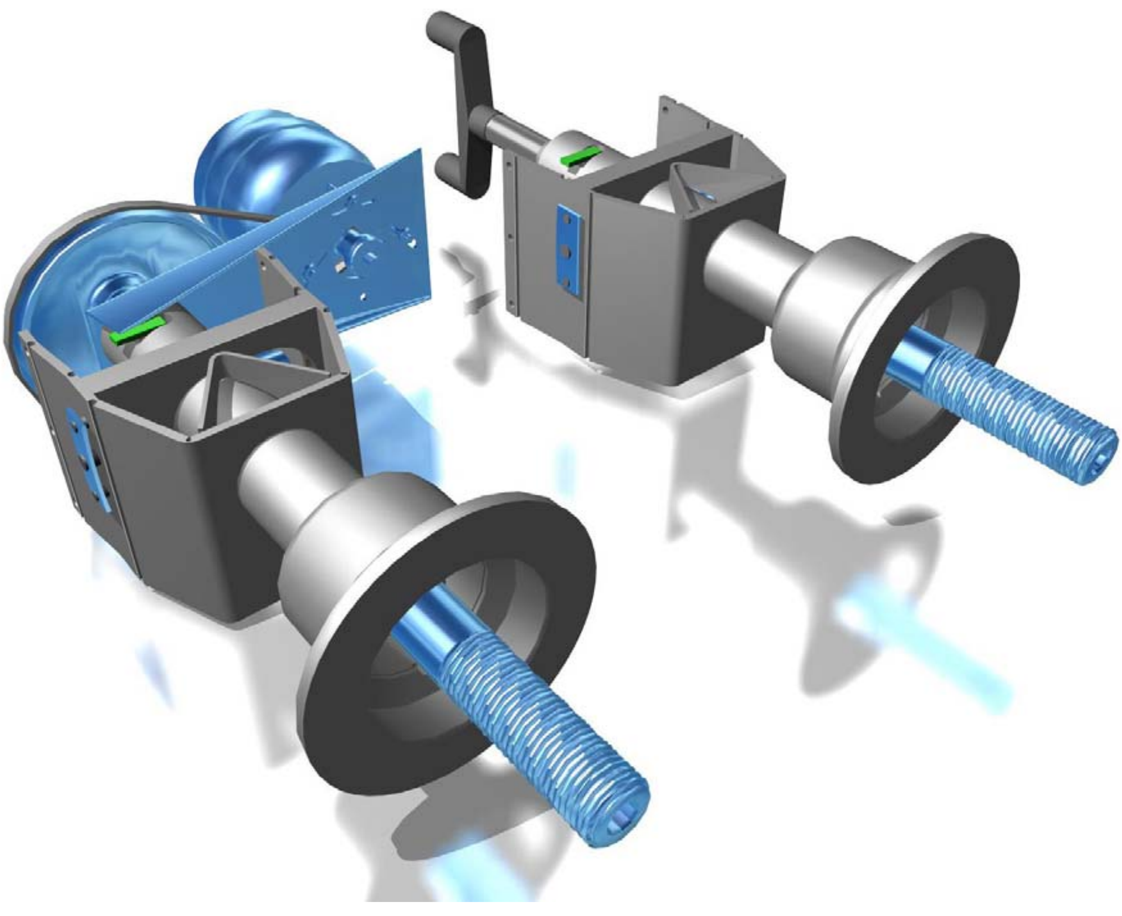
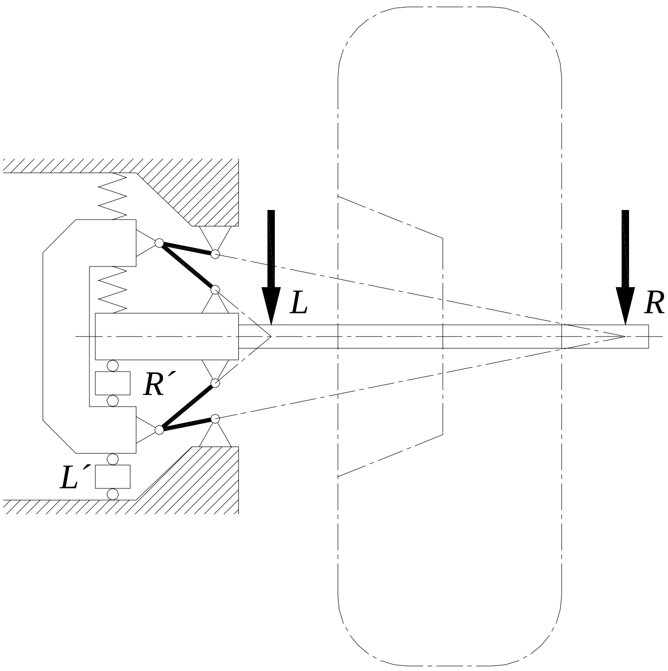
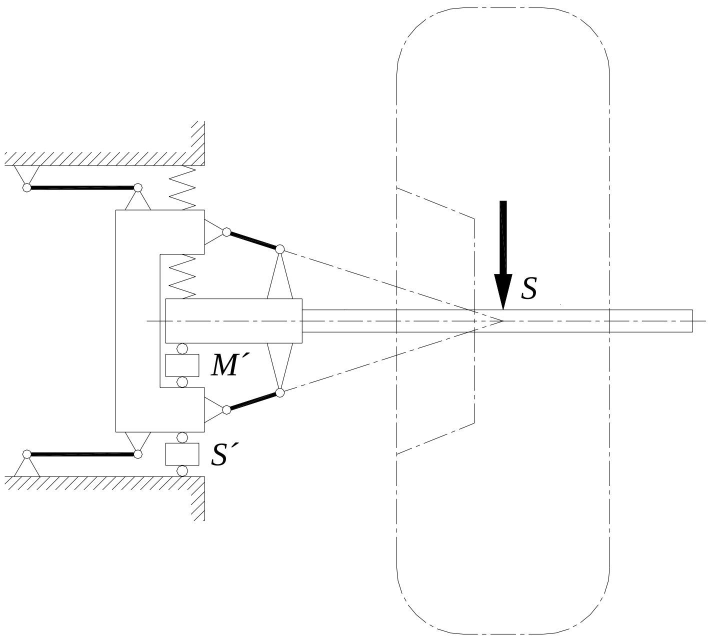
SERVICE

of the Y2k balancing platform



The vibratory assemblies of the Y2k balancing platform





New principle for vibratory system
– designed to reduce the effects of force relations

The disadvantages of the former solutions are the considerable effects of force relations. As a result the plane separator circuit mostly had to form the difference between high measured values in the transducer planes in order to calculate the unbalances present in the correction planes. If sensitivity substantially of one transducer changed by a certain percentage under different influences, the calculated difference, that is the reading of unbalance present in the correction planes, would change disproportionately.
The problem of the effects of force relations will now be illustrated in *Fig. 1* and the following derived algorithms. To make the problem quite clear we assume that an unbalance U_R is present in the right-hand correction plane only, this unbalance being calculated by the plane separator circuit on the basis of data measured in the planes *R* and *L*.

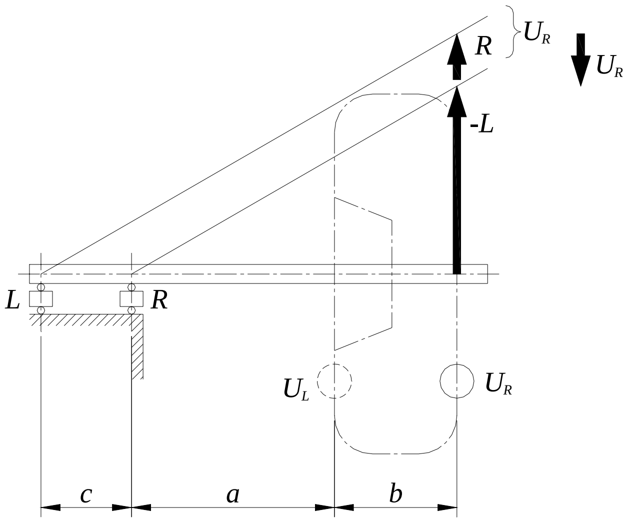


Fig. 1 *Illustration of the effect of force relations at an increasing distance (a+b)*

Following the condition

$$\sum Moments = 0$$

the measured value L is

$$L = \frac{U_L \cdot a + U_R \cdot (a+b)}{c}$$

or $$L = \frac{U_R \cdot (a+b)}{c}, \text{ if } U_L = 0.$$

Analogously the measured value *R* is

$$R = -\frac{U_L \cdot (a+c) + U_R \cdot (a+b+c)}{c}$$

or $$R = -\frac{U_R \cdot (a+b+c)}{c}, \text{ if } U_L = 0$$

Following the condition

$$\sum TransverseForces = 0$$

the plane separator circuit calculates that

$$U_R = -(L+R).$$

As the measured value *L* is oppositely directed to *R*, U_R is practically the difference between the absolute measured values $|L|$ and $|R|$.

The dependence of the measured values L from distance $(a+b)$ and R from distance $(a+b+c)$ respectively becomes obvious from the straight lines in Fig. 1. They intersect the axis in the measuring planes. The forces in the measuring planes increase linearly with increasing distance. It is quite obvious that the the effects of force relations increase in the ratio

$$\frac{L}{a+b} \text{ and } \frac{R}{a+b+c} \text{ respectively}$$

with increasing distance. Consequently the mistake in the calculated unbalance U_R will be disproportionately large if the sensitivity of only one transducer changes following different influences such as temperature, fatigue, shock, overload, vibrations in transport, humidity, etc. The target should be to reduce the effects of force relations such that any change in the sensitivity of one transducer does not affect unbalance readings disproportionately when calculated by a plane separator circuit.

The disadvantages specified above are basically typical of a vibratory system with outboard rotors. Using state-of-the-art technology an improvement is hardly possible because of given physical restrictions.

A possibility to improve the results is the physical displacement of the right measuring plane to outside the machine housing such as illustrated in *Fig. 2*. In this case the hollow space inside the rim is used, for instance with *geodyna 3001* of HWT and all machine types of Balco. Given the rim shapes as they are displacement is quite limited and possible for one measuring plane only.

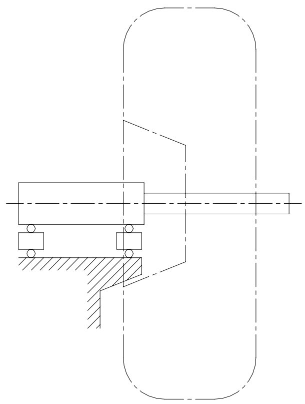


Fig. 2 *Measuring system with physical support of the rotor outside the machine housing*

Another possibility to reduce the effects of force relations is an increased distance between measuring planes as illustrated in *Fig. 3.* This condition is not always feasible for lack of space and makes sense to a limited extent only because the left-hand measuring signal is reduced and consequently the influence from fluctuations of measured values will increase.

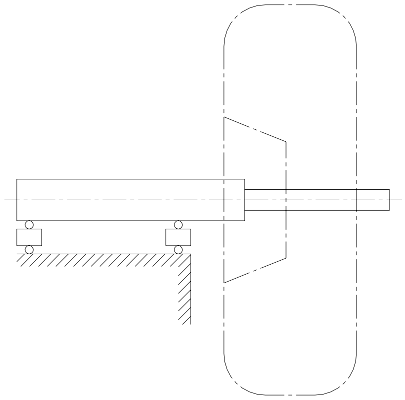


Fig. 3 *Measuring system with increased distance between measuring planes*

Theoretically an inboard rotor with correction planes between the measuring planes such as illustrated in *Fig. 4* can be considered an improvement as well.

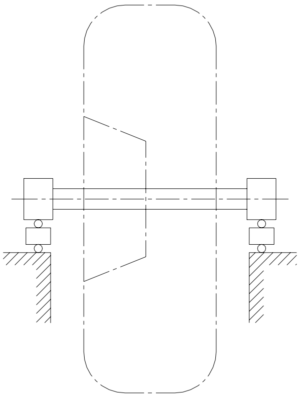


Fig. 4 *Inboard rotor with one measuring plane on every side of the rotor*

Considering state-of-the-art technology this possibility is not feasible for automotive wheels because at least one point of support will hinder clamping of the wheels.
It is now the idea for a new vibratory system to maintain the basic concept of an outboard rotor, but to displace the two measuring planes virtually far outside the machine housing. The measuring planes and points of support respectively will be displaced so far outside the machine housing that the virtual measuring planes have no physical support on the machine housing any longer. This means that independent of physical conditions the measuring planes may be virtually located in optimum positions along the shaft axis which could cover the whole range of wheels to be balanced.

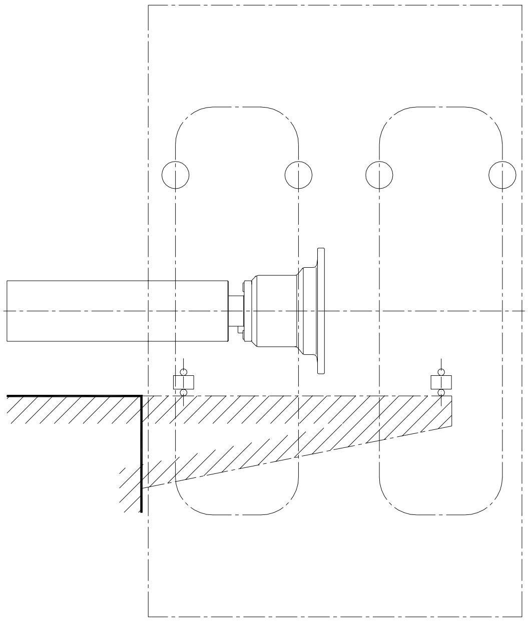


Fig. 5 *System with two virtual measuring planes outside of the physical range*

When the measuring planes are located in optimum positions, the virtual left-hand measuring plane is just inside the wheel disc when the wheel is as close as possible to the housing of the wheel balancer (see *Fig. 5).* In this extreme case the left-hand correction plane is slightly displaced left of the left-hand measuring plane. Analogously the right-hand virtual measuring plane is slightly displaced left of the right-hand correction plane in the case where the wheel is in the remotest location relative to the housing of the wheel balancer. Apart from these extreme cases the two correction planes are mostly located between the two virtual measuring planes. Locations of the two measuring planes can be calculated such that the effects of force relations are minimum over the entire range where correction planes can be located.
Virtual displacement is based on a vibratory system where the support levers are not located in parallel, but in an angle relative to the measuring shaft as illustrated in *Fig. 6.*

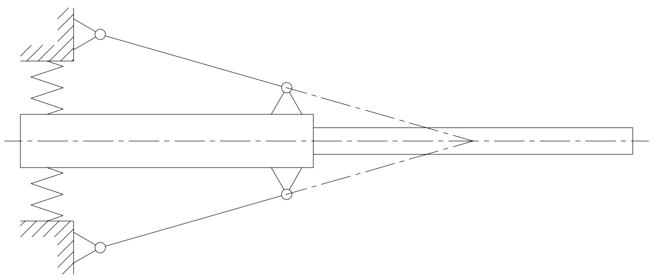


Fig. 6 *Vibratory system with virtual node of vibration*

In this arrangement a node of vibration forms approximately in the point of intersection of extended support levers. When forces act on the measuring shaft, e g centrifugal forces caused by rotating unbalance, it comes to a vibrating deflection of the vibratory system. Magnitude and location of such deflection also depend on the axial distance of the point of application of the forces relative to the node of vibration. *Fig. 7a* illustrates that the vibratory system responds in opposite direction of the forces applied if they are applied right of the node of

vibration. If forces are applied left of the node of vibration such as illustrated in *Fig. 7b* the vibratory system will respond in the direction of the forces applied. If, however, the forces are applied in the node of vibration as illustrated in *Fig. 7c* the vibratory system will maintain a state of rest.
The simplified Figures below do not include the springs.

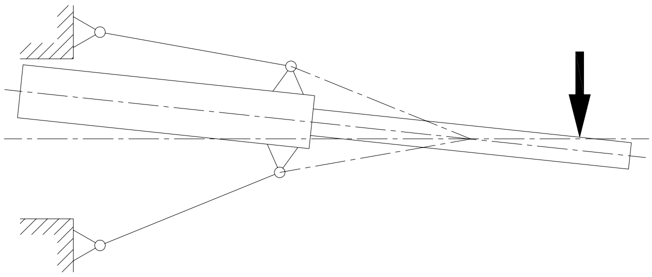


Fig. 7a *Deflection of vibratory system with forces applied right of the node of vibration*

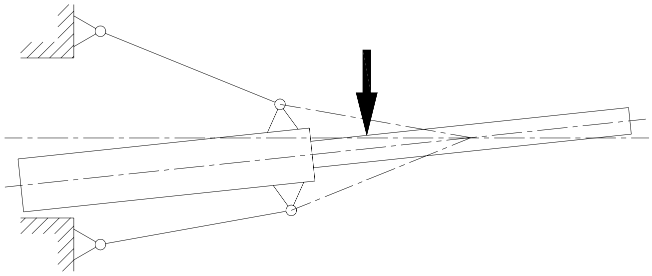


Fig. 7b *Deflection of vibratory system with forces applied left of the node of vibration*

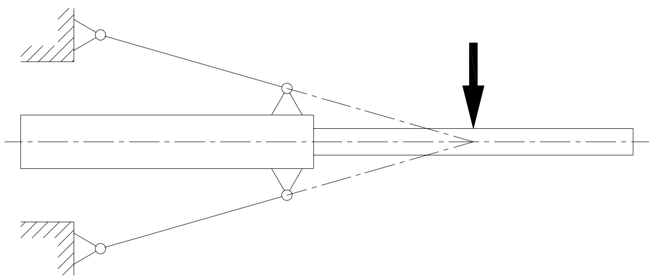


Fig. 7c *Vibratory system with forces applied in the node of vibration*

The vibratory system as illustrated in *Fig. 8* is the basis of a force measuring system. Basically it would be enough to replace one of the two springs by a transducer as shown in *Fig. 8*. Following Figures 7 this transducer will not supply a signal if the centrifugal force acts on the node of vibration (point no. 1). If acting on any other points (nos. 2 and 3) the forces will produce a signal which is proportional to $F \cdot a$. The displacement of the node of vibration as a result of the force measuring system during vibrations can be neglected.

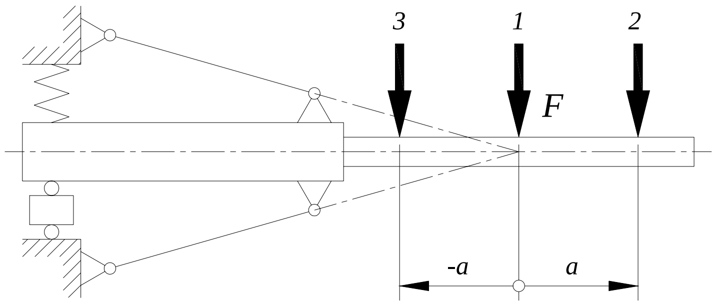


***Fig. 8** Force measuring system with one virtual point of support*

In **Fig. 9** two of the systems illustrated in Fig. 8 are arranged in series at different distances relative to the node of vibration. Consequently it is possible to establish a force measuring system for measurement of unbalances in two virtual measuring planes. The two virtual measuring planes are located in points L and R whereas the relative physical transducers are marked L' and R'.

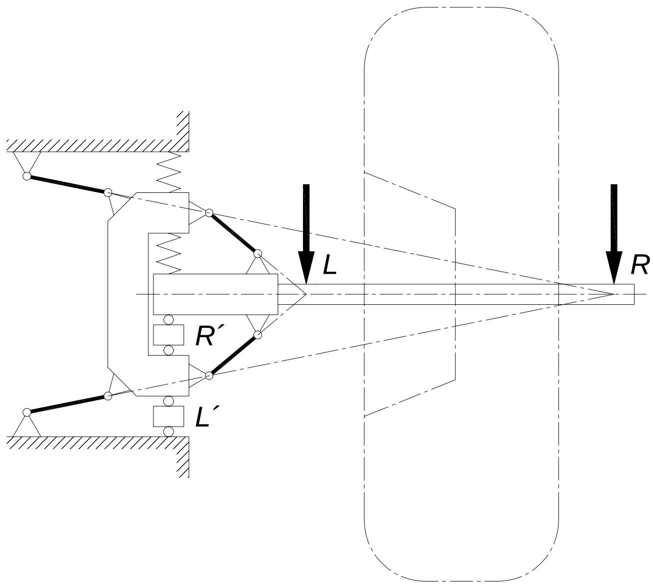


***Fig. 9** Two systems arranged in series with different virtual points of support*

If for instance a centrifugal force acts on the left-hand node of vibration L, a signal proportional to the magnitude of the centrifugal force is supplied from transducer L', whereas transducer R' does not supply a signal. On the other hand only transducer R' will supply a signal when the centrifugal force acts on the right-hand node of vibration R. This arrangement is indeed a measuring system as illustrated in Fig. 4 with an outboard rotor and with correction planes being located between the measuring planes. If forces are applied between points L and R, the bearing forces are divided in proportion to the relative distances to the points of support.
Figures 10 to 12 show possible alternatives.

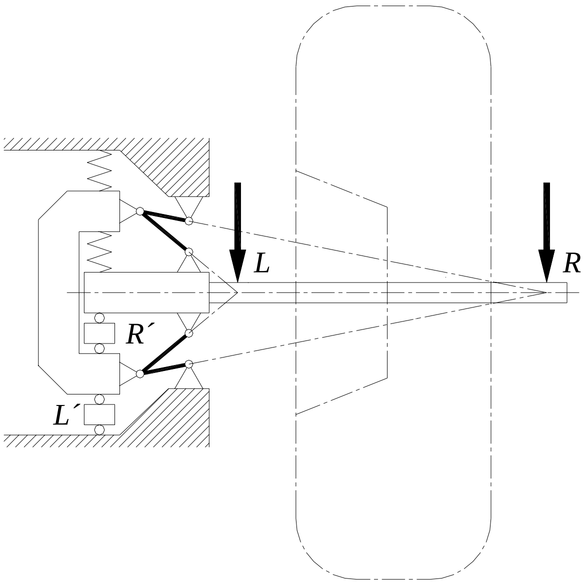


Fig. 10 *Two systems arranged one above the other with different virtual points of support*

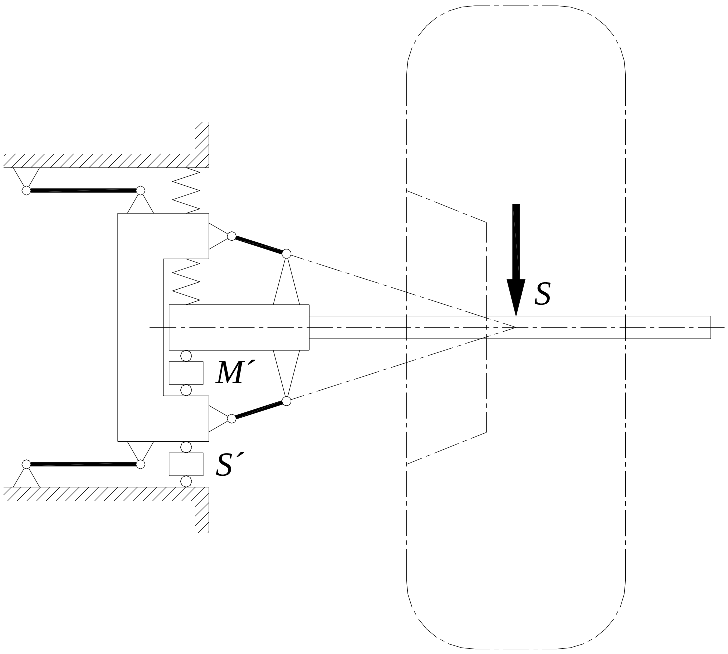


Fig. 11 *Two systems arranged in series with a parallel pair of springs*

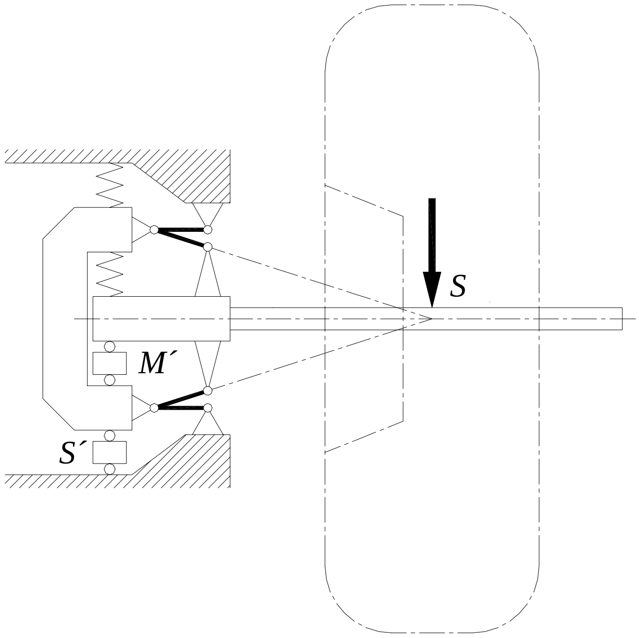


***Fig. 12** Two systems arranged one above the other with a parallel pair of springs*

In case of alternatives as shown in *Fig. 11* and *12*, a centrifugal force introduced in S will be detected by transducer S' only as long as transducer M' does not supply any signal. Irrespective of the distance of the introduced centrifugal force transducer S' will always supply a signal proportional to the quantity of the centrifugal force. According to *Fig. 8* and relative specifications transducer M' will supply a signal proportional to the product of the amount of unbalance times the distance between the unbalance and point S. As the distance of a single centrifugal force increases, the quantity of the signal M' will first decrease and then, when having passed the node of vibration, increase with the relative other sign (plus or minus).

Reduced the effects of force relations bring about the following advantages:

- Reduction of influence on sensitivity changes in the transducers following different influences such as temperature, fatigue, shock, overload, vibrations in transport, humidity, etc.
- Reduced necessity for replacement of a transducer.
- Reduced necessity for readjustment after transport and installation of the machine.
- Reduced service cost.
- Increased accuracy of measurement.
- Less critical requirements to resolution of A/D converters owing to digitized analogue unbalance signals.
- Wide virtual distance between measuring planes despite of compact design of the vibratory system.

The vibratory assemblies of the Y2k balancing platform

Contents

Hints for the field engineer

Please provide machine model, serial number and program version number with problem reports.
If there are unstable unbalance readings, insufficient plane separation or weight chasing problems, in addition to the vibratory assembly consider the following causes:

a) Does the wheel slip on the adaptor?
   Chalk mark adaptor and rim. After measurement run, check if both marks are still in line.
b) Do components obstruct the barely discernible movements of the vibratory assembly?
   The Motor or Bowden cable is in contact with the cabinet close to the vibratory assembly.
c) Did the leaf spring at the rear transducer slacken during transport?
d) Poor stance of the machine?
   The cabinet standing on tiptoe instead of being supported right under the vertical sheet metal.
   Bolting down does not improve balancing accuracy. It just stops the balancer moving around while clamping the wheel.
e) Bad or missing welds at the cabinet.

The Vibratory assemblies

The vibratory assembly is the central module of a wheel balancer.
It consists of the force guidance structure for directing the alternating unbalance forces via the transducers. The main shaft is supported on ball bearings in the vibratory tube with the wheel adaptor at the right-hand end. The drive system is then propelling and stopping the main shaft.
The incremental encoder B8 is acquiring rotational travels, direction of rotation and absolute angular position of the main shaft.
The vibratory assembly is fastened and supported towards the ground by the cabinet, so that unbalance produces a minimum of vibration while the wheel is rotating.
To measure the unbalance, the wheel is clamped to the main; the shaft is accelerated to measurement speed, with the electronic unit exploiting the signals of the incremental encoder and the unbalance transducers.
The Y2k vibratory assemblies utilise the ***V****irtual* ***P****lane* ***M****easurement* force guidance structure (patent pending). With this force guidance structure, inadvertently produced forces and the unbalance forces are directed horizontally via the transducers in an almost a one to one ratio, thus avoiding overload. Without the lever action of conventional vibratory assemblies, interfering vibrations and changes in transducer sensitivity caused by temperature changes, fatigue, overload, humidity, etc. have minimum effect thus achieving good long-term and repeatable measurement accuracy.
The unbalance transducers are located in close proximity inside the cabinet. Exposed to almost identical temperature, temperature variations have little effect on plane separation. The cabinet supports transducer B2, located in the rear. Transducer B3 at the front is clamped 7° diagonal between the vibratory tube and vibratory plate. Two leaf springs provide mechanical pre-stress to the transducers.
ATTENTION! Other machine parts must not obstruct the barely discernible movements of the vibratory assembly.
Does the Bowden cable touch the cabinet immediately below the vibratory assembly, or the weight tray rests on the vibratory assembly, part of the alternating forces produced by unbalance are conveyed to the cabinet, side-stepping the transducers. That kind of force bypass can have considerable negative effect on measurement accuracy.

Variants of vibratory assemblies within the Y2k balancing platform

The vibratory assemblies (currently 13 variants) consist of the following main parts:
Welded part with force guidance structure and tube (6 variants):

1) Motor drive with short tube for fixed adaptor flange
2) Motor drive with long tube, for tapered shaft
3) Motor drive with very short tube for power-clamping device
4) Motor drive with very short tube for motor cycle variant
5) Hand drive with short tube for fixed adaptor flange
6) Hand drive with long tube, for tapered shaft.

   The main shaft, two transducers with temperature sensor, the optoelectronic unit, the motor, and the main shaft lock are attached to the welded part.

Main shafts, supported by ball bearings in the vibratory tube (6 variants)

1) Motor drive, hardened, fixed adaptor flange for Ø 28,5 or Ø 40 mm sub shaft
2) Motor drive, tapered shaft for removable adaptor
3) Motor drive, hollow shaft for power-clamping device (tapered shaft only)
4) Motor drive, hollow shaft for non-rotating arbor (tapered shaft only)
5) Hand drive, fixed adaptor flange for Ø 40 mm stub shaft only
6) Hand drive, long shaft to the left for left hand crank

Replacement

The main shaft with ball bearings is glued into the vibratory tube. The gluing cannot be detached in the field. A defective vibratory assembly has to be exchanged as an entity.

Incremental encoders (2 different applications)

1) At the main shaft, needed with all balancers
2) At the big pulley (power-clamping device only).

Drive systems (2 alternatives)

1) Hand drive
2) Motor drive.

Brakes

Brakes for decelerating the main shaft after unbalance measurement (3 alternatives):

1) Braking by reversing the torque of the motor
2) Big electromagnetic brake acting on the main shaft (power-clamp only)
3) Shaft brake band for hand drive.

Main shaft locks (3 alternatives):

1) Mechanical foot operated double jaw brake acting on motor pulley
1) Small electromagnetic brake acting on the motor shaft
2) Mechanical foot operated single lever brake acting on the main shaft (hand drive only)

Position brakes for the "sticky on top" function (3 alternatives):

1) Small electromagnetic brake acting on the motor shaft
2) Big electromagnetic brake acting on the main shaft (power-clamp only)
3) DC current supplied by AC-Controller to motor windings.

Power-clamping device

Rims with a centre bore of more than 40 mm can be clamped comfortable, quickly and reliably to the main shaft.
Clamping power is provided by the drive motor, thus no further energy source is needed.

15.1.1 Vibratory assembly for hand drive with fixed adaptor

Snap-on P/N EAA0260D01A (used with *b9000* and EEWB305A)
A stub shaft of 28,5 or 40-mm diameter can be fastened to the main shaft. There is sufficient length of shaft extending to the left of the vibratory assembly, to fit a crank at the left-hand side of the cabinet.
Decelerating the main shaft after measurement is by the shaft brake band, described under 15.5a.
For the main shaft lock, the foot operated single lever brake, described under 15.5.2a, is used.

15.1.2 Vibratory assembly for motor drive with fixed adaptor

Snap-on P/N EAA0260D51A (used with *b9450*, *b9460* and GS S1200)
A stub shaft of 28,5 or 40-mm diameter can be fastened to the main shaft. Left-hand tapered shaft end with centre thread, for fastening the big pulley.

15.1.3 Vibratory assembly for motor drive with tapered shaft

Snap-on P/N EAA0260D02A (used with *b9750*), HOFFMANN Mat-Nr. 6418868 used with HOFMANN *geodyna 980*, *4300* und *4800*.
Utilising tapered main shaft for various adaptors as customary with HOFMANN balancers.
The shaft lock is of the mechanical design described under chapter 15.5.2.2.

Removal and fitting of the vibratory assemblies

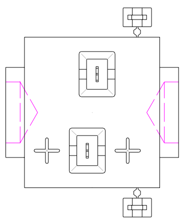
Tools required: Hexagon keys 2.5 and 5 mm,
open-end wrench 17-mm width across flats,
½"■ drive hexagon socket wrench 6-mm across flats 140 mm long (DIN 7422).

For removal undo, for installation fasten the following connections:

a) With hand drive: Two receptacles from shaft band brake solenoid Y4.
With motor drive: Motor connector X42 (4-positions) at Power Interface board.
b) Connector X3 (16-positions) of the ribbon cable for the Optoelectronic unit, the unbalance transducers and temperature sensor at the Controller Board.
c) Unscrew the two hexagon socket screws M4 (2.5-mm width across flats) at the rear leaf spring and take the spring off. Slacken nut (17 mm across flats), then screw back hexagon socket screw (5 mm width across flats) for 3 mm. Support the transducer at the same time, not to trop the steel balls, placed at both ends of the transducer.
d) Three caps of black plastic at the front of cabinet.
e) Six hexagon-socket screws M8 (6-mm width across flats) at the cabinet (Torque 23 Nm).

15.2 Unbalance transducers and temperature sensor

Two transducers (*Snap-on* P/N EAA0260D59A, HOFMANN Mat-Nr. 6717253) and the accompanying temperature sensor are used with all variants of the Y2k vibratory assemblies. The alternating forces, produced during rotation of the unbalance, are converted into a proportional electrical charge utilising the piezo effect. Charge amplifiers on the processor board convert the transducer outputs to alternating voltages.



A transducer consists of a single piezo disc with contact plates; insulation discs and thrust spreading members at both sides of it. This sandwiched arrangement is encapsulated by a moulded case of black plastic. The slotted terminal strips of the two contact plates jut out of the plastic case, protected by collars.
Connection to plug X3 is via the wire harness (*Snap-on* P/N EAW0239D00A, HOFMANN Mat-Nr. 6792035), by means of insulation displacement.
The wires from position 12 and 16 of connector X3 are marked with a small black bush and have to be connected to the transducer terminals marked with the embossed +. Wires 11 and 12 of X3 hook up transducer B3 located at the front, wires 15 and 16, connect transducer B2 at the rear of the vibratory assembly.
To make the insulation displacement connection to the transducer, proceed as follows:

a) To connect a transducer to an already used wire harness, cut off the wire ends at the notches.
b) Check the position of the terminal strips relative to the surrounding collar.
If the pointed ends of the terminal strip 0,6-mm below the edge of the collar, contact problems can arise.
c) Brake off the two small plugs, formed with the moulding process of the transducer case.
d) The insulated wire of the ribbon cable is put in the slot at the collar of the transducer, with the end protruding about 3-mm over the collar.
e) The plug, with the slot aligned to the wire, is placed upon the collar and then pushed into the collar, to be level with the edge.
The narrow slot in the terminal strip will cut the insulation and a gas-tight bond is formed between the tinned copper wire and the contact strip.

A capacitance meter across positions 11 and 12 respectively 15 and 16 of the unplugged connector X3 should read in the range of 1700 to 2100 pF. The resistance across the same positions and the insulation to the force spreading members should be more than 10^9 Ohms. Service code C75 (*JBC 8500* F64) or a special high-resistance measurement instrument has to

be used for the insulation test.
To obtain and keep good insulation, transducers, cable harness and connector X3 have to be kept clean. The collars should be positioned vertically below the transducers, to keep dust from the contacts (6-aclock position).
For disconnecting the wires, the two plugs have to be removed using a pointed device like a scriber. Insert the scriber in the slot of the collar just above the wire and lift off the plug. To pull out the wires, take hold of it at both sides of the collar to avoid warping of the terminals. Keep the plugs with the transducer or as spare parts.
As the transducers take pressure forces only, they are clamped into the vibratory assembly under mechanical pre-load, which is greater than the maximum forces produced by unbalance. The forces are conveyed via 8-mm balls to the thrust spreading members, so that lateral movement does not introduce forces on the piezo disc.
ATTENTION! With an already calibrated balancer, twisting the transducers can adversely effect plane separation.

Fitting and pre-stressing the transducers

Tools required: Hexagon keys 2.5-mm and 5-mm, open-end wrench 17-mm across the flats.

The transducer attached to wires 11 and 12 of connector X3 is placed in the front; the one attached to wires 15 and 16 is placed in the rear of the vibratory assembly.
To fit and mechanically pre-load a transducer, carry out the following steps:

a) The two setscrews M10x1x29 (Snap-on P/N EAM0005D07A, HOFMANN Mat-Nr. 1528370) with ball sockets (inverse cones) should be screwed into the vibratory plate of 20-mm thickness and the rigid support plate welded to the cabinet.
b) Put some stiff grease in the recesses at both ends of the transducer.
   Put balls of 8-mm Ø in the recesses (Snap-on P/N 8-1144, HOFMANN Mat-Nr. 1317080).
c) Insert the transducer in the jog of the vibratory plate with one of the balls contacting the indentation opposite the setscrew. Tighten the setscrew until the transducer is centred.
d) Screw on the locknut M10x1 (17-mm across the flats), but do not tie up yet. At the rigid support plate, a nut M10x1 of 5-mm thickness (Snap-on P/N 1-11833, HOFMANN Mat-Nr. 1556106), at the front with the slightly slant screw; a nut of 8-mm (Snap-on P/N1-4034, HOFMANN Mat-Nr. 1556101) is used.
e) Adjust the M10x1 screw, so that the transducer is held firmly but can be twisted easily using two fingers.
   Fasten the locknut. To prevent the setscrew to turn, hold it with the hexagon wrench 5-mm inserted.
f) Put the steel leaf spring on the setscrew M10, with the counterpunch visible. Fasten it using two countersunk head screws M4.
   Drive in the screws M4, so that the leaf spring is in equal distance at both ends but not bend in the middle.
g) While twisting the transducer with two fingers back and forth, fasten the screws M4 that an effect on slewability is felt.
h) Align the leaf spring to be in parallel to the vibratory plate.
   The screws M4 have to be in the middle of the bores behind the leaf springs. Whatsoever, neither the screws M4 nor the leaf springs should touch the vibratory or support plate.
i) Turn the transducer, so that the collar, protecting the cable connection, is pointing downwards (six a clock position).

j) Pre-stress the transducer by turning both screws M4 by one revolution. Do so by turning the upper screw half a revolution, the lower a full and the upper a further half of a revolution.

k) For the second transducer, repeat steps b trough j.

Checking continuity and the relevant insulation resistance of the transducers

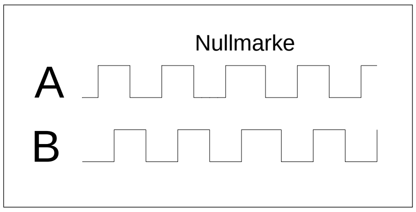
Prerequisites:
The balancer is completely assembled and power is switched on. The test rotor, but not a wheel, may be clamped to the main shaft.

1. Put service code C75 (JBC 8500 F64) into action.
2. With the *b9000*, *b9450* and *b9460* press the minus key to select the source AdE 2. "AdE 2" is read out for one second, then the voltage difference between the outputs of the unbalance signal amplifiers N4A and N4B is indicated. AdE 2 is the channel indicating the signal of transducer B3 located in the front.
   Normally, the readings are fluctuating around ± 0.005x volts.
3. Standing in front of the balancer, push at the end of the main shaft repeatedly by hand and observe the readings.
   (Pushing at the flange will put inadequate force on the front transducer, since this plane is the pivot axis of the force guidance structure.)
   If there is no effect on the readings, the transducer is not connected properly.
   If the two wires are connected in the order intended, there is a minus sign as long you press. Pushing by hand, readings of 0.5xxx volts are easily obtained.
4. In order to assess the relevant insulation resistance; do not touch the machine, just read the indicated voltage.
   With the transducer in the humid for several days, the insulation resistance can decline to less than 500 Meg Ohms. Insulation resistance of 500 Meg Ohms will produce 0.14 volts at the input of the analogue to digital converter.
5. Press the minus key (JBC 8500 the F key) to select channel "AdE 1", transducer B2 in the rear is connected to, and repeat steps 3 and 4.

The Temperature sensor

The signal from temperature sensor B1 is used to compensate for the temperature-dependant force to charge conversion of the unbalance transducers.
The temperature sensor is fixed to the vibratory plate by a u-shaped spring (*Snap-on* P/N EAS2025D12A, HOFMANN Mat-Nr. 1628090). Electrical connection to the Controller board is via the AWG 28 ribbon cable harness and connector X3.
With a disconnected or defective temperature sensor, the balancer will stay operational except for temperature correction of the unbalance amount reading. The actual temperature will be substituted by temperature value determined during calibration.
Indication of current temperature and the voltage at connector X3 pin 13 is with service code C57. Is service code C57 not available, use service code C75. Select "Ad3" to get the temperature dependant voltage. At 24 °C there are about 1.3 volts.

15.3 The Incremental encoders



An incremental encoder picks up the rotational travel , direction of rotation, and absolute angular position of a rotating shaft.
One revolution is divided in increments (periods or intervals).
The output signals A and B have about the shape and relationship shown. An intended irregularity (Nullmarke) is detected, with the main shaft rotating at constant speed. On detection of the irregularity, the position counter is set to zero thus providing absolute angular reference to the shaft.

15.3.1 The Incremental encoder at the main shaft

Incremental encoder B8 is located between the ball bearings inside the vibratory tube. It consists of an annular polygon mirror at the main shaft and the Optoelectronic unit D72.6387, fastened with a screw M4 to slot in the vibratory tube.
ATTENTION! To keep dust and light out of the tube, the opening for the Optoelectronic unit has to be covered with a piece of adhesive tape 30 by 50 mm e.g. "Tesa Nr.: 4651" (HOFMANN Mat-Nr. 5198320).
In the encoder IC on the Optoelectronic unit, behind a lens there is a red, in the direction of the main shaft, oblong Light Emitting Diode (LED). Behind a second lens, there are four light detectors on an integrated circuit.
The light of the LED is reflected back to the encoder by one of the 256 mirrors of the polygon, focused by the lens on the four detectors. During rotation of the main shaft, the mirrors will tilt and deflect the light across the detectors A, A`, B and B`. With further rotation in the same direction, the light will hit the next mirror, and with a full revolution, it will be deflected 256 times across the detectors in the above given sequence.
The light detectors A and A` respectively B and B` are connected to one amplifier. The difference in brightness between the detector pairs determines the current state of the output channels A and B. To keep the signals A and B free from interference, an integrated circuit amplifies the signals.
An intended irregularity in the arrangement of the mirrors is detected with the main shaft rotating at constant speed, serving as absolute reference. On detection of the reference, the position counter is set to zero thus providing absolute angular position of the main shaft.

Checking the incremental encoder is via service code C74.
The surfaces of the 256 polygon mirrors have to be clean and shiny. A dirt particle at the polygon ring should be removed using adhesive tape. About 20-mm of adhesive tape is put on a 10-mm wide strip of paper, so that half of the sticky surface extends over the paper. With the sticky end, the dirt can be picket up without scratching the mirrors.
If the electronic unit fails to detect the zero reference and neither exchanging the Optoelectronic unit nor cleaning the polygon sleeve proofed successful, the following measure may help. Turn the main shaft until the solder joint of the code sleeve becomes visible. Wrap some soft cleaning paper round your forefinger and press the code sleeve slightly, so it will set in a different way.
The red LED of the reflective encoder IC does not light up immediately after power on, since voltage is applied under program control!
Is there a defective polygon ring, the complete vibratory assembly has to be exchanged. The main shaft cannot be removed from the vibratory tube, as the ball bearings are glued-in.

Non-volatile memory at Optoelectronic unit

Beside the EEPROM on the Controller board, there is a second non-volatile memory soldered to the Optoelectronic unit. Both EEPROMs should hold the same data: machine model, adjustment data, counts of counters, selected modes of operation and stored error-codes. Having two non-volatile memories becomes beneficial when the Controller board or the electronic box has to be replaced.
With service code C86, the contents of the EEPROM on the Optoelectronic unit can be copied to the EEPROM located on the Controller board, saving to set machine model number via C47 and to carry out calibration.
On power up self-test, the contents of the EEPROMs are compared. If differing but valid data is detected, with the *b9000* and *b9450*, C85 "Copy contents of the EEPROM on the Controller board to the Optoelectronic unit" is displayed.
Do not un-plug connector X3 or X10 with power connected. A difference in memory contents of the non-volatile memories may occur!

15.3.2 The Incremental encoder for the power-clamp

Incremental encoder B9 acquires the rotational travel, direction of rotation and the absolute angular position of the big pulley at the vibratory assembly with power-clamp. The travel of the tie-rod is derived by program from rotational travel of the pulley.
The pattern of a code strip, fixed to the circumference of the big pulley, is sensed optically by an encoder board positioned 1-mm above the pulley.
The adhesive code strip (Snap-on P/N EAM0005D64A, HOFMANN Mat-Nr. 6419096) consists of a transparent foil with alternating black and white zones (32 increments) printed on.
CAUTION! The wider zone of the zero reference has to be positioned to the edge of the pulley.
The small encoder board D72.6392 (Snap-on P/N EAP0201D20A, HOFMANN Mat-Nr. 6726392) carries four SMT reflective interrupters, some resistors, an integrated circuit (Hex-Schmitt-Trigger) and a 4-position ribbon cable with receptacle.
The reflective interrupters A and A` respectively B and B` are placed with a radial offset of half an increment, so the interrupters work in a push pull arrangement. The push pull mode of operation makes the encoder insensitive to the light output of the infrared LEDs and the reflectance of the code strip. The lateral offset of the interrupters A to A` respectively B to B` is essential for the push pull operation for the zero reference as well. In this way the zero reference marking with its 25 to 75% mark to space ratio can be mapped complementary on the two tracks.
The analogue waveforms at the phototransistors of the interrupters are converted to sharp edge square-waves with low output impedance by the Schmitt-Trigger circuit.
The encoder board is fastened via a plate screwed to a corner bracket to the stator of the electromagnetic brake. The corner bracket and the plate serve also to keep the abrasion of the brake lining away from the encoder. To compensate for lateral work tolerance, the encoder board can be aligned to the code strip with the aid of the movable plate. The two standing back edges of the encoder board should be in line with the left-hand edge of the code strip.
Incremental encoder B9 can be checked with code C98.
CAUTION! Too much abrasion from the brake lining on the encoder board or code strip will degrade the function of the incremental encoder. Both parts should be cleaned with a soft cloth or brush occasionally.

15.4 The drive systems

The wheel clamped to the main shaft has to be put in rotation, so that the dynamic unbalance produces measurable alternating forces.

15.4.1 Hand drive

The operator, turning a crank, puts the main shaft with the clamped on wheel in rotation.
At reaching the minimum measurement speed of 100 RPM, an audible signal is given.
The flywheel mass of the wheel supported by low-friction ball bearings keeps the rotational speed during the ten revolutions of unbalance measurement almost constant.
The clamp nut is fitted with two turning handles, serving as a crank.
A main shaft with an extension to the left of the vibratory assembly is available for a left-hand crank (used with JEBEG *b9000*)
ATTENTION! For precise measurements and calibration, use the crank at the clamping nut. Since the left-hand crank is some distance away from the vibratory assembly, turning the crank introduces strong forces by lever action, which does not decay completely before unbalance measurement begins.

15.4.2 Motor drive

The primary functions of the motorised drive system are, to accelerate the main shaft with the wheel clamped to it up to measurement speed, keeping the speed constant during measurement and subsequently slow down to a dead stop. Acceleration and deceleration should be rapid but with controlled torque, avoiding slippage of the wheel on the adaptor.
During unbalance measurement, no vibrations should be generated by the drive system.
With some variants of the vibratory assembly, the drive motor is used for breaking as well.
The mechanical parts of the Y2k drive system differ little from the previous HOFMANN design, the principle of operation is quite different, making the drive system suitable for high and low speed balancers.
The drive system consists of the motor (*Snap-on* P/N 2-22066, HOFMANN Mat-Nr. 4104280) fastened to a bracket, welded to the vibratory tubing. The small pulley at the motor, the big pulley at the left end of main shaft and the Multirib belt (*Snap-on* P/N 8-3531, HOFMANN Mat-Nr. 1252584) called mlti-vee belt as well. The screws fastening the motor to bracket are used for belt tensioning also.
The big pulley is seated on the tapered left end of the main shaft and fastened wit one central screw M8. For separating the big pulley, the central bore is furnished with a Thread M12.
After putting the big pulley back on the shaft, main shaft unbalance has to be compensated for using code C84.
With a single-phase squirrel cage motor with a nominal voltage of 230-volts AC and a maximum current of 4,5 A, the power requirements of the balancers can be easily met. It can be hooked up to 50 or 60 Hz line frequency via a plug to ordinary wall outlets.
The drive system will work in a range of 170 to 264 volts AC. With 110 line voltage, a step-up transformer (*Snap-on* P/N 7-00902A, HOFMANN Mat-Nr. 4501081) should be fitted inside the cabinet.

Functional description of the drive system

Irrespective of line frequency, the Y2k drive system (patent applied for) accelerates to the pre-set speed within a range of 80 to 200 RPM. With low speed operation (100-RPM) selected, low torque is applied first. With the speed still near zero after half a second, full motor torque will be applied. This is for preventing speed overshot with low flywheel mass as there might be no wheel guard fitted with a low speed balancer.

At reaching the pre-set speed, torque is cut back. The low torque is set to a rate, compensating the friction, for the most part, caused by the belt and by air drag of the wheel.
Torque reduction is accomplished by lowering the voltage supplied to the motor with an AC controller, located on the Power Interface board. Utilising semiconductor devices, this novel AC controller provides arc-less switching for a long service life.
Unbalance measurement is carried out with reduced torque at slightly in- or decreasing speed of the main shaft, hence avoiding pendulum oscillations in the motor.
Measurement speed can be held within set bounds to any length of time by varying the motor torque. Detecting the speed via the incremental encoder B8, speed control is implemented in software by varying the pulse-duty factor to the AC controller. Subsequently, the already reduced voltage supplied to the motor is varied by 5% (dual-mode control).
With more than 150 RPM of main shaft speed, the torque capacitor C_T is switched off by relay K4 under program control. With increasing speed, the effect of C_T on torque drops and reactive current increases.
Direction of rotation of the main shaft is appointed by the order of wires attached to connector X42. Connect motor wire marked 2 to the left-hand terminal 1, wire 3 to terminal 2 and wire 3 to terminal 3, the red/green wire to the right-hand terminal 4 of connector X42.

ATTENTION! There were IGBT failures within the drive system on the Power Interface board.
To improve reliability, remove the Surge Arrester F8 from Power Interface board.
CAUTION! There are two Surge Arresters on the Power Interface board. Do not remove the one with the red coloured body!
The Power Interface board equipped the four black heat sinks; the Surge Arrester is located between the heat sinks and the relays beside a 2k Ohm 2 Watt resistor.
The more recent Power Interface with one heat sink, the Surge Arrester marked F8 is located in front of the heat sink.
The Surge Arrester F8 has a cylindrical white ceramic body with red printing on it, metal discs on both ends with wires welded to in the middle of the discs.

Belt tension

With the Y2K drive system, belt tension is crucial as it has great influence on friction. Friction can hinder extended measurement runs, e.g. service code C63. If friction uses up more energy than supplied to the motor during prolonged measurement, the speed will drop and measurement will be terminated. During a normal balancing cycle (10 revolutions) with a wheel clamped on, the effect of friction will hardly be noticed. Before the speed reduction becomes significant, unbalance data collection is completed and the brake is turned on.
Excess belt tension puts extra load on the ball bearings and can reduce measurement accuracy.
With the belt too slack, it will slip causing premature wear and in most cases, disturbing squeaking noises as well.

Exchanging the belt and adjusting belt tension

Tools required: open-end wrench 13-mm width across flats, big screwdriver,
¼"■ ratchet with hexagon socket wrench 10-mm width across flats.

Four hexagon distance bolts are fastened to the shield of the electric motor, in order to obtain room for the Multirib belt between motor and its support bracket, welded to the vibratory tube.
To exchange the belt, the motor together with the distance bolts has to be taken off from the bracket.
For the three upper spacer bolts, curved oblong holes are punched in the bracket. The lower bolt serves as a swivel pin for the motor.
To adjust the belt tension, slacken the four screws (10 and 13 mm across flats, since two are

used as pivots for the shaft lock, if provided). Insert a big screwdriver between the upper and rear distance bolts. Lift the handle of the screwdriver in order to push the motor backwards and tighten the upper screw (10-mm width across flats).
The initial tension of a new Multirib belt should be set to 200 N (Newton). When re-adjusting or checking a belt fitted several days ago, 150 N is sufficient, since the belt has already stretched and tension is not likely to decrease any further.
Belt tension should be checked and be re-adjusted if necessary.
The following belt tension meters are suitable alternatives:
Optikrik I of Messrs. Arntz-Optibelt-KG, Postfach 100132, D-37669 Höxter (www.optibelt.com) or the
TRUMMETER by HILGER u. KERN Antriebstechnik, Käfertaler Straße 253, D-68167 Mannheim (www.hilger-kern.de).
The TRUMMETER derives the belt tension $T [N] = 4 * m * L^2 * f^2$, where

m = linear belt mass in [kg/m] (m = meters),
L = length of belt free to vibrate in [m],
f = vibration frequency of free length of belt in [Hz] (measured by the TRUMMETER).

For the Multirib belt used with the Y2k passenger car vibratory assembly, the following values have to be entered: m = 0.038 kg/m, L = 0.1689 meters.
For those gifted with perfect pitch, a tone of 183 Hz = 150 N / 212 Hz = 200 N should be heard plucking the belt.
In future, belt tension checking should be supported by a service code.

15.5 The brakes

Within the Y2k balancing platform, there are a number of brakes of different design and for various applications. All brakes have controlled torque, to avoid slippage of the wheel on the adaptor, preserving counterweight positions.

- Brakes for decelerating the main shaft after completion of unbalance measurement.
- Shaft locks for blocking the rotation of the main shaft, actuated by the operator or under program control.
- Position brakes under program control for stopping of the slowly rotating main shaft, with one of the compensation locations at the top (12-aclock) or other wanted position:
  a) Braking at the compensation location of the left-hand plane after measurement.
  b) Indexing to the compensation location of the right-hand plane with the aid of the drive motor. c) Finding the next compensation location, with the operator slowly rotating the wheel.
  (so-called "sticky on top" function)

15.5.1 Brakes for decelerating after measurement

After completion of measurement, the main shaft, with the wheel clamped on, has to be brought to a dead stop, for the operator to fit the counterweights or take the wheel off.

15.5.1.1 The Shaft band brake of the hand spin vibratory assembly

With the vibratory assembly EAA0277D45A used in the JBEG *b9000*, decelerating the main shaft is initiated automatically.
The shaft band brake and the accompanying solenoid are equivalent to that in the balco balancers.
The band brake consists of two semi-circular band clamps of bronze, joint to a ring around the main shaft. To make the braking torque adjustable, a rubber washer is placed between the link plates at one of the screws. With the opposite screw, a steel washer is inserted. Different long screws M8x25 versus M8x20 compensate the weight difference of the washers.

The inner surface of the band clamps has to be greased with "Molykote 33 medium" before assembly. To set the braking torque, so that the test rotor accelerated to 100 RPM will stop after one revolution, the rubber washer is compressed by tightening the self-locking nut (13-mm width across flats).
ATTENTION! For optimum measurement precision during calibration or determining the distance-depending phase shift using code C72, deactivate the shaft band brake temporarily by pulling off one of the receptacles from solenoid.

15.5.1.2 Decelerating the main shaft by pressing the pedal

With the BOXER *S1100* and HOFMANN *geodyna 930,* a mechanical foot operated brake is used for decelerating the main shaft after measurement and as the shaft lock (see chapter 15.5.2.1).

15.5.1.3 Braking by reversing the motor torque

For this economical and robust brake with well-controlled torque, just the relay K4 had to be added to the drive system.
After reaching standstill of the main shaft, motor voltage has to be switched off immediately. With the semiconductor AC controller, this is accomplished easily.

15.5.2 The main shaft locks

All vibratory assemblies of the Y2k balancing platform are equipped with a main shaft lock. To place the compensation weights precisely and conveniently in the determined position, the main shaft can be blocked.

15.5.2.1 The main shaft lock of the hand drive vibratory assembly

The outside shoe brake is pedal operated and acts via Bowden cable and single lever on a disk fitted to the main shaft.
A coil spring inserted between Bowden cable jacked and the support plate protects the Bowden cable from overload and restricts the braking torque, preventing the wheel to slip on the adaptor.
The nuts (10-mm across the flats) at the end of the Bowden cable are adjusted for 0,1-mm clearance between brake pad and the brake disc.

15.5.2.2 The shaft lock of the motor drive vibratory assembly

The mechanical brake is pedal operated and acts on the motor pulley. There is no electrical interlock. The motion of the pedal, conveyed via Bowden cable, pulls together the two brake levers with glued on brake pads. The front fastening screw of the motor serves as the lever pivot.
The locknuts (10-mm across the flats) at the end of the Bowden cable are adjusted for 1-mm travel before the levers, moved together by hand, hit the rear fastening screw of the motor.

15.5.2.3 The electromagnetic brakes

- Big solenoid brake with a brake power of 30 Nm (Newton meters) acting on the main shaft. Used with the power-clamping device only.
- Small solenoid brake of three Nm braking torque, acting on the motor pulley is used as shaft-lock and position brake e.g. for the "sticky on top" function.

Different in size but identical in design, the brakes, designated Y2, comprise of a ring shaped stator with the winding behind the brake lining and the brake disc fastened axially movable to the hub by an annular leaf spring. Without power, there is no friction at all, since the brake disc is separated from the stator by an air gap. With current applied to the solenoid, the disc is pulled to the stator by magnetic force. With rotary motion of the hub, friction will develop between the brake disc and both the lining and the steel body of the stator (hybrid friction). CAUTION! There is line voltage at the brake solenoids.

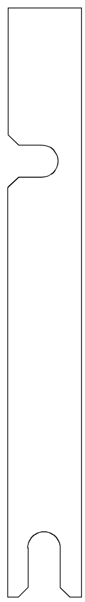
Adjusting the air gap

The small solenoid brake is used, as a shaft lock only, so there is hardly any abrasion. After slackening the headless screw (hexagon key 3-mm across the flats) of the hub and pulley arrangement, the air gap of 0,2-mm is set by lateral movement on the motor shaft.

With the big solenoid brake, the clearance between the stator and brake disc can be set in two ways:

1) Shims inserted between the brake stator and the welded part of the vibratory assembly. For this, recommended alternative, at least two shims of 0.2-mm (HOFMANN Mat-Nr. 6417655) or 0.5-mm (HOFMANN Mat-Nr. 6417656) plate thickness must be available.
2) Removal of washers between the brake hub and support disc on the main shaft.

Insertion of shims (spacer plates)



Tools required: Philips screwdriver, 0.1 - 1.0-mm feeler gauge, hexagon key 5-mm.

Proceed as follows:

a) Remove the weight tray.
b) Determine and note the size of the clearance between brake disc and stator using the feeler gauge.
c) Slacken the four hexagon socket-head screws holding the stator but do not remove them.
d) Insert shims of the thickness to get a clearance $0.5^{+/- 0,1}$ mm.
e) Tighten the hexagon socket head screws and check the clearance.
f) Switch on the machine and check the function of the solenoid brake using code C73. Make sure that the brake disc comes completely free of the stator when the brake current is switched off. Otherwise, the unbalance measuring results will be falsified.
g) Check the alignment of the encoder board to the code strip at the big pulley. Correct if necessary.
h) Put back, the weight tray and fasten it.

Removal of washers

Tools required: Philips screwdriver No. 2, feeler gauge 0.1 to 1.0-mm, hexagon keys 2,5-mm and 5-mm across the flats.

Carry out the following steps:

a) Remove the MZV-p adaptor from the main shaft.
b) Take off the weight tray (machine cover).
c) Determine and note the size of the clearance between brake disc and stator.
d) Take off the multi-vee belt from the big pulley.
e) Unscrew the 4 hexagon socket screws (5-mm) at the clamping nut and pull out the clamping nut together with tie rod.
f) Loosen three headless setscrews M3x10 (use hexagon key 2,5-mm) at the set collar. Push the set collar inwards and remove the circlip and then the set collar from the main shaft.
g) Pull off the drive pulley and the ball bearing from the main shaft.
h) Pull off the brake hub and lever out the sunken key from the main shaft.

i) Remove a corresponding number of 0.2-mm thick washers from the main shaft, to get a clearance between stator and brake disc of 0.5 $^{+/- 0,1}$ mm.
j) Check that tie rod, clamping bolt and nut are sufficiently greased.
CAUTION! Use ball bearing grease Klüberplex BEM34-132 (HOFMANN Mat-Nr. 1317060).
k) Assemble all parts in reverse order and check the clearance.
l) Switch on machine and check the function of the solenoid brake with code C73. Make sure that the brake disc is fully clear of the stator when the brake current is switched off. Otherwise, the unbalance result will be falsified.
m) Carry out adjustment of the unbalance measurement using codes C83 and C84.

If problems with the solenoid brake arise, exchange stator and brake disc at the same time.

15.6 The power-clamping device

The power-clamping device, moving the tie rod comprises of the following components:

a) The axially bored main shaft with the tapered end, the MZV-*p* adaptor is fitted on and tightened axially by two hexagon screws (13 mm across the flats) to the to bayonet disc.
b) The tie-rod with a spline shaft as part of it, so axial moveable in the bore of the main shaft.
A short piece left-handed thread of 8-mm pitch is fitted spring loaded to the left-hand end of the tie-rod.
c) The big pulley at the left-hand end of the main shaft supported by ball bearings.
d) The clamping nut of 8-mm pitch is flange-mounted to the big pulley with the thread of the tie-rod engaged in it.
e) The incremental encoder B9 to determine tie rod travel and angular position of the drive disc.
f) Solenoid brake Y2. The stator is fastened to the welded part and the brake disc to the main shaft.
g) The pedal unit with two micro-switches S4 and S5 for actuating clamping action and the main shaft lock.
g The Power Interface board providing the following functions:
  The high voltage brake driver with brake ammeter
  The AC controller for various motor torque
  The motor ammeter
  Inputs for polling the pedal micro switches and the proximity detector.

Functioning of the power-clamping device

Once the clamping operation has been initiated, the solenoid brake Y2 is switched on and the motion of the brake disk is monitored via incremental encoder B9. The brake locks the main shaft. The motor M1 is switched on in the direction of rotation as during the measurement run. The multi-vee belt conveys the motor torque to the big pulley and clamping nut. As the tie rod cannot rotate inside the main shaft, the rotary motion of the clamping nut is converted into longitudinal motion of the tie rod and later pulled to the left (max. travel is 76-mm). Via the yoke with the two clamping jaws and the clamping sleeve, the motion is transferred to the clamping head pulling the wheel on the cone and against the adaptor flange. With the wheel pressed to the adaptor flange, longitudinal movement and the motor come to a stop. The stop of the motion is detected via encoder B9. The drive and shortly afterwards the brake are switched off.

The pitch-to-diameter ratio of the clamping nut thread has been selected that self-locking occurs in the clamped state; i.e. the clamped state is retained.
To carry out a measurement run, the motor M1 is switched on but with the main shaft is free to rotate. As the tie rod cannot be pulled any further to the left, the motor torque is transferred to the main shaft via the clamping nut, thus accelerating the wheel for the measurement run. After measurement, the motor is switched off and the solenoid brake decelerates the main shaft.
To release clamping, the solenoid brake locks the main shaft again; the motor is switched on in the reverse direction of rotation. The tie rod moves back to the right-hand starting position, causing the clamping jaws to retract in the adaptor sleeve thus releasing the clamping sleeve. As with clamping, motion is monitored by the encoder. Motor and brake are switched of in succession.

Releasing a wheel from the power-clamping device in the event of a power failure

Behind a 15-mm hole in the front of the cabinet closed by a black plastic cap, two pegs project axially out of the big pulley. Take off the cap an insert a rod or screwdriver of 7 to 14-mm width for a length of 130-mm. With the rod engaging in the pegs, rotation of the big pulley is hindered.
By turning the wheel in the direction of rotation of a measurement run (the top of the wheel to the rear) while inhibiting rotation of the pulley, clamping force will slacken. By further turning at the adaptor flange, the tie rod is moved to the right-hand limit position so that the clamping sleeve and the wheel can be removed. Finally, put back the black cap.

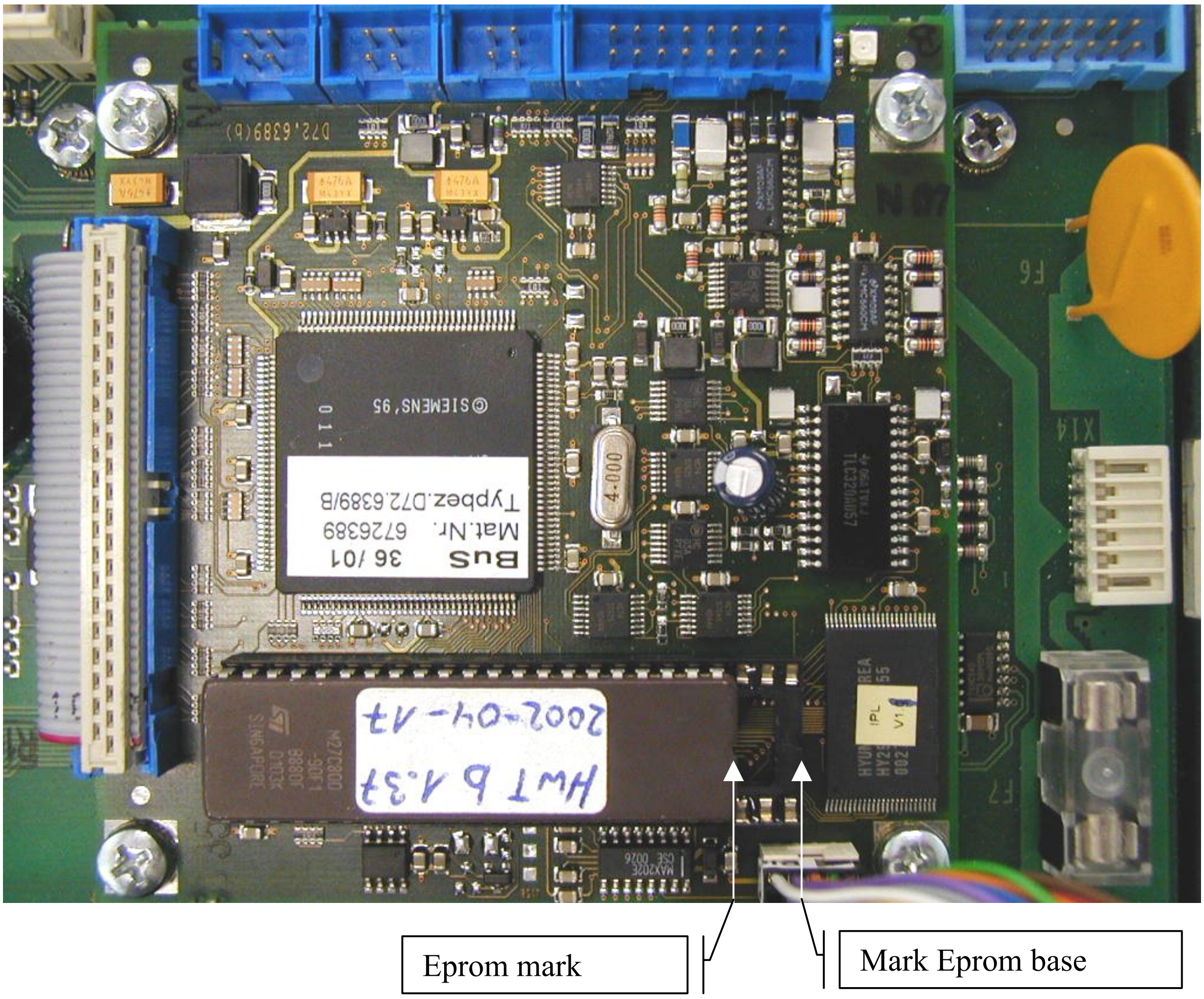
TO UPDATE /FLASH THE NEW SOFTWARE FOR THE NEW GENERATION WHEEL BALANCERS.

1. **Digital Display Wheel Balancers. (930/980/4300/6300 – b9000/b9450/b9460)**
2. **Switch off the Wheel Balancer and Remove the weight tray . Then open up the Electronic Box inside the balancer . Insert the New Version Of Eprom (as shown on attached page).**
3. **Switch on Wheel Balancer and wait till you hear the three tone signal beeping for approx 20 seconds . The Downloading or Flashing of the New software will now begin. It takes about 2 - 3 minute´s or more.**
4. **Once the down loading is completed the Machine will start Beeping constantly and will not stop till you switch off. The beeping means the down loading is completed.**
5. **Now Switch "Off" the balancer and Remove the Eprom. Switch "On" the Machine and use C47 to select what type of machine/model it is. On the HWT balancers select model with the fine botton pressed and rotating the shaft. On the balco balancers use the plus and minus keys. The Eprom is used to update all the New Generation Balancers AND YOU SELECT THE MODEL BY USING CODE C47.**
6. **After updating you must re-calibrate the Model using Calibration codes C80/C81/C82/C83/C84 and C88. On HWT balancers Save calibration with C90**

1. **Screen type Balancers (4800/6800/6800p – b9750)**
2. **Switch off the unit and Remove the Flash card from the Inbeded Pc at the rear of the unit and replace if with New version of Flash card. One for One Exchange.**
3. **Now follow the instructions as ABOVE to down load the New Version of Eprom Step for step (Steps 1 to 6).**

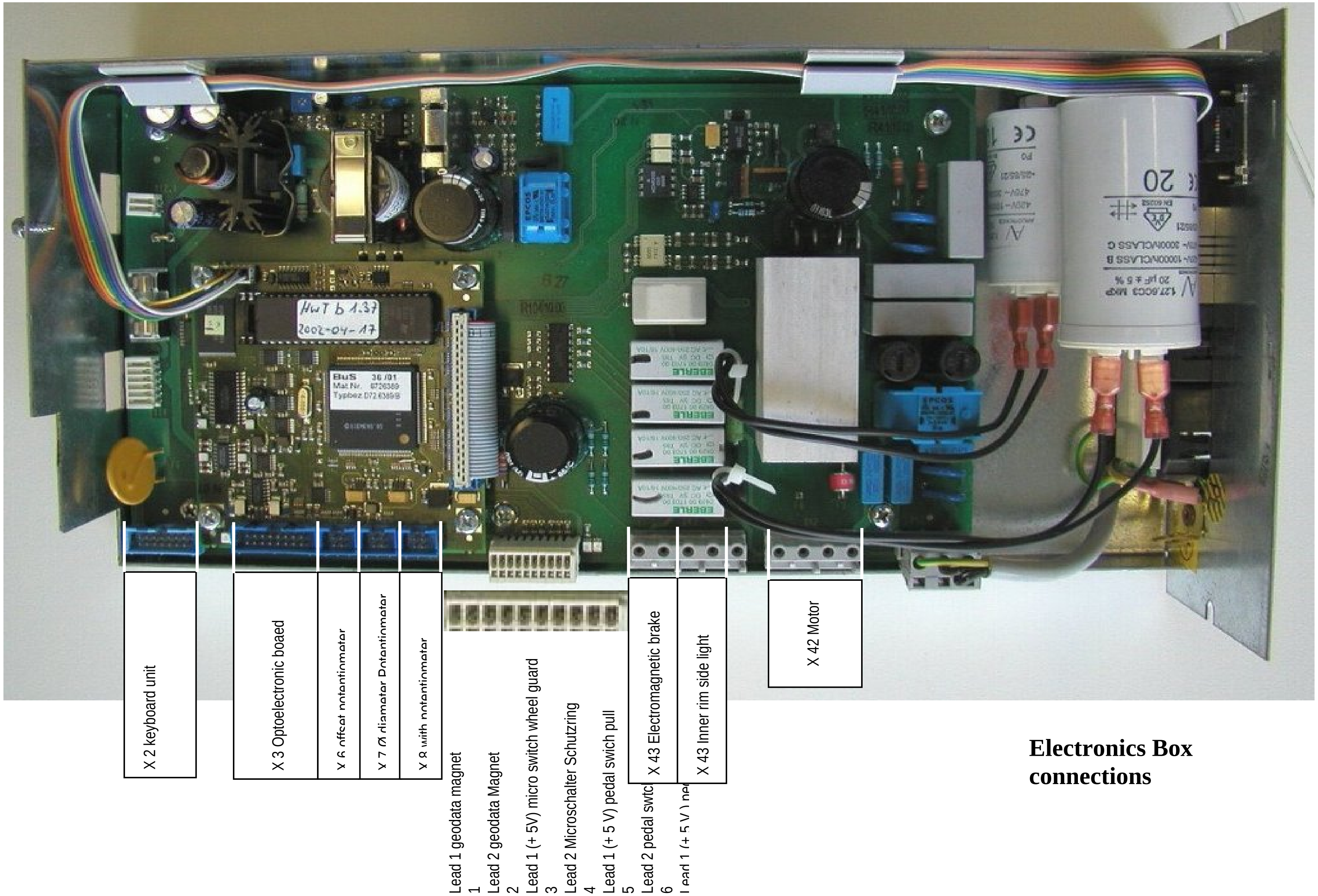
Changing the program E-proms version

Electronic view inside the machine



Basic settings of the potentiometers

	Distance Gauge arm in home position; on axial guide bushing	Diameter Gauge arm applied onto outher radius of cone adaptor flange (185 mm diameter)	Width Gauge arm in home position on open wheel guard
1D- SAPE Snap-on/ from front	4,25 - 4,30		
1D- SAPE HWT/rear side	0,10 - 0,15		
2D- SAPE Snap-on/ from front	4,25 - 4,30	3,55 - 3,60	
2D- SAPE HWT/rear side (f. exam. PB-100 Japan)	0,10 - 0,15	0.60-0,70	
3D- SAPE Snap-on			4,25 - 4,30
2D- SAPE with ASS In M1 cabinet (f. exam. PB-100 Japan) Snap-on/ from front	0,10 - 0,15	3,55 - 3,60	
	Distance Gauge arm in home position;	**Diameter** Halfcone tip under gauge head applied to calibration groove in vibratory system.	**Width** Gauge arm in home position on open wheel guard.
Geodata Snap-on	0,10 - 0,15	0,10 - 0,15	4,25 - 4,30



Electronics Box connections

How to configure the PCM-3350 bios

The required BIOS configuration for the PCM-3350 is as follows:
Standard CMOS-Setup please set manuel

Standard CMOS Setup	
Primary master	None
Primary slave	None
Secondary master	Auto
Drive A	None
Drive B	None
Video	EGA / VGA
Halt on	NO Errors

BIOS 3350SON.bin
After flashing the new BIOS please set Default Settings

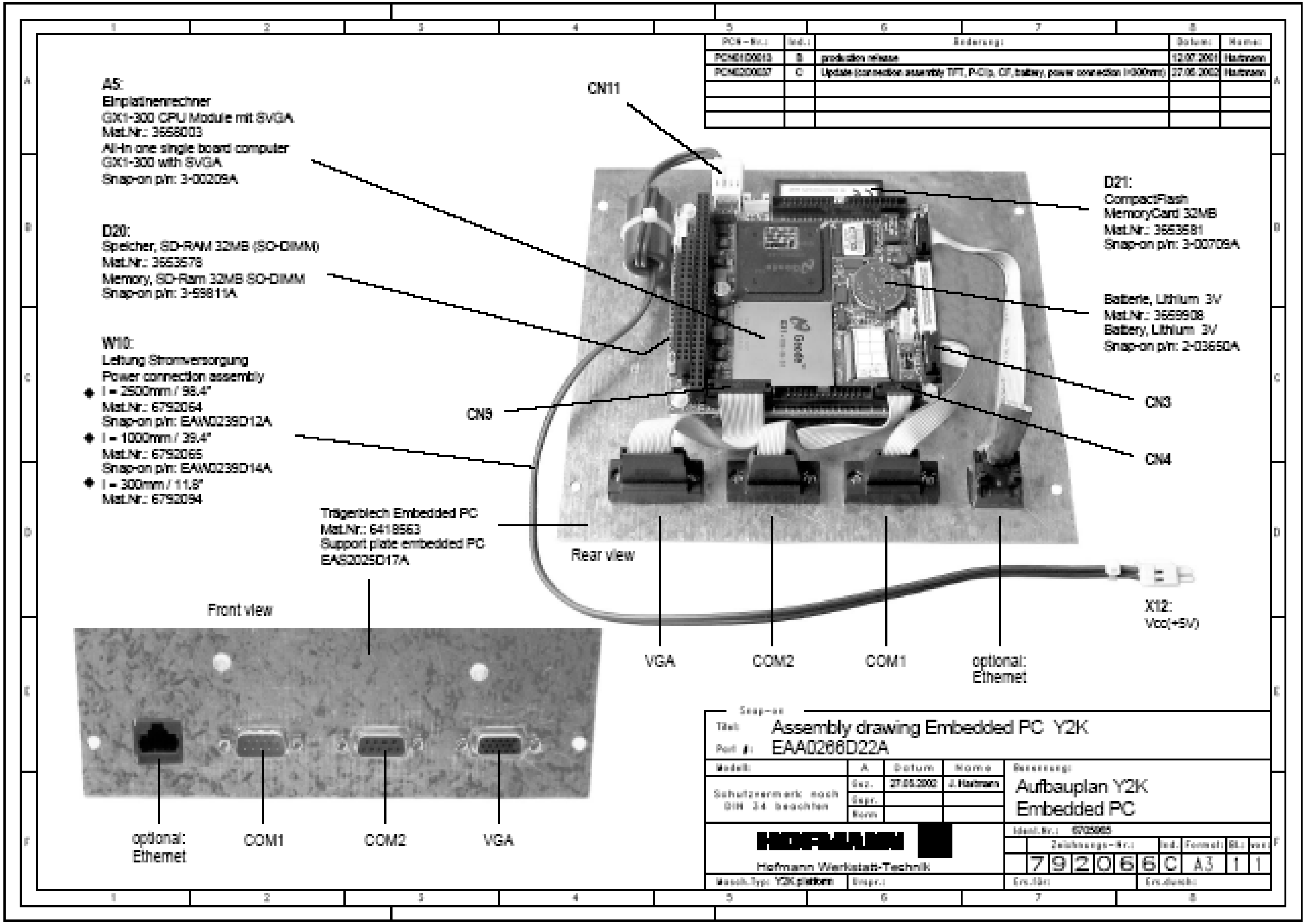
BIOS Features Setup	
Virus warning	disabled
CPU internal cache	enabled
Quick POST	enabled
Boot from LAN	disabled
Boot sequence	D, A, SCSI
Swap floppy drive	disabled
Bootup floppy seek	disabled (Standard enabled)
Bootup numlock	ON
Bootup system speed	high
Gate A20	fast
Memory parity check	enabled
Typematic rate setting	disabled
Typematic rate (char/sec)	6
Typematic rate (Msec)	250
Security option	setup
PCI / VGA palette snoop	disabled
OS select for DRAM > 64MB	Non-OS2
Report No FDD For Win 95	Yes
Video BIOS Shadow	Enabled
C8000-CBFFF Shadow	disabled
CC000-CFFFF Shadow	disabled
D0000-D3FFF Shadow	disabled
D4000-D7FFF Shadow	disabled
D8000-DBFFF Shadow	disabled
DC000-DFFFF Shadow	disabled

Chipset Features Setup	
SDRAM CAS latency time	2T (Standard 3 T)
SDRAM clock ratio divide by	4 (Standard 3)
16-bit I/O recovery	5
8-bit I/O recovery	5
USB controller	disabled (Standard enabled)
USB legacy support	disabled

Power Management Setup	
Power management	disabled
Standby mode	disabled
HDD power down	disabled
MODEM use IRQ	NA
Throttle duty cycle	33.3%

PNP/PCI configuration	
PNP OS installed	NO
Resources controlled by	auto
Reset configuration data	disabled
PCI IRQ activated by	level

Integrated Peripherals	
IDE HDD block mode	enabled
Primary IDE channel	disabled (Standard enabled)
Master drive PIO mode	(Standard auto)
slave drive PIO mode	(Standard auto)
Secondary IDE channel	enabled
Master drive PIO mode	auto
IDE primary master UDMA	disabled (Standard auto)
IDE primary slave UDMA	disabled (Standard auto)
IDE secondary master UDMA	auto
Onboard speaker	enabled
Onboard PCI LAN chip	enabled
KBC input clock	8 MHz
Onboard FDC controller	enabled
Onboard serial port 1	3F8 / IRQ 4
Onboard serial port 2	2F8 / IRQ 3
Serial Port 2 mode	RS232
Onboard IR controller	disabled
Onboard Parallel port	378 / IRQ 7
Parallel port mode	ECP + EPP
ECP mode use DMA	3
EPP mode select	EPP1.9
Multiple monitor support	No onboard
Video memory size	2.5M
Flat panel status	Disable (Standard Enabled)
Flat panel resolution	800x600


A5:
Einplatinenrechner
GX1-300 CPU Module mit SVGA
Mat.Nr.: 3668003
All-in one single board computer
GX1-300 with SVGA
Snap-on p/n: 3-00209A
D20:
Speicher, SD-RAM 32MB (SO-DIMM)
Mat.Nr.: 3663678
Memory, SD-Ram 32MB SO-DIMM
Snap-on p/n: 3-59811A
W10:
Leitung Stromversorgung
Power connection assembly
l = 2500mm / 98.4"
Mat.Nr.: 6792064
Snap-on p/n: EAW0239D12A
l = 1000mm / 39.4"
Mat.Nr.: 6792065
Snap-on p/n: EAW0239D14A
l = 300mm / 11.8"
Mat.Nr.: 6792094
CN11
CN9
Trägerblech Embedded PC
Mat.Nr.: 6418563
Support plate embedded PC
EAS2025D17A
Front view
Rear view
D21:
CompactFlash
MemoryCard 32MB
Mat.Nr.: 3663681
Snap-on p/n: 3-00709A
Batterie, Lithium 3V
Mat.Nr.: 3669908
Battery, Lithium 3V
Snap-on p/n: 2-03650A
CN3
CN4
X12:
Vcc(+5V)
VGA
COM2
COM1
optional:
Ethernet
COM1
COM2
VGA
PCN-Nr.: | Ind.: | Änderung: | Datum: | Name:
PCN01D0013 | B | production release | 12.07.2001 | Hartmann
PCN02D0037 | C | Update (connection assembly TFT, P-Clip, CF, battery, power connection l=300mm) | 27.06.2002 | Hartmann
Snap-on
Titel: Assembly drawing Embedded PC Y2K
Part #: EAA0266D22A
Modell:
Datum
Name
Gez. 27.06.2002 J. Hartmann
Gepr.
Norm
Schutzvermerk nach DIN 34 beachten
Benennung:
Aufbauplan Y2K
Embedded PC
HOFMANN
Hofmann Werkstatt-Technik
Zeichnungs-Nr.: 7920666
Ind.: C
Format: A3
Bl.: 1
von: 1
Masch.Typ: Y2K platform
Urspr.:
Ers. für:
Ers. durch:

Service

Some notes about the operations of the wheel balancer:

All measured angular positions are related to the mass to balance the wheel; they are not the positions of the imbalance mass itself.

If the balancer is in service mode, some of the normal behaviour is changed:

- Some error codes will be written into the error record in normal operation mode. This is disabled in service mode, errors will not be recorded.
- The number of revolution for a measurement run in service mode is set to
  - 20 turns (GS, JBEG models)
  - two times of the C6 setting but minimum 20 turns (CRT, HNA, HWT models)

In Field Reprogramming of Balancer

1. Turn off balancer.
2. **Place EEPROM in micro-controller socket with flat end at bottom of socket close to large blue connector. Notched end is 3 spaces short of other end of socket.**
3. Turn on balancer.
4. Three audible beeps accompanied by three flashes of the led on the micro-controller board indicate that program is loading.
5. A continuous sequence of beeps and flashes indicates that program loading is complete.
6. Turn off balancer.
7. Remove EEPROM and turn on balancer.
8. The normal startup procedure will be performed.
9. Perform service codes in the following order;

- **C47** - Select machine model
- **C80** - Calibration of inner SAPE gauge arm
- **C81** - Measurement of flange to zero plane distance
- **C82** - Calibration of outer gauge arm
- **C83** - Basic calibration of vibratory system
- **C84** - Measurement of residual main shaft unbalance
- **C88** - Adjustment of 12 h position
- **(C90)** - Saving calibration data (HWT only)

The machine is now ready for use.

Recommended service steps

In case of an error it is recommended to perform some service code to check the system. The following are some common service codes for this job.

- **C28** - Indicate the content of the error record
- **C74** - Check the incremental encoder of the main shaft
- **C54** - Some more testing for the incremental encoder of the main shaft
- **C98** - Check the incremental encoder of the power clamp
- **C63** - Continuous measurements for test of valid results
- **C56** - Check the pedal switches. The switches and the Function-Code to lock the power clamp should be checked if the power clamp does not work.
- **C75** - Check Voltages of SAPE potentiometers (AD8, AD9, AD10) or perform STEP 1 of C80 and C82
- **C80** - Check Voltages for left SAPE
  ATTENTION This is a calibration function; interrupt this function after the test in STEP 1 with the STOP or ESC key
- **C82** - Check Voltages for right SAPE
  ATTENTION This is a calibration function; interrupt this function after the test in STEP 1 with the STOP or ESC key
- **C55** - Check lines Voltage
- **C110** - Check VCC Voltage
- **C111** - Check belt tension

The following codes allow some deeper tests of the vibratory system:

- **C67** - Indicate the phase stability/shift of the vibratory system
- **C72** - Measure the angular deviation of the vibratory system
- **C63** - Continuous measurements to check measurement deviation.

Selftest during startup (CRT/HNA/HWT)

A series of tests is accomplished after the machine has been turned on. If a test is not successful:

- a series of audible signals is given, or
- an error code is read out.

On HNA/HWT or CRT models, a three-tone signal is given once, if the machine is operative.
In case there is a functional error it must be acknowledged by pressing the STOP or ESC key and there is no three-tone signal.

1. Communication between microcontroller and embedded PC	Blue screen

Affected models : CRT models

Service Codes : No service code available

Communication between micro-controller and embedded PC is not OK (check connecting cable).
This can also indicate a bad connection to the keyboard.

2. Check availability of keyboard	E 300

Affected models : CRT models

Service Codes : No service code available

The microcontroller was not able to detect a keyboard.
Check cabling between microcontroller and keyboard.

3. Check content of permanent memories	E 145

Affected models : All models

Service Codes : C85, C86 to copy content of permement memory

Contents of both permanent memories are different, but both contain valid data.

If the trouble signalled by the error code is not remedied (using service codes C85 or C86), the machine will remain in service code mode.

4. Check model information	E 900

Affected models : All models

Service Codes : C47 to set model

The stored machine model is not known.

If the trouble signalled by the error code is not remedied (using service codes C47), the machine will remain in service code mode.

5. Check keyboard	E 89

Affected models : All models

Service Codes : No service code available

One of the keys F1 to F6, HELP, ESC, START supplies a key code.
The machine will proceed with the next step only if the trouble is remedied.

6. Check pedal switches	E 89

Affected models : Models with power clamp or electromagnetic brake

Service Codes : C56 to check the pedal switches.
C75, AdC16 to check voltage to external switches

Models with solenoid brake only (e.g. 6300(p)):
One or, if available, both pedal switches are actuated. The user can now remedy the trouble. Press STOP or ESC key to check the pedal switch once again and to delete the error code reading. If the trouble cannot be remedied, the pedal is made inoperative.

7. Check OPTIMA Calibration	E 360

Affected models : Models with optima hardware

Service Codes : All codes available for the model

The optima hardware requires wheel profiler position calibration.

When the camera controller board is replaced on the machine, the SW detected that calibration data are missing.

Calibration procedure C122 is required to calibrate the actual position of the laser scanners with respect to the balancer reference plane,

8. Check OPTIMA Hardware	E 361

Affected models : Models with optima hardware

Service Codes : All codes available for the model

Wheel profiler is not present or is not responding during self test.

The balancer controller board was not able to communicate with the camera controller board during start-up self test.

Possible causes:

- The camera controller board is missing or dead.
- The flat cable connecting the balancer controller board and the camera controller board is unplugged, damaged or missing,

9. Check OPTIMA Hardware	E 362

Affected models : Models with optima hardware

Service Codes : All codes available for the model

Main camera board self test fail.

Balancing is not possible since wheel data cannot be scanned.

Problem during power up. Switch power off and on again. Should the problem not go away please call service.

10. Check OPTIMA inner scanner	E 363

Affected models : Models with optima hardware

Service Codes : All codes available for the model

Left side scanner self test fail or CCD not calibrated or zero mark not detected.

Balancing is not possible since wheel data cannot be scanned.

Problem during power up. Switch power off and on again. Should the problem not go away please call service.

11. Check OPTIMA outer scanner	E 364

Affected models : Models with optima hardware

Service Codes : All codes available for the model

Right side scanner self test fail or CCD not calibrated or zero mark not detected.

Balancing is not possible since wheel data cannot be scanned.

Problem during power up. Switch power off and on again. Should the problem not go away please call service.

12. Check OPTIMA inner scanner	E 365

Affected models : Models with optima hardware

Service Codes : All codes available for the model

Rear scanner self test fail or CCD not calibrated or zero mark not detected.

Wheel data can be scanned, balancing is possible. Run out measurement of the wheel is not possible.

Problem during power up. Switch power off and on again. Should the problem not go away please call service.

13. Hardware tests	C 1 - - - -

Affected models : All models

Service Codes : All codes available for the model

There is an error occured during the hardware test. The four hyphens replace the digits 0 to 9 and the letters A to F which all characterize an error/defect. The following test will be performed:

1. Power supply voltage (235V)
2. 5V line
3. Incrementalencoder (Current of optoelectronic LED)
4. Transducer signal available
5. Auto Stop System (Voltage for relay)

14.1 Hardware tests - common errors

C10F02
C10F07
C10F18

Affected models : All models
Service Codes : All codes available for the model

A hardware tests couldn't executed successfully.
C10F02: Test returned with an error. No valid test results available.
C10F07: Test function reported an unknown error.
C10F18: Test timed out. No valid test results available

14.2 Hardware test - Power supply voltage

C10800
C10801
C10804

Affected models : Models with motor
Service Codes : C55 to check line voltage.

If the line voltage is below or above a limit the error code is displayed.
Please refer to chapter 0 Error ID.

14.3 Hardware test - 5V line

	C10810 C10811

Affected models : All models

Service Codes : C110 to heck 5V voltage.

If the 5V voltage is below or above a limit the error code is displayed.
Please refer to chapter 0 Error ID.

14.4 Hardware test - Current of optoelectronic LED

	C10705 C10706 C10707 C10708

Affected models : All models

Service Codes : C75, AdC1 to check LED

If the current / voltage is below or above a limit the error code is displayed.
Please refer to chapter 0 Error ID.

14.5 Hardware test - Transducer signals

	C10410 C10420 C10430

Affected models : All models

Service Codes : C103/C104 to check transimpedance and signal amplifiers and transducer values.

If no signals from the transducers are detected the error code is displayed.
Please refer to chapter 0 Error ID.

14.6 Hardware test - Auto stop system

	C10380 C10381 C10382 C10383

Affected models : Models with auto stop system

Service Codes : C75, Adc21 to check voltage on capacitor of the auto stop system.

If the voltage is below or above a limit or the recharging time is above a limit the error code is displayed.
Please refer to chapter 0 Error ID.

15. Hardware test disturbed	H 82

Affected models : All models

Service Codes : All codes available for the model

A self test was disturbed (e.g. wheel was rotated during the transducer test)
The code is read out for 3 seconds, then measurement is repeated (10 times maximum), or aborted using the STOP or ESC key.

16. Check home position of left SAPE	E3

Affected models : Models with 1D-, 2D-SAPE or geodata

Service Codes : C80 (& C81) to calibrate SAPE
C92 to check distance and diameter of actual calibration

Inner SAPE gauge arm not in home position.
Re-place SAPE gauge arm in home position and press STOP or ESC key to continue.

17. Disable left SAPE	E92

Affected models : Models with 1D-, 2D-SAPE or geodata

Service Codes : C80 (& C81) to calibrate SAPE
C92 to check distance and diameter of actual calibration

During the second attempt the inner SAPE gauge arm was again not re-placed to home position. Inner and outer SAPE gauge arms are turned off. Wait for 5 seconds, or press STOP or ESC key to continue.

18. Check home position of right SAPE	E4

Affected models : Models with 3D-P-SAPE

Service Codes : C82 to calibrate SAPE

Outer SAPE gauge arm not in home position.
Re-place SAPE gauge arm in home position and press STOP or ESC key to continue.

19. Disable right SAPE	E93

Affected models : Models with 3D-P-SAPE

Service Codes : C82 to calibrate SAPE

During the second attempt the outer SAPE gauge arm was again not re-placed to home position. Outer SAPE gauge arms are turned off. Wait for 5 seconds, or press STOP or ESC key to continue.

20. Check calibration	E901

Affected models : All models

Service Codes : C80, C81, C82, C83, C84, C88, C90

Machine was not calibrated. For calibration the following calibration codes will have to be carried out in the sequence as given below:

C80 – Calibration of inner SAPE gauge arm
C81 – Measurement of flange to zero plane distance
C82 – Calibration of outer gauge arm
C83 – Basic calibration of vibratory system
C84 – Measurement of residual main shaft unbalance
C88 – Adjustment of 12 h position
C90 – Saving calibration data

21. Power clamp service interval expired	E93

Affected models : Models with power clamp

Service Codes : All codes available for the model

Error Codes

H codes (CRT/HNA/HWT)

ui_error.h revision 1.11

	H	Internal code(s)	Description
0			
	H0		Wheel running conditions cannot be improved by optimisation
	H1		Further optimisation not recommended but feasible
	H2		Weight minimisation is recommended, optimisation can achieve no further improvement
20			
	H20		The correction plane cannot be re-located using the gauge arm
	H21		Indexing position does not match correction plane
	H22	0x492215	Unclamping of power clamp device is disabled
	H26		The gauge arm was pulled out too quickly (normal operation, ASS calibration)
	H28		NEW : The gauge arm was pulled out too slowly (ASS calibration)
80			
	H80	0x810510	No provision was made for readjustment
	H82		Self test disturbed during execution
90			
	H90	0x492203,	- acceleration during start or stop too slow - measuring speed not reached
	H91	0x492204	Speed variations during measuring run

E codes (CRT/HNA/HWT)

ui_error.h revision 1.11

	E	Internal code(s)	Description
0			
	E1		Rim dimensions entered incorrectly
	E2		Wheel guard is not closed
	E3		Gauge arm not in home position
	E4		Outer gauge arm not in home position
	E5		Range of electrical unbalance compensation exceeded (residual adapter unbalance)
	E6	0x812560, 0x812561, 0x812565, 0x812566	Calibration weight not attached to flange
	E7		No balancing mode for this wheel type
	E8		Valve position was not entered
	E9		Optimisation was carried out incorrectly
10			
	E10		Wheel guard is not open, wheel may not be clamped / unclamped
	E12	Not available to date	Pedal is operated, measuring run not possible
	E13	Not available to date	The clearance of the solenoid brake is too wide.
	E14		The power clamping device is not clamped
	E15		Corrective terms for readjustment are out of range
	E16	0x812570, 0x812571	Calibration weight attached erroneously to flange
	E17	0x492207	Wheel slipped on adapter
20			
	E28	0x492205	Wrong direction of rotation (hand spin)
	E29		Speed too high (hand spin ?)
30			
	E30		Run-out measurement failed
	E31		Rim only mounted during geometric matching when rim and tyre expected.
80			
	E83		Vibration of the machine disturbed the unbalance measurement
	E85		Power clamp service interval expired
	E88	0x492208	The rotating speed of the main shaft exceeds the safety limit
	E89		Key contact or pedal switch closed
90			
	E92	0x441350, 0x441351, 0x441360, 0x441361	The inner gauge arm for distance and rim diameter is defective
	E93	0x441370, 0x441371	The outer gauge arm for rim width is defective
100			
	E101	0xC30E01	ASA: Status of an activeted order has changed due to network manager or shop management software activities.
140			

	E	Internal code(s)	Description
	E141	0x000169	Check sum of EEPROM 1 is wrong
	E144	0x00016D	Check sums of both EEPROMs are wrong
	E145	0x000168	Contents of the EEPROMs are different
300			
	E300		The microcontroller was not able to detect a keyboard. Check cabling between microcontroller and keyboard.
	E341	0x00016A	Check sum of EEPROM 2 is wrong
	E360		OPTIMA hardware wheel profiler position calibration required
	E361		OPTIMA wheel profiler is not present or is not responding during self test
	E362		OPTIMA main camera board self test fail.
	E363		OPTIMA left side scanner self test fail or CCD not calibrated or zero mark not detected
	E364		OPTIMA right side scanner self test fail or CCD not calibrated or zero mark not detected
	E365		OPTIMA rear scanner self test fail or CCD not calibrated or zero mark not detected
810			
	E812		The drive pulley was not readjusted by 180º relative to the main shaft
900			
	E900		No model selected
	E901		Machine not calibrated
990			
	E990		Internal error (message server : message buffer overflow(1)) Machine halts.
	E991		Internal error (message buffer overflow(2)) Machine halts.
	E992		Internal error (synchronous receive time-out) Machine halts.

K codes (Kernel errors)

(see y2kbkclrm.doc revision 30)

Structure of an error code

A complete error code consists of 6 hexadecimal digits.

Prefix	Digit 6	Digit 5	Digit 4	Digit 3	Digit 2	Digit 1
0X	**Module ID**		**Priority ID**	**Error code**		
Digital Display	Left Display			Right Display		

The module ID is a 2-digit hexadecimal value and indicates the software module which detected the error.
The priority ID represents the kind of error (message only, critical error).
The error code itself determines the kind of the fault.

Module ID

Mod. ID	Description
21	Time Service
22	I2C bus device driver
23	Serial device driver
24	Sound device driver
25	External AD converter
26	Internal AD converter
27	Temperature measurement
28	Piezo transducer
29	Incremental encoder Main shaft
2A	Incremental encoder belt disc
2B	Relay management
2C	Hand-spin brake
2D	Electromagnetic brake
2E	main supply line
2F	motor
30	Supervisor
31	Watchdog timer
41	Auto stop system
42	Data conditioning
43	Rim data management
44	Sape device
45	Display device
46	Keyboard device
47	Brake device
48	Motor device
49	Drive (Motor & Brake)

Mod. ID	Description
4A	Power clamp
4B	Incremental potentiometer
4c	Rim light
61	Balancing algorithm
62	Balancing calibration
63	Behind the spokes placement
64	<not used>
65	Optimisation
66	Measurement control
81	Command language (Commands coming from the UI)
82	Calculator
83	Message Server (Message service from BK to UI)
84	Message Server (User messages from BK to UI)
85	Sleep command
86	Balancing Kernel : Test statemachine (eg selftest during startup)
A1	Event system
A2	User management
A3	State machine
A4	complex data type
A5	Persistent objects
A6	Pipe device
A7	Power on time counter (-> time stamp for error recording)
A8	Counter for total spins / in service-, in user mode
C1	Self test
C2	User interface
C3	User interface

Priority ID

Prior. ID	Description
0	Critical error (will be recorded in user mode)
1	Warning message
2	For information only
3	All of above, but will not be recorded in the error record (persistent objects p30 to p39)

Error ID

The table lists the error codes and gives some examples for an error.

Error ID	Limits	Description	
F01		Not complete	
F02		Invalid job Mod 2D, Brake : Mod 49, Drive system : Mod 66, Meas Control : Mod C1, Self-test :	 Module gets invalid event. Internal error, command not valid in actual mode of operation Internal error. Module gets invalid user event. command not valid in actual mode of operation Self-test failed, see error record for more information (kernel register err0,...err9 or User interface: C28).
F03		Out of memory	
F04		Out of range Mod 27, Temperature:	 Out of Range
F05		Buffer full	
F06		Channel not found	
F07		Not found Mod 41, ASS : Mod 44, SAPE : Mod C1, Self-test :	 Time client not found Time service not found during unregister Self-test failed, result of test invalid
F08		Already exists	
F09		In use Mod 44, SAPE : Mod 49, Drive system :	 AWP already in use Internal error, command not valid in actual mode of operation Many "490F09" errors in the error record indicates a malfunction of the pedal.
F0A		End of file	
F0B		Drive full	
F0C		Bad name	
F0D		Xmit error Mod C3, User Interface :	 **Communication Error between balancing kernel and user interface (BK <- UI). Machine should be restarted.** This error can caused by a bad connection of the RS232-E serial line. Check external and internal cabling.
F0E		Format failed	
F0F		Bad parameter Mod 41, ASS : Mod 44, SAPE : Mod 81, cmd :	 Invalid time specified Bad parameter during calling time service Parameter of a kernel command is bad. Such an error can occur as a result from a hardware malfunction.

Error ID	Limits	Description
F10		Bad medium
F11		Error in expression Mod C3, User Interface : **Communication Error between balancing kernel and user interface (BK -> UI). This error can be cleared by pressing STOP or Escape.** This error can caused by a bad connection of the RS232-E serial line. Check external and internal cabling.
F12		Overflow Mod 41, ASS : Too many time clients Mod 44, SAPE : Overflow (e.g. invalid time period)
F13		Not implemented
F14		Read only
F15		Bad line
F16		Bad data type
F17		Not running (still not initialised) This error can occur after a measuring run, if the incremental encoder of the power clamp is not able to detect the reference mark (810F17). Please check the incremental encoders with C54, C74 (main shaft) and C98 (power clamp)
F18		Timeout Mod 31, Watchdog: Recorded during start-up: Watchdog causes last reset. Please check error record (C28). Mod 42, Data cond. : Can't get data from external AD converter This error can caused by - a malfunction of the incremental encoder. Please check C74 and C54. - a malfunction of the micro-controller board Check C75 if ADE1 and ADE2 displays valid results. Mod 44, SAPE : Communication timeout (No answer from AWP) Mod C1, Self-test : Self-test failed, test function does not response (timed out)
F20		Access denied Mod 49, Drive system : Access denied : e.g. - use of the clamp device if it is not available (not a power clamp machine?) - Requested action not allowed
50		UT_CMPLX_ERROR_MatrixSingular
60		ERR_VOLTAGE_ZERO
61		ERR_VOLTAGE_BELOW_LIMIT
63		ERR_VOLTAGE_ABOVE_LIMIT
64		ERR_VOLTAGE_really_HIGH
100		Keyboard : No time client available
101		ERROR_KEYB_NO_HARDWARE_AVAILABLE
102		ERROR_KEYB_ORDER_BUSY
120		Display (Digital) : No Hardware available
130		Bad parameter for the frequency of beep command
131		Bad parameter for the volume of beep command
132		Bad parameter for the sound file of beep command
133		Bad parameter for the repetition of a beep
134		Sound file corrupted

Error ID	Limits	Description
140		RS232-E : Wrong parameter for ioctl call.
141		RS232-E : Input buffer overrun occurred
142		RS232-E : Transmission error
143		FIFO_KORRUPT
144		FIFO_WRONG_ACTION
145		FIFO_EMPTY_READ
146		FIFO_FULL_WRITE
147		FIFO_STRING_ENDE
148		PIPE_NO_COMPLETE_MESSAGE_AVAILABLE
149		SER_WRONG_ACTION
14A		SER_NO_HARDWARE
14B		SER_ERR_RESET_FIFO
14C		SER_ERRORCODE_EXISTS
160		ERROR_PO_INIT_READORDER_FAILED
161		ERROR_PO_INCORRECT_DATA_OR_HEADER_SIZE
162		ERROR_PO_EEPROM_IS_FULL
163		ERROR_PO_I2C_WRITE_ORDER
164		ERROR_PO_NO_TIMECLIENT_AVAILABLE
165		ERROR_PO_ORDER_IS_BUSY
166		ERROR_PO_ORDER_IS_FULL
167		ERROR_PO_PRODUCTION_READ_WRONG_TYPE
168		ERROR_PO_EEP1_EEP2_ARE_DIFFERENT
169		ERROR_PO_CRC_EEP1_ERROR
16A		ERROR_PO_CRC_EEP2_ERROR
16B		ERROR_PO_ORDER_HAS_FAILED
16C		ERROR_PO_NOT_AVAILABLE
16D		ERROR_PO_CRC_EEP1_EEP2_ERROR
180		ERROR_I2C_QUEUE_FULL
181		I2C_ERROR_ORDER_NOT_FOUND
182		I2C_ERROR_ORDER_TOO_BIG
183		I2C_ERROR_ORDER_BUSY
184		I2C-Bus : No order in I2C queue
185		I2C-Bus : No active order in I2C queue
186		I2C_ERROR_TOO_MANY_SOP
187		I2C_bad_SDA
188		I2C_bad_SCL
189		I2C_busy
18A		I2C_no_Acknowledge
18B		No Acknowledge from device
18C		I2C_ERROR_NO_ACK_FROM_START
18D		I2C_ERROR_NO_ACK_FROM_STOP
18E		I2C_ERROR_NO_ACK_FROM_SEND1

Error ID	Limits	Description
18F		I2C_ERROR_NO_ACK_FROM_SEND2
190		2C_ERROR_NO_ACK_FROM_RECEIVE
191		ERROR_I2C_SYNCHRONOUS_ORDER_TIMEOUT
192		ERROR_I2C_ASYNCHRONOUS_ORDER_TIMEOUT
193		ERROR_I2C_ORDER_HAS_FAILED
201		ERROR_DS_USER_BREAK
202		Drive system : Timeout during speed up - hand-spin only! speed does not settle after start command
203		ERROR_DS_SPEED_NOT_REACHED
204		Drive system : Speed slows down during measuring - speed falls below limit while measuring
205		Drive system : Wheel speeds up in reverse turn - Hand-spin only! main shaft rotating backwards on start command
206		Drive system : No acceleration during speed up or braking detected 1. Motor 2. Belt mounted? 3. Incremental encoder main shaft
207		Drive system : Slip detected (speed up to fast) 1. Wheel not clamped strong enough 2. no wheel or wheel mass to low
208		Drive system : Speed limit exceeded - speed exceeds security limit (mainly wheel guard open and drive management set to high speed)
210		Drive system : Clamping device got stuck in clamped position
211		Drive system : Clamping device got stuck in unclamped position
212		Drive system : Displacement limit exceeded during (un)clamping
213		Drive system : Belt disc rotates backward after clamping.
214		Drive system : Main shaft rotates during clamping (e.g. EMB defective?)
215		Drive system : Clamp device is locked
216		Drive system : Time limit for clamping process exceeded
300		Motor over-current detected by hardware. Over-current-LED on the power interface board will be cleared on the next activation of the motor
350	0.05 V	First Potentiometer : Voltage below measuring range (AD value : 0..10)
351	4.45 V	First Potentiometer : Voltage above measuring range (AD value : 1014..1024)
360	0.05 V	Second Potentiometer : Voltage below measuring range (AD value : 0..10)
361	4.45 V	Second Potentiometer : Voltage above measuring range (AD value : 1014..1024)
370	0.05 V	Third Potentiometer : Voltage below measuring range (AD value : 0..10)
371	4.45 V	Third Potentiometer : Voltage above measuring range (AD value : 1014..1024)
380	4.50 V	ASS : Voltage magnet below limit - off state.
381	1.00 V	ASS : Operating Voltage magnet below limit - on state.
382	2.00 V	ASS : Operating voltage magnet above limit - on state.
383	0.5 s	ASS : Operating Voltage magnet recharging time above limit

Error ID	Limits	Description
400		During measuring run : Data conditioning can't get proper speed information.
401		During measuring run : User break. (Measuring run stopped by user)
402		During measuring run : Temperature information invalid, 20°C used instead.
403		During measuring run : Can't perform transducer correction.
405		Channel 1 - channel 2 Phase shift too big
410		Transducer 1, No signal
411		Transducer 1, transimpedance to low
412		Transducer 1, RC time constant out of range
415		Transducer 1, transimpedance amplifier; idle voltage out of range
416		Transducer 1, DC amplifier; idle voltage out of range
418		Transducer 1, amplifier saturation
419		Transducer 1, Transfer function out of range
420		Transducer 2, No signal
421		Transducer 2, transimpedance to low
422		Transducer 2, RC time constant out of range
425		Transducer 2, transimpedance amplifier; idle voltage out of range
426		Transducer 2, DC amplifier; idle voltage out of range
428		Transducer 2, amplifier saturation
429		Transducer 2, Transfer function out of range
430		Transducer 1&2, No signal
431		Transducer 1&2, transimpedance to low
432		Transducer 1&2, RC time constant out of range
435		Transducer 1&2, transimpedance amplifier; idle voltage out of range
436		Transducer 1&2, DC amplifier; idle voltage out of range
438		Transducer 1&2, amplifier saturation
439		Transducer 1&2, Transfer function out of range
500		BL_BAL_ERROR_NoConverge
501		BL_BAL_ERROR_ResultInvalid
502		BL_BAL_ERROR_TooMuchLoops
510		BL_BAL_ERROR_NoCalUser
511		BL_BAL_ERROR_FailCalUser
512		BL_BAL_ERROR_SideCalUser
560		c1 value too low, if a user calibration tool assumed
561		c2 value too low, if a user calibration tool assumed
565		c1 value too low, if a 100g weight and calibration rotor assumed
566		c2 value too low, if a 100g weight and calibration rotor assumed
570		c1 value too high, if a calibration rotor only assumed
571		c2 value too high, if a calibration rotor only assumed

Error ID	Limits	Description
580	-30°C	Temperature below -30°C or hardware fault.
581	100°C	Temperature above 100°C or hardware fault.
585	0.23 V	Temperature Input near to ground Voltage.
586	4.05 V	Temperature Input near to reference Voltage.
601		Internal error : To many event sinks
602		Internal error : Cannot register event sink
603		Internal error : Invalid event level
701		ERROR_IEMS_INV_PARAM
702		Incremental encoder not initialised. - software is not able to detect the reference mark.
703		Incremental encoder : Counter - reference mark mismatch
705	2.50 V	Opto electronic, No voltage on shunt resistor
706	4.30 V	Opto electronic, VCC on shunt resistor
707	16 mA	Opto electronic, Current through LED below limit
708	20 mA	Opto electronic, Current through LED above limit
710		Hand-spin with electromagnetic released brake - main shaft rotates backwards
800	170 V	Line voltage below limit
801	265 V	Line voltage above limit
804	275 V	Line voltage much too high
810	5.10 V	VCC below limit
811	5.35 V	VCC above limit
820	5.00 V	Keyboard/display voltage below limit
821	5.35 V	Keyboard/display voltage above limit
830	4.50 V	External voltage (pedal) below limit, see keyboard module
831		External voltage (pedal) above limit, see keyboard module
900		Power fail detected
950		OPTIMA hardware main board fault detected
951		OPTIMA hardware inner scanner fault detected
952		OPTIMA hardware outer scanner fault detected
953		OPTIMA hardware rear scanner fault detected
9FF		ERROR_SELFTEST
e01		ASA: Status of an activated order has changed due to network manager or shop management software activities.

Beep codes

Abbreviations

Beeps

*	Frequency Duration Pause	: 2000 Hz : 100 ms : 100 ms (Pause after beep, total length = 200 ms)
S	Frequency Duration Pause	: 1600 Hz : 200 ms : 400 ms
L	Frequency Duration Pause	: 1600 Hz : 500 ms : 400 ms
nS or **nL**	**n** repeats of **S** or **L**	

Pause

Pn	Duration	: n seconds

Beep sequences

A beep sequence consists of a

- \- A - : prefix beep
- \- B - : beeps which indicates the initialisation step
- \- C - : beeps which indicates the module/object
- \- D - : pause

- A - Each beep will be indicated by an prefix beep

*** * P0.5**

- B - Indication of the initialisation step

No	Beep sequence	Description
1	**S P1**	Error during basic initialisation: - I2C bus - Message server - Command language - Extended key codes (Stop key, ...) - Basics for the persistent objects - Inner rim light

No	Beep sequence	Description
2	S S P1	Error during PO (persistent objects) based initialisation: - Persistent objects initialisation - Bit field POs - Power on timer - Error recording - Incremental encoder of main shaft - External AD converter - Internal AD converter - Temperature measurement - Data conditioning - Balancing module - Optimisation module - Counters
3	S S S P1	Extensions, based on POs - Drive system - Measurement control - keyboard/display, SAPE, brake, motor

- C - Indication of the module/object with the error

No	Beep sequence	Description
1	S	Initialisation of the I2C bus fails. 1. SDA or SCL level is wrong
2	S S	Initialisation message server 1. No resources available (RAM, timer)
3	S S S	Initialisation command language 1. No resources (RAM, pipe)
4	S S S S	Initialisation of keyboard device driver (including STOP, wheel guard, pedal) 1. Resource not available (timer)
5	5S	Initialisation persistent object basics.
6	6S	Initialisation inner rim light.
7	7S	Initialisation of the incremental potentiometer (Snap-on, SUN) and display drivers
10	L	Persistent objects: 1. PO not available 2. Wrong version 3. Different versions (Opto- / micro-controller board)
11	L S	Bit fields for persistent objects
12	L S S	Power-on timer 1. Persistent object for power-on timer not available 2. Resource not available (timer)
13	L S S S	Error recording 1. Persistent object for error recording not available
20	L L	Incremental encoder of main shaft 1. Persistent object not available
21	L L S	External AD converter 1. Persistent object not available
22	L L S S	Internal AD converter 1. Persistent object not available
23	L L S S S	Temperature measurement 1. Persistent object not available 2. Resource not available (timer)
24	L L 4S	Incremental encoder of power clamp 1. Persistent object not available
25	L L 5S	Data conditioning 1. Persistent object not available
26	L L 6S	Balancing module 1. Persistent object not available

No	Beep sequence	Description
27	**L L 7S**	Optimisation module 1. Persistent object not available
28	**L L 8S**	Counters 1. Persistent object not available
30	**3L**	Extensions: - keyboard/display, SAPE, brake, motor 1. Persistent object not available 2. Resource not available (timer)
31	**3L S**	Extensions: - Drive system 1. Persistent object not available 2. Resource not available (timer)
32	**3L S S**	Extensions: - Measurement control 1. Persistent object not available 2. Resource not available (timer)
33	**3L S S S**	Initialisation of the supervisor program. Possible faults: 1. Resource not available (timer)

- D - Pause between the cycles

P3 : 3 seconds pause

Example:

* * P0.5	S P1	5S	P3		* * P0.5
2 init beeps with half a second pause after	One short beep and a one second pause	5 short beeps	3 seconds pause		NEXT cycle ...

-> Error during initialisation of the persistent objects. e.g. the opto-electronic board is not connected.

C codes

Table of C codes

1. Column "HWT/HNA indicates the C codes available to this date. The number behind the letter indicates the revision since this code is available.
   U : C code is available for the user
   S : C code is available for service operator
   NA : C code will be discontinued

C	Description	CRT,HNA, HWT	GS	JBEG
0	Set to default profile and settings	U		
1	Resolution of unbalance readings	U		
2	Suppression of minor unbalance readings (0=off(default), 1=on)	U		
3	Measurement units of unbalance readings (0=grams(default), 1=ounces)	U		
4	Compensation of adaptor unbalance	U	U	U
5	Automatic braking when wheel guard is opened ATTENTION : SAFETY REQUIREMENTS	U		
6	Number of revolutions for measurement	U		
7	Volume of audible signals	U	S	S
8	Threshold value for suppression of minor unbalance readings in units selected with C3	U		
9	Threshold value for suppression of minor unbalance readings in ounces. Use C8 instead of C9.	NA		
10	**Save user settings**	U		
11	Position brake after measuring run	U 2.2	S	
12	Indication of total numbers of measurement runs -> Type of counters depends on brand !	U	U	S
13	Starting measurement run by closing the wheel guard	U		
14	User calibration	U	U	U
15	GS: Enable sticky on top		S	
16				
17	RCL (recalling) of a profile	U		
18	STO (storing) of a profile	U		
19				
20	Selecting the language	CRT		
21	Indication of the program version number (= p52)	U		
22	Lock power clamp in clamped position	U		
23				
24				
25	Non-volatile wheel data	NA		
26	Change pedal functionality (down= brake, up=(un)clamp or opposite)	U		
27	Set time for screensaver or disable screensaver.	CRT 2.2		
28	Display the last 10 error codes	U/S	S	S
29	Disable/enable AutoStopSystem	NA		
30				
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				
41				
42				
43	Reset counters	S	S	S

C	Description	CRT,HNA, HWT	GS	JBEG
44				
45				
46	Selecting the private brand	**NA**		
47	Select machine model	**S**	**S**	**S**
48	Download of application to FLASH memory. (Needs special software version) Please refer to chapter 0 "In Field Reprogramming of Balancer" for details how to program the balancer.	**(S)**		
49				
50	Indication of voltage on distance analogue input	**NA**		
51	Indication of voltage on diameter analogue input	**NA**		
52	Indication of voltage on width analogue input	**NA**		
53	Display test - Only balancers with digital display	**S**		
54	Checking the incremental encoder on the main shaft	**S**		
55	Indication the line voltage	**S**		
56	Indication of the circuit state of the wheel guard switch	**S**		
57	Indication of temperature	**S**		
58	Indication of balancing calculation values			
59	Indication of the residual unbalance compensated for using code C84	**S**		
60	Motor : Indication of RPM of main shaft Hand-spin : Measure amount of measuring turns (C84 simulation)	**S**		
61	Indication of correction values for user calibration	**S**		
62	Indication of angular position [0,360) of unbalance weight.			
63	Continuous measurement (with statistics)	**S**	**S**	**S**
64	Indication of the transducer sensitivity as measured with C code 83	**S**		
65	Indication of phase differences and phase shifts			
66	Display calibration values as measured with C code 83 (virtual dimensions)	**S**	**S**	**S**
67	Display phase stability of the vibratory system as measured with C code 83	**S**	**S**	**S**
68	Indication of time to reach measurement speed during last measurement run			
69	Successive measurement runs with pauses and statistics	**S 2.2**	**S**	**S**
70	Test light for inner rim.	**NA**		
71				
72	Measurement of angular deviation	**S**	**S**	**S**
73	Indication of delay of solenoid brake			
74	Indication of position counter and basic incremental encoder test	**S**	**S**	**S**
75	Display values from AD converter	**S**	**S**	**S**
76	Indication of the voltages used by the 2 step motor control	**S**	**S**	**S 4.19**
77				
78	Restarting the program with self test			
79				
80	Calibration of the inner SAPE gauge arm and the AutoStopSystem	**S**	**S**	**S**
81	Measuring the adaptor flange and the zero plane.	**S**	**S**	**S**
82	Calibration of the outer SAPE.	**S**	**S**	**S**
83	Calibration of the unbalance measurement with wheel/test rotor.	**S**	**S**	**S**
84	Compensation of unbalance of main shaft	**S**	**S**	**S**
85	Copy content of serial EEPROM (EEP) from micro-controller EEP to incremental encoder EEP.	**S**	**S**	**S**
86	Copy content of serial EEPROM (EEP) from incremental encoder EEP to micro-controller EEP.	**S**	**S**	**S**
87				
88	Calibration of the 12 o'clock position for fitting position of weights	**S**	**S**	**S**
89				
90	**Saving the adjustments data in the PO's (CRT, HNA, HWT only)**	**S**		
91				
92	Display of actual distance and diameter of inner SAPE/geodata	**S**		
93	Indication of line frequency.			
94				
95	Test of serial line (RS-232-E).			

C	Description	CRT,HNA, HWT	GS	JBEG
96	Indication of motor current.			
97	Conditioning of the solenoid brake	**S**		
98	Display of angular position of power clamp pulley, incremental encoder test (see C74).	**S**		
99	Disabling the plane separation calculator.			
100	Indication of the unbalance data in Cartesian coordinates.			
101	Indication of the vibrations picked up by the unbalance transducers as an effective value.			
102	Performing a measuring run and indication of harmonic contents of the unbalance signals	**S**		
103	Test of the transimpedance and unbalance signal amplifiers	**S 2.3**		
104	Test the RC time constant of the unbalance transducers	**S 2.2**		
105	Set the parameters for the HUMSR feature with an EMB	**S 2.6**		
106	Test watch-dog timer.			
107	Indication of the difference of the angular momentum of the motor between forward and reverse rotation.			
108	Test and measurement of the relay delays.			
109	Save service/user mode for next power-on.			
110	Indication of the operating voltages supplied by the power supply module.	**S**		**S 4.21**
111	Belt tension: Measure first harmonic of the belt.	**S 2.2**	**S 0.24**	
112				
113				
114				
115	Calibration of the unbalance measurement with a test rotor. (see C83)			
116				
117				
118				
119				
120	Enable / disable the laser pointer (OPTIMA machines)	**Optima**		
121	Set the geometric matching bead seat recommendation threshold (OPTIMA machines)	**Optima**		
122	Position calibration of the OPTIMA hardware.	**Optima**		
123	Display of the STATUS and DIAGNOSTIC flags of the OPTIMA sub-system and perform manufactoring/diagnostic tests.	**Optima**		

Entering C codes and options

CRT balancer

- **C code** — In the function screen press the function selection button (F6) three times, then press the appearing button "Service" to go to the service code menu.
  Press "C-Code" key (menu key) and turn wheel to choose a service code.
- **Options** — Press FINE key (F4) and turn wheel to choose an option of a C code.
  Exceptions are C12, C21, C54, C61, C63, C64, C66, C72, C74, C98, as these codes either switch over to an alternative reading, or operation with wheel is no longer possible (C54, C63).
- **Acknowledge** — Press ENTER key to acknowledge the option chosen.
- **Abort** — Press STOP or ESC key to abort a C code.
- **Special function** — Press the Optimisation key (F3) to activate extra functionality on some C codes (e.g. C28, C74, C75).
- **Measuring run** — The START symbol invites the user to start a measuring run.

GS Digital balancer

- **C code** — The service menu is accessed by holding down the "FINE" and "CAL" keys for 7 seconds and restarting the machine. At the first the "DIS 115" will be displayed and machine waits for input of rim data. Use "+ -" key for input of rim data. On machines with automatic sape the user can also use sape to input rim data. If no input is made, a default setting will be used (offset = 115 mm, rim width = 6.50 inch and rim diameter = 14.5 inch) .Press F key service code (C4) will be displayed and machine is now in state service code. Use "+ -" key to change service code. To select a service code press F key again.
- **Options** — Press +/- keys to choose an option of a C code.
- **Acknowledge** — Press F key to acknowledge the option chosen.
- **Abort** — The service menu can be exited by pressing the "FINE" key. The display is cleared and a beep is generated.
- **Special function** — not available
- **Measuring run** — The START symbol invites the user to start a measuring run.

HWT Digital balancer

- **C code** — Press C key and turn wheel to choose a user C code.
  Press C and weight placement keys and turn wheel to choose a service code.
- **Options** — Press precision /FINE key and turn wheel to choose an option of a C code.
  Exceptions are C12, C21, C54, C61, C63, C64, C66, C72, C74, C98, as these codes either switch over to an alternative reading, or operation with wheel is no longer possible (C54, C63).
- **Acknowledge** — Press C key to acknowledge the option chosen.
- **Abort** — Press STOP or ESC key to abort a C code.
- **Special function** — Various activities are accessible through the Optimisation key for various C codes (e.g. C28, C74, C75). Press the Optimisation key to activate the special function.
- **Measuring run** — The START symbol invites the user to start a measuring run.

JBEG Digital balancer

- **C code** The service menu is accessed by holding down the plus and minus keys for 7 seconds when the machine is idle. Note: The service menu is for service personnel only. Not for customers. The last service code used since power on is displayed. The service codes available can be accessed by using the plus and minus keys and selecting the desired code by pressing the return key.
- **Options** Press +/- keys to choose an option of a C code.
- **Acknowledge** Press Return key to acknowledge the option chosen.
- **Abort** The service menu can be exited by pressing the plus and minus keys together. The display is cleared and a beep is generated.
- **Special function** Not available.
- **Measuring run** Indicator not available.

Truck Digital balancer

- **C code** The service menu is accessed by holding down the c-code and weightplacement keys. The user c-code menu is accessed by pressing the F-key and afterwards the c-code key.
  Note: The service menu is for service personnel only. Not for customers. The last service code used since power on is displayed.
  The service codes or c-codes available can be accessed by using the plus and minus keys and selecting the desired code by pressing the c-code key.
- **Options** Press +/- keys or precision /FINE key to choose an option of a C code.
- **Acknowledge** Press C key to acknowledge the option chosen.
- **Abort** Press STOP key to abort a C code.
- **Special function** Various activities are accessible through the Optimisation key for various C codes (e.g. C28, C74, C75). Press the Optimisation key to activate the special function.
- **Measuring run** Indicator not available.

Saving settings for modes of operation and calibration data

GS, JBEG balancer

These balancers save modes of operation and calibration data are stored automatically into permanent memory.

HNA, HWT and CRT balancer

CAUTION
Unlike previous HWT balancer generations the new generation balancers have two C codes to save modes of operation and calibration data:

C10 : Save modes of operation (user settings) and
C90 : save calibration data.

Consequently C10 is available only for user C codes and C90 only for service C codes.

System Reset

The balancer is always reset after C47, C85, C86 have been carried out.

John Bean

Functional description

The information relates up to software version 4.24

Note: Functional Requirements detailed in this document apply to B9000 (Handspin), B9450 (Low Digital) and B9460 (High Digital). Any model specific functionality is explicitly stated as model specific.

Table of Contents:

Definition of Terms

JBEG	John Bean Equipment Group, Balancer Brand Name
Y2K	Reference to the Snap-On common wheel balancer platform project
B9000	JBEG handspin wheel balancer model designation
B9450	JBEG entry level motorised (low-digital) wheel balancer model designator
B9460	JBEG motorised (high-digital) wheel balancer model designator
NORMAL	A weight placement mode typically used for steel wheel rims. Two clip on weights are attached. One on either rim flange.
ALU	A weight placement mode typically used for alloy wheel rims. Two stick on weights are attached in a variety of possible locations.
STATIC	A weight placement mode typically used for motorcycle wheel rims.
HWM	Hidden Weight Mode (HWM) is a special ALU mode which allows the operator to enter the weight offsets exactly, thereby providing more accurate ALU mode balancing.
SWM	Split Weight Mode (SWM) is a special function which allows the operator to split the weight at position 3 (see fig. 2) when using HWM 2 (a hidden weight mode described below). This function allows the "hiding" of weights behind wheel spokes.
Rim Data	Rim data refers to the nominal wheel rim dimensions; offset, rim width and rim diameter.
SAPE / Gauge Arm	These terms refer to the arm used to automatically enter offset dimensions, and apply weights in hwm modes.
C88 Offset	This is a small offset (0 – 5 degrees) to the weight application position for clip on weights and stick on weights in modes other than hwm, which ensures that the weight application position is at exactly the 12 o'clock position. This offset is produced by a service function.
Gauge arm offset	This is a large offset (10 – 30 degrees for example) to the weight application position which is used internally by the machine when stick on weights are to be applied with the gauge arm. This offset is rim diameter dependant.

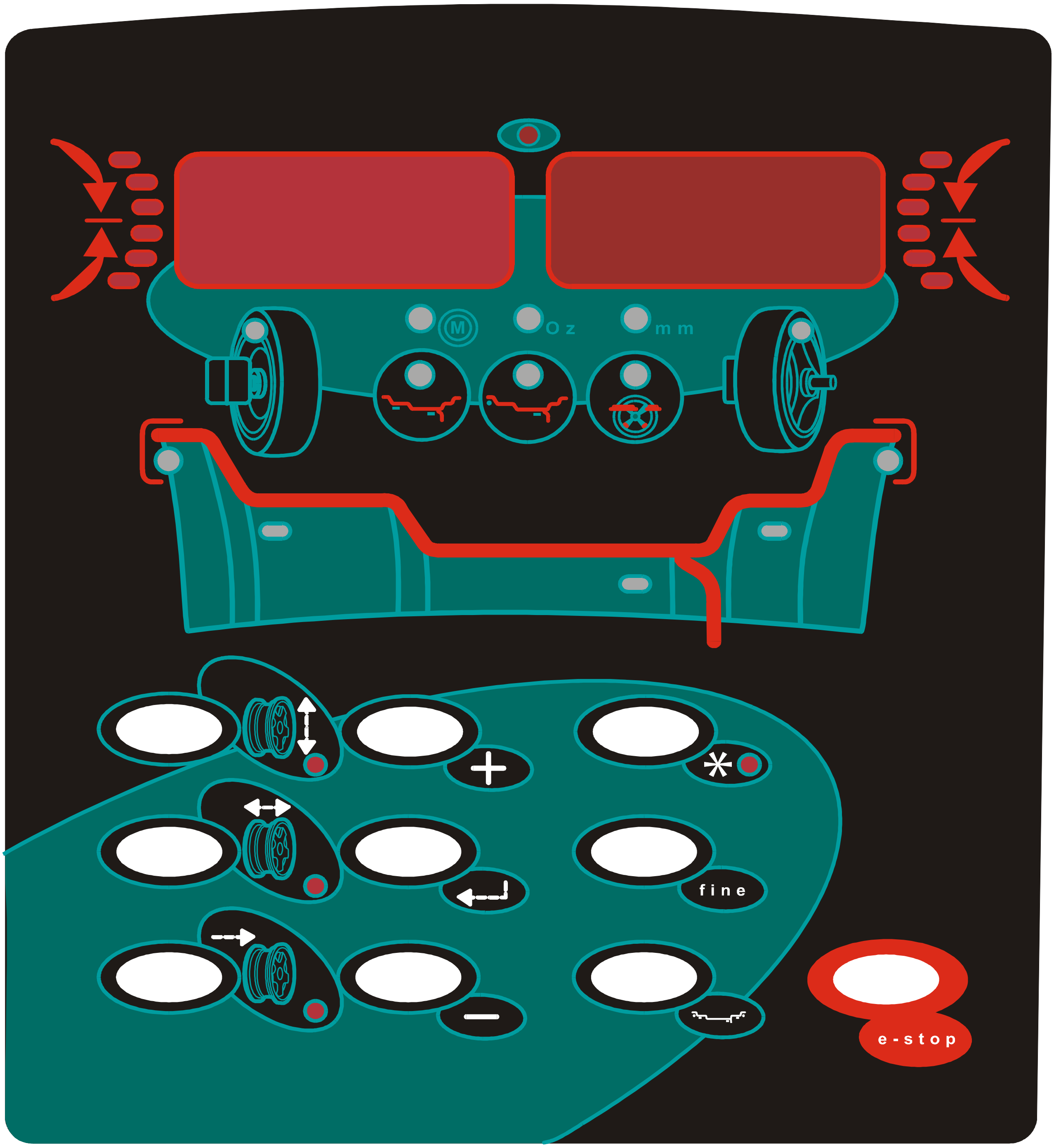


Figure 1. JBEG B9000 / B9450 User Interface

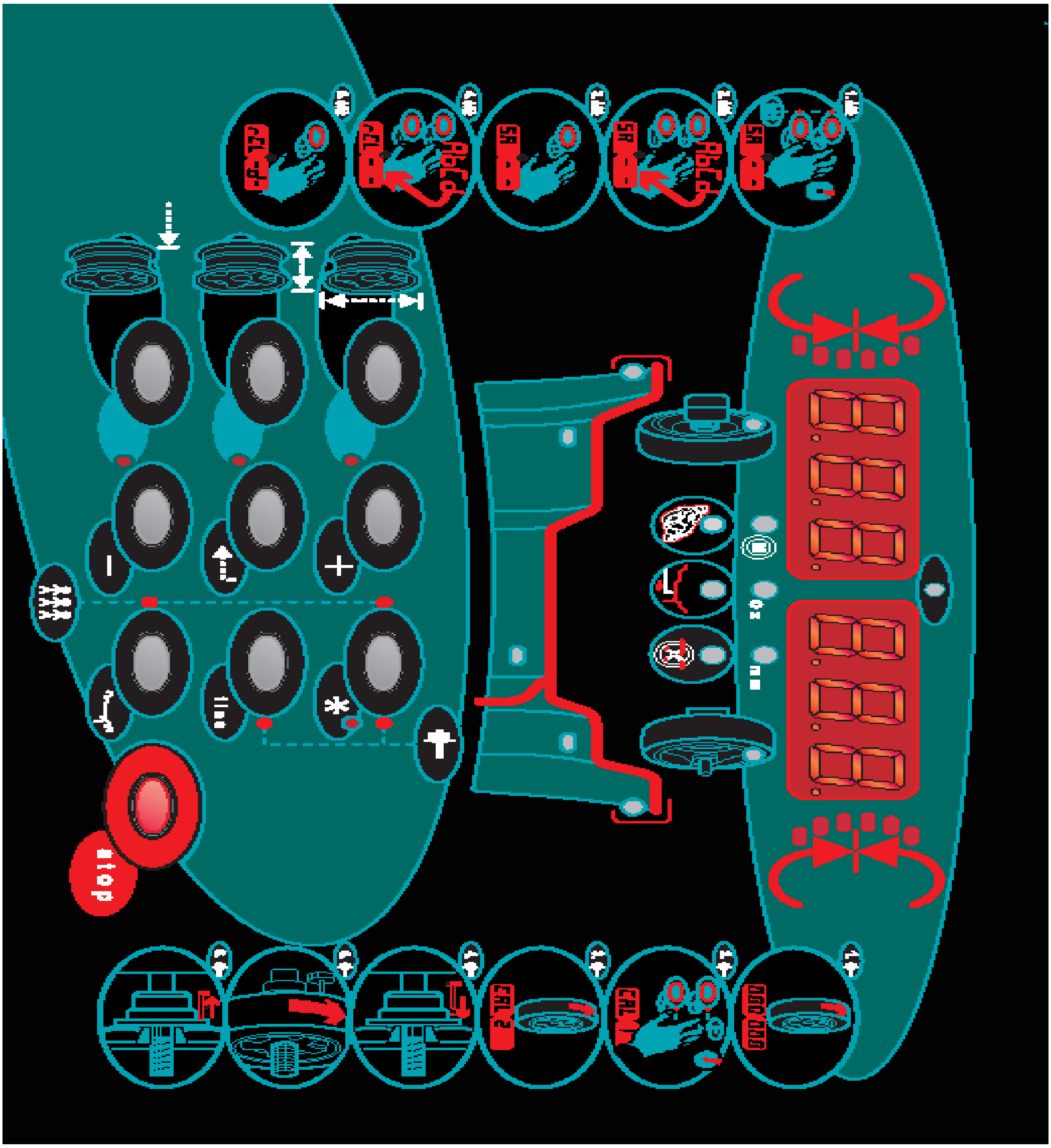


Figure 2. JBEG B9460 User Interface

1. Initialisation

Common Features

Prior to User Interface initialisation the machine Operating System (balancing kernel) initialises. If any problems are detected a sequence of beeps are generated to describe the problem.
When the UI initialises the display board identifier is checked. If the correct display board is not connected a 1 second beep is generated and the machine halts.
If the display board is correct, the contents of the two non-volatile memory chips (one on the microcontroller board and one on the opto-encoder board) are compared. If they are different (due to a component change for example) "C85" is diplayed. The user can use the plus and minus keys to select either C85 or C86. Pressing return causes the selected function to be executed and the machine to reset. C85 and C86 are used to synchronise the two flash chips. For a description see a Hofmann service manual.
If the machine repeatedly fails to initialise and generates a sequence of audible beeps with no display leds lit there is a low-level machine fault detected (kernel initialisation failed). In the absence of troubleshooting documentation for this scenario contact engineering.
On initialisation where the flash chips are in agreement and the kernel has successfully initialised, the entire display is lit for a lamp test. The display board speaker sounds also. The lamp test ends and the current software release number is displayed in the right display panel.
At this point a machine self-test is performed. If any problems are identified during this self test an error message "E82" is displayed for a number of seconds. It may still be possible to use the machine without problems depending on the specific problem encountered. Under normal conditions, the self test is completely transparent to the user and results in no output.
After the self test the version number display is cleared. The default settings are then loaded from flash and the appropriate leds are lit.
After lamp test "E11" is displayed if the sape arm is not in the home position. If the sape is properly calibrated, moving it to the home position will clear this message. If the sape requires calibration the service menu must be selected to calibrate the sape.

B9000 Specific Features

The default weight placement mode is "Normal". By holding the "return" key down during power on (until initialisation is complete) the default mode can be toggled between "normal" and "Hwm1".

B9450 Specific Features

The settings for the user which was active prior to power off are reloaded automatically.

B9460 Specific Features

After lamp test "E13" is displayed if the outer sape arm is not in the home position. If the sape is properly calibrated, moving it to the home position will clear this message. If the sape requires calibration the service menu must be selected to calibrate the sape.

2. Weight Placement Modes

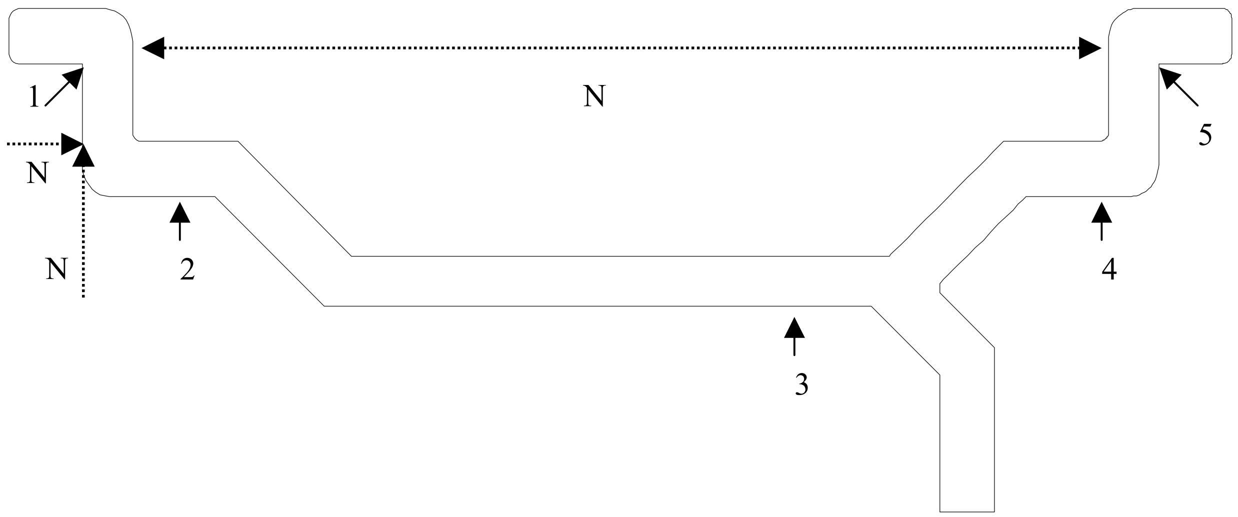


Figure 2. Weight placement positions 1 to 5. Nominal rim dimensions N1 to N3.

The weight placement modes are described below. These modes are accessed by pressing the "weight" key. This cycles through the positions available. The order of the list is as follows; Normal, Alu1, Alu2, Alu3, Alu4, Hwm1, Hwm2, Static.

This key can only be used when the balancer is idle. That is, there is no spin in progress and no other functions are in use.

Changing the mode causes the leds to change to represent the appropriate weight positions. In the hidden weight modes, the appropriate HWM led also lights. On cycling the weight mode an audible beep is generated.

Modes are as follows;

Normal Positions 1 and 5. Rim data required. (Rim data are rim offset, width and diameter).

Alu1 Positions 1 and 4. Rim data required.

Alu2 Positions 2 and 4. Rim data required.

Alu3 Positions 1 and 3. Rim data required.

Alu4 Positions 2 and 3. Rim data required.

Hwm1 Positions 2 and 3. Rim diameter and actual weight offsets required. Weights applied using gauge arm.

Hwm2 Positions 1 and 3. Rim diameter and actual weight offsets required. Stick on weight applied using gauge arm.

Static Position 3 indicated. Weight can be applied in centre of rim, or split and applied at either side (either stick on or clip on).

Weight Placement Quick Mode

Holding down the weight placement key for 2 seconds results in a beep being generated and the weight placement selection mode being toggled between standard (the default) and quick mode. In quick mode the weight placement key cycles through NORMAL, HWM1 and HWM2 modes only. Upon machine power-on the selection mode active prior to power-down is restored.

3. Balancing Results Recalculation

Whenever possible, the balancing results displayed are recalculated and re-displayed following a change to the underlying data (wheel rim data, balancing run raw data). A recalculation may change the magnitude of the results displayed in the display panels. It also causes the weight bars to be updated.

Results are recalculated and displayed;

- After a measuring run.
- Whenever rim data is changed after a measuring run has been performed.
- Whenever the weight placement mode is changed after a measuring run has been performed.

The HWM modes are designed to enable greater accuracy by allowing the exact correction plane offsets to be entered (bypassing wheel type based estimates). For this reason recalculations are performed as follows for HWM;

- After a measuring run, only if the two weight offsets have been entered and the rim diameter is within HWM specific limits (greater than 305 for hwm1 and hwm2 (12")).
- Whenever rim data (diameter only) is changed if a measuring run has been performed and the weight offsets have been entered.

  B9460 Specific Features

  Rim data cannot be entered manually during HWM modes with the B9460. This is because the machine has a 2D inner sape which enters both offset and diameter. Diameter is entered manually for the B9000 and B9460.
- Whenever the weight offsets are changed after a measuring run has been performed and the rim diameter is within HWM specific limits (greater than 305 for hwm1 and hwm2 (12")).

  B9460 Specific Features

  There is no HWM minimum diameter limit for the B9460. The diameter is limited mechanically by what the user can enter using the gauge arm.

4. Manual Data Entry

The nominal rim dimensions of the wheel can be entered by using the offset, width and diameter keys. These keys can be used when the balancer is idle. That is, there is no spin in progress and no other functions are in use.

To enter a value press the appropriate key. The led next to the key will light and the current value will be displayed (offset in left panel, diameter and width in right panel).

Enter the value using the "plus" and "minus" keys. Holding the keys down will cause the value to increment / decrement automatically at an increasing rate. The value can be stored and the function exited by performing any of the following actions;

- Starting a wheel spin (see below).
- Pressing the "return" key or the dimension key which is in use.
- Pressing another dimension key to edit another value.
- Pulling out the sape.

Exiting the function using any of these methods causes the relevant dimension led to turn off, saves the value and may cause a result recalculation. A beep is heard upon selecting and exiting this function.

B9000 / B9450 Specific Features

Only Diameter can be entered while in a hidden weight mode (width and offset are not required, weight offsets are entered with the sape). The rim diameter range in HWM modes is reduced due to the mechanical constraints of using the gauge arm to apply the weights. For this reason, HWM modes will only allow results to be displayed if the rim diameter is within range.

B9460 Specific Features

No manual data entry can be performed during HWM modes with the b9460 balancer as both offset and diameter are entered via the 2D sape.

Value limits are:

Width   80 - 510 mm or 3 - 20 inches.

Diameter   205 - 635 mm or 8 - 25 inches in all modes.

12 – 25 inches in Hwm1 or HWM2 modes with inches selected.

Offset   1 - 500 mm.

Increments are;

Inch   0.25 or 0.5 depending on size of value (0.25 below 10.0)

MM   1mm.

5. Weight Bar Operation

The weight bars indicate the direction required to rotate the wheel to bring the weight application position to the correct place for weight application.
If there are no results displayed the bars rotate with the wheel (after encoder initialisation) but the green application led is never displayed.
If static mode is active only the left bar is displayed.
If results are available and the result for each plane is greater than the threshold (see fine mode below), the green application led of the relevant bar is lit and all bar leds are lit when the wheel is at the correct position for application (+/- 1.4 degrees).
The correct position for application is 12 o'clock - C88 offset for non-hwm modes and 12 o'clock + gauge arm offset for stick on weights in hwm modes.
During SWM mode when results are displayed, the result magnitude shown for the right or outside correction plane is that closest to the application position (see below).

6. Sape Operation

High Level Functionality

The sape can be used for both data entry and weight application.
During a non-hwm weight application mode (anything but hwm1 and hwm2) removing the sape from the home position causes any results displayed to be removed from the display.
If the sape is removed while in manual data entry mode the data entry function is first exited (see above) and then the sape becomes functional as detailed below.
If the sape is removed while a measuring run is in progress the run will be terminated, a beep will sound, the wheel will be braked and "E10" is displayed. After 7 seconds E10 is cleared.
If an attempt is made to use the sape while in another mode of operation (service menu, user management, star menu, etc...) the sape does not interrupt the function in use and cannot be used. When the function is exited by the user the sape becomes active if it is not at the home position.
If we are in HWM mode 1 or 2 there are two modes of sape operation, data entry and weight application.
Data entry is the default mode of operation when hwm1 is entered. When valid results are made available (see recalculation above) weight application is enabled. Weight application is disabled by pressing the "offset" key with the sape in the home position. A beep is generated.

Non-HWM Sape Data Entry

B9000/B9450

If the sape is held stationary for 1 second or more a beep is generated and the offset is shown in the left display panel. The value is removed from the display when the sape is returned to the home position. If a measuring run has been performed the results are recalculated and displayed when the sape is returned to the home position.

B9460

When a sape is removed from the home position the left and right rim positions flash on the weight application graphic. If a sape is held stationary for 1 second or more a beep is generated and the relevant LED is disabled. The other LED keeps flashing. When the second position is entered using the other SAPE the wheel width and diameter are displayed until both sapes are returned to their home positions. If a measuring run has been performed the results are recalculated and displayed.

HWM Sape Data Entry

When the sape is removed from the home position the appropriate inner plane weight led blinks. This shows the operator where to apply the arm to the rim. After the sape is stationary for 1 second a beep is generated, the inner plane position is stored and the outer plane led blinks. At this point the sape can be returned to the home position. If this is done, the results are not recalculated as the user has only partly entered the required parameters with the sape. Pressing the offset key enables a beep and resets the sape to the inner plane so that the inner plane led will flash when the sape is removed. If the offset key is not pressed and the sape is removed again from the home position, the outer plane led will flash and the user must enter this value. Holding the sape stationary for 1 second causes the value to be entered, a beep to be generated and the led to stop flashing. The sape must now be returned to the home position. If a measuring run has been performed and the rim diameter is within limits for HWM the results are recalculated and displayed when the sape is returned to the home position.

B9000/B9450

If the rim diameter is less than 12 inches "E12" will be displayed. This is done because it is not possible to apply weight to the wheel using HWM modes with a rim diameter of less than 12 inches. Pressing the diameter entry key will automatically increase the diameter to the minimum required value for the HWM mode.

Note: The inner and outer planes must be separated by 3 inches or more. Holding the sape stationary in an attempt to enter an outer plane offset less than 3 inches from the inner plane will not store the plane offset.

Sape Weight Application

When valid results become available in a hwm mode, the sape is configured for weight application. When the sape is now removed from the home position the sape position is checked against the stored offset positions. The sape arm is used to apply stick on weights only. If a stick on weight is required for a plane, the value of the weight is above the threshold and the wheel is rotated so that the green application led is lit for that plane, the machine will beep when the sape arm is moved to within +/-1.5mm of the weight position. While the sape is in this position the appropriate weight led will flash. Moving out of this position will stop the led from flashing.

Application mode can be canceled by pressing the offset key (as described above) when the sape is in the home position.

7. Star Menu Access and Operation

The star menu is accessed by pressing the star key while the machine is idle (idle defined above). The star led next to the key will light.

There are four possible menu items in the star menu; swm, minimisation, oz and mm.

The first selected item is determined as follows;

Hwm modes not active: Minimisation led flashes.

Hwm mode active, no results: oz led starts to flash.

Hwm mode active, results displayed, outer plane unbalance of 10 grams or greater: swm led starts to flash.

Minimisation can only be selected as an option when not in a hwm mode.

Oz and mm can be selected in any mode.

To go to the next item in the menu press star.

To select an item and exit the menu press return.

To exit the menu from the mm position press star again and the star led goes out.

Starting a measuring run exits the star menu.

Selecting SWM causes the SWM function to be selected (see below).

Selecting minimisation causes the minimisation function to be started (see below).

Selecting oz causes the unbalance units to be toggled between ounces and grams. Led is lit when ounces are selected.

Selecting mm toggles width and diameter display between mm and inches. Led is lit when mm are selected.

B9460

The first LED selected in the star menu is the motorcycle mode led. Selecting this mode causes 100mm to be added to all SAPE entered offset values. This is to be used only in combination with the motorcycle mode sape adaptor.

8. Wheel Spin Functionality

Common Features

A wheel spin can be started when the machine is idle, when the star menu is active, when data is being entered manually and during user calibration, minimisation and some service codes. When the wheel spin starts the display is cleared of all data and a beep is generated. When the spin is completed successfully a beep is generated and the results are displayed if the weight placement mode allows this (see above), and the bar graph(s) are enabled.

Errors which can be generated during a wheel spin are as follows;

E22 Speedup timeout

E23 Speed not reached

E24 Speed low

E26 No Acceleration

E27 Slip Detected

E28 Speedlimit

If one of the above errors is displayed the spin is aborted, the wheel is braked and the balancer returns to the idle state.

If the wheel rotates in the wrong direction above a preset speed "E25 reverse error" is generated. This error resets when the speed is reduced to a near stop.

B9000 Specific Features

A wheel spin is started using the B9000 by hand-spinning the wheel. It is stopped by pressing the stop key.

B9450 Specific Features

A wheel spin is started by lowering the hood. It is stopped by raising the hood or pressing the stop key.

B9460 Specific Features

A wheel spin is started by lowering the hood. It is stopped by raising the hood or pressing the stop key. The wheel spin is a high speed spin. Slip detection can be disabled for one measuring run by holding down the return key while lowering the hood.

9. Auto-Off Mode

B9000 Specific Features

If the balancer is not used for 5 minutes or more, the display is turned off to conserve power. Upon pressing a key, starting a measuring spin or removing the SAPE the display is re-enabled.

10. Auto-Orientation Mode / Sticky-On-Top

B9460 Specific Features

If C11 has been set to mode 1 or 2, the balancer will automatically brake to either the left or right weight application position after a measuring run. Pressing and releasing the PLUS key will auto-orientate the wheel into the weight application position for the other correction plane.
Rotating the shaft by hand following a measuring run will result in a motor pulse being generated when the wheel is turned through either weight application position where the unbalance is greater than the set threshold.

11. Split Weight Mode

The split weight mode is accessed via the star menu (see above). Upon selecting this mode "S1" or "S--" is displayed in the right display panel. The left plane and its display panel are unaffected throughout this function.
"S1" indicates that the first spoke can be selected in the present wheel position. Spoke positions are entered at the 12 o'clock position. Spoke 1 can be +/- 120.0 degrees from the original outer plane weight position. Spoke 1 is entered by pressing return.
"S2" or "S--" is now displayed similarly to before. Again, the return key is used to enter he second spoke position.
The second spoke can be within 120.0 degrees of spoke 1, but must be on the "other side" of the original weight position.
If the return key is pressed a number of times while "S--" is displayed (invalid spoke position) the function exits.
Upon selecting spoke 2 the results are recalculated and displayed. The application position shown in the weight bar incorporates the sape offset and the split weights must be applied with the sape (like all stick on weights in HWM modes). The closest weight to the application position is that which is displayed in the right display panel.
The function is exited by pressing the return key. A beep is generated and the original weight value is displayed.
Split weight mode can also be exited at any time by starting a wheel spin.
SWM can only be selected from a HWM mode with an outer plane unbalance of 10 grams or greater. SWM is always performed in low resolution mode (not fine mode) regardless of whether fine mode is active prior to SWM selection.

12. Weight Minimisation

All Models

From version 4.00 weight minimisation has been replaced with Hofmann Weight minimisation / optimisation.

All functionality is identical to existing Hofmann wheel balancers with the following key mappings.

Hofmann Key	JBEG Key
STOP KEY	STOP KEY
RESOLUTION KEY	FINE KEY
OPT KEY	RETURN KEY
C-KEY	STAR KEY

13. Fine Mode

While the machine is in the idle state pressing the fine key toggles the display of unbalance between high and low resolution. This is indicated by observing the displayed results values. Upon pressing the key a beep is generated and the results (if displayed) are updated.

Resolutions are;

Gram, 1 or 5 grams.

Ounce, 0.05 or 0.25 ounces.

Thresholds are;

35.0 g default. Selectable via C8.

14. User Management (B9450 and B9460 only)

User management enables the operator or operators to store 4 sets of preset data. The data stored are; rim offset, rim width, rim diameter, fine mode, weight placement mode, oz / gram section, mm / inch selection.

If the user recalls a user with a weight placement mode which is not available for selection in the quick weight placement selection mode, standard weight placement selection mode is enabled upon user recall.

Select user management by holding down the star and weight keys for 3 seconds while the machine is idle. A beep is generated.

"SA" is displayed in the left panel and "- -" is displayed in the right panel.

The user can cycle through the four users (A to d) using the plus and minus keys.

The user selects where to save the current settings by pressing return. Pressing return while "- -" is displayed does not perform a save.

After save, "Rcl" is displayed in the left panel (recall) and "- -" is displayed in the right panel. As before, the user can specify which user's settings he wishes to recall, or alternatively, by selecting "- -" can choose not to recall any settings.

A beep is generated, the function exits and the display panels are cleared.

15. User Calibration

The user must balance a wheel in normal mode to less than 5 grams in both planes.

User calibration is selected by holding down the star and fine keys for 5 seconds while the machine is idle. "Cal 1" is displayed and a beep is generated.

The user performs a wheel spin. After the spin "Cal 2" is displayed. The user mounts the calibration weight and performs another spin.

After the spin the wheel is braked and there is up to a two second delay. After this delay "Cal dne" is displayed if calibration was successful. Otherwise an error message is displayed. Possible messages are;

E50 Factory calibration was not completed.

E51 Calibration failed.

E52 Calibration weight on opposite side to factory calibration.

Any operator wheel spin errors occurring during user calibration or minimisation cause the functions to exit.

16. Service Menu

The service menu is accessed by holding down the plus and minus keys for 7 seconds when the machine is idle. Note: The service menu is for service personnel only. Not for customers.

The last service code used since power on is displayed.

The service codes available can be accessed by using the plus and minus keys and selecting the desired code by pressing the return key.

The service menu can be exited by pressing the plus and minus keys together. The display is cleared and a beep is generated.

17. Service Codes

C0 Setting Factory Defaults

Displayed on selection:

"0" in display.

Step 1 options:

The PLUS or MINUS keys will toggle the displayed value between zero and one. Pressing RETURN with "1" displayed will reset the factory defaults for; rim dimensions, weight placement mode, weight placement selection mode, unbalance resolution, gram / ounce unbalance display, machine volume and unbalance suppresion threshold (3.5g).

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code without changing anything.

C4 Unbalance compensation (B9000 Version)

Displayed on selection:

"C4" in left display, "0" or "1" in right display. Factory setting is "0".

Step 1 options:

A. Spin wheel to compensate for adaptor unbalance.

The digit "1" is displayed in the left display to indicate the step number.

All adaptors, cones and wheels must be removed from the machine shaft.

Spin the flange by hand in the correct direction for wheel balancing.

Upon completion of the spin a beep is generated and the step number is incremented and displayed. Ten spins are required in total to perform the compensation. The user must repeatedly spin the shaft until this number of spins have been achieved. The machine will then beep and the function will exit.

The machine stores the new compensation values and exits to the service menu.

B. Alternatively, if C4 is already active when the service code is selected, the PLUS or MINUS keys will toggle the status of the code between 0 and 1. Pressing RETURN with 0 displayed cancels the code. If 1 is displayed and return is pressed an error beep is generated as to enable the function the shaft must be spun.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code without changing anything.

C4 Unbalance compensation (B9450 / B9460 Version)

Displayed on selection:

"C4" in left display, "0" or "1" in right display. Factory setting is "0".

Step 1 options:

A. Spin wheel to compensate for adaptor unbalance.

The digit "1" is displayed in the left display to indicate the step number.

All adaptors, cones and wheels must be removed from the machine shaft.

Lower the hood to commence a spin. After the spin is complete the machine will then beep and the function will exit.

The machine stores the new compensation values and exits to the service menu.

B. Alternatively, if C4 is already active when the service code is selected, the PLUS or MINUS keys will toggle the status of the code between 0 and 1. Pressing RETURN with 0 displayed cancels the code. If 1 is displayed and return is pressed an error beep is generated as to enable the function the shaft must be spun.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code without changing anything.

C7 Volume of Audible Signals

Displayed on selection:

"C7" in left display, "0" - "9" in right display. Factory setting is "5".

Step 1 options:

Select the required volume using the PLUS and MINUS keys. Press RETURN to confirm the value.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code without changing anything.

C8 Unbalance Threshold Suppression

Displayed on selection:

Suppression threshold in grams or ounces depending on selected display mode. Factory setting is 3.5g or equivalent.

Step 1 options:

Select the required threshold using the PLUS and MINUS keys. Press RETURN to confirm the value.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code without changing anything.

C11 Setting the Orientation mode (B9460 only)

Displayed on selection:

"0", "1" or "2" in display.

Step 1 options:

The PLUS or MINUS keys will alter the displayed value between zero and two. Pressing RETURN will select the appropriate mode. The modes are;

0 No position braking after measuring run.

1 Brake to left plane if unbalance is above threshold.

2 Brake to right plane if unbalance is above threshold.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code without changing anything.

C12 Counter Indication

Displayed on selection:

A 6-digit number is displayed across both displays (0 – 999,999).

This number indicates the total number of measurement runs performed.

Step 1 options:

Pressing the PLUS or MINUS keys will display another counter. Four counters are available. These are;

Counter 1 (C1): Total spins counter.

Counter 2 (C2): Spins since last calibration counter (can be reset by C43).

Counter 3 (C3): Total user spins counter.

Counter 4 (C4): Total service spins counter.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code.

Pressing the RETURN key will also exit the code.

C14 User Calibration

See User Calibration Description.

C21 Displaying Machine model and software version.

Displayed on selection:

Machine model name.

Step 1 options:

Holding down the PLUS or MINUS key displays the software version.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code.

Pressing the RETURN key will also exit the code.

C28 Display of the last 10 kernel error messages

Displayed on selection:

A 6 hex-digit error number is displayed across both displays. At two second intervals this number is switched with a number from 1 – 10 (1 being the most recent) indicating which error message is currently displayed.

Step 1 options:

Pressing the PLUS and MINUS keys cycles through the list of error codes.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code. Pressing the RETURN key will also exit the code.

C43 Resetting the Spin Counter C2

Displayed on selection:

"C43" in left display, "0" or "1" in right display. 0 is normal, 1 is counter reset.

Step 1 options:

The PLUS or MINUS keys will toggle the status of the code between 0 and 1. Pressing RETURN with 0 displayed exits the code without resetting the counters. If 1 is displayed and return is held down for 10 seconds the code is exited and the counters are reset.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code without changing anything.

C47 Configuring the non-volatile memory (C46 pre-version 3.50)

Displayed on selection:

"b9000", "B9450" or "b9460" in displays.

Step 1 options:

The PLUS or MINUS keys will toggle the selected machine model. Pressing RETURN will program the flash for the appropriate machine. The machine will then reset.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code without changing anything.

C63 Continuous Measuring Run (b9450 / B9460 only).

Displayed on selection:

"C63".

Step 1 options:

Lower the wheel hood to start the run. The wheel spins continuously and measuring results are displayed in grams periodically.

Raise the hood at any stage to exit the code.

C66 Displaying Virtual Dimensions of the Vibratory System.

Displayed on selection:

A floating point number in degrees from 0 – 360. This represents the vibratory system virtual distance.

Step 1 options:

Holding down the PLUS or MINUS key displays the right hand transducer distance to virtual plane.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code. Pressing the RETURN key will also exit the code.

C67 Displaying Vibratory System Phase Shift

Displayed on selection:

A 3 – 6 digit floating point number in degrees from 0 – 360. This represents the vibratory system phase shift of the left plane.

Step 1 options:

Holding down the PLUS or MINUS key displays the vibratory system phase shift of the right plane.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code. Pressing the RETURN key will also exit the code.

C69 Continuous Measuring Runs With Pauses (b9450 / B9460 only).

Displayed on selection:

The digit "1" in the left display to indicate the step number. The first pause value in the right display.

Step 1 options:

Select the first pause period in seconds using the PLUS and MINUS keys. Confirm your selection using the RETURN key.

Step 2 options:

The digit "2" in the left display to indicate the step number. The second pause value in the right display. Select the second pause period in seconds using the PLUS and MINUS keys. Confirm your selection using the RETURN key.

Step 3 options:

The digit "3" in the left display to indicate the step number.
Lower the hood to begin the measuring runs. The runs will continue to execute and results will be displayed in grams. There will be a pause between each run and the balancer will beep repeatedly to indicate that C69 is in progress.

Raise the hood at any stage to exit the code.

C72 Measuring the Mechanical Phase Shift of the Vibratory System

Displayed on selection:

The digit "1" in the left display to indicate the step number.

Step 1 options:

Mount the factory calibration rotor on the balancer. Perform a measuring run.

Step 2 options:

The digit "2" in the left display to indicate the step number.

Mount the calibration weight on the left side of the calibration rotor. Perform a measuring run.

Step 3 options:

The digit "3" in the left display to indicate the step number.

Remove the calibration weight and mount the calibration weight on the right side of the calibration rotor. Perform a measuring run.

Step 4 options:

The phase shift of the left hand plane is shown as a floating point number in degrees from 0 – 360.

Holding down the PLUS or MINUS key displays the phase shift of the right hand plane.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code.

Pressing the RETURN key will also exit the code.

C74 Indication of the Position Counter

Displayed on selection:

A positive integer representing encoder increments (512 increments from 0 – 511). This represents the angular wheel position. If the wheel position subsystem is not initialised (possibly because the machine has just been turned on and the system requires at least one revolution to initialise) "buSY" is displayed until a value is available.

Step 1 options:

Rotate the wheel to view the encoder increments changing with the wheel rotation.

Step 2 options:

NOTE: To perform this test you will have to remove the drive belt from the measuring shaft if you are testing a motor driven balancer (b9450 / b9460).

A. To test the encoder handspin the shaft mounted wheel clockwise (measuring direction) and then press the RETURN key. After a few seconds "539" should be displayed.

B. To test the encoder handspin the shaft mounted wheel counter-clockwise and then press the RETURN key. After a few seconds "551" should be displayed.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code.
Pressing the RETURN key will also exit the code.

C75 Indication of all voltages supplied to the analog-to-digital converter

Displayed on selection:

A 3 digit voltage level is displayed in the right display. An identifier from the range (a)"de1", (a)"de2", (a)"d0" – (a)"d23" indicating which A/D channel is being shown, is displayed in the left display.

Step 1 options:

Pressing the PLUS and MINUS keys cycles through the list of A/D channels.
Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code.
Pressing the RETURN key will also exit the code.

C76 Indication of the drive system voltages (B9450 / B9460 only)

Displayed on selection:

A 3 digit voltage level is displayed in the right display. An identifier indicating which value is being shown, is displayed in the left display.

Step 1 options:

Pressing the PLUS and MINUS keys cycles through the list of values.
Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code.
Pressing the RETURN key will also exit the code.

C80 SAPE Arm Calibration (b9000 / b9450)

Displayed on selection:

The digit "1" in the left display to indicate the step number. The raw value from the SAPE input potentiometer is displayed in the right display.

Step 1 options:

Pressing the RETURN key will store the home position of the SAPE arm.

Step 2 options:

The digit "2" in the left display to indicate the step number.
Pressing the RETURN key will store the fully extended position of the SAPE arm and exit the service code.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code.

C80 SAPE Arm Calibration (b9460)

Displayed on selection:

The digit "1" in the left display to indicate the step number.

Step 1 options:

Pressing the RETURN key will store the home position of the SAPE arm offset.

Step 2 options:

The digit "2" in the left display to indicate the step number.

Pressing the RETURN key will store the fully extended position of the SAPE arm.

Step 3 options:

The digit "3" in the left display to indicate the step number.

Pressing the RETURN key will store the rotary position of the SAPE arm when resting on the bottom of the calibration weight.

Step 4 options:

The digit "4" in the left display to indicate the step number.

Pressing the RETURN key will store the rotary position of the SAPE arm when resting on the top of the calibration weight and exit the service code.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code.

C81 Flange position calibration (b9460)

Displayed on selection:

The digit "1" in the left display to indicate the step number.

Step 1 options:

Pressing the RETURN key will store the distance of the flange from the machine cabinet as entered by the inner sape and exit the service code.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code.

C82 3D SAPE Arm Calibration (b9460)

Displayed on selection:

The digit "1" in the left display to indicate the step number.

Step 1 options:

Pressing the RETURN key will store the home position of the SAPE arm offset.

Step 2 options:

The digit "2" in the left display to indicate the step number.

Pressing the RETURN key will store the flange position of the extended SAPE arm.

Step 3 options:

The digit "3" in the left display to indicate the step number.

Pressing the RETURN key will store the calibration weight position of the SAPE arm and exit the service code.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code.

C83 Adjustment of the Unbalance Measurement (Factory Calibration)

Displayed on selection:

The digit "1" in the left display to indicate the step number.

Step 1 options:

Mount the factory calibration rotor on the balancer. Perform a measuring run.

Step 2 options:

The digit "2" in the left display to indicate the step number. "100" in the right display to indicate the mass in grams of the calibration weight.

Press the PLUS or MINUS keys to increment or decrement the value and RETURN to select the value.

Step 3 options:

The digit "3" in the left display to indicate the step number.

Mount the calibration weight on the left side of the calibration rotor. Perform a measuring run.

Step 4 options:

The digit "4" in the left display to indicate the step number.

Remove the calibration weight and mount the calibration weight on the right side of the calibration rotor. Perform a measuring run.

Step 5 options:

The digit "5" in the left display to indicate the step number.

Remove the calibration weight. For the motor driven machine you may leave the calibration rotor on the shaft if you wish. For the handspin machine either the rotor shaft, or a balanced wheel is required to provide the necessary momentum for the spin.

Perform a measuring run.

Step 6 options:

The digit "6" in the left display to indicate the step number.

Mount the "adjustment weight" on the shaft. Perform a measuring run.

After the measuring run the machine stores the new calibration values and exits to the service menu.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code.

C84 Compensation of the Residual Main Shaft Unbalance (B9000 version)

NOTE: This code must be used after C83 is performed. The values produced are stored and used for every subsequent unbalance measurement where C4 is disabled.

Displayed on selection:
The digit "1" in the left display to indicate the step number.

Step 1 options:
All adaptors, cones and wheels must be removed from the machine shaft.
Spin the flange by hand in the correct direction for wheel balancing.
Upon completion of the spin a beep is generated and the step number is incremented and displayed. Ten spins are required in total to perform the compensation. The user must repeatedly spin the shaft until this number of spins have been achieved. The machine will then beep and the function will exit.
The machine stores the new compensation values and exits to the service menu.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the function.

C84 Compensation of the Residual Main Shaft Unbalance (B9450 / B9460 version)

NOTE: This code must be used after C83 is performed. The values produced are stored and used for every subsequent unbalance measurement where C4 is disabled.

Displayed on selection:
The digit "1" in the left display to indicate the step number.

Step 1 options:
All adaptors, cones and wheels must be removed from the machine shaft.
Lower the hood to commence a spin. After the spin is complete the machine will then beep and the function will exit.
The machine stores the new compensation values and exits to the service menu.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the function.

C85 Copy Persistent Memory Contents from Controller Board to Opto. Board

Displayed on selection:

The service code number is shown.

Step 1 options:

Pressing the RETURN key will perform the memory copy and exit the service code.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code.

C86 Copy Persistent Memory Contents from Opto. Board to Controller Board.

Displayed on selection:

The service code number is shown.

Step 1 options:

Pressing the RETURN key will perform the memory copy and exit the service code.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the code.

C88 Compensation of the Residual Main Shaft Unbalance

Mount a medium heavy wheel on the shaft.

Enter the wheel data and balance the wheel (below 10 grams) in normal weight placement mode.

Activate service code C88 from the service menu.

Displayed on selection:

The digit "1" in the left display to indicate the step number.

The current adjustment value (0 – 5 degrees).

Step 1 options:

Perform a measuring run.

After the measuring run the digit "2" is shown in the left display to indicate the step number.

Step 2 options:

Attach a weight of 80 – 100 grams in the left correction plane and perform a measuring run.

Step 3 options:

Turn the wheel until the weight is exactly vertically below or above the main shaft. Lock this position with the mechanical shaft lock. The correction value will follow the rotation of the main shaft within the permissible range. Outside the range no value is shown.

Press the return key to store the adjustment value and exit the service code.

Pressing the PLUS and MINUS keys together at any stage will act like an Escape key and exit the function.

C110 Indication of Vcc (5V line voltage)

Displayed on selection:

The value of kernel register Vcc is displayed to 4 decimal places across both display panels. The value is updated every 200ms.

Step 1 options:

Pressing the PLUS and MINUS keys will exit the code.

C111 Measure First harmonic of the belt (b9450 / b9460)

Displayed on selection:

A scrolling display appears in the left display panel.

Step 1 options:

Tap the belt (with a weight calipers for example). The balancer will beep to confirm that measuring has started. After 2 – 3 seconds a second beep indicates the end of the measurement and the frequency is displayed in the right display panel. If no harmonic frequency was detected, "Err" is displayed. The operator can repeat the test as often as required. The test is started automatically when the belt is tapped.

The frequency is displayed in Hz from 100 – 300 Hz.

18. Factory Configuration Procedure

Perform service codes in the following order;

1. **C47**
2. **C80**
3. **C81 (b9460 only)**
4. **C82 (b9460 only)**
5. **C83**
6. **C84**
7. **C88**

The machine is now ready for use.

19. Summary of user error messages

Errors which can be generated during initialisation;

E11 SAPE arm not at home position
E13 3D SAPE arm not at home position
E82 Error encountered during self test

Errors which can be generated during a wheel spin are as follows;

E10 SAPE removed during wheel spin
E22 Speedup timeout
E23 Speed not reached
E24 Speed low
E26 No Acceleration
E27 Slip Detected
E28 Speedlimit

Error which can be generated as a result of a user calibration procedure.

E50 Factory calibration was not completed.
E51 Calibration failed.
E52 Calibration weight on opposite side to factory calibration.

Other Errors.

E12 Balancing Results cannot be displayed for HWM mode because entered rim diameter value is less than 12" if inches selected, or 305mm (HWM2), or 320mm (HWM1) if mm selected. (b9000 / b9450 only)
E25 Wheel spun in wrong direction.

20. In Field Reprogramming of Balancer

10. Turn off balancer.
11. **Place EEPROM in micro-controller socket with flat end at bottom of socket close to large blue connector. Notched end is 3 spaces short of other end of socket.**
12. Turn on balancer.
13. Three audible beeps accompanied by three flashes of the led on the micro-controller board indicate that program is loading.
14. A continuous sequence of beeps and flashes indicates that program loading is complete.
15. Turn off balancer.
16. Remove EEPROM and turn on balancer.
17. The lamp test will light and the new version number should be shown.
18. Perform service codes in the following order;
    - **C47**
    - **C80**
    - **C81 (b9460 only)**
    - **C82 (b9460 only)**
    - **C83**
    - **C84**
    - **C88**

The machine is now ready for use.