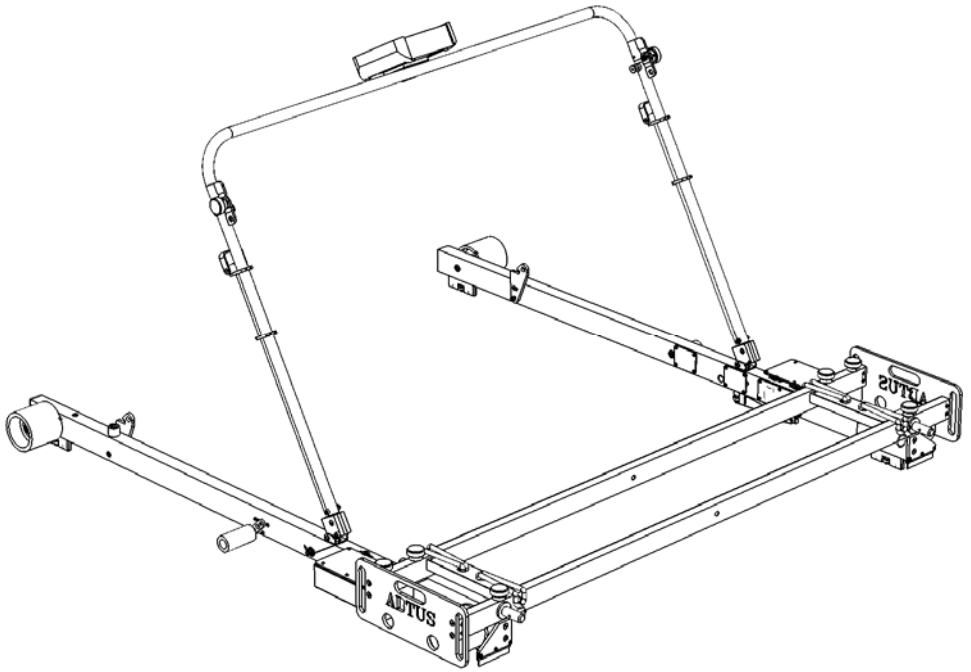
abtuslimited
Established in 1908—100 years of excellence in railway and marine technology

ABT4530

Alignment Trolley



Instruction Manual

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2.0 Item List

1. Cross Beam
2. Rail Beam (Left)
3. Rail Beam (Right)
4. Handle Bar
5. Control Unit
6. Carry Case
7. Instruction Manual
8. Trolley Charger
9. Control Unit Charger

3.0 Specification

Weight	-	On Track In Box	20kg 35kg
Physical Dimensions	- - -	On Track Folded In Box	1750 x 1700 x 1200 (mm) 1750 x 1700 x 200 (mm) 1800 x 550 x 320 (mm)
Operating Temperature	-		-20°C to + 50°C (-4°F to 122°F)
Environmental Rating	-		IP65
Battery Life	- -	Control Unit Trolley	5 hours[1] 8 hours
Operating System	-		Microsoft Windows CE

[1] Spare batteries can be purchased separately and can be swapped during operation to extend operating time

4.0 Getting Started

4.1 Overview

The Abtus ABT4530 Trolley has been developed to provide the maximum degree of measurement from a small, lightweight apparatus.

The measurement sensors and data-logging electronics are embedded in the two Trolley Beams. The raw measurement data is transmitted via Bluetooth to the Control Unit for interpretation, display and user interaction. The Control Unit uses the standard Windows operating system found on most mobile devices – this provides a familiar environment for the user to work in.

The use of wireless technology means that there are three separate batteries in your ABT4530:

- Trolley Beam (Left)
- Trolley Beam (Right)
- Control Unit

Each of these batteries must be fully charged for the trolley to function for the specified operating period. The battery charger for the Trolley Beams has two connectors on it to enable both Trolley Beams to be charged simultaneously.

Please review Sections 6.0 and 8.1 prior to using your ABT4530 for the first time.

4.2 Assembly

On receipt of your ABT4530 and prior to switching on any of the equipment, ensure that all batteries are given a full charge. When the batteries are ready for use, it is recommended that the trolley is first assembled indoors to familiarise yourself with the operating procedure prior to using it on track. Figure 1 shows an outline of the separate trolley parts and how it is assembled.

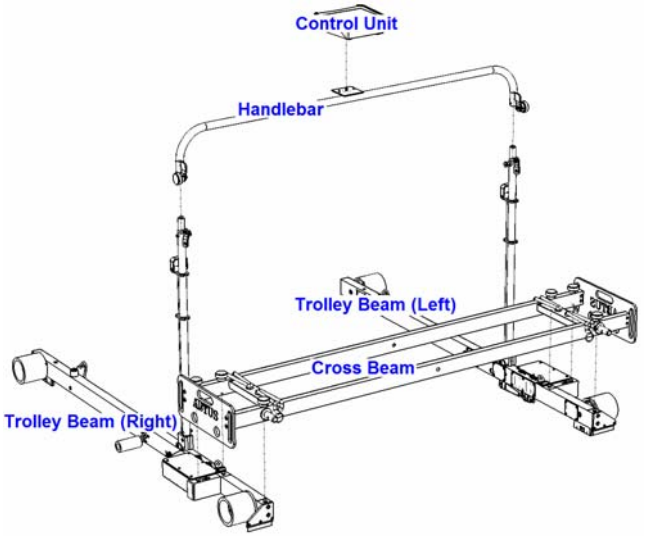


Figure 1

1. Lay the two Trolley Beams out on the ground approximately the correct distance apart
2. Place the Cross Beam on top of the Trolley Beams and fix in place using the three knobs on each side (Figure 2a) – this should be done with care to avoid damage to the electrical connection on the underside of the Cross Beam (Figure 2b). Tighten the knobs so that there is no gap between the Cross Beam and the Trolley Beam.

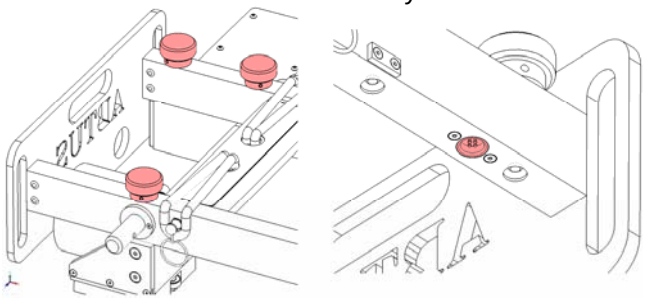


Figure 2

3. Fit the Handlebar to the uprights on the Trolley Beams and secure in place using the two knobs (Figure 3)

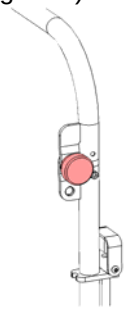


Figure 3

4. Locate the two pins of the mounting plate (in the centre of the Handlebar) into the holes in the base plate of the Control Unit and lock in place using the knob (Figure 4)

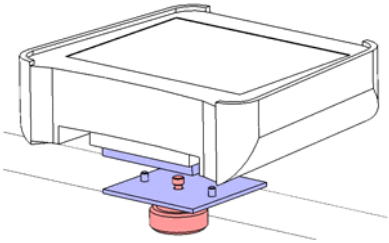


Figure 4

4.3 Switching On

1. Turn on the Control Unit by pressing and holding (for a few seconds) the button on the back (Figure 5). This button is under the index finger on your right hand as you hold the unit towards you

Figure 5

2. Switch on the Right Trolley Beam followed by the Left Trolley Beam by firmly pressing and releasing the black button on each one (Figure 6). The blue LED indicates that power is on. You should hear a short beep from the Left Trolley Beam shortly after switching it on. If you do not hear this beep, please refer to Section 8.0

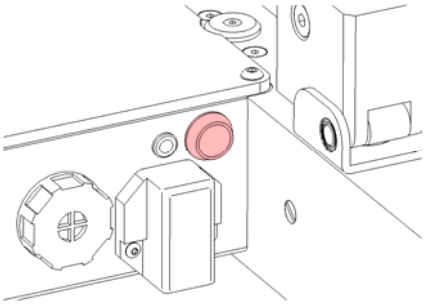


Figure 6

3. Load the Abtus Gauge Interface software from the Start Menu (Figure 7) – the software launches directly to the 'Connection' screen

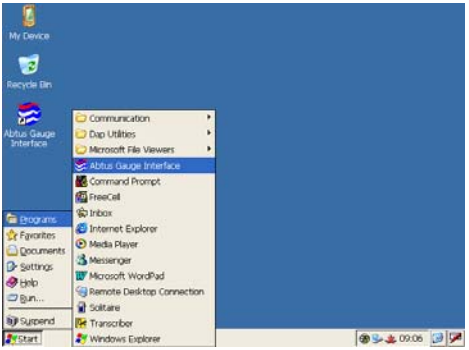


Figure 7

4.4 Bluetooth Connection

Before recording can start, a Bluetooth connection must be made between the Control Unit and the ABT4530 – imagine this step is like plugging in a cable between the Trolley Beams and the Control Unit

1. Select the desired gauge from the list[2] and tap the 'Connect' button
2. Please be patient while the Control Unit makes the connection
3. When the connection has been made, the 'Options' screen (Figure 8) is displayed
4. If the connection fails, see Section 8.0 for help

[2] The Abtus Gauge Interface software is common to all Abtus Bluetooth products and so it is possible to 'Pair' the Control Unit with a number of different gauges.

4.5 Recording Data

The Abtus Gauge Interface software provides a versatile framework in which to record and analyse track data. These features are covered in depth in Section 5.0 – this section will only describe the steps necessary to start a recording.

1. Check that the gauging arms have been withdrawn using the red handles
2. Place the trolley carefully on the track and then release the gauging arms
3. Select 'Start Recording' from the 'Options' screen (Figure 8)

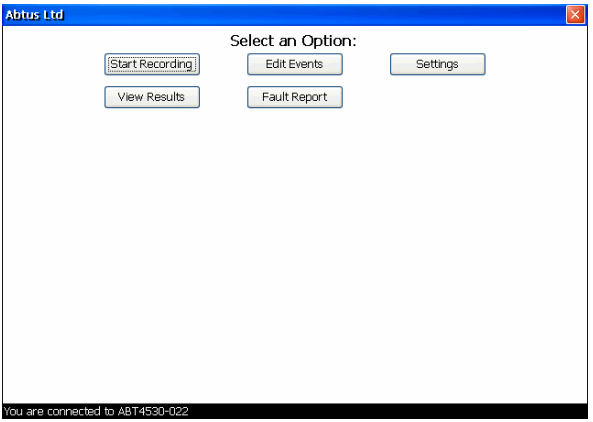


Figure 8

4. Input a file name for the recording in the 'Title' box (Figure 9)
   - 'Files' displays a list of existing recordings
   - Tapping 'More' will allow you to input additional information
     - Start Description
     - Start Distance
     - Whether the distance should 'Count Up' or 'Count Down'

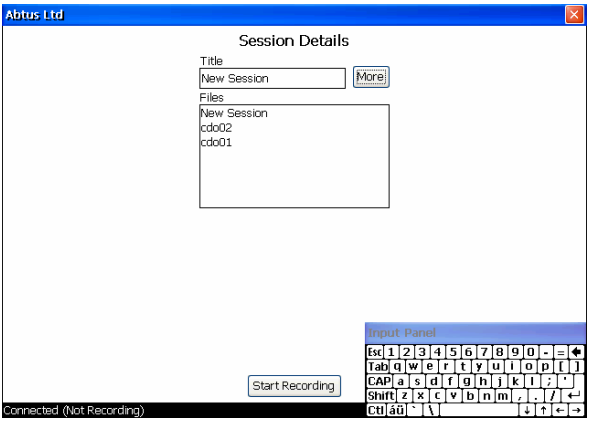


Figure 9

5. Check that the gauging arms have been released and that the trolley is in the correct position on the track
6. Release the safety brake[3] by pulling the handle back towards you
7. Tap 'Start Recording' – this will begin the data acquisition process and load up the 'Results' screen (Figure 10)
    - Two measurements can be displayed on the screen at one time
    - Tap in the box containing the measurement to cycle through the available measurements
    - Tap in the yellow 'Interval' box to toggle between a coarse and a fine measurement interval
    - Data is recorded at every 'Interval', however, if the trolley is pushed very slowly or is stationary then the data on the screen is refreshed twice a second

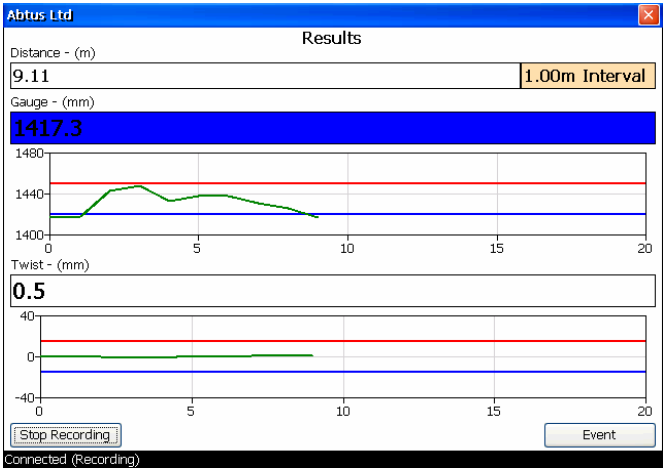


Figure 10

8. When you have recorded the required length of track, tap 'Stop Recording'. This will take you back to the 'Session Details' screen
9. Input a 'Finish Description' if required
10. Tap 'Finish' to complete the recording process and save the file

[3] Your ABT4530 has been fitted with a fail-safe brake which locks the rear wheel on the Right Trolley Beam. The brake is active when the handle is either vertical or horizontal – the operator must hold the handle in an intermediate position to release the brake.

5.0 Software Features

5.1 Events

The ABT4530 trolley has the facility to store 12 separate events. Events are of one of three types:


Warning


Information


Marker

It is not possible to edit the events while recording. To edit the events:

1. Tap the 'Edit Events' button in the 'Options' screen (Figure 8)
2. Tap on the text of the event you want to edit (Figure 11)
3. Edit the text
   or
4. Tap the icon to the left to change the event type

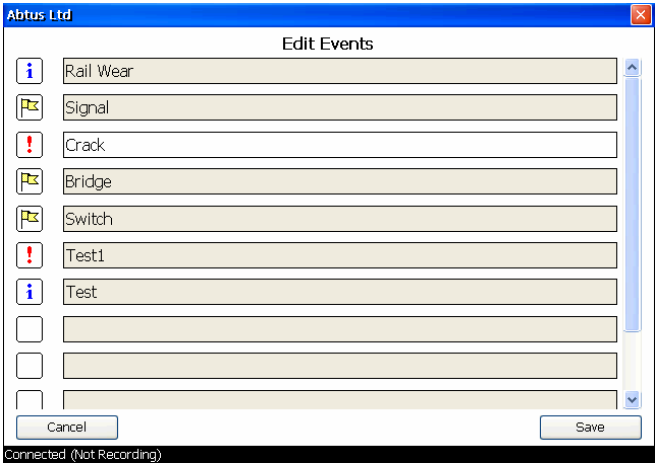


Figure 11

These events can be selected at any time while recording. To select an event:

1. Tap the 'Event' button when in the 'Results' screen (Figure 10)
2. Select the required event
3. Tap the 'Add Event' button

The event text is inserted into the recorded Data File after the most recent measurement point.

5.2 Settings

The settings screen (Figure 12) is where recording parameters and tolerances are defined. Multiple Settings Profiles can be created to suit various requirements such as different line speeds.

To create a new Settings Profile, select ‘Create profile…’ from the ‘Select a Settings Profile’ drop-down list box.

To rename or delete a Settings Profile, select the required Settings Profile and then tap and hold on the drop-down list box.

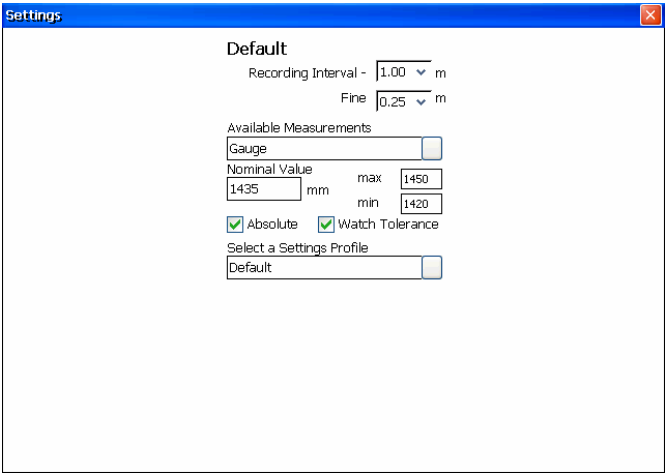


Figure 12

For each Settings Profile, the following parameters can be set:

- Coarse measurement interval
- Fine measurement interval
- Twist Base
- Vertical Cord Length
- Horizontal Cord Length
- Upper and Lower bounds for each measurement
- Whether the measurement is ‘watched’ or not

Distance

Two different measurement intervals can be set up. It is possible to toggle between Coarse and Fine while recording.

The coarse interval can not be less than 1.0m and is restricted to values which divide exactly into the specified Twist Base and Cord Lengths.

The fine interval must be less than the coarse interval and can not be less than 100mm. Fine interval values are restricted to values which divide exactly into the coarse interval.

Twist Base/Cord Length
To set the Twist Base /Cord Length:

1. Select the required measurement from the drop down list
2. Tap and Hold on the drop-down list box
3. Tap 'Change Twist Base/Cord Length'
4. Enter the new value and tap 'OK'

Bounds
Upper and lower bounds can be set for each measurement either as absolute values or as +/- values relative to the nominal value (e.g. 1435 +3/-2 is equivalent to 1438/1433). Check or uncheck 'Absolute' to toggle between the two modes

'Watching' a Measurement
When the tolerance of a watched measurement is exceeded while recording, the trolley gives an audible warning. The box containing the measurement (in the 'Results' screen) is also coloured in **RED** if over tolerance and **BLUE** if under.

Measurements must also be 'watched' to appear in a Fault Report (see section 5.4).

To create a new Settings Profile, select '*Create Profile…*' from the drop down box at the bottom of the screen.

To rename/delete a profile:
1. Select the required Settings Profile
2. Tap and Hold on the drop down list
3. Carry out the required action

5.3 View Results

To review recorded Data Files and Fault Reports (see section 5.4) tap the 'View Results' button in the Options screen. Select the file you wish to review from the drop down box at the bottom of the screen. Toggle between file types (see section 5.5) using the button in the bottom right of the screen.

5.4 Fault Reports

It is possible to generate a fault report from a recorded Data File. A fault report is a condensed version of a recorded Data File which highlights any tolerance exceedences in the selected Data File. To create a fault report:

1. Ensure that the 'Settings Profile' you want to use for the fault report has been selected in the 'Settings' screen
2. Tap 'Fault Report' in the 'Options' screen
3. Select the file you want to create a fault report for
4. You will be notified by a message when the fault report has been created
5. You can review the fault report through the 'View Results' screen

Note – it is possible to create a fault report using a different tolerance profile than that which was used to record the file.

5.5 File Types

The ABT 4530 automatically saves two files for each recording. The file types are:

- *.csv
- *.sec

The CSV file is in a standard format which will open in almost any software package (e.g. Excel, Word, Notepad etc). This file contains all the Start and Finish information along with all the recorded data in an easy to read layout.

The SEC file contains exactly the same information as the CSV file but is encrypted. It is possible to view this 'secure' file through the 'View Results' screen (see section 0) however it is not possible to edit it. This file is tamper-proof and is suitable for auditing purposes.

5.6 Transferring Recorded Data Files to a PC

Recorded Data is stored on the Control Unit in the following location:

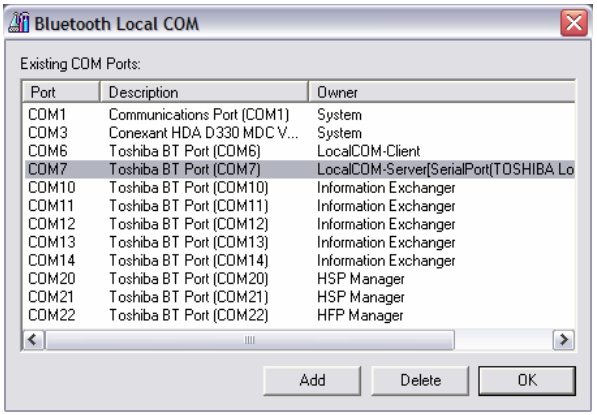
\\My Device\DiskOnChip\Abtus Gauge Interface\Recorded Data\ABT4530\....

Files may be transferred from the Control Unit to a PC using ActiveSync. If your PC does not already have ActiveSync installed then it must be downloaded from the Microsoft website and installed prior to connecting the Control Unit to your PC.
In order to comply with the high IP65 rating on some Control Units, there may not be a USB socket for connecting the Control Unit to a PC. In this case, the connection must be made using Bluetooth[4].

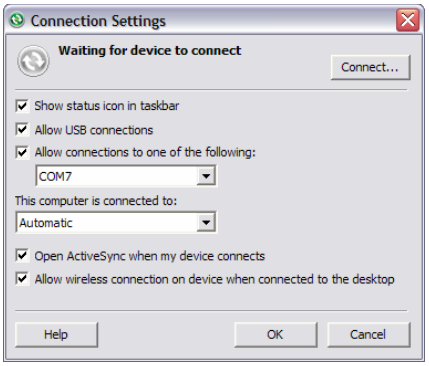
[4] It is possible to purchase a USB-Bluetooth adaptor if your PC is not Bluetooth enabled. Please contact your local Abtus distributor for help.

Bluetooth ActiveSync – Setup

1. Setup ActiveSync on the PC to search for connections on Bluetooth
   - Find out which COM port the PC uses as a Bluetooth server (in this example it is COM7). Where to find this information varies between PCs but it is generally found somewhere in the Settings of the Bluetooth Manager that is installed on your PC

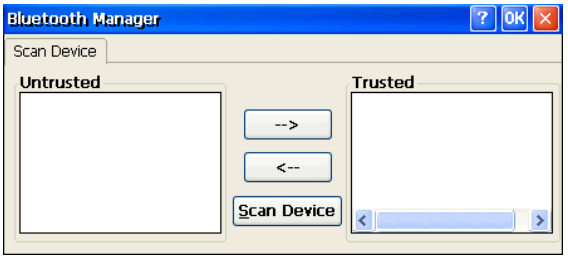


   - Display the ActiveSync window then File -> Connection Settings



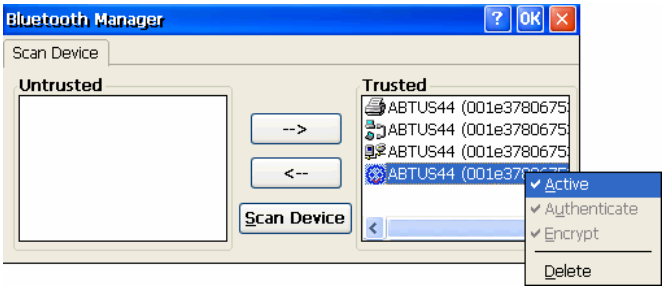
   - Tick ‘Allow’ connections to one of the following
   - Select the appropriate COM port (in this example it is COM7)
2. Ensure that Bluetooth on the PC is switched on and is discoverable
3. Switch on Bluetooth on the DAP unit
   - *Start -> Settings -> Control Panel -> _Wireless*
   - Ensure ‘Bluetooth Powered’ is ticked
   - Ensure ‘Wifi Powered’ is NOT ticked

4. Search for the PC from the DAP unit
   - *Start -> Settings -> Control Panel -> Bluetooth Device Properties*
   - Click ‘Scan Device’ and wait for the PC to be found



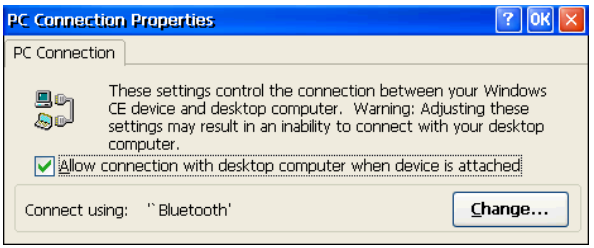
   - Select the service on the PC with the ActiveSync symbol
   - Click the ‘→’ button
   - Click ‘Yes’ when asked if you need to authenticate the device
   - When prompted, enter the PIN ‘1234’ and click ‘OK’
   - On the PC, when prompted, enter the PIN ‘1234’ and click ‘OK’

   - When the ActiveSync service on the PC has appeared in the ‘Trusted’ box on the DAP unit, double click it and select ‘Active’. A red tick should now have appeared over the ActiveSync symbol in the ‘Trusted’ box



- Click the 'OK' button in the top right of the 'Bluetooth Manager' window to close it.

5. Set PC Connection type on the DAP unit
   - *Start -> Settings -> Control Panel -> PC Connection*
   - Tick 'Allow connection with desktop computer when device is attached'



- Click 'Change' and then select 'Bluetooth' from the drop down list
- Click the 'OK' button in the top right of the 'Change Connection' window to close it
- Click the 'OK' button in the top right of the 'PC Connection Properties' window to close it

Bluetooth ActiveSync – Making the connection

1. Ensure that Bluetooth on the PC is powered
2. Ensure that Bluetooth on the Control Unit is powered
3. On the DAP Unit click *Start -> Programs -> Communication -> PC Link*
4. A progress box should appear and display the following messages:
   - Opening Port
   - Connecting to Host
   - User Authenticated
5. If the connection fails, recheck the steps in the **Bluetooth ActiveSync – Setup** stage

6.0 Maintenance

6.1 Before Each Use

The following routine checks should be carried out immediately prior to use:

1. Ensure all batteries are fully charged (see section 4.1 for more information)
2. Ensure both front wheels are clean and turn freely
3. Check the Vertical Cord rollers (see Figure 1) are clean and turn freely
4. Wipe any accumulated grime/grease from the rollers on the gauge/flange-way arms (see Figure 1)
5. Ensure that the Gauge/Flange-Way arms rotate freely and spring back easily
6. Check that safety brake is working correctly

6.2 Every 3 Months

Check all rolling surfaces for flats – if any flats are found, the trolley should be returned to Abtus for the affected parts to be replaced.

6.3 Annual

The trolley must be returned to Abtus Ltd annually for re-calibration to ensure measurements are within specification.

The condition of all trolley components will be checked and any remedial work or replacement parts will be quoted at this time.

6.4 Control Unit Battery

The high-quality Lithium-Ion battery provided with the Control Unit may be re-charged over 500 times according to the battery manufacturer.

The main battery should last from 12 to 24 months if used under normal working conditions.

6.5 Storage

If the trolley is not going to be used for a few days or more, it is recommended to keep batteries directly on charge.

If the trolley is not going to be used for a few weeks, it is strongly recommended that the batteries be fully charged and that the trolley be stored out of direct sunlight in a location of low humidity where the temperature will be between +20°C (+68°F) and +25°C (+77°F)

If the trolley has been stored for a long period of time, recharge the batteries completely prior to use

If extended storage time is necessary, it is important to backup all data from the Control Unit to ensure no data is lost or corrupted

Keeping the trolley permanently on charge is also possible; however, this may affect the battery life and capacity over time

7.0 Measurement Characteristics

7.1 Distance

Accuracy	±0.25%
Resolution	0.01m
Min Interval	0.1m

Distance is measured by the front left wheel. Irregularities such as rail joints will adversely affect distance accuracy. Greasy, dirty or frosty rails will also degrade accuracy

7.2 Gauge

Accuracy	±0.8mm
Resolution	0.1mm

Gauge is measured as the distance between the rollers on the two gauging arms. Gauge is measured at a point 350mm behind the distance wheel.

7.3 Check-Gauge

Accuracy	±1.2mm
Resolution	0.1mm

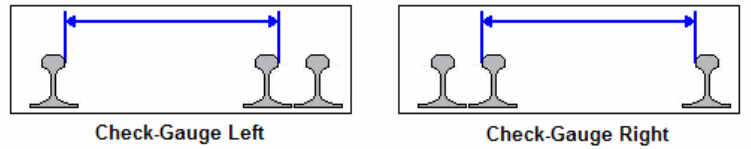


Figure 13

Check-Gauge is defined as shown in Figure 13. Check-Gauge is measured at a point approximately 500mm behind the distance wheel.

7.4 Flange-Way

Accuracy	±0.8mm
Resolution	0.1mm

Flange-Way is defined as the distance between a running rail and a check rail. Flange-Way is measured at a point approximately 425mm behind the distance wheel.

7.5 Super-Elevation

Accuracy	±1.2mm
Resolution	0.1mm

Super Elevation (SE) is a very sensitive measurement – 1mm of SE equates to approximately 0.038°. As it is so sensitive, excessive vibration will decrease accuracy.

7.6 Gradient

Accuracy	±0.05°
Resolution	0.1°

Gradient is a very sensitive measurement – see notes on Super Elevation.

7.7 Twist

Accuracy	±1.2mm
Resolution	0.1mm

The Twist Base used for calculating twist can be defined by the user in **Settings** but must be in multiples of 1.0m.

Twist is calculated as the measured difference in Super Elevation between the present position and the position one 'Twist Base' back. For this reason, no Twist data can be calculated until the distance travelled is greater than the Twist Base.

7.8 Horizontal Versine

Accuracy	±10mm (@ 20m cord)
Resolution	1.0mm

The Cord Length used for calculating horizontal versine can be defined by the user in **Settings** but must be in multiples of 1.0m.

Horizontal versine is calculated by the Arc Difference method. Both of the trolley's front wheels measure distance – by analysing the difference in the measured distance between the two wheels it is possible to calculate the instantaneous rail curvature.

A value for the local/instantaneous horizontal versine is taken at every measurement point. When the trolley has travelled the same distance as the cord length specified by the user, the effect of all the instantaneous versine measurements is added together, this gives the required value for the user specified cord length. For this reason, no horizontal versine data is available for the first cord length of measurement.

Due to this method of measuring versine, there are a number of points that should be taken into consideration when analysing the recorded data.

Severe irregularities in the rail such as joints may cause an instantaneous spike in the data. The graph in Figure 14 demonstrates how such a spike would look. Such errors should be ignored when examining versine data.

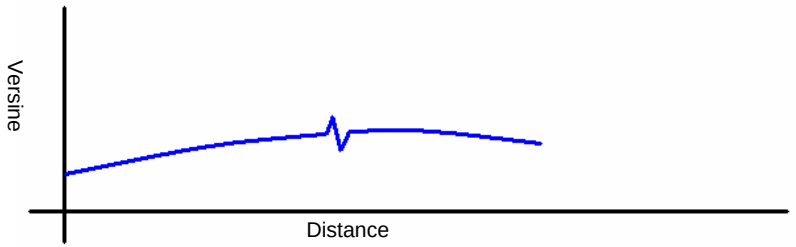


Figure 14

It is unlikely that results from the trolley will directly match results obtained from stringing the track. For example, there could be a kink in the track that falls within the half cord length when stringing the track. The blue line in the exaggerated diagram (Figure 15) represents the estimated track position from the stringing method; the green line represents the estimated track position as calculated by the trolley.

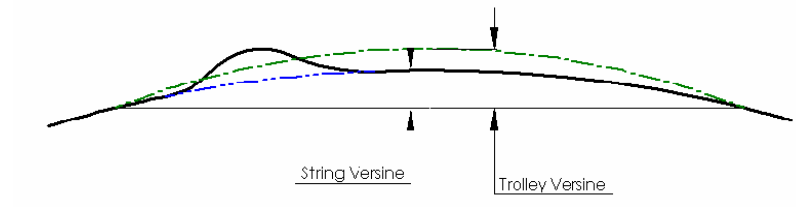


Figure 15

Because of these differences, it is important to compare the overall trend of versine vs. distance rather than discreet values.

The distance against the recorded versine measurement on the trolley corresponds to the end position of the cord. For example, if a 20m cord were used and stretched between 0m and 20m, the measured versine would be displayed on the trolley at 20m.

7.9 Vertical Versine

Accuracy	±0.2mm (@1.5m cord) ±10mm (@20m cord)
Resolution	1.0mm

The Cord Length used for calculating vertical versine can be defined by the user in **Settings** but must be in multiples of 1.0m.

A value for the local/instantaneous vertical versine (based on a 1.5m cord) is taken at every measurement point. When the trolley has travelled the same distance as the cord length specified by the user, the effect of all the instantaneous versine measurements is added together, this gives the required value for the user specified cord length[5]. For this reason, no vertical versine data is available for the first cord length of measurement.

[5] This is **not** the same as an extrapolated versine value which assumes that the curvature at the local/instantaneous point represents the curvature over the larger cord length.

8.0 Trouble shooter

8.1 Tips for Good Recording

The ABT4530 is a very accurate piece of equipment – many of the parameters that it measures rely on extremely sensitive sensors. Whilst every reasonable effort has been made to make it 'railway proof', users should treat it with extreme care.

The SE and Gradient measurements rely on accelerometers. As such, rogue accelerations can cause excessive errors – these can be caused by:

- Vibrations resulting from a dirty track/dirty wheels
- Starting/stopping suddenly or rapid changes in direction of travel

At all times, keep the measurement process as smooth and steady as possible.

The speed at which the trolley is pushed should be such that one measurement is taken every second.

e.g.

Recording Distance Interval	Walking Speed
1.00m	1m/s (slow/medium walking speed)
0.25m	0.25m/s (slow walking speed)

8.2 No Power

Check that all the batteries are fully charged. Each Trolley Beam takes approximately 6 hours to charge and the Control Unit takes approximately 3 hours.

8.3 No Beep

Power down both Trolley Beams, wait for 5 seconds and then switch back on. If there is still no beep, please refer to Section 8.2. If, after a full charge there is still no beep, please contact your local Abtus distributor.

8.4 Battery life is not to specification

If the battery's duration does not last the normal time-frame specified, it may be time to change it.

The Control Unit battery may be replaced in the field. Replacing the batteries in the Trolley Beams requires that the trolley be returned to Abtus Ltd. Contact your local Abtus distributor for assistance.

See Sections 6.4 and 6.5 for additional information.

8.5 Can not connect

The connection between the Control Unit and the Trolley is via Bluetooth. Obstacles such as metal and water (the human body is mostly water!) can degrade wireless signals – ensure that nothing is restricting 'in the way' of the signal.

Ensure that all batteries are fully charged (see section 4.1 for more information on the batteries).

8.6 The safety brake does not release

The brake is prevented from releasing if the trolley wheel is trying to rotate against the brake. Take the strain off the brake by rolling the trolley backwards very slightly as you release the brake.

If you still cannot release the brake check the condition of the brake cable (close to the power button on the Right Trolley Beam) – if this is loose or broken please contact your local Abtus distributor for help.

The Abtus Range of Track Geometry products include:

ABT 4530 – Alignment Trolley

ABT 4370 – Data Logging Trolley

ABT 4650 – Route Scan

ABT 4640 – Laser Height and Stagger Gauge

ABT 4610 – Datum Offset Gauge

ABT 4505 – Data Logging Switch Gauge

ABT 4190 – Platform and Offset Gauge

ABT 4050 – Collapsible Platform Gauge

ABT 4071 – 3rd Rail Gauge Folding

ABT 4070 – 4th Rail Inspectors Gauge

ABT 4160 – Lead Rail Inspectors Gauge (LUL Type)

ABT 4580 – 6’ Relative Level Gauge

ABT 4216 – 4’/6’ Retractable Cross Level Transfer Gauge

ABT 4090 – Side-Cut and Railhead Gauge

ABT 4590 – NR4 Stepped Sidewear Gauge

ABT 4080 – Trackspread Gauge

ABT 4660/1 – P8 Profile SE Gauges

ABT 4269 – Combination Gauge

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