ATS100 (with GPS)
Intelligent Turn Assistant
User Guide

Autel Intelligent Automobile Co., Ltd.

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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

ATS100 is a turn assistant with precise target recognition and vehicle blind spot warnings. The system components are as follows: a millimeter wave radar with an operating frequency of 76-77 GHz and a maximum RF output power of 12 dBm, a spirit level, a mounting bracket (optional), a warning screen, a GPS and IMU module, and the cable. The millimeter wave radar can accurately measure object distance, speed, angle and other information through the difference in echoes between the transmitting and receiving electromagnetic waves. It is an all-weather and all-day turn assistant with a working temperature of -40℃ - 85℃. The warning screen warns the driver of a dangerous object in the blind spot and reminds the driver to make timely adjustments on the road to avoid accidents.

The ATS100 turn assistant covers 180° on one side, no blind spots, with a target detection range of up to 80 x 4.5m. With a compact structure, it has collision prediction and graduated alarm function, can be connected with external CAN (Controller Area Network) and CAN FD (Flexible Data) interfaces can be integrated and supports 12 V or 24 V supply voltage.

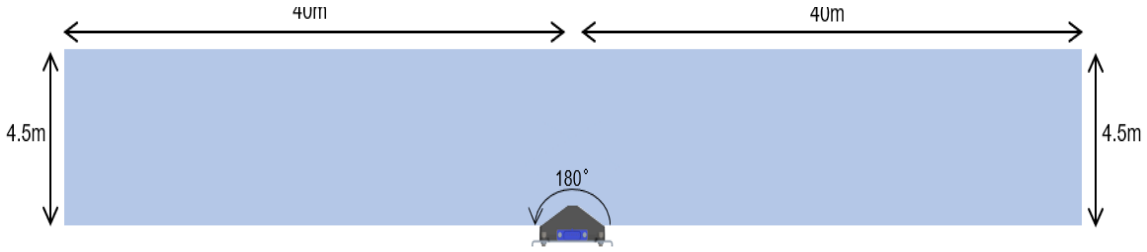


Figure 1-1 ASR100 radar coverage

The warning objects of the ATS100 turning assistant include:

- Dynamic vulnerable road users moving at speeds equal to or exceeding 5 km/h , including pedestrians, bicycles, electric bicycles, etc.

1.1 ASR100 Radar Introduction

The ASR100 77 GHz millimeter wave radar is a compact, rugged radar sensor designed and manufactured by Autel Intelligence Vehicle® in China to warn heavy duty trucks/ buses etc. of side blind spots with IP69K protection housing, in line with the environment for commercial vehicle use .

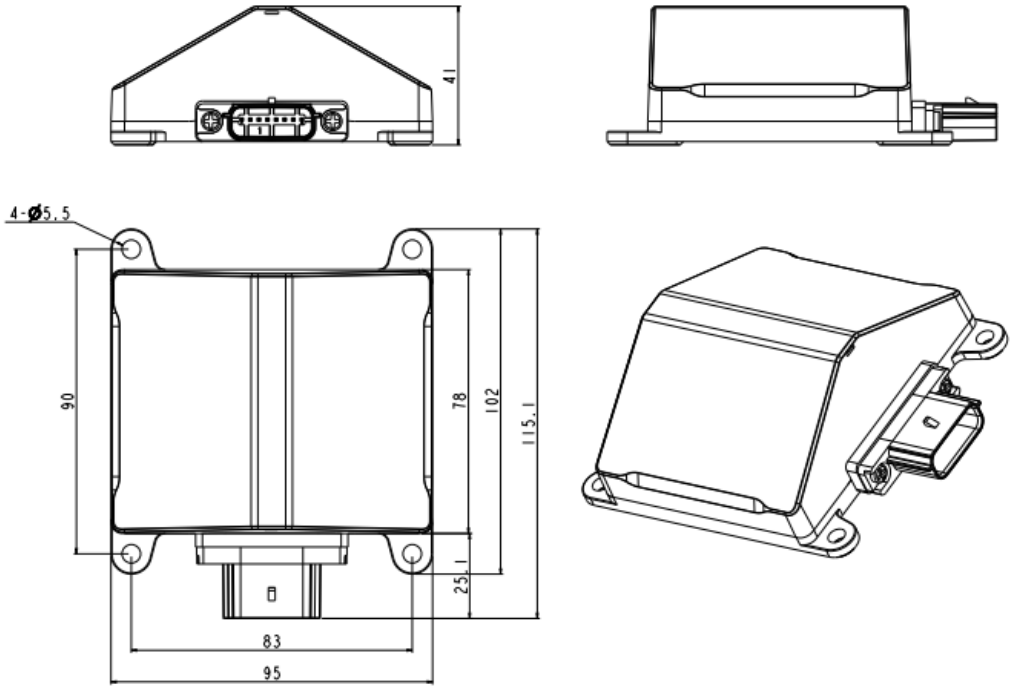


Figure 1-2 ASR100 dimensions

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 A TS 100 turning assistance system uses a precision detection system to predict the future probability of collision with the object and provides users with dynamic detection and display-based intelligent alerts to remind drivers to take timely preventive measures to reduce the possibility of accidents. The warning display screen supports adaptive brightness control, allowing the screen brightness to adjust based on the brightness of the surrounding environment to provide a reduction in driver's eye fatigue during the night.

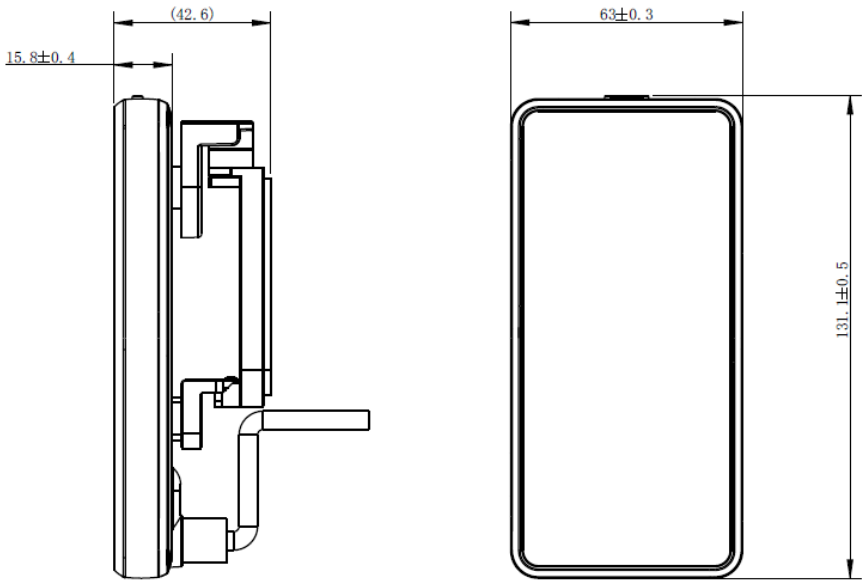


Figure 1-3 Display size

The warning function is divided into three levels as follows:（Note: Conditions for activating the warning function: The vehicle speed is less than or equal to 30km/h.）

- **Level 1 warning** : The steering wheel angle is less than 30° and the object enters the warning area, then a section of warning light LEDs will light up, as shown in Figure 1-4.
- **Level 2 Warning** : The vehicle is turning right, the steering wheel angle is more than 30°, or the turn signal is turned on (if the turn signal is connected), and the vehicle and the object are expected to collide within a certain time, then a section of warning light LEDs will start flashing.
- **Level 3 Warning** : The vehicle turns right, the steering wheel angle is greater than 30°, or the turn signal is turned on (if the turn signal is connected), and the vehicle and the object are about to collide, then the warning light starts to flash and also an acoustic warning tone is triggered.

The driver can get the approximate location of the object based on the section of warning light LEDs that are on or flashing.
The detailed description of each warning light on the display is as follows:

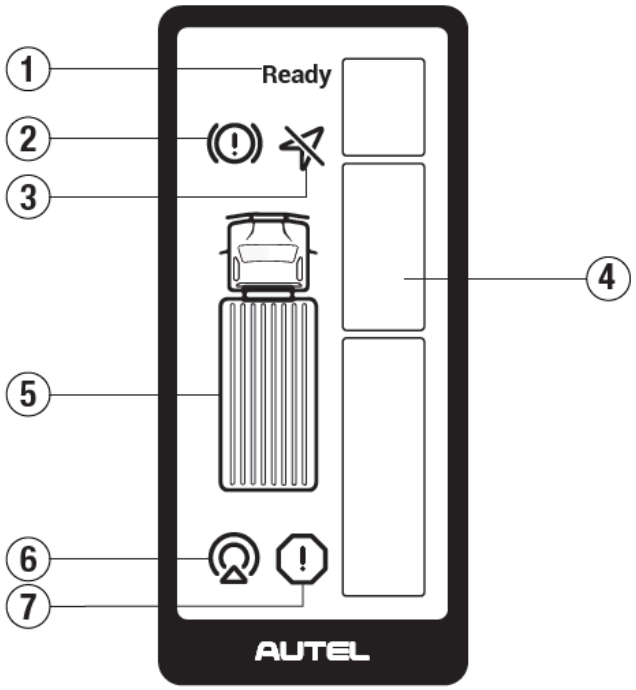


Figure 1-4 Warning light description

① Warning module operation and status indicator: Lights up when the status of the warning module is normal.

② Brake Indicator: This light flashes when braking is active. (Currently this function is not available.)

③ GPS error indicator: lights up when the GPS sensor has no signal (temporarily), flashes when the GPS sensor has an permanent error signal.

④ Warning light: Provides early warning of dangerous objects. The warning area is divided 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 - 7 m behind the vehicle front), and lower zone (7-30 m behind the vehicle front). If several objects are in the upper, middle or lower zone at the same time, give priority to the middle, then the lower, then the upper zone.

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

⑥ Radar Status Indicator: Steady light indicates temporary radar failure, usually caused by factors such as blocked radar or poor weather conditions; Blinking indicates permanent radar failure that requires professional repair.

⑦ System malfunction indicator : The indicator light flashes when there is a malfunction 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. Obstructed by objects such as snow, mud, etc. 2. Extreme weather, heavy rain and snow, etc. 3. The installation angle is greater than 5°
Radar Status Indicator	Fault light flashes	Hardware failure and needs to be replaced
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, no input signal such as speed, acceleration or yaw rate from vehicle is needed.

1.4 System connections and the wiring harness

Connect each connector of the radar, display, GPS and IMU module harness as shown below.

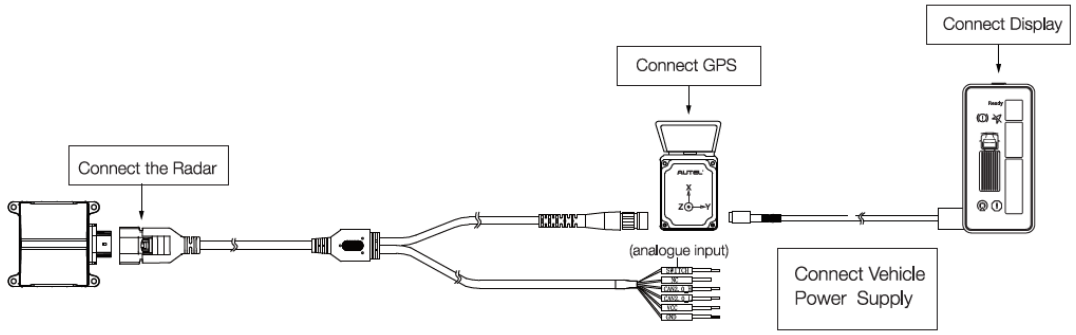


Figure 1-5 System Connections Schematic

Description of the radar wiring harness

In the figure below, connector P1 is connected to the radar. It has 8 pins and the pin order is shown below. The pin number in the figure corresponds to the pin definition in Table 1-2. The P2 connector is connected to the GPS&IMU module; it has 8 pins, and the pin number of P2 in the figure corresponds to the pin definition in Table 1-3. The P3 connector is connected to the vehicle and the power supply, it has 6 pins, and the pin number of P3 in the figure corresponds to the pin definition in Table 1-4. The end of each cable has a printed label. Please check this carefully during installation. Do not turn on the device if the connectors are not properly connected.

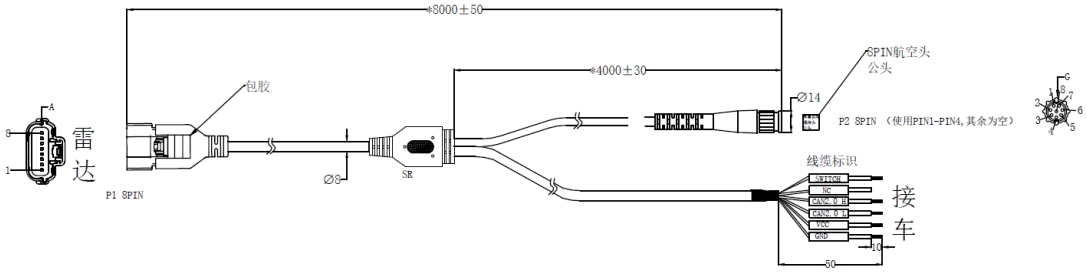


Figure 1-6 Radar Wiring Harness Diagram

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 image below, the left P4 connector of the display harness is connected to the GPS module. It has 8 pins and the pin order is shown below. The pin number in the figure corresponds to the pin definition in Table 1-5.

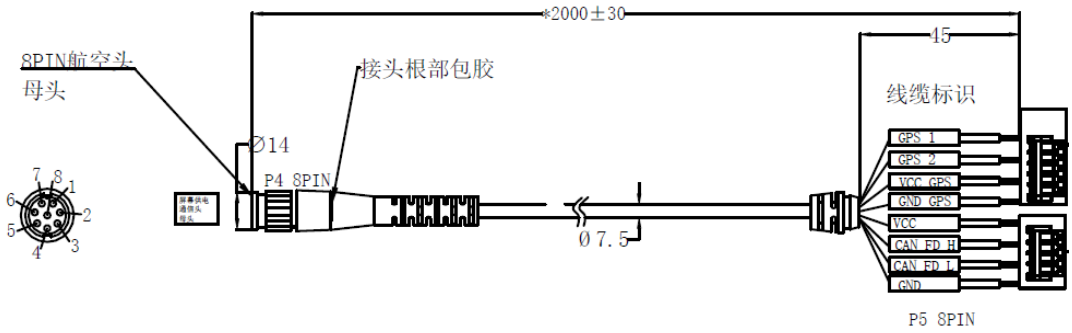


Figure 1-7 Display Wiring Harness Diagram

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 should be mounted on a low-vibration component. Strong vibrations will affect the detection function.
- The radar should be installed on the most protruding level on the side of the truck to prevent it from being blocked by other parts and affecting its detection performance.

Installation position: The radar must be installed on the right side of the truck. The radar must always be attached to the vehicle in front of the first rear axle! We recommend mounting on the side protection plate, side protection rail or similar installation locations on the vehicle.

Figure 2-1 Radar installation location diagram

Installation area:

When the radar is used, the reference coordinate origin is the center of the rear axle of the vehicle. The standard installation position parameters of the radar are shown in Table 2-1, which are only suitable for vehicles with a wheelbase of approx. 3.5-5 m and the installation position (plug and play variant) as shown in Figure 2-3.

Table 2-1 Radar default installation parameters

installation location	right side	Left side
Lateral distance X (m)	2.85	2.85
Longitudinal distance Y (m)	-1.25	1.25
Installation angle （°）	90	-90
Warn_dx (m)	6.15	6.15

Lateral distance X: the longitudinal distance of the radar installation position relative to the center of the rear axle of the vehicle;

Longitudinal distance Y: The lateral distance of the radar mounting position relative to the center of the rear axle of the vehicle;

Mounting angle: the angle of rotation of the radar mounting position relative to the center of the rear axle of the vehicle;

Warn_dx: the distance from the center of the rear axle to the front edge of the vehicle.

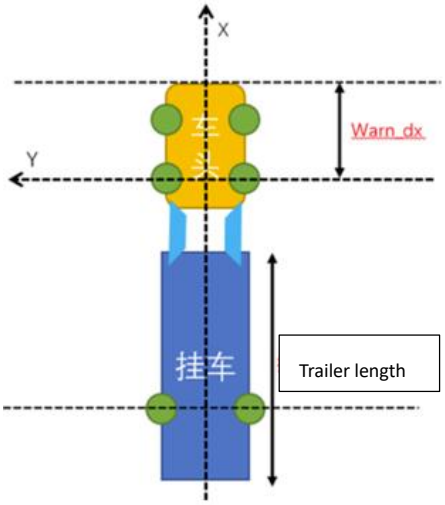


Figure 2-2 Diagram of calibration parameters for radar installation site

The recommended or preconfigured sensor location is shown in Figure 2-3 below. The radar can be installed at a distance of 230-430 cm backwards from the front edge of the vehicle and at a height of 30-120 cm from the ground. As long as the sensor stays within this installation area, no parameterization is required after installation. It is the plug and play built-in version of the system.

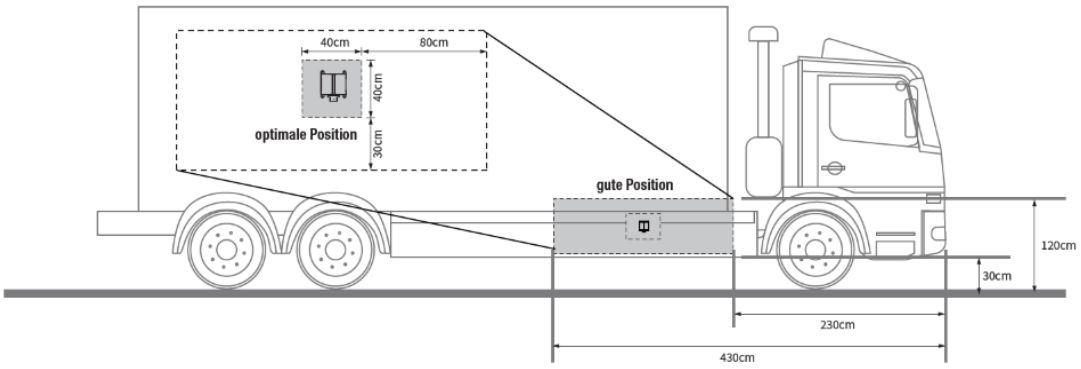


Figure 2-3 Recommended or Plug and Play installation position diagram

If the wheelbase of 3.5-5 meters or the installation position is out of the plug and play installation range, the installer needs to re-enter the installation position of the sensor. At this time, the installer needs to measure the distance between the actual installation position of the radar and the center of the rear axle of the vehicle to renew the installation position of the radar.

To parameterize the radar installation position, please use a Windows PC with the CAN box we have provided and our AutelRadarCfgTools software. First connect the CAN box with radar sensor via CAN 2.0 interface, see Table 1-2. The working steps are shown in Figure 2-4 below:

(1) Click the Open button to open the CAN device

(2) Click the Close button to close the CAN device

(3) Select the baud rate of channel 2, the current default is 250K

(4) Click Start button to open Channel 2

(5) Click stop button to close channel 2

(6) Choose whether the installation position faces the left or right side of the vehicle front

(7) Enter the values dx , dy, theta and warn_dx

(8) With Write you write the values in the radar sensor, with Read you can read out the values in the radar sensor again

(9) You can also use the Report button to print out an installation report. A detailed description can be found in Chapter 2.7

dx: Longitudinal distance from the installation position of the radar to the center of the rear axle of the vehicle. unit: meters

dy: The lateral distance from the radar installation location to the center of the vehicle's rear axle, typically 1.25 m

Installation Angle: The left side is -90°, the right side is 90°

Warn_dx: the distance from the center of the rear axle to the front edge of the vehicle. Unit: meter

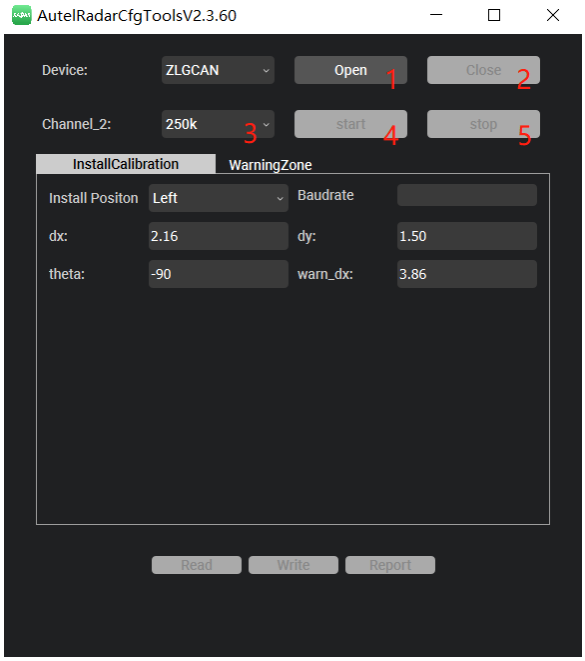


Figure 2-4 AutelRadarCfgTools interface icon

Maximum installation area: The maximum installation area is shown in Figure 2-4.1. The sensor may be installed with software parameterization from the front of the vehicle up to a maximum of 700 cm to the rear. At the same time, the sensor must not be installed behind the first rear axle. The installation height is the same as the Plug and Play installation variant and remains unchanged at 30cm - 120cm.

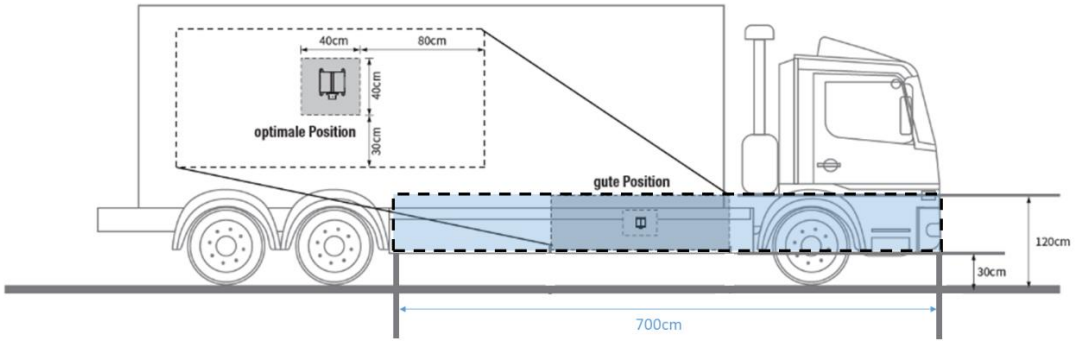


Figure 2-4.1 Maximum installation area

Installation Deviation: In order to ensure detection accuracy, the horizontal angle error of the radar installation should be within ±1° at best. The vertical angle error when installing is best within 2°.

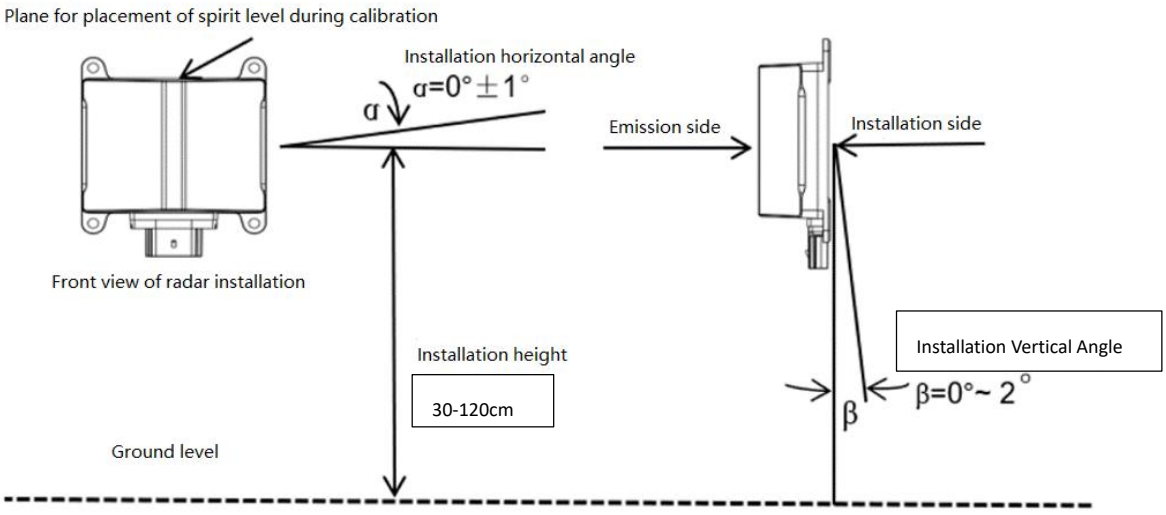


Figure 2-5 Radar Installation Deviation Chart

Installation example

To control installation variations, an optional additional mounting bracket can be used to adjust direction and angle during installation.

1. With the front of the radar (the side with the plastic case) facing the detection area, attach the radar to the mounting bracket with the screws.
2. Place the bubble level in the center of the top tier of the radar and adjust the mounting position adjustment screw until the bubble overlaps the ring in the center.
3. Secure the mounting position adjustment screw, and then connect the cable.

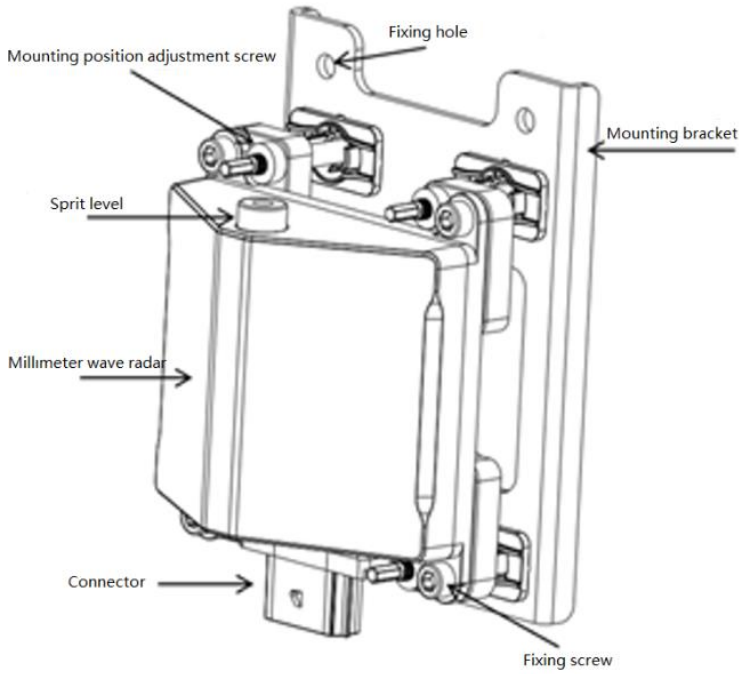


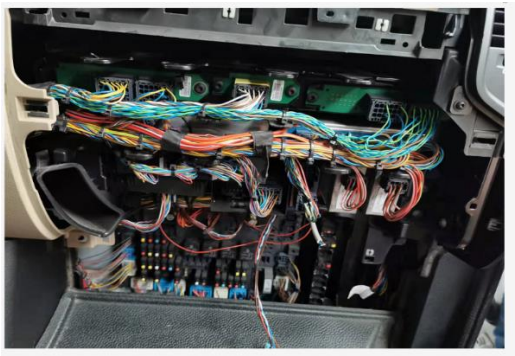
Figure 2-6 Radar installation and calibration diagram

2.2 Radar Wiring

After the radar cable is connected to the radar, it should be routed into the cabin along with the chassis cable as shown in the figure below.

The entry for the chassis cable into the cab is on the underside of the cab. Therefore you need to lift the cabin during wiring as shown in the picture below.

In front of the passenger seat (where the main fuse and main ECU are located), connect the power supply, screen and other parts of this product as shown in the figure below.



2.3 Input signal for the system

The system has two feed options for the input signals.

Feeding in with the supplied GPS/IMU module

Feeding in without the supplied GPS/IMU module, directly with the vehicle CAN signals

The supplied GPS/IMU module provides the required input signals for the system. If the supplied GPS/IMU module is not used. Alternatively, the system can also be used if the input signals are provided via vehicle CAN Bus. The Autel ATS100 requires the 5 CAN signals shown below for its normal operation. By default, the radar automatically reads these CAN J1939 signals. This means only vehicles with standardized J1939 signals are supported by the system. If the vehicle does not provide standardized J1939 signals, we recommend using the supplied GPS/IMU module. The baud rate for vehicle communication is 250 KB:

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

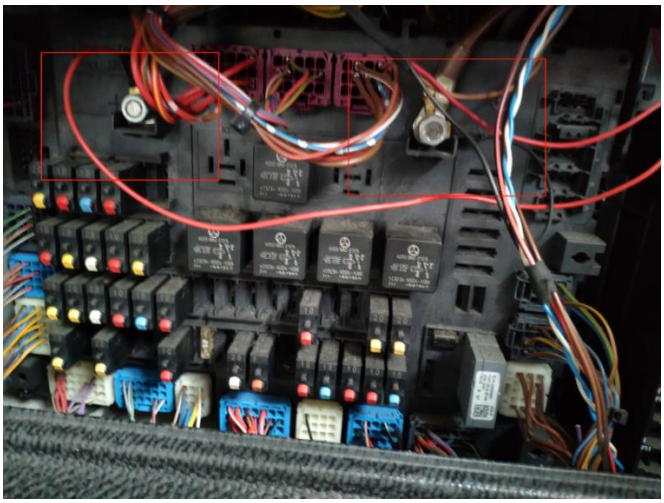
signal _	byte	start bit	length	resolution	offset	minimum	Maximum	Unit
vehicle speed	6	48	16	0.00390625	0	0	250,996	km/h

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 must be supplied via KL15 or terminal 15 (12V or 24V). We recommend you find KL15 on the main fuse board and connect the radar to it.



2.5 Installation of GPS and IMU module

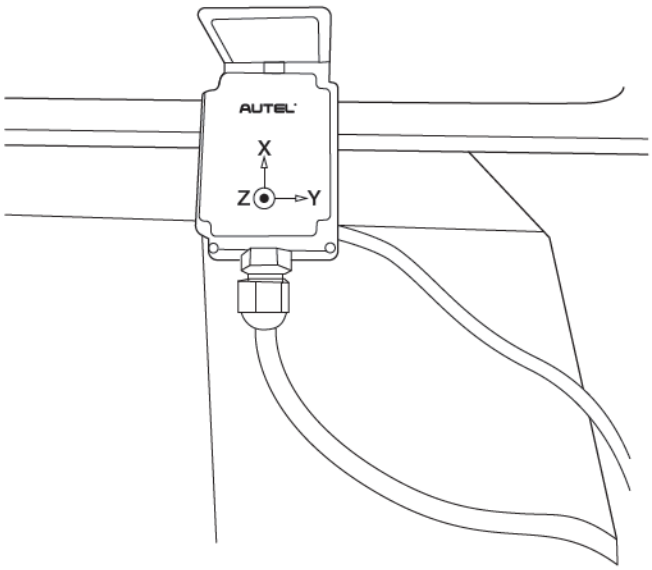
The GPS/IMU module can be placed anywhere in the driver's cabin, the preferred position is behind the windscreen and somewhere in the middle of the cockpit.

a. Place the GPS&IMU module horizontally, noting that the X-axis direction is the same as the vehicle's forward direction.

b. The module can be fixed with screws or double-sided tape.

c. Connect the two harnesses at the 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

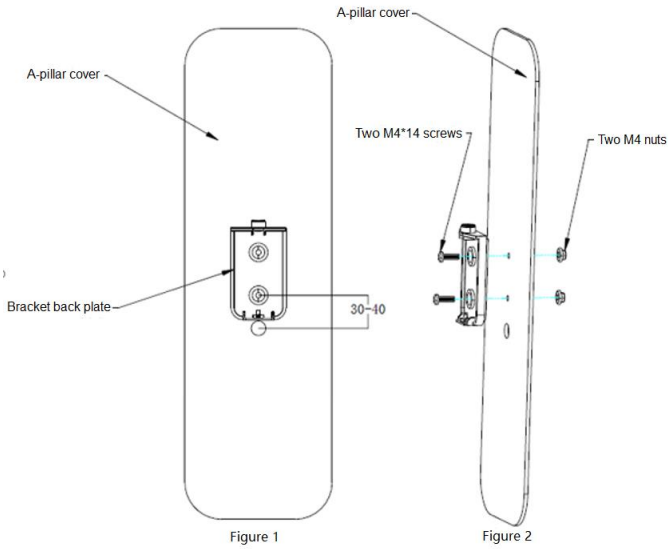


Figure 1 Figure 2

a. Remove the A-pillar cover and drill holes: Using the mounting holes on the bracket back plate as shown in Figure 1 as reference points, drill two 4.5mm mounting holes and one 12mm hole to pass the cable (30th hole). -40 mm below the mounting holes).

b. As shown in Figure 2, use two M4*14 screws to attach the bracket back plate to the A-pillar cover.

Note: 3M adhesive on the bracket back plate allows the bracket to be glued to the A-pillar cover.

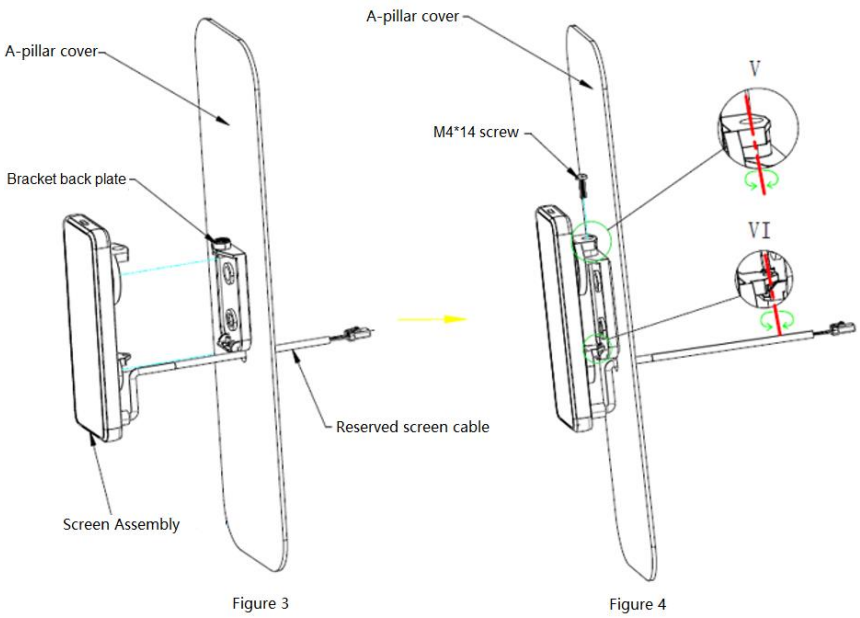


Figure 3 Figure 4

c. As shown in Figure 3, route the cable on the strainer assembly through the cable hole on the A-pillar cover.

i.e. Referring to Figure 4, place the display assembly in the appropriate location on the bracket backplate as shown in View V and View VI. You can rotate the screen around the axis to adjust its angle, and then fix the screen assembly with M4*14

screws.

e. Reinstall the cover on the A-pillar.

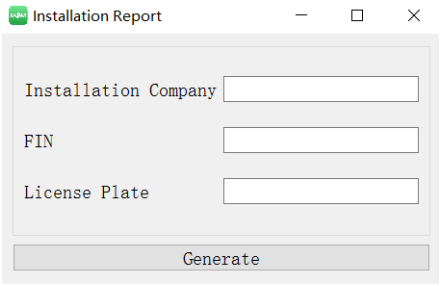
2 .7 Generation of installation report

The AutelRadarCfgTools V2.3.60 has a function to print installation report or vehicle configuration report, which automatically creates a pdf file with the registered vehicle information, radar serial number and software version and radar installation location after user input the related information.

The instructions for using the report printing feature are as follows:

(1) Establish communication between the AutelRadarCfgTools and the radar as described in Figure 2-4 in Section 2.1. This step is not necessary if the radar is already connected to the client.

(2) Click the "Report" button on the bottom right corner and the following window will appear. Enter your name, vehicle identification number and license plate number and click "Generate" to automatically generate a radar configuration report on your computer desktop.



(3) Follow the steps above and you will receive a report with your entries and radar information as shown below.

Radar Installation Report

ATS100 Series

Installations Company: Autel Europe GmbH

FIN: 0000000000000

License Plate: M 8888

Radar

Serial Number: ASR100A1AGCN08A0045

Software Version: ASR101_TA_ABE_V1.1.12.rc3

Installation-Info

Type: Right Radar

dx: 8 m

dy: -1.25 m

theta: 90 degree

warning_dx: 12 m

Signature:

Autel Europe GmbH
Landsberger Str.408, 4.OG
81241 München, Germany

Data: 2022/09/14-15:05:03