Radar Predict

ATS100 (with GPS)
Intelligent Turn Assistant
User Guide

Right Hand Drive

BRIGADE®

In partnership with

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Trademark

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IMPORTANT

Before operating or servicing this equipment, please read this manual carefully, paying particular attention to the safety warnings and precautions.

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1. ATS100 Turn Assistant Introduction

The ATS100 serves as a precision turn assistant, featuring precise Vulnerable Road User (VRU) recognition and warnings for vehicle blind spots. Its components comprise a millimeter wave radar with an operating frequency of 76-77 GHz and a maximum RF output power of 12 dBm, a spirit level, an optional mounting bracket, a warning screen, a GPS and IMU module, and the necessary cable.

The millimeter wave radar excels in accurately measuring object distance, speed, angle, and other parameters by analysing the discrepancies in echoes between transmitted and received electromagnetic waves. This all-weather, all-day turn assistant operates within a temperature range of -40℃ to 85℃.

The warning screen plays a crucial role in alerting the driver to potential dangers within the blind spot, prompting timely adjustments to prevent incidents. The ATS100's coverage spans 180° on one side, eliminating blind spots, and boasts a VRU detection range of up to 80 x 4.5m. Its compact structure incorporates collision prediction and graduated alarm functions. Furthermore, it seamlessly integrates with external Controller Area Network (CAN) and Flexible Data (CAN FD) interfaces, supporting both 12 V and 24 V supply voltages.

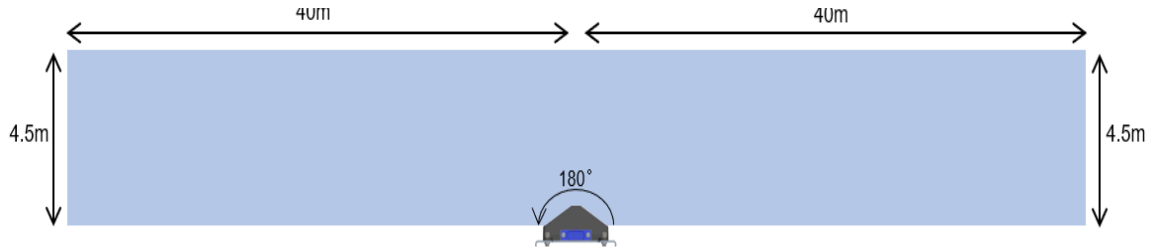


Figure 1-1 ASR100 Radar Coverage

- Dynamic vulnerable road users, identified by movement at speeds equal to or surpassing 5 km/h, encompass pedestrians, cyclists, electric bicycles, and similar entities.

1.1 ASR100 Radar Introduction

The ATR100, a 77 GHz millimeter wave radar, stands as a compact and robust radar sensor meticulously crafted by Autel Intelligence Vehicle® in China. Its primary purpose is to alert heavy-duty trucks, buses, and similar vehicles to side blind spots. Housed within an IP69K protection enclosure, the design aligns seamlessly with the demanding environmental standards for commercial vehicle applications.

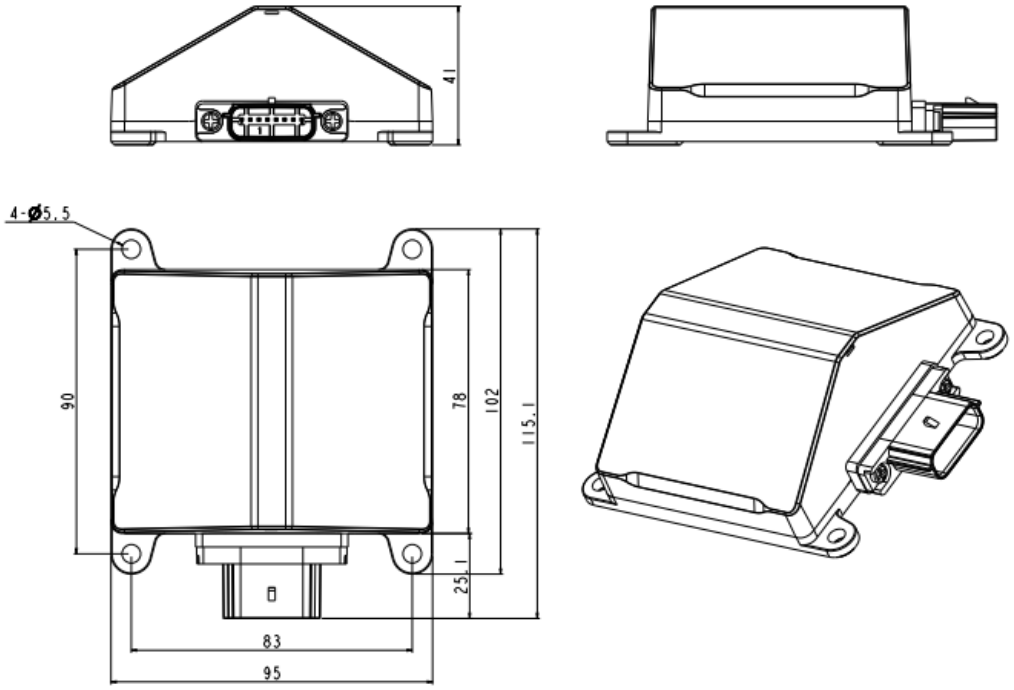


Figure 1-2 ASR100 dimensions

Performance parameters:

working frequency	76-77GHz	
Maximum detection range	±80 m (vehicle) ±40 m (pedestrian/bicycle)	
working mode	slow speed	High speed
minimum detection range	0.25m	0.9m
distance resolution	0.31 m	0.96 m
distance accuracy	±0.16m	±0.5m
speed range	±60km/h	±150km/h
speed accuracy	±0.43km/h	
speed resolution	0.86km/h	
horizontal angle	180°	
angular accuracy	±0.8°	

General parameters:

size	115mm x 95mm x 41mm
weight	2 30g
power consumption	6.5W
communication interface	CAN2.0, CAN_FD
operating voltage _	8V - 32V; Passenger car 12V , Commercial vehicle 24V
operating temperature _	-40℃ ~ 85℃
storage temperature	-40℃~105℃
installation angle redundancy	-2°~2°
protection rating _	IP69K
operating cycle	60ms

1.2 Warning indicator

The ATS100 Intelligent turning assistant system utilises a precision detection system to forecast the future probability of collision with objects. It offers dynamic detection and display-driven intelligent alerts, prompting drivers to take timely preventive measures and reduce the likelihood of incidents. The warning display screen incorporates adaptive brightness control, adjusting its brightness based on the surrounding environment to alleviate driver eye fatigue, particularly during night-time operations.

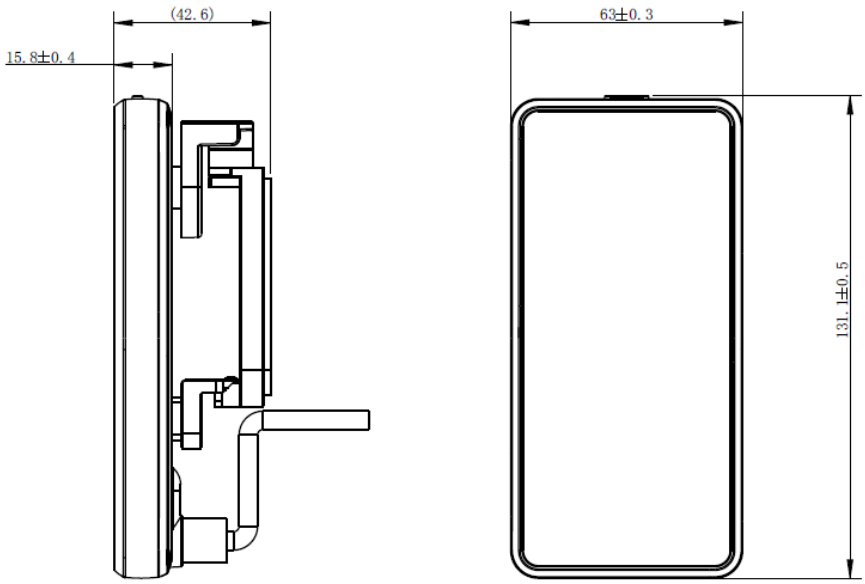


Figure 1-3 Display size

The warning function is categorised into three levels as detailed below: (Note: activation conditions for the warning function include a vehicle speed less than or equal to 30 km/h.)

- **Level 1 Warning**: If the steering wheel angle is below 30° and an VRU enters the warning area, a section of warning light LEDs illuminates, as depicted in Figure 1-4.
- **Level 2 Warning**: When the vehicle executes a left turn, the steering wheel angle exceeds 30°, or the turn signal is activated (if connected), and an anticipated collision with an object is imminent within a specified timeframe, a section of warning light LEDs initiates a flashing sequence.
- **Level 3 Warning:** In the scenario where the vehicle is making a left turn, the steering wheel angle surpasses 30°, or the turn signal is activated (if connected), and an imminent collision with a VRU is detected, the warning light begins flashing, accompanied by an activated acoustic warning tone.

The driver can determine the approximate location of the object by referring to the illuminated or flashing section of warning light LEDs.

The detailed description of each warning light on the display is as follows:

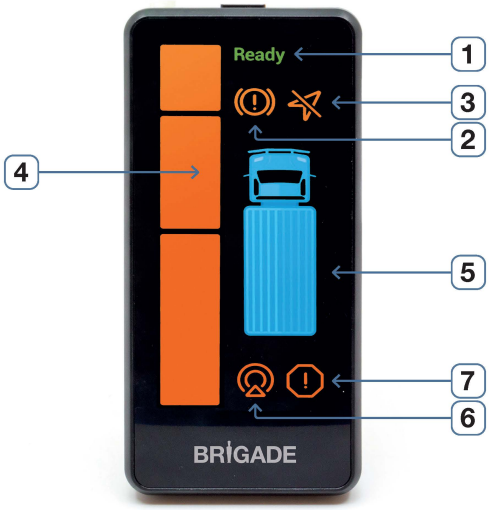


Figure 1-4 Warning light description

① Warning module operation and status indicator: Illuminates when the warning module is in a normal operational status.

② Brake Indicator: This light flashes during active breaking. (Currently, this function is not available.)

③ GPS error indicator: lights up when the GPS sensor temporarily lacks a signal, and flashes when the GPS sensor detects a permanent error signal.

④ Warning light: offers advance warning of hazardous objects. The warning area is categorised into three different priorities: upper zone (2-5 m in front of the vehicle front), middle zone (2 m in front of the vehicle front - 9 m behind the vehicle front), and lower zone (9-30 m behind the vehicle front). In the event of multiple objects simultaneously occupying the upper, middle, or lower zone, priority is given to the middle, followed by the lower, and then the upper zone.

⑤ Vehicle model (for reference only): is in a steady light state after switching on.

⑥ Radar Status Indicator: A steady light indicates a temporary radar failure, typically caused by factors such as a blocked radar or adverse weather conditions. Blinking indicates a permanent radar failure, calling for professional repair.

⑦ System malfunction indicator : The indicator light flashes when a malfunction occurs in the entire system.

Troubleshooting:

Table 1-1 Error description and troubleshooting

status symbol	Error Description	repair manual
Warning module operation and status display	does not light up after switching on	Hardware failure and needs to be replaced
Radar Status Indicator	The error lamp is always on	possible reason: 1. Hindered by obstructions, such as snow, mud, etc. 2. Severe weather conditions, including heavy rain and snow, etc. 3. The installation angle exceeds5°
Radar Status Indicator	Fault light flashes	Hardware failure; needs replacement
system error display	Fault light flashes	Hardware failure and needs to be replaced
GPS error display	Fault light flashes	Restart after power off, if the error persists, you need to replace the hardware

1.3 GPS&IMU module

This module integrates a high-precision gyroscope, an accelerometer and a GPS module. With this module, there is no need for input signal such as speed, acceleration or yaw rate from the vehicle.

1.4 System connections and the wiring harness

Establish connections for each connector of the radar, display, GPS, and IMU module harness as depicted in the illustration below.

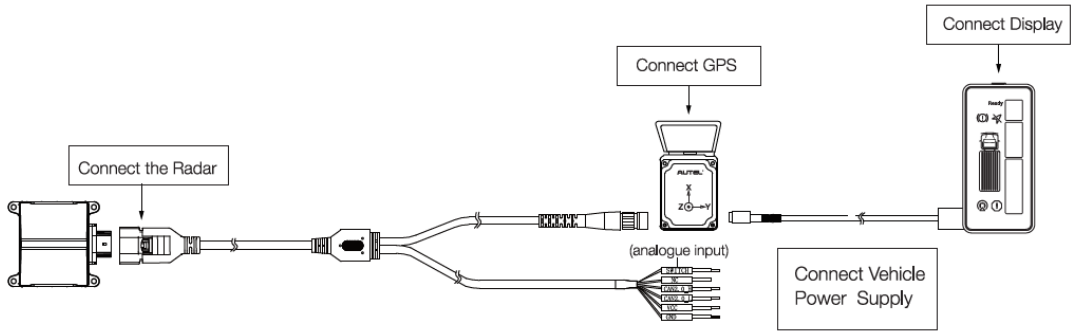


Figure 1-5 System Connections Schematic

Radar Wiring Harness Description

In the figure below, connector P1 connects to the radar. It comprises of 8 pins, and the pin order is outlined below. The pin numbering in the figure corresponds to the pin definition in Table 1-2. Connector P2 is linked to the GPS&IMU module, featuring 8 pins, and the pin numbers on P2 align with the pin definitions in Table 1-3. Connector P3 establishes connections with the vehicle and power supply, having 6 pins, and the pin numbers on P3 in the figure correspond to the pin definitions in Table 1-4. Each cable terminates with a printed label. It is crucial to verify this label carefully during installation. Do not activate the device if the connectors are not properly connected.

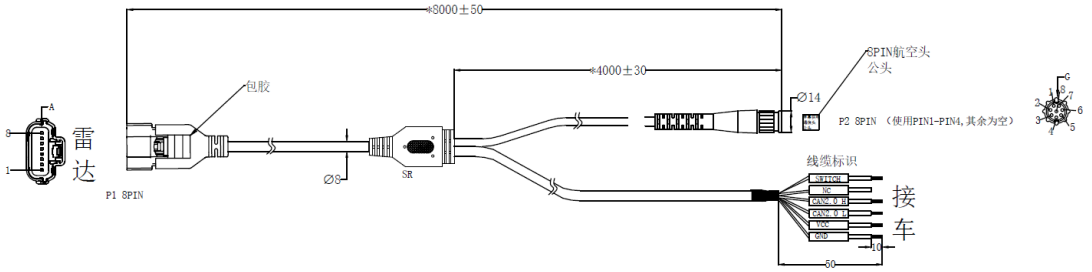


Figure 1-6 Radar Wiring Harness Diagram

Radar interface P1 definition table:

Table 1-2 Definition of radar interface P1

Pin No.	definition	Area	cable color
1	VCC	8~32V DC	Red
2	NC	empty	Orange
3	SWITCH	Input : 1 2/2 4V DC Output : 0VDC _	Blue
4	Dimensions	0 V DC voltage	Black

5	CAN2.0_H	-58~58VDC	Green
6	CAN2.0_L	-58~58VDC	Yellow
7	CAN _FD _H	-58~58VDC	White
8th	CAN_FD_L	-58~58VDC	Violet

GPS interface P2 definition table:

Table 1-3 Definition of the GPS interface P2

Pin No.	definition	Area	cable color
1	CAN_FD_H	-58~58VDC	White
2	CAN_FD_L	-58~58VDC	Violet
3	VCC_SCREEN	8~32VDC	Red
4	GND_SCREEN	0 V DC voltage	Black

Vehicle power interface P3 definition table:

Table 1-4 Definition of Vehicle power interface P3

Pin No.	definition	Area	cable color
1	VCC	8~32V DC	Red
2	NC	empty	Orange
3	SWITCH	Input : 1 2/2 4V DC Output : 0VDC _	Blue
4	Dimensions	0 V DC voltage	Black
5	CAN2.0_H	-58~58VDC	Green
6	CAN2.0_L	-58~58VDC	Yellow

Show description of wire harness

In the subsequent illustration, the P4 connector on the left side of the display harness is engaged with the GPS module, which comprises an 8-pin configuration. The arrangement of pins is explicitly presented below. Correspondence between the pin numbering in the figure and the pin definitions as specified in Table 1-5.

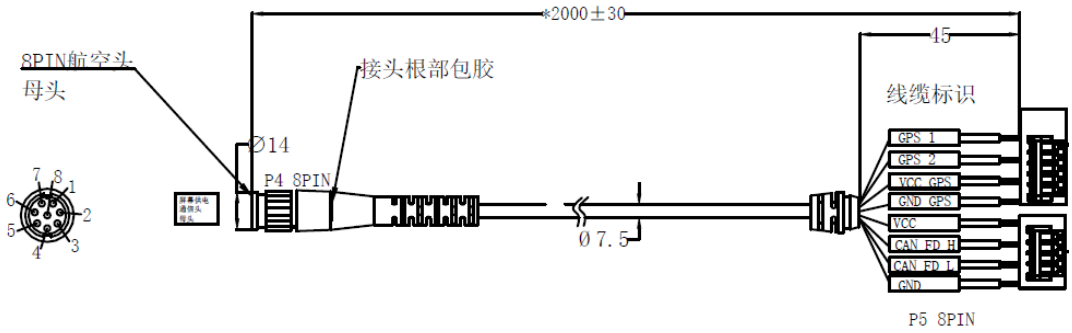


Figure 1-7 Display Wiring Harness Diagram

GPS interface P4 definition table:

Table 1-5 Definition of the GPS interface P4

Pin No.	definition	Area	cable color
1	CAN_FD_H	-58~58VDC	White
2	CAN_FD_L	-58~58VDC	Violet
3	VCC	8~32VDC	Red
4	Dimensions	0 V DC voltage	Black
5	GPS_1 Rx	0 ~5VDC	blue_ _
6	GPS_2 Tx	0 ~5VDC	Orange
7	VCC_GPS_ _	5 V DC voltage	Green
8th	GND_GPS	0 V DC voltage	Yellow

2. User Guide

2.1 Radar installation

Notes on installation

- The radar ought to be affixed to a component that exhibits low vibrational characteristics to preserve the integrity of its detection functionality.
- It is imperative for the radar to be positioned on the most prominent and level area on the side of the vehicle to prevent obstruction by other components, thereby ensuring maximal efficacy of its detection capability.

Installation Location: The radar is required to be mounted on the truck's left side, positioned consistently ahead of the foremost rear axle. It is advised to fix the radar to the side, following the guide below.

Figure 2-1 Diagram of calibration parameters for radar installation site

The radar should be installed within a distance of 230 to 430 cm from the front edge of the vehicle and at a height ranging from 30 to 120 cm above the ground. Installation within these parameters negates the need for post-installation parameterisation, thanks to the system's design as a 'plug and play' model. For DVS2 compliance and for tractor units only, the radar can be positioned at a minimum distance of 180cm from the front of the vehicle.

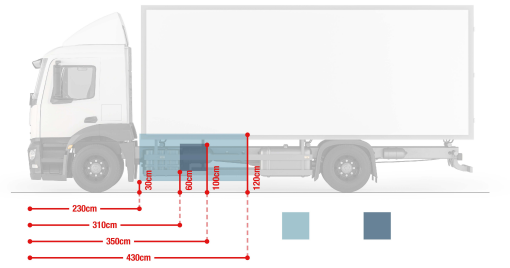


Figure 2-2 Recommended or Plug&Play installation positioning diagram for rigid and articulated vehicles

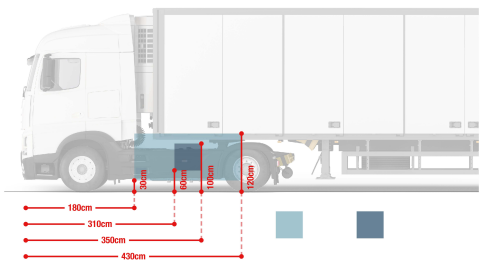


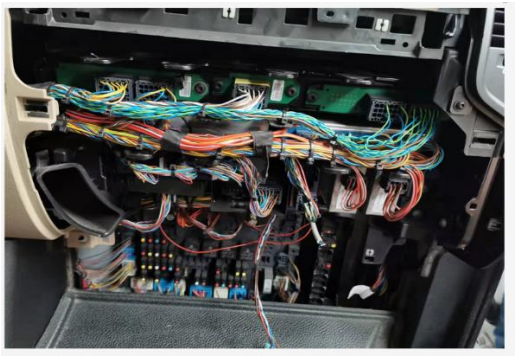
Figure 2-2A Recommended Installation Positioning Diagram for Articulated Vehicles: ONLY for compliance with Blind Spot Information System (BSIS) as Part of Progressive Safe System Standards.

2.2 Radar Wiring

Once the radar cable has been connected to the radar, it should be channelled into the cabin, following the path of the chassis cable as illustrated in the figure below.

The ingress point for the chassis cable into the cab is located on the cab's underside. Consequently, it is necessary to elevate the cabin for wiring purposes, as depicted in the image below.

Adjacent to the passenger seat—where the main fuse and the primary ECU reside—establish connections for the power supply, display, and other components of this product as demonstrated in the image below.



2.3 System Input Signal Options

The system is designed to accept input signals through two alternative methods:

Utilising the provided GPS/IMU module for input signal integration.

1. Connecting directly to the vehicle's Controller Area Network (CAN) signals in the absence of the supplied GPS/IMU module.

The GPS/IMU module that comes with the system is engineered to deliver the necessary input signals. However, should the GPS/IMU module not be utilised, the system is capable of operating with input signals sourced directly from the vehicle's CAN Bus. The Autel ATS100 system necessitates the reception of the five specific CAN signals listed below to function correctly. By default configuration, the radar is set to automatically interpret these CAN J1939 signals. Consequently, only vehicles that emit standardised J1939 signals are compatible with the system. In instances where a vehicle does not emit standardised J1939 signals, it is advisable to use the provided GPS/IMU module. The standard baud rate set for vehicle communication is 250 kilobits per second (KB/s).

1. vehicle speed
2. steering wheel angle
3. yaw rate
4. longitudinal acceleration
5. lateral acceleration

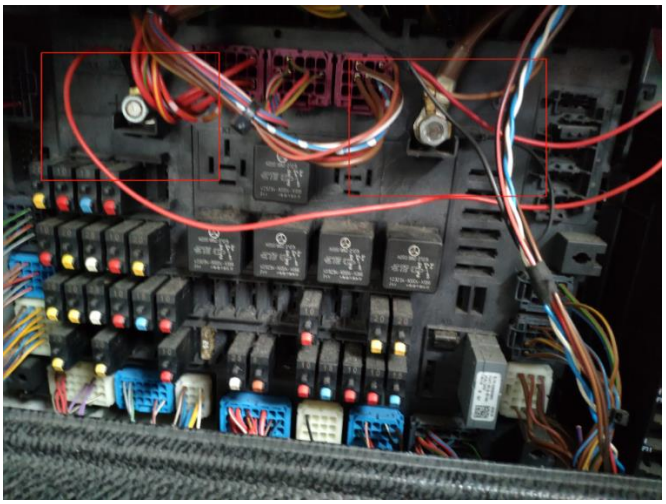
identifier	min	Tmax	message type	bytes or
0xCFE6CEE	50ms	50ms	cyclic	intel

identifier	min	Tmax	message type	bytes or
0xCF0090B	20ms	20ms	cyclic	intel

signal _	byte	start bit	length	resolution	offset	mini-mum	Maximum	Unit
steering wheel angle	0	0	16	0.055952	-1797.6	-1797.6	1797.6	Degree
yaw rate	3	24	16	0.00699088	-224.6	-224.6	224.6	degrees/sec-ond
lateral acceleration	5	40	16	0.000488273	-15,687	-15,687	15,687	m/(s*s)
longitudinal accel-eration	7	56	8th	0.1	-12.5	-12.5	12.5	m/(s*s)

2 .4 Power Access

The radar requires power from either KL15 or terminal 15, supporting both 12V or 24V supply. It is advisable to locate KL15 on the main fuse board and establish a connection for the radar to this source.



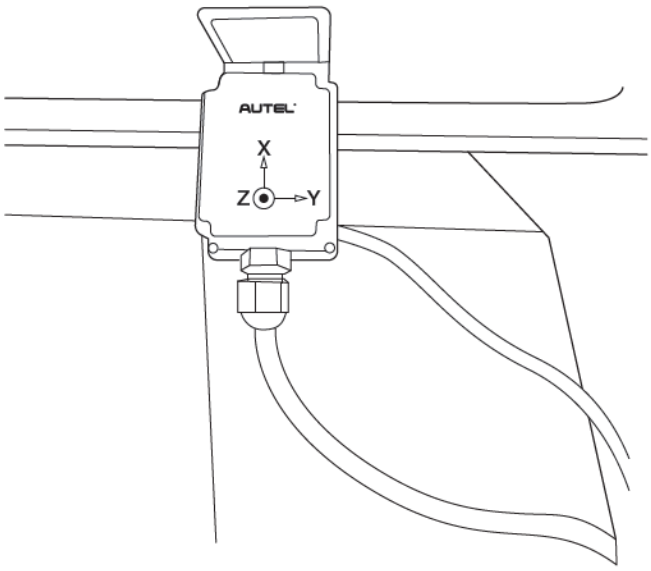
2.5 Installation of GPS and IMU module

The GPS/IMU module may be situated at any location within the driver's cabin; however, the optimal position is central to the cockpit and just behind the windscreen.

a. Install the GPS&IMU module on a horizontal plane, ensuring that the direction of the X-axis aligns with the vehicle’s forward movement.

b. The module may be secured in place using screws or adhesive double-sided tape.
c. Attach the two harnesses at the terminal end of the GPS&IMU module to the radar and the display, respectively.

Note: Installation angle tolerance of the GPS and IMU module<30°



2.6 Screen Installation

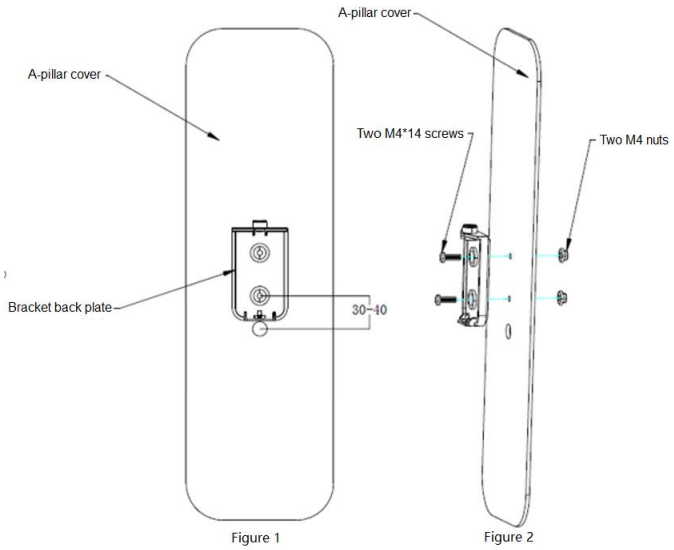


Figure 1 Figure 2

a. Detach the A-pillar cover and prepare for drilling: Refer to image below, Figure 1 depicts the bracket back plate's mounting holes, to drill two 4.5mm holes for mounting and a single 12mm hole for cable routing (position the cable hole approximately 30-40 mm beneath the mounting holes).

b. Following the guidelines in Figure 2, secure the bracket back plate to the A-pillar cover using two M4*14 screws.

Note: The bracket back plate is fitted with 3M adhesive, providing the option to adhere the bracket directly to the A-pillar cover.

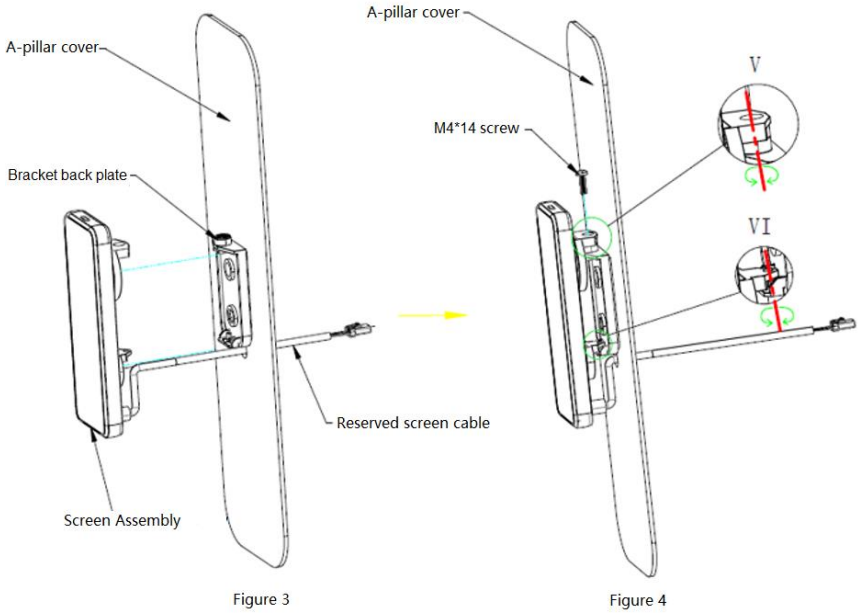


Figure 3 Figure 4

c. Follow the depiction in Figure 3 to thread the cable along the strainer assembly and through the cable entry point on the A-pillar cover.

i.e. Refer to Figure 4 for the correct placement of the display assembly on the bracket back plate, as presented in Views V and VI. Adjust the screen to the desired angle by rotation around its axis and secure it using M4*14 screws.

e. After installation, replace the A-pillar cover to its original position.