Service Manual
Temperature Calibrators
JOFRA CTC-140/320/650 A/B, CTC-1200 A
JF INSTRUMENTS MTC-140/320/650 A

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1.0 General

1.1 Introduction

This service manual applies to the following instruments:

- **Jofra CTC-140 A (with or without RS232)**
- **Jofra CTC-320 A (with or without RS232)**
- **Jofra CTC-320 B (with or without RS232)**
- **Jofra CTC-650 A (with or without RS232)**
- **Jofra CTC-650 B (with or without RS232)**
- **Jofra CTC-1200 A (with RS232)**
- **JF Instruments MTC-140 A (without RS232)**
- **JF Instruments MTC-320 A (without RS232)**
- **JF Instruments MTC-650 A (without RS232)**

All calibrators are produced from quality components by skilled staff.

Each calibrator passes several tests during assembly and undergoes a final inspection and test following a special calibration procedure laid down by our technical staff.

Caution…

If you decide to check and/or re-calibrate the calibrator, you must **always** use certified test equipment only and ensure proper contact between the test probe and the well of the calibrator.

Operating guidelines and technical specifications are outlined in the reference manual order no. 123198 for CTC instruments and in the user manual order no. 105337 for MTC instruments. Please note that these are only available in English.

Technical assistance

The following information regarding testing and repair was correct at the time of issue. Do not hesitate to contact our service department or your local distributor, however, if you have further queries.

AMETEK DENMARK A/S
Gydevang 32- 34
DK-3450 Allerød

Phone: +45 48 16 80 00
Fax: +45 48 16 80 80

Note…

Please note that we would be very interested in hearing from you if you have any ideas or suggestions for changes to our products.

1.2 Safety instructions

Read this manual carefully before doing any maintenance on the instruments!

Please follow the instructions and procedures described in this manual in order to maintain the instruments correctly and to avoid any personal injuries and/or damage to the instruments.

Warning

- The calibrator is designed for **interior use only** and should **not be used in risk-prone areas**, where vapour or gas leaks, etc. may constitute an explosives hazard.
- **Never** use heat transfer fluids such as silicone, oil, paste, etc. These fluids may penetrate the calibrator and cause damage or create poisonous fumes.

Caution – Hot surface

This symbol is engraved in the grid plate.

- **Do not touch** the grid plate, the well or the insertion tube as the calibrator is heating up – they may be very hot.
- **Do not touch** the handle of the calibrator during use – it may be very hot.

Note…

- The product liability **only** applies if the instrument is subject to a manufacturing defect. This liability becomes void if the service personnel fails to follow the maintenance instructions set out in this manual or uses unauthorised spare parts.
- The instrument must **not** be exposed to draughts.

2.0 Maintenance

2.1 Adjusting and calibrating the instrument

You are advised to return the calibrator to Ametek Denmark A/S or an accredited laboratory at least once a year for calibration and adjustment.

Alternatively, you can calibrate/adjust the calibrator yourself.
You will need a calibrated, traceable sensor and thermometer with an accuracy better than ±0.1°C / ±0.18°F (all MTC and CTC instruments except CTC-1200 A), ±1.4°C / ±2.5°F (CTC-1200 A only) . Ensure that the ambient temperature is 23°C±3°C / 73.4°F±5.4°F.

To calibrate/adjust the instrument five different temperatures are needed. These are all preset in the various types of instruments.

The calibration temperatures are:

CTC-140 A / MTC-140 A	1.	-15°C / 5°F
	2.	20°C / 68°F
	3.	60°C / 140°F
	4.	100°C / 212°F
	5.	140°C / 284°F
CTC-320 A/B / MTC-320 A	1.	50°C / 122°F
	2.	120°C / 248°F
	3.	180°C / 356°F
	4.	250°C / 482°F
	5.	320°C / 608°F
CTC-650 A/B / MTC-650 A	1.	50°C / 122°F
	2.	200°C / 392°F
	3.	350°C / 662°F
	4.	500°C / 932°F
	5.	650°C / 1202°F

CTC-1200 A	1.	50°C / 122°F
	2.	300°C / 572°F
	3.	600°C / 1112°F
	4.	900°C / 1652°F
	5.	1200°C / 2192°F

Prepare to adjust/calibrate the instrument by doing the following (see Fig. 1):

Caution…

- The well and the insertion tube **must** be clean before use.
- The insertion tube must **never** be forced into the well. The well could be damaged as a result, and the insertion tube may get stuck.
- **Do not touch** the tip of the sensor when it is removed from the insertion tube/well – it may be very hot.

Ⓐ Insulate the part of the sensor which is above the heating well (use insulation tube part no. 65-F100 to 65-F107 and insulation 30x30 mm part no. 105173).

Ⓑ Protect the sensor head from heat radiation from the well by use of thermal protection shield (part no. 104216) or similar.

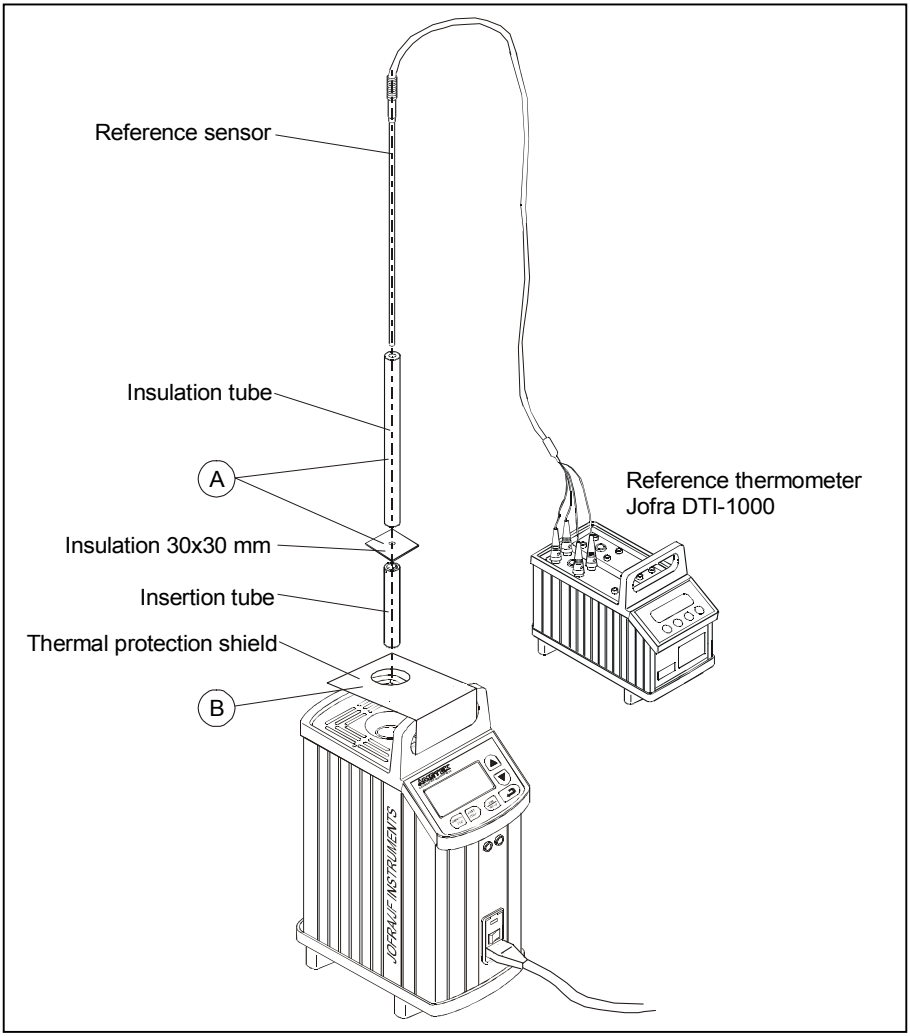
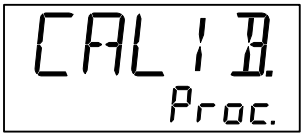


Fig. 1

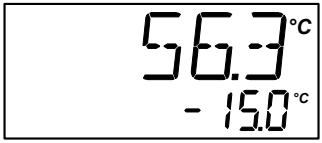
① To enter service mode, switch on the instrument while pressing the ESC/MENU button.

② Press ▲ or ▼ until Calib. Proc. is reached:

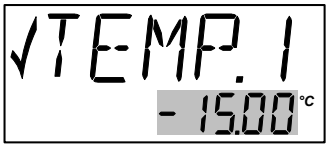


③ Press ↵ to accept.

The instrument will now heat up/cool down to reach the first of the 5 calibration temperatures:



④ Once the calibrator is stable, press ▲ or ▼ to enter the true temperature found using the reference thermometer (the calibration temperature is suggested as a reference point):



⑤ Press ↵ to accept the temperature.

Repeat this procedure for TEMP.2, TEMP.3, TEMP.4 and TEMP.5.

All five calibration temperatures and associated true temperatures have now been entered.

The instrument will now check whether the true temperatures which have been entered are within the permitted tolerances.

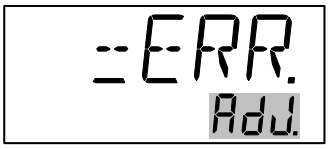
Permitted tolerances:

- CTC-140 A, CTC-320 A / B, MTC-140 A, MTC-320 A : ±0.15°C / 0.27°F
- CTC-650 A, MTC-650 A : ±0.25°C / 0.45°F
- CTC-650 B : ±0.35°C / 0.63°F

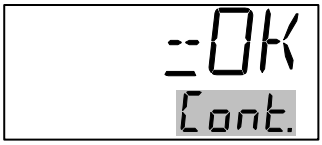
- CTC-1200 A : ±0.8°C / ±1.44°F

There are two possible outcomes:

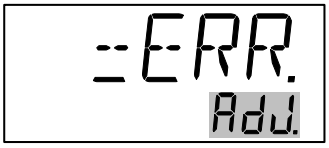
If the instrument detects excessive deviations for one or more steps, the display will read =ERR. at the top. A message reading AdJ. will flash at the bottom of the display to indicate that an adjustment is required:



If, on the other hand, the deviations are found to be within the permitted tolerances, the instrument will display the text =OK at the top of the display. The text Cont. will flash at the bottom of the display to indicate that you may continue without adjustments:



If the calibration results in the message ERR. AdJ., the following options are available:



- Press ESC MENU to cancel the function and return to service mode.
- Press ▲ to go back and select between the calibration temperatures if you want to repeat one of the steps.
- Press ▼ to toggle between ERR. AdJ. and ERR. Cont.

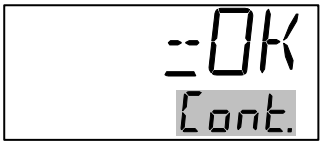
- Press ↵ when ERR. Cont. is displayed to accept the calibration although the deviations are outside the permitted tolerances.

- Press ↵ when ERR. AdJ. is displayed to calculate new coefficients.

  If the coefficients deviate by more than 4% from the standard values, the instrument will read ERROR 2 in the display. The calculated coefficients will be ignored:

- Press ESC MENU to cancel the function and return to service mode, or press ↵ to repeat the calibration. If the coefficients are within the permitted tolerances, the instrument will start a calibration.

If the display reads OK Cont., the following options are available:



- Press ▼ to toggle between OK Cont. and OK AdJ.

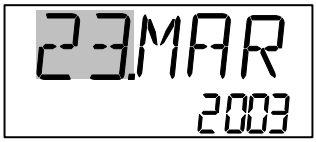
- Press ESC MENU to cancel OK Cont. or OK AdJ. and return to service mode.

- Press ↵ when the display reads OK Cont. to accept the calibration. Next, enter a new calibration date.

- Press ↵ when the display reads OK AdJ. to calculate new coefficients even though the calibration was within the permitted tolerances. A new calibration procedure will start.

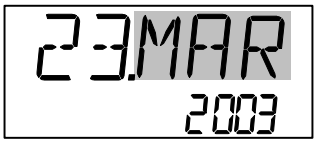
⑥ Adjust the date by toggling through the available days, months and years. Begin by selecting the required day as shown below:

Press ▲ or ▼ to select the required day in the interval 1-31.



⑦ Press ↵ to accept your selection.

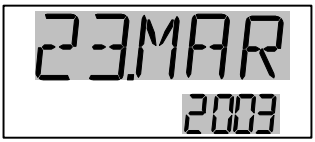
⑧ Press ▲ or ▼ to select the required month from JAN / FEB / MAR / APR / MAY / JUN / JUL / AUG / SEP / OCT / NOV / DEC.



⑨ Press ↵ to accept your selection.

⑩ Press ▲ or ▼ to select a year between 2001–2025.

⑪ Press ↵ to accept your selection. The day will be adjusted if necessary to ensure the legality of the date. Finally, the day, month and year will flash:



⑫ Press ↵ to accept the date.

or

press ESC MENU to cancel the whole selection.

⑬ Switch the instrument off and on again using the power control switch and cool down the instrument.

2.2 Caring for the instrument after use

① The following routine must be observed **before the insertion tube is removed** and the instrument switched off:

Over 100°C/212°F

If the calibrator has been heated up to temperatures above 100°C/212°F, you must wait until the instrument reaches a temperature **below 100°C/212°F** before you switch it off.

Below 0°C/32°F (applies only to CTC/MTC-140 A models)

If the calibrator has reached a temperature below 0°C/32°F, ice crystals may form on the insertion tube and the well. This, in turn, may cause verdigris to form on the material. To prevent this from happening, simply heat up the calibrator to 50°C/122°F.

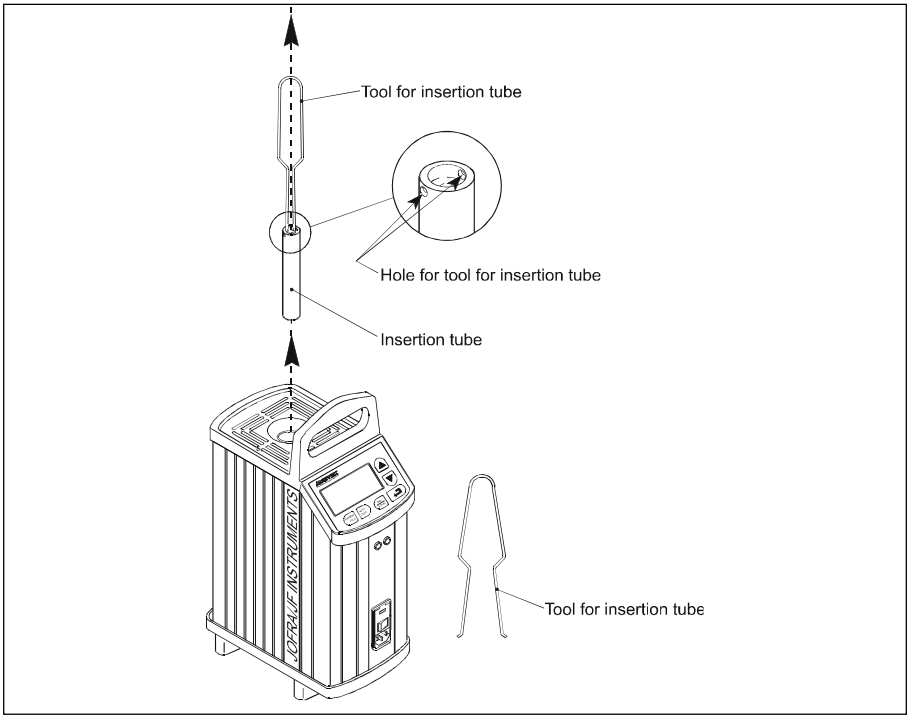


Fig. 2

② Remove the insertion tube from the calibrator using the tool for insertion tube as shown in Fig. 2.

③ Switch off the calibrator using the power control switch.

Caution…

- The insertion tube must **always** be removed from the calibrator after use.
  The humidity in the air may cause verdigris to form on the insertion tube inside the instrument. There is a risk that the insertion tube may become stuck if this is allowed to happen.
- The insertion tube **must** be removed to avoid damage to the instrument if the calibrator is to be transported long distances.

Warning

Never leave hot insertion tubes which have been removed from the calibrator unsupervised – they may constitute a fire hazard.

If you intend to store the calibrator in the aluminium carrying case (optional – for CTC) after use, you **must** ensure that the instrument has cooled to a temperature **below 100°C/212°F** before placing it in the carrying case.

3.0 Repairs

Warning

The calibrator **must** be switched off before any attempt is made to service the instrument.

Note…

Ametek Denmark's liability ceases if:

- Parts are replaced/repaired using spare parts which are not identical to those recommended by the manufacturer.
- non-original parts are used in any way when operating the instrument.

Ametek Denmark's liability is restricted to errors which originated in the factory.

3.1 Trouble shooting

Error: No light in display

Likely cause:	Solution:
Defective fuses:	Check fuses in the mains inlet. Check fuses on the POWER PCB inside the calibrator.
Supply to CONTROLLER PCB:	Check the supply – minimum 22V on CN1 terminal 1(+) and CN1 terminal 2(-). • If supply voltage is 22V or higher, replace CONTROLLER PCB and adjust and re-calibrate the unit.

	• If supply voltage is lower than 22V, replace POWER PCB and adjust POWER PCB.

Error: 

Likely cause:	**Solution:**
The measured temperature is out of range:	Check RTD sensor (not CTC-1200 A) At 23°C the impedance should be: • 1090 ohm ±20 ohm (CTC-140 A, CTC-320 A/B, MTC-140/320 A) or • 109 ohm ±3 ohm (CTC-650 A/B, MTC-650 A). • If RTD sensor is OK, replace CONTROLLER PCB and then adjust and re-calibrate the unit. • Otherwise, replace RTD sensor and re-calibrate the unit. Check thermocouple for open circuit (CTC-1200 A only). If the TC is broken, change the entire well unit.

Error: 

Likely cause:	Solution:
The new coefficients calculated by the unit in the CALIB. Proc. deviate by more than 4% from the standard values. The calculated coefficients will be ignored:	Check the accuracy of the reference thermometer used for calibration and repeat the calibration/adjustment procedure. If the calibrator shows ERROR 0002 again, the internal RTD-, TC sensor or the CONTROLLER PCB is defective.

Error: 

Likely cause:	Solution:
Defective CONTROLLER PCB:	Replace the CONTROLLER PCB and then adjust and re-calibrate the unit.

Error: Temperature reading is acting bizarre (CTC-1200 A only)

Likely cause:	Solution:
The thermocouple has been wrongly polarised.	Check the polarity of the thermocouple.

Error: Fan does not work.

Likely cause:	Solution:
Fan obstructions:	Remove any obstructions.
Supply for fan:	CTC-140 A, MTC-140 A Check the supply on CN2 terminal 1(+) and terminal 2(-) on the POWER PCB. • If supply voltage is 11-18V, replace fan. • If supply voltage is lower than 11V, replace and adjust POWER PCB. CTC-320/650 A/B,MTC-320/650 A, CTC-1200 A Check the supply on CN6 terminal 1(+) and terminal 2(-) on the POWER PCB. • If supply voltage is 11-18V, replace fan. • If supply voltage is lower than 11V, replace and adjust POWER PCB.

Error: Switch test does not work.

Likely cause:	Solution:
Defective I/O PCB:	• Check signal from switch test input. The voltage between CN2 terminal 1(+) and CN2 terminal 2(-) on the CONTROLLER PCB changes from 0V to 5V when the switch test input changes from closed to open. If the signal does not change and the voltage between CN1 terminal 3 (+) and CN1 terminal 4(-) on the I/O PCB is 5V, replace the I/O PCB. • Otherwise, replace the CONTROLLER PCB and adjust and re-calibrate the unit.

Error: Calibrator does not cool or heat sufficiently (CTC-140 A and MTC-140 A only).

Likely cause:	Solution:
Defective well:	• Set the SET temperature to -40°C. Measure the voltage between CN6 terminal 1(+) and terminal 2(-) and the voltage between CN3 terminal 1(+) and terminal 2(-). If the voltage on CN3 is higher than 18V, replace the well and re-calibrate the unit.

	• If the voltage on CN6 is correct and the calibrator does not cool down sufficiently, replace the well and re-calibrate the unit.
Defective POWER PCB:	If the voltage on CN3 is less than 18V and the voltage on CN6 differs from 0.330V ±0.005V, adjust R9 until the voltage is 0.330V ±0.005V. If it is impossible to adjust the voltage on CN6, replace the POWER PCB.

Error: Calibrator does not heat (CTC-320/650 A/B, CTC-1200 A, MTC-320/650 A).

Likely cause:	**Solution:**
Defective POWER PCB:	• Check impedance of the heating elements: - approx. 23 ohm for CTC-320/650 A, MTC-320/650 A - approx. 44 ohm for CTC-320 B and - approx. 22 ohm for CTC-650 B - approx. 4-5 ohm for CTC-1200 A Turn on the instrument and set the SET temperature to: - 320°C (CTC-320 A/B, MTC-320 A) - 650°C (CTC-650 A/B, MTC-650 A) or - 1200°C (CTC-1200 A) Check that relay K1 has been pulled.

	If the relay has not been pulled, check that the over-temperature sensor (CTC-320/650 A, CTC-1200 A, MTC-320/650 A) or the short circuit connector (CTC-320/650 B) has been mounted and is OK. If the sensor/switch is OK, change and adjust the POWER PCB. • If the 2 light diodes on the POWER PCB are lit, change and adjust the POWER PCB. • <u>CTC-1200 A only</u> Check voltage between CN3 pin 5 and 6 on Power PCB. If the voltage is higher than 0.6V, change the Power PCB.
Defective CONTROLLER PCB:	If the 2 light diodes on the POWER PCB are not lit, measure the voltage on CN3 between terminal 3(+) and terminal 4(-), terminal 5(+) and terminal 6(-) and between terminal 9(+) and terminal 10 (-). If the first two voltages are less than 0.6V and the last voltage is less than 1V, change CONTROLLER PCB and adjust and re-calibrate the calibrator. If not, change and adjust the POWER PCB.

	• CTC-1200 A only There is no LED on PCB and terminal 3 has no function but the rest of the text comply.

Error: RS232 interface can not be initialized. The display on the calibrator does not show "REMOTE" (models with RS232 only).

Likely cause:	**Solution:**
The connection between PC and calibrator is not correct:	• Check that the calibrator is connected to the selected RS232 port. • Check that the correct RS232 is used.
Defective I/O-PCB:	• Replace the I/O-plate.
Defective CONTROLLER PCB:	• Replace the CONTROLLER PCB and adjust and re-calibrate the calibrator.

3.2 Replacement of spare parts

See exploded views in Chapter 4.0.

Caution…

Remember to disconnect the instrument from the mains supply before it is dismantled.

Necessary tools:

- Wire cutter
- Screw drivers
- 7 mm wrench

A. **Removal of display and keyboard unit** (exploded views, pos. 1)

1. Remove the 2 screws (pos. 2) mounted at an angle through the handle of the top frame.
2. Ensure that you also remove the washers beneath the screws.
3. Lift the unit by carefully loosening it with a small screwdriver near the handle of the top frame.
4. To remove the unit completely, disconnect the 3 wires: The 16 circuit ribbon cable (pos. 3), the 10 circuit ribbon cable (pos. 4) and the reference sensor wire ending in a 4-poled connector (pos. 5).

The top frame must be removed if further replacements are necessary.

B. **Removal of top frame** (exploded views, pos. 6)

1. Remove the grid plate (pos. 7) by removing the 3 screws (pos. 8) holding it in place.
2. Remove the 5 screws now accessible (pos. 9) holding the top frame.
3. Ensure that you also remove the washers beneath the screws.

4. The top frame can now be removed entirely to render the interior of the instrument accessible.

C. Removal of Power PCB

(Section 4.2, exploded view - **CTC-140 A, MTC-140 A**)

1. Disconnect the 3 cables on the Power PCB which run to the fan (pos. 10), the Peltier elements (pos. 11) and the transformer (pos. 12).
2. It is now possible to retract the Power PCB (pos. 13) from the instrument.

(Section 4.3, 4.4 exploded views - **CTC-320/650 A, MTC-320/650 A**)

1. Disconnect the 4 cables from the heating elements (8 poled connector) (pos. 10), from the power inlet (4 poled connector) (pos. 11) from the thermocoupler (2 poled connector) (pos. 12) and from the fan (pos. 13).
2. It is now possible to retract the Power PCB (pos. 14) from the instrument.

(Section 4.5, 4.6 exploded views - **CTC-320 B, CTC-650 B**)

1. Remove the support plate (pos. 23) by pulling it up.
2. Disconnect the 3 cables from the heating elements (8 poled connector) (pos. 10), from the power inlet (4 poled connector) (pos. 11) and from the fan (2 poled connector) (pos. 12).
3. It is now possible to retract the Power PCB (pos. 13) from the instrument.

(Section 4.7 exploded view - **CTC-1200 A**)

1. Disconnect the 4 cables from the heating elements (4 poled connector) (pos. 10), from the transformer (6 poled connector) (pos. 11) from the thermocoupler (2 poled connector) (pos. 5B) and from the fan (pos. 12).
2. It is now possible to retract the Power PCB (pos. 13) from the instrument.

Note…

If the Power PCB has been replaced, you must adjust the new PCB in accordance with section 3.3.

D. Removal of well

Please follow steps A, B and C for all models.

(Section 4.2, exploded view - **CTC-140 A, MTC-140 A**)

1. Remove the plate (pos. 14) in front of the well by pulling it up.
2. Pull out the well (pos. 15). Remember that it is necessary to calibrate the instrument after the well has been removed/replaced.
3. When reassembling the unit ensure that the well and the plates are placed in the exact same slots as before removal.

(Section 4.3, exploded view - **CTC-320 A, MTC-320 A**)

1. Remove the plate (pos. 15) in front of the well by pulling it up.
2. Loosen the ground wire (pos. 22) connecting the well unit to the bottom part.
3. Cut the straps holding the wire from the fan close to the wires from the well.
4. Pull out the well (pos. 20). Remember that it is necessary to calibrate the instrument after the well has been removed/replaced.
5. When reassembling the unit ensure that the well and the plates are placed in the exact same slots as before removal.

(Section 4.4, exploded view - **CTC-650 A, MTC-650 A**)

1. Remove the 2 plates (pos. 15) in front of the well by pulling them up.
2. Loosen the ground wire (pos. 22) connecting the well unit to the bottom part.
3. Cut the straps holding the wire from the fan close to the wires from the well.
4. Pull out the well (pos. 20). Remember that it is necessary to calibrate the instrument after the well has been removed/replaced.

5. When reassembling the unit ensure that the well and the plates are placed in the exact same slots as before removal.

(Section 4.5, exploded view - **CTC-320 B**)

1. Remove the plate (pos. 14) in front of the well by pulling it up.
2. Loosen the ground wire (pos. 22) connecting the well unit to the bottom part.
3. Cut the straps holding the wire from the fan close to the wires from the well.
4. Pull out the well (pos. 16). Remember that it is necessary to calibrate the instrument after the well has been removed/replaced.
5. When reassembling the unit ensure that the well and the plates are placed in the exact same slots as before removal.

(Section 4.6, exploded view - **CTC-650 B**)

1. Remove the 3 plates (pos. 14) in front of the well by pulling them up.
2. Loosen the ground wire (pos. 22) connecting the well unit to the bottom part.
3. Cut the straps holding the wire from the fan close to the wires from the well.
4. Pull out the well (pos. 16). Remember that it is necessary to calibrate the instrument after the well has been removed/replaced.
5. When reassembling the unit ensure that the well and the plates are placed in the exact same slots as before removal.

(Section 4.7, exploded view - **CTC-1200 A**)

1. Remove the 2 plates (pos. 14) in front of the well by pulling them up.
2. Remove the screws (pos. 22), attaching the side panels to each other, from the top of the side panels.
3. Remove the side panels (pos. 23) by loosen the screws at the bottom of the calibrator.

4. Loosen the ground wire (pos. 21) by unscrewing the screw attaching the wire to the bottom part.
5. Pull out the well (pos. 20). Remember that it is necessary to calibrate the instrument after the well has been removed/replaced.
6. When reassembling the unit ensure that the well and the plates are placed in the exact same slots as before removal.

E. Removal of fan (exploded views, pos. 17)

Having followed steps A through D, you can remove the fan from the bottom part by loosening the 4 screws (pos. 18) holding it in place.

F. Removal of transformer

(section 4.2, exploded view - **CTC-140 A**, **MTC-140 A,** pos. 16)

You can remove the transformer in CTC-140 A, MTC-140 A.

1. Follow steps A through C.
2. Disconnect the wires from the transformer to the power inlet.
3. Loosen the nut with a 7 mm wrench and remove the transformer.

(section 4.7, exploded view - **CTC-1200 A,** pos. 16)

You can remove the transformer in CTC-1200 A.

1. Follow steps A through D.
2. Disconnect the wires from the transformer to the power inlet.
3. Loosen the nut with a 7 mm wrench and remove the transformer.

G. Removal of I/O plate (exploded views, pos. 19, 19A, 19B)

1. Follow steps A through C.
2. The I/O plate is secured by 4 screws, 2 from below through the bottom frame and 2 Allen screws mounted from the top. These should all be removed.
3. Dismount the wires from the power inlet before retracting

the plate.

H. Replacement of reference sensor

To replace the reference sensor in the well unit, follow steps A through D and then follow the procedure given below:

For CTC-140 A, MTC-140 A:

1. Turn the well upside down so that Connection PCB is facing upwards.
2. Loosen the two wires in the 4-poled connector.
3. Loosen the two wires in the 2-poled connector placed next to the 4-poled connector.
4. Remove the two screws securing the PCB to the insulation and tip the PCB aside gently.
5. Remove the old reference sensor and replace it with the new spare part 105287.
6. Reassemble the unit carefully in reverse order.

For CTC-320 A, MTC-320 A:

1. Turn the well upside down to expose the bottom of the unit.
2. Use a wire cutter to cut the straps holding the wires together.
3. Remove the screw and clamp holding the reference sensor in position.
4. Pull out the old reference sensor and replace it with the new spare part 105288.
5. Before mounting the new sensor, make a 90° bend between the two ceramic tubes.
6. Mount the new reference sensor in the same position as the old sensor.
7. Ensure that the two wires in the bend between the ceramic tubes do not short-circuit.
8. Replace the clamp and the screw as before.

For CTC-650 A, MTC-650 A:

1. Turn the well upside down to expose the bottom of the unit.
2. Use a wire cutter to cut the straps holding the wires together.
3. Remove the screw and clamp holding the reference sensor in position.
4. Pull out the old reference sensor and replace it with the new spare part 105476.
5. Before mounting the new sensor, make a 90° bend between the two ceramic tubes.
6. Mount the new reference sensor in the same position as the old sensor.
7. Ensure that the two wires in the bend between the ceramic tubes do not short-circuit.
8. Replace the clamp and the screw as before.

For CTC-320 B:

1. Place the well on its side on a table with the reference sensor wire facing upwards.
2. Remove the screw and clamp holding the reference sensor in position.
3. Pull out the old reference sensor and replace it with the new spare part 105290.
4. Insert the new reference sensor in the same position as the old sensor.
5. Ensure that the two wires in the bend between the ceramic tubes do not short-circuit.
6. Replace the clamp and the screw as before.

For CTC-650 B:

1. Place the well on its side on a table with the reference sensor and earth wire facing upwards.

2. Remove the screw and clamp holding the reference sensor in position.
3. Pull out the old reference sensor and replace it with the new spare part 105291.
4. Insert the new reference sensor in the same position as the old sensor.
5. Ensure that the two wires in the bend between the ceramic tubes do not short-circuit.
6. Replace the clamp and the screw as before.

For CTC-1200 A:

If the reference- or overtemperature sensor is defect the entire well unit must be replaced. Follow steps A through D for removal of well unit.

Note…

Instruments should be reassembled in reverse order. Ensure that all parts are in good working order and that all wires are connected correctly.

3.3 Adjusting and testing PCBs

3.3.1 CONTROLLER PCB

The CONTROLLER PCB must be adjusted if it has been replaced.

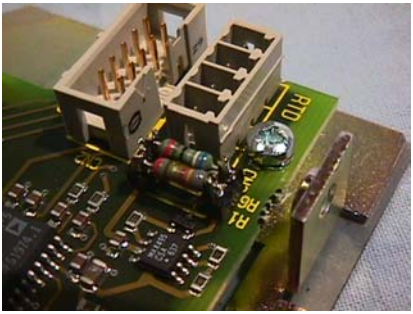
Adjustment

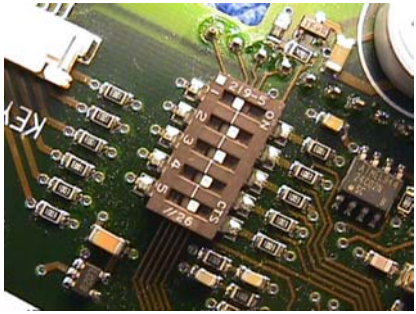
① Set up the dipswitch and solder the resistors R1 and R6 with values as shown in the table.

Dipswitch 1 = ON

Model	R1	R6	S1 (Dipswitch)
CTC			**1 2 3 4 5**
140 A	487R	4K64	1 1 1 0 1
320 A	487R	4K64	0 1 1 0 1
320 B	487R	4K64	1 0 1 0 1
650 A	73R2	698R	0 0 1 0 1
650 B	73R2	698R	1 1 0 0 1
1200 A	-	-	1 0 1 1 0

Model	R1	R6	S1 (Dipswitch)
MTC			**1 2 3 4 5**
140 A	487R	4K64	0 1 0 0 1
320 A	487R	4K64	1 0 0 0 1
650 A	73R2	698R	1 1 1 1 0





② In order to change the serial number stored in the calibrator, remove the flatcable from the internal I/O board to the I/O board with RS232 communication.

③ Connect the calibrator to a PC with a serial null modem cable.

④ Turn on the power and run the SetSerial program.

⑤ The program reads the serial number stored in the calibrator.

⑥ Enter the serial number labeled on the cabinet and press “Go”.

⑦ The entered serial number is now stored in the calibrator.

⑧ Run the calibration and adjustment procedure on the calibrator as described in the manual.

3.3.2 POWER PCB CTC-140 A, MTC-140 A

The POWER PCB must be adjusted if the POWER PCB or CONTROLLER PCB have been replaced.

Necessary equipment

Voltmeter 0-1V with an accuracy of 0.01V and a resolution of 0.001V.

Adjustment

① Switch off the calibrator using the power control switch.

② Turn the preset potentiometer R9 counter clockwise as far as it will go.

③ Switch the calibrator on using the power control switch.

④ Set the calibrator to –20°C.

⑤ Connect a voltmeter to CN6.

⑥ Adjust R9 until the voltage for CN6 reaches 0.330V±0.005V.

⑦ Switch off the calibrator using the power control switch.

3.3.3 POWER PCB CTC-320/650 A/B, CTC-1200 A, MTC-320/650 A

The POWER PCB must be adjusted if the POWER PCB or the CONTROLLER PCB have been replaced.

Necessary equipment

Voltmeter to ensure that the mains voltage is 115V ± 5V or 230V±10V. If the mains voltage falls outside this range, a variotransformer must be used to generate the correct mains voltage.

Adjustment

① Switch off the calibrator using the power control switch.

② Turn the present potentiometer R37 (R26 for CTC-1200 A) counter clockwise as far as it will go. Then turn the potentiometer R37 (R26 for CTC-1200 A) clockwise 15 times.

③ Hold down the  key while turning on the calibrator using the control switch. Release  once the calibration date is displayed.

④ Set the calibrator to max. temperature (320°C, 650°C or 1200°C) and press  .

⑤ Instead of the SET temperature, the display will show a figure which is updated every 2.6 seconds.

⑥ Turn R37 (R26 for CTC-1200 A) clockwise until the figure reads between 95.0 and 97.5.

⑦ Switch off the calibrator using the power control switch.

3.3.4 Testing the CONTROLLER PCB and keyboard

① Switch the calibrator on using the power control switch and press ESC MENU for 1 second when the display shows the calibration date. All parts of the display should now be lit. Press ESC MENU again to continue.

② Press SWITCH TEST and check that the display reads MIN. in the top line.

③ Press ESC MENU followed by AUTO STEP. Check that the display reads STEPS in the top line.

④ Switch off the calibrator using the power control switch.

4.0 Spare parts and drawings

4.1 Spare parts - generel

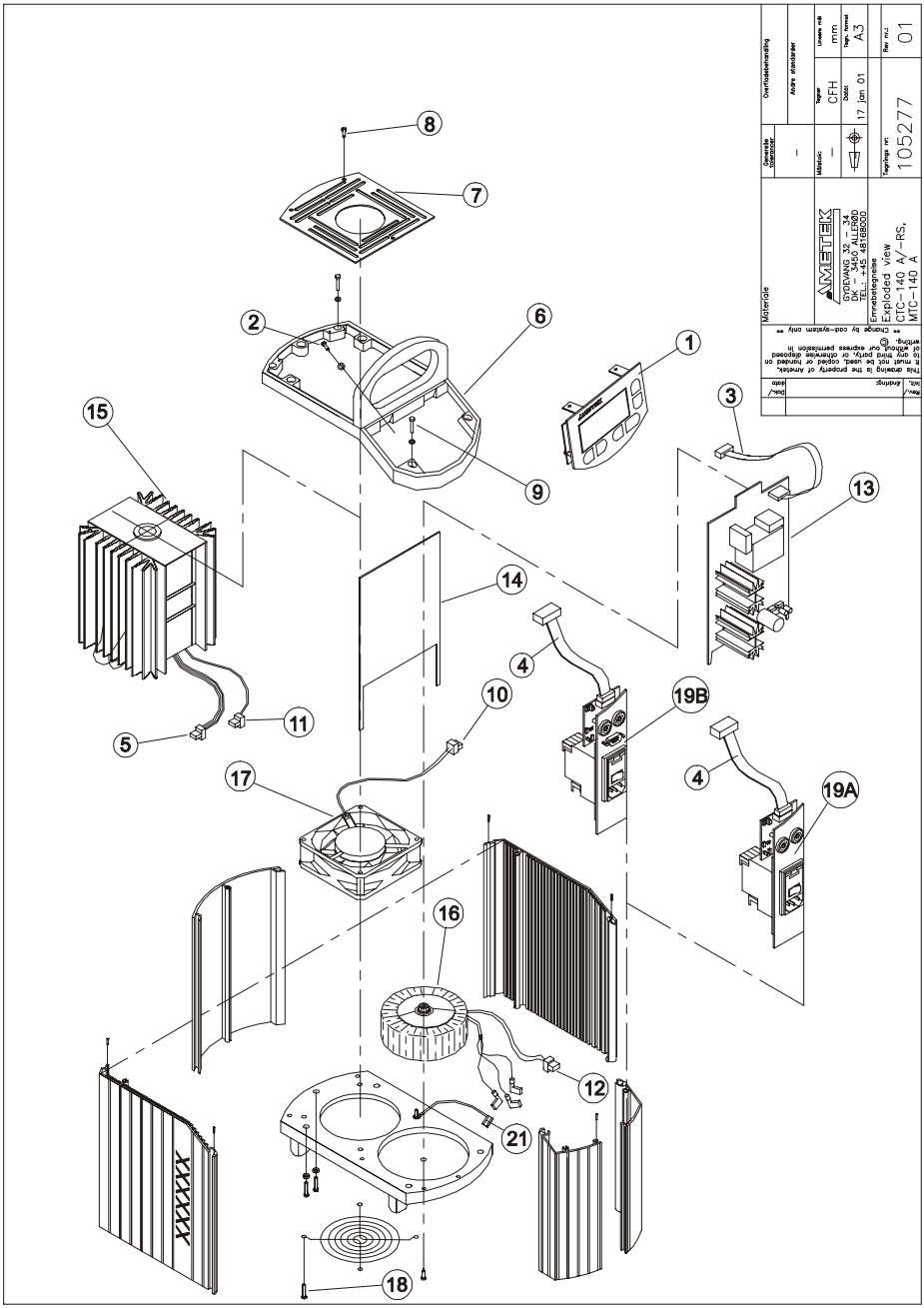
All parts listed in the lists of spare parts can be obtained from the factory through our dealer (see exploded views).

Please contact your dealer for assistance if you require parts which do not appear on the lists.

4.2 List of spare parts – CTC-140 A/-RS, MTC-140 A

Pos.	Spare parts	Number
(Compare exploded view, next page)		
1	Keyboard (CTC)	105247
1	Keyboard (MTC)	105436
3	16 circuit ribbon cable	105102
4	10 circuit ribbon cable	105112
5	Reference sensor wire w. 4-poled connector	105140
7	Grid plate	105000
11	Cable for Peltier elements	105103
13	Power PCB	105065
15	Well, cpl. incl. sensor	105258
16	Transformer	105137
17	Fan	105264
19A	I/O plate (MTC)	105434
19A	I/O plate (CTC)	123662
19B	I/O plate with RS232 connection (CTC)	105357
21	Wire for I/O plate, 145 mm.	105149
-	Reference sensor	105287
-	Controller PCB w. R1 + R6	105245
-	Washer for display	104559
-	Fuse 115V, 2AT	105014
-	Fuse 230V, 1AT	105007
-	Fuse 4 A (T), 5x20mm IEC	105334
-	Screw for fan, M5x25mm	60V103
-	Rubber foot for fan and PCB, black	60N131
-	Rubber foot for bottom part, black	60G032
-	Power entry module, PSOSXSS3A	60E013
-	Screw, UNC-4-40 (for RS232 - CTC)	122513
-	Screw set, complete	123382

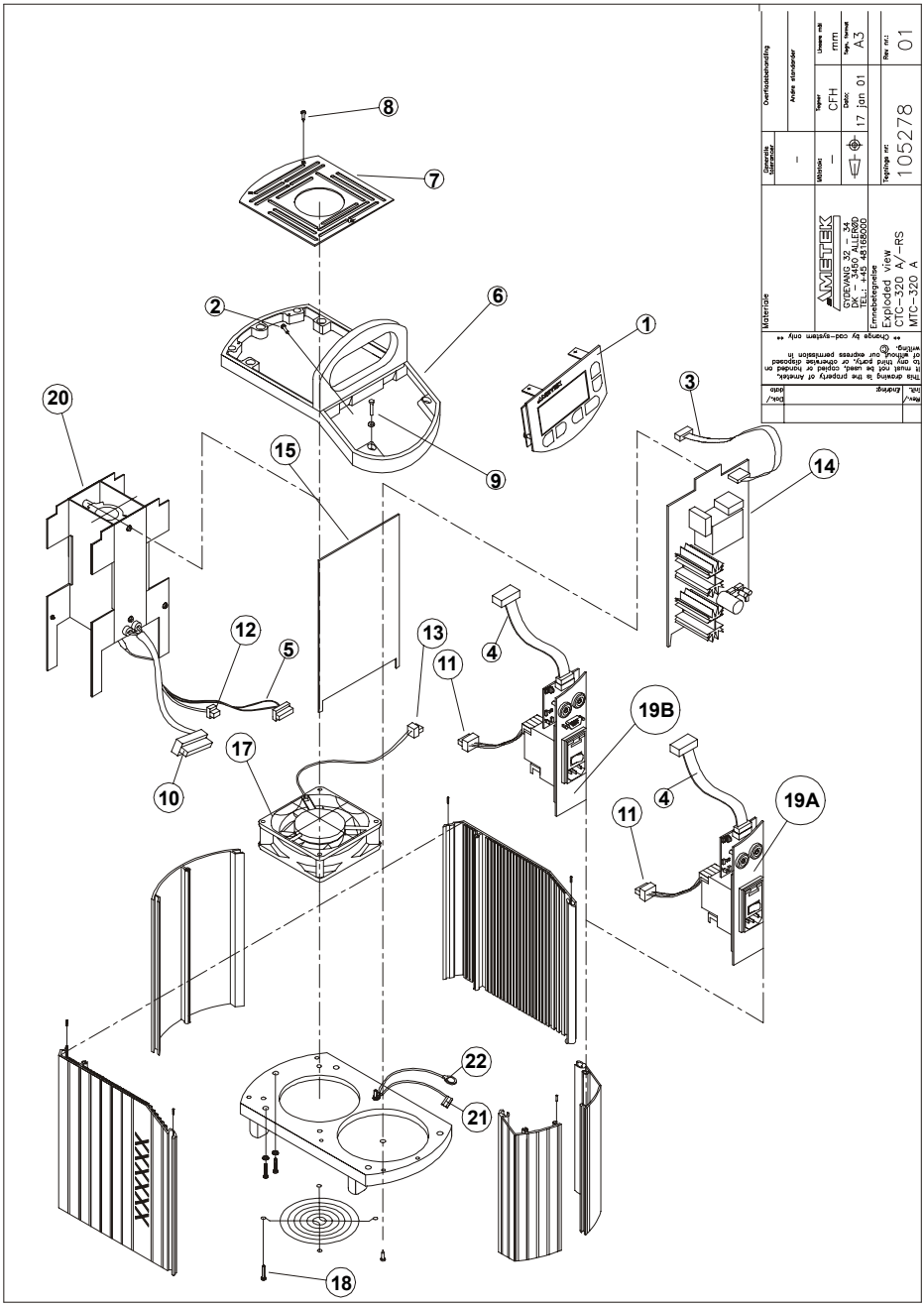
Exploded view – CTC-140 A/-RS, MTC-140 A



4.3 List of spare parts – CTC-320 A/-RS, MTC-320 A

Pos.	Spare parts	Number
(Compare exploded view, next page)		
1	Keyboard (CTC)	105247
1	Keyboard (MTC)	105436
3	16 circuit ribbon cable	105102
4	10 circuit ribbon cable	105112
5	Reference sensor	105288
7	Grid plate	105000
11	Cable for power inlet	105100
12	Thermocoupler	105081
14	Power PCB	105248
17	Fan	105264
19A	I/O plate (MTC)	105435
19A	I/O plate (CTC)	123663
19B	I/O plate with RS232 connection	105358
20	Well, cpl. incl. sensor	105261
21	Wire for I/O plate, 145 mm.	105149
22	Wire for well, 145 mm.	105104
-	Controller PCB w. R1 + R6	105245
-	Washer for display	104559
-	Rubber foot for bottom part, black	60G032
-	Fuse 115V, 10AF	60B302
-	Fuse 230V, 5AF	60B301
-	Fuse 63 mA (T), 5x20mm IEC	105333
-	Fuse 100 mA (T), 5x20mm IEC	123850
-	Fuse 160 mA (T), 5x20mm IEC	124494
-	Cover for fuseholder	105332
-	Power entry module, PSOSXSSXA	60D542
-	Screw, UNC-4-40 (for RS232 - CTC)	122513
-	Screw set, complete	123382

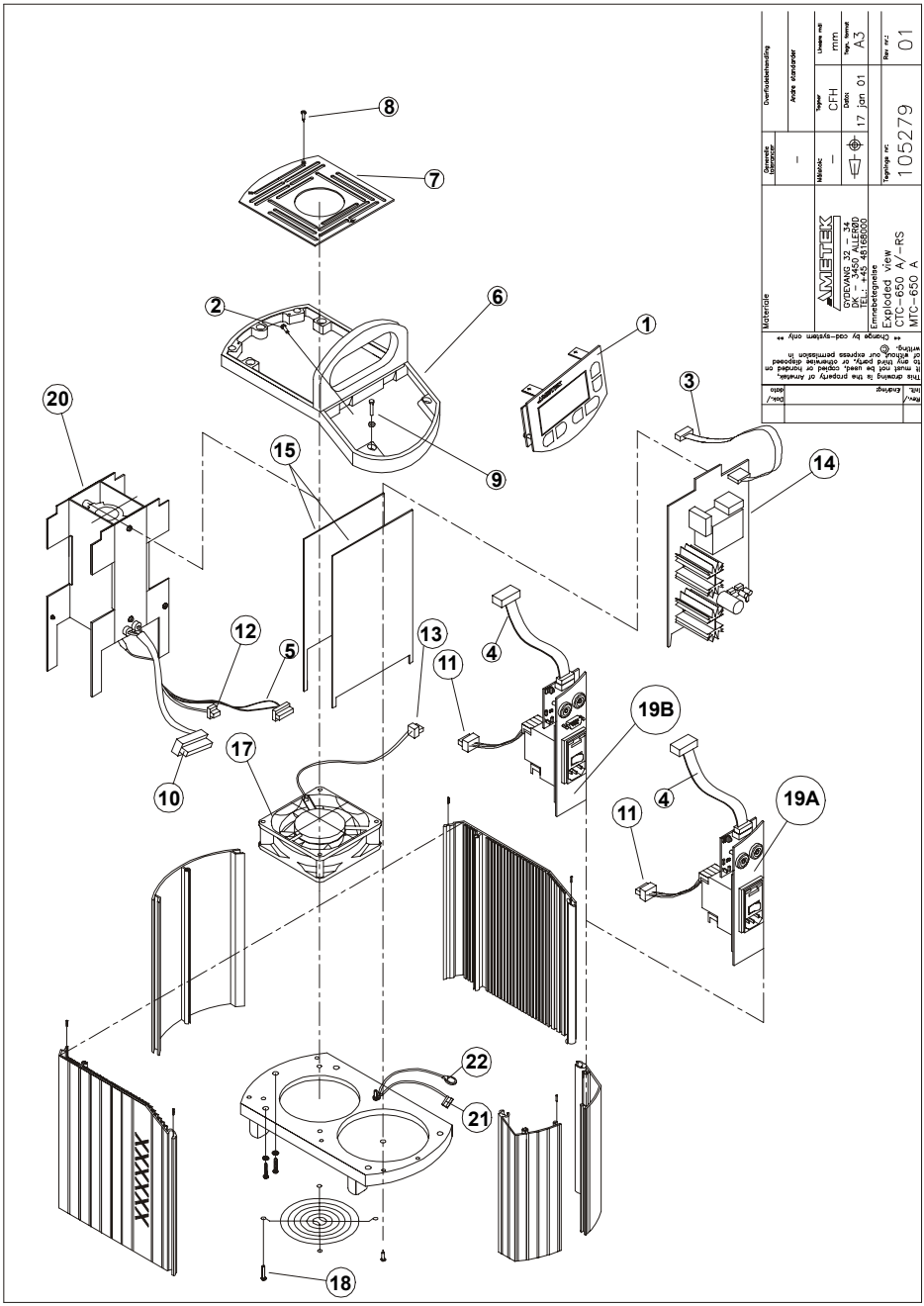
Exploded view – CTC-320 A/-RS, MTC-320 A



4.4 List of spare parts – CTC-650 A/-RS, MTC-650 A

Pos.	Spare parts	Number
(Compare exploded view, next page)		
1	Keyboard (CTC)	105247
1	Keyboard (MTC)	105436
3	16 circuit ribbon cable	105102
4	10 circuit ribbon cable	105112
5	Reference sensor	105476
7	Grid plate	105000
12	Thermocoupler	105081
11	Cable for power inlet	105100
14	Power PCB	105250
17	Fan	105264
19A	I/O plate (MTC)	105435
19A	I/O plate (CTC)	123663
19B	I/O plate with RS232 connection (CTC)	105358
20	Well, cpl. incl. sensor	105262
21	Wire for I/O plate, 145 mm.	105149
22	Wire for well, 145 mm.	105104
-	Controller PCB w. R1 + R6	105246
-	Washer for display	104559
-	Rubber foot for bottom part, black	60G032
-	Fuse 115V, 10AF	60B302
-	Fuse 230V, 5AF	60B301
-	Fuse 63 mA (T), 5x20mm IEC	105333
-	Fuse 100 mA (T), 5x20mm IEC	123850
-	Fuse 160 mA (T), 5x20mm IEC	124494
-	Cover for fuseholder	105332
-	Power entry module, PSOSXSSXA	60D542
-	Screw, UNC-4-40 (for RS232 - CTC)	122513
-	Screw set, complete	123382

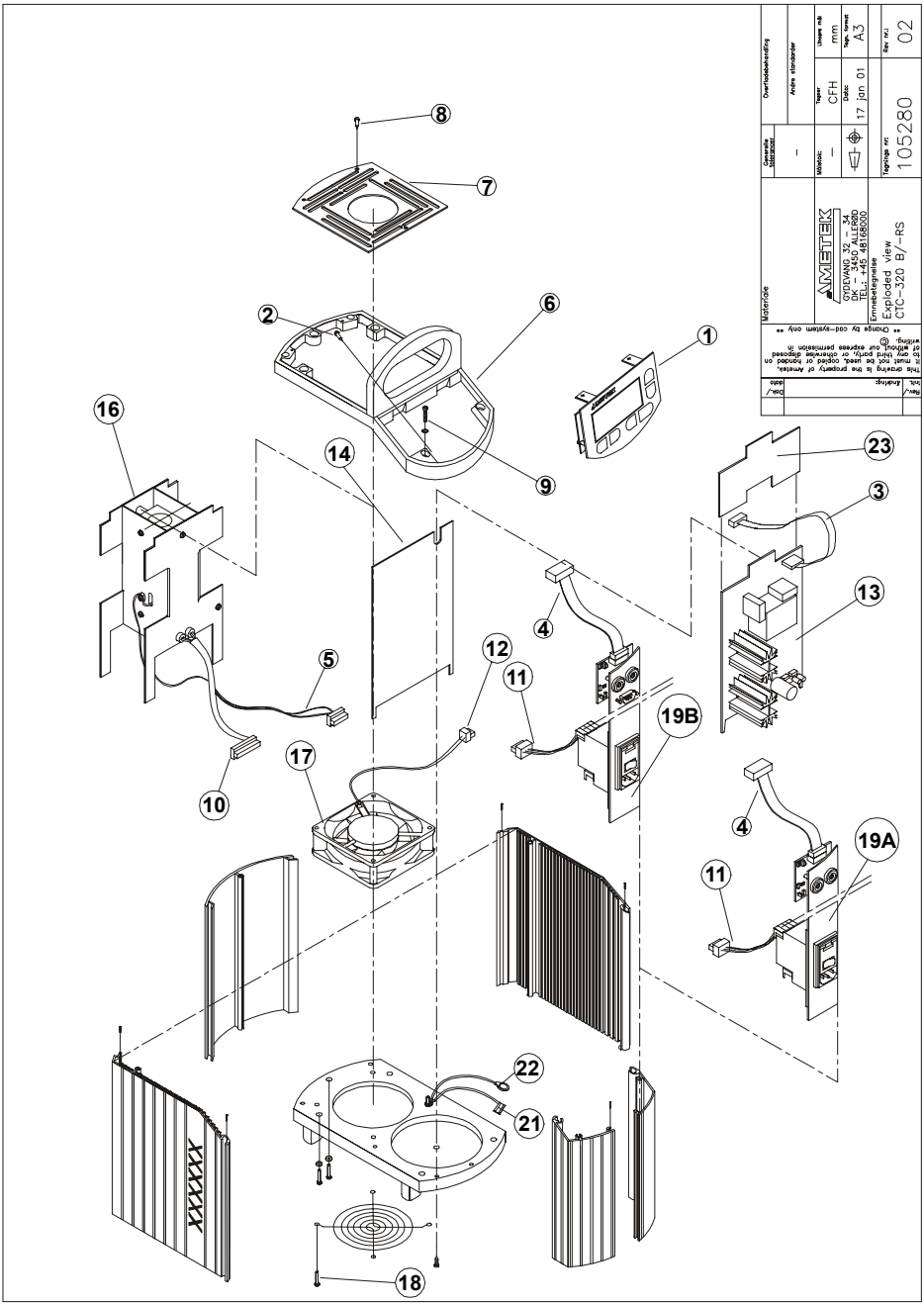
Exploded view – CTC-650 A/-RS, MTC-650 A



4.5 List of spare parts – CTC-320 B/-RS

Pos.	Spare parts	Number
(Compare exploded view, next page)		
1	Keyboard	105247
3	16 circuit ribbon cable	105102
4	10 circuit ribbon cable	105112
5	Reference sensor	105290
7	Grid plate	105000
11	Cable for power inlet	105101
13	Power PCB	105249
16	Well, cpl. incl. sensor	105259
17	Fan	105257
19A	I/O plate	123664
19B	I/O plate with RS232 connection	105359
21	Wire for I/O plate, 145 mm.	105149
22	Wire for well, 145 mm.	105104
-	Controller PCB w. R1 + R6	105245
-	Washer for display	104559
-	Rubber foot for bottom part, black	60G032
-	Fuse 115V, 10AF	60B302
-	Fuse 230V, 5AF	60B301
-	Fuse 63 mA (T), 5x20mm IEC	105333
-	Fuse 100 mA (T), 5x20mm IEC	123850
-	Fuse 160 mA (T), 5x20mm IEC	124494
-	Cover for fuseholder	105332
-	Power entry module, PSOSXSSXA	60D542
-	Screw, UNC-4-40 (for RS232)	122513
-	Screw set, complete	123382

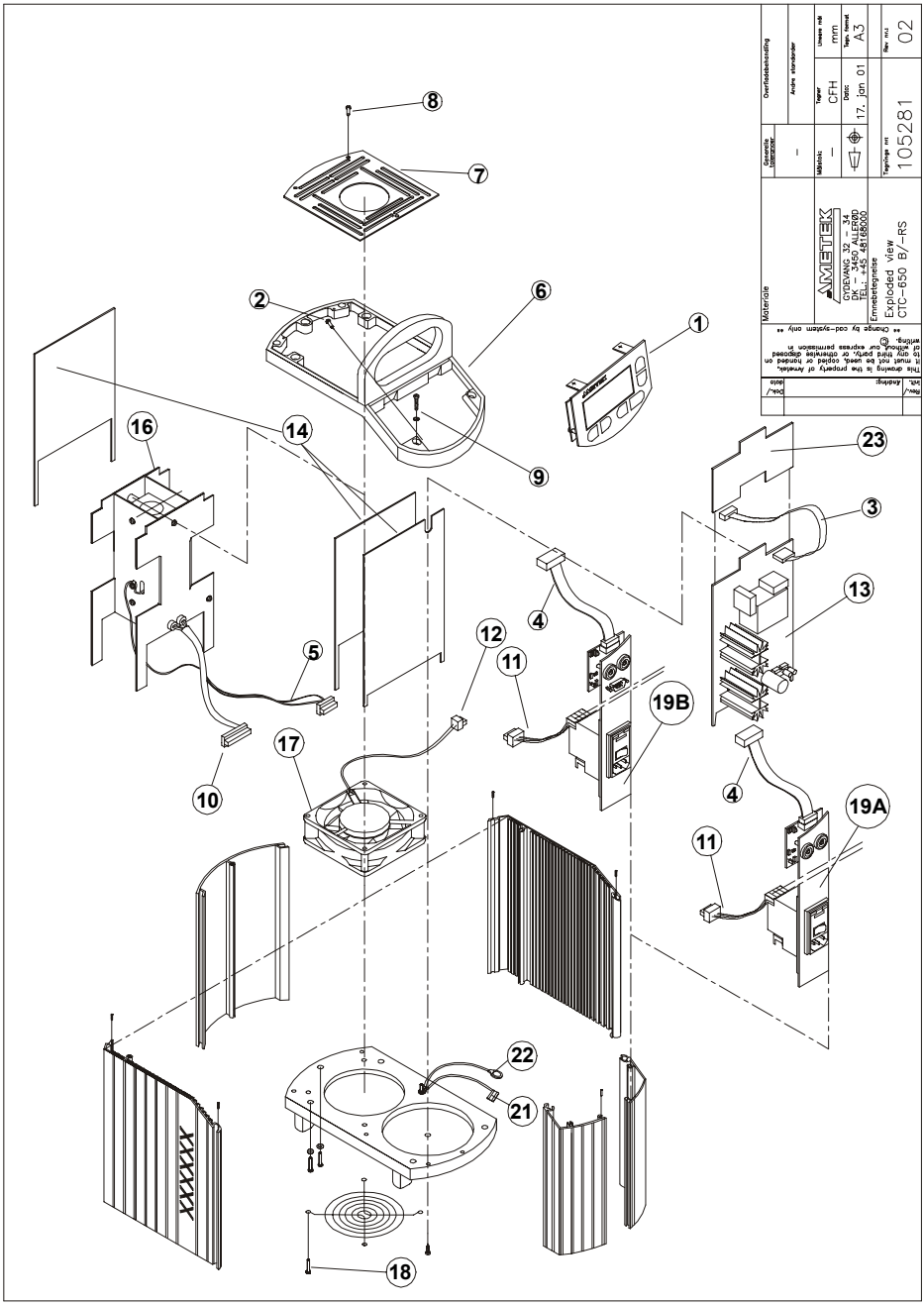
Exploded view – CTC-320 B/-RS



4.6 List of spare parts – CTC-650 B/-RS

Pos.	Spare parts	Number
(Compare exploded view, next page)		
1	Keyboard	105247
3	16 circuit ribbon cable	105102
4	10 circuit ribbon cable	105112
5	Reference sensor	105291
7	Grid plate	105000
11	Cable for power inlet	105101
13	Power PCB	105251
16	Well, cpl. incl. sensor	105260
17	Fan	105257
19A	I/O plate	123664
19B	I/O plate with RS232 connection	105359
21	Wire for I/O plate, 145 mm.	105149
22	Wire for well, 145 mm.	105104
-	Controller PCB w. R1 + R6	105246
-	Washer for display	104559
-	Rubber foot for bottom part, black	60G032
-	Fuse 115V, 10AF	60B302
-	Fuse 230V, 5AF	60B301
-	Fuse 63 mA (T), 5x20mm IEC	105333
-	Fuse 100 mA (T), 5x20mm IEC	123850
-	Fuse 160 mA (T), 5x20mm IEC	124494
-	Cover for fuseholder	105332
-	Power entry module, PSOSXSSXA	60D542
-	Screw, UNC-4-40 (for RS232)	122513
-	Screw set, complete	123382

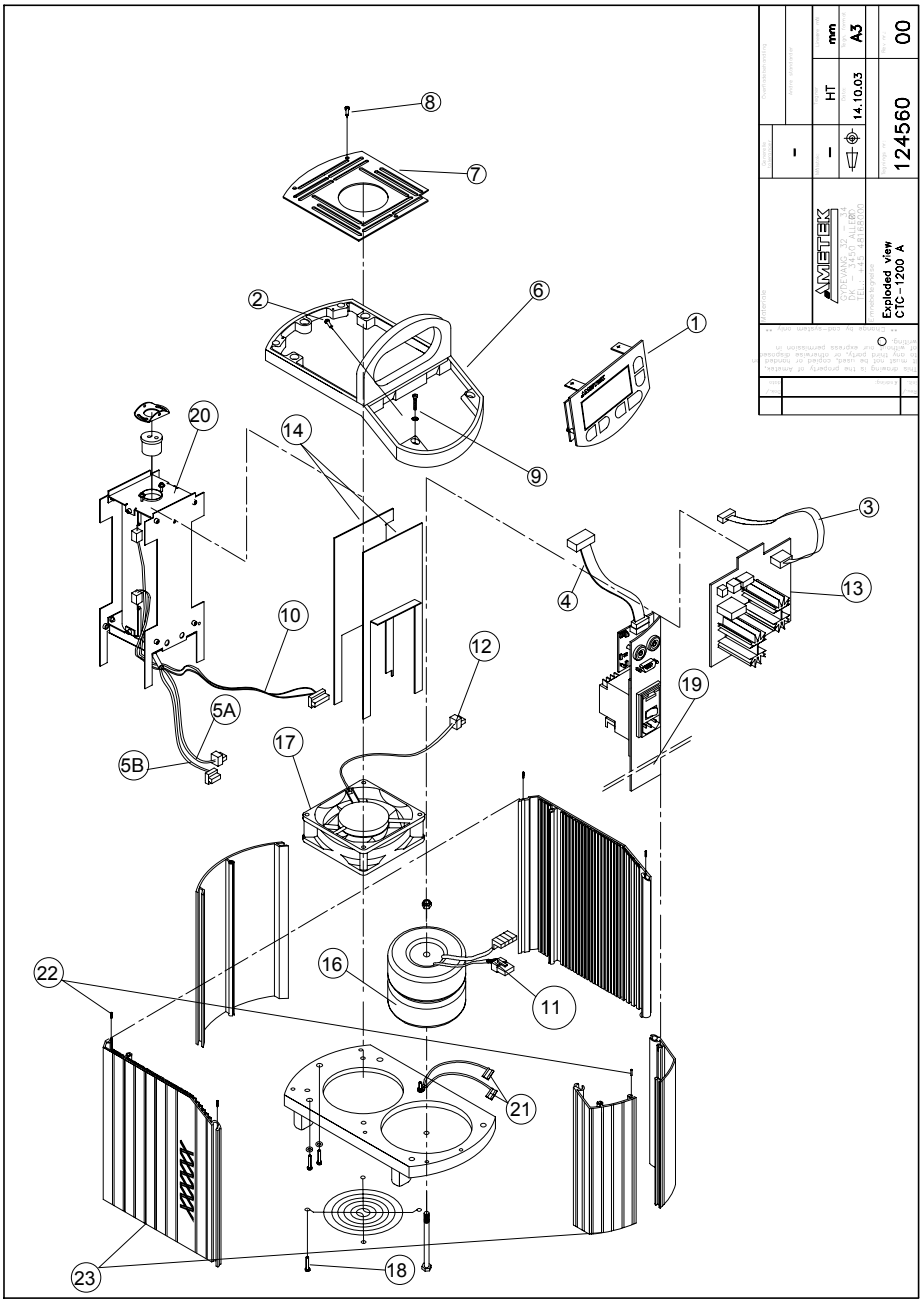
Exploded view – CTC-650 B/-RS



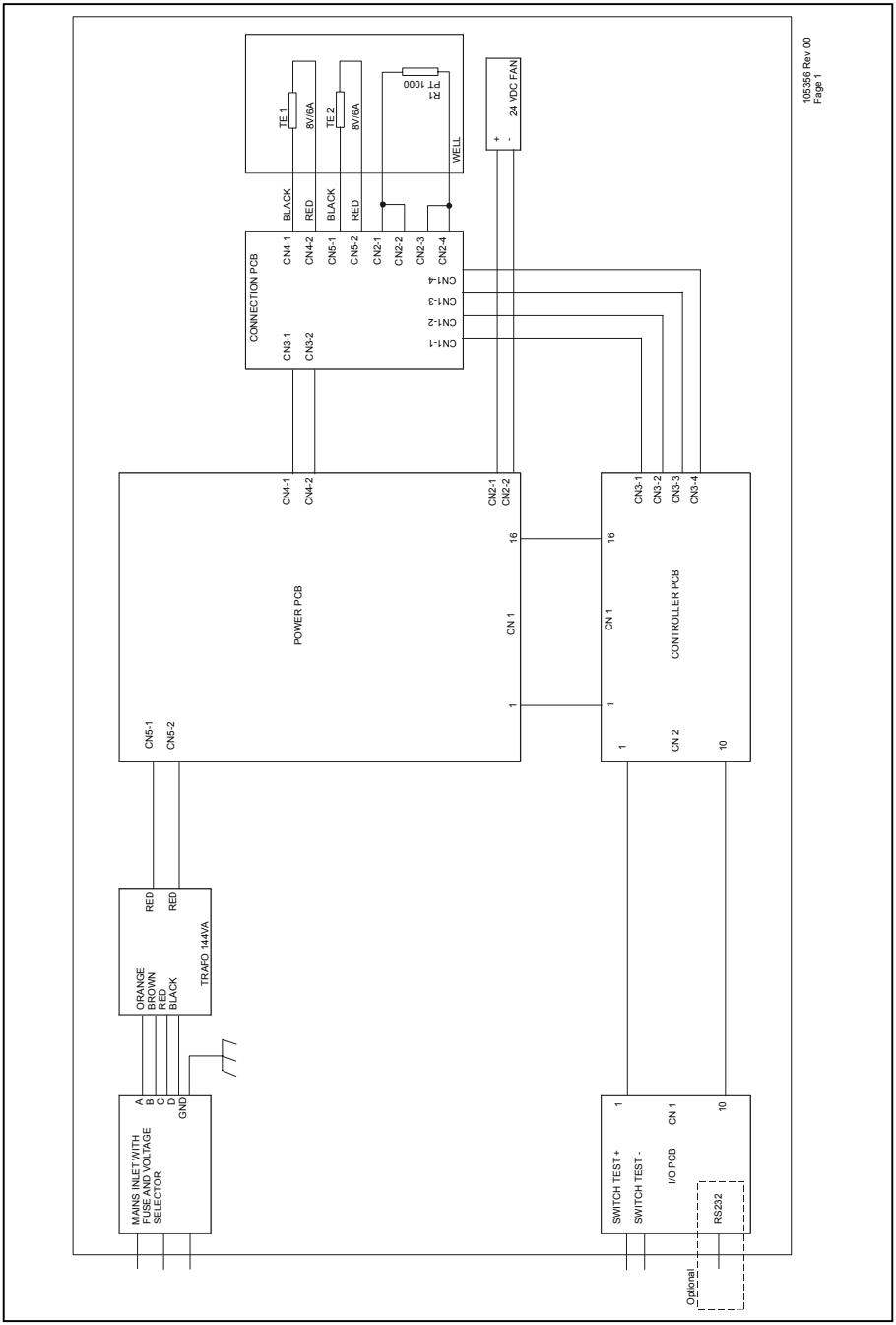
4.7 List of spare parts – CTC-1200 A-RS

Pos.	Spare parts	Number
(Compare exploded view, next page)		
1	Keyboard	105247
3	16 circuit ribbon cable	105102
4	10 circuit ribbon cable	105112
7	Grid plate	124338
13	Power PCB	124264
16	Transformer	124335
17	Fan	105257
19	I/O plate with RS232 connection	124563
20	Well, cpl. incl. sensor	124570
21	Wire for I/O plate, 145 mm.	124354
21	Wire for well, 145 mm.	124354
-	Controller PCB w. R1 + R6	124582
-	Washer for display	104559
-	Rubber foot for bottom part, black	60G032
-	Fuse 115V, 6.3AT	60B313
-	Fuse 230V, 3.15AT	60B312
-	Fuse 800 mA (T)	124428
-	Cover for fuseholder	105332
-	Power entry module, PSOSXSSXA	60D542
-	Screw, UNC-4-40 (for RS232)	122513
-	Screw set, complete	123382

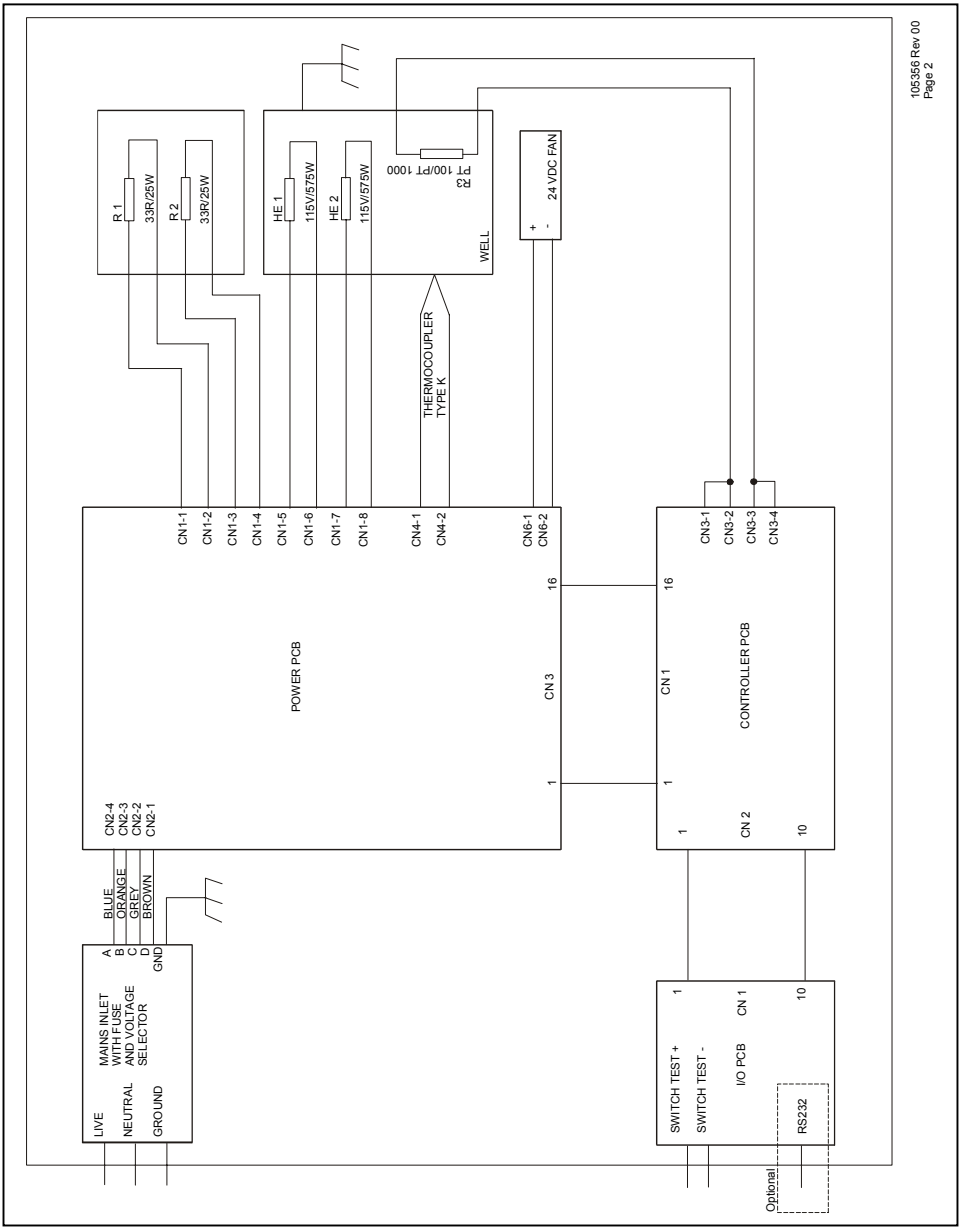
Exploded view – CTC-1200 A-RS



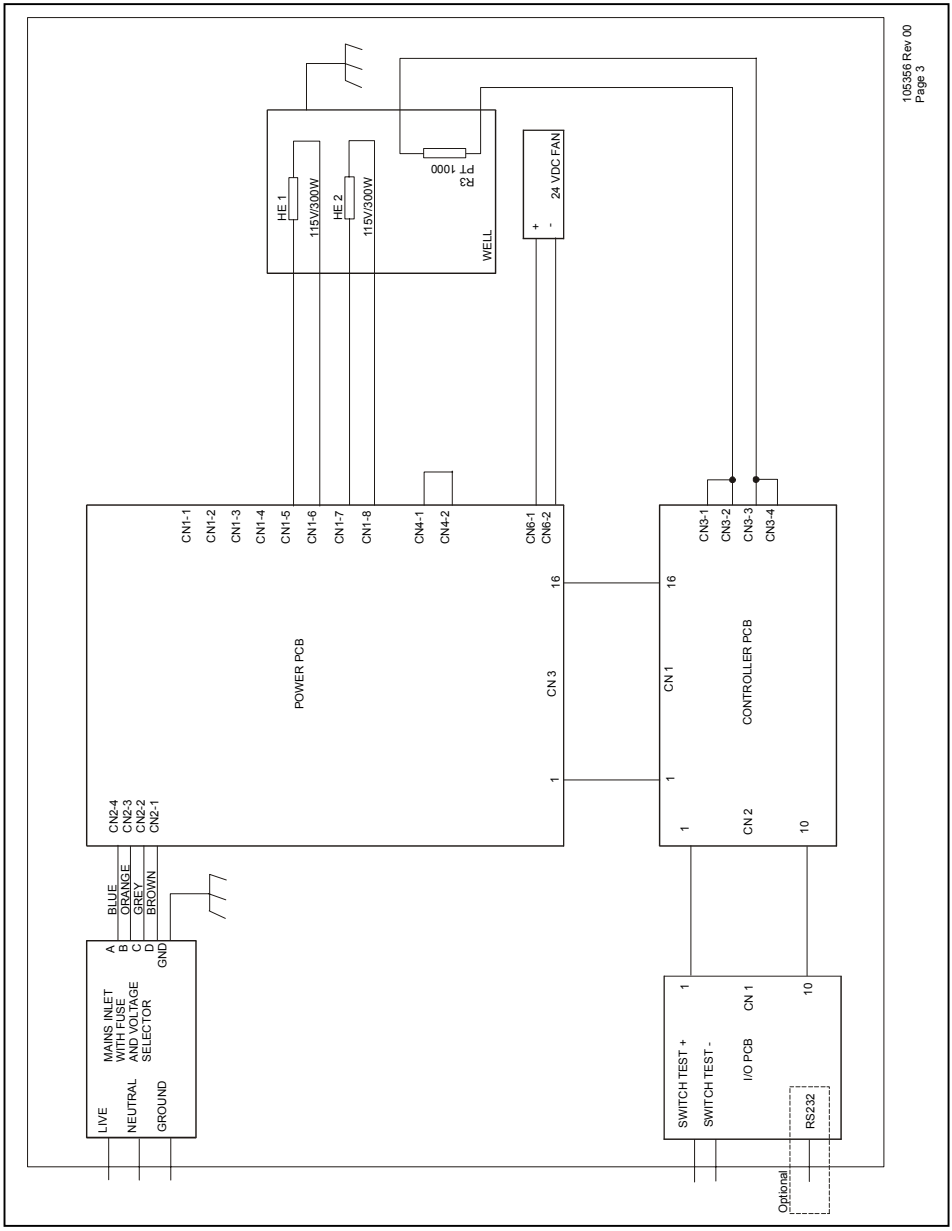
4.8 Wiring diagram – CTC-140 A/-RS, MTC-140 A



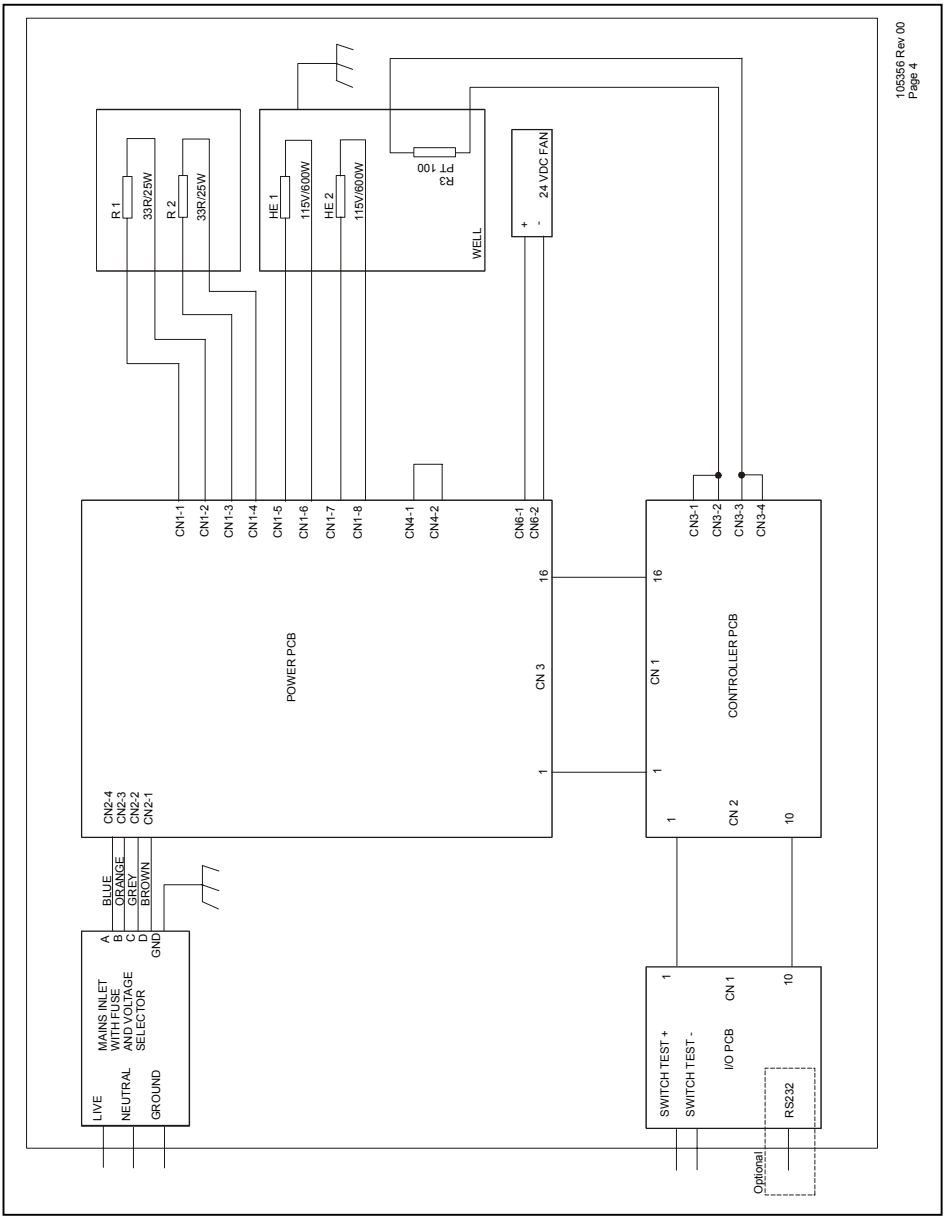
4.9 Wiring diagram – CTC-320/650 A/-RS, MTC-320/650 A



4.10 Wiring diagram – CTC-320 B/-RS



4.11 Wiring diagram – CTC-650 B/-RS



4.12 Wiring diagram – CTC-1200 A-RS