industrial computer (IPC)

The industrial computer processes the commands entered by the operator and the data received from the control devices.

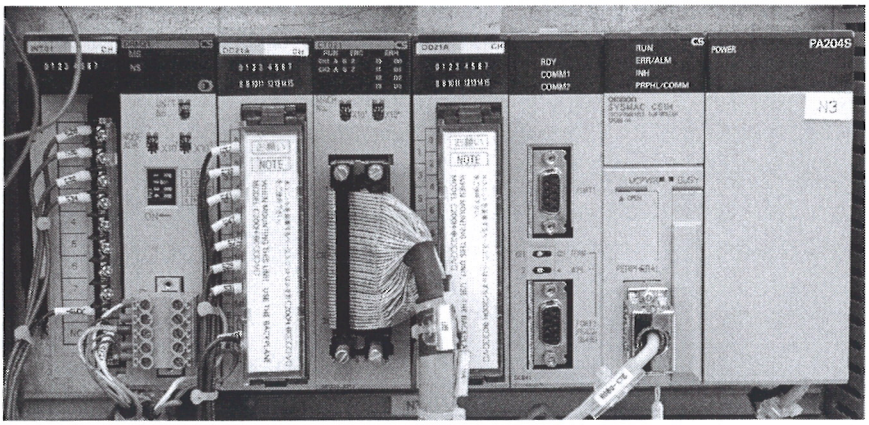
All the software used to integrate machine control and weight control functions is installed on the computer.

The computer has a touch-screen monitor which acts as the system/operator interface. The monitor is used to enter commands and display warning messages.

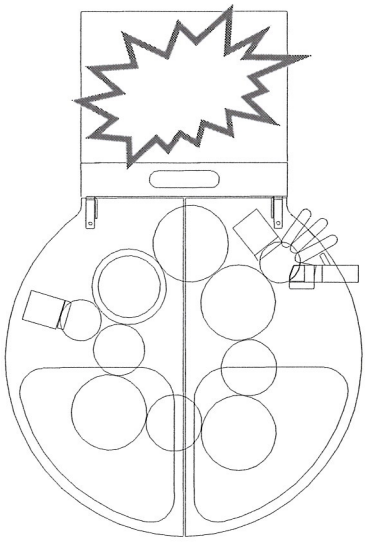
Machine PLC



The machine PLC processes information and performs logic sequences to enable the actuator devices.

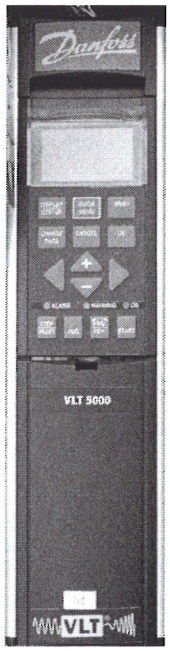


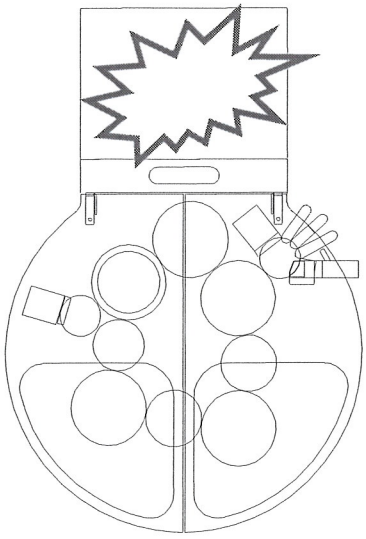
The information is the data received from the machine sensors and other control devices.



MACHINE MOTOR DRIVE (Frequency driver)

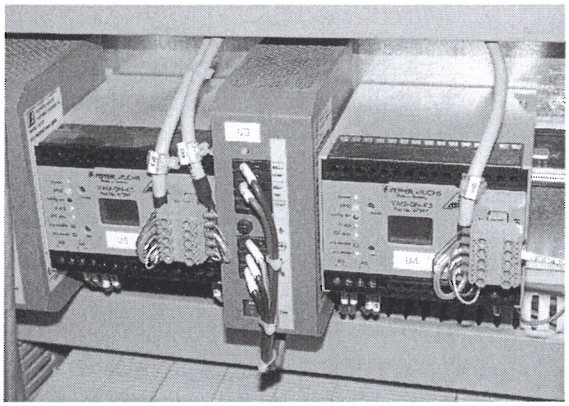
This device, applied to the machine motor, permits slight variations of production speed to obtain the best performance of some applicable dosing units. In addition, the drive lets you maintenance functions on the machine.

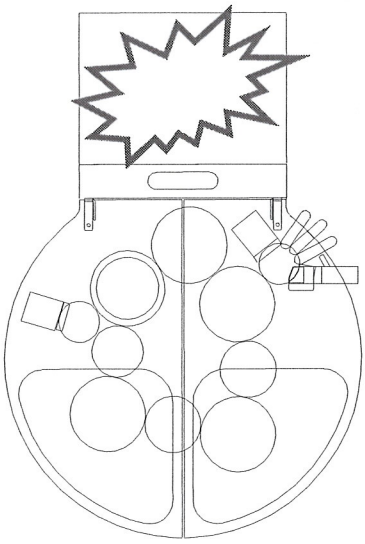




ASI and BUS GATEWAYS

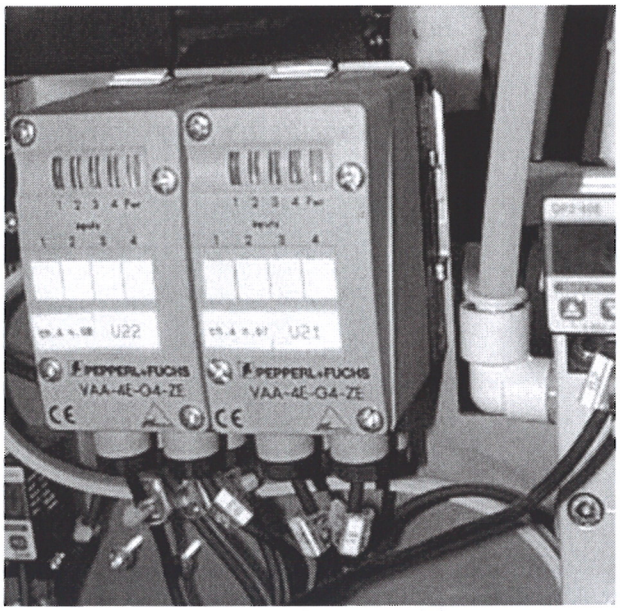
This device has an internal logic that creates an interface between the PLCs and the Input/Output modules.



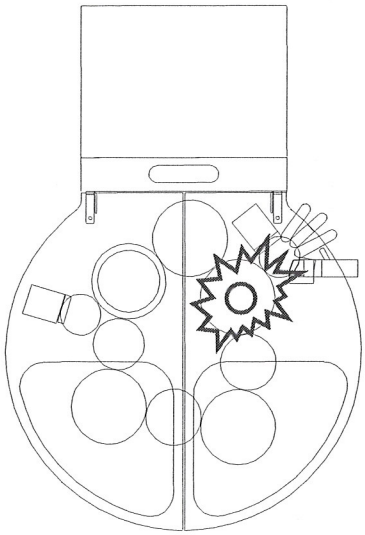


INPUT/OUTPUT MODULES (ASI BUS)

These are interface devices which transmit sensor signals to the PLC and processed signals from the PLC to the machine actuators.

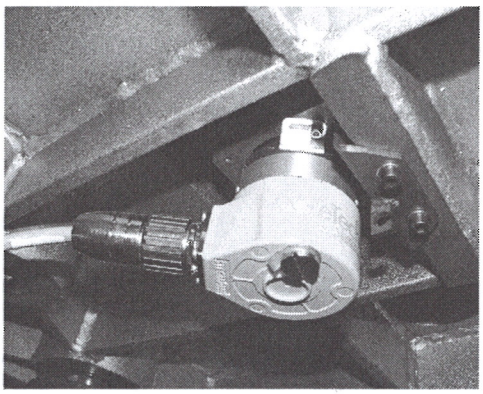


13.3 Detection devices (Sensors)



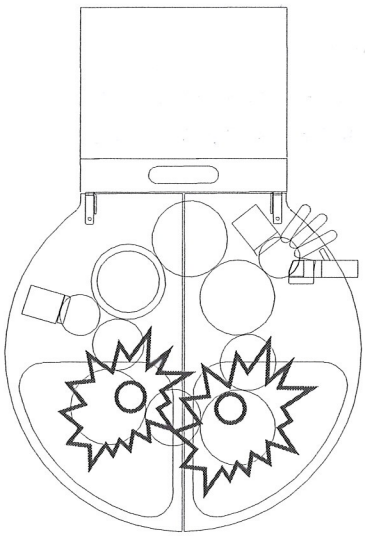
Machine phase Encoder

It is an incremental line-driver encoder.
This device links together the phases of the mechanical units with the machine electronic control phases.
The encoder reads a mechanical position and translate it in electric position. This makes possible the machine phasing and an accurate recognition of each position for the machine.

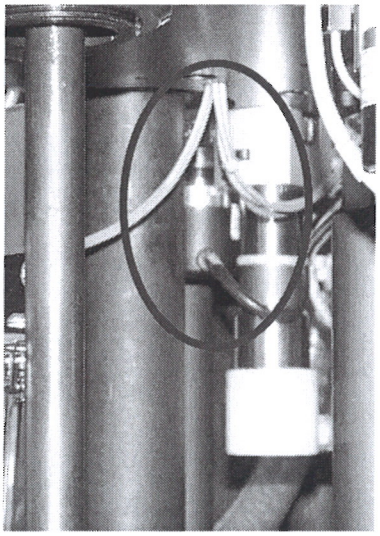


If the encoder malfunctions, the control system stops the machine and displays a message on the monitor.

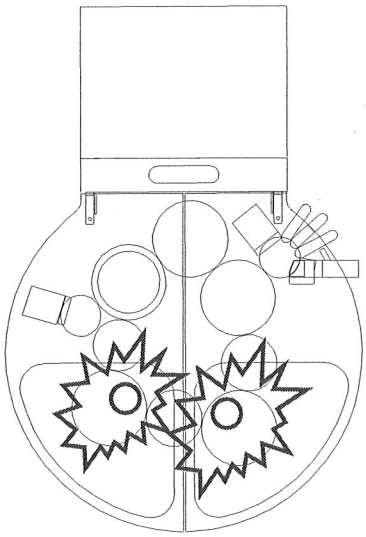
Dosing chamber encoder



It is an incremental line-driver encoder.
This device allows to control the chamber adjustment during powder dosing.

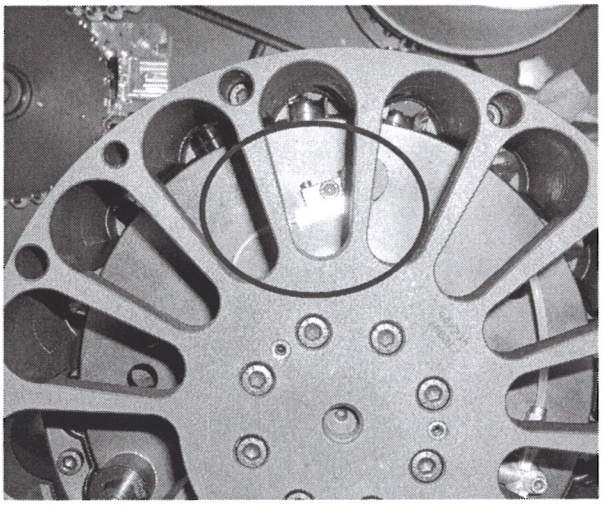


If the encoder malfunctions, the control system stops the machine and displays a message on the monitor.
Each dosing unit is equipped with a chamber encoder for the adjustment of relevant dosing chamber.



Dosing chamber maximum limit sensor

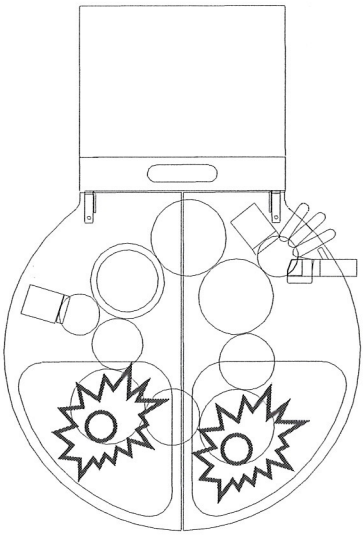
This device is an inductive sensor N.C. (Normally closed). It is used to detect the maximum value performable in the powder dosing chamber.



It also enables the set value and the real mechanical value to be aligned. The sensor intervention means that the maximum mechanical limit value for the chamber has been reached.

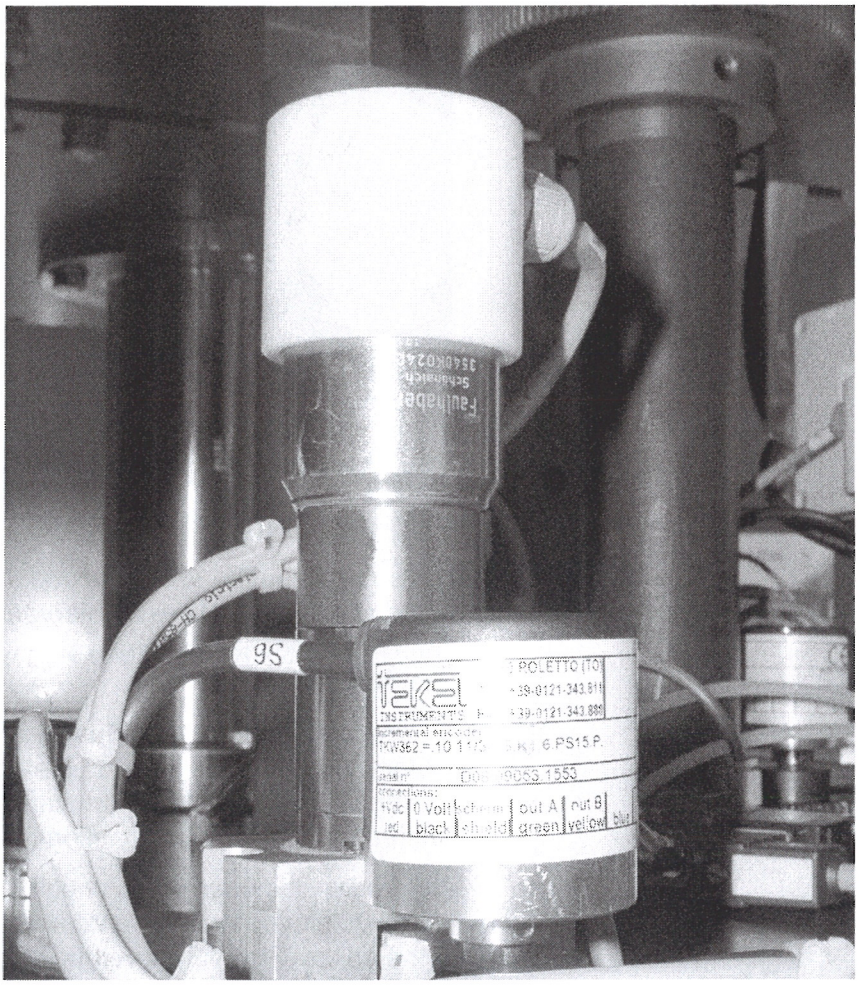
During chamber height adjustment, if the sensor is triggered before the adjustment is completed, the adjustment command is aborted and an alarm message is displayed within the drive control function (on the panel).

Moreover, it is possible to check the alignment between the value displayed on the panel and the real mechanical value if the sensor intervenes within 1 mm of the maximum value.



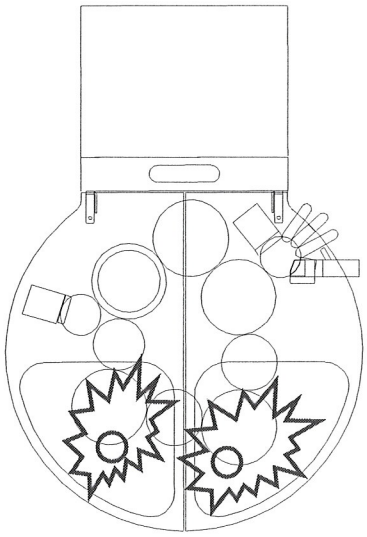
Powder compression encoder

It is an incremental encoder.
This device is used to set the compression level during powder dosing.



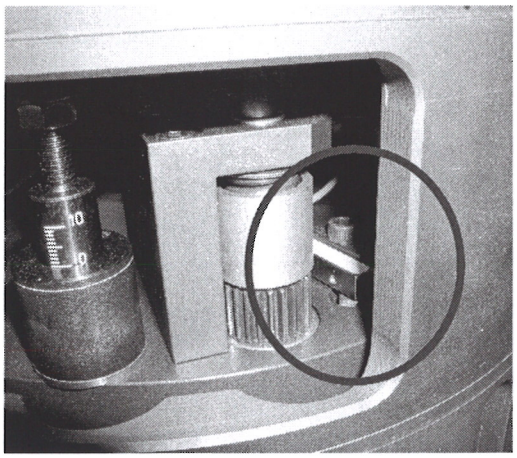
If there is a fault the control system stops the machine and displays a message on the monitor.

Each powder dosing unit has an encoder for adjustment of powder compression.

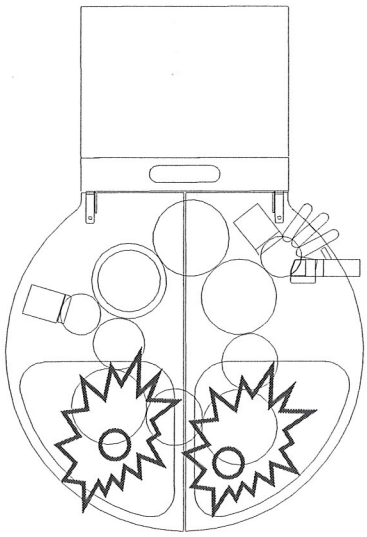


Powder compression minimum limit sensor

This device is an inductive sensor N.C. (Normally closed). This device checks when the minimum possible limit is reached during powder compression.

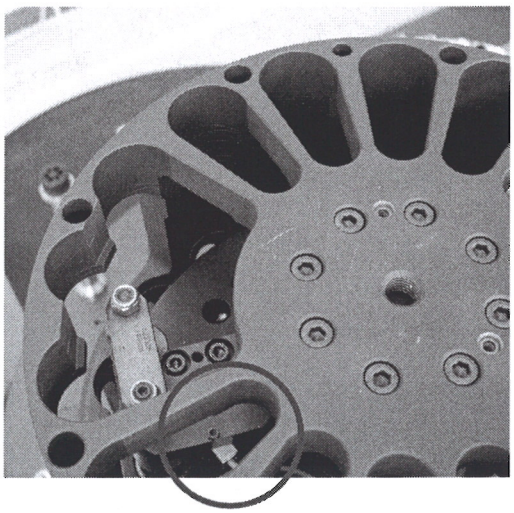


This sensor is triggered when the minimum compression limit is reached. During compression adjustment, if the sensor is triggered before the adjustment is completed, the adjustment command is aborted and an alarm message is displayed within the drive control function (on the panel). Moreover, it is possible to check the alignment between the value displayed on the panel and the real mechanical value if the sensor intervenes within 1 mm of the minimum value.

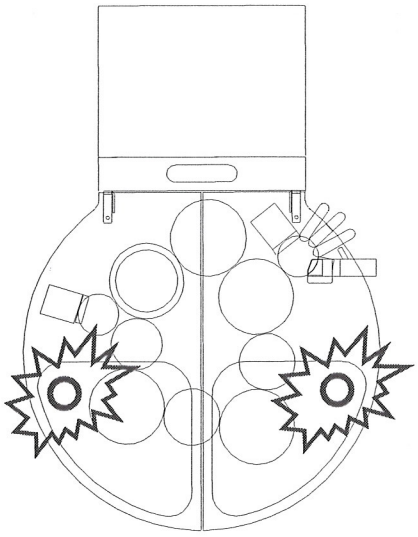


Powder compression maximum limit sensor

This device is an inductive sensor N.C. (Normally closed). This device checks when the maximum allowed limit is reached during powder compression.

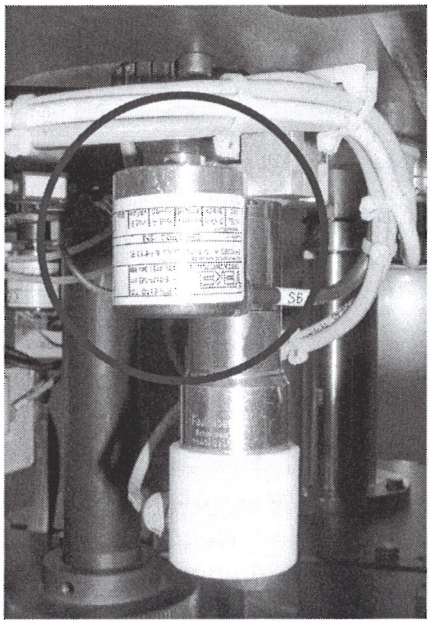


When powder compression reaches the maximum level, or in case of incorrect adjustment, the control system stops the machine and displays a message on the monitor.



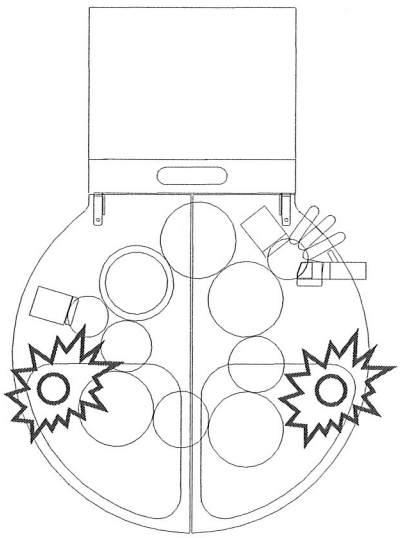
Layer encoder

It is an incremental encoder.
This device is used to set and measure the layer inside the rotary container.



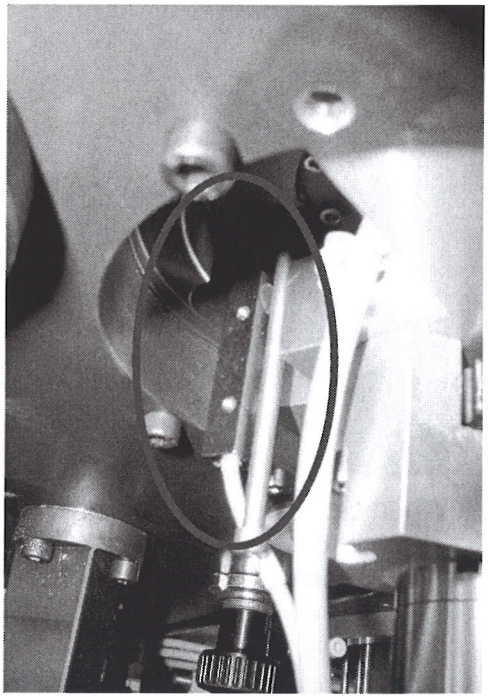
If there is a fault the control system stops the machine and displays a message on the monitor.

Each dosing unit has an encoder for adjustment of powder compression.



Powder layer maximum limit sensor

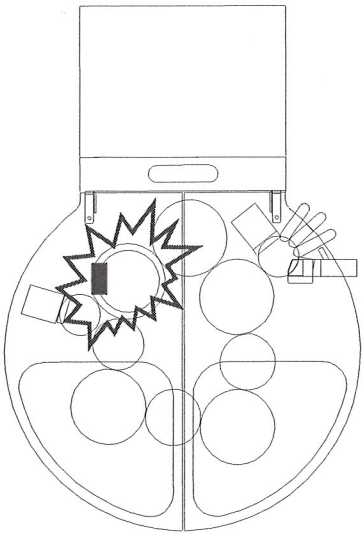
This device is an inductive sensor N.C. (Normally closed).
This device checks when the maximum allowed limit is reached for the powder layer inside the rotary container.



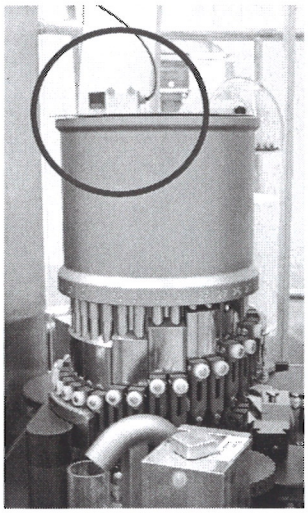
When the powder layer reaches the maximum level the control system stops the machine and displays a message on the monitor.

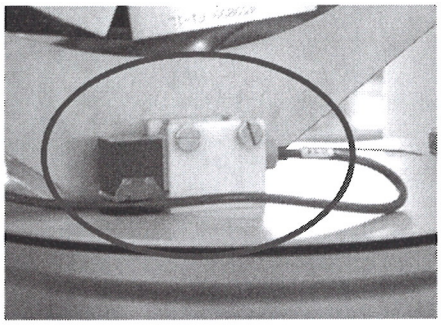
During layer adjustment, if the sensor is triggered before the adjustment is completed, the adjustment command is aborted and an alarm message is displayed within the drive control function (on the panel).
Moreover, it is possible to check the alignment between the value displayed on the panel and the real mechanical value if the sensor intervenes within 1 mm of the maximum value.

Capsule hopper minimum level sensor



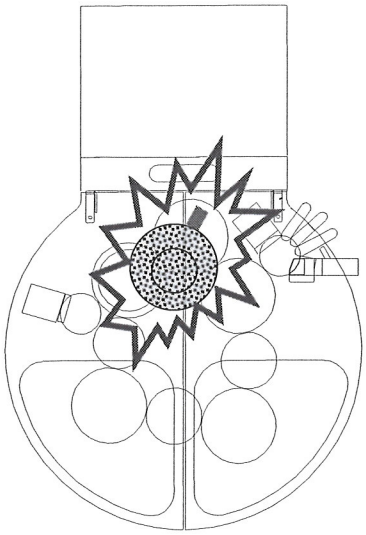
It is an optical sensor (reflection photocell).
This device detects when the minimum level of empty capsules in the rotary hopper has been reached.



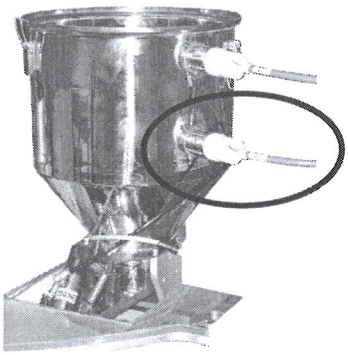


When capsule level drops below the minimum set limit, a warning message is displayed on the monitor and the vibrating infeed hopper is turned on.

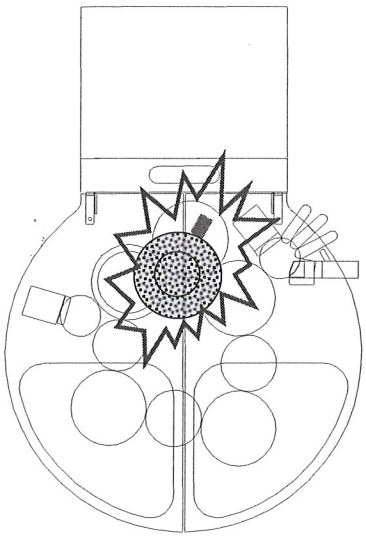
Lev. sensor MIN. capsules in hopper



It is a capacitive sensor N.O. (normally opened).
This device detects when the **MINIMUM** level of capsules in the external hopper has been reached.

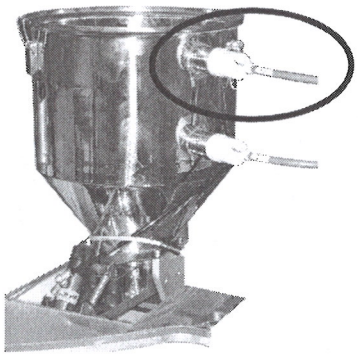


The system enables the automatic loading device when capsule level falls to the set minimum level detected by the sensor.

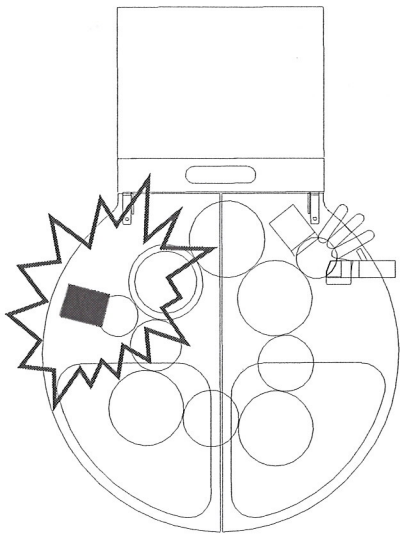


MAX. capsules in hopper level sensor

It is a capacitive sensor N.O. (normally opened).
This device detects when the **MAXIMUM** level of capsules in the external hopper has been reached.

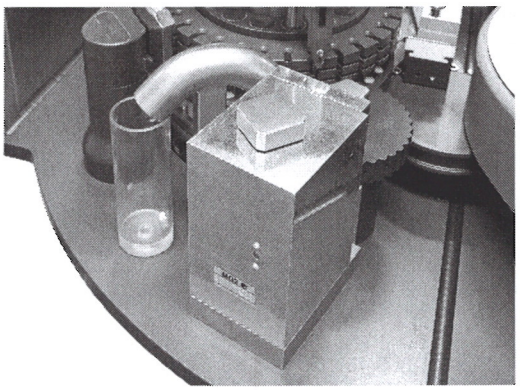


The system stops the automatic loading device when capsule level reaches the set maximum level.



ECCS sensor

The **ECCS** sensor (Empty Capsule Capacitive Sensor) is capacitive.
This device is positioned on the capsule infeed transfer wheel and, in addition to detecting capsule presence, it calculates empty capsule mass.

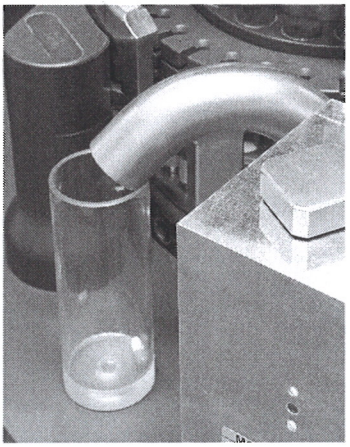


The **NETT** system that controls this sensor can detect any malfunction and generate a message on the monitor.

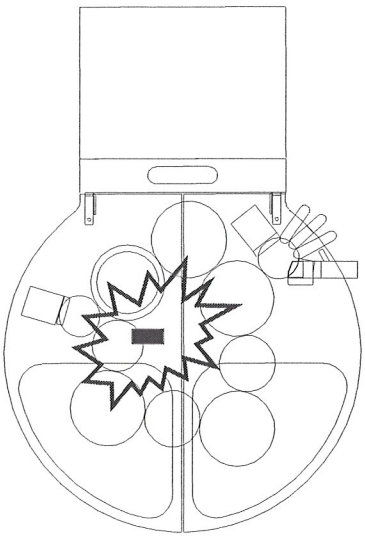
If a capsule is missing after a set number of consecutive cycles, the control system stops the machine and a message is displayed on the screen.

If the machine is fitted with a tube cleaning device, the system stops the machine and enables the cleaning air jet if a capsule is missing after a set number of consecutive cycles.

The sensor also detects non-transferred capsules from the feeding wheel to the feeding and orientation unit and generates their rejection into the reject container (see photo below):



📖 *For more information on the function of the ECCS sensor, see the "Weight control system" paragraph in this chapter.*

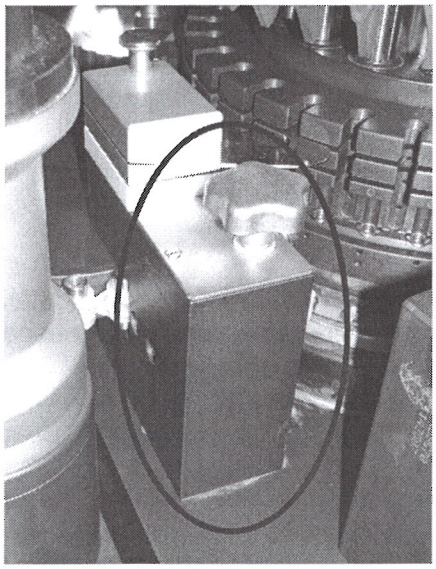


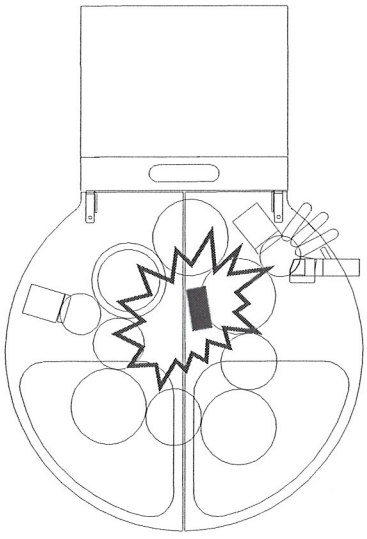
Body presence sensor (unopened capsules)

It is a ultrasound sensor with transmitter and receiver.
This device detects any unopened capsules in the body transfer belt after the opening and positioning phase.

When an unopened capsule is detected, it is ejected by the system.

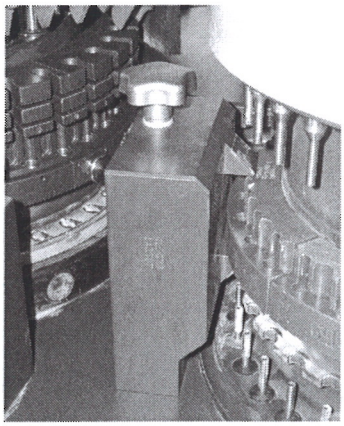
In case of **n** pre-set (fixed)unopened capsules in the same position or in generic positions, the control system stops the machine and displays an appropriate fault message on the monitor.



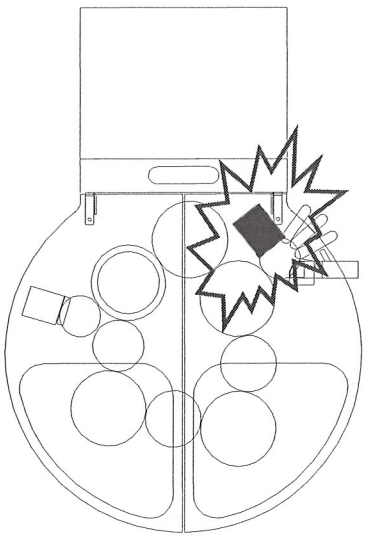


Lid presence in closing unit sensor

It is an ultrasound sensor with a transmitter and receiver.
This device detects the presence of lids in the closing unit.

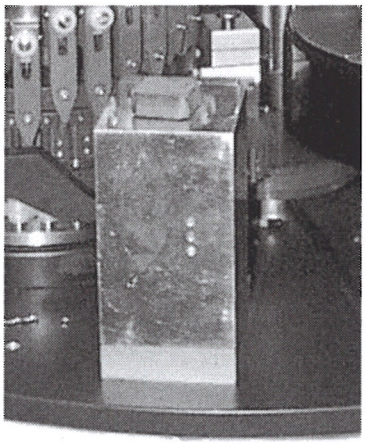


If the device does not detect the presence of a lid, the system ejects the body into the reject container without stopping the machine. After a set number of consecutive missing lids, the control system stops the machine and displays a message on the monitor.



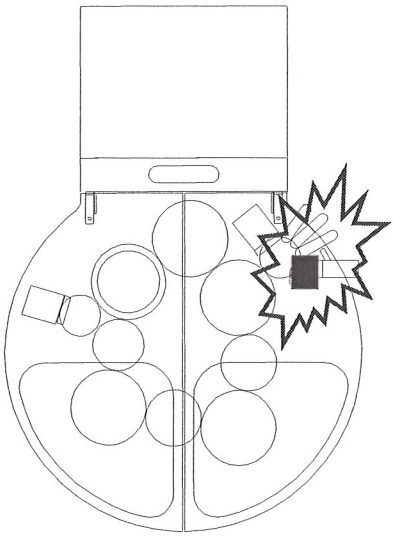
FCCS sensor

The **FCCS** sensor (Empty Capsule Capacitive Sensor) is capacitive.
This device is positioned on the capsule outfeed transfer wheel and, in addition to detecting capsule transfer, it measures filled capsule mass.



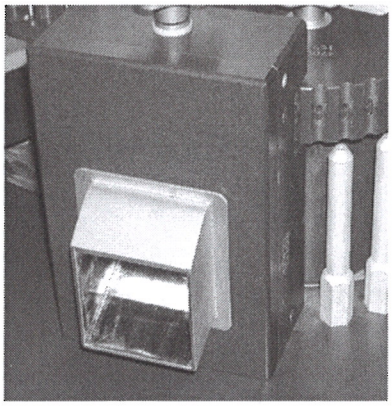
The **NETT** system that controls this sensor can detect any malfunction and generate a message on the monitor.

📖 *For more information on the function of the FCCS sensor, see the "Weight control system" paragraph in this chapter.*



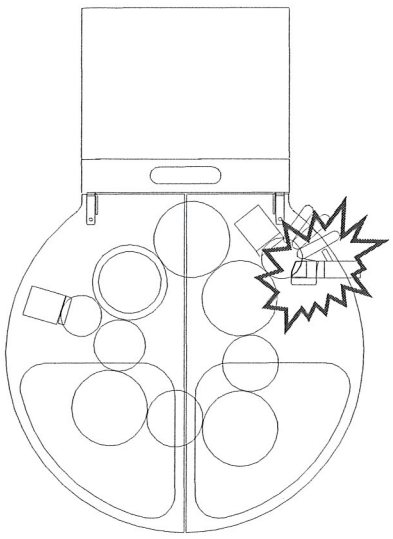
Outfeed reject control sensor

It is an ultrasound sensor with a transmitter and receiver.
This device detects capsule presence on the outfeed wheel before the capsules are fed out from the production cycle.



This enables the system to check whether any non-conforming capsules have been rejected by the previous devices.
If a non-conforming capsule is detected during the production outfeed stage, the system stops the machine and a message is displayed on the monitor.

If the flap is enabled, the system rejects some capsules before and after the capsule detected NOT REJECTED.

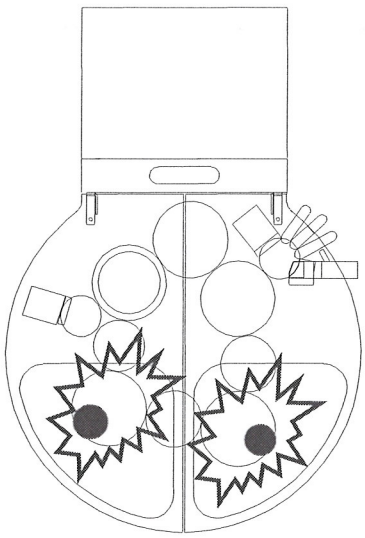


Capsule outfeed flap status sensor

This is an inductive sensor positioned on the capsule outfeed flap control device which detects the flap in the reject position.

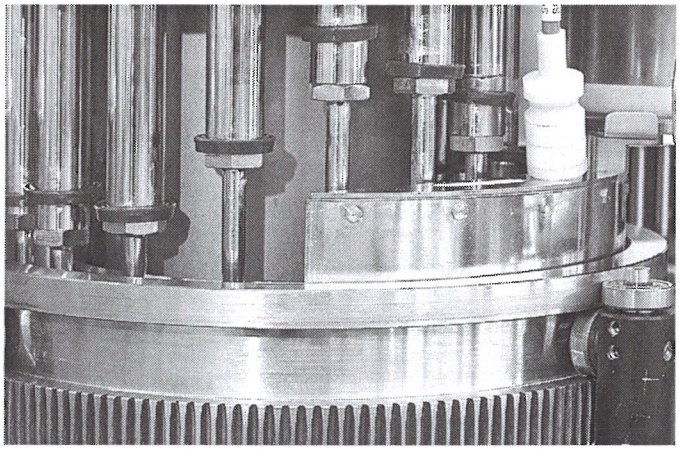
PHOTO

The position commanded by the PLC (reject or production) must be signalled correctly by the sensor.
If not, the control system stops the machine and displays an alarm message.



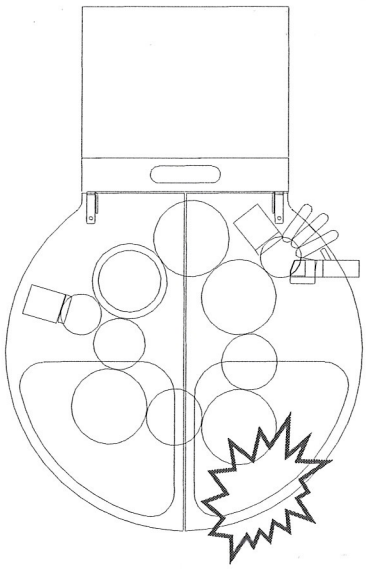
Powder call sensor

This is a capacitive sensor on the sector container present in the rotary container.



This sensor detects the drop in the powder level and sends a signal to the system indicating the need to restore a sufficient powder level inside the rotary container.

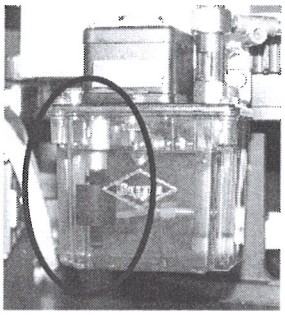
If the sensor does not signal a change in the rotary container product level within a set time, the control system stops the machine and an alarm message is displayed.

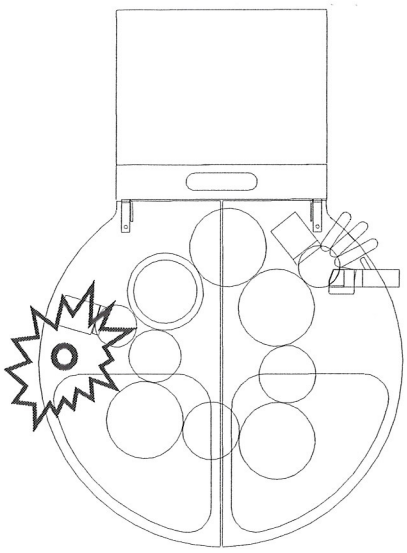


Oil pump level sensor

This is a magnetic sensor which acts as a float to detect when the minimum oil level in the lubrication pump is reached.

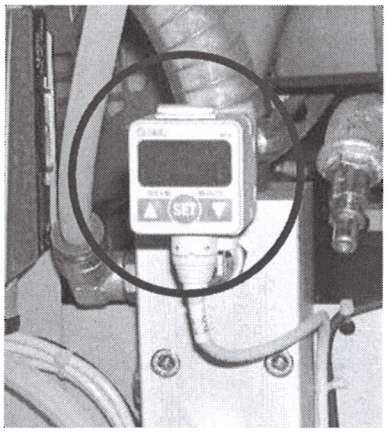
When the oil falls below the set minimum level, the system stops the machine and a message is displayed on the monitor.



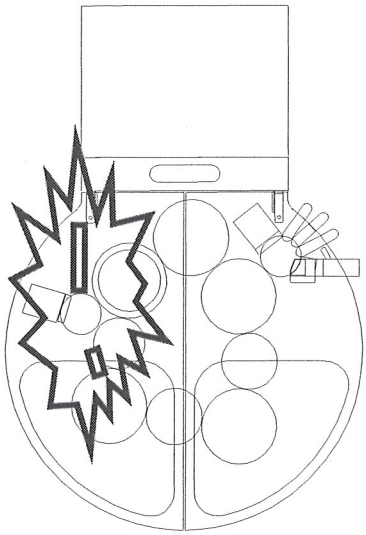


Pressure gauge

This device is used to control compressed air pressure entering the pneumatic system.

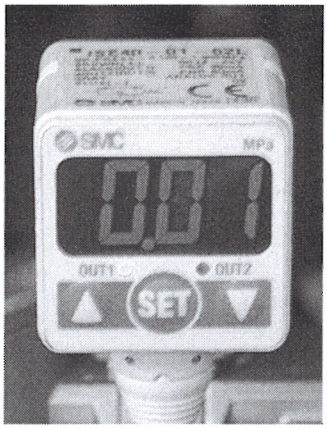


When the pressure is below the minimum set value, the control system stops the machine and a message is displayed on the monitor. A pressure value too low (under the lower limit set) compromise the right machine functioning.



Vacuum gauges

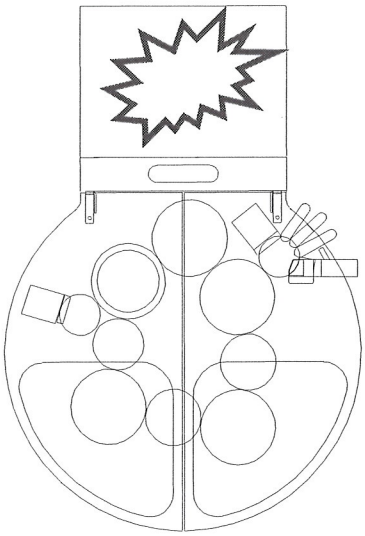
These devices are used to control the vacuum level of air in the suction and vacuum system.



When the value is below the minimum set value, the control system stops the machine and a message is displayed on the monitor.

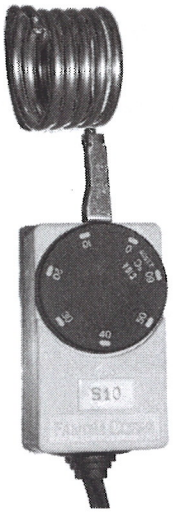
Pressure negative value shown in the vacuum gauge indicates that the relevant filter located in the service cabinet is full.

There is a vacuum regulator on each suction unit and/or vacuum pump.



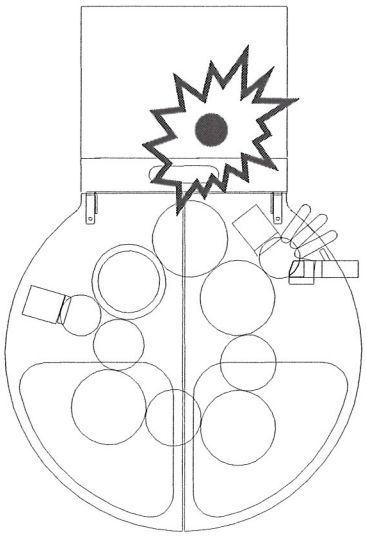
Thermostat

This device is used to control the temperature inside the electrical cabinet.



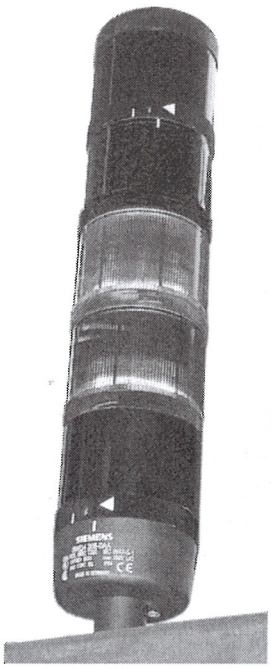
When the temperature exceeds the maximum set limit, the control system stops the machine and a message is displayed on the monitor. A high temperature value indicate the electrical cabinet indicates a overheating condition of a device or a problem in the cooling due to the obstruction of the filters of the cooling funs.

13.4 Signalling devices



Machine status signalling beacon

A beacon with coloured sections signals machine functioning conditions.
The beacon is clearly visible on the electrical cabinet.

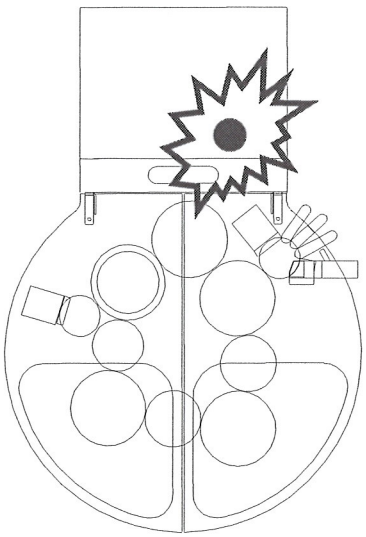


The following conditions are signalled when the various beacon sections are ON.

- ***RED section permanently ON = emergency or open hood***
- ***FLASHING RED section = machine stopped in alarm condition***
- ***ORANGE SECTION permanently ON = low product level***
- ***FLASHING ORANGE section = product loading underway***
- ***GREEN SECTION permanently ON = machine functioning***
- ***WHITE SECTION permanently = machine running***

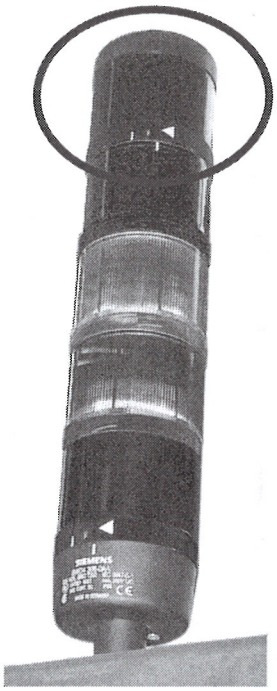
The signals given by the beacon are linked to the messages displayed on the control panel monitor.

📖 *For more information on the warning messages, see the chapter entitled **DIAGNOSTIC MESSAGES**.*



Acoustic warning device

An acoustic warning device (*buzzer*) is enabled to indicate the following situations.



An acoustic warning device (*buzzer*) is enabled to indicate the following situations.

- ***Maintenance time:*** *the buzzer sounds when the set production time has expired. The machine stops to enable maintenance.*
- ***Capsule sub-lot:*** *the buzzer sounds when the number of capsules set as a sub-lot has been reached.*
- ***Communication system problems (WATCH DOG):*** *the buzzer sounds if communication between monitor and PLC is interrupted and the machine cannot start.*
- ***Dosing head movement:*** *the buzzer sounds when the dosing head is moving downwards and the machine cannot start.*
- ***Capsule hopper and pellet hopper moving down***
  In both cases,the buzzer sounds during downward movement: The machine cannot start.

The acoustic signals are linked to the messages displayed on the control panel monitor.

📖 *For more information on the warning messages, see the chapter entitled* ***DIAGNOSTIC MESSAGES.***

14. Electrical cabinet

The machine electrical cabinet contains the following:

- ***Power components***
- ***Control components***
- ***Safety components***

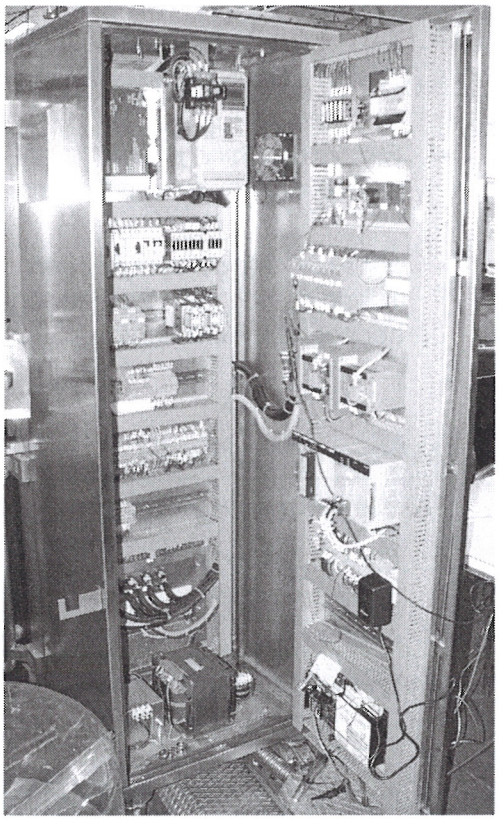


Figure 42 – Photo showing open electric cabinet

NOTA: *la centralina può assumere aspetti differenti a seconda ad esempio del lato di apertura dello sportello che a seconda delle esigenze del cliente può essere frontale o laterale.*
Inoltre i dispositivi contenuti all'interno possono variare a seconda della configurazione della macchina acquistata.

Power components

The main power components are:

- ***Transformer***
- ***Power supply units***
- ***Suppressers***

Control components

The control components enable the machine to be controlled electrically. They consist mainly of:

- ***Machine drive control components***
  These control the machine motor and the rotary container motor in the dosing head.

- ***Machine PLC***
  This converts the signals from the industrial PC (touch screen control panel) into specific machine commands.

- ***PLC for machine phase***
  Converts signals from the encoder into machine phases.

- ***Sensor interface components***
  These devices are the interface between the PLC and the sensors on the machine.

Safety components

The safety devices are the following:

- ***Overload switches***
- ***Safety switches***
- ***Fuses***
- ***Temperature probe***

15. Technical specifications

Common technical data for the line and specific data for each component are shown below.

☞ ***NOTE:*** *The data refer to devices in the standard configuration. Further information concerning the main components available is shown in the relevant manuals supplied to the customer.*

Hourly production rate	***PLANETA*** *Nominal production speed is 6,000, 12,000, 25,000, 50,000, 100,000 capsules/h.* *The real line production speed depends on product characteristics.*
Applicable capsule sizes	***PLANETA*** *00, 0, 0L, 1, 1L, 2, 3, 4, 5, SUPRO C, SUPRO D, SUPRO E, DBA, DBB, DBAA*
Available dosing units	***POWDER*** ***PELLETS*** ***TABLETS*** ***MICROTABLETS***
Working conditions	*These working conditions necessary for correct machinery functioning are due to the capsule features.* ***TEMPERATURE:*** *20-25°C* ***RELATIVE HUMIDITY:*** *45-55% RH*
Weight	*The weight of each machine in the line is shown on the relevant* ***IDENTIFICATION PLATE****.*
Dimensions	*The dimensions of each component are shown on the* ***LAYOUT*** *supplied*
Voltage ***Power*** ***Electrical frequency*** ***Power factor (cos ϕ)***	*The data is shown on the electrical drawings supplied and on the identification plates.* *A three-phase power supply must be provided. The power supply must be protected against any overloads or short-circuits that may be generated by the MG2 electrical cabinet and must be protected against any current peaks generated when the transformers or the motors are started.* *A correct earthing must be guaranteed as required by EN 60204-1 standards.*

Parts in contact with the product	*All parts in contact with the product to be dosed and with the capsules are made from stainless steel or biocompatible materials. MG2 machines comply with the EC Machinery Directive 98/37 and the Good Manufacturing Practice (GMP) standard.*
Noise levels	***73.6 dB(A)** average value (Reference standards: ISO 3746-79) The value refers to the machine with ABS guards.*
Lubrication system	***INTERFLON FOOD LUBE G220 oil*** *Composition FDA/NFA H1* *PTFE (TEFLON), "food grade" mineral oil, EP additives and anticorrosive agents.* *Density at 20°C (approx.) ASTM D4052 0.88 g/ml* *Dynamic viscosity 20°C (approx.) ASTM D4052* *Kinematic viscosity DIN 51 561 (m2/s) at 100°C: 33* *Viscosity index DIN ISO 2909°C: > 170* *Flash point DIN ISO 2592°C: > 200* *Pour point DIN ISO 3016°C: < = - 35* ***PARALIQ GA 343** special lubrication grease* *Density DIN 51 757 (g/cm3) a 20°C (approx.): 0.92* *Dew point DIN ISO 2176°C: > 250* *Working temperature: from - 30 to 120°C* *Penetration DIN ISO 2137 °C: approx. 310 (0.1 mm)* *Strength class DIN 51 8181: NLGI 1* *Apparent dynamic viscosity: approx 5000 (mPa.s)* *Speed factor (n.dm): approx. 300,000* *Welding load (4 ball device) DIN 51 350 part 4: above 2200 (N)* *Water resistance DIN 51 807 at 3 h/50°: classification level 1-50* *Water resistance DIN 51 807 at 3 h/100°: classification level 1-90* *Flow pressure DIN 51 805 at -30°C: < 1000 mbar* ***CAUTION:*** *only use the lubricants indicated or equivalent products. Please contact the MG2 Technical Service and Quality Assurance Service for additional information on lubricants.*

15.1 Weight control system

Standard analytical balance	*SARTORIUS, BASIC PLUS series (the specific model is indicated on the balance).* *For data on weighing precision, weight field and standard deviation, refer to the technical specifications in the instruction manual supplied with the balance*
Optional analytical balance (optional/on request)	*METTLER, AG series (the specific model is indicated on the balance).* *For data on weighing precision, weight field and standard deviation, refer to the technical specifications in the instruction manual supplied with the balance*

15.2 Services cabinet

Distance from the capsule filling machine	**8 m** *(standard)* **NOTE:** *contact MG2 for greater distances.*
Structure	**Uncovered** *(standard).* **Covered** *(optional)*
Suction heads	**5** *(standard with powder dosing unit installed)*
Vacuum pump	**1** *(standard)*
Noise levels	**Less than 85 dB(A)** *average value* *(Reference standards: ISO 3746-79)* *This value refers to the uncovered structure cabinet with five 1.5 HP suction units and one 60m³ vacuum pump.*
Pre-filters	*The pre-filters are paper filters.* *Permeability to air: 180 l/dm²*
Filters	*The filters are 100% cotton felt filters.* *Permeability to air: 70 l/dm² min (+/- 5 l/m²)* *Weight: 560 g/m² (+/- 5 g/m²)* *Filtering capacity: 1μ with performance of 90% at 25°* *Polyester filters are also available.*

15.3 Standard suction head

Electrical power	*1.5 HP.*
Vacuum	*Flow rate for each coupling: 60 dm³/sec* *Vacuum: -140 mbar* *Coupling diameter: 40 mm*
Dissipated heat	**190 Kcal/h (at 50 Hz and 60 Hz)** *(depending on the network frequency shown on the wiring diagrams supplied)* *This figure is a rough estimate as the heat varies in accordance with the filter saturation levels.*

15.4 Standard vacuum pump

Flow rate	60 m³/hour
Vacuum level	60 kPa
Coupling diameter	int. diam. 20 mm
Heat	In accordance with the mains frequency indicated in the wiring diagrams supplied. 215 kcal/h (at 50Hz) 258 kcal/h (at 60 Hz) This figure is a rough estimate as the heat varies in accordance with the filter saturation levels.