Service Manual
Bel Toploading Balances

Binary
Milligram
Centigram
Decigram
Classic
Analytical

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BEL ENGINEERING

SERVICE MANUAL

TOPLOADING BALANCES

JANUARY - 2004

REV. 1.0P

Note!

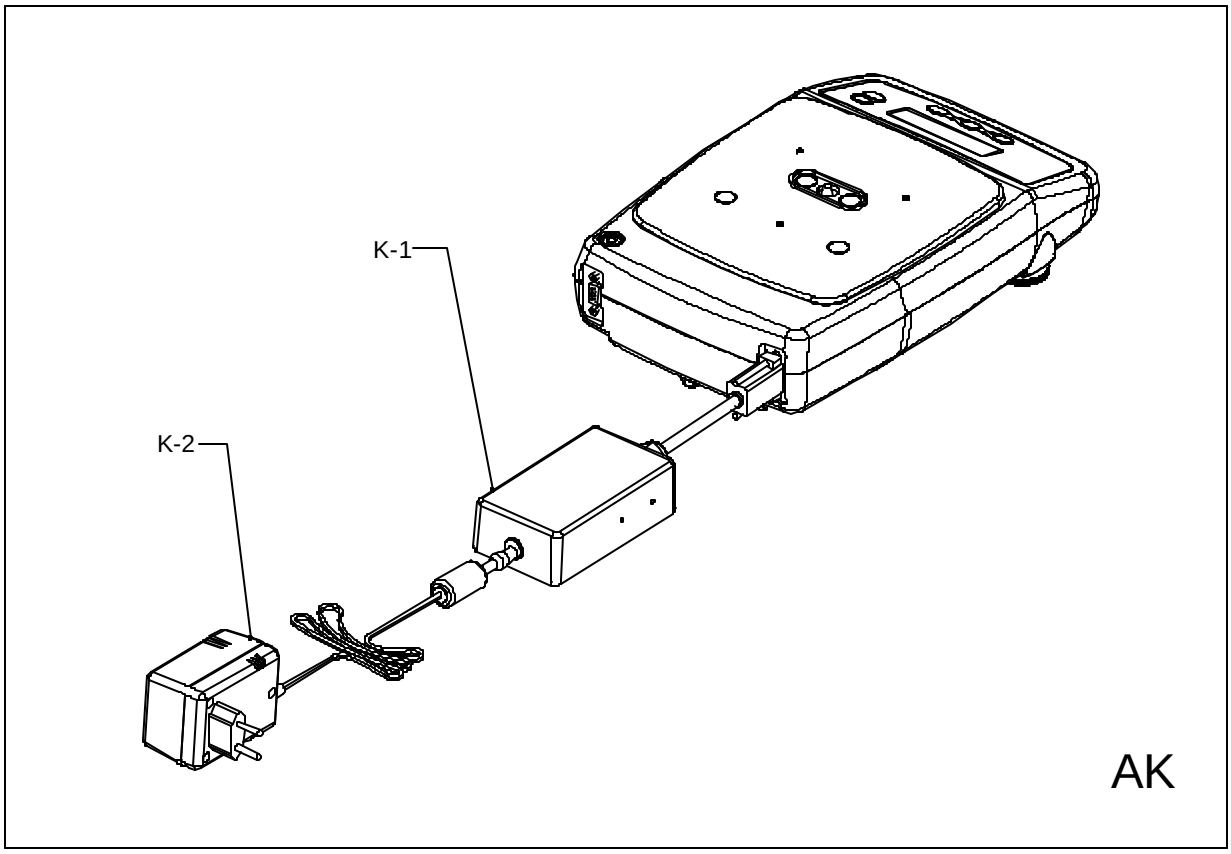
The power supply for Bel balances is 120 VAC input and 24VAC output.

All analytical Bel balances have a power supply conditioner fitted to ensure accurate weighing results.

BALANCE PARTS

SHEET	NO.	NAME	CODE
AK	K-1	EXTERNAL VERSION OF BOARD "ALINT REV4-B"	/
AK	K-2	AC ADAPTER	/
BK	K-3	SCREW M4x45 FOR BALANCE CLOSING	/
BK	K-4	SCREW M4x25 FOR BALANCE CLOSING	/
CK	K-5	COVER	02-90-0399
CK	K-6	DISPLAY	/
CK	K-7	SCREW M3x6 FOR DISPLAY FIXING	/
CK	K-8	KEYBOARD	/
CK	K-9	SCREW REGULATOR CAP	DP 500
CK	K-10	COLUMNS CAP	DP 562
CK	K-11	SPIRIT LEVEL	/
DK	K-12	CONNECTOR RS 232	/
DK	K-13	CONNECTOR AL EXT LS	/
EK	K-14	INTERNAL VERSION OF BOARD "ALINT REV4-B"	/
EK	K-15	SCREW M3x6 FOR BOARD FIXING	
FK	K-16	SCREW M5x14 FOR ENBLOCK FIXING	/
FK	K-17	WASHER FOR SCREW M5	/
FK	K-18	SCREW M4x14 FOR ENBLOCK SHIELD FIXING	/
GK	K-19	ENBLOCK	/

GK	**K-20**	ENBLOCK SHIELD	02-01-0368
GK	**K-21**	SPACER FOR ENBLOCK	02-07-0363
HK	**K-22**	BOARD "BIL 2407A REV1 6K" Mod. 0,1g / 0,01g / 0,001g	/
HK	**K-23**	SCREW M3x6 FOR BOARD FIXING	/
HK	**K-24**	SCREW M3x6 FOR SIGNAL RESISTOR FIXING	/
HK	**K-25**	PLASTIC WASHER FOR SCREW M3	/
HK	**K-26**	MICA	/
IK	**K-27**	ADJUSTABLE FOOT	/
IK	**K-28**	HOOK CAP	SP 1000
IK	**K-29**	CAP FOR HOLE CLOSING	/
LK	**K-30**	BASE	02-90-0398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K-2
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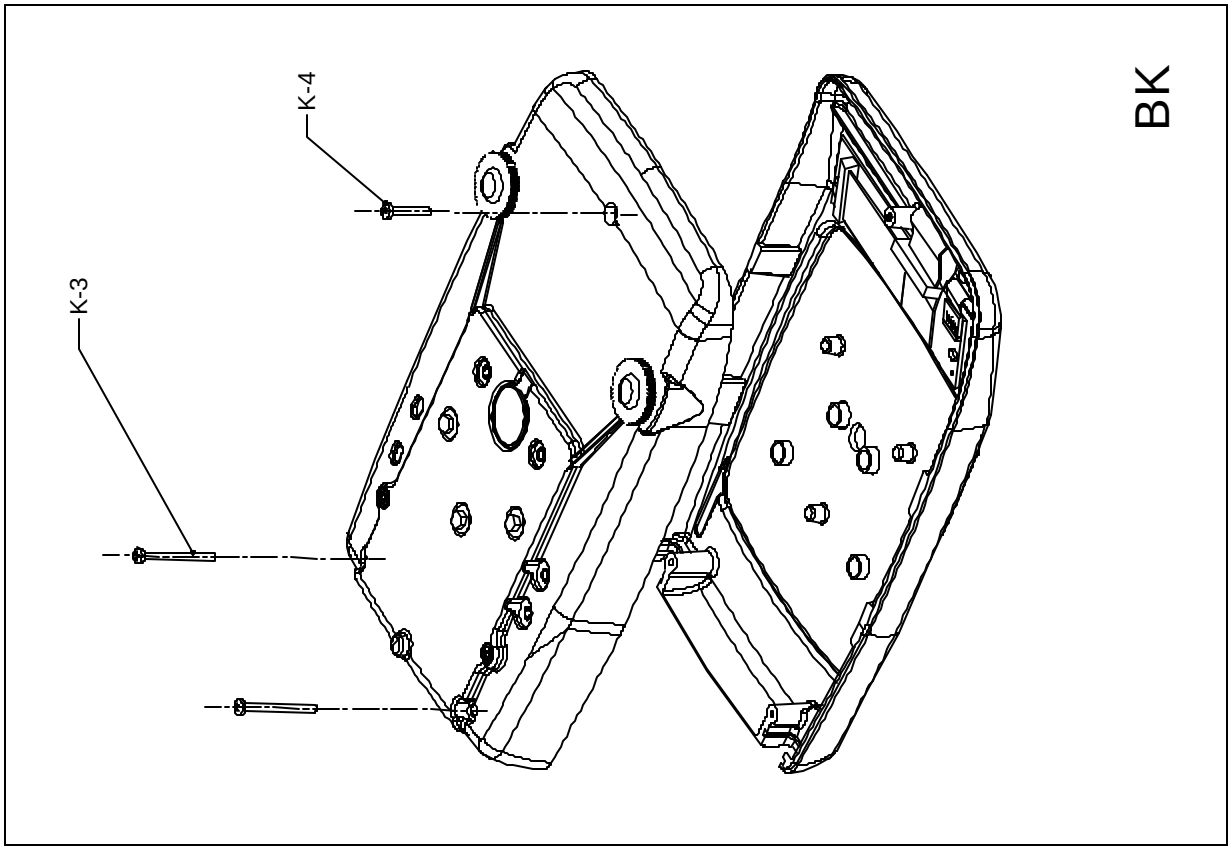
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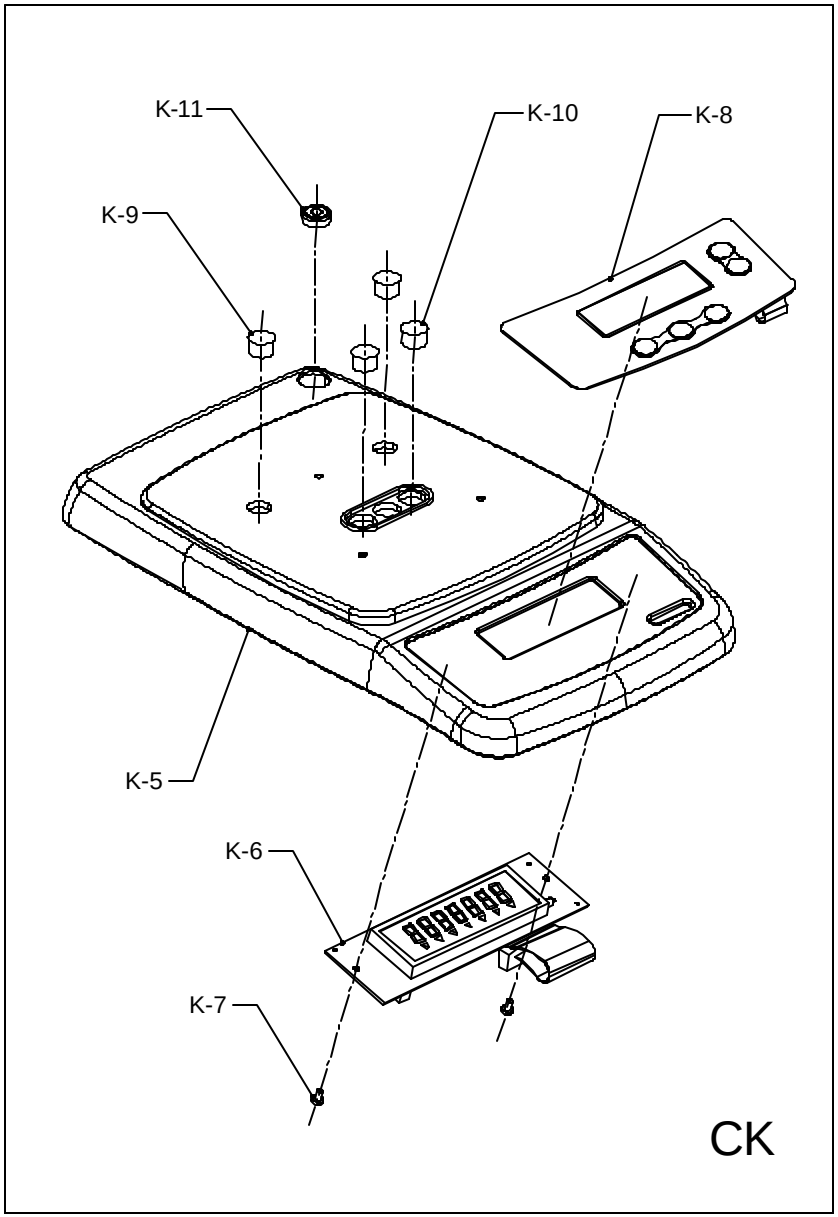
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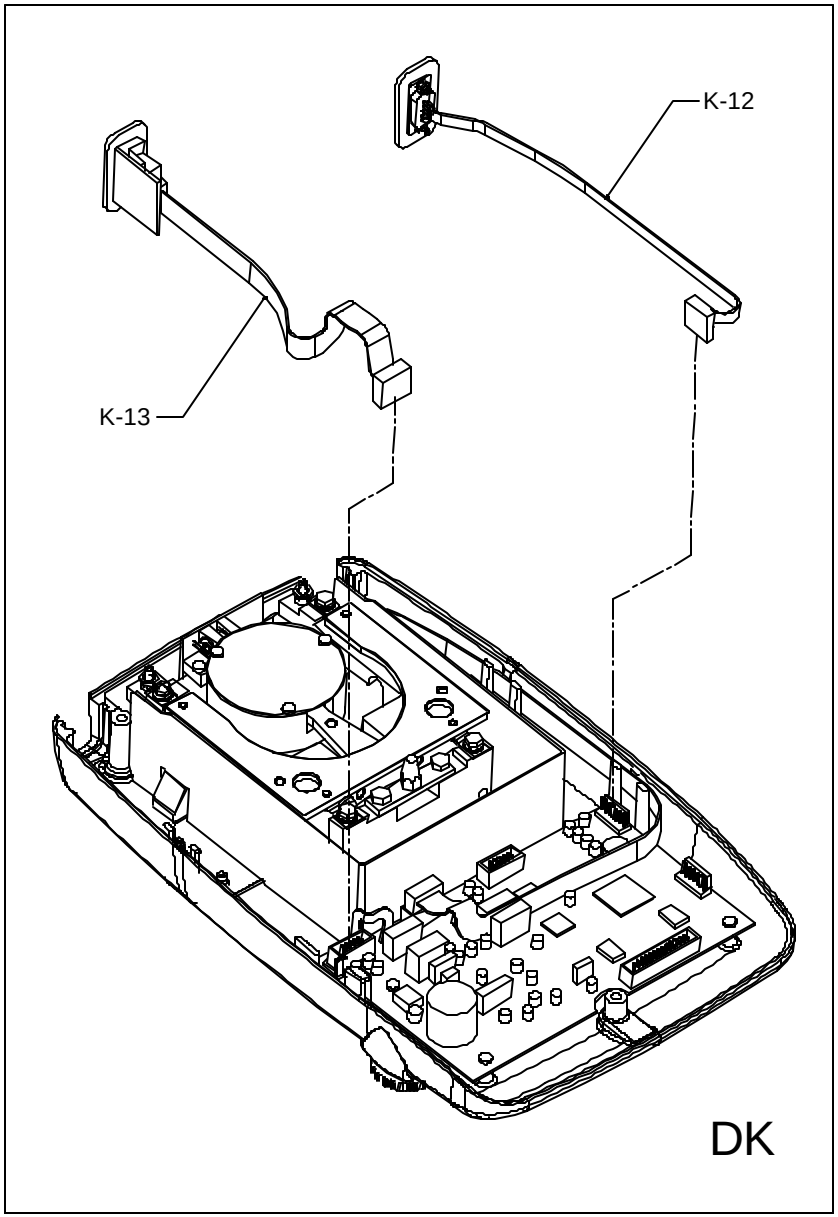
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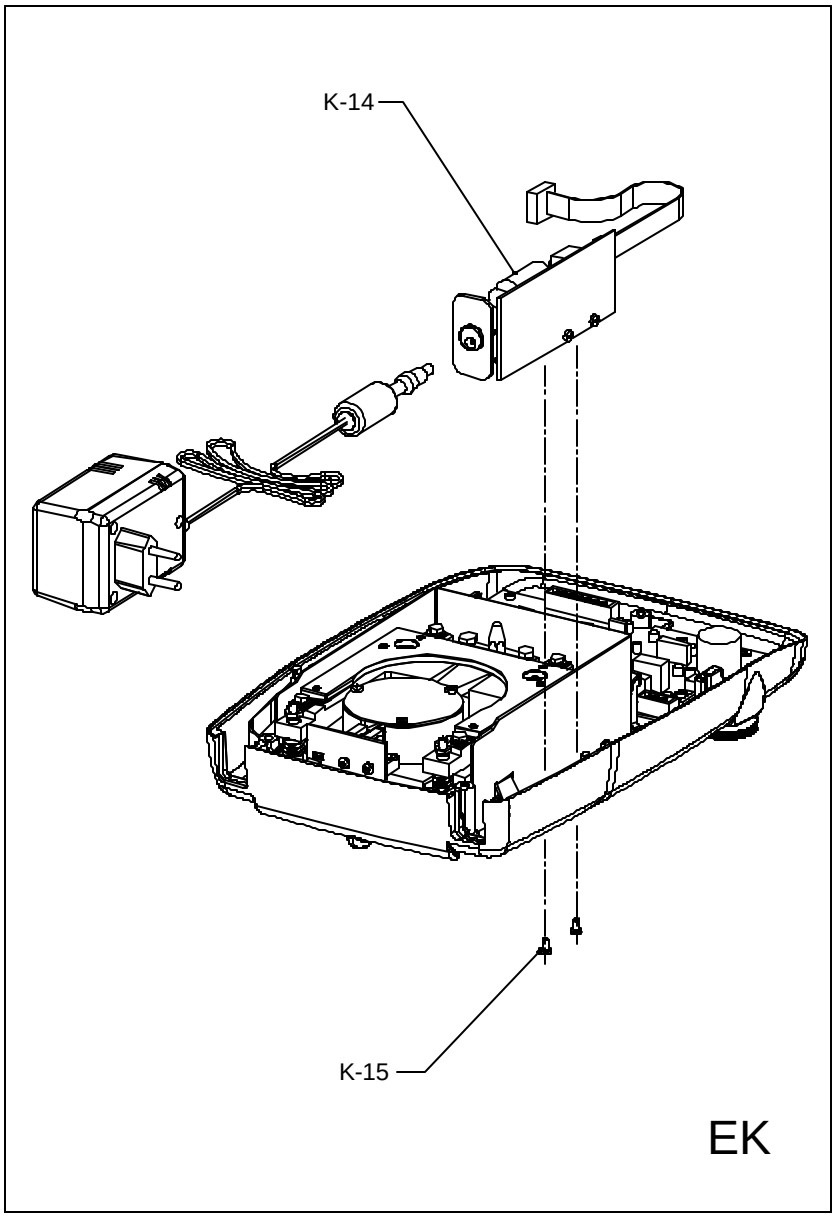
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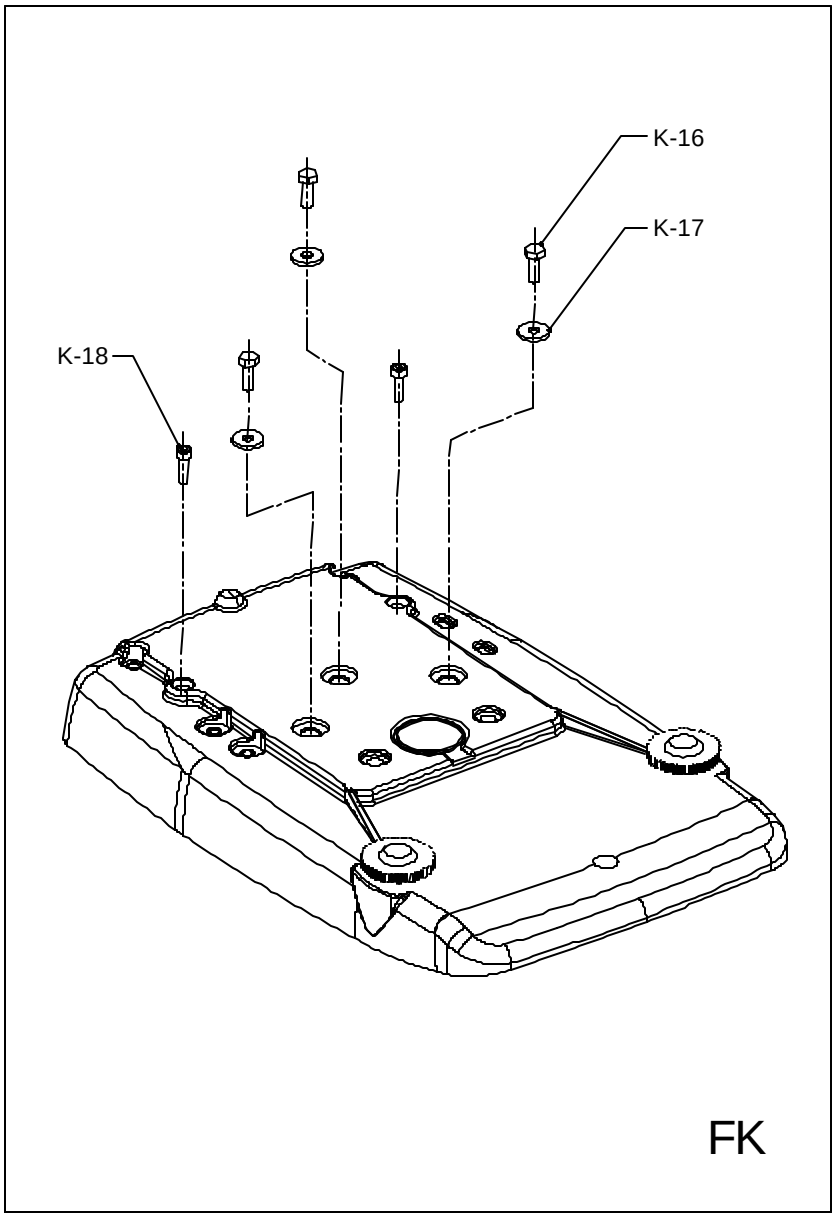
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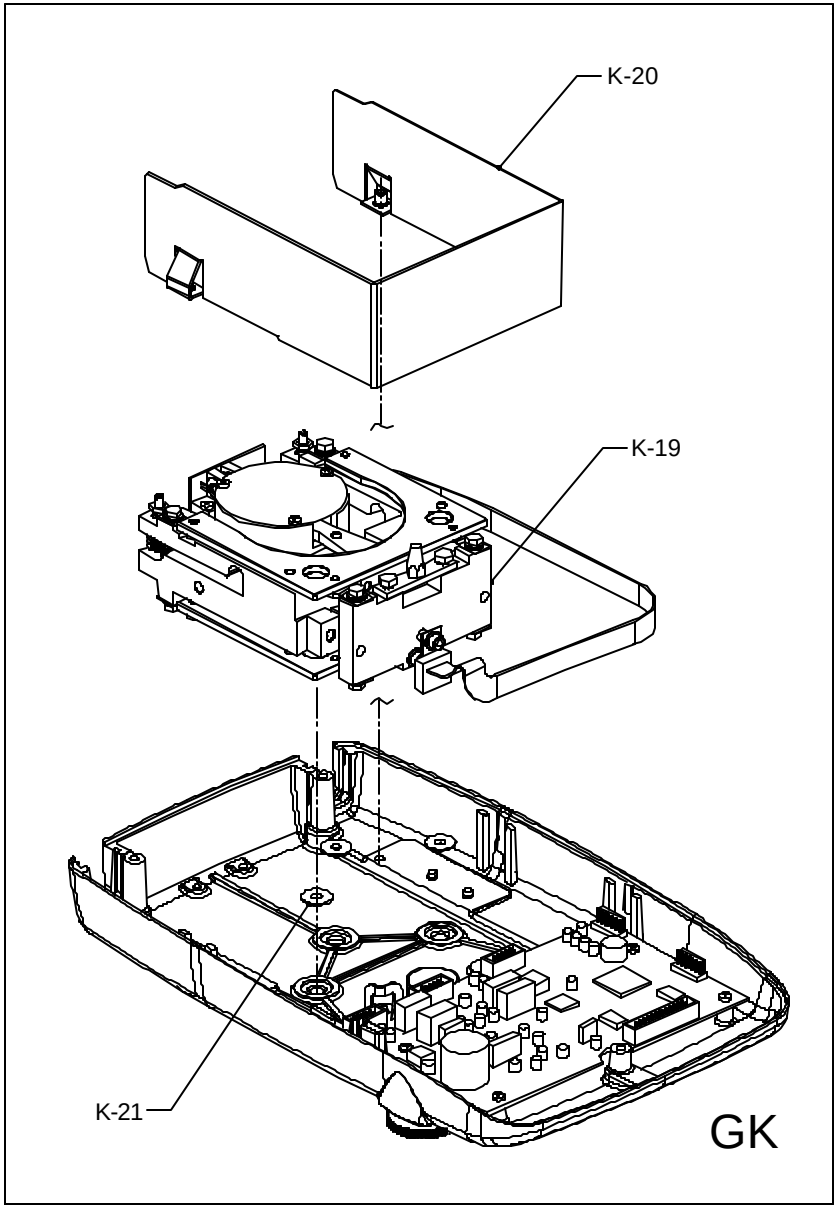
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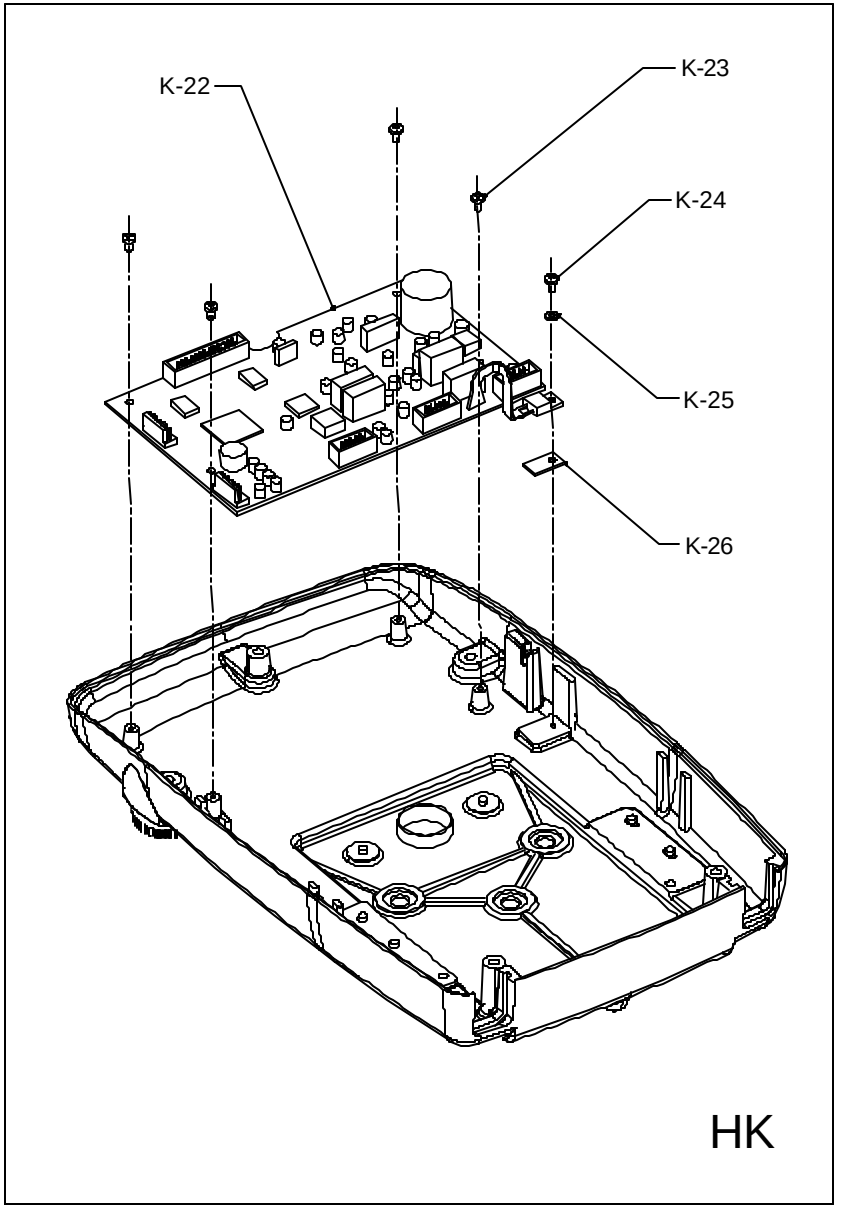
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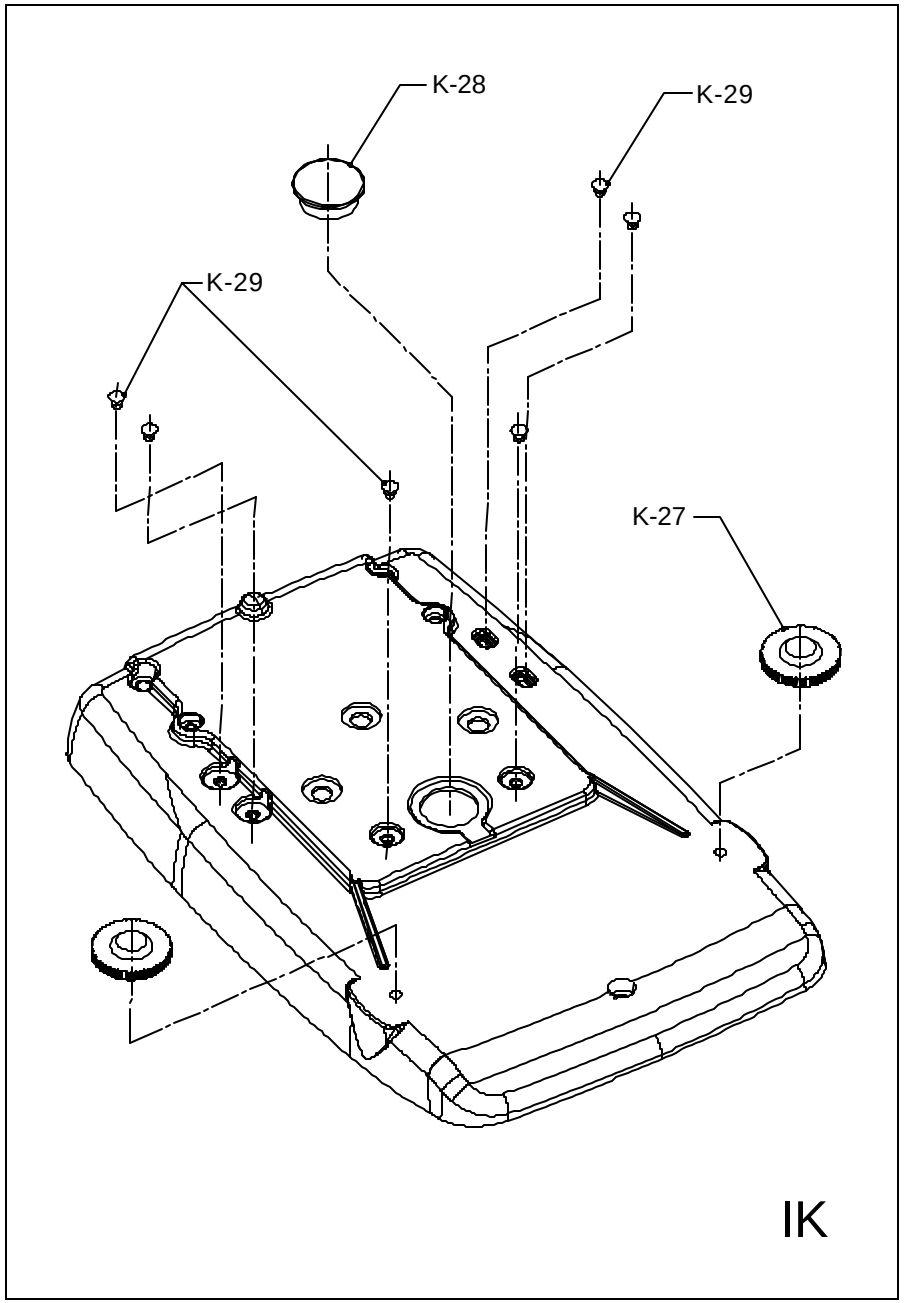
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K-29
K-27
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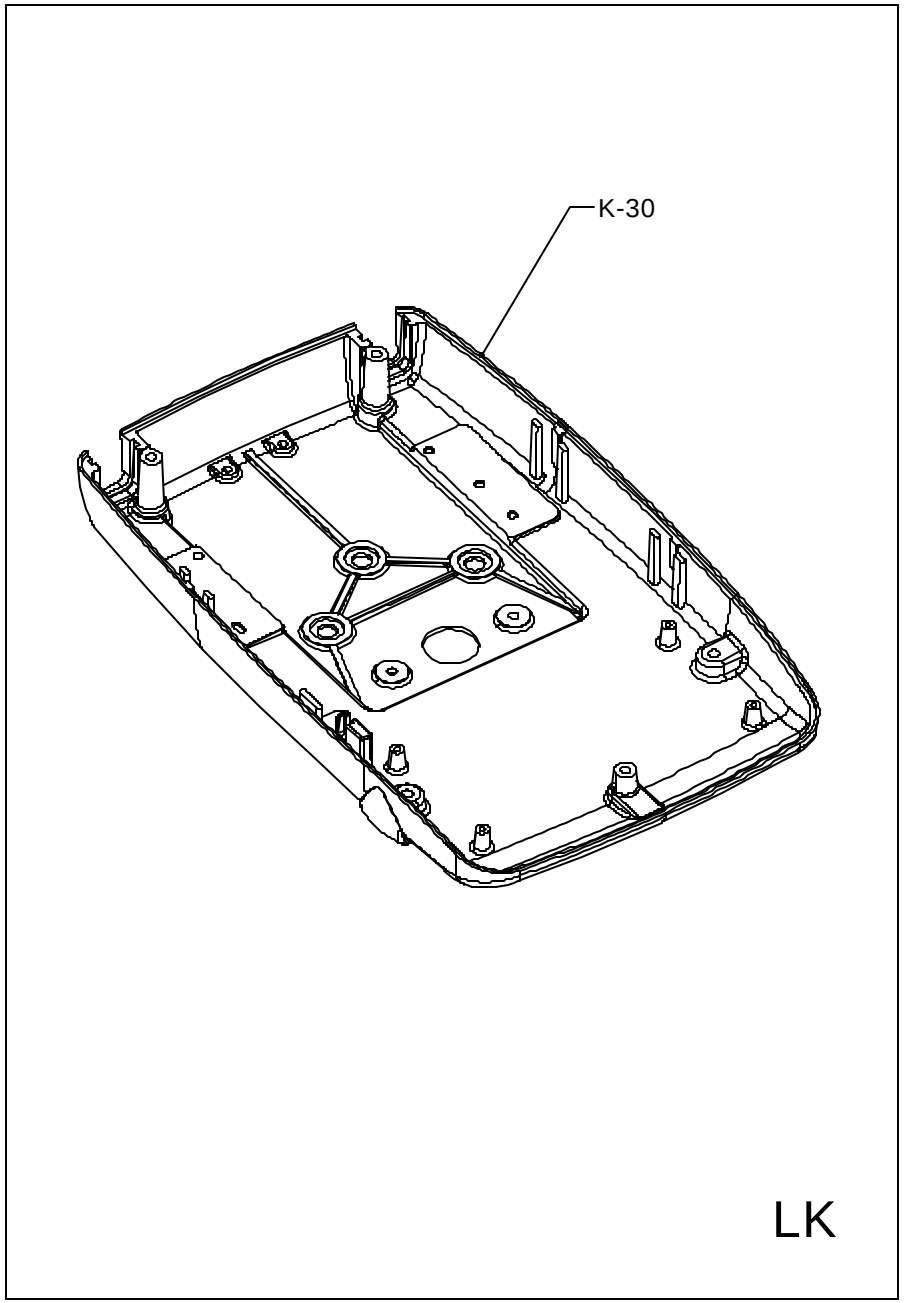
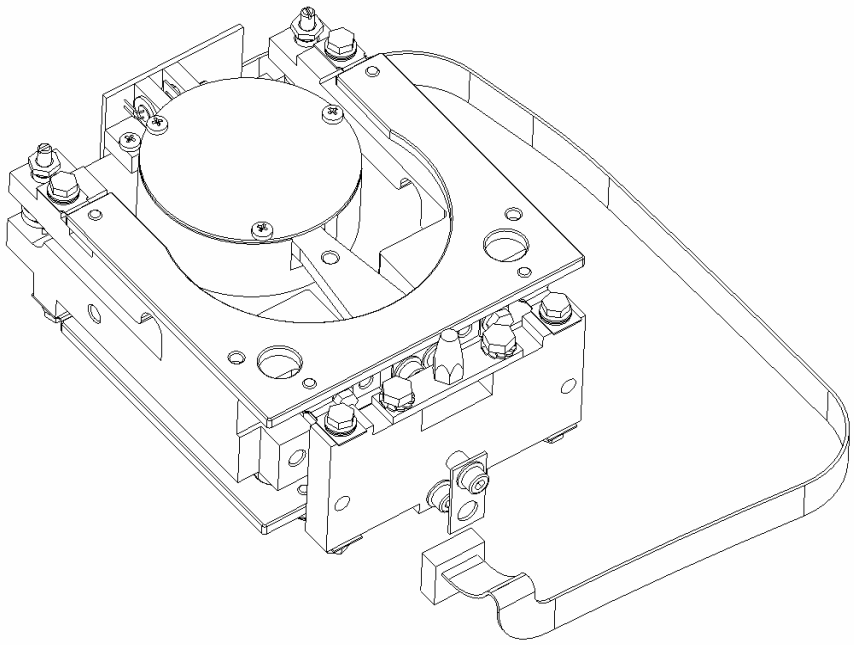

K-30
LK

WEIGHING CELL ENBLOCK FOR "MARK" BALANCES

0,1g / 0,01 / 0,001g RESOLUTION

SHEET	NAME
A	TOP PARALLEL GUIDE COMPLETE
B	BOTTOM PARALLEL GUIDE COMPLETE
CM	MOVING PILLAR COMPLETE FOR 0,1g / 0,01g
CN	MOVING PILLAR COMPLETE FOR 0,001g
D	MAGNETIC GROUP
E	LEVEL AND COIL COMPLETE
F	OPTICAL GROUP COMPLETE
G	REGULATORS FOR CORNER ERROR
H	WEIGHING CELL ENBLOCK
I	DETAIL OF OPTICAL GROUP AND SENSOR CABLE



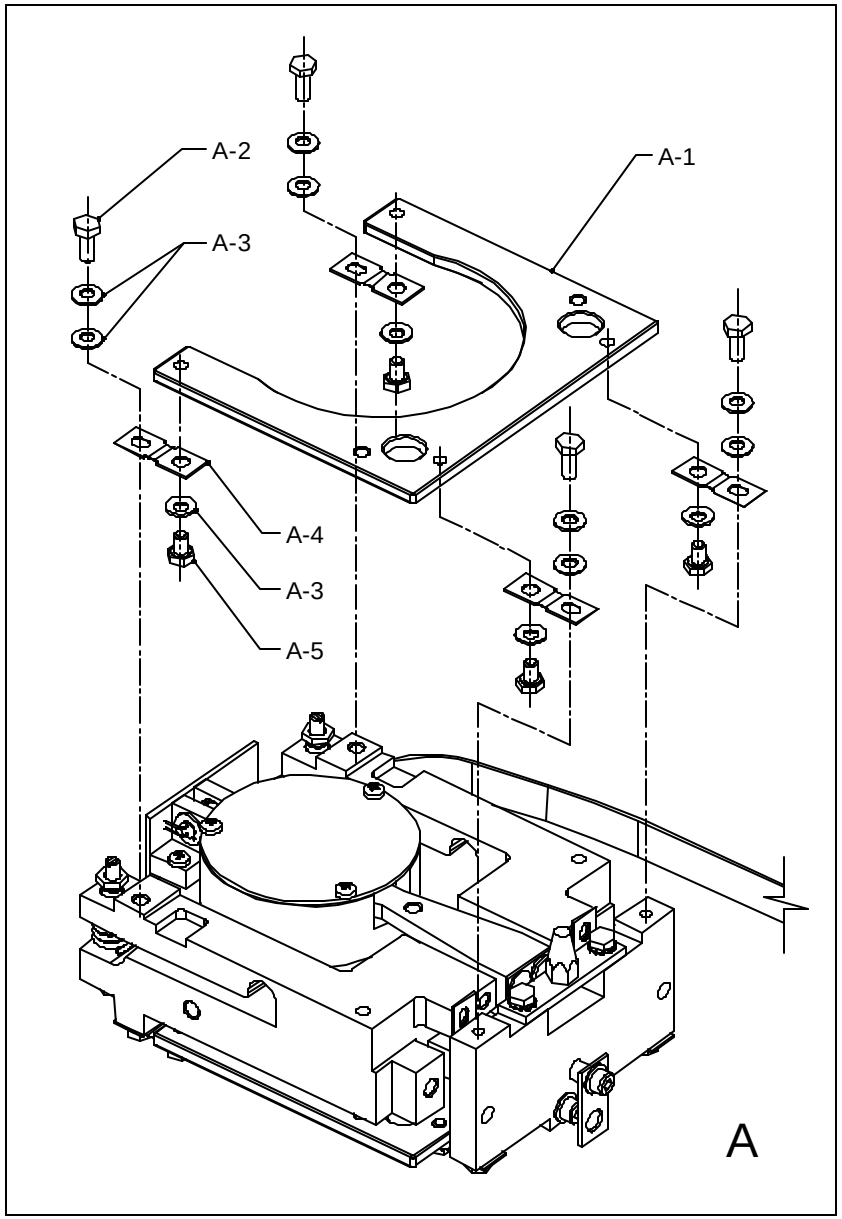
PARTICULARS CELL ENBLOCK 0,1g / 0,01g / 0,001g

NO.	NAME	CODE
A-1	TOP PARALLEL GUIDE	02-06-0074
A-2	SCREW M4x10	/
A-3	WASHER FOR SCREW M4	/
A-4	FLAT SPRING LEF05 0.12	02-08-0258
A-5	SCREW M4x6	/
********	**********	**********
B-1	BOTTOM PARALLEL GUIDE	02-06-0075
B-2	SCREW M4x10	/
B-3	WASHER FOR SCREW M4	/
B-4	FLAT SPRING LEF05 0.12	02-08-0258
B-5	SCREW M4x6	/
********	**********	**********
CM-1	MOVING PILLAR	02-06-0071
CM-2	VERTICAL FLAT SPRING LT1 0.12	02-50-0263
CM-3	SPACER FOR VERTICAL FLAT SP. 1mm.	02-02-0417
CM-4	SPACER FOR VERTICAL FLAT SP. 5mm.	02-07-0246
CM-5	PLATE FOR V. SPRING CLAMPING	02-02-0118
CM-6	SCREW M4x10	/

CM-7	WASHER FOR SCREW M4	/
CM-8	CONE 6K PF	02-04-0309
CM-9	SCREW M5x10	/
CM-10	WASHER FOR SCREW M5	/
CM-11	PLATE FOR CONE	02-02-0306
CM-12	SPACER FOR VERTICAL FLAT SP. 0,5mm.	02-02-0418
CM-13	SCREW M4x22	/
CM-14	PLATE FOR HOOK	02-04-0410
CM-15	SPACER FOR HOOK	02-07-0169
CM-16	SCREW M4x16	/
********	**********	**********
CN-1	MOVING PILLAR	02-06-0071
CN-2	VERTICAL FLAT SPRING LT05 0.09	02-50-0261
CN-3	SPACER FOR VERTICAL FLAT SP. 1mm.	02-02-0417
CN-4	SPACER FOR VERTICAL FLAT SP. 5mm.	02-07-0246
CN-5	PLATE FOR V. SPRING CLAMPING	02-02-0118
CN-6	SCREW M4x12	/
CN-7	WASHER FOR SCREW M4	/
CN-8	CONE	02-04-0092
CN-9	SCREW M5x10	/
CN-10	WASHER FOR SCREW M5	/
CN-11	PLATE FOR CONE	02-02-0306

CN-12	SCREW M4x16	/
CN-13	SCREW M4x18	/
CN-14	PLATE FOR HOOK	02-04-0410
CN-15	SPACER FOR HOOK	02-07-0169
********	**********	**********
D-1	MAGNETIC CIRCUIT	02-09-0065
D-2	MAGNET	02-14-0063
D-3	POLE SHOE	02-90-0064
D-4	COVER FOR MAGNETIC CIRCUIT	02-02-0072
D-5	SCREW M3x6	/
D-6	SCREW M5x8	/
D-7	ELECTRICAL PLATE AND SENSOR	/
********	**********	**********
E-1	LEVEL TYPE 0.1 LEVEL TYPE 0.01	02-12-0054 02-12-0055
E-2	SUPPORT FOR COIL	02-04-0057
E-3	SCREW M3 END-STOP	/
E-4	PLATE FOR COIL CLAMPING	02-02-0119
E-5	SCREW M3x6	/
E-6	WASHER FOR SCREW M3	/
E-7	FLAG	02-90-0265
E-8	SCREW M2x4	/

E-9	FLAT SPRING LEF05 0.10	02-08-0257
E-10	SCREW M4x10	/
E-11	WASHER FOR SCREW M4	/
********	**********	**********
F-1	OPTICAL GROUP COMPLETE	/
F-2	SCREW M3x12	/
********	**********	**********
G-1	SCREW FOR CORNER ERROR	02-15-0066
G-2	BUSH FOR CORNER ERROR	02-15-0067
G-3	HEXAGON NUT M4	/
G-4	WASHER FOR SCREW M4	/
G-5	SPRING FOR REGULATOR	02-16-0159
********	**********	**********
H-1	WEIGHING CELL ENBLOCK TYPE 0.1 / 0.01 WEIGHING CELL ENBLOCK TYPE 0.1 / 0.01	01-05-0051 02-05 0052
********	**********	**********
I-1	CABLE	/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A-3
A-4
A-3
A-5
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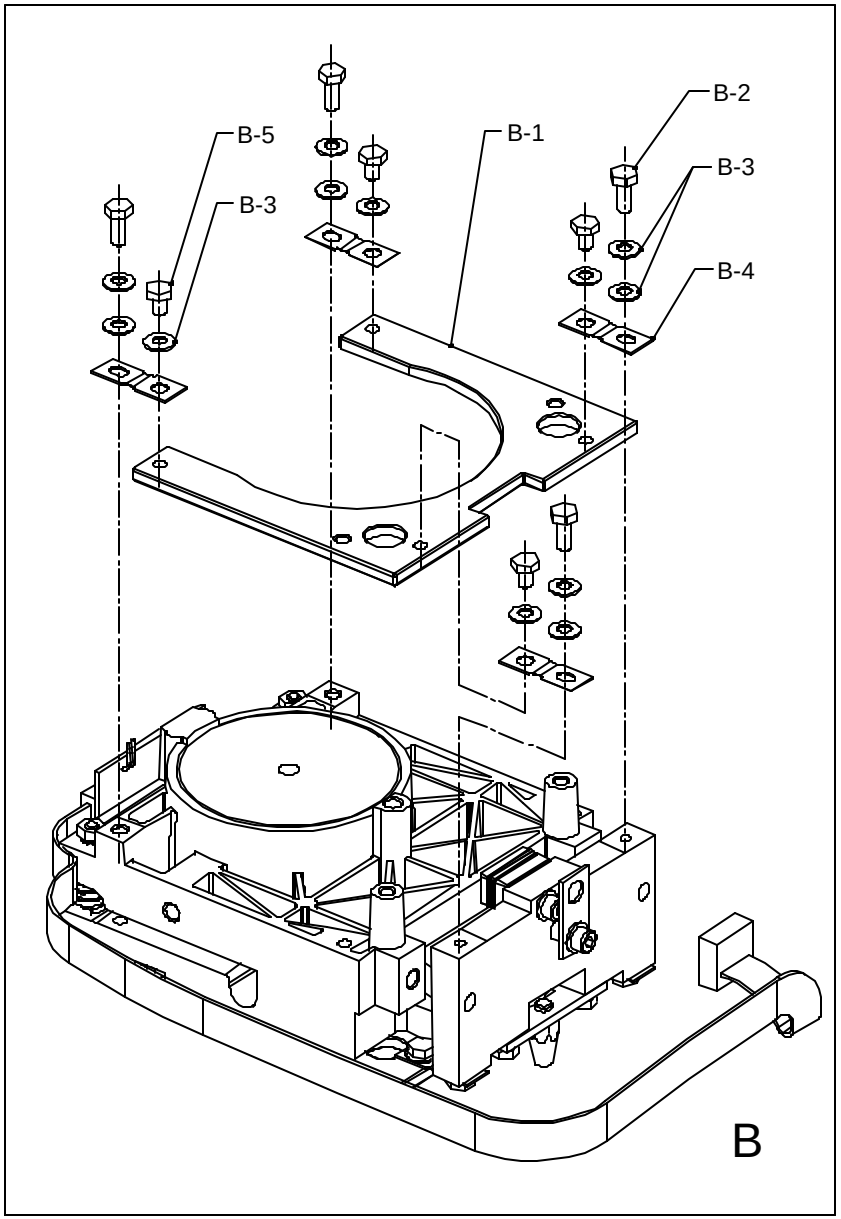
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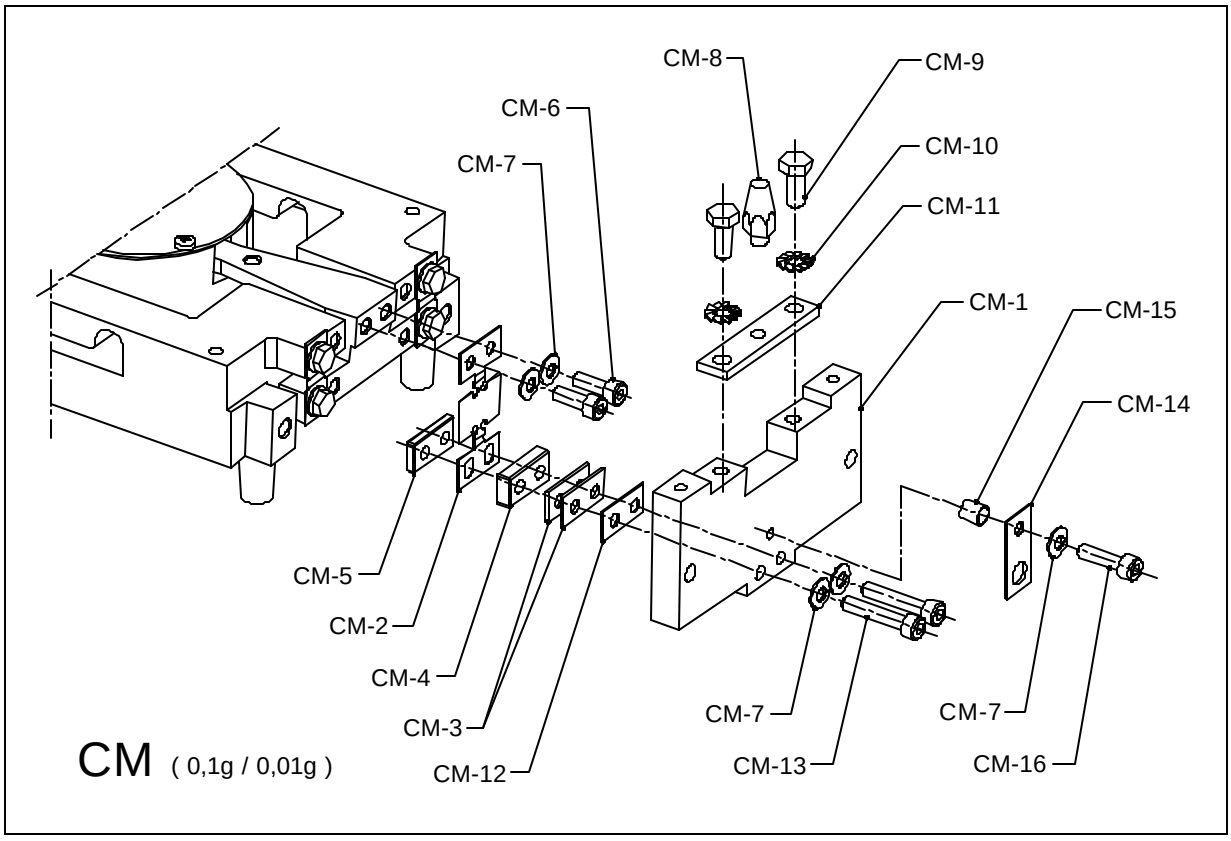
B-4
B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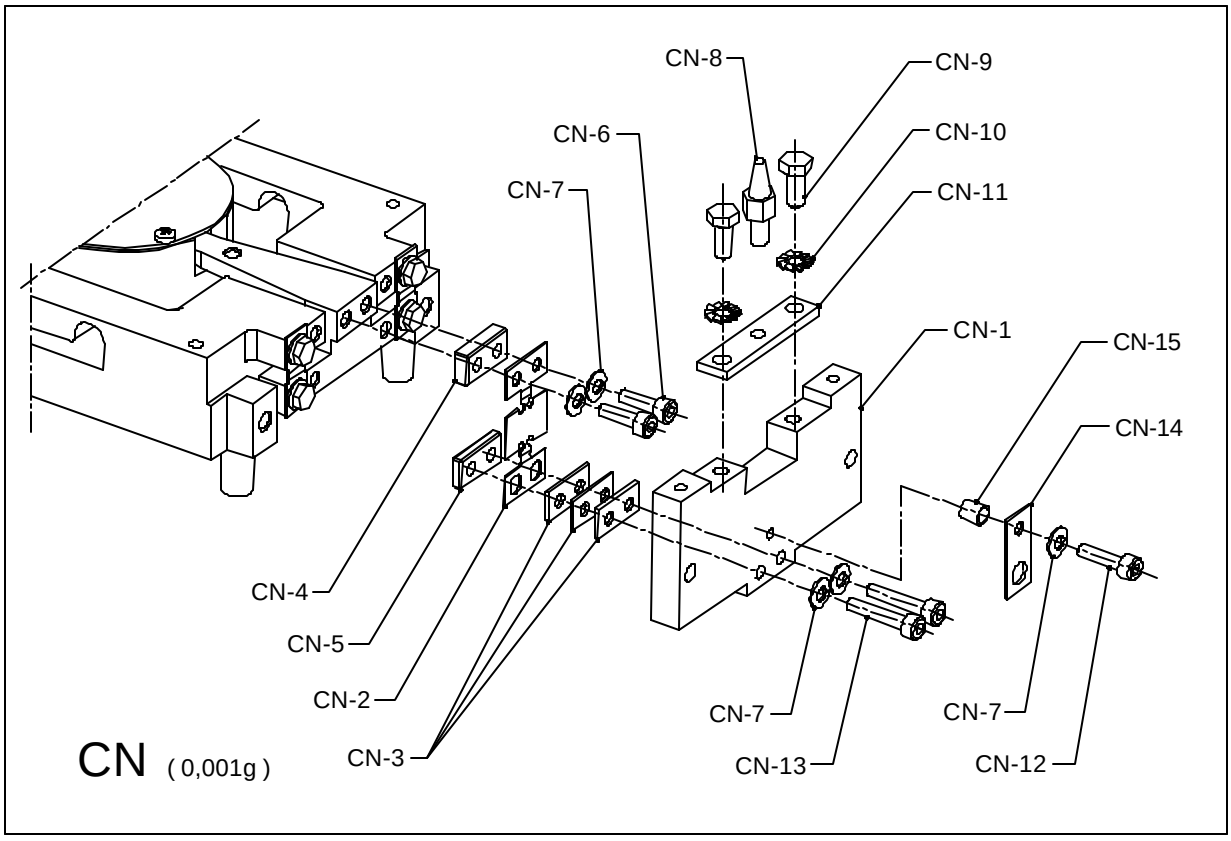
CM-7
CM-13
CM-7
CM-16
CM (0,1g / 0,01g)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CN-15
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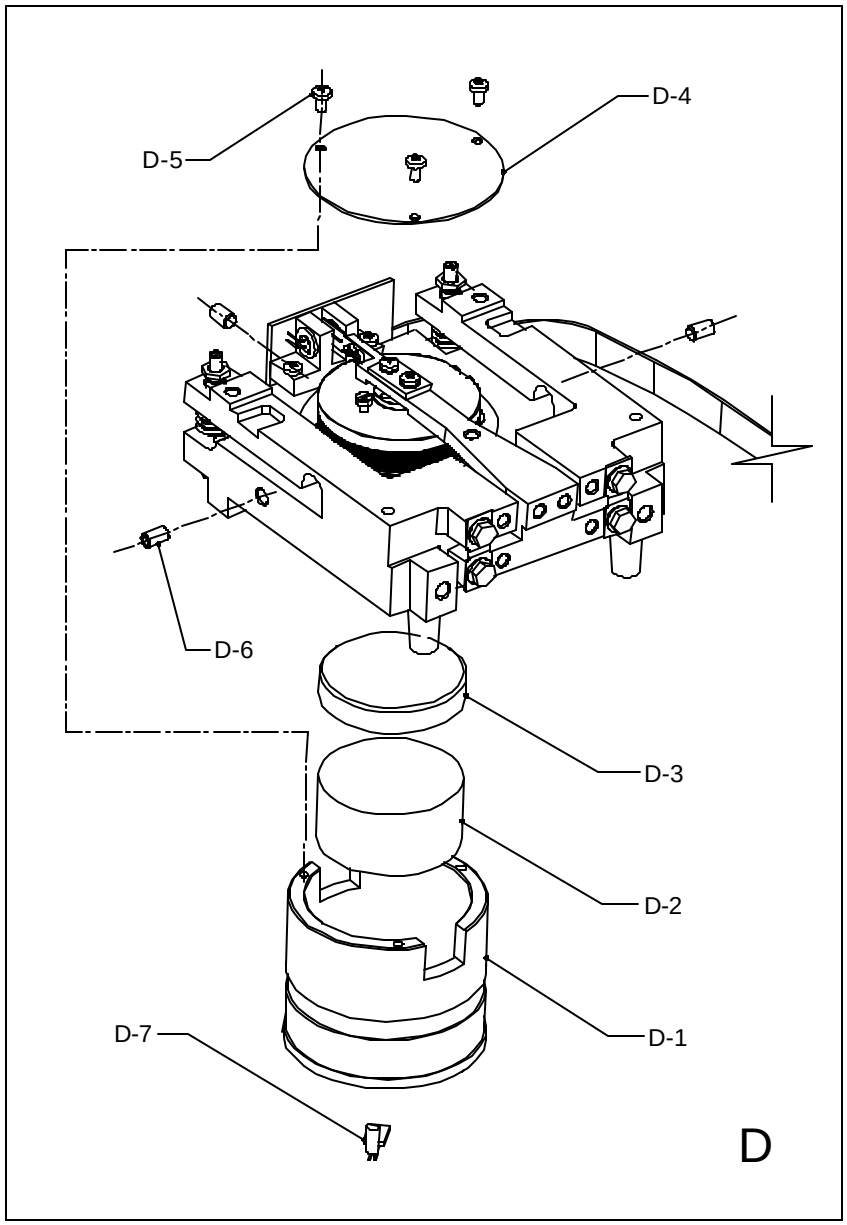
CN-7
CN-12
CN (0,001g)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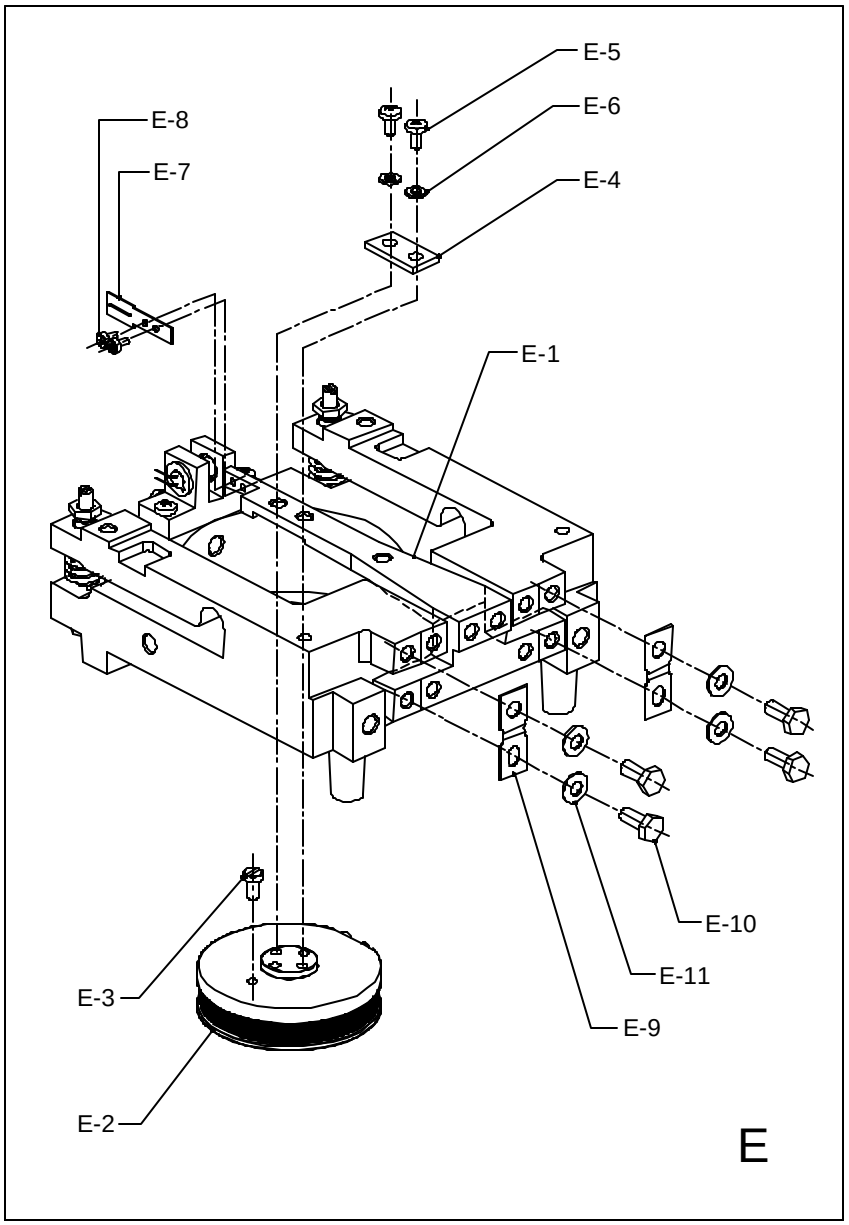
D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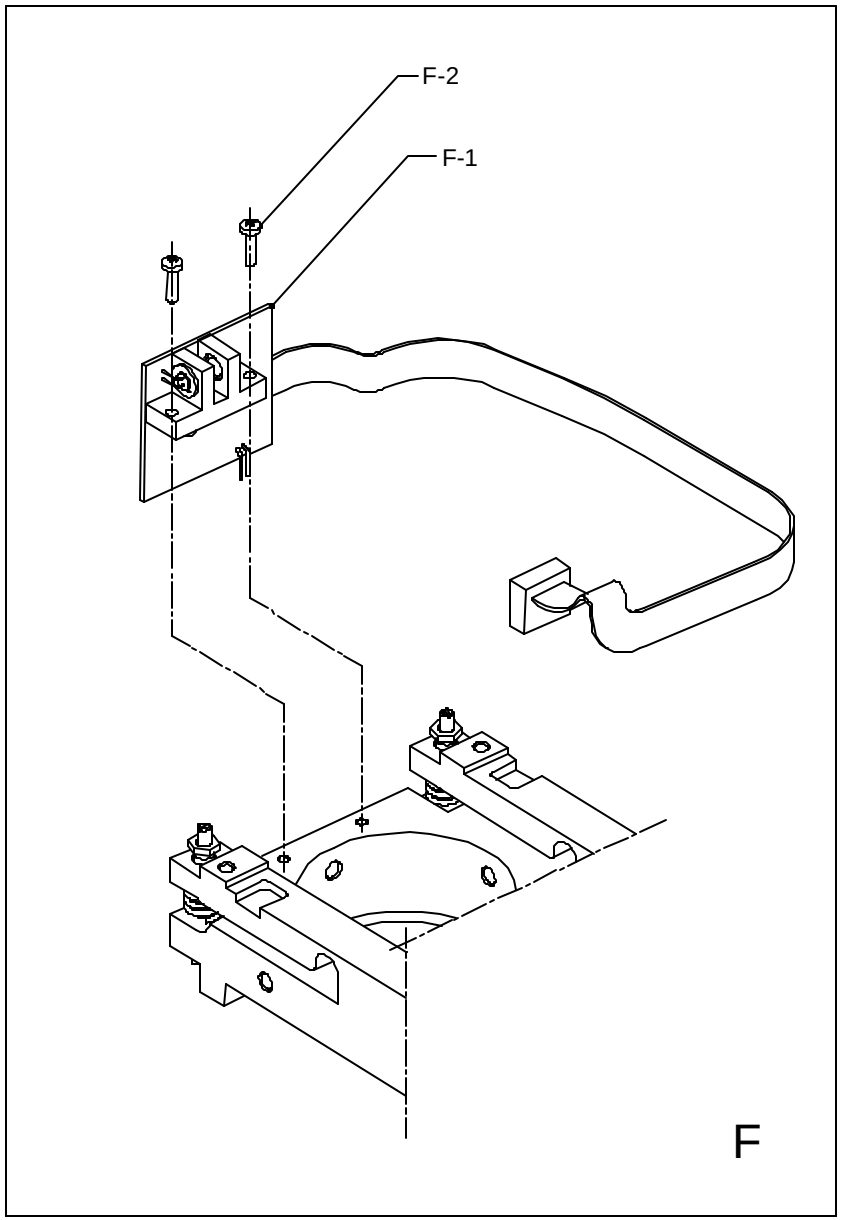
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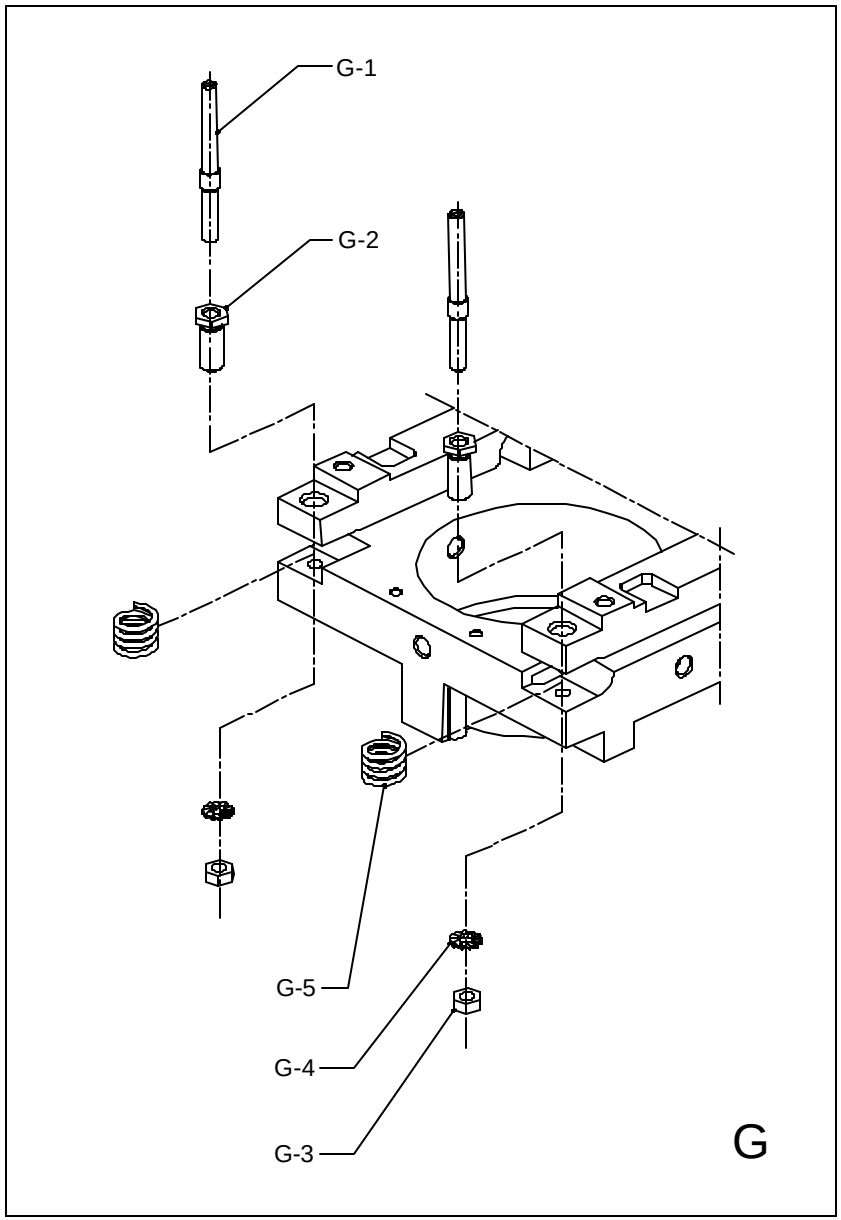
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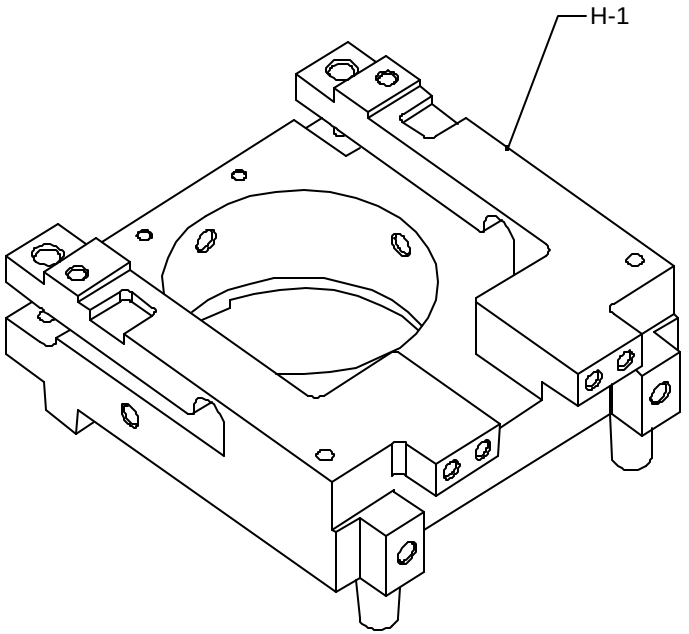
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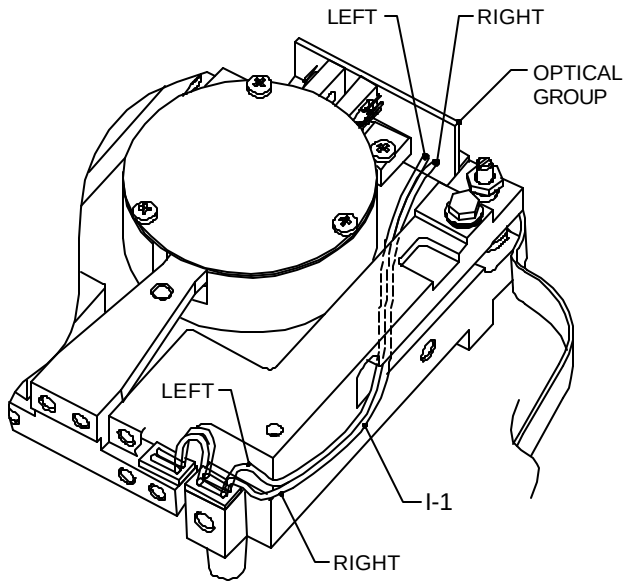
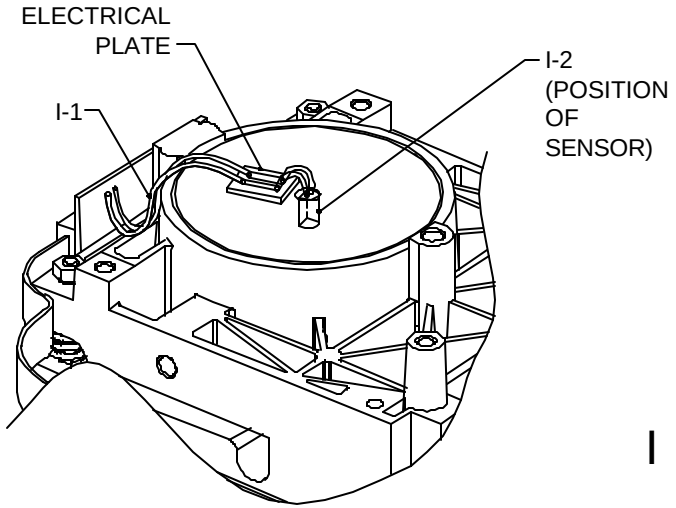
H


LEFT
RIGHT
OPTICAL GROUP
LEFT
I-1
RIGHT


ELECTRICAL PLATE
I-2 (POSITION OF SENSOR)
I-1

I

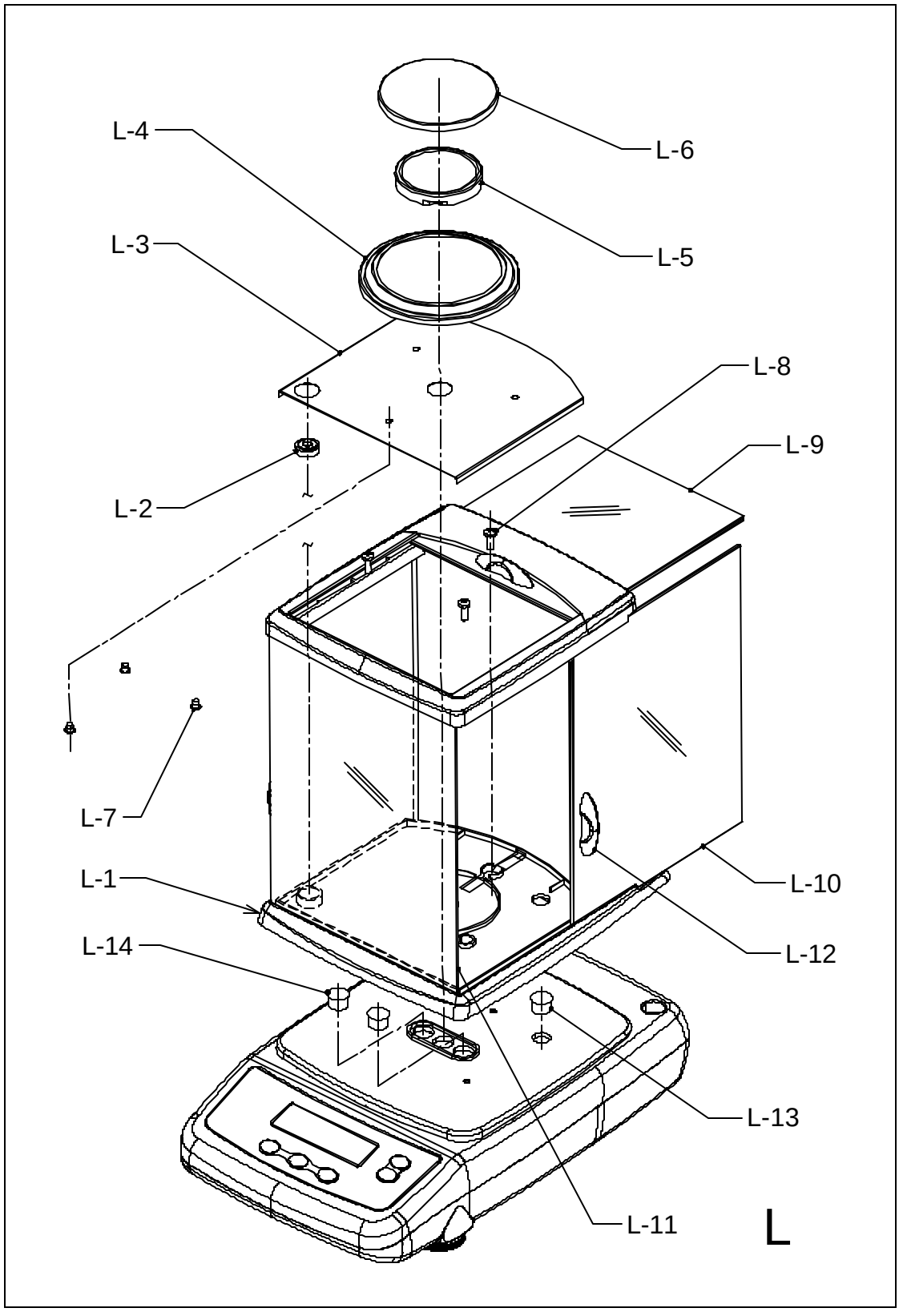
EXTERNAL PARTS FOR "MARK" BALANCES

SHEET	NAME
L	ANALYTICAL BALANCE
M	BALANCE TYPE 0,1g / 0,01g
N	BALANCE TYPE 0,001g

EXTERNAL PARTS

NO.	NAME	CODE
L-1	WIND SHIELD COMPLETE	01-20-0397
L-2	LEVEL BUBBLE	/
L-3	STAINLESS PLATE	02-02-0369
L-4	PROTECTION RING	02-15-0097
L-5	UNDERPAN COMPLETE	01-00-0088
L-6	WEIGHING PAN Ø80mm. COMPLETE	01-00-0095
L-7	CAP FOR PROTECTION RING FIXING	/
L-8	SCREW M4x12 FOR WIND SHIELD FIXING	/
L-9	TOP SLIDING DOOR	02-18-0370
L-10	SIDE SLIDING DOOR	02-18-0371
L-11	FRONT DOOR	02-18-0372
L-12	HANDLE COMPLETE FOR SLIDING DOOR	02-20-0387/0388
L-13	SCREW REGULATOR CAP	DP 500
L-14	COLUMNS CAP	DP 562
********	**********	**********
M-1	UNDERPAN FOR SQUARE PLATE 6K PF	02-02-0324
M-2	SCREW M5x10 FOR UNDERPAN FIXING	/
M-3	SQUARE PAN 6K PF	02-09-0325
M-4	MOUSSE	/
M-5	SCREW REGULATOR CAP	DP 500

M-6	WEIGHING PAN Ø160mm. COMPLETE	01-00-0244
M-7	UNDERPAN COMPLETE	/
M-8	COLUMNS CAP	DP 562
M-9	SUPPORT COLUMN FOR SQUARE PAN	02-07-0085
********	**********	**********
N-1	BASE FOR WIND SHIELD	02-09-0305
N-2	UNDERPAN COMPLETE	01-00-0088
N-3	WEIGHING PAN Ø110mm. COMPLETE	01-00-0096
N-4	PLEXIGLASS WIND SHIELD Ø160x70	02-18-0420
N-5	COVER WIND SHIELD	02-09-0283
N-6	SCREW M4x10	/
N-7	COLUMNS CAP	DP 562
N-8	SCREW REGULATOR CAP	DP 500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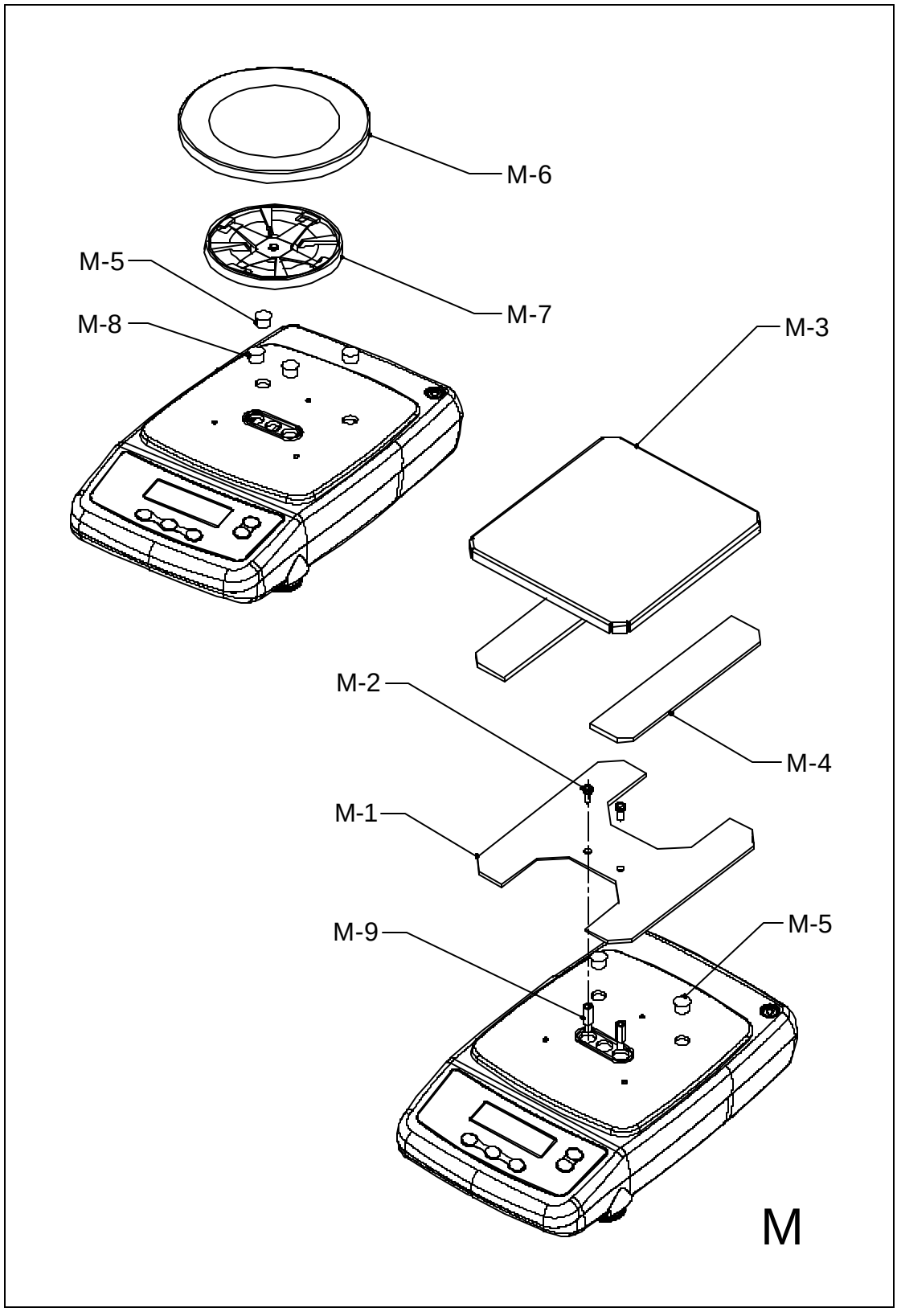
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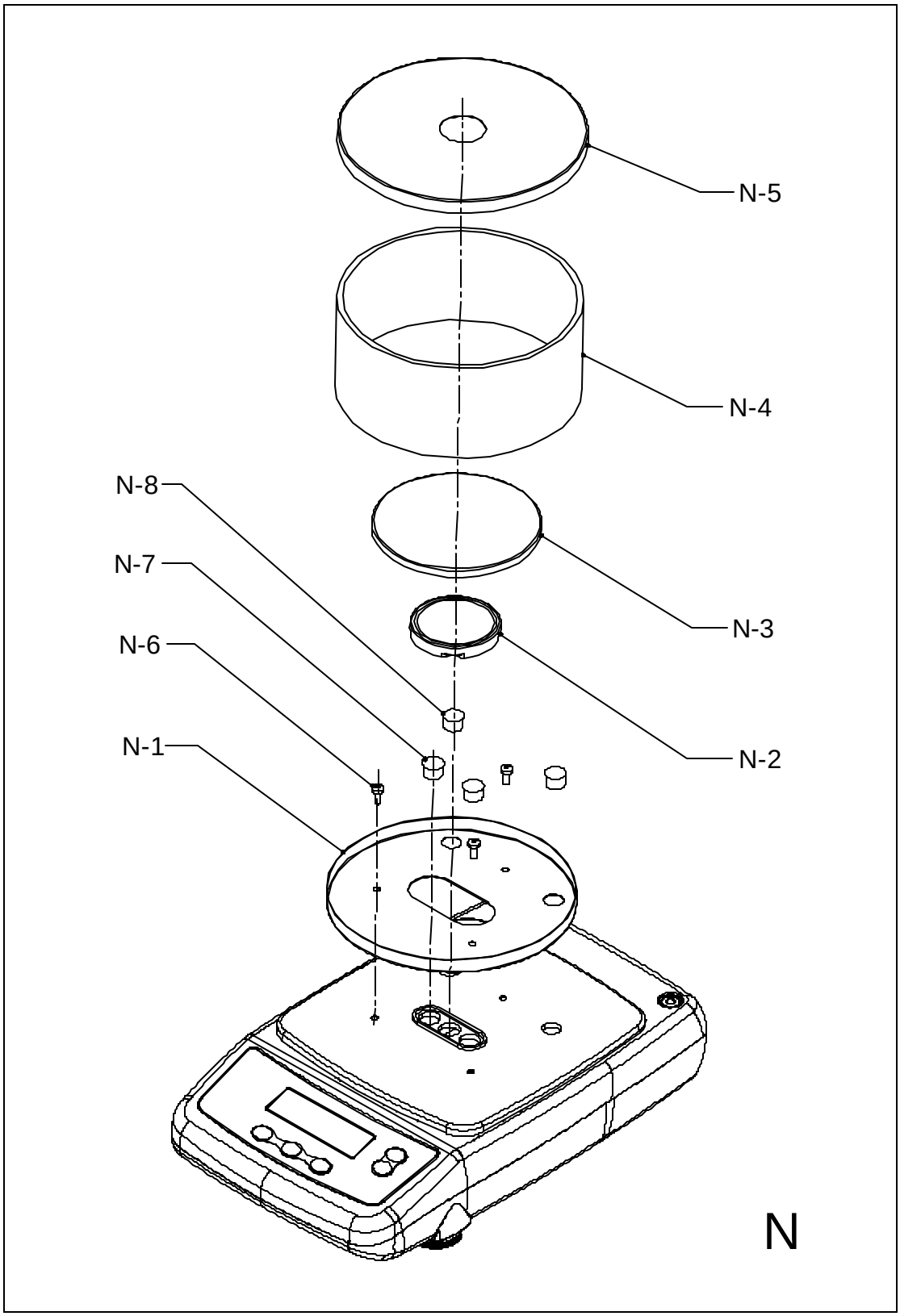
N-5
N-4
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N-2
N

Bel Engineering Service Notes.

Balances

Classic
Centigram
Binary
Decigram
Milligram
Analytical

Bel balances are calibrated and linearized in California prior to shipping, using Class 1 weights traceable to NIST or Class M OIML weights traceable to OIML Europe.

Upon receipt they should only need calibtration to take account of local acceleration due to G factors.

The balances should always be placed on a solid, stable and vibration free surface and free from drafts and air currents. Do not use balances in bright sunlight as this may set up uneven temperature changes in the unit.

When the unit is positioned correctly, power up the unit and for analytical or milligram balances, do not press the “On/Off” button for at least 25 minutes.

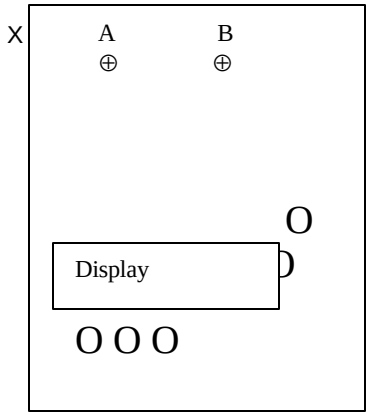
Following the warm up period, press the “On/Off” button.

Decigram, Classic and Centigram balances can be used immediately, but correct use analytical balances should remain turned on for at least 2 hours before calibration or use. Milligram balances should ideally be allowed to stabilize for 30 minutes after turning on.

Corner Loading.

Corner Load Error.

Corner load error is adjusted by the use of two adjusters in top of beam. In most balances access can be obtained via access holes in the top of the balance cover.



A screw adjusts X-Y

B screw adjusts P-Q
If Y is + & X is - turn A clockwise etc.

Q Y

Calibration/Linearity.

In order to linearize the balance correctly, the balance should be allowed to warm up for at least 2 hours for analytical balances and 30 minutes for milligram balances.

Press and keep pressing CAL then plug in the power supply. The scale displays the notional thermometer reading and then 00000.

Press CAL three times.
Display reads “LIN”
Press PRINT
Display shows “ZERO”
Press CAL again (no weight on pan)
Displays LIN 1 & arrow at 2nd ZERO.
Load 1/3rd weight (See attached chart for linearity weights)
Press CAL when stable.
Displays LIN 2 & arrow on 3rd ZERO
Load 2/3rd weight
Press CAL when stable.
Displays LIN 3 & arrow on 4th ZERO
Load Full Weight.
Press CAL when stable
End by pressing “On/Off”.

Always recalibrate after LINEARITY adjustment.

Linearization Values for Bel Balances

Model	Resolution (g)	Point 1	Point 2	Point 3	Point 4
120A	0.0001	0	40	80	120
150A	0.0001	0	50	100	150
205A	0.0001	0	60	120	180
160	0.001	0	50	100	150
220	0.001	0	70	140	210
330	0.001	0	110	220	330
500	0.001	0	150	300	450
2040	0.001/0.01	0	130	260	390
2060	0.001/0.01	0	200	400	600
800	0.01	0	250	500	750
1000	0.01	0	300	600	900
1300	0.01	0	400	800	1200
1700	0.01	0	500	1000	1500
2200	0.01	0	700	1400	2100
3100	0.01	0	1000	2000	3000
3500	0.01	0	1100	2200	3300
4100	0.01	0	1300	2600	3900
2020	0.01/0.1	0	600	1200	1800
8055	0.01/0.1	0	1700	3400	5100
6045	0.01/0.1	0	1500	3000	4500
SSR 10000	0.1/1 g	0	3300	6600	9900
4500	0.1	0	1500	3000	4500
6500	0.1	0	2000	4000	6000
8000	0.1	0	2500	5000	7500

K 12	0.1	0	4000	8000	12000
K 16	0.1	0	5000	10000	15000
K 20	0.1	0	6000	12000	18000
K 30	0.1	0	10000	20000	30000

Fault Finding on Bel Engineering Balances.

Test Points

TP-7 is Analog Ground
TP-8 is Digital Ground

Symptom: Display frozen 00000 - No output

1. Check that all springs and flexures are intact and not bent or broken. If damaged, replace and reassemble. Jigs are available on request for this purpose.
2. Check that Level (E1) is centered, i.e. moves up and down and when power is supplied to the balance, the Level tries to return to the mid point.
3. If not centered, check power supply voltage, TP3 to TP7 (Analog Ground). Voltage must be 12 VDC or more. (If not see Section a.).
4. If voltage at TP3 is correct, check voltage at TP4 to TP7. This should read = 12.5 VDC (if not see Section b.). If this is OK, remove J6 connector and check with meter that resistance between coil connections (see diagram I on page 19 of manual). Resistance between right and left should be 38-42 O. If not correct or no resistance, check connection from coil to optical group Board F1. Possible cause is the gold wires connecting monoblock to the level are broken.
5. If none of the above, it is possible that the optical group itself has failed. Remove and replace.

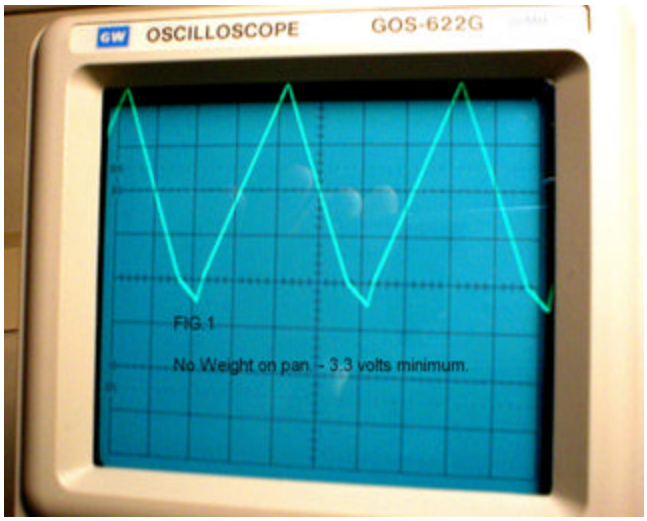
a. If this measurement is not correct, remove J4 connector and check the output on U@-7812 Rectifier. This should be 12 volt. If not, remove and replace the power board.
b. If this measurement is not OK, remove J4 connector & check output on U3-7912 this should be = 12.5 volt. If not correct remove and replace the power board.

See drawing ALINT Rev. 4.

Optical Group

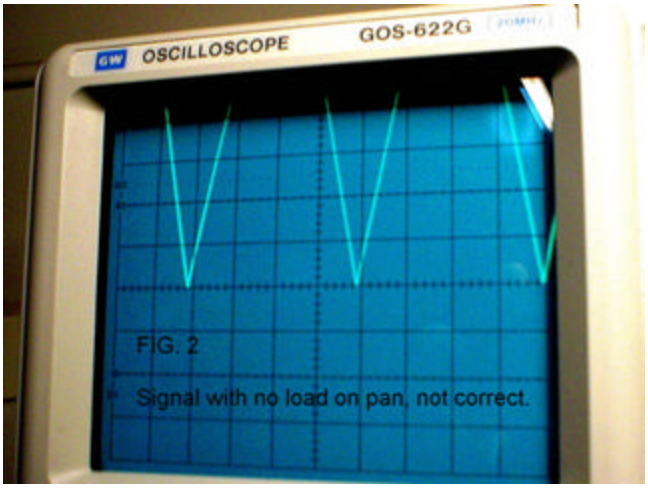
To check veracity of signal from optical group:

a. With the pan fitted, but no load on pan (at rest), test between TP7 (ground) and TP6, the value should be minus 3.3 volts minimum signal. **(See FIG.1).**



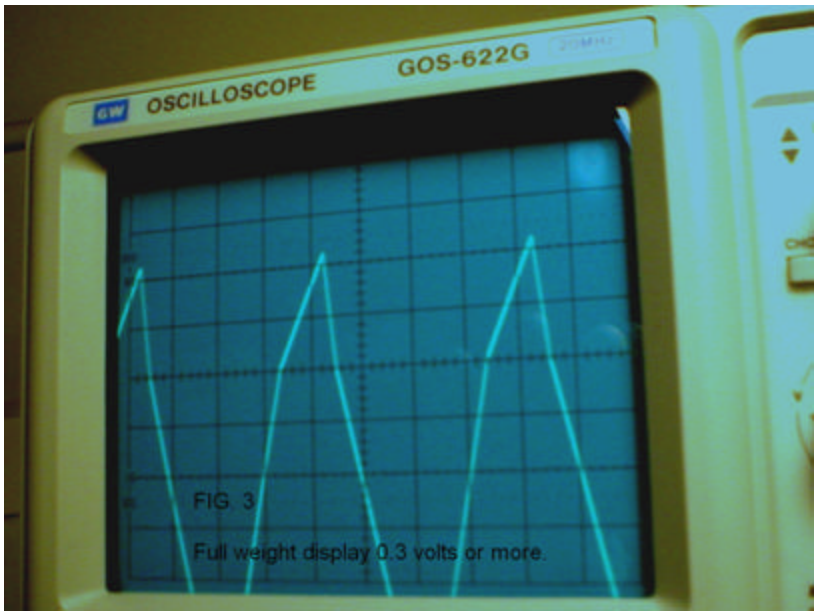
Generally factory set for 1 volt reading, this will allow technicians to see a negative reading when the pan is removed, rather than an underweight signal.

If the Signal shown is below minus 3.3 volts **(See FIG.2)**

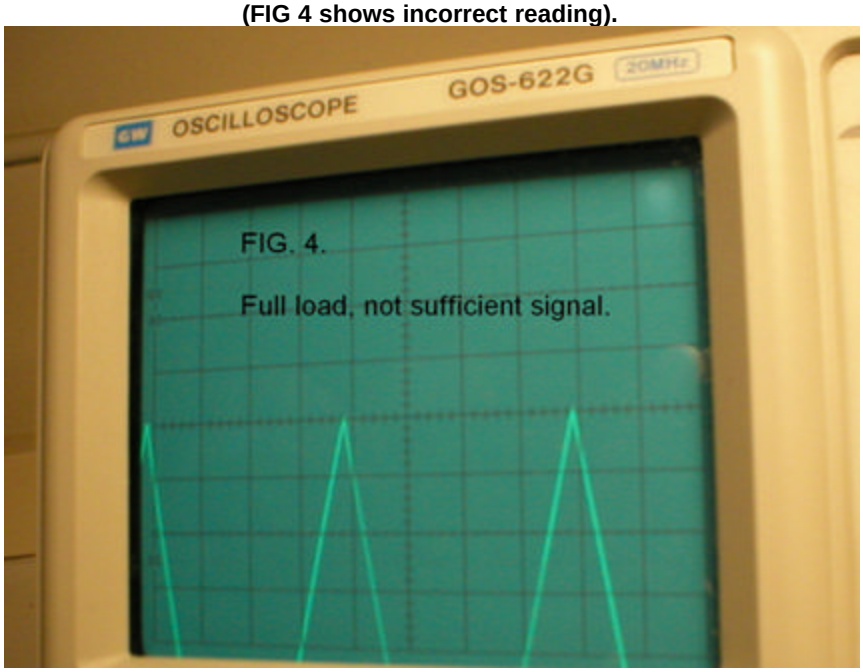


b. Apply full load to balance. Test between TP7 and TP6. It is important that the positive signal is 0.3 volts or more.

(FIG 3 shows correct reading)



(FIG 4 shows incorrect reading).



If either signal is not correct, change the resistance at 70.

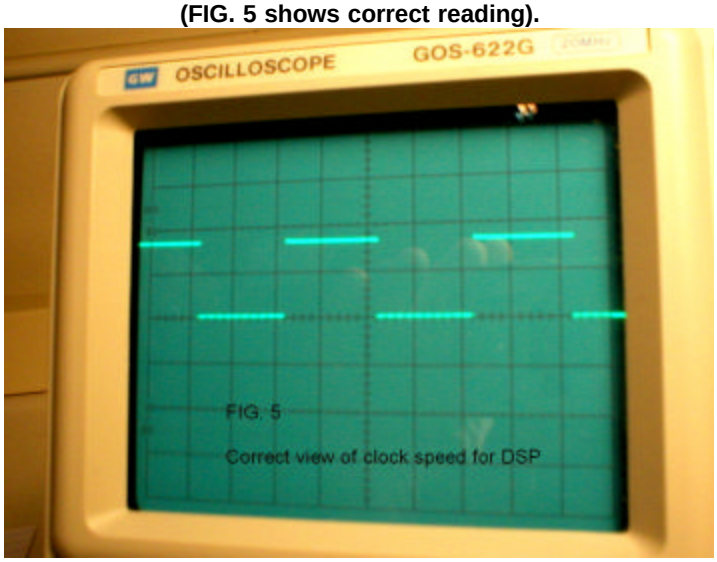
No load, no negative signal, increase resistance.
Full load, no positive signal, decrease resistance.

Note! on analytical balances, the balance should be returned to Intelligent Weighing Technology for fitting of specialized resistances.

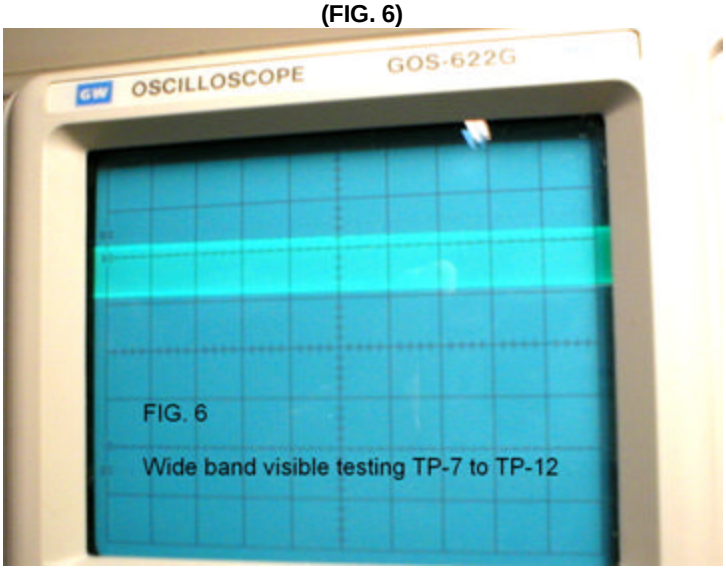
To check the clock speed of DSP.

Test between TP-7 and TP-13, you should be able to clearly see equal distances between signal values and 3.3 volts positive between signal values. If no signal Crystal Y1 is malfunctioning. (7.3728)

(FIG. 5 shows correct reading).

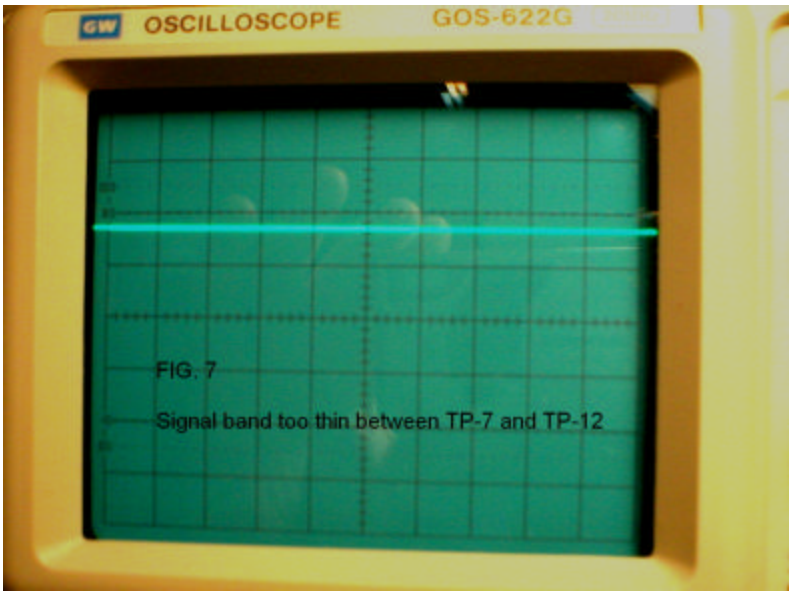


Test TP-7 to TP-12. Should show wide band on screen
(FIG. 6)



A thin band shows a malfunction

(FIG. 7).

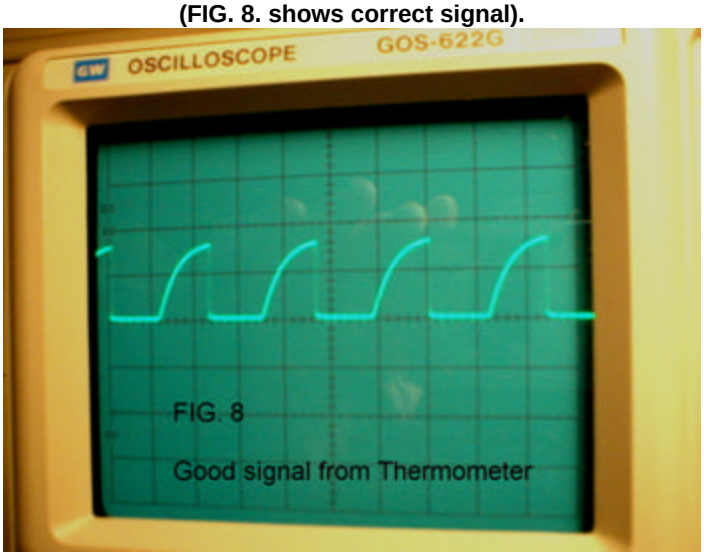


If the band is thin, change crystal Y2.

Test Thermometer Frequency to Analog to Digital converter.

Test TP-7 to TP-14.

(FIG. 8. shows correct signal).



(See FIG. 9, showing bad or no signal. Possible cause is inverted signal wires on connections to magnet).

TP-7 to TP-16

Signal must be +5 VDC, if not, suspect U15 thermometer is faulty.

TP-7 to TP-15

Signal should be +2.5 to 3 VDC, if not, suspect U16 thermometer is faulty.

TP-7 to TP-11

This is a reference voltage, it should be -7 VDC. If not, suspect U18 (Under Foam Insulator) is faulty.

Removal of Magnet

Remove top 3 screws from cover and remove. Remove the two wires from the base of the magnet (note they must be reattached in the same order). Remove the three positioning grub screws and the two inner ones (same threaded hole) and withdraw magnet from unit. Inspect and clean, then

replace using 4 spacers to position the magnet in the exact middle of the unit only if you moved the level arm.

If there is drift in the balance and it is always in one direction, then suspect that there is physical damage to the system. Start with magnet, then gold connecting wires, finally the flexure system.

Display

No Power to Display

Check power to jack plug, 24 VAC.
If no power or not correct voltage then replace the complete unit.
If the above are OK, connect meter to TP7 and TP2 (DC voltage) should read 5 volts ± 2% if not OK see section "A" 1. If voltage is OK then check TP7 to TP1 should read 3.3 volts ± 2% If not OK see section "A" 2
If OK then TP7 to TP5 should be 32-34 VDC (for display) See section A.1. If this is OK change the display. Note! Be sure to order the same build # code as on the back of the display unit.
If the display has power but does not illuminate any segments when pushing the "on/off" switch, fit new keyboard (K-8)

Section A.

A.1. Change power supply board K-14. See ALINT Rev 4-B.

A.2. Check TP-7 ground to regulator U8 LM-3940. Should read 5.0 VDC input and 3.3 VDC output. If no output, change regultor or main board.

If none of the above cure the problem, change the main board. K-22 Bil 2407 A rev 1
It is possible for the optical group to cause interference and instability. Replace complete group.

Display Error Codes

Display shows | _ _ _ _ _ | Underweight Condition

Display shows _ _ _ _ _ Overweight Condition
| |

Following power up and pressing "On/Off" display shows - - - - - means balance is not stable. Check for interference, vibration, air currents. If OK remove top plate from magnet and clean. Check that the lever is centered in the magnet and will return to the center when moved (power must be connected). Finally, check flexures and vertical and horizontal springs for distortion or damage.

Poor Return To Zero

1. **Check all flexures and vertical springs for damage or breakage and replace where neccessary.**
2. **Remove magnet cover and clean. Check lever for physical interference.**