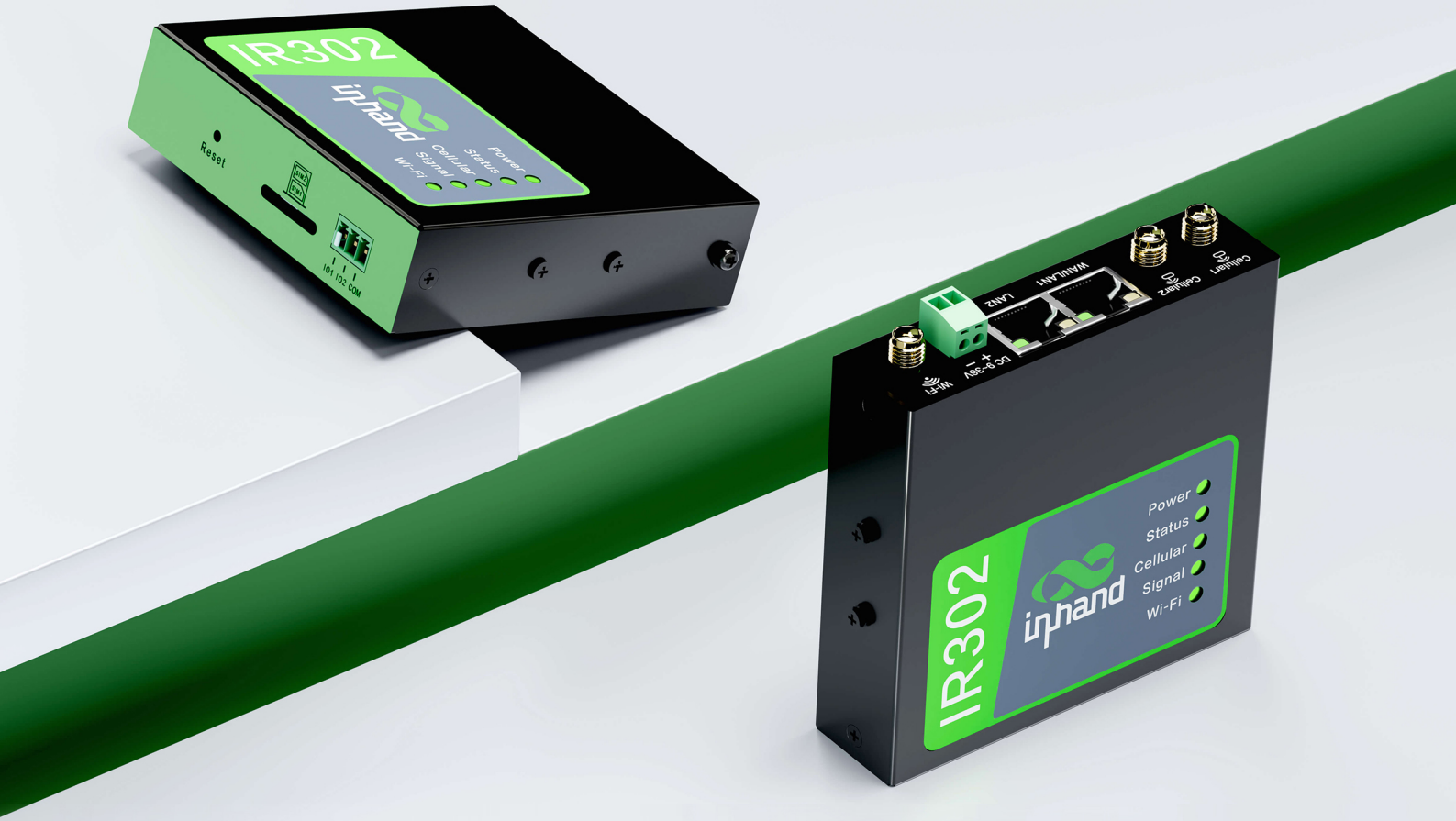
InHand Networks

Compact Industrial Cellular Router for IoT



IR302 Series

Industrial-Grade

4G LTE / Wi-Fi

VPN Security

Smart O&M

1. Product Overview

The IR302 is a compact industrial cellular router launched by Beijing InHand Networks Technology Co., Ltd., designed specifically for Internet of Things (IoT) and industrial automation scenarios. Built on a high-performance industrial-grade processor, it integrates 4G LTE cellular network, Ethernet, Wi-Fi, and rich industrial interfaces to provide stable and secure network connectivity in harsh environments.

The IR302 adopts a fanless cooling design, supports wide temperature and wide voltage operation, and features comprehensive link backup, VPN encryption, firewall, and remote management functions to meet the stringent requirements of industries such as power, transportation, environmental protection, and smart manufacturing for device networking.

2. Key Features

2.1 Industrial-Grade Reliability

- **Wide Temperature Design**: Operating temperature range of Normal:-35℃to70℃，Extended:-40℃ to 75℃
- **Wide Voltage Power Supply**: Supports 9~36V DC input, compatible with 12V DC adapters, with reverse polarity protection and surge protection
- **Fanless Design**: Full metal enclosure with natural convection cooling, no moving parts, significantly improved MTBF
- **Electromagnetic Compatibility**: Passes industrial-grade EMC testing, adaptable to strong electromagnetic interference environments

2.2 Full-Scene Network Access

- **4G LTE**: Built-in Quectel EC25-AF(D) industrial-grade module, supports full network coverage and overseas frequency bands
- **Wi-Fi**: Supports 802.11 b/g/n, can function as both AP and STA simultaneously, meeting on-site wireless coverage and bridging requirements

- **Ethernet**: 1 x 100 Mbps WAN/LAN switchable port + 1 x 100 Mbps LAN port, supports dual-port isolation and link backup
- **Link Backup**: Intelligent switching among cellular/wired/Wi-Fi multi-link connections to ensure business continuity
- **Dual SIM Redundancy**: Supports dual SIM card network backup, ICCID binding, and signal threshold automatic switching

2.3 Enterprise-Grade Security and VPN

- **VPN Protocols**: IPSec (IKEv1/v2), GRE, L2TP, PPTP, OpenVPN, WireGuard, ZeroTier
- **Advanced Encryption**: Supports AES256 / SHA512 / ECP521 (DH21) and other military-grade encryption algorithms
- **Firewall**: Access control, port forwarding (50 rules), virtual IP mapping, DMZ, MAC-IP binding (20 rules), NAT, content filtering, SIP ALG
- **Wi-Fi Security**: 802.1X authentication, Portal authentication (captive portal), AP whitelist/blacklist / MAC filtering, Wi-Fi client isolation, Wi-Fi password encrypted storage
- **Access Security**: User login failure lockout (automatic account/IP lockout after consecutive failures), PAM authentication parameter configuration
- **Secure Boot**: SPI Flash version rollback restriction mechanism to prevent downgrade to incompatible versions that could brick the device

2.4 Intelligent Operations and Maintenance Management

- **Remote Management Platform**: Supports Device Manager (DM) batch management and InConnect Service (ICS) cloud management platform
- **DTU Function**: Supports serial RS232 and Ethernet DTU modes for transparent data transmission
- **SNMP/Trap**: Standard SNMP v1/v2c/v3 and Trap alarms, compatible with mainstream network management systems
- **WebUI/CLI**: Graphical Chinese interface + complete command line (show/ping/telnet/traceroute/reboot/arping, etc.)
- **SSH Client**: Device can act as SSH client to connect to remote servers
- **HTTP API**: Provides HTTP and HTTPS protocol management interfaces, supporting remote configuration and status queries

- **Network Diagnostics**: Built-in network packet capture (tcpdump), export system operating status, Wake-on-LAN remote wake-up

2.5 Key Technical Specifications

Specification	Details
Cellular	4G LTE Cat.4/Cat.1/3G/2G, multi-band coverage, dual-SIM redundancy, ICCID binding and RSRP threshold auto-switching
Wi-Fi	IEEE 802.11 b/g/n, 2.4 GHz, AP/STA/AP+STA mixed mode, up to 32 clients
VPN	IPSec (IKEv1/v2), GRE, L2TP, PPTP, OpenVPN, WireGuard, ZeroTier
Security	Firewall, ACL access contro/l, MAC-IP binding (200 entries), content filtering, SIP ALG, attack protection
Cloud Management	Device Manager (DM) batch configuration and firmware upgrade; InConnect Service (ICS) cloud management
Remote Management	SNMP v1/v2c/v3, WebUI, CLI, SSH Client, HTTP/HTTPS API
Processor	580MHz industrial-grade embedded processor, 128 MB DDR, 32 MB SPI Flash
Ethernet	1× 10/100 Mbps WAN/LAN switchable + 1× 10/100 Mbps LAN
Serial Interface	1× RS232 combo terminal, DTU transparent transmission (TCP Server/Client/UDP/MQTT)
Power Supply	9~36V DC wide voltage input, typical power consumption 2~5W, peak < 10W, reverse polarity protection
Dimensions	Approx. 100 mm × 30 mm × 100 mm (L × W × H, excluding mounting ears and antennas)

Specification	Details
Operating Temperature / Protection	Normal:-35℃ to 70℃，Extended:-40℃ to 75℃, IP30, full metal fanless natural convection cooling

3. Typical Application Scenarios

3.1 Smart Grid

- Remote communication for distribution automation terminals (FTU/DTU)
- Charging pile data collection and remote billing
- State Grid encrypted data transmission (supports national cryptographic algorithm module expansion)

3.2 Smart Transportation

- Intelligent traffic signal controller networking
- On-board video monitoring backhaul
- ETC gantry system backup link

3.3 Industrial Automation

- PLC/SCADA system remote maintenance
- Industrial equipment condition monitoring (Smart-EMS)
- AGV/RGV wireless roaming control

3.4 Smart City and Environmental Monitoring

- Environmental water quality/air station data backhaul
- Smart streetlight centralized control
- Self-service terminal (Smart ATM) networking

3.5 New Energy

- Distributed photovoltaic power station remote monitoring
- Energy storage system BMS data upload to cloud
- Wind farm box transformer measurement and control communication

4. Product Innovations

4.1 Dual SIM Intelligent Redundancy and Cellular Refined Operations

- **ICCID Binding + Multi-Dimensional SIM Switching Strategy**: Supports signal strength (RSRP) threshold switching, packet loss rate triggered switching, and maximum dial attempt limit, achieving truly intelligent dual-SIM network backup, eliminating simple polling-based SIM switching
- **Cellular Signal Parameters Real-Time Cloud Upload**: Key RF metrics such as RSRP, RSRQ, SINR, PCI, and BAND are reported in real-time through the DM platform, allowing remote monitoring of on-site network quality without dispatching engineers
- **IMS Parameter Configuration**: Supports VoLTE private network IMS configuration to meet operator private network voice convergence communication requirements

4.2 Power Industry End-to-End Security Solution

- **State Grid Encryption Hardware Module**: Optional -SEC model includes built-in national cryptographic algorithm chip, supports IEC101/IEC104 power protocols, meeting State Grid access requirements for distribution automation terminals (FTU/DTU)
- **Firmware Signature Verification + Version Rollback Restriction**: System firmware includes digital signature to prevent tampering; before upgrade, firmware-hardware compatibility admission verification is performed through image header model identification matching + integrity/signature verification + version compatibility (anti-downgrade) constraint, with mismatches rejected. Combined with A/B redundant partitions and automatic rollback on failure to prevent bricking from incorrect firmware flashing

4.3 Military-Grade VPN Encryption Upgrade

- IPSec VPN supports **AES256 / SHA512 / ECP521 (DH21)** advanced encryption suites, meeting Grade Protection 2.0 and power/military industry compliance requirements
- Provides pre-quantum computing era security assurance for cross-border data channels and sensitive business

4.4 Box-Free Intelligent Operations and Maintenance Toolkit

- **WebUI Built-in Network Packet Capture (tcpdump)**: No need to carry laptops and packet capture tools; capture and download network packets directly in the browser, significantly improving on-site troubleshooting efficiency
- **One-Click System Operating Status Export**: Complete export of device configuration, logs, and diagnostic information enables precise remote technical support issue identification
- **Wake-on-LAN + HTTP API**: Supports remote wake-up of downstream devices in the LAN; HTTP and HTTPS protocol management interfaces enable automated integration with upper-level operations platforms
- **SSH Client**: Device can actively initiate outbound SSH client connections to remote servers, bypassing NAT restrictions

4.5 DTU Offline Data Resumption

- **TCP Server Channel Expansion**: Virtual serial port function supports up to 32 concurrent channels, meeting multi-device simultaneous access scenarios

4.6 Compact High-Reliability Industrial Design

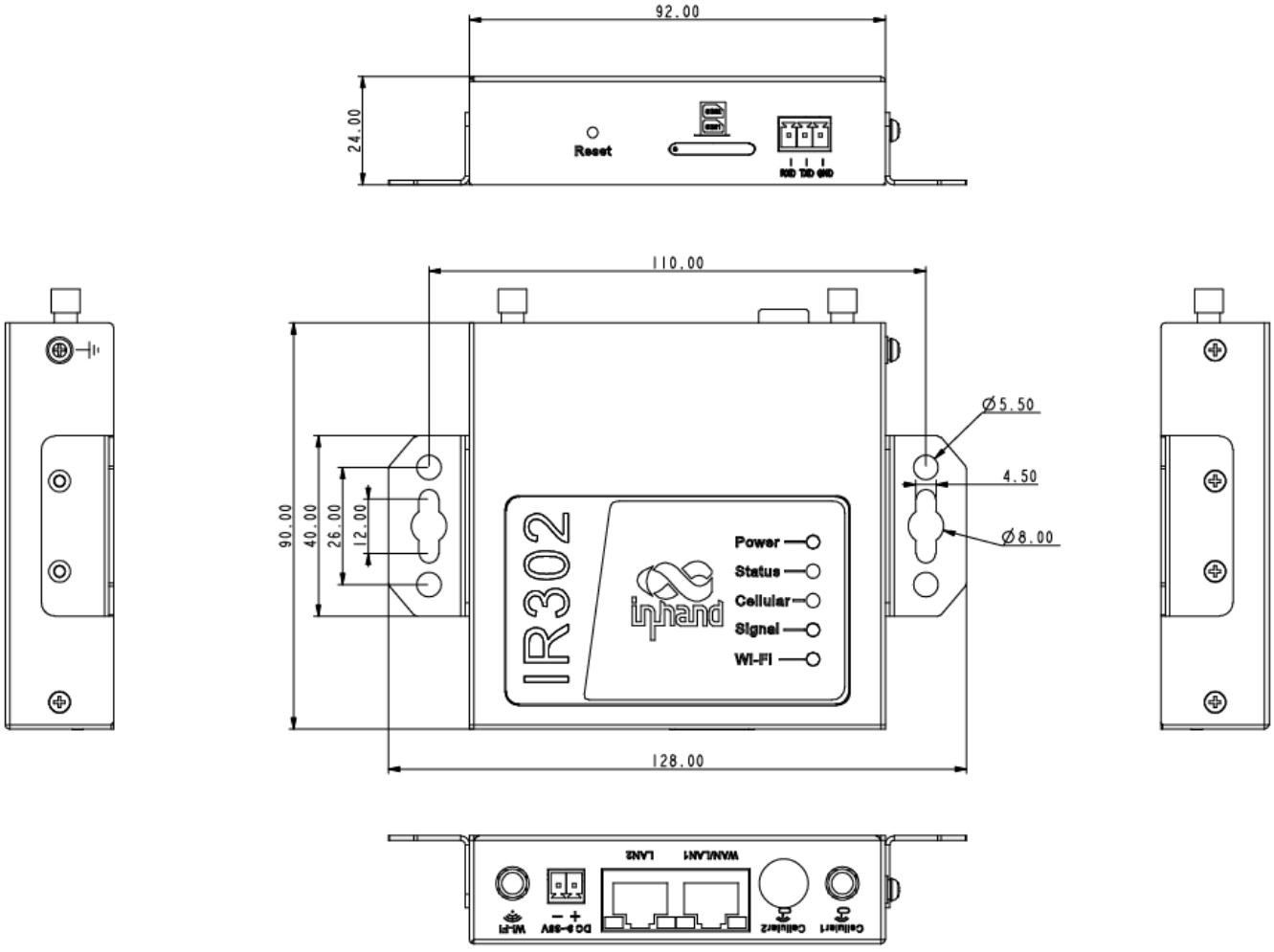
- Compared to the IR615 in the same series, the IR302 is more compact, adopting a **1x1 Wi-Fi antenna solution** to achieve balance between cost and performance. It still provides stable throughput of 31 Mbps within 10 meters, meeting the vast majority of industrial inspection and SCADA data interaction requirements

5. Hardware Specifications

Item	Specification
Processor	580MHz industrial-grade embedded processor
Memory	128 MB DDR
Storage	32 MB SPI Flash
4G Module	Depends on model configuration, covering LTE Cat.1/LTE Cat.4 (see Ordering Information for details)
Ethernet Interfaces	1 x 10/100 Mbps WAN/LAN switchable port 1 x 10/100 Mbps LAN port
Serial Port	1 x RS232 combo terminal (supports DTU transparent transmission)
SIM Card Slots	2 x dual SIM card slots (drawer type / Nano-SIM, supports dual-SIM network backup)
Antenna Interfaces	2 x 4G main/diversity antennas (SMA female) 1 x Wi-Fi antenna (SMA female, FQ38-WLAN configuration)
Power Interface	2-pin industrial terminal (9~36V DC) Optional 12V DC adapter
Power Consumption	Typical 2~5W, peak <10W
LED Indicators	Power (red), Status (green), Cellular (yellow) Signal (red/yellow/green), Wi-Fi (green)
Reset Button	Supports hardware factory reset
Enclosure Material	Full metal enclosure, IP30 protection rating

Item	Specification
Mounting	DIN rail mounting / Wall mounting
Product Dimensions	Approx. 100 mm x 30 mm x 100 mm (L x W x H, excluding mounting ears and antennas)
Total Weight	Approx. 250g

5.1 Product Size



Notes:

1. All dimensions are in millimeters (mm), with inches (in) in parentheses.
2. Dimensions (L × W × H): 92 × 90 × 24 mm(3.62 × 3.54 × 0.94 in).
3. All dimensions are approximate values and for reference only.

6. Network Connectivity

6.1 Cellular Network

- **Standard Support**: Depends on selected cellular module, covering 4G LTE Cat.4 (DL 150 Mbps / UL 50 Mbps), 4G LTE Cat.1, 3G WCDMA, 2G GSM/EDGE, etc.
- **Frequency Bands**: Varies by module, see 8.1 Ordering Information Model Naming Convention
- **Dual SIM Management**: Supports dual SIM card network backup, ICCID binding, signal strength threshold (RSRP) automatic switching, packet loss rate triggered switching, maximum dial attempt limit, minimum connection time control
- **SIM Functions**: Supports operator private network APN, PIN code lock, traffic statistics
- **IMS Configuration**: Supports cellular dial IMS parameter configuration
- **SMS**: SMS remote reboot/dial control, custom commands, access whitelist/blacklist

6.2 Wi-Fi Wireless LAN

- **Standard**: IEEE 802.11 b/g/n, 2.4 GHz band
- **Antenna Configuration**: 1x1 single antenna, theoretical peak 72 Mbps
- **Operating Modes**: AP mode (default), STA station mode, AP+STA mixed mode
- **Access Control**: AP whitelist/blacklist / MAC filtering, Wi-Fi client isolation (inter-client isolation)
- **AP Capacity**: Supports up to 32 STAs simultaneously
- **Actual Performance** (typical test environment):

Distance	Negotiated Rate	Throughput (LAN→WLAN Typical)
1 m	72 Mbps	54 Mbps
5 m	72 Mbps	41 Mbps
10 m	72 Mbps	31 Mbps
30 m	72 Mbps	14 Mbps (depending on obstacles)

- **Multi-Client Access Capability** (suction cup rod antenna, typical values):

Number of Clients	LAN→WLAN	WLAN→LAN
1	~29.7 Mbps	~20.8 Mbps
5	~20.8 Mbps	~13.3 Mbps
10	~19.9 Mbps	~12.1 Mbps
15	~16.5 Mbps	~2.7 Mbps

> **Note**: Wi-Fi performance is affected by environmental interference, obstacles, and terminal capabilities. The above data represents typical laboratory values for reference only.

6.3 Wired Ethernet

- **Interface Rate**: 10/100 Mbps auto-negotiation
- **Operating Mode**: WAN/LAN software switchable
- **Protocol Support**: PPPoE, DHCP Client, Static IP

6.4 Link Backup and Redundancy

- **Backup Strategy**: 4G ↔ wired WAN ↔ Wi-Fi STA intelligent switching
- **Detection Mechanism**: Link keepalive detection (ICMP), fast switching
- **VRRP**: Supports Virtual Router Redundancy Protocol, dual-device hot standby
- **Load Balancing**: Multi-WAN traffic sharing (optional policy)

7. Software Functional Specifications

7.1 Network Services

Function Module	Details
DHCP Server	Supports DHCP server/relay, expert options (dhcp-option) customization, supports Option 43/60/82 and other extensions
DNS	DNS forwarding, domain name service, custom DNS servers
DDNS	Supports PeanutShell, DynDNS, No-IP and other mainstream dynamic DNS providers
NTP	Network time synchronization, supports custom NTP servers and calibration cycles
Static Routing	Supports multiple static routes and policy routes, supports route priority configuration
NAT	SNAT/DNAT, NAPT, port forwarding (100 rules), virtual IP mapping, DMZ
TCP Checksum	Supports TCP checksum option configuration
Dual SIM Management	Dual-SIM network backup, ICCID binding, signal threshold (RSRP) automatic switching, packet loss rate triggered switching, maximum dial attempt limit, minimum connection time control
SMS Management	SMS remote reboot/dial control, custom commands, access whitelist

7.2 VPN Tunnels

VPN Type	Support Details
IPSec	IKEv1 / IKEv2, supports pre-shared key/certificate authentication, encryption algorithms include AES128/192/256, 3DES, DES; hash algorithms include MD5, SHA1, SHA256, SHA384, SHA512; DH groups include Group1/2/5/14/15/16/17/18/19/20/21 (ECP521); supports AES256+SHA512+ECP521 combination
GRE	Standard GRE tunnel, supports over IPSec
L2TP	L2TP over IPSec, supports MS-CHAPv2 authentication
PPTP	PPTP client/server
OpenVPN	Supports TUN/TAP mode, UDP/TCP transport, TLS/SSL encryption
WireGuard	Next-generation high-performance VPN protocol, simple configuration, high encryption strength
ZeroTier	Supports SD-WAN virtual networking, quickly build global private LAN

7.3 Firewall and Security

- **Access Control**: IP, port, protocol, and time-period based ACL rules; supports login failure lockout (automatic account/IP lockout after consecutive failures)
- **MAC-IP Binding**: Supports 200 binding entries to prevent ARP spoofing
- **Content Filtering**: URL keyword filtering, MAC address whitelist/blacklist
- **Application Layer Gateway**: SIP ALG (VoIP audio/video transmission support)
- **Attack Protection**: Ping of Death protection, SYN Flood protection

7.4 Industrial Communication and DTU

Function	Description
Serial DTU	RS232 transparent transmission, supports TCP Server/Client, UDP, MQTT modes, supports multi-center reporting
Ethernet DTU	Supports transparent transmission of Ethernet port data to remote TCP/UDP servers
Protocol Conversion	Supports Modbus RTU/TCP protocol conversion (optional)
State Grid Encryption	Supports national cryptographic algorithm module (optional, model suffix -SEC), supports IEC101/IEC104 power protocols

7.5 Bandwidth and Traffic Management

- **IP Rate Limiting**: Uplink/downlink bandwidth rate limiting based on IP address
- **Traffic Statistics**: Interface-level traffic statistics, supports traffic alarm thresholds

7.5.1 Scheduled Tasks

- **Scheduled Reboot**: Supports daily/advanced rule scheduled device reboot
- **Cellular Scheduled Redial**: Supports planned triggering of cellular interface redial

7.6 Remote Management

Platform/Protocol	Function
Device Manager (DM)	InHand device management platform, supports batch configuration delivery, firmware upgrades, status monitoring, alarm management

Platform/Protocol	Function
InConnect Service (ICS)	Cloud management platform, supports OpenVPN cloud configuration delivery and unified management
SNMP	v1/v2c/v3, supports standard MIB-II and private MIBs, supports Trap alarms; supports custom SNMP ports; extended OIDs can query dial IP, operator, SIM phone number, ICCID, BAND, etc.
WebUI	Responsive Chinese web management, supports wireless client parameter display, network packet capture (tcpdump), export system operating status
CLI	Complete command line: show version/system/clock/modem/log/users/interface/ip/route/ arp, ping, telnet, traceroute, reboot, arping, etc.
SSH	Secure remote command line access; device can act as SSH client to connect to remote servers
HTTP API	HTTP and HTTPS protocol management interfaces, supports remote configuration and status queries

7.7 Industry Application Functions

- **Smart ATM**: Self-service terminal device status monitoring and remote management (standard)
- **Status Report**: Device status scheduled reporting to platform, supports alarm message reporting (standard)
- **Smart-EMS**: Energy management system data interface (optional)
- **State Grid Encryption**: Supports national cryptographic algorithm module and IEC101/IEC104 power protocols (optional, model suffix -SEC)

8. Ordering Information

8.1 Model Naming Convention

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IR302 - [4G Module] - [Wi-Fi] - [IO/S] - [L]
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Field	Code	Description
4G Module	LQ28	China, LTE CAT4 FDD: B1/B3/B5/B8 TDD: B34/B38/B39/B40/B41 WCDMA: B1/B5/B8 GSM/EDGE: B3/B8
	FQ58	Europe/APAC, LTE CAT4 FDD: B1/B3/B7/B8/B20/B28A WCDMA: B1/B8 GSM: B3/B8
	FQ58-L	Europe/APAC/Australia/Middle East/Africa, LTE CAT4 FDD: B1/B3/B5/B7/B8/B20/B28 TDD: B38/B40/B41 WCDMA: B1/B5/B8 GSM/EDGE: B3/B8
	FQ38	North America, LTE CAT4 FDD: B2/B4/B5/B12/B13/B14/B66/B71 WCDMA: B2/B4/B5
	FQ33	North America, LTE CAT1 FDD: B2/B4/B5/B12/B13/B25/B26 WCDMA: B2/B4/B5

Field	Code	Description
	FQ88	Japan, LTE CAT4 FDD: B1/B3/B8/B18/B19/B26 TDD: B41 WCDMA: B1/B6/B8/B19
	EN00	No cellular module (Ethernet + Wi-Fi only)
	FQ68	Latin America, LTE CAT4 FDD: B1/B2/B3/B4/B5/B7/B8/B28/B66 TDD: B40 WCDMA: B1/B2/B4/B5/B8 GSM: B2/B3/B5/B8
Wi-Fi	WLAN	Supports 802.11 b/g/n Wi-Fi
	(blank)	No Wi-Fi function (omitted)
Serial/IO	S	1×RS232
	IO	2×IO
	(blank)	No serial/IO (omitted)

8.2 Standard Model List

Model	4G	Wi-Fi	Serial/IO	Description
IR302-LQ28-WLAN-S-L	✓	✓	1×RS232	China (LTE CAT4)
IR302-LQ28-S-L	✓	—	1×RS232	China, no Wi-Fi
IR302-FQ58-WLAN-S	✓	✓	1×RS232	Europe/APAC (LTE CAT4)
IR302-FQ58-WLAN-IO	✓	✓	2×IO	Europe/APAC (LTE CAT4)
IR302-FQ58-S	✓	—	1×RS232	Europe/APAC, no Wi-Fi
IR302-FQ58-IO	✓	—	2×IO	Europe/APAC, no Wi-Fi
IR302-FQ58-WLAN-S-L	✓	✓	1×RS232	Europe/APAC/Australia（LTE CAT4）

Model	4G	Wi-Fi	Serial/IO	Description
IR302-FQ58-WLAN-IO-L	✓	✓	2×IO	Europe/APAC/Australia（LTE CAT4）
IR302-FQ58-S-L	✓	—	1×RS232	Europe/APAC/Australia，no Wi-Fi
IR302-FQ58-IO-L	✓	—	2×IO	Europe/APAC/Australia，no Wi-Fi
IR302-FQ38-WLAN-S	✓	✓	1×RS232	North America (LTE CAT4)
IR302-FQ38-WLAN-IO	✓	✓	2×IO	North America (LTE CAT4)
IR302-FQ38-S	✓	—	1×RS232	North America (LTE CAT4), no Wi-Fi
IR302-FQ38-IO	✓	—	2×IO	North America (LTE CAT4), no Wi-Fi
IR302-FQ33-WLAN-S	✓	✓	1×RS232	North America (LTE CAT1)
IR302-FQ33-WLAN-IO	✓	✓	2×IO	North America (LTE CAT1)
IR302-FQ33-S	✓	—	1×RS232	North America (LTE CAT1), no Wi-Fi
IR302-FQ33-IO	✓	—	2×IO	North America (LTE CAT1), no Wi-Fi
IR302-FQ88-WLAN-S	✓	✓	1×RS232	Japan (LTE CAT4)
IR302-FQ88-S	✓	—	1×RS232	Japan (LTE CAT4), no Wi-Fi
IR302-EN00-WLAN	—	✓	—	No cellular module, Ethernet + Wi-Fi only
IR302-FQ68-WLAN-S	✓	✓	1×RS232	Latin America (LTE CAT4)
IR302-FQ68-S	✓	—	1×RS232	Latin America (LTE CAT4), no Wi-Fi

8.3 Accessories List (Per Unit Standard)

Accessory Name	Quantity	Remarks
IR302 Host	1 unit	—
12V DC Power Adapter	1 pc	With 2PIN 3.5 mm pitch industrial terminal
Mounting Ears	1 pair	Wall mounting kit
Network Cable	1 pc	1.5 m

Accessory Name	Quantity	Remarks
4G Suction Cup Antenna	1 pc / 2 pcs	FQ33, FQ38 series models come with 2 pcs, others with 1 pc (cellular-equipped products only)
Wi-Fi Suction Cup Antenna	1 pc	WLAN models only
Product Warranty Card	1 pc	1 year warranty
Certificate of Conformity	1 pc	—

8.4 Optional Accessories

- DIN rail mounting kit (1 set)
- RS232 serial cable
- Wall mounting bracket
- High-gain 4G/Wi-Fi antenna (extension cable 3m/5m/10m)

9. Reliability Standards and Certifications

9.1 Environmental Adaptability

Item	Parameter
Operating Temperature	Normal:-35°C to 70°C，Extended:-40°C to 75°C
Storage Temperature	-40°C ~ +85°C
Operating Humidity	5% ~ 95% RH (non-condensing)
Storage Humidity	5% ~ 95% RH (non-condensing)
Protection Rating	IP30
Altitude	≤ 5000 m

9.2 Power and Protection

Item	Parameter
Input Voltage	9 ~ 36V DC (typical 12V/24V)
Input Current	Typical 0.2A@12V, peak 0.8A@12V
Reverse Polarity Protection	Supported

Item	Parameter
Surge Protection	Power port: IEC 61000-4-5 standard, common mode 2kV, differential mode 1kV
ESD Protection	Contact discharge 4kV, air discharge 8kV (IEC 61000-4-2)

9.3 EMC and Safety Certifications

Certification/Standard	Status/Level
CE	Compliant with EU EMC Directive 2014/30/EU, RED Directive 2014/53/EU
FCC	Compliant with FCC Part 15/Part 22/Part 24/Part 27
RoHS	Compliant with EU RoHS 2.0 Directive
WEEE	Compliant with EU WEEE Directive
EMC	IEC 61000-4-2 (Electrostatic Discharge) IEC 61000-4-3 (RF Electromagnetic Field Immunity) IEC 61000-4-4 (Electrical Fast Transient/Burst) IEC 61000-4-5 (Surge Immunity) IEC 61000-4-6 (RF Field Induced Conducted Disturbance Immunity) IEC 61000-4-8 (Power Frequency Magnetic Field Immunity)
Safety	UL/cUL, CB (IEC 62368-1)

9.4 Reliability Indicators

Item	Indicator
MTBF	≥ 100,000 hours (Telcordia SR-332 standard, 25°C environment)

Item	Indicator
Warranty Period	3 years

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