Service Manual

Bel High Capacity Balances

Intelligent Weighing Technology serves the scale industry in the USA, Canada, Central and South America. We provide competitive pricing on a complete range of scales, from floor scales to laboratory scales, load cells for spare parts and scale manufacturing along, with other specialist weighing and testing equipment.

Intelligent Weighing Technology has more than 50 years of experience in the scale business, both in the USA and worldwide. With contacts in over 50 countries including the USA, we provide you with the weighing equipment you need.

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BEL ENGINEERING

ELECTRONIC BALANCES

SERVICE MANUAL

12-16-20K

OCTOBER - 2003

REV. 2.0

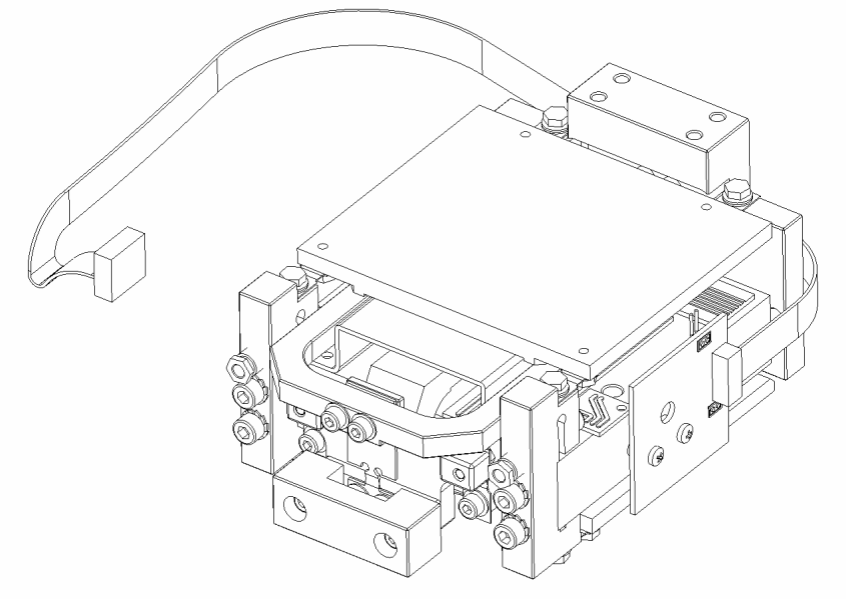
Note!

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

12/1/03

WEIGHING CELL ENBLOCK FOR "MARK" 16K

SHEET	NAME
16KA	TOP PARALLEL GUIDE COMPLETE
16KB	BOTTOM PARALLEL GUIDE COMPLETE
16KC	SUPPORT FOR PARALLEL GUIDE AND REGULATOR FOR CORNER ERROR
16KD	MOVING PILLAR COMPLETE
16KE-M	BIG LEVEL AND "OMEGA" SHIELD
16KE-N	DETAIL OF END-STOP POSITION FOR LEVEL
16KF	CENTRAL LEVEL AND COIL COMPLETE
16KG	MAGNETIC GROUP
16KH	BASE AND OPTICAL GROUP COMPLETE
16KI	DETAIL OF CABLES



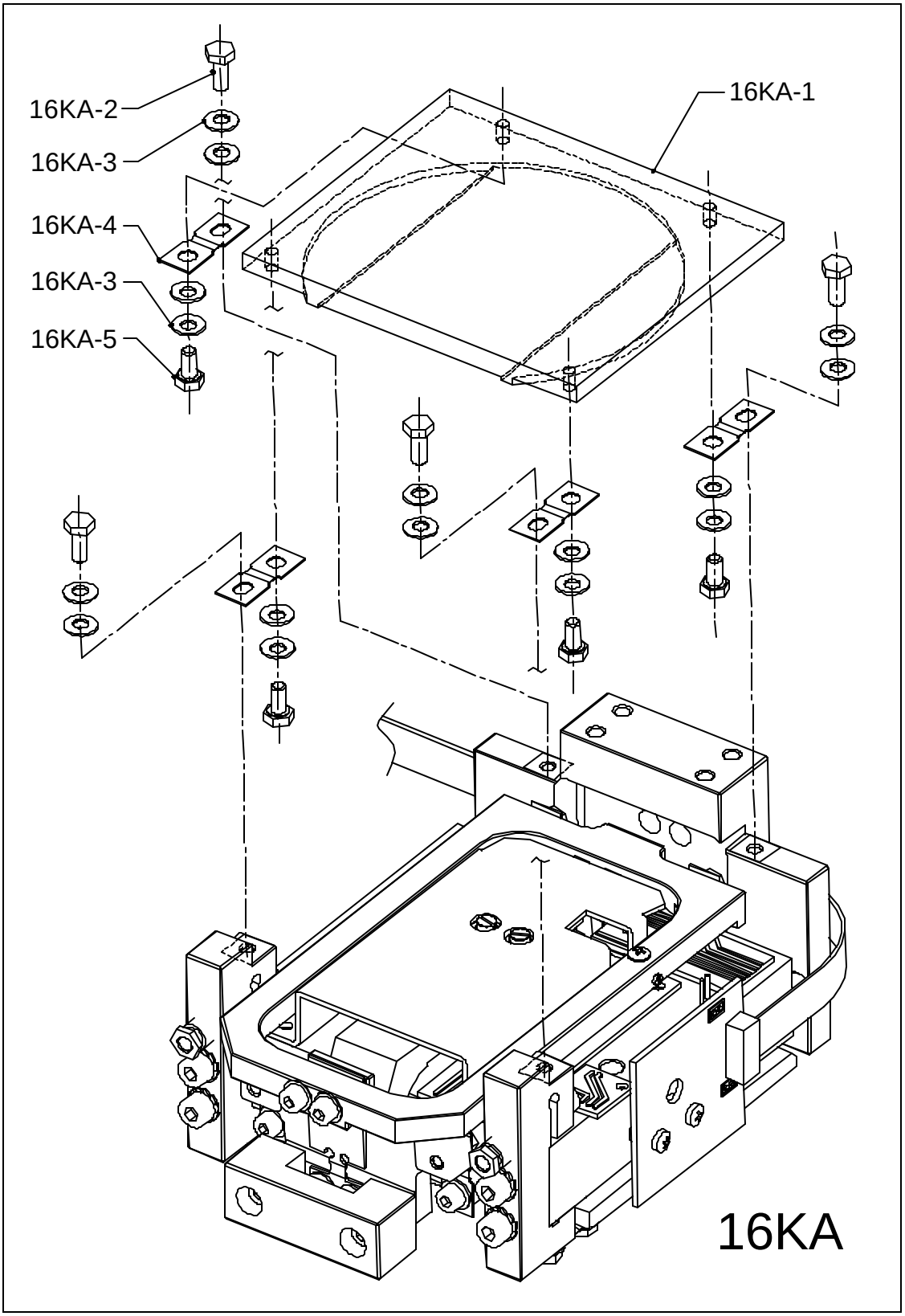
PARTICULARS CELL ENBLOCK FOR "MARK" 16K

NO.	NAME	CODE
16KA-1	TOP PARALLEL GUIDE	02-06-0361
16KA-2	SCREW M4x10	/
16KA-3	WASHER FOR SCREW M4	/
16KA-4	FLAT SPRING LEGP1 0.14	02-08-0260
16KA-5	SCREW M4x8	/
*******	**********	**********
16KB-1	BOTTOM PARALLEL GUIDE	02-06-0362
16KB-2	SCREW M4x10	/
16KB-3	WASHER FOR SCREW M4	/
16KB-4	FLAT SPRING LEGP1 0.14	02-08-0260
16KB-5	SCREW M4x8	/
*******	**********	**********
16KC-1	SUPPORT FOR PARALLEL GUIDE	02-07-0360
16KC-2	BUSH FOR CORNER ERROR	02-15-0124
16KC-3	SCREW FOR CORNER ERROR	02-15-0125
16KC-4	SCREW M5x25	/
16KC-5	WASHER FOR SCREW M5	/
*******	**********	**********
16KD-1	MOVING PILLAR	02-06-0071
16KD-2	VERTICAL FLAT SPRING LT1 0.14	02-50-0264

16KD-3	SPACER FOR VERTICAL FLAT SP. 1mm.	02-02-0417
16KD-4	PLATE FOR V. SPRING CLAMPING	02-02-0118
16KD-5	SCREW M4x10	/
16KD-6	WASHER FOR SCREW M4	/
16KD-7	SCREW M4x16	/
16KD-8	WASHER FOR SCREW VERTICAL FLAT SPRING FIXING	/
16KD-9	PLATE FOR HOOK	02-04-0410
16KD-10	SPACER FOR HOOK	02-07-0169
********	**********	**********
16KE-1	BIG LEVEL	02-12-0123
16KE-2	FLAT SPRING LEGP1 0.14	02-08-0260
16KE-3	SCREW M4x10	/
16KE-4	WASHER FOR SCREW M4	/
16KE-5	SCREW M4x16	/
16KE-6	PLATE FOR V. SPRING CLAMPING	02-02-0118
16KE-7	"OMEGA" SHIELD	02-90-0122
16KE-8	SCREW M3x6	/
16KE-9	END-STOP	02-90-0133
16KE-10	SCREW M3x4	/
********	**********	**********
16KF-1	CENTRAL LEVEL	02-12-0136
16KF-2	FLAT SPRING LEGP1 0.12	02-08-0259
16KF-3	SPACER FOR FULCRUM FLAT SPRING	02-07-0131

16KF-4	SCREW M4x10	/
16KF-5	WASHER FOR SCREW M4	/
16KF-6	SCREW M4x16	/
16KF-7	VERTICAL FLAT SPRING LT1 0.10	02-50-0262
16KF-8	SCREW M4x10	/
16KF-9	BARYCENTER COUNTERWEIGHT	02-03-0127
16KF-10	PLATE FOR COIL CLAMPING	02-02-0119
16KF-11	SCREW M3x14	/
16KF-12	WASHER FOR SCREW M3	/
16KF-13	FLAG	02-90-0134
16KF-14	SCREW M3x4	/
16KF-15	SUPPORT FOR COIL	02-04-0057
16KF-16	ELECTRICAL PLATE FOR COIL	/
16KF-17	ELECTRICAL PLATE FOR CENTRAL LEVEL	ST 0008
********	**********	**********
16KG-1	COVER FOR MAGNET	02-02-0120
16KG-2	SCREW M4x10	/
16KG-3	MAGNET	02-14-0063
16KG-4	POLE SHOE	02-90-0064
********	**********	**********
16KH-1	BASE	02-05-0364
16KH-2	OPTICAL GROUP COMPLETE	/
16KH-3	SCREW M3x8	/

16KH-4	BOARD "GO REV 0.0"	ST 0013
16KH-5	SCREW M3x12	/
16KH-6	SPACER	02-07-0169
16KH-7	ELECTRICAL PLATE	ST 0008
16KH-8	COLUMN FOR MECHANICAL GROUP	02-04-0137
16KH-9	ELECTRICAL PLATE FOR OPTICAL GROUP	ST 0009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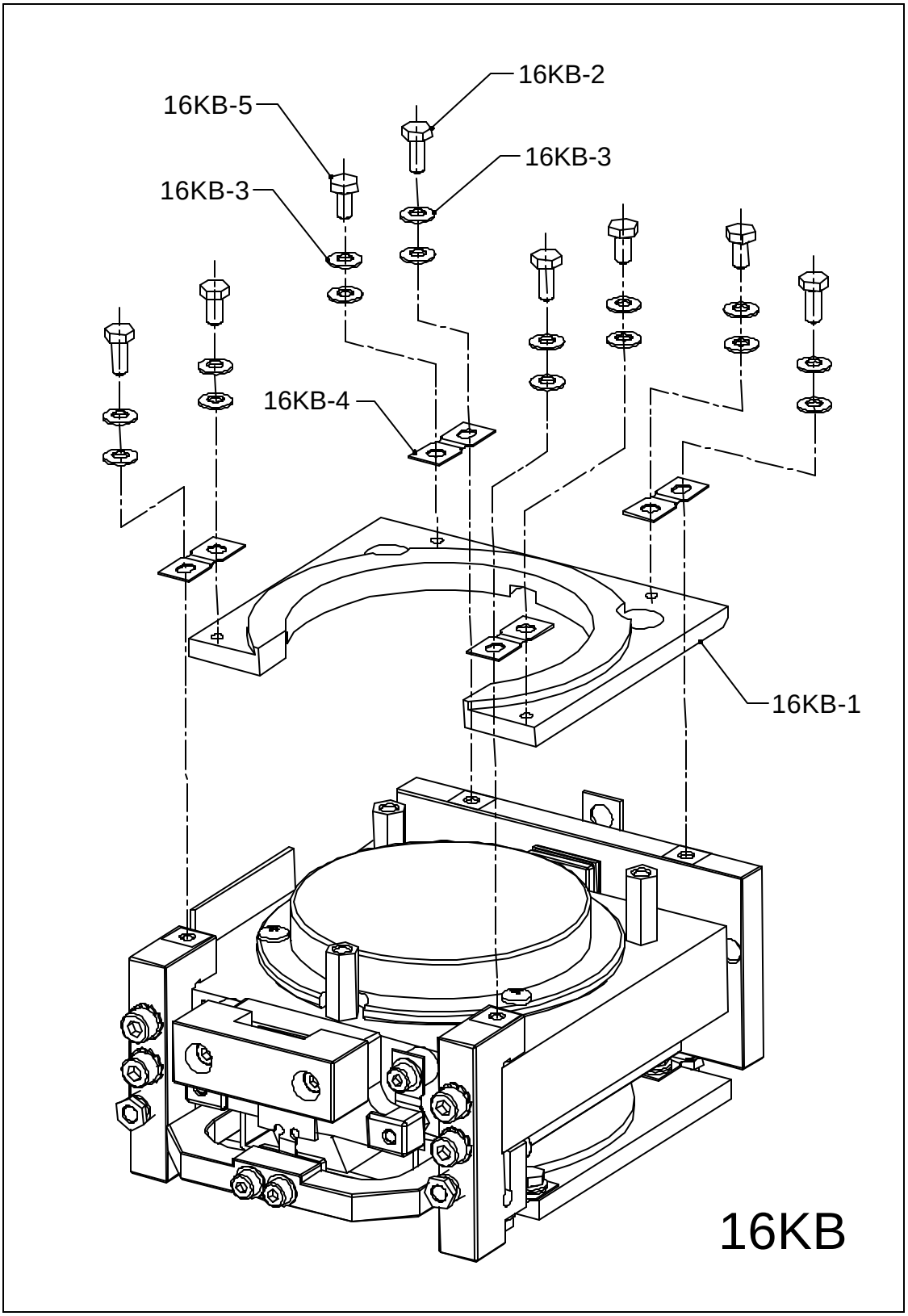
16KA-3
16KA-4
16KA-3
16KA-5
16KA-1
16KA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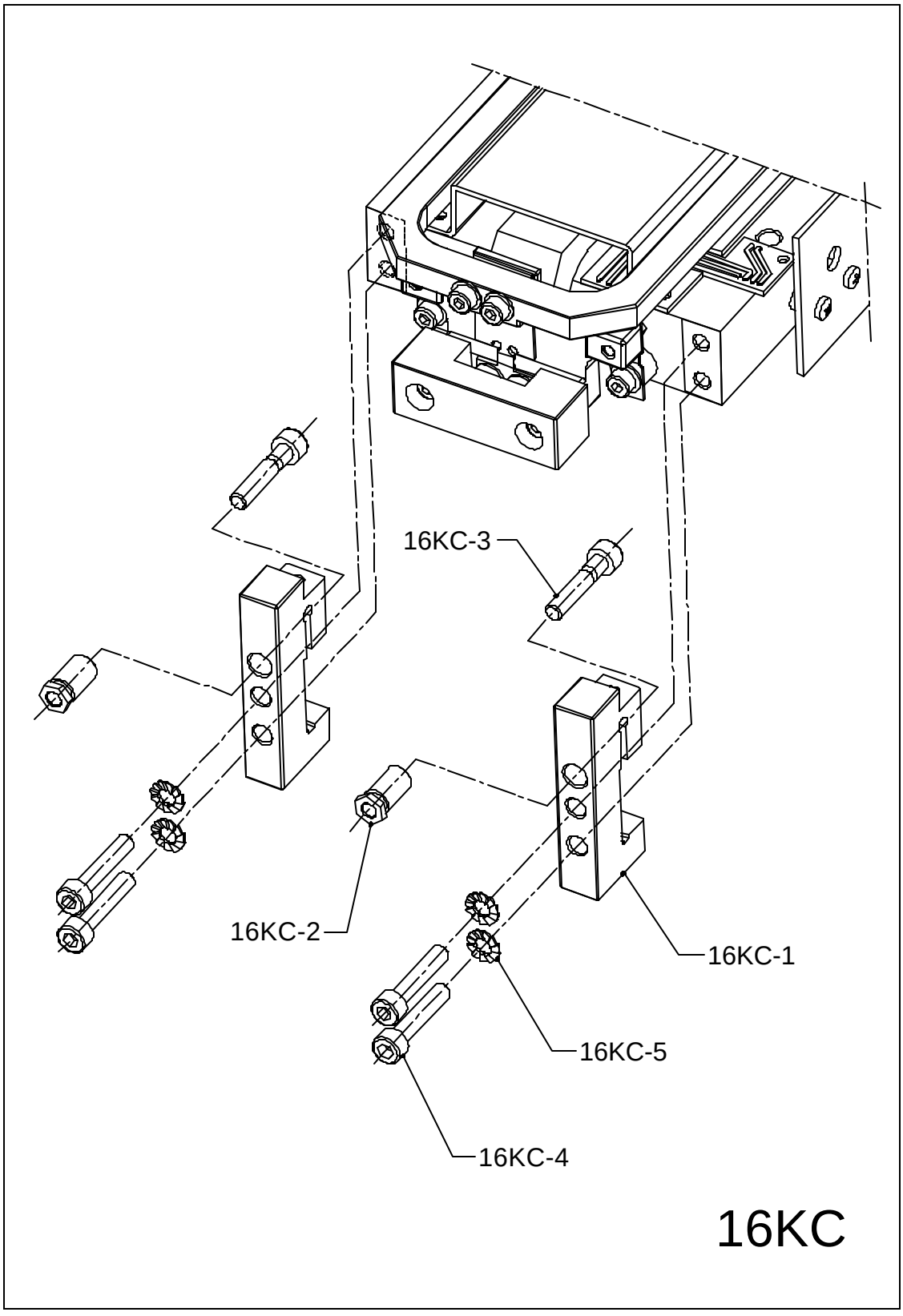
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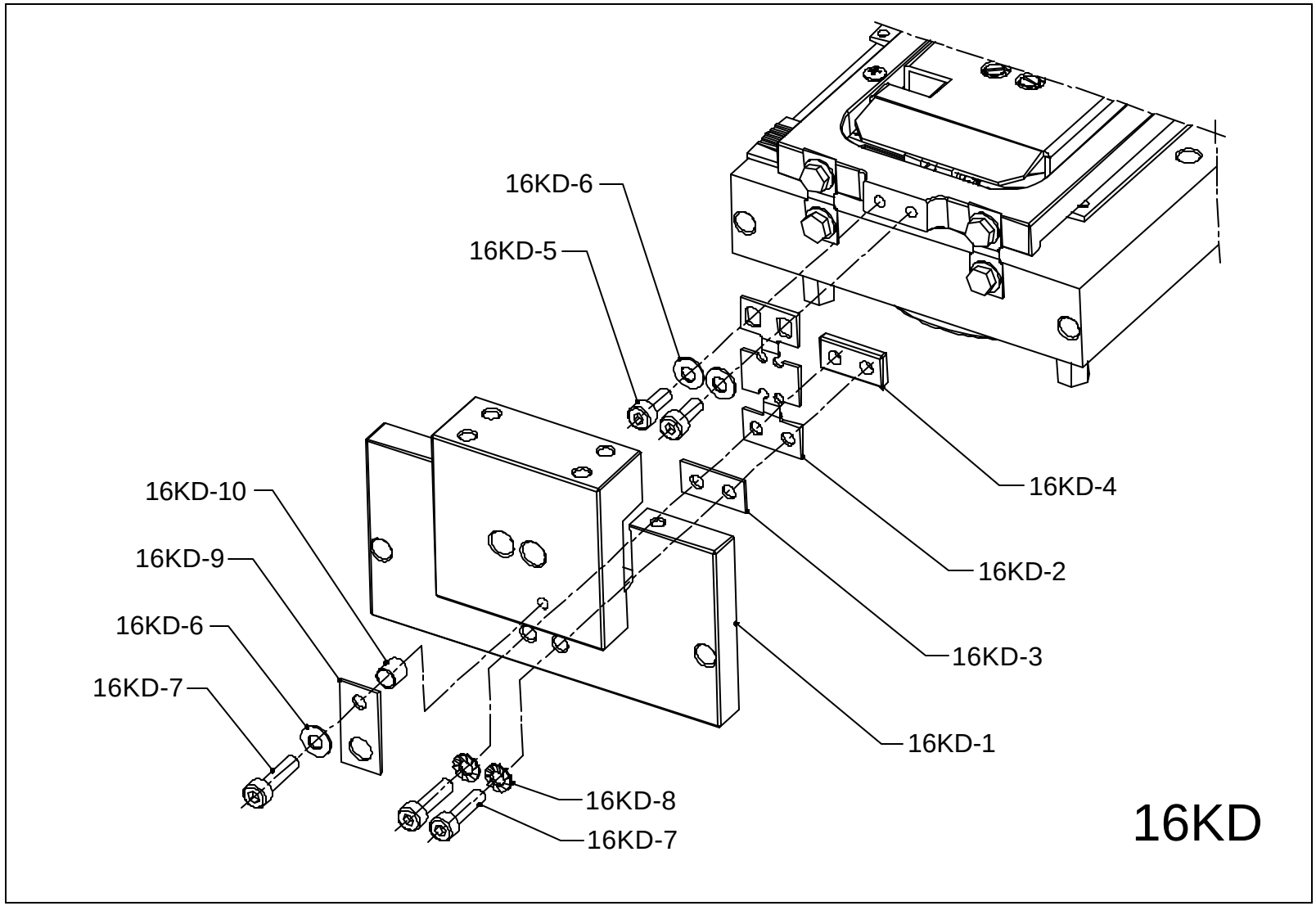
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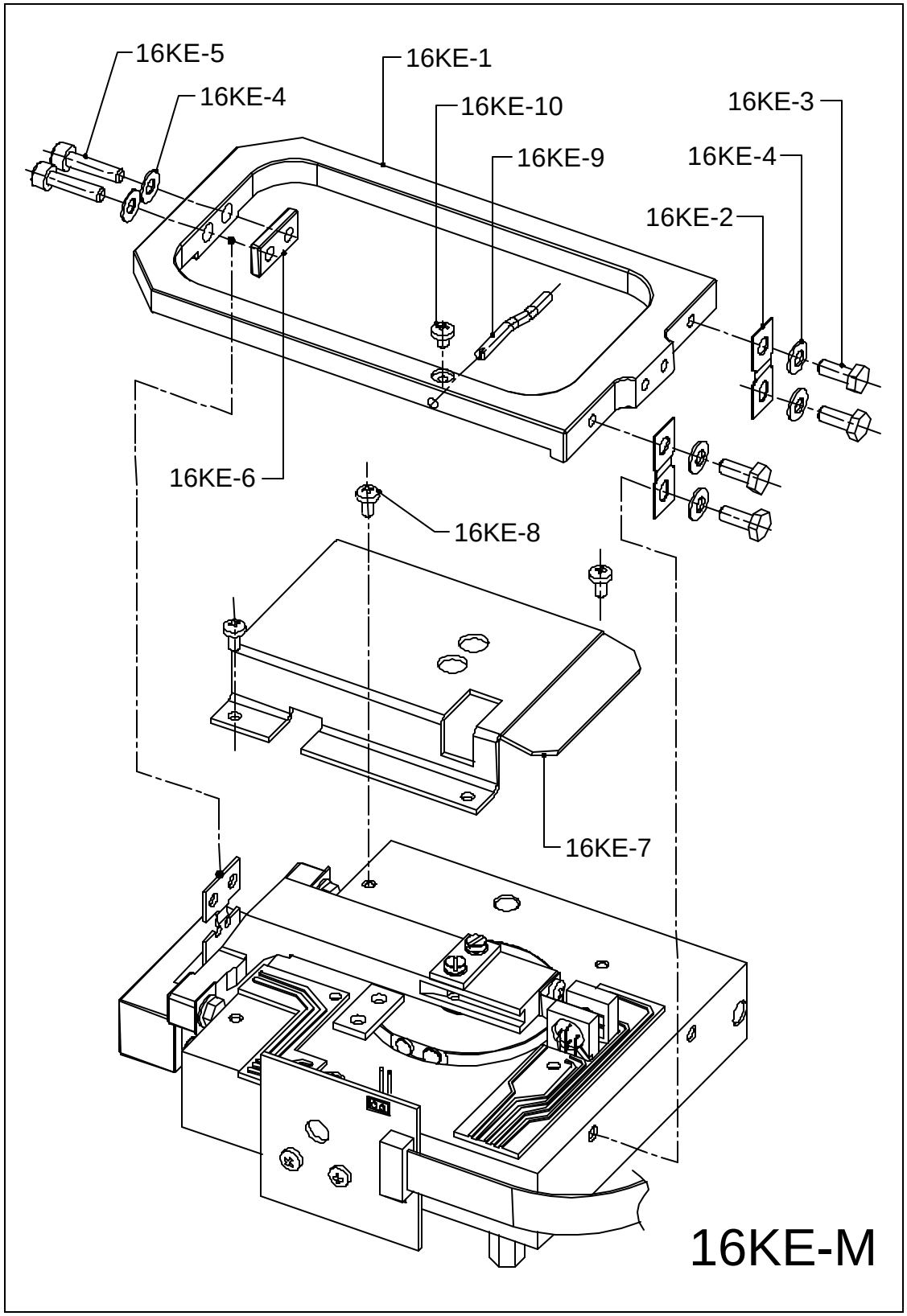
16KD-7
16KD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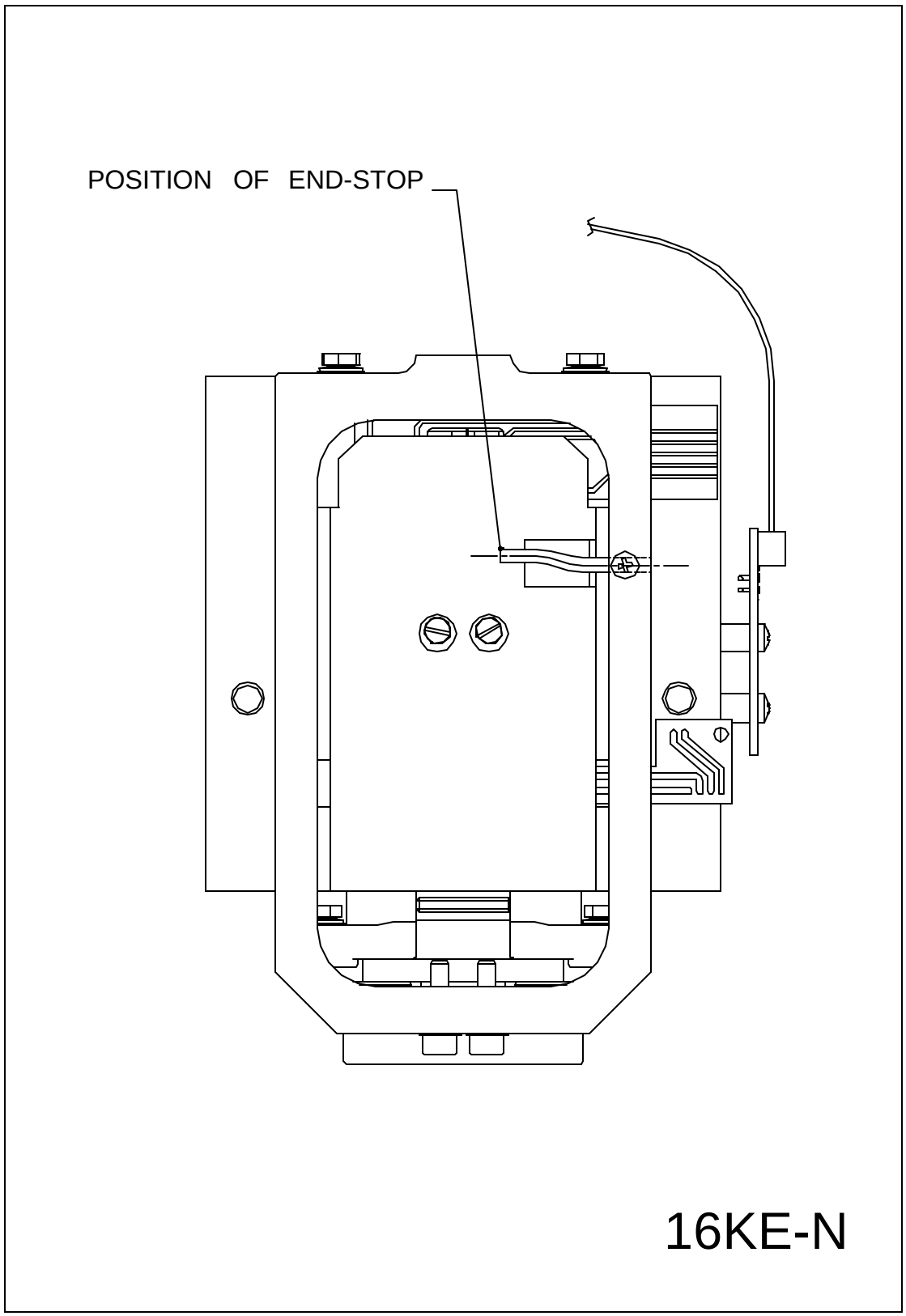
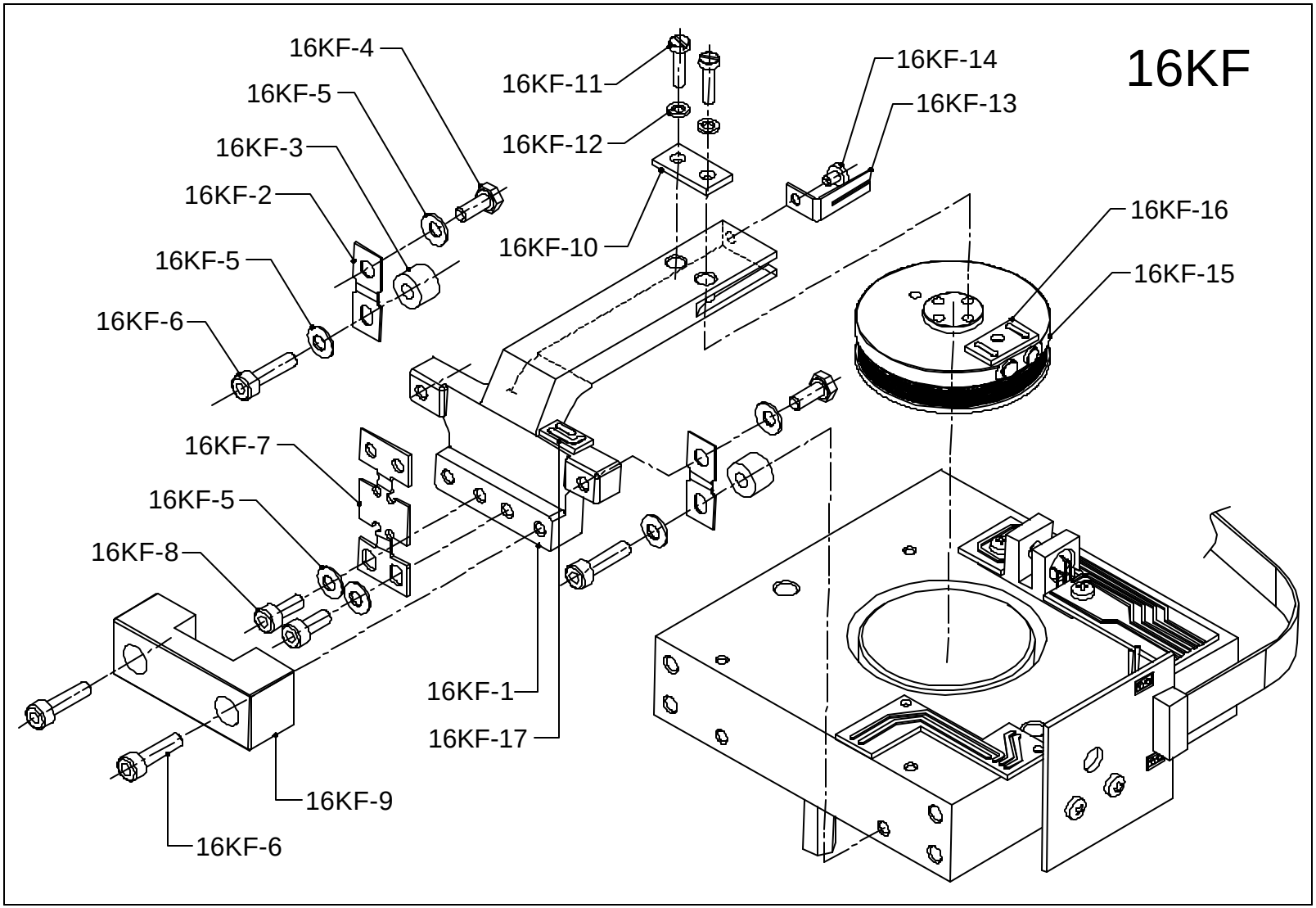
16KE-M


POSITION OF END-STOP
16KE-N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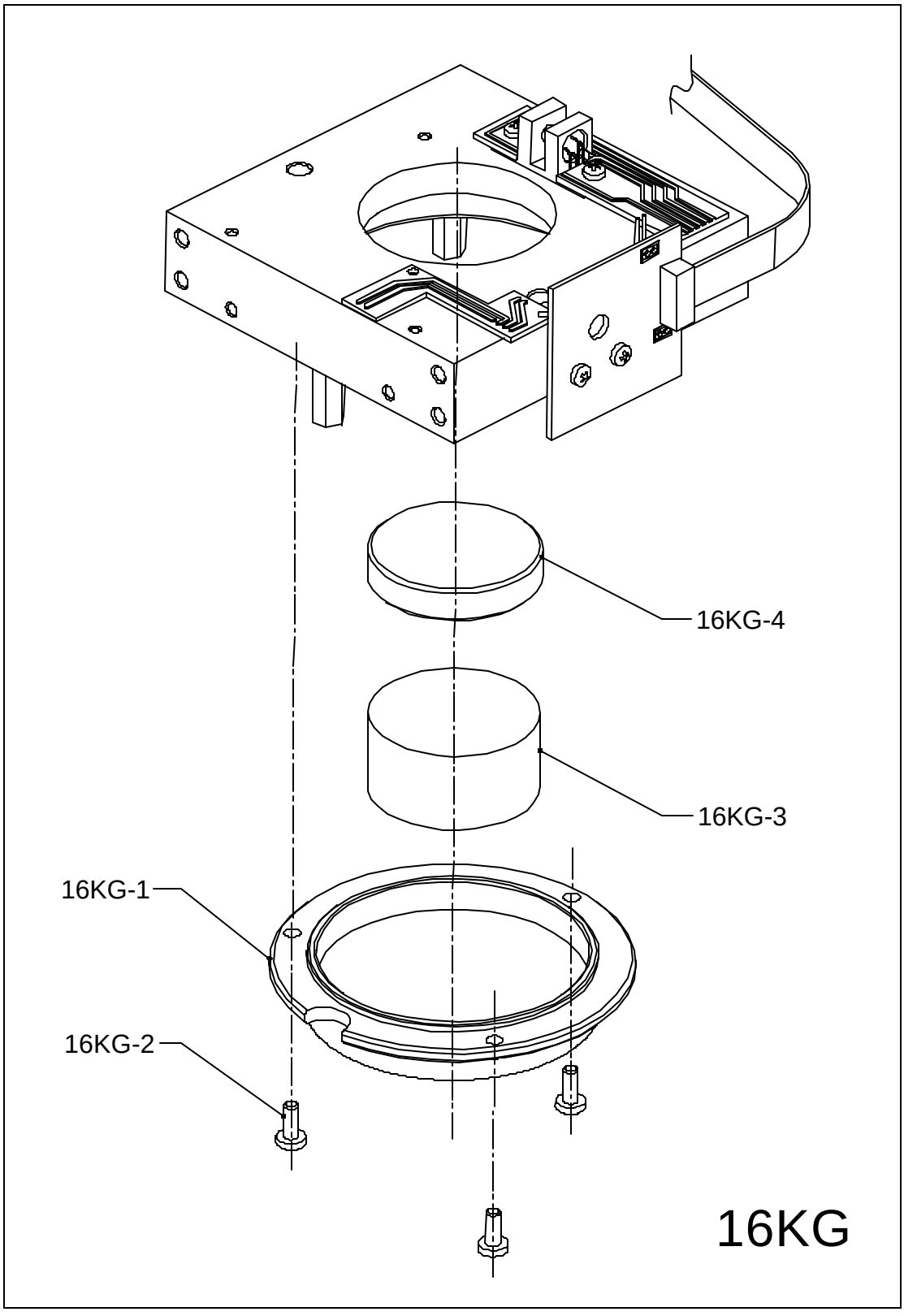
16KF-1
16KF-17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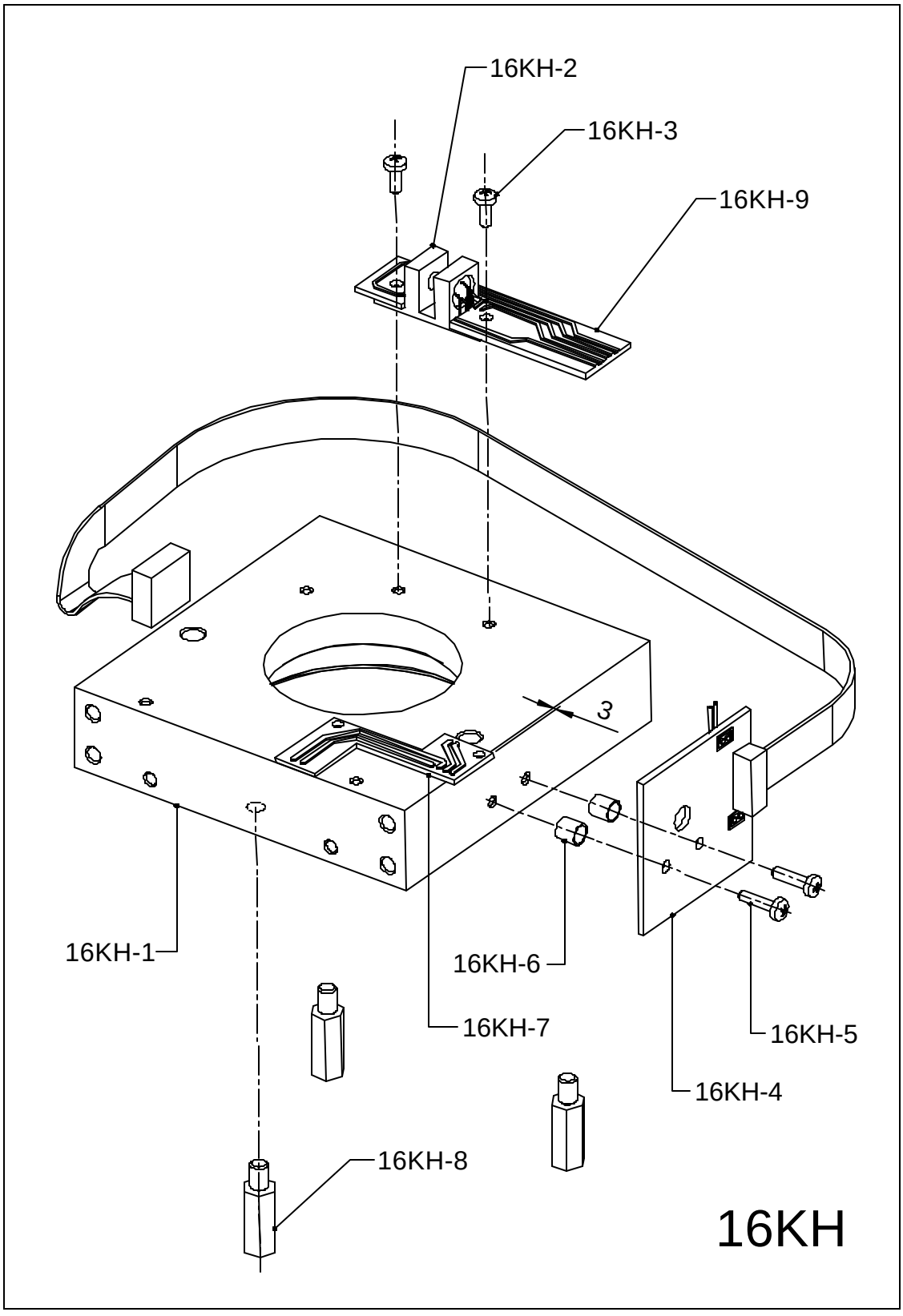
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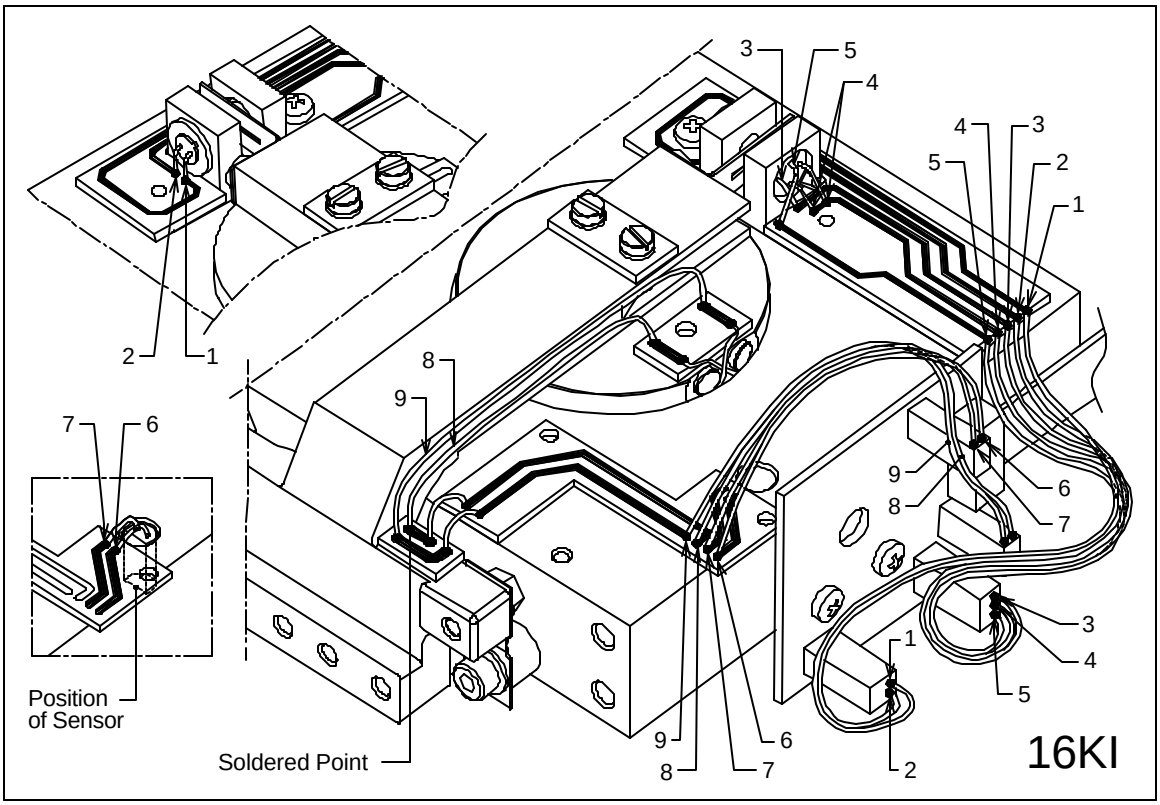
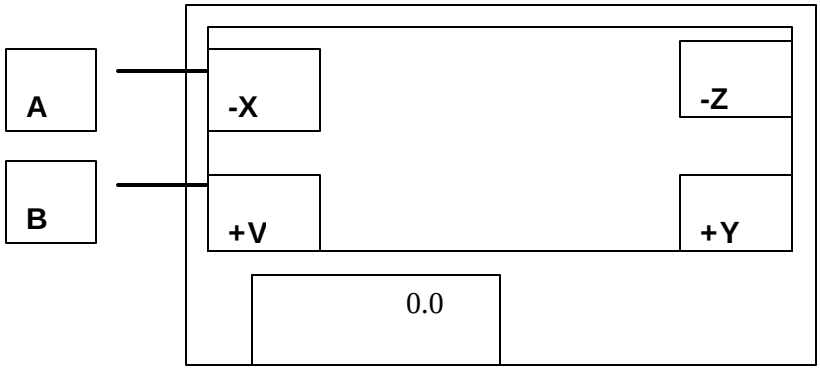
16KH



Corner Load Error.

12-16-20 kg Capacity.

Corner load adjustment for 12-16-20 K models is the following (and it is different from adjustment of 6K): Access top the two regulators is through the two apertures in the side casing.



A adjusts X and Y
B adjusts V and Z
If V is positive, rotate the regulator B anticlockwise.
If Y is positive, rotate the regulator A clockwise
And vice versa

Bel Engineering Service Notes.

Balances

High Capacity

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 “cceleration 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.

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 other 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” (balance will set 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.

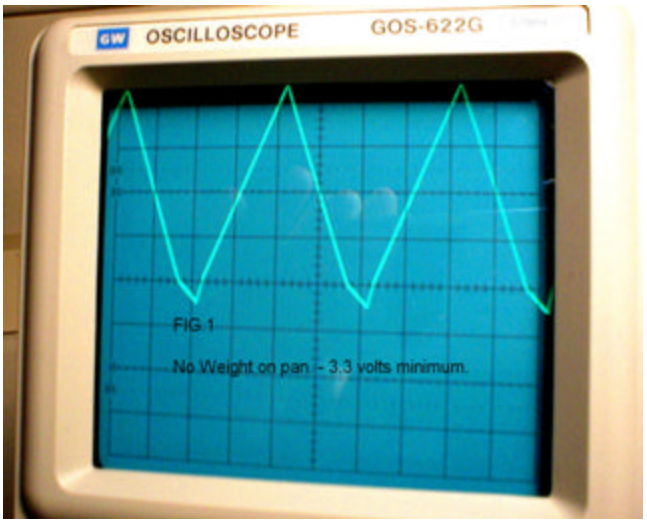
a. If this measurement is not correct, remove J4 connector and check the output on U@-7812 Rectifier. This should be 12 volt. If not, remove and replace the power board.
b. If this measurement is not OK, remove J4 connector & check output on U3-7912 this should be = 12.5 volt. If not correct remove and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

See drawing ALINT Rev. 4.

Optical Group

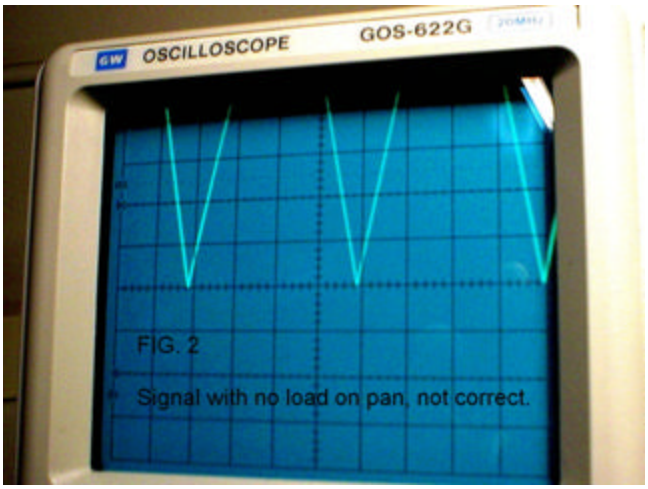
To check veracity of signal from optical group:

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).**



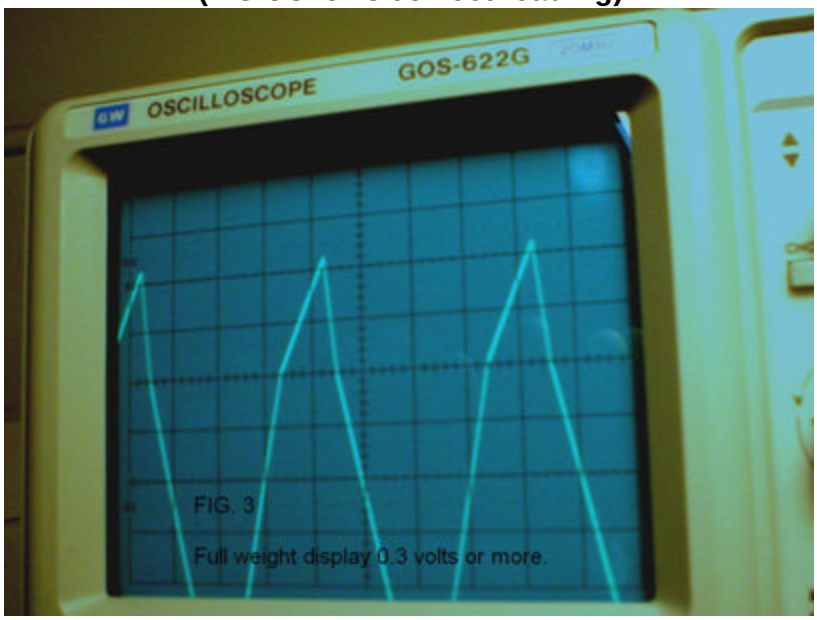
Generally factory set for 1 volt reading, this will allow technicians to see a negative reading when the pan is removed, rather than an underweight signal.

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

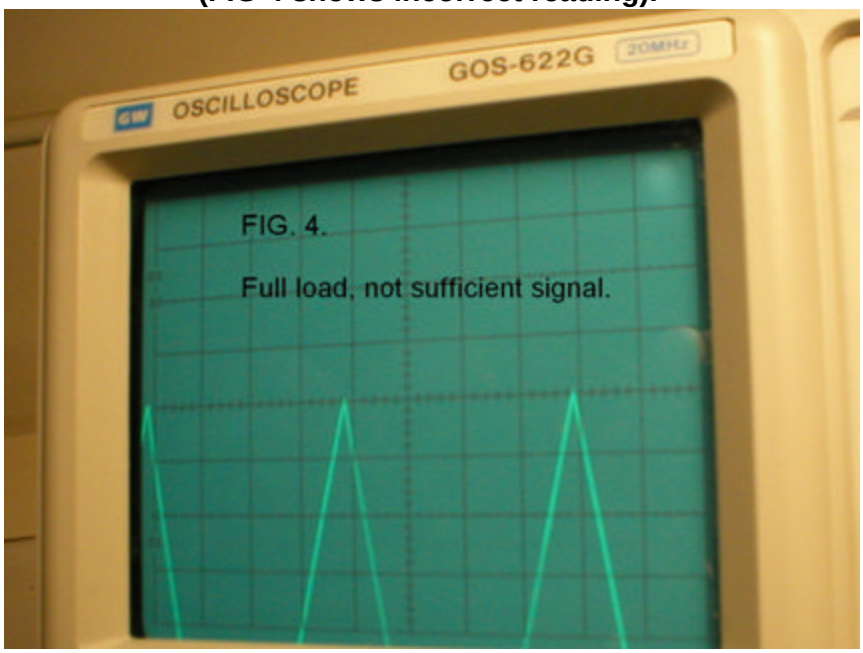


b. Apply full load to balance. Test between TP7 and TP6. It is important that the positive signal is 0.3 volts or more.

(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.

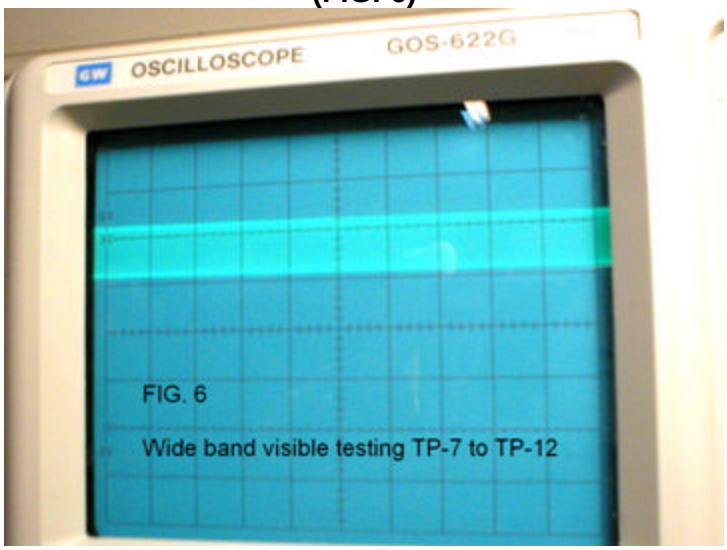
Note! on analytical balances, the balance should be returned to Intelligent Weighing Technology for fitting of specialized resistances.

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)

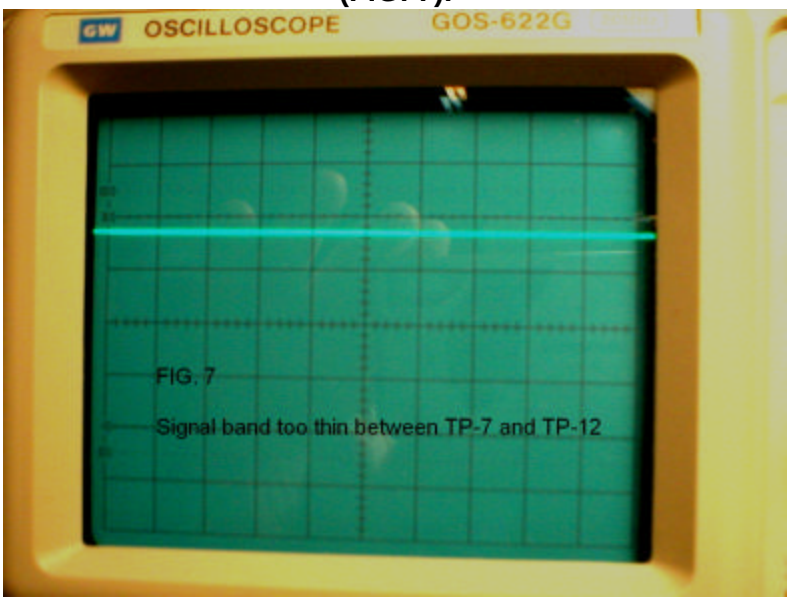
(FIG. 5 shows correct reading).

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



A thin band shows a malfunction

(FIG. 7).

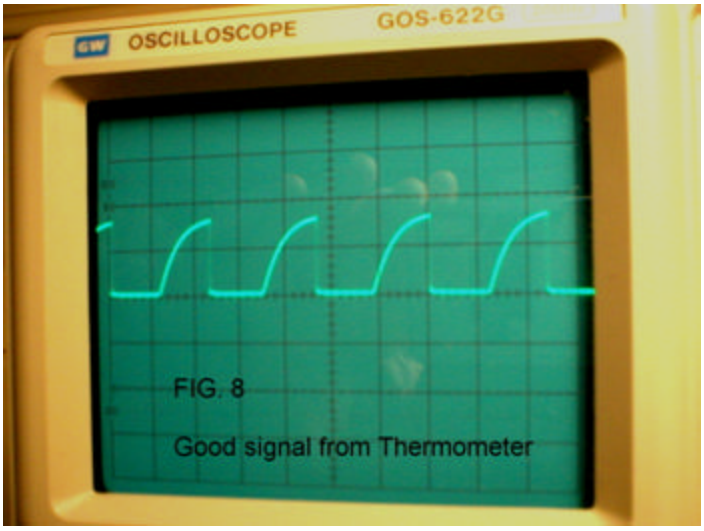


If the band is thin, change crystal Y2.

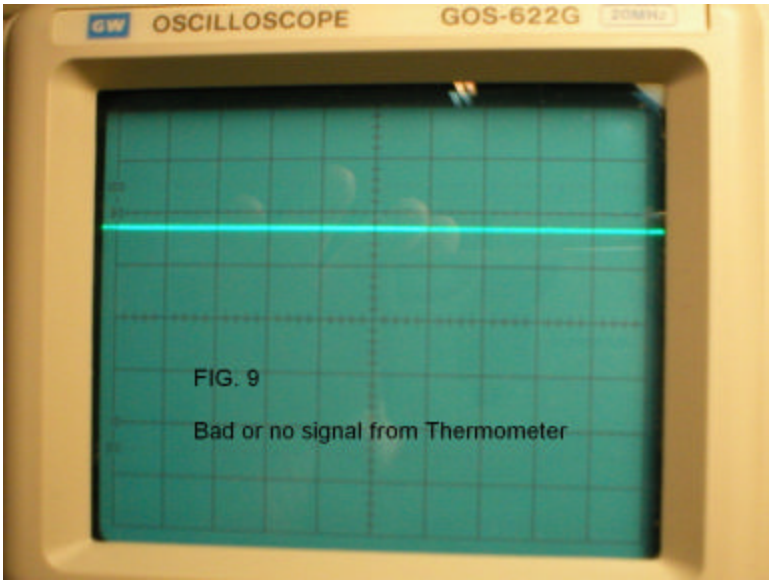
Test Thermometer Frequency to Analog to Digital converter.

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.**