Snap-on Equipment

Hofmann Optima Series
JBC BFH / RFV Series

Service Manual

January, 2012

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4 ALL CODES

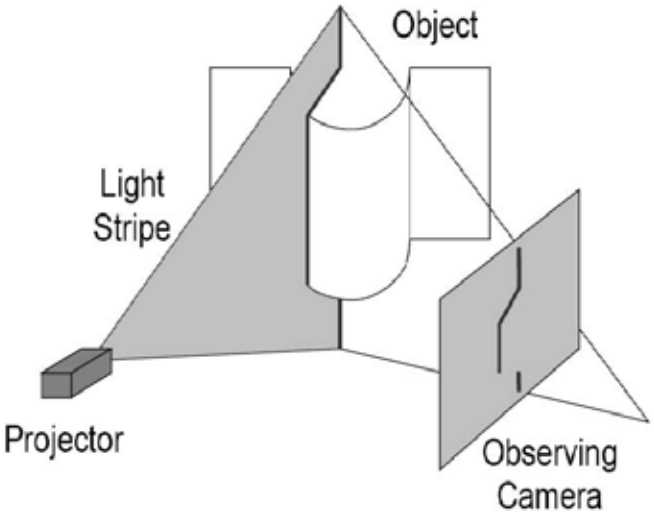
SYSTEM OVERVIEW

STRIPE OF LIGHT WHEEL DATA SYSTEM

The OPTIMA-2 and RFV 2000 are wheel balancing machines equipped with 5 camera sensors. Two cameras capture images of the wheel rim profiles (inner and outer), so that the co-ordinates of positions for application of the balancing weights can be calculated automatically and without user inputs. The cameras are also used to obtain geometrical data about rim deformation, deviation of the rim edges from its axis of rotation (Rim Runout). The third scanner provides geometrical data about tire deformations, deviation of the tire from its axis of rotation (Tire Runout), tread depth indication, tread conicity, tire wear pattern The two lateral cameras are also used to obtain tire sidewall bulges and depression, rim and tire damaging. Such data is used for advanced diagnosis of the wheel as well as to provide the user with indications on how to proceed in order to minimize the effects of such deformations.

STRIPE OF LIGHT SYSTEM

On Optima -2 and BFH 1000 -2 the sheet-of-light imaging system consists of a distance measuring device based on the principle of optical laser triangulation. This device comprises a laser source with an optical line generator, a lens and an area image sensor, CMOS on our machines. The beam of coherent light emitted by the laser source is shaped in a stripe by the optical line generator – typically a cylindrical lens. The light stripe – or sheet of light – hits the object whose distance is to be measured and intersects the object in a plurality of points. For each point, the light is diffused – scattered – in a plurality of light rays from the surface of the object and the rays are concentrated by the lens in a curve on the sensitive surface of the area image sensor. The positions of the points in the curve on the sensor are determined by digital processing of the electrical signal produced by the sensor. The positions of the points in the curve on the sensor determine, after calibration, the positions of the correspondent points on the target.



The complete process is as follows:

1. Laser power – exposure time settling. The system is able to set the optimum values of laser power and CMOS exposure time according to the ambient light, amount of reflected light, and reflectivity of objects.
2. Background subtraction. Two successive readings are taken: in the first the laser source is off, in the second is on. Complete sensor readouts are kept in the computer's memory. The difference of the acquired data provide an image of the CMOS camera without effects due to ambient light.
3. Detecting the position of the light peak on the linear optical image sensor.
4. Calculating the distance to the object by means of polynomial interpolation.

CAMERA / LASER

The OPTIMA 2 and The RFV 2000 are equipped with 5 Cameras assemblies and 1 laser assembly. Each of these assemblies are installed and calibrated as complete assemblies. A role call is performed with each one on boot up. There are no serviceable components on these assemblies with the exception of the manufactures mechanical adjustments. The laser and the rear camera assemblies have a zero stop that has no adjustment. All cameras assembly are identical and can be swapped. For troubleshooting purposes the units can be swapped at board level. Should any of these assemblies require replacement the balancer will flag an error code and force a camera calibration.

ASSY LASER POSITIONER # EAA0362G16A

This tool allows a high accuracy calibration of the Touch-less cameras.
Use this tool to adjust and calibrate the Optima 2 and RFV 2000 cameras

This tool is required after:

- Embedded PC replacement.
- HUB Board replacement.
- Camera replacement.
- Laser replacement.
- IBP box replacement.
- Geodata potentiometer/s replacement
- Vibratory assembly replacement

POWER SUPPLY BOARD (TOUCH LESS BALANCERS ONLY)

The Power Supply PCB receives 230VAC power from the Electronic box. This voltage can be measured using a Digital Volt Meter at J1 pins 1 and 2 on the Power Supply PCB. The AC power passes through onboard bridge rectifiers converting the power to 9,35 VDC which is used to power all of the (4) Scanner Motors. This 12 VDC can be measured at J2 pins 1,2 and 3. Pins 4,5 and 6 are ground connections. This voltage must be adjusted after the installation of the Power Supply PCB. Follow the procedure below to measure and adjust the output voltage to the scanner motors.

The Power Supply Board receives 230VAC from splitter connector on the EBOX and it is turned on and off by the main switch.

The 12 VDC power supply is used to power the following components:
OPTIMA 2, RFV 2000:

- HUB board, Switch Ethernet, EPCs 1, 2, 3, 4

Function:

- process the input power and distribute that to the relevant peripherals.
- exchange input signals from and output signals to peripherals.

Peripherals are the AWP board, Motor Driver Board, HUB board, Switch Ethernet, EPCs 1, 2, 3, 4
A malfunction in this module can generate an error code that belongs to a component that is correct in itself.

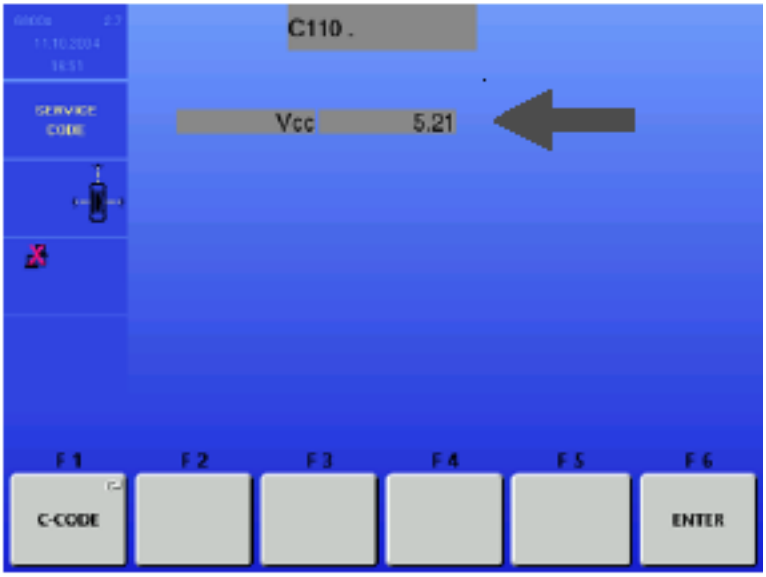
Revision identification:
The described revision can be identified on the board itself, in between connector X2 and X13.

the power supplier board is placed inside the cabinet.

12VDC POWER SUPPLIER BOARD

CHECK AND ADJUSTEMENT OF THE POWER SUPPLIER VOLTAGE

The operating voltage of the processor is +5.23 VDC ± .25 volts. If the voltage is out of range the balancer may experience a reset problem or it may display 81118b indicating that the voltage is to high or 81018b indicating that the voltage is below the acceptable range. A small adjustment on the balancer power supply can be made. Follow the procedure below to bring the voltage within the acceptable range. Before adjusting the output voltage of the power supply observe the voltage reading using C110 and record this reading. Place a DVM on the input power leads on the embedded PC, the acceptable voltage is +5.10 ± .05 A difference of .20 volts between the output (power supply pcb) and input (embedded PC) may indicate a problem with a connection or cable. Repairs must be made before attempting the voltage adjustment below.



TO CHECK THE VOLTAGE

- Power up the unit and access the “Service Menu”.
- Enter the “C-110” mode.
- Make sure that the voltage show on the screen is 5.24VDC

TO ADJUST THE VOLTAGE

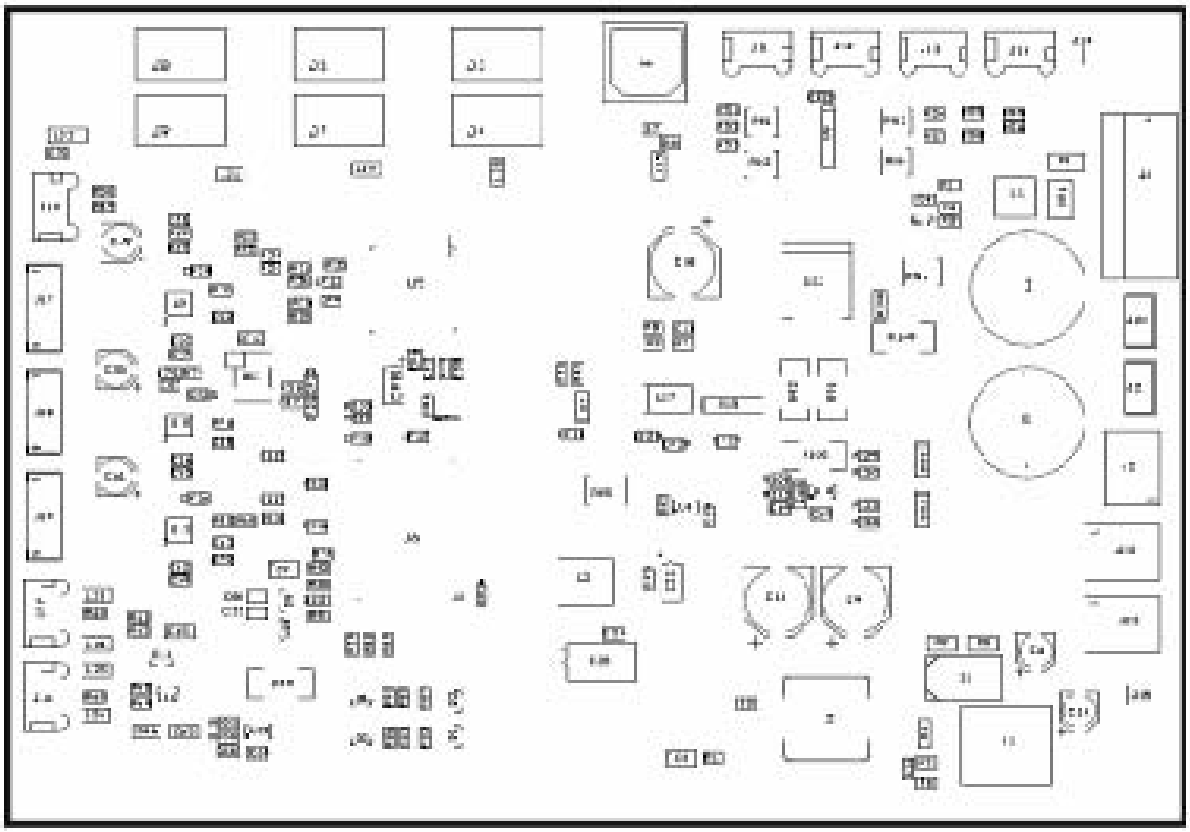
WARNING!
Dangerous High Voltages are present in this Equipment

- Turn the balancer off.
- Remove the weight tray.
- Remove the cover from the power supply.
- Turn the balancer on.
- Using a tweaker tool, rotate the trimmer to adjust the on screen voltage to +5.24VDC.

IMPORTANT! THE TRIMMER IS VERY SENSITIVE AND THEREFORE IT MUST ROTATED SLOWLY TO AVOID DANGEROUS JUMPING OF POWER SUPPLY.

HUB BOARD (OPTIMA 2 AND RFV 2000)

The HUB board is the liaison between the cameras and the Main Processor PCB inside the IBP box.
On the Optima 2 the HUB board is placed behind the wheel guard while in the RFV 2000 it is placed inside of the cabinet.



Main functions:

- Six ports Usb Hub
- Three stepper motor driver (two only are used)
- Encoder signals reading
- Three home position reading (two only are used)
- Two laser driver (one only is used)

J1	Board Power input	
pins	1,2,3	+12V (in)
	4,5,6	Gnd
J2	5.24V Power output (to Epc)	
	1,2	Gnd
	3,4	+.245V (out)
J20	Auxiliary laser supply output (NOT USED)	
	1,3	+5V when laser on, 0 when off
	2	Gnd
J21	Laser supply output	
	1,3 +	5V when laser on, 0 when off
	2	Gnd
J22	Auxiliary output (NOT USED)	
J23	Auxiliary output (NOT USED)	
J6	USB port B Connected to main EPC	
J3	USB Port A	
J4	USB Port A	
J5	USB Port A	
J7	USB Port A	
J8	USB Port A Rear Camera	
J9	USB Port A	
J11	Encoder reading input	
	1	phase A
	2	reference
	3	phase B
	4	Gnd
J12	Home position input (rear motor slotted optical switch)	
	1	+5V (out)
	2	Signal input (5V when the motor is at home position, 0V otherwise)
	3,4	Gnd
J13	Home position input (motorized laser pointer slotted optical switch)	
	1	+5V (out)
	2	Signal input (5V when the motor is at home position, 0V otherwise)
	3,4	Gnd
J14	Auxiliary input (NOT USED)	
	1	+5V (out)
	2	Signal input (0V when slotted optoswitch is closed)
	3,4	Gnd
J10	I2C bus (NOT USED)	
	1	5V out
	2	I2c Scl (Clock)
	3	I2c Sda (Data)
	4	Gnd
J17	Bipolar stepper motor drive (rear motor)	
	1	phase 1 B
	2	phase 1 A
	3	phase 2 A
	4	phase 2 B

J18 Bipolar stepper motor drive (pointer motor)
- 1 phase 1 B
- 2 phase 1 A
- 3 phase 2 A
- 4 phase 2 B

J19 Auxiliary bipolar stepper motor (NOT USED)
- 1 phase 1 B
- 2 phase 1 A
- 3 phase 2 A
- 4 phase 2 B

J15 Analog input 1 (NOT USED)
- 1 3.3V output voltage reference
- 2 Signal input
- 3 12V output
- 4 Gnd

J16 Analog input 2 (NOT USED)
- 1 3.3V Output voltage reference
- 2 Signal input
- 3 12V output
- 4 Gnd

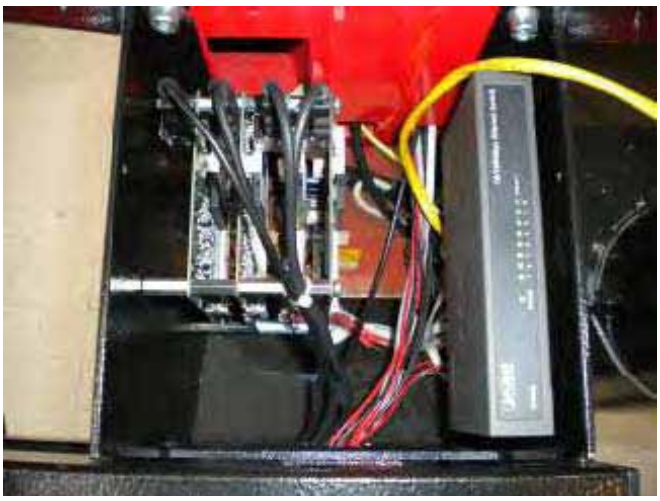
J24 Gnd

J25 Gnd

EPC CONFIGUARTION (OPTIMA 2 AND RFV 2000)

The machines are equipped by 4 EPCs Alix 3D2 assembled in a unique package inside of the cabinet on the Optima 2 and into the wheel guard support on the BFH 1000 – 2having the following data.

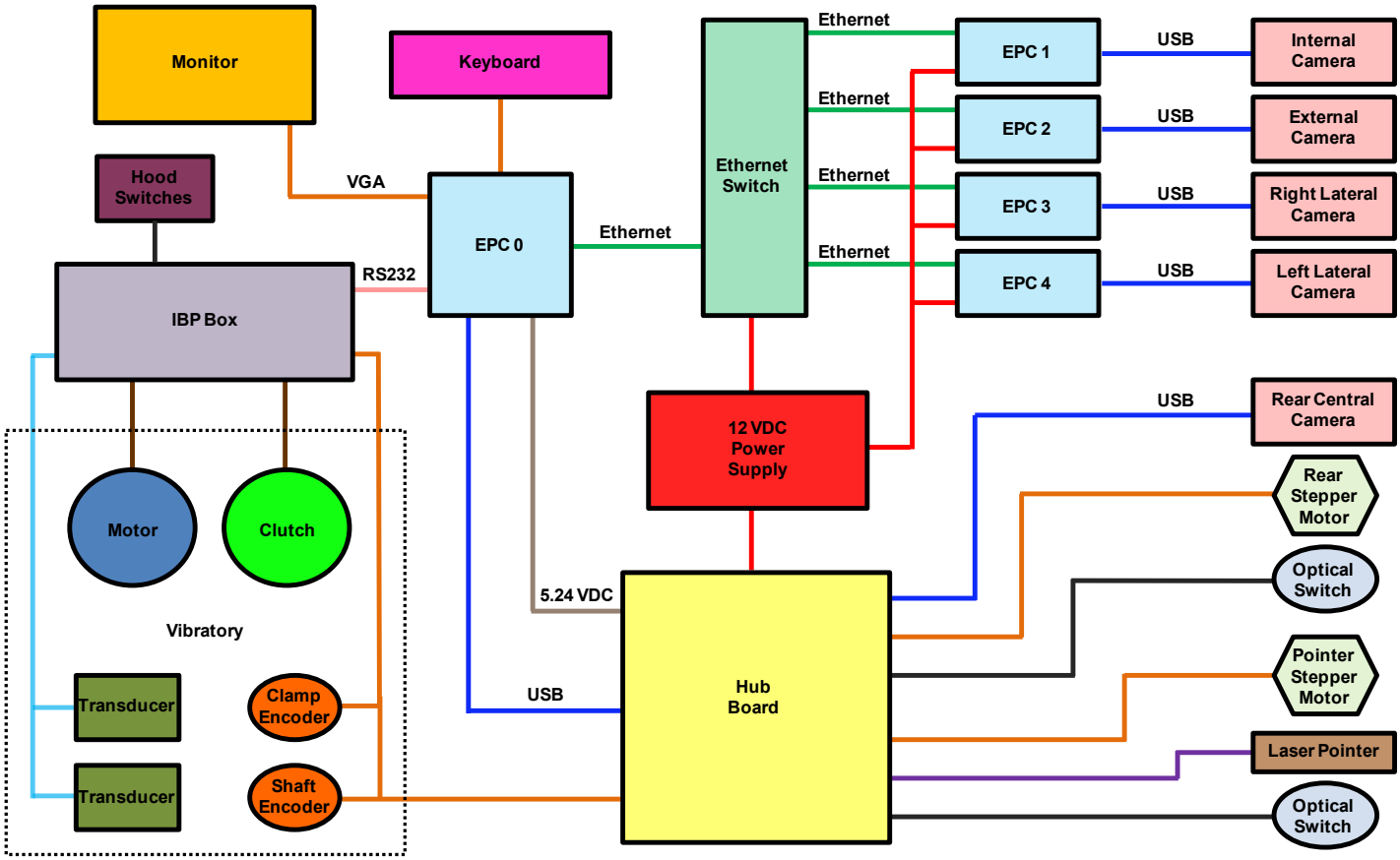
- 128MB of RAM
- USB ports: 2 Only 1 is used to connect the camera.
- NET ports: 1 used for a switch ethernet connection.
- Serial ports: 1 Not used.
- Power supplì: 12VDC



They are supplied at 12 VDC by the power supplier board and communicate to the Main EPC trough the switch Ethernet.

Every EPC is equipped by 256 MB or more Compact Flash card memory and supports a Linux software. They are used to send the images to the main EPC 0.

The switch Ethernet is placed inside of the cabinet on the Optima 2 and into the wheel guard support on the BFH 1000 – 2


Monitor
Keyboard
Hood Switches
VGA
EPC 0
Ethernet
Ethernet Switch
Ethernet
EPC 1
EPC 2
EPC 3
EPC 4
USB
Internal Camera
External Camera
Right Lateral Camera
Left Lateral Camera
IBP Box
RS232
12 VDC Power Supply
USB
Rear Central Camera
Motor
Clutch
Vibratory
5.24 VDC
Hub Board
Rear Stepper Motor
Optical Switch
Pointer Stepper Motor
Laser Pointer
Optical Switch
Transducer
Transducer
Clamp Encoder
Shaft Encoder
USB

REPLACING THE POWER CLAMP ENCODER BOARD ON OPTIMA 2 AND RFV 2000.

- Disconnect power supply.
- Remove weight tray.
- Remove the VPM plastic cover on Hofmann only
- Remove the screws that secure the camera to the balancer cabinet to access to the Optoencoder board.
- Disconnect the 4 Pin ribbon cable from the encoder PCB.
- Remove the phillip screws holding the encoder board to the bracket.
- Install the new encoder board. It must be positioned at 1- mm above the pulley and have to read the small and wider strip zones.
- Connect the 4 pin ribbon cable to the encoder PCB
- Secure again camera support to the cabinet
- Mount the VPM plastic cover.
- Mount the weight tray.

TO REPLACE THE 10 TURNS DISTANCE POTENTIOMETER ON OPTIMA 2

- Disconnect the power from the rear of the machine.
- Remove the weight tray.
- Disconnect the 1D SAPE belt from the distance rod.
- Remove the 10mm nut holding the SAPE wheel to the frame.

NOTE: DO NOT LET THE RETURN SPRING UNCOIL.

- Extract the toothed SAPE wheel from the potentiometer by using gently a small screwdriver.
- Remove the 13mm nut holding the potentiometer to the frame..

- Install 10K 10 turns potentiometer onto bracket and tighten 13mm nut.

- Make sure about the correct direction of the potenziometer. An incorrect position will cause the breakage of the potentiometer.
- Install SAPE Wheel onto potentiometer shaft and hand tighten 10mm nut.

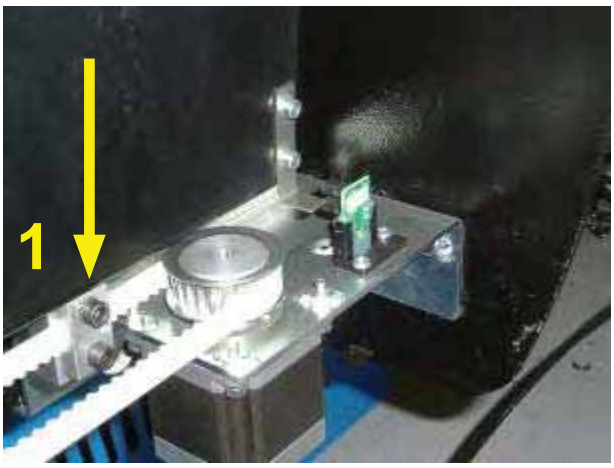
- Attach SAPE belt to the guide roller.
- Test SAPE assembly by pulling on the SAPE arm to it's full out position several times. Make sure their is no binding.
- With the SAPE arm in the HOME position select service code C80.
- Hold the SAPE wheel firmly, using a flat blade screwdriver adjust the potentiometer referring to the paragraph of C code C80
- Run service code C80 and C81 for SAPE calibration.
- Perform service code C123 to adjust the camera, C84 and C122.

REAR SCANNER DRIVE BELT

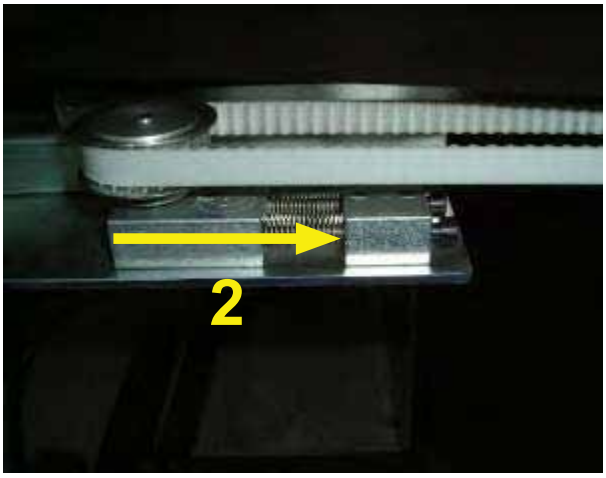
The belt will come as a single toothed belt. The rear scanner assembly moves across the back of the balancer driven by the belt installed on a drive motor and on a driven pulley system.

The replacement of the belt is very easy as follows.

1. Remove the screws (1) of the metal sheet that hold the rear scanner to the belt.
2. Push the mobile pulley (2) support as shown by the arrow and remove the bad belt.



3. Install the new belt on the pulleys and make the belt tension will be automatically made again.
4. Lock firmly the scanner to the belt with the metal sheet
5. Retest the rear scanner.
6. Remount the rear cover.



CHECK AND REPLACEMENT OF CAMERA, LASERS

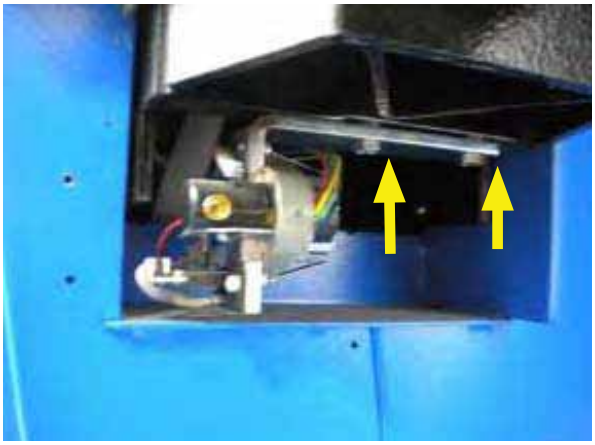
Should any of the camera assemblies require replacement it will be necessary to make some mechanical adjustment before calibrating the unit (C115, 84, 88 and 122) and returning it to service. The laser spot must run parallel to the cabinet with the C123. The ribbon cable that feeds the Laser must have some slack at the laser assembly. This can be tested with C123. A small amount of play is necessary and they should return to the home postion.

REPLACEMENT OF LASER ON OPTIMA 2 AND RFV 2000

1. Power down the unit.
2. Remove the weight tray.
3. Remove the cover behing the wheel guard (Optima 2 Only).
4. Disconnect the ribbon cable from J21 of the HUB board.
5. Disconnect the laser stepper motor cable from J18 of the HUB board.
6. Remove the 4 phillip screws that secure the shield.

7. Remove the two Hex Head Screws that secure the assembly to the vibratory.

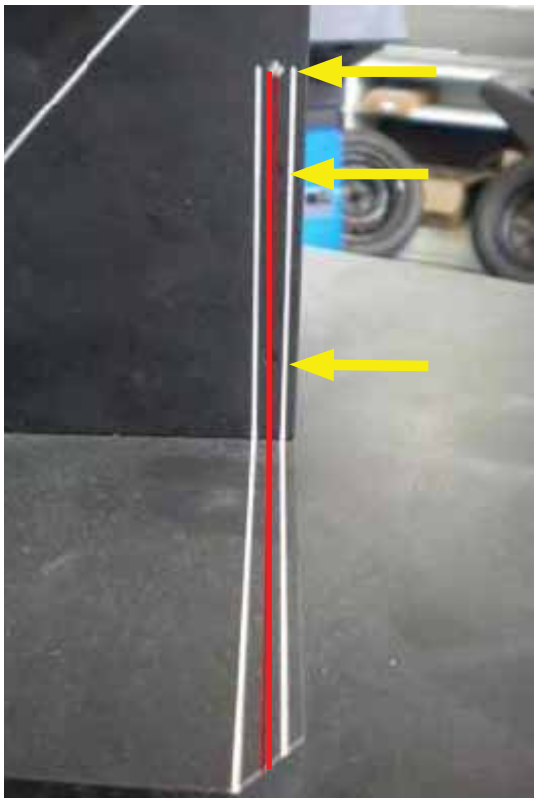
DO NOT DROP THE LASER ASSEMBLY.



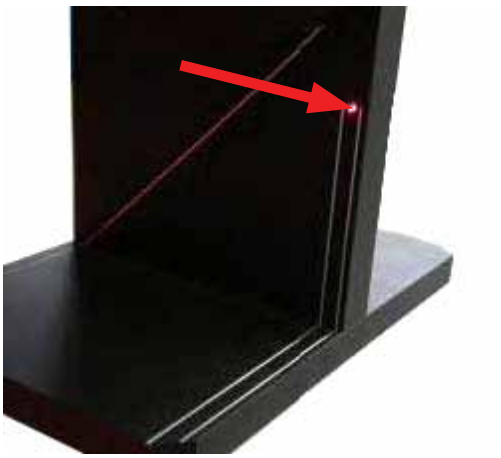
8. Install the new laser and tight the screws firmly.
9. Connect the ribbon cable to J21 of the HUB board.
10. Mount the laser shield.
11. Connect the laser stepper motor cable to J18 of the HUB board.
12. Turn the balancer on.
13. Mount the Assy Laser Positioner on the balancer with the laser reference toward the laser.

14. Select C code C123.
15. Level the Assy Laser Positioner and press the brake to lock it in position.

16. Enter “STEP 1” to turn on and move the laser.
17. Make sure that The ribbon cable that feeds the Laser must have some slack at the laser assembly.
18. Make sure that the laser spot is running within the reference lines of Assy Laser Positioner and, more important, make sure that the spot will cross the three notches shown by the arrows

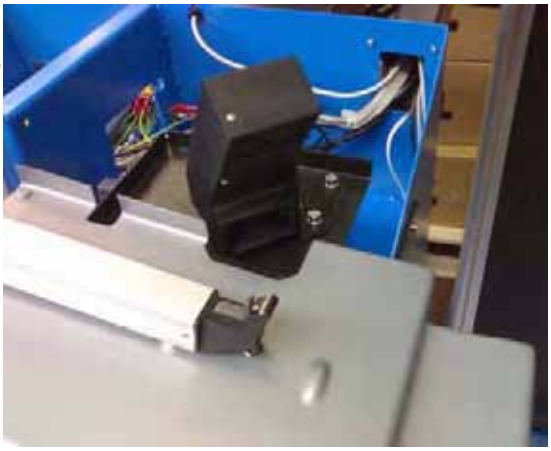


19. Make sure that when the laser stops, the laser spot is projected into the Assy Laser Positioner top notch.
20. Exit C123.
21. Remove the Assy laser positioner.
22. Turn off the balancer
23. Mount the weight tray.
24. Check if the balancer for proper operation.



REPLACEMENT OF THE INTERNAL CAMERA ON OPTIMA 2 AND RFV 2000

1. Power down the unit.
2. Remove the 3 philip screws that secure the weight tray and remove it.

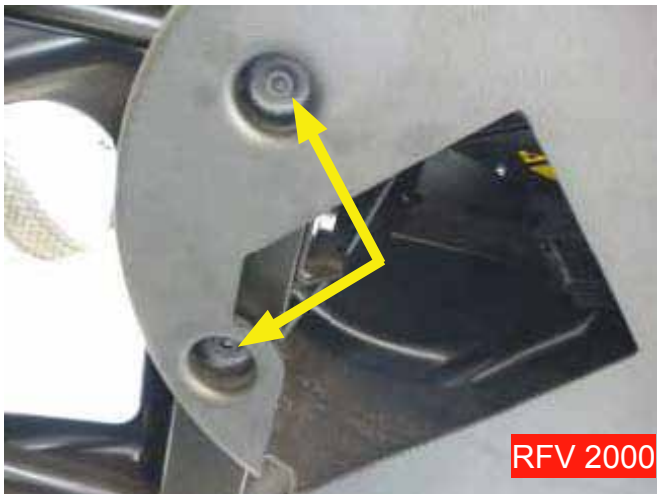


3. Unplug the USB cable. (red arrow)
4. Remove the three philip screws (yellow arrows) that secure the camera to the bracket.

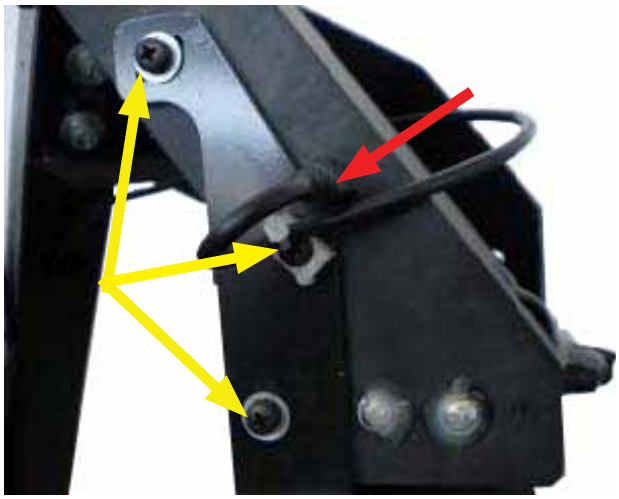
5. Install a new camera and plug the usb cable.
6. Mount the weight tray.
7. Turn on the balancer.
8. Change the operating mode of the balancer from “PROFILING” tov“MANUAL”.
9. Perform a couple of balancing spins.
10. Make the camera adjustment with C code C123.
11. Perform the camera calibration with C code C122.
12. Save with C90.
13. Change the operating mode of the balancer from “MANUAL” to “PROFILING”.
14. Check the balancer for proper operation.

REPLACEMENT OF THE LATERAL CAMERA ON OPTIMA 2 AND RFV 2000

1. Power down the unit.
2. Remove the screws that secure the shield and remove the shield to access to the camera.



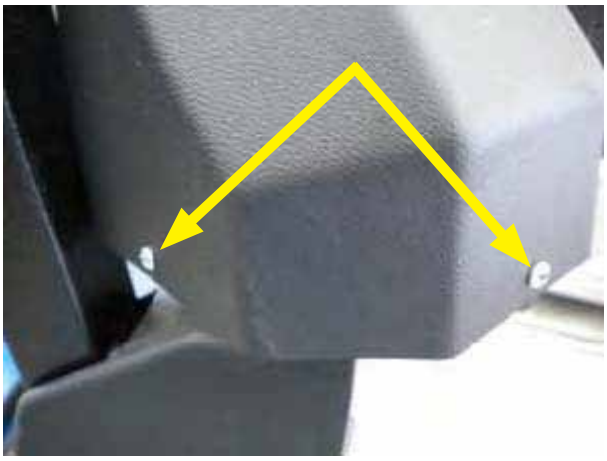
3. Unplug the USB cable. (red arrow)
4. Remove the three philip screws (yellow arrows) that secure the camera to have remove for the holder.



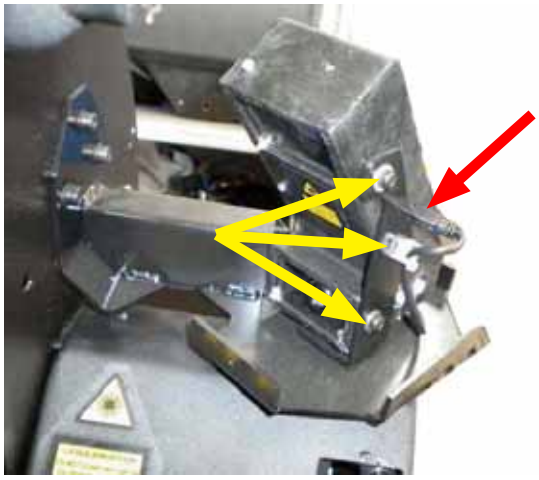
5. Install a new camera and plug the usb cable.
6. Turn on the balancer.
7. Change the operating mode of the balancer from “PROFILING” to “MANUAL”.
8. Perform a couple of balancing spins.
9. Make the camera adjustment with C code C123.
10. Perform the camera calibration with C code C122.
11. Save with C90.
12. Change the operating mode of the balancer from “MANUAL” to “PROFILING”.
13. Install the shield again.
14. Check the balancer for proper operation.

REPLACEMENT OF REAR RIGHT AND LEFT CAMERAS ON OPTIMA 2 AND RFV 2000

1. Power down the unit.
2. Remove the screws that secure the shield and remove the shield to access to the camera.



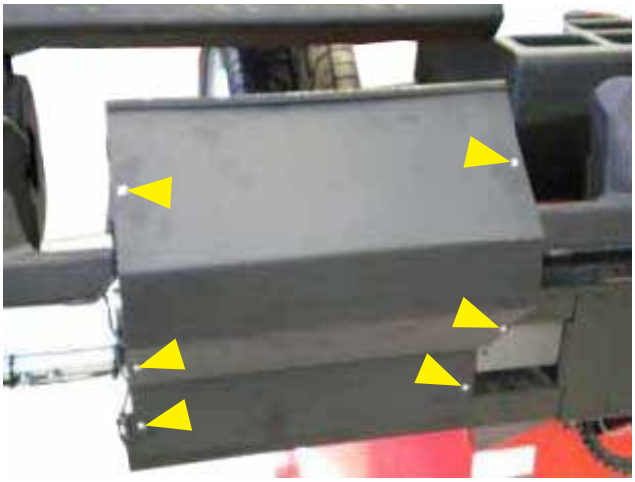
3. Unplug the USB cable (red arrow)
4. Remove the three philip screws (yellow arrows) that secure the camera to the bracket.



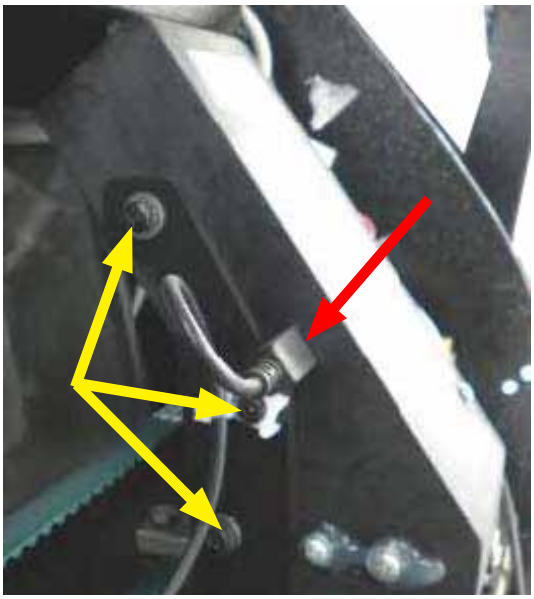
5. Install a new camera and plug the USB cable.
6. Turn on the balancer.
7. Change the operating mode of the balancer from “PROFILING” to “MANUAL”.
8. Perform a couple of balancing spins.
9. Make the camera adjustment with C code C123.
10. Perform the camera calibration with C code C122.
11. Save with C90.
12. Change the operating mode of the balancer from “MANUAL” to “PROFILING”.
13. Install the shield.
14. Check the balancer for proper operation.

REPLACEMENT OF THE REAR CAMERA ON OPTIMA 2 AND RFV 2000

1. Power down the unit.
2. Remove the screws that secure the rear cover and remove it to access to the camera.



3. Unplug the USB cable. (red arrow)
4. Remove the three philip screws (yellow arrows) that secure the camera to bracket.

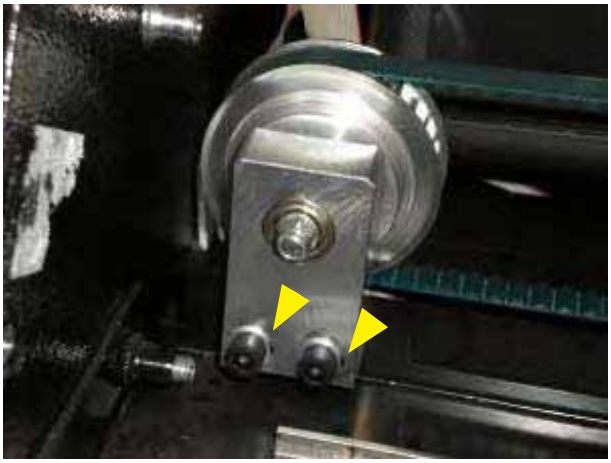


5. Install a new camera and plug the usb cable.
6. Turn on the balancer.
7. Change the operating mode of the balancer from “PROFILING” to “MANUAL”.
8. Perform a couple of balancing spins.
9. Make the camera adjustment with C code C123.
10. Perform the camera calibration with C code C122.
11. Save with C90.
12. Change the operating mode of the balancer from “MANUAL” to “PROFILING”.
13. Install the cover.
14. Check the balancer for proper operation.

REAR CAMERA DRIVE BELT REPLACEMENT

The belt will come as a single toothed belt. The rear camera assembly moves across the back of the balancer driven by the belt installed on a drive motor and on a driven pulley system.

1. Remove the screws that secure the rear cover and remove it to access to the rear camera (see 4.28.12)
2. Loosen the screws (yellow arrows) to release the defective belt.



3. Loosen the two hex head screws and remove the defective drive belt.
4. Install the new belt on the pulleys and tighten the screws firmly.
5. Complete the belt tension by sliding the drive pulley and firmly tighten the two set screws.
6. Retest the camera with C123.
7. Remount the rear cover.

SELF TEST DURING START UP

The BFH/Optima performs a start-up routine when power is applied. A series of self diagnostic tests is conducted 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 displayed. A three-tone signal is given once, the machine is operative. In case there is a functional error, it must be acknowledged by pressing the STOP or ESC key to proceed.

This is for informational purposes.

POSSIBLE “E-CODES” “C-CODES” AND “H-CODES”

1. ***Communication between microcontroller and embedded PC (Blue screen)***
   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. Check cabling between embedded PC and processor or cable to switches on the front panel.

2. ***Check availability of keyboard (E 300)***
   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)***
   Service Codes: C85, C86 to copy content of permanent 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. It will be necessary to perform a manufatures calibration (C83, C84, C88)

4. ***Check model information (E 900)***
   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)***
   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)***
   Service Codes: C56 to check the pedal switches.
   C75, AdC16 to check voltage to external switches. (See “C75”)
   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. ***Power clamp service interval expired E93***
   All codes available for this model.
   C10810
   C10811
   Service Codes: C110 to check 5V voltage.
   If the 5V voltage is below or above a limit the error code is displayed.

8. ***OPTIMA 1,OPTIMA 2, BFH 1000, RFV 2000 Calibration*** ***(E 360)***

Service Codes : All codes available for this model
The BFH/Optima hardware requires wheel profiler position calibration.
When the camera controller board is replaced on the machine, the software detected that calibration data is missing.
Calibration procedure C122 is required to calibrate the actual position of the laser scanners with respect to the balancer reference plane.

9. ***OPTIMA 1,OPTIMA 2, BFH 1000, RFV 2000 Hardware*** ***(E 361)***

Service Codes: All codes available for this model
Wheel profiler is not present or responding during the self test. The balancer controller board was not able to communicate with the camera controller board during start-up test.
Possible causes:

- ► The camera controller board is missing or dead.
- ► The cable connecting the balancer controller board and the camera controller board is un plugged, damaged or missing.

10. ***OPTIMA 1,OPTIMA 2, BFH 1000, RFV 2000 Hardware (E 362)***

Service Codes : All codes available for this model
Main camera board self test failed.
Balancing is not possible since wheel data cannot be scanned.
Problem during power up. Switch power off and on again. Possible camera board failure.

11. ***OPTIMA 1,OPTIMA 2, BFH 1000, RFV 2000 Inner Scanner*** ***(E 363)***

Service Codes : All codes available for this model
Left side scanner self test failed or CCD not calibrated or zero mark not detected.
Balancing is not possible since wheel data cannot be scanned.

12. ***OPTIMA 1,OPTIMA 2, BFH 1000, RFV 2000 Outer Scanner*** ***(E 364)***

Service Codes : All codes available for this model
Right side scanner self test failed or CCD not calibrated or zero mark not detected.
Balancing is not possible since wheel data cannot be scanned.

13. ***OPTIMA 1,OPTIMA 2, BFH 1000, RFV 2000 Rear Scanner*** ***(E 365) (Excluding 800)***

Service Codes : All codes available for this model
Rear scanner self test failed or CCD not calibrated or zero mark not detected.
Wheel data can be scanned, balancing is possible. Runout measurement of the wheel is not possible.

14. ***OPTIMA 1,OPTIMA 2, BFH 1000, RFV 2000 main camera board memory*** ***(E 366)***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:

- ► there is a fault in the camera controller board

Corrective actions:

- ► check the camera controller board

15. ***OPTIMA 2 BFH 1000 RFV 2000 motor power supply*** ***(E 367)***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:

- ► the cable connecting the camera controller board and the motor power supply board is unplugged, damaged or missing
- ► the motor power supply is not configured properly
- ► there is a fault in the motor power supply board
- ► the cable connecting the mains supply and the motor power supply board is unplugged, damaged or missing

Corrective actions:
- ► check all items above

16. ***OPTIMA 1,OPTIMA 2, BFH 1000, RFV 2000 main camera board A/D converter*** ***E 368***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:
- ► there is a fault in the camera controller board

Corrective actions:
- ► check the camera controller board

17. ***OPTIMA 1,OPTIMA 2, BFH 1000, RFV 2000*** main shaft encoder zero mark ***E 369***

Affected models: Models with optima hardware
Service Codes : C123
Possible causes:
- ► there is a fault in the camera controller board
- ► there is a fault in the encoder
- ► the cable connecting the camera controller board and the encoder board is unplugged, missing or damaged

Corrective actions:
- ► check the camera controller board
- ► check the encoder
- ► check the connections

18. ***OPTIMA 1,OPTIMA 2, BFH 1000, RFV 2000 inner CCD signals*** ***E 370***

Affected models: Models with optima hardware
Service Codes : C123
Possible causes:
- ► the flat cable connecting the camera controller board and the inner scanner CCD board is unplugged, missing or damaged
- ► there is a fault in the inner scanner CCD board
- ► there is a fault in the camera controller board
- ► the supply voltage is configured too high on the power interface board

Corrective actions:
- ► check all items above
- ► switch power off and on again; should the problem not go away please call service

19. ***OPTIMA 1,OPTIMA 2, BFH 1000, RFV 2000 inner scanner memory*** ***E 371***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:
- ► the flat cable connecting the camera controller board and the inner scanner CCD board is unplugged, missing or damaged
- ► there is a fault in the inner scanner CCD board
- ► there is a fault in the camera controller board

Corrective actions:
- ► check the connections
- ► check the inner scanner CCD board
- ► check the camera controller board
- ► switch power off and on again; should the problem not go away please call service

20. ***OPTIMA 1,OPTIMA 2, BFH 1000, RFV 2000 inner scanner memory*** ***E 372***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:

- ► he flat cable connecting the camera controller board and the inner scanner CCD board is partially unplugged or damaged
- ► there is a fault in the inner scanner CCD board

Corrective actions:

- ► check the connections
- ► check the inner scanner CCD board
- ► switch power off and on again; should the problem not go away please call service

21. ***OPTIMA 1,OPTIMA 2, BFH 1000, RFV 2000 inner scanner calibration*** ***E 373***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:

- ► the inner scanner has not been factory calibrated

Corrective actions:

- ► please call service and replace the inner scanner

22. ***OPTIMA 1,OPTIMA 2, BFH 1000, RFV 2000*** inner motor power supply ***E 374***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:

- ► the cable connecting the camera controller board and the inner scanner motor is unplugged, damaged or missing
- ► the motor power supply is not configured properly
- ► there is a fault in the motor power supply board
- ► the cable connecting the mains supply and the motor power supply board is unplugged, damaged or missing
- ► there is a fault in the inner scanner motor
- ► there is a fault in the camera controller board motor drivers

Corrective actions:

- ► check all items above

23. ***OPTIMA 1,OPTIMA 2, BFH 1000, RFV 2000*** inner scanner zero mark ***E 375***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:

- ► the flat cable connecting the camera controller board and the inner scanner CCD board is unplugged, missing or damaged
- ► there is a fault in the inner scanner CCD board
- ► the inner scanner is locked
- ► the inner scanner zero mark is missing, bent, locked or damaged
- ► the cable connecting the camera controller board and the inner scanner motor is unplugged, damaged or missing
- ► there is a fault in the motor power supply board
- ► there is a fault in the inner scanner motor
- ► there is a fault in the camera controller board motor drivers

Corrective actions:

- ► check all items above

24. ***OPTIMA 1,OPTIMA 2, BFH 1000, RFV 2000*** inner motor missing steps ***E 376***

Affected models: Models with optima hardware
Service Codes : C123
Possible causes:

- ► the inner scanner movement is not smooth or it is striking the frame
- ► the motor power supply is not configured properly
- ► there is a fault in the motor power supply board
- ► there is a fault in the inner scanner motor
- ► there is a fault in the camera controller board motor drivers
- ► the cable connecting the camera controller board and the inner scanner motor is partially unplugged or damaged

Corrective actions:

- ► check all items above

25. ***OPTIMA 1,OPTIMA 2, BFH 1000, RFV 2000*** inner laser power supply ***E 377***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:

- ► the flat cable connecting the camera controller board and the inner scanner CCD board is unplugged, missing or damaged
- ► the cable of the laser module of the inner scanner is damaged or there is a fault in the laser module itself
- ► there is a fault in the camera controller board laser drivers

Corrective actions:

- ► check all items above

26. ***OPTIMA 1,OPTIMA 2, BFH 1000, RFV 2000*** inner laser modulation ***E 378***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:

- ► the flat cable connecting the camera controller board and the inner scanner CCD board is unplugged, missing or damaged
- ► the cable of the laser module of the inner scanner is damaged or there is a fault in the laser module itself
- ► there is a fault in the camera controller board laser drivers

Corrective actions:

- ► check all items above

27. ***OPTIMA 1,OPTIMA 2, BFH 1000, RFV 2000*** outer CCD signals ***E 380***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:

- ► the flat cable connecting the camera controller board and the outer scanner CCD board is unplugged, missing or damaged
- ► there is a fault in the outer scanner CCD board
- ► there is a fault in the camera controller board
- ► the supply voltage is configured too high on the power interface board

Corrective actions:

- ► check all items above
- ► switch power off and on again; should the problem not go away please call service

28. OPTIMA 1, OPTIMA 2, BFH 1000, RFV 2000 outer scanner memory E 381

Affected models : Models with optima hardware
Service Codes : C123

Possible causes:
- ► the flat cable connecting the camera controller board and the outer scanner CCD board is unplugged, missing or damaged
- ► there is a fault in the outer scanner CCD board
- ► there is a fault in the camera controller board

Corrective actions:
- ► check the connections
- ► check the outer scanner CCD board
- ► check the camera controller board
- ► switch power off and on again; should the problem not go away please call service

29. OPTIMA 1, OPTIMA 2, BFH 1000, RFV 2000 outer scanner memory ***E 382***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:
- ► the flat cable connecting the camera controller board and the outer scanner CCD board is partially unplugged or damaged
- ► there is a fault in the outer scanner CCD board

Corrective actions:
- ► check the connections
- ► check the outer scanner CCD board
- ► switch power off and on again; should the problem not go away please call service

30. OPTIMA 1, OPTIMA 2, BFH 1000, RFV 2000 outer scanner calibration ***E 383***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:
- ► the outer scanner has not been factory calibrated

Corrective actions:
- ► please call service and replace the outer scanner

31. OPTIMA 1, OPTIMA 2, BFH 1000, RFV 2000 outer motor power supply ***E 384***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:
- ► the cable connecting the camera controller board and the outer scanner motor is unplugged, damaged or missing
- ► the motor power supply is not configured properly
- ► there is a fault in the motor power supply board
- ► the cable connecting the mains supply and the motor power supply board is unplugged, damaged or missing
- ► there is a fault in the outer scanner motor
- ► there is a fault in the camera controller board motor drivers

Corrective actions:
- ► check all items above

32. OPTIMA 1, OPTIMA 2, BFH 1000, RFV 2000 outer scanner zero mark ***E 385***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:
- ► the flat cable connecting the camera controller board and the outer scanner CCD board is unplugged, missing or damaged
- ► there is a fault in the outer scanner CCD board
- ► the outer scanner is locked
- ► the outer scanner zero mark is missing, bent, locked or damaged

- ► the cable connecting the camera controller board and the outer scanner motor is unplugged, damaged or missing
- ► there is a fault in the motor power supply board
- ► there is a fault in the outer scanner motor
- ► there is a fault in the camera controller board motor drivers

Corrective actions:
- ► check all items above

33. OPTIMA 1, OPTIMA 2, BFH 1000, RFV 2000 outer motor missing steps ***E 386***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:
- ► the outer scanner movement is not smooth or it is striking the frame
- ► the motor power supply is not configured properly
- ► there is a fault in the motor power supply board
- ► there is a fault in the outer scanner motor
- ► there is a fault in the camera controller board motor drivers
- ► the cable connecting the camera controller board and the outer scanner motor is partially unplugged or damaged

Corrective actions:
- ► check all items above

34. OPTIMA 1, OPTIMA 2, BFH 1000, RFV 2000 outer laser power supply ***E 387***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:
- ► the flat cable connecting the camera controller board and the outer scanner CCD board is unplugged, missing or damaged
- ► the cable of the laser module of the outer scanner is damaged or there is a fault in the laser module itself
- ► there is a fault in the camera controller board laser drivers

Corrective actions:
- ► check all items above

35. OPTIMA 1, OPTIMA 2, BFH 1000, RFV 2000 outer laser modulation ***E 388***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:
- ► the flat cable connecting the camera controller board and the outer scanner CCD board is unplugged, missing or damaged
- ► the cable of the laser module of the outer scanner is damaged or there is a fault in the laser module itself
- ► there is a fault in the camera controller board laser drivers

Corrective actions:
- ► check all items above

36. OPTIMA 1, OPTIMA 2, BFH 1000, RFV 2000 rear CCD signals ***E 390***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:
- ► the flat cable connecting the camera controller board and the rear scanner CCD board is unplugged, missing or damaged
- ► there is a fault in the rear scanner CCD board
- ► there is a fault in the camera controller board
- ► the supply voltage is configured too high on the power interface board

Corrective actions:

- ► check all items above
- ► switch power off and on again; should the problem not go away please call service

37. OPTIMA 2 BFH 1000 RFV 2000 rear scanner memory ***E 391***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:

- ► the flat cable connecting the camera controller board and the rear scanner CCD board is unplugged, missing or damaged
- ► there is a fault in the rear scanner CCD board
- ► there is a fault in the camera controller board

Corrective actions:

- ► check the connections
- ► check the rear scanner CCD board
- ► check the camera controller board
- ► switch power off and on again; should the problem not go away please call service

38. OPTIMA 2 BFH 1000 RFV 2000 rear scanner memory ***E 392***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:

- ► the flat cable connecting the camera controller board and the rear scanner CCD board is partially unplugged or damaged
- ► there is a fault in the rear scanner CCD board

Corrective actions:

- ► check the connections
- ► check the rear scanner CCD board
- ► switch power off and on again; should the problem not go away please call service

39. OPTIMA 2 BFH 1000 RFV 2000 rear scanner calibration ***E 393***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:

- ► the rear scanner has not been factory calibrated

Corrective actions:

- ► please call service and replace the rear scanner

40. OPTIMA 2 BFH 1000 RFV 2000 rear motor power supply ***E 394***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:

- ► the cable connecting the camera controller board and the rear scanner motor is unplugged, damaged or missing
- ► the motor power supply is not configured properly
- ► there is a fault in the motor power supply board
- ► the cable connecting the mains supply and the motor power supply board is unplugged, damaged or missing
- ► there is a fault in the rear scanner motor
- ► there is a fault in the camera controller board motor drivers

Corrective actions:

- ► check all items above

41. OPTIMA 2 BFH 1000 RFV 2000 rear scanner zero mark ***E 395***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:

- the flat cable connecting the camera controller board and the rear scanner CCD board is unplugged, missing or damaged
- there is a fault in the rear scanner CCD board
- the rear scanner is locked
- the rear scanner zero mark is missing, bent, locked or damaged
- the cable connecting the camera controller board and the rear scanner motor is unplugged, damaged or missing
- there is a fault in the motor power supply board
- there is a fault in the rear scanner motor
- there is a fault in the camera controller board motor drivers

Corrective actions:

- check all items above

42. OPTIMA 2 BFH 1000 RFV 2000 rear motor missing steps ***E 396***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:

- the rear scanner movement is not smooth or it is striking the frame
- the motor power supply is not configured properly
- there is a fault in the motor power supply board
- there is a fault in the rear scanner motor
- there is a fault in the camera controller board motor drivers
- the cable connecting the camera controller board and the rear scanner motor is partially unplugged or damaged

Corrective actions:

- check all items above

43. OPTIMA 1, OPTIMA 2, BFH 1000, RFV 2000 rear laser power supply ***E 397***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:

- the flat cable connecting the camera controller board and the rear scanner CCD board is unplugged, missing or damaged
- the cable of the laser module of the rear scanner is damaged or there is a fault in the laser module itself
- there is a fault in the camera controller board laser drivers

Corrective actions:

- check all items above

44. OPTIMA 1, OPTIMA 2, BFH 1000, RFV 2000 rear laser modulation ***E 398***

Affected models: Models with optima hardware
Service Codes : C123
Possible causes:

- the flat cable connecting the camera controller board and the rear scanner CCD board is unplugged, missing or damaged
- the cable of the laser module of the rear scanner is damaged or there is a fault in the laser module itself
- there is a fault in the camera controller board laser drivers

Corrective actions:

- check all items above

45. OPTIMA 1, OPTIMA 2, BFH 1000, RFV 2000 rear shift motor power supply ***E 404***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:

- the cable connecting the camera controller board and the rear shift scanner motor is unplugged, damaged or missing
- the motor power supply is not configured properly
- there is a fault in the motor power supply board
- the cable connecting the mains supply and the motor power supply board is unplugged, damaged or missing
- there is a fault in the rear shift scanner motor
- there is a fault in the camera controller board motor drivers

Corrective actions:

- check all items above

46. OPTIMA 1, OPTIMA 2, BFH 1000, RFV 2000 rear shift scanner zero mark ***E 405***

Affected models: Models with optima hardware
Service Codes : C123
Possible causes:

- the flat cable connecting the camera controller board and the rear shift scanner CCD board is unplugged, missing or damaged
- there is a fault in the rear shift scanner CCD board
- the rear shift scanner is locked
- the rear shift scanner zero mark is missing, bent, locked or damaged
- the cable connecting the camera controller board and the rear shift scanner motor is unplugged, damaged or missing
- there is a fault in the motor power supply board
- there is a fault in the rear shift scanner motor
- there is a fault in the camera controller board motor drivers

Corrective actions:

- check all items above

47. Check OPTIMA rear shift motor missing steps ***E 406***

Affected models : Models with optima hardware
Service Codes : C123
Possible causes:

- the rear shift scanner movement is not smooth or it is striking the frame
- the motor power supply is not configured properly
- there is a fault in the motor power supply board
- there is a fault in the rear shift scanner motor
- there is a fault in the camera controller board motor drivers
- the cable connecting the camera controller board and the rear shift scanner motor is partially unplugged or damaged

Corrective actions:

- check all items above

48. 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.

49. 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

50. 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.

51. ***Hardware tests C1- --- -***

If an error occurs 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. Refer to all Error Codes in Appendix A

The following test are performed:

- ► Power supply voltage (235V)
- ► 5V line
- ► Incremental encoder (Current of optoelectronic LED)
- ► Transducer signal available
- ► Auto Stop System (Voltage for relay on Motor Control Board)

A. Hardware test - common errors

C10F02 - Test returned with an error. No valid test results available
C10F07- Test function reported an unkown error
C10F18- Test timed out. No valid test results available

B. Hardware test - Power supply voltage

C10800
C10801
C10804

Service Codes: C55 to check line voltage.
If the line voltage is below or above a limit the error code is displayed. (See “C55”)

C. Hardware test - 5V line

C10810
C10811

Service Codes: C110 to check 5V voltage.
If the 5V voltage is below or above a limit the error code is displayed.

D. Hardware test - Current of optoelectronic LED

C10705
C10706
C10707
C10708

Service Codes: C75, AdC1 to check LED
If the cutrrent / voltage is below or above a limit the error code is displayed.

E. Hardware test - Transducer signals

C10410
C10420
C10430

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.

F. Hardware test - Auto stop system

C10380
C10381
C10382
C10383

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.

After a successful boot up the following screen will appear on the display.

NOTES

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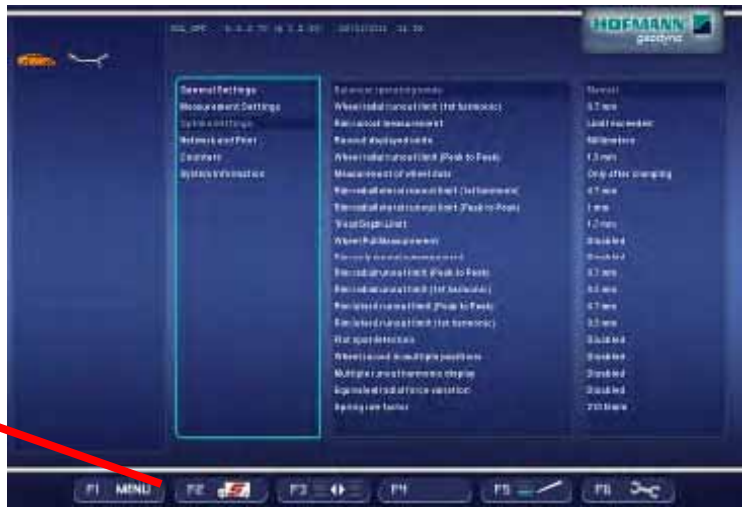
SERVICE CODES

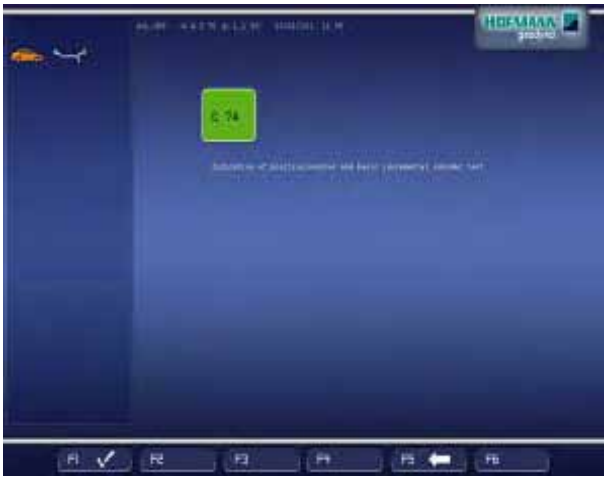
ENTERING C CODES AND OPTIONS

1. From the main screen open the F1 MENU, then select the voice “SETTINGS”.

2. Press F4 three times and the Service button will appear on F2.



3. Press the appearing button "Service" to go to the service code menu.
4. Turn the wheel or scroll with a finger the digital touch cursor to choose a service code.



5. Press F1 or OK to confirm the choice.

Options	Turn the wheel or scroll with a finger the digital touch cursor and 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 (F1) to acknowledge the option chosen.
Abort	Press STOP or ESC or F5 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.

USER C CODES REFERENCE

C0 Load configuration from default profile

Options

0 : No action
1 : Set default values

Special function
None

Description
Pressing the Acknowledgment key resets the user settings to values defined under factory setting profile (default values).
The chosen mode of operation can be transferred to the permanent memory.
The following modes of operation are activated simultaneously by pressing the Acknowledgment key:

Function	***Status/value***		***Code***
Unbalance display	dynamic		
Wheel dimensions	distance = 115mm (SAPE) = 165mm (geodata) diameter = 6.5”, width = 14”		
Wheel type	car in inches	Type 1	
Weight placement	normal	nor.	
Resolution of unbalance readings	low	0	C1
Suppression of minor unbalance readings	on	1	C2
Measurement units of the unbalance readings	according to the model	HWT:0	
	HWT: gram, HNA: ounces	HNA:1	C3
Compensation of adaptor unbalance	off	0	C4
Automatic braking on lifting the wheel guard	on	1	C5
Number of revolutions for measurement	5 - 25	10	C6
Volume of audible signal	0 - 100	50	C7
Threshold for unbalance suppression in grams/ounces	3.5 -20 g	3.5 g	C8
according to C3	0.12 - 0.71 oz	0.12 oz	
Position brake and indexing (R2.2 or higher)	on	1	C11
Start of measurement by closing wheel guard	off	0	C13
Actuation direction of pedal for clamping/releasing	lifting	0	C26
Time for screensaver (R2.2 or higher)	disabled	0	C27

C1 Resolution of unbalance readings

Options
0 * : Low resolution
1 : High resolution

Special function
None

Description

Wheel type	Resolution of unbalance readings		Suppression of
	low	high	minor readings
1, 2, 3, 6(car)	5 grams	1 grams	threshold value x 1
4, 5 (light truck)	10 grams	2 grams	threshold value x 2
1, 2, 3, 6 (car)	0.25 ounces	0.05 ounces	threshold value x 1
4, 5 (light truck)	0.5 ounces	0.1 ounces	threshold value x 2

The selected mode of operation can be transferred to the permanent memory.

Comments
The asterisk “*” marks the factory-adjusted default.

C2 Suppression of minor unbalance readings

Options
0 : Suppression off
1 * : Suppression on

Special function
None

Description
In order to signal to the operator that the required balance quality for a correction plane has been reached, the unbalance below the threshold set using C8 will be read out as zero. In some cases this suppression may not be useful and can, therefore, be switched off temporarily using the precision/FINE key, or permanently using code C2.
The chosen mode of operation can be transferred to the permanent memory.

Comments
The asterisk “*“ marks the factory-adjusted default.

C3 Measurement units of unbalance readings

Options
0 * : Readings in gram
1 ** : Readings in ounce

Special function
None

Description
The state defines the measurement unit of the unbalance readings (gram/ounce) active after power-on and execution of C0.
The chosen mode of operation can be transferred to the permanent memory.

Comments
The asterisk
“*“ marks the factory-adjusted default for HWT models,
“**” marks the default for the HNA models

C4 Compensation of adaptor unbalance

Options
None

Special function
None

Description
Set code C4, close the wheel guard and start an extended measuring run by pressing the START key. After the measuring run state switches automatically to 1, the adaptor symbol comes up and the mode is quit.
Resetting the state to 0 cancels compensation of adaptor unbalance.
Compensation is also cancelled by calibration, readjustment by the operator, an optimisation run or by turning off the machine.

C5 Automatic braking when the wheel guard is opened

Options

0	:	No braking when wheel guard is lifted
1 *	:	Braking when wheel guard is lifted

Special function
None

Description
With status = 0, there is no braking action when the wheel guard is raised; but the drive is switched off, so that lateral and radial run-out of the wheel can be observed. Safety goggles should be worn when doing so. If the wheel guard is raised before the measurement run has been completed and if the mode of operation «Starting a measurement run by closing the wheel guard» is set, the measurement run will be re-started on closing the wheel guard again. After completion of the unbalance measurement and observation of run-out, the rotation of the main shaft can be decelerated by pressing the STOP key.

The selected mode of operation can be transferred to the permanent memory.

Comments
The asterisk “*“ marks the factory-adjusted default.

C6 Number of revolutions for measurement

Options
5 to 25 : Number of revolutions per measuring run
10 revs/run: Factory-adjusted value

Special function
None

Description
WARNING! Reducing the number of measurement revolutions will reduce the accuracy of measurement. Measurement accuracy can be evaluated using test mode C63.
The chosen mode of operation can be transferred to the permanent memory.

Comments

C7 Volume of audible signals

Options

0 to 100	: Volume (0 : low, 100 high)
50	: Factory-adjusted value

Special function
None

Description
The volume is not changed before the Acknowledgment key is pressed for quitting the mode.
The chosen mode of operation can be transferred to the permanent memory.

Comments

C8 Threshold suppression of minor unbalance values selected with C3

Options

3.5 - 20g	(0.12 - 0.71oz)	: Threshold value
3.5g	(0.12oz)	: Factory-adjusted value

Special function
None

Description
To set a new value use the option selection. Finally press the Acknowledgment key to acknowledge the entered value or press the Abort key to retain the former one.
To keep balance quality independent of weight placement, the OK indication is only visible if the unbalance readings for the normal balancing mode (balance clips on rim flanges) and the static unbalance are lower than the thresholds set via C8. Therefore the rim width must be known for a correct assessment of the balance quality (and for recommendation of optimisation).
If OK is displayed the unbalance readings will always be 0, irrespective of the selected balancing mode. If the precision/FINE key is now pressed to disable the suppression of minor unbalance readings temporarily, this may result in unbalance readings that are higher than the threshold in other than the normal balancing mode. This is due to the fact that larger balance weights are usually required for adjacent correction planes and small diameters in the rim disc.
The threshold value can be transferred to the permanent memory.

Comments
The unit of measurement is chosen according to the one set with C3:
C3: gram -> C8 unit of measurement is also gram.
C3: ounce -> C8 unit of measurement is also ounce.
C9 is omitted.

C9 Weight Miser function

Options

Step 1 : Weight Miser status (0 = disabled, default value; 1 = enabled)
When step 1 is set to 0, other steps are not available

Step 2 : Static threshold (5 – 10g, step 1g; 0.20 – 0.35oz, step 0.05oz; 5g default value)
Step 3 : Dynamic threshold (10 – 30g, step 1g; 0.35 – 1.05oz, step 0.05oz; 10g default value)

Step 4 : Clip weights money factor (1 – 999money/kg, step 1money/kg; same for money/lb; 20money/kg default value)
Step 5 : Stick weights money factor (1 – 999money/kg, step 1money/kg; same for money/lb; 20money/kg default value)

Step 6 : 0 = default value; 1 = reset the temporary counters (shown by C20)

Special function

None

Description

Weight Miser is a new feature which allows to achieve wheel balancing using less (smaller) balancing weights. It must be very clear that the feature works assuming that some residual imbalance can be left on the wheel.

When the WM feature is enabled, it will provide:

- reduced amount of required weight, depending on the programmed thresholds (steps 2 and 3);
- single weight capability, whenever possible: if it is possible to reduce both static and dynamic imbalance below the given thresholds (steps 2 and 3) using a single weight, then a single weight will be recommended; if not, standard two-weight Weight Miser balancing will be proposed; depending on the type of imbalance present on the wheel, the single weight will be placed either to the left or to the right: this is determined by the unit SW and is not selectable by the operator;
- auto static mode, whenever possible: the unit determines if the dynamic imbalance is below the given fixed threshold (step 3); if this is the case, the unit automatically switches to the static balancing mode.

The weights and money saved are collected in C19 (cumulated counters) and C20 (temporary counters).

Comments

The unit of measurement is chosen according to the one set with C3.

GS and JBEG save changed values automatically into permanent memory.
HWT and HNA save changed values with C10.

When in the Weight Miser mode, the Weight Miser calculations above will be applied before displaying the imbalance values. The imbalance values shall also be rounded and the standard suppression threshold will be applied.

When in the Weight Miser mode, the fine button is available. When the fine button is pressed, the unit displays the original imbalance values, without Weight Miser correction, rounding and thresholds.

C10 Saving the user settings in the POs (permanent memory)

Options

0 * : No storage
1 : Data is stored in the permanent memory

Special function

None

Description

Set code C10 to save user settings in the permanent memory. To do so, use the option selection to set 1. Acknowledge by pressing the Acknowledgment key.
All data so far temporary is stored in the permanent memory. This is acknowledged by a three-tone signal.

The following modes of operation will be stored by pressing the Acknowledgment key:

Function	Values	Code
Resolution of unbalance readings	low, high	C1
Suppression of minor unbalance readings	off, on	C2
Measurement units of the unbalance readings	gram, ounces	C3
Automatic braking on lifting the wheel guard	off, on	C5
Number of revolutions for measurement	5 - 25	C6
Volume of audible signal	0 - 100	C7
Threshold for unbalance suppression in grams/ounces according to C3	3.5 -20 g 0.12 - 0.71 oz	C8
Weight Miser preferences	off, on; 5 – 10g (0.20 – 0.35oz); 10 – 30g (0.35 – 1.05oz); 1 – 999money/kg (1 – 999money/lb); 1 – 999money/kg (1 – 999money/lb);	C9
Position brake and indexing (R2.2 or higher)	off, left right	C11
Start of measurement by closing wheel guard	off, on	C13
Static mode	off, on	C17
Unclamping of power clamp locked	off, on	C22
Actuation direction of pedal for clamping/releasing	lifting, pressing	C26
Time for screensaver (R2.2 or higher)	disabled, enabled	C27
Network protocol	none, ASA	---
Unclamping of wheel only if it is balanced (R3.2 or higher)	off, on	---

Comments

Behaviour changed !
This C code is no longer used to save calibration data.
Calibration data is now saved using C90.

The asterisk „*“ marks the factory-adjusted default.

C11 Position brake after measuring run

Options

0	:	No position brake after measuring run
1*	:	Position brake after measuring run for left plane
2**	:	Position brake after measuring run for right plane

Special function

None

Description

The position brake stops the main shaft in or near the correction position by initiating a braking pulse.
The position brake will be active after setting the on state and after a measurement run has been carried out with an unbalance display for the correction plane exceeding the threshold value.

Option = 1:
After the measurement run the wheel is braked for the left-hand correction plane. If the unbalance in the left-hand correction plane is smaller than the threshold, the wheel will be braked for the right-hand correction plane.
Indexing of the wheel for the right-hand correction plane is initiated by pressing the START key while the wheel guard is open.

Option = 2:
After the measurement run the wheel is braked for the right-hand correction plane. If the unbalance in the right-hand correction plane is smaller than the threshold, the wheel will be braked for the left-hand correction plane.
Indexing of the wheel for the left-hand correction plane is initiated by pressing the START key while the wheel guard is open.

With p-variants and manual indexing of the wheel with open wheel guard, a braking pulse will be initiated shortly before reaching one of the correction positions.
The selected mode of operation can be transferred to the permanent memory.

Comments

This feature is available in HWT R2.2 or higher
The asterisk “*“ marks the factory-adjusted default for HWT and JBEG models.
Two asterisk “**“ mark the factory-adjusted default for GS models.

C12 Recall counter - Only balancers with digital display

Options
1. CRT - none -
2. GS
1 : Total counter for all spins
2 : Counter for spins with OK
3 : Counter for spins with optimisation / minimisation
4 : Counter for spins in service mode
5 : Counter for spins since last calibration

3. HNA, HWT
(Only press the Option key, do not turn the wheel)
1 : Total number of measuring runs
2 : Number of measuring runs where balance quality was considered OK
3 : Number of optimisations or minimisations
4 : Number of measuring runs in service mode
5 : Number of measuring runs since the last calibration
6 : Total number of clamping operations (p models only)

4. JBEG
1 : Total spins counter.
2 : Resetable spin counter.
3 : User spins since last calibration counter.
4 : Service spins since last calibration.

Special function
None

Description
Various counter readings.

The CRT balancer has three lines in the menu “Modes of operation” to read out:
1. Total number of spins / spins with OK
2. Number of optimisation runs / clamping cycles
3. Number of measuring runs since last calibration / service

Comments
This mode has been adjusted to usual sequences of operation.

C13 Starting measurement run by closing the wheel guard

Options
0 * : No start of measurement by closing the wheel guard
1 : Start of measurement by closing the wheel guard

Special function
None

Description
The chosen mode of operation can be transferred to the permanent memory.

Comments
The asterisk „*“ marks the factory-adjusted default.

C14 User calibration

Options : None

Special function
None

Description
Re-calibration serves to compensate for sensitivity losses of the transducers.
Mount adaptor without calibration weight, wheel, clamping nut, centring cone and spacer ring on the main shaft.
With p-variants, attach the spacer ring, two small centring cones and clamping sleeve without the clamping head to the adaptor sleeve, and initiate the clamping operation. Set code C14.
With the m-variant mount the motorcycle wheel adaptor on the main shaft. Insert and tighten two driver bolts opposite to each other in the diameter range D3.

The following is displayed: 1. and the symbol of the START key.
Press the START key to start the first extended measuring run (twice as long as regular measuring run). (Instantaneous compensation of residual unbalance.)

The following is displayed after the run: 2. and the symbol of the START key.
Insert the calibration weight in the adaptor flange and press the START key to initiate the second extended measuring run.
With the m-variant insert and tighten a third driver bolt in the diameter range D1.

There is no third step as with the previous machine generations. Readjustment is completed after the measuring run of step 2 and the corrective factors determined are saved automatically.
Remove calibration weight and place in storage location.

Comments

C17 Loading rim data from profile

Options
1 to 4 (or 9) : Choosing the profile number

Special function
None

Description
A profile (1 – X) can be chosen by using the option selection.
The maximum number of profiles depends on the machine model (9 maximum).
Press the C key to load a stored wheel profile. This replaces the previously valid settings.
The following information is available (if applicable):

- ► Nominal wheel dimensions
- ► Values measured with the SAPE gauge arm
- ► Weight positions
- ► Wheel type
- ► Positions for relocation

Also see code C18.

Comments
New C code
The number of available profiles depends from the model.

C18 Saving rim data in profile

Options
1 to 4 (or 9) : Choosing the profile number
Special function: None

Description
A profile (1 – X) can be chosen by using the option selection.
The maximum number of profiles depends on the machine model (9 maximum).
Press the C key to save a wheel profile.
The following information is available (if applicable):

- ► Nominal wheel dimensions
- ► Values measured with the SAPE gauge arm
- ► Weight positions
- ► Wheel type
- ► Positions for relocation

Also see code C17

Comments
New C code
The number of available profiles depends from the model.

C19 Weight Miser cumulated counters

Options
1. CRT - none -
2. HWT, HNA, GS, JBEG
   - 1 : Weights saving (kg) : difference between original weight (weight necessary to balance the wheel, if WM is disabled) and WM weight
   - 2 : Money saving (money) : calculated multiplying weights saving with money factor
   - 3 : Weight Miser spins
   - 4 : Weights saving (%)
   - 5 : Money saving (%)
   - 6 : Weight Miser spins (%)

Special function
None

Description
Various counters readings.

Comments
Performing C43 is the only way to reset these values.

C20 Weight Miser temporary counters

Options
1. CRT - none -
2. HWT, HNA, GS, JBEG
   - 1 : Weights saving (kg) : difference between original weight (weight necessary to balance the wheel, if WM is disabled) and WM weight
   - 2 : Money saving (money) : calculated multiplying weights saving with money factor
   - 3 : Weight Miser spins
   - 4 : Weights saving (%)
   - 5 : Money saving (%)
   - 6 : Weight Miser spins (%)

Special function
None

Description
Various counters readings.

Comments
Execute step 6 of C9 to reset these values (or the C43)

C21 Indication of the program version & model number

Options
Indication of model designation

Special function
None

Description
Indication of program version number.
Press Option key to read out the model designation.
From IBP / Kernel Ver. 2.0: Press Optimization key to read out the Kernel Version of present Software.

Comments

C22 Unclamping of power clamp locked

Options
0 * : Unclamping of power clamp device enabled
1 : Unclamping of power clamp device locked.

Special function
None

Description
The power clamp device is locked in clamped position.

Comments
The asterisk „*“ marks the factory-adjusted default.

C26 Change pedal functionality

Options

0 * : Lift pedal to clamp/unclamp
1 : Depress pedal to clamp/unclamp

Special function: None

Description

Actuation of the power clamping device can be set to the preference of the operator. Locking the main shaft is by moving the pedal in the opposite direction.
The chosen mode of operation can be transferred to the permanent memory.

Comments

The asterisk „*“ marks the factory-adjusted default.

C27 Disable or set time for screensaver (CRT only)

Options

0 to 60 : Time to enable screensaver in 5 minute steps. Zero “0” disables the screensaver.
0 : Factory-adjusted value (Screensaver disabled)

Special function

None

Description

The time is not changed before the Acknowledgment key is pressed for quitting the mode.
The chosen mode of operation can be transferred to the permanent memory.

Comments

This feature is available in HWT-CRT R2.2 or higher

SERVICE C CODES REFERENCE

C28 Display & Clear Error Record

Options
In step 1:
► Select one of the 10 malfunction code messages

In step 2: (Only CRT, HNA, HWT)
0 : Do not clear the error memory
1 : Clear the error memory

Special function
In step 1 :
1. CRT : none
2. GS : none
3. HNA/HWT : display of memory location and number of incidents
4. JBEG : none

Description
The last 10 different malfunction codes are written into the error memory so that they can be called up and reported by the operator of the wheel balancer e.g. for remote diagnosis of malfunctions. The most recent malfunction code is written into memory location 1 and the previous error codes are shifted to the higher memory locations.
Display of internal error code (6 digits).
Use the option selection to proceed to the next error message (reading Err1 -Err10). If no error occurred, “---” is read out.
HNA/HWT:
Press the special function key to display the memory location (left) and the number of incidents (right).
Clearing the entire error memory:
Press the Acknowledgment key (in order to proceed to the 2nd step, then use the option selection to choose “1“, acknowledge with the Acknowledgment key to clear the error memory.
CRT:
The reading comes up in a single line on the monitor:

Err1 -10	Error no.	Number of incidents	

Clearing the entire error memory (step 2):
Press the Acknowledgment key to proceed to step 2.
Use the option selection to choose “1” and acknowledge with the Acknowledgment key.

C43 Reset Counters

Options

0 : No reset of counters
1 : Reset of counters

Special function

None

Description

During first setting into operation in the factory the following counters and memories can be reset simultaneously using this code:

1. CRT, GS, HNA, HWT
   - ► Total number of measuring runs
   - ► Number of measuring runs where balance quality was considered OK
   - ► Number of optimisations and minimisations
   - ► Number of measuring runs in service mode
   - ► Number of measuring runs since the last calibration
   - ► Total number of clamping operations (p models only)
   - ► Weight Miser cumulated and temporary counters

The error memory which can be called up using C28 will not be reset. To this end please use C28.

2. JBEG
   - ► Resetable counter
   - ► Weight Miser cumulated and temporary counters

Comments

No additional actions as used to be taken with previous HWT machine generations are required.
Only on HWT models: The error record is cleared too because of compatibility reasons.

C45 Special Measuring Parameters

Options: None

Special function: None

Description

This C code define the start mode and automatically the necessary number of revolution for measurement.

The Special function can be read out one below the other:
In step 1:
0 : Disactivate the Adaptive Measuring Cycle
1 : Activate the Adaptive Measuring Cycle

In step 2:
0 : Disactivate the Goertzel algorithm
1 : Activate the Goertzel algorithm

In step 3:
0 : Disactivate the Soft Start Function
1 : Activate the Soft Start Function

In step 4:
Start delay can be controlled, by chosen the preferred value. Default value is:
Motorized Wheel Balancer Machine - 0,8
Truck Wheel Balancer Machine - 1,5
Hand-Spin Wheel Balancer Machines - 2,5

Comments
This feature is available from BK Rev.2.0 or higher.
The selected mode of operation disappear when machine is turned off. To transfer the selection to the permanent memory perform a C90 code.

C47 Select machine model

C48 Download application/IPL from EPROM to FLASH (Y2K only, HWD digital only)

Options
0 : No action
1 : Download from EPROM to FLASH

Special function
None

Description
Once this code is called up 0 is read out in the right display.
Download is initiated by using the option selection until “1” is read out on the right display, then acknowledge with the Acknowledgment key.
There is no progress bar.
After the download a beep code signals success or failure of the action. Then the machine must be turned off and on again (wait some time before turning on again).

Comments
Not available.

C48 Download BK2 firmware to IBP board (CRT only, IBP only)

Options
0 : No action
1 : Start firmware download to IBP board

Special function
None

Description
The download operation is started by pressing the Acknowledgment key when the value is “1”.
Make sure the machine is not shut down during download operations.
Once download has been completed, the machine has an automatic reboot.

Comments
No further action is required.

C49 Download AWP firmware to AWP board

Options
0 : No action
1 : Start firmware download to AWP board

Special function: None

Description
The download operation is started by pressing the Acknowledgment key when the value is “1”.
Make sure the machine is not shut down during download operations.
Once download has been completed, the machine has an automatic reboot.

C53 Display test - Only balancers with digital display

Options : None
Special function : None

Description

Only machines with LC display:
All 80 segments of the LC display come up.

Comments

C54 Checking the incremental encoder on the main shaft

Options
Digital: Go to next step

Special function
Digital: Switch between average and min/max value.

Description
Display of measured data/measurement statistics for the incremental encoder/code bar
So that the opto-electronic unit and the code bar can be checked, the main shaft must rotate with constant speed. As proper performance of the opto-electronic unit is not ensured during execution of C54, speed and direction of rotation cannot be supervised.
So after the START key is pressed to call up the function, the motor is turned on and operated under full voltage and with the starting capacitor turned on until the START key is released. This should be done when the final speed is reached. Once the START key is released the starting capacitor is turned off and motor voltage is reduced so that speed can be easily maintained.
If no signal is identified in one or both channels, no reading is given for the relative channel and for the phase shift.

Step	Description	min value [%]	average value [%]	max value [%]
1	A bar	min	Avg From 40 to 60	max
2	B bar	min	avg	max
3	A gap	min	Avg From 40 to 60	max
4	B gap	min	avg	max
5	A to B phase shift	min	avg	max
6	N gap channel A		biggest neighbour	N gap
			[%] of average gap around [-8...+8] of reference mark	
7	N gap channel A	<=108	From 160 to 220	
8.1	Number of increments			
	Number of invalid measurements		256 or ---	256 or ---

The values for 1-6 are read out in per-cent of the average cycle time.
The values for 7 are read out in per-cent of the average gap width in the interval [-8 .. +8] around zero reference.
The values for 8 are counts and in case of malfunction additional error codes.
With digital machines the minimum and maximum values are read out upon operation of the Special function key, the Option key is used to proceed to the next value.

Comments
On CRT models all values are read out simultaneously.
Step 8 is available in truck wheel balancers R2.6 or higher.

From IBP / Kernel Ver. 2.0: the value 0 appears on channel B at steps 2, 4, and 5 of the program.
More detailed information about step 8 :

Cases of indication with digital display in step 8:

LH display	RH display	Increment count channel A	Increment count channel B	Malfunction
8.	---	Not analyzed	Not analyzed	No
8.	256	256	256	No
8.-	256	256	256	Yes
8.-A	256	256	Not analyzed	Yes
8.-A	XXX	XXX	Not analyzed	Yes
8.-A	XXX	XXX	256	Yes
8.-A	XXX	XXX	YYY	Yes
8.-B	256	Not analyzed	256	Yes
8.-B	YYY	Not analyzed	YYY	Yes
8.-B	YYY	256	YYY	Yes

Table legend:
“XXX”, “YYY“: Number different from 256; 0 has the special meaning: 2nd zero mark was not detected, but should have been.
“Not analyzed”: Due to the limited range of memory, increment data of only 1.5 revolutions is stored. The probability that two zero marks fall inside the 1.5 revolutions range, is 50 %. With only one zero mark detected inside the range, the data recorded cannot be analyzed.

LH display group:

Reading	Meaning
8.__	Step 8 of Test function C54 active
__-_	Divergence between channel A and channel B
___A	RH display is count of channel A
___B	RH display is count of channel B

Display while optimization button is pressed :
While the optimisation button is kept depressed, the LH display will show the number of measurements differing from 256. The RH display shows the total number of valid measurements.
If the total number exceeds 999, further measurements have no effect on the sums.

C55 Indication of the line voltage

Options: None

Special function: None

Description: Indication of line voltage

Comments
Please refer to chapter 05.12.3 ERROR ID (800, 801, 804) for the limits.

C56 Indication of the circuit state of the wheel guard switch

Options
None

Special function
None

Description

The wheel guard switch is assigned to the hundreds digit, the micro-switch actuated by depressing the pedal to the tens digit and the micro-switch actuated by lifting the pedal to the units digit. This test function can be used to determine the angle at which the wheel guard switch trips.

0 : off (released)
1 : on (activated)

Display	0/1	0/1	0/1
Switch	wheel guard switch	depress pedal	lift pedal

C57 Indication of the temperature

Options
None

Special function
None

Description
Indication of temperature in centigrade (°C)

Comments
Please refer to chapter 05.12.3 ERROR ID (580, 581, 585, 586) for the limits.

C59 Residual unbalance of main shaft compensated for using C84

Options
Switching over to residual unbalance of drive pulley (p models only)

Special function
None

Description
Indication of the residual unbalance of the main shaft compensated for using C84.
On p models, pressing the Option key will indicate the residual unbalance of the drive pulley.

Comments

C60 Indication of RPM of main shaft (Motorised models only)

Options
None

Special function
None

Description
Once this code is called up “---” is read out in the right display.
As soon as measured data is available, the current speed is read out.

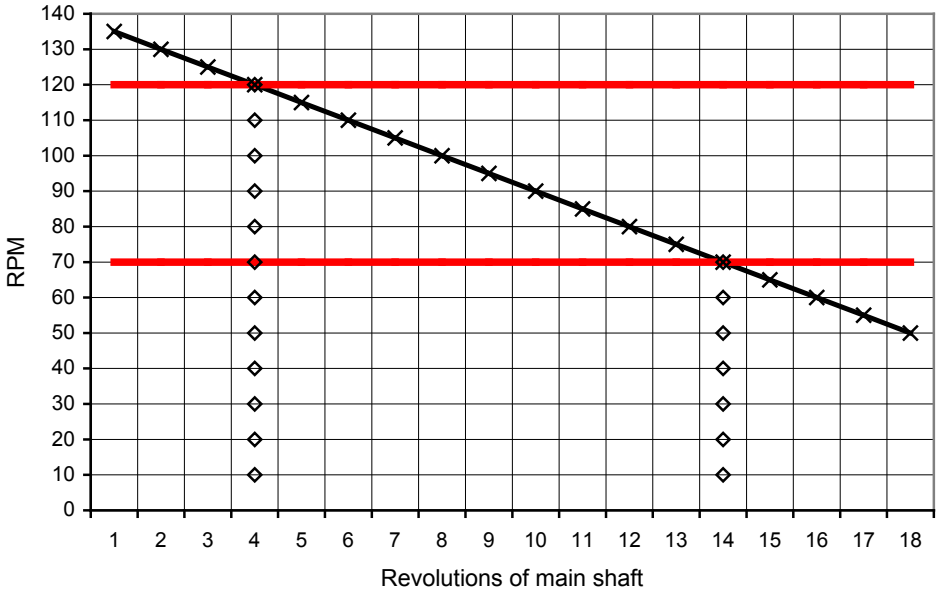
Comments
Motorised wheel balancers only.

C60 Measure amount of measuring turns (hand-spin models only)

Options
None

Special function
None

Description
Once this code is called up “1.” is read out in the right display.
Spin up the main shaft to start the measure. If the speed is higher than 120 RPM the measure starts and the display shows “---”.
When the speed drops below 70 RPM the measure ends and the display shows the amount of measuring runs performed during the slow down.
The measuring run can be repeated until ESC key is pressed to exit or C-Code key is pressed to go to the next step.
This service function is for simulating a C84 measuring run. This means the operator starts a measuring run like for a C84 (only main shaft & flange) and gets the amount of measuring turns displayed afterwards. The wait time after acceleration is as for the C84 (1 second) and the speed range for the measurement is from 120 RPM down to 70 RPM.
In the example below the result is “10”, because the machine was able to perform 10 measuring turns between 120 and 70 RPM.



Press C-Code key to enter in Step 2.
The measure performed in this Step calculates the amount of time elapsed in the slow down of the main shaft, from 200 RPM to stand still.
Once C-Code key is pressed “2.” is read out in the right hand display.
Spin up the main shaft to start the measure. If the speed is higher than 200 RPM the machine emits a beep and the display shows “---”.
The measure starts when the speed slows down to 200 RPM.
The display shows in the left hand side the actual speed of the shaft (expressed in RPM) and in the right hand side it shows the time elapsed since the measuring run is started (expressed in seconds).
After the counter shows 12 seconds (12 seconds from the measure starting) a beep is emitted.
When the shaft slows down to stand still the measure ends and the display shows the time elapsed.
The measuring run can be repeated until ESC key is pressed to exit.

Comments
Hand-spin wheel balancers only.
Step 2 is a new feature.

C61 Indication of the correction factors for user calibration

Options
Digital machine: Press the Option key to switch over between the factors of the two transducers.
CRT machine: None

Special function: None

Description
Indication of the correction factors for user calibration.
The correction factors determined during user calibration are read out in form of 6 digits.

CRT:
The correction factors determined during user calibration for the rear and front transducer are read out in form of 6 digits.
1. Field : Rear transducer
2. Field : Front transducer

HWT/HNA:
Press the Option key to switch between left and right transducer. The relative measuring plane is signalled through the direction indicator.

Comments

C63 Continuous measurements - balancers with digital display

Options
(Only press Option key without turning the wheel)
1. Amount of unbalance of both correction planes
2. Amount of unbalance plus angular location in degrees for left-hand correction plane
3. Amount of unbalance plus angular location in degrees for right-hand correction plane.

(The relative correction plane is signalled through the direction indicator)

Special function
1. Number of measurements carried out during the test with code C63.
2. The mean of unbalance plus angular location in degrees.
3. The mean of vectorial deviation of the measured mean of unbalance after the number of measurements exceeded 9.
4. The maximum vectorial deviation of the measured mean of unbalance after the number of measurements exceeded 9.

Description
Set code C63 and press the START key to carry out continuous measurements.
Minor unbalance readings are not suppressed, but read out in high resolution. For readings in gram the amount of unbalance is read out in floating point format.
After the first measuring run the Option key can be pressed to switch over readings (see options). The original reading is restored the third time the Option key is pressed.
The following values can be read out successively by pressing the Special function key:
1. Number of measurements carried out during the test with code C63.
2. The mean of unbalance plus angular location in degrees of the measurements carried out so far, whereby the plane is signalled by the direction indicator.
3. The mean of vectorial deviation of the measured mean of unbalance after the number of measurements exceeded 9.
4. The maximum vectorial deviation of the measured mean of unbalance after the number of measurements exceeded 9.

After pressing the Special function key a fourth time the number of measurements carried out so far will be shown again. By pressing the Option key the standard display of values is selected again.

Comments
The options and the special functions are still available after braking the measuring run with the STOP key. The angular position of the unbalance will be indicated. The C-Code will be exited by pressing the STOP key a second time.

C63 Continuous measurements - balancers with CRT display

Options: None

Special function
1. Number of measurements carried out during the test with code C63.
2. The mean of unbalance plus angular location in degrees.
3. The mean of vectorial deviation of the measured mean of unbalance after the number of measurements exceeded 9.
4. The maximum vectorial deviation of the measured mean of unbalance after the number of measurements exceeded 9.

Description
Set code C63 and press the START key to carry out continuous measurements.
Minor unbalance readings are not suppressed, but read out in high resolution. For readings in gram the amount of unbalance is read out in floating point format.

Until V2.2:
After the first measuring run the amounts of unbalance plus angular locations in degrees of both correction planes are read out in a single line on the screen as follows:

1. Field: Amount of left-hand correction plane
2. Field: Angular location of left-hand correction plane
3. Field: Amount of right-hand correction plane
4. Field: Angular location of right-hand correction plane

The Special function key can be pressed to proceed to display of statistiscal evaluations so that the following data is read out one below the other:

1. Number of measurements carried out during the test with code C63.
2. The mean of unbalance plus angular location in degrees.
3. The mean of vectorial deviation of the measured mean of unbalance after the number of measurements exceeded 9.
4. The maximum vectorial deviation of the measured mean of unbalance after the number of measurements exceeded 9.

Press the Option key again to return to standard display.

V2.3 and later:
After the first measuring run the amounts of unbalance plus angular locations in degrees of both correction planes are read out in a single line on the screen as follows:

- **First line:**
  1. Field: Number of measurements carried out during the test with code C63
  2. Field: angular position of the main shaft (only available after Stop)
- **Second line intentionally left free**
- **Third line: angular distance to the angular location(only available after Stop)**
  1. Field: Angular location of left-hand correction plane
  2. Field: Angular location of right-hand correction plane
- **Fourth line:**
  1. Field: Amount of left-hand correction plane
  2. Field: Angular location of left-hand correction plane
  3. Field: Amount of right-hand correction plane
  4. Field: Angular location of right-hand correction plane
- **Fifth line intentionally left free**
- **Sixth line: angular distance to the mean angular location (only available after Stop)**
  1. Field: Angular location of left-hand correction plane
  2. Field: Angular location of right-hand correction plane
- **Seventh line: The mean of unbalance plus angular location in degrees**
  1. Field: Amount of left-hand correction plane
  2. Field: Angular location of left-hand correction plane
  3. Field: Amount of right-hand correction plane
  4. Field: Angular location of right-hand correction plane
- **Eighth line: The mean of vectorial deviation of the measured mean of unbalance after the number of measurements exceeded 9**
  1. Field: Amount of left-hand correction plane
  2. Field: Amount of right-hand correction plane
- **Ninth line: The maximum vectorial deviation of the measured mean of unbalance after the number of measurements exceeded 9.**
  1. Field: Amount of left-hand correction plane
  2. Field: Amount of right-hand correction plane

Comments

The options and the special functions are still available after braking the measuring run with the STOP key. The angu-

lar position of the unbalance will be displayed above the unbalance values. The C-Code will be exited by pressing the STOP key a second time.
The options and the special functions are no longer available with V2.3.

C64 Indication of the transducer sensitivity as measured with C83

Options
Digital machine: Switching over between rear and front transducers
CRT machine: None

Special function
None

Description
The readings refer to amplification factors which were determined during the latest calibration of unbalance measurement using code C83 or C115. The higher the sensitivity of the transducer, the lower is the amplification factor. Press the Option key to switch over between rear and front transducer.

On Digital balancers the amplification factor of the rear transducer is indicated first.

On Mid Tier balancers the amplification factor on Left Display must be from 450 to 950 and from 10 to 120 on the right one.

Reading on the CRT machine:
1. Field : Rear transducer
2. Field : Front transducer

Comments
The shown values are those calculated in the latest calibration performed, not those saved from the latest C90.

C66 Display calibration values measured with C83 (virtual dimensions)

Options
Digital machine : Switching over between the two virtual distances of the transducers
CRT machine : None

Special function
None

Description
Values for both transducers in mm.
Reference mark is the zero reference of SAPE (SAPE in home position for 1D and 2D SAPE, right-hand edge of machine cabinet for geodata)

On Digital balancers the virtual distance of the rear transducer is indicated first.

On Mid Tier balancers the virtual distance on Left Display must be from 30 to 80 and from 1000 to 10000 on the right one.

Reading with CRT machine:
1. Field : Rear transducer
2. Field : Front transducer

Comments
The shown values are those calculated in the latest calibration performed, not those saved from the latest C90.

C67 Display phase stability of the vibratory system measured with C83

Options

Digital machine : Switching over between
- the distance-dependant phase shift of the rear transducer and
- the phase shift between the rear and front transducers

CRT machine : None

Special function

None

Description

On Digital balancers the distance-dependant phase shift of the rear transducer is indicated first.

Reading with CRT balancers:
1. Field : distance-dependant phase shift of rear transducer
2. Field : phase shift between rear and front transducers

Comments

The shown values are those calculated in the latest calibration performed, not those saved from the latest C90.

C69 Successive measuring runs with pauses

Options

In step 1:
0 to 50 : First pause, which simulates the weight application (init value = 50 seconds)

In step 2:
0 to 170 : Second pause, which simulates the (un)clamping of the wheel (init value = 170 seconds)

In step 3: Only models with power clamp
0: Do not unclamp/clamp the wheel
1: Unclamp/Clamp the wheel after the second pause.

Special function

please refer to the service function C63

Description

Displayed values and usage of this service function is the same as service code 63, with the except of the pauses and the unclamp/clamp cycle.

Comments

This feature is available in HWT R2.2 or higher

C71 Display angular deviation of the vibratory system as measured with C83

Options
Digital machine : Switching over between rear and front transducers
CRT machine : None
Special function : None

Description
Values for both transducers.

On Digital balancers the value for the rear transducer is indicated first.

On the Mid Tier balancer the value of the left display must be from 177 to 182 and from 178 to 182 on the right one.

Reading with CRT machine:
1. Field : Rear transducer
2. Field : Front transducer

Comments
The shown values are those calculated in the latest calibration performed, not those saved from the latest C90.

C72 Measurement of angular deviation

Options
Digital machine : Switching over between rear and front transducers
CRT machine : None
Special function : None

Description
3. Remove wheel or test rotor and centring cone from the adaptor. With p variants fit the spacer bushing, the medium centring cone and the clamping sleeve without clamping head onto the bushing and carry out clamping operation. Set code C72.
4. Press START key in order to initiate temporary compensation of unbalance.
5. Insert the user calibration weight into the adaptor flange so that it extends to the left and press the START key.
6. Insert the user calibration weight into the adaptor flange so that it extends to the right and press the START key. After three measuring runs the angle for the rear transducer is read out.

The step numbers are indicated on the left display:
angle = arg(2nd measuring run – 1st measuring run) - arg(3rd measuring run – 1st measuring run)

Display on CRT balancers:
Field : Rear transducer
Field : Front transducer

If C90 is performed, the shown values are saved in two new persistent objects:
p541 : Rear transducer
p542 : Front transducer

Comments
New feature: values saved in two new persistent objects

C74 Display of angular position of main shaft, incremental encoder test

Options

Digital machine: Switching over between position reading and reading of incremental encoder flags, and vice versa
CRT machine: None

Special function: Reset of incremental encoder flags

Description

Once this code is called up, the angular position and incremental encoder status register are display continuously. On digital machines the angular position is displayed in initially. Pressing the Option key toggles the right-hand display between angular location and status register. On CRT machines the angular location is read out at the right-hand side and the status register at the left-hand side simultaneously.

For a short test turn the main shaft at least 2 turns in both directions, the status register then must show **23F** . For detailed status information see below.

Angular position:

As long as the incremental encoder has not jet synchronized with the zero reference, the angular location reading is "- - -". After synchronization the angular position is display as a value in a range between 0 and 511.

Status register:

The status register is read out in form of a three-digit hexadecimal code XYZ:
X signals the status of the incremental encoder:

0 not initialised (only in case of an software malfunction)
1 not synchronised
2 synchronised

YZ covers the 8 flags er, ev, sr, sv, ba, ab, b, a

a A channel signal available
b B channel signal available
ab phase sequence channel A before B identified (reverse rotation)
ba phase sequence channel B before A identified (foreward rotation)
sv zero reference identified in forward rotation
sr zero reference identified in backward rotation
ev synchronising error in forward rotation
er synchronising error in backward rotation

Pressing the Special Function key will reset the YZ part of the reading to 00, the X part will not be reset.
Characteristic values of the status register (YZ part)

-00 after switching power on (main shaft not moved at all), or after pressing the Special function key
-07 after 2 turns backward > A- and B channel signals are OK, but there is no synchronisation in backward direction
-0b after 2 turns forward > A and B channel signals are OK, but there is no synchronisation in forward direction
-1b after 2 turns forward backward > A and B channel signals are OK, synchronisation in forward rotation is OK as well.
-1F after 2 turns in each direction > A and B channel signals are OK, but synchronisation was made in forward direction only
-27 after 2 turns backward > A and B channel signals are OK, synchronisation in backward direction is OK as well
-2F after 2 turns in each direction > A and B channel signals are OK, but synchronisation was made in backward direction only

23F Incremental encoder was rotated by more than 2 turns in each direction and performs properly.
>-40 Synchronisation error in forward direction
>-80 Synchronisation error in backward direction

Comments

If this test fails (no 23F) please check

- ► the cabling of the opto electronic – micro-controller
- ► the connectors of the cable
- ► clean the incremental encoder sleeve

C75 Display values from AD converter

Options: Choosing the AD channel

Special function

Digital machine : Display of original channel number and of the multiplexed channel

CRT machine : None

Description

Display: Display of voltage in Volts

AD	input	Channel		Description
AdC	0	0.0	REF-AD**	Reference voltage of external AD converter
AdC	1	1.0	fLED-CW	LED current control
AdC	2	2.0	fSON-TMP**	Temperature ultrasonic unit
AdC	3	3.0	fBAL-TMP	Temperature of transducer/vibratory system
AdC	4	4.0	fANA3**	Motor current
AdC	5	5.0	fANA2**	Power interface board multiplexer channel Y (see 5.0-5.3 below)
AdC	6	6.0	fANA1**	Power interface board multiplexer channel X (see 6.0-6.3 below)
AdC	7	7.0	fPOT	free
AdC	8	8.0	fPOt-WHO	Width potentiometer
AdC	9	9.0	fPOT-OFS	Distance/extraction potentiometer
AdC	10	10.0	fPOT-DIA	Diameter/angle potentiometer
AdC	11	11.0	RF1V23**	Internal reference voltage of analogue unit potentiometer
AdC	12	12.0	VCC-W	½ voltage of +5V supply
AdC	13	13.0	fLINE-V	Mains voltage control
AdC	14	14.0	AIR**	Input of voltage amplifier in front unbalance channel
AdC	15	15.0	AIL**	Input of voltage amplifier in rear unbalance channel
AdC	16	5.0	VCSSw* **	0.793 * supply voltage to external switches
AdC	17	6.0	**	free
AdC	18	5.1	VBrCur* **	Coil current of solenoid brake
AdC	19	6.1	**	free
AdC	20	5.2	VDisp*	Supply voltage of display board
AdC	21	6.2	VAssStat*	Voltage on capacitor of AutoStopSystem
AdC	22	5.3	VRimSens* **	Identification of rim material
AdC	23	6.3	VRelCur* **	Coil current of relay
AdE	1	AE1		External AD converter (rear transducer)
AdE	2	AE2		External AD converter (front transducer)

* via multiplexer on the power interface

** Not present in IBP type (thus 0.0V will be displayed)

Reading with CRT machine:	1. Field	2. Field	3. Field
	AD input	Channel	Voltage

Comments

Voltage Range is:

0.0 - 4.5V for Y2K

0.0 - 3.3V for IBP

C76 Indication of the voltages used by the 2-step motor controller

Options
Selecting the motor control voltages to be displayed.
L5b : Low speed, 50Hz, lower set point of 2-step motor controller (bottom)
L5t : Low speed, 50Hz, upper set point of 2-step motor controller (top)
H5b : High speed, 50Hz, lower set point of 2-step motor controller (bottom)
H5t : High speed, 50Hz, upper set point of 2-step motor controller (top)
L6b : Low speed, 60Hz, lower set point of 2-step motor controller (bottom)
L6t : Low speed, 60Hz, upper set point of 2-step motor controller (top)
H6b : High speed, 60Hz, lower set point of 2-step motor controller (bottom)
H6t : High speed, 60Hz, upper set point of 2-step motor controller (top)
Indication starts always with the appropriate “bottom” voltage of the current machine,
for instance if a lows peed machine is connected to a 50 Hz power supply system, the actual H6t is displayed. If the Option key is pressed, the display will return to L5b.

Special function
None

Description
After calling this code, the “bottom” voltage of the 2-step controller appropriate for the machine is displayed. Other set points of the 2-step controller can be selected by pressing using the option selection. The following will be displayed:
Left Display: L/H 5/6 b/t
| | |
| | b = bottom (lower set point) / t = top (upper)
| 5 = 50 Hz / 6 = 60 Hz,
L = Low speed / H = High speed

Right Display : Value [Volt]

Limits:
L5b : ≥ 31 V
L5t : ≤ 57 V
H5b: ≥ 47 V
H5t : ≤ 85 V
L6b : ≥ 37 V
L6t : ≤ 64 V
H6b: ≥ 46 V
H6t : ≤ 78 V

Comments
Available since HNA, HWT Version 1.35

C80 Calibration of the inner SAPE gauge arm and the AutoStopSystem

Options : None
Special function : ASS, Auto Stop System not to be done if IBP version

Description
The calibration positions and the associated voltages may depend on brand and model, therefore we give here only a general specification of operations. For specific positions please refer to the table further below.
1D SAPE:
- ► Step 1 : Move gauge arm to calibration position 1 and adjust extraction potentiometer mechanically. Press acknowledge key to confirm step 1.
- ► Step 2: Move gauge arm to calibration position 2. Press acknowledge key to confirm step 2.

2D SAPE:

Step 1: Move gauge arm to calibration position 1 and adjust the potentiometers mechanically (The voltage of the diameter potentiometer is indicated in the left 3-digit display). (The voltage of the distance potentiometer is indicated in the right 3-digit display).
Step 2: Move gauge arm to calibration position 2: Press acknowledge key to confirm step 2.
Step 3: Move gauge head to calibration position 4. Press acknowledge key to confirm step 4.
Step 4: Move gauge head to calibration position 5. Press acknowledge key to confirm step 5.

If ASS is available and Kernel (BK) is previous than 2.0, continue calibration as stated below.
Note: For BK 2.x or higher, ASS Calibration is NOT PRESENT. Calibration is completed at Step 4.
GEODATA:

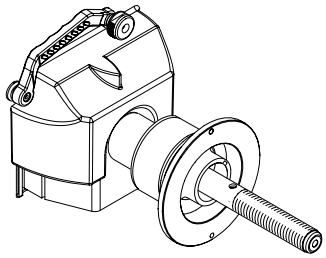
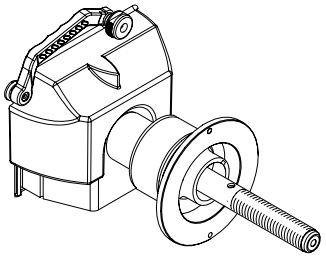
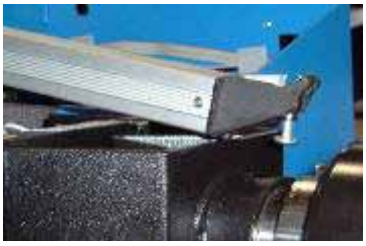
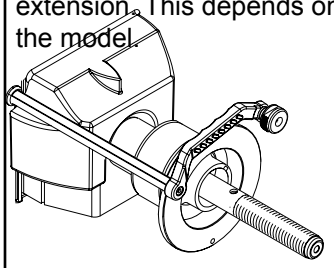
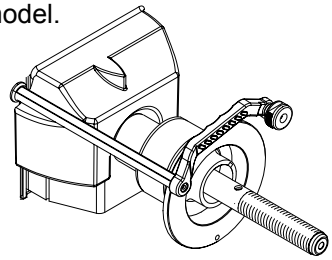
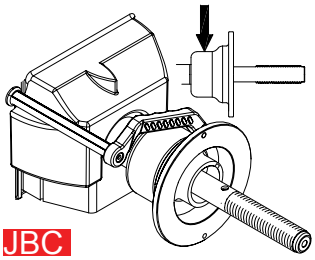
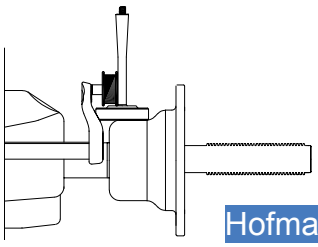
Step 1: Move gauge arm to calibration position 1 and adjust potentiometers mechanically (The voltage of the diameter potentiometer is indicated in the left 3-digit display The voltage of the distance potentiometer is indicated in the right 3-digit display) Re-place gauge arm in home position (if necessary fit the weight box). Press acknowledge key to confirm step 1.
Step 2: Move gauge arm to calibration position 2. Press acknowledge key to confirm step 2.
Step 3: Move gauge head to calibration position 3 (notch in vibratory system). Press acknowledge key to confirm step 3.
Step 4: Move gauge head to calibration position 4 (with calibration bar). Press acknowledge key to confirm step 4.

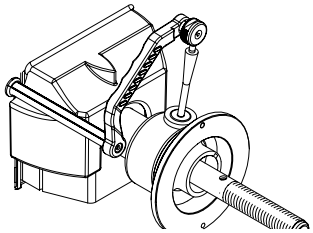
Continue with ASS calibration as stated below.
ASS calibration:

Step 5: No function, just skip
Step 6: At first reads out 0 on right display.
Slowly extend gauge arm until the AutoStopSystem brake responds.
Maintain the gauge arm until the brake cuts off.
Re-place the gauge arm in home position.
The reading in the right display is increased by 1.
If the brake does not respond, the gauge arm was moved too fast. After a third repetition the left display changes to step 7.
Step 7: At first reads out 0 on right display.
Quickly extend gauge arm at constant speed until the AutoStopSystem brake responds.
Maintain the gauge arm until the brake cuts off.
Re-place the gauge arm in home position.
The reading in the right display is increased by 1.
If the brake does not respond, the gauge arm was moved too fast, or too slowly. After the sixth repetition calibration is completed and the service mode is quit.

Comments

The calibration data can be saved in the permanent memory using C90 code.

Cal Step	1D SAPE	2D SAPE	Geodata
1	Gauge arm fully returned to home position. The reading for distance sape must be: • 3.99 – 4.01V for Y2K • 2.92 – 2.93V for IBP 	Gauge arm fully returned to home position. The reading for – distance sape must be: • 4.25 – 4.30V for Y2K • 3.11 – 3.15V for IBP – diameter sape must be: • 3.55 – 3.60V for Y2K • 2.60 – 2.63V for IBP 	Halfcone tip under gauge head applied to calibration groove in vibratory system. The reading must be: • 0.15 – 0.20V for Y2K • 0.10 – 0.14V for IBP  Gauge arm fully returned to home position. The reading must be: • 0.15 – 0.20V for Y2K • 0.10 – 0.14V for IBP 
2	Gauge arm extended to max extension. This depends on the model. 	Gauge arm extended to max extension. This depends on the model. 	Gauge arm extended to 300mm. The reading must be: • 4.15 – 4.20V for Y2K • 3.04 – 3.0V7 for IBP 
3		Position 1 of calibration template, or head of calibration weight  JBC  Hofmann	Gauge arm extended to 300mm. The reading must be: • 4.15 – 4.20V for Y2K • 3.04 – 3.0V7 for IBP 

4		Position 2 of calibration template, or tip (screw) of calibration weight 	Using calibration bar 
5		From software 3.0.60 end calibration Before software 3.0.60 No function. Just skip	From software 3.0.60 end calibration Before software 3.0.60 No function. Just skip
6		Pull the distance gauge out slowly at least 3 times until the “Auto Lock” clamps and locks the distance gauge, after which return it to the home position. Repeat this process 3 consecutive times, the software will then advance to step 7. Watch the “Status Area” if the arm is pulled out to quickly or to slowly the balancer will flash an “H26” or “H28” code.	Pull the distance gauge out slowly at least 3 times until the “Auto Lock” clamps and locks the distance gauge, after which return it to the home position. Repeat this process 3 consecutive times, the software will then advance to step 7. Watch the “Status Area” if the arm is pulled out to quickly or to slowly the balancer will flash an “H26” or “H28” code.
7		Pull out the gauge arm 7 times with increased constant speeduntil it clamps. After each clamping hold the gauge arm for at least 1 second in the clamped position before repeating the procedure. When the gauge arm has been pulled out and clamped 7 times, the reading will automatically advance to C ---	Pull out the gauge arm 7 times with increased constant speeduntil it clamps. After each clamping hold the gauge arm for at least 1 second in the clamped position before repeating the procedure. When the gauge arm has been pulled out and clamped 7 times, the reading will automatically advance to C ---

C81 Measuring the adaptor flange and the zero plane

Options : None
Special function : None

Description

To keep the machine operative and to allow width measurement in case the gauge arm is defective, the distance SAPE will be calibrated relative to the clamping surface of the adaptor on the condition that the gauge arm has already been calibrated. Having applied the gauge arm to the outer edge of the adaptor flange, press the Acknowledgment key to acknowledge the input. No further inputs are necessary.

Comments

The calibration data can be saved in the permanent memory using code C90.

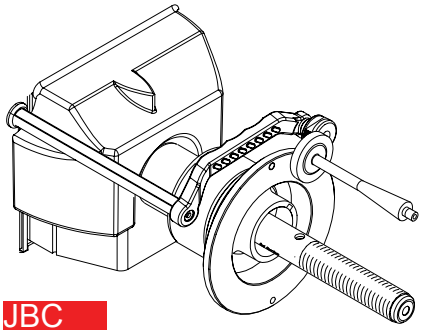
C82 Calibration of the outer SAPE

Options : None

Special function: None

Description

When the outer gauge arm is calibrated the inner gauge arm must already have been calibrated and the position of the adaptor flange and zero plane must already have been measured.
There is a raised mark on the toothed wheel of the outer gauge arm which should point towards the first tooth of the



JBC

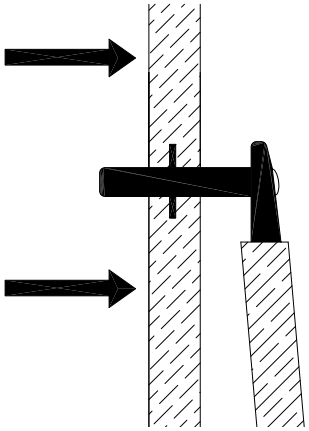
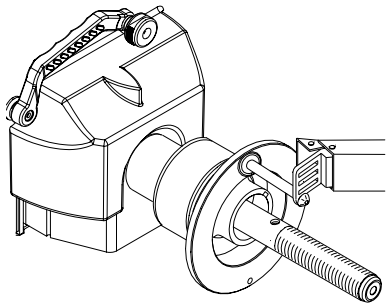
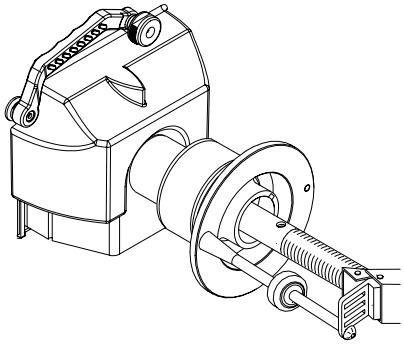
Hofmann

toothed segment when the gauge arm is in its home position

Step 1: Move gauge arm to calibration position 1 and adjust the potentiometer mechanically such that the voltage indicated below is read out. Press acknowledge key to confirm step 1.
Step 2: Move gauge arm to calibration position 2. Press acknowledge key to confirm step 2.
Step 3: Move gauge arm in calibration position 3. Press acknowledge key to confirm step 3.

Calibration positions
Position 1: Home position
Position 2: Clamping surface of adaptor
Position 3: Head of calibration weight, fitted to adaptor flange from the right.

Comments
The calibration data can be saved in the permanent memory using code C90.

Step/Position 1	Step/Position 2	Step/Position 3
Readout Voltage Range in home position: • 4.28 – 4.32V for Y2K • 3.14 – 3.17V for IBP c82 1 		

C83 Calibration of the unbalance measurement with wheel/test rotor. (Digital Model)

Options : None

Special function: None

Description

With the calibration of the unbalance measurement the following are determined:

- ► the sensitivity of the transducers,
- ► the phase difference of the transducer signals,
- ► the comparative data for readjustment by the operator and temperature compensation
- ► the phase shift of the unbalance signal amplifiers and
- ► the angular deviation

After the 1st step, that is the measuring run, a beep signal is heard.
After acknowledgement/setting of weight size in step 2 a beep signal is heard (in addition to the beep made by the key).

In step 6 the ambient transducer temperature will be read out for 1 second.

Comments

The calibration data can be saved in the permanent memory using code C90.

NOTE: THE F80 CALIBRATION MUST BE DONE BEFORE THIS OPERATION.

A balanced tire and wheel assembly can be substituted if a Pruefrotor is not available. The calibration procedures are the same and can easily be performed. However custom parameters must be used for this procedure if using a balanced tire and wheel assembly

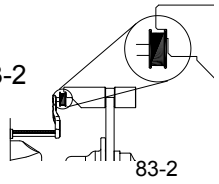
Beginning with a balanced Tire and Wheel assembly

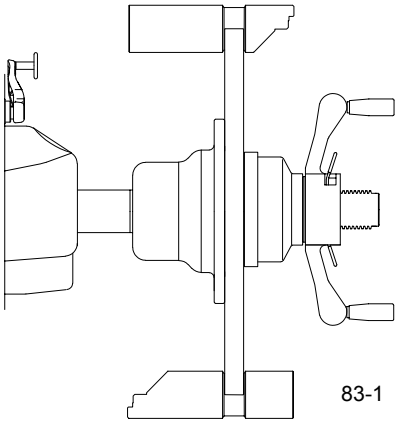
- Mount the tire and wheel assembly on the shaft. For this example a 14” X 5.5” wheel will be used.
- Enter the distance, diameter and width (user defined).
- Press and release the **<F/P>** key, turn the shaft until the display reads “**F/P**” “83” is displayed and press <ENTER> to activate function of **F/P** 83.
- After entering the **F/P**83 function the balancer will automatically switch to default parameters (15” X 6.5”).
- Press the <**F/P**> button to change from default parameters to user defined parameters. The display will change to “USE” “CST” “PAR” for one second and then display “SPN” “1”. Pressing the <**F/P**> button again will toggle the unit back to factory defaults.

NOTE: IF A TIRE AND WHEEL ASSEMBLY IS USED PROCEED TO STEP 6.

Beginning with a Pruefrotor

1. Mount the Pruefrotor on the balancer shaft 83-1
2. Pull the distance gauge arm out and touch the Pruefrotor 83-2



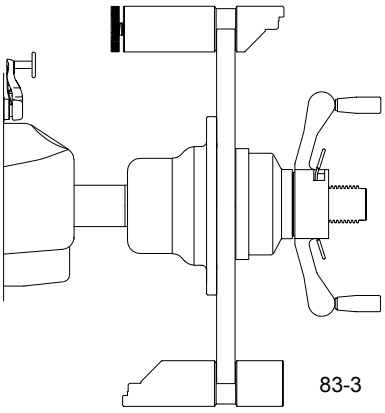


3. Return the Distance Gauge to the home position.

4. Press and release the **<F/P>** key, turn the shaft until the display reads "**F/P**" 83" is displayed. The display changes to "CAL" "BAL" for one second.

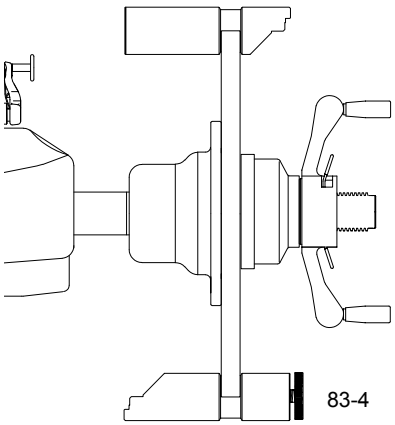
5. The display then changes to "SPN" "1".

6. Spin shaft with the Pruefrotor/Tire & Wheel by lowering the hood or pressing the enter key. The board displays the information in the following order.
   - Displays "CAL" "1" when the shaft reaches calibration speed. The machine is taking data and doing calculations. After taking data, shaft is automatically braked to a stopped.
   - Displays "SPN" "2" when shaft stops.



7. Attach the 3.5 ounce weight (100 gr) on the inside of the Pruefrotor/Tire & Wheel.
   - Spin the Pruefrotor/Tire & Wheel by lowering the hood or pressing the enter key.
   - Displays "CAL" '2" when the shaft reaches 90 RPM's. The machine is taking data and doing calculations. After taking data, shaft is automatically braked to a stopped.
   - Displays "SPN" "3" when shaft stops.

8. Attach the 3.5 ounce weight (100 gr) on the outside of the Pruefrotor/Tire & Wheel.



NOTE: IF USING A TIRE AND WHEEL ASSEMBLY ATTACH THE 3.5 OZ WEIGHT ON THE OUTSIDE 180 DEGREES OPPOSITE THE INSIDE WEIGHT LOCATION.

- Spin the Pruefrotor/Tire & Wheel by lowering the hood or pressing the enter key.
- Displays "CAL" '3" when the shaft reaches calibration speed. The machine is taking data and doing calculations. After taking data, shaft is automatically braked to a stopped.
- Displays "CAL" "GOO" "d" when the third step of calibration is finished and the calibration is successful or displays "CAL" "FAL" "L" if the calibration fails.
- Display then changes to "**F/P**" "CNT" to prompt operator to press the <**F/P**> key to continue calibration, or operator can press the <STOP> key to exit out of calibration, basic calibration is all that is performed.

NOTE: IF THIS IS THE FIRST TIME FOR FACTORY CALIBRATION AND THE OPERATOR PRESSES THE STOP KEY TO STOP THE REMAINDER OF CALIBRATION F14 WILL NOT BE AVAILABLE TO THE OPERATOR.

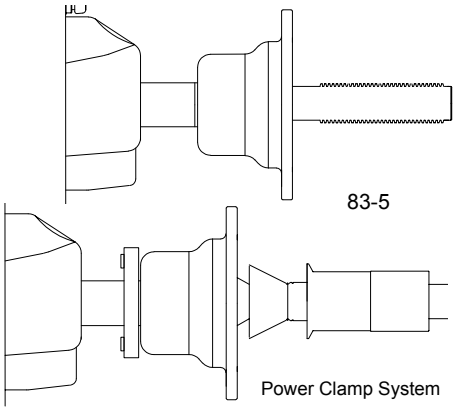
9. Press <**F/P**> to continue calibration.
   - Displays “SPN” “4”
10. Remove the Pruefrotor/Tire & Wheel from the shaft
    - Spin the empty shaft by lowering the hood or pressing the enter key (Figure 83-5). The board displays the information in the following order.

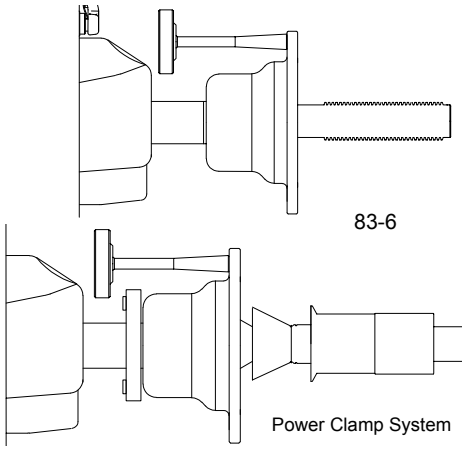
NOTE: 2 CONES AND THE POWER CLAMP NUT MUST BE USED ON A POWER CLAMP SYSTEM.

   - Displays “CAL” ‘4” when the shaft reaches calibration speed. The machine is taking data and doing calculations. After taking data, shaft is automatically braked to a stopped.
   - Displays “SPN” “5” when shaft stops.

11. Install the calibration slug on the left side of the bell housing. Spin the shaft by lowering the hood or by pressing the enter key.
    - Displays “CAL” “5” when the shaft reaches calibration speed. The machine is taking data and doing calculations. After taking data, shaft is automatically braked to a stopped.
    - Displays “CAL” “FIN” “ISH” after a successful calibration.
    - Displays “---” “---” when shaft stops and machine is in a stand-by mode. Must complete **F/P** 84 after this function!

CALIBRATION COMPLETE



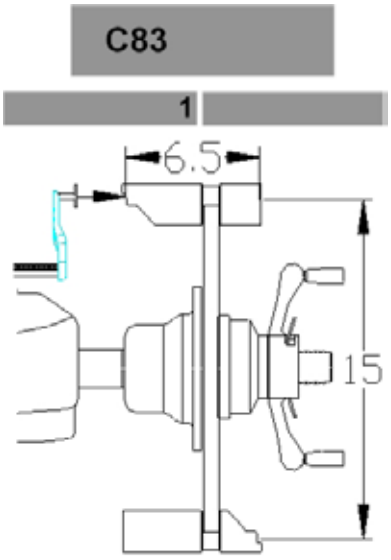


C83 CALIBRATION OF UNBALANCE MEASUREMENT (CRT Model)

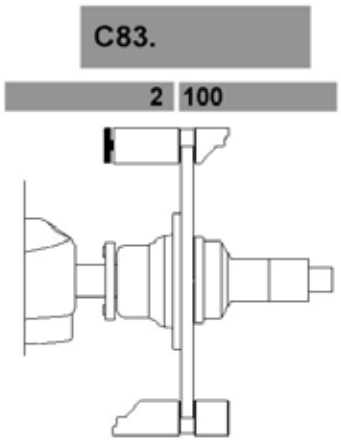
This test must be done using a Pruefrotor.

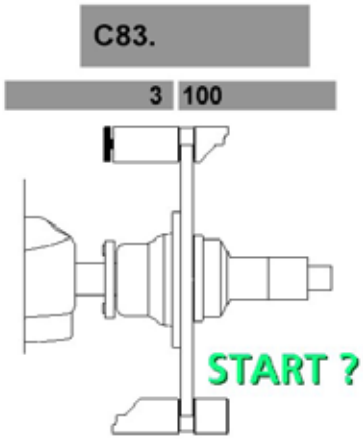
NOTE: THIS TEST REQUIRES THE USE OF A PRUEFROTOR. ALL TESTS MUST BE DONE WITH THE BALANCER IN THE MANUAL MODE. AFTER ALL TEST ARE DONE THE BALANCER MUST BE SWITCHED BACK INTO THE PREFERRED OPERATING MODE. ALSO CHECK THE VCC VOLTAGE “C110” AND ADJUST IF NECESSARY BEFORE ANY CALIBRATION IS DONE.

1. Mount the Pruefrotor on the balancer shaft and enter in the parameters of the Pruefrotor using the balance screen.
2. Enter the “Service” routine and select C83. Press the <START> button to begin the measuring run.

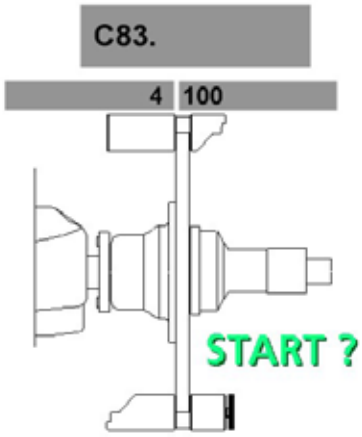


3. After the spin cycle completes, screw the 100 gram weight on the left side of the Pruefrotor and press the <ENTER> key (F6) to enter the value of the test weight and to advance to step 3. Press the <START> button to begin the measuring run.

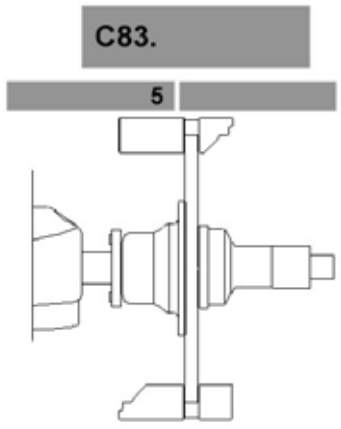




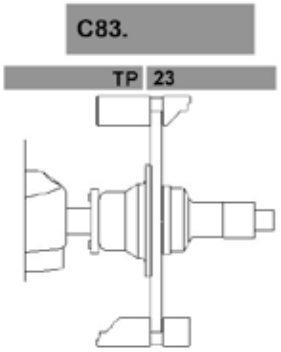
4. Remove the 100 gram calibration weight and insert it into the right hand plane of the Pruefrotor. Press the <START> key to begin the measuring run.



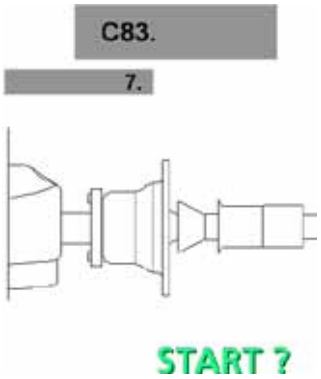
5. Step Number 5 has not been programmed. Press the <ENTER> key (F6) to advance to the next step.



6. The ambient transducer temperature is displayed for 1 second.



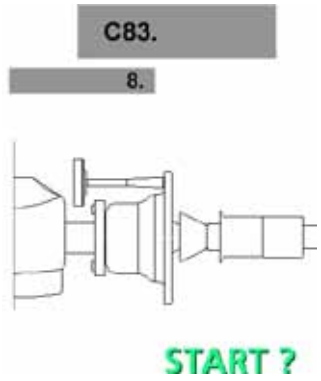
7. Remove the Pruefrotor. Install the small and medium cone on the shaft. Remove the pressure cup from clamping nut and clamp both cones on the shaft. Lower the hood and press the <START> button to begin a measuring run.



8. Insert the calibration weight that is supplied with the balancer on the left side of the backing plate. Press the <START> button to begin a measuring run.

9. Store the new factors using C90.

NOTE: MUST COMPLETE C84 AFTER THIS FUNCTION



CALIBRATION COMPLETE

C84 Compensation of unbalance of main shaft

Options : None

Special function
None

Description
Compensating for residual unbalance left in the main shaft
To save balancing of the main shaft by drilling out material or by adding balance weights, the residual unbalance of the main shaft is determined and compensated for (subtracted) in all subsequent measurement runs.
To compensate for the residual unbalance of the main shaft on a machine without power clamping device carry out the following steps:

1. Remove wheel adaptor from main shaft.
2. Activate adjustment function C84
3. Close the wheel guard and start the measurement run by pressing the START key.

The residual unbalance of the main shaft is determined in an extended measuring run.

Compensating for the residual unbalance of the main shaft and drive pulley on a digital model

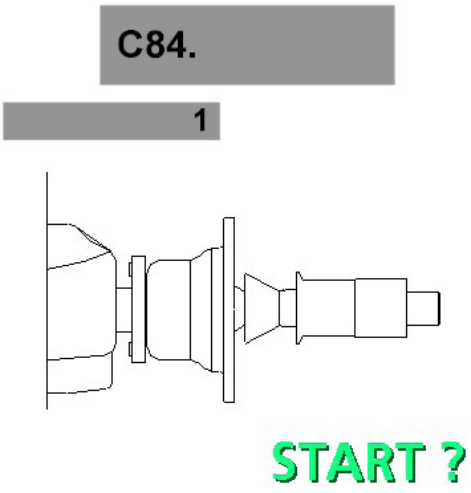
F/P 84 Empty Shaft Calibration Procedure JBC Digital

1. Press and release the <F> key, toggle the <UP / DOWN> button or press and hold the <P> key while turning the Diameter/Function Knob until “F/P” “84” is displayed. The display changes to “CAL” “SHF” for one second.

2. Then it displays “SPN” “1“.

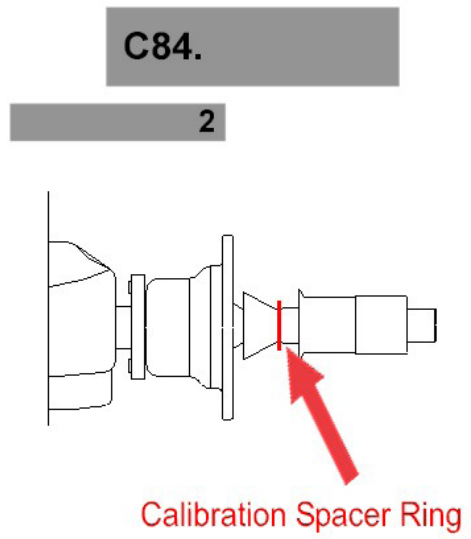
3. Spin the empty shaft by pressing the <ENTER> button or lower the hood.
   The board displays the following information.
   - Displays “CAL” “ 1” when the shaft reaches calibration speed. The machine is taking data and doing calculations. After taking data, shaft is automatically braked to a stopped. Then displays
   - CAL” “SHF” “FIN” for one second. The machine displays the shaft resident unbalances in fine mode. The fine mode LED indicator is automatically on.
   - By pressing <STOP> key to exit F84 and return to idle state. The fine mode LED indicator is automatically turned off.

Compensating for the residual unbalance of the main shaft and drive pulley on a p model
Since the angular position of the drive pulley relative to the main shaft is random in the clamped state, the residual unbalances of main shaft and drive pulley have to be determined and stored separately.
To separate the residual unbalances, two measuring runs have to be performed. Between these measurement runs, the drive pulley has to be adjusted by approx. 180 degrees relative to the main shaft. To accomplish adjustment of the drive pulley by 180 degrees, the tie rod must be displaced by another 4 mm in the clamping operation prior to the second measuring run.



NOTE: THIS PROCEDURE REQUIRES THE USE OF A SPECIAL CALIBRATION RING (EAM0033D53A). DO NOT ATTEMPT THIS PROCEDURE WITHOUT IT. THE BALANCER MUST BE IN THE MANUAL MODE FOR THIS PROCEDURE.

1. Mount the Small Cone, Medium Cone and the clamping sleeve on the shaft.
2. Lower the hood and press the <START> button to begin the measuring run.
3. After the spin cycle completes remove the clamping sleeve and install the 4mm calibration ring (EAM0033D53A) between the Medium Cone and the clamping sleeve. Press the <Spin> button for the balancer to complete a spin cycle. After the balancer comes to a stop the empty shaft calibration is complete.
4. Store the new factors using C90.



CALIBRATION COMPLETE

Comments
The calibration data can be saved in the permanent memory using code C90.

C85 Copy Contents Of Main Pcb To Encoder (CRT Models)

Options

0 : No action
1 : Copy from controller board EEP to opto EEP

Special function : None

Description

To make sure the content is not overwritten by mistake, first set display from 0 to 1 by using the option selection.

Then the copying operation is started by pressing the Acknowledgment key.
Once copying has been completed, the machine is started again automatically.

Comments
No further action is required (such as necessary with former HWT balancer generations).

C86 Copy Contents Of Encoder To Main PCB (CRT Models)

Options
0 : No action
1 : Copy from opto EEP to controller board EEP

Special function
None

Description
To make sure the content is not overwritten by mistake, first set display from 0 to 1 by using the option selection.

Then the copying operation is started by pressing the Acknowledgment key.
Once copying has been completed, the machine is started again automatically.

Comments
See C85

F/P 85 Copy Contents Of Main Pcb To Encoder (Digital Models)
When an Encoder PCB is replaced and on initial power up the unit will display “F/P 85”. The technician needs to simply press the <F/P> key to transfer the calibration factors from the Main PCB over to the new Encoder. To change the display from 85 to 86 simply press the <UP ARROW>.

F/P 86 Copy Contents Of Encoder To Main PCB - BK 1.21 (Digital Models)
1. Change microprocesser board and download the new software.
2. Remove the software chip from the socket and return it to the carrying case.

Senario 1
If the Balancing Kernel refered to as “BK” has not changed when a Main PCB is replaced and on initial power up the unit will display “F/P 86 S-b” meaning copy the (S)haft contents to the (b)oard. Simply press the <F/P> key to transfer the calibration contents from the Encoder to the Main PCB.

Senario 2
If the “BK” software has changed, the machine will reset. After resetting the balancer will display the proper model of software that matches the balancer if all SAPE arms are in good working order. Press the <SPIN> button to set the model correctly.

Senario 3
If the “BK” software has changed, the balancer will reset. If the SAPE arms are not adjusted correctly the balancer may display the model that does not the balancer. Example: VPI System II with an out of adjustment or broken diameter potentiometer the unit may display JBC 1 instead of JBC 2, or it may display some SAPE failure. If the balancer does not display the correct model, the operator can simply press the <F/P> button to switch the software to display the correct model of balancer and then press the <SPIN> button to set the model. The balancer may display “Sur E” asking the operator if he/she is SURE, if the answer is yes press the <SPIN> button again to force the model.

C88 Calibration of 12 o'clock position for fitting position of weights

Options
None

Special function
None

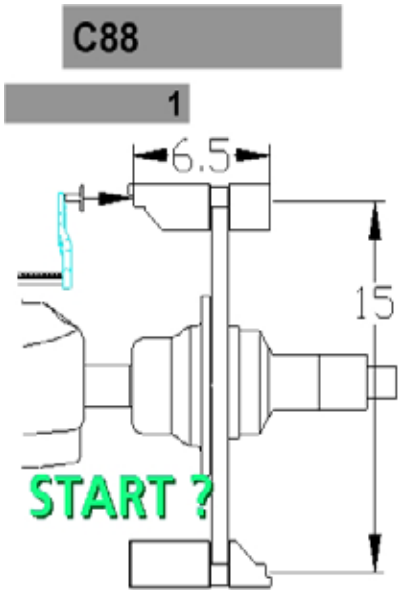
Description
With this calibration code it is possible to compensate for the individual angular deviation of a machine. During the basic calibration in the factory this code will only be carried out if there is a clearly noticeable angular deviation, and not as a general procedure. Since the angle of the static unbalance is used for this purpose, the service technician can select the correction plane in which he can best and most accurately assess the vertical position above the main shaft.

One possibility is to attach the weight to the left-hand correction plane and to use the gauge arm as reference point, in which case it is first necessary to make sure that the gauge arm is aligned parallel to and vertically above the main shaft.

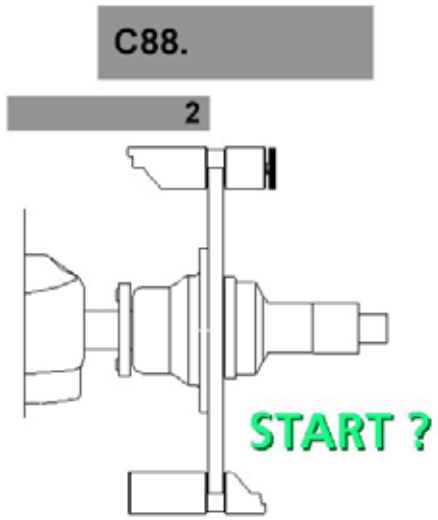
The second possibility is to attach the weight in the right-hand rim flange and to turn the weight in step 3 so that it is exactly vertical below the main shaft. In this position a plumb line can be used as the reference point.

Possible angle correction is read out in +/- 5 degrees (used to be called increments)
If the angular deviation is more than +/- 5 degrees the reading will be "---".

1. Mount the Pruefrotor on the balancer shaft and enter in the parameters of the Pruefrotor using the balance screen. Press the <START> button to begin the measurement run.

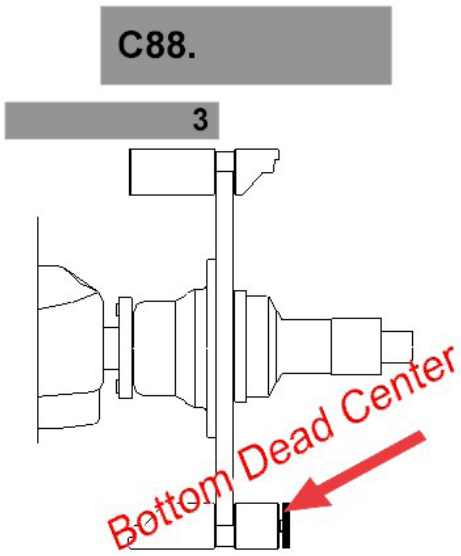


2. Attach the 100 gram weight to outside of the Pruefrotor and press the <START> button.



3. After the shaft comes to a complete stop rotate the shaft to locate the 100 gram weight at “BOTTOM DEAD CENTER” position. Press the <ENTER> key (F6) to save the data.

4. Store the new factors using C90.



CALIBRATION COMPLETE

C90 Saving Calibration Data

All calibration data must be saved into memory before powering down the unit. Any data that is not saved will be lost if the power is recycled.

1. Press and hold the <ENTER VALUES> key (F4) and rotate the shaft to change the selection window from “0” to “1”, release the key.

2. Press the <ENTER KEY> to save all previous calibration data to permanent memory.

CALIBRATION DATA SAVED

C92 Display of actual distance and diameter of inner SAPE/geodata

Options: None

Special function: None

Description
Display on digital and CRT machines:

1. Field / left display : diameter
2. Field / right display : distance

F/P 95 Clean & Reset EEPROM 1 & 2 (Digital Models)
Care should be taken before running this function. All information in the EEPROM will be lost including manufacture calibration which can not be reversed once performed. However this function can be very useful if data is corrupted on the EEPROM's. Performing this function can be much quicker than re-flashing the software.

1. Press and release the <F> key, toggle the <UP / DOWN> button or press and hold the <P> key while turning the Diameter/Function Knob until "F/P" "95" is displayed. The machine displays "CLN EEP" immediately. The user can press the <STOP> button at anytime before step 5 to abort this procedure.
2. Press F/P button, the balancer displays " 1 1 1 ".
3. Press F/P button again, the balancer displays " 2 2 2 ".
4. Press F/P button again, the balancer displays " 3 3 3 ".
5. If user press F button again, balancer displays " CLN EEP" and erases all information in the EEPROM and resets the machine.

NOTE: ALL FACTORY CALIBRATION PROCEDURES ARE REQUIRED.

F/P 97 Sticky At Top Stop At Top (Digital Models)
Used to turn "Sticky at Top" on or off. Press <F> <97> <ENTER> display changes to "STY" "TOP" "ON" sticky at top is now on. Pressing <F> <97> <ENTER> again changes the display to read "STY" "TOP" "OFF" sticky at top is now off.

C97 Conditioning of the solenoid brake
Options: None

Special function: None

Description
Conditioning of the solenoid brake (p-variants only)
WARNING! With this test function the main shaft still rotates when the wheel guard is open.
Enter code C97 and then press the START key to run the motor with brake activated in order to remove contamination such as fingerprints from the brake lining, thus improving the braking effect of a new solenoid brake. As this function causes the brake to heat up quickly, it is deactivated automatically after one minute.
The motor speed is held constant by controlling the brake current.

Comments
Brake current is not read out.

C98 Display of angular position of power clamp pulley, incremental encoder test

Options

Digital machine : Switching over from position reading to incremental encoder flags and vice versa

CRT machine : None

Special function:

Resetting incremental register flags

Description

Once this code is called up, the reading is "---"
Only after the incremental encoder has identified zero reference, the angular location is read out in a range between 0 and 63.
Use of the C code and meaning of the flags are identical with C code C74 (incremental encoder of main shaft).

Comments

Only for power clamp models.

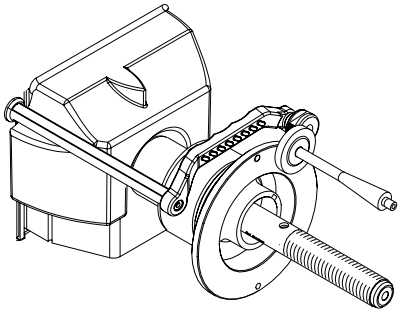
If this test fails (no 23F) please check

- the cabling of the opto electronic – micro-controller and
- the cabling opto electronic power clamp - opto electronic main shaft
- the connectors of the cables
- clean the incremental encoder tape

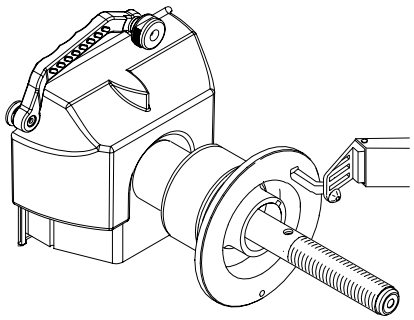
F99 Sape-2 Accuracy Test (Digital Models)

The balancer must have a width gauge for this procedure to work.

1. Place a flat edge (Calibration Slug) flat against the flange.
2. Gently pull the distance arm and touch the back of the flat edge.

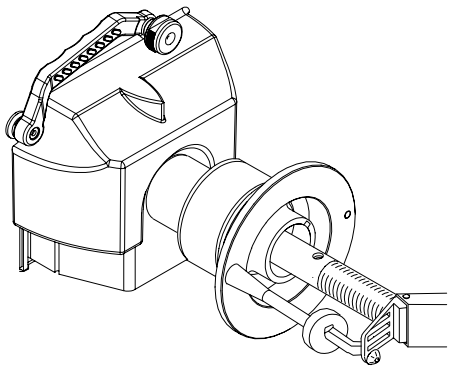


3. Press and release the <F> key, toggle the <UP / DOWN> arrow keys until "F" "99" is displayed and press <ENTER> to activate function of F99.
4. Pull the 3-D-P SAPE arm and touch the face of the flange.



5. View the value in the left display, the value should be 0 ± 2.
6. Screw the caibration weight onto the outside of the flange.
7. View the value in the left display, the value should be 116 ± 2

NOTE: IF THE READINGS DO NOT RETURN REQUIRED VALUES PERFORM AN F79 AND RETEST.



C110 Indication of the operating voltages supplied by the power supply module

Options: None

Special function: None

Description
Indication of the operating voltage supplied by the power supply module for the controller board.

Comments
Please refer to chapter ERROR ID (810, 811) for the limits.

C111 Belt tension: Measure first harmonic of the belt

Options: None

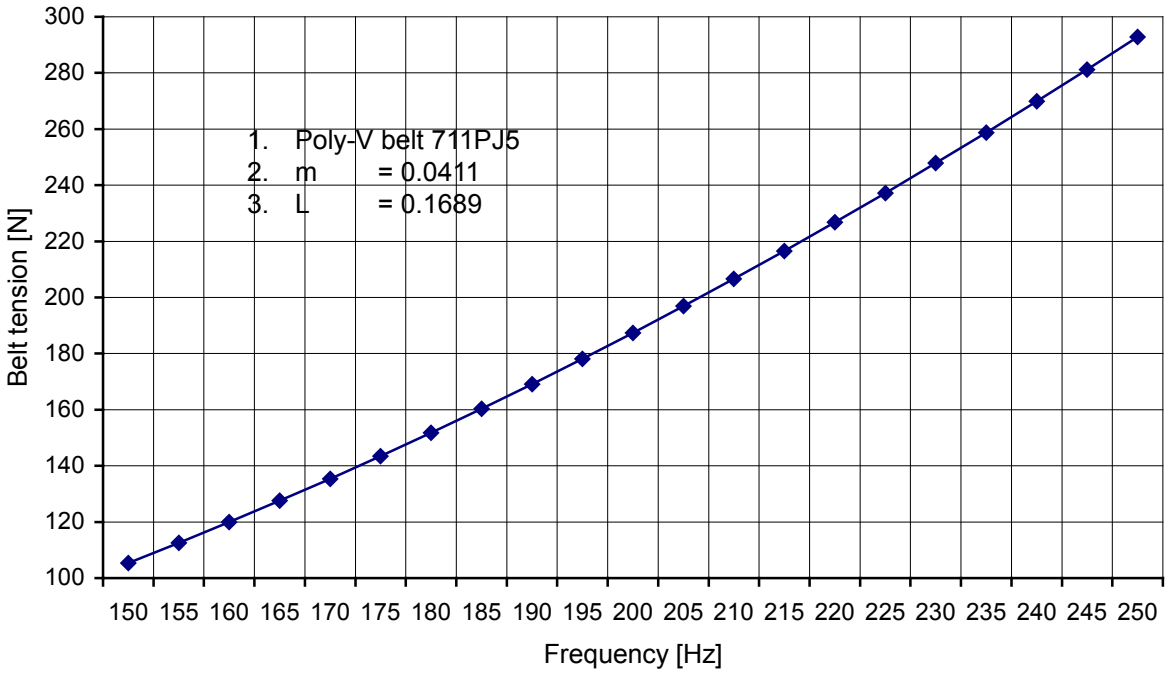
Special function: None

Description

Once this code is called up, the reading is a running " - ".
After beating on the belt a beep indicates the start of the measurement. After 3 sec. a second beep indicates the end of the measurement and the frequency is displayed. If the harmonic analysis doesn't find any significant frequency, "Err" is displayed until the next measurement is started.
The test should be repeated with different forces during picking the belt and with different sections of the belt (rotating the main shaft).
The frequency is displayed in a range from 100 Hz up to 300 Hz.
The begin of a new measurement will be detected automatically.

Comments

This feature is available in HWT R2.2 or higher
Only for belt driven balancer.
The diagram shows the relation between frequency and belt tension for a y2k vibratory system and a Poly-V belt 711PJ5.



C115 Calibration of the unbalance measurement with test rotor only

Options: None

Special function: None

Description
With the calibration of the unbalance measurement the following are determined:

- the sensitivity of the transducers,
- the phase difference of the transducer signals,
- the comparative data for readjustment by the operator and temperature compensation
- the phase shift of the unbalance signal amplifiers and
- the angular deviation

After the 1st step, that is the measuring run, a beep signal is heard.
After acknowledgement/setting of weight size in step 2 a beep signal is heard (in addition to the beep made by the key).

In step 6 the ambient transducer temperature will be read out for 1 second.

Comments
If necessary, the calibration data can be saved in the permanent memory using code C90.

Preconditions:
1. Set operating mode to 0: “manual” in those machine in which automatic or other mode are possible;
2. Clamp the calibration rotor p/n EAA0277D12A;
3. Set rim dimensions manually to the default values (pay attention to the Offset value, specific for the model);

C120 OPTIMA: Enable / disable the laser pointer

Options: None

Special function: None

Description
On selection the current status is displayed (0 / 1).
Select 0: Disable laser pointer.
Select 1: Enable laser pointer.

The setting can be stored to persistent memory by performing code C90.

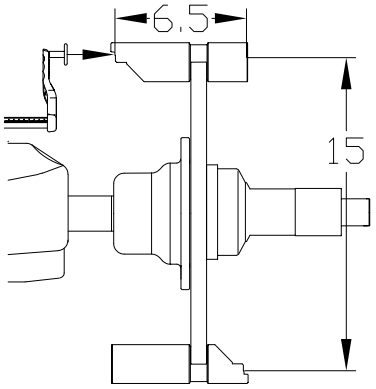
Comments
This feature is available on OPTIMA CRT models only.

C122 Camera And Sonar Calibration (BFH800 / 9600P)

Before the Scanner and Sonar can accurately obtain the dwata needed to balance the wheel and tire assembly they must be calibrated. The calibration information is stored on the CCD / Scanner PCB. This information is stored using C90 after completing the calibration.

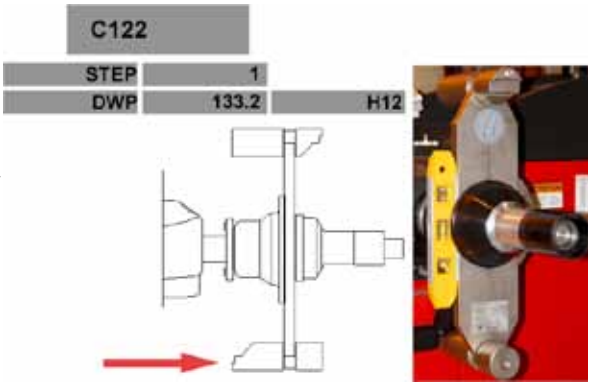
NOTE: THE BALANCER MUST BE IN THE MANUAL MODE AND ALL PRUEFROTOR PARAMETERS ENTERED BEFORE CONTINUING THIS PROCEDURE . AT LEAST TWO REVOLUTIONS OF THE SHAFT SHOULD BE MADE SO THAT THE SHAFT ENCODER CAN LOCATE HOME REFERENCE. THIS CAN BE DONE BY QUICKLY ROTATING THE SHAFT UNTIL THE ENCODER READS.

1. Mount the Pruefrotor as shown in the figure on the right, making sure the the orientation of the Pruefrotor is turned correctly. Failure to do so will fail the calibration procedure.

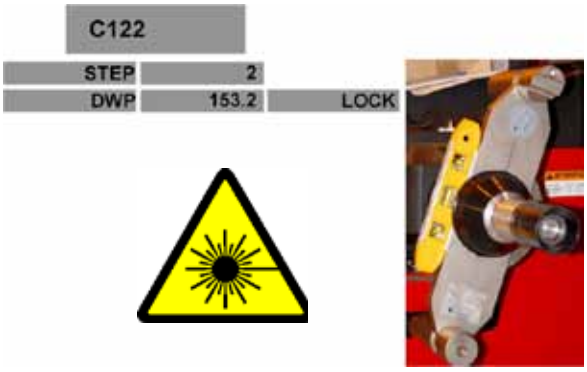


2. Using a small magnetic torpedo level, turn the shaft until the Pruefrotor is in the verticle position.

3. Press the <Enter> key (F6). After doing so the display will change and display a random number. This number is not important however make note of the number for the next step. For our example we have used 133.2.



4. Slowly rotate the shaft clockwise 20° (153.2). The display will quickly show “LOCK” and the magnetic brake of the balancer will engage. The inner scanner will scan the inside profile of the Pruefrotor DO NOT MOVE THE SHAFT UNTIL INSTRUCTED. After the scanner completes the profile a beep will sound.



Lower the hood for the following step.

5. Remove the Pruefrotor from the shaft and install the Sonar Calibration tool (EAA0344G09A). Slowly rotate the calibration fixture (Figure A below) clockwise until a reading between 284 - 304mm appears on the sonar diagnostic flag. Press the <F6> key to enter this value. Rotate the shaft 180° (Figure B), the reading should be approximately 50mm less than the previous reading. A tape measure can be used to verify the distance from the sonar to the face of the calibration fixture.

6. The balancer will emit a tone after completing the calibration procedures and an “END” will be displayed for step 5. Perform a C90 to store the new calibration factors.

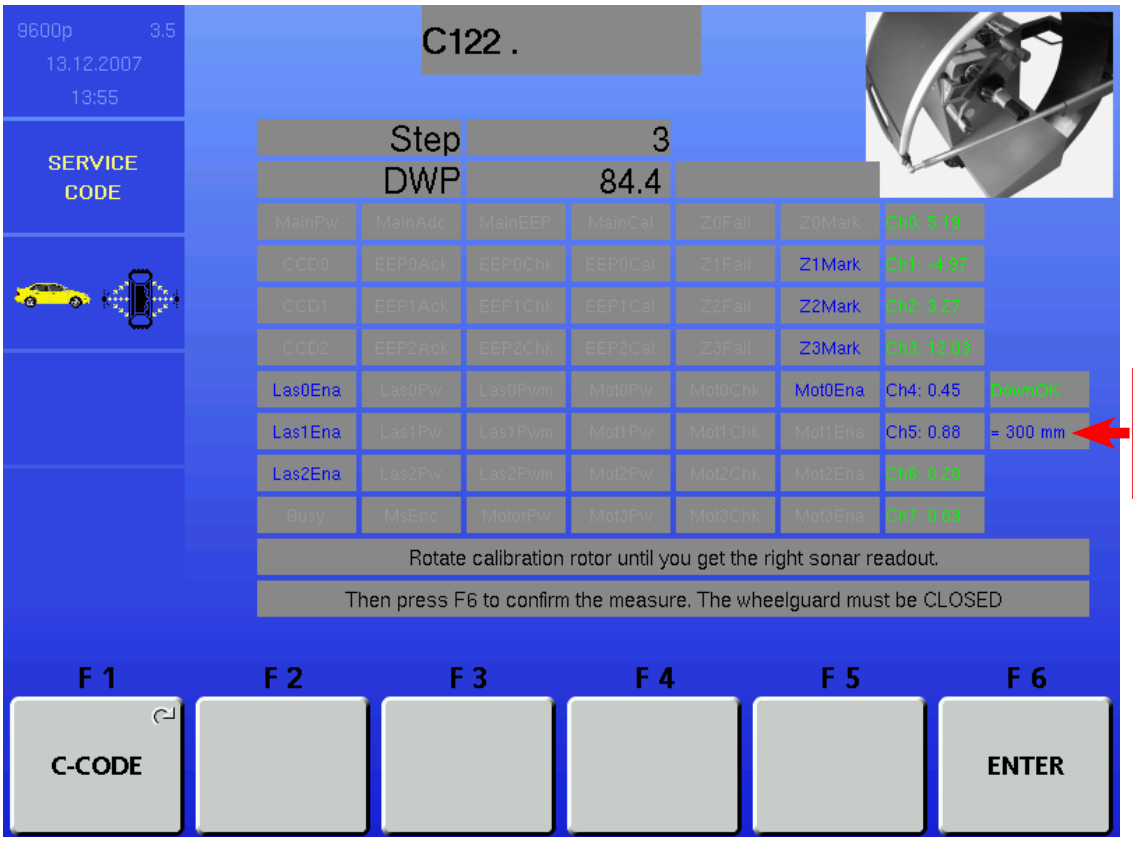
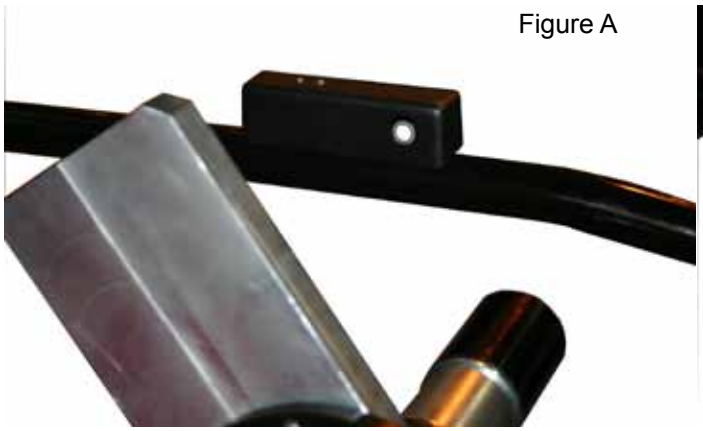
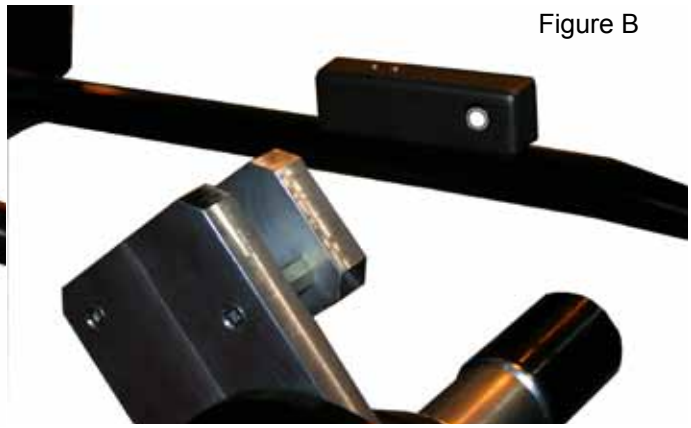


Figure A



Between 284 - 304

Figure B



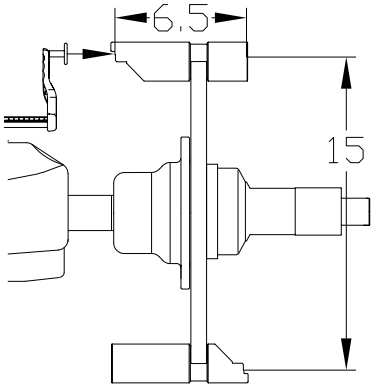
Between 234 - 254

C122 Scanner / Laser / Ccd Calibration (Optima / BFH 1000)

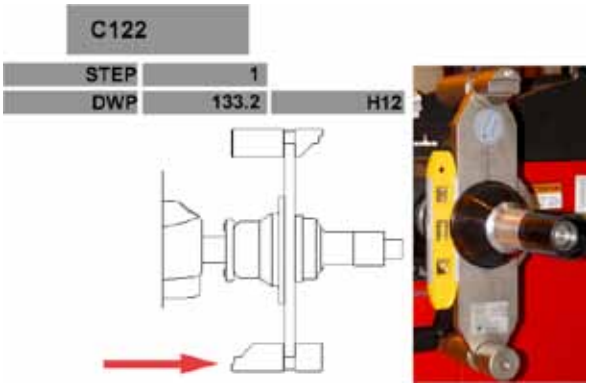
Before the Scanner assemblies can accurately obtain the data needed to balance the wheel and tire assembly they must be calibrated. The calibration information is stored on the CCD / Scanner PCB. This information is stored automatically after completing the calibration. It is recommended that a check of scanner adjustments be made using the C123 procedure before calibrating the scanner assemblies.

NOTE: THE BALANCER MUST BE IN THE MANUAL MODE AND ALL PRUEFROTOR PARAMETERS ENTERED BEFORE CONTINUING THIS PROCEDURE . AT LEAST TWO REVOLUTIONS OF THE SHAFT SHOULD BE MADE SO THAT THE SHAFT ENCODER CAN LOCATE HOME REFERENCE. THIS CAN BE DONE BY QUICKLY ROTATING THE SHAFT UNTIL THE ENCODER READS.

1. Mount the Pruefrotor as shown in the figure on the right, making sure the the orientation of the Pruefrotor is turned correctly. Failure to do so will fail the calibration procedure.



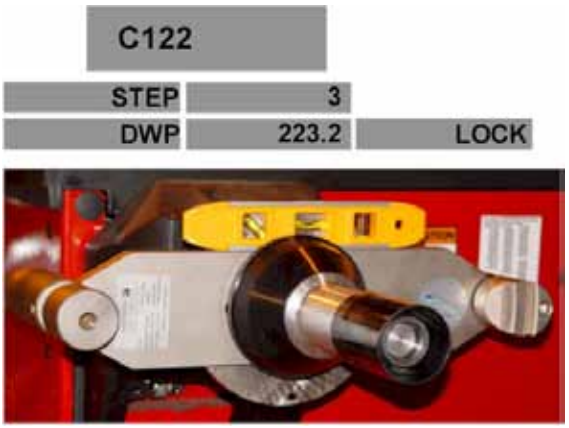
2. Using a small magnetic torpedo level, turn the shaft until the Pruefrotor is in the verticle position.
3. Press the <Enter> key (F6). After doing so the display will change and display a random number. This number is not important however make note of the number for the next step. For our example we have used 133.2.



4. Slowly rotate the shaft clockwise 20° (153.2). The display will quickly show “LOCK” and the magnetic brake of the balancer will engage. The inner scanner will scan the inside profile of the Pruefrotor DO NOT MOVE THE SHAFT UNTIL INSTRUCTED. After the scanner completes the profile a beep will sound.

NOTE: LOWER THE HOOD FOR THE FOLLOWING STEPS.

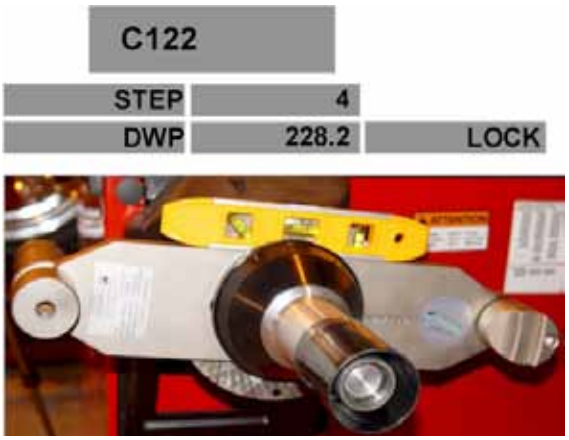
5. Slowly rotate the shaft clockwise 70° (223.2). Once again the "LOCK" will display and the magnetic brake will engage.



The outside scanner will begin to take an outside profile of the Pruefrotor The laser light will move from the balancer shaft out to the end of the Pruefrotor (See the red arrow to the right). After the profile has been taken a beep will sound.

At this point it is possible to proceed two different ways providing you have a "T" calibration tool, UI 2.9 (or higher) AWP 0.71 (or higher). If the balancer has the software and tool to accomodate the "T" fixture proceed to step 6b.

6. Slowly rotate the shaft clockwise 5° (228.2). Once the correct position is reached the "LOCK" will be displayed and the magnetic brake will engage and lock the shaft.



The rear scanner will begin to travel and make a complete cycle from the left to the right and back to the left. The scanner is determining the location of the face of the bell housing and the runout profile of the Pruefrotor.

7. The balancer will emit a tone after completing the calibration procedures and an "END" will be displayed for step 5.

Perform a C90 to store the new calibration factors.

6b. Unclamp the Pruefrotor and clamp the "T" fixture on the shaft with the reference hole (yellow arrow) away from the balancer. Using a torpedo level, vertically level the "T" fixture. Press <F6> to confirm.

7b. Slowly rotate the "T" fixture -85 degrees (CCW) until "LOCK" appears and engages the magnetic brake. Hold that position until the brake locks and "CAL" appears on the screen. The rear scanner assembly will engage and travel across the back. When the scan is complete the brake WILL NOT release. Firmly grab the "T" fixture and press <F6>, the brake will release. Perform a C90 to store the new calibration factors.

NOTE: IF AN "ERROR" OCCURS DURING CALIBRATION REPEAT EACH STEP CAREFULLY. SHOULD AN ERROR OCCUR A SECOND TIME MAKE SURE EACH SCANNER IS ADJUSTED CORRECTLY USING C123.

CALIBRATION COMPLETE

C122 Scanner / Laser / Ccd Calibration (Optima2 / RFV 2000)

Preconditions:

- Wheel balancer and SAPE must be already calibrated.
- The balancer must be in the manual mode before continuing this procedure.
- At least two revolutions of the shaft should be made so that the shaft Encoder can locate home reference. This must be done using the manual balancing mode.
- HUB Diagnostic Flags must be in an acceptable state; See Appendix “HUB Flags for C122 / C123”.
- The calibration rotor must be clamped without cone and with plastic spacer mounted on the clamping nut.

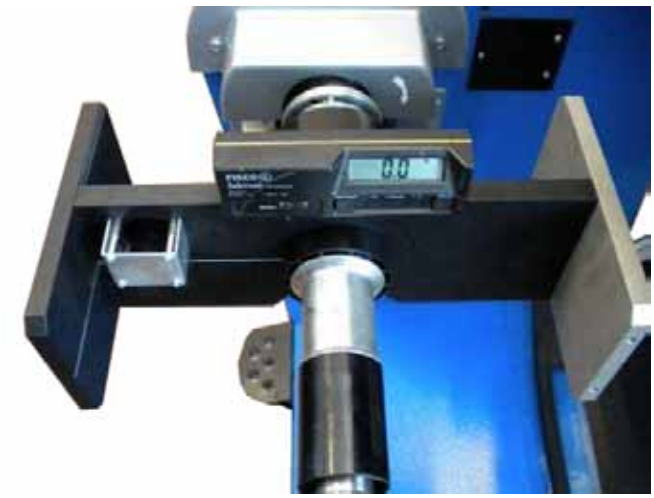

- Press F1 button (enter) or OK to start the calibration

STEP 1:

Under the “Diag” writing, 56 flags are displayed: 16 diagnostic flags + 32 status flags + 8 analog input flags; the meaning of all these flags is explained in the Appendix “HUB Flags for C122 / C123”.

- In the first line the actual step number is displayed.
- In the second line appears the angular position of the shaft.
- In the right upper side, over the picture, the operation status is shown.
- Check if all the flags are OK (grey or blue color), except for the MainCal flag, which may be red-lighted if calibration is required. Any different situation means that an error occurred;

- Place the calibration rotor with the white plate backward to 9 o’clock.
- Using a spirit level or an inclinometer, set the calibrator in horizontal position at 0° degrees and press F6 or “OK” button on the keyboard



- Press F6 (enter) or OK to enter step 2;

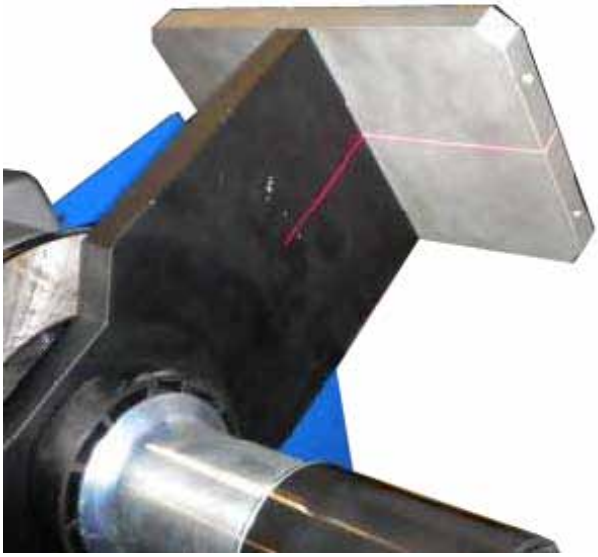
STEP 2: INNER CAMERA

- Slowly rotate the calibration rotor watching the screen upper right side. When the 0° degrees value is reached, hold the position for few seconds so that the SW automatically brakes the rotor in position displaying “LOCK” on the screen and then “CAL” will be displayed on the screen meaning the scanning procedure is starting.

- When scan is completed, a beep is emitted and the software will move automatically to step 3: if an error occurred, “ERROR” appears on line 2; else if 100 seconds pass without results, “Timeout” is displayed. Press F6 to retry;

STEP 3: EXTERNAL CAMERA

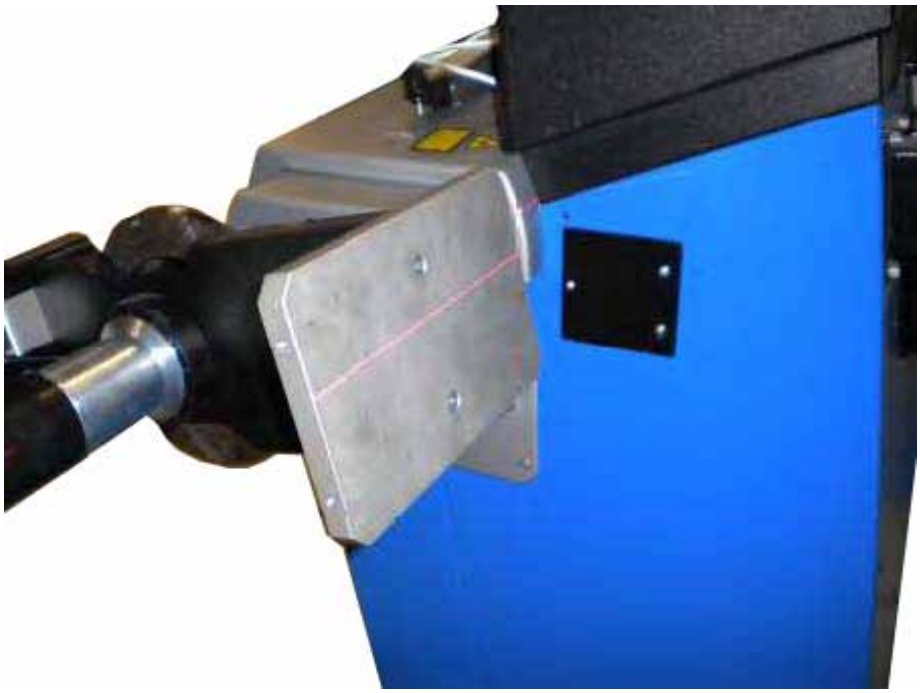
- Close the hood and slowly rotate the calibration rotor watching the screen upper right side. When the 0° degrees value is reached, hold the position for few seconds so that the SW automatically will brake the rotor in position displaying on the screen “LOCK” followed after a while by “CAL”, meaning that the scanning procedure is starting.



- When scan is completed, a beep is emitted and the software will move automatically to step 4: if an error occurred, “ERROR” appears on line 2; else if 100 seconds pass without results, “Timeout” is displayed. Press F6 to retry;

STEP 4: REAR CAMERA

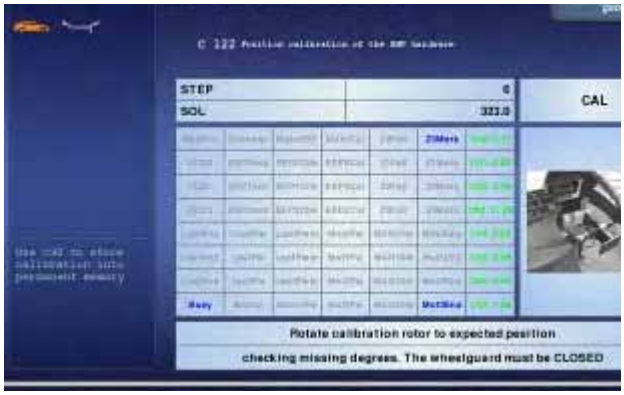
- Keep the hood closed and slowly rotate the calibration rotor watching the screen upper right side. When the 0° degrees value is reached, hold the position for few seconds so that the SW automatically will brake the rotor in position displaying on the screen “LOCK” followed after a while by “CAL”, meaning that the scanning procedure is starting.

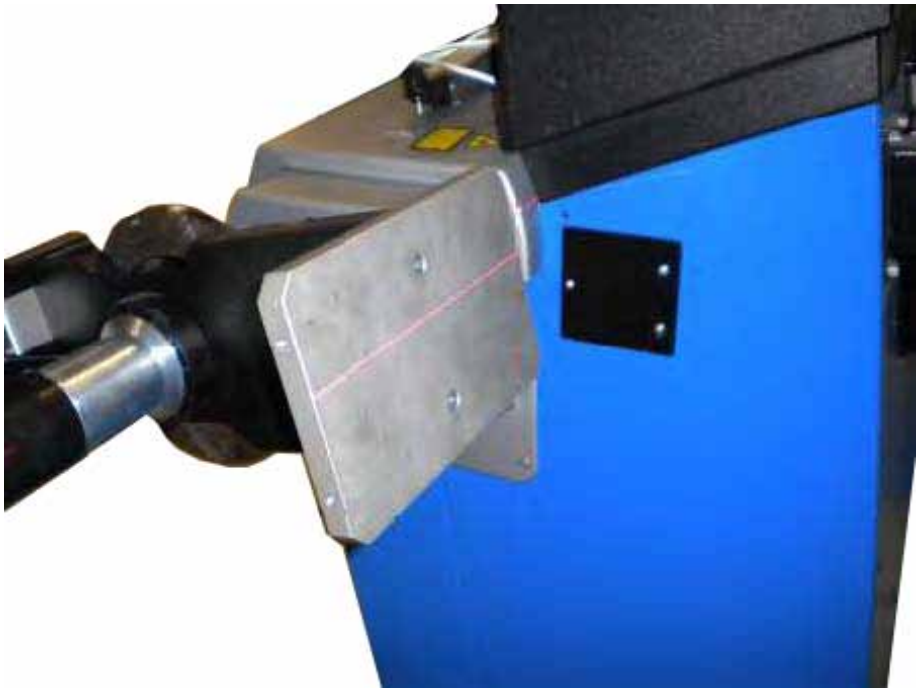


- When scan is completed, a beep is emitted and the software will move automatically to step 5: if an error occurred, “ERROR” appears on line 2; else if 100 seconds pass without results, “Timeout” is displayed. Press F6 to retry;

STEP 5 AND 6: LATERAL REAR LEFT AND RIGHT CAMERA

- The calibration in Step 5 (lateral rear left camera) and in Step 6 (lateral rear right camera) will be performed automatically after Step 4 because the calibrator is already positioned.





STEP 7: END OF CAMERA CALIBRATION

C123 Diagnostic functions (Optima 1 / BFH 1000)

When troubleshooting the BFH/Optima series balancer it is recommended that the technician use the diagnostic information that is available on screen in both the C122 and C123 functions. Information from each scanner / laser assembly is reported on screen and is color coded for easy diagnostics. When the balancer is initially powered up the unit will run a self diagnostic test of all internal components. Each of these test are outlined in the service manual (TEEWB519A). After running the internal diagnostic test the software initiates a self test of all 3 scanner and laser assemblies along with the AWP board. If there are any failures to report the technician can determine the failed component using C123. Some failures reported are easily repaired with minor adjustments and calibration and other failures may require scanner replacement.

The information on C122 and C123 is broken into 3 categories:

1. Diagnostic bits - Self diagnostic test on CCD, EEP (memory), Cal (calibration) and ZMarks (home reference). If a Diagnostic bit is in red the unit will display an error code on boot up.
2. Status Flags - Status flags are used to indicate that a command has been issued to a device and the device has responded to the command. This does not mean that the component is functioning correctly.
3. Analog Inputs - There are eight A/D converter channels checked. Normal Analog errors reflect AWP failures.

When analyzing data from C122 / C123 diagnostic screen the scanner and laser assemblies are identified as:

Inside Camera	***Outside Camera***	***Rear Camera***	***Rear Slide Car***
CCD0 (camera)	CCD1 (camera)	CCD2 (camera)	
EEP0 (memory)	EEP1 (memory)	EEP2 (memory)	
Mot0 (motor)	Mot1 (motor)	Mot2 (motor)	Mot3 (motor)
Zmark0 (motor home)	ZMark1 (motor home)	ZMark2 (motor home)	ZMark3 (motor home)

ACCESSING THE DIAGNOSTIC FEATURES (BFH 1000 / Optima 1)

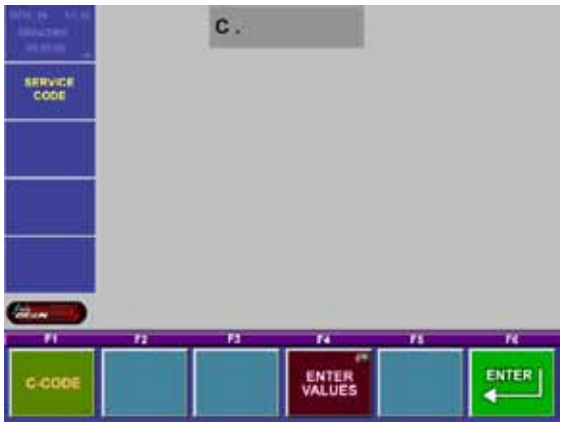
1. From the Introduction Screen press the <***FUNCTION***> key (F1) to enter in to the Function Menu.

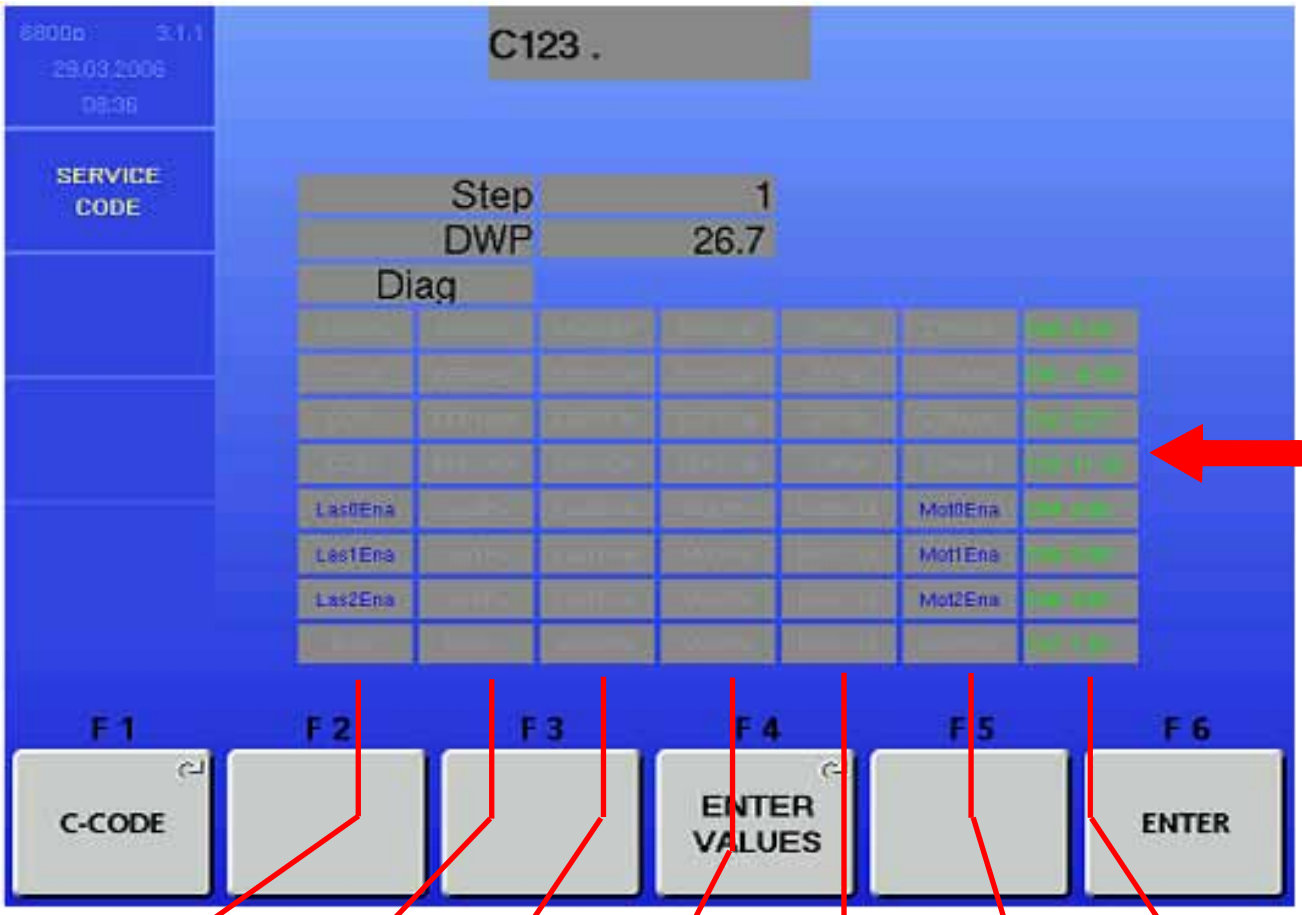
2. By pressing the **<F6>** key 3 times successively the "***SERVICE***" key (F4) will become active.

NOTE: BEFORE PERFORMING ANY "C-CODES" ON THE BFH/ OPTIMA BALANCER THE TECHNICIAN MUST FORCE THE BALANCER INTO THE MANUAL MODE.

3. By pressing the **<F4>** key the service program will become active.

4. Press and hold the <***C-CODE***> key (F1) and rotate the main shaft the to select C122 or C123. Release the <F1> key once the desired C-code is displayed.





MainPw(0)	MainAdc(36)	MainEEP(4)	MainCal(8)	Z0Fail(12)	Z0Mark(28)	Ch0:X.XX
CCD00(1)	EEP0Ack(33)	EEP0Chk(5)	EEP0Cal(9)	Z1Fail(13)	Z1Mark(29)	Ch1:X.XX
CCD1(2)	EEP1Ack(34)	EEP1Chk(6)	EEP1Cal(10)	Z2Fail(14)	Z2Mark(30)	Ch2:X.XX
CCD2(3)	EEP2Ack(35)	EEP2Chk(7)	EEP2Cal(11)	Z3Fail(15)	Z3Mark(31)	Ch3:X.XX
Las0Ena(45)	Las0Pw(37)	Las0Pwm(41)	Mot0Pw(20)	Mot0Chk(16)	Mot0Ena(24)	Ch4:X.XX
Las1Ena(46)	Las1Pw(38)	Las1Pwm(42)	Mot1Pw(21)	Mot1Chk(17)	Mot1Ena(25)	Ch5:X.XX
Las2Ena(47)	Las2Pw(39)	Las2Pwm(43)	Mot2Pw(22)	Mot2Chk(18)	Mot2Ena(26)	Ch6:X.XX
Busy(44)	MsEnc(40)	MotorPw(32)	Mot3Pw(23)	Mot3Chk(19)	MoteEna(27)	Ch7:X.XX

Diagnositc Bits (shown in black)

Diagnostic bits, 0 (failure) is displayed in **RED**, 1 (ok) is **GRAY**.

Note: Diagnostics bits will produce an error code.

Bit	Shown label	Meaning	Notes
0	MainPw	Analog/logic power supply	
1	CCD0	Inner CCD signals	
2	CCD1	Outer CCD signals	
3	CCD2	Rear CCD signals2	
4	MainEEP	Main board EEPROM memory valid	
5	EEP0Chk	Inner EEPROM memory valid	
6	EEP1Chk	Outer EEPROM memory valid	
7	EEP2Chk	Rear EEPROM memory valid	2
8	MainCal	Cameras calibration (E360,C122)	
9	EEP0Cal	Inner scanner factory calibration	
10	EEP1Cal	Outer scanner factory calibration	
11	EEP2Cal	Rear scanner factory calibration	2
12	Z0Fail	Inner motor home mark detection	
13	Z1Fail	Outer motor home mark detection	
14	Z2Fail	Rear motor home mark detection	2
15	Z3Fail	Rear shift motor home mark detection	2
16	Mot0Chk	Inner motor missing steps	
17	Mot1Chk	Outer motor missing steps	
18	Mot2Chk	Rear motor missing steps	2
19	Mot3Chk	Rear shift motor missing steps	2
20	Mot0Pw	Inner motor current sink / power check	1
21	Mot1Pw	Outer motor current sink / power check	1
22	Mot2Pw	Rear motor current sink / power check	1 - 2
23	Mot3Pw	Rear shift motor current sink / power check	1 - 2
32	MotorPw	External motor power supply	1
33	EEP0Ack	Inner EEPROM memory ACK	
34	EEP1Ack	Outer EEPROM memory ACK	
35	EEP2Ack	Rear EEPROM memory ACK	2
36	MainAdc	Camera board A/D converter check	
37	Las0Pw	Inner laser current sink / power check	1
38	Las1Pw	Outer laser current sink / power check	1
39	Las2Pw	Rear laser current sink / power check	1 - 2
40	MsEnc	Shaft encoder zero mark detection	3
41	Las0Pwm	Inner laser modulation	1
42	Las1Pwm	Outer laser modulation	1
43	Las2Pwm	Rear laser modulation	1 - 2

Notes:

1. Available only on new camera boards (EAP0204G50B), default to 1 on former boards.
2. Obviously fails on any BFH/Optima without the rear scanner. (this unit does not have a rear scanner and camera assembly)
3. Valid after runout measurement only.

Status Flags (Shown in Blue)

Status Bits, 0 (disable) is displayed in **GRAY**, 1 (enable) is **BLUE**.

Bit	Displayed	Meaning
24	Mot0Ena	Inner motor power enable
25	Mot1Ena	Outer motor power enable
26	Mot2Ena	Rear motor power enable
27	Mot3Ena	Rear shift motor power enable
28	Z0Mark	Inner motor home mark
29	Z1Mark	Outer motor home mark
30	Z2Mark	Rear motor home mark
31	Z3Mark	Rear shift motor home mark
44	Busy	Firmware ready/busy status
45	Las0Ena	Inner laser power enable
46	Las1Ena	Outer laser power enable
47	Las2Ena	Rear laser power enable

Analog Inputs: (Shown in Green)

For ***Analog Values***, normal data is GREEN, out of range is **RED**.

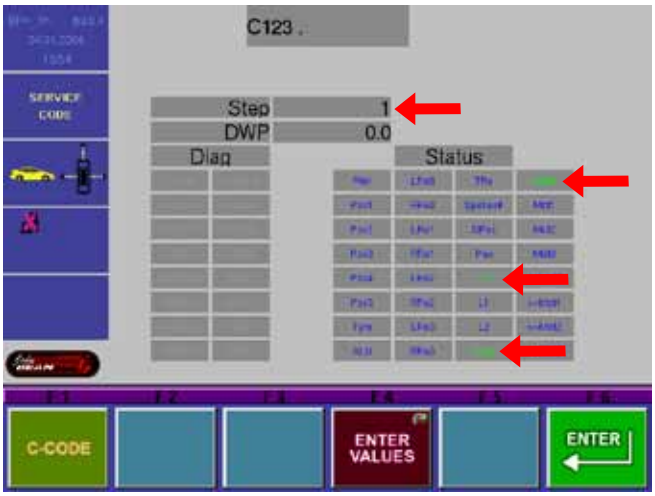
Ch	Analog input	Valid range
0	5.00 V power supply	4.80 V ÷ 5.60 V
1	-5.00 V analog power supply	-5.60 V ÷ -4.80 V
2	3.30 V logic power supply	3.00 V ÷ 3.60 V
3	9.00 V external motor power supply	8.00 V ÷ 12.00 V
4	AUX 0 external input	0 V ÷ 4.096 V
5	AUX 1 external input	0 V ÷ 4.096 V
6	Laser current sink	0 V ÷ 4.096 V
7	Motor current sink	0 V ÷ 4.096 V

C123 Mechanical Scanner / Laser / CCD Adjustment

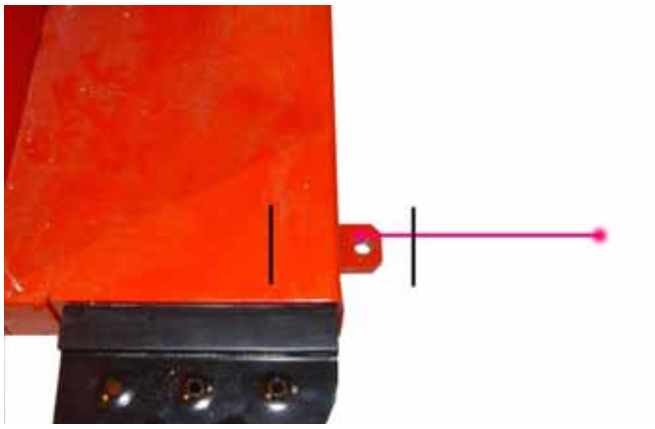
If the BFH/Optima balancer fails any part of the C122 camera calibration it may be necessary to adjust one or more of the cameras. If any of the Scanner assemblies require replacement it will also be necessary to check the mechanical adjustment before calibration.

1. Access the service menu and program the balancer to run C123.

2. Step 1 accesses and avtivates the inside laser and “motor 0”. Press the **<Enter>** key (F6) to start the inside scanner. Deactivate the scanner motor by pressing the **<Enter>** key (F6).



3. Looking down at the anchor tab just under the main shaft a laser light will be illuminated. The figure to the right shows the direction of travel. The scanner must stop somewhere between the two black illustrated lines. See ***“Inside Scanner Adjustment”*** for procedure.

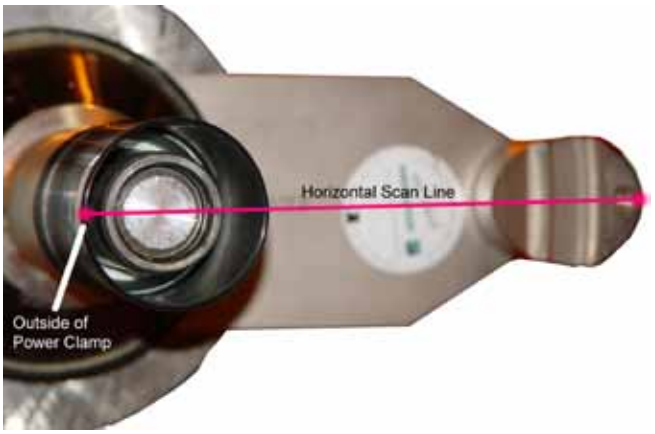


4. Press the **<Enter Values>** key (F4) and turn the shaft to proceed to the outside scanner.

5. Step 2 accesses and runs the outside scanner test “motor 1”. The Pruefrotor must be mounted on the shaft to verify the accuracy of this test.

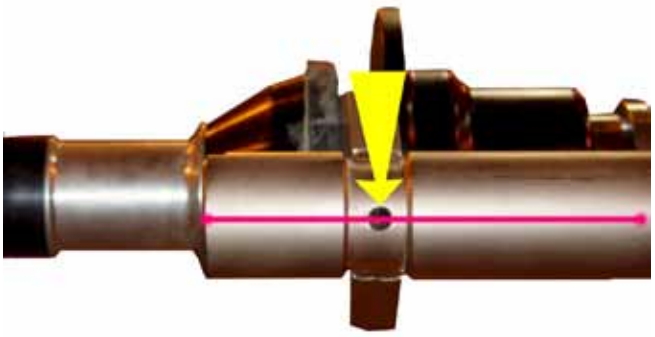
NOTE: THE HOOD OF THE BALANCER MUST CLOSE TO THE CORRECT HEIGHT BEFORE ANY ADJUSTMENTS ARE MADE. SEE “HOOD ADJUSTMENT” FOR THIS PROCEDURE.

6. Press the **<Enter>** key (F6) to start the outside scanner motor and laser. The laser must scan from the outside edge of the power clamp horizontally across the Pruefrotor towards the back of the balancer. See *Outside Scanner Adjustment* for procedure. Press the **<Enter>** key to stop the scanner motor and to proceed to the next step.

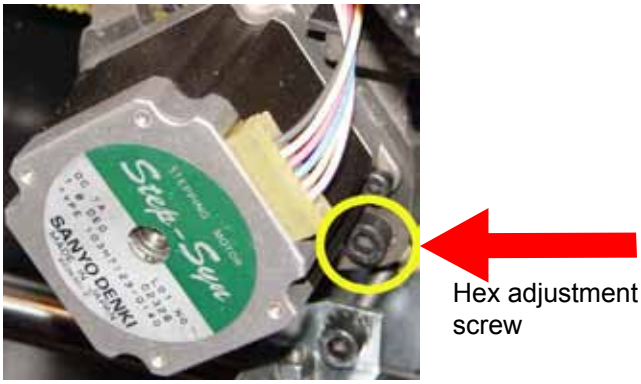


7. Press the ***<Enter Value>*** key (F4) and turn the shaft to access the rear scanner “motor 2”. Rotate the Pruefrotor forward 5° from a level position.

8. Press the **<Enter>** key (F6). The rear scanner assembly will leave the home position and stop towards the middle. The scanner motor will begin to move between two fixed points. The laser line should fall somewhere within the cutout hole on the Pruefrotor.



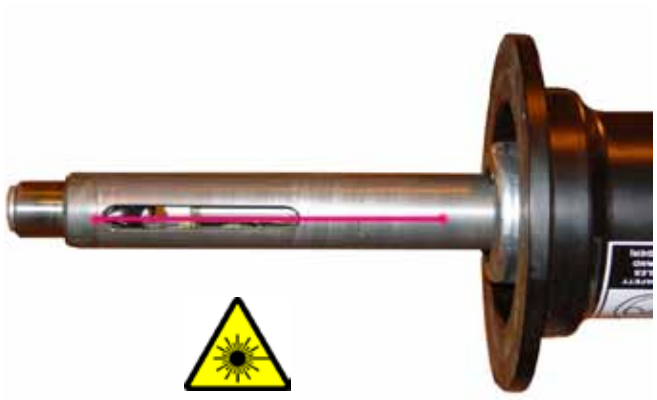
If the laser line does not scan the prefered area, adjust the hex screw on the back of the assembly to move the laser to the correct position.



Hex adjustment screw

9. Press the **<Enter>** key to stop the scanner motor and to proceed to step 4. Press and hold the ***<Enter Value>*** key (F4) and turn the shaft to access the rear scanner horizontal drive “motor 2”.

10. Remove the Pruefrotor from the shaft. Press the **<Enter>** key (F6). The rear scanner will begin to scan from left to right. From the rear of the unit see where the laser line is running along the shaft. The rear drive laser should run parallel with the shaft and in the center. If the laser does not run parallel with the shaft the rear scanner assembly may not be mounted parallel with the



C123 Optima 2 / RFV 2000

If the OPTIMA 2 and RFV 2000 balancers fail any part of the C122 camera calibration it may be necessary to adjust one or more of the cameras.

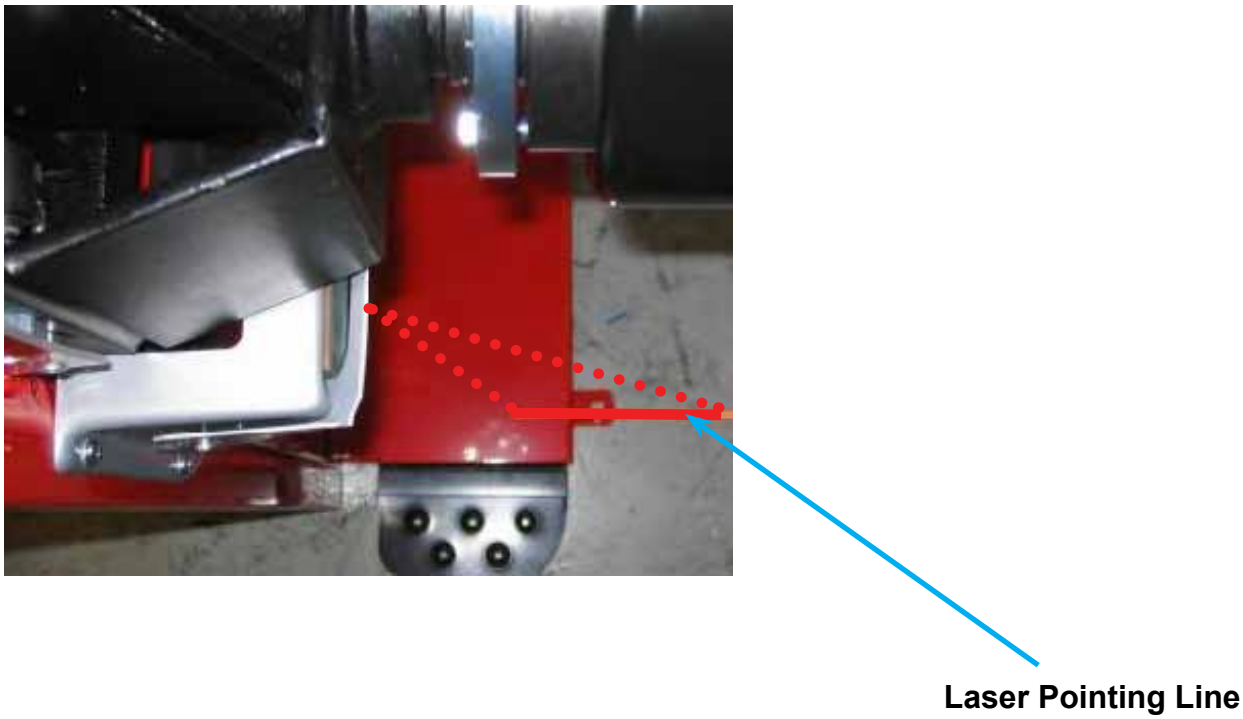
- Press F1 button to enter C123

STEP 1: INNER CAMERA AND LASER

- When C123 procedure is selected, the following screenshot is displayed
- Under the “Diag” writing, 56 flags are displayed: 16 diagnostic flags + 32 status flags + 8 analog input flags; the meaning of all these flags is explained in the Appendix “HUB Flags for C122 / C123”.
- In the first line of the screen the step number 1 is already selected.

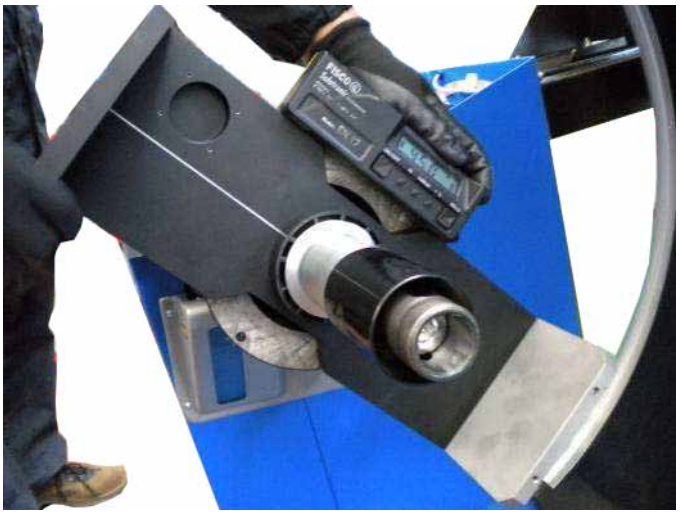
- Press F6 (ENTER) button or “OK” on the keyboard to confirm the test step number and start the test.
- The camera will to turn on to allow to watch the image on screen.

- Inner laser begins to move continuously between two fixed position. Make sure that its spot is moving parallel to the cabinet
- If the laser moves parallel continue with step 3. If not exit C123 and check the laser following paragraph??



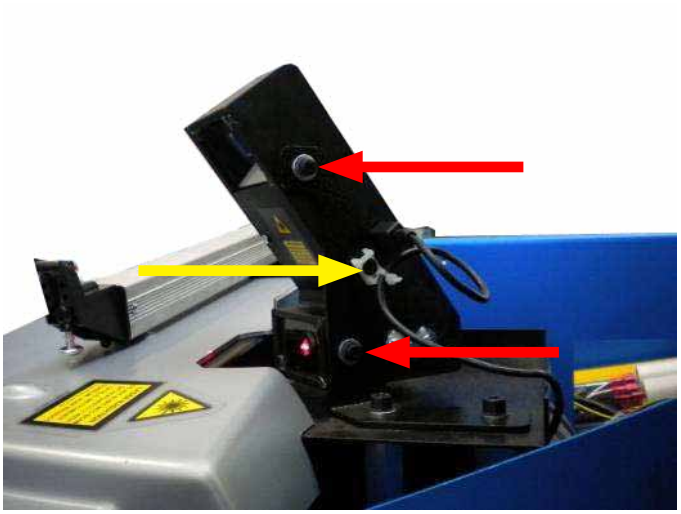
- Clamp the assy laser positioner without cone and with plastic spacer mounted on the quick nut.

- Place the assy laser positioner with the white plate backward to 9 o'clock.
- Place an electronic inclinometer on the laser positioner and rotate it at 45°.
- Press the pedal to brake and freeze the position. If necessary press again the pedal to unlock.



- Make sure that the stripe of light is perfectly superimposed to the line marked on the positioner.

- To adjust the strip of light position loose a little the central screw (fulcrum) and loose the other screws (red arrows) to adjust the camera slope.



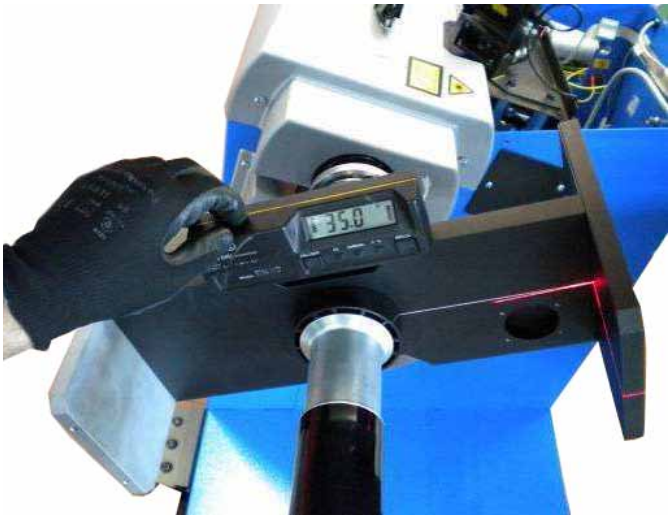
- When the stripe of light is perfectly superimposed to the line marked on the positioner, lock firmly the three adjustment screws.
- Press the pedal to unlock the positioner
- Press F6 to exit Step 1

- Press and hold F4 button and rotate the positioner to select step 2.

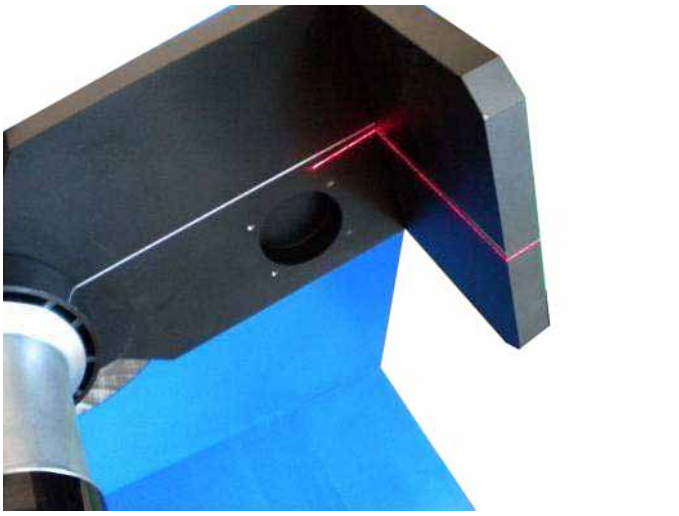
STEP 2: EXTERNAL CAMERA

- Press F6 (ENTER) button or “OK” on the keyboard to confirm the test step number.
- Camera will turn on to watch the image on scree and test can start..

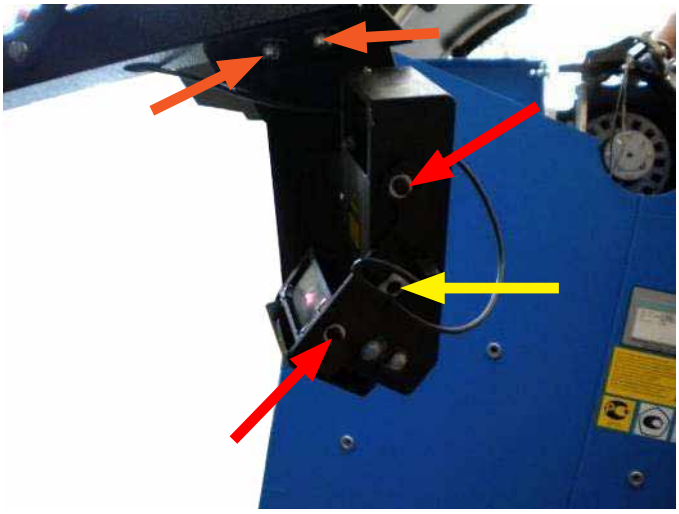
- Place the assy laser positioner with the white plate forward to 6 o’clock.
- Place an electronic inclinometer on the laser positioner and rotate it at 30°.
- Press the pedal to brake and freeze the position. If necessary press again the pedal to unlock.



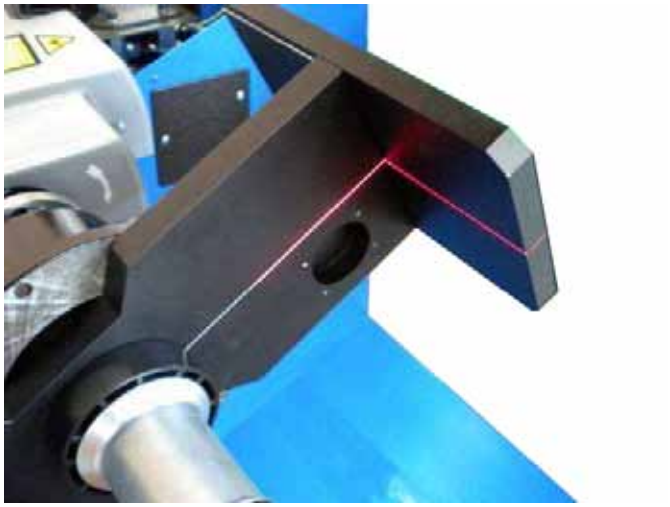
- Make sure that the stripe of light is perfectly superimposed to the line marked on the positioner.



- To adjust the strip of light position loose a little the central screw (fulcrum) and loose the other screws (red arrows) to adjust the camera slope.
- Besides for this camera, there are more adjustments, using the upper screws (orange arrows).



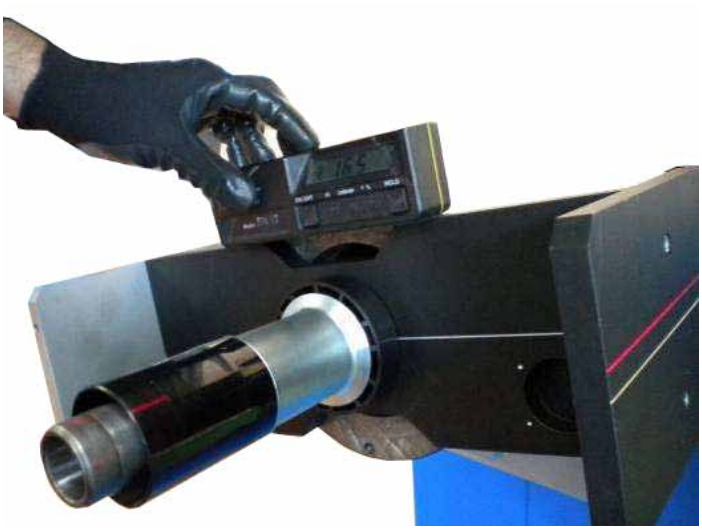
- When the stripe of light is perfectly superimposed to the line marked on the positioner, lock firmly the adjustment screws.
- Press the pedal to unlock the positioner
- Press F6 to exit Step 2



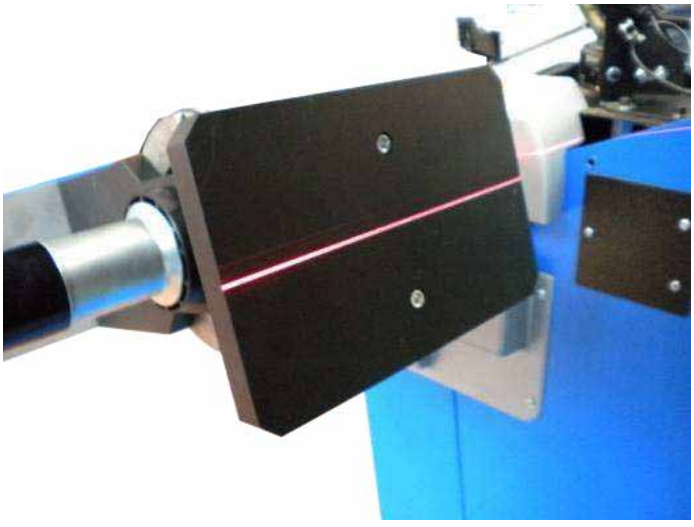
- Press and hold F4 button and rotate the positioner to select step 3.

STEP 3: REAR CAMERA

- Press F6 (ENTER) button or “OK” on the keyboard to confirm the test step number.
- Camera will turn on to watch the image on screen and test can start.

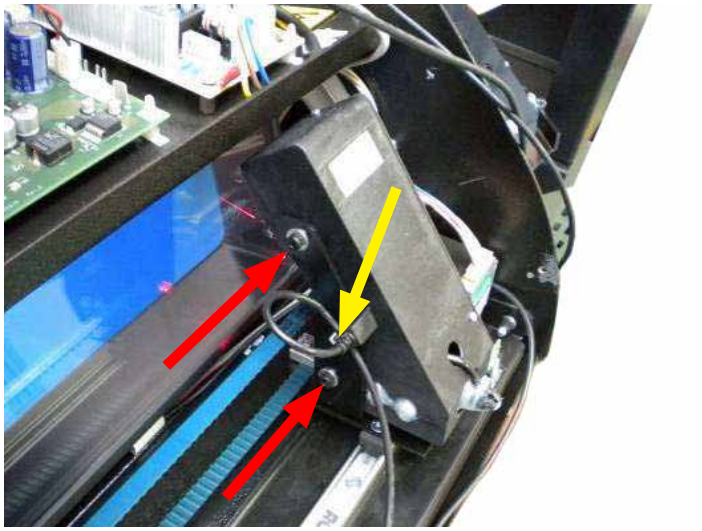


- Place the assy laser positioner with the white plate forward to 6 o’clock.
- Place an electronic inclinometer on the laser positioner and rotate it at 15.0°.
- Press the pedal to brake and freeze the position. If necessary press again the pedal to unlock.



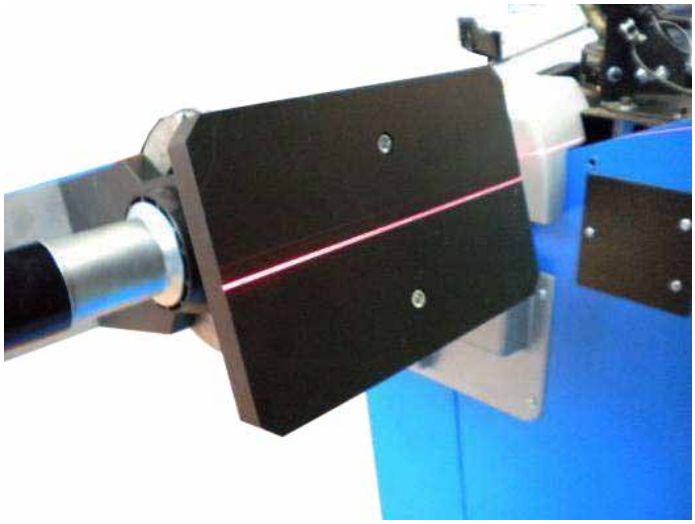
- Make sure that the stripe of light is perfectly superimposed to the line marked on the positioner.

- Loose a little the central screw (fulcrum) and loose the other screws (red arrows) to adjust the camera slope.



- If necessary adjust the camera carriage slope using the screw pointed the orange arrow.

- When the stripe of light is perfectly superimposed to the line marked on the positioner, lock firmly the three adjustment screws.
- Press the pedal to unlock the positioner
- Press F6 to exit Step 3

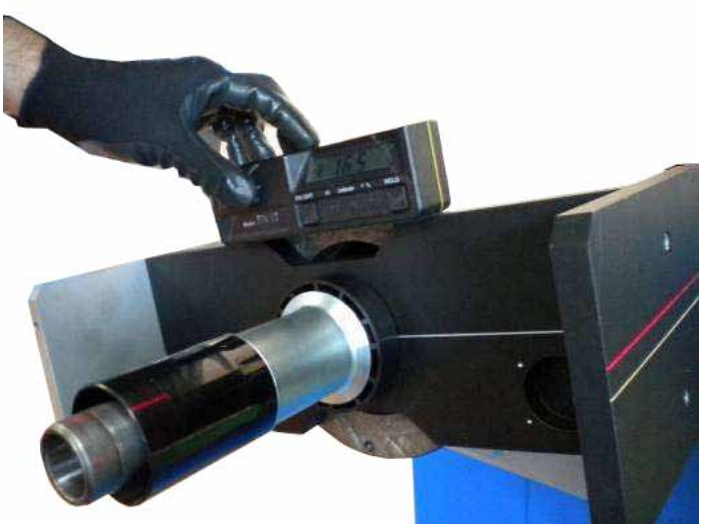


- Press and hold F4 button and rotate the positioner to select step 4.

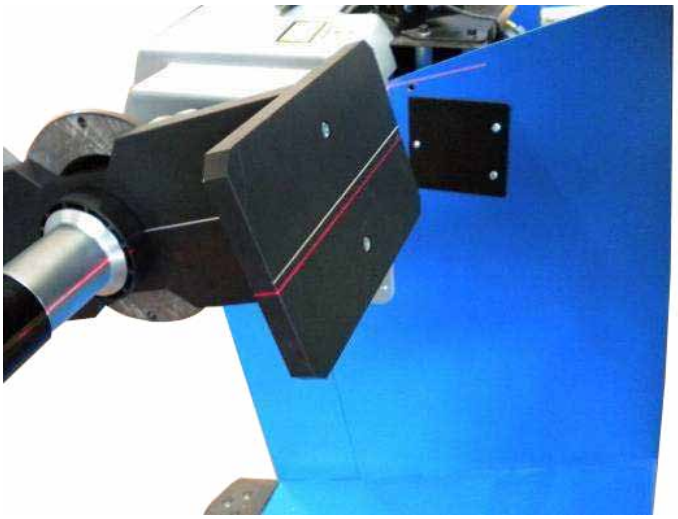
STEP 4: REAR LATERAL LEFT CAMERA

- Press F6 (ENTER) button or “OK” on the key-board to confirm the test step number.
- Camera will turn on to watch the image on screen and test can start.

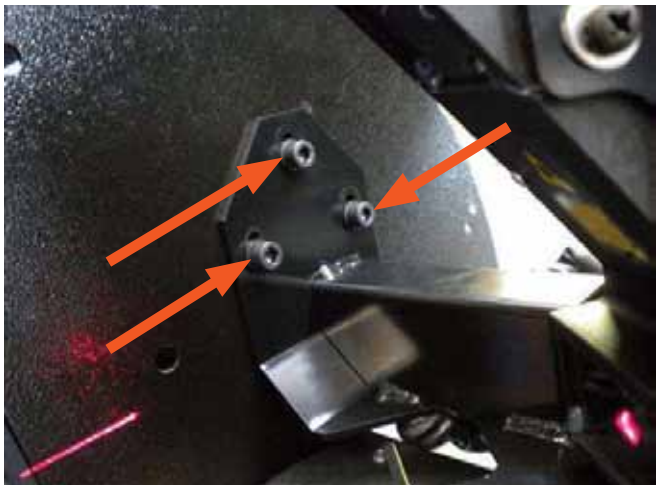
- Place the assy laser positioner with the white plate forward to 6 o’clock.
- Place an electronic inclinometer on the laser positioner and rotate it at 15.0°.
- Press the pedal to brake and freeze the position. If necessary press again the pedal to unlock.



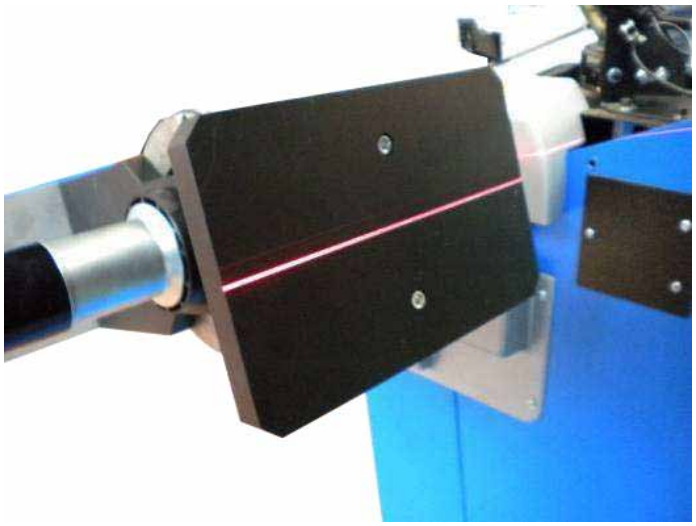
- Make sure that the stripe of light is perfectly su-perimposed to the line marked on the positioner.



- Adjust the support arm about in the middle of the three slots (orange arrows) and then loose a little the central screw (fulcrum) and loose the other screws (red arrows) to adjust the camera slope.



- When the stripe of light is perfectly superimposed to the line marked on the positioner, lock firmly the three adjustment screws.
- Press the pedal to unlock the positioner
- Press F6 to exit Step 4

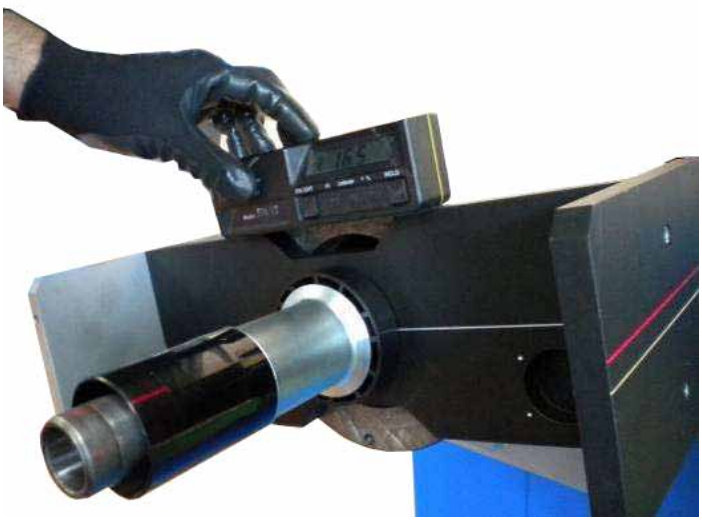


- Press and hold F4 button and rotate the positioner to select step 5.

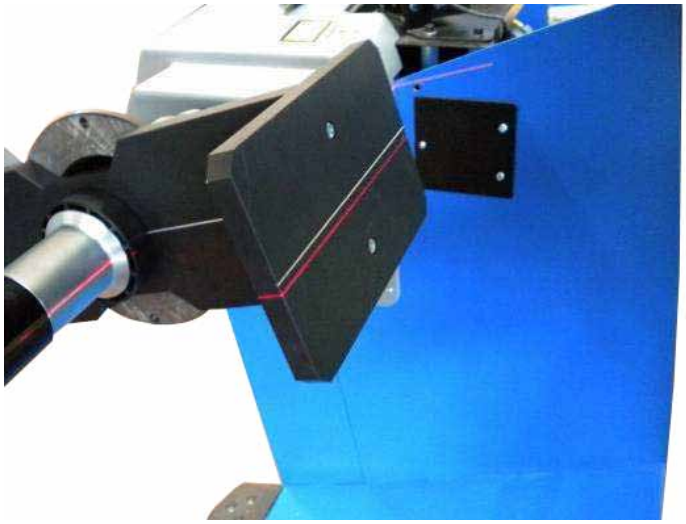
STEP 5: REAR LATERAL RIGHT CAMERA

- Press F6 (ENTER) button or “OK” on the key-board to confirm the test step number.
- Camera will turn on to watch the image on screen and test can start.

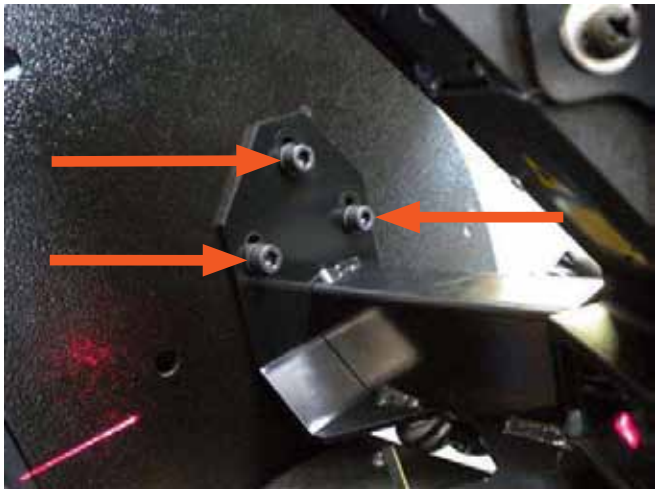
- Place the assy laser positioner with the white plate forward to 6 o'clock.
- Place an electronic inclinometer on the laser positioner and rotate it at 15.0°.
- Press the pedal to brake and freeze the position. If necessary press again the pedal to unlock.



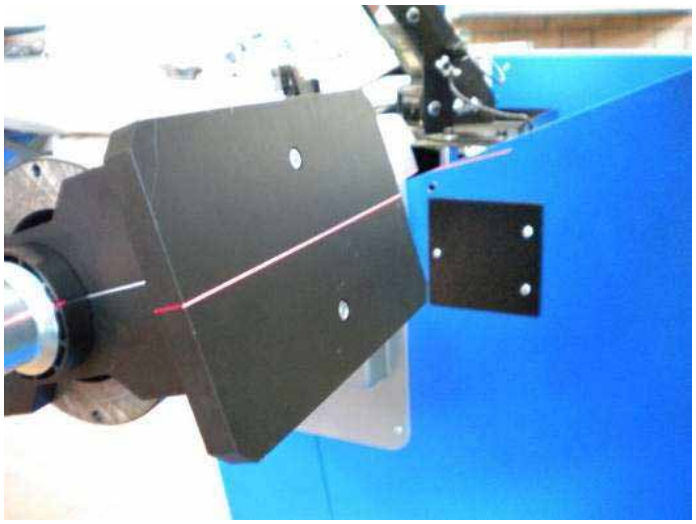
- Make sure that the stripe of light is perfectly superimposed to the line marked on the positioner.



- Adjust the support arm about in the middle of the three slots (orange arrows) and then loose a little the central screw (fulcrum) and loose the other screws (red arrows) to adjust the camera slope.



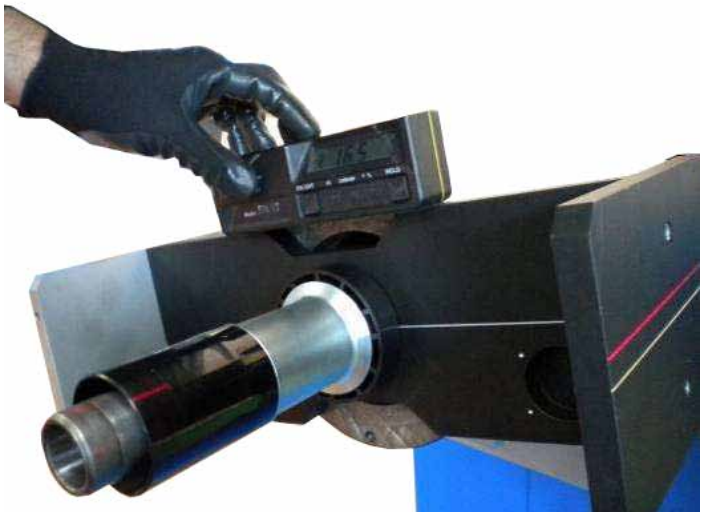
- When the stripe of light is perfectly superimposed to the line marked on the positioner, lock firmly the three adjustment screws.
- Press the pedal to unlock the positioner
- Press F6 to exit Step 5
- Press and hold F4 button and rotate the positioner to select step 6.



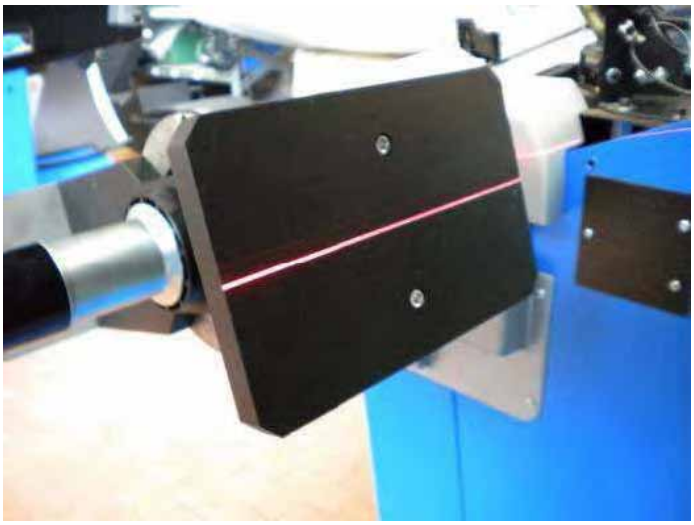
STEP 6: REAR CAMERAS STRIPS OF LIGHT COMPLANARITY.

- Press F6 (ENTER) button or “OK” on the keyboard to confirm the test step number.
- Camera will turn on to watch the image on screen and test can start.

- Place the assy laser positioner with the white plate forward to 6 o’clock.
- Place an electronic inclinometer on the laser positioner and rotate it at 15.0°.
- Press the pedal to brake and freeze the position. If necessary press again the pedal to unlock.

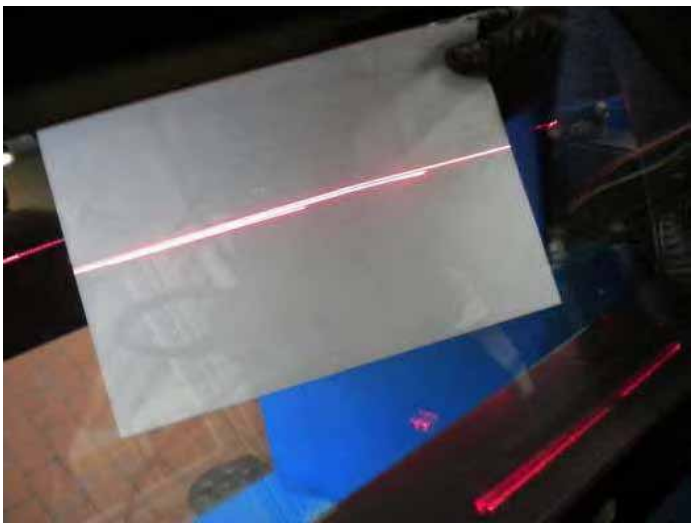


- Make sure that the three strips are coplanar each other and superimposed to the line marked on the positioner

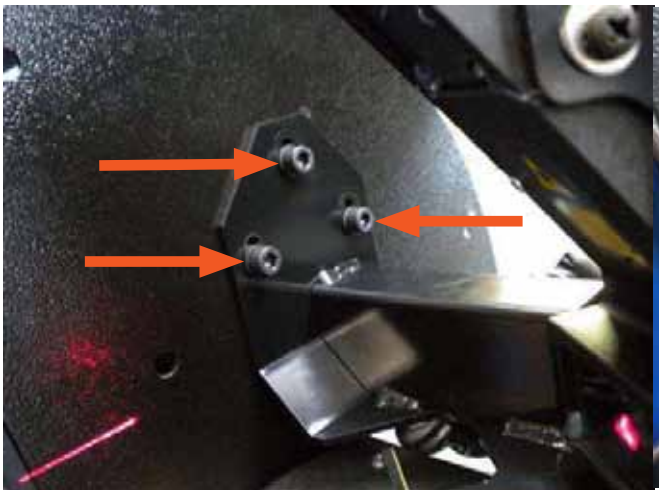


IMPORTANT!

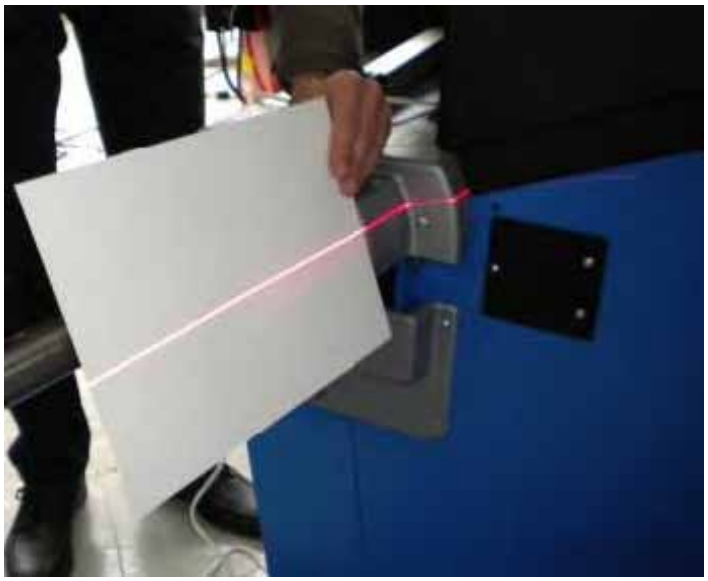
- To make sure about the strips coplanarity, a sheet of paper is needed. Hold in your hand the paper sheet and place it in between cameras and camera positioner.
- Move the paper sheet forward and backward Compared to the cameras and make sure the laser strips do not change alignment, like in the picture.



- To align properly the three planes, it is necessary to repeat the step 5 Rear Lateral Cameras. First adjusting the support arm up / down (orange arrows)
- Then loosen the central screw (fulcrum) and the other screws (red arrows) to adjust the camera slope.



- The final result has to be the projection of a unique line that does not have to change near as well as far to the cameras.



- Press the pedal to unlock the positioner
- Press F6 to exit Step 6
- Unclamp the laser positioner
- Press and hold F4 button and rotate the shaft to select step 7.

STEP 7: LASER AND REAR CAMERA MOTORS CONTROL.

- Press F6 (ENTER) button or “OK” on the keyboard to confirm the test step number.
- Use this step to make sure about the regular functioning of the laser and rear camera motors.

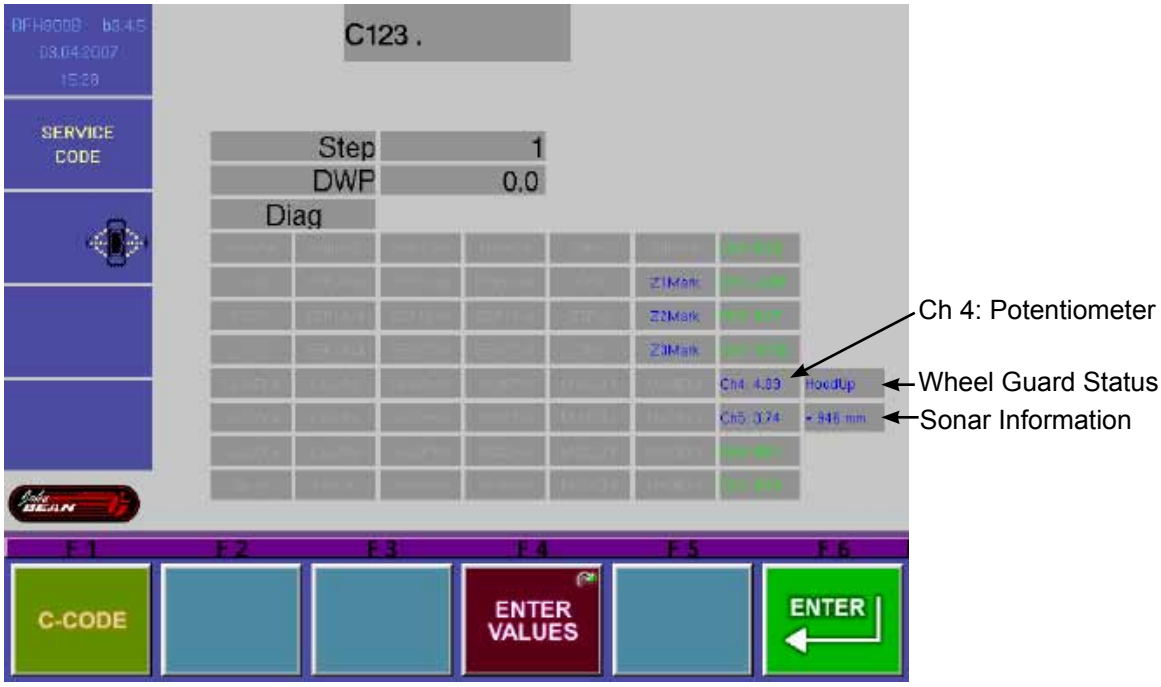
- Press F6 to exit Step 7.
- Press ESC button to exit C codes.

C123 Status / Diagnostic Sonar (BFH 800 / 9600P)

Follow the C83, C84 and C88 outlined earlier before performing a C122. The following setup and calibration procedures must be followed in order for the balancer to profile and diagnose any correction needed to balance a tire and wheel assembly correctly. Failure to follow the setup will introduce errors in the balancer that will result in comebacks.

The BFH800 / 9600P incorporates a potentiometer that monitors the state of the hood guard. The potentiometers measures the speed of the wheel guard as it closes so that it can accurately profile the outside of the wheel. If the potentiometer should get out of adjustment the balancer would display an error icon to the user indicating that the sonar was not able to accurately profile the wheel when the guard was closed thus forcing the user to manually enter the tire and wheel parameters. The output of the potentiometer can be located using the diagnostic flag screen in C123.

Below is a captured screen poining out the additional diagnostice flags while servicing a BFH800 / 9600P.



1. With the wheel guard closed measure from the ground to the center of the sonar on the outside of the wheel guard. The measurement should be between 32.375 and 32.625. Adjust the hood guard bolt as shown in figure 1 to bring the sonar device to the correct height.

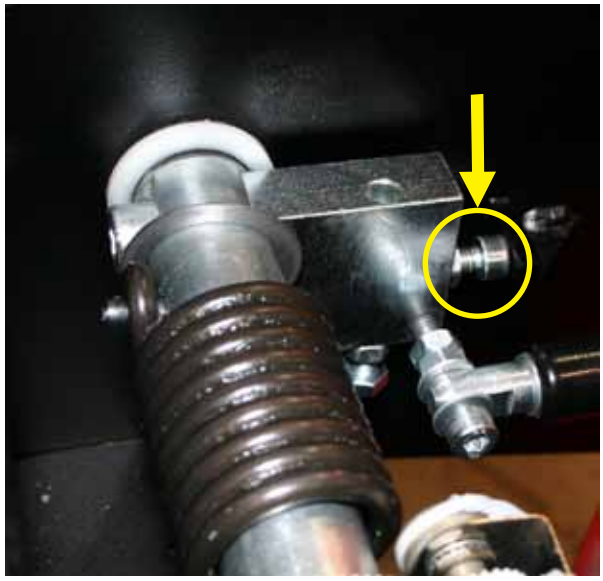
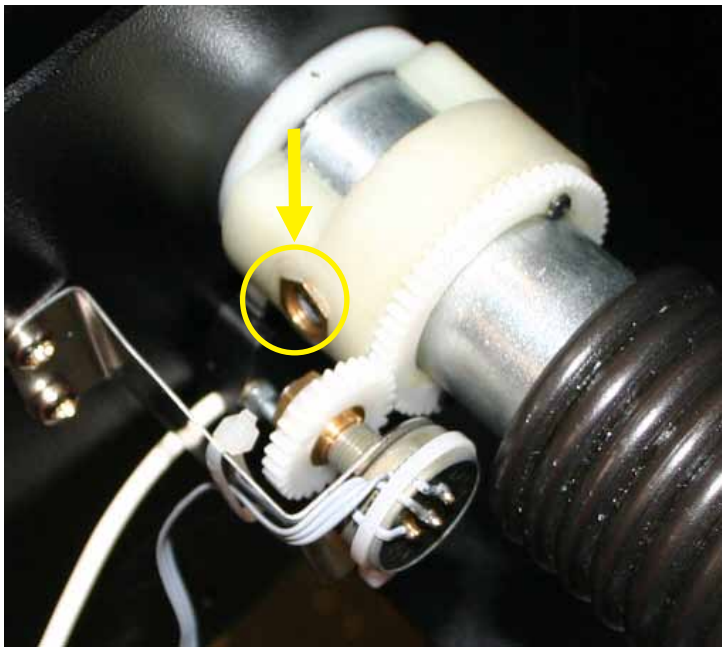


Figure 1

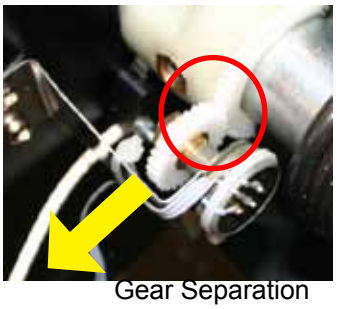
Figure 2

2. Check the Hood Shock for the proper tension

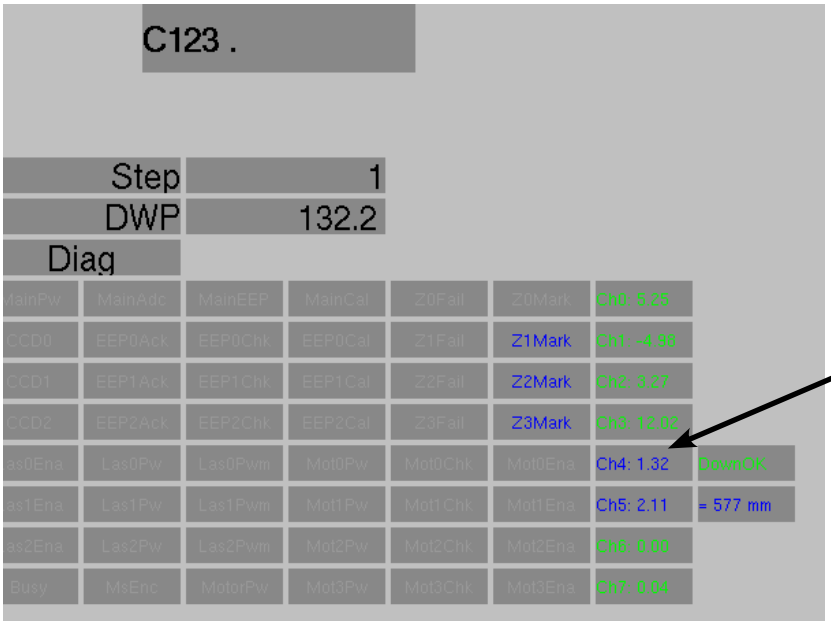
3. Using the C56 feature adjust the hood cam so that the hood switch will remain in the open position (000) until the hood is almost fully closed. At that point the value should read (100). Tighten the 2 set screws once the correct adjustment is obtained.



4. Using the C123 dianostic screen refer to the potentiometer voltage on Channel 4. The value must be between .5V - 1.8V. If the values are not correct gently separate the gear mounted on the potentiometer with the large gear and turn the potentiometer until the correct value is reached. Gently release the potentiometer bracket and make sure that the teeth on both gears meet correctly.



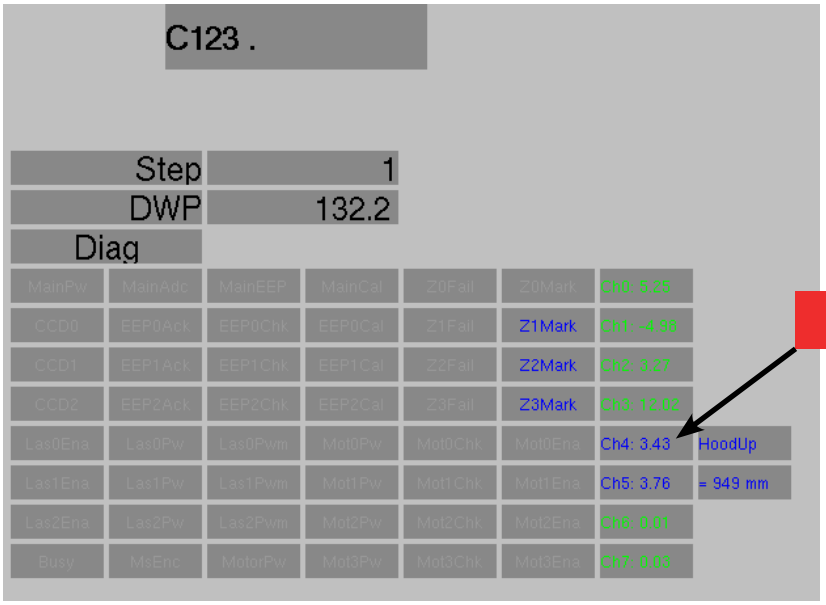
Gear Separation



Wheel Guard Closed

Ch 4: Set at 1.32V

5. Raise the wheel guard to it's most open position. Channel 4 value should be at least 2V above what it was in the closed state. It may be necessary to adjust the hood guard bolt shown in Figure 4 to achieve the required voltage.



Wheel Guard Open

Ch 4: Set at 3.43V

6. Press <F6> to check the inner scanner for proper travel and operation
7. Return to the Function screen and set the balancer to the manual mode.
8. Enter Pruefrotor measurements.
9. Spin the balancer once to wake up the encoder.
10. Perform C83 - C84 - C88 - C122

C124 OPTIMA: Driver Seat Side selection

Options: None

Special function: None

Description
On selection the current status is displayed (0 / 1).
Select 0: Driver Side to Left (Default selection)
Select 1: Driver Side to Right

The setting can be stored to persistent memory by performing code C90.

Comments
This feature is available on OPTIMA CRT models only.

C126 OPTIMA: enable / disable Accurate Profiling

Options: None

Special function: None

Description
On selection the current status is displayed (0 / 1).
Select 0: Standard Profiling (Default selection)
Select 1: Accurate Profiling

The setting can be stored to persistent memory by performing code C90.

Comments
This feature is available on OPTIMA CRT models only.

DIAGNOSTIC CODES

GENERAL OVERVIEW:

Balancers that have been manufactured since 2000 contain diagnostic codes to aid the technician in trouble-shooting and repair of the balancer. There are 5 different types of diagnostic codes (Start up Errors, Error Codes, H Codes, E Codes and IBP Codes). It is important that the code type be properly identified before calling technical support for assistance. In most cases, the problem may be quickly determined and corrected by properly using the diagnostics codes to troubleshoot. All future code updates will be documented on this bulletin and redistributed. 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 behavior 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. (IBP) Remove dummie plug and place secure disk into opening.
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. (IBP) Remove secure disk.
8. The normal start-up 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

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.

Diagnostic Codes

- 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

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.

SELF-TEST DURING START-UP (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 serial cables).This can also indicate a bad connection to the keyboard.

2.	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.

3.	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.

4.	Check weights usage database	E50

Affected models: Models with AWP
Service Codes : C125 to format the weights usage database
An attempt to access the weights usage database has failed; restart the balancer to re-initialise the database, or call service if the problem persists

5.	Power clamp service interval expired	E85

Affected models: Models with power clamp
Service Codes : All codes available for the model

6.	Check Keyboard	E89

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.

7.	Check Pedal switches	E85

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 and power clamp: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.

8.	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.

9.	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.

10.	Check content of permanent memories	E145

Affected models: All models
Service Codes : C85, C86 to copy content of permanent 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.

11.	Check availability of keyboard	E300

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.

12.	Check Optima Calibration	E360

Affected models: Models with optima hardware
Service Codes : C123
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,

13.	Check Optima Hardware	E360

Affected models: Models with optima hardware
Service Codes : C123
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,

14.	Check Optima Hardware	E362

Affected models: Models with optima hardware
Service Codes : C123
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.

15.	Check Optima inner scanner	E363

Affected models: Models with optima hardware
Service Codes : C123
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.

16.	Check Optima outer scanner	E364

Affected models: Models with optima hardware
Service Codes : C123
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.

17.	Check Optima rear scanner	E365

Affected models: Models with optima hardware
Service Codes : C123
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. Verify if the scanner is on its rail. Switch power off and on again. Should the problem not go away please call service.

18.	Check Optima main camera board memory	E366

Affected models: Models with optima hardware
Service Codes : C123
Possible causes: there is a fault in the camera controller board
Corrective actions: check the camera controller board

19.	Check Optima motor power supply	E367

Affected models: Models with optima hardware
Service Codes : C123
Possible causes: - the cable connecting the camera controller board and the motor power supply board is unplugged, damaged or missing
- the motor power supply is not configured properly
- there is a fault in the motor power supply board
- the cable connecting the mains supply and the motor power supply board is unplugged, damaged or missing
Corrective actions:- check all items above

20.	Check Optima main camera board A/D converter	E368

Affected models: Models with optima hardware
Service Codes : C123
Possible causes: - there is a fault in the camera controller board
Corrective actions:- check the camera controller board

21.	Check Optima main shaft encoder zero mark	E369

Affected models: Models with optima hardware
Service Codes : C123
Possible causes: - there is a fault in the camera controller board
- there is a fault in the encoder
- the cable connecting the camera controller board and the encoder board is unplugged, missing or damaged
Corrective actions:- check the camera controller board
- check the encoder
- check the connections

22.1.	Check Optima inner CCD signals	E370

Affected models: Models with optima hardware
Service Codes : C123
Possible causes: - the flat cable connecting the camera controller board and the inner scanner CCD board is unplugged, missing or damaged
- there is a fault in the inner scanner CCD board
- there is a fault in the camera controller board
- the supply voltage is configured too high on the power interface board
Corrective actions:- check all items above
- switch power off and on again; should the problem not go away please call service

22.2	Check Optima inner scanner memory	E371

Affected models: Models with optima hardware
Service Codes : C123
Possible causes: - the flat cable connecting the camera controller board and the inner scanner CCD board is unplugged, missing or damaged
- there is a fault in the inner scanner CCD board
- there is a fault in the camera controller board
Corrective actions:- check the connections§ check the inner scanner CCD board
- check the camera controller board
- switch power off and on again; should the problem not go away please call service

22.3	Check Optima inner scanner memory	E372

Affected models: Models with optima hardware
Service Codes : C123
Possible causes: - the flat cable connecting the camera controller board and the inner scanner CCD board is partially unplugged or damaged
- there is a fault in the inner scanner CCD board
Corrective actions:- check the connections
- check the inner scanner CCD board
- switch power off and on again; should the problem not go away please call service

22.4	Check Optima inner scanner calibration	E373

Affected models: Models with optima hardware
Service Codes : C123
Possible causes: - the inner scanner has not been factory calibrated
Corrective actions:- please call service and replace the inner scanner

22.5	Check Optima inner motor power supply	E374

Affected models: Models with optima hardware
Service Codes : C123
Possible causes: - the cable connecting the camera controller board and the inner scanner motor is unplugged, damaged or missing
- the motor power supply is not configured properly

- there is a fault in the motor power supply board
- the cable connecting the mains supply and the motor power supply board is unplugged, damaged or missing
- there is a fault in the inner scanner motor
- there is a fault in the camera controller board motor drivers

Corrective actions:- check all items above

22.6	Check Optima inner scanner zero mark	E375

Affected models: Models with optima hardware
Service Codes : C123
Possible causes:
- the flat cable connecting the camera controller board and the inner scanner CCD board is unplugged, missing or damaged
- there is a fault in the inner scanner CCD board
- the inner scanner is locked
- the inner scanner zero mark is missing, bent, locked or damaged
- the cable connecting the camera controller board and the inner scanner motor is unplugged, damaged or missing
- there is a fault in the motor power supply board§ there is a fault in the inner scanner motor
- there is a fault in the camera controller board motor drivers

Corrective actions:- check all items above

22.7	Check Optima inner motor missing steps	E376

Affected models: Models with optima hardware
Service Codes : C123
Possible causes:
- the inner scanner movement is not smooth or it is striking the frame
- the motor power supply is not configured properly
- there is a fault in the motor power supply board§ there is a fault in the inner scanner motor
- there is a fault in the camera controller board motor drivers
- the cable connecting the camera controller board and the inner scanner motor is partially unplugged or damaged

Corrective actions:- check all items above

22.8	Check Optima inner laser power	E377

Affected models: Models with optima hardware
Service Codes : C123
Possible causes:
- the flat cable connecting the camera controller board and the inner scanner CCD board is unplugged, missing or damaged
- the cable of the laser module of the inner scanner is damaged or there is a fault in the laser module itself
- there is a fault in the camera controller board laser driversCorrective actions:
- check all items above

22.9	Check Optima inner laser modulation	E378

Affected models: Models with optima hardware
Service Codes : C123
Possible causes:
- the flat cable connecting the camera controller board and the inner scanner CCD board is unplugged, missing or damaged
- the cable of the laser module of the inner scanner is damaged or there is a fault in the laser module itself
- there is a fault in the camera controller board laser driversCorrective actions:
- check all items above

23.1	Check Optima outer CCD signals	E380

Affected models: Models with optima hardware
Service Codes : C123
Possible causes: - the flat cable connecting the camera controller board and the outer scanner CCD board is unplugged, missing or damaged
- there is a fault in the outer scanner CCD board §there is a fault in the camera controller board
- the supply voltage is configured too high on the power interface boardCorrective actions:
- check all items above
- switch power off and on again; should the problem not go away please call service

23.2	Check Optima outer scanner memory	E381

Affected models: Models with optima hardware
Service Codes : C123
Possible causes: - the flat cable connecting the camera controller board and the outer scanner CCD board is unplugged, missing or damaged
- there is a fault in the outer scanner CCD board
- there is a fault in the camera controller board
Corrective actions:
- check the connections§ check the outer scanner CCD board
- check the camera controller board
- switch power off and on again; should the problem not go away please call service

23.3	Check Optima outer scanner memory	E382

Affected models: Models with optima hardware
Service Codes : C123
Possible causes: - the flat cable connecting the camera controller board and the outer scanner CCD board is partially unplugged or damaged
- there is a fault in the outer scanner CCD board
Corrective actions:
- check the connections§ check the outer scanner CCD board
- switch power off and on again; should the problem not go away please call service

23.4	Check Optima outer scanner calibration	E383

Affected models: Models with optima hardware
Service Codes : C123
Possible causes: - the outer scanner has not been factory calibrated
Corrective actions:- please call service and replace the outer scanner

23.5	Check Optima outer motor power supply	E384

Affected models: Models with optima hardware
Service Codes : C123
Possible causes: - the cable connecting the camera controller board and the outer scanner motor is unplugged, damaged or missing
- the motor power supply is not configured properly
- there is a fault in the motor power supply board§ the cable connecting the mains supply and the motor power supply board is unplugged, damaged or missing
- there is a fault in the outer scanner motor
- there is a fault in the camera controller board motor drivers
Corrective actions:
- check all items above

23.6	Check Optima outer scanner zero mark	E385

Affected models: Models with optima hardware
Service Codes : C123
Possible causes: - the flat cable connecting the camera controller board and the outer scanner CCD board is unplugged, missing or damaged
- there is a fault in the outer scanner CCD board
- the outer scanner is locked
- the outer scanner zero mark is missing, bent, locked or damaged
- the cable connecting the camera controller board and the outer scanner motor is unplugged, damaged or missing
- there is a fault in the motor power supply board§ there is a fault in the outer scanner motor
- there is a fault in the camera controller board motor drivers

Corrective actions:- check all items above

23.7	Check Optima outer motor missing steps	E386

Affected models: Models with optima hardware
Service Codes : C123
Possible causes: - the outer scanner movement is not smooth or it is striking the frame
- the motor power supply is not configured properly
- there is a fault in the motor power supply board§ there is a fault in the outer scanner motor
- there is a fault in the camera controller board motor drivers
- the cable connecting the camera controller board and the outer scanner motor is partially unplugged or damaged

Corrective actions:
- check all items above

23.8	Check Optima outer laser power supply	E387

Affected models: Models with optima hardware
Service Codes : C123
Possible causes: - the flat cable connecting the camera controller board and the outer scanner CCD board is unplugged, missing or damaged
- the cable of the laser module of the outer scanner is damaged or there is a fault in the laser module itself
- there is a fault in the camera controller board laser drivers

Corrective actions:
- check all items above

23.9	Check Optima outer laser modulation	E388

Affected models: Models with optima hardware
Service Codes : C123
Possible causes: - the flat cable connecting the camera controller board and the outer scanner CCD board is unplugged, missing or damaged
- the cable of the laser module of the outer scanner is damaged or there is a fault in the laser module itself
- there is a fault in the camera controller board laser drivers

Corrective actions:
- check all items above

24.1	Check Optima rear CCD signals	E390

Affected models: Models with optima hardware
Service Codes : C123
Possible causes:
- the flat cable connecting the camera controller board and the rear scanner CCD board is unplugged, missing or damaged
- there is a fault in the rear scanner CCD board
- there is a fault in the camera controller board
- the supply voltage is configured too high on the power interface board

Corrective actions:
- check all items above§ switch power off and on again; should the problem not go away please call service

24.2	Check Optima rear scanner memory	E391

Affected models: Models with optima hardware
Service Codes : C123
Possible causes:
- the flat cable connecting the camera controller board and the rear scanner CCD board is unplugged, missing or damaged
- there is a fault in the rear scanner CCD board
- there is a fault in the camera controller board

Corrective actions:
- check the connections
- check the rear scanner CCD board
- check the camera controller board
- switch power off and on again; should the problem not go away please call service

24.3	Check Optima rear scanner memory	E392

Affected models: Models with optima hardware
Service Codes : C123
Possible causes:
- the flat cable connecting the camera controller board and the rear scanner CCD board is partially unplugged or damaged
- there is a fault in the rear scanner CCD board

Corrective actions:
- check the connections§ check the rear scanner CCD board
- switch power off and on again; should the problem not go away please call service

24.4	Check Optima rear scanner calibration	E393

Affected models: Models with optima hardware
Service Codes : C123
Possible causes:
- the rear scanner has not been factory calibrated

Corrective actions:
- please call service and replace the rear scanner

24.5	Check Optima rear motor power supply	E394

Affected models: Models with optima hardware
Service Codes : C123
Possible causes:
- the cable connecting the camera controller board and the rear scanner motor is unplugged, damaged or missing
- the motor power supply is not configured properly
- there is a fault in the motor power supply board
- the cable connecting the mains supply and the motor power supply board is unplugged, damaged or missing
- there is a fault in the rear scanner motor

- there is a fault in the camera controller board motor drivers

Corrective actions:- check all items above

24.6	Check Optima rear scanner zero mark	E395

Affected models: Models with optima hardware
Service Codes : C123
Possible causes:
- the flat cable connecting the camera controller board and the rear scanner CCD board is unplugged, missing or damaged
- there is a fault in the rear scanner CCD board
- the rear scanner is locked
- the rear scanner zero mark is missing, bent, locked or damaged
- the cable connecting the camera controller board and the rear scanner motor is unplugged, damaged or missing
- there is a fault in the motor power supply board
- there is a fault in the rear scanner motor
- there is a fault in the camera controller board motor drivers

Corrective actions:- check all items above

24.7	Check Optima rear motor missing steps	E396

Affected models: Models with optima hardware
Service Codes : C123
Possible causes:
- the rear scanner movement is not smooth or it is striking the frame
- the motor power supply is not configured properly
- there is a fault in the motor power supply board
- there is a fault in the rear scanner motor
- there is a fault in the camera controller board motor drivers
- the cable connecting the camera controller board and the rear scanner motor is partially unplugged or damaged

Corrective actions:- check all items above

24.8	Check Optima rear laser power supply	E397

Affected models: Models with optima hardware
Service Codes : C123
Possible causes:
- the flat cable connecting the camera controller board and the rear scanner CCD board is unplugged, missing or damaged
- the cable of the laser module of the rear scanner is damaged or there is a fault in the laser module itself
- there is a fault in the camera controller board laser drivers

Corrective actions:- check all items above

24.9	Check Optima rear laser modulation	E398

Affected models: Models with optima hardware
Service Codes : C123
Possible causes:
- the flat cable connecting the camera controller board and the rear scanner CCD board is unplugged, missing or damaged
- the cable of the laser module of the rear scanner is damaged or there is a fault in the laser module itself
- there is a fault in the camera controller board laser drivers

Corrective actions:- check all items above

25.1	Check Optima rear shift motor power supply	E404

Affected models: Models with optima hardware
Service Codes : C123
Possible causes:
- the cable connecting the camera controller board and the rear shift scanner motor is unplugged, damaged or missing
- the motor power supply is not configured properly

- there is a fault in the motor power supply board
- the cable connecting the mains supply and the motor power supply board is unplugged, damaged or missing
- there is a fault in the rear shift scanner motor
- there is a fault in the camera controller board motor drivers

Corrective actions:- check all items above

25.2	Check Optima rear shift scanner zero mark	E405

Affected models: Models with optima hardware
Service Codes : C123
Possible causes:
- the flat cable connecting the camera controller board and the rear shift scanner CCD board is unplugged, missing or damaged
- there is a fault in the rear shift scanner CCD board
- the rear shift scanner is locked§ the rear shift scanner zero mark is missing, bent, locked or damaged
- the cable connecting the camera controller board and the rear shift scanner motor is unplugged, damaged or missing
- there is a fault in the motor power supply board
- there is a fault in the rear shift scanner motor
- there is a fault in the camera controller board motor drivers

Corrective actions:- check all items above

25.3	Check Optima rear shift motor missing steps	E406

Affected models: Models with optima hardware
Service Codes : C123
Possible causes:
- the rear shift scanner movement is not smooth or it is striking the frame
- the motor power supply is not configured properly
- there is a fault in the motor power supply board
- there is a fault in the rear shift scanner motor
- there is a fault in the camera controller board motor drivers
- the cable connecting the camera controller board and the rear shift scanner motor is partially unplugged or damaged

Corrective actions:- check all items above

26.	Check model information	E900

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.

27.	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

28.	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.

29.	Check Optima main shaft encoder zero mark	C1- ---

Affected models: All models
Service Codes : All codes available for the model
There is an error occurred 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. Incremental encoder (Current of opto-electronic LED)
4. Transducer signal available
5. Auto Stop System (Voltage for relay)

30.1	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

30.2	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. ***Refer to section 2.3.4 Error ID.***

30.3	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. ***Refer to section 2.3.4 Error ID.***

30.4	Hardware test - Current of opto-electronic 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. ***Refer to section 2.3.4 Error ID.***

30.5	Hardware test - Transducer signals	C10410 C10420 C10430

Affected models: All models
Service Codes: C103/C104 (CRT only) to check transimpedance and signal amplifiers and transducer values. If no signals from the transducers are detected the error code is displayed. ***Refer to section Error ID.***

30.6	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.
Refer to section Error ID.

4 ALL 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 minimization 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
	H23		Unclamping of wheel not allowed
	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 too low 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.
	E32		The user selected to proceed with a bare rim measurement but the machine actually detects that a complete wheel is on the machine. Mount a bare rim.
50			
	E50		An attempt to access the weights usage database has failed; restart the balancer to re-initialise the database, or call service if the problem persists
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			
	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 micro-controller was not able to detect a keyboard.Check cabling between micro-controller and keyboard.
	E341	0x00016A	Check sum of EEPROM 2 is wrong
360			
	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 power on self test failure
	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
	E366		OPTIMA main camera board memory self test failure
	E367		OPTIMA motor power supply missing or out of range
	E368		OPTIMA main camera board A/D converter failure
	E369		OPTIMA main shaft encoder zero mark detection failure or missing cable
370			
	E370		OPTIMA inner CCD signals failure
	E371		OPTIMA inner scanner memory not responding
	E372		OPTIMA inner scanner memory not valid
	E373		OPTIMA inner scanner not calibrated
	E374		OPTIMA inner motor current sink or power supply failure
	E375		OPTIMA inner scanner zero mark not detected
	E376		OPTIMA inner motor missing steps
	E377		OPTIMA inner laser current sink or power supply failure
	E378		OPTIMA inner laser modulation failure
380			
	E380		OPTIMA outer CCD signals failure
	E381		OPTIMA outer scanner memory not responding
	E382		OPTIMA outer scanner memory not valid

	E383		OPTIMA outer scanner not calibrated
	E384		OPTIMA outer motor current sink or power supply failure
	E385		OPTIMA outer scanner zero mark not detected
	E386		OPTIMA outer motor missing steps
	E387		OPTIMA outer laser current sink or power supply failure
	E388		OPTIMA outer laser modulation failure
390			
	E390		OPTIMA rear CCD signals failure
	E391		OPTIMA rear scanner memory not responding
	E392		OPTIMA rear scanner memory not valid
	E393		OPTIMA rear scanner not calibrated
	E394		OPTIMA rear motor current sink or power supply failure
	E395		OPTIMA rear scanner zero mark not detected
	E396		OPTIMA rear motor missing steps
	E397		OPTIMA rear laser current sink or power supply failure
	E398		OPTIMA rear laser modulation failure
400			
	E400		OPTIMA pull index user calibration failure
	E404		OPTIMA rear shift motor current sink or power supply failure
	E405		OPTIMA rear shift scanner zero mark not detected
	E406		OPTIMA rear shift motor missing steps
600			
	E623	0x620530	Virtual dimensions wrong
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.

STRUCTURE OF AN ERROR CODE

A complete error code consists of 6 hexadecimal digits.

EXAMPLE: 810 - 511
81 = Command language (Commands coming from the UI)
0 = Critical error (will be recorded in user mode)
511 = BL_BAL_ERROR_FailCalUser

Module ID: 2-digit hexadecimal value and indicates the software module which detected the error.
Priority ID: Represents the kind of error (message only, critical error).
Error ID: Determines the kind of the fault.

Module ID	Priority ID	Error ID
81	0	511

MODULE ID

Module 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)

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 state machine (eg self-test during start-up)
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	
F01		Not complete
F02		Invalid job Mod 2D, Brake : Module gets invalid event. Mod 49, Drive system : Internal error, command not valid in actual mode of operation Mod 66, Meas Control : Internal error. Module gets invalid user event. command not valid in actual mode of operation Mod C1, Self-test : 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 : Time client not found Mod 44, SAPE : Time service not found during unregister Mod C1, Self-test : Self-test failed, result of test invalid
F08		Already exists
F09		In use Mod 44, SAPE : AWP already in use Mod 49, Drive system : 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 RS2-32-E serial line. Check external and internal cabling.
F0E		Format failed
F0F		Bad parameter Mod 41, ASS : Invalid time specified Mod 44, SAPE : Bad parameter during calling time service Mod 81, cmd : Parameter of a kernel command is bad. Such an error can occur as a result from a hardware malfunction.
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 RS2-32-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
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
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 - 0.037 V(for IBP)	First Potentiometer : Voltage below measuring range (AD value : 0..10)
351	4.45 V - 3.36 V(for IBP)	First Potentiometer : Voltage above measuring range (AD value : 1014..1024)

360	0.05 V - 0.037 V(for IBP)	Second Potentiometer : Voltage below measuring range (AD value : 0..10)
361	4.45 V - 3.36 V(for IBP)	Second Potentiometer : Voltage above measuring range (AD value : 1014..1024)
370	0.05 V - 0.037 V(for IBP)	Third Potentiometer : Voltage below measuring range (AD value : 0..10)
371	4.45 V - 3.36 V(for IBP)	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
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
530		Distance of the virtual left plane from the reference plane out of range
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
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.

IBP CODES

Error ID	Error tag	Equivalent Y2K error	Hofmann User error
001-001	BK_ERROR_PO_NOTFOUND	internal	-
001-002	BK_ERROR_PO_READING	internal	-
001-003	BK_ERROR_PO_WRITING	new	-
001-004	BK_ERROR_PO_EEP1_RD	internal	-
001-005	BK_ERROR_PO_EEP2_RD	internal	-
001-006	BK_ERROR_PO_EEP1_WR	new	-
001-007	BK_ERROR_PO_EEP2_WR	new	-
001-010	BK_ERROR_KBD_DISPLAY	internal	-
001-011	BK_ERROR_KBD_VOLTAGE	46x-xxx	-
001-012	BK_ERROR_KBD_READING	46x-xxx	-
001-020	BK_ERROR_DC_OVERRUN	xxx-401	E83
001-021	BK_ERROR_IEM_ZERO_MISMATCH	290-703	-
001-022	BK_ERROR_IEP_ZERO_MISMATCH	2A0-703	-
001-030	BK_ERROR_POWER_FAIL	xxx-900	-
001-031	BK_ERROR_TEMP_SENSOR	xxx-58x	-
001-032	BK_ERROR_VCC_ABOVE_LIMIT	xxx-811	-
001-033	BK_ERROR_VCC_BELOW_LIMIT	xxx-810	-
001-034	BK_ERROR_VDISP_ABOVE_LIMIT	xxx-821	-
001-035	BK_ERROR_VDISP_BELOW_LIMIT	xxx-820	-
001-036	BK_ERROR_LINE_ABOVE_LIMIT	xxx-801	-
001-037	BK_ERROR_LINE_BELOW_LIMIT	xxx-800	-
001-038	BK_ERROR_OPTO_SHORT_HIGH_CUR	xxx-708	-
001-039	BK_ERROR_OPTO_OPEN_LOW_CUR	xxx-707	-
001-040	BK_ERROR_SAPE_1D_LOW_VOLT	xxx-350	E92
001-041	BK_ERROR_SAPE_1D_HIGH_VOLT	xxx-351	E92
001-042	BK_ERROR_SAPE_2D_LOW_VOLT	xxx-360	E92

001-043	BK_ERROR_SAPE_2D_HIGH_VOLT	xxx-361	E92
001-044	BK_ERROR_SAPE_3D_LOW_VOLT	xxx-370	E93
001-045	BK_ERROR_SAPE_3D_HIGH_VOLT	xxx-371	E93
001-046	BK_ERROR_SAPE_1D_INVALID_CAL	new	E92
001-047	BK_ERROR_SAPE_2D_INVALID_CAL	new	E92
001-048	BK_ERROR_SAPE_3D_INVALID_CAL	new	E93
001-050	BK_ERROR_SIDE_CAL_BAL	xxx-512	E16
001-051	BK_ERROR_SIDE_CAL_USER	xxx-512	E16
001-052	BK_ERROR_NO_CAL_USER	xxx-510	H80
001-053	BK_ERROR_FAIL_CAL_USER	xxx-511	E15
001-054	BK_ERROR_VIRT_DIM_OUTOFRANGE	xxx-530	E623
001-055	BK_ERROR_C1_100G_LOW	xxx-565	E6
001-056	BK_ERROR_C2_100G_LOW	xxx-566	E6
001-057	BK_ERROR_C1_0G_HIGH	xxx-570	E16
001-058	BK_ERROR_C2_0G_HIGH	xxx-571	E16
001-059	BK_ERROR_C1_USERCALTOOL_LOW	xxx-560	E6
001-060	BK_ERROR_C2_USERCALTOOL_LOW	xxx-561	E6
001-070	BK_ERROR_SPOKE_SAME_POS	internal	-
001-071	BK_ERROR_UG_NOT_BET_SPOKES	internal	-
001-072	BK_ERROR_ANG_SPOKES_TOOHIGH	internal	-
001-073	BK_ERROR_ANG_SPOKES_FAIL	internal	-
001-080	BK_ERROR_SPINUP_TIMEOUT	490-202	H90
001-081	BK_ERROR_NO_ACCELERATION	490-206	H90
001-082	BK_ERROR_SPEED_LOW	490-204	H91
001-083	BK_ERROR_SPEED_HIGH	490-208	E88
001-084	BK_ERROR_REVERSE_TURN	490-205	E28
001-085	BK_ERROR_SLIP_DETECTED	490-207	E17
001-090	BK_ERROR_STUCK_CLAMP	490-210	-
001-091	BK_ERROR_STUCK_UNCLAMP	490-211	-
001-092	BK_ERROR_CLAMP_MAXDISP	490-212	E14
001-093	BK_ERROR_CLAMP_TIMEOUT	490-216	E14
001-094	BK_ERROR_CLAMP_LOCKED	490-215	H22
001-095	BK_ERROR_CLAMP_SLIP	490-214	-
001-096	BK_ERROR_CLAMP_FALLBACK	490-213	-
001-100	BK_ERROR_WATCHDOG	new	-

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309 Exchange Ave.
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