

Service manual Precision balances

KERN PLE-N KERN PLS-F / PLJ-F

Version 2.1
2/2010
GB

with strain gauge (DMS)





KERN PLE-N, PLS-F

Version 2.1 2/2010

Service manual

Precision balances

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1 Basic Information

Grundlegende Hinweise

The device must be repaired only by trained specialist staff or personnel with professional formation (such as a repair-specialist accredited by law concerning verification).

The service manual is obligatory for repair work.

After repair, original conditions of the device have to be restored.

Only original spare parts should be used.

Instructions about conformity-evaluated scales:

Repair must be carried only at 100% compliance with the type approval.

A violation of this specification will result in a loss of the type approval!

After successful repair the balance will have to be reverified before it can be used again in a statutorily regulated field.

Das Gerät darf nur von geschultem oder beruflich ausgebildetem Fachpersonal (z. B. eichrechtlich anerkannter Instandsetzer) repariert werden.

Die Serviceanleitung ist bindend für Reparaturen.

Das Gerät muss nach erfolgter Reparatur wieder in den Originalzustand zurückversetzt werden.

Es dürfen nur Originalersatzteile verwendet werden.

Hinweis zu konformitätsbewerteten Waagen:

Reparatur darf nur in 100% -iger Übereinstimmung mit der Bauartzulassung erfolgen. Ein Verstoß gegen diese Vorgabe führt zum Erlöschen der Bauartzulassung!

Nach erfolgreicher Reparatur muss eine Nacheichung erfolgen, um die Waage wieder im gesetzlich geregelten Bereich verwenden zu können.

2 Calibration

2.1 Models with external weight

- ⇒ Observe stable environmental conditions. A warming up time of approx. 2 - 4 hours is required for stabilization.
- ⇒ Ensure that there are no objects on the weighing plate.

2.1.1 Calibration with recommended calibration weight (factory setting)

Weight value of the required calibration weight see operating manual, chpt. 1
"Technical specifications":



- ⇒ Ensure that there are no objects on the weighing plate. Press the **CAL** key



- ⇒ Wait until the weighed value for the required calibration weight appears flashing.



- ⇒ **During** the flashing display put the required calibration weight carefully in the center of the weighing plate.
The flashing display disappears.
After successful calibration the balance automatically returns to weighing mode.
- ⇒ Take away calibration weight.



2.1.2 Calibration with weights of other nominal values

Weights of different nominal values may be used for calibration but are not optimal for technical measuring, possible calibration points see table 1.



- ⇒ Ensure that there are no objects on the weighing plate. Press the **CAL** button and keep it pressed until the acoustic signal gets mute.



- ⇒ Wait until „load“ appears.



- ⇒ **During** the flashing display put the calibration weight carefully in the center of the weighing plate.
The flashing display disappears.
After successful calibration the balance automatically returns to weighing mode.
- ⇒ Take away calibration weight.



An error message will be displayed in the event of a calibration error or incorrect calibration weight. Wait until the balance is again in weighing mode and repeat the calibration procedure.

Table 1

Model	Recommended calibration weight (see chap. 2.1.1)	Other measurement-technically not optimal nominal values for calibration (see chap. 2.1.2)
PLE-N models		
PLE 310-3N	300 g	100 g, 200 g
PLE 3100-2N	3000 g	1000 g, 2000 g
PLS-F-models		
PLS 210-3FM	200g	100g
PLS 310-3F	300g	100g, 200g
PLS 610-2FM	500g	100g, 200g, 300g, 400g, 600g
PLS 2100-2FM	2000g	1000g
PLS 3100-2F	3000g	1000g, 2000g
PLS 6100-1FM	5000g	1000g, 2000g, 3000g, 4000g, 6000g
PLS 20000-1F	20000g	10 kg
PLS 20000-1FM	20000g	10 kg

2.2 Models with internal weight

For non verified balances four calibration possibilities are available in the menu.

Menu settings In weighing mode press the **MENU** button and keep it pressed until the acoustic signal gets mute. The first menu item „**units**“ is displayed.

Press **MENU** button repeatedly until „**CALib**“ appears and confirm using **PRINT** button.

Use the **MENU** key to choose between the following settings:

AUT-CAL Automatic calibration with internal weight if there is a change in temperature or time controlled.
Factory settings of verified balances.

I-CAL Calibration with internal weight after having pressed CAL, locked in verifiable units.

E-CAL Calibration with external weight
locked for verifiable units

TEC-CAL Technical calibration
Adjustment of internal calibration weight

Take over selection using the **PRINT** button.

To confirm „**TEC-CAL**“ press **PRINT** button and keep it pressed until the acoustic signal gets mute.

The balance returns to menu „**CALib**“.

To finish the menu press the **MENU** button and keep it pressed until the acoustic signal gets mute. The balance returns automatically into weighing mode.

AUT-CAL
Factory setting of
verified balances

With activated AUT-CAL function the internal calibration is automatically started when the balance

- after the weighing balance was disconnected from the mains
- after pressing **ON/OFF** in stand-by mode
- after a temperature change of 1.5 °C with non loaded weighing plate / zero display
- after a time interval of 20 min with non loaded weighing plate / zero display

The automatic calibration function is always enabled. You can start calibration at any time by pressing the **CAL**-key manually.

I-CAL

When the I-CAL function is activated, the internal calibration is started only by pressing the **CAL** button. Before pressing CAL ensure that there are no objects on the weighing plate.

E-CAL

At the models with internal calibration weight the calibration with external weight is not recommended.

TEC-CAL


Technical Calibration
Adjustment of internal calibration weight
This function allows storing the value of internal reference mass.


3 Verification Mode / Certified balances (OIML)

On certified balances (only PLS-FM, PLJ-FM), some parameters are locked, e.g. TEC-CAL. In order to change these parameters, proceed as follows:

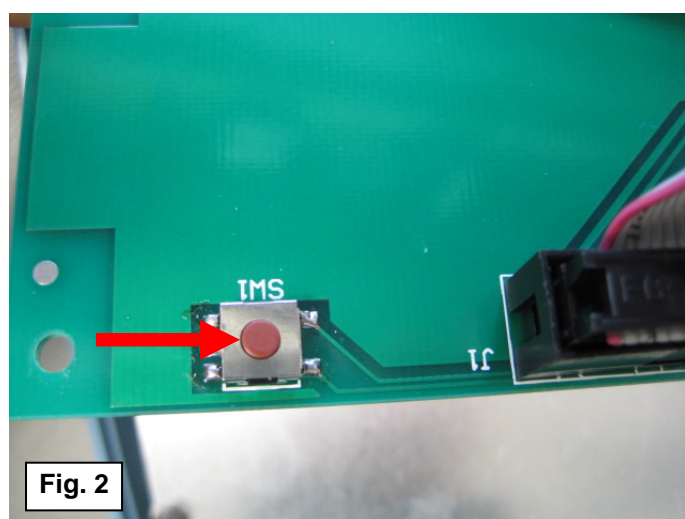
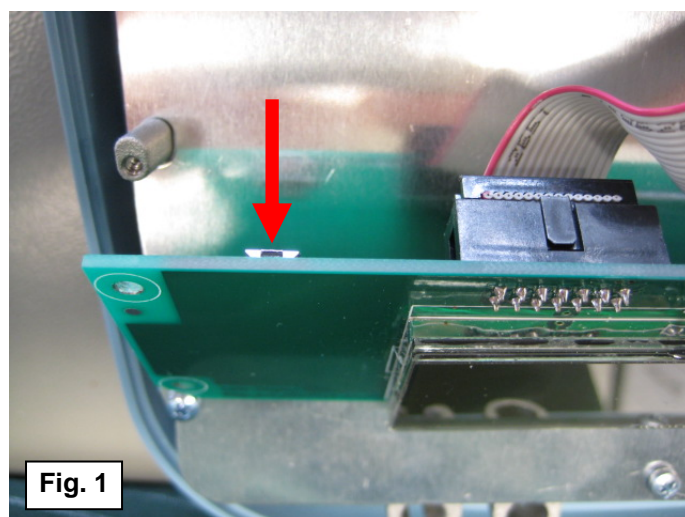
1. Switch off the balance, unplug the power supply and open the housing.
2. Press and hold button **SW1** on the backside of LCD-display board (see Fig. 1 and 2) and plug-in the power supply of the balance.

You get an acoustic signal and [OIML on] or [OIML off] is displayed.

3. Press the  key to select desired setting.

4. Take over selection using the  key.














The balance returns automatically into weighing mode.



4 Linearity Adjustment

4.1 Procedure - Software release rL 2.xx

For models with four linearity points (“up and down mode”)

1. Switch on the balance and notice the warming-up time.
2. Press sequentially buttons  –  – .
3. You will see "Lin" on display, press  to confirm.
4. The display shows on left side the number “1”. Wait for stability (approx. 3 seconds) and press  to confirm the zero point..
5. When display shows on left side the number “2”, put on first weight (see table 2). Wait for stability (approx. 3 seconds) and press  to confirm.
6. Display shows number “3”. Put on second weight, wait for stability and press  to confirm.
7. Display shows number “4”. Put on third weight, wait for stability and press  to confirm.
8. Display shows number “5”. Now press  and keep it pressed until the acoustic signal gets mute. Release the key. Display shows number “3”.
9. Remove the last weight from weighing pan, wait for stability and press  to confirm.
10. Display shows number “2”. Remove the second weight from weighing pan, wait for stability and press  to confirm.
11. Display shows number “1”. Remove the first weight from weighing pan (pan is unloaded), wait for stability and press  to confirm.
12. The balance goes automatically in stand-by mode. Press  to return to weighing mode.
13. Do the calibration and check the linearity.



ATTENTION:

During linearity adjustment (“up and down mode”) loads the required weights according table 2 incremental on weighing pan.




For example load 100g weight and then add another 100g weight and so on, as you reached the last value. Then unload the weights in reverse order.

Table 2


MODEL	RANGE (g)	RES. (g)	LINEARITY (g) UP	LINEARITY (g) DOWN
PLE 310-3N	310	0,001	0 + 100 + 100 + 100	100 - 100 - 100 - 0
PLE3100-2N	3100	0,01	0+1000+1000+1000	1000-1000-1000-0
PLS 310-3F	310	0,001	0 + 100 + 100 + 100	100 - 100 - 100 - 0
PLS 3100-2F	3100	0,01	0+1000+1000+1000	1000-1000-1000-0

4.2 Delete linearity and calibration values

1. Switch on balance.

2. Press sequentially buttons  –  – .









3. You will see "Lin" on display, press  to confirm.

4. The display shows on left side the number “1”. Press  key and keep it pressed until the display shows **CLEAR**.

5 Adjustment of Internal Calibration Weight (only PLJ-F models)

Technical Calibration (TEC-CAL)

This function allows storing the value of internal reference mass.

1. In weighing mode press the  button and keep it pressed until the acoustic signal gets mute. The first menu item “**units**” is displayed.
2. Press  button repeatedly until “**CALib**” appears and confirm using  button.
3. Use the  button to choose “**TEC-CAL**”. Press the  button and keep it pressed until the acoustic signal gets mute. Display shows “**CALib**”.
4. To finish and store the menu setting, press the  button and keep it pressed until the acoustic signal gets mute. The balance returns automatically into weighing mode.
5. With empty pan press  button. The display appears “- **CAL** -”.
6. Wait until the exact size of calibration weight appears flashing in the display. Now place the required weight in the centre of the weighing pan. The flashing display disappears.
7. The balance returns to normal weighing mode. Take away calibration weight.
8. Display shows the zero point, e.g. “**0.000**”. Press the  button and keep it pressed until the acoustic signal gets mute. The technical calibration starts. During this process the display appears “**tEc MEM**”.
9. After having stored the value of internal calibration weight automatically, the balance returns to normal weighing mode.
10. Return to calibration mode (see chapter 2.2) and set the desired calibration mode (AUT-CAL or I-CAL).

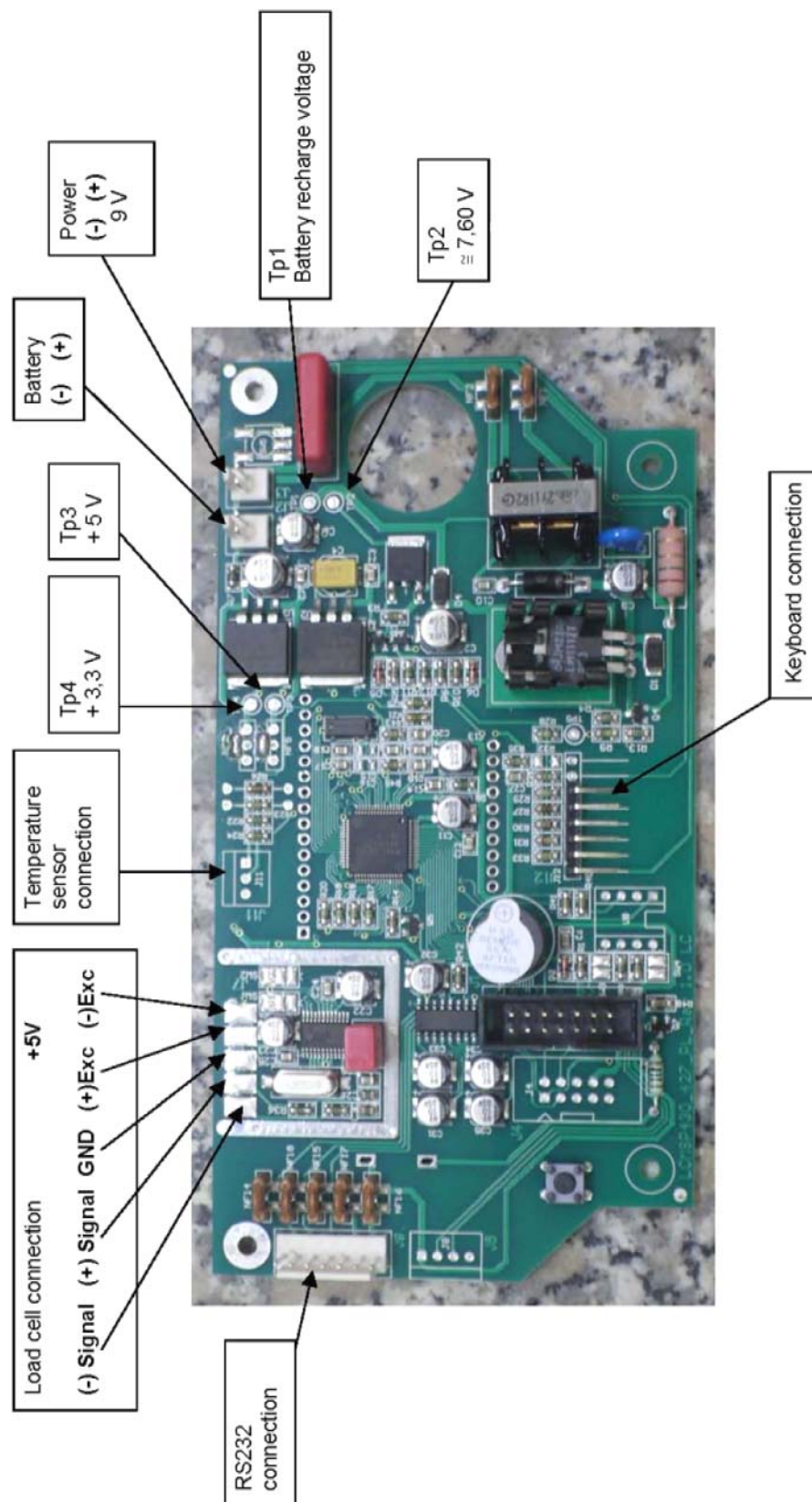


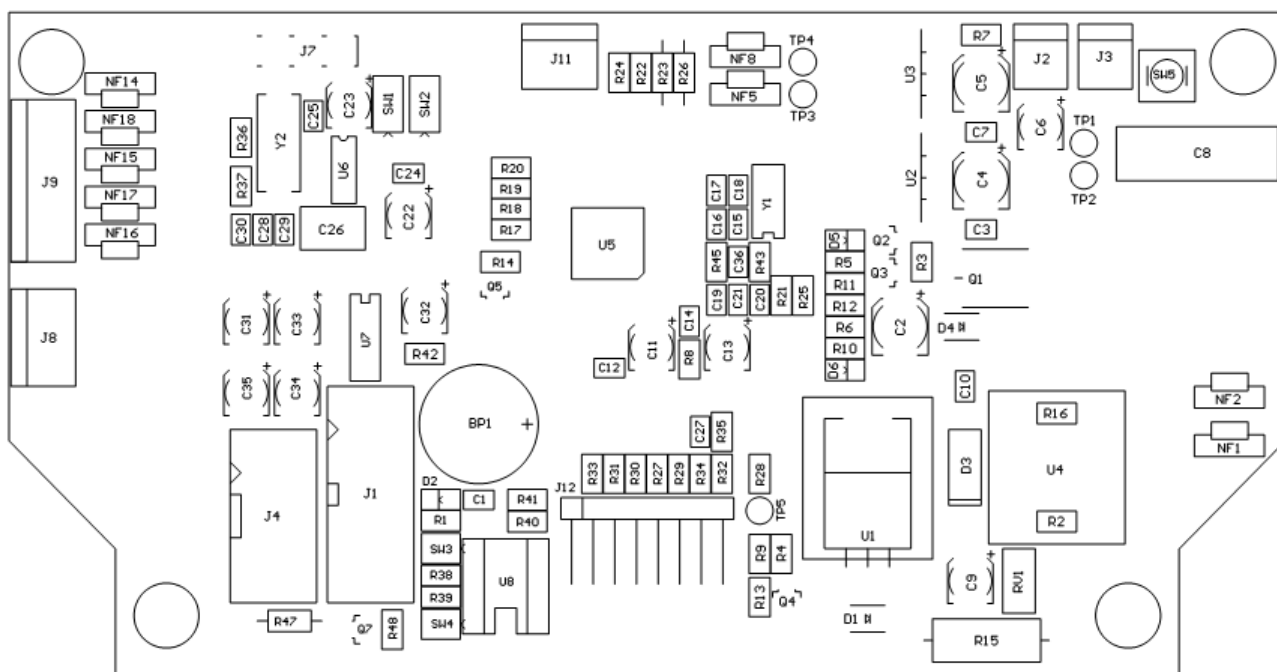
ATTENTION

Use weights class E2 to maintain the accuracy !

6 Measuring Points on Main Board

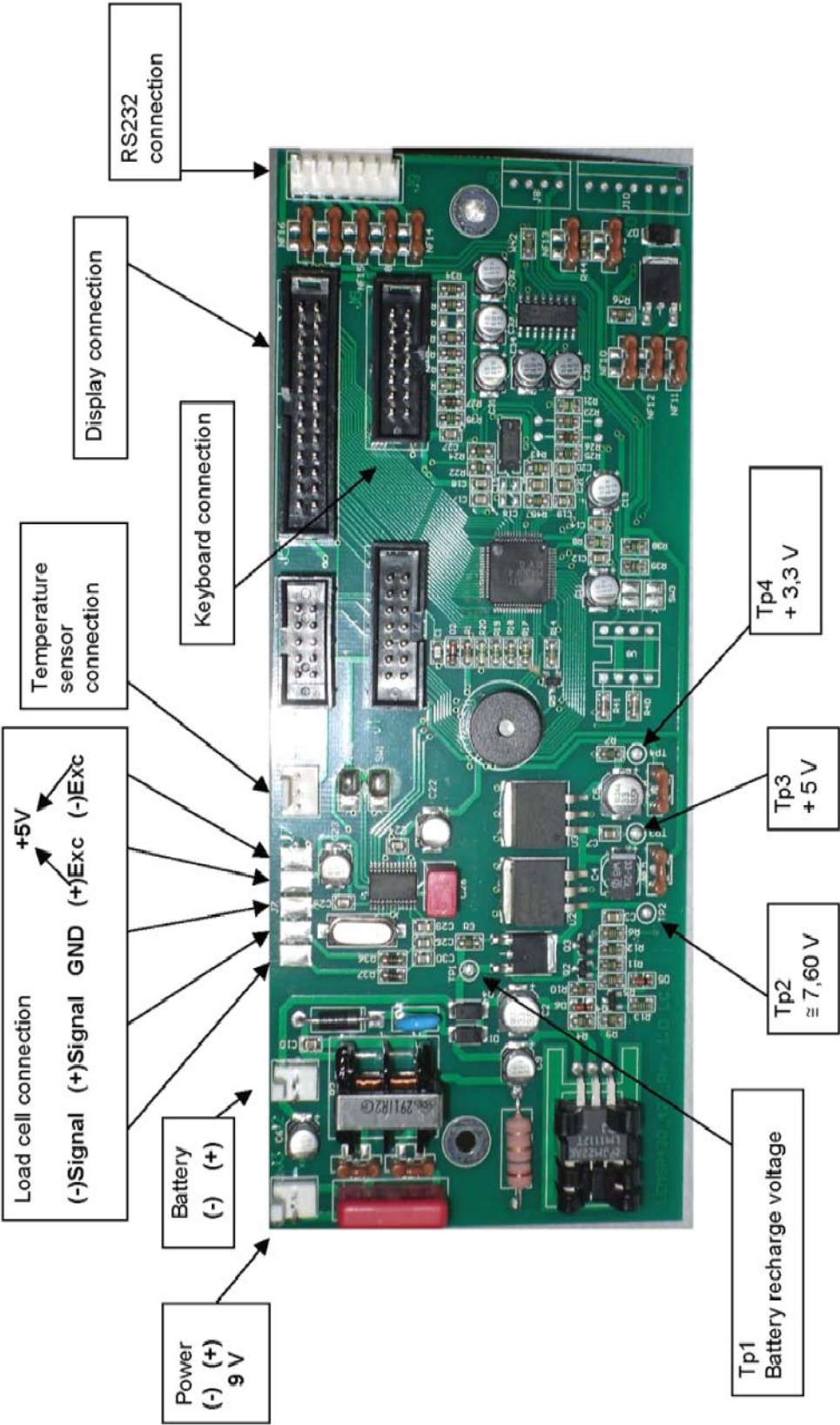
6.1 PLE-N

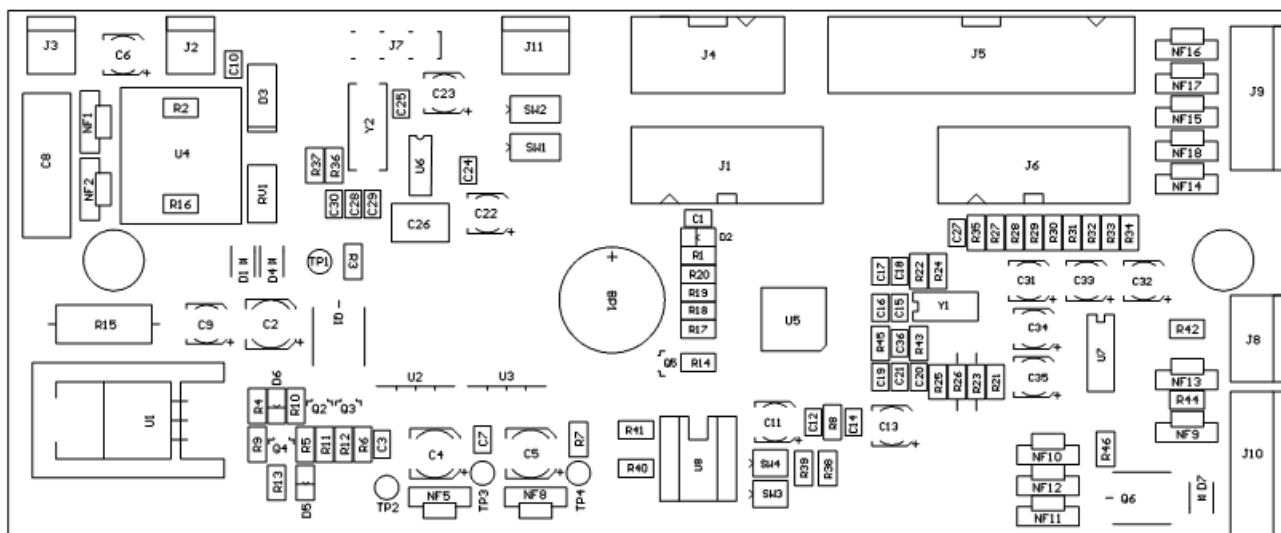




Test point		Value	If the value is not correct
J3 Pin2 (-)	J3 Pin1 (+)	+ 9 Volt DC	Check Power supply
J2 Pin2 (-)	J2 Pin1 (+)	0 to 7 Volt DC without external power supply	Check battery
(J7) GND (-)	Tp3 (+)	+ 5 Volt DC	Check LM2940 (U2)
(J7) GND (-)	Tp4 (+)	+ 3,3 Volt DC	Check LM3940 (U3)
(J7) GND (-)	Tp1 (+)	$\approx + 7,6$ Volt DC	Check LM1117 (U1)
(J7) GND (-)	Tp2 (+)	$\approx +7,6$ Volt DC	Check IRF9120 (Q1)
(J7) EXC (-)	(J7) EXC (+)	+ 5 Volt DC	Check LM2940 (U2)
(J7) SIGNAL (-)	(J7) SIGNAL (+)	Without load on weighing pan (0 g) $\approx \pm 0$ mV	Check load cell
(J7) SIGNAL (-)	(J7) SIGNAL (+)	With maximum load on weighing pan $\approx +5$ mV	Check load cell

6.2 PLS-F





Test point		Value	If the value is not correct
J3 Pin2 (-)	J3 Pin1 (+)	+ 9 Volt DC	Check Power supply
J2 Pin2 (-)	J2 Pin1 (+)	0 to 7 Volt DC without external power supply	Check battery
(J7) GND (-)	Tp3 (+)	+ 5 Volt DC	Check LM2940 (U2)
(J7) GND (-)	Tp4 (+)	+ 3,3 Volt DC	Check LM3940 (U3)
(J7) GND (-)	Tp1 (+)	\approx + 7,6 Volt DC	Check LM1117 (U1)
(J7) GND (-)	Tp2 (+)	\approx +7,6 Volt DC	Check IRF9120 (Q1)
(J7) EXC (-)	(J7) EXC (+)	+ 5 Volt DC	Check LM2940 (U2)
(J7) SIGNAL (-)	(J7) SIGNAL (+)	Without load on weighing pan (0 g) \approx \pm 0 mV	Check load cell
(J7) SIGNAL (-)	(J7) SIGNAL (+)	With maximum load on weighing pan \approx +5 mV	Check load cell

7 Load Cell Replacement

EXAMPLE OF PLS-F

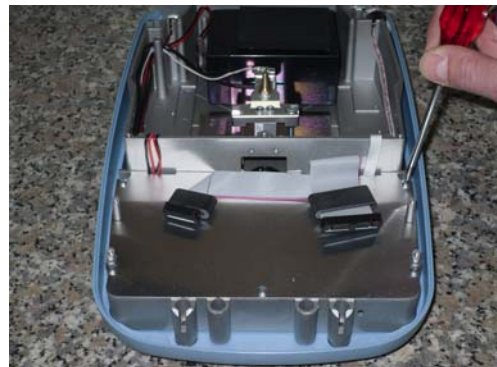
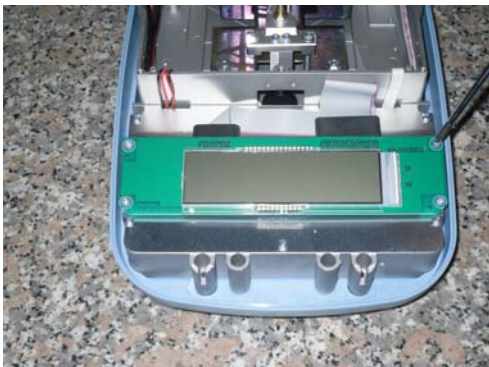
1. REMOVE THE COVER OF BALANCE (REMOVE THE FRONT SCREW ON THE TOP AND FOUR SCREWS ON THE BOTTOM).



2. REMOVE THE LOAD CELL SHIELD.



3. REMOVE THE DISPLAY BOARD AND THE BOARD SHIELD.



4. DISCONNECT BATTERY AND TEMPERATURE SENSOR AND UNSOLDER LOAD CELL'S CABLE.



5. REMOVE LOAD CELL'S SUPPORT (REMOVE THE SCREW ON THE BOTTOM).



6. REMOVE LOAD CELL FROM THE SUPPORT AND REMOVE THE CONE SUPPORT.



7. REMOVE TEMPERATURE SENSOR AND BOARD FROM THE LOAD CELL.



NOW YOU CAN ASSEMBLE THE NEW LOAD CELL:

8. FIX TEMPERATURE SENSOR AND BOARD TO THE LOAD CELL.

9. FIX THE CONE SUPPORT TO LOAD CELL AND FIX THE LOAD CELL TO THE SUPPORT.

10. FIX LOAD CELL'S SUPPORT TO THE BASE OF BALANCE.

11. CONNECT BATTERY AND TEMPERATURE SENSOR AND SOLD ON LOAD CELL'S CABLE.

12. FIX THE DISPLAY BOARD AND THE BOARD SHIELD.

13. CHECK AND REGULATE OFF-CENTER LOAD AND LINEARITY.

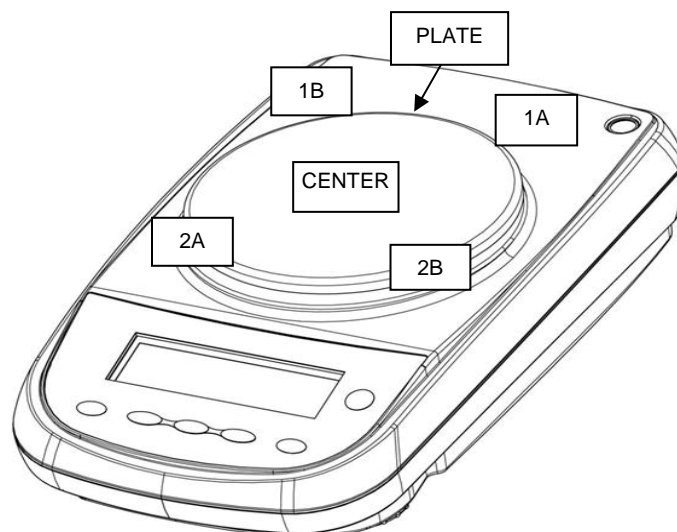
14. FIX THE LOAD CELL SHIELD.

15. FIX THE COVER OF BALANCE.

8 Off-Center Load Adjustment (Eccentricity)

EXAMPLE OF PLS-F

TOP VIEW



1. REMOVE THE COVER OF BALANCE (REMOVE THE FRONT SCREW ON THE TOP (Fig. 3) AND FOUR SCREWS ON THE BOTTOM (Fig. 4)).
2. REMOVE THE LOAD CELL SHIELD (Fig. 5).
3. PUT ON THE PLATE AND SWITCH-ON ON THE BALANCE.
4. PUT A TEST WEIGHT $\frac{1}{3}$ OF MAX. IN THE CENTER OF THE PLATE, WAIT FOR STABILITY AND PRESS TARE.
5. MOVE THE WEIGHT TO POINT 2A. MAKE A NOTE OF THE DIFFERENCE.
6. MOVE THE WEIGHT TO CENTER AND PRESS TARE.
7. MOVE THE WEIGHT TO POINT 2B. MAKE A NOTE OF THE DIFFERENCE.
8. TAKE THE FILE AND SCRATCH AS ILLUSTRATED.

Fig. 3



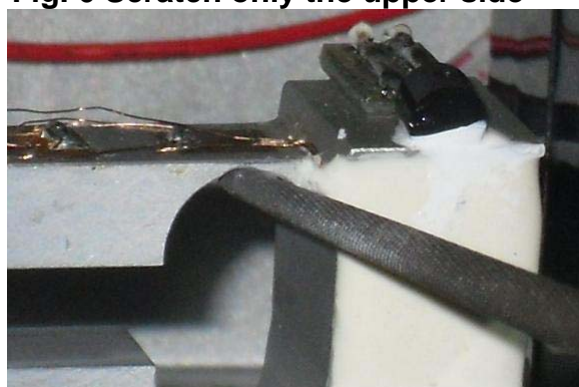
Fig. 4



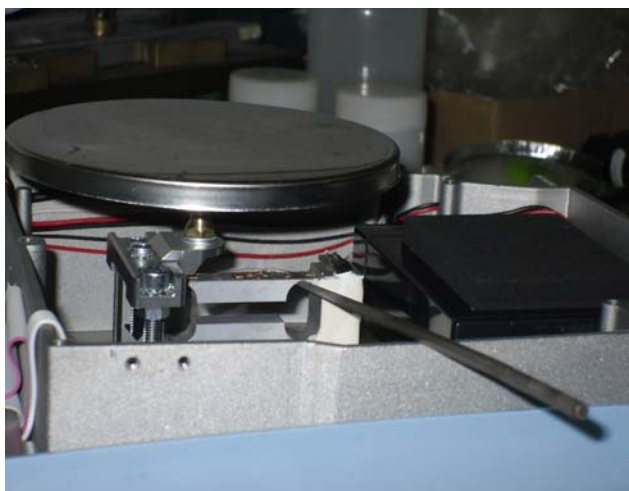
Fig. 5



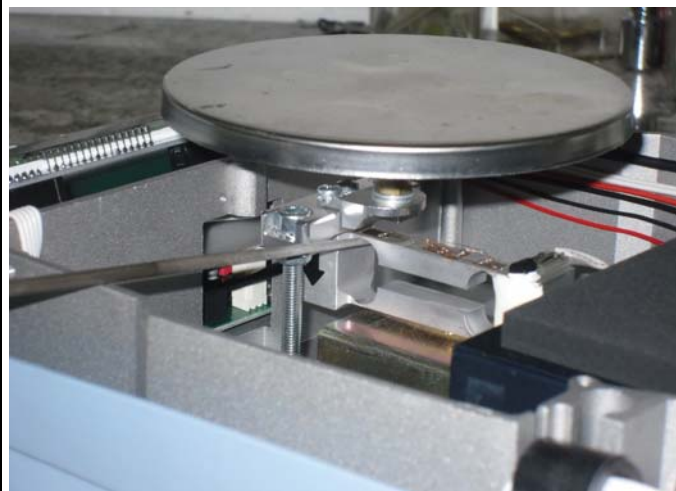
Fig. 6 Scratch only the upper side



2A + SCRATCH SIDE 1A (Rear Right)



2A - SCRATCH SIDE 2A (Front Left)



2B + SCRATCH SIDE 1B (Rear Left)



2B - SCRATCH SIDE 2B (Front Right)



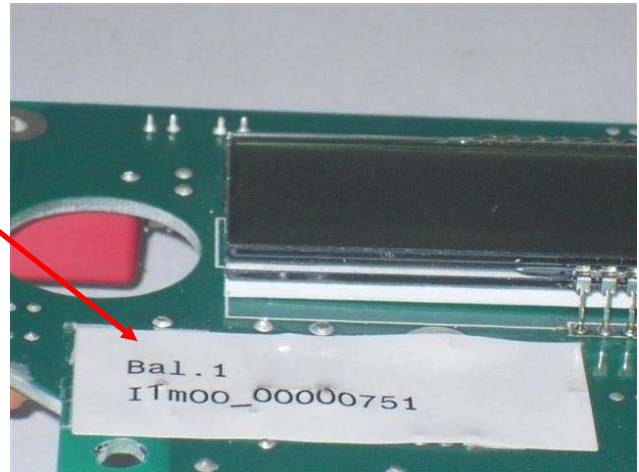
ATTENTION: If the corner 1A or 1B is not correct, check if the load cell is ok.

9 Main Board Replacement

If you have to order a new main board, please tell us the **serial number** of balance and the **reference code** (inside housing) like shown below.



PLS-F, PLJ-F



PLE-N

KERN will program the new main board (incl. temperature compensation data) with special developed adjustment software and a hardware key.



After replacing the main board you have only to do the "Linearity Adjustment" (see chapter 4) and the "Calibration" (see chapter 2).

If necessary do the "Adjustment of Internal Calibration Weight" (only PLJ-F models) according to chapter 5.

In case of a faulty configuration (e.g. wrong resolution), it is advisable to send the device back to KERN for the proper configuration and adjustment procedure.

The configuration and the adjustment itself require extensive service training and a special developed hardware key.

10 Troubleshooting / Error Messages

ERR01	Weight value instable or zeroing not possible. Check the environmental conditions.
ERR02	Calibration error, e.g. environmental conditions instable
ERR03	Calibration error, e.g. incorrect calibration weight
ERR04	Piece weight too small/instable
ERR05	Data transfer not possible, as weighing value is instable. Check the environmental conditions.
ERR06	Weighing value in density determining mode instable. Check the environmental conditions.
ERR07	Data input error
“UNLOAD”:	Weighing range not achieved. Check position of the weighing plate
“CAL But”	Calibrate balance
	Weighing range exceeded, placed load exceeds the capacity of the balance. Unload the balance.
	Weighing range not reached, e.g. weighing plate not in place






Unstable reading	<ul style="list-style-type: none"> - Check if the load cell touched the base plate - Check if something comes in contact with plate - Check the input and output signal of load cell (see chapter 6 “measuring points on main board”)
Only zero – no weighing results	<ul style="list-style-type: none"> - Delete linearization values (see chapter 4.2 “delete linearity and calibration values”) - Check the input and output signal of load cell (see chapter 6 “measuring points on main board”)
Display don’t work correctly	<ul style="list-style-type: none"> - Check connection of 26 poles cable - Check power signal (see chapter 6 “measuring points on main board”) - Change display board
Keyboard failure	<ul style="list-style-type: none"> - Check connection of 14 poles cable - Change keyboard
Off-center load error	<ul style="list-style-type: none"> - Do off-center load adjustment (see chapter 8) - Check if the load cell is bent
Linearity error	<ul style="list-style-type: none"> - Do linearity adjustment (see chapter 4) - Check if the load cell is bent

11 Spare Parts

11.1 PLE 310-3N













PLE 310-3N		
CODE	DESCRIPTION	IMAGE
A359	LOAD CELL SUP2 –300g	
A131	SUPPORT S LOAD CELL	
M926	SPACER LOAD CELL SUP2	
A135	CONE SUPPORT S SUP2	
M922	MILLIGRAM CONE	
T011	MILLIGRAM UNDERPLATE	
M635	PLATE 80mm	
A117	COVER MARK S	
A118	BOTTOM MARK S	
A128	HOOK CAP S	

PLE 310-3N		
CODE	DESCRIPTION	IMAGE
A121	PLASTIC RING	
A124	DISC INOX 130mm	
A133	CIRCULAR WIND SHIELD MARK S	
A134	COVER WIND SHIELD MARK S	
A123	ADJUSTABLE FEET MARK S	
A132	DUST COVER MARK S	
A503	LEVEL BUBBLE	
S308	LCMSP430_427_PL_REV1.0	
E317	LCD WITH BACKLIGHT ADT7138	
A736	KEYBOARD PLE	
E755	INTERNAL BATTERY 6V 1,2Ah	
A127	BRACKET FIX BATTERY	
E809	CABLE WITH CONNECTOR FOR RS232 S	
E667	CABLE WITH DC PLUG S	

PLE 310-3N		
CODE	DESCRIPTION	IMAGE
E502	CABLE FOR WITH SENSOR TEMPERATURE	
E501	CABLE FOR BATTERY	
E807	POWER SUPPLY IN 230V OUT 9V EUROPEAN PLUG	
E808	POWER SUPPLY IN 120V OUT 9V US PLUG	
E810	POWER SUPPLY IN 230V OUT 9V UK PLUG	

11.2 PLE 3100-2N













PLE 3100-2N		
CODE	DESCRIPTION	IMAGE
A368	LOAD CELL SUP1 –3000g	
A131	SUPPORT S LOAD CELL	
A136	CONE SUPPORT S SUP1	
M002	CENTIGRAM CONE S	
A120	CENTIGRAM UNDERPLATE S	
A126	PLATE 130mm	
A117	COVER MARK S	
A118	BOTTOM MARK S	
A130	HOOK	
A128	HOOK CAP S	
A121	PLASTIC RING	
A124	DISC INOX 130mm	

PLE 3100-2N		
CODE	DESCRIPTION	IMAGE
A123	ADJUSTABLE FEET MARK S	
A132	DUST COVER MARK S	
A503	LEVEL BUBBLE	
S308	LCMSP430_427_PL_REV1.0	
E317	LCD WITH BACKLIGHT ADT7138	
A736	KEYBOARD PLE	
E755	INTERNAL BATTERY 6V 1,2Ah	
A127	BRACKET FIX BATTERY	
E809	CABLE WITH RS232 CONNECTOR S	
E667	CABLE WITH DC PLUG S	
E502	CABLE WITH SENSOR TEMPERA-TURE	
E501	CABLE FOR BATTERY	
E807	POWER SUPPLY IN 230V OUT 9V EUROPEAN PLUG	

E808	POWER SUPPLY IN 120V OUT 9V US PLUG	
E810	POWER SUPPLY IN 230V OUT 9V UK PLUG	

11.3 PLS 310-3F












PLE 3100-2N		
CODE	DESCRIPTION	IMAGE
A368	LOAD CELL SUP1 –3000g	
A131	SUPPORT S LOAD CELL	
A136	CONE SUPPORT S SUP1	
M002	CENTIGRAM CONE S	
A120	CENTIGRAM UNDERPLATE S	
A126	PLATE 130mm	
A117	COVER MARK S	
A118	BOTTOM MARK S	
A130	HOOK	
A128	HOOK CAP S	
A121	PLASTIC RING	
A124	DISC INOX 130mm	

PLE 3100-2N		
CODE	DESCRIPTION	IMAGE
A123	ADJUSTABLE FEET MARK S	
A132	DUST COVER MARK S	
A503	LEVEL BUBBLE	
S308	LCMSP430_427_PL_REV1.0	
E317	LCD WITH BACKLIGHT ADT7138	
A736	KEYBOARD PLE	
E755	INTERNAL BATTERY 6V 1,2Ah	
A127	BRACKET FIX BATTERY	
E809	CABLE WITH RS232 CONNECTOR S	
E667	CABLE WITH DC PLUG S	
E502	CABLE WITH SENSOR TEMPERA-TURE	
E501	CABLE FOR BATTERY	
E807	POWER SUPPLY IN 230V OUT 9V EUROPEAN PLUG	

E808	POWER SUPPLY IN 120V OUT 9V US PLUG	
E810	POWER SUPPLY IN 230V OUT 9V UK PLUG	

11.4 PLS 3100-2F

PLS 3100-2F		
CODE	DESCRIPTION	IMAGE
A368	LOAD CELL SUP1 –3000g	
M921	OMEGA SUPPORT FOR SUP1 CELL	
M914	SPACER LOAD CELL SUP1	
M915	CONE SUPPORT SUP1	
M923	CENTIGRAM CONE	
M917	HOOK LOAD CELL SUP	
M401	UNDERPLATE FOR CENTIGRAM	
M406	PLATE 160mm	
A717	PLASTIC COVER 6K	
A718	PLASTIC BOTTOM BLUE	

CODE	DESCRIPTION	IMAGE
A712	LOAD CELL SHIELD	
A711	MAIN BOARD SHIELD	
A719	ADJUSTABLE FEET PLASTIC CASE	
T222	DUST COVER 6K	
A713	ALLUMINIUM INTERNAL CASE	
A503	LEVEL BUBBLE	
A716	DISC INOX 160mm	
S307	MAIN BOARD LCMSP430_427_REV1.0	
S304	DISPLAY BOARD DISP_LCD_ADT7124_REV1.1	
E318	LCD ADT7124	
S310	CABLE 14 PIN FOR KEY CONNECTING	
S311	CABLE 26 PIN FOR DISPLAY CON- NECTING	

PLS 3100-2F		
CODE	DESCRIPTION	IMAGE
A735	KEYBOARD PLS	
E755	INTERNAL BATTERY 6V 1,2Ah	
E493	CABLE WITH DC PLUG	
E748	CABLE WITH RS232 CONNECTOR	
E496	CABLE WITH SENSOR TEMPERATURE	
E495	CABLE FOR BATTERY	
E807	POWER SUPPLY IN 230V OUT 9V EUROPEAN PLUG	
E808	POWER SUPPLY IN 120V OUT 9V US PLUG	
E810	POWER SUPPLY IN 230V OUT 9V UK PLUG	