Electronic Metal Melting Machines
F1-D Turbo • F3-D • F4-D • F5-D
F9-D • F12-D
Operator's manual

Serial number: _____

Attention!

Operate the Unit referring to the Technical Booklet having the same serial number of the Machine.

INSTRUCTIONS

ATTENTION!
READ THESE INSTRUCTIONS CAREFULLY BEFORE WORKING WITH THE DEVICE

- Read this booklet carefully before installing or operating the device and before carrying out maintenance operations. Keep this booklet in a safe place, for future reference.
- CEIA products may be operated with a high degree of safety provided that all the safety standards (following good sense and the manufacturer's advice) are observed. It is therefore essential that the heads of staff safety make sure that all operators read this manual before being allowed to use the device.
- At all times during the installation, use and maintenance of the device follow the guidelines presented in this booklet. CEIA will not be held responsible for any damage as a result of the device being used for purposed that are not expressly indicated in this booklet.
- Whenever there is the risk that the safety standards have been lowered, the device must be placed out of service in such a way that as to render its accidental usage impossible and assistance must be requested.
  The safety standards are to be considered lowered when:
  - the device shows visual signs of deterioration;
  - the device does not work correctly;
  - the device has been stored in less than satisfactory conditions for a long period of time;
  - the device has had to undergo severe strain during transportation;
  - the device has come into contact with liquid substances.
- The area directly surrounding the working zone must be supplied with adequate anti-incendiary devices.
- All combustible materials must be removed from the working zone and placed at a safe distance.
- Do not use excessive force during installation, use or maintenance of the device.
- The operator must be able to access the controls of the device easily, without running personal risks.
- Before providing the device with electrical power, check that the voltage from the power mains corresponds to the voltage shown on the device's electrical specifications plaque.
  Only connect the device to the power mains after having made all the connections needed for its complete installation.
- The electrical plug must only be inserted into a socket containing a grounding contact. Any interruption in the protective conductor either inside or outside the device, or the detaching of the protective grounding terminal, renders the device dangerous. Intentional interruption is forbidden.
- After melting, ensure that the metal that has been worked upon is allowed sufficient time to cool before handling it or bringing it into contact with combustible material.
- All electrical shocks are potentially fatal. Never touch parts charged with mains power. Keep clothes and body dry and never work in wet environments. Whenever one becomes aware that the device or part of it has accidentally become electrically charged, immediately stop the soldering operations and do not use the device until the problem has been located and resolved by qualified personnel.
- Wearers of electronic devices, such as pacemakers, must consult a doctor before coming into close contact with the device in order to ascertain whether the magnetic fields produced by high currents may influence the functioning of the pacemaker.
- Always remove the plug by hand when disconnecting the power supply cable, never by pulling on the cable.
- To prevent damage by lightening, disconnect the power supply cable during thunderstorms.
- Do not wash the device with water, liquid detergents or chemical substances. Use a slightly moist, non-abrasive cloth for cleaning.
- Never cut off the safety features of the device.
- Before any maintenance, cleaning or movement, the device must first be disconnected from all sources of power.
- Carefully read the "Maintenance" chapter of this booklet before contacting your service centre. In the event of a problem, only technicians that are specialized and authorized to work on CEIA machinery should be contacted.
- Any malfunctioning parts must be replaced with parts specifically designed for the device.
- It is important, as much as possible, to avoid carrying out maintenance or repairs on the device while it is open and supplied with electrical power; if absolutely essential, such work must be carried out only by qualified personnel who are well aware of the risks that are involved.
- The capacitors within the device may remain charged even after the device has been disconnected from all sources of power. Wait 60 seconds before beginning repair work on the device.

Symbols

	The device is marked with this symbol whenever the operator or the maintenance personnel, in order to avoid possible damage, have to refer to the present manual. The same symbol appears in the booklet at points where warnings or particularly important instructions are given - instructions that are vital to a safe and correct use of the device
	The device is marked with this symbol in those areas where a dangerous amount of voltage is present. Only specialized maintenance personnel should make adjustments in these areas**.**

WARRANTY TERMS

The Warranty on all CEIA equipment relates to goods delivered from our factory, under our general and specific conditions of sale.

CONTENTS

Page

I - DESCRIPTION

Working diagram and description

The working diagram of the **Electronic Melting Machine** is shown in Fig. I-1. The following sections are illustrated:

1) Control panel: this is located on the front of the device, and allows the operator to select the amount of power delivered and the operating temperature.

2) Medium-frequency generator: transforms the power supply voltage into medium-frequency energy, which drives the coil. The amount of energy supplied to the coil can be adjusted.

3) Coil: transforms the medium-frequency energy, provided by the medium-frequency generator, into a variable magnetic field.

4) Crucible: contains the metal to be melted; the crucible is heated by currents induced therein by the magnetic field generated by the coil. In order to obtain an efficient transfer of energy, the crucible is placed within the coil.

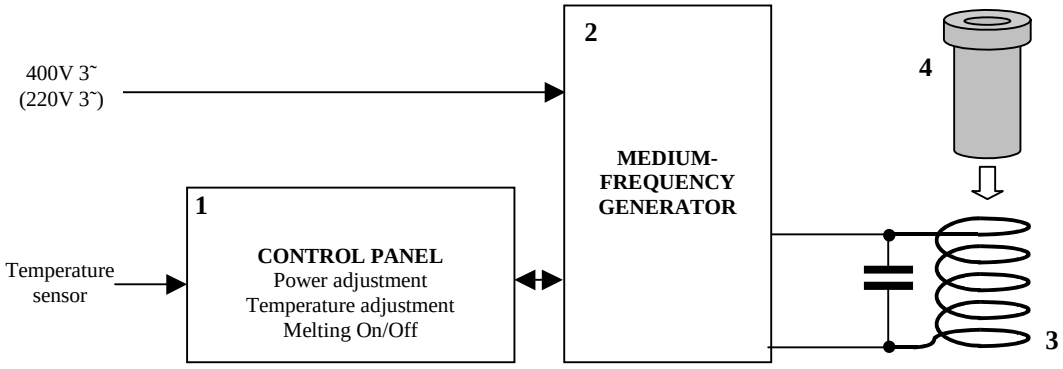


Fig. I-1 Melting machine block diagram

Control of the apparatus is entrusted to a **microcomputer**, which accepts instructions from the operator (switching on and off, adjustment of the power delivered and selection of melting temperature), checks that the machine is working correctly by means of a self-diagnostic device, and uses voice synthesis to give information about the melting of the metal and any action necessary on the part of the operator
The power delivered, which depends on the temperature to be reached and the mass of the metal to be melted, can be adjusted digitally by the operator.

The machine is also equipped with a **thermoregulator with a pyrometer,** via which the temperature the metal must reach during the melting phase can be set.
The temperature sensor can be a dual-wavelength optical reader or an immersion thermocouple (for measurement ranges see the “Technical Characteristics” section).
In addition to the power supply, the machine requires a water supply for the cooling system for the electronic power devices inside, connections for which are made on the left side of the machine
The cooling water supply is monitored by a flowswitch, which prevents the machine from operating in the case of supply failure or low water flow-rate.

The water temperature is controlled by a thermostat which blocks operation of the machine if overheating occurs.

Figures I-2 and I-3 illustrate the electronic melting machines described in this manual.

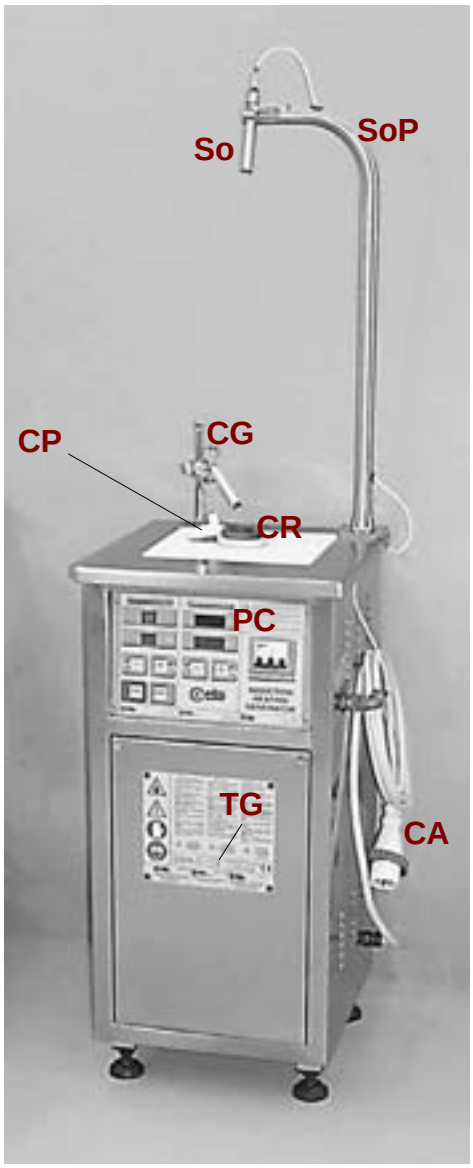


Fig. I-2 models F1-D Turbo , F3-D and F4-D with optical temperature sensor (optional)

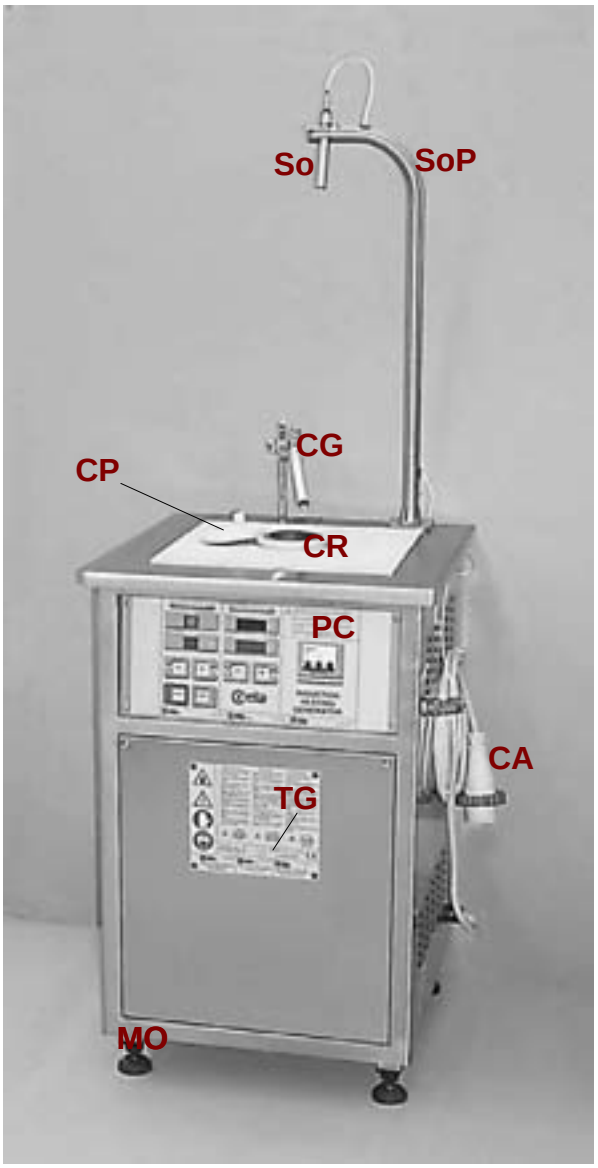


Fig. I-3 models F5-D, F9-D and F12-D with optical temperature sensor (optional)

Fig. I-4a cooling water inlets and outlets.

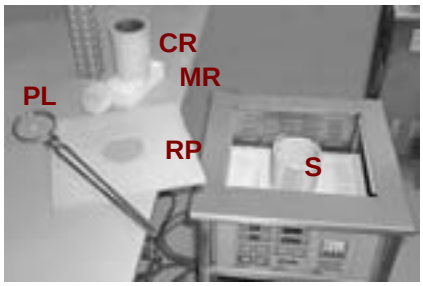


Fig. I-4b detail of the melting unit

Fig. I-4c detail of the immersion thermocouple

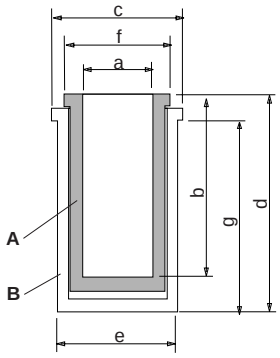
CA	power supply cable
CG	gas torch
CP	crucible lid
CR	crucible
H2O IN	water inlet
H2O OUT	water outlet
S	coil
MO	container unit
MR	refractory brick
PC	control panel
PL	crucible tongs
RP	refractory plate
So	optic temperature sensor (optional)
SoP	support of the optic temperature sensor
Ti	immersion thermocouple (optional)
TG	label

fig. I-5 detail of the plaque, with the details of an F9-D melting machine.

Crucibles

The machines are supplied with graphite or silicon-graphite crucibles selected to provide optimum performance in terms of power delivered and melting quality. Their characteristics are set out below.

☞ In order to obtain the best possible results, we strongly recommend that **only approved crucibles** be used with CEIA melting machines.



Machine model	Crucible model	Code	Type	Capacity	a	b	c	d	e	f	g
F1-D	**C1/G1**	21463	graphite*	60cc	30	85	56	98	50	48	82
F3-D	**C3/G1**	2316	graphite*	161cc	42	117	80	138	70	68	118
F4-D	**C4/G1**	19230	graphite*	350cc	60	124	98	140	88	-	122
F5-D	**C5/G1**	2314	graphite*	500cc	70	138	118	154	112	92	146
F9-D	**C9/G1**	2315	graphite*	800cc	80	160	128	176	116	100	168
F9-D	**C9/S1**	14764	silicon-graphite for high temperatures**	800cc	80	160	128	176	116	100	168
F12-D	**C12/G1**	19611	graphite*	980cc	90	155	140	180	130	108	170

* recommended for operating temperatures up to 1200°C ** recommended for operating temperatures up to 1600°C

fig. I-6 available crucibles; **A:** crucible; **B:** refractory container

TABLE OF SPECIFIC WEIGHTS OF SOME METALS	
Al	2.56
Ag	10.53
Cd	8.60
Ni	8.40
Au	19.26
Pd	11.40
Cu	8.85
Rh	12.10
Zn	6.86

SPECIFIC WEIGHT AT DIFFERENT FINENESSES		
Au		
750‰	18KT	15.54
585‰	14KT	13.04
417‰	10KT	11.70
375‰	9KT	10.82
333‰	8KT	10.75
917‰	22KT	17.82
Ag		
925‰	Ag.	10.37
835‰	Ag.	10.28

800‰	Ag.	10.20

Technical characteristics of melting machines F1-D-Turbo, F3-D, F4-D, F5-D, F9-D, F12-D

Model	Operating capacity in pure gold	Power supply voltage (three-phase 50/60 Hz)	Maximum absorbed power	Maximum output power	Dimensions (width x depth x height)	Machine weight
F1-D-Turbo/220	1kg	200 - 240 V	4,5 kVA	50 kVAR	430x450x905 mm	63 kg
F1-D-Turbo/400	1kg	360 - 440V	4,5 kVA	50 kVAR		63 kg
F3-D/220	2,8kg	200 - 240 V	4,5 kVA	50 kVAR		63 kg
F3-D/400	2,8kg	360 - 440V	4,5 kVA	50 kVAR		63 kg
F4-D/220	6kg	200 - 240 V	5,5 kVA	60 kVAR		63 kg
F4-D/400	6kg	360 - 440V	5,5 kVA	60 kVAR		63 kg
F5-D/220	8,6 kg	200 - 240 V	7 kVA	80 kVAR	575x580x905 mm	133 kg
F5-D/400	8,6 kg	360 - 440V	7 kVA	80 kVAR		90 kg
F9-D/220	13,5 kg	200 - 240 V	9,5 kVA	95 kVAR		133 kg
F9-D/400	13,5 kg	360 - 440V	9,5 kVA	95 kVAR		90 kg
F12-D/220	17 kg	200 - 240 V	12 kVA	115 kVAR		140 kg
F12-D/400	17 kg	360 - 440V	12 kVA	115 kVAR		90 kg

Metal melting temperature: selectable thanks to a digital thermoregulator and pyrometer with an immersion thermocouple or an optical sensor (optional).
Measurement range:
- K-type thermocouple : 150÷1300 °C. *
- optical sensor: 700÷2000 °C.

* The maximum value should not be considered applicable for continuous use. We recommend that operational temperatures should be at least 150°C below these values.

Water cooling: via a tank witha 0.5 Hp pump, or via a direct supply at the pressure indicated in the table below:

	F1-D-Turbo • F3-D • F4-D	F5-D	F9-D	F12-D
intermittent working (50%)				
tank				
capacity	200 l	300 l	300 l	500 l
pump power	0.5 Hp	0.5 Hp	0.5 Hp	0.5 Hp
direct supply				
pressure	200-600kPa	200-600kPa	200-600kPa	200-600kPa
flow	> 2 l/min	> 22.5 l/min	> 2.5 l/min	> 2.5 l/min
continuous working (<1300°C)				
tank				
capacity	500 l	750 l	750 l	1000 l
pump power	0.5 Hp	0.5 Hp	0.5 Hp	0.5 Hp
direct supply				
pressure	200-600kPa	200-600kPa	200-600kPa	200-600kPa
flow	> 2 l/min	> 2.5 l/min	> 2.5 l/min	> 2.5 l/min

Inlet: 3/4" screw fitting; Outlet: hose fitting, ø12mm

Safety features Monitoring of thermocouple operation.
Monitoring of cooling-water temperature and flow.
Monitoring of all phases of the power supply.

Monitoring of the power supply voltage, for both excess and insufficient voltage.

Special features

Very high efficiency: fast melting with the minimum energy consumption. No generator maintenance required.
Consistent melting results thanks to microprocessor control.
Digital selection and control of the power and melting temperature.
Monitoring of wear on crucible.
Automatic cut-out if crucible is missing.
Self-diagnosis with messages by voice synthesis and display indication.

Accessories supplied

- Gas torch: useful to avoid metal oxidation during melting. Installed on the induction melting machine plate, in order to let the flame spread on the crucible.
- Crucible
- Crucible cover
- Crucible tongs
- Water circuit connection pipes: length 4 m.

Options

TCS700-LPD Optical Temperature Sensor: this can replace a thermocouple sensor, and has the following advantages:

- temperature measurement without contact
- no inertia, so allowing precision and reliability of reading
- no sensor maintenance
- no problem of metal contamination during melting caused by damage to the thermocouple sheath

Sensor accuracy is not influenced by the metal state or type, nor by the presence of smoke.

Immersion thermocouple
Measurement range:
- K-type thermocouple : 150÷1300 °C. *

* The maximum value should not be considered valid for continuous use. We recommend that operational temperatures should be at least 150°C below this value.

MTA 10 Cooling unit: Characterized by its compact dimensions and equipped with digital regulating, it allows continuous operation for standard melting (temperatures below 1300°C), maintaining the temperature of the cooling water at the optimum level of 25°C.
Cooling capacity: 3.31 kW

MTA 20 Cooling unit: Characterized by its compact dimensions and equipped with digital regulating, it allows continuous operation for standard melting (temperatures below 1300°C), maintaining the temperature of the cooling water at the optimum level of 25°C.
Cooling capacity: 6.94 kW

II - INSTALLATION

In this chapter the procedure for correct installation and maintenance of the machine is explained.

In the event that further information or clarification is required, customers are requested to contact the Technical Department of C.E.I.A.

It should be noted that C.E.I.A. is not responsible for any damage that may result from installations that do not follow the guidelines laid down in this chapter.

Power supply

Connect the machine to earth/ground and to the voltage indicated on the plate and in the CONFIGURATION sheet (at the end of the manual), using the power supply cable.

The line conductors should have a minimum section equal to those specified in the CONFIGURATION sheet:

For the standard model with 380-400V power supply the line conductors should have:

- a minimum section of 4 mm^2
- a 16A-rated socket (models F1-D ... F5-D)
  or
  a 32A-rated socket (models F9-D ... F12-D)

fig. II-1

For the model with 208-230V power supply the line conductors should have a minimum section of 6 mm^2 and a 50A-rated socket.
N.B.: in this case the power supply cable is not fitted with a plug. The conductor key is as follows:

Function	Conductor colour (EUROPE)	(USA)
L1	blue	black
L2	brown	red
L3	black	orange
Earth/Ground	yellow/green	green

Cooling

Feed "**H_2O IN**" plant with water from from a water system or from a zinc-coated steel tank (see Technical characteristics).

N.B. It is important to ensure that the temperature of the water entering the machine does not exceed **40°** C.

The water-supply must be controlled, upstream, by a safety cock. If a tank is used (Fig. II-1) the pump will take water from the bottom of the tank, while the water returning to the tank from the machine will be deposited at the top of the tank.
Connect the water drain "**H_2O OUT**"(**Important**: do not invert load and drain).

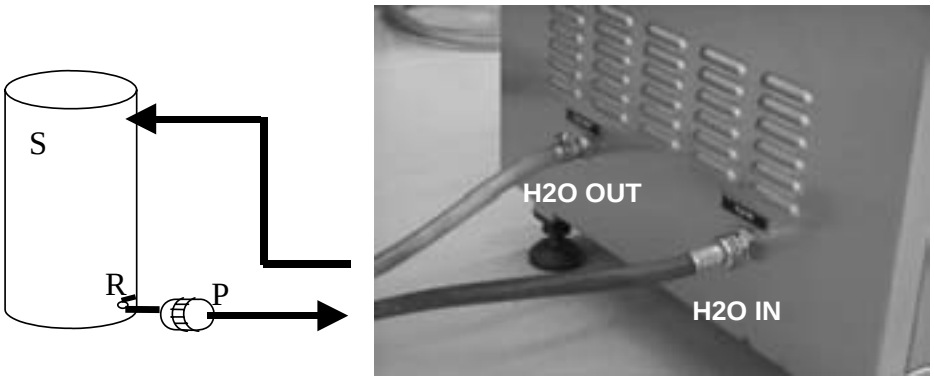


fig. II-2 **S**: tank; **R**: water cock; **P**: pump

The liquid of the cooling unit must be water only, without additives, anti-freeze, anti-calcium agents, salts, etc. In order to allow proper heat transfer from the water to the environment, do not use a tank in insulating material (plastic, fiberglass, etc.).

Gas Torch

We recommend fitting the crucible with a gas torch which will prevent the metal oxidation and will lengthen the life of the crucible. This accessory is fitted directly onto the melting machine work-surface, and orientated so that the flame completely envelops the crucible opening.

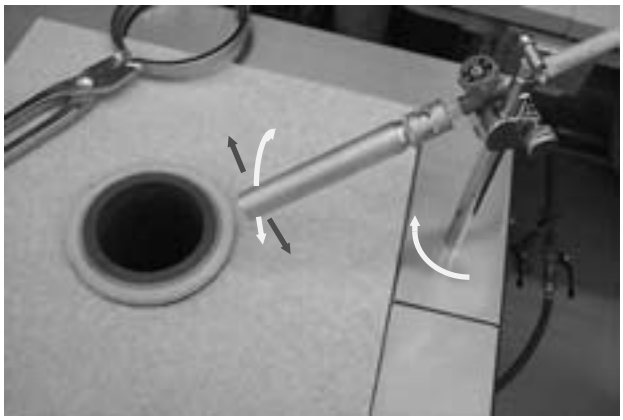


fig. II-3

Upstream of the gas torch, install a valve to bring the pressure to **200÷300 kPa**. Flame adjustment is made by balancing the intake of air (using the **Fs** locking ring and **Ra** regulator) and the gas flow (using the **Rg** tap).

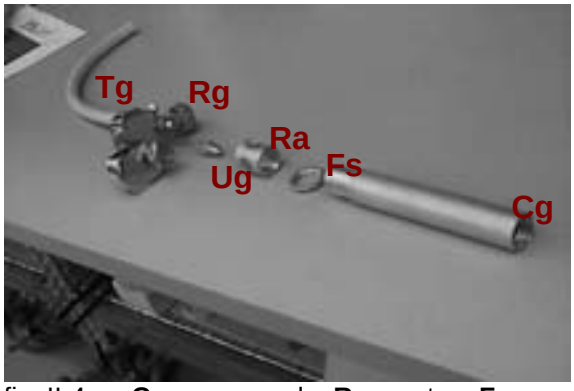


fig. II-4a - **Cg** gas cannula; **Rg** gas tap; **Fs** locking ring; **Tg** hose for inflow of gas; **Ra** air adjuster; **Ug** nozzle

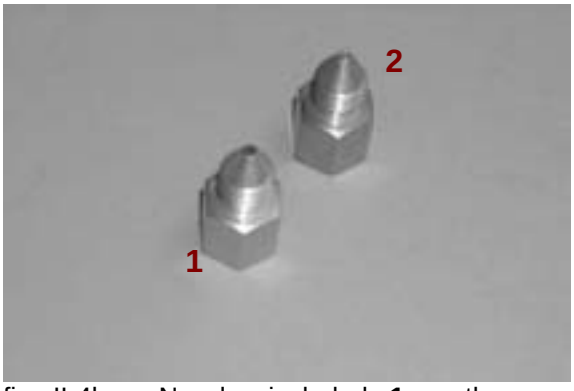


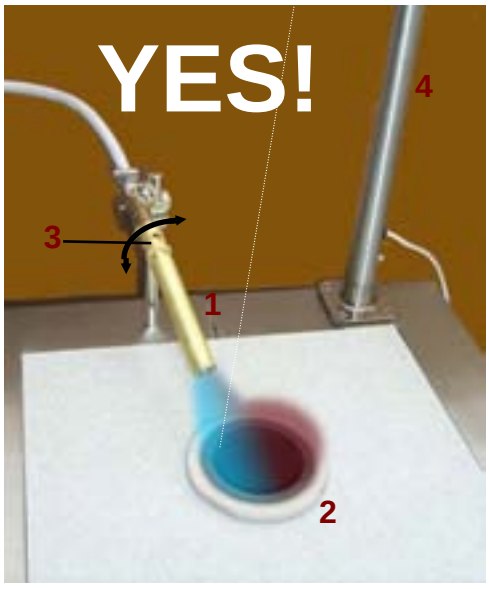
fig. II-4b - Nozzles included: **1:** methane or town gas nozzle; **2:** propane gas nozzle

ATTENTION! The nozzle **Ug** of the gas torch must be changed depending on the gas used:

GAS	Propane	Methane or Town gas
ø nozzle	0.4mm	2,2mm

Gas torch orientation

The orientation must enable the flame to envelop the crucible mouth completely.
If the Melting Machine is fitted with an optical pyrometer, the gas torch must be positioned correctly and the air flow properly adjusted, otherwise the pyrometer will measure the flame temperature rather than the metal temperature during melting.
The figures below show the proper position of the gas torch: the flame must be aimed towards the rear rim of the crucible and must create a whirl over the crucible mouth.



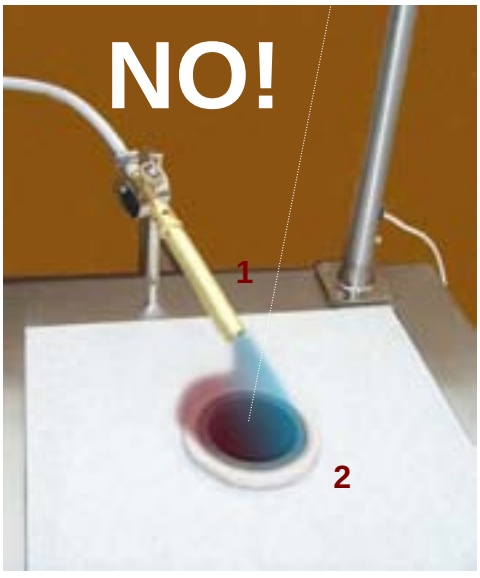


fig II-5:. **1**: gas torch; **2**: crucible; **3**: air adjustment; **4**: optical sensor.

Air intake ferrule adjustment

The locking ring **3** must be adjusted so as to obtain a blue flame as far as the rim of crucible and a yellow-red one when over the crucible mouth.

Checking correct adjustment of the gas torch on machines with optical temperature reader

- Turn the melting machine on at the main switch; place a crucible at room temperature in the melting unit; do not start the melting process.
- Light the gas: if the position and the air adjustment are correct, the thermoregulator should indicate a temperature below the measurement range (display symbol ).

Use of an auxiliary gas torch

Do not use an auxiliary gas torch, as the pyrometer might read the gas temperature instead of the metal temperature: **always keep the torch on the same side as the optical sensor**.

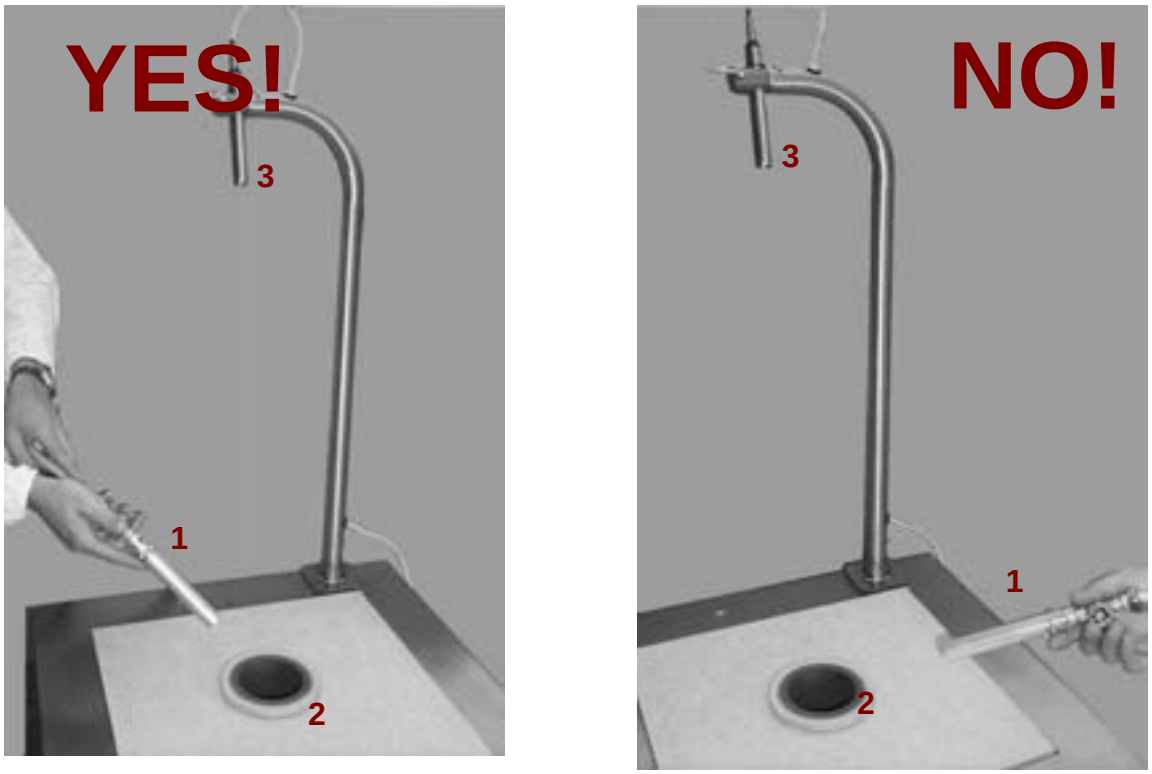


fig. II-6 . **1**: gas torch; **2**: crucible; **3**: optical sensor.

Metal temperature sensor

Two types of temperature sensor can be installed on the electronic melting machine:

Thermocouple

Fix the two thermocouple supports **St** to the surface of the unit, on the right-hand side of the machine, using the screws supplied.
Connect sensor cable **C** to the **Ct** connector on the side of the unit and rest the sensor on the supports.

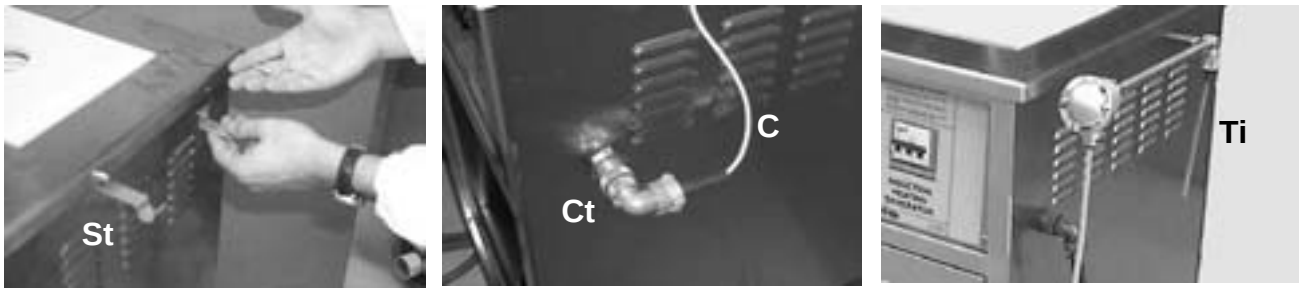


fig. II-7 **Ti**: thermocouple; **St**: thermocouple supports; **C**: thermocouple cable ; **Ct**: sensor cable connector

Dual-wavelength Optical Sensor

Fix the tubular support **SoP** to the surface of the machine: the sensor **So** will point at the crucible's interior automatically. Then connect the sensor cable to connector **Ct**.

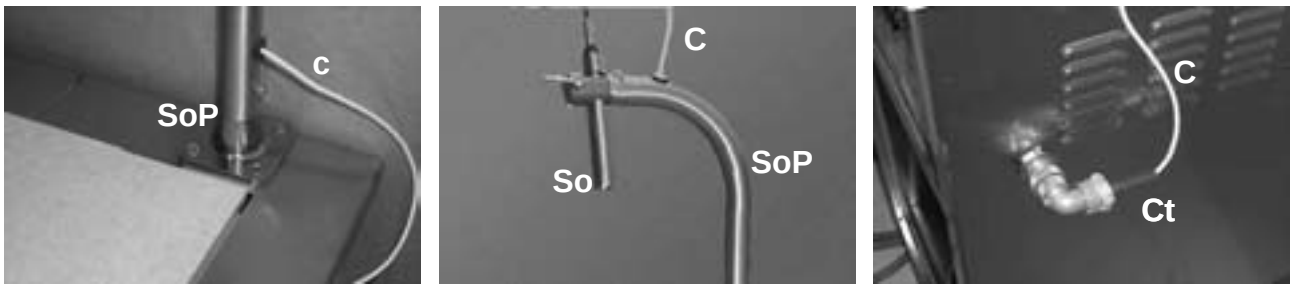


fig. II-8 **So**: optical sensor; **C** optical sensor cable; **Ct**: optical sensor connector

⚠ **DO NOT CHANGE the orientation of the sensor-cylinder So !**

III - INSTRUCTIONS FOR USE

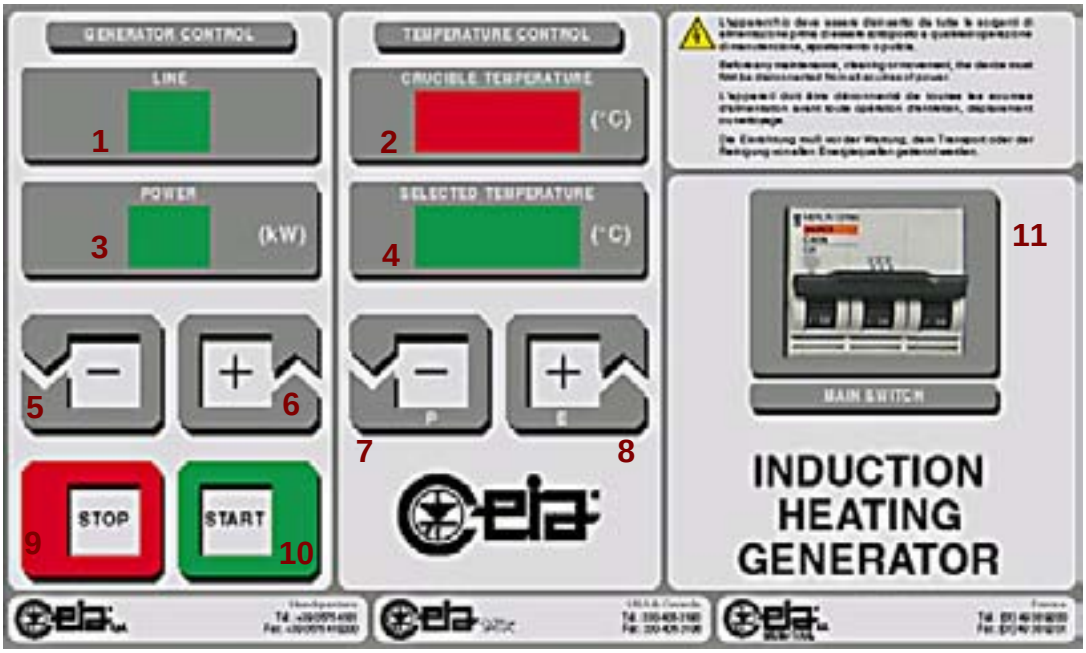
⚠ CEIA will not accept any responsibility for improper or negligent use, or for use which does not comply with the rules laid down in this user's manual.

⚠ Before each melting operation

- **Crucible wear and tear**
  Before each melting operation the condition of the crucible should be checked: if there are areas that have suffered damage the crucible should be replaced with a new one.
- **Noxious fumes**
  Additives and some alloys may produce noxious fumes during melting: all necessary measures should therefore be taken to protect the health of the operator.
- **Additives**
  Do not put into the crucible compounds or materials which may produce phenomena harmful to persons or property during operation and use of the melting machine. **CEIA will not accept any responsibility for improper or negligent use, or for use which does not comply with the rules laid down in this user's manual.**
- **Crucibles**
  During the first melting operation, crucibles must be subjected to a gradual temperature increase, to allow evaporation of any moisture which may have been absorbed. It is advisable to keep crucibles near a source of heat to avoid the absorption of environmental humidity.
  Check periodically, and always after moving the melting machine, that the coil is perfectly centred, in order to avoid undue wear on the coating of the coil itself due to the friction of the crucible
- **Metal temperature**
  Do not overheat the metal to temperatures significantly above that of melting, so as to avoid splashing of incandescent metal and the consequent risk of damage to persons or property. **CEIA will not accept any responsibility for improper or negligent use, or for use which does not comply with the rules laid down in this user's manual.**
- **Cooling system**
  The cooling unit must be supplied with water only, without additives, anti-freeze, anti-calcium agents, salts, etc.
- **Cooling system**
  If the melting machine cooling system is connected directly to a water mains outlet, the hydraulic unit should be cleaned every six months (see Maintenance section)
- **Optical temperature sensor**
  During operation the lens of the sensor may become dirty due to dust or smoke: it should be cleaned at least once a week.

The melting machine is equipped with a magnetothermal **MAIN SWITCH**, located on the control panel. This switch serves as a protection against malfunctions.

Work Cycle



1	LED power indicator	7	Selected temperature decrease button
2	Measured temperature	8	Selected temperature increase button
3	Indicator of power delivered	9	Melting process Stop button
4	Selected temperature	10	Melting process Start button
5	Power decrease button	11	Main switch
6	Power increase button		

fig. III-1 detail of the control panel

- Supply the correct voltage (see values indicated on the plate attached to the rear of the unit) and water.
- Turn on the **MAIN SWITCH**:
  - the "**LINE**" indicator comes on
  - the POWER display indicates the device's software version (2-figure sequence)
  - the SELECTED TEMPERATURE display indicates the selected melting temperature
- When the melting machine is operative, the status of the indicators is as follows::

on		
	model with temperature sensor	model without temperature sensor

- Place the crucible in position. Absence of the crucible is noticed by the machine when the button is pressed**;** if this happens, the machine switches itself off and gives the message "**Crucible missing**".

Avoid melting when the crucible is very worn, as the crucible heats more slowly and the apparatus might not reach its normal operational rating

The melting machine is delivered with the voice messages in the language indicated on the CONFIGURATION sheet at the end of the manual. To activate a different language, follow the procedure described in the MAINTENANCE section.

- If the crucible is too worn, the message "**Attention - replace crucible**" is given a few seconds after the machine is switched on; after this message, the machine will continue to work as long as there is no immediate danger to the apparatus.

⚠ Here it must be noted that in continuing to use a worn-out crucible, one runs **the risk of it breaking during melting**, which could cause serious injury to the operator or damage to the machine. **CEIA will not accept any responsibility for improper or negligent use, or for use which does not comply with the rules laid down in this user's manual.**

- Insert the metal into the crucible, taking care not to scratch the sides and calculating the quantity so that during the melting stage it will remain a few centimetres below the rim of the crucible. This allows it to be stirred using a graphite rod, and thus a constant fineness of product can be obtained.

- **Melting additives**
  For quicker, better melting, use additives such as boric acid; the resulting deposit can easily be removed with a graphite rod when melting is completed.

- Adjust the melting temperature using the  (increase) and  (decrease) buttons: the indication on the SELECTED TEMPERATURE display will change.

- Press the  button (green) to start the melting process.

- During melting, the POWER display shows the power delivered by the generator: the generator is switched on and off automatically to keep the melting temperature constant. When the generator is off, the display shows the message  .

☞ When the  button is pushed and during the heating phase, a **short audible signal** is emitted at intervals of about 30" to indicated that the melting machine is in operation.

- Adjust the power to the desired value using the  (increase) and  (decrease) buttons: the POWER display indication with flash during adjustment.

- **Metal temperature control**
  Thermocouple
  When metal is on the point of melting, start the temperature control by inserting the thermocouple into the crucible. **IMPORTANT**: after insertion of the probe, the temperature sensor takes some time to reach thermal equilibrium with the crucible; in this situation the pyrometer reading is not completely reliable and the temperature of the crucible will not correspond exactly to that programmed. If one wants to be certain of the working temperature of the metal, it is necessary to wait till the thermoregulator is stabilized: this is indicated by the frequency with which the pyrometer is activated, which initially is of the order of every few minutes, but when balance is reached is of the order of every few seconds.

⚠ When the immersion thermocouple reaches high temperatures or is subjected to sudden fluctuations in temperature, it becomes mechanically weak: in this situation, handle the thermocouple with care, and avoid impacts agaist the melting machine casing or other hard surfaces.

Optical temperature sensor
This is aimed at the crucible'sinterior. If a cover is necessary, remember that it darkens the crucible. Due to the lack of inertia, the pyrometer will show a valid measurement of the metal's temperature when the cover is taken off.

⚠ If the optical sensor malfunctions, refer to the notes in the "MAINTEANCE" section.

- **Gas torch**
  If a gas torch is used to avoid oxidation of the metal, keep the flame on the crucible for the entire duration of the melting. It is advisable to use an auxiliary gas torch during the casting phase.

⚠ Before removing the crucible during melting, stop the machine by pressing the 

button(red)

Halting processing

- After use, turn off the **MAIN SWITCH**. Disconnect the mains supply.

⚠ Before closing the water cock or disconnecting the pump, wait till the crucible has completely cooled or take the crucible out.

☞ To prolong the life of crucibles, we recommend that it is removed from the machine when work is finished and allowed to cool slowly with a cover on, in order to reduce thermic shock. It is a good idea to put in some boric acid in this case, as the acid vaporizes during the cooling phase and, as it is in a closed container, causes convection which helps to distribute it uniformly over the inside of the crucible.

IV - MAINTENANCE

Any maintenance or repair to the machine must only be carried out after the power supply cable has been disconnected. CEIA will not accept any responsibility for improper or negligent use, or for use which does not comply with the rules laid down in this user's manual.

Instructions for periodic maintenance

Melting unit - Crucible

It is very important to check the condition of the crucible **before every melting operation**. Here it must be noted that in continuing to use a worn-out crucible, one runs the risk of it breaking during melting, which could cause serious injury to the operator or damage to the machine. **CEIA will not accept any responsibility for improper or negligent use, or for use which does not comply with the rules laid down in this user's manual.**

In the event that the melting device is under-powered (indication lower than 70% of maximum power), it is recommended that the crucible be replaced (information given by the machine in the form of a voice-synthesized message).
To prolong the life of crucibles, we recommend that they are allowed to cool slowly with a cover on, in order to reduce thermal shock. It is advisable to put in some boric acid in this case, as the acid vaporizes during the cooling phase and, as it is in a closed container, causes convection, which helps to distribute it uniformly over the inside of the crucible.
The parts that make up the melting unit are illustrated in Fig. IV-1. It is recommended that weekly checks are made on the condition and correct positioning of these parts, and in particular of the condition of the coil insulation.

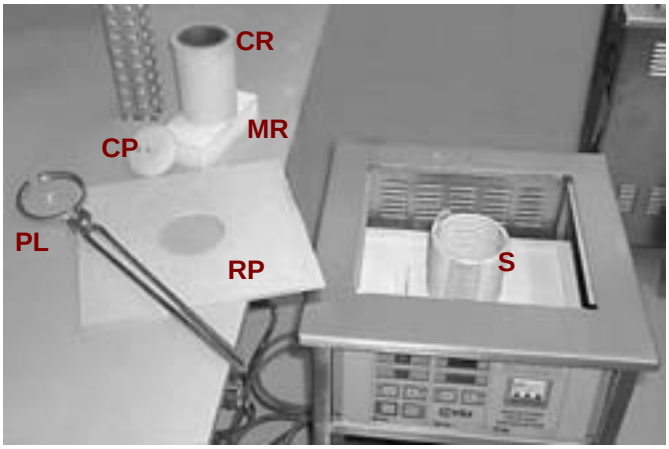


Fig. IV-1 Melting unit components

Rif.	Description
RP	Refractory plate
MR	Refractory brick
CR	Graphite crucible with refractory container
CP	Refractory crucible cover
PL	Tongs
S	Heating inductor

In order to obtain the best possible results, we strongly recommend that **only approved crucibles** be used with CEIA melting machines.

Hydraulic unit

The liquid supplied to the cooling unit must be water only, without additives, anti-freeze, anti-calcium agents, salts, etc **. For closed-circuit systems, distilled water should be preferred.**

⚠ **To avoid periodic cleaning of the cooling system, we recommend that a closed-circuit system with distilled water be used.**
With the use of non-distilled water, the tubes of the hydraulic cooling unit are subject to the build-up of calcium sediment. As a result, one or more sections of the tubes may become totally or partially blocked .

If this occurs, a partial block stops the water from flowing smoothly, causing overheating: the machine control system interrupts the melting and signals a malfunctioning with a vocal message.

A total block stops the flow of water: again, the machine control system interrupts the melting and signals a malfunctioning with a vocal message.
If blocking of the unit occurs, a complete check and manual cleaning of each component of the cooling unit should be carried out (rubber tubing and power modules). It is advisable to disconnect one tube at a time, to avoid the risk of mistakes in re-assembly

⚠ **It is important that cleaning of the cooling unit be carried out with the machine switched off in order to avoid the danger of injury to the operator**

After the above operation, however, it is still advisable to carry out the periodic cleaning.

⚠ **It is recommended that cyclical cleaning be carried out every six months.** The cleaning operation is carried out by means of a series of washes of the unit with a solution of water and solvay soda and continues until the tubes are completely clean.

Water filter

The water intakes " **H_2O IN** " are equipped with a filter net to ensure that any impurities in the water do not get into the cooling system and impede the flow. Check regularly that this filter is not blocked.

Fig. IV-2a Detail of the water inlet fitting

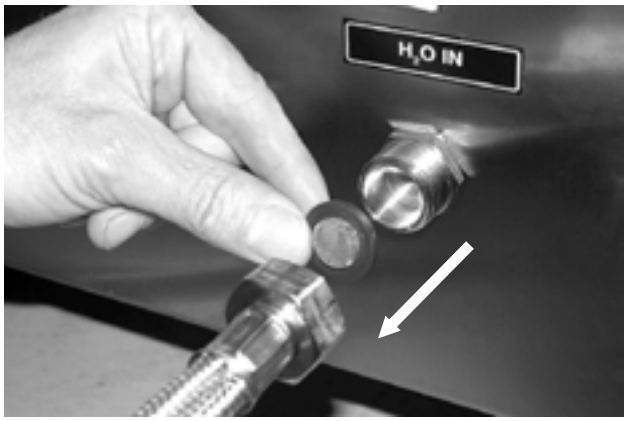


Fig. IV-2b Water inlet fitting components Taking out the filter

Closed-circuit system (MTA cooler)

The system does not need any maintenance apart from periodic topping-up of the liquid.

⚠ **N.B.: Use only distilled water for topping up!** If distilled water is not used, the instructions in the section above should be followed.

Optical temperature sensor

If the thermoregulator does not measure variations in the temperature during melting operations, or the reading is erroneous, check that the sensor is aimed correctly and that the lens is clean. Also check that the gas torch is not directed toward the sensor during use (see Installation section).

Clean the sensor lens periodically. The lens can be cleaned with a cotton-tipped stick dipped in alcohol. It is advisable to carry out this cleaning every six months.

Procedure for checking the aim of the optical sensor

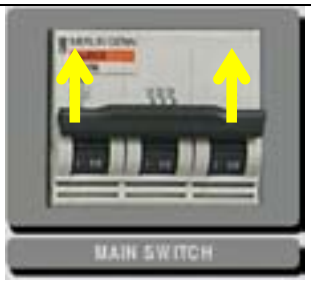
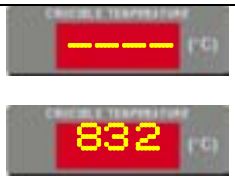
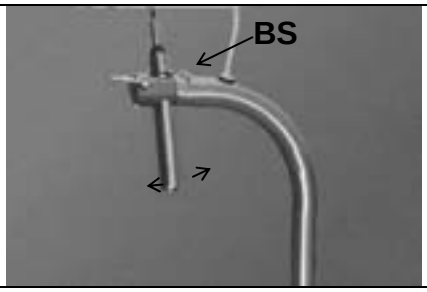
	Switch the main switch to the ON position
	Press the START button
	Wait for the temperature read-out to exceed 800°C.
	Press the START button for at least 5 seconds: the message “Or =” appears on the CRUCIBLE TEMPERATURE display, whilst the SELECTED TEMPERATURE display shows a number which updates every second.
	Loosen the sensor locking screw **BS** and find the position which gives the maximum reading on the SELECTED TEMPERATURE display. This figure should generally be > 15.
	Lock the sensor again.
	Press the STOP button to return to normal operation.

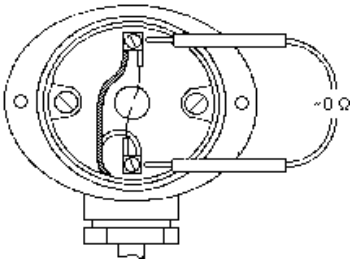
Fig. IV-3

Instructions for replacing a thermocouple

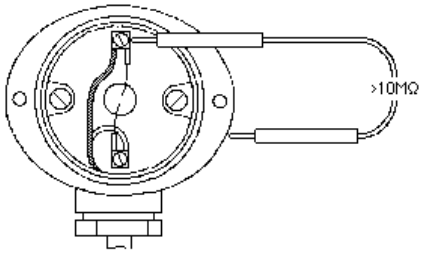
If the sensor fails, the thermoregulator stops the machine in order to save the metal being treated. The digital temperature controller will show an error message.
The thermocouple may stop functioning for one of two reasons:

1) The stainless steel protective sheath for the conductors in Cr-Al has become worn.
2) The working temperature has gone beyond the maximum limit of 1300°C causing fusion of the above-mentioned components.

Correct operation of the thermocouple can be verified by checking the thermocouple terminals after having removed it from the machine.



The Ohm value displayed by the multimeter (a scale of Ohm x 10) must be close to zero, which indicates uninterrupted operation. (To access the terminals see step 2 of the procedure given below).



Another check is to verify that the external sheath is insulated from one of the thermocouple terminals (once again by using the multimeter); that is to say, the tube in stainless steel must be insulated from the head in Cr-Al. In this case the resistance must be above 10 MOhm.

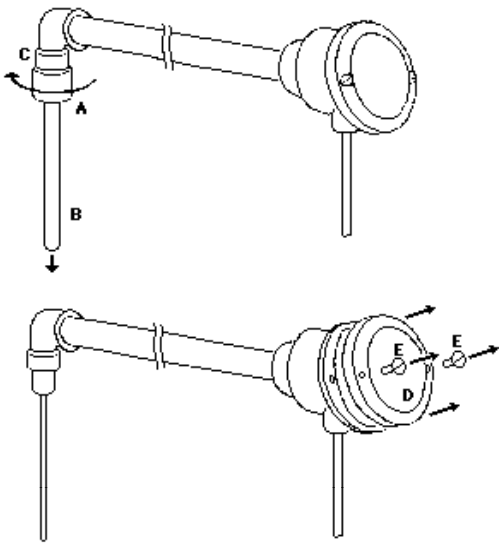
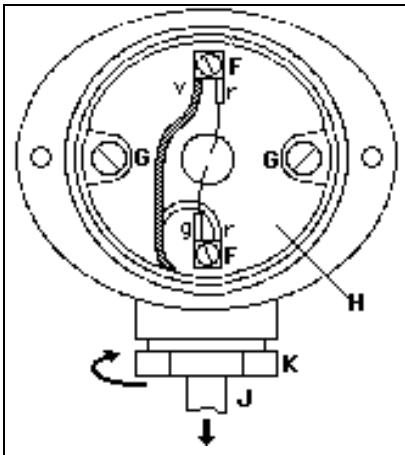


Fig. IV-4a

Should the test results not correspond to the above-mentioned values, the thermocouple must be replaced. To do so follow the procedure given below.

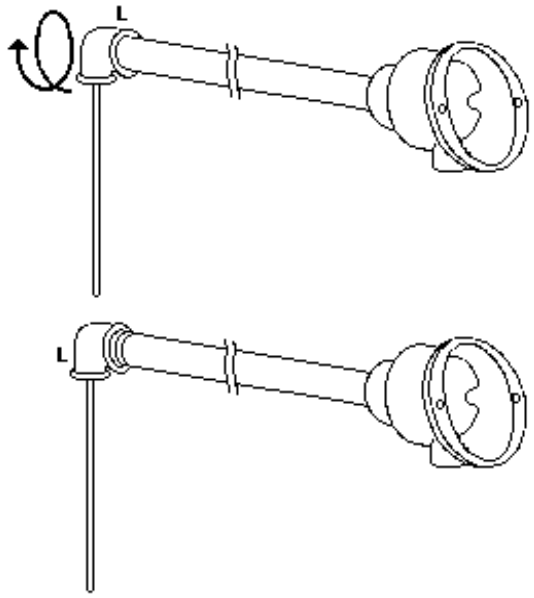
1) Unscrew the locking ringlet A, which frees the external protective sheath B from the thermocouple. Unscrew the joint C.

2) Remove the screws E which seal the outside cover D.

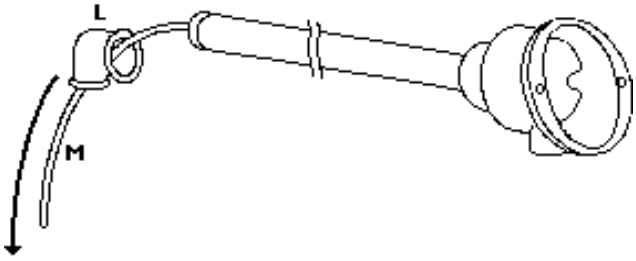


3) Remove the fixing screws G for the ceramic terminal-support H and loosen the terminal-support in such a way that it can be rotated. Free connecting cable J by loosening screws F and ring nut K and then remove this cable. The correspondence between the conductors and the terminals is shown below:

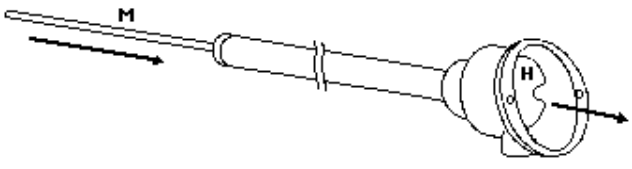
green conductor (v) - red terminal(r)
red conductor (r) - yellow terminal(g)



4) Rotate the square joint L anti-clockwise until it can be removed from the support tube.



5) Bend the rear of the thermocouple M into a wide curve and carefully remove the square joint L.



6) Straighten the sheath M and pull it out of the support tube.

7) Insert the new thermocouple M, with its ceramic support H into the support tube and reassemble by following the above-mentioned procedure in reverse.

Fig. IV-4b

Fault signals

Voice messages

The melting machine is fitted with an effective system of self-diagnosis which notifies the operator when some parts of the apparatus malfunction. Messages relating to this self-diagnosis are as follows:

" Attention - water temperature too high"	This is a continuous check. The machine turns itself off and will not accept further instructions until the situation changes (**T < 65°C**).
" Attention - insufficient water pressure"	This is a continuous check. The machine turns itself off and will not accept further instructions until the situation changes. **Check that the water flow corresponds to that shown in the "Technical Characteristics" section.** The message is also given when the tubing is obstructed by calcium deposits - in this case the water cooling system must be cleaned.
" Attention - one phase missing"	This is a continuous check, and warns the operator that the three-phase power circuit is unbalanced and will therefore not allow the machine to work properly. The machine will not accept instructions until the situation returns to normal.
" Attention, crucible missing"	Absence of the crucible is noticed by the machine when button  is presed; if this happens, the machine switches itself off and gives the message.
" **Attention - replace crucible** "	If the crucible is too worn, the message is given a few seconds after the machine is switched on; after this message, the machine will continue to operate as long as there is no immediate danger to the apparatus. Here it must be noted that in continuing to use a worn-out crucible, one runs **the risk of it breaking during melting**, which could cause serious injury to the operator or damage to the machine. **CEIA will not accept any responsibility for improper or negligent use, or for use which does not comply with this warning.**
" **Attention – high voltage"**	This is a continuous check. The machine turns itself off and will not accept further instructions until the correct voltage supply resumes.
" **Attention – interrupted thermocouple"**	Check the thermocouple and replace if necessary. If the spare part is not immediately available,disconnect the thermocouple cable from connector **Ct** on the side of the casing.
" **Attention – internal fault"**	Contact CEIA technical service personnel.

Fault signalling on SELECTED TEMPERATURE display

Fault code	Cause	Action
Er1	Crucible missing	Put the crucible in.
Er2	Internal fault	Contact CEIA technical service personnel.
Er3	Insufficient water flow	• Check the water supply outlet • Check the H_2O IN filter
Er4	Internal fault	Contact CEIA technical service personnel.
Er5	High water temperature	Check the temperature of the water entering the machine
Er6	One phase missing	Check power supply connections
Er7	interrupted thermocouple	Check the thermocouple and replace if necessary.
Er8	Low voltage	Check the power supply voltage
Er9	High voltage	Check the power supply voltage

If the machine malfunctions without giving a diagnostic message, please contact C.E.I.A.

Selection of voice message language

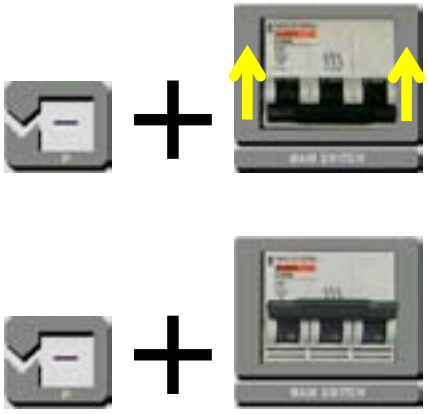
	**1.** To enter programming, switch the **MAIN SWITCH** to **ON** while holding down the **P** key**.**
	1. The code of the **Lg** (language) parameter appears on the CRUCIBLE TEMPERATURE display, while the number of the currently-selected language appears on the SELECTED TEMPERATURE display.
	2. Press key **E** to enter modification phase: the number on the SELECTED TEMPERATURE display will begin to flash.
	2. Modify the value of the setting using the power adjustment keys **+** and **-**, according to the table: 1 Italiano 2 English 3 Français 4 Deutsch 5 Español 6 Turkish
	5. Press key **E** (or **P**) to leave the parameter modification phase: the number on the SELECTED TEMPERATURE display will stop flashing.
	6. Press key **P** to exit programming.

Fig. IV-5

Entering the TCS700 optical sensor coefficient

Every **TCS700** optical sensor has a numerical coefficient which determines its accuracy of measurement.
If an optical sensor is replaced, or fited to a melting machine as an upgrade kit, this coefficient must be assigned to the **OC** operating parameter.

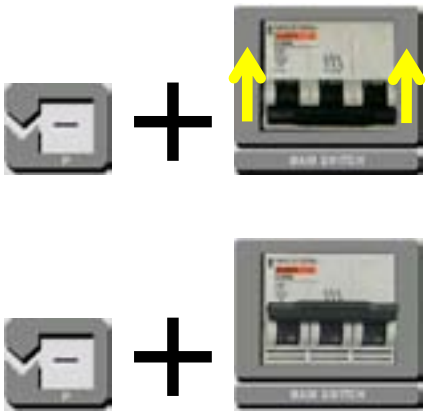
	**1.** To enter programming, switch the **MAIN SWITCH** to **ON** while holding down the **P** key**.**
	2. The code of the **Lg** (language) parameter appears on the CRUCIBLE TEMPERATURE display, while the number of the currently-selected language appears on the SELECTED TEMPERATURE display.
	1. Press power adjustment keys  (increase) or  (decrease) until you get to the **OC** command.
	2. Press key **E** to enter modification phase: the number on the SELECTED TEMPERATURE display will begin to flash.
	3. Modify the value of the setting using the power adjustment keys **+** and **-**.
	5. Press key **E** (or **P**) to leave the parameter modification phase: the number on the SELECTED TEMPERATURE display will stop flashing.
	6. Press key **P** to exit programming.

Fig. IV-6

V – LIST OF PARTS

Spare parts

Modell	F1-D Turbo/ 220	F1-D Turbo / 400	F3-D/ 220	F3-D/ 400	F4-D/ 220	F4-D/ 400	F5-D/ 220	F5-D/ 400	F9-D/ 220	F9-D/ 400	F12-D/ 220	F12-D/ 400
Generator MFG-F3/220	19505	-	19505	-	-	-	-	-	-	-	-	-
Generator MFG-F3/400	-	19506	-	19506	-	-	-	-	-	-	-	-
Generator MFG-F4/220	-	-	-	-	19507	-	-	-	-	-	-	-
Generator MFG-F4/400	-	-	-	-	-	19508	-	-	-	-	-	-
Generator MFG-F5/220	-	-	-	-	-	-	19509	19509	-	-	-	-
Generator MFG-F9/400	-	-	-	-	-	-	-	-	19510	19510	-	-
Generator MFG-F12/400	-	-	-	-	-	-	-	-	-	-	19609	19609
Power module D	19244	19244	19244	19244	19244	19244	19244	19244	19244	19244	19244	19244
Control panel complete with display card 00800SDP	19247	19247	19247	19247	19247	19247	19248	19248	19248	19248	19248	19248
Temperature sensor connection card 00800SGN	19243	19243	19243	19243	19243	19243	19243	19243	19243	19243	19243	19243
Heating inductor	19596	19596	19116	19116	19127	19127	19128	19128	19129	19129	19608	19608
Main switch	19249	19246	19249	19246	19249	19246	19592	19246	19592	19249	19592	19249
Surface in refractory material	20219	20219	7775	7775	19193	19193	9849	9849	9835	9835	19617	19617
Brick in refractory material	9876	9876	9876	9876	9876	9876	14960	14960	14960	14960	14960	14960
Gas torch	4045	4045	4045	4045	4045	4045	4047	4047	4047	4047	4047	4047
Optical pyrometric sensor	TCS700	TCS700	TCS700	TCS700	TCS700	TCS700	TCS700	TCS700	TCS700	TCS700	TCS700	TCS700
Support arm for optical sensor	19250	19250	19250	19250	19250	19250	19250	19250	19250	19250	19250	19250
Crucible cover	-	-	2176	2176	19889	19889	2177	2177	2177	2177	2177	2177
Crucible tongs	12078	12078	12079	12079	14448	14438	12080	12080	12081	12081	19619	19619

Options

K-type thermocouple	19241
Complete optical pyrometric sensor	TCS700-LPD

Accessories

Model	F1-D Turbo/ 220 • F3-D/ 220 • F4-D/ 220 F5-D/ 220 • F9-D/ 220 • F12-D/ 220	F1-D Turbo/ 400	F3-D/ 400	F4-D/ 400	F5-D/ 400	F9-D/ 400	F12-D/ 400
300 litre zinc-coated steel tank with 0.37kW 230V˜ pump	300L-230	-					
500 litre zinc-coated steel tank with 0.37kW 230V˜ pump	500L-230	-					
300 litre stainless-steel tank with 0.37kW 230V˜ pump	300L-230AQ	-					
300 litre zinc-coated steel tank with 0.37kW 400V˜ pump	-	300L-400					
500 litre zinc-coated steel tank with 0.37kW 400V˜ pump	-	500L-400					
300 litre stainless-steel tank with 0.37kW 400V˜ pump	-	300L-400AQ					
Cooler MTA10 220-240V 1˜	-	6309	6309	6309	6309	6309	-
Cooler MTA20 380-415V 3˜	-	-	-	-	-	-	6308

Consumables

Model	F1-D Turbo / 220 • F1-D Turbo / 400	F3-D/ 220 F3-D/ 400	F4-D/ 220 F4-D/ 400	F5-D/ 220 F5-D/ 400	F9-D/ 220 F9-D/ 400	F12-D/ 220 F12-D/ 400
Graphite crucible	21463 (C1/G1)	2316 (C3/G1)	19230 (C4/G1)	2314 (C5/G1)	2315 (C9/G1)	19611(C12/G1)
Silicon-Graphite crucible	-	-	-	-	14764 (C9/S1)	-
Crucible cover	-	2176	19889	2177	2177	2177

DECLARATION OF CONFORMITY CE

DECLARATION OF CONFORMITY CE

DECLARATION DE CONFORMITE CE KONFORMITÄTSERKLÄRUNG CE
DECLARACION DE CONFORMIDAD CE DICHIARAZIONE DI CONFORMITÁ CE

Manufacturer / *Fabricant / Hersteller / Fabricante / Costruttore:*

CEIA S.p.A.
Zona industriale Viciomaggio 54/G 52040
Viciomaggio - Arezzo - ITALY

Declares that the product
déclare que ce produit / erklärt, daß das Produkt / declara que el producto / dichiara che il prodotto:

Product name:
Nom du produit: / Produktname:
Nombre del producto: / Nome:

Melting machine
Fondeuse a moyenne fréquence / Schmelzofen
Fundidora electrónica de metales / Fonditrice ad induzione

Model *Série / Serie Serie / Modello:*	**F1-D-TURBO F3-D F4-D F5-D F9-D F12-D**	***all model*** *tous modèles/ alle Modelle todos los modelos/ tutti i modelli*

conforms to the following Product Specifications
est conforme aux spécifications suivantes / folgenden Produktspezifikationen entspricht
es conforme a las siguientes especificaciones / è conforme alle seguenti specifiche di prodotto:

Safety */ Sécurité / Sicherheit / Seguridad / Sicurezza:*

EN 60204 - 1 (1997)

This product complies with the requirements of the Low Voltage Directive 73/23/EEC and following modifications indicated in the 93/68/EEC Directive.
Le produit ci-dessus répond aux exigences de la Directive 73/23/CEE et aux modifications suivantes mentionnées dans la Directive 93/68/CEE concernant la basse tensions.
Dieses Produkt entspricht den Anforderungen an Niederspannungsgeräte gemäß der Norm 73/23/EEC und nachfolgender, in der Norm 93/68/EEC angegebener Änderungen.
El producto indicado cumple los requisitos de la Low Voltage Directive 73/23/CEE y siguientes modificaciones indicadas en la Directiva 93/68/EEC/.
Il prodotto è conforme alle norme della direttiva 73/23/EEC e successive modifiche indicate nella direttiva 93/68/EEC sulla bassa tensione.

EMC

EN 55011: Group 2 - Class A
EN 61000-4-2
EN 61000-4-3
EN 61000-4-6
ENV50204
EN 61000-4-4

This product complies with the requirements of the EMC Directive 89/336/EEC and following modifications indicated in the 92/31/EEC and 93/68/EEC Directives.
Le produit ci-dessus répond aux exigences de la Directive 89/336/CEE et aux modifications suivantes mentionnées dans les Directives 92/31/EEC et 93/68/CEE concernant les interférences électromagnétiques.
Dieses Produkt entspricht den Anforderungen der EMC-Norm 89/336/EEC und nachfolgender in den Normen 92/31/EEC und 93/68/EEC angegebener Änderungen.
El producto indicado cumple los requisitos de la Directiva EMC 89/336/CEE y siguientes modificaciones indicadas en las Directivas 92/31/EEC y 93/68/EEC.
Il prodotto è conforme alle norme della direttiva EMC 89/336/EEC e successive modifiche indicate nelle direttive 92/31/EEC e 93/68/EEC.

Arezzo, 2000-05-24

CEIA SpA

Person in charge Lab. EMC
Resp. Laboratoire EMC / Laborattaché EMC
Resp. Laboratorio EMC / Resp. Lab. EMC
Ing. E. Sorini

Ennio Sorini