ROMANOFF®
INTERNATIONAL SUPPLY CORPORATION

9 Deforest Street
Amityville, NY, 11701
USA

Technical Documentation

Mini Casting unit MC100V

Romanoff order service for consumables:	Romanoff technical service
www.romanoff.com	**Tel.: +1-631-842-2400**
	service@romanoff.com

Keep for future use!

revision

Date	chapter	Reason	responsible
2011-05-26	All	New edition	Schmidt
2017-07-06	All	Edition 2017	RK
2019-03-18	All	last corrections	RK

This manual has been prepared in good faith by us. Nevertheless, should you find any mistakes or ambiguities, please let us know. Furthermore, we are grateful for comments and suggestions

Contents

1 General information

1.1 Scope of delivery and responsibilities

The vacuum pressure casting machine MC100V is delivered complete. Please check delivery immediately after receiving the shipment if there is something missing or possible transport damages. Please tell the faults the shipping agency and your dealer.

1.2 Liability, warranty and guarantee

The company *INDUTHERM Erwärmungsanlagen GmbH* take liability, warranty and guarantee according to the legal regulations.

The vacuum pressure casting machine is built to be state-of-the-art and in compliance with the accepted safety regulations. Nevertheless, can improper installation and non-intended using lead to danger and damages.

INDUTHERM Erwärmungsanlagen GmbH don't take liability for damage caused by untrained personnel operating the machine.

For damages because of demonstrably misusing of machine or because of abnormal behaviour no liability will be taken by *INDUTHERM Erwärmungsanlagen GmbH!*

INDUTHERM Erwärmungsanlagen GmbH don't take liability for damages caused by faulty protection of power supply and/or wrong connecting the supplies (protective gas, water, compressed air).

There is no guarantee for consumables by *INDUTHERM Erwärmungsanlagen GmbH*.

Company *INDUTHERM Erwärmungsanlagen GmbH* can not and will not take responsibility for all consequential damages caused by above mentioned circumstances.

This operating manual is of the technical state at printing date. All rights reserved regarding technical changings and different equipment.

Damages caused by disregard, wrong interpretation and non-compliance with specifications in this manual will lead to expiration of guarantee for this system.

1.3 Responsibility of operating company

The operator has to meet with national accident preventing regulations and technical regulations.

Operating company is allowed to let operate machine by trained and trustworthy personnel only.

Operating company has to make sure the system is supervised by personnel which is trained at this device.

Operating manual must be kept right next to the system.

Operating company has to ensure operating personnel has **read and understood** the manual before they are going to use the machine.

Operating company has to ensure unauthorized person has no access to the system.

Maintenance actions may only be done by authorized personnel or by service technicians from manufacturer.

1.4 EC-conformity

Declaration of European Community conformity is attached to this manual.

1.5 Observation of the product

The management will provide you with a secure machine at state-of-the-art.
Please let us know immediately if there are:

- failures at safety measurement devices,
- failures during production,
- modified parameter settings,
- difficulties in using the system,
- accidents or near accidents and
- remarks for improvement of the manual.

2 Safety

2.1 Intended use

Operational safety of the mini casting machine is only guaranteed at intended use.

The mini casting machine serves exclusively for melting, pouring and vacuum casting of commercially available precious metals and of copper- or aluminium-alloys. Dental alloys and high reactive alloy like magnesium can't be melted. The specified temperature ranges must be complied with.

Every other use of the overall plant or parts is considered as not intended.

Unauthorized modifications of the plant are prohibited because of reasons for safety! The declaration of conformity will expire with modification.

Intended use includes reading, knowing and obeying the operating instructions. That also contains observing of servicing and maintenance regulations.

Set up, operation and maintenance is only allowed to be carried out by trained qualified personal that has read and understood all documents.

The plant may affiliate only to the specified media. Supply voltage and input respectively output pressure have to be observed to the given device labelling accordingly.

The machine has been developed for use in enclosed spaces and for the above mentioned application.

Only original INDUTHERM consumables and spare parts are admitted for operation.

It is not allowed to change or vary the system in any way. Technical changes need explicit written approval of *INDUTHERM Erwärmungsanlagen GmbH*.

The casting machine must not be placed in areas with explosive atmospheres.

Predictable abuse:

- Warming of human body parts on hot surfaces.
- Heating and casting of others then the mentioned metals.

2.2 Demands on staff, duty for utmost care

Work on and with the machine is allowed to be accomplished by reliable, trained and instructed staff only. Responsibilities for the separate sections have to be regulated clearly which include operation, preparation, service and repair.

Only authorized personnel may act at the system.

The machine may never be operated by personnel under influence of reflex diminishing medicine or people not able to work because of illness or disorder.

Running of the system has to be always supervised by trained staff.

Personnel which have to be trained und introduced to this job or within in the course of vocational training may work only under permanent observation of a person experienced with the machine.

Work on the electrical equipment is only allowed for workers skilled in the field of electricity.

The instruction manual has to be freely disposable at the location of the system. The employees have to know the storage place.

Every person working at the system has to read and apply the instruction manual especially the safety advices. The personnel have to read and understand the chapters referring to safety aspects for the particularly components of the machine. Please read before beginning the work.

Please control the personnel for paying attention to all facts of safety and danger prevention.

2.3 Protective measures

This operator's guide contains all important advices to operate the system secure.

Basic prerequisite for safe dealing and trouble-free running of this system is the knowledge of fundamental safety advices and industrial safety rules.

In commercial facilities you have to regard the accident prevention regulations of the professional association for electrical systems and tools.

The internal regulations of industrial safety are to be observed.

2.3.1 Concept of safety

Objective is the safety:

- of the staff against injuries;
- of the system against damage or standstill and
- of the environment against endangering.

The list of actions taken:

- deployment of protective equipment like covers and mains switch; you can unplug the mains plug as an emergency stop. The wall socket for the mini-casting unit MC100V must be freely accessible.
- water-cooled inductor housing;
- duty of wearing personal protective equipment (PPE);
- affix safety markings on the installation;
- create safety advices in the manual.

2.3.2 Protective gear

Protective gear (PPE) includes:

- heat-resistant clothes,
- heat-resistant, closed shoes,
- heat-resistant protective gauntlets protecting artery and
- face guard.

Caution!

Wear always for every process step the right protective gear.

2.3.3 Safety equipment

The safety of the machine is only guaranteed if all safety equipment is proper installed and working proper. Don’t use the system without the safety equipment!

Disassembling safety equipment is only allowed in power supply free state (mains switch in off-position, mains plug disconnected and placed in sight). Install every part of the safety equipment after repair. Perfect function has to be checked.

Caution!

Safety equipment protect from unintentional access of the staff to danger spots. They prevent possible injuries. Never manipulate the safety devices!

2.3.4 Safety markings on the unit

A necessary condition for safe dealing with and undisturbed running of the machine is the knowledge of safety instructions and industrial safety regulations.
At the machine casing the following safety markings are attached.

safety marking	meaning	safety marking	meaning
	Warning of dangerous electrical voltages.		Wear heat resistant safety clothing.
	Warning on hot surfaces.		Wear heat resistant protective gauntlet gloves protecting artery.
	Forbidden for persons with pacemaker.		Wear face guard.
	Read instruction manual.		Wear protective shoes.

Advice

Keep the safety markings always clean. Replace the markings if they aren't recognizable. Observe the warnings and commands. Don't expose yourself careless to dangerous situations.

2.4 Safety marking

The following signal words are used in this document which are associated with safety markings for presentation of possible dangerous situations.

Danger!
Death, serious body injury or substantial property damage **will result** if proper precautions are not taken.

Warning!
Death, serious injury or substantial property damage **can result**, if proper precautions are not taken.

Careful!
Minor personal injury can result if proper precautions are not taken.

Danger!
Property damage can result, if proper precautions are not taken.

Information/advice
Here you get information and advices to carry out the following activities effective and safe.

2.5 Safety advices

Check always the condition of the system before you switch on the system. Examine the supply pipes and insulations if there are leaks and damages. Operate the system only if it is in proper and faultless shape.

Operate the system never:

- if there are malfunctions,
- if it is showing damage or
- after heavy transportation stress.

The system has to be constantly controlled when running to be able to recognize and avoid dangerous situations. The system may not run if it is unsupervised.
Do never change, remove or close the safety valves inside the machine.

Danger!

Danger to life because of strong electromagnetical fields (induction). For persons with pacemaker it is not allowed to approach or to be near to the machine.

Danger!
Danger to life are caused also by the fact that very hot and liquid metals solidify in cold liquids. In this case, may arise physical and chemical reactions that have to be previously analysed by the user. During this it can emerge physical and chemical reaction, which is to be evaluated by the operator.

Warning!

Risk of burning on hot surfaces and hot metal (until ~ 2000 °C). Wear always personal protective equipment when you work with the machine.

Utmost caution during using graphite crucibles and graphite moulds. The heat of these parts is only visible when the temperatures are over 500 °C.

Warning!

Maintenance and servicing of the machine only when the system is disconnected from the mains supply (Pull out mains plug).

Advice!

Don’t disconnect mains plug, while machine is running or in standby. Switch off for pulling out or putting in mains plug.

Danger!

Risk of burns. If metal is melted without the supply of protective gas, can cause a flash fire or explosion when opening the bell.
Melt at temperatures above 500 °C always with protective gas. Use as a protective gas exclusively argon or nitrogen

Danger!

Danger because of touching parts conducting voltage.

Work on the electrical equipment is only allowed for authorized qualified staff.

Access to the electrical distribution box is only allowed for authorized qualified staff with tool.

Work on the electrical equipment is only allowed when the system is disconnected from power supply (pull out mains plug).

- The capacitors can retain their charge even after deactivation of the system.
- Keep the housing of the mini-casting unit closed continually.
- No work must be carried out on parts conducting high voltage.
- Remove loose connections.
  Replace immediately damaged scorched or slightly burned cables. Perform work only when mains plug is pulled out.
- Cables may not wedge in or rather squeezed. Cables have to be laid in a way that they not become a tripping hazard or can be not damaged.

Danger!

Threat of health injury by escape of medias from damaged hoses. Danger of system damages.

- Remove loose connections. Replace damaged hoses immediately. Perform work only when mains plug is pulled out.
- Hoses may not wedge in or rather squeezed. Hoses have to be laid in a way that they not become a tripping hazard or can be not damaged.

Warning!

Risk of burns:

- burns because of squirting liquid metal and
- burns at hot surfaces.

Warning!

Danger of explosion.

Dripping liquid metal can't be excluded.
The set-up place (table) and the floor beneath the system should be made of non-flammable material. As well there shouldn't be stored inflammable materials within a radius of 5 metres.

Attention!

At crucible temperatures over 100 °C the cooling water supply must be switched on. If it is not turned on, the inductor will be destroyed. If cooling water supply fails, the heating system immediately is turned off. Inspect the system for damage before putting back into operation again.

Danger!

Lethal injuries happen because of false transport by forklift truck.

- Pay attention of the right attachment of the means of transportation, otherwise the system can fall from forklift truck.
- With too small dimensioned or forks adjusted too narrowly there is danger for the system to fall from the means of transportation.
- Wear appropriate personal protective equipment (PPE).
- Move the system only by skilled personnel qualified for transportation jobs.

For damages resulting from non-compliance of regulations in transit there is no assertion possible for warranty claims.

Warning!

Danger of burns by leaking liquid metal.

Warning!

Health risk because of lifting heavy weight.

Lift and transport the machine only by two persons.

Warning!

Risk of injury.

Make pressure leading system parts depressurized before you carry out servicing.

Warning!

Risk of slip on the floor around the installation in case someone had spilled lubricant or solvent.
Clean the floor from dirt immediately! Dispose cleaning tissues in the specific collecting boxes.

Caution!

Observe regulations for the mains supply written from the responsible electric power supply company, the association VDE and the local electric power station. Inappropriate connecting can lead to injuries and damages of the machine.

Caution!

Danger for health because of inhalation of fibre particles.

- Store the vacuum chamber insulation in dustproof package.
- Remove the material just before installation.
- Pack the materials immediately after removal dustproof and dispose the materials in this packaging.

2.6 Residual risks

risk characterisation	risk reduction
Health risk for persons with cardiac pacemaker who approach the running system.	Instruct people.
Burn injury on hot surfaces or hot molten metal.	Teach people.
Danger of explosion because of dripping of liquid metal in a water filled steel tub during melting of aluminium or aluminium-alloys.	Fill the tub with sand.
Jet flame or explosion when opening the lid of the melting chamber in case of melting without protective gas.	Always melt with protective gas at temperatures above 500 °C.
Tilting and toppling of the system due to improper transportation.	Consider shipping instructions.

2.7 Behaviour in an emergency

The personnel working at the installation must be trained about the behaviour in an emergency.

All persons who are working with the machine must be informed of the possibility of rapid standstill of the device.

3 Technical Data

	MC100V
Crucible volume (1)	50 cm^3 (ceramic crucible) 30 cm^3 (with graphite inlay) 450 g gold 18 kt)
Pressure range in melting chamber in bar	-1 to 3
Crucible temperature in °C	max. 2000
Melting performance in kW	8
Mains supply	3x 400 V, 50 or 60 Hz
Fuse protection in A	3x 16
Abduct current in mA	4.45
Thermocouple	Type N (NiCr-Ni), max. 1300 °C Optional type S (PtRhPt) max. 1400 °C
Cooling water supply	Øi 13 mm, 2.5 - 5 bar / min. 1.8 liter/minute, 120 l/h, max. 6 °dH
Cooling water recoil	Øi 13 mm, pressureless, expected water temperature maximum 70 °C (158 °F)
Cooling water entry temperature	15 - 25 °C / 59 - 77 °F {to prevent condensation 20 -25 °C/68 – 77 °F}
Ambient temperature	10 - 35 °C / 50 - 95 °F
Relative humidity	20 - 80 %
Protective gas supply	Øi 6 mm, argon or nitrogen, 6 bar, estimated consumption 1 to 3 l/min
Vacuum	Øi 13 mm, min. 21 m^3/h, 0.1 mbar abs.
Weight in kg	ca. 60
Dimensions in mm (Wide x Depth x Height)	500 x 700 x 600 (without option bottom cabinet)
Maximum melting temperature	Depends from used thermocouple: type N (NiCr-Ni): 1300 °C type S (PtRhPt): 1400 °C Pyrometer: 2000 °C
Noise emission in dB (A)	75

(1) These are standard values which can be changed optional.

4 Description of the system

4.1 Components of the system

The system consists of several modules assembled in one housing.

Inside the housing there are:

- mains cable and mains filter,
- microprocessor controlled induction generator F-type,
- middle-frequency transformer,
- oscillating circuit capacities and
- pneumatic (magnet-) valves.

The front plate contains:

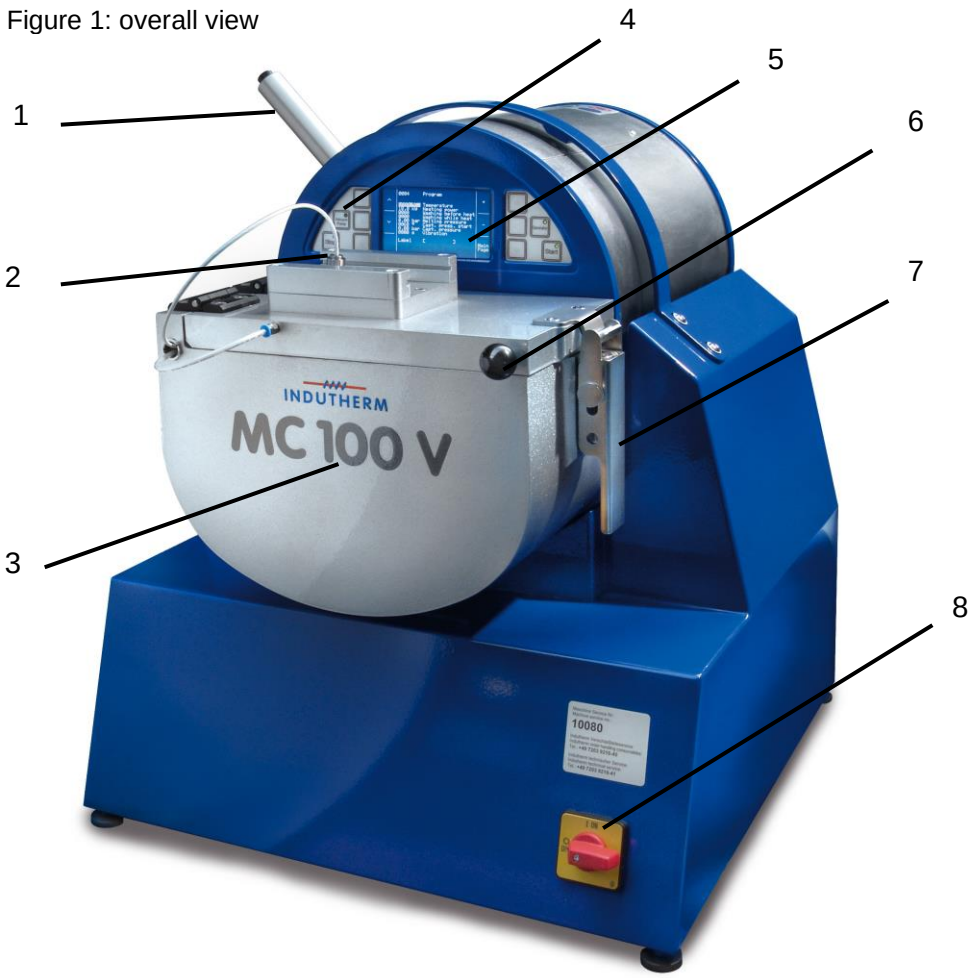
- front panel for control of the casting process.

To the melting system belongs:

- inductor housing, water cooled with inductor, crucible, insulations and thermocouple.

4.2 Schematic representation

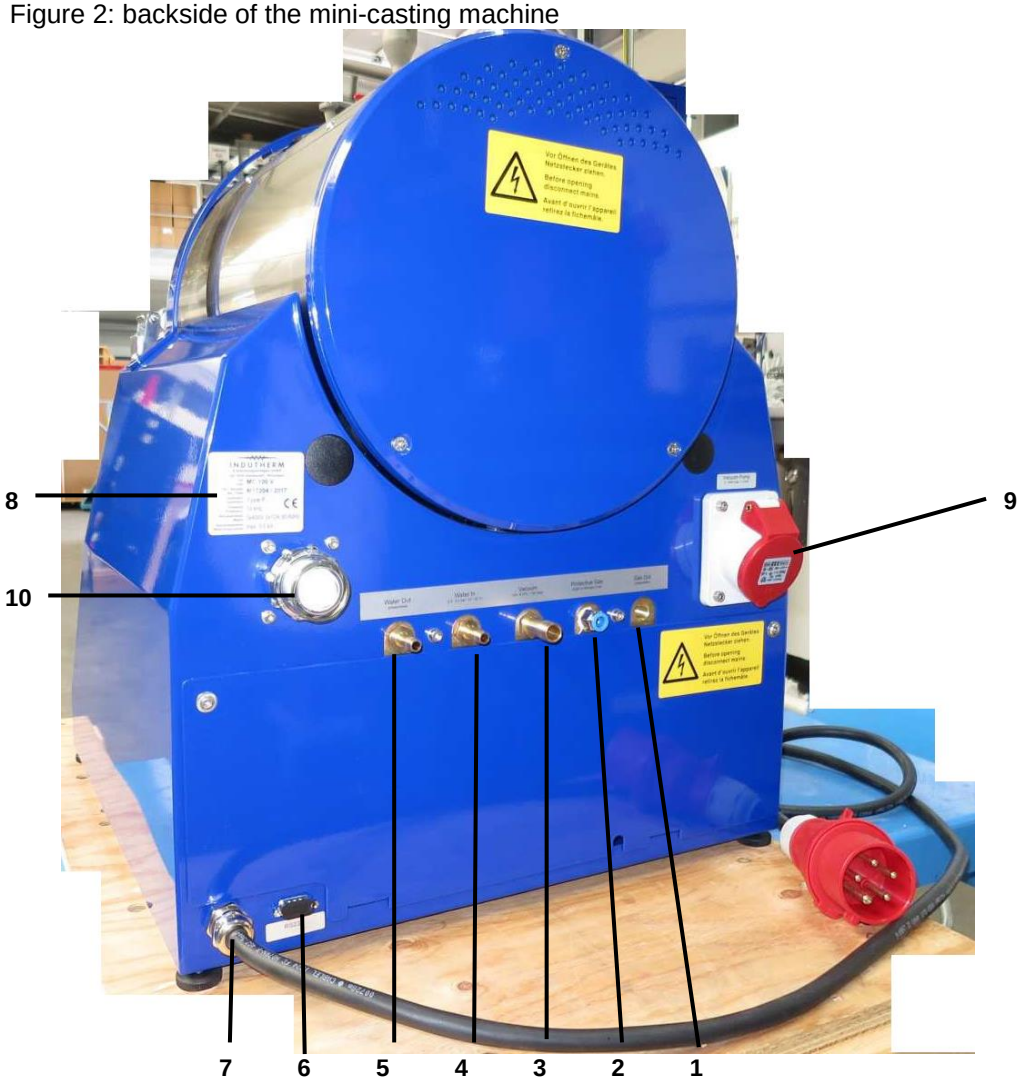
Figure 1: overall view



Position	Description	Function
1	tilting handle with lock	Due to movement to the right the machine will cast.
2	pyrometer	Allows temperature measurement above 1300 °C.
3	inductor housing	The melting and casting process takes place here.
4	control buttons.	Control the casting process. See ch. 4.6.
5	LCD screen	See chapter 4.5
6	top plate with handle	Locks the inductor housing.
7	lock	Locks the system for safety reasons and to allow overpressure.
8	mains switch	Machine will be turned on and off here.

4.3 Connections on the backside

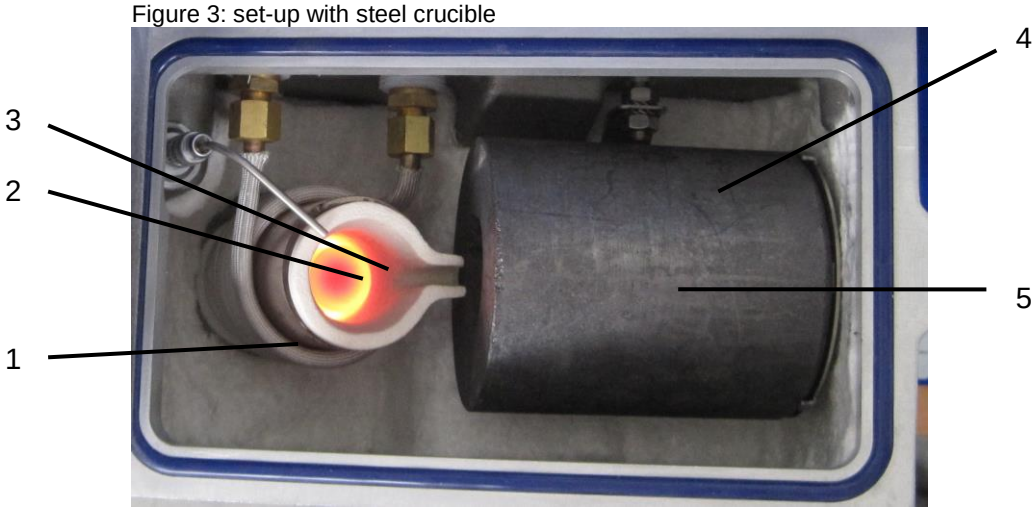
Figure 2: backside of the mini-casting machine



Position	Description	Function of the connection
1	Gas out	gas outlet
2	Protective gas	input for protective gas
3	Vacuum	connection for external vacuum pump
4	Water In	input for cooling water
5	Water Out	output for cooling water
6	RS232	connection for PC or modem for service issues
7	mains cable	electrical connection for machine
8	Identification label	Important information about the machine.
9	Vacuum pump	Connection of the vacuum pump. 1.0 kVA
10	vacuum filter	filters the vacuum

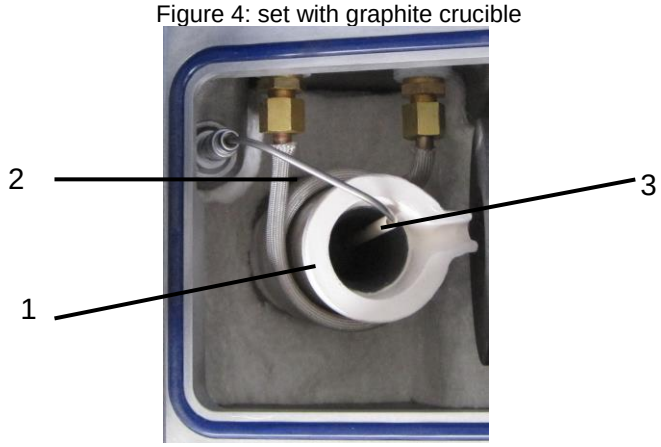
4.4 Set-up in the vacuum chamber

Figure 3: set-up with steel crucible



Position	Description	Function
1	thermocouple type S	Allows a temperature measurement up to 1400 °C.
2	ceramic crucible	In this crucible the material will be directed inductively melted
3	ceramic cover	Protects the thermocouple against contamination with liquid metal or graphite.
4	Flask adapter	Adapter for various flasks and mould sizes.
5	Mould	Here graphite mould. You can use flasks too.

Figure 4: set with graphite crucible



Position	Description	Function
1	Ceramic crucible with graphite insert	In this crucible the graphite serves as a heat carrier and transfers its energy to the metal.
2	thermocouple Typ N	Allows a temperature measurement up to 1300 °C.
3	Ceramic protective cover	Protects the thermocouple against contamination by metal or graphite.

4.4.1 Different crucibles

Figure 5: crucibles for steel

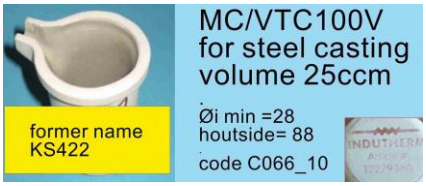
	
12279380	12279390
for steel	for steel
25 cm³	30 cm³
not coated	coated with ZrO

Figure 6: crucibles for platinum

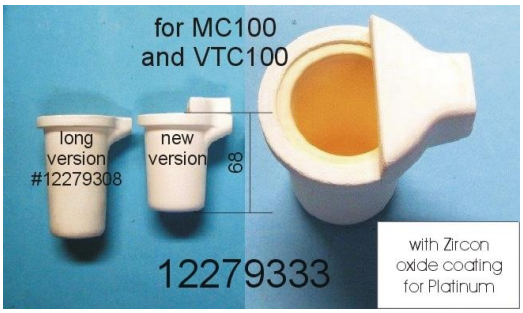
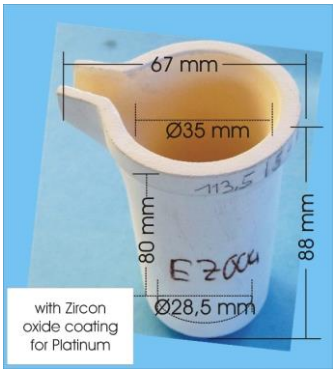
			
12279333	12279371	12279312	
for platinum	for platinum	for platinum	
17 cm³	30 cm³	30 cm³	
coated with ZrO	not coated	top cover and ZrO coated	

Figure 7: crucible for gold and silver

	
12279305	12279330
for gold and silver	for platinum
25 cm³	30 cm³
with graphite inlet	coated ZrO

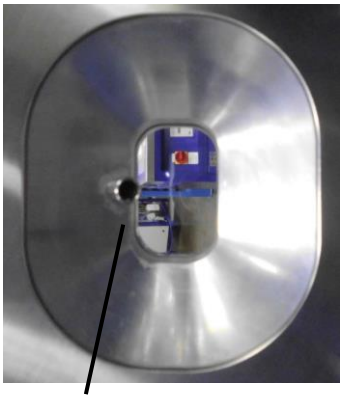
4.5 Options

4.5.1 Base cabinet

Figure 8: option base cabinet

4.5.2 Multi-color pyrometer (can not be retrofitted)

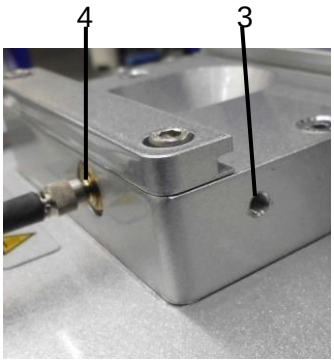
Figure 9: option multi color pyrometer



1 mirroring unit

2 opening (check it)

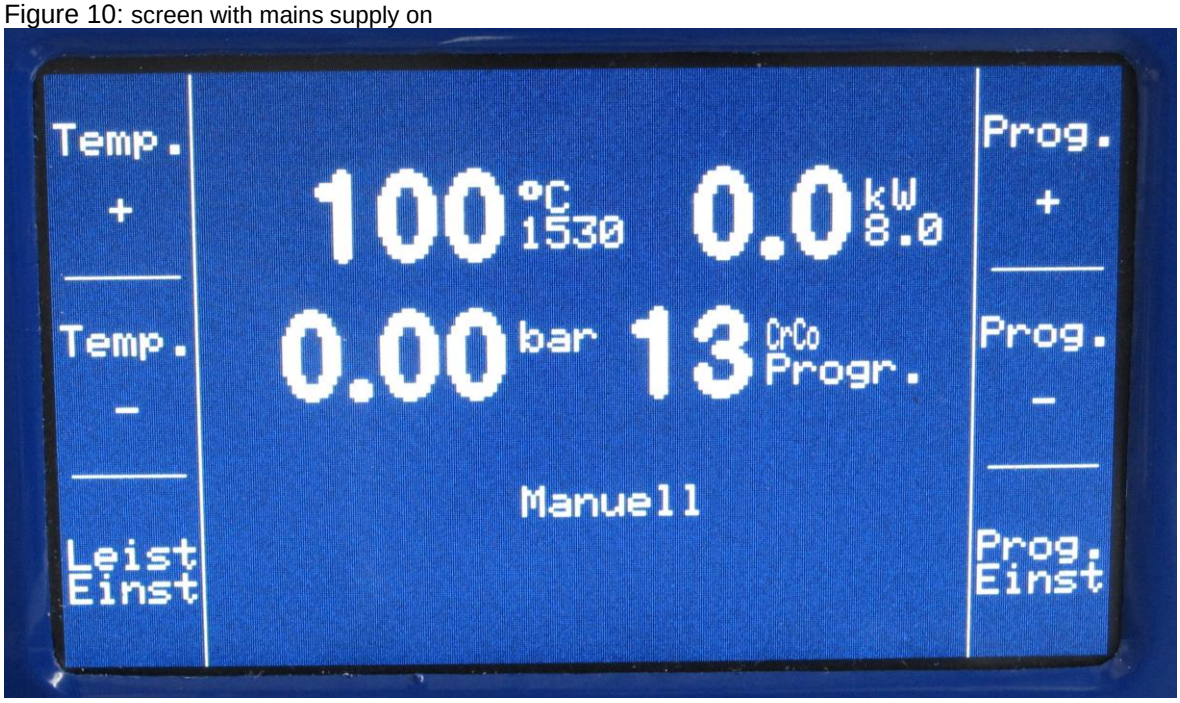
3 Access with Allen key to loose the pyrometer head (4).



4.6 Front panel display

4.6.1 MC100V screen when starting the machine

Figure 10: screen with mains supply on



Display in the middle section:	
100 °C	actual temperature
1530 °C	set temperature.
0.00 bar	actual crucible pressure (-1 to 3.0 bar)
0.0 kW	actual heating power in kW
3.5	maximum heating power in kW
13 Progr	active program
CrCo	program name
Manual	Casting mode

On the left side shown:	
Temp. +	Rise the set temperature even within a program.
Temp. -	Lower the set temperature even within a program.
Power Edit or Temp. Edit	Changes display to achieve temperature or power controlling.

On the right side shown:	
Progr. +	Go to the next program (here program 14).
Progr. -	Go to the next program one place lower (here program 12).
Progr. Setup	Level to modify the selected program (here program 13).

4.6.2 MC100V modify program screen

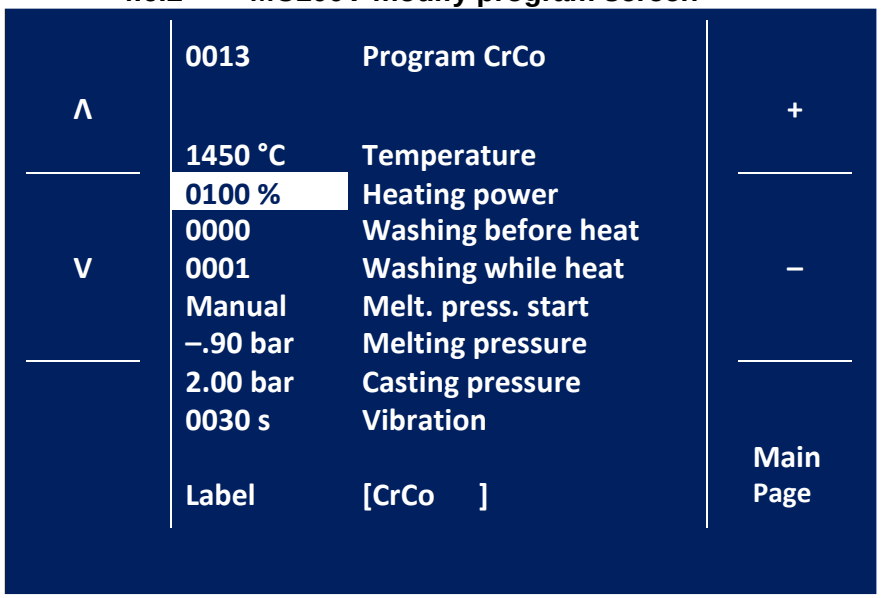


Figure 11: program parameter

middle section with program parameter

Outer area with choice

Display in the middle area:			
0013	Program CrCo	'0…19'	Selected program to modify.
1450 °C	Temperature	'10…2000 °C'	Set temperature inside the crucible.
0100 %	Heating power	'1…100' %	You can reduce heating power here.
0001	Washing before heating	'0…5'	Washing cycles before heating (starts with vacuum, then backfill to 0.0 bar with protective gas). Number displays the cycles that will be done. It is recommended for palladium alloys (very reactive).
0000	Washing while heating	'0…5'	Washing cycles during the machine heats.
Manual	Melting pressure start	Manual	To start pressure, you need to press the start button again.
		Automatic	Pressure starts after the washing cycles.
–.90 bar	Melting pressure	'-1.00… 0.00' bar	Melting pressure set value in chamber during heating.
2.00 bar	Casting pressure	'-1.00…3.00' bar	Casting pressure set value.
0020 s	Vibration		Vibration time in seconds
Label	[CrCo]	'a…z, 0…9,…'	Here you can change the name of the program.

Display on the side:	
Λ	Moves the input area (highlighted area) one level above.
V	Moves the input area one level below.
+	Increases the value within specified limits.
-	Decreases the value.
Main page	Display returns to main menu.

4.6.3 MC100V modify system parameter

If you start from the main page and you press „Program setup“ for 5 seconds you get access to the system parameter.

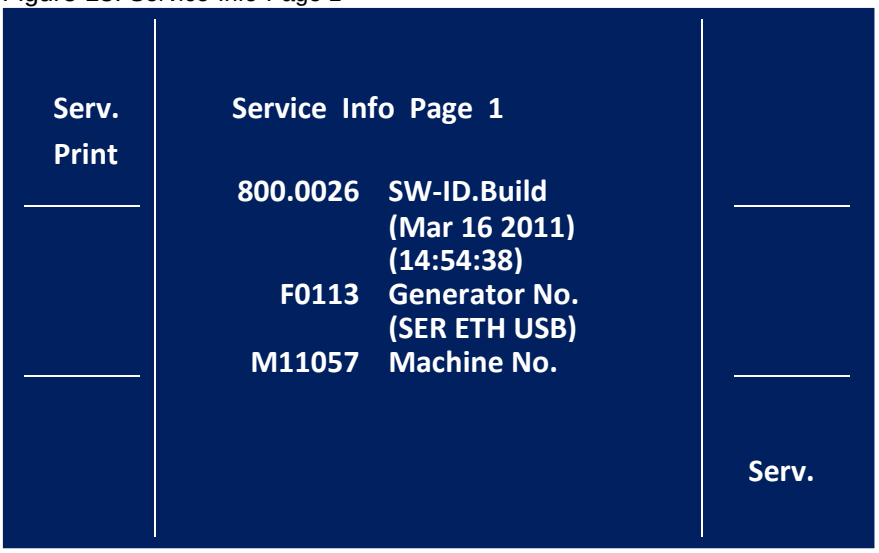
Figure 12: System-parameter-menu

Display-functions:		
155:	00001	selected parameter is 155 If value of parameter 155 is one, then exhibition mode is activated.
Λ		With pressing Λ you get to next parameter 156.
V		With pressing V you get to previous parameter 154.
+		With pressing “+” you can increase to value 2 of selected parameter.
-		With pressing ‘-’ you can decrease to value 0.
Serv.		You can see service information on Service Info Page 1 about serial numbers.

4.6.4 MC100V State-Level (Service Info Page 1 + 2)

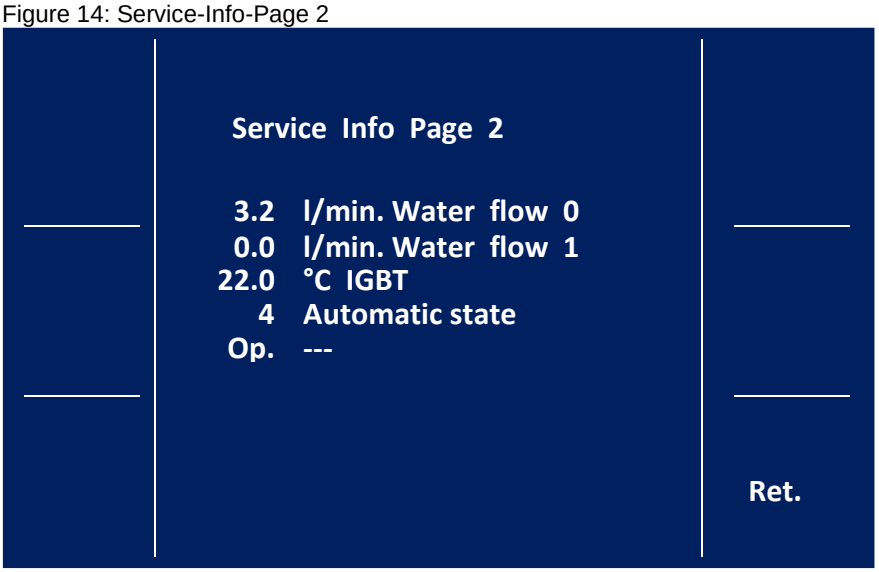
If you press “Serv.” in system parameter menu, you’ll see software ID, generator no. and machine no.

Figure 13: Service-Info-Page 1



If you press „Serv.“-button again, you’ll see cooling water flow, generator temperature and actual machine state.

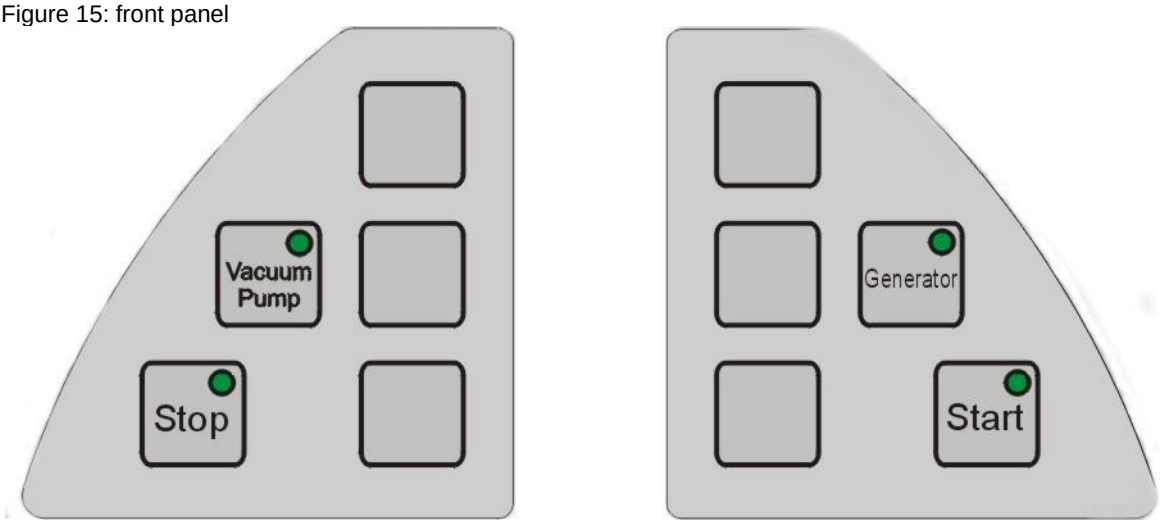
Figure 14: Service-Info-Page 2



With pressing Ret. (Return) button the display shows main page again.

4.7 Front panel buttons

Figure 15: front panel



From left to the right

Button	Function
Stop	Stops active program.
Vacuum Pump	Switching on and off the vacuum pump (For this purpose, the machine must be connected to the vacuum pump via the rear-side connector).
6 push buttons left and right from display	Function of these buttons you can see in display. See previous chapter too
Generator	Starts and stops heating with induction generator outside the automatic mode.
Start	Starts selected program. Second push starts melting pressure in manual mode.

Special function of "Start" button:

If you are operating within a program cycle and melting pressure is active, you can release and reactivate the melting pressure by pressing the start button.

4.8 Functional description

With the casting machine, castings of different dimensions can be produced from the metals to be used as intended. For this purpose, the casting material is first melted inductively under a protective gas atmosphere and then poured into a flask or into a mould.

The advantage of the inductive heating is the rapid attainment of the melting temperature, since the heat is generated directly in the melt material and in the crucible. Likewise, the metal is thoroughly mixed through the magnetic field during the melting process, so that homogeneous metal mixing is achieved even in new alloys.

The built-in thermocouple or built-in pyrometer is used to precisely measure the temperature and to control the power of the unit so that the set temperature is kept constant.

Note:
The standard pyrometer of the MC100V achieves reliable temperature measurement and process control for the casting of steel and chrome cobalt alloys.
For Platinum - and Palladium casting we strongly recommend the option 71779420 two-colour-pyrometer or the optical temperature controlling of the operator.

The material is melted as standard with protective gas purge. For metals, which are more susceptible to oxidation, it is recommended to draw vacuum after the material has been filled, and subsequently to return with protective gas. In addition, in the case of metals with a high oxygen content (e.g. commercially available copper or silver), degassing of the molten metal under vacuum is possible.

The INDUTHERM mini casting machine MC100V is suitable to cast all kind of metals into moulds or into investment flasks. Exceptions are dental alloys and very reactive alloys like magnesium. The melting charge is heated up by induction. The special advantage of strong inductive heating is that the melting temperature is reached rapidly, because the heat is directly generated in the metal or will transported to the metal by a crucible with graphite insert. During the melting process, the metal is thoroughly mixed by means of a magnetic field, ensuring a homogenous mixing even when using mixtures of pure metals.

Crucibles with graphite inlet are used for metals up to 1300 °C and ceramic crucibles for steel or platinum up to 2000 °C.

Vacuum-Pressure mode in only one chamber

The casting mode is based on this new method: during the melting process the metal and the flask are under full vacuum. The metal is poured into the flask by tilting the whole chamber. Inside flask is also a vacuum which guarantees pouring without air counter pressure. Now the vacuum will be replaced by gas overpressure rapidly: The pressure impulse (inside of the flask is still under vacuum!) ensures excellent form filling. The effect of vacuum in the flask and outside

overpressure lasts for some time, long enough until metal is already solid.

The most important fact of this system is quickly creating of vacuum and very fast pressure built-up in the system. To the evacuate chamber it needs a strong vac pump with 8 m³/h minimum, releasing vacuum + creating over pressure it needs a gas bottle with PRESSURE regulator (NEVER a flow regulator !!!). Short connection pipes make rapid pressure supply even better.

All functions are linked with the turning of the chamber: immediately after pouring metal into the flask, over pressure comes automatically.

As mentioned before, a pressure impulse on top of liquid metal, while inside there is still a vacuum, makes the good form-filling of this system. This means, the flask by itself is a reservoir of the vacuum. As smaller the flask, as less reservoir is there and pressure equalisation is quicker. In case of doubt (very delicate items) or form filling problems take one size bigger for the flask than necessary from aspect of dimensions.

4.9 Videos

On our website www.indutherm.de or on YouTube you will find MC100V installation videos. Please use this possibility for a better understanding of the machine.

4.10 Casting programs for MC100V (05.05.2014)

Figure 16: predefined casting programs

MC100V

Material		**Silver 935**	**Yellow gold 18k**	**Platinum 950**	**Stainless steel CrCo**	**Palladium 950**	**Test 1**	**Test 2**
Crucible		Graphite	Graphite	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Temperature reading		Thermocouple	Thermocouple	Pyrometer	Pyrometer	Pyrometer	Pyrometer	Pyrometer
Program No.		**10**	**11**	**12**	**13**	**14**	**18**	**19**
Temperature*	°C	1000	1050	2000***	2000***	2000***	10	1200
Heating power	%	0050	0050	0100	0100	0100	0100	0100
Washing before heating		0000	0000	0000	0000	0001	0000	0000
Washing while heating		0000	0000	0000	0001	0000	0000	0000
Melting pressure start		Manual	Manual	Manual	Manual	Manual	Manual	Manual
Melting pressure**	bar	-1.00	-1.00	-0.80	-0.90	-0.80	-1.00	-1.00
Casting pressure	bar	2.00	2.00	3.00	2.00	3.00	3.00	1.00
Vibration time	sec.	0030	0030	0030	0030	0030	0005	0005
Label		935/Ag	750/YG	950Pt	CrCo	950Pd	Indu-Test 1	Indu-Test 2

*	Temperature: Please see the alloys data sheet for recommended casting temperature.
**	Melting pressure: When the display shows “Melting”, the melting pressure can be applied at any time by pressing the “Start” button again.
***	Casting should be as fast as possible. The temperature controlling takes too long. The casting needs to be done by vision. Once the material is liquid wait 5-10 seconds and then cast!

Figure 17: additional casting recommendations

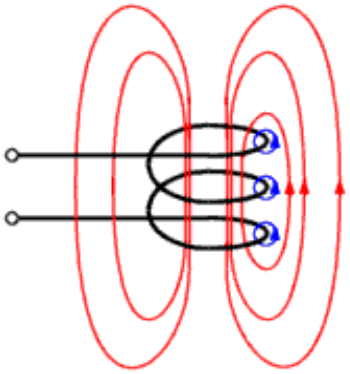
MC100V			
Material		**Brass**	**Bronze**
Crucible		Graphite	Graphite
Temperature reading		Thermocouple	Thermocouple
Program No.			
Temperature*	°C	1100	1100
Temperature sensor type		Type N	Type N
Heating power	%	0050	0050
Washing before heating		0000	0000
Washing while heating		0000	0000
Melting pressure start		Manual	Manual
Melting pressure**	bar	-1.00	-1.00
Casting pressure	bar	2.00	2.00
Vibration time	sec.	0030	0030
Label		Brass	Bronze

4.11 Direct induction heating in ceramic crucible

Direct induction melting is necessary on metals with high temperature melting points, such as Pt., steel etc. High temperatures do not allow use of graphite crucibles because of quick burning under standard atmosphere. Also, direct induction melting is necessary on metals, which reacts unwanted with graphite.

An Induction Coil, used in our systems, creates streamlines of electrical field, with a specific direction.

Figure 18: field line profile in an induction coil



If now a conductive material like metal is brought into this induction field, metal absorbs energy, it couples. This metal is separated in a nonconductive ceramic crucible in between.

As bigger now the working surface of the metal, as more energy can be absorbed, as quicker melting can happen.

This is why metal parts should be placed rectangular to field line = horizontal, to provide optimal absorption of energy.

So it makes sense to place metal plates horizontal, also bigger wires couple more energy in horizontal position.

Please also take notice, that induction melting systems need a certain amount of volume to absorb enough energy for melting. The MC100V with direct induction heating needs a filling level of at least 20 % of the crucible's volume. Thin wires, chipping do not have enough volume and should be compressed (by a press) or better, charged into already melted liquid metal. Caution, Danger of splashing!

When using cast-iron plates, care must be taken that they lie horizontally, parallel to the crucible base to achieve a good inductive coupling. Even short cast-iron cylinders can be warmed flat better. Please take care that this metal parts have enough distance to crucible's wall to prevent disruption of crucible by extension of the metal pieces before melting.

At direct induction melting please notice following hint:

If a too voluminous piece of metal will be added to an already molten metal, molten metal can "freeze", it becomes solid again. If this form-fitting metal now is heated-up again, it expands can disrupt the crucible. Hint: load complete amount of metal in cold crucible or charge only small pieces into molten metal. Caution: danger of squirting!

Direct melting is usually used for metals with a high melting point.
Often (as in the case of, for example, platinum), the ceramic coating material is at the limits of its thermal compatibility. Therefore, melt as soon as possible and drain immediately. To play with liquid platinum strikes the ceramic immensely and shortens the life of the crucible.

4.12 Temperature control

To use the temperature controller a thermocouple

type N article no 13400016 up to 1300 °C (parameter P.000 - must be set to 0002)

or

type S article no 13000032 up to 1400 °C (parameter P.000 - must be set to 0001)
has to be connected to the socket inside the casting chamber. Very important is that you use the thermocouple together with the thermocouple protection cover article no 13200046/48.

Figure 19: thermocouple type S

Figure 20: thermocouple type N

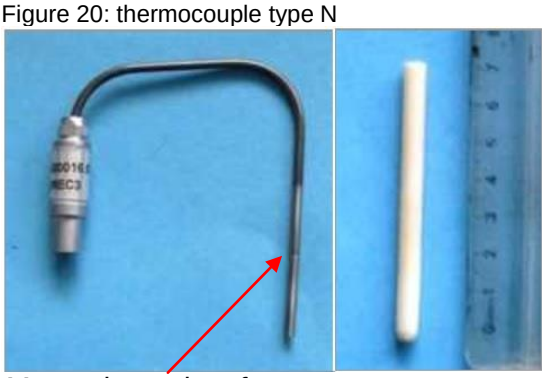
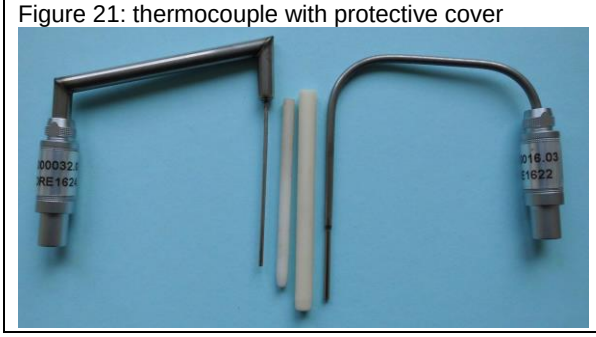


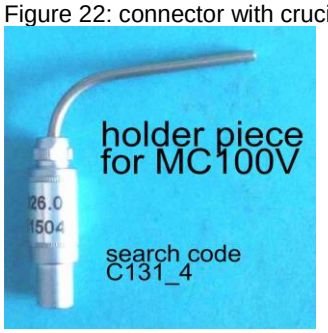
Figure 21: thermocouple with protective cover



13200046 protective cover (Typ N)
13200048 protective cover (Typ S)

Important: Use thermocouple for melting only in crucibles **with graphite inlet**. Otherwise induction energy will stimulate thermocouple directly (without protection by graphite). Result, read in display, is pure nonsense!

Figure 22: connector with crucible holder



Item no. 13400026 – connector with crucible holder for using pyrometer. Another name is dummy plug.

The nominal temperature can be set with the buttons "Temp. +" and "Temp. -". The heating power is now controlled by the temperature controller. If you use the pyrometer (e.g. for temperatures above 1400 °C, platinum alloys) the dummy plug must be connected to the thermocouple socket and in program the right temperature probe must be set. Additionally the heating power can now be adjusted with the buttons "Power +" and "Power -" (display shows 0.0 kW (0 %) or 8 kW (100 %).

Without thermocouple, without dummy plug or with defective thermocouple the display shows "E041".

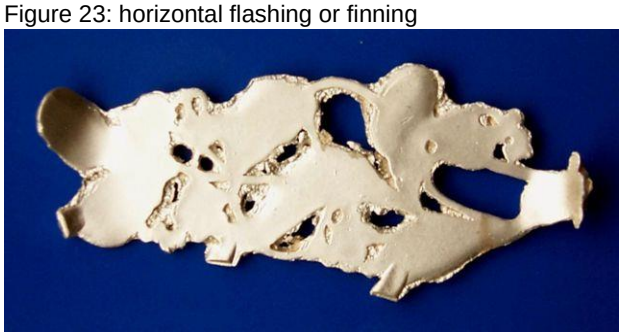
Attention:

Do not use a thermocouple in direct heating process! Energy will melt thermocouple! If you use graphite crucible and thermocouple the output power needs to be reduced to 50%. Otherwise the temperature overshoot is too high and will burn the thermocouple.

4.13 Collection of spoiled castings

Horizontal flashing or finning

Figure 23: horizontal flashing or finning



Cause

- Incorrect powder / water ratio (too much water).
- Work time of investment not used up.

Remedy

- Using correct amount of water (especially important with vacuum investing machines).
- Ensuring the work time is used up and slurry temperature is 20 – 22 ºC.

Other flashing or finning

Figure 24: other flashing or finning

Cause

- Work cycle too long. Investment beginning to set while still under vacuum.
- Disturbing the flasks too soon.
- Heating too quickly during de-wax.
- Moulds allowed drying out before burn out.

Remedy

- Ensuring the work cycle is not too long and slurry temperature is 20 – 22 ºC.
- Leave the flasks for at least one hour undisturbed.
- Do not put the flasks in the hot oven. Do not exceed 150 ºC during de-waxing.
- If not burning out the same day, keep moulds wet by covering with wet sacking or plastic sheets.

Bubbles - Complete Spheres

Figure 25: bubbles - complete spheres

Cause

- Investment too thick. Too little water.
- Vacuum pump/ tank faulty.
- Work cycle too long. Investment beginning to set while still under vacuum.

Remedy

- Use correct powder / water ratio.
- Ensure equipment is regularly serviced and adequate for the task.
- Ensuring the work cycle is not too long and slurry temperature is 20 – 22 ºC. Release vacuum after full-filled flask.

Bubbles-Incomplete Spheres

Figure 26: bubbles - incomplete spheres

Cause

- Static electricity on waxes.
- Grease or dirt on waxes.

Remedy

- Use a wax wash. NOTE: THE WAX MUST BE COMPLETELY DRY BEFORE INVESTING.

Water marking

Figure 27: water marking

Cause

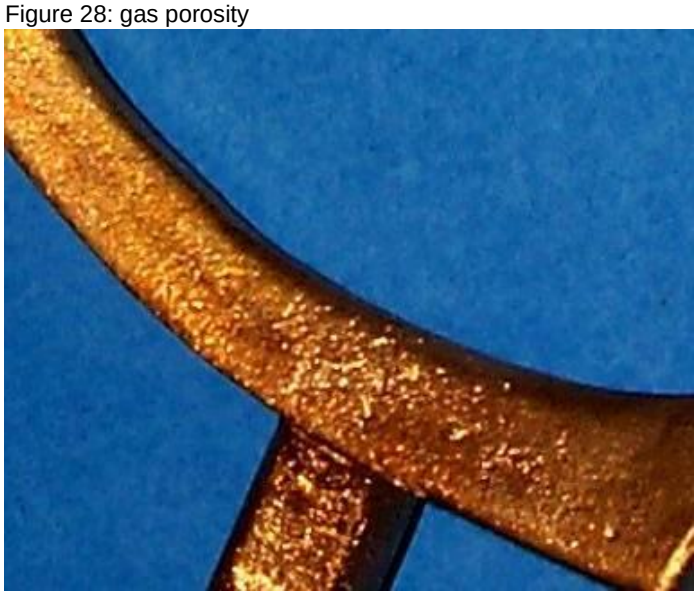
- Incorrect powder / water ratio (too much water).
- Work time of investment not used up.

Remedy

- Use correct amount of water (especially important with vacuum investing machines).
- Ensuring the work time is used up and slurry temperature is 20 – 22 ºC.

Gas porosity

Figure 28: gas porosity



Cause

- Overheating the metal.
- Inadequate burn out.
- Flask overheated during burn out.
- Impurities in the metal.

Remedy

- Reduce metal casting temperature.
- Increase the time at 730 ºC.
- Ensure maximum burn out temperature does not exceed 730 ºC.
- Do not use more than 50 % recycled alloy and ensure it is clean.

Rough Surfaces

Figure 29: rough surfaces

Cause

- Rough waxes.
- De-wax temperature too hot.
- Steam de-waxed for too long.
- De-waxed too quickly.
- Flasks overheated during burn out.
- Metal too hot.

Remedy

- Use less release agent on the rubbers. This can be caused by excess of talcum. Use only a trace of talcum. Never use silicon spray.
- Do not exceed 150 ºC during de-wax.
- Steam, de-wax for a maximum of 1 hour. Steam will erode surface of the investment.
- Leave flask for at least 1 hour to achieve maximum strength before de-waxing.
- Ensure maximum burn out temperature does not exceed 730 ºC.
- Reduce casting temperature.

Inclusions

Figure 30: inclusions

Cause

- Improper sprues.
- Crucible break down.
- Dirty metal.
- Flasks overheated during burn out.

Remedy

- Eliminate sharp corners in sprue system.
- Replace crucible. Do not used old, disintegrating crucibles.
- Do not use more than 50 % recycled alloy and ensure it is clean.
- Ensure maximum burn out temperature does not exceed 730 ºC.

Incomplete castings

Figure 31: incomplete castings

Cause	Remedy
• Metal or flask too cold.	• Please increase casting temperature. If the metal or mould is too cold, the metal will freeze before completely filling the mould.
• Improperly sprue.	• The sprue system should be designed to allow the metal to enter easily and without restriction.
• Incomplete burn out.	• Increase the burn out time at 730 ºC. If the flask is not properly burnt out it will be impermeable and not allow gases to escape when the metal enters the mould.

Shrinkage porosity

Figure 32: shrinkage porosity

Cause	Remedy
• Incorrect sprue.	• Sprues should be attached to the heaviest piece of the casting. There should be sufficient sprues to ensure the casting is adequately fed.
• Flask temperature too low and sprue is incorrect.	• The flask temperature should be just hot enough to achieve complete fill, according to the mass of the casting material.

Blisters, spalling

Figure 33: blisters, spalling

Cause

- Flask has been heated too rapidly during de-wax.
- Flasks overheated during burn out.
- Flasks put in furnace too soon after investing.

Remedy

- Do not exceed 150 ºC during de-wax. Wax will boil and erode investment surface.
- Ensure maximum burn out temperature does not exceed 730 ºC.
- Leave flasks undisturbed for a minimum of one hour before de-wax.

5 Transport

Danger!

Injuries because wrong transport.

- Take care of the right position using transport device to avoid tilting of the system.
- Please wear appropriate personal protective equipment (PPE).
- Let do transportation only by trained personnel.

There is no guarantee for damages because of failure to comply transport regulations.

> Transport the system upright. If the machine is transported in another position, the system will be damaged.

6 Mounting and commissioning

6.1 Safety advices for mounting

Danger!

Only experts may work at the electrical equipment.

Danger!

Observe the mains supply to requirements of the local electricity supply company, the VDE and the local electricity company.

Use always the 2-pin power plug with safety contacts for connecting the system to the mains supply. Improper connection can result in injury and damage to the system.

Danger!

Check before connecting the system, whether the existing mains voltage corresponds with the operating voltage of the system. If the voltages do not match, the system can be damaged.

6.2 Mounting process

Place the system on a clean and dry table horizontal. The ground must be firm and level. Around the machine the following work area must be kept free: left and right 0.5 m. Behind the machine 0.5 m. Before the installation at least 1.5 m of free workspace.

Cooling air may not exceed 35 °C (95 °F) and should be free of contaminations.

Establish supply connections according to the information in chapter 3 „Technical Data”:

- current,
- protective gas,
- cooling water and
- vacuum.

Examine supply lines and connections for damages.

Only after the correct connection of all supply and connecting systems, the system may be put into operation.

6.3 Apply supply connections

6.3.1 Power supply

The electrical connection may only be performed by a specialist. Note the information specified on the nameplate rated voltage or frequency. The single-phase power supply may differ for max. +/- 10% from the rated voltage.
The mains supply must be equipped with a 16 A fuse (slow). The system is supplied with a CEE power plug with earthing contacts is supplied with this machine. All four lines (L1, L2, L3 and PE) must be connected correctly.

The wall socket of the mini-casting unit MC100V must be freely accessible.

On the installation site must be provided by a loop impedance measurement of the detection of the switch-off of the overcurrent protective device.

High leakage current:

This machine has a leakage current of 4.45 mA.

Please take notice: The machine must have own mains line. It is not allowed to use the machine at the same fuse as the burnout furnace!

6.3.2 Cooling water

Cooling water supply is connected to machine by 2 hoses with outside diameter of 13 mm.

Water pressure must be 2.5 bar at minimum and don't exceed 5 bar. Water outlet must be pressureless.

Input water temperature should be between 15 °C (59 °F) and 25 °C (77 °F). To prevent damage caused by condensation is especially recommended temperature area of 20 to 25 °C (68-77 °F).

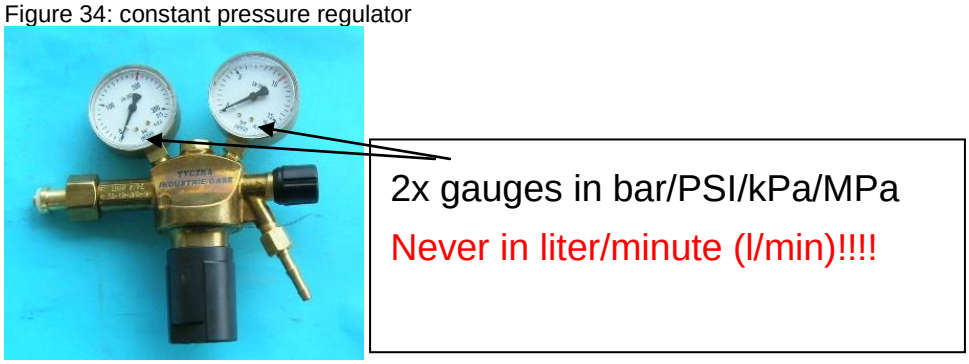
Lime concentration may not exceed of maximum 6 German hardness degrees. The water should be free of pollutions.

Attention:
The cooling water flows continuously even when the mains switch is switched off!

6.3.3 Protective gas

The protective gas only nitrogen or argon may be used with a purity status of at least 99.9 %. The supply is effected via a compressed air hose having an inner diameter of 6 mm. The inlet pressure must not exceed 8 bar. Gas consumption is about 1 - 3 l/min. Please use only a constant pressure regulator.

Figure 34: constant pressure regulator



6.3.4 Vacuum

Here, a vacuum pump with a suction capacity of at least 21 m³/h and a final pressure of 2 mbar should be connected via a tube of 13 mm in outside diameter. Keep the tube short to avoid vacuum loss. The pump should run 5 minutes **before and after** the casting to bring the pump at working temperature and evaporate moisture in the end.

For detailed information, please also refer to the operating manual in maintenance of the vacuum pump.

6.3.5 Gas out

Exit to the pressure reduction. This output must be kept clear at all times. You can connect a hose to lead fumes to the outside.

6.3.6 Vacuum pump connector

This socket is only for the connection of a three phase vacuum pump (400 V AC) with maximum power of 1.5 kVA. Inside machine there are fuses for this connector. During installation you have to check for right rotation of attached vacuum pump. With wrong direction pump can be destroyed.

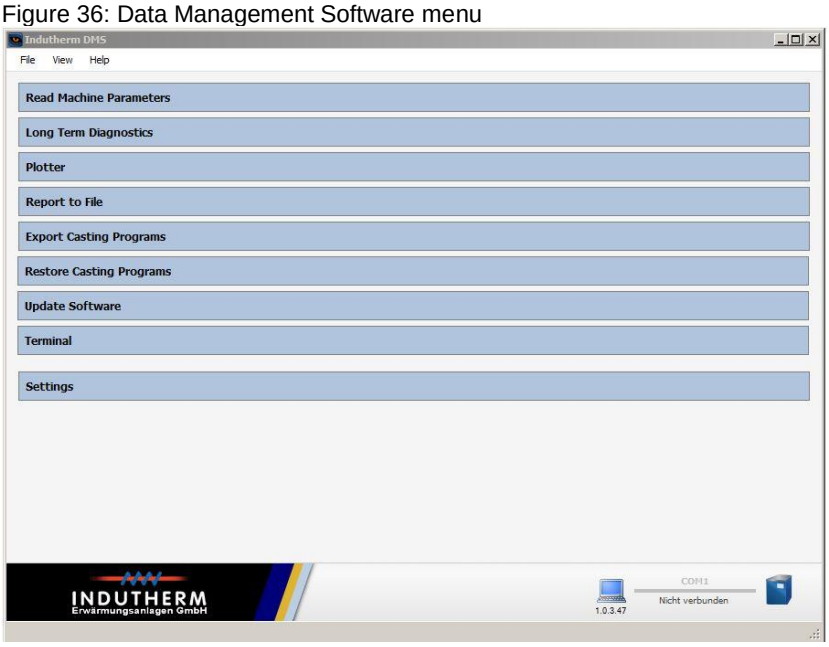
Figure 35: Check of the backside connections

6.3.7 RS232 for service

At this plug behind a black cover our modem (item no. 71000320) or our serial cable (50500060) can be connected for service issues.

With help of DMS you can read out system-data and casting programs for service questions.

Figure 36: Data Management Software menu



7 Operation

7.1 Safety advices for operation

Caution!

Examine all consumables, insulations and hoses before switching on. Check for damages and cleanliness, especially crucible and glass shield. Operate the system only when it's free of damages.

Warning!

Risk of burning on hot surfaces and hot metal (until ~ 2000 °C). Wear always personal protective equipment when you work with the machine.

Utmost caution during using graphite crucibles and graphite moulds. The heat of these parts is only visible when the temperatures are over 500 °C.

Danger!

Risk of burns. If metal is melted without the supply of protective gas, can cause a flash fire or explosion when opening the bell.
Melt at temperatures above 500 °C always with protective gas. Use as a protective gas exclusively argon or nitrogen.

Attention!

At crucible temperatures over 100 °C the cooling water supply must be switched on. If it is not turned on, the inductor will be destroyed. If cooling water supply fails, the heating system immediately is turned off. Inspect the system for damage before putting back into operation again.

7.2 Changing casting parts

Attention!
Switch off the machine at mains switch, when you change consumables, like e.g. crucible.

7.2.1 Removal

> Open the top plate of the casting chamber.

> Remove “old crucible”. Check glass inductor shield.

7.2.2 Mounting

> Check crucible surface for damages and cleanliness before you start casting.

> Put a small piece of quartz fleece in glass inductor shield.

Figure 37: quartz fleece in inductor shield

The crucible should be sitting easily on the quartz fleece. The crucible collar should be close to the glass inductor shield.

Figure 38: crucible and glass inductor shield

Place crucible with glass inductor shield in the induction coil.

7.3 Recommendation for a casting process

Figure 39: further suggestions of casting programs

Suggestions		
Material		**Yellow gold 14k**
Crucible		Graphite
Temperature reading		Thermo-couple
Program No.		
Temperature	°C	1080
Heating power	%	0050
Washing before heating		0000
Washing while heating		0001
Melting pressure start		Manual
Melting pressure	bar	-0.80
Casting pressure	bar	2.00
Vibration time	sec.	0010
Label		585/YG

> Switch on water-, protective gas and vacuum supply.

> Prepare crucible with thermocouple. Switch on mains switch (booting takes about 10 seconds).

> Fill in casting material.

> Put in preheated flask (620...650 °C).

> Close and lock casting chamber secure.

Figure 40: safe handling of lock

Close the lock with the ball of hand. Hold the hand open and use a glove.

> Start your casting program with “Start” button.

> If casting temperature is reached press “Start”-button again for building up vacuum (melting pressure).

> After 10 seconds please press the button on the handle and tilt the chamber uninterrupted clockwise til the catch. Release the button on the handle to lock the unit in the tilted position. During the tilting the unit automatically switches from vacuum (melting

pressure) to overpressure (casting pressure) inside the chamber. The generator stops heating. On the display “Time” a timer counts the seconds after casting.

> After a sufficient waiting time, unlock the handle and tilt the unit back to horizontal position. The casting pressure inside the crucible chamber is released through “Gas Out” to ambient pressure.

> Open the casting chamber and remove flask and flask holder.

Attention!

You have to activate the melting pressure by pressing “Start”-button after the washing cycles.

7.4 Error diagnosis

There two types of trouble.

- Error and
- Warnings.

If an error occur the heating will be switched off and you’ll see error code in display.
With a light fault a warning appear in display. You’ll see the warning code in display.

7.5 Troubleshooting

Only an expert may open the system.

Trouble	Cause
Machine can’t be switched on.	• Missing mains supply.
Heating don’t work	• Missing water supply. • Missing protective gas supply. • Thermocouple not connected or defect. • Generator overheated (too hot). • Other error.
Temperature indication not right	• Wrong thermocouple programmed, see software documentation. • Thermocouple faulty. Because of that the generator can stop heating!
Low generatoroutput	• Set-value of temperature too low.

Additional error messages see software-documentation.

7.6 Service

If you need technical support from company INDUTHERM Erwärmungsanlagen GmbH, we’d like to have following information with first contact:

- Service No. M19999 near to mains switch of machine or
- Service No. from manual cover or nameplate at backside of machine.

8 Maintenance

8.1 Safety advices for repair and maintenance

For reliable use and highest work accuracy use is regular maintenance and service of your system a prerequisite. The necessary working steps are summarized in this chapter and have to carry out in time.

Warning!

Perform maintenance and repair work on the system only if the system has been disconnected from the power supply (pull the plug).

Danger!

Danger of death from touching electrical parts.

Work on electrical equipment may only be performed by authorized personnel.

Access to the electrical installation room is allowed only for authorized personnel with a tool.

Work on the electrical equipment may only be carried out when the system has been disconnected from the power supply (pull the plug).

- The capacitors may still be charged even after turning off the system.
- The cabinet of the mini casting machine must be kept close always.

- No work carried out on energizes parts.
- Eliminate loose connections.
  Replace damaged, scorched or burned cables immediately. Perform work only when the mains plug is out.
- Cables must not be clamped or pinched. Cables must be routed so that they do not form a tripping hazard or be damaged.

Danger!

Risk of health problems due to exposure to medium from damaged hoses. Risk of damage to the system.

- Eliminate loose connections. Replace damaged hoses immediately. Maintain only when the mains plug is out.
- Hoses must not be clamped or pinched. Hoses must be routed so that they do not form a tripping hazard or be damaged.

Warning!

Risk of injury.
Make pressurized plant parts at zero pressure before works is carried out there.

Warning!

Slipping on the floor in the area around the plant, if lubricants or solvents were spilled.
Clean the dirty floor immediately! Discard the cleaning cloths in the collecting means made available.

8.2 Maintenance schedule

Follow the maintenance schedule to obtain the functionality of the system.

Daily (before casting)

Warning!

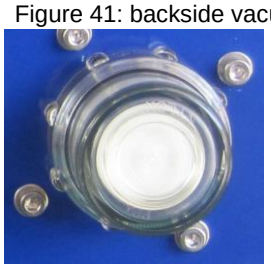
Burning hazard because of leaking melted metal.

- Remove thermocouple, crucible and crucible shield. Clean inductor housing carefully with a vacuum cleaner. Check components before installing and replace them if necessary.

Please take care of oil quality from vacuum pump: If the oil is cloudy or milky, think of let running machine before and after. Additionally think of “gas ballast filter” if you have water vapour in your oil. Study the pump manual too.

Check the backside vacuum filter with compressed air. Don’t blow the dust in the room and wear a dust mask. When the filter is clogged takes it longer time for vacuum level of -1.00 bar and warning E081 will appear.

Figure 41: backside vacuumfilter



Every year

- Cooling water system with about 25% citric acid rinse for about an hour. Then system thoroughly flush with clean water and check for possible leaks. This cleaning-supply cycle is highly dependent on the hardness and cleanliness of the cooling water.
- Tighten all electrical connections, especially the high current connections.
- Retighten all screws of the water cooling, compressed air and protective gas supply.

Every 4 years

- Repeat electrical test of the device.

  The intervals of 4 years relate to a trouble-free operation of the electrical equipment. After an exchange of components (repair or extension) are in
  EN60204-1: 2006 + A1: 2009
  defined tests to be performed.

Note:

The operator is in accordance with the Industrial Safety Regulation (BetrSichV) in Germany or pursuant to Directive 2009/104 / EC * in the EU required to define the cycle for the safety inspection of mechanical and electrical equipment.

8.3 Repair

The system must be repaired only by authorized personnel. Never try to repair the system yourself. Incorrect repairs can lead to health problems or damage to the equipment.

*Directive 2009/104/EG

of the European Parliament and of the Council of 16 September 2009 concerning minimum safety and health protection for the use of work equipment by workers at work (second individual Directive within the meaning of Article 16 paragraph 1 of Directive 89/391 / EEC).

9 Dismantling and cleaning up

Warning!

Permanent skin damages after touching lubricant or solvent of every description (long term effects).

- Avoid touching lubricants, solvents and coolants.
- Wash the sprinkled skin parts thoroughly.
- Wear protective gauntlets when using lubricants, solvents and coolants.

Attention!

Disposal of possibly applied lubricants and harmful cleaning agents is strictly regulated by the Environmental Protection Act and its regulations.

- Deliver applied lubricants at the hazardous waste collection point.
- Spilled lubricants must immediately sprinkle with binder and dispose them after binding as hazardous waste.
- Provide all materials to collect spilled materials (sealed bottom, catch basins, collecting tarpaulins).

> Separate the system off the mains supply and other supply connections.

> Depressurize all system parts which can be under pressure.

> Dispose the system with the help of an appropriate lifting gear.

> Clean the parts of the system.

> Follow legal regulations at handling and cleaning up of old system parts.

> Bring metal pieces to the recycling.

10 Annexe

10.1 List of figures

10.2 CE Declaration of conformity

Manufacturer:	INDUTHERM Erwärmungsanlagen GmbH Brettener Str. 32, 75054 Walzbachtal, Germany
Product type:	Mini-casting machine
Machine type:	MC100V
Serial number:	10121 or higher
Authorized to sign:	Peter Hofmann

We herewith declare that the machine named above corresponds to the essential safety and health requirements of the following EC directives because of its design and construction in the version which we have placed on the market.

Legal normative basis

Machinery Directive 2006/42/EG (MRL) in extracts Reference - Directive 2006/42 / EC, EU-Ab. No L 157/24 of 9 June 2006
EN 60204-1:2006+A1:2009 Security of machines Electrical equipment of machines Part 1 General requirements
EN 61010-1:2010 (in extracts) Safety requirements for electrical equipment for measurement, control and laboratory use Part 1: General requirements
EN ISO 12100:2010 Safety of machinery General principles for design Risk assessment and risk reduction
EN 349:1993+A1:2008 Safety of machinery Minimum gaps to avoid crushing of parts of the human body
EN ISO 13849-1:2015 Safety of machinery Safety-related parts of control systems Part 1: General principles of design
EN ISO 13849-2:2012 Safety of machinery Safety-related parts of control systems Part 2: Validation
EN ISO 13850:2008 Safety of machinery Emergency stop function – Principles of design

EN ISO 13857:2008 Safety of machinery Safety distances to prevent hazard zones being reached by upper and lower limbs
EN ISO 14120:2015 Safety of machinery Guards – General requirements for the design and construction of fixed and moveable guards
EN 1037:1995+A1:2008 Safety of machinery Prevention of unexpected start-up
EN ISO 11201:2010 Acoustics Noise emitted by machinery and equipment – Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections.

EC Directive on Electromagnetic Compatibility Reference - Directive 2014/30 / EU, EU-Ab. No L 96/79, 29 March 2014
EN 61000-6-2:2005 Electromagnetic compatibility (EMC) Part 6-2: Generic standards - Immunity for industrial environments
EN 61000-6-4:2007+A1:2011 Electromagnetic compatibility (EMC) Part 6-4: Generic standards - Emission standard for industrial environments

The declaration of conformity relates only to the machine in the state in which it was placed on the market; Parts and / or retrospective interventions carried out subsequently by the end user remain unaffected.

The test protocols are stored at INDUTHERM for 10 years.

city/date/signatory: Walzbachtal/2019-03-18/Peter Hofmann, chairman

10.3 Connection diagrams

Figure 42: connection diagram – power part

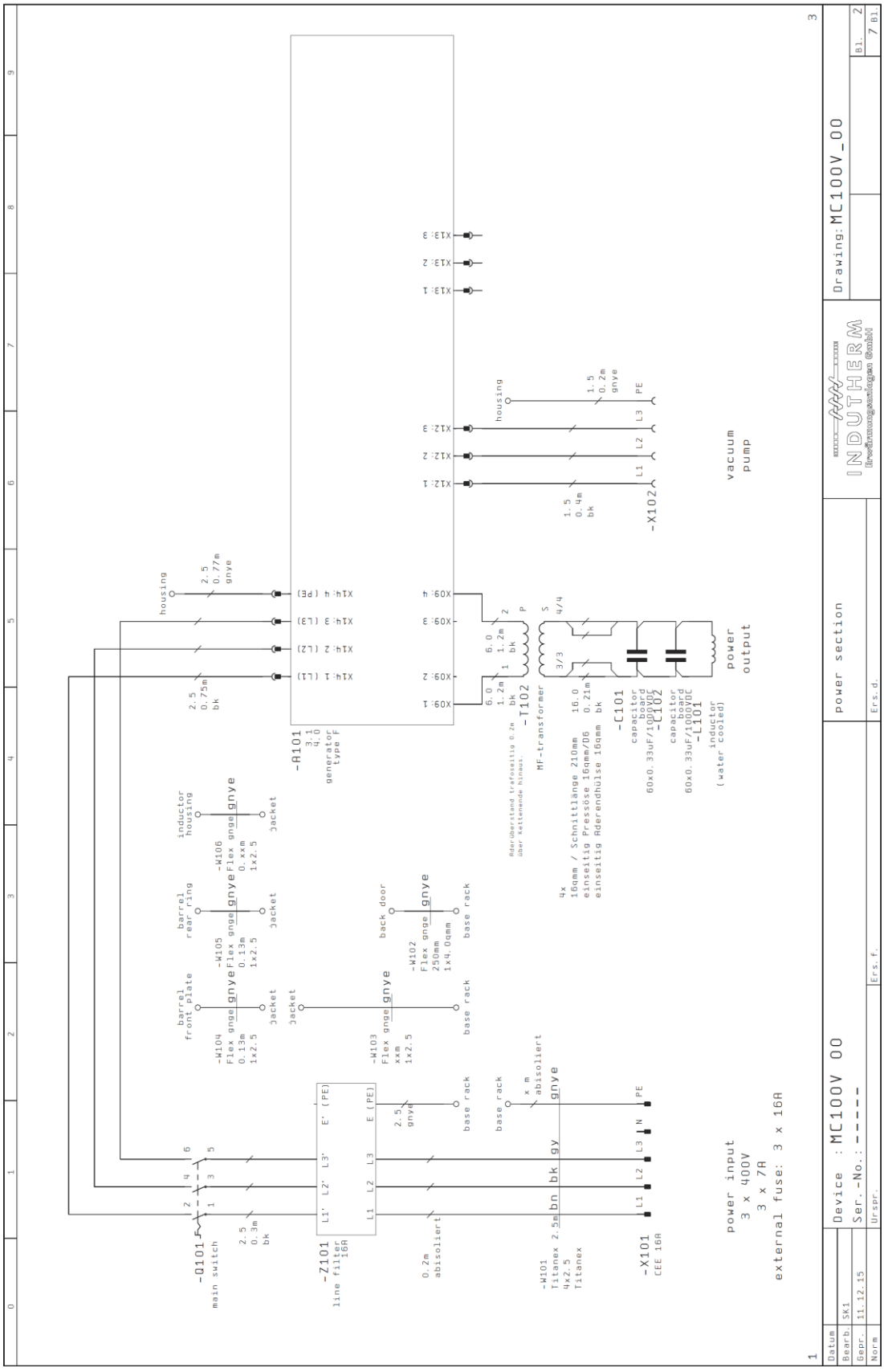


Figure 43: connection diagram –panel and temperature

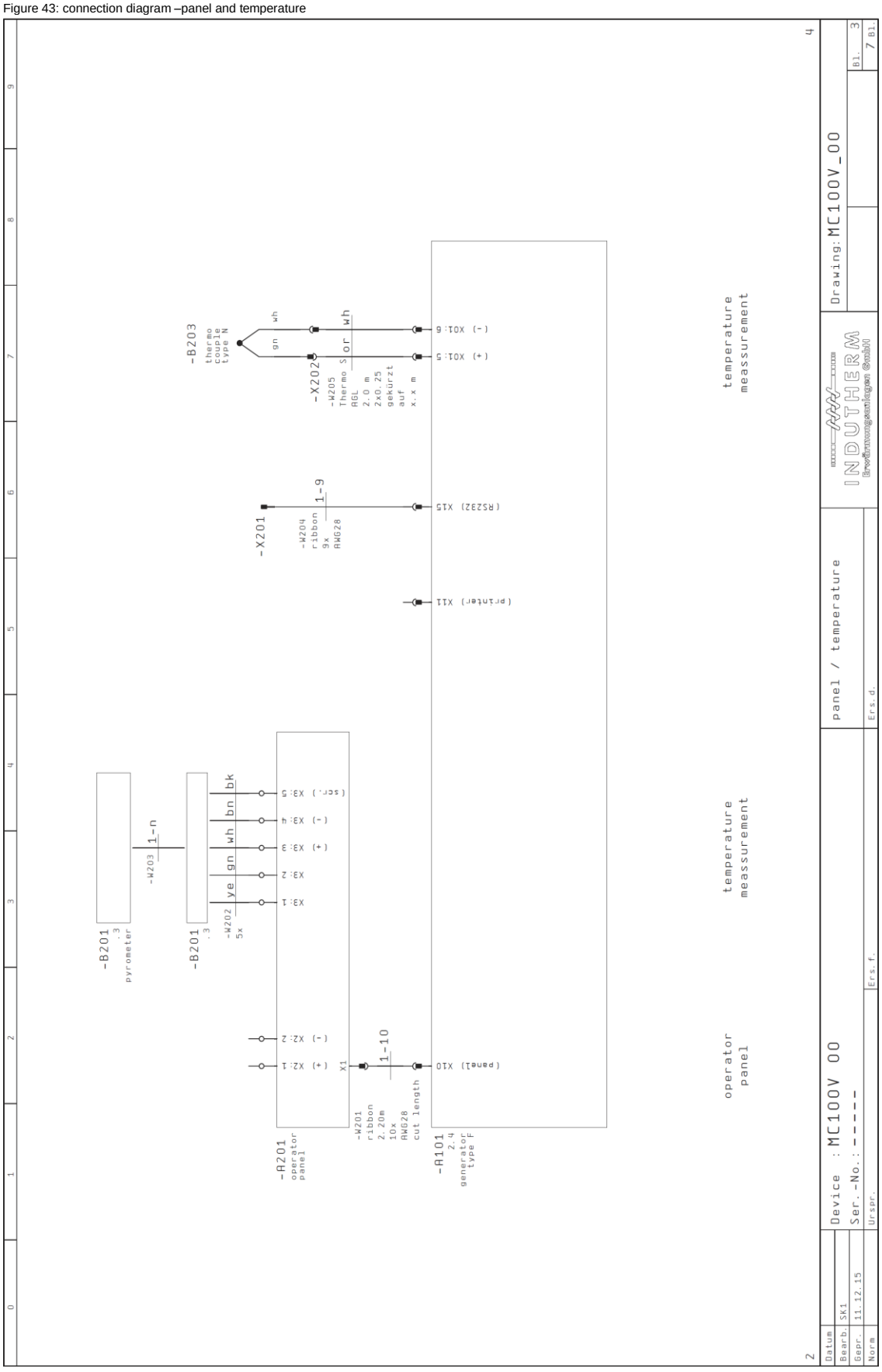


Figure 44: connection diagram – digital input/output

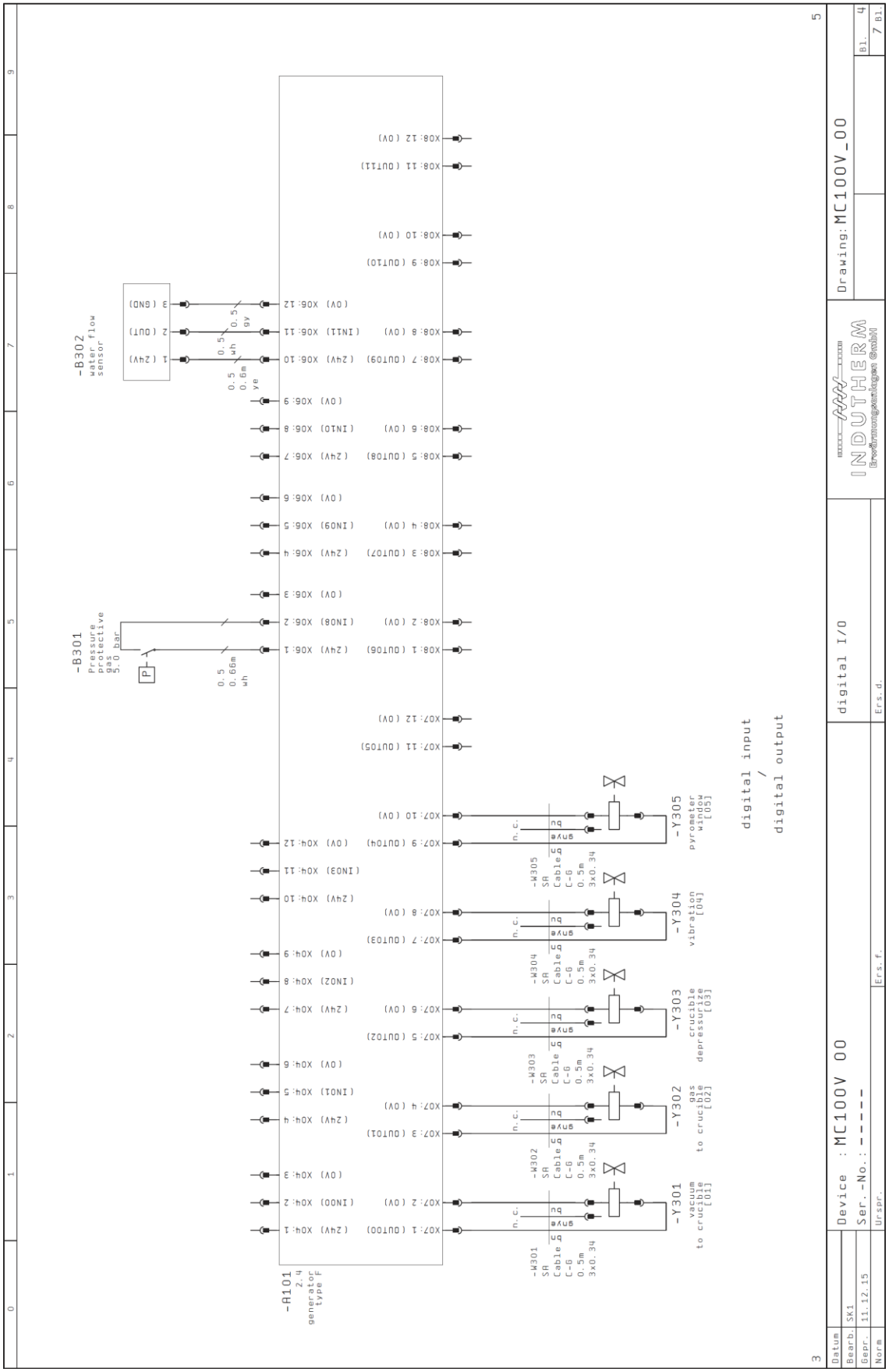
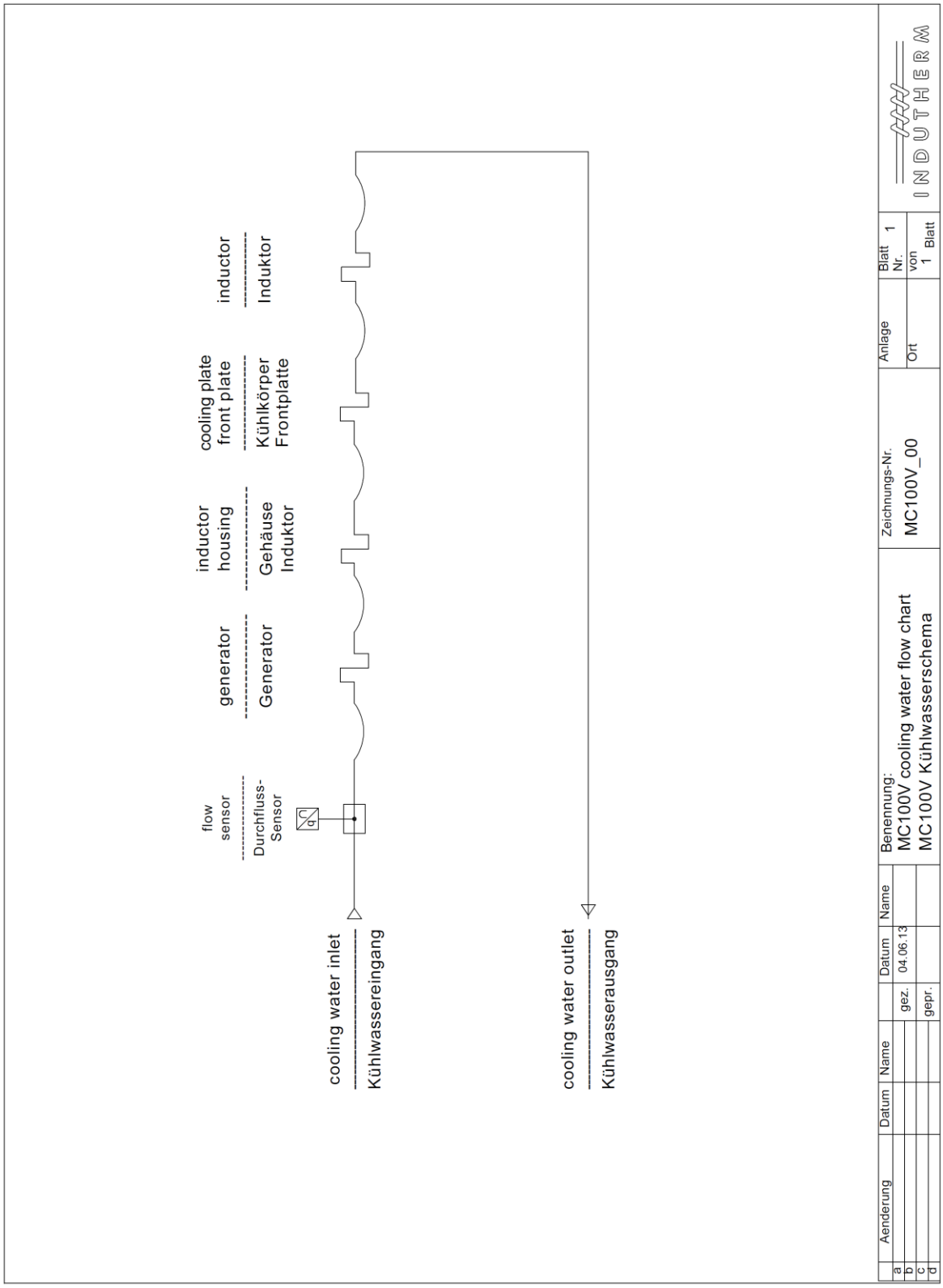
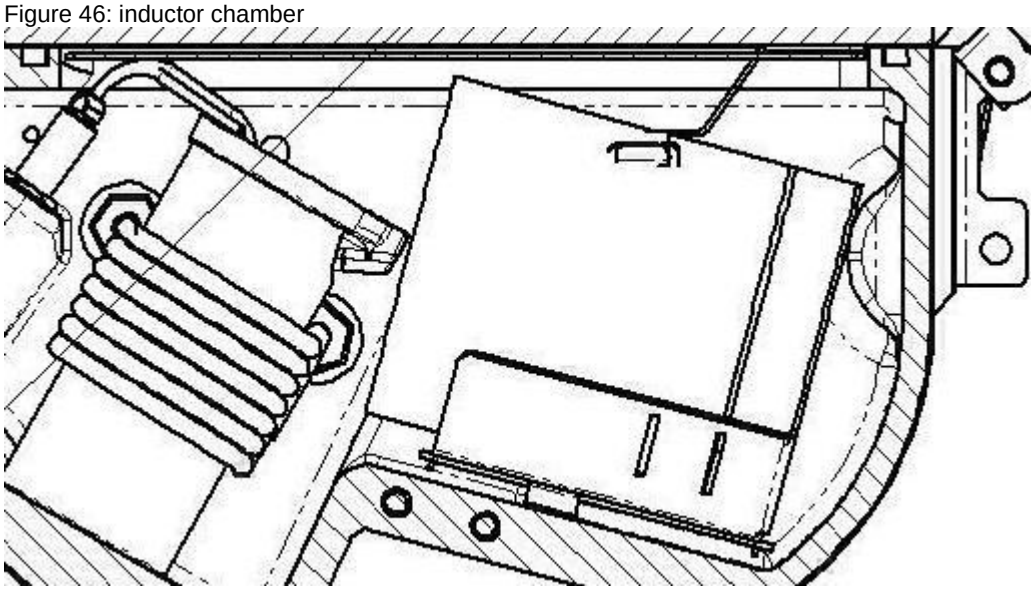


Figure 45: water flow diagram



10.4 Cut diagram of the replacement parts

Figure 46: inductor chamber



10.5 Consumable – and spare parts list

INDUTHERM is now using only machine specific spare parts list, which contain all the information for your machine.

At following page, the spare parts list for this machine will start.

The item number of the consumables list is composed by following parts:

1.) G (for starter kit/basic equipment)

2.) The next five digits are the machine service number.

3.) The following combination of letters describe the application (please read further below).

4.) The last two digits are the actual state, starting with '_00'.

One example: G19999_MC_00. This is the consumables list of machine no. 19999, equipped as mini casting machine with delivery index '00'.

At request we can send you the actual consumables list in PDF-format. Is there a consumable part or replacement piece replaced by an advanced or better one, change the index number in the end of item no. in ascending order, in this case to G19999_VC_01? This list replaces the previous edition with index ‚_00'. This should lead to the situation you have always access at the actual consumable and replacement parts of your machine.

For ordering of replacement and consumable parts please contact your dealer or at our order service with

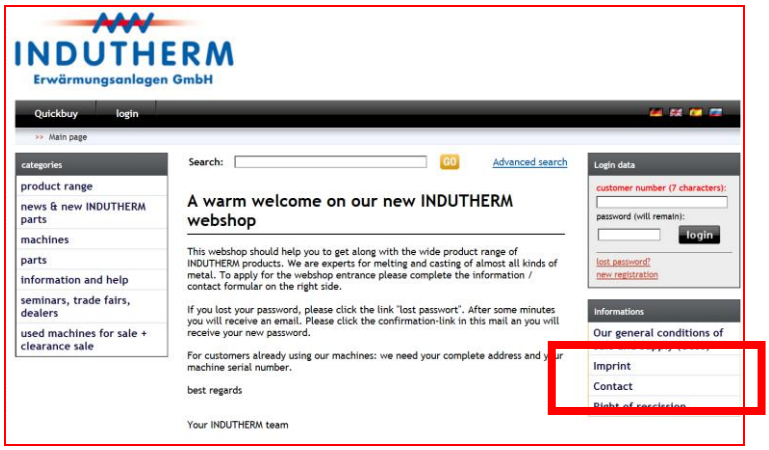
telephone number: +49-(0)-7203-9218-40.

10.6 Software documentation with error messages

Software-Documentation starts at next pages. The label of the bilingual documentation is “generator_documentation_80000xxx_customer_DM_F_PM_Gen.pdf”. xxx is the software state.

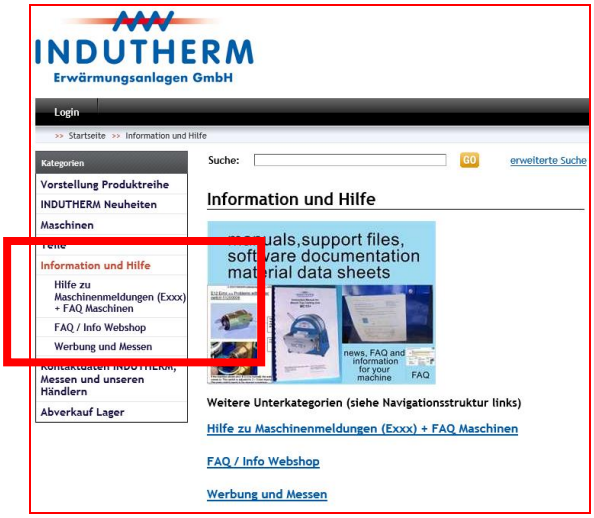
Please note: At our Internetpage http://www.indutherm.de/webshop you can get after registration access to important data.

Figure 47: contact form webshop



Until you can enjoy the advantages of the Webshop you have to apply for an access. Therefore please fill in the form of contact and send it to us. With mentioning the machine number you’ll get full access to webshop content.

Figure 48: Webshop help with machine messages



Then we will send you the access codes. You’ll find explaining documents in the subdirectory “help with machine messages”.