AUTO TEST
Products Pty Ltd

User Manual
Version 6

Auto Test

Calibrator

DECLARATION OF CONFORMITY
We, Auto Test Products Pty Ltd. declare under our sole responsibility that the product Auto*Test* Calibrator is in conformity with the provisions of the following Council Directive: 1999/5/EC.
A copy of the Declaration of Conformity is available from http://www.autotest.net.au

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Auto*Test* Calibrator User Manual

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1. UNPACKING

Congratulations on your purchase of an Auto*Test* Calibrator. Please take the time to read this User's Manual. Incorrect or inappropriate use of this instrument may void the warranty.
Ensure that all pieces are removed from the box. Retain the packing materials for future shipping and transport of the unit for periodic calibration. The packing box should contain:

1. Auto*Test* Calibrator with reference load cell and reference accelerometer attached
2. This User Manual
3. One CD containing the Calibration Software
4. Warranty Registration Card
5. 1 set of data cables (3 cables in total)
6. Screwdriver tool
7. Battery Charger
8. Calibration certificate for reference load cell and reference accelerometer

Before using your Calibrator, you must charge the battery for 8 hours. Refer to Section 4.6 for instructions for recharging the battery.

2. GENERAL INFORMATION

Figure 1. The Front Panel of the Auto Test Calibrator

2.1 Qualifications

To use the Calibrator the following qualifications are assumed and required:

- Good understanding of Personal Computers, including the Windows 2000 or greater operating system
- Good understanding of the Internet
- Good understanding of basic instrumentation calibration principles
- Understanding of scientific principles
- Understanding of braking and brake test measurement

2.2 General Description

The Auto*Test* Calibrator is designed for the calibration of the Auto*Test* range of brake testers, including the Auto*Test* Maxi, Heavy and Mini. The Calibrator bridges the gap between Brake Meter and computer and enables a calibration test to be carried out. The Auto*Test* Calibrator has reference sensors and compares the values from these sensors to those of the Brake Meter. Due to its unique design, the Auto*Test* Calibrator will be ideally suited for portable fieldwork. The Calibrator provides a high precision accelerometer and a high precision loadcell that are used as a reference to measure the sensitivity and linearity of the high precision accelerometer and high precision loadcell inside the Brake Meter. Results are displayed on your PC, and may be saved to disk or printed.

2.3 Description of Major Components and Design Features

Design Feature	Function
D.C. Power Supply	A 12V DC power supply is required to operate the analog/digital circuit, sensors and flash memory. The power supply circuit is designed to provide an output with current limit, short circuit protection and low noise. It includes one internal 12V rechargeable battery as the power source. Use the 12V, 1A Plug Pack to recharge the battery for 12-16 hours after using the calibrator for more than 10 hours. A charge plug is located on the rear of the calibrator. The red LED indicates that the charging circuit is operational. Refer to Section 4.6 for full instructions for recharging the battery.
Program download switch	The program download switch has three positions. Generally it shouldn't be touched and it should remain in the centre position for normal operation. It is only required when new firmware is to be downloaded, in which case, the switch needs to be pushed towards the RS232 ports. The third position has no effect is reserved for future use. Refer to Section 4.9 for details about downloading a new program.
Buttons: "ON/OFF" "YES" "NEXT" "1000", "100", "10", "1" and "0.1"	The "ON/OFF" button turns the unit on and off. The "YES" and "NEXT" buttons are used for menu navigation. The remaining five buttons are used to enter numerical values. Digits 0→9 can be entered by continuously pressing one button. The minimum value is 0000.0 and the maximum value is 9999.9. Refer to Section 4.7.1 for an example of how to use the keypad to enter numbers.
Memory	A microprocessor supports the on-chip flash memory to store the program data. All calibration data of the reference accelerometer and loadcell is stored in EEPROM. This program can be reinstalled from our website if necessary. Refer to Section 4.9 for details.
+5V Multi-Channel RS-232 Driver/ Receiver	Line driver/receiver is intended for all EIA RS232E communication interfaces and uses no external components.

3. INSTALLATION AND CONNECTIONS

3.1 Hardware Setup

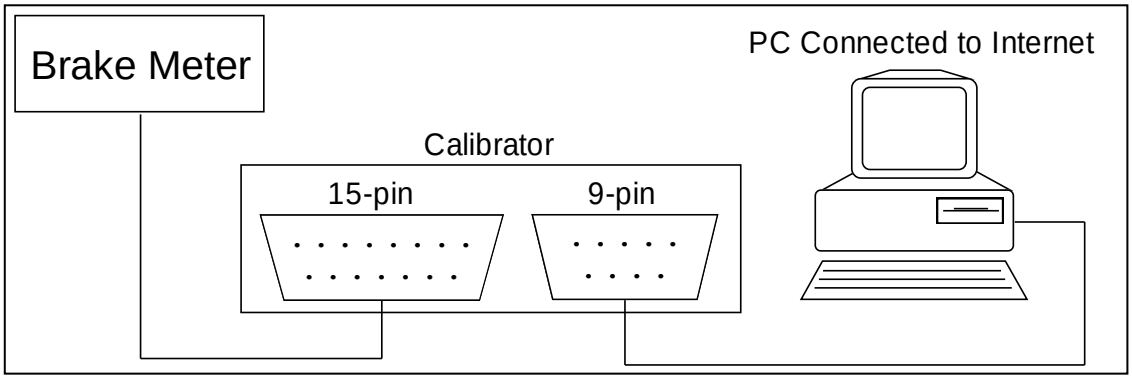


Figure 2. Calibrator, Brake Meter and PC Connections

Two communication sockets - 15-pin and - 9-pin are located on the rear of the Calibrator. To install the Calibrator, follow these Steps:

Step 1: Plug the 9-pin plug (cable supplied with AutoTest Calibrator) into the Calibrator and plug the other end into a free serial COM Port on your PC.

Step 2:

- For an AutoTest Mini, plug the *2.5mm plug* (cable supplied with AutoTest Calibrator) into the Brake Meter, and plug the other end of the cable *(15-pin plug)* into the AutoTest Calibrator.

- For an AutoTest Maxi or Heavy, plug the *3.5mm Stereo plug* (cable supplied with AutoTest Calibrator) into the Brake Meter, and plug the other end of the cable *(15-pin plug)* into the AutoTest Calibrator.

- For an AutoTest MiniPlus, plug the *D 9 connector* (cable supplied with the AutoTest Calibrator) into the Brake Meter, and plug the other end of the cable (15-pin plug) into the AutoTest Calibrator.

- For an AutoTest MicroPlus, plug the *3.0 mm plug* (cable supplied with AutoTest Calibrator) into the Brake Meter and plug the other end of the cable (15-pin plug) into the AutoTest Calibrator.

- For an AutoTest Pedal Effort Sensor, plug the *3.0 mm plug* (cable supplied with AutoTest Calibrator) into the Brake Meter and plug the other end of the cable (15-pin plug) into the AutoTest Calibrator.

3.2 Software Setup

The Calibration software is provided on a USB.

To install the software:

- Turn on your PC and start Windows
- When Windows has finished loading, insert the USB
- Double click the AutoStop Calibrator Software Installer.exe file
- If the Installer is in a .7z archive then the installer will have to be extracted first

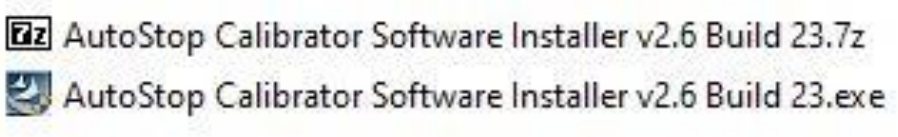


Figure 3. Installing the Calibration Software

- The setup program will run. The software will be installed to your computer.
- After the setup program finishes a shortcut will be placed on your desktop with the title 'Brake meter Calibration'. You can use this shortcut to start the program. You will also see a shortcut entitled 'Example Calibration Certificate'. If you have Microsoft Word '95 or better, you can double-click on this icon to see our example Calibration Certificate template.

4. OPERATING PROCEDURE

4.1 Getting Started

Turn on the AutoTest Calibrator. First it will perform a quick self test for battery level, memory errors etc. The first option on the main menu will appear on the display. In the main menu, you may either press, "Yes" to select the displayed option, or "No" to display the next option in the menu.

The first option in the menu is:

a). **"Brake Meter Calibration?"**
Press "Yes" to calibrate your Brake Meter. If you press "No", the display will show:

b). **"Reference Calibration?"**
Press "Yes" to calibrate reference accelerometer and loadcell. If you press "No", the display will show:

c). **"View Reference Calibration Result?"**
Press "Yes" to check the linearity of the reference accelerometer and loadcell. If you press "No", the display will show:

d). **"View Two Reference Gains?"**
Press "Yes" to check the gain of the reference accelerometer in counts/g and reference loadcell in counts/KN (4095 counts = 5V). If you press "No", the display will show:

e). **"Self Check?"**
Press "Yes" to see the acceleration due to gravity in m/s2 and weight in N. If you press "No", the display will show:

f). **“Change Reference Gain?”**
Press “Yes” to change two reference gains without going through reference calibration procedure. If you press “No”, the display will show:

g). **“Transmit Credits?”**
Press “Yes” to send new credits to the calibrator. If you press “No”, the display will show:

h) **“Clear Credits?”**
Press “Yes” to set the remaining credits to zero. Warning, do not clear credits unless you are sure. If you press “No”, you have reached the end of the menu options, and the display will again show **“Brake Meter Calibration?”**

4.2 Calibration of Auto*Stop* Maxi and Auto*Stop* Heavy

The calibration procedure for each of the Maxi and Heavy Brake Meters are the same.

1). Turn on the Calibrator and press “Yes” for the menu option “Brake Meter Calibration?” The Calibrator will then display how many credits are left in the calibrator. If there are no credits left in the calibrator, the calibration function is disabled. Refer to Section 4.8 for details about credits and how to obtain them.

2). After selecting the Calibration option, the display will read “Hand shaking with PC…” The Calibrator will stay in this state until the software on your PC connects to it.

3). Run the calibration software on your PC. Enter the 5-digit serial number of the Brake Meter you are calibrating into the “Serial Number” field.

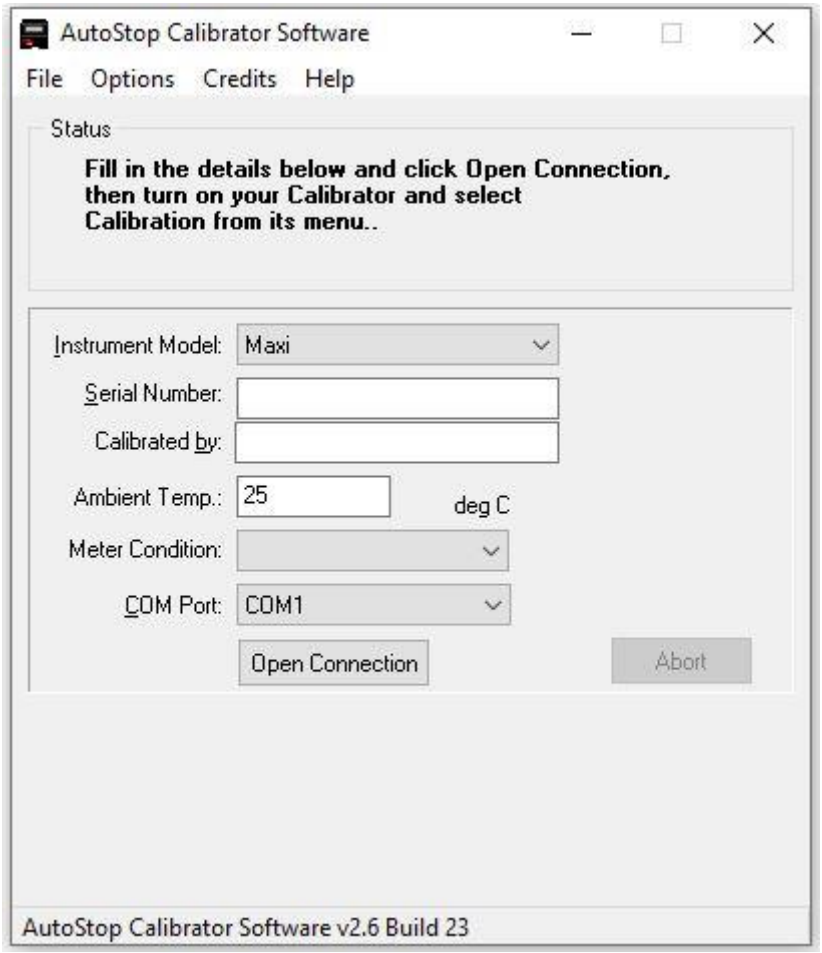


Figure 4. Calibration Software

Next, select the COM Port number that corresponds to the PC COM Port to which you connected the cable. This is usually COM1 or COM2, depending on what other serial devices are connected to your computer. Next, click the “Open Connection” button. If you have entered an invalid serial number (i.e. not containing 5 digits), or selected an invalid comport (i.e. a COM Port already in use by another device or application), an error message will appear detailing the problem.

4). If there are no communication errors between the Calibrator and the PC, the Calibrator will display “Ready-PC” (otherwise the Calibrator will show “COM ERROR”). Both Calibrator and PC will then prompt you for the Brake Meter model.
Use the Calibrator to select the model.
For example, the Calibrator will display “Is your Brake meter Auto*Test* Maxi?” Press “Yes“ if you are calibrating a Maxi, otherwise press “No”, etc.

5). After selecting the correct Brake Meter model, turn the Brake Meter on.
After the Brake Meter initialises itself, and if there are no communication errors, the Calibrator will display “Ready-BM”, the PC Software will display “Start Testing..” and the Brake Meter will display “Remote Control”.

7). Put your Brake Meter on its back in a level position facing towards you (this is 0° and the tolerance is ±5°) and place the reference accelerometer metal box on top of the Brake Meter in the left corner, with the chamfered edge pointing away from you as shown in the diagram below.

Figure 5. Maxi / Heavy Calibration

To calibrate the accelerometer, you must put the accelerometer and the reference accelerometer in a number of different positions. At each position you must click “OK” and wait a second to allow the Calibrator to read the current values. Refer to the following pages for photographs and details of appropriate positions.

The best way to do this is to create a structure to hold the Brake Meter and the reference accelerometer in place (i.e. with Velcro or tape). However, you may also perform the calibration by hand. If you do this, you must make sure that the accelerometer is firmly attached to the Brake Meter (i.e. with tape) and that the Brake Meter and Accelerometer do not move while you are

clicking the “OK” button. Also make sure when putting the Brake Meter in a position of 0° that the surface you are using is within ±5° of 0° to ensure an accurate calibration.

To calibrate the load cell, you must put the load cell inside the reference load cell under a number of different loads. As with the accelerometer, you must click “OK” and wait a second after each load is applied. The calibration results are calculated by comparing the values from the accelerometer and load cell to those from the reference accelerometer and load cell (Refer to Section 4.4 - Calibration Certificate, for more information on the calibration results).

The following two steps will detail the angles for each position for the accelerometer, and the loads for the loadcell, with photos demonstrating the approximate angles (photos are taken from a side-on view).

Calibrate the Accelerometer

a). Position 1: Put both accelerometers approximately 45-90° from horizontal (by tipping it away from you) and click “OK”.

Figure 6. Maxi / Heavy Calibration position 1

b). Position 2: Put both accelerometers approximately 0-45° from horizontal and click “OK”.

Figure 7. Maxi / Heavy Calibration position 2

c). Position 3: Put both accelerometers at 0° from horizontal and click “OK”.

Figure 8. Maxi / Heavy Calibration position 3

d). Position 4: Put both accelerometers approximately 0 to -45° from horizontal (by tipping it towards you) and click “OK”.

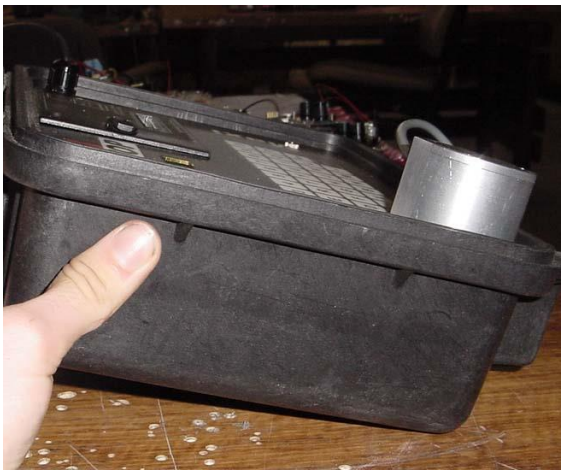


Figure 9. Maxi / Heavy Calibration position 4

e). Position 5: Put both accelerometers approximately -45-(-90)° from the horizontal and click “OK”.

Figure 10. Maxi / Heavy Calibration position 5

Calibrate the Load cell:

Place the Brake Meter loadcell squarely inside the reference loadcell.

Figure 11. Maxi / Maxi-X / Heavy Loadcell Placement

a). Position 1: Apply no pressure to the loadcell, and click “OK”.

b). Position 2: Apply approximately 0-200N to both load cells and click “OK”.

c) Position 3: Apply approximately 200-400N to both load cells and click “OK”.

d) Position 4: Apply approximately 400-600N to both load cells and click “OK”.

e) Position 5: Apply approximately 600-1000N to both load cells and click “OK”.

10). Once you have finished all the calibration positions, the Calibrator encodes and sends all information to your PC, then the results (gains, offsets, triggers) are calculated and sent back to the Calibrator.

11). Finally the Calibrator will ask ‘Do you want 0.01g Trigger?’ If you are calibrating an AutoTest Heavy Brake Meter, press ‘Yes’, otherwise press ‘No’ on the Calibrator. The Calibrator then sends the result data to the Brake Meter, and removes one credit from the credit store. The Brake Meter is automatically turned off at this point.

12). The software will display the results on screen. You may save the results to a file by selecting ‘Save Certificate File’ from the menu, or you can print the results in certificate format by selecting ‘Print.’ from the menu.

After you have saved a certificate file, you can load it later by starting the software then selecting ‘Open Certificate File’ from the menu. The files are stored as “.txt” files. The program defaults to saving and loading certificate files from the program directory. Refer to Figure 30 for a diagram showing how to Load a certificate file.

When you print a certificate, the results are printed in the middle of the page, leaving room for a header at the top and sides of the data. Therefore you can print the results on your own header paper. As an example, we have included a Certificate Template in Microsoft Word ’95 format. You can alter this template as necessary, and use it to print Calibration Certificates. If necessary, you can alter the position of the data on the page by altering the Print margins for your printer when you select ‘Print’.

Note: if there is a communication error between the Calibrator and the PC, the Calibrator will automatically return to the main menu and the PC may display an error message. Restart the software and try again. If the Brake Meter stops responding during calibration while displaying 'Remote Control', you may have to manually reset it by removing a battery for a few seconds before you can retry the calibration. Remember, you won't be charged for a calibration unless the test is completed, and a certificate is displayed on the screen.

4.3 Calibration of Auto*Stop* Mini

1) ~ 4). Step 1 to step 4 are same as above.

5). After selecting the correct Brake Meter model, turn the Brake Meter on. Press "ON/NEXT" until you read "CALIBRATION?" Press "Yes".
After the Brake Meter initialises itself, and if there are no communication errors, the Calibrator will display "Ready-BM", the PC Software will display "Start Testing." and the Brake Meter will display "Remote Control".

6). To calibrate the accelerometer, you must put the accelerometer and the reference accelerometer in a number of different positions. At each position you must click "OK" and wait a second to allow the Calibrator to read the current values.

The best way to do this is to create a structure to hold the Brake Meter and the reference accelerometer in place (i.e. with Velcro or tape). However, you may also perform the calibration by hand. If you do this, you must make sure that the Brake Meter and accelerometer are firmly attached (i.e. with tape) and do not move while you are clicking the "OK" button. Also make sure when putting the Brake Meter in a position of 0° that the surface you are using is within ±5° of 0° to ensure an accurate calibration.

The following two steps will detail the angles for each position for the accelerometer, and the loads for the loadcell, with photos demonstrating the approximate angles (photos are taken from a side-on view).

X-Y-Z Representative Diagrams are as shown below:

Calibrate the X axis of the accelerometer

Place the Brake Meter in a horizontal position with the display face up (this is 0° and the tolerance is ±5°). Put the reference accelerometer on the top of or beside the Brake Meter, with the chamfered edge pointing towards you (downward in the following diagram).

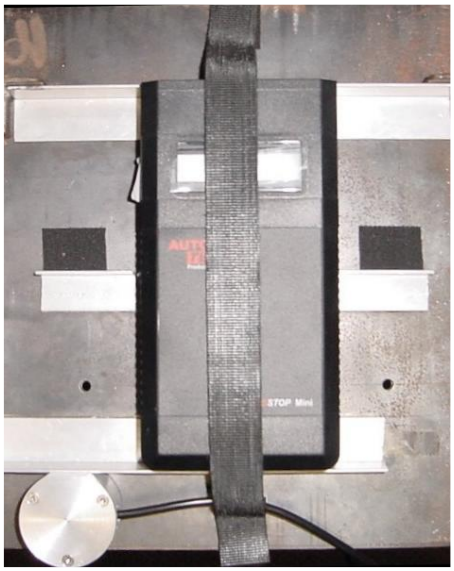


Figure 12. Mini Calibration – X Axis

Position 1: Put both accelerometers approximately 45-90° (tipping away from you) and click “OK”.

Figure 13. Mini Calibration – X Axis position 1

Position 2: Put both accelerometers approximately 0-45° and click “OK”.

Figure 14. Mini Calibration – X Axis position 2

Position 3: Put both accelerometers at 0° (level position) and click “OK”.

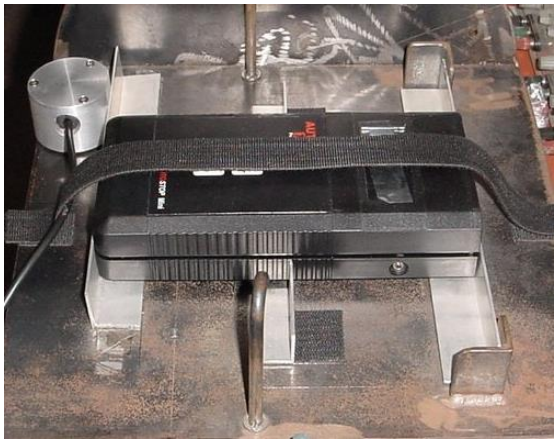


Figure 15. Mini Calibration – X Axis position 3

Position 4: Put both accelerometers approximately 0- (-45)° (tipping towards you) and click “OK”.

Figure 16. Mini Calibration – X Axis position 4

Position 5: Put both accelerometers approximately -45- (-90)° and click “OK”.

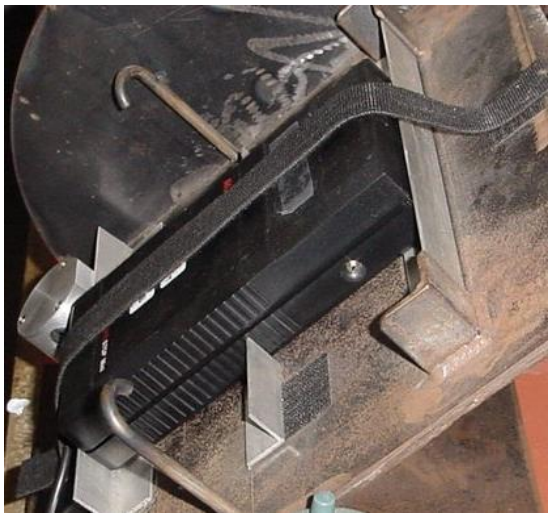


Figure 17. Mini Calibration – X Axis position 5

Calibrate the Y axis of the accelerometer

Put the reference accelerometer on top of or beside the Brake Meter, with the chamfered edge pointing towards you (facing down in the diagram below).

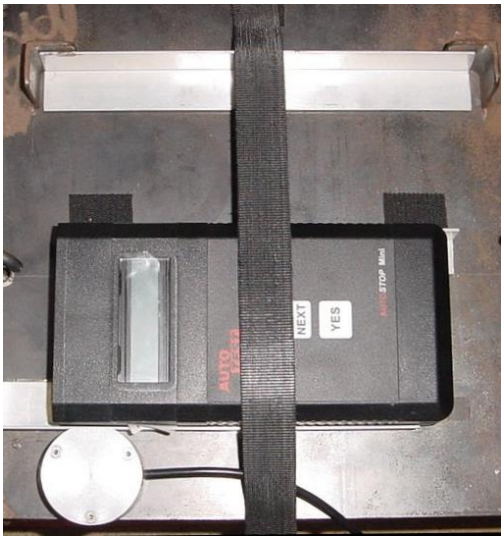


Figure 18. Mini Calibration – Y Axis

Position 1: Put both accelerometers approximately 45-90° (tipping to the right) and click “OK”.

Figure 19. Mini Calibration – Y Axis position 1

Position 2: Put both accelerometers approximately 0-45° and click “OK”.

Figure 20. Mini Calibration – Y Axis position 2

Position 3: Put both accelerometers at 0° (level position) and click “OK”.

Figure 21. Mini Calibration – Y Axis position 3

Position 4: Put both accelerometers approximately 0- (-45)° (tipping left) and click “OK”.

Figure 22. Mini Calibration – Y Axis position 4

Position 5: Put both accelerometers approximately -45-(-90)° and click “OK”.

Figure 23. Mini Calibration – Y Axis position 5

Calibrate the Z axis of the accelerometer

Put the Brake Meter standing vertically so that the display faces you (this is 0° and the tolerance is ±5°). Put the reference accelerometer box on top of or beside the Brake Meter, so that when the Brake Meter is at 0° the reference accelerometer is at 90°. Place the reference accelerometer so that the chamfered edge points vertically downward (towards the floor when the Brake Meter is at 0°).

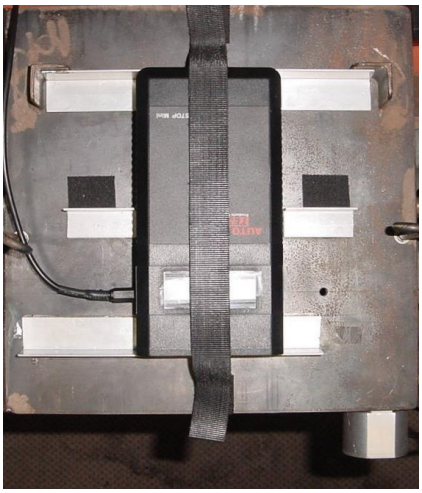


Figure 24. Mini Calibration – Z Axis

Position 1: Put both accelerometers approximately 45-90° (tilted right), click “OK”.

Figure 25. Mini Calibration – Z Axis position 1

Position 2: Put both accelerometers approximately 0-45° and click “OK”.

Figure 26. Mini Calibration – Z Axis position 2

Position 3: Put both accelerometers at 0° (level position) and click “OK”.

Figure 27. Mini Calibration – Z Axis position 3

Position 4: Put both accelerometers approximately 0- (-45)° (titled left), click “OK”.

Figure 28. Mini Calibration – Z Axis position 4

Position 5: Put both accelerometers approximately -45-(-90)° and click “OK”.

Figure 29. Mini Calibration – Z Axis position 5

7). Once you have finished all the calibration positions, the Calibrator encodes and sends all information to your PC, then the results (gains, offsets, triggers) are calculated and sent back to the Calibrator. The Calibrator sends this data to the Brake Meter, and removes one credit from the credit store.

8). The Brake Meter is automatically turned off after calibration.

9). The software will display the results on screen. You may save the results to a file by selecting 'Save Certificate File' from the menu, or you can print the results in certificate format by selecting 'Print.' from the menu.

When you print a certificate, the results are printed in the middle of the page, leaving room for a header at the top and sides of the data. Therefore you can print the results on your own header paper. As an example, we have included a Certificate Template in Microsoft Word '95 format. You can alter this template as necessary, and use it to print Calibration Certificates. If necessary, you can alter the position of the data on the page by altering the Print margins for your printer when you select 'Print'.

After you have saved a certificate file, you can load it later by starting the software then selecting 'Open Certificate File' from the menu. The files are stored as ".txt" files. The program defaults to saving and loading certificate files from the program directory. Refer to Figure 30 for a diagram showing how to Load a certificate file.

Note: if there is a communication error between the Calibrator and the PC, the Calibrator will automatically return to the main menu and the PC may display an error message. Restart the software and try again. If the Brake Meter stops responding during calibration while displaying 'Remote Control', you may have to manually reset it by removing a battery for a few seconds before you can retry the calibration. Remember, you won't be charged for a calibration unless the test is completed and a certificate is displayed on the screen.

4.4 Calibrating the Auto*Stop* MiniPlus

1)~4) Step1 to 4 are same as above.
5) After selecting the correct Brake Meter model, turn the Brake Meter on.
After the Brake Meter initialises itself, and if there are no communication errors, the Calibrator will display "Ready-BM", the PC Software will display "Start Testing." and the Brake Meter will display "Remote Control".
6) To calibrate the accelerometer, you must put the accelerometer and the reference accelerometer in a number of different positions. At each position you must click "OK" and wait a second to allow the Calibrator to read the current values.

The best way to do this is to create a structure to hold the Brake Meter and the reference accelerometer in place (i.e. with Velcro or tape). However, you may also perform the calibration by hand. If you do this, you must make sure that the Brake Meter and accelerometer are firmly attached (i.e. with tape) and do not move while you are clicking the "OK" button. Also make sure when putting the Brake Meter in a position of 0° that the surface you are using is within ±5° of 0° to ensure an accurate calibration.

The following two steps will detail the angles for each position for the accelerometer, and the loads for the loadcell, with photos demonstrating the approximate angles (photos are taken from a side-on view).

X-Y-Z Representative Diagrams are as shown below:

Calibrate the X-axis of the accelerometer

Place the Brake Meter in a horizontal position with the display face up (this is 0° and the tolerance is ±5°). Put the reference accelerometer on the top of or beside the Brake Meter, with the chamfered edge pointing towards you (downward in the following diagram).

Figure 30. MiniPlus Calibration – X Axis

Position 1: Put both accelerometers approximately 45-90° (tipping away from you) and click “OK”.

Figure 31. MiniPlus Calibration – X Axis position 1

Position 2: Put both accelerometers approximately 0-45° and click “OK”.

Figure 32. MiniPlus Calibration – X Axis position 2

Position 3: Put both accelerometers at 0° (level position) and click “OK”.

Figure 33. MiniPlus Calibration – X Axis position 3

Position 4: Put both accelerometers approximately 0- (-45)° (tipping towards you) and click “OK”.

Figure 34. MiniPlus Calibration – X Axis position 4

Position 5: Put both accelerometers approximately -45- (-90)° and click “OK”.

Figure 35. MiniPlus Calibration – X Axis position 5

Calibrate the Y-axis of the accelerometer

Put the reference accelerometer on top of or beside the Brake Meter, with the chamfered edge pointing towards you (facing down in the diagram below).

Figure 36. MiniPlus Calibration – Y Axis

Position 1: Put both accelerometers approximately 45-90° (tipping to the right) and click “OK”.

Figure 37. MiniPlus Calibration – Y Axis position 1

Position 2: Put both accelerometers approximately 0-45° and click “OK”.

Figure 38. MiniPlus Calibration – Y Axis position 2

Position 3: Put both accelerometers at 0° (level position) and click “OK”.

Figure 39. MiniPlus Calibration – Y Axis position 3

Position 4: Put both accelerometers approximately 0- (-45)° (tipping left) and Click “OK”.

Figure 40. MiniPlus Calibration – Y Axis position 4

Position 5: Put both accelerometers approximately -45-(-90)° and click “OK”.

Figure 41. MiniPlus Calibration – Y Axis position 5

Calibrate the Z-axis of the accelerometer

Put the Brake Meter standing vertically so that the display faces you (this is 0° and the tolerance is ±5°). Put the reference accelerometer box on top of or beside the Brake Meter, so that when the Brake Meter is at 0° the reference accelerometer is at 90°. Place the reference accelerometer so that the chamfered edge points vertically downward (towards the floor when the Brake Meter is at 0°).

Figure 42. MiniPlus Calibration – Z Axis

Position 1: Put both accelerometers approximately 45-90° (tilted right), click “OK”.

Figure 43. MiniPlus Calibration – Z Axis position 1

Position 2: Put both accelerometers approximately 0-45° and click “OK”.

Figure 44. MiniPlus Calibration – Z Axis position 2

Position 3: Put both accelerometers at 0° (level position) and click “OK”.

Figure 45. MiniPlus Calibration – Z Axis position 3

Position 4: Put both accelerometers approximately 0- (-45)° (titled left), click “OK”.

Figure 46. MiniPlus Calibration – Z Axis position 4

Position 5: Put both accelerometers approximately -45-(-90)° and click “OK”.

Figure 47. MiniPlus Calibration – Z Axis position 5

7). Once you have finished all the calibration positions, the Calibrator encodes and sends all information to your PC, then the results (gains, offsets, triggers) are calculated and sent back to the Calibrator. The Calibrator sends this data to the Brake Meter, and removes one credit from the credit store.

8). The Brake Meter is automatically turned off after calibration.

9). The software will display the results on screen. You may save the results to a file by selecting ‘Save Certificate File’ from the menu, or you can print the results in certificate format by selecting ‘Print.’ from the menu.
When you print a certificate, the results are printed in the middle of the page, leaving room for a header at the top and sides of the data. Therefore, you can print the results on your own header paper. As an example, we have included a Certificate Template in Microsoft Word ’95 format. You can alter this template as necessary, and use it to print Calibration Certificates. If necessary, you can alter the position of the data on the page by altering the Print margins for your printer when you select ‘Print’.

After you have saved a certificate file, you can load it later by starting the software then selecting ‘Open Certificate File’ from the menu. The files are stored as “.txt” files. The program defaults to saving and loading certificate files from the program directory. Refer to Figure 30 for a diagram showing how to Load a certificate file.

Note: if there is a communication error between the Calibrator and the PC, the Calibrator will automatically return to the main menu and the PC may display an error message. Restart the software and try again. If the Brake Meter stops responding during calibration while displaying ‘Remote Control’, you may have to manually reset it by removing a battery for a few seconds before you can retry the calibration. Remember, you won’t be charged for a calibration unless the test is completed and a certificate is displayed on the screen.

4.5 Calibrating the Auto*Stop* MicroPlus

1)~4) Step 1 to 4 are same as above.
5) After selecting the Brake Meter model, turn the Brake Meter on.
After the Brake Meter initialises itself, and if there are no communication errors, the calibrator will display “Ready-BM”, the PC software will display “Start Testing” and the Brake Meter will display “remote Control”
6) To calibrate the accelerometer, you must put the accelerometer and the reference accelerometer in number of different positions. At each position you must click “OK” and wait a second to allow the calibrator to read the current values.

The best way to do this is to create a structure to hold the Brake Meter and the reference accelerometer in place (i.e. with Velcro or tape). However, you may also perform the calibration by hand. If you do this, you must make sure that the Brake Meter and accelerometer are firmly attached (i.e. with tape) and do not move while you are clicking the “OK” button. Also make sure when putting the Brake Meter in a position of 0° that the surface you are using is within ±5° of 0° to ensure an accurate calibration.

The following two steps will detail the angles for each position for the accelerometer, and the loads for the loadcell, with photos demonstrating the approximate angles (photos are taken from a side-on view).

X-Y-Z Representative Diagrams are as shown below:

Calibrate the X-axis of the accelerometer

Place the Brake Meter in a horizontal position with the display face up (this is 0° and the tolerance is ±5°). Put the reference accelerometer on the top of or beside the Brake Meter, with the chamfered edge pointing towards you (downward in the following diagram).

X 

Figure 48. MicroPlus Calibration – X Axis

Position 1: Put both accelerometers approximately 45-90° (tipping away from you) and click “OK”.

Figure 49. MicroPlus Calibration – X Axis position 1

Position 2: Put both accelerometers approximately 0-45° and click “OK”.

Figure 50. MicroPlus Calibration – X Axis position 2

Position 3: Put both accelerometers at 0° (level position) and click “OK”.

Figure 51. MicroPlus Calibration – X Axis position 3

Position 4: Put both accelerometers approximately 0- (-45)° (tipping towards you) and click “OK”.

Figure 52. MicroPlus Calibration – X Axis position 4

Position 5: Put both accelerometers approximately -45- (-90)° and click “OK”.

Figure 53. MicroPlus Calibration – X Axis position 5

Calibrate the Y-axis of the accelerometer

Put the reference accelerometer on top of or beside the Brake Meter, with the chamfered edge pointing towards you (facing down in the diagram below).

Figure 54. MicroPlus Calibration – Y Axis

Position 1: Put both accelerometers approximately 45-90° (tipping to the right) and click “OK”.

Figure 55. MicroPlus Calibration – Y Axis position 1

Position 2: Put both accelerometers approximately 0-45° and click “OK”.

Figure 56. MicroPlus Calibration – Y Axis position 2

Position 3: Put both accelerometers at 0° (level position) and click “OK”.

Figure 57. MicroPlus Calibration – Y Axis position 3

Position 4: Put both accelerometers approximately 0- (-45)° (tipping left) and Click “OK”.

Figure 58. MicroPlus Calibration – Y Axis position 4

Position 5: Put both accelerometers approximately -45-(-90)° and click “OK”.

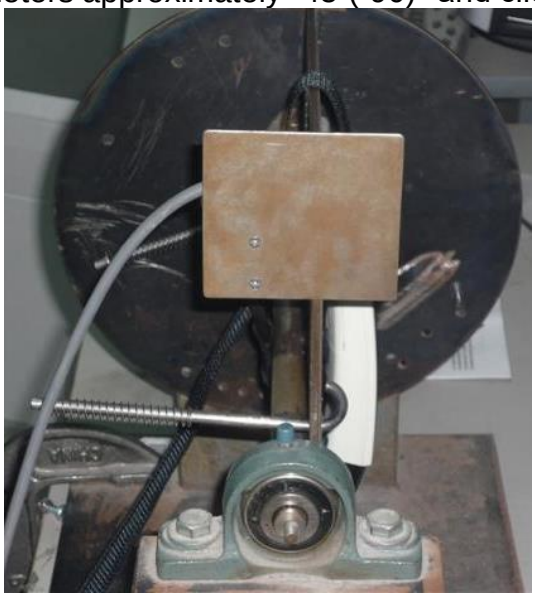


Figure 59. MicroPlus Calibration – Y Axis position 5

Calibrate the Z-axis of the accelerometer

Put the Brake Meter standing vertically so that the display faces you (this is 0° and the tolerance is ±5°). Put the reference accelerometer box on top of or beside the Brake Meter, so that when the Brake Meter is at 0° the reference accelerometer is at 90°. Place the reference accelerometer so that the chamfered edge points vertically downward (towards the floor when the Brake Meter is at 0°).

Figure 60. MicroPlus Calibration – Z Axis

Position 1: Put both accelerometers approximately 45-90° (tilted right), click “OK”.

Figure 61. MicroPlus Calibration – Z Axis position 1

Position 2: Put both accelerometers approximately 0-45° and click “OK”.

Figure 62. MicroPlus Calibration – Z Axis position 2

Position 3: Put both accelerometers at 0° (level position) and click “OK”.

Figure 63. MicroPlus Calibration – Z Axis position 3

Position 4: Put both accelerometers approximately 0- (-45)° (titled left), click “OK”.

Figure 64. MicroPlus Calibration – Z Axis position 4

Position 5: Put both accelerometers approximately -45-(-90)° and click “OK”.

Figure 65. MicroPlus Calibration – Z Axis position 5

7). Once you have finished all the calibration positions, the Calibrator encodes and sends all information to your PC, then the results (gains, offsets, triggers) are calculated and sent back to the Calibrator. The Calibrator sends this data to the Brake Meter, and removes one credit from the credit store.

8). The Brake Meter is automatically turned off after calibration.

9). The software will display the results on screen. You may save the results to a file by selecting 'Save Certificate File' from the menu, or you can print the results in certificate format by selecting 'Print.' from the menu.

When you print a certificate, the results are printed in the middle of the page, leaving room for a header at the top and sides of the data. Therefore you can print the results on your own header paper. As an example, we have included a Certificate Template in Microsoft Word '95 format. You can alter this template as necessary, and use it to print Calibration Certificates. If necessary, you can alter the position of the data on the page by altering the Print margins for your printer when you select 'Print'.

After you have saved a certificate file, you can load it later by starting the software then selecting 'Open Certificate File' from the menu. The files are stored as ".txt" files. The program defaults to saving and loading certificate files from the program directory. Refer to Figure 30 for a diagram showing how to Load a certificate file.

Note: if there is a communication error between the Calibrator and the PC, the Calibrator will automatically return to the main menu and the PC may display an error message. Restart the software and try again. If the Brake Meter stops responding during calibration while displaying 'Remote Control', you may have to manually reset it by removing a battery for a few seconds before you can retry the calibration. Remember, you won't be charged for a calibration unless the test is completed and a certificate is displayed on the screen.

4.6 Calibrating the AutoStop Suspension Meter

1)~4) Step1 to 4 are same as above.
5) After selecting the correct Suspension Meter model, turn the Suspension Meter on.
After the Suspension Meter initialises itself, and if there are no communication errors, the Calibrator will display "Ready-BM", the PC Software will display "Start Testing." and the Suspension Meter will display "Remote Control".
6) To calibrate the accelerometer, you must put the accelerometer and the reference accelerometer in a number of different positions. At each position you must click "OK" and wait a second to allow the Calibrator to read the current values.

The best way to do this is to create a structure to hold the Suspension Meter and the reference accelerometer in place (i.e. with Velcro or tape). However, you may also perform the calibration by hand. If you do this, you must make sure that the Suspension Meter and accelerometer are firmly attached (i.e. with tape) and do not move while you are clicking the "OK" button. Also make sure when putting the Suspension Meter in a position of 0° that the surface you are using is within ±5° of 0° to ensure an accurate calibration.

The following two steps will detail the angles for each position for the accelerometer, and the loads for the loadcell, with photos demonstrating the approximate angles (photos are taken from a side-on view).

X-Y-Z Representative Diagrams are as shown below:

Calibrate the X-axis of the accelerometer

Place the Suspension Meter in a horizontal position with the display face up (this is 0° and the tolerance is ±5°). Put the reference accelerometer on the top of or beside the Suspension Meter, with the chamfered edge pointing towards you (downward in the following diagram).

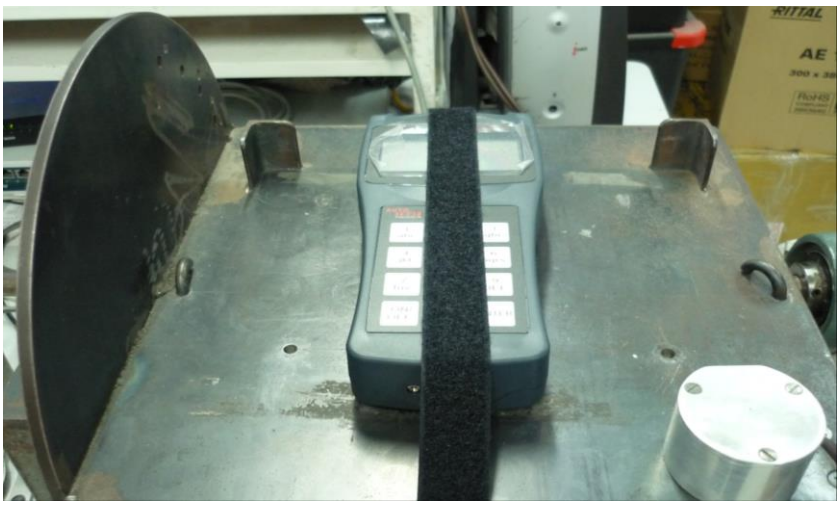


Figure 66. Suspension Meter – X Axis

Position 1: Put both accelerometers approximately 45-90° (tipping away from you) and click “OK”.

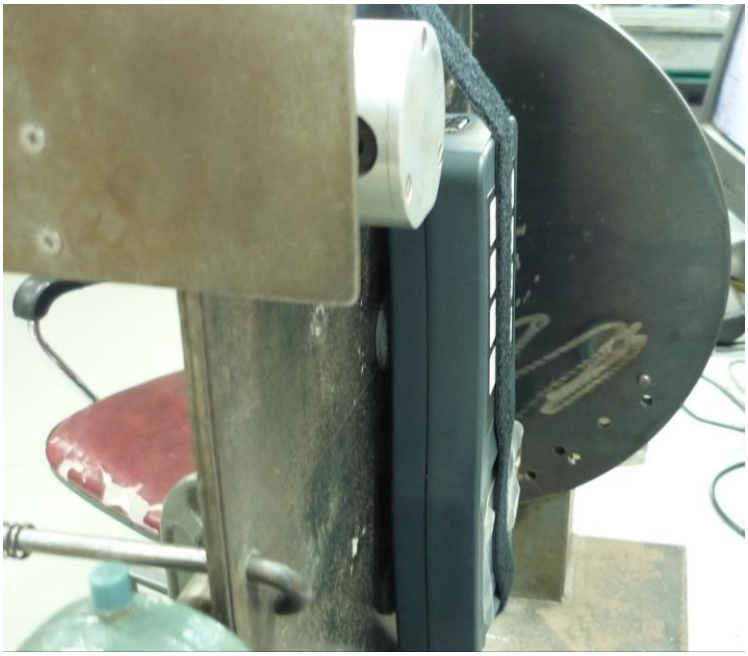


Figure 67. Suspension Meter Calibration – X Axis position 1

Position 2: Put both accelerometers approximately 0-45° and click “OK”.

Figure 68. Suspension Meter Calibration – X Axis position 2

Position 3: Put both accelerometers at 0° (level position) and click “OK”.

Figure 69. Suspension Meter Calibration – X Axis position 3

Position 4: Put both accelerometers approximately 0- (-45)° (tipping towards you) and click “OK”.

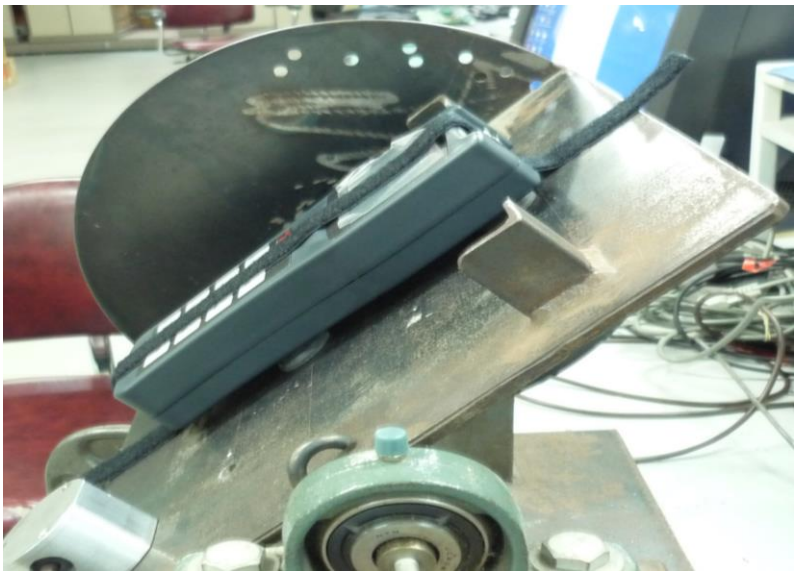


Figure 70. Suspension Meter Calibration – X Axis position 4

Position 5: Put both accelerometers approximately -45- (-90)° and click “OK”.

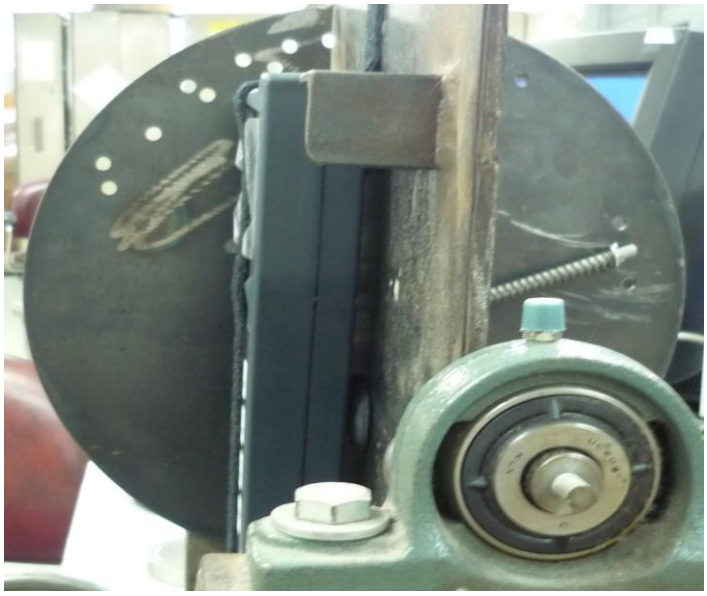


Figure 71. Suspension Meter Calibration – X Axis position 5

Calibrate the Y-axis of the accelerometer

Put the reference accelerometer on top of or beside the Suspension Meter, with the chamfered edge pointing towards you (facing down in the diagram below).

Figure 72. Suspension Meter Calibration – Y Axis

Position 1: Put both accelerometers approximately 45-90° (tipping to the right) and click “OK”.

Figure 73. Suspension Meter Calibration – Y Axis position 1

Position 2: Put both accelerometers approximately 0-45° and click “OK”.

Figure 74. Suspension Meter Calibration – Y Axis position 2

Position 3: Put both accelerometers at 0° (level position) and click “OK”.

Figure 75. Suspension Meter Calibration – Y Axis position 3

Position 4: Put both accelerometers approximately 0- (-45)° (tipping left) and Click “OK”.

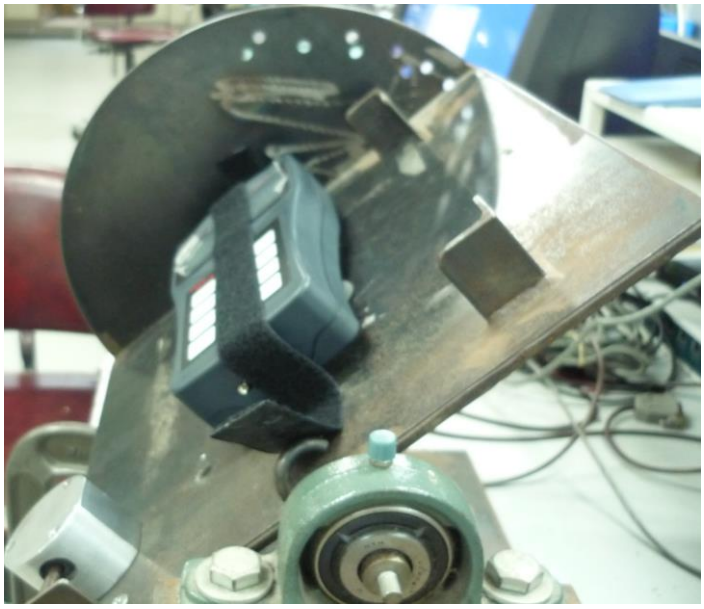


Figure 76. Suspension Meter Calibration – Y Axis position 4

Position 5: Put both accelerometers approximately -45-(-90)° and click “OK”.

Figure 77. Suspension Meter Calibration – Y Axis position 5

Calibrate the Z-axis of the accelerometer

Put the Suspension Meter standing vertically so that the display faces you (this is 0° and the tolerance is ±5°). Put the reference accelerometer box on top of or beside the Suspension Meter, so that when the Suspension Meter is at 0° the reference accelerometer is at 90°. Place the reference accelerometer so that the chamfered edge points vertically downward (towards the floor when the Suspension Meter is at 0°).

Figure 78. Suspension Meter Calibration – Z Axis

Position 1: Put both accelerometers approximately 45-90° (tilted right), click “OK”.

Figure 79. Suspension Meter Calibration – Z Axis position 1

Position 2: Put both accelerometers approximately 0-45° and click “OK”.

Figure 80. Suspension Meter Calibration – Z Axis position 2

Position 3: Put both accelerometers at 0° (level position) and click “OK”.

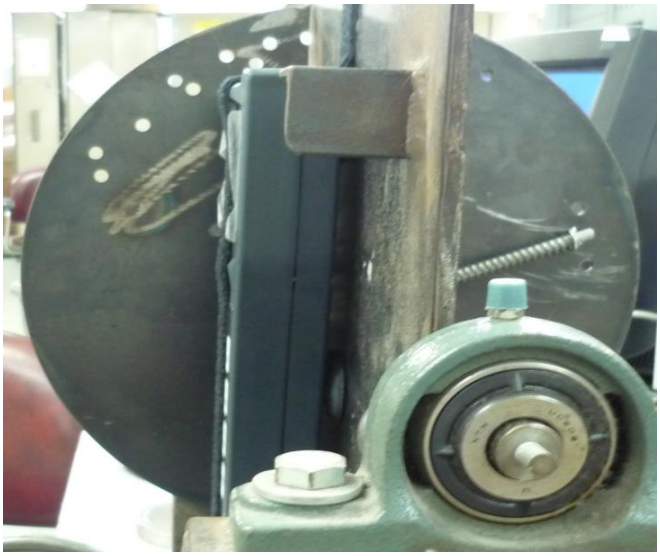


Figure 81. Suspension Meter Calibration – Z Axis position 3

Position 4: Put both accelerometers approximately 0- (-45)° (titled left), click “OK”.

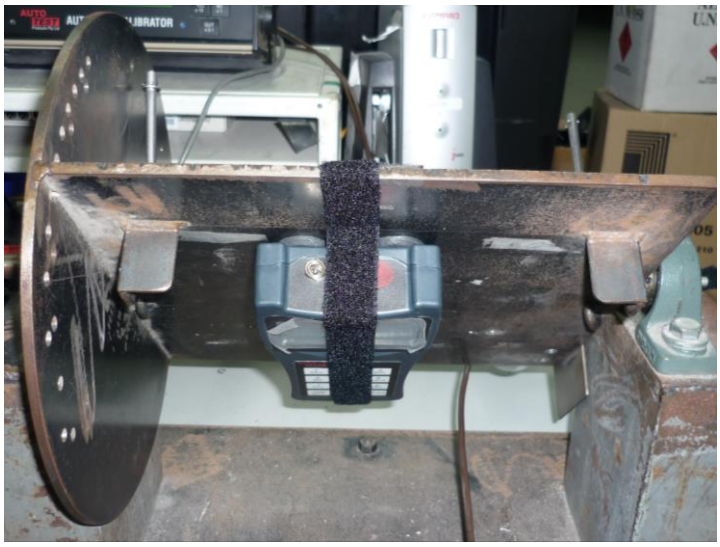


Figure 82. Suspension Meter Calibration – Z Axis position 4

Position 5: Put both accelerometers approximately -45-(-90)° and click “OK”.

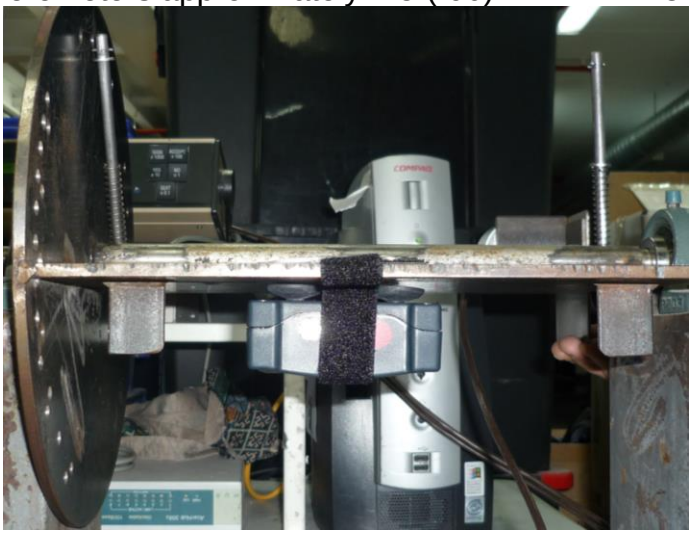


Figure 83. Suspension Meter Calibration – Z Axis position 5

7). Once you have finished all the calibration positions, the Calibrator encodes and sends all information to your PC, then the results (gains, offsets, triggers) are calculated and sent back to the Calibrator. The Calibrator sends this data to the Suspension Meter, and removes one credit point from the credit store.

8). The Suspension Meter is automatically turned off after calibration.

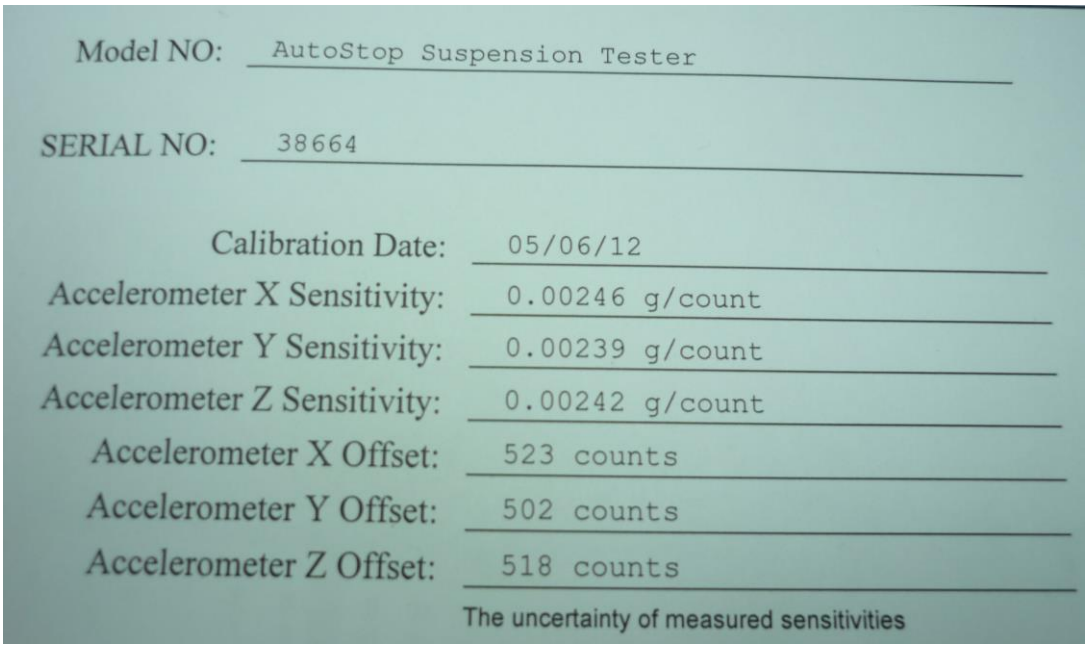
9). The software will display the results on screen. You may save the results to a file by selecting 'Save Certificate File' from the menu, or you can print the results in certificate format by selecting 'Print.' from the menu.

When you print a certificate, the results are printed in the middle of the page, leaving room for a header at the top and sides of the data. Therefore you can print the results on your own header paper. As an example, we have included a Certificate Template in Microsoft Word '95 format. You can alter this template as necessary, and use it to print Calibration Certificates. If necessary, you can alter the position of the data on the page by altering the Print margins for your printer when you select 'Print'.

After you have saved a certificate file, you can load it later by starting the software then selecting 'Open Certificate File' from the menu. The files are stored as ".txt" files. The program defaults to saving and loading certificate files from the program directory. Refer to Figure 30 for a diagram showing how to Load a certificate file.

Also make sure the battery is 100% before calibrations.

Accelerometer sensitivities and offset values should be in the range as shown below.


Model NO: AutoStop Suspension Tester

SERIAL NO: 38664

Calibration Date: 05/06/12

Accelerometer X Sensitivity: 0.00246 g/count

Accelerometer Y Sensitivity: 0.00239 g/count

Accelerometer Z Sensitivity: 0.00242 g/count

Accelerometer X Offset: 523 counts

Accelerometer Y Offset: 502 counts

Accelerometer Z Offset: 518 counts

The uncertainty of measured sensitivities

Accelerometer offset should be from 500 to 525 counts.

Note: if there is a communication error between the Calibrator and the PC, the Calibrator will automatically return to the main menu and the PC may display an error message. Restart the software and try again. If the Suspension Meter stops responding during calibration while displaying 'Remote Control', you may have to manually reset it by removing a battery for a few seconds before you can retry the calibration. Remember, you won't be charged for a calibration unless the test is completed and a certificate is displayed on the screen.

4.7 Calibrating the AutoTest Pedal Effort Sensor

1)~4) Step1 to 4 are same as above.
5) After selecting the correct Brake Meter model, turn the Brake Meter on.
After the Brake Meter initialises itself, and if there are no communication errors, the Calibrator will display “Ready-BM”, the PC Software will display “Start Testing.” and the Brake Meter will display “Remote Control”.
6) To calibrate the Pedal Effort Sensor, you must put the load cell inside the reference load cell under a number of different loads, you must click “OK” and wait a second after each load is applied. The calibration results are calculated by comparing the values from the load cell to those from the reference load cell (Refer to Section 4.4 - Calibration Certificate, for more information on the calibration results).

Calibrate the Load cell:

Place the Pedal Effort Sensor loadcell squarely inside the reference loadcell.

a. Standalone P.E.S b. Workshop Pro Bluetooth P.E.S.

Figure 84. Pedal Effort Sensor Loadcell Placement

a). Position 1: Apply no pressure to the loadcell, and click “OK”.
b). Position 2: Apply approximately 0-200N to both load cells and click “OK”.
c) Position 3: Apply approximately 200-400N to both load cells and click “OK”.
d) Position 4: Apply approximately 400-600N to both load cells and click “OK”.
e) Position 5: Apply approximately 600-1000N to both load cells and click “OK”.

10). Once you have finished all the calibration positions, the Calibrator encodes and sends all information to your PC, then the results (gains, offsets, triggers) are calculated and sent back to the Calibrator.

4.8 Calibration Certificate

After a calibration test, the results of the test will be displayed on screen under the heading ‘Calibration Test Results’. The results may be printed by selecting ‘Print’ from the ‘Print’ menu, or saved by selecting ‘Save Certificate File’ from the ‘File’ menu. Saved certificate files are stored as .TXT files and are saved in the main program directory by default. To find a saved certificate file, simply run the program by clicking the ‘Brake Meter Calibration’ icon on the desktop, then select ‘Load Certificate File’ from the File Menu:

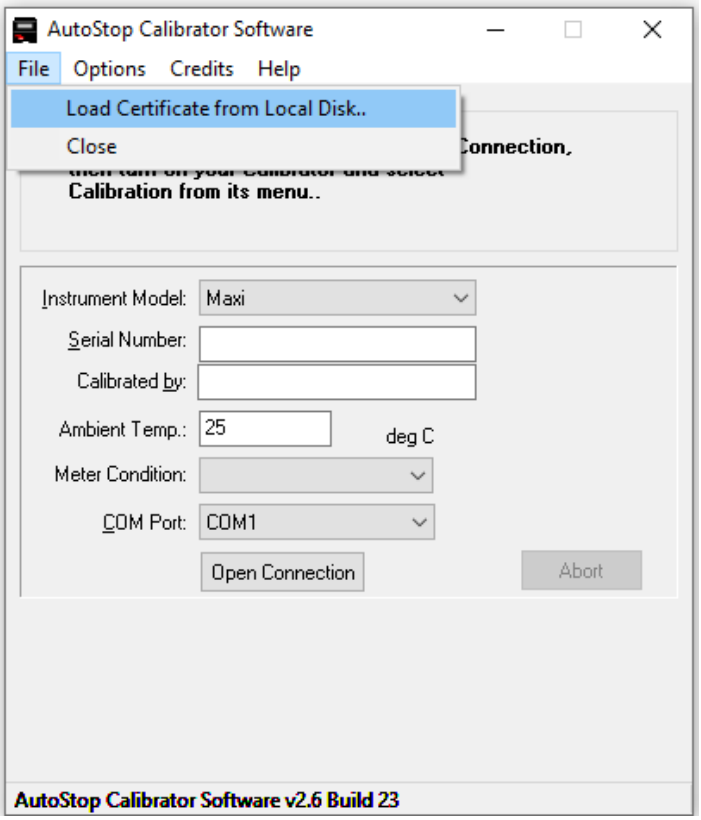


Figure 85. Loading a certificate file

The certificate displays the serial number, calibration date (based on the current date of the PC), calibration details, and the Calibration Status. The Calibration Status is either SATISFACTORY or UNSATISFACTORY.

During a test the Calibrator takes a number of readings from the reference accelerometer or load cell and from the Brake Meter itself. For each set of positions an r^2 value is calculated by putting a line of best fit through the values. If the r^2 value is equal to 1.0 then all the positions fit perfectly along a line and the hardware is accurate. If the r^2 value is outside the threshold (0.998 to 1.0) it means that either your testing procedure was incorrect (i.e. the Brake Meter was not held completely still at each position during testing) or there is a hardware fault, and the Calibration Status will be UNSATISFACTORY. See Section 7.2 (Regression Analysis) for a full explanation and examples of the calculation of r^2 values.

Depending on the type of Brake Meter being tested, there will different r^2 values displayed on the certificate. For a satisfactory calibration, every r^2 value must fall within the range 0.998 - 1.0

4.9 Self Check

1). Put the reference accelerometer in a flat position and select “Self Check?” from the menu.

2). While the Accelerometer is stabilising, be sure not to touch it. After two minutes of stabilising, the Calibrator will begin displaying the acceleration value. Check that the value matches the angle of the Accelerometer.

3). Press any key (hold for a few seconds) to switch to loadcell reading.

4.10 Recharging the Battery

After using the Calibrator for more than 8 hours, the internal 12V battery should be recharged. Connect the supplied Battery Charger to the charge plug located on the rear of the Calibrator. A red LED will light to indicate that the charging circuit is operational. The Calibrator should be charged for 12 to 16 hours.

4.11 Reference Calibration

The reference accelerometer and reference loadcell are calibrated prior to shipping (calibration certificates for each of these are included), however you may re-calibrate them yourself by selecting this option. Some mathematical knowledge and a method of measuring angles and load accurately are required to do this. This calibration can also be performed by AutoTest Products, or by a suitable calibration laboratory. The basic procedure is to set the reference accelerometer is to set it at different angles and to note the corresponding count on the calibrator. Similarly the loadcell can be subjected to different loads and the calibrator count for each load has to be noted. These results are then used to calculate the accelerometer and loadcell gains, which are entered into the Calibrator.

4.12 Downloading Calibration Credits

Your AutoTest Calibrator uses a credit system to pay for each Brake Meter calibration that you perform. The Calibrator can store a maximum of 20 credits, and the credits must be downloaded into your Calibrator from the AutoTest web server via the Internet. Before using the service, you must supply AutoTest Products Ltd. with your payment details (credit card etc.) and receive a login name and password.

Requirements:

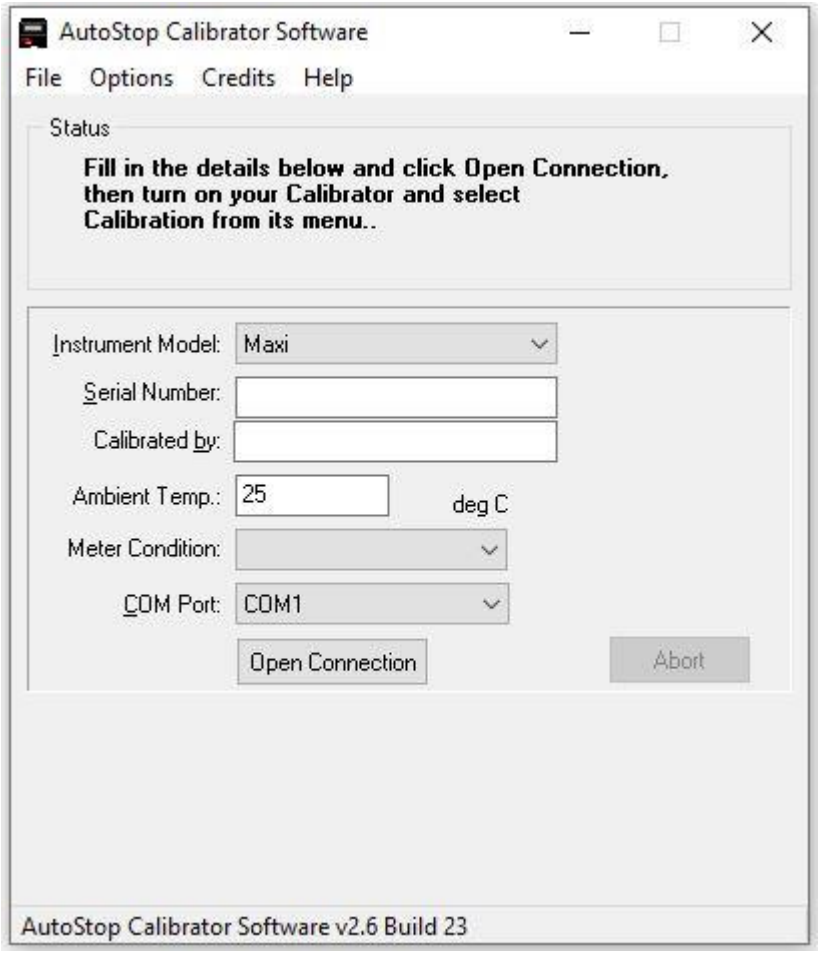
- One AutoTest Calibrator
- A PC connected to the Internet
- Calibration Software version 2.1 build 02 or greater
- A login name and password to use the service
- The qualifications listed in Section 2.1

Procedure:

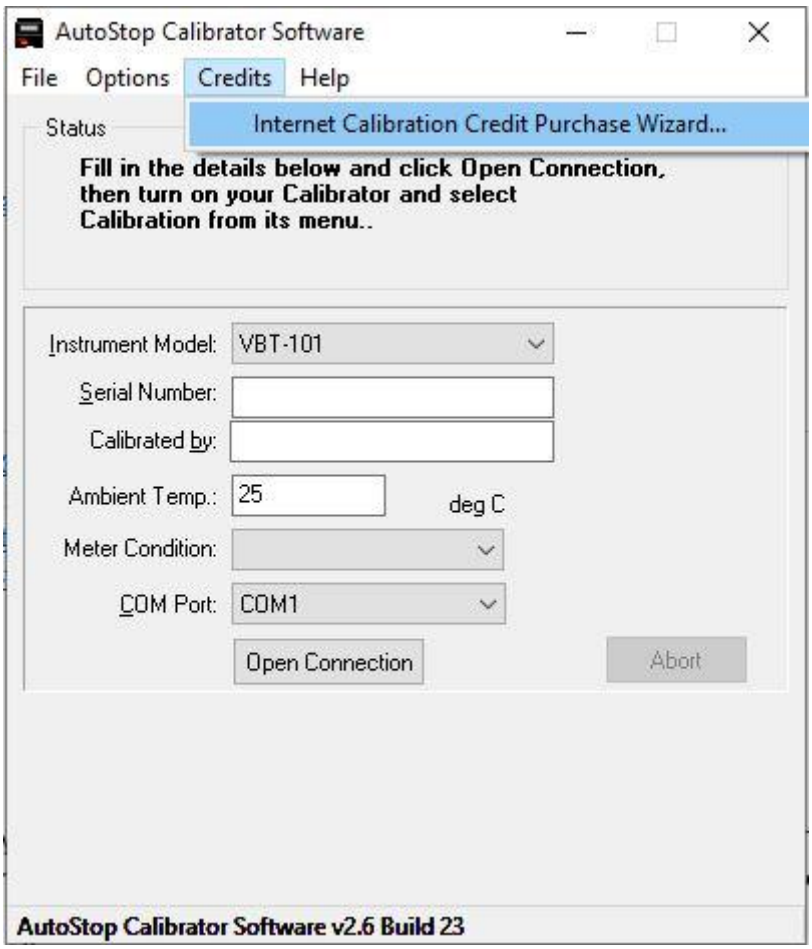
1) Connect the AutoTest Calibrator to a spare 9-pin serial port in the back of your computer, using the RS-232 9-pin serial cable supplied with your AutoTest Calibrator.

2) Connect to the Internet on your PC, and run the Calibration Software.

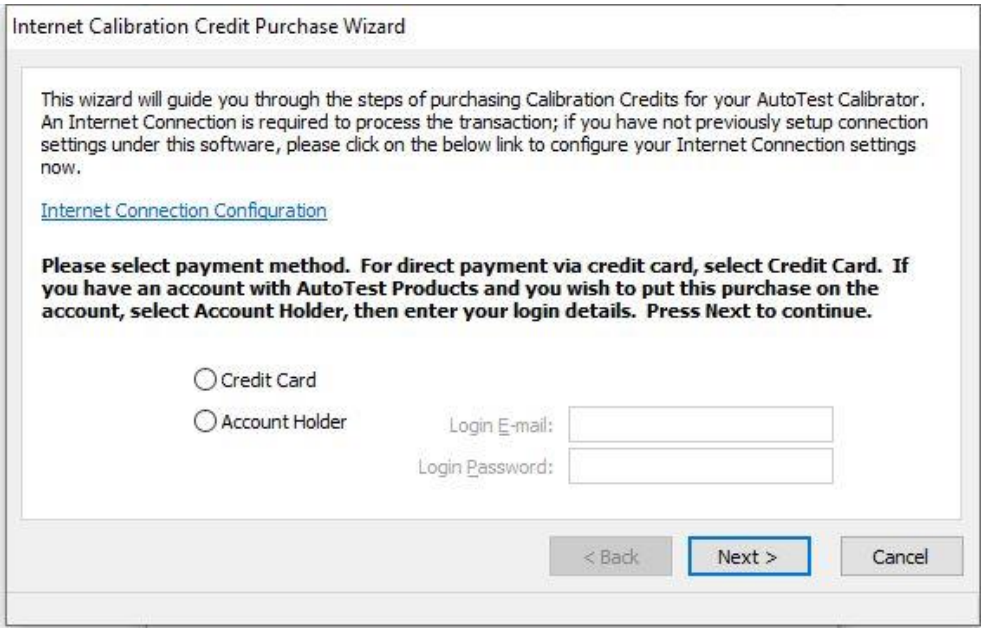
3) Next, select the instrument model; enter the serial number and select the COM Port number that corresponds to the PC COM Port to which you connected the cable. This is usually COM1 or COM2, depending on what other serial devices are connected to your computer.



4) On the menu bar, open “Credits”, then click on “Internet Calibration Credit Purchase…”

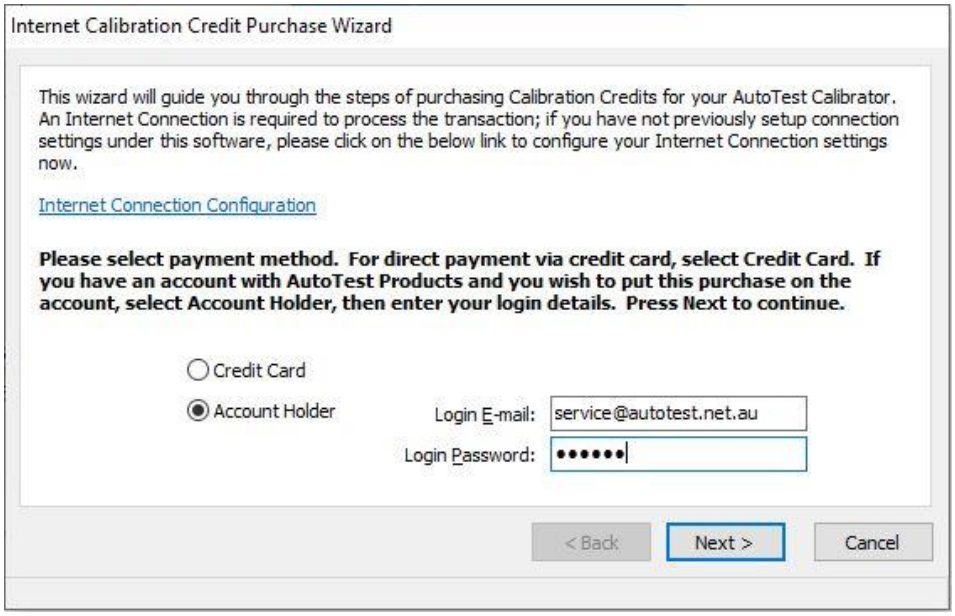


5) In the Internet Calibration Credit Purchase window, click on the “Internet Connection…” button to configure your Internet connection settings.

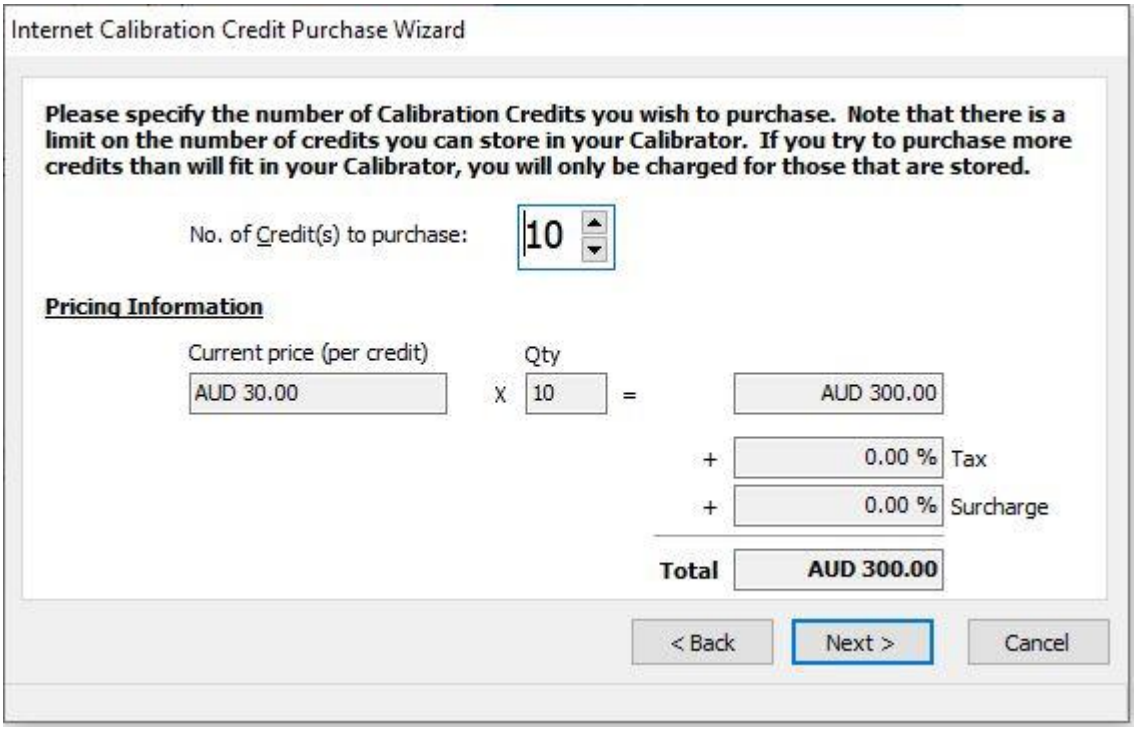


6) In most cases the “Directly connected to the Internet” option will work, but If your connection requires the use of a Proxy Server, select “Use a Proxy Server” and enter your proxy server and port number. Click OK to save configuration and continue.

7) If you are an account holder enter login e-mail address and password and click “next”

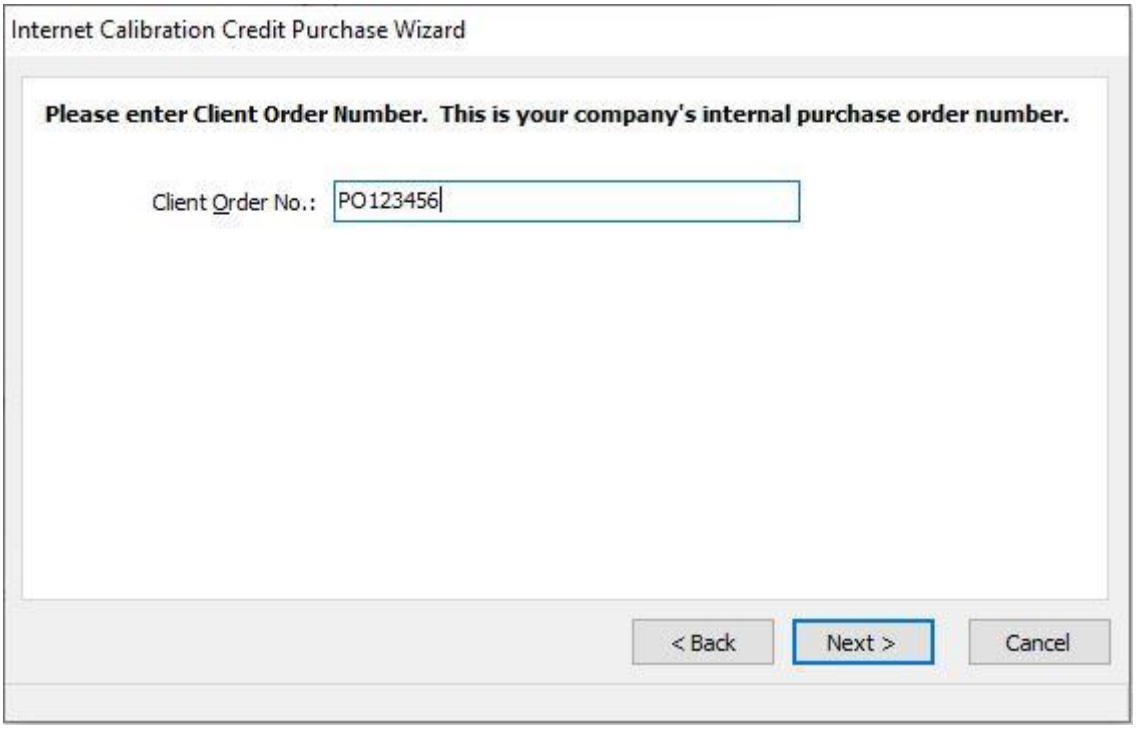


8) Enter the number of Credits required.
9)

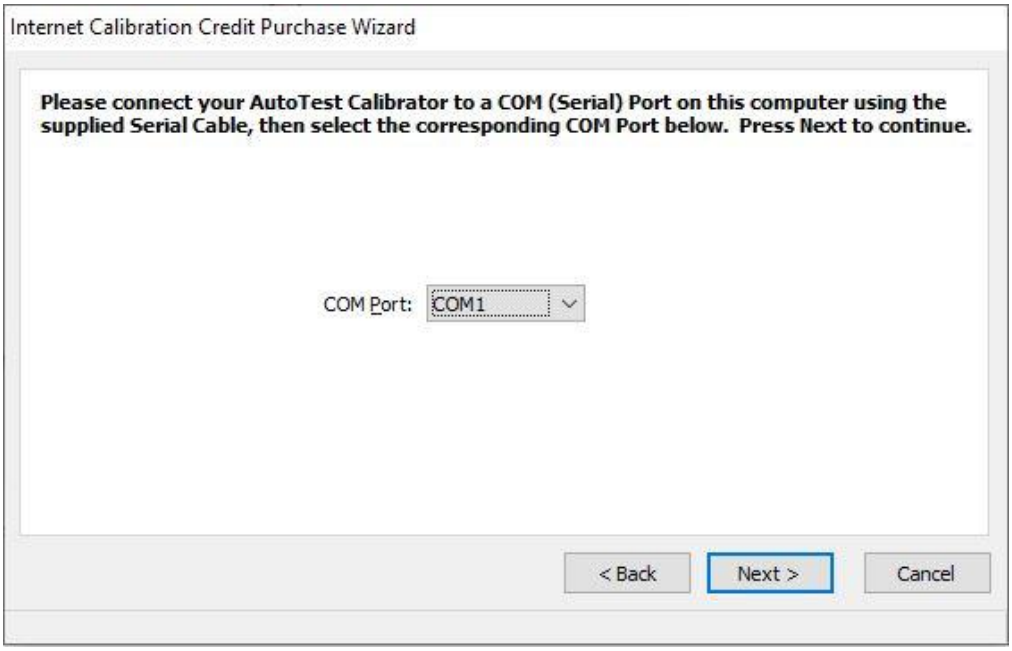


10) Enter the number of Credits you wish to purchase and click the “Next” button. The maximum number of credits that your AutoTest Calibrator can store at any one time is 20. If you try to purchase more than 20 credits, you will be only charged for the 20 that are stored. If you purchase 20 credits, but there are still 5 credits stored in the Calibrator, for example, you will only be charged for the 25 that are added.

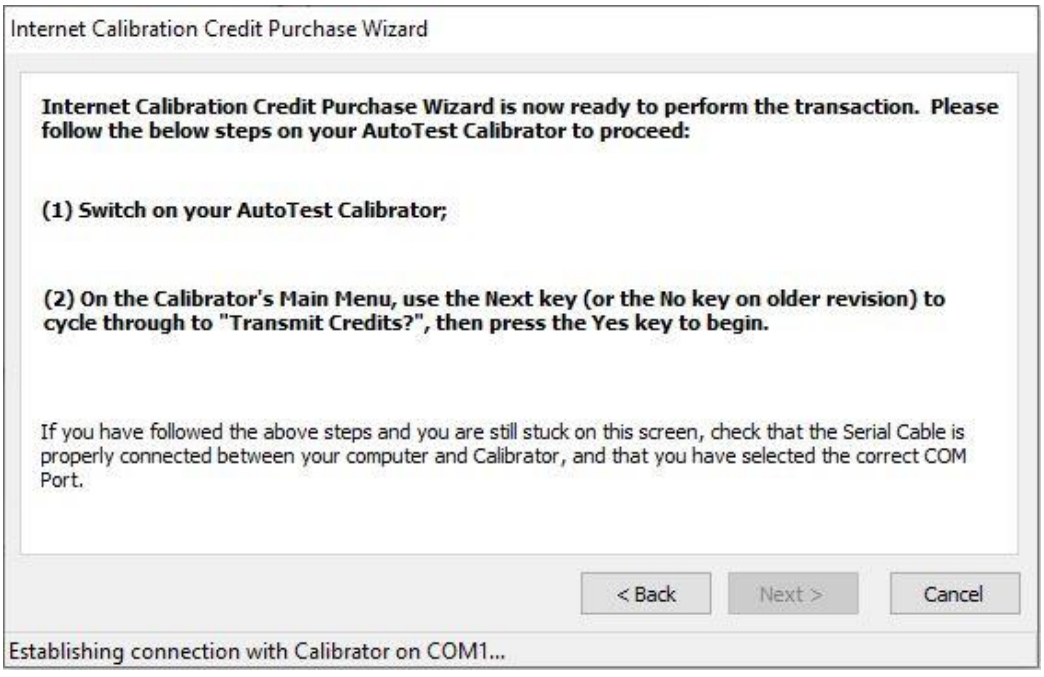
11) After clicking the “Next” button, enter your Client Order Number and click” Next”



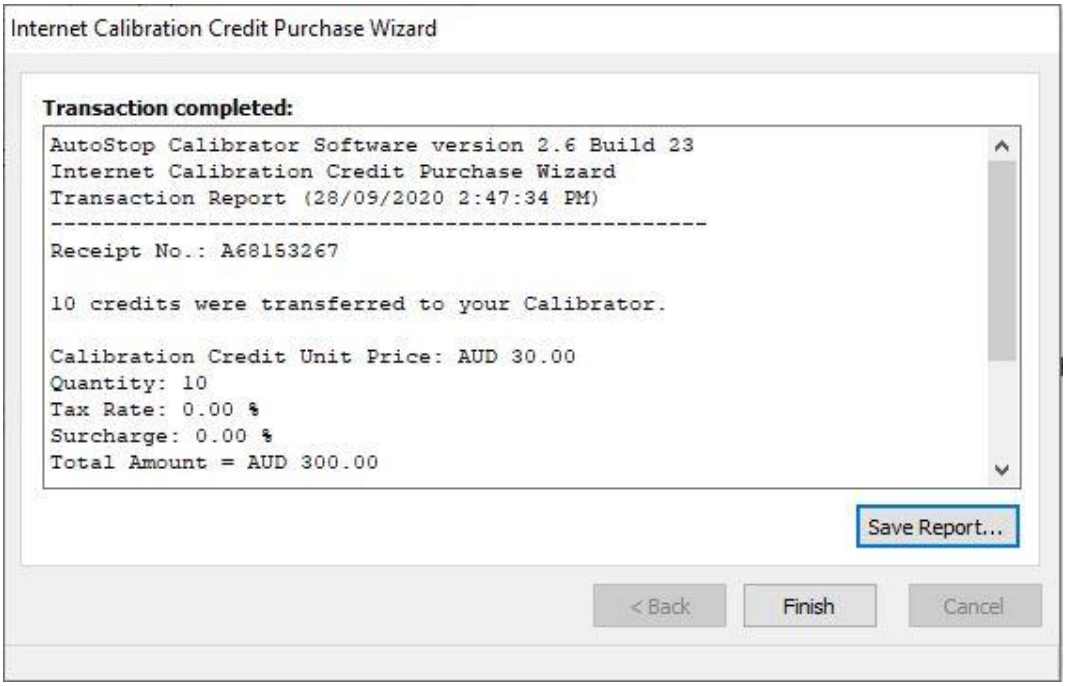
12) Select you COM port.



13) You will be presented with a brief instruction window if your details were verified successfully. Switch on your AutoTest Calibrator, and select the menu option labelled "Transmit Credit". You should see a display of the number of Credits left in the Calibrator, followed by the words "Handshaking with PC…" Click OK on the PC to proceed with credit transfer.

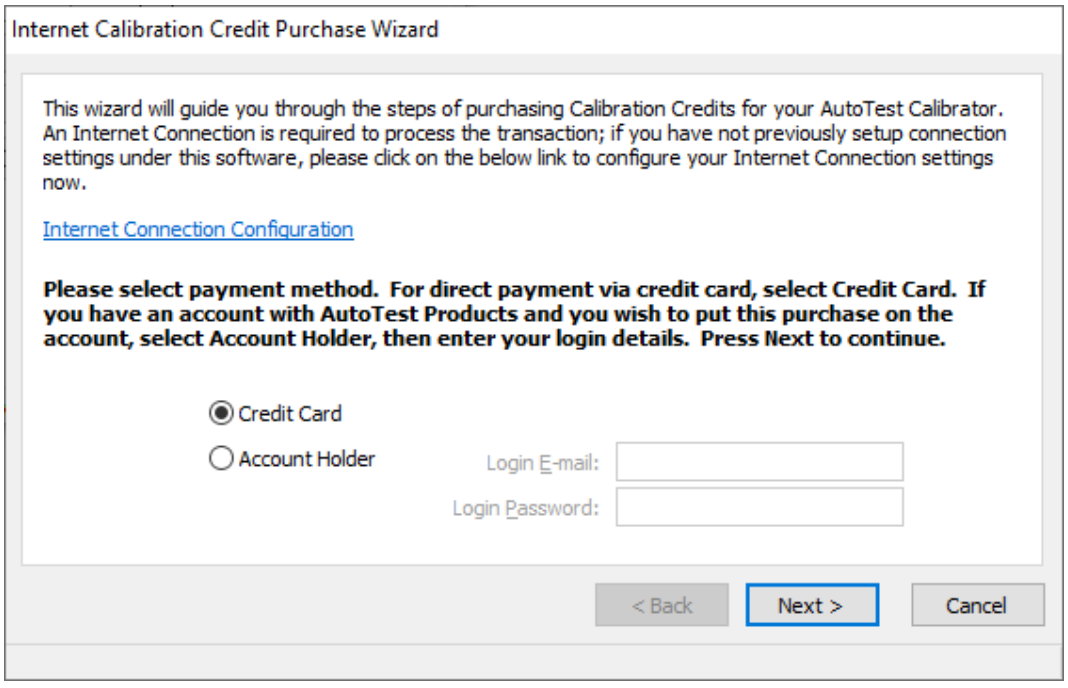


14) If the transfer is successful, a new window will appear informing you of the number of credits transferred into the Calibrator. The number of credits you purchased is stored in our database, and your Credit Card will be processed shortly with the details you provided when you obtained a Login name and Password

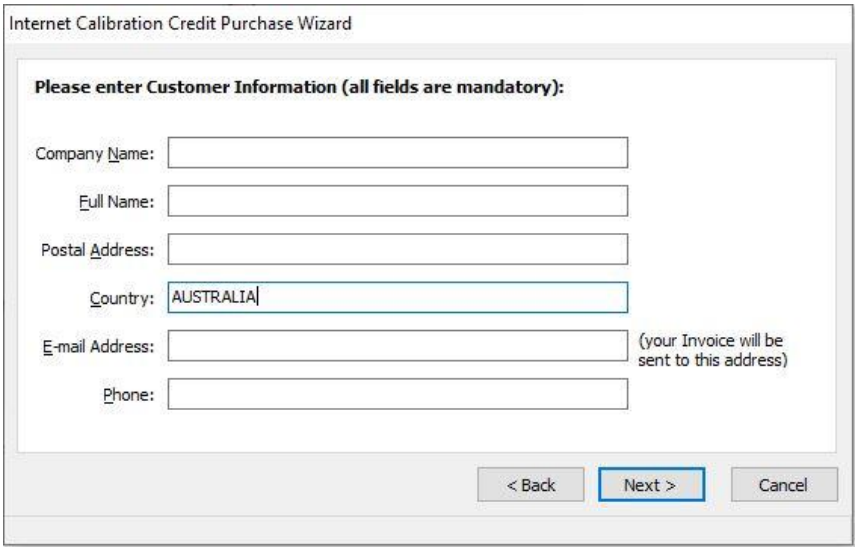


If the process is successful, the Calibrator will now contain the number of credits you selected. You can verify this by selecting “Brake Meter Calibration” from the Calibrator menu and checking the display of credits remaining. You will not be able to purchase any more credits until the credit card transaction is processed and the database is updated.
Remember that you must remain connected to the Internet throughout the transfer procedure. If you are disconnected during the process or if communication fails for some reason you will not be charged unless the credits were successfully transferred to your AutoTest Calibrator.

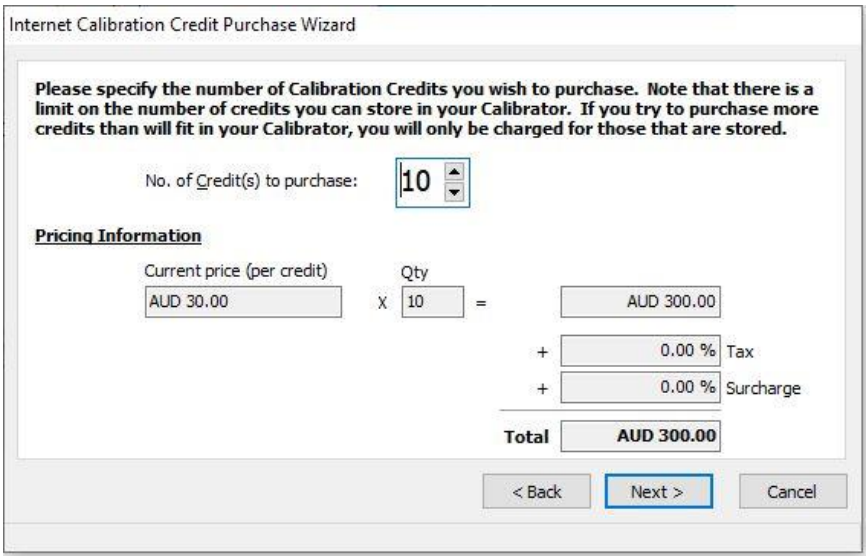
15) If you are not an account holder you can select the credit card option



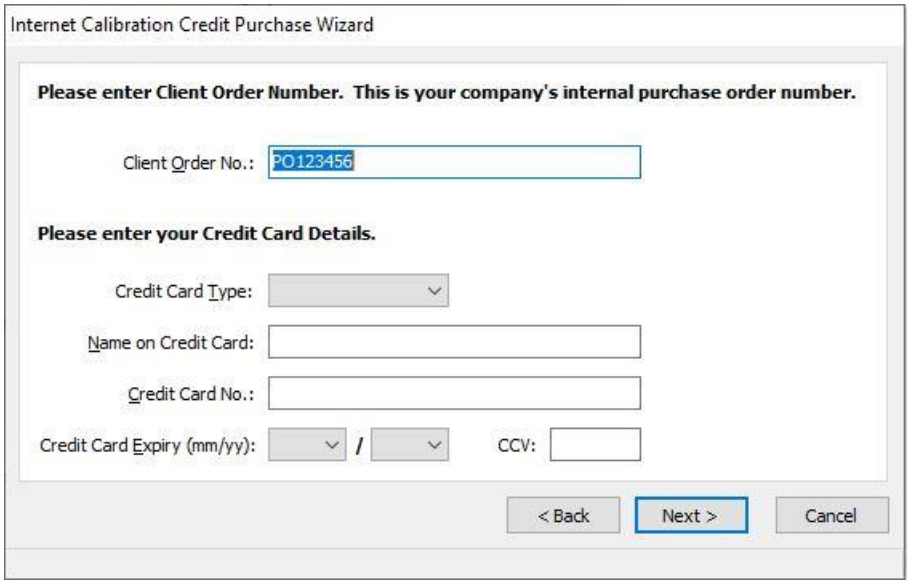
16) Fill in the Customer Information



17) Enter the number of Credits required.



18) Enter Client order number and the credit card details



19) Same as Steps11)~13)

5. TROUBLESHOOTING

Problem	Potential Cause and Action Necessary
Calibrator will not turn on	Battery has discharged. Recharge the battery for 12-16 hours (refer to Section 4.6 for instructions).
Calibrator will turn on but there is nothing displayed on the LCD display	Check that the 'download program switch' is off (middle position).
Problem downloading a new program into the Calibrator memory	Check the 9-pin to 9-pin cable. Make sure you set the download switch to "on" and checked that the LED light is on, then pressed the "reset" button once. Note that while you will probably never need to use the program download feature, the microprocessor supports a maximum of ~100 program downloads in its lifetime.
PC does not handshake with the Calibrator when you try to calibrate	Check that you have selected the right COM port, and that all cables are connected securely.
Brake Meter displays 'Remote Control' and cannot be turned off	This can occur if a Calibration fails partway through. The solution is to manually remove a battery (for Mini's) or manually remove a battery connection (for other Brake Meters) for a few moments then replace the battery / connection. This will force the Brake Meter to switch off. To remove a battery connection for Maxi / Heavy Brake Meters you will need to unscrew the screw on the bottom of the Brake Meter.
Applet does not load	Check that you are using Internet Explorer version 5.01 or later. You can check this by loading Internet Exploring, then selecting 'About Internet Explorer' from the 'Help' menu. You can download the latest version of Internet Explorer for free from http://www.microsoft.com/ You cannot use Netscape or any other browser except for Microsoft Internet Explorer 5.01 or later.

6. SPECIFICATION

Maximum Acceleration/Deceleration ± 2g

Reference Accelerometer

Accuracy	< 0.05%
Coefficient of Determination r^2	> 0.9997

Reference Loadcell

Accuracy	< 1%
Coefficient of determination r^2	> 0.9995
Maximum Load	2000kg

Battery	12V, 1.9AH, sealed lead acid, rechargeable
Charge Output	12V DC, center positive, 300mA
Display	40x2 LCD, character size 8x5
Temperature Range	15 - 35°C
Humidity	up to 70%
Dimensions	70mm x 300mm x 140mm
Weight	5kg

Environment Limits

The AutoTest Calibrator is designed to operate from 15-35°C with up to 70% relative humidity. Do not store the calibrator in an area which exceeds 70°C or 95% relative humidity.

7. TECHNICAL INFORMATION

7.1 Cable Connections Used for Asynchronous Interface

DB9 PIN	FUNCTION
2	RxD -- PC receive data from Calibrator
3	TxD – PC transmit data to Calibrator
5	Signal Ground

DB15 PIN	FUNCTION
2	RxD -- Brake Meter receive data from Calibrator
3	TxD – Brake Meter transmit data to Calibrator
1,8	Signal Ground

PC Cable

9-pin plug Connected to Calibrator		9-pin socket Connected to PC
Pin 2	———	Pin 2
Pin 3	———	Pin 3
Pin 5	———	Pin 5

Maxi/heavy pre version 7

15-pin plug
Connected to Calibrator

3.5mm Stereo plug
Connected to Maxi

Pin 1

Pin 2

Pin 3

100 Ohm Resistor
between Pin 3 and Pin 6.

Maxi/Heavy version 7 and above/MicroPlus/Pedal Effort Sensor

15-pin plug
Connected to Calibrator

3.5mm Stereo Angle plug
Connected to Maxi

Pin 1

Pin 3

Pin 2

NOTES:

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