



Heraeus Megafuge11

SORVALL T1

Centrifuges

SERVICE MANUAL

11290095

*CAREFULLY READ THIS MANUAL AND THE OPERATING MANUAL
BEFORE REPAIRING YOUR INSTRUMENT*

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Revision Status

REV	DATE	AMENDED PAGES	NOTES
A	Oct 2006	Initial release	
B	Feb 2007	Extension to Sorvall T1	

CONTENTS

1	INTRODUCTION	4
	Purpose	4
2	Biological Risk	5
3	DESCRIPTION AND THEORY OF OPERATION	6
	Description	6
	Specification	6
	Installation precautions	7
	Component layout	8
	Mains front-end rack	8
	Functional principles	9
	Management of the induction motor	10
	3.1.1 Introduction	10
	3.1.2 The motor	10
	3.1.3 Power control operating principle	10
	Electronics	11
	3.1.4 Generality	11
	3.1.5 Differences between models (230V-120V)	11
	3.1.6 Micro Processor + PWR board	11
	3.1.7 Imbalance detector	12
	3.1.8 Speed sensor	13
	3.1.9 Inputs – Outputs connection	14
4	DIAGNOSTICS AND REPAIRS	16
	Introduction	16
	Messages	16
	Error codes and messages	16
5	REPLACEMENTS PROCEDURES	17
	Front panel removal	17
	Lid replacement (see Fig. 11)	17
	Centrifuge bowl removal (see Fig. 11)	18
	Imbalance sensor replacement (see Fig. 12)	18
	Motor replacement (see Fig. 11)	18
	Speed sensor and shock absorbers replacement (see fig.13)	19
	Lid latch assembly	20
	Replacement of the lid latch assembly	20
	Replacement of lid latch spare parts	21
	5.1.1 Micro-switches replacement ① & ②	21
	5.1.2 Latch replacement	21
	5.1.3 Reed relay (13)	21
	5.1.4 Solenoid (14)	21
	Electronic rack and Mains front-end rack removal (see Fig. 16)	22
	Gas spring replacement	22
	Micro Processor + PWR board replacement	23
	EPROM replacement	23
6	DIAGNOSTIC AND CALIBRATION PROGRAM	24
	Access to the Diagnostic Menu	24
	Imbalance Calibration	25
7	MOTOR VERIFICATIONS	26
	Motor checking	26
	Centering device assembly	26
8	SPARE PARTS LIST	27
	Centrifuge spare parts	27
	Electronic rack spare parts	28
	Motor spare parts	29
	Lid latch spare parts	30
	Mains front-end spare parts	31
	Rotors and Accessories	32
9	Appendix 1	33
	Wiring diagram 230 V version 50-60Hz	33
	Wiring diagram 120V version 60Hz	34

1 INTRODUCTION

Purpose

This manual contains maintenance instructions for Megafuge11 centrifuges and is intended for use by a qualified maintenance or service technician (We suggest reading also respective Operating Manual).

It is organised to provide maintenance personnel (Thermo or authorised service organisation) with basic data and information on the theory of operation to assist in troubleshooting, it outlines parts replacement and calibration procedures for putting the centrifuges back into service.

Should a specific maintenance problem arise which is not covered in this manual, please ask the authorised service organisation, or contact our division indicated here below.

Concerned units:

75004410	HERAEUS MEGAFUGE 11	230V 50/60Hz
75004411	HERAEUS MEGAFUGE 11	120V 60Hz
75002381	SORVALL T1	230V 50-60HZ
75002382	SORVALL T1	120V 60HZ

Note: Sorvall T1 models differ from Megafuge 11 only for the keypad membrane .

However it is always possible to have copies, updated or revisions of this manual contacting our division:



Technical Service Address

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2 BIOLOGICAL RISK

Most of the safety problems related to appliance maintenance are due to human errors caused by tiredness, lack of attention, negligence, incompetence, and more frequently than you might think, as a consequence of extreme “familiarity” with biological risk; attitudes which bring to underestimate the risk of exposure to pathogens.

It is not possible to carry out effective techniques of biological risk containment without taking into account previous attitude of final user. Any prevention and biological risk containment program has to be based on correct **information** and **training** aimed to make all people concerned adopt **ways of acting** so that risk of auto-contamination and contamination of working area is reduced to the minimum.

Potential exposed people directly or no directly concerned in lab activities are usually researchers, lab technicians, but also cleaning staff, maintenance personnel, no-technical personnel (employees, storekeepers, drivers, caretakers, etc.), occasional visitors (agents, visitors, etc.) and, in case of accidents or disasters, rescue service (firemen, stretcher-bearers, doctors, policemen, civil defence, etc.).

Technical, organisational and procedural measures for biological risk containment, according to Art. 79 of D.L. 626/94, must include:

Evaluation of the danger level and quantity of biological material handled,

A careful planning of working process to reduce or avoid the use of harmful pathogens and to reduce the number of exposed people,

The choice of technical measures of protection, collective and individual, as well as hygienic ones to prevent an accidental spreading of biological agents out of working place,

Arrangement of suitable procedures and systems for conservation, handling, collecting, and transporting inside and outside working place, safe discharge of biological material used and periodic check of an eventual presence of pathogens inside working place.

To satisfy partly requirements mentioned before, Thermo established a **Declaration of Decontamination**, which must be filled in by final user before sending the centrifuge to a Technical Assistance Centre. The principle that inspires this declaration is awareness that user only knows what has been put into the centrifuge, and who handles these substances only is able to choose and use suitable product for decontamination.

Obviously, this assumption of responsibility by final user does not relieve maintenance personnel of adopting protection measures against residual **risk** eventually occurring when handling a product that conditions of use are unknown. Anyway, residual risk can be further reduced by means of **Individual Protection Devices**: gloves (lattice made, not yet used), masks, safe glasses.

3 DESCRIPTION AND THEORY OF OPERATION

Description

The Megafuge11 is designed to separate substances made of different density elements by Relative Centrifugal Force (RCF).

Different rotating equipment can be used in order to match the sample containers and the required performances.

The maximum speed and by consequence the resultant RCF is a function of the rotor in use, swing-out rotor can usually carry a higher load than fixed angle or aerodynamic rotors which can spin at higher speed.

For more information on operating principle refer to the User's Manual.

Specification

		Dimensions
Height	H	37,5 cm
Width	W	40 cm
Depth	D	48 cm
Packaging	H x W x D	48 x 54 x 61 cm
		Weight
Net weight		40 kg
Net weight including packaging		45 kg
		Centrifugation characteristics
Max allowable capacity:		
swing-out		4 x 280 ml
fixed-angle		6 x 94 ml
Max allowable density		1200 kg/ m ³
Max allowable weight		1.34 kg
Max speed:		
swing-out		4100 rpm
fixed-angle		14600 rpm
Max RCF at Tip:		
swing-out		3176 x g
fixed-angle		23113 x g
Working temperature		Ta + ΔT
Max noise		< 63 dBA
		Electrical characteristics
Operating voltage:		230 V~ ±10% 50/60 Hz 120 V~ ±10% 60 Hz
Operating current		I _(max) V _{Mains} 5,5 A _{rms} 230 V 9,5 A _{rms} 120 V
Power max (steady)		400 W
Power max (acceleration)		930 W
Heat dissipation		1195 BTU/h

Other Characteristics

- Microprocessor controlled
- 4 quick selection programs
- RCF control
- Work temperature $T_{\text{ambient}} + \Delta T$
- Set/reading speed: 500 - 14600 rpm (10 - 100 rpm incr.)
- Acceleration profiles (5 shapes selectable)
- Deceleration profiles (5 shapes + 1 free coasting) selectable
- Set timer from 0.30 min up to 99 min + ∞
- Pulse key "Momentary Spin"
- Electronic (accelerometer) imbalance detector
- Three Phase Induction Motor
- Direct drive

Installation precautions

The centrifuge is designed to be safe under the following conditions:

- Indoor use
- Altitude up to 2000m
- Temperature: from 5°C to 40°C
- Maximum relative humidity 80% (for temperature up to 31 °C)
- Mains supply voltage fluctuation up to $\pm 10\%$ of the nominal voltage



Incorrect installation will affect safety and equipment performances.

The machine must be installed in a dust and non corrosive environment.

1. The Bench top must be rigid, sufficiently strong and levelled.
2. 300 mm of free space gap must be left on each side of the machine, behind to ensure the proper ventilation.

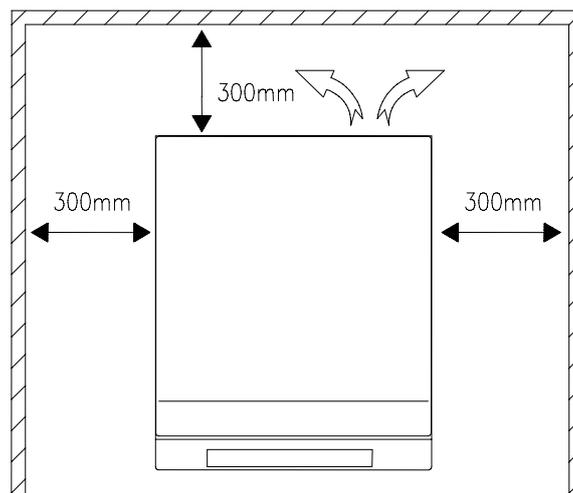


Fig. 1



The centrifuge could move as a result of rotor imbalance, rotor disruption or drive failure. To avoid dangerous consequences a safety envelope clearance around the unit must be respected.

Component layout

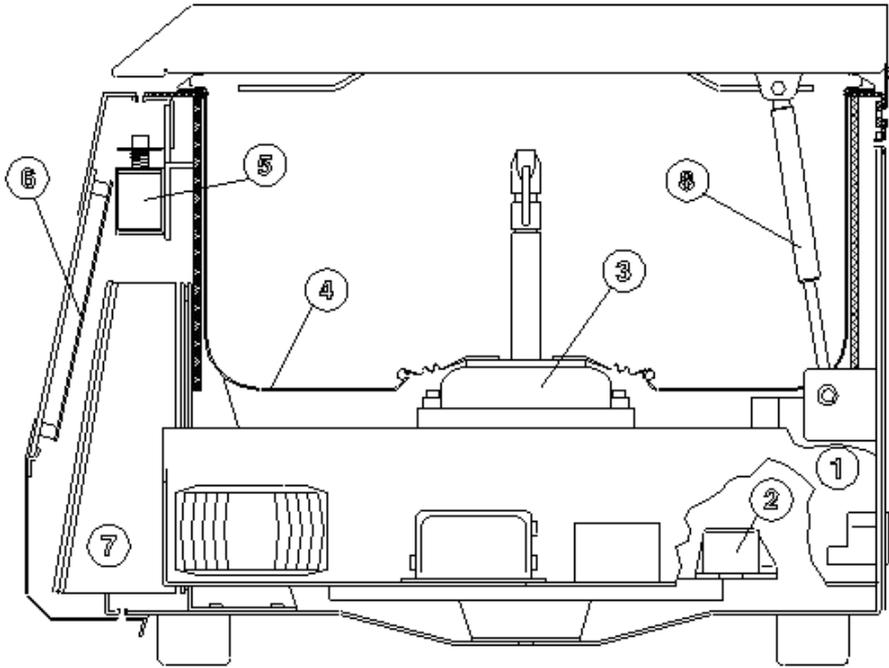


Fig. 2

- | | |
|--------------------------|-------------------------------|
| ① Inlet appliance | ⑤ Lid lock solenoid |
| ② Imbalance sensor | ⑥ Display assembly + keyboard |
| ③ Asynchronous motor | ⑦ μ P +PWR board |
| ④ Centrifugation chamber | ⑧ Gas spring |

Mains front-end rack

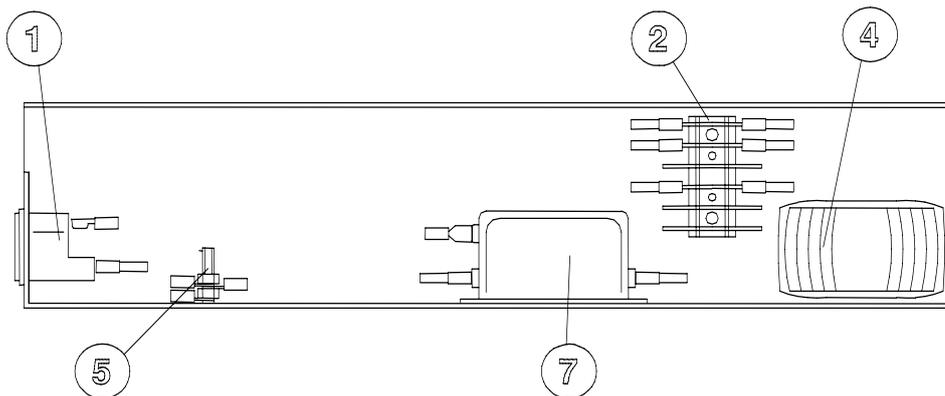


Fig. 3

- | | |
|------------------------------------|---------------------------------|
| ① Appliance inlet and fuses holder | ⑤ Protective conductor terminal |
| ② Terminal block Fast-on | ⑦ Mains filter |
| ④ Mains transformer | |

Functional principles

The microprocessor system controlling the Megafuge11 ensures the following functions:

Operator interface management

The operator interface, composed of a LED display and a keyboard, enables programming of the centrifugation parameters and visualisation of operating conditions in real time

Rotation speed servo-control management

From a tachometer signal, the microprocessor calculates in real time the controls to be applied to the power components to perform as programmed :

- rotor type identification (maximum speed restriction)
- acceleration and braking profiles
- rotating speed/g-force
- time

Management of the safety devices

The control system manages all the safety devices:

- lid locking system
- imbalance detection system
- zero speed detection system
- motor over-temperature detection system
- over-speed control

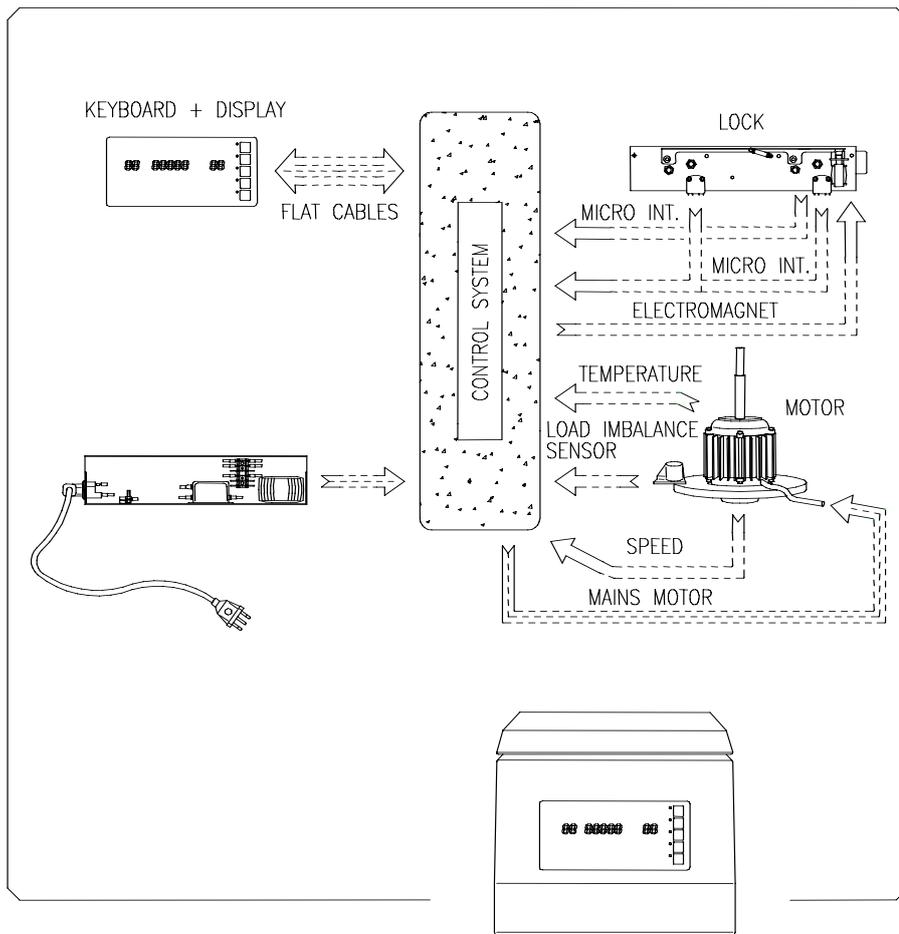


Fig. 4

3.1.1 Introduction

The Megafuge11 is equipped with an asynchronous 3 phase induction motor. During operation, the control electronics generates a system of sinusoidal 3 phase voltages, variable in amplitude and frequency. During the braking phase, the energy generated by the motor is dissipated through a resistor.

3.1.2 The motor

It is an AC Induction Motor, called squirrel cage motor, is comprised of a simple cage-like rotor and a stator containing three windings. The changing field produced by the AC line current in the stator induces a current in the rotor which interacts with the field and causes the rotor to rotate. No brushes are necessary in this design. The base speed of the AC motor is determined by the number of poles built into the stator windings and the frequency of the AC input voltage. Variable speed control of an AC motor can be accomplished by increasing or decreasing the input frequency. A load on the motor causes the motor to "slip" in proportion to the load.

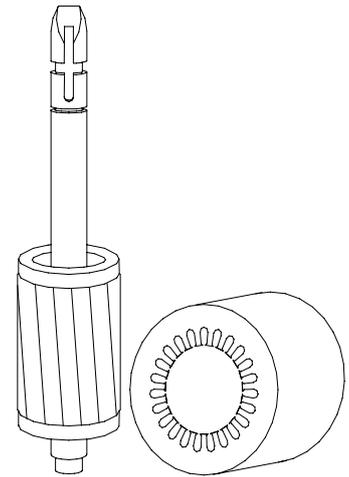


Fig. 5

3.1.3 Power control operating principle

It consists in a single phase rectifier (in case of 120V is used in the voltage doubler configuration) which converts the AC single phase source in a DC supply. Electrolytic capacitors are used to provide energy storage for the DC supply.

A three phase inverter consisting of six IGBT is used to drive the motor.

Three phase AC is then generated by using sine wave pulse with modulation. The microprocessor controls the voltages and frequency of the AC output supplied to the motor.

Because AC motor under sine wave excitation are also capable of generating a dynamic brake is used. When the speed command is reduced in an AC drive, the motor will regenerate. The real part of the three phase power flows from the motor to the inverter. This results in current flowing from the inverter into the DC bus capacitors. Because this energy cannot flow back into the AC supply it must be stored in the capacitors or dissipated through a brake resistor if the voltage will rise over the defined safety level.

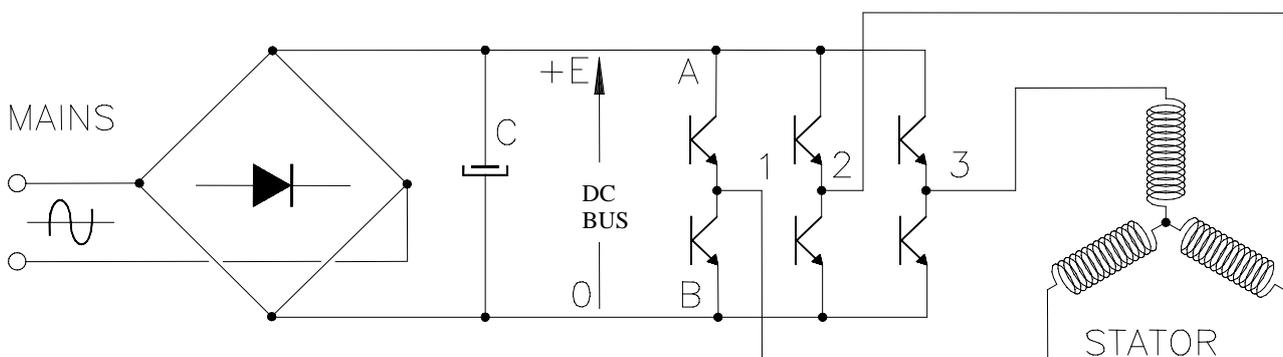


Fig. 6

3.1.4 Generality

Electronic consist in two boards:

- μ P + PWR board (equipped with 16bit micro-controller) located behind the front panel (see Fig.2, n.⑦).
The centrifuge management program is stored “EPROM” memory, configuration data are stored in non-volatile “RAM”.
- User interface (display and a keyboard) attached directly on the rear of the front panel (see fig. Fig. 2.⑥).

The imbalance sensor is fixed on motor counterweight trough elastic suspension (see Fig. 2, number ②); it detects motor vibrations (usually caused by improper rotor load).

3.1.5 Differences between models (230V-120V)

The main difference between 230V and 120V is on the input stage of the motor power control. As mentioned in par. 3.1.3 the single phase rectifier, in case of 120V, is used in the voltage doubler configuration. The bridge rectifier is onboard for the 230V version, located on the electronic rack (see par.0 - ④) for the 120V. So two different μ P + PWR boards are used.

3.1.6 Micro Processor + PWR board

3 distinct areas can be identified on this board. Each of the 3 areas has its own power supply. Insulation between the different parts is ensured by the use of opto-couplers. (Fig.7).

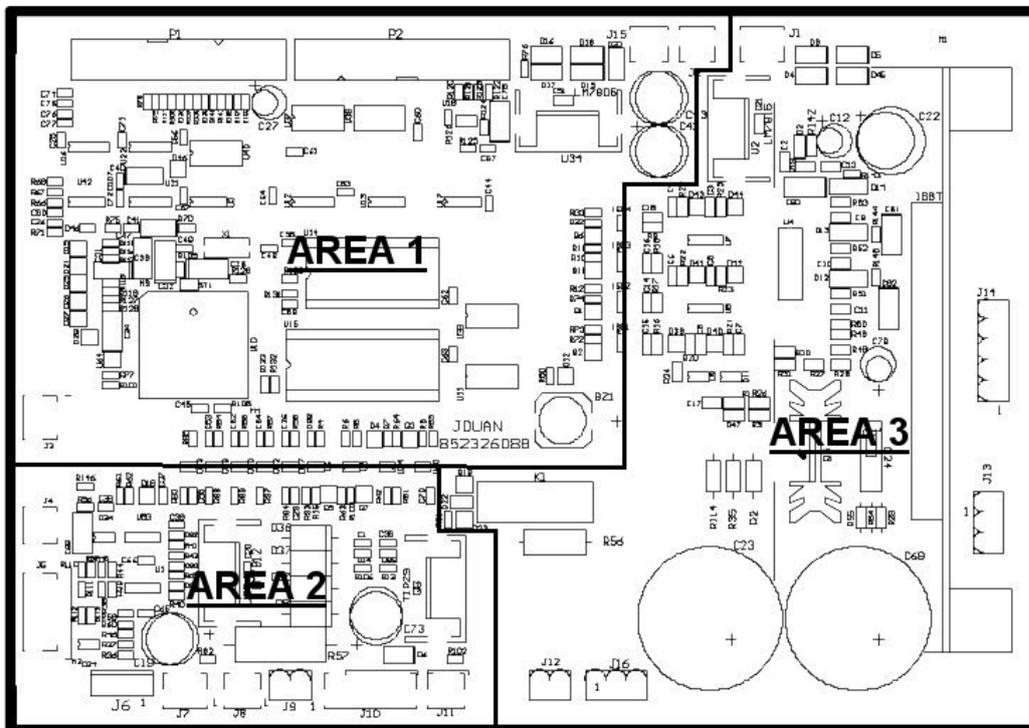


Fig. 7

AREA 1

It includes the microprocessor, the EPROM, the RAM memory and the backup battery. The power supply for this part of circuits is 5 V_{DC}.

AREA 2

It consist in sensors interface and signal conditioning circuits, including the Opto-couplers which improve the level of noise immunity

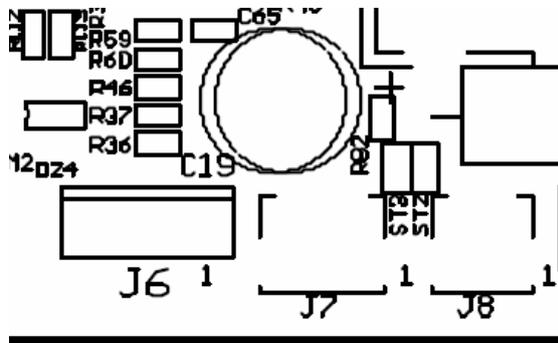
The power supply for this part of circuits is 12 V_{DC}.

Note: In case of replacement of MOTOR or μ P+PWR it is mandatory to have the proper jumpers configuration



The motor with magnetic speed sensor
REQUIRES

Jumper ST2 = Closed (short circuit)
Jumper ST3 = Open



AREA 3



CAUTION : RISK OF ELECTRIC SHOCK !

Includes all the power circuits and it is directly connected to the mains.

Main function are:

- DC bus (320 Volt_{DC}), the incoming AC power is rectified and filtered to supply the 3 phases motor inverter
- The optical insulation (barrier which provides protection against electric shock) between life parts and microprocessor circuits
- Three phase inverter consisting of six IGBT (one package module) and his control logic circuit.
- Motor brake (IGBT).

3.1.7 Imbalance detector

The imbalance sensor detects the mechanical vibration of the motor which are converted in electric signal managed by the microprocessor.

In case of anomalous vibration the run is aborted.

Imbalance sensor connector (J4 μ P + PWR board) :

- pin 1: Power Supply +12V
- pin 2: GND
- pin 3: SIGNAL

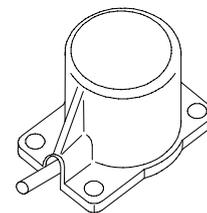


Fig. 8

3.1.8 Speed sensor

It is a magnetic encoder system based on aluminium disk holding two magnets and a Hall-effect sensor underneath (see Fig. 13).

Magnetic sensor connector (J7 μ P + PWR board):

pin 1: GND

pin 2: SIGNAL

pin 3: Power Supply +12V (selected by Jumper ST2)

pin 4: Not used

3.1.9 Inputs – Outputs connection

230V version

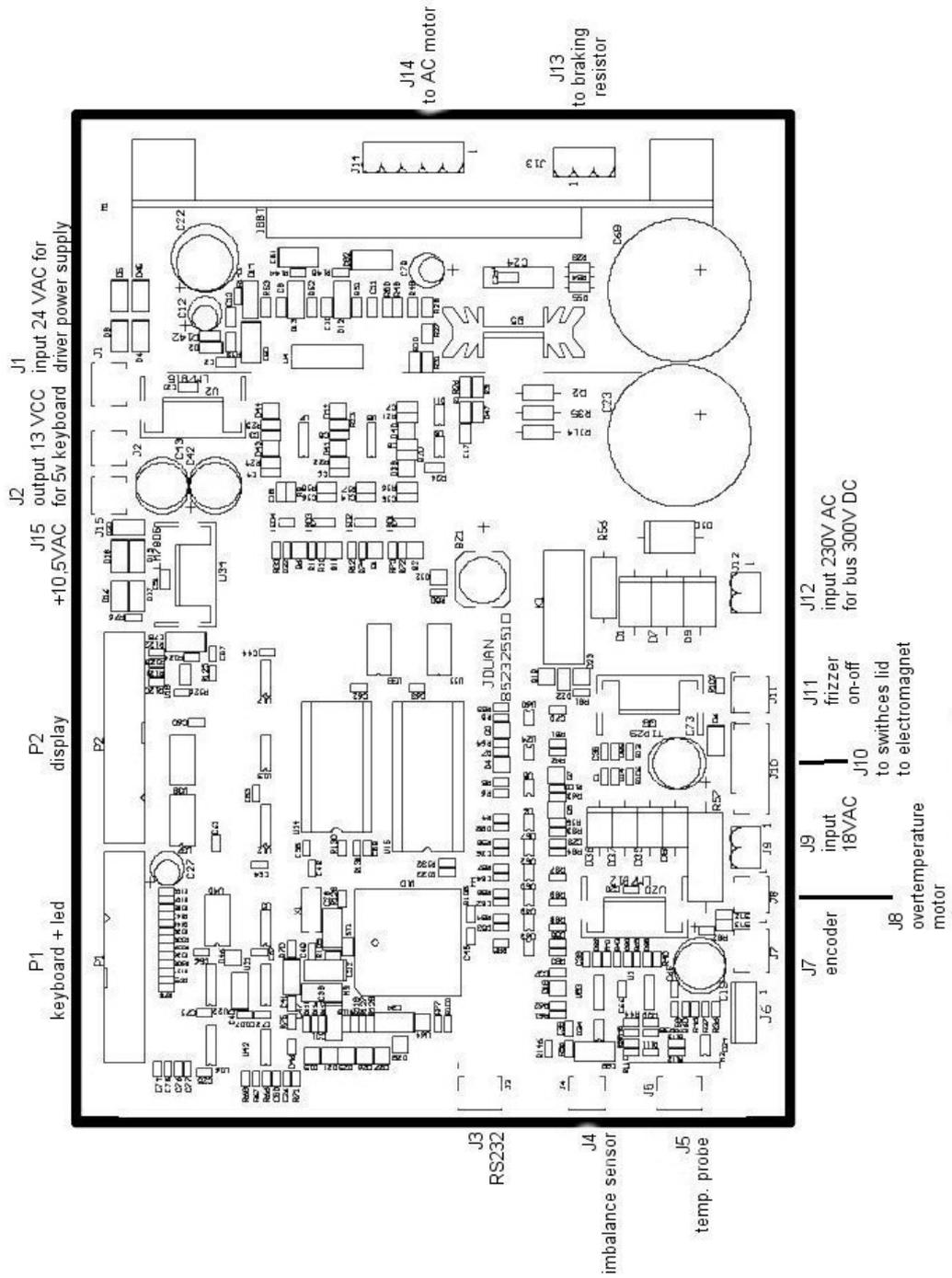


Fig. 9

4 DIAGNOSTICS AND REPAIRS

Introduction

The Megafuge11 has some built-in functional tests which facilitate checks such as for the tachometer generator and lid lock solenoid.

In case of anomaly the display shows error codes combined with an audible alarm.

Messages

At power on:

- The "TIME" display shows the CENTRIFUGE MODEL (M11)
- The "SPEED" display lights all the segments (88888).
- The "TEMPERATURE" display shows the PROGRAM -EPROM REVISION (A, B, C....).

Error codes and messages

When a problem is detected an error code (combined with audible alarm) is displayed. According to the severity of the anomaly the run can be aborted, in this case the centrifuge stops automatically. For the details refer to the following table:

CODES	REASON	COMMENTS/EXIT
E 01	Incorrect speed measurement -The rotor will brake to a stop. -Lid opening is impossible till speed is zero and a 4 minutes- timeout is expired	Wait for rotor to stop. Wait for the 4 minutes timeout. To erase the message , open the lid, turn the power switch off and turn the power switch on
E 03	Power was interrupted during a run. -At power off the rotor will coast to a stop.	Press any keyboard button to erase this message. Note: if Error 01 has been detected and not cleared, as above described, the alarm reset is possible only after a safety time of 30 minutes
E 04 E 06 E 08	Speed > 0 RPM at power ON -The rotor will coast to a stop. Lid open in running mode -The rotor will brake to a stop. Motor Over-temperature OR Lid lock error -The rotor will brake to a stop.	Wait for rotor to stop. Press any keyboard button to erase this message. Wait for the centrifuge to stop. Press any keyboard button to erase this message. Wait for the centrifuge to stop. Press any keyboard button to erase this message. Wait for motor cooling down.
E 11	Electronic failure - All controls are disabled	To erase the message turn the power switch off and turn the power switch on
LID	Lid open at start - The centrifuge doesn't start if the lid isn't properly closed	Press any keyboard button to erase this message. Close the lid and press "START"
IMBAL	Imbalance. - The rotor will brake to a stop.	Wait for the centrifuge to stop. Press any keyboard button to erase this message. Verify that a balanced load is installed. Inspect the rotor and rearrange the tubes, or add additional tubes with fluid to balance the rotor.

5 REPLACEMENTS PROCEDURES



CAUTION:

**BEFORE ANY REPLACEMENT PROCEDURES
DISCONNECT THE MAINS, REMOVING THE POWER CORD FROM
THE CENTRIFUGE !**

Front panel removal

Removal of the control panel allows access to many internal components. Follow this procedure to remove the front control panel:

1. Unplug the unit
2. Remove the 5 screws from the top and bottom edge of the front panel
②
3. Disconnect the wire harnesses:
 - the mains switch wires
 - the Flat Cables
 - the display power supply cable
 - the protective earth wire.

The two Flat Cables can be disconnected either from the μ P+PWR side (connectors P1 and P2) or from the front panel: it is better to disconnect all of them from the same side to avoid errors during refitting. Disconnect the display power supply cable (red-black) from the front panel.

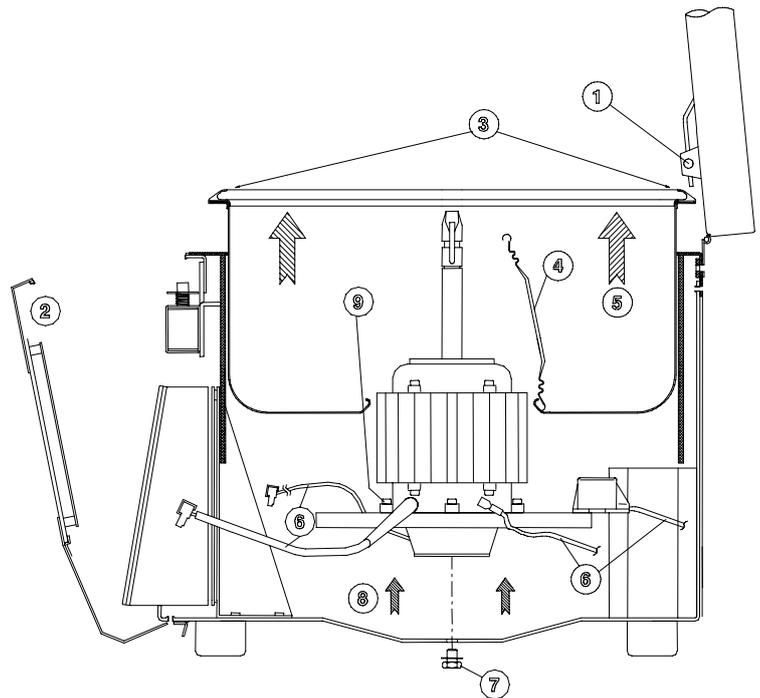


Fig. 11

Lid replacement (see Fig. 11)

1. Open the lid
2. Remove the spring pin from the gas spring ①
3. Unscrew the five screws connecting the lid to the lid hinge
4. Remove the lid.
5. Replace the lid in the same fashion, reversing the steps



FIXING SCREWS MUST BE CONSIDERED AS A COMPONENTS OF MECHANICAL SAFETY. CHECK CAREFULLY THAT THEY HAVE BEEN STRONGLY TIGHTENED !

Centrifuge bowl removal (see Fig. 11)

1. Remove the spring pin from the gas spring ①
2. Remove the bowl gasket ③ and unscrew the 3 screws from the centrifugation chamber top.
3. Remove the bowl-motor gasket ④.
4. Remove lifting-up the centrifugation bowl ⑤.

Imbalance sensor replacement (see Fig. 12)

1. Remove the bowl (see paragraph 0)
2. The detector is located on the motor counterweight
3. Unscrew the 2 screws and remove the sensor
4. Unplug the wire harness from the μ P+PWR board, J4
5. Replace the sensor in the same fashion, reversing the steps
6. **Perform the sensor calibration**

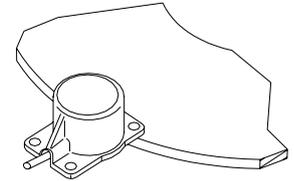


Fig. 12

Motor replacement (see Fig. 11)

1. Remove the front panel ② (see par. 0)
2. Remove the μ P+PWR board
3. Remove the spring pin from the gas spring ①
4. Remove the bowl gasket ③ and unscrew the 3 screws from the centrifugation chamber top.
5. Remove the bowl-motor gasket ④.
6. Remove lifting-up the centrifugation bowl ⑤.
7. Disconnect the motor wire harnesses ⑥:
 - Encoder (J7, μ P+PWR board),
 - Imbalance sensor (J4, μ P+PWR board)
 - Temperature sensor (J8, μ P+PWR board)
 - Motor windings (from the contactor)
8. Unscrew the motor fixing screw ⑦ located on the centrifuge basement plate
9. Unscrew the 4 screws (Allen key, number 4) to separate the motor from the counterweight .
10. Lift the motor up ⑧
11. Replace the motor in the same fashion, reversing the steps.



**Check jumpers ST2 and ST3 (on μ P+PWR board), as described in par 3.1.6
Check the rotation direction of the motor. IT MUST BE COUNTERCLOCKWISE**

Speed sensor and shock absorbers replacement (see fig.13)

1. Remove the bottom flange ① unscrewing the 5 Phillips screws ②
2. Remove the encoder disk ⑥ unscrewing the screw ④ and the elastic washer ⑤
3. Remove the Hall effect sensor removing the 3 screws (10,11,12)
4. Unscrew the 5 shock absorbers ③
5. Remove the flange ⑦ unscrewing the 3 screws ⑧
6. Replace the flange and the shock absorbers reversing the steps
7. Replace the sensor reversing the steps
8. Replace the encoder disk reversing the steps



**Screws ② ④ ⑧ (10) must glued using
"Loctite 243"**

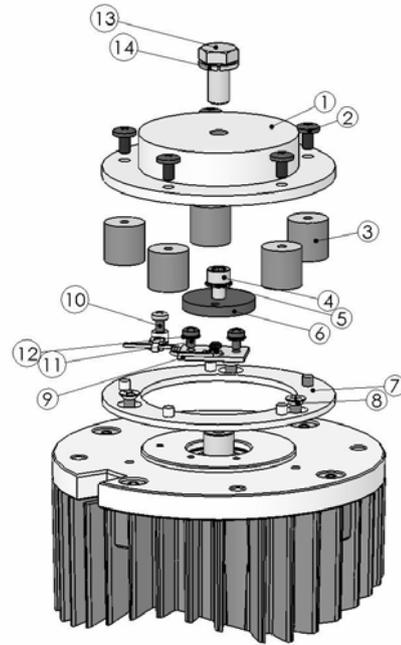


Fig. 13

Lid latch assembly

The latch assembly consists of the handle, two latches, 2 switches, a linkage, a locking solenoid and a reed relay. The cover strikers engages the latches, and when the latch is locked in the closed position disengage the two switches. The solenoid when is not activated locks the linkage movement. The switch senses the status of the cover (open, closed), the reed relay senses if the handle (and the linkage) is locked.

Replacement of the lid latch assembly

1. Open the lid.
 - Remove the front panel unscrewing the five screws (see Fig. 11) and disconnect:
 - the mains switch wires
 - the Flat Cables
 - the display power supply cable
 - the protective earth wire.
2. Disconnect the lid latches assembly from the μ P+PWR board (J10).
3. Unscrew the four Phillips screws①.
4. Remove the lid lock mechanism support
5. Reassemble (reversing the steps) with the new lid latch ensuring the alignment to get the proper latching

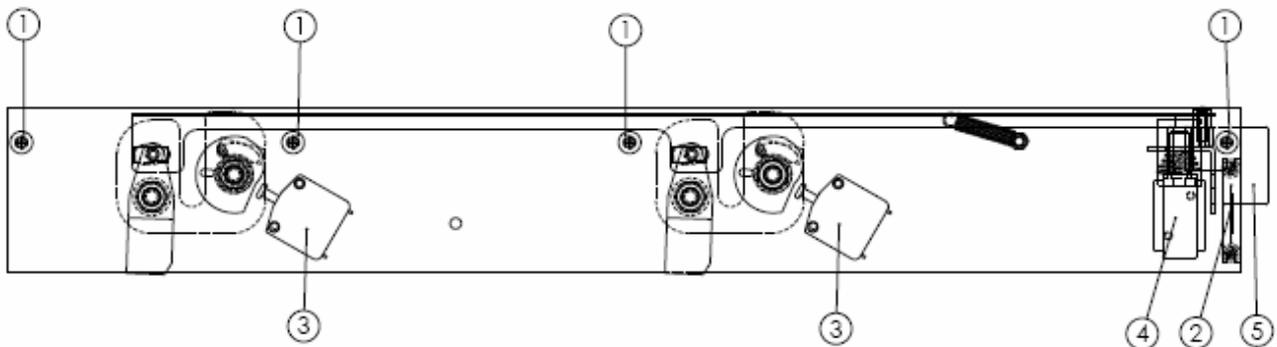


Fig. 14

- ① Fixing Phillips screws
- ② Solenoid micro-switch
- ③ Lid micro-switches
- ④ Solenoid
- ⑤ Lid handle

Replacement of lid latch spare parts

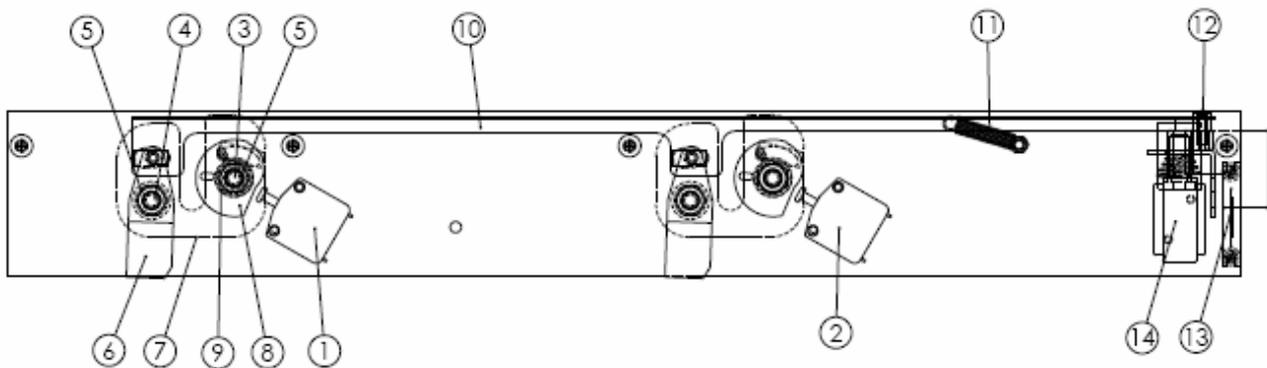


Fig. 15

5.1.1 Micro-switches replacement ① & ②

1. Disconnect the Fast-on connectors
2. Remove the two screws that secure the switch in place ②
3. Reposition the new switch securing it with the screws
4. Connect the Fast-on connectors
5. Test the lid latch (use a multimeter to measure resistance across the switch leads)
 - Switch ① should read open, when the cover is open (closed, when the cover is closed)
 - Switch ② should read open, when the cover is open (closed, when the cover is closed)
 - The reed relay should read closed when the solenoid is activated

5.1.2 Latch replacement

1. Remove the lid latch assembly as described in par 0
2. Unscrew the nut ⑤
3. Remove the mass ⑥
4. Extract the screw ④
5. Unscrew the nut ⑨
6. Remove the cam ⑧
7. Unscrew the nut underneath the cam
8. Extract the screw ③
9. Remove the latch ⑦
10. Replace the latch in the same fashion, reversing the steps

5.1.3 Reed relay (13)

1. Remove the two plastic screws
2. Unsolder the wire harness
3. Replace the sensor reversing the steps
4. Test the reed relay (use a multimeter to measure resistance across the sensor)
 - The reed relay should read open when lid is open (and the unit is not powered)
 - The reed relay should read closed when the solenoid is activated (during centrifugation)

5.1.4 Solenoid (14)

1. Remove the lid latch assembly as described in 0
2. Disconnect, cutting, the wiring to the solenoid
3. Unscrew the two fixing screws (latches side)
4. Slide the locking plunger out
5. Replace the new solenoid reversing the steps

6. Verify that the locking plunger is moving freely

Electronic rack and Mains front-end rack removal (see Fig. 16)

On the Electronic rack are located the μ P+PWR board, the motor contactor, and the brake resistor (behind the μ P board). Remove the μ P board to access the brake resistor.

On the mains front-end rack are located the mains inlet socket with fuses, the line filter, the terminal block and the mains transformer. To replace one of those components the rack must be removed.

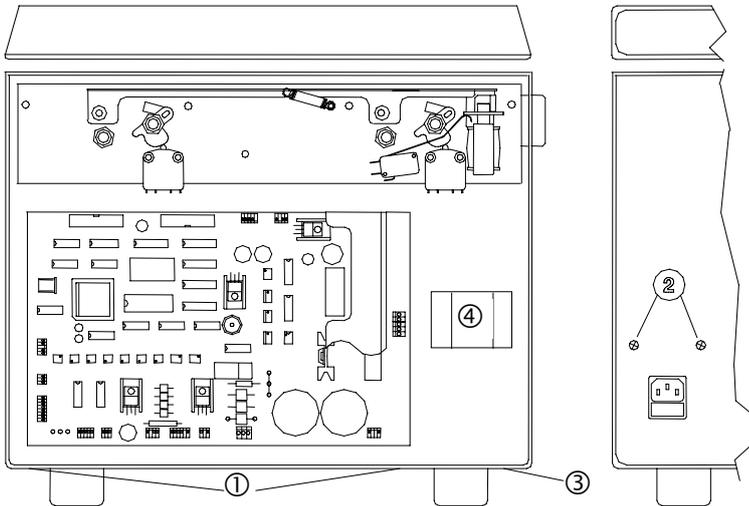


Fig. 16

1. Remove the front panel (see par 5.1)
2. Disconnect the wire harness to the contactor ④
3. Disconnect all cable μ P+PWR board and the protective earth wire
4. Remove the electronic rack unscrewing the 4 screws ① located on the bottom of the centrifuge
5. Unscrew the Mains front-end rack (2 screws ② on the rear panel and 2 screws ③ located on the bottom of the centrifuge)
6. Slide out the Mains front-end rack

Gas spring replacement

1. Remove the front panel (see par 0)
2. Remove the centrifuge bowl (see par 0)
3. Remove the Electronic rack (see par 0)
4. Remove the Mains front-end rack (see par 0)
5. Remove the gas spring unscrewing the bolt located inside the centrifuge underneath the protective ring
6. Replace the gas spring reversing the steps

Micro Processor + PWR board replacement

1. Remove the front panel (see par 0)
2. Disconnect all cables and wire harnesses from the board:
3. Remove the board unscrew the 5 nuts.
4. Replace the board reversing the steps



Don't forget the plastic insulation foil (Mylar®) between the chassis and the board.

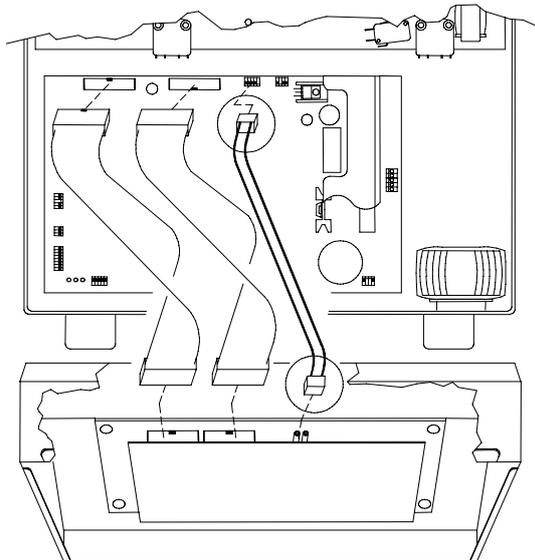


Fig. 17

EPR0M replacement

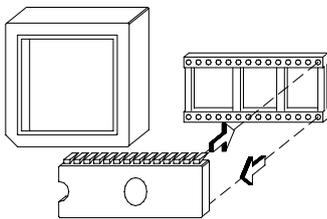
It is not required to remove the P+PWR board for the EPROM replacement



ATTENTION

STATIC SENSITIVE.

Proper handling and grounding precaution required



FOR EPROM REPLACEMENT USE ONLY THE SUITABLE EXTRACTOR !

DURING REPLACEMENT OPERATION KEEP THE EPROM PARALLEL TO THE SOCKET

INSERT THE NEW EPROM KEEPING THE KEY (SLOT) TOWARDS THE MICROPROCESSOR, ALWAYS USING THE EXTRACTOR

1. Unplug the unit
2. Remove the front panel (see par 4.1)
3. Replace the EPROM
4. **Perform the Memory Reset and the Imbalance calibration as described in par. 6**

6 DIAGNOSTIC AND CALIBRATION PROGRAM

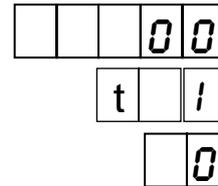
The centrifuge has a built-in diagnostic program which can be accessed by pressing a combination of buttons at power on.

Access to the Diagnostic Menu

1. At power-on, while the buzzer is activated press simultaneously the buttons “acceleration” and “deceleration” ramps



2. The display will show



3. **Memory Reset**

Keep pressed simultaneously (3 sec) the buttons “Pulse” and SPEED ▲ . The default imbalance level, **350**, is loaded



AND



After a memory reset is mandatory to proceed with the imbalance calibration

4. **Solenoid test**

Pressing the button “user’s program 2” the solenoid will be powered



5. **User’s programs reset**

Pressing the button “user’s program 4” the User’s programs will be cleared



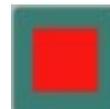
6. **Imbalance calibration menu**

Press the “Start” button to access the **Imbalance calibration menu**



7. **Exit from Diagnostic and calibration Program**

Press the button “Stop” to exit from

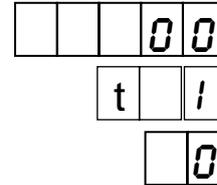


Imbalance Calibration

1. At power-on, while the buzzer is activated, press simultaneously the buttons "acceleration" and "deceleration"



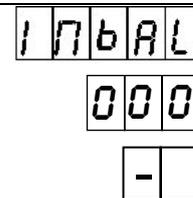
2. The display will show



3. **Second menu**
Press the "Start" button to access the **Imbalance calibration menu**



4. The display will show

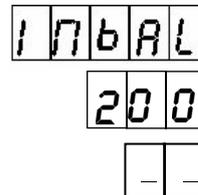


5. Install the rotor **T41 (unloaded)** and press the "Pulse" button. The first calibration cycle (**2500rpm, 50 sec**) will start.



The rotor must be balanced. The difference in weight between buckets should be maximum $\pm 0,5$ grams

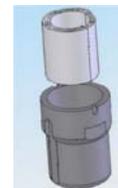
6. At the end of the run the imbalance level measured is displayed.



For a balanced rotor the value detected shall be < 200

If the value is > 200 and the rotor is balanced the sensor could be defective

7. Load bucket n° 1 with the calibrated weight (17 grams-Mylar)
8. Press the pulse button, the second calibration cycle will start (2500rpm, 50 sec).
At the end of the run the imbalance level detected will be displayed.



The imbalance level must be between 300 and 700

9. **Exit from Diagnostic and calibration Program**
Press the button "Stop" to exit from



7 MOTOR VERIFICATIONS

Motor checking

Simple electrical tests suggested to verify the status of the motor, (use a multimeter to measure resistance across the motor windings).

Check :

1. Electrical continuity between all the two phases combinations.
In case of open circuit the motor will not run
2. Resistance of two phases values must be $7\Omega \pm 20\%$
3. The difference between two phases should not differ more than $\pm 0.2\Omega$;
If not the motor doesn't run smoothly (jerks)

Centering device assembly

Verify:

1. the correct washers sequence
2. the free movements of the washers
3. the washers must be properly greased.

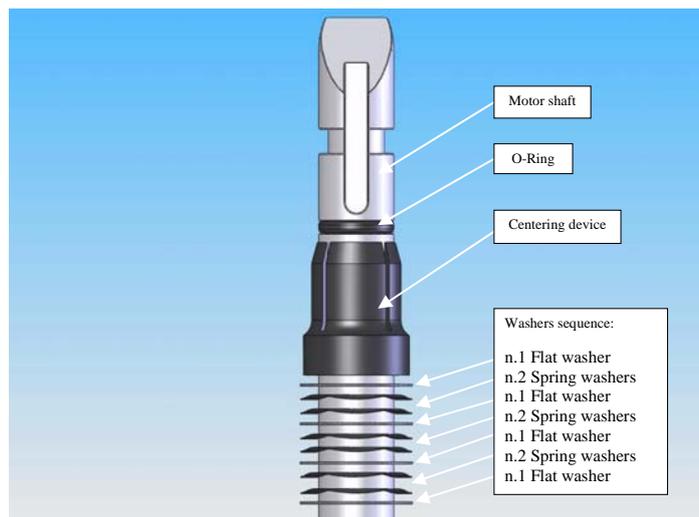


Fig. 18

Centrifuge spare parts

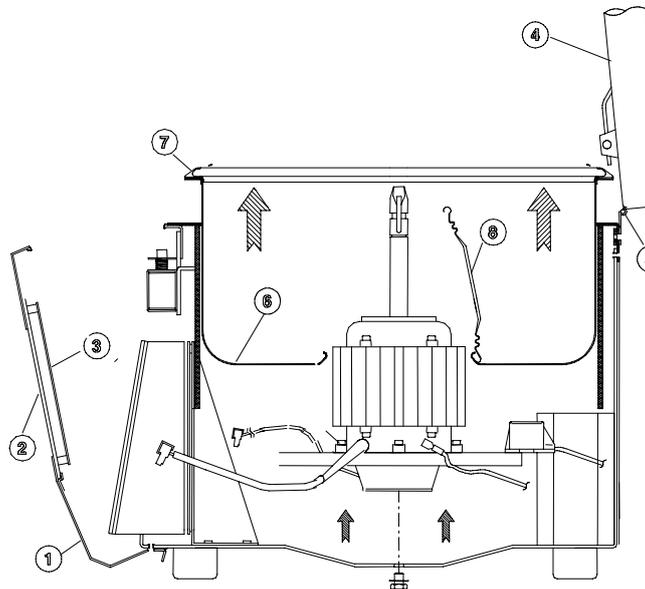


Fig. 19

Reference	CAT n.	DESCRIPTION	Qty.
	25535010	Tool to open the unit without power	1
	11202979	Tool to remove the rotor	1
	86005398	Grease for buckets	1
See Fig. 19			
Fig 19 - ①	89000838	Mains switch	1
Fig 19 - ②	39903507	Keypad membrane Megafuge 11	1
Fig 19 - ②	11250236	Keypad membrane Sorvall T1	1
Fig 19 - ③	89003600	Display board	1
Fig 19 - ④	11250223	Lid Assy	1
	85240195	Latch strike (hook)	1 of 2
Fig 19 - ⑤	11200717	Lid hinge	1
	26962012	Gas spring	1
Fig 19 - ⑥	89002039	Centrifugation bowl chamber	1
Fig 19 - ⑦	89000943	Bowl gasket	1
Fig 19 - ⑧	89000839	Bowl-Motor gasket	1
	11200593	Centrifuge feet	4
	11201653	Inner plastic part of the lid	1

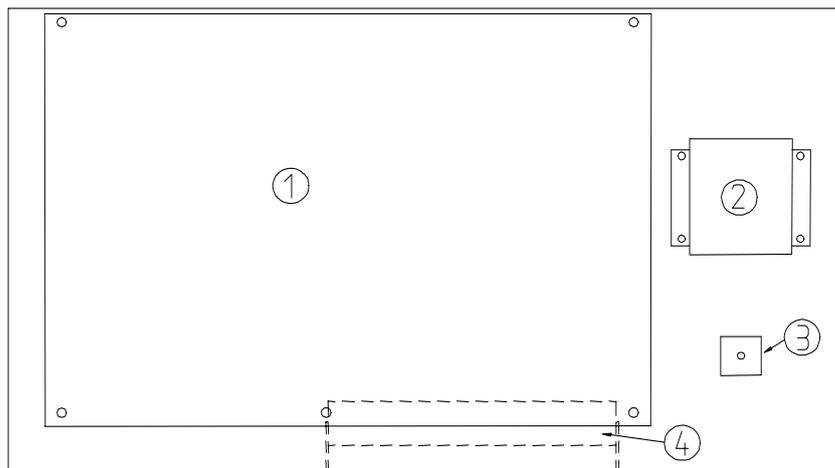


Fig. 20

See Fig. 20			
① + ② + ③ + ④	85481424	Electronic rack (kit of components 230V)	1
Fig 20 - ①	39903581*	μP+PWR board (230V)	1
Fig 20 - ②	86004585	Contactor (230V)	1
Fig 20 - ④	86001432	Brake resistor	1
① + ② + ③ + ④	85481425	Electronic rack (kit of components 120V)	1
Fig 20 - ①	39903582*	μP+PWR board (120V)	1
Fig 20 - ③	86004598	Bridge rectifier (120V)	1
Fig 20 - ②	86004586	Contactor (120V)	1
Fig 20 - ④	86001432	Brake resistor	1
	11250221	EPROM programmed	1

* doesn't contain eprom

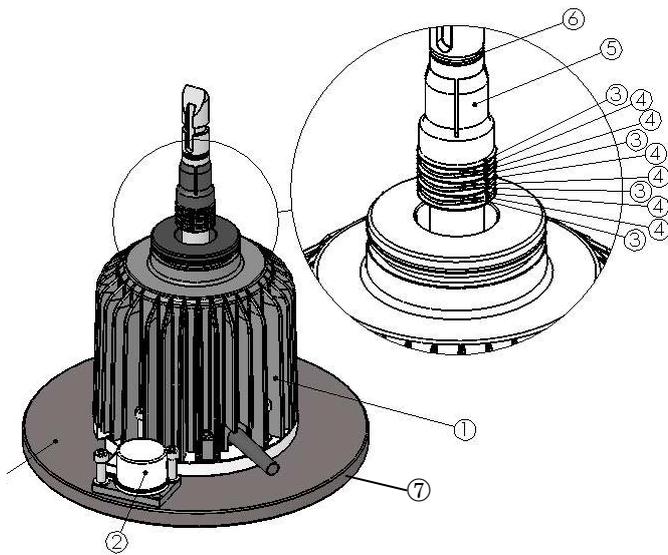


Fig. 21

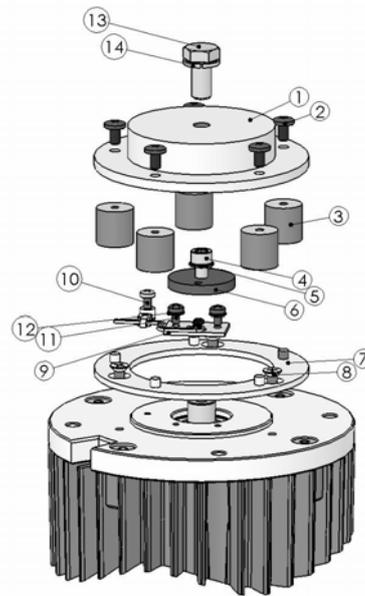


Fig. 22

Reference	CAT n.	DESCRIPTION	Qty.
See Fig. 21			
Fig. 21	11250202	Motor assy	1
Fig.21 - ③④⑤⑥	11250172	Shaft accessory Kit	
Fig.21 - ③		Flat washer (thickness 0.5)	4
Fig.21 - ④		Spring washer	6
Fig.21 - ⑤		Plastic Centering device	1
Fig.21 - ⑥		O-Ring	1
Fig.21 - ②	39902739	Imbalance detector	1
Fig.21 - ⑦	11200508	Motor Counterweight	1
	86005398	Grease	1
See Fig. 22			
Fig.22	11250204	Shock Absorbers kit	1
Fig.22 - ①		Shock absorbers bottom flange	1
Fig.22 - ③		Shock absorbers Ø15x15 f-f 55ShA	5
Fig.22 - ⑥		Magnetic disk assy	1
Fig.22 - ⑦		Shock absorbers upper flange	1
Fig.22 - ⑨		Hall effect sensor kit	1
-		Set of screws	-
		Grease	1
Fig.22 - ③	11250203	Shock absorbers Ø15x15 f-f 55ShA (set of 5)	1
Fig.22 - ⑨	11250212	Hall effect sensor kit	1

Lid latch spare parts

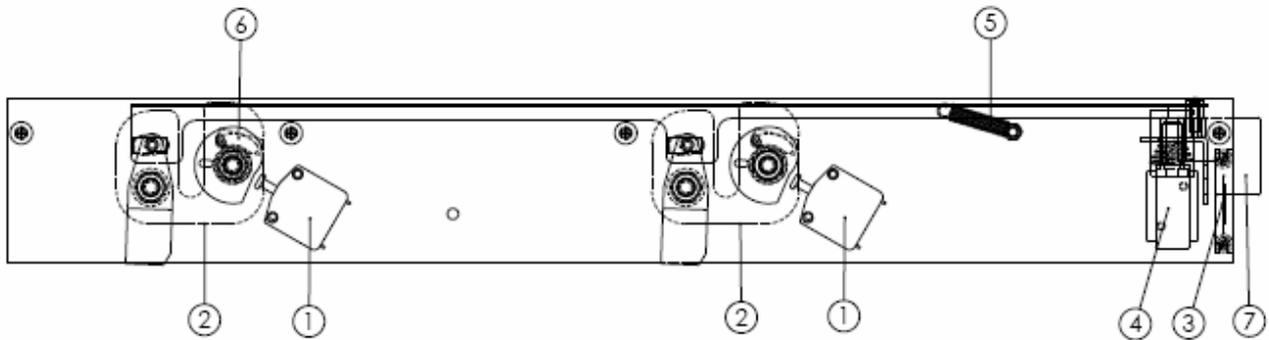


Fig. 23

Reference	CAT n.	DESCRIPTION	Qty.
Fig. 23	85481432	<i>Lid Latch assy</i>	1
Fig. 23 - ①	86001406	<i>Lid micro-switch</i>	1
Fig. 23 - ②	11201185	Latch	2
Fig. 23 - ③	39900043	<i>Solenoid switch (Reed Relay)</i>	1
Fig. 23 - ④	85140275	<i>Solenoid</i>	1
Fig. 23 - ④	85440187	Solenoid Spring	1
Fig. 23 - ⑤	11250207	<i>Spring</i>	1
Fig. 23 - ⑥	11201156	Locking cam	2
Fig. 23 - ⑦	85440203	Handle	1

Mains front-end spare parts

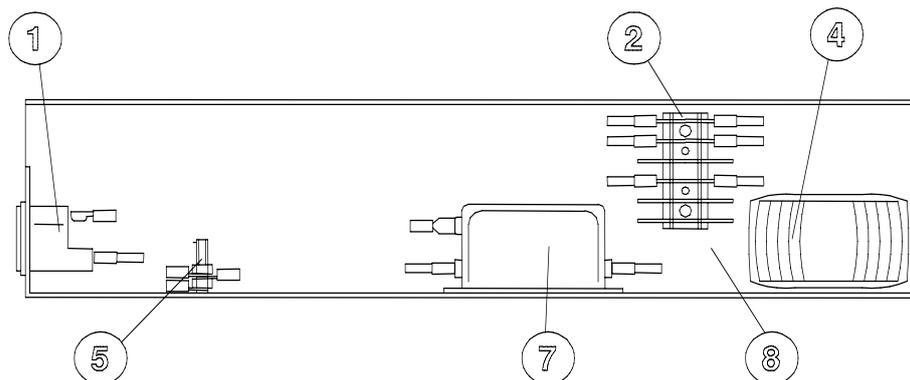


Fig. 24

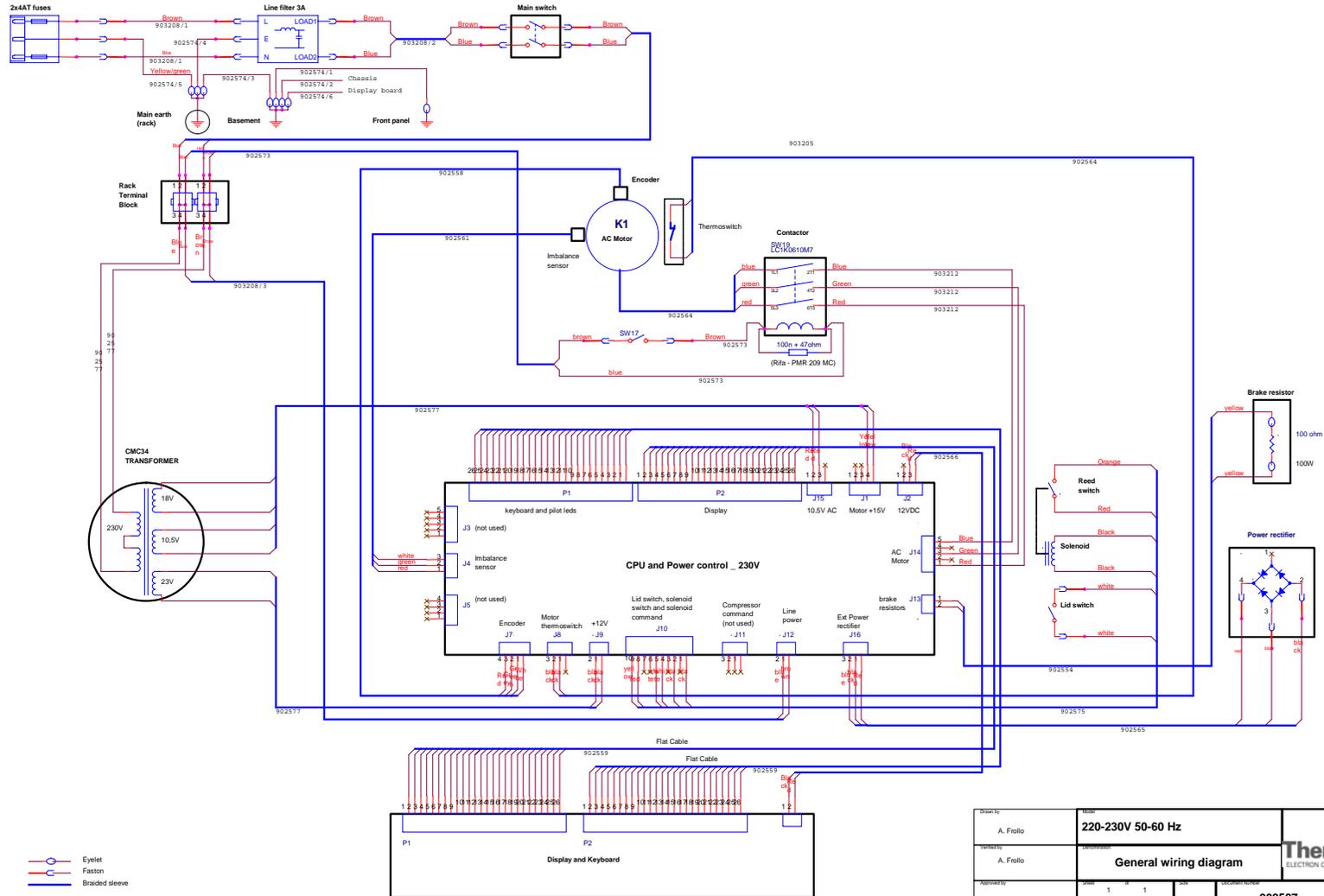
Reference	CAT n.	DESCRIPTION	Qty.
① + ④ + ⑦	39902981	Mains front-end rack (kit of components 230V)	1
Fig. 24 - ④	86004803	<i>Toroidal transformer 230Volt</i>	1
Fig. 24 - ⑦	86003248	<i>Line filter 230Volt</i>	1
Fig. 24 - ①	86000775	<i>Mains inlet and fuse holder</i>	1
① + ④ + ⑦	39902587	Mains front-end rack (kit of components 120V)	1
Fig. 24 - ④	39903078	<i>Toroidal transformer 120Volt</i>	1
Fig. 24 - ⑦	86003256	<i>Line filter 120Volt</i>	1
Fig. 24 - ①	86000775	<i>Mains inlet and fuse holder</i>	1

Rotors and Accessories

Reference	CAT n.	DESCRIPTION	Qty.
	11210435	T41 Swing-Out Rotor	1
	11210246	S41 Swing-Out Rotor (4x200ml)	1
	11175750	T20 Microtiter Plate Rotor for 2 x 3 Plates, 1157xg	1
	11175755	AC15.4 Angle Rotor, 30 x 15ml (17.5x100mm)	1
	11175756	AC100.10A Angle Rotor, 6 x 100ml (38x101mm)	1
	11175754	AC50.10A Angle Rotor, 6 x 50ml	1
	11175741	AC2.14 Sealed Angle Rotor, 24 x 1.5-2ml (11x39mm)	1
	11175743	DC6.11 Drum Rotor, 6 Micro tubes Racks	1
	11210351	AC2.13, Sealed FiberLite Angle Rotor, 48 x 1.5ml	1

9 APPENDIX 1

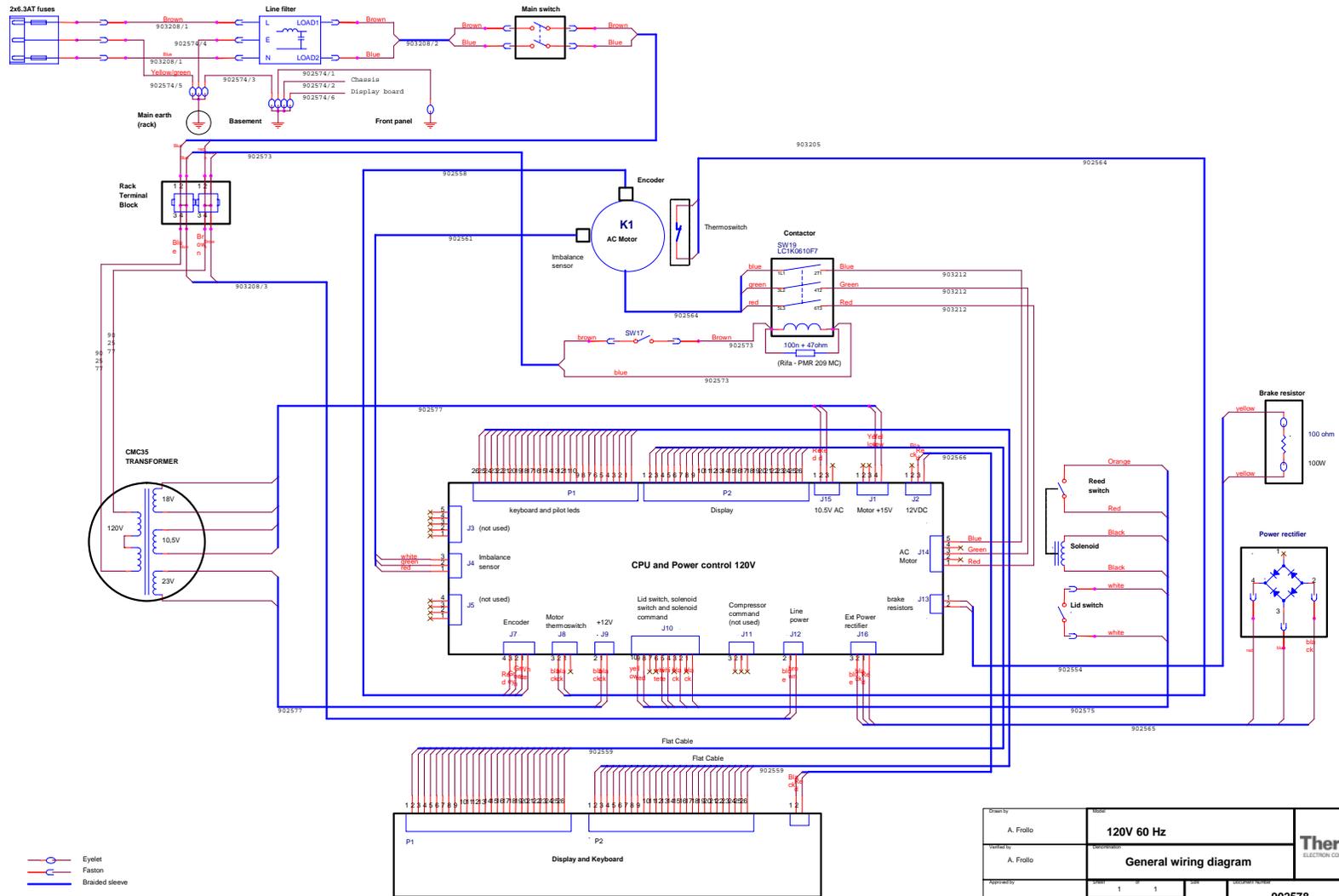
Wiring diagram 230 V version 50-60Hz



Drawn by	A. Frolo	Model	220-230V 50-60 Hz			
Verified by	A. Frolo	Version	General wiring diagram			
Approved by		Page	1 of 1	Document number		
		Date	Wednesday, October 12, 2005	A2	902587	B

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Wiring diagram 120V version 60Hz



Drawn by A. Frolo	Model 120V 60 Hz	Thermo ELECTRON CORPORATION
Verified by A. Frolo	Accessories General wiring diagram	
Approved by	Sheet 1 of 1	Doc. location number 902578
	Date Wednesday, October 12, 2005	Rev. B

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