

ABT-7100 Abtus Track Geometry Measurement Device



Instruction Manual

1.0 Index

1.0	Index	2
2.0	Item List	3
3.0	Specification	4
4.0	Getting Started	5
4.1	Overview	. 5
4.2	Assembly	. 6
5.0	Maintenance	13
5.1	Every 3 Months	13
5.2	Annual	13
6.0	Measurement Characteristics	13
6.1	Gauge	13
6.2	Super-Elevation	13
6.3	Twist	14
6.4	Distance	14
6.5	GPS	14
7.0	Transportation and Storage	14
8.0	Software Introduction	15
8.1	Track Geometry Measurement Device Software	15
8.2	Initial Setup	15
9.0	Before going on track	15
9.1	Check Battery Levels	15
9.2	Check Wireless Connection	15
9.3	Before Each Use	16
9.4	Training and responsibilities	16
10.0	Step by Step Guide to Recording Geometry Measurements on Track	17
10.1	Tools	23
11.0	Troubleshooting	25
12.0	Software Updates	26
13.0	Directive and standards	27

2.0 Item List

- TGMD = R (Right Side Sprung end) + L (Left Side Fixed end) + H (Handle) (See assembly section of this manual)
 - (1) (Right Side) contains: Gauge Retraction Lever (A)
 - (2) (Left Side) contains: 2x Removable 12V Lithium Ion Batteries (B), On/Off Power Button (C) & Locking Lever (D)
- 2. FZ-G1 Panasonic Tablet + User Manual & Charger
- 3. FZ-G1 Panasonic Tablet Holder
- 4. Battery Charger + Accessories
- 5. TGMD Instruction Manual
- 6. Transit Bags



3.0 Specification

	- TGMD on Track	25 kg
	- Bag 1 & Bag 2	3 kg ea. (Total 6 kg)
Weight	- Panasonic Fz-G1 Tablet	1.1 kg
·	- Chargers & Other	1 kg & 1 kg
	- TGMĎ in Bags	35 kg
	- TGMD on Track	Length: 1610 mm to 1700 mm
		Height: 1000 mm
		Width: 720 mm
	- Bag 1	Length: 850 mm
Physical Dimensions	0	Height: 250 mm
,		Width: 450 mm
	- Bag 2	Length: 850 mm
	2092	Height: 250 mm
		Width: 345 mm
Operating Temperature	-	-10°C to + 50°C (-4°F to 122°F)
Environmental Rating	-	IP65 Assembled
Battery Life	- TGMD 2x Lithium Ion	Up to 6 hours per battery
	- Panasonic FZ-G1 Tablet	Up to 11 hours
Operating System	-	Windows 64 bit
Trolley Connectivity	-	Wi-Fi

4.0 Getting Started

4.1 **Overview**

The Abtus ABT-7100 is a measuring device which records track geometry while being pushed by an operator at walking speed.

The device can be assembled by one operator. Since the trolley weighs 25 kg, it should only be lifted in its entirety if the user feels feel fit to do so, otherwise the trolley should be disassembled and carried by two operators. The device can be dismantled to fit into two protective storage bags.

Track geometry data is transmitted from the measuring device via Wi-Fi to a Panasonic FZ-G1 running a Windows 64-bit operating system supplied with the Track Geometry Software. The software displays track geometry data including Distance, Cant/ SE, Twist and Gauge in real time. The data is saved as a .csv file that you can open in excel. Saved data and fault reports can be transferred from the tablet via a USB flash drive or via email.

The TGMD is designed with the following characteristics:

- This product is used to accurately record Distance, Cant/SE, Twist and Gauge.
- Non-conducting: The trolley is insulated and therefore does not create electrical contact between the two running rails. This is achieved by using plastic wheels and also accommodates a non-conductive insulation block between the wheel arm and contact bearings.
- Compact: The TGMD breaks down into 5 separate parts to allow it to fit into most vehicle.
- Portability: The TGMD is designed to be easily lifted onto and off the track. This is done
 using the plastic lifting handles provided.
- The unit has been designed to be user-friendly with only limited training required.

4.2 Assembly

 Place the wheel arm labelled 'L' and the fixed end of the track geometry trolley side by side as shown in Figure 1.



Figure 1 Attaching wheel arm to trolley (Left side)

- Push the locating pins at the end of the trolley body into the corresponding slots on the wheel arm.
- Once they are placed square, push the wheel arm attachment screw inwards and start tightening the screw in clockwise direction using the knob. When tightened there should be no gap between the two parts and they should be secure.
- Repeat the same process for the right-hand side wheel arm (labelled 'R') and the sprung end side of the trolley (Figure 2).



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• Position the locking lever towards the left as shown in Figure 3.



Figure 3 - Initial Locking Position

• Push the two halves together as shown in Figure 4 & Figure 5.



Figure 4 - Joining of the Fixed & Rotating Halves



Figure 5 - Two Halves Together

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 Lock the two halves together by pushing the locking lever towards the right until it firmly snaps into position.





 Before attaching the handle, ensure that the locking levers are positioned towards the plunger on the back of the handle block as shown in Figure 7Figure 7.



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 Attach the handle to the TGMD ensuring that the indication marks are aligned as shown in Figure 8.







Figure 9 - Handle Before Locked (levers towards green dot)

• To lock the handle into position, rotate the locking levers away from the indication mark (green dot) as shown in Figure 10.



Figure 10 - Handle in its Locked Position

 The TGMD comes with a tablet holder for the Panasonic FZ-G1 as shown in Figure 11, which is spring loaded for ease of insertion and removal.



Figure 11 – Panasonic FZ-G1 Tablet and Holder

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• To attach the holder to the TGMD handle, simply insert the two 1" diameter rubber balls into the short double socket arm cups as shown in Figure 12Figure 12.



Figure 12 - Short Double Socket Arm

The TGMD has been designed with the user in mind. The trolley has a rotating handle to
prevent the user having to lift and rotate the trolley on track. The handle has three locking
positions and a position has been added to allow the user to push the trolley in the cess or in
areas of limited access. To rotate the handle please see Figure 13.



Figure 13 - Handle Rotation

 The TGMD trolley has a retraction lever to allow the user on track to retract the gauge through switch and crossing. The trolley uses a spring to self-align in the running rails, the gauge is in its released position when the lever is towards the right as shown in Figure 14.



The gauge is in its retracted position when the lever is towards the left as shown in Figure 15.



5.0 Maintenance

The TGMD does not require any lubrication as all the moving parts have sealed or dry running bearings. However, the following routine checks must be carried out on the trolley:

5.1 Every 3 Months

• Visually inspect the TGMD for signs of damage. If necessary, contact your distributor for help.

• Check that when the trolley is assembled, there is no play in the central joint.

5.2 Annual

The TGMD must be returned to Abtus Ltd annually for re-calibration to ensure measurements are within specification. The condition of all components will be checked at this time and replaced as required. Each trolley should have at least one trained operator who is responsible for returning the trolley.

The trolley is marked with a calibration sticker inside of the battery compartment showing the next annual due date and must be returned to Abtus for annual calibration and maintenance. If the trolley is used beyond the calibration due date, the performance may be degraded.

If the equipment becomes defective, or if it has an out of date calibration sticker, a warning notice should be placed on the device to prevent further use and should be returned to Abtus for repair, maintenance and re-calibration.

6.0 Measurement Characteristics

6.1 Gauge

Note: This measurement is taken from the internal running edges of the tracks at P-point (usually - 14mm) distance from the top of the rail.

Range	-25/+65mm (on nominal gauge 1435mm)
Accuracy	±1mm
Resolution	0.1mm

6.2 Super-Elevation

Range	±250mm
Accuracy	±1mm
Resolution	0.1mm

Super Elevation (SE) is measured across the running rails and is displayed as height differential between the high and low rail in millimetres.

The default sign convention is: Left rail up is positive Cant/SE.

During geometry measurements the left and right side is determined by the direction of travel. The user is able to spin the handle around and whichever direction they are walking in, the left rail up is positive cant.

6.3 Twist

Range	±250mm
Accuracy	±1mm
Resolution	0.1mm

Twist is when one rail has a downward gradient while the other rail has an upward gradient, causing the carriage to twist. Twist is normally calculated over the bogie length (Traditionally 3m) and the bogie centre to centre distance (Normally 12m).

6.4 Distance

Maximum limit on the number of measurements per recording for Gauge, SE & Twist	50,000
Recording Increment	0.1, 0.2, 0.25, 0.5 & 1.0 m
Accuracy	±1%
Resolution	10mm

6.5 GPS

Accuracy ±4 m (In sunny clear sky conditions)	
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The GPS accuracy varies by time and location thus the user should wait 1 - 2 minutes to achieve the best accuracy.

7.0 Transportation and Storage

The TGMD must be transported inside its transportation bags. The bags should be moved by two people following safe manual handling practices. The bags should be stored flat to prevent them falling over.

If the trolley is not going to be used for several weeks, it is strongly recommended that the batteries be fully charged and that the trolley be stored away from direct sunlight in a location of low humidity where the temperature will be between: $+15^{\circ}C \& +25^{\circ}C (68OF to 77OF)$.

8.0 Software Introduction

8.1 Track Geometry Measurement Device Software

The Track Geometry Measurement Device software is installed on the Windows device that comes with the TGMD. This guide explains the important features of the TGMD software that are necessary for measuring and analysing Track Geometry faults.

8.2 Initial Setup

No initial setup is required as Abtus will install the TGMD software and any necessary wireless drivers. If the Windows device does not connect to the TGMD, contact Abtus for support.

9.0 Before going on track

9.1 Check Battery Levels

The TGMD has two removable batteries which are accessed from the lid in the top of the Measurement Device. Press the battery indicator button to check the charge of the batteries and charge them if necessary. Check the battery levels on the Panasonic FZ-G1 Tablet.

9.2 Check Wireless Connection

Switch on the TGMD and 'Track Geometry SNXXX' should appear in the list of wireless networks available and windows should automatically connect to it. Open the TGMD software on the Windows tablet and click 'Connect via Wi-Fi' to check that the connection is working between the tablet and the trolley.



Figure 16 - TGMD Software Home Screen

9.3 Before Each Use

The following checks should be carried out in the office or depot before taking the trolley onto the track.

- The condition of the trolley should be checked by the operator before it is used. The trolley must be in good condition with no loose or broken components.
- The trolley must be marked with a valid calibration sticker showing the next annual due date located inside of the battery compartment. The trolley should not be used after the calibration due date.
- The batteries should have sufficient charge before the trolley is taken onto track. This is shown by pressing the battery indicator button on each battery.
- The electrical connection pins between the two parts of the device should be clean.
- An appropriate and adequate safe system of work must be in place before the trolley is used.
- Ensure that all wheels rotate freely.
- Ensure that there is nothing on the wheels. (dried mud, leaves or any other debris)
- Check for dirt and grease build up around the guide bearing shroud, ensure this is clear to allow the bearings to run freely.
- The trolley is fitted with a dead man brake which can cause flat spots on the wheels if the brakes are engaged whilst pushing the trolley. Check all wheels for flats or grooves. If any are found, the trolley must be returned to Abtus as this can result in inaccuracies.
- The safety brakes should be functioning correctly. The brakes are applied to two of the wheels which can be tested by spinning the wheels and releasing the brake lever on the main handle ensuring that both wheels lock firmly.

9.4 Training and responsibilities

Only trained and competent people should use the trolley.

- All users must have received adequate training for the use of the trolley.
- A trained person will be responsible for the trolley during the work shift. This includes carrying out the safety and performance related checks described in the user manual.
- Operators should have read the instruction manual for the TGMD and have access to it for reference. Operators should understand the accuracy levels of the trolley.
- The trained operator is responsible for using the trolley safely in accordance with the safety
 guidelines in the ABT7100 HAZOP Safety Risk Assessment and for ensuring that any risks
 identified are kept as low as reasonably practical. They are responsible for informing any
 other staff of safety requirements relating to the trolley that affect the planning of the work
 to be carried out. The trained operator should challenge any instruction that compromises
 safe use of the equipment and is responsible for communicating the risks involved.

10.0 Step by Step Guide to Recording Geometry Measurements on Track

Step 1 Setting New Geometry Profiles

Open TGMD software on the windows tablet and click "Geometry Profiles" to set the tolerance parameters (Figure 17).



Figure 17 Chaining Geometry Profile

You can create a new profile by clicking on the "Create New Profile", which will open the window shown in Figure 18. Enter the required details and click "OK" to create the new geometry profile.



Figure 18 Creating new profile

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承 Create a new profile		_		\times
Profile name (e.g. John):	Test			
Recording increment:	0.25			
Rec. inc. unit of measure	\bigcirc the unit of measure when recording	 meters 	\bigcirc yard	s
Gauge low limit [mm]:	1425			
Gauge high limit [mm]	1430			
Twist 3m warning [mm]:	10			
Twist 3m fault [mm]:	20			
		OK	Cancel	

Figure 19 Profile settings

Figure 20 shows the newly Geometry Profile. Pressing the "Make profile active" button will make this profile the active profile used in the succeeding recordings.

Demo Marius office Test	^	Parar 1 Recording increment	meter 0.25	Value	
Test		1 Recording increment	0.25		
		2 Rec inc unit of measure	0.20		
		r they may are or the area	re meters		
		3 Gauge low limit [mm]	1425		
		4 Gauge high limit [mm]	1430		
		5 Twist 3m warning (mm)	10		
		6 Twist 3m fault (mm)	20		
	, ,				
Save profile	Make profile active				

Figure 20 Activating the profile

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STEP 2. Put the TGMD on the track

The TGMD should be positioned on the track with the fixed side (marked L) on the left rail, facing the desired direction of travel.

STEP 3. Connect the Windows device to the TGMD

- Turn on the TGMD and the Windows device.
- Open the TGMD software to see the home screen.
- Click 'Connect to Wi-Fi' in the top left corner of the screen.

- The trolley begins to send real time data to the Windows device. The Gauge, Cant/SE are displayed below the 'Connect to Wi-Fi' button, but they are not recorded.



Figure 21 Connecting to TGMD

Once the TGMD is in position press the "Set Zero Position" to reset the position reading to zero.



Figure 22 Setting the zero position

Press "Geometry Recording" to open the window shown in Figure 23.

- Input the Operator name.
- Input the Filename.
- Click 'Start recording'

The other fields in the window are optional. The "Counting" can be "Up" or "Down" depending on the direction of travel and will change the on-screen position of the trolley when it is moved.

🛋 Start a new recording	- 🗆 X
Geo	metry recording
Operator:	Default operator
Filename:	untitled 1
Tolerance profile:	Demo
Start location [MCY or m]:	
Counting:	UP DOWN
Current GPS loc:	Tap here to turn GPS on or off
Fault GPS loc (please enter):	
Distance to fault:	•
Start recording	Cancel

Figure 23 New geometry recording settings

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Figure 24 Geometry recording in progress

Push the TGMD along the track and the red line of the screen which indicates the position of the TGMD will also move along the graph. The Gauge, SE and Twist are all measured and the instantaneous readings can be found above the graph along with the current position.

You can add events such as Signal, Crack, Bridge etc. as well as custom text events which may happen during the recording by pressing the corresponding buttons on the right side of the screen as shown in Figure 24. TGMD software will record the position of the event and the type of event when such a button is pressed. Pressing the "Type in an event" button will open a window as shown in Figure 23 where you are able to type a custom event name and add it to the recording.

承 E. —	×
Type in the event bel	ow
Rail Wear	
OK	Cancel

Figure 25 Geometry recording in progress

When the recording is finished, press "Finish Recording" to stop the measurement and save the data.







Figure 26 Viewing track gauge results with events

This will show the Results screen. You can choose to plot Track gauge, Super elevation or Twist over 3 metres. Choose the recording by clicking on the name and press "Plot" to see the recording graphically. This will also show the events that were added during the recording.

STEP 6: Opening CSV report

All recordings are saved in the "Recordings" folder in the software directory (C:\ABT7100\recordings) where the user can access the .csv reports. Figure 27 shows an example of such a report. The user is able to view the position at which faults, such as Gauge and twist faults, occurred, where events were recorded as well as various other information.

An additional fault report is created at the location 'C:\ABT7100\faultReports' after each geometry recording is saved. This file exclusively shows recorded points that are outside the tolerance of the active Geometry profile settings and can be accessed by clicking the 'GEO fault report' button in the 'View a recording' screen.



ABT 7100 - Issue 02

	A	В	C	D	E	F	G	H
1	ABT7000 geometry measurement file							
2	File version: 2							
3	Operator: Default operator							
4	Filename: 181005-CTT3-10KGS-001							
5	Profile: Marius test track							
6	Gauge low limit: 1420							
7	Gauge high limit: 1460							
8	Twist 3m warning limit: 12							
9	Twist 3m fault limit: 15							
10	Start location:							
11	Counting: up							
12	Date and time of recording: 05-Nov-2018 11:15:10							
13	GPS of start position:							
- 14	Length of measured track [m]: 140							
15	End of header							
16	Distance [m]	Gauge [mm]	SE [mm]	Twist 3m [mm]	Gauge fault [mm]	Twist 3m warning [mm]	Twist 3m fault [mm]	Event
1048	103.1	1432.9	34	14.5	j	2.5		
1049	103.2	1433.3	35.3	15	5	3		
1050	103.3	1433.5	36.5	15.5	5	3.5	0.6	5
1051	103.4	1433.8	36.8	15.3	5	3.3	0.3	3
1052	103.5	1433.8	36.8	15.1		3.1	0.1	
1053	103.6	1433.7	36.9	14.9)	2.9		
1054	103.7	1434	36.9	14.3	8	2.3		
1055	103.8	1434	37.7	14.4		2.4		
1056	103.9	1434.2	38.4	14.3	8	2.3		
1057	104	1434.6	38.8	13.5	5	1.5		
1058	104.1	1434.9	38.8	12.7		0.7		
1059	104.2	1435.1	38.7	12	2	3.5527e-15		
1060	104.3	1435.2	38.8	11.8	8			



10.1 Tools

- The Track gauge, Super elevation and their limits of the track can be shown.



Figure 28 Track Gauge

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Figure 29 Super Elevation (Cant)

- The Twist can be shown along with whether it is within allowable limits (shown by dotted horizontal blue and red lines).



Figure 30 Twist Over 3 Meters

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11.0 Troubleshooting

Track Geometry Software not working The software does not work as expected, for example graphs do not show or buttons in the user interface do not work.	Close the program, turn off the trolley, wait 3 seconds and try to turn the trolley on. Open the software and try to connect to the trolley.
No Wi-Fi connection The TGMD and Windows device are not connected.	Check in the Wi-Fi connection on the right side of the Windows taskbar that the device is connected to the trolley Wi-Fi. Try restarting the trolley and if problem persists try and restart the tablet & app. Check the connecting pins on the trolley for dust, dirt or damage if no connection is being made.
Negative distance During a recording the current distance displayed is negative.	When measuring a Track Geometry fault, negative distance is shown when the trolley is pushed the wrong way round. The trolley should be positioned with the fixed side marked (L) to the left facing in the direction of travel of the measurement train.

12.0 Software Updates

Abtus will alert users of software updates but you can check by connecting the tablet to the internet.

Open up the TGMD software and click "Help" followed by "Check for updates". If an update is available a popup message will alert the user and ask if they would like to proceed with the update.

Eile	Hal									- 0	×
0, (1101	Help									
-		About			Connection	status					
Check for updates Ctrl+U											
Connect via WI-FI			ŀFI			Geometry recordin	g	Finish recording		NOT RECORDING	
		Position [m]: Gauge [mm]:		: SE	E (mm):	Twist 3m (mm):	Battery charge:	Set zero position	Add events:		
	1 0.9								Signal	Crack	
[unual o	0.7								Switch	Crossing	
cie c	0.3								Rail wear	Bridge	
	0.2								Type	in an event	
	č	0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 Distance [m]									
Maint menu Start a recording Vi			View a recording		Geometry profiles	Settings					

Figure 31 Check for updates button

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13.0 Directive and standards

The equipment has been tested and found to comply with the relevant sections of the below referenced specifications.

The unit complies with all relevant essential requirements of the following directives and the design has been made in accordance with the following standards.



In order to fulfil the requirements of CE marking the TGMD meets the following requirements:

2014/30/EU Conforms with the essential performance requirements of the Electromagnetic Compatibility Directive (EMC Directive) and it's amending directives. Standard **EN50121-4**

2014/53/EU Conforms with the essential performance requirements of the Radio Equipment Directive (RED Directive) and it's amending directives. Standard **EN300 328**

The TGMD also meets the following additional requirements:

2013/35/EU Conforms with the essential performance requirements of the Electromagnetic Fields Directive (EMF Directive) and it's amending directives. Standard **EN62479**