Indústria de Bens de Equipamento, Lda.

CONTGRAV

Users Guide

IBE - Indústria de Bens de Equipamento, Lda.

Rua do Solão, 75 4475-240 Gondim – Maia PORTUGAL ◆ Telef. +351 229871400 ◆ Fax: +351 229871409 ◆ ibe@ibe.pt ◆ www.ibe.pt

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Introduction

The **CONTGRAV** system was developed to control the linear weight and the regularity of extruded materials through the control of the haul off speed or the control of the rotating speed of the extruder screw. The operator can program the required linear weight in grams/meter. The **CONTGRAV** continuously measures with high accuracy the raw materials throughput at the inlet of the extruder screw (kg/hour) and the actual haul-off speed (meters/minute). It is therefore possible to compare the actual linear weight with the programmed value and adjust speeds to meet the required value. Should you want thickness control, you just have to keep the external dimensions constant, like for instance the external diameter. This principle of gravimetric control assures that the linear weight and the thickness of the extruded material is not affected by variations of apparent density of raw materials, fluctuations of the power supply voltage, variations of the screw rotating speed or haul off speed.

The **CONTGRAV** was developed focusing on two important aspects, combining simple mechanics and easy to maintain with a high precision and user-friendly equipment. These goals, usually difficult to achieve, were attained due to the philosophy used and the command system especially developed for the **CONTGRAV**.

The **CONTGRAV** system assures an accuracy higher than 0,5%. In case of extruded films, it is possible to achieve raw materials savings of about 10%, due to the reduction of the average thickness and the attained regularity of the extruded product. Our experience in this field did show us that it is possible to obtain even higher savings, particularly in cases where non-systematic manual control was formerly used.

Due to the obtained regularity of the extruded materials is it possible to improve the quality of welding and the associated production rates

The **CONTGRAV** is easy to integrate and install in any extruder. It is supplied with all accessories, including a tachometer and a motorized potentiometer and/or terminals for the motor speed control. This equipment is able to detect any malfunctions and anomalies. In these cases, an alarm will be activated.

The linear weight can be programmed directly on the control panel through a remote computer (option). Machine status, control and production parameters are permanently displayed.

Besides the indications of the throughput, speed and linear weight there are also control counters for total and partial weight and length

This manual will be applied from ***software release V2.30***.

Security and other dispositions

Installation and assembly operations should be performed by qualified personnel after reading and studying this manual.

Art rules and good working practices should always be taken into consideration and any questions should be clarified with the equipment manufacturer (see contact on last page).

The safety regulations in force in each country must always be respected. In particular, particular attention should be paid to live parts.

Under no circumstances should the equipment be operated without previously disconnecting the power supply.

Electrical voltages present on equipment may be dangerous or even lethal. It is the responsibility of the owner or user to ensure that the installation of the equipment complies with all applicable legal standards as well as the rules of the art.

Existing mechanical guards should always be in place in good condition and all equipment should be kept free of dust and / or moisture.

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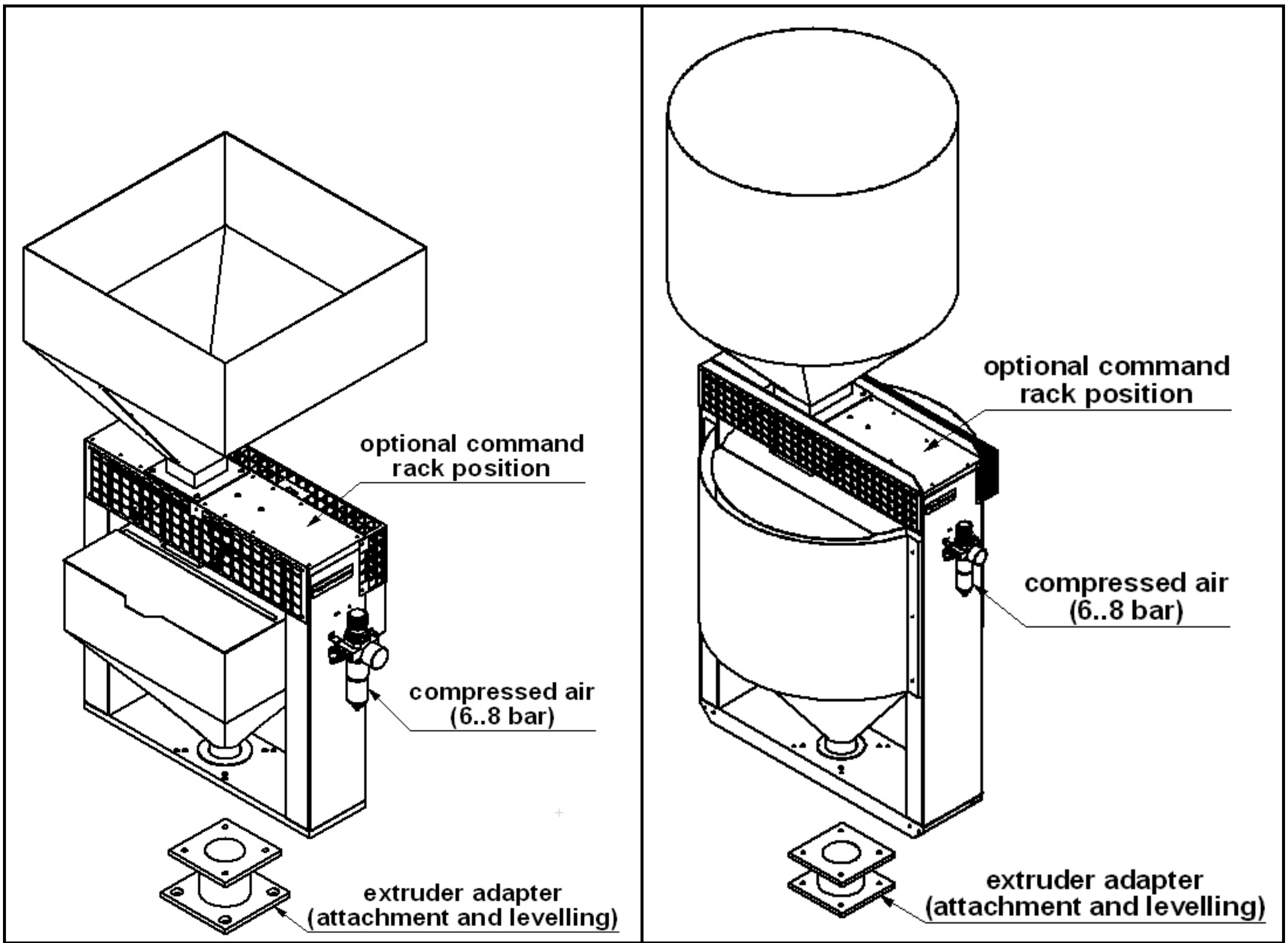
1. Installation

1.1. Extruder assembly



Models C3E and C7E | Model C20E

Fig. 1

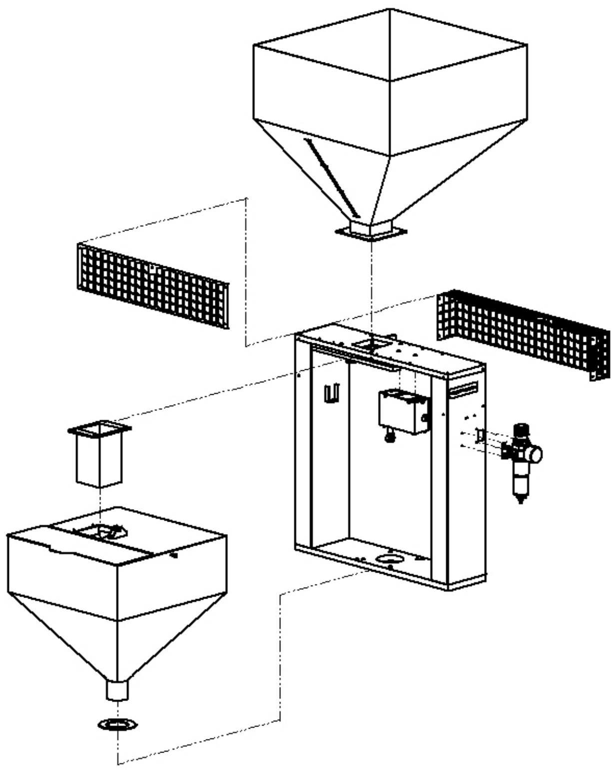
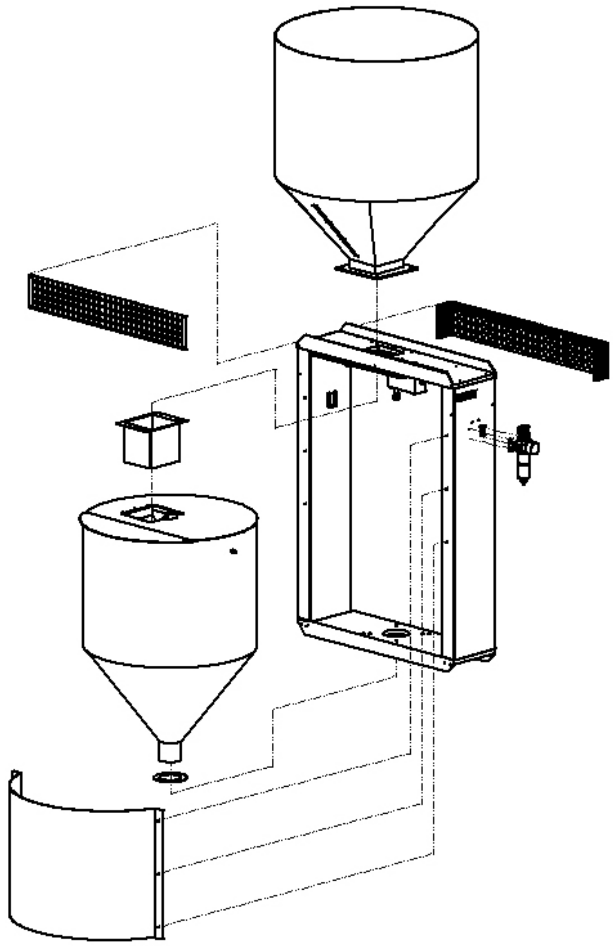
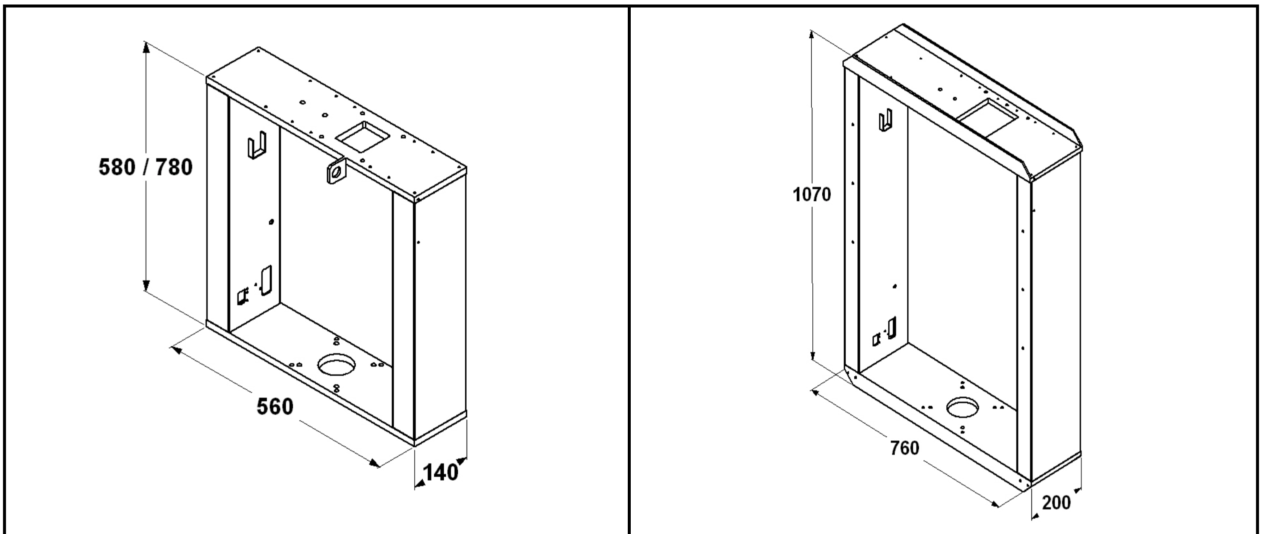
	
Models C3E and C7E	Model C20E

Fig. 2

1.1.1. Main mechanical support installation

The **CONTGRAV** main structure must be assembled directly over the extruder feeding entrance/screw, therefore disassembling the raw material hopper from it.

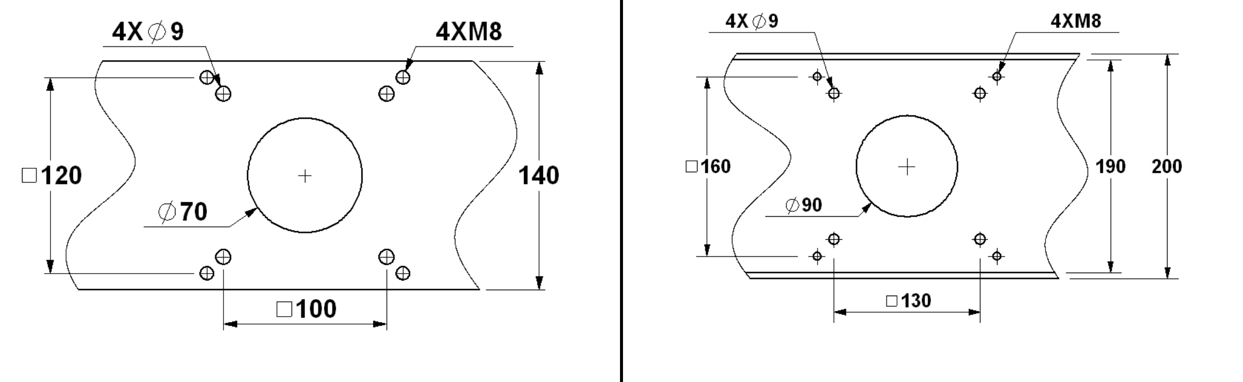


Models C3E e C7E | Model C20E

Fig. 3

Verify the fixation points in the extruder.

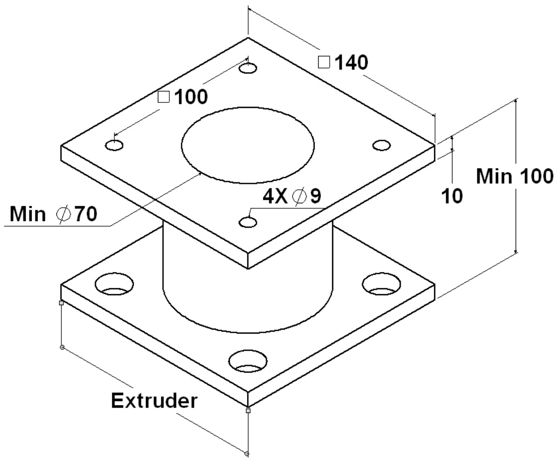
It must be guaranteed a minimal distance of 100 mm from the extruder screw to the bottom level of the. There are four ∅9 fixation holes on the **CONTGRAV** (see figure 4). There are also four M8 threaded holes for levelling purposes (see figure 4).



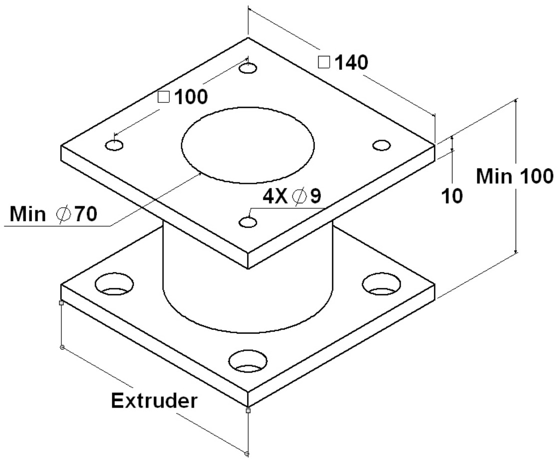
Models C3E e C7E | Model C20E

Fig. 4

This structure should be assembled over a flange built by the installer, and has to adapt to the extruder on one side, and on the other to the **CONTGRAV** (see figure 5).



Models C3E e C7E



Model C20E

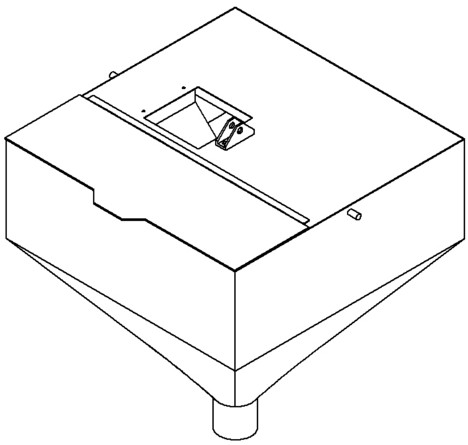
Fig. 5

We recommend a very robust construction. In fact, it must withstand large forces and torque as well as strong vibrations. Should a material outlet for purging/cleaning purposes or closing valve are required, these cane be built on this flange. In case of any doubt or further information, please contact **IBE** or any of its representatives or distributors.

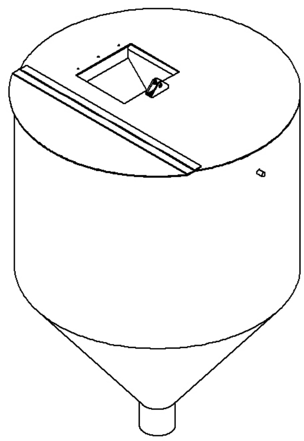
Install the flange on the extruder and the **CONTGRAV** support on the flange. Choose the position of the **CONTGRAV** in order to have the command's front panel and the transparent weight hopper (bottom hopper) accessible to the operator.

Use the external holes on the base of the support to level the **CONTGRAV** (figure 4).

1.1.2. Weighing hopper installation



Models C3E e C7E



Model C20E

Fig. 6

It is necessary to unscrew the weighing sensor (load cell and protections) from the **CONTGRAV**'s support.

Do not disassemble the weighing sensor as it is calibrated during the assembly phase. Never overload the sensor, handle it with care and keep it clean. No maintenance is needed.

The material guide (tube with square section) must be placed in the hole on the top of the hopper. Place the transparent ring on the bottom neck of the hopper. Fix it temporarily with for example one or two pieces of adhesive band.

Now, carefully place the hopper in its position. See that the lateral pins are placed within the protections on the support. These protections should prevent the hopper to rotate and to fall in case of a rupture of the weighing sensor or any other piece

Place the weighing sensor in its position and connect it to the hopper.

Connect the material guide with four screws to the material valve.

Verify that the hopper do not touch the material guide in any position and is correctly levelled. The hopper must be completely free. This is absolutely necessary in order to guarantee a correct weighing of the material.

We strongly recommend that the regulations and protections of the weighing hopper should not be changed, this way avoiding any permanent damage to it or supplying defective information to the computer. This system must be kept always clean and permanently treated with the utmost caution.

1.1.3. Buffer hopper and lateral protections

Install the top hopper with four screws. Please respect the normal position (figure 1).

The lateral protections may be installed taking care that the two cables (weighing sensor and pneumatic control) are not squeezed or damaged and come freely to the top of the **CONTGRAV**'s support.

1.1.4. Compressed air

The compressed air consumption is very low, used just to open the feeding valve of the weighing hopper, allowing the material to flow.

Nevertheless, this must be filtrated and set to a six bar pressure. For this matter, a filter/regulator set is supplied.

The volume regulators installed in the escapes of the electro valve, will have to be regulated, in order that the valve can be put into motion fast enough, without, however, beating violently.

When the valve is closed, its frontal edge must surpass in 5mm the respective edge of the top support.

The schematic is as follows; nevertheless, equivalent material can be used:

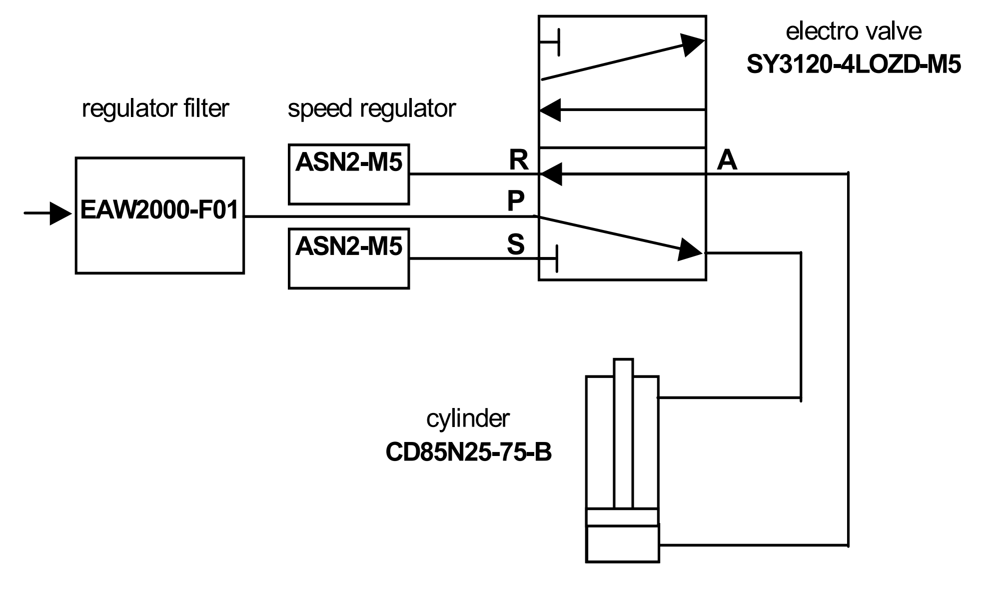


Fig. 7

Before placing the machine in functioning with compressed air some security measures must be taken:

→ Assure that the pressure of the line, or of the compressor, is compatible with the elements that if go to use.

→ Guarantee good condition of the connection hose and its connectors, besides verifying that the length of the hose is enough and adjusted.

→ If the length of the hose is too short, do not pull the hose. The machine must be approached if possible, or a longer hose must be connected. Test the set before its use.

→ Guarantee the good functioning of the taps and valves. The compressed air feeding will have to be able to be quickly stopped in emergency case.

→ When connecting to general net, it must be guaranteed that the said net is effectively of compressed air and not of another gas. If in doubt do not connect.

→ The connectors to the compressed air nets should not be able to be connected to connectors used for other gases.

→ Before changing any accessory, the compressed air feeding must be stopped.

1.1.5. Unlocking protection

The nuts in the connecting rod of the pneumatic cylinder must be pressed in way to leave free the support of the valve, or either, does not have to be pressed deep, but only adjusted.

Due to vibrations and to prevent any screw from unlocking, we recommend the use of LOCTITE 242 or equivalent.

1.2. Command rack assembly

The command rack (255x154x325 mm) may be installed over the **CONTGRAV**'s support. This is the standard position. In this case, just use the fixation holes.

Nevertheless, this rack can be installed in other places, for example, on the extruder command panel. Should this be the case, the weighing cell and the electro valve cables will have to be extended, in order to be connected to the command rack (max. 5 m).

Special attention must be paid to the extension of the cable from the weighing sensor. Use a shielded six-wire cable (min 0,22 mm^2) connected as described in figure 8. It may be necessary to place the cable inside a metallic tube connected to earth in order to reduce the effect of the electromagnetic perturbations created by power cables, motors, etc. Never place the shielded cable near or parallel to a power cable or polluted command cables.

The pin 7 of the connector (central pin) must be connected on both ends exclusively to the shield of the extension cable.

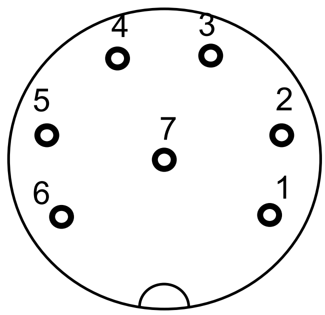


Fig. 8

1 - White
2 - Blue
3 - Red
4 - Grey
5 - Green
6 - Black
7 - Shield (yellow)

The command itself may be separated from the rack, extending the connecting flat cable up to 500mm. In this case, the part left open must be covered with the suitable metallic plate, built for this purpose.

1.3. Speed sensor installation

The main purpose of the speed sensor is to supply electrical impulses to the **CONTGRAV** in order to calculate the line instant speed, as well as the length produced.

The idea is to create one electrical impulse every 3 to 10 cm of extruded film. The frequency ranges from 1Hz, for lower velocities, up to a maximum of 75 Hz, for higher velocities. This frequency must not be surpassed to avoid misinterpretation as noise by the **CONTGRAV** therefore risking it to reject the signal. If necessary, use another wheel with a different number of teeth.

A metallic (ferromagnetic) wheel with ten teeth and an inductive sensor are supplied. This wheel can be used/modified/adapted so that the signal frequency can be set within the indicated range values. It is very important that this wheel is perfectly centred to avoid variations in the measurement of the speed according to its (wheel) position.

The sensor must be installed in a place that can supply accurate speed information to the **CONTGRAV**. It must be taken in consideration that the product may contract, if measured in a hot place, the system skidding on the product, etc.

The **CONTGRAV** will control the linear weight in the measured speed place. If product characteristics change from the place were speed is measured up to the exit off your machine, a deviation on the final product, corresponding to the variation characteristics, may occur. This deviation may be compensated in the linear weight value to be programmed in the **CONTGRAV**.

Every metallic part of the extruder must be correctly grounded. Failing to connect the metallic parts of the plant to earth may generate perturbations to the inductive sensor or cable and give false speed indication. The cable to the sensor should be a three wire shielded type with a section superior than 0,22mm^2 (recommended > 0,5mm^2). The shield should be connected to earth (ex.: pin A of the relay's board).

It is necessary to measure the most accurate possible the perimeter of the cylinder (in millimetres) in which it will be installed the speed sensor. This information will be used later to parameterise the command computer.

1.4. Motorized potentiometer installation

The speed set point potentiometer for the haul off extruder screw speed has to be replaced by the delivered motorized potentiometer.

This potentiometer will be installed in the supplied device to motorize it, this way, achieving the same manual function as previously and automating its movement from the command computer.

Mount this potentiometer on the extruder panel, or in other suitable place, taking in consideration the following schematic:

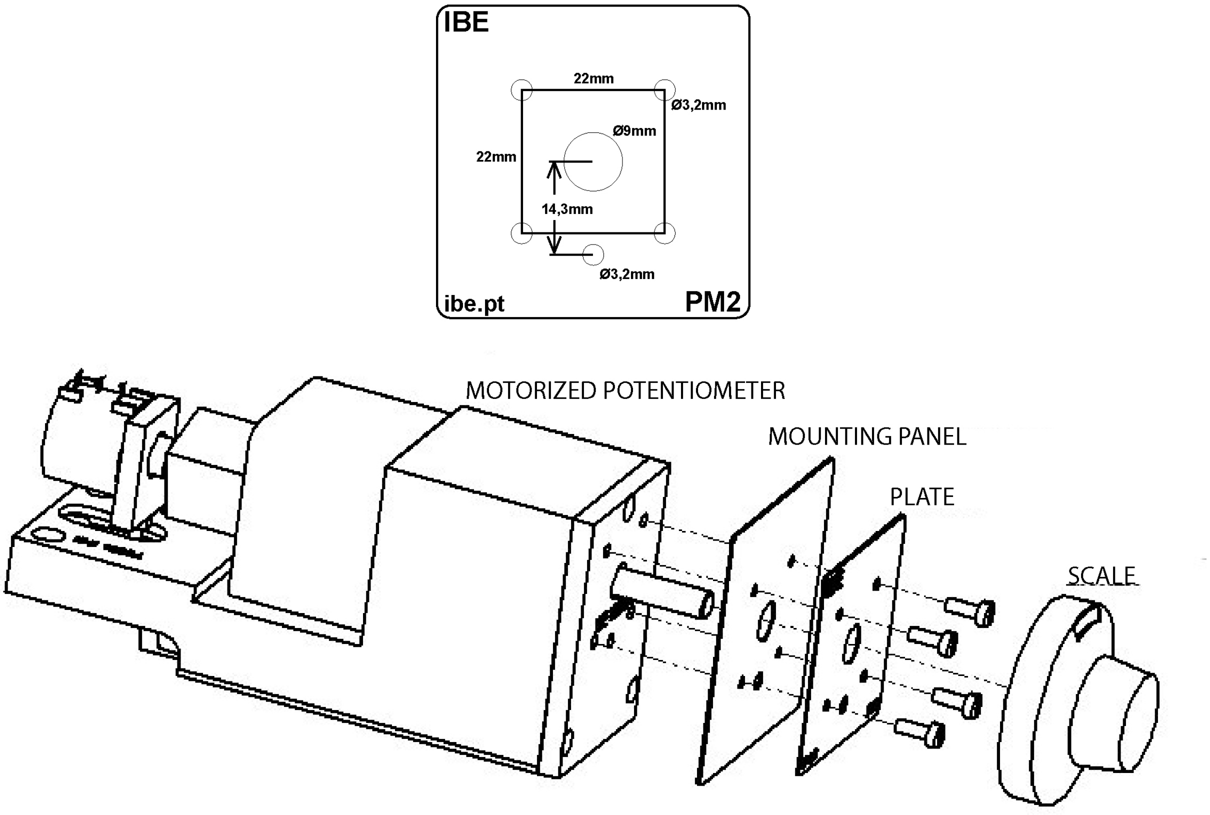


Fig. 9

The supplied mirror must be placed on the outside and fixated with the supplied screws (M3X12).

Install the graduated scale, taking in consideration its correct position.

The electrical connections for the command motor (24VDC) are specified in Chapter II.

2. Electrical Installation

2.1. Power supply

The power supply must be 230VAC (± 10%), 50 Hz or 60 Hz. Load, neutral and earth must be correctly connected.

The input protection is T500mA type fuse. This fuse is accessible through the back of the command rack.

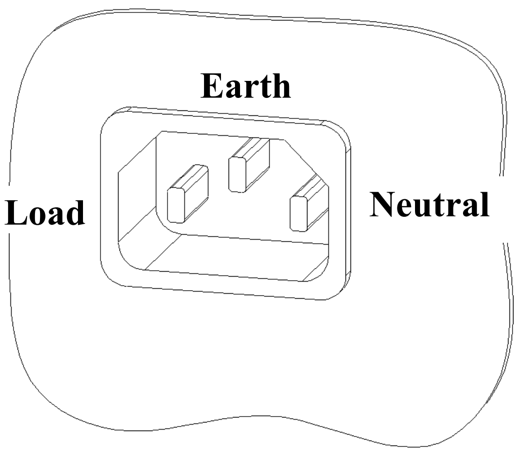


Fig. 10

In order to avoid sporadic malfunctions of the microprocessor control, it is important to deliver a "clean" power supply to the **CONTGRAV**. A separate supply from a low impedance point should be installed.

Every metallic part in an industrial plant must absolutely be connected to earth for safety and electrical reasons. Therefore, particular attention must be paid to the quality of the earth connections and earth electrodes. Earth resistance should be measured at least twice a year.

The power supply of the speed sensor and of the relay in 24VDC is protected by a T1A fuse or by a resettable fuse. This fuse is accessible from the command rack interior, after withdrawing the inferior protection plaque. This plaque is easily removed, unscrewing the four screws on its back.

2.2. Electrical pollution

Although all precautions being taken in filtering all abnormalities in the power supply, it is not possible to eliminate all, especially those of inductive origin or from electrical motors commands.

Therefore, it is very important that the 230VAC power supply is clear of any abnormality and harmonic pollution. For this matter an autonomous power supply should be installed based on a guaranteed quality point.

If this is not enough, an exterior filter of adjusted performance should be used. These filters are easily available in the market.

These precautions must also be used when powering electronics or telephonic systems in an industrial environment.

2.3. Earth

For safety reasons, it is indispensable to guarantee a good electrical earth of all metallic parts, in particular, those that might be in contact with a person.

In an industrial environment, especially when static electricity is produced, the electrical earth still serves to unload this static, thus protecting the electronic components, which are very sensible to the eventual discharges.

In the case of the **CONTGRAV**, particular attention to the electrical earth of the feeding, the structure and hoppers and the device must be given where if it points out the speed sensor.

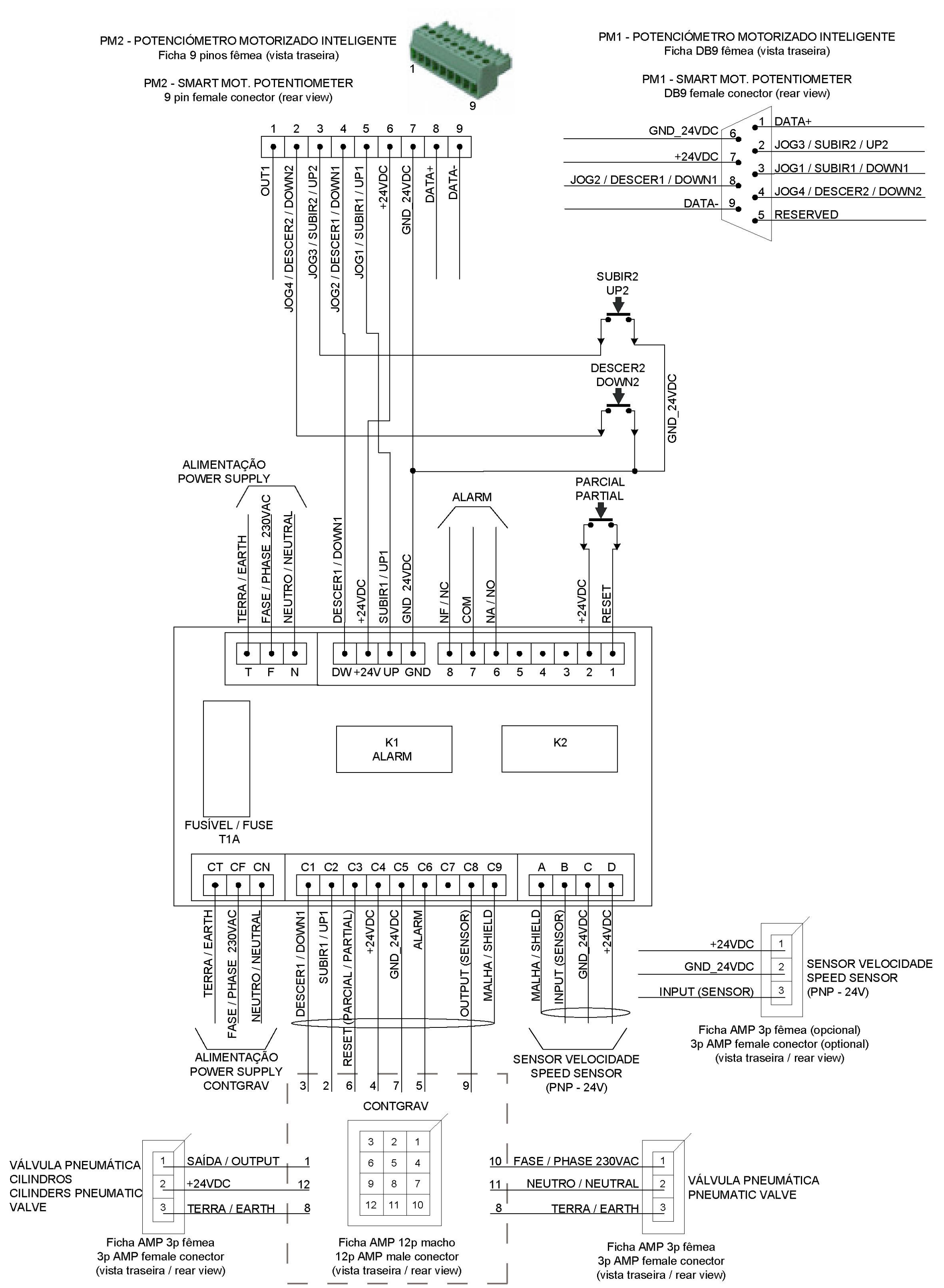
Additional local regulations must imperatively be respected.

2.4. Relays' PCBoard

One relay is used and controlled by the **CONTGRAV** computer. This relay is used to control the alarm.

A printed circuit board with this relay is supplied and ready to be used. The circuit board must be installed in a protected place, usually in the extruder electric rack.

The board is delivered with connections for the 24VDC motorized potentiometer (see fig. 11). For other applications, please contact **IBE**.



PM2 - POTENCIÓMETRO MOTORIZADO INTELIGENTE
Ficha 9 pinos fêmea (vista traseira)
PM2 - SMART MOT. POTENTIOMETER
9 pin female conector (rear view)
PM1 - POTENCIÓMETRO MOTORIZADO INTELIGENTE
Ficha DB9 fêmea (vista traseira)
PM1 - SMART MOT. POTENTIOMETER
DB9 female conector (rear view)
OUT1
JOG4 / DESCER2 / DOWN2
JOG3 / SUBIR2 / UP2
JOG2 / DESCER1 / DOWN1
JOG1 / SUBIR1 / UP1
+24VDC
GND_24VDC
DATA+
DATA-
GND_24VDC
+24VDC
JOG2 / DESCER1 / DOWN1
DATA-
DATA+
JOG3 / SUBIR2 / UP2
JOG1 / SUBIR1 / DOWN1
JOG4 / DESCER2 / DOWN2
RESERVED
SUBIR2
UP2
DESCER2
DOWN2
GND_24VDC
ALIMENTAÇÃO
POWER SUPPLY
ALARM
PARCIAL
PARTIAL
TERRA / EARTH
FASE / PHASE 230VAC
NEUTRO / NEUTRAL
DESCER1 / DOWN1
+24VDC
SUBIR1 / UP1
GND_24VDC
NF / NC
COM
NA / NO
+24VDC
RESET
T F N
DW +24V UP GND
8 7 6 5 4 3 2 1
K1
ALARM
K2
FUSÍVEL / FUSE
T1A
CT CF CN
C1 C2 C3 C4 C5 C6 C7 C8 C9
A B C D
TERRA / EARTH
FASE / PHASE 230VAC
NEUTRO / NEUTRAL
DESCER1 / DOWN1
SUBIR1 / UP1
RESET (PARCIAL / PARTIAL)
+24VDC
GND_24VDC
ALARM
OUTPUT (SENSOR)
MALHA / SHIELD
MALHA / SHIELD
INPUT (SENSOR)
GND_24VDC
+24VDC
+24VDC
GND_24VDC
INPUT (SENSOR)
SENSOR VELOCIDADE
SPEED SENSOR
(PNP - 24V)
Ficha AMP 3p fêmea (opcional)
3p AMP female conector (optional)
(vista traseira / rear view)
ALIMENTAÇÃO
POWER SUPPLY
CONTGRAV
SENSOR VELOCIDADE
SPEED SENSOR
(PNP - 24V)
CONTGRAV
VÁLVULA PNEUMÁTICA
CILINDROS
CILINDERS PNEUMATIC
VALVE
SAÍDA / OUTPUT
+24VDC
TERRA / EARTH
Ficha AMP 3p fêmea
3p AMP female conector
(vista traseira / rear view)
Ficha AMP 12p macho
12p AMP male conector
(vista traseira / rear view)
FASE / PHASE 230VAC
NEUTRO / NEUTRAL
TERRA / EARTH
VÁLVULA PNEUMÁTICA
PNEUMATIC VALVE
Ficha AMP 3p fêmea
3p AMP female conector
(vista traseira / rear view)

Fig. 11

The alarm relay supplies two dry contacts that can be used to control an acoustic or luminous indicator (not delivered).

A dry contact for **[PARTIAL RESET]** should be delivered by the cutting device (if any) or installed in an accessible place to the operator, enabling him to easily indicate the beginning of a new piece of product (bobbin, etc.). At that moment the value displayed in the partial counter is transferred to the *Partial Last* register *(Prtial Last)* and then resettled to zero. This is valid for the weight and the length counters as well. Pulsing the **[PARTIAL]** button on the **CONTGRAV** panel will produce the same effect.

The connections made to the command rack of the **CONTGRAV** must be through the supplied special socket (AMP MATE N'LOCK 12 pins), as per figure 11. In this case, the supplied pins must be used, which must be fixated with the aid of special pliers or be welded. These pins can later be removed of the socket with the aid of a special tool (an **AMP** Extractor).

Before connecting the power plug to the **CONTGRAV**, it should be checked that the 230VAC supply voltage is present at the plug terminals.

When everything is connected, check if the potentiometer increases or decreases the speed and if the alarm activates by pressing the buttons on the relay's board.

Enter parameterization mode (see section 3.1.1.).

Press **[OK]**. The following indication appears on the display:

```
PESO(hex)  = XXXX
 TAQ(hex)  = XXXX
```

Lightly press the weighing hopper (lower) and check if the PESO value rises. Stop pressing and the value will return to the initial value.

Check whether the potentiometer increases or decreases the speed by pressing the **[CANCEL]** and **[↑]** or **[CANCEL]** and **[↓]** respectively. Pressing the **[CANCEL]** again will undo the speed change.

Check that the material valve opens by pressing the **[CANCEL]** and **[AUTO]** simultaneously. Pressing **[CANCEL]** closes the valve.

2.5. Winder traction motor

Particularly in the film extrusion, the tension of the film between the haul off rolls – located in the top of the tower – and the winder must be kept constant.

By permanently correcting the haul off speed, the **CONTGRAV** can alter this tension if the winder was not correctly designed.

In fact, the winder is sometimes of the constant speed type. However, it should be constant torque type. If necessary, please contact **IBE**.

3. Parameterisation

3.1. Parameterisation mode

The parameterisation mode is used to adapt the **CONTGRAV** equipment to each extruder and to each operator needs. On the other hand, it is also used to calibrate the weight, speed and length measurement systems. This calibration is entirely made by software, which eliminates errors normally associated to calibration through hardware.

3.1.1. How to access the parameterisation mode

First, it is necessary to unscrew the four corner screws located in the back of the command rack. Then remove its upper cover.

In the back of the **CONTGRAV**'s front panel (control board) there is a small switch, which must be set into - *parameterisation*. Just turn this switch upwards.

To change from parameterisation mode to normal mode of operation, just turn this switch downwards, setting the **CONTGRAV** in normal mode.

3.1.2. Hexadecimal units base

A hexadecimal units base units is used in the parameterisation mode. As known, this numerical base has 16 digits (0…9 + A...F), instead of the 10 digits available in the decimal base.

Usually any pocket calculator enables the conversion of any integer from one numerical base to the other. We strongly recommend the use of this procedure to avoid conversion errors.

As soon as you change to parameterisation mode, the LCD located on the front panel displays the value referring to the absolute weight (in machine units) of the loading cell, as well as the software version of the equipment. The units displayed are internal computer units. Even though these do not represent regular units, they are used to verify whether the weighing hopper is correctly suspended, for calibrating both weight and alarms, as explained further ahead.

By pressing **[OK]** the first parameter will be displayed. If you press it again, the next parameter will be displayed and so on for the rest of the parameters.

3.1.3. Calibration

Upon changing to parameterisation mode the LCD will display the absolute weight value (in machine units) of the weighing hopper. This value will be used in the following calibrations.

3.1.3.1. Load cell

This calibration is usually performed at the factory and does not need to be changed. We recommend this operation at least once every two years due to the ageing of the components (decrease of accuracy). It is necessary to execute it again when one of the following situations occurs:

- changing of the load cell
- modification of the CPU pcb
- decrease of accuracy due to the ageing of the components

The procedure is very simple and consists in two readings of the weight, one with only the tare and the other with a known weight on the weighing hopper.

Let's start by entering into the parameterisation mode and balance perfectly the weighing hopper (without material) assuring that it does not touches any part. The system can be shacked a little to eliminate residual tensions. Then annotate the value displayed in the parameters sheet in the position ***Tara (AAAA)*** (consult annex III).

Then put the calibration weight (accurately weighted previously), between 5 kg and 15 kg, in the weighing hopper, during this procedure please avoid any contact between the hopper and any part of the equipment. Read the displayed value and annotate it in the parameter sheet in the position ***Calibre (BBBB)***.

Write the value of the weight used (in grams) in the parameter list in the position ***Peso Calibre (AAAA)*** after its conversion to the hexadecimal base. For example, if the used weight were 10.000 gr., the value to write in ***Peso Calibre*** would have been 2710_h.

We can then calculate the parameter ***Const KPI (AAAA)*** to be written on the list, as described in the following formula:

$$KPI = \frac{Peso\_Calibre}{(Calibre - Tara)} \cdot \frac{10}{72} \cdot 100000$$

Please use the nearest approximated value. For example, if

Tara = $414A_h$

Calibre = $E42B_h$

Peso_Calibre = $3C2B_h$

Then ***KPI*** = $140B_h$

3.1.3.2. Alarms

The default factory values are usually usable. However, if the alarms start operating in a different way or should a magnet (which increases the dead weight of the weighing hopper) is used to retain any metallic object present in the material to be processed, this calibration has to be performed.

Alarm of minimum: refers to the minimum quantity of material present in the hopper. Whenever the material quantity drops below this level an alarm will be set off indicating lack of material. In case of the existence of a magnet a global weighing should be performed. Please fill the hopper with material until the hopper is filled with the necessary amount you find fit to set off the alarm. Note that this alarm is calibrated according to your specific needs towards the minimum quantity present in the hopper. Annotate the displayed value in the parameter sheet in ***Alarm Mn (AAAA)***.

Minimum weight: this refers to the level of material present in the weighing hopper, which orders the refilling of the hopper. Usually, this level is just a bit above the one corresponding to the level Alarm of minimum. Please fill the hopper with the desired amount and annotate the presented value in the display in the parameter sheet in the position ***Peso Min (BBBB)***.

Maximum weight: corresponds to the level of material present in the weighing hopper. When this level is attained, the filling valve will be closed. Normally this level is set at three quarters of the total capacity of the weighing hopper. The value displayed should be annotated in the parameter sheet in ***Peso Max (AAAA)***.

Alarm of maximum: corresponds to the level of material present in the weighing hopper, which will set off the alarm "RAW MAT EXCESS". This level of material should never be attained in normal conditions of operation. If this alarm is set off, one should verify if the valve is working without friction or if there is no lack of pressure in the compressed air circuit. This limit should be selected with enough safety to avoid false alarms due to the material that continues to fill the hopper after Maximum weight level is reached. This is caused by the voluntary limited closing speed of the valve. The displayed value should be annotated in the parameter sheet in ***Alarm Mx (BBBB)***.

3.1.3.3. Speed and length

It is necessary to calculate the length of product produced between two speed sensor pulses, called *TAQ_DIST*, in order to calculate the parameters ***TAQ_DIST1*** and ***TAQ_DIST2***.

The ***TAQ_DIST1 (AAAAAAAA)*** parameter must be filled in with the result of the multiplication (see calculation example) after properly converted to the hexadecimal base, like all other parameters.

TAQ_DIST2 = *TAQ_DIST* * 65,536. The result should be rounded to the nearest unit and converted to the hexadecimal base, with the ***TAQ_DIST2 (AAAA)*** parameter filled in with this result (see calculation example).

TAQ_DIST calculation on a film extruder:

The perimeter of the roller in which the speed sensor is to be installed (see Chapter I) must be carefully measured. We recommend measuring it at three different points and using the calculated mean value. Let's call this value Per_total.

Divide the Per_total value (in millimeters) by the number of teeth of the coding wheel used (usually 10 teeth):

$$TAQ\_DIST = \frac{Per\_total}{Nr\_dentes}$$

TAQ_DIST calculation on a tube extruder:

Provide a pipe where a length of at least 2 meters can be marked.

With the haul-off stopped, place the tube in the track, with the first mark (0 meters) of 2 meters properly aligned with a fixed point.

Enter parameterization mode (see section 3.1.1.).

Press **[OK]**.

Confirm that the TAQ value shown on the display is zero. If not, press **[PARCIAL]**.

Put the haul-off in motion.

When the second mark (2 meters) is approaching the fixed point, reduce the haul-off speed. As soon as the second mark reaches the fixed point, stop the haul-off immediately.

Check the display for TAQ and convert it to decimal. It should be at least 500.

$$TAQ\_DIST = \frac{Total\_length}{TAQ}$$

Example of calculation of parameters ***TAQ_DIST1*** and ***TAQ_DIST2***:

TAQ_DIST = 32

RLW / ALW and SPD units	***TAQ_DIST1*** calculation
RLW / ALW in gr/m SPD in m/min	***TAQ_DIST1*** = 32 * 100000 = 3200000d = 0030D400h
RLW / ALW in g/cm SPD in cm/mn	***TAQ_DIST1*** = 32 * 100 * 100000 = 320000000d = 1312D000h

RLW / ALW in kg/m SPD in m/min or mm/min	***TAQ_DIST1*** = 32 * 1000 * 100000 = 3200000000d = BEBC2000h

TAQ_DIST2 = 32 * 65,536 = 2097,152 => rounded to 2097d = 0831h

It is necessary to change bits 4 and 5 of the ***DEC*** parameter (see section 3.1.3.5.).

3.1.3.4. Gain factor for the speed control

The factor for the speed control gain, called ***KSD***, must be calculated.

If the value is too low, the **CONTGRAV** may take longer to reach the correct speed; if the value is too high, the speed may oscillate due to overshooting.

KSD calculation for speed control (***COEX*** = 0):

1. Read the current speed.

2. Change the haul-off speed for a perfectly defined time (acting on the relay and never directly on the potentiometer). For example, for 30 seconds.

3. Read speed again (after stabilization).

Please, pay attention to bits 4 and 5 of the ***DEC*** parameter (see section 3.1.3.5.), to perform the following calculations:

RLW / ALW and SPD units	***KSD*** calculation	
RLW / ALW in gr/m and SPD in m/min RLW / ALW in g/cm and SPD in cm/mn RLW / ALW in kg/m and SPD in mm/mn	$KSD = \frac{Time}{Speed\_Variation} \times 1536$	***KSD*** = 30 / 0,2 x 1536 = 230400 Reducing 15% ***KSD*** = 195840d = 02FD00h
RLW / ALW in kg/m and SPD in m/min	$KSD = \frac{Time}{Speed\_Variation} \times 1536 / 1000$	***KSD*** = 30 / 0,2 x 1536 / 1000 = 230,4 Reducing 15% ***KSD*** = 195,840 = 196d = 0000C4h

It is recommended to reduce the calculated value by approximately 10 to 15% in order to avoid any possible overshoot, as shown in the example.

KSD calculation for throughput control (**COEX** = FF):

1. Read current throughput control in kg/h. For example, 150 kg/h.

2. Change the screw speed for a perfectly defined time (acting on the relay and never directly on the potentiometer). For example, for 30 seconds.

3. Read the throughput control value again (after stabilization). For example 212,5 kg/h.

$$KSD = \frac{Time}{Throughput\_Variation} \times 60398$$

Example: ***KSD*** = (30/62,5) x 60398 = 28991d = 00713Fh.

It is recommended to reduce this value by approximately 10 to 15% to avoid any possible overshoot. In this example ***KSD*** = 006000h.

3.1.3.5. Other parameters

AL2_T2(CC)	This value multiplied by 0,25 seconds gives the actuation time of the cylinders on the hoppers, so that the material is separated (when applicable).
AL2_T1 (BB)	This value multiplied by 0,25 seconds gives the time interval between two actuations of the cylinders on the hoppers (when applicable).
End (CC)	Refers to the machine address on **IBEBUS** (in hexadecimal units), when a communication board is also acquired.
Ling (BB)	Selects the language used to communicate through the display: 0 = Portuguese 1 = Spanish 2 = English 3 = French 4 = German 5 = Polish
Usually it will not be necessary to change any of the following parameters.	
TAQ_ESP_MAX (AA)	This value multiplied by 0,6 seconds gives the maximum time that the computer will wait for an impulse from the tachometer encoder before changing system operation from automatic to manual. It is used to prevent wrong corrections in speed when the operator stops the pulling operation.
BUZ (EE)	Can have the value of zero or different from zero. In case the value presented is zero, the alarm will be activated intermittently (0,6 seconds ON and 0,6 seconds OFF). If the value is different from zero (usually FF), the alarm will be activated continuously.
DEC (DC)	Number of decimal digits to display on RLW, RLA, throughput

IBE - Indústria de Bens de Equipamento, Lda.
Rua do Solão, 75 4475-240 Gondim – Maia PORTUGAL ◆ Telef: +351 229871400 ◆ Fax: +351 229871409 ◆ ibe@ibe.pt ◆ www.ibe.pt

and speed, and units to display on RLW, RLA and counters.

D					UNITS		
bit				hex	RLW / ALW	SPD	Counters
7	6	5	4				
-	-	0	0	0	gr/m	m/min	xx m
-	-	0	1	1	g/cm	cm/mn	xx.xx m
-	-	1	0	2	kg/m	m/min	xx m
-	-	1	1	3	kg/m	mm/min	xx.xxx m

Bits 3, 6 and 7 are not assigned. They can have any value.

C				
bit				x = 0 => 2 decimal digits x = 1 => 1 decimal digit
3	2	1	0	
-	-	-	x	PRD
-	-	x	-	SPD
-	x	-	-	RLW / ALW

Example:
In case of wanting to display RLW and RLA with one decimal digit, throughput and speed with two decimal digits and the counters with 2 decimal digits (consequently, RLA and RLW will have its units in g/cm and speed in cm/mn), the parameter will have the following value:

00**010100** binary base = 14 hexadecimal base.

The number of decimal digits displayed and the respective units do not have any influence in the precision of the system.

AFX (BB)

Menus to display (see Chapter IV).
In case of not wanting that a determined menu be displayed, the referring bit to this menu must be 1.
By default, menu 2 always is displayed, independently of the value of its bit.
Normally, this parameter has value 00, witch means all the menus can be displayed.

Menu 1 => bit 0
Menu 2 => bit 1
Menu 3 => bit 2
Menu 4 => bit 3
Menu 5 => bit 4
Menu 6 => bit 5

Bits 6 and 7 are not assigned. They can have any value.

Example:
If only menus 4 and 2 are desired, the parameter will have the

	following value in binary base, placing the value in hexadecimal base: 11110101 binary base = F5 hexadecimal base
COEX (AA)	Can have the value of zero or different from zero. If the value is zero, this means that it is set to control the drag speed. When different from zero (usually FF), indicates that it is installed in order to control the extruder's throughput as, for example, in a co-extruder.
Velcdade_Ti (DD)	Minimum time between two consecutive speed corrections (multiplied by 0,6 seconds).
Velcdade_K0 (CC)	Can have a value between two and eight. We recommend a value between three and five. This parameter is used to filter the information received from the tachometer encoder in order to stabilise the production speed displaying.
Velcdade_Vi (BB)	Can have a value between two and eight. We recommend a value between three and five. This parameter is used to filter the information received from the tachometer encoder in order to stabilise the production speed displaying.
Velcdade_Zm (AA)	Corresponds to the dead zone of control. This parameter must have the values 8 or 9 in normal cases.
TCORR_MAX (BBBB)	Corresponds to the maximum time for speed correction for a single correction. This parameter prevents **CONTGRAV** to change speed too fast, which could destabilize the balloon. The speed corrections will be therefore a train of impulses of maximum duration equal to this parameter and a waiting time defined by parameter ***Velocidade_Vi***. The units used are 0,01 seconds. For example, a value of 0300_h corresponds to 7,68 seconds.
TCORR_MIN (AAAA)	This parameter was introduced to prevent too short correction times. If the deviation observed in production is higher than the control dead band limit, but the time needed for speed correction is inferior to this parameter, then there will be no order for speed correction. The units used are 0,01seconds.
FltrNor_Ta_K2_K1_K0 (DDCCBBAA)	This value must not be changed.
FltrRAP_K2_K1_K0 (DDCCBBAA)	This value must not be changed.
Débito_Mínimo (AAAAAAAA)	When the measured throughput is inferior to this parameter, the following will be displayed ***THP = 0***. A value around 5 kg/h has proven to give good results. The units used are 1/100000 gr/sec. For instance, the value 21000_h corresponds to 4,866 kg/h.
Débito_Máximo (AAAAAAAA)	When the measured throughput is higher than this value, the reading cycle is restarted because this flow is not possible in normal conditions for the extruder to operate. For instance, the value 800000_h corresponds to 301,98 kg/h.
DEB_DIF (AAAAAAAA)	When the throughput of the extruder is quickly modified, it will be necessary for **CONTGRAV** to restart its internal variables to adapt

	itself to the new throughput. One way to detect if the flow has been strongly changed is comparing both input and output of the filtering flow pipeline. If this difference is higher than this parameter, **CONTGRAV** will restart all its internal variables. This is noticeable on the display, the symbol * will appear just after the flow indication in normal mode. The units used are 1/100000 gr/sec. The value 20000_h has proven to give good results.
PLR (AAAAAA)	This is the programmed RLW (Reference Linear Weight) in the normal mode. There is no need to change this parameter.

3.2. Parameter introduction

After carefully filling out completely the parameter sheet, as described in the previous paragraphs, it will be necessary to introduce these parameters into the **CONTGRAV**'s memory.

After accessing into the parameterisation mode, as previously described (see How to access into the parameterisation mode), press **[OK]** once. The type of machine and the software version are displayed:

```
CONTGRAV CL2
CPU - V2.30
```

Press **[OK]**. The following information will be displayed:

```
PESO(hex) = XXXX
 TAQ(hex) = XXXX
```

PESO(hex) represents the electric value of the load cell

TAQ(hex) represents the number of the speed sensor pulses

Pressing **[PARTIAL]** TAQ value resets to zero.

Pressing **[OK]**, the following information will be displayed:

```
Calibre XXXXXXXX
Tara    XXXXXXXX
```

X represents a hexadecimal digit

The first line displays the actual value stored into the memory and the second line displays the same parameter changed by the operator. This value will only be stored into the memory after pressing once **[OK]**.

The cursor points to the left most digit (_). This cursor indicates which digit can be changed in this moment. To change the value of this digit, just press **[↑]** or **[↓]**. When the selected digit reaches the desired value, by pressing **[MENU]** the next digit will be selected. Now the cursor skips to the next digit. This digit can then be changed as described above.

At any time, you can press **[CANCEL]** to cancel all the changes previously made and restart with the value presently stored into memory. Then, the inferior line will have the same value as the top line, this is the new set point to all future changes to the presently memory stored values.

After all changes made and to store the new values into **CONTGRAV**'s memory, and therefore loosing permanently the previous stored values, simply press **[OK]** and pass to the next parameter. If you wish to pass to the next parameter without storing the previous changes made, just press **[TOTAL]**.

Should you want to return to the beginning of the parameter introduction, press RESET. This button is located on the back of the panel, alongside the "switch" that changes from normal mode to parameterisation.

3.3. Counters

Upon reaching last parameter, it is still possible to change several counters in the same way parameters are changed (see previous chapter). These counters are as follows:

RST_ext ***RST_wdog***	***RST_ext*** counts the number of resets by hardware (Power-up or reset button) that was performed. ***RST_wdog*** counts the number of resets by software (watchdog). The resets by watchdog take place mainly when there are too many disturbances in the main power source. When this value increases fast in a small period of time one should improve the power source characteristics and behaviour through, for instance a supplementary external filtering.
Note: When changing the position of the switch from parameterisation mode to normal mode or vice-versa, the watchdog counter will be incremented by one unit for each change in position. This is therefore a normal situation.	
WDI_RST ***E_NVRAM***	These are the internal malfunction counters. Values too high indicate problems in the power source, as described in the previous paragraph.

The other values are used internally and must not be changed.

4. Operation

CONTGRAV was designed to control the average **A**ctual **L**inear **W**eight (**ALW**) of the extruded product, through the control of the speed of the haul off speed or through the control of the screw speed of the extruder (gravimetric control)

The operator has just to introduce the desired **R**eference **L**inear **W**eight (**RLW**) in gr/m.

CONTGRAV measures, with high accuracy, the throughput at the inlet of the extruder (kg/h) and the real haul off speed (m/min). Thus, it's possible to compare **A**ctual **L**inear **W**eight (**ALW**) with the programmed value (**RLW**), and to correct the speeds so that these values approach.

In case you need to control the thickness of the final product, you just need to keep the outer dimensions constant, as for example the width in case of the film production, the outer diameter for pipes, etc.

This gravimetric control philosophy and the speed of control system allows us to assure that the linear weight and the thickness of the final product are insensitive to variations of the apparent density of the raw material, to variations of the power supply, to variations of the screw speed or of the haul off, to degradation of filters, etc.

In general the savings of raw material and scrap, the increase in quality and in productivity of machines and operators are extremely important, making the investment in this CONTGRAV system to be returned in a very short period. Congratulations for your decision.

Do not forget to install a **CONTGRAV** in every extruder or coextruder in your factory.

CONTGRAV is constituted mainly by:

- Easily dismountable mechanical system for maintenance or cleanness
- Electrical system controlled by dedicated microprocessor
- Firmware that assumes all the tasks of calibration, digital filtering of the weight and the speed, inputs and outputs control, display and keyboard, permanent update of the different counters and of course of all the control process

The theoretical precision of the linear weight can be parameterised, being able to reach ±0.2%. Due to the normal oscillations of the extruder process, on field an error less than ±0.5% can be achieved. The **CONTGRAV** system is able to separate process noise from deviations. One should not intent to control noise. Only the deviations are going to be controlled.

The supplied firmware significantly attenuates the effect of the fast cyclical variations of the speed, due to the speed regulator, mechanical deformations, etc.

In these cases, it is probable that the thickness of the final product slightly oscillate from point for point.

Fast extruder's screw speed variations (throughput) also obviously have influence in the final result.

Usually, **CONTGRAV** is used to control the average thickness of the final product. In this case, it is necessary to always have in mind that the effectively controlled variable is the linear weight (grams per linear meter). Therefore, the thickness will effectively be kept constant if the outer dimensions (width, outer diameter, etc.) of the final product do not vary. This way, it is necessary to keep the width of the final product in its nominal value.

The weighing hopper is a high precision device. Please keep it free from perturbations that may disturb the weighing sensor.

Electric disturbances due to the industrial environment are, in most cases, automatically filtered.

External mechanical disturbances, as for example the deposition of objects in the weighing hopper, leaning or touching the hopper, maintaining the cover in the open position, etc., must be completely avoided.

Please verify regularly if the load cell freely suspends the weighing hopper and eliminate all perturbations that can arm the weighing process.

The load cell is a sensitive and fragile component. Although the load cell is mechanically protected against overloads, maximum load limit (static or dynamic) should not be exceeded. Possible permanent damages or rupture of the load cell are possible in case of overloading.

Note: The dynamic load can easily exceed the destroying limit if an object falls on the weighing hopper.

The electronic system uses advanced technology and solutions, sophisticated, but sensible. Never try to repair it even if its behaviour seems incorrect. Please, inform **IBE** immediately.

Please keep the system clean and free from dust or any other dirt. Please be sure that no heat source increases the temperature of the electronic components over 40ºC. This way you will have a correct functioning system for long years.

The recommended working temperature is situated between 0ºC and 40ºC. Temperatures outside of this interval may provoke a defective or inexact functioning and quickly speed up the aging of the electronic components. Please verify that the closets are conveniently ventilated and are not directly exposed to heat sources.

4.1. Manual mode

After initialisation (for instance after power or, reset), the system will be in manual mode of operation. In this case, all parameters of the process are acquired, the alarm detection is activated, the counters are actualised and the refill valve is automatically controlled. ***Only the speed will not be controlled***.

After an alarm, an error due to a perturbation, a sudden change in the throughput or loss of signal from the speed sensor, the system automatically changes to manual mode.

If the system is operating in automatic mode, pressing **[AUTO]** will change the system to manual mode. Pressing **[AUTO]** again changes it to automatic mode.

By pressing simultaneously **[CANCEL]** and **[↑]**, the speed increases. If **[CANCEL]** is pressed again, you will stop the speed increase. When you press simultaneously **[CANCEL]** and **[↓]**, you will decrease the speed. As before, by pressing **[CANCEL]**, you will cancel the previous action, stopping the speed decrease.

If both **[CANCEL]** and **[AUTO]** are pressed simultaneously, the material filling valve is opened. To cancel this action, just press **[CANCEL]**.

4.2. Automatic mode

Led indicator *(Auto)* turned on.

If the system is in manual mode, pressing **[AUTO]** will to change it to automatic mode.

The speed control is performed if the material in the weighing hopper is between the maximum and the minimum level (pre-programmed parameters). All other functions are activated.

In case of frequent perturbations or large variations of the throughput of the extruder, it may happen that speed control will not be performed, due to lack of consistent data. Larger perturbations may even change its mode from automatic to manual.

4.3. Programming – Reference linear weight (RLW)

At any time (no matter the displayed menu - except in an alarm situation), by pressing **[↑]** or **[↓]** it is possible to change the **RLW** value. When the second line displays the new desired value, by pressing **[OK]** you will store this new value into the memory of the equipment and return to previously displayed menu.

To cancel this operation, just press **[CANCEL]**. The previously displayed menu will be displayed again.

4.4. Buttons - Description

4.4.1. [↑] or [↓]

Pressing any of these buttons (in manual or automatic mode) starts the programming or modification of the **L**inear **R**eference **W**eigh (**RLW**). In this case, the display shows in the first line the **RLW** previously selected and in the second line the changed value.

If the button is kept pressed the **RLW** value increases - **[↑]** - or decreases rapidly - **[↓]**. In case of fine tuning adjustments, it is possible to press successively the corresponding button to increase or decrease the **RLW** in 0,01gr/m or of 0,1 gr/m [1].

The selected menu has no effect on the function of these buttons.

In case of an active alarm, it is not possible to change the **RLW** value. Please first acknowledge the alarm.

4.4.2. [OK]

Accepts and stores the **R**eference **L**inear **W**eight (**RLW**) that had been changed.

If the **RLW** value has not been changed, it has no effect.

4.4.3. [ALARM] and [CANCEL]

This button has two functions.

In case of a modification in **RLW**, pressing this button will cancel all changes previously made;

In case of an alarm detection the button will blink, a message is shown in the display and an external alarm signal is activated. This external signal can be continuous or intermittent, according to the parameter introduced.

Pressing once the button, the external alarm signal switches off, and the button will be illuminated continuously. New alarm conditions will only be shown in the display and will not actuate on the external signal.

Pressing the button a second time, the alarm detection will be rearmed and the display will show the previously selected menu.

[1] The selection of one or two decimal figures is only possible in the parameterisation mode. Note that the display has no effect at all on the accuracy or the operation of the system.

4.4.4. [AUTO] and [MANUAL]

Each press in this button toggles the operation mode between manual and automatic.

In manual mode, the button is not illuminated.

In automatic mode, the button is illuminated. The system will only run under this mode of operation if there are no alarm situations or any external perturbation.

4.4.5. [TOTAL]

When this button is pressed the actual values of weight and length of the total and partial counters are transferred into the previous total and partial counters. It also resets the value of the total and partial counters of weight and length.

To avoid the loss of the previous value, namely when the operator presses this button several times, button actuation that follow the first one are not valid for six seconds.

This counter is usually used as a production totalizer regarding a specific order, shift, day, …

4.4.6. [PARTIAL]

Pressing this button, the actual values of weight and length of the partial counter (bobbin) are transferred to the previous partial counter. This action also resets the value of the partial counter for length and weight (bobbin).

To avoid the loss of the previous value, namely when the operator pushes this button several times, button actuation that follow the first one are not valid during a period of 6 seconds.

The partial counter is usually used as a counter for each bobbin produced.

We strongly recommend installing a button in the winding station, this way enabling the operator to easily press it when he starts a new part of the production, for instance a new bobbin. Pressing this button has exactly the same effect as the pressing the **[PARTIAL]** button on the control panel of the **CONTGRAV**.

In case you have an automatic cutting device, just take cutting signal for automatic operation.

4.4.7. [MENU]

Pressing successively **[MENU]** changes the display, on a circular basis, between following menus:

4.4.7.1. Menu 1

```
RLW= xxx.xxgr/m
ALW= xxx.xxgr/m
```

Displayed menu after system initialisation.

RLW = **R**eference **L**inear **W**eight. Programmed value by the user for the control process.

ALW = **A**ctual **L**inear **W**eight. Value actually produced (calculated; ALW=Throughput/Speed).

4.4.7.2. Menu 2

```
PRD= xxx.xxkg/h
SPD= xxx.xxm/min
```

PRD = **Prod**uction presently measured. The display of the symbol (*) in the superior right corner indicates that the **CONTGRAV** is searching the correct production value. In this case, the displayed value may not be the correct one. This happens in case of sudden or fast perturbations or changes in the extruder or throughput. At this time, even if the **CONTGRAV** system is under automatic mode, the speed correction is temporarily disabled.

SPD = **Sp**ee**d**. Haul-off speed presently measured.

4.4.7.3. Menu 3

```
Prtial xxxxx.xkg
Actual xxxxxxxm
```

Actual weight and length values being produced since the last reset action.

If an alarm or error happens, the symbol (*) appears in the superior right corner of the display, meaning that the weight indication may not be exact. This means that, since the last reset action, one or more alarms or power down has been detected. Therefore the CONTGRAV has lost the control for some time and it is possible that the measured values are not correct. Just reset the counter by pressing **[PARTIAL]** or **[TOTAL]**.

These values are resettled at any moment by pressing the button **[PARTIAL]** or **[TOTAL]**, even if this is not the selected menu. The values of these counters are transferred, at this moment, to the previous counters for further use. The same effect can be obtained through a button or switch placed at the winding device, as previously described.

4.4.7.4. Menu 4

```
Prtial xxxxx.xkg
Last   xxxxxxxm
```

Previous weight and length value (reel) produced before the last reset action.

If an alarm or an error happened during the production, the symbol (*) appears in the right superior corner of the display, meaning that the weight indication may not be exact.

4.4.7.5. Menu 5

```
Total   xxxxx.xkg
Actual  xxxxxxxm
```

Actual weight and length values being produced since the last reset action (Total button).

If an alarm or an error happened during the production of, at least, one of the parts of this order, the symbol (*) appears in the right superior corner of the display, meaning that the weight indication may not be exact.

These values are resettled by pressing button **[TOTAL]**. The values of these counters are transferred to the counters of previous total. The same happens to the partial counters.

4.4.7.6. Menu 6

```
Total   xxxxx.xkg
Last    xxxxxxxm
```

Previous weight and length values of the activity produced just before the last reset action (Total button).

If an alarm or an error happened during the production of, at least, one of the parts of this order, the symbol (*) appears in the right superior corner of the display, meaning that the weight indication may not be exact.

4.5. Alarms

An alarm will be activated if the quantity of the raw material in the weighing hopper overpasses the maximum or minimum pre-programmed levels (minimum Alarm and maximum Alarm).

In this case the alarm light indicator blinks, the display will indicate a probable cause of the alarm and the system will change automatically to manual mode.

The alarm output (relay) can operate in a continuous or intermittent way, in accordance to the pre-programmed parameter.

Pressing **[ALARM]** once, the alarm output will de-activate and the indicator lights continuously. If the alarm situation is maintained, the output will not be activated again.

Pressing **[ALARM]** a second time, the light indicator will be switched off, the message in the display will be erased and the menu previously selected will appear again. The alarm detection becomes active again.

To select the automatic mode of operation it will be necessary to press **[AUTO]**.

If the hopper refilling takes more than about 15 seconds, a warning will be displayed. The normal operation will not be affected. To cancel the warning, just press **[ALARM]**.

4.6. Changing the raw material

Whenever is necessary to change from one raw material kind to another in the extruding machine, without stopping the extrusion process, as for instance in the case of change of colour, the following procedure can be used.

Stop feeding with raw material the upper hopper of **CONTGRAV**;

When the system opens the valve to refill the weighing hopper, the "LOW MATERIAL" warning will be activated. Press **[ALARM]** once to de-activate the sound and light alarms;

When the raw material weight is lower than the minimum alarm level, the "LOW MATERIAL" alarm will be activated and the system will pass to manual mode. Press **[ALARM]** once to de-activate the sound and light alarms. At this moment, the valve will close, thus enabling the refilling of the upper hopper with the raw material to be extruded next;

When the level of material in the hopper is sufficiently low to avoid mixing with the new material, press **[ALARM]** again to open the valve and fill the hopper with the new material to be extruded.

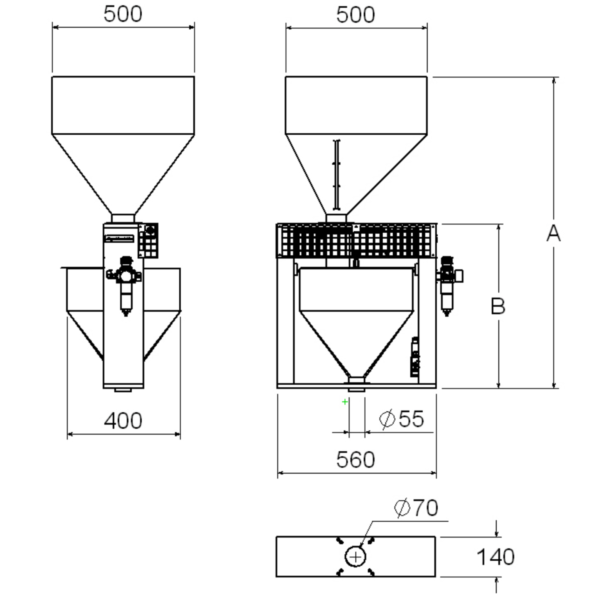
4.7. IMPORTANT

The speed and length of the extruded product are measured or calculated using the perimeter of the haul-off cylinder, where the speed sensor is installed.

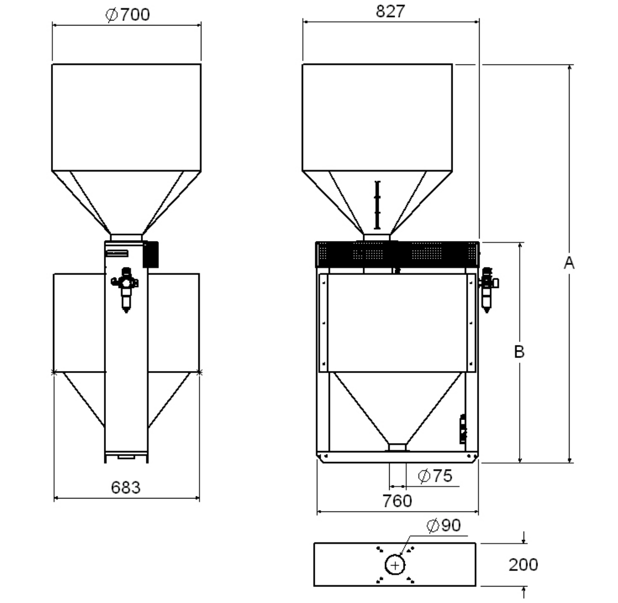
Therefore, any change in this cylinder should be mentioned to **IBE**, in order to change the corresponding parameter.

Each load cell and respective electronic board is calibrated together. Therefore, they only work accurately as a set. These components are not interchangeable from one machine to another unless a new calibration procedure is performed.

5. Technical Characteristics



Models C3E and C7E



Model C20E

Version	A(mm)	B(mm)	Recommended throughput
C3E	1098	580	< 350 kg/h
C7E	1298	780	< 750 kg/h
C20E	1870	1035	< 2000 kg/h ***thp. > 2000 kg/h on demand***

Command rack (255x154x325 mm)

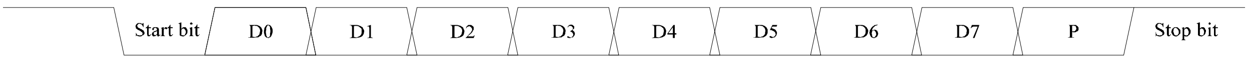
Power supply:	**230VAC** (+/- 10%)**, 50/60Hz.** (other values possible on request)
Electrical consumption:	**50W**

6. Communication Protocol CG2.1

6.1. Serial port configuration (Level 0)

- 9600 bits per second (bps)
- 1 start bit
- 8 data bits (LSB first)
- 1 parity bit (even)
- 1 stop bit
- No handshaking
- RS485[2]

The transmission of each byte has the following logical form:



6.2. Communication (Level 1)

The communication uses exclusively ASCII characters.

Every message starts with the ASCII character **Xon** (#11h), followed by the address of the **CONTGRAV** (C□□)[3], request or command, and finishes with the ASCII character **Xoff** (#13h).

Every message may only be initiated when the precedent is terminated.

The **CONTGRAV** operates in slave mode[4], and responds only after a clear and formally correct request received through the network. A new request can only be made after the **CONTGRAV** has concluded the transmission of the data concerning the prior message, thus preventing the risk of aborting the present message and/or not being able to respond to the new request.

If the **CONTGRAV** do not respond within a 0,5 second period after the request is made, this means that the message was not correctly received, or, either the **CONTGRAV** or the RS485 serial connection is offline.

---

[2] May be connected to a normal PC serial port, for example through a RS232/RS485 converter. Communication is from type half duplex.

[3] Address C00 is reserved.

[4] At each moment, it is only possible to have one a master device on the network.

Each message is composed by commands (an ASCII character), eventually followed by a set of ASCII characters (0..9, A..F) of fixed length, which represent a numeric value in hexadecimal base.

6.3. Communication IBEBUS → CONTGRAV – Commands

Command	Value	Description
X_{on}	C□□[5]	Message start and address of the **CONTGRAV**
P	□□□□□□	RLW (units: 0,01 gr/m) – **Re**ference **L**inear **W**eight
T / R[6]		**T**otal reset / par**T**ial reset
a / M[7]		**a**utomatic / **M**anual
b / e[8]		Data request in **b**ase mode / data request in **e**xtended mode
c		**c**ancel the alarm
X_{off}		Message end

Example 1:

Message	Description
X_{on}C01aeX_{off}	**CONTGRAV** nº. 01: Change to automatic mode; Requests complete set of data (extended mode)

Example 2:

Message	Description
X_{on}C05P0012FCbX_{off}	**CONTGRAV** nº. 05: Change **RLW** to 48,60gr/m (**0012FC**h=4860d;=>48,60gr/m); Requests short set of data (**b**ase mode)

[5] Any □ corresponds to a hexadecimal nibble. The most significant nibble is send first.

[6] Commands "**T**" and "**R**" are mutually exclusive. The reception of both commands is an error condition. None of the commands will be executed.

[7] Commands "**a**" and "**M**" are mutually exclusive. The reception of both commands is an error condition. None of the commands will be executed.

[8] Commands "**b**" and "**e**" are mutually exclusive. The reception of both commands is an error condition. None of the commands will be executed.

6.4. Communication CONTGRAV → IBEBUS – Commands

The **CONTGRAV** only sends data upon an explicit and formally correct request has been made through the **IBEBUS** network.

This request is made through a message containing the commands "**b**" or "**e**". Please note that these commands are mutually exclusive.

Any command will only be executed after a complete and valid reception of a frame

The reception will be interrupted in case of parity error or reception of any invalid command.

Only a new frame beginning with the **Xon** command will initiate the reception again.

The transmission will abort if the character present in the RS485 line is different from the value transmitted by the **CONTGRAV**. This may occur in case of high noise level or in case of data contention.

6.4.1. Base mode

The base mode has the necessary data to simply monitor the **CONTGRAV**.

It is composed by a message of 36 bytes as described bellow:

Command	Value	Description
X_{on}	C□□	Message start and address of the **CONTGRAV**
P	□□□□□□	RLW (units: 0,01 gr/m) - Linear Reference[9] Weight
d	✪□□□□□□□□	Throughput (units: 1/100.000 gr/sec)[10]
V	□□□□□□□□	Speed (units: mm/sec). This value is composed by the integer part (first two bytes) and fractional part (last two bytes)[11].
a / M		**a**utomatic mode / **M**anual

[9] The value of **ALW** – **A**ctual **L**inear **W**eight may be calculated by dividing the Throughput by the Line Speed: **ALW** = (Throughput/Speed)/100. The units of the result are gr/m.

[10] ✪ May be "0" (ASCII #30h) or "*" (ASCII #2Ah).

The character "0" indicates that value is a stable value.

The character "*" indicates that the value displayed is not yet stable and may not correspond to the reality. The value is transmitted just for debugging and maintenance reasons and should be interpreted as missing value. This situation may happen in case of perturbation of the weighing hopper, fast change of throughput or refill of the weighing hopper.

[11] The speed value is composed of integer part and fractional part (hexadecimal base). To convert the value to decimal base, first convert the integer part as usual; secondly divide the fractional part (2 bytes) by 10000h (= 65536d); finally add both values. Example: ***Speed****= 01AF8DF0h.* ***Integer part****= 01AFh=431d;* ***fractional part****= 8DF0h/10000h=0,554443d;* ***Final result****= 31,554443d mm/sec (=25,89 m/min).*

X	□	Alarm active: □ = 0: normal (without any alarm) □ = 1: Low level of material □ = 2: valve failure □ = 3: power supply failure
r	□	reset occurred: □ = 0: no reset[12] since last transmission □ = 1: power reset (power on) □ = 2: total counter reset □ = 4: partial counter reset
X_{off}		Message end

6.4.2. Extended mode

The extended mode is composed by the base mode information plus the weight and length counters status (36 Bytes + 76 Bytes = 112 Bytes), as follows:

Command	Value	Description
i	□□□□□□□□□	Total length (units: speed sensor impulses).
j	✪□□□□□□□□□	Total weight (units: grams).
k	□□□□□□□□□	Partial length (units: speed sensor impulses).
l	✪□□□□□□□□□	Partial weight (units: grams).
m	□□□□□□□□□	Previous Total length (units: speed sensor impulses).
n	✪□□□□□□□□□	Previous Total weight (units: grams).
o	□□□□□□□□□	Previous Partial length (units: speed sensor impulses).
p	✪□□□□□□□□□	Previous Partial weight (units: grams)

Note 1: ✪□ may contain the character "0" (ASCII 30h) or the character "*" (ASCII 2Ah).

The character "0" indicates that the referred value is accurate and reliable.

The character "*" indicates that the value may not be accurate or true due to any incident (alarm, perturbation, power reset, etc.) during the time the counter was active.

We recommend to check the weight and length in these cases.

Note 2: The length values are given as a number of pulses from the speed sensor. To have its correspondence in meters it is necessary to multiply this value by a constant that represents the length of material produced between two pulses (see **CONTGRAV** parameter "***TAQ_DIST***").

[12] After one or more of these events, the **CONTGRAV** will send **just once** the corresponding code. In case, more than one event has occurred since last transmission, the sum of the values will be sent.

Example 3:

XonC01P00099Cd0001034EFV01AF8DF0aX0r0Xoff

In this case, the base information is sent.

RLW (**P**): **00099C**$_h$ = 24,60 gr/m;

Throughput (**d**): **0001034EF**$_h$ = 38,23 kg/h stable.

Speed (**V**): **01AF8DF0**$_h$ = 25,89 m/min.

Automatic mode (**a**).

No alarms (**X0**).

No reset (**r0**).

Example 4:

XonC01P00099Cd0001034EFV01AF8DF0aX0r0i00215901j00014A465k001159 01l00002A465m01215901n*0024A465o00235A01p00024A895Xoff

On top of above-mentioned information from example 3, the following information is also sent:

Total length (**i**): **00215901**$_h$ pulses. If constant (***TAQ_DIST***) = 3 mm, length = 6556 m.

Total Weight (**j**): **0014A465**$_h$, reliable = 1352 kg.

Partial length (**k**): **00115901**$_h$ pulses. If constant (***TAQ_DIST***) = 3 mm, length =3410 m.

Partial weight (**l**): **0002A465**$_h$, reliable = 173 kg.

Previous Total length (**m**): **01215901**$_h$ pulses. If constant (***TAQ_DIST***) = 3 mm, length = 56888 m.

Previous Total Weight (**n**): ***0024A465**$_h$, not reliable = 2401 kg.

Previous Partial length (**o**): **00235A01**$_h$ pulses. If constant (***TAQ_DIST***) = 3 mm, length =6950 m.

Previous Partial weight (**p**): **0024A895**$_h$, reliable = 2402 kg.

7. Troubleshooting

This section helps to isolate certain problem or equipment malfunction. Should this is not enough or if a different cause of malfunctioning is observed, please contact **IBE**.

7.1. CONTGRAV DO NOT POWER UP

Verify if the power supply has 230VAC (±10%), 50/60Hz.

Verify the main fuse. If necessary, replace with a T500mA fuse.

7.2. MEASURED SPEED UNSTABLE

Verify the state of the speed sensor. Replace if necessary.

Verify cables and earthling.

Maximum sensor frequency is higher than 75 Hz. Reduce the number of impulses.

7.3. "!!! ALARM !!!" "RAW MATERIAL LOW"

Weight of material inferior to the level of programmed Minimum Alarm (see parameterisation).

Add raw material and press the keyboard key **[ALARM]**.

If the valve does not open, verify if the compressed air pressure is between five and six bar; verify cylinder and pneumatic valve; verify if the valve stuck.

Verify if some object disturbs the weighing. Eliminate disturbance.

The time necessary to fill the hopper is too long. Eliminate the cause and verify if there is sufficient material.

7.4. "!!! ALARM !!!" "RAW MAT EXCESS"

Weight of material is higher than Maximum Alarm level (see parameterisation).

If the valve does not close, verify if the compressed air pressure is between five and six bar; verify cylinder and pneumatic valve; verify if the valve stuck.

Hopper has excess of material. Wait until the extruder consumes the excess or remove this excess of material.

7.5. "POWER SUPPLY" ALARM

Verify if the power supply has 230VAC (±10%), 50/60Hz.

7.6. POTENCIOMETER DOES NOT WORK

Verify if the relays' board has power supply.

Verify fuse on the relays' board. If necessary, substitute with a T1A fuse.

Verify 24VDC protection fuse (see Chapter II). Replace if necessary.

7.7. OTHER PROBLEM

Please contact **IBE**.

Rua do Solão, 75 ◆ 4475-240 Gondim - MAIA ◆ PORTUGAL

☎ +351 229 871 400 ◆ Fax +351 229 871 409

e-mail: ibe@ibe.pt ◆ www.ibe.pt

8. ANNEX I – Correspondence between bases decimal, hexadecimal and binary

Decimal	Hexadecimal	Binary
0_d	0_h	0000_b
1_d	1_h	0001_b
2_d	2_h	0010_b
3_d	3_h	0011_b
4_d	4_h	0100_b
5_d	5_h	0101_b
6_d	6_h	0110_b
7_d	7_h	0111_b
8_d	8_h	1000_b
9_d	9_h	1001_b
10_d	A_h	1010_b
11_d	B_h	1011_b
12_d	C_h	1100_b
13_d	D_h	1101_b
14_d	E_h	1110_b
15_d	F_h	1111_b

9. ANNEX II – ASCII table code

CODE	CARÁCTER	CODE	CARÁCTER	CODE	CARÁCTER	CODE	CARÁCTER
0_h	NUL	20_h	' '	40_h	'@'	60_h	'`'
1_h	SOH	21_h	'!'	41_h	'A'	61_h	'a'
2_h	STX	22_h	'"'	42_h	'B'	62_h	'b'
3_h	ETX	23_h	'#'	43_h	'C'	63_h	'c'
4_h	EOT	24_h	'$'	44_h	'D'	64_h	'd'
5_h	ENQ	25_h	'%'	45_h	'E'	65_h	'e'
6_h	ACK	26_h	'&'	46_h	'F'	66_h	'f'
7_h	BEL	27_h	'''	47_h	'G'	67_h	'g'
8_h	BS	28_h	'('	48_h	'H'	68_h	'h'
9_h	HT (TAB)	29_h	')'	49_h	'I'	69_h	'i'
$0A_h$	LF	$2A_h$	'*'	$4A_h$	'J'	$6A_h$	'j'
$0B_h$	VT	$2B_h$	'+'	$4B_h$	'K'	$6B_h$	'k'
$0C_h$	FF	$2C_h$	','	$4C_h$	'L'	$6C_h$	'l'
$0D_h$	CR	$2D_h$	'-'	$4D_h$	'M'	$6D_h$	'm'
$0E_h$	SO	$2E_h$	'.'	$4E_h$	'N'	$6E_h$	'n'
$0F_h$	SI	$2F_h$	'/'	$4F_h$	'O'	$6F_h$	'o'
10_h	DLE	30_h	'0'	50_h	'P'	70_h	'p'
11h	DC1 (X-ON)	31_h	'1'	51_h	'Q'	71_h	'q'
12_h	DC2 (TAPE)	32_h	'2'	52_h	'R'	72_h	'r'
13_h	DC3 (X-OFF)	33_h	'3'	53_h	'S'	73_h	's'
14_h	DC4 (TAPE)	34_h	'4'	54_h	'T'	74_h	't'
15_h	NAK	35_h	'5'	55_h	'U'	75_h	'u'
16_h	SYN	36_h	'6'	56_h	'V'	76_h	'v'
17_h	ETB	37_h	'7'	57_h	'W'	77_h	'w'
18_h	CAN	38_h	'8'	58_h	'X'	78_h	'x'
19_h	EM	39_h	'9'	59_h	'Y'	79_h	'y'
$1A_h$	SUB	$3A_h$	':'	$5A_h$	'Z'	$7A_h$	'z'
$1B_h$	ESC	$3B_h$	';'	$5B_h$	'['	$7B_h$	'{'
$1C_h$	FS	$3C_h$	'<'	$5C_h$	'¥'	$7C_h$	'|'
$1D_h$	GS	$3D_h$	'='	$5D_h$	']'	$7D_h$	'}'
$1E_h$	RS	$3E_h$	'>'	$5E_h$	'^'	$7E_h$	'→'
$1F_h$	US	$3F_h$	'?'	$5F_h$	'_'	$7F_h$	'←'

10. ANNEX III – CONTGRAV’s parameter list

Client	Name:		Date:	
	Machine:			
Command:		Structure:		
Load Cell:		Software:	V2.30	

Display	Posição								X	Descrição
Calibre	B	B	B	B	A	A	A	A	B	Reference weight
Tara									A	Tare
Peso Min	B	B	B	B	A	A	A	A	B	Minimum weight. Order to refill.
Alarm Mn	5	0	0	0	4	8	0	0	A	Minimum Alarm
Alarm Mx	B	B	B	B	A	A	A	A	B	Maximum Alarm
Peso Max	A	0	0	0	7	0	0	0	A	Maximum weight. Order to stop refill.
Peso	X	X	X	X	A	A	A	A	A	Reference weight in grams
Calibre	0	0	0	0	1	9	0	4		
Const	X	X	X	X	A	A	A	A	A	Weight constant / Machine Units
KPI	0	0	0	0						KPI = Peso_Calibre/(Calibre-Tara)*(10/72)*100000
TAQ	A	A	A	A	A	A	A	A	A	Production between 2 impulses from velocity sensor (mm) = TAQ
DIST 1										TAQ_DIST1 = TAQ * 100000 if RLW/ALW in gr/m
										TAQ_DIST1 = TAQ * 100000 * 100 if RLW/ALW in g/cm
										TAQ_DIST1 = TAQ * 100000 * 1000 if RLW/ALW in kg/m
AL2 T2T1	C	C	B	B	A	A	A	A	C	ALARM2 (VIBRATOR) TIME OFF (T2)
TAQDIST2	0	0	0	0					B	ALARM2 (VIBRATOR) TIME ON (T1)
									A	TAQ_DIST2 = TAQ * 65,536
TMxE End	D	D	C	C	B	B	A	A	D	Lower Hopper Maximum Filling Time (*0,6 seconds)
Lg ESPMx	1	8	0	1	0	0	0	8	C	IBEBUS address
									B	0=Port.; 1=Spa.; 2=Eng.; 3=Fren.; 4=Ger.; 5=Pol.
									A	Maximum time waiting for velocity sensor Time = TAQ_ESP_MAX * 0,6 seconds
BUZ DEC	E	E	D	C	B	B	A	A	E	0/1 => Alarm blink/continuous
AFX COEX	0	0	0	0	0	0	0	0	D	

D:

BITS				HEX	UNITS		
7	6	5	4		RLW / ALW	SPD	Counters
-	-	0	0	0	gr/m	m/min	xx m
-	-	0	1	1	g/cm	cm/mn	xx.xx m
-	-	1	0	2	kg/m	m/min	xx m
-	-	1	1	3	kg/m	mm/mn	xx.xxx m

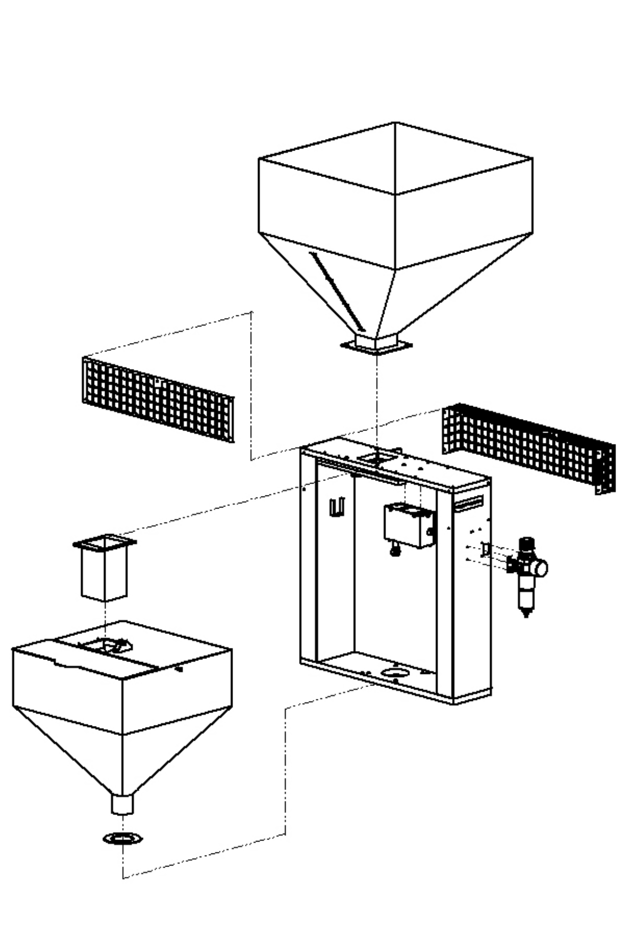
C:

BITS				x = 0 => 2 decimal digits x = 1 => 1 decimal digit
3	2	1	0	
-	-	-	x	PRoDuction
-	-	x	-	SPeeD
-	x	-	-	ALW / RLW

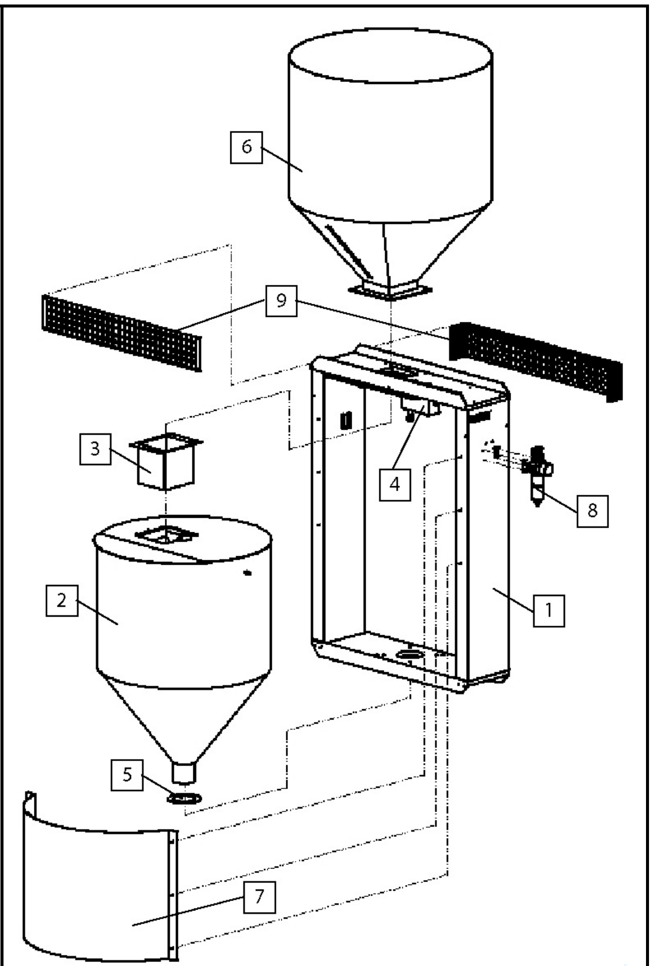
X	Descrição
B	Bit = 0 => Menu on
A	0/1 => Speed /Throughput control

Velcdade	D	D	C	C	B	B	A	A	D	Minimum time between 2 corrections (* 0,6 sec)
TiK0ViZm	0	8	0	3	4	0	0	8	C	Speed filter constant (2..8) (K0)
									B	Nr. velocity sensor impulses between corrections (Vi)
									A	Dead zone (1/2^Zm)
TCORR	B	B	B	B	A	A	A	A	B	Maximum correction time (* 10 msec)
MAX MIN	0	D	0	0	0	0	0	A	A	Minimum correction time (* 10 msec)
FltrNor	D	D	C	C	B	B	A	A	D	Delay for beginning of correction (* 0,6 sec)
TaK2K1K0	0	5	0	5	0	5	0	5	C	Constant K2 for normal throughput filter
									B	Constant K1 for normal throughput filter
									A	Constant K0 for normal throughput filter
FltrRAP	X	X	C	C	B	B	A	A	C	Constant K2 for fast throughput filter
K2K1K0	0	0	0	3	0	3	0	3	B	Constant K1 for fast throughput filter
									A	Constant K0 for fast throughput filter
Debito	A	A	A	A	A	A	A	A	A	Minimum throughput
Minimo	0	0	0	2	1	0	0	0		unit: 1/100000 gr/sec
Debito	A	A	A	A	A	A	A	A	A	Maximum throughput
Maximo	0	0	8	0	0	0	0	0		unit: 1/100000 gr/sec
KSD	X	X	A	A	A	A	A	A	A	Control gain (3 Bytes)
- 2 1 0	0	0								
DEB_DIF	A	A	A	A	A	A	A	A	A	Throughput variation limit
3 2 1 0	0	0	0	2	0	0	0	0		unit: 1/100000 gr/sec
PLR	X	X	A	A	A	A	A	A	A	RLW - Reference Linear Weight. unit: 1/100 gr/m, g/cm or kg/m
-- 2 1 0	0	0	0	0	0	0	0	0		Changed during operation!

11. ANNEX IV – CONTGRAV's assembly



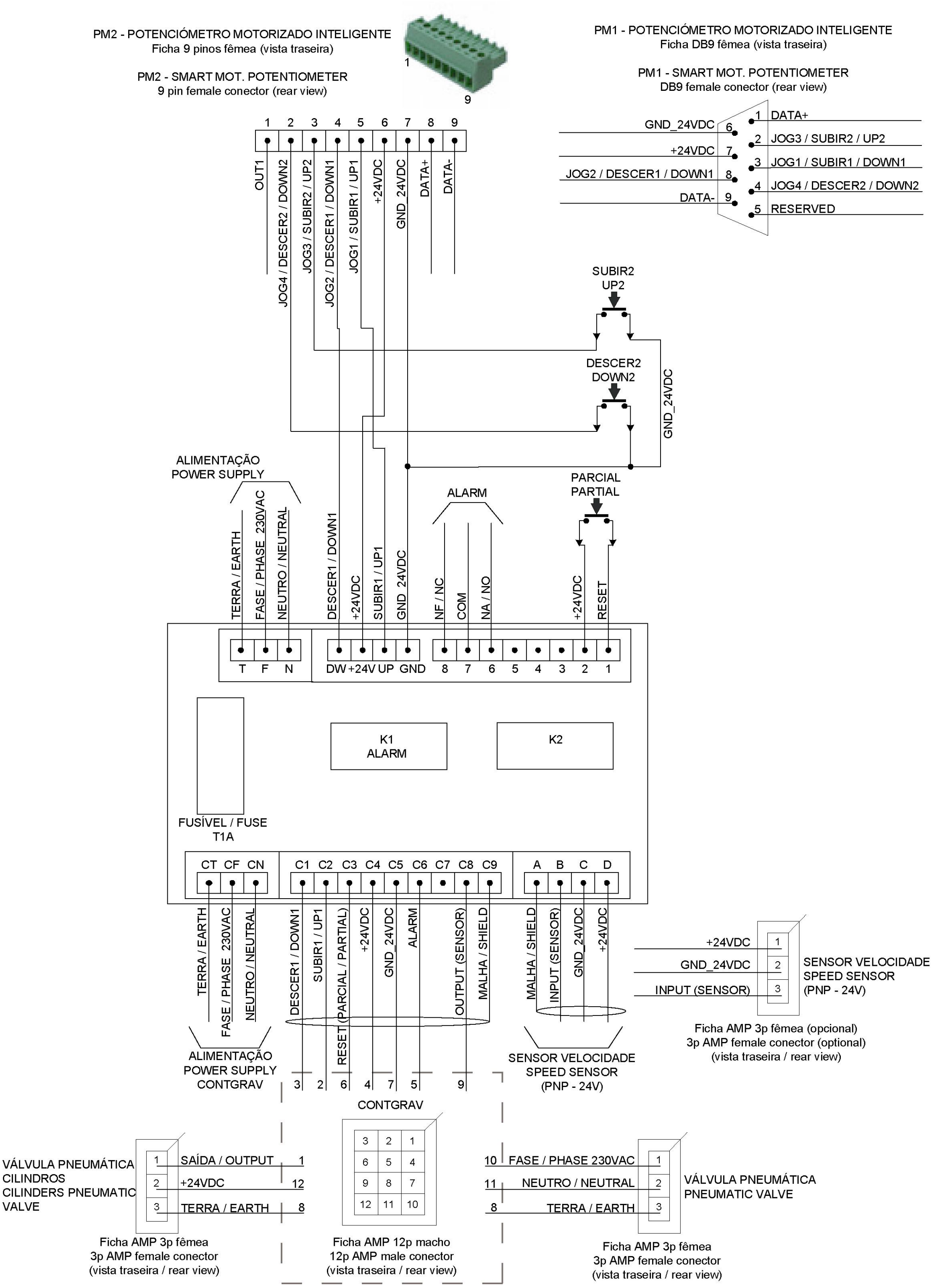
Models C3E and C7E



Models C20E

A. Install **1** and level.
B. Place **3** in **2**, with the narrowest part of your flange facing the side where the load cell will be.
C. Tighten **4** in the lifting eye of **2**.
D. Place **5** on the material outlet neck of **2** and carefully install on **1**, being careful to check that the side studs rest on the supports provided in the frame. The acrylic cap of **2** should face away from the pneumatic cylinder of **1** so that **2** can be opened.
E. Tighten **3** on the pneumatic valve guides.
F. Firmly tighten **4** in **1**, being careful to check that the hopper is perfectly suspended without any hindrance.
G. Instal **6**, **7** and **8** on **1**.
H. After the electrical installation is complete, install **9** in **1**.

12. ANNEX V – Relay's board v3.1 schematic



13. ANNEX VI – Electrical installation quick guide

A. Install command rack in the intended location (see section 1.2.).

B. Install speed sensor (see section 1.3.).

C. Install motorized potentiometer (see section 1.4.).

D. Install relay's board.

E. Make electrical connections using the relay's board diagram (see section 2.4 or annex V).

F. Verify that the 230VAC is present on the power plug that reaches the **CONTGRAV**.

G. Connect all plugs.

H. Switch on the **CONTGRAV** and enter maintenance mode (see section 3.1.1.).

I. I. Check if the potentiometer increases or decreases the speed and if the alarm activates by pressing the buttons on the relay's board.

J. Press the **[OK]**. The following indication appears on the display:

```
PESO(hex) = XXXX
 TAQ(hex) = XXXX
```

K. Lightly press the weighing hopper (lower) and check if the PESO value rises. Stop pressing and the value will return to the initial value.

L. With the haul-off running, check if the TAQ value increases.

M. Check whether the potentiometer increases or decreases the speed by pressing the **[CANCEL]** and **[🡅]** or **[CANCEL]** and **[🡇]** respectively. Pressing the **[CANCEL]** again will undo the speed change.

N. Check that the material valve opens by pressing the **[CANCEL]** and **[AUTO]** simultaneously. Pressing **[CANCEL]** closes the valve.

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English