Hardware Installation Guide

ClairWav Microwave Radar

Signal Control

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TraffiClair Technology Co., Ltd.

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Chapter 1: Millimeter Wave Radar System Structure

1.1 System Topology

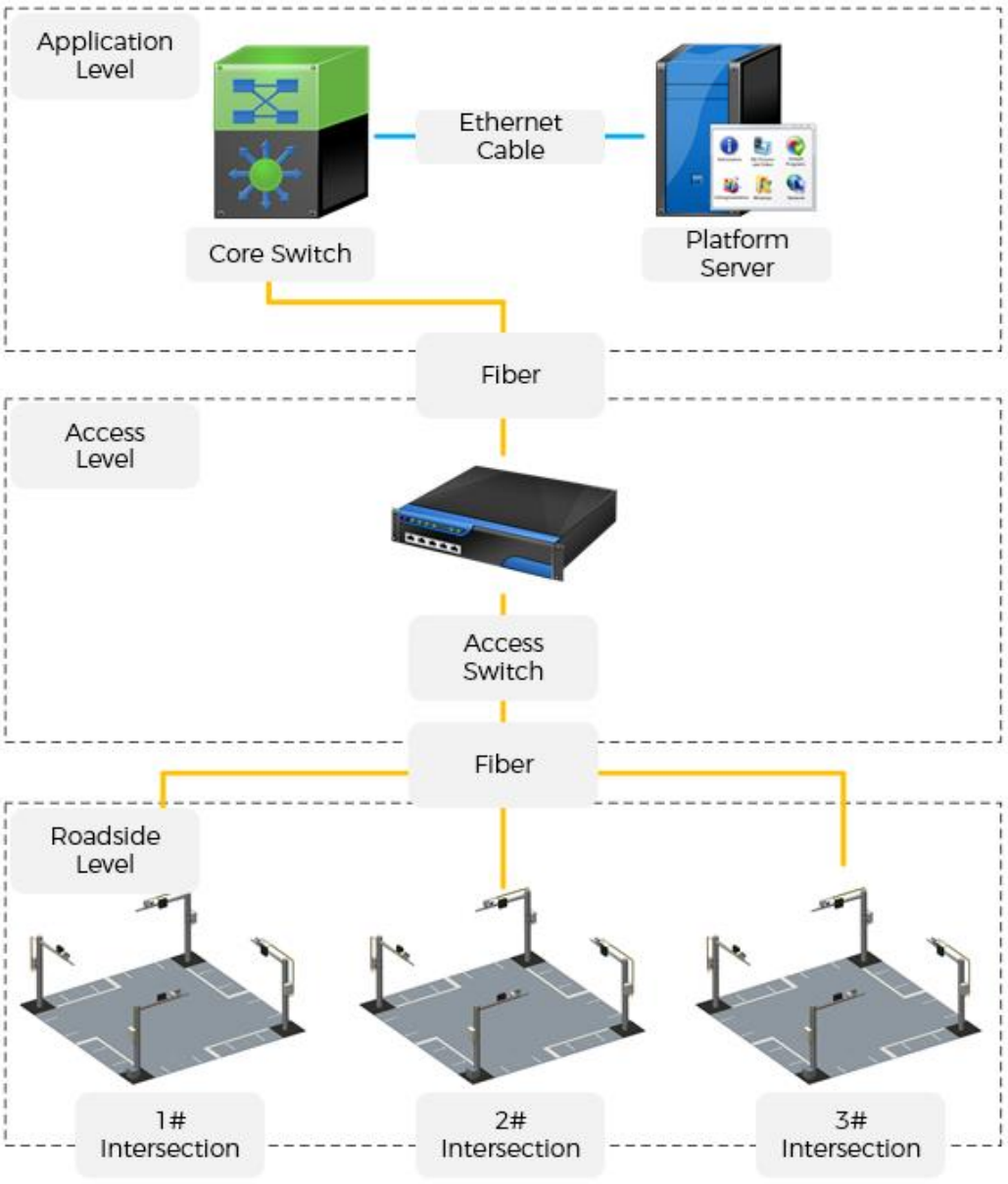


Figure 1: System Topology

The structure of the millimeter wave radar vehicle detection system consists of three main components:

1. **Roadside Unit**: This includes the phased-array radar sensor, edge computing unit, camera, and traffic signal controller.
2. **Access Unit**: The network transmission unit.
3. **Application Unit**: The platform server.

The system enables real-time automatic control and optimization of traffic signal timing at intersections. Additionally, it features comprehensive traffic parameter collection capabilities, allowing for real-time traffic flow data collection and statistics. This provides users with accurate and reliable data.

Chapter 2: Product Introduction

2.1 Radar Dimension

Radar dimension: 210mm*58mm*154mm

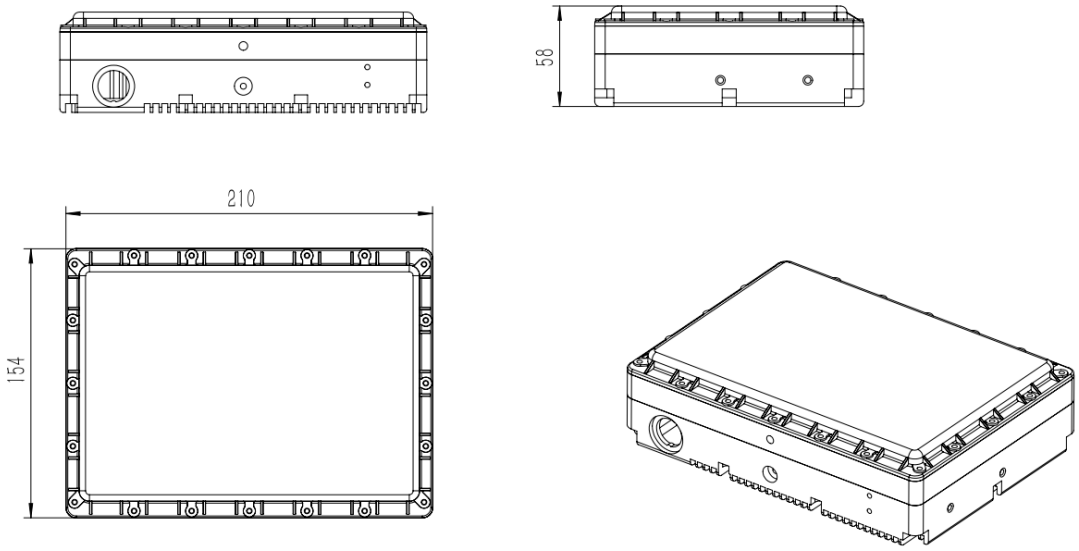


Figure 2: Radar dimension

2.2 Radar Installation Accessories

Radar Product Item List:

1. Radar Main Unit: 1 piece
2. Radar Supporting Bracket: 1 piece
3. Fixing Screws: 4 pieces
4. Connection Cable: 1 piece
5. Waterproof Cap (Three-Piece Set): 1 set
6. Power Adapter: 1 unit

Fixing Accessories:

- Universal Joint
- Pole-Mount Bracket

- M6 Bracket Screws (with Flat and Spring Washers) and Nuts: 7 sets

Chapter 3 Installation

3.1 Installation Method and Precautions

1. Connect the Microwave Traffic Flow Detector Bracket, Universal Joint, and Pole-Mount Bracket:

   Assemble the components securely.

2. **Fix the Pole-Mount Bracket to the Pole Using Hose Clamps**:

   Ensure the bracket is tightly secured to prevent movement.

3. **Install the Microwave Traffic Flow Detector onto the Bracket**:

   Make sure the detector is not installed upside down (the text on the nameplate on the back should be upright for correct installation).

4. **Connect the Radar Cable**:

   Ensure all connections are secure and waterproof as necessary.

5. **Adjust the Tilt and Roll Angles of the Detector to 0°**:

   Use the universal joint to make precise adjustments for proper alignment.

6. **Confirm the Power Output of the Adapter is DC24V Using a Multimeter**:

   Only power the radar device after verifying the adapter output is correct to prevent damage.

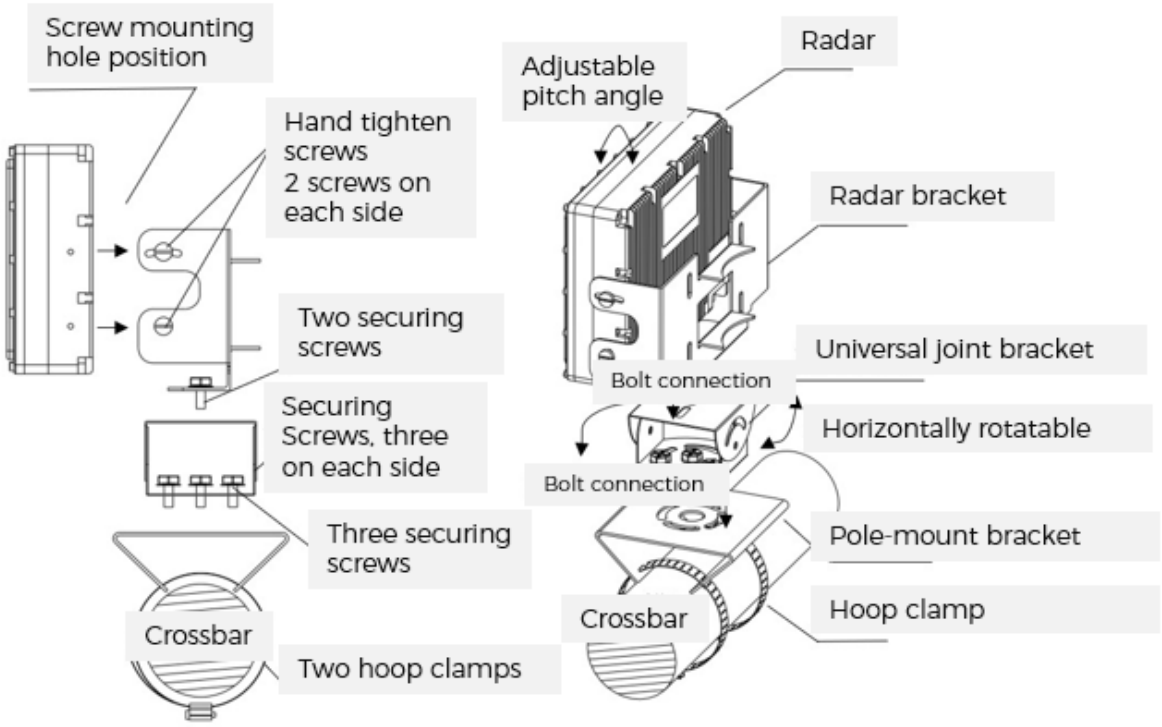


Figure 3: Radar Crossbar Installation Method

3.2 Millimeter Wave Radar Connection Cable Instructions

1. Connecting the Cable to the Radar:
    - Align the red dots on the aviation plug and the radar connector before connecting.
    - Insert the cable until you hear a slight "click" sound, indicating that it is properly installed.
2. Disconnecting the Cable:
    - To remove the cable, pinch the handle of the plug and pull it out gently.
3. Waterproofing:
    - After inserting the cable, tighten the waterproof cap on the Ethernet port to ensure a secure seal.

- Once the power cable is connected, apply waterproofing measures to prevent moisture ingress.

4. Sealing Unused Connectors:
    - For any unused connectors, wrap them tightly with tape to seal and protect them from external elements.

Note:

After installing the radar, be sure to connect the radar cable to the radar unit. This will prevent rain, dust, or other debris from entering the radar's aviation connector, which could cause poor contact or damage to the radar interface.

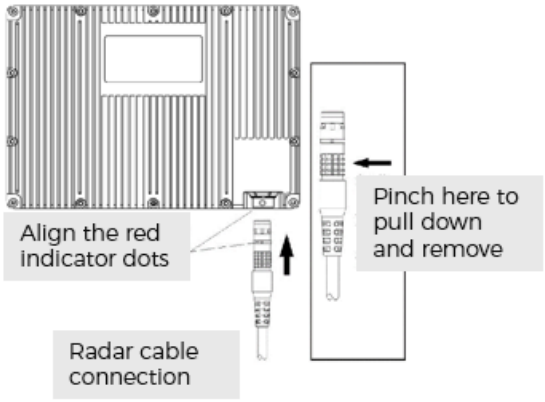


Figure 4: Connection of cable head

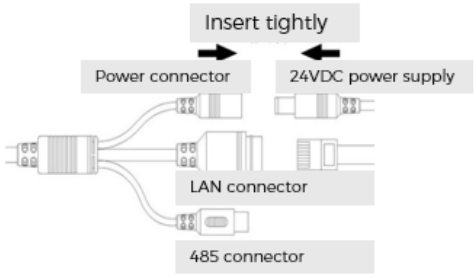


Figure 5: Connection of cable tail

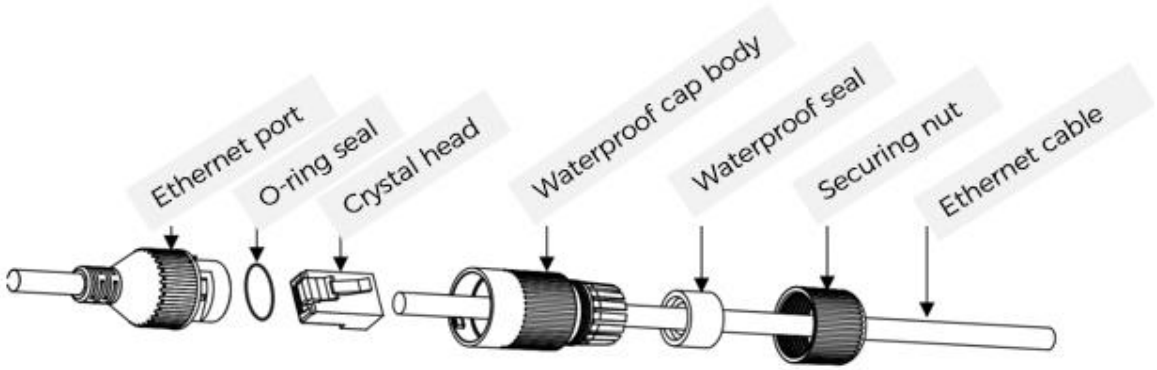


Figure 6: Waterproof Cap for Ethernet Port

3.3 Millimeter Wave Radar Installation Angle Instructions

- **Recommended Installation Height**: The radar should be installed at a height of **5 to 8 meters**.
- **Lateral Tilt (Roll Angle)**: The microwave traffic flow detector's lateral tilt should be adjusted to **horizontal**.
- **Pitch Angle**: The pitch angle of the radar should also be adjusted to **horizontal**.
- **Target Orientation**: The microwave traffic flow detector should be oriented **towards the target direction** for optimal detection.

This ensures that the radar is properly positioned for accurate and reliable traffic flow detection.

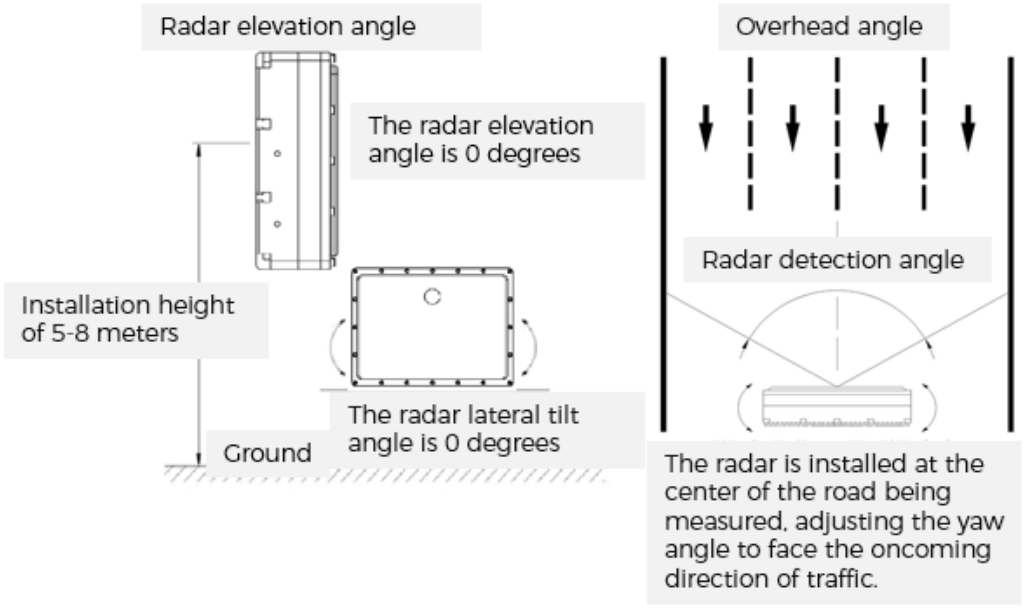


Figure 7: Microwave Traffic Flow Detector Angle Adjustment

Chapter 4: Standard Intersection Installation Plan

4.1 Single Intersection Equipment System Diagram

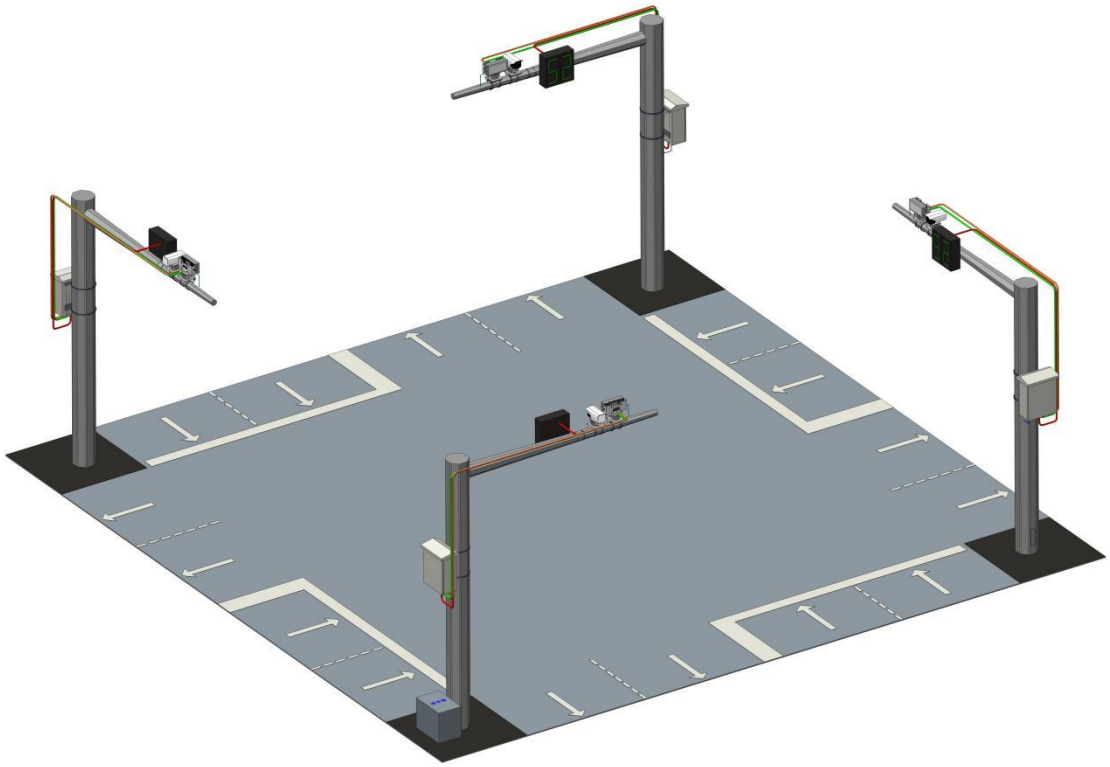


Figure 8: Front-End Intersection Equipment System Diagram

a) **Roadside Unit System**:

The roadside unit system consists of the radar, camera, pole-mounted box, edge computing unit, and other related equipment.

b) **Installation Location of Radar and Camera Equipment**:

The radar and camera should be installed at the middle position of the lane directly opposite the traffic signal's horizontal bar. The equipment IPs are assigned based on the direction of the intersection (North, East, South, West) and numbered as 1, 2, 3, 4.

c) **Contents of the Pole-Mounted Box**:

The pole-mounted box contains the following equipment:

- TP-Link Fiber Optic Transceiver x1
- Chint 2P Circuit Breaker C10 x1
- Radar Adapter x1
- 3-Outlet Power Strip x1

The pole-mounted box should be installed at a height of 2.5 meters above the ground, using a 400mm diameter stainless steel clamp to securely fasten it to the signal light pole, ensuring it is out of reach from pedestrians.

This setup ensures the equipment is organized, easily accessible, and properly mounted for reliable operation.

4.2 Radar and Camera Equipment Installation

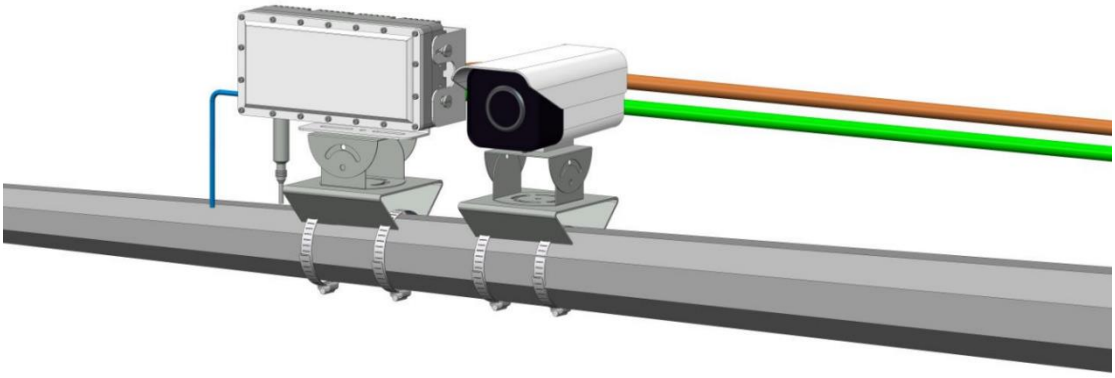


Figure 9: Radar and Camera Installation

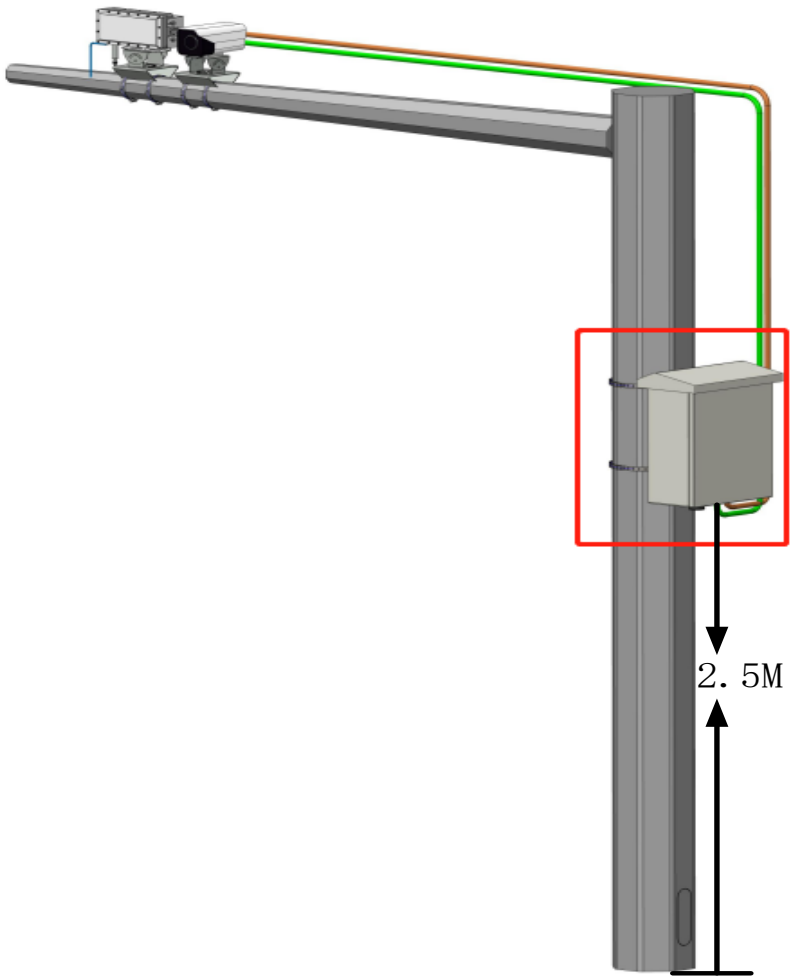


Figure 10: Pole-Mounted Box Installation

The installation details for the equipment are as follows:

1. Power Distribution Box Installation:
    - The **waterproof distribution box** is mounted using **two 400mm diameter stainless steel clamps** at a height of **2.5 meters** from the ground on the traffic signal pole. This positioning ensures it is protected from pedestrian interference.
    - To access and maintain the box, a **ladder** should be used.
2. Radar Installation:
    - The **traffic radar** is secured to the horizontal bar using **two 300mm diameter**

clamps, positioned at **3/4** of the horizontal bar.

- The **tilt angle** (pitch) is adjusted to **±0°**, the **roll angle** is **±0°**, and the **azimuth** is aligned **directly with the oncoming lane** for optimal detection.

3. Camera Installation:
   - The **camera** is mounted using **two 300mm diameter clamps**, positioned approximately **15-20 cm to the right** of the radar on the horizontal bar.
   - The **tilt angle** (pitch) is set to **5°**, the **roll angle** is **±0°**, and the **azimuth** is aligned **directly with the oncoming lane**, ensuring proper monitoring of traffic.
4. Power Distribution Box Door Orientation:
   - The door of the **distribution box** should face the **auxiliary road** (side road) for easy access and servicing.

This setup ensures that all equipment is securely mounted, properly aligned, and easily accessible for maintenance while minimizing the risk of damage.

4.3 Single Pole Equipment Wiring

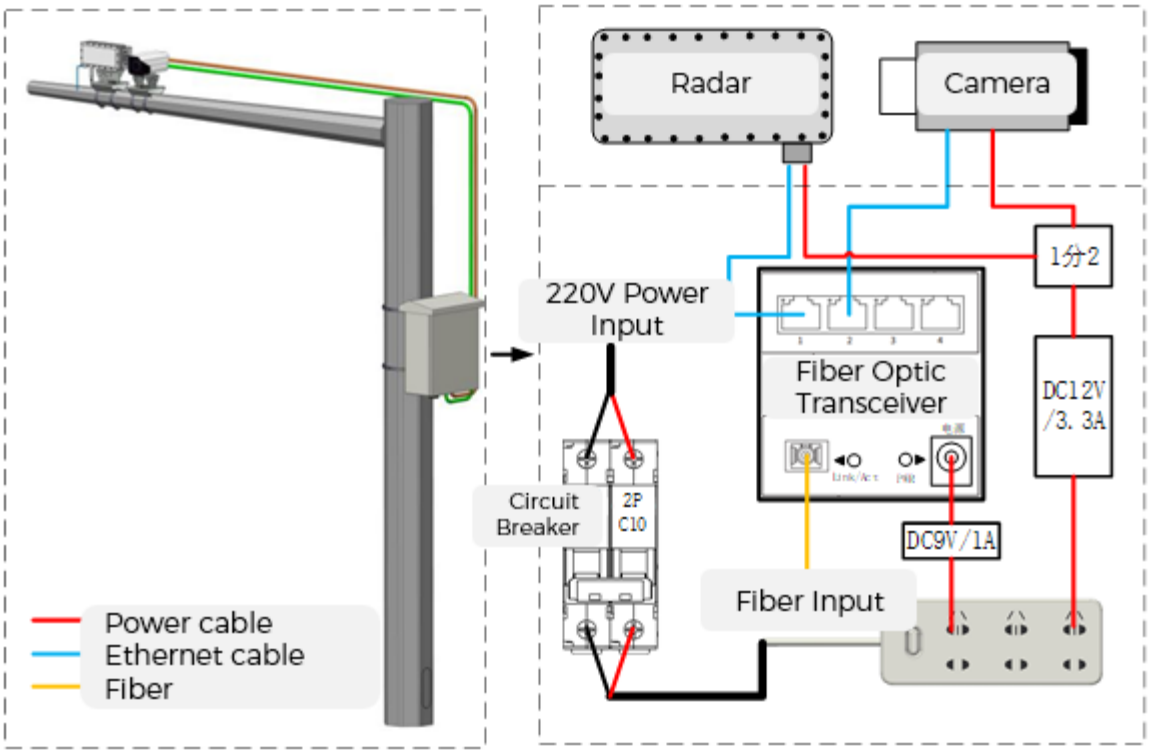


Figure 11: Wiring Diagram for Pole-Mounted Box, Radar, and Camera Equipment

Wiring Details for Pole-Mounted Equipment:

a) Main Power Input (220V):

- The **220V AC power supply** is drawn from the signal controller's power strip, leading to the **2P circuit breaker input terminals** inside the distribution box mounted on the signal pole.
- Cable: National Standard RVV 3*1.5mm² power cable.

b) Radar and Camera Ethernet Wiring:

- **Outdoor Cat 5e twisted pair cable** is used to connect the radar and camera from the pole to the **distribution box**.
- The **fiber optic transceiver** should be connected to any available **RJ45 port**.

c) Radar Power Supply:

- The **radar power cable** (RVV 3*1.5mm²) runs from the pole to the distribution box, connecting to the **Radar Adapter's DC 12V output**, ensuring the radar receives power.
- The **power polarity** is important to ensure correct connection: **± terminals**.

d) Fiber Optic Transceiver and Signal Communication:

- The fiber optic transceiver is powered by a DC 9V/1A adapter.
- The **radar and camera** should be connected to the **RJ45 ports** on the transceiver.
- The transceiver will then connect to the signal controller's **fiber optic transceiver** via the **SC fiber optic connector**.

These steps ensure proper power distribution, data transmission, and signal communication for the radar and camera systems mounted on the pole.

4.4 Microwave Traffic Flow Detector Power Supply Instructions

1. Wiring and Extension:
    - Use **wire strippers** to cut the power adapter's output wire in the middle.
    - Depending on the site requirements, extend the cable by adding **2-core 1.5mm² power cable** to the cut end.
    - The power adapter's tail wire is a **coaxial cable** (with the central white insulation indicating the **positive** terminal, and the surrounding shield layer indicating the **negative** terminal).
2. Power Supply Length:
    - The **power supply extension cable** should not exceed **30 meters** to avoid voltage drop and ensure proper functioning.
3. Voltage Verification:
    - Before connecting the power supply, use a **multimeter** to confirm that the output voltage is **DC 24V** to ensure correct power supply.
    - It is critical to ensure that the voltage does not exceed or fall below the specified range (DC 24V ±10%).

4. Waterproofing:
    - All **cable connections** should be properly sealed with **waterproof tape** to prevent water ingress and ensure long-term reliability, especially in outdoor installations.

Important Note:

- The **microwave traffic flow detector** operates on **DC 24V** with a **25W stable power supply**. Exceeding or dropping below the specified voltage range may damage the detector, and the user will be responsible for any associated damage costs.

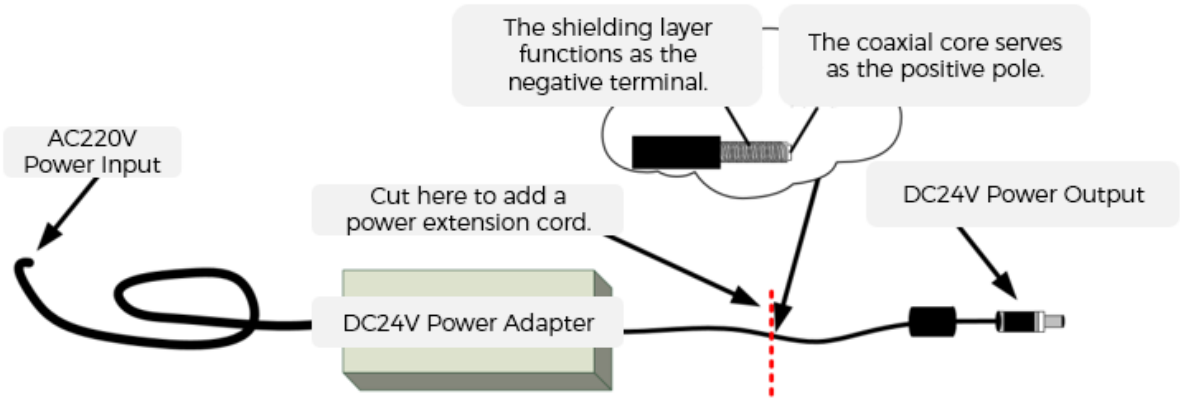


Figure 12: Power Supply Wiring Diagram for Microwave Traffic Flow Detector

4.5 Microwave Traffic Flow Detector Bottom Indicator Light Status Description

Status	Red LED	Green LED
Power On	Steady On	-

Starting Up	Steady On	Slow Flashing
Normal Operation	Steady On	Steady Flashing (Fixed frequency)
Fault	Steady On	Off
Power Off	Off	Off

4.6 Equipment Grounding Standard

The **radar grounding** is performed as follows:

1. Grounding Connection:
    - A **screw** is used to secure a **terminal lug (line nose)** to the **threaded hole** on the side of the radar unit.
2. Grounding Wire:
    - A **grounding wire** is then connected to the terminal lug, leading it to the **grounding column** of the horizontal pole (or a dedicated grounding point).

This ensures that the radar is properly grounded, helping to prevent electrical hazards, reduce interference, and improve the overall safety and performance of the system.

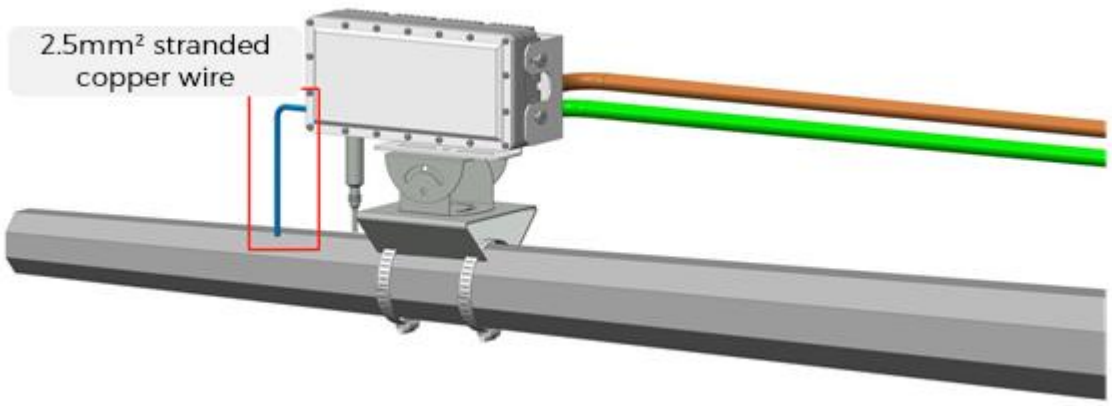


Figure 13: Radar Grounding

4.7 Pipeline Installation

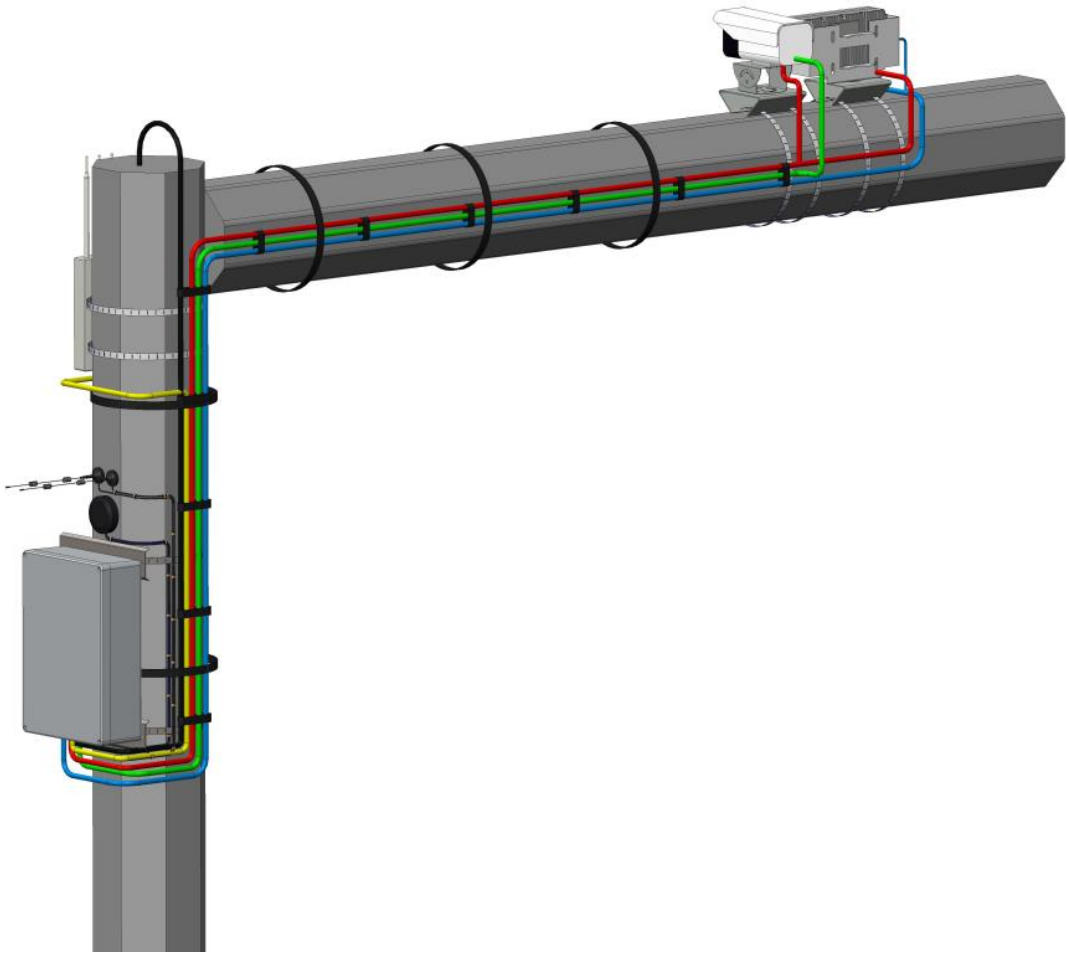


Figure 14: Pipeline Installation

Radar and Camera Network Power Cable Installation

The **network and power cables** for the radar and camera system should be laid following these steps:

1. Cable Bundling:
    - Begin by bundling the **two network cables** and **one power cable** together.
    - Use **100mm cable ties** to secure the cables, with a spacing of approximately

0.5 meters between each tie. This helps maintain cable organization and prevents tangling.

2. Internal Cable Routing:
    - Once the cables are bundled, route them through the **horizontal pole** and **vertical pole**.
    - Ensure the cables are securely fastened and properly routed inside the poles to prevent damage during installation or operation.
3. Power Input Cable Installation:
    - For the **power input cable**, add it to the bundle at the **vertical pole**.
    - Route this power cable from the pole to the **distribution box**, ensuring it is securely fixed along the path and protected from external factors.

By following this installation method, the radar, camera, and power cables are neatly organized, well-protected, and properly routed, ensuring optimal functionality and ease of maintenance.

Chapter 5: Signal Controller Equipment Installation

5.1 Signal Controller Wiring Diagram

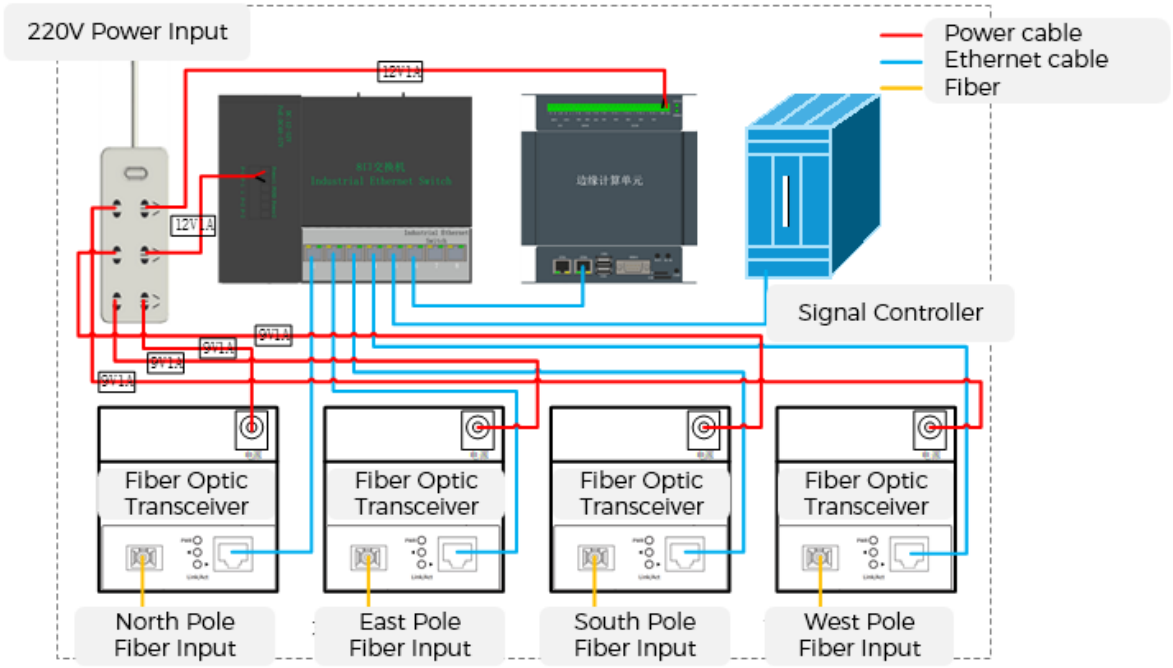


Figure 15: Signal Controller Internal Equipment Wiring Diagram

The **signal controller** is equipped with an **edge computing unit** to send radar data to the signal controller and the data platform. Additionally, it needs to connect four directional fiber optic cables that converge in the signal controller's box into a switch, connecting the local area network of all four directions at the intersection. Ultimately, all directional networks converge within the signal controller. The equipment wiring is shown in **Figure 15**.

Chapter 6: Construction Acceptance

6.1 Radar Vehicle Detector Installation Acceptance Form

Radar Vehicle Detector Installation Acceptance Form						
Project						
Intersection						
	Devices	Installation Check	North	East	South	West
Device Online Check	Microwave Radar	Use the radar search tool to check the online status of radar devices in four directions.				
	Edge Computing Unit	Use the radar search tool to check the online status of ARM devices.				
Device installation standard confirmation	Hose Clamp	Two fixed clamps are tightened, ensuring that the traffic radar is stable without any shaking.				
	Radar fixing screws	Tighten the radar fixing screws using a flathead screwdriver.				

	Bracket fixing screws	Tighten the structural fastening bolts using the appropriate tool to ensure they are secure, without any thread stripping.				
	Radar orientation	The angle between the radar's normal line and the incoming traffic lane should be within 5 degrees.				
	Radar level	Place the spirit level directly above the radar and check if the radar is level.				
	485 Interface	Use waterproof tape to ensure proper waterproofing.				
	Power connector	The power terminal connector should not have any exposed copper wires.				
	Pole mount box	The box should be mounted 2 meters or more above the ground.				
	Device connector	All DC12V male and female connectors should be tightly wrapped with tape.				
	Network	All the port lights on the switch, where				

	connector	the network cables are plugged in, are fully lit, and the cable connectors are not loose.				
Inspector:		Installer:		Date:		

Chapter 7: Equipment List

7.1 Single Intersection Vehicle Detector Installation Equipment List

	NO.	Devices	Brand	Specs	QTY	Notes
Traffic Signal Pole Equipment List	1	Microwave Radar	TraffiClair	Includes power supply, radar cable, and radar bracket.	4	Provided by TraffiClair.
	2	Pole mount bracket base		Dimension: 120*112*45	4	Provided by TraffiClair.
	3	Universal joint		Dimension: 80*75*50	4	Provided by TraffiClair.
	4	Stainless steel clamp		Dimension: 0-400mm	8	Provided by TraffiClair.
	5	Stainless steel screws		Type: M6	28	Provided by TraffiClair.
	6	Stainless steel nuts		Type: M6	28	Provided by TraffiClair.
Pole	1	Pole Mount Box		Dimension: 500*400*300	4	Customer

Mount Box Equipment List						self-purchase
	2	Pole mount box clamp bracket		Length: 250mm	8	Customer self-purchase
	3	Stainless steel clamp		Length: 0-400mm	8	Customer self-purchase
	4	Air circuit breaker		Spec: C10 AC220V	4	Customer self-purchase
	5	Fiber Optic Transceiver	TP-Link	TP-LINK TL-FC314B-3 Gigabit Single-Mode Single-Fiber Fiber Optic Transceiver 1SC + 4GE Optical-Electrical Converter	4	Customer self-purchase
	6	Fiber optic fusion splice box	Shengwei	FBO-104F Fiber Optic Terminal Box, 4-port empty box with square holes, compatible with SC/LC connectors, suitable for both single-mode and	4	Customer self-purchase

				multi-mode.		
	7	Four-way power strip	Bull	Power Voltage: AC220V, Bull	4	Customer self-purchase
	8	Radar power adapter.	Meanwell	Included in the standard package of the radar.		Provided by TraffiClair.
Signal controller end equipment list.	1	Edge Compute Unit	TraffiClair		1	Provided by TraffiClair (optional).
	2	Fiber Optic Transceiver	TP-Link	TP-LINK TL-FC314B-3 Gigabit Single-Mode Single-Fiber Fiber Optic Transceiver 1SC + 4GE Optical-Electrical Converter	4	Customer self-purchase
	3	SC pigtail.	Shengwei	Telecom-grade fiber optic patch cord, SC-SC single-mode single-core.	8	Customer self-purchase
	4	Fiber Optic	Shengwei	FBO-104F Fiber Optic	1	Customer

		Fusion Splice Box		Terminal Box, 4-port empty box with square holes, compatible with SC/LC connectors, suitable for both single-mode and multi-mode.		self-purchase
	5	8 port Ethernet Switch	Ober	8 port 100M D808F	1	Customer self-purchase
	6	Six-way Power Strip	Bull	Power Voltage: AC220V	1	Customer self-purchase
	7	Power Adaptor	Meanwell	Output: DC-12V 3.34A	1	Customer self-purchase
Cable	1	Outdoor Ethernet cable		Specification: Genuine national standard, Category 5e (Cat 5e) with oxygen-free copper.	100m	Customer self-purchase
	2	Outdoor fiber optic cable		Specification: Single-mode, single-fiber, available in 4 to 8 cores.	600m	Customer self-purchase

	3	Power cable		Specification: National standard RVV 3*1.5mm^2 power cable.	600m	Customer self-purchase