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Innovative Transportation Solutions

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INNOVATIVE TRAFFIC MANAGEMENT SOLUTIONS

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for Best V2X Experience

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YUNEX TRAFFIC

ROADSIDE UNIT 2X
High Performance Edge Computing
for Best V2X Experience

The New Best in Vehicle2x Communication

The Yunex Traffic RSU2X is the communication and application hub between roadside infrastructure and Onboard Units (OBUs). The bidirectional communication via the RSU enables both the transmission of information such as speed limits and the reception of onboard unit messages in real time. The RSU2X provides key data for a precise picture of the traffic situation, enabling more efficient traffic control, a significant reduction in accident numbers and reduction in emissions.
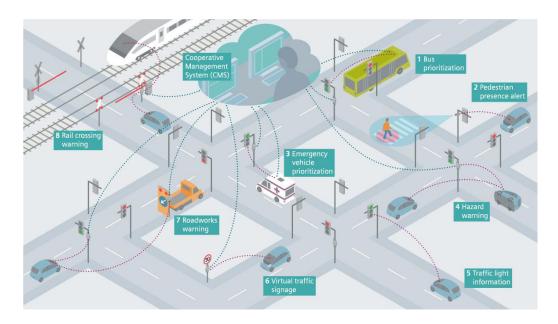
High Level of Security

The RSU2X has been developed according to the Product and Solution Security process with regular threat and risk analyses and hardening measures. These include secure passwords, secure boot, as well as the use of encrypted and authenticated TLS interfaces to protect your network infrastructure. The unit is additionally protected with a tamper response mechanism, a Hardware Security Module (HSM) and a TPM chip for secure storage of private keys.

Superior Performance and Ease of Use

It is designed for best-in-class performance in every aspect. The RSU2X provides dual-radio, dual-stack technology and can be used in 802.111p/DSRC as well as in C-V2X (3GPP Rel. 14/15) environments, making it a flexible and future proof choice. It is powered via Power-Over-Ethernet. All antennas are fully integrated inside the weatherproof housing and custom designed for maximum radio coverage of up to 2500m. The quad core processor in combination with the powerful radio modules ensures superior edge-computing performance even in high traffic load scenarios with up 4000 message verifications and 130 message signature operations per second. For maximum connectivity the unit features various additional communication interfaces like Ethernet, RS485, USB, LTE, Wi-Fi and Bluetooth 5.0. All necessary interfaces and connectors are easily accessible directly or via a service hatch.

Eight use cases for perfect Vehicle2X communication

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YUNEX TRAFFIC

ROADSIDE UNIT 2X
High Performance Edge Computing for Best V2X Experience

Key Features

- Dual-Mode with support for DSRC/802.11p as well as C-V2X
- Fully integrated antennas custom designed for maximum range (up to 2500m)
- Optional external antenna connectors for remote antenna setups
- Superior performance with up to 4000 message verifications per sec & 130 message signatures per sec
- Ruggedized enclosure IP67/NEMA6P enclosure suitable for harsh environment
- High security level with tamper response and secure key storage
- Browser based service interface for easy configuration, diagnosis, and remote software update
- LTE cellular radio for long distance backhaul communication
- Supports all global V2X standards
- Service hatch

Technical Details

- 5.9 GHz Dual-Radio: 1 x IEEE 802.11p / C-V2X (3GPP Rel. 14/15), 1 x IEEE 802.11p
- Receiver sensitivity of up to -97 dBm (802.11p)
- All antennas integrated with ext. antenna option
- Software stack available for ITS-G5 and WAVE (IEEE 1609)
- Wi-Fi / Bluetooth hotspot for smart devices and travel time applications
- GNSS with 2.0 m CEP position accuracy and WAAS corrections support (GPS, Galileo, GLONASS, Beidou)
- 2 x Ethernet with one Power over Ethernet for power supply
- LTE for cellular backhaul (plan not included)
- Browser based WebGUI for remote diagnosis and configuration
- Sealed weatherproof enclosure and connectors with waterproof service hatch
- ~2500 meter range, open-field, line-of-sight

Security

- Hardware Security Module (HSM) for secure storage of V2X private keys and signature generation
- Trusted platform module (TPM) for secure storage (e.g. for X.509 certificates)
- Tamper response mechanism

CPU/Memory

- Quad core CPU at 1200 MHz for edge computing
- 3 GB DDR RAM
- 16 GB Flash

Performance

- Up to 4000 message verifications per second
- Up 130 message signatures per second

Interfaces

- 1 x 802.11p/C-V2X + 1x 802.11p
- 2 x RJ45 100/1000 MBit Ethernet
- 1 x 802.11 b/g/n Wifi & Bluetooth 5.0 BR/EDR/BLE
- 1 x RS485
- 1 x LTE Cat4
- 1 x internal mPCIe slot for future extension

Mechanics

- Dimensions: 30 H x 28 W x 10 D cm
                   12" H x 11" W x 4" D
- Weight: approx. 3kg / 7 pounds
- RSU2X Shell: Plastics

Environmental

- Operating Temperature: -40 to +85°C
                              -40 to +185°F
- Housing: Sealed, IP66, IP67, NEMA 6P

Power

- Input Power: 48 V PoE+ (802.3at)
- Power consumption: 12 W (typ.)

DENSO HERCULES
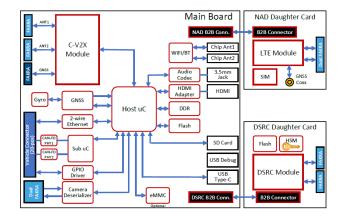
Modular, dual-mode (DSRC and C-V2X) telematics control unit (TCU) designed to support development of V2X-based advanced vehicle safety and mobility features

Hercules is a modular telematics control unit (TCU) designed to support development of advanced vehicle safety and mobility features. DENSO has built on the success of the Wireless Safety Unit (WSU) product line to create Hercules, a highly capable development platform bringing together the latest short-range and wide-area automotive communication technologies.

Hercules includes C-V2X and DSRC radios to enable V2X performance benchmarking and technology transition strategies, plus LTE and Wi-Fi / Bluetooth. Hercules packages these technologies together to promote development of advanced features including platooning, sensor sharing, high-definition maps, and video streaming.

The Hercules electrical architecture and mechanical design is flexible to support future modem devices (ex. 5G) by using plug-in daughter cards that can be upgraded without changing the system core. While Hercules is considered a development platform for research, automotive components and connectors ensure reliable operation for extended field trials.
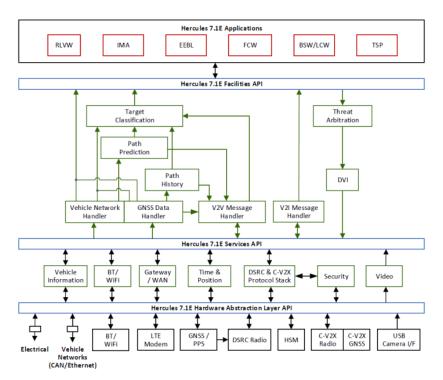
To protect against cyber-attacks, Hercules uses the latest generation V2X hardware security module for tamper resistant key storage. A high performance GNSS positioning solution with dead reckoning is capable of supporting lane level target classification up to 20Hz.

DENSO has invested over a decade in research developing a standards compliant V2X communication protocol stack and associated connected vehicle applications for use with C-V2X or DSRC. DENSO has also developed a full complement of V2X modeling and test tools to validate designs and reduce time to market.

V2X is enabled by Cellular-V2X (C-V2X) and Dedicated Short Range Communications (DSRC) designed for short-range (~1000m) ad-hoc communication. V2X leverages 75MHz of licensed spectrum at 5.9GHz reserved for Intelligent Transportation Systems (ITS). ITS applications supporting safety-of-life demand a reliable, low-latency communication medium. V2X addresses shortcomings of many automotive safety sensor technologies by providing true 360 degree situational awareness at low cost, even in harsh multi-path and non-line-of-sight environments.

DENSO HERCULES

Key Features

- Modular design with plug-in daughter cards
- Supports US (IEEE, SAE) V2X protocols
- V2X Application Suite
- V2X Facilities Software (SAE protocols)
- V2X Services API (CAN, GNSS, V2X Radio)
- Quad-core ARM Automotive System On-Chip
- LPDDR4 SDRAM
- NOR Flash
- eMMC / SD Card (Bootable)
- GNSS w/ multi-constellation support and dead reckoning
- C-V2X Radio
- DSRC Radio
- 4G LTE Modem
- 802.11ac Wi-Fi + Bluetooth 4.1 (Future Capabilities)
- V2X Hardware Security Module (HSM) (x2)
- 2-wire Ethernet
- CAN-FD w/ wake-up (x2)
- USB Camera Support
- USB-C
- USB Debug
- HDMI Output
- Audio Output / Mic Input
- HMI Driver Output (x3)

Safety Applications

- Red light violation warning (RLVW)
- Intersection Movement Assist (IMA)
- Emergency Electronic Brake Lights (EEBL)
- Forward Collision Warning (FCW)
- Blind Spot /Lane Change Warning (BSW/LCW)
- Transit Signal Priority (TSP)

Specifications

V2X Standard Conformance
- IEEE 802.11 – 2012
- IEEE 1609 – 2016
- SAE J2735 – 2016
- 3GPP R14 (PC5 C-V2X)
- SAE J2945/1 – 2016

Frequency Band
- C-V2X/DSRC: 5.9GHz ITS
- WiFi/BT: 2.4GHz / 5GHz
- LTE: 2/4/5/7/12/13/17/29
- GNSS: L1 C/A, L1OF, B1, B1I, E1/BC

Bandwidth
- C-V2X (20 MHz)/DSRC (10MHz)

Data Rate
- DSRC: 3 – 27 Mbps (10 MHz)
- WiFi/BT: 300Mbps / 24Mbps
- LTE: 600Mbps DL / 50Mbps UL

Antenna Diversity
- C-V2X: RX-MRC
- DSRC: TX-CDD, RX-MRC
- WiFi/BT: 2x2 MIMO
- LTE: 2x2 MIMO

Max Transmit Power
- C-V2X/DSRC: +23dBm
- WiFi: +15dBm
- LTE: +23dBm

Receiver Sensitivity (w/ diversity)
- C-V2X: -96.5 dBm
- DSRC: -95 dBm

GNSS
- 2.0m CEP (10Hz with Dead Reckoning)

V2X Security
- 15 year key storage
- FIPS 140-2 Hardware Security Module

Operating System
- Linux

Operating Temperature Range
- LTE: -30°C to +70°C
- All other systems: -30°C - 85°C

Dimensions
- 160mm x 138mm x 50mm (W x D x H)

Power Supply
- 12V / 24V (< 22 Watts)

Vehicle Harness
- Extended vehicle wire harness (~25')

Hercules Kit (optional)

DENSO can supply Hercules as a kit, with the following accessories
1. Integrated V2X and GNSS Antennas with 10' RF Cables
2. LTE Antenna with 10' Low Loss Cable

Advanced Traffic Controller

Next generation traffic control platform – at your fingertips today

YUTRAFFIC Blade

High Performance IoT Field Device

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YUTRAFFIC Blade
High Performance IoT Field Device

YUTRAFFIC Blade
Edge Capable Advanced Traffic Controller

New Design

Next Generation Traffic Control

YUTRAFFIC Blade is a next generation traffic controller with advanced edge/IoT capabilities. It is designed to receive sensor data from various sources such as cameras, radar sensors, and in-ground loop detectors for real-time intersection control.

The YUTRAFFIC Blade serves as an edge processing platform able to store and analyze large data sets directly on the device and utilize AI-based algorithms to improve traffic control.

YUTRAFFIC Blade supports all common cabinet types and can be configured individually according to the specific customer requirements in terms of interfaces and capabilities.

High Level of Security

The YUTRAFFIC Blade has been designed with IT Security in mind from day one, and responds to growing needs around critical infrastructure and Zero Trust environments. The YUTRAFFIC Blade supports a wide range of security features to implement state-of-the-art level of protection and can be configured to utilize the security capabilities that your agency currently has, as well as capabilities for future requirements. Account management functionality provides single user role-based sign-in, allowing for complete change traceability from operational and cybersecurity areas.

Ease of Use and Predictive Maintenance

This advanced edge device provides a modern user experience with a full color touch screen, web user interface, and optimized workflows. The YUTRAFFIC Blade can be upgraded remotely, saving agencies time and money, and provides detailed device health data for diagnostics and maintenance. With the ability to deploy additional features overtime, you are future-proofing your traffic platform for today and tomorrow's needs.

The redundant hot-swappable power supply means zero downtime to replace a failed unit. The YUTRAFFIC Blade has been designed and tested for high MTBF in harsh environmental conditions, from the system architecture to the component selection, making it extremely durable and reliable.

Closed View

YUTRAFFIC Blade
High Performance IoT Field Device

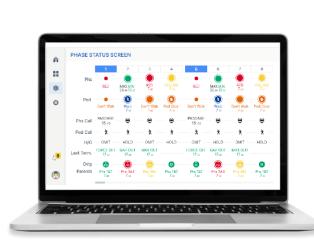## YUTRAFFIC Blade

Full Color Touchscreen Display

Device Settings

Detector Status

Message Center

With broswer-based WebGUI that allows access from remote devices

Phase Status

SEPAC

Event Log

YUTRAFFIC Blade Controller Series Features

Key Features

- Experience versatility with a Slim 2U enclosure for both rack and shelf mount versions.

- Enhanced UX and optimized workflows for ease of use.

- Powerful Quad-Core ARM Co-Processor to compliment PowerPC Engine Board.

- Enhanced communication options including 4-port managed switch, Wi-Fi Access Point, LTE/5G modem, and Power-over Ethernet.

- Direct GNSS connection.

- Easily configure, diagnose and remotely update with the browser-based user interface.

- Ready for 48 VDC cabinets.

- High security level with authentication and security updates, secure boot, firewall and VPN support.

- Supports all ATC and NEMA standards.

- 7-inch full color touch display for superior user experience.

Technical Details

- Configurations for NEMA TS1/TS2, ATC and 33X cabinets

- Engine board with Linux 4.4 with Super Longterm support for running SEPAC

- Compatible with NEMA, ATC 5201 v06, NTCIP 1202 and NTCIP 1211 standards

- Wi-Fi / Bluetooth hotspot for smart devices and travel time applications

- GNSS with 2.0 m CEP position accuracy and WAAS corrections support (GPS, Galileo, GLONASS, Beidou)

- 4 x Ethernet with 4 port Ethernet switch

- Browser-based WebGUI for remote diagnosis and configuration

- Optional built in PoE injector

Security

- Compliant with CTIA Cybersecurity Certification

- Integrated Advanced Security, Safety and Reliability

CPU / Memory

- Quad core CPU at 1.6 GHz for edge computing

- 4GB DDR RAM

- 32GB Flash

Interfaces

- NEMA TS1 A, B, C, D connectors

- NEMA TS2 Port 1 connector

- 4x 10x100/1000BASE-T Ethernet ports

- Optional 1 x 802.11 b/g/n Wi-Fi & Bluetooth 5.0 BR/EDR/BLE

- Optional legacy GPS, RS-232, FSK

- Optional 4-port managed 10/100 1000BASE-T switch

- 1 x internal mPCIe slot for future extension

Mechanics

- Dimensions: 3.5" H x 17.3" W x 11.5" D

- Weight: 15 lbs.

Environmental

- Operating Temperature: -34 to +74°C

Power

- Input: 110/220 VAC

- Power consumption: 45 W

- Optional advanced feature: redundant power supply

YUNEX TRAFFIC M62 ADVANCED TRAFFIC CONTROLLER (ATC)
Creating Smart, Safe and Innovative Intersections

Overview

The Yunex Traffic m62 controller combines the state-of-the-art SEPAC traffic controller software with the reliable and proven m50 hardware architecture with the Linux platform. This combination of robust hardware and innovative software gives you better control of your intersections. Yunex Traffic has made the m62 ATC a feature-rich traffic signal controller along with the robust performance required to meet ever-changing traffic demands for agencies of all sizes.

Key Features

OS Powerful and easy to use Linux operating system

Operates in both TS-2 Type 1 and 2 traffic signal cabinets

64MB DRAM, 512MB FLASH, 2MB SRAM

Exceeds ATC (Advanced Traffic Controller) 5.2 standard compliance

Surpasses NEMA (National Electrical Manufactures Association) TS-2 requirements

Multiview LCD display allows for easy configuration while viewing status windows

YUNEX TRAFFIC M62 ADVANCED TRAFFIC CONTROLLER (ATC)
Creating Smart, Safe and Innovative Intersections

All Features

- Linux operating system
- Operates in both TS-2-Type 1 and 2 cabinets
- 64MB DRAM, 512MB FLASH, 2MB SRAM
- Five RJ-45 Ethernet connectors
- 4 Port USB hubs
- Active TFT backlit LCD display
- Yunex Traffic Multiview Display technology designed for the everyday user in mind
- m50 USB upgrade package available
- Compatible with SEPAC traffic controller software

ATC Variant

- Exceeds ATC 5.2 standard compliance
- Modular ATC communications hub
- m62 ATC upgrade package available

NEMA Variant

- Exceeds NEMA TS-2 requirements
- m62 NEMA upgrade package available

Central Processor Unit (CPU)

- Open architecture platform with standard Linux operating system
- MPC 8270 266MHz processor
- 512MB FLASH, 64MB DRAM and 2MB SRAM
- TOD Clock with automatic daylight savings time adjustment
- Power supply will power the SRAM during power failures
    - Supports SEPAC controller software
    - SD memory card
    - Operating System: Linux 2.6.39

Keyboard and Display

- Yunex Traffic Multiview Display with dual view screens
    - 5 1/8 inch active TFT display
    - Easily removable display and keypad
    - Easily identifiable, discrete HELP button
    - Real-time context sensitive HELP screens
    - User programmable function buttons F1 to F5
- Removable LED backlit LCD with 16 lines of 40 characters with adjustable contrast
- Emulation of terminal per Joint NEMA/AASHTO/ITE Standard
- Key quantity and function per Joint NEMA/AASHTO/ITE Standard

m62 Communications Module

- 10 Base-T Ethernet with built-in switch and 4 front panel RJ-45 connectors
    - ENET1 and ENET2 network switches
    - 5 10/100 TCP/IP ports
- 4 USB 2.0 Ports and a Datakey Port
- Dedicated GPS - SP8 Port (9pin EIA-574)
- Unique MAC address assigned by the Institute of Electrical and Electronic Engineers (IEEE)

Controller Housing

- 7 slots with card guides for standard size Versa Modules
- 2 slots with card guides for standard Joint NEMA/AASHTO. ITE ATC modems (optional) or ATC Communication Module or USB Plate
- Polycarbonate construction (excluding back panel), rear mounting tabs and aluminum power supply mounting plate for electrical grounding
- Carrying handle

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YUNEX TRAFFIC

Software/Firmware/User Interface

Keep traffic flowing. Advanced Traffic Management Solution for even the most complex intersections

SEPAC LOCAL CONTROLLER SOFTWARE
Creating Smart, Safe and Innovative Intersections

Overview

SEPAC offers exciting state-of-the-art traffic control features, including support for connected vehicles, priority for multimodal transportation and the ability to create a local adaptive peer-to-peer network. The software is user-friendly, accommodating a large variety of traffic control requirements by providing extensive configuration flexibility and full compatibility with m60 and CalTrans 2070 style traffic controllers.

Benefits

Peer-To-Peer Traffic Communications
Using the peer-to-peer communications module of SEPAC and existing on-street detection you can identify platoons of vehicles traveling through a network of interconnected signalized intersections. Combine this with the industry-leading priority routines within SEPAC and the identified platoon can be prioritized by applying phase reductions or green time extensions.

Traffic Priority
The Yunex Traffic SEPAC software has a powerful traffic signal priority mechanism that enables mobility, safety and a better environment to improve the quality of life in cities by enhancing performance of traffic signal control for a number of transportation channels such as Light Rail Transit (LRT) and Bus Rapid Transit (BRT) with minimal impact on pedestrian and vehicle traffic.

Adaptive Traffic Control
SEPAC can be integrated with SCOOT adaptive traffic control, helping to manage traffic conditions in real-time by optimizing the signal timing at intersections. It also supports powerful peer-to-peer functionality for a local adaptive solution.

Key Features

- Support for Vehicle-to-Infrastructure (V2I) Signal Phase and Timing (SPaT) data for DSRC-enabled connected vehicles.

- Ability to link multiple intersections to create a local adaptive green wave that enhances traffic flow.

- Rich sets of logging, diagnostics and reporting capabilities available for troubleshooting and data analysis.

- Ability to export/import intersection configuration and remotely upload software using the Yunex Traffic TACTICS™ 5.

SEPAC LOCAL CONTROLLER SOFTWARE

Creating Smart, Safe and Innovative Intersections

Phases

- 16 vehicle phases
- 8 pedestrian phases
- 4 phase timing banks
- 4 timing rings
- 15 alternate sequences
- 16 overlaps

Coordination

- 6 modes of coordination
- Locally based traffic responsive routines
- 253 unique signal timing patterns
- 255 actions for mapping patterns (including FREE and FLASH)
- 255 actions to day plans maps
- 255 day plan to schedules maps
- 8 special function maps
- 16 phase function maps
- 3 diagnostic auxiliary functions

Detection

- 64 vehicle detectors
- 8 pedestrian detectors1)
- 8 system detectors1)
- Interface for Sensys Network's Ethernet Access Points for magnetometers
- Interface to Iteris Vantage Vector™ video and radar detectors
- Interface to traffic priority detectors such as Opticom's GTT, EMTRAC and E-Views

Communications and Interfaces

- Supports Yunex Traffic SCOOT Communication Server interface via Ethernet
- IP, serial and FSK communications to TACTICS™
- IP standard on "m60" and 2070 series controllers 1-B, 1-C and 1-E cards (2009 TEES)
- Peer-to-peer communications
- Dual support of ECOM and NTCIP communications within a single software instance
- USB memory sticks and DataKey interfaces

Peer-to-Peer

- 16 IP configured peer addresses
- 34 source functions from connected peers
- 18 input functions for storing peer information

Pre-emption

- 12 pre-empts
- Return to coordination after pre-empt
- Safe flashing yellow arrow operation with pre-empt eliminating yellow trap conditions

Priority

- 6 priority routines for buses and light rail
- 4 priority banks with unique timing
- Allows for: 19 vehicles tracked simultaneously
- Tracks vehicles at any distance from intersection using up to 6 inbound detectors and one exit detector
- Allows for seamless operation between transit and vehicle traffic coordination
- Adjusts splits, skips phases when necessary, and adjusts lead/lag in order to make the transitions between normal operation and priority service more fluid

Miscellaneous

- 4 system data banks for traffic responsive data
- Bicycle minimum green and passage timing
- Advanced and delayed WALK operations
- Advance warning flasher functions
- 16 SPaT IP addresses for Vehicle-to-Infrastructure operations
- Logging and diagnostics, including cycling, coordination, pre-emption, detection, outputs, alarms and communications information
- Anti-backup (yellow trap avoidance)
- Password protection
- Collision avoidance routines (Red Protect)
- External back-up facilities using USB or DataKey for use with TACTICS™ 5
- Help screens
- Illinois Rail Road security available
- International timing
- Extensive reporting capabilities

Hardware

- Linux operating system
- Meets NEMA or CalTrans specifications
- Meets NTCIP specifications for traffic signal control
- Supported cabinet types include ATC, TS-1, TS-2 Type 1, TS-2 Type 2, CalTrans 332 style, ITS and CBD

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YUNEX TRAFFIC
A Siemens Business

TACTICS CENTRAL MANAGEMENT SYSTEM
Easily Manage your Community's Traffic Network

Overview

TACTICS brings best in class features and innovative technology for advanced traffic management, helping communities create safer and more efficient intersections and roadways. It is a modular, full-featured traffic control system that complies with industry standards to deliver a reliable, powerful and easy to use system. With its robust reporting and management features, all through an intuitive interface, you can better manage your traffic network.

Benefits

Detailed Monitoring & Alert Notifications
With an intuitive interface, TACTICS provides summarized system dashboards in addition to detailed traffic intersection information (phase status, splits, termination reasons and more).

Automated Traffic Control
TACTICS allows for the creation and management of triggers and actions for pre-defined events – helping you to manage planned and unforeseen situations better.

Easy Installation
TACTICS can be installed and upgraded onto servers, workstations and standalone systems with just a few clicks.

Seamless Integration with SEPAC
The system is backwards compatible with older versions of SEPAC and offers full support to the latest Yunex Traffic SEPAC 5 traffic controller software.

Controller Support
TACTICS can be used to monitor and manage controller software, including SEPAC and SEMARC. Additionally, it supports NTCIP equipment.

Key Features

Manage on-street traffic equipment through a single user interface.

Monitor the overall system status through a summary dashboard.

Configure devices and download controller software remotely.

Quickly manage intersections using a map view.

Easily search and quickly filter information throughout the system.

TACTICS CENTRAL MANAGEMENT SYSTEM
Easily Manage your Community's Traffic Network

Additional Features

- Built-in real-time traffic response to identify volume and occupancy data to help select predefined timing plans.

- Changes to enhance NTCIP v1202 compliance by adding support for patterns, sequences, 255 day plans and removal of dial/split data.

- Supports a new data human-readable format (using YAML) for controller configuration data.

- Introduces functionality to import controller configuration data, including NTCIP-related OIDs, from SEPAC into TACTICS.

- Introduces functionality to export system configuration data from TACTICS into a USB data stick to be imported and used with SEPAC 5 or later.

- Offers ability to convert existing controller data into the new YAML data format supported by SEPAC 5 and later versions, allowing SEPAC 5, newer and older versions to co-exist as part of the same system.

Available Modules

TACTICS View
Designed for portable use, ideal for consultants and engineers who wish to manage intersection data and edit the controller database.

TACTICS Central
Full signal control and traffic management features ideal for smaller cities or areas with a limited number of intersections.

TACTICS SmartGuard
Web-based traffic management solution that allows remote system management from any Internet-connected browser.

TACTICS MARC
A closed-loop for field masters using SEMARC controller software that connects masters on the street for uploads/downloads with simple analysis and map displays.
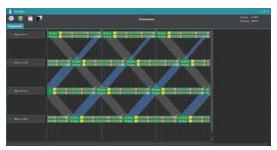
TACTICS Enterprise
Full signal control and traffic management features plus advanced functionality such as quick response, perfect for larger volumes of traffic equipment.

Home Page View   **Split Monitor View**   **Time Space View**

Signal Performance Measurements/Adaptive/Integrated Corridor Management

Manage traffic intelligently and in real time

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Yutraffic Insights
More than your typical Signal
Perfomance Measure (SPM) tool

The mobility revolution is ongoing, and cities need to react

It is time for smart mobility infrastructure, more CO2 reduction, and safer, more livable cities. We are meeting our responsibility with the most comprehensive end-to-end portfolio of traffic management solutions on the market.

Yutraffic Insights empowers agencies and industry professionals to effortlessly manage and improve the efficiency of their intersections by gaining actual insights to their data, not just viewing data reports.

Yutraffic Insights
More than your typical Signal
Perfomance Measure (SPM) tool
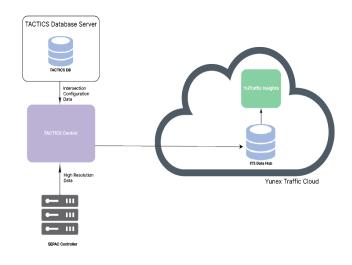
What is Yutraffic Insights?

Yunex Traffic's newest product family, Yutraffic, now includes Yutraffic Insights, a cloud-based platform that empowers traffic agencies and industry professionals alike to effortlessly manage and improve the efficiency of their intersections, with no additional setup required. Designed to be more than the typical Signal Performance Measures (SPM) tool, Yutraffic Insights offers advanced analytics, alarm customization and management, and automatic data transfer from TACTICS™, enabling traffic professionals to optimize their intersections with utmost ease when sudden or expected disruptions occur.

More than your typical SPM

From alarm management and customization, to advanced analytics and automatic and instantaneous data transfer, Yutraffic Insights makes intersection management simple. Its seamless integration with Yunex Traffic's Advanced Traffic Management System, TACTICS, allows users to access Yutraffic Insights without ever having to leave the TACTICS platform itself. Yutraffic Insights' interactive Dashboard highlights key problem areas, such as intersections with open alarms, making it easy for traffic professionals to prioritize their time.

Optimization

Yutraffic Insights uses Artificial Intelligence and Machine Learning to predict the most optimized intersection configuration by analyzing historic data. Yutraffic Insights can help optimize configuration settings such as Offset Times, Split Times, Cycle Lengths, and Day Plan Schedules.

Features and Benefits

- Automatic and instantaneous data transfer from controllers and TACTICS to Yutraffic Insights
- Seamless integration with TACTICS. Access Yutraffic Insights directly from your TACTICS platform or an internet browser
- Access intersection data anywhere, anytime via the cloud
- Build and subscribe to customized alarms with the Intuitive Alarm Logic Builder ms
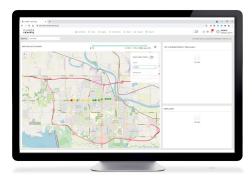
Yutraffic Insights

Yutraffic Insights Dashboard

Yutraffic Insights' Dashboard provides traffic professionals with a quick overview on problem intersections

- Heat map provides users with a quick overview of problem intersections
- Display top 10 intersections with most alarms
- Make metric management easy with customized controls and thresholds

Yutraffic Insights Alarm Management

Not every city or municipality is the same. So why should we have to use the same alarms? Yutraffic Insights was designed with each user in mind. It's intuitive Alarm Logic builder allows each city to create customized alarms and alarm categories based off of each city's respective needs.

- Create customized alarms with the Intuitive Alarm Logic Builder
- Manage metrics with customizable alarm categories such as "Pedestrian" and "Safety"
- Direct access to analytics with one click
- Subscribe to and forward alarms
- View all triggered alarms

Yutraffic Insights Analytics

To facilitate data analytics, Yutraffic Insights has a user-friendly design that allows technical and non-technical users alike to pull, manipulate, analyze and share data with just a few clicks.

- High resolution data automatically uploaded from TACTICS
- Easily compare data across different days, hours and phases
- Export and share analysis with one click
- Use as metric to gauge coordination and time performance
- View performance metrics of intersections such as Split Failures, Approach Delay, and Coordination Health
- Summaries of how traffic plans are performing

Product	Part Number
Yutraffic Insights: Set-up	TYZ:INSIGHT_SETUP
Yutraffic Insights: Subscription	TYZ:RCM_INSIGHT

SCOOT ADAPTIVE TRAFFIC CONTROL
Manage your Community's Traffic in Real-Time

Overview

As the volume of traffic on highways and roadways continues to grow, the effect it has on communities is an ever-increasing problem. Yunex Traffic SCOOT is a dynamic, real-time adaptive that continuously measures traffic demand in a network and optimizes the signal timings at each intersection to minimize delays and stops. By making calculated adjustments, SCOOT helps to avoid significant disruption to traffic flows while allowing rapid response to ever-changing conditions.

Benefits

Proven to Optimize Traffic
SCOOT has been proven effective in over 100 communities around the world by reducing traffic delays by 20% or more.

Increase Road Safety
By improving traffic, SCOOT reduces the number of stops and delays, which can lead to a reduced probability of rear-end collisions.

Protect Pedestrians
SCOOT recalculates intersections to support and protect pedestrians in a variety of situations.

Supports Public Transit
SCOOT's algorithm improves bus progression by implementing phased reductions and extensions as well as exclusive transit phases so that buses are more likely to arrive at stops and stations on schedule.

Key Features

Respond in real-time to varying traffic flow conditions such as sporting events and incidents.

Suitable for implementation on all types of urban roads, grids, corridors, and arteries.

Easy-to-use window style graphical user interfaces.

Can be added to existing urban or freeway traffic management systems or provided as part of a complete traffic management system.

Western Systems

YUNEX TRAFFIC

Sitraffic Symphony
The next generation traffic management platform

The mobility revolution is ongoing, and cities need to react

It is time for smart mobility infrastructure, more CO2 reduction, and safer, more livable cities. We are meeting our responsibility with the most comprehensive end-to-end portfolio of traffic management solutions on the market.

Our new software platform Sitraffic Symphony enables cities to solve their individual traffic challenges. Ensure safety of all road users, limit the impact on the environment and increase your city's quality of life.

Sitraffic Symphony
The next generation traffic management platform

Western Systems

YUNEX TRAFFIC

Mobility is a key factor for livable cities

Traffic within and between cities is growing - and with it the challenges for traffic management. How can the capacity of the road be used in such a way that traffic jams and accidents are avoided? How can urban traffic be made more climate and environmentally friendly? And how can this be reconciled with the basic need for mobility?

Legacy traffic management systems have been limited to a given set of functions with limited capabilities to flexibly address modern mobility challenges. New emerging transportation modes, providers and data sources translate to the direct need for cities to extend their traffic management systems. At the same time, the rise of cyber threats demands secure and always up-to-date systems. Operators also need flexible workflows and user centric UIs to be able to combat critical incidents on the road. Given the disruptive and constantly evolving mobility landscape, modern traffic management needs to address multiple challenges simultaneously:

- Staying ahead of congestion and proactively act when sudden or expected disruptions occur.

- Keeping pollutant emissions constantly under control and below acceptable thresholds.

- Coordinating the complex urban mobility landscape with multiple operators in a multimodal environment to ensure quick incident responses and safety for all road users.

- Designing, bringing to life, and executing innovative solutions that built on the operator's expertise and ingenuity.

Modern cities need flexible traffic management systems, that can grow with their requirements and challenges. With our advanced traffic management solutions, you can address all aspects of urban mobility.

Western Systems
YUNEX TRAFFIC

The next generation traffic management platform:
Sitraffic Symphony

We have reimagined traffic management and build Sitraffic Symphony to not only excel at what we know best, but to adapt, grow, and transcend boundaries with our customers. From day one, Sitraffic Symphony offers your city the following key benefits:

Built for today and tomorrow
Sitraffic Symphony has been developed to meet current and future mobility challenges by continuously expanding our range of existing applications together with our customers.

Cloud and on-premises
Choose whether your Sitraffic Symphony system is hosted on-premises in your custody or in the cloud as worry-free full-service package.

Easy to use
A modern user interface for fast yet flexible workflows, even in time-critical situations. The design and processes are based on our experience with more than 600 traffic management customers worldwide.

Open and secure
Built on state-of-the-art technology for secure development, deployment, and operations. Easily integrate external data sources, share data, and enable 3rd party app development.

Modular and flexible
A wide range of mobility applications for every traffic management use case that grow with your city's needs.

Western Systems

YUNEX TRAFFIC

Sitraffic Symphony
The next generation traffic management platform

Open and versatile – exactly like your city

From urban traffic control to multimodal traffic management: Sitraffic Symphony enables a wide range of use cases in and between cities of all sizes. Simple tasks such as monitoring field devices, but also complex solutions such as traffic management involving environmental data, simulations or even networked vehicles are possible. Intelligent technologies make it possible to take all important aspects of mobility into account today - especially about increasing traffic demand and a multitude of modes of transport.

Sitraffic Symphony's modular system architecture makes it possible to develop solutions for a wide variety of tasks and areas, which can be easily scaled to meet the growing demands of modern traffic management.
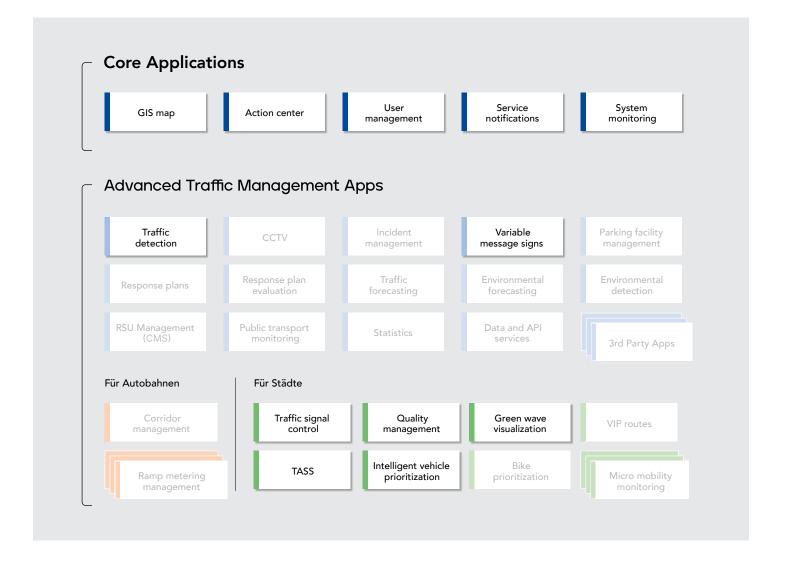
Urban Traffic Control

Monitor, control and optimize traffic light systems in real time.

With Sitraffic Symphony, you can control the traffic lights in your transport infrastructure dynamically, as required. Define dynamic thresholds to adapt your traffic light control to the current traffic volume in real time. Inform maintenance and service teams and transmit the status of the affected field devices. Sitraffic Symphony supports you with intuitive dashboards and diagrams, so that you can always keep an eye on the status of your traffic lights – including information on functions such as green wave, circuit diagrams and priority circuits for public transport.
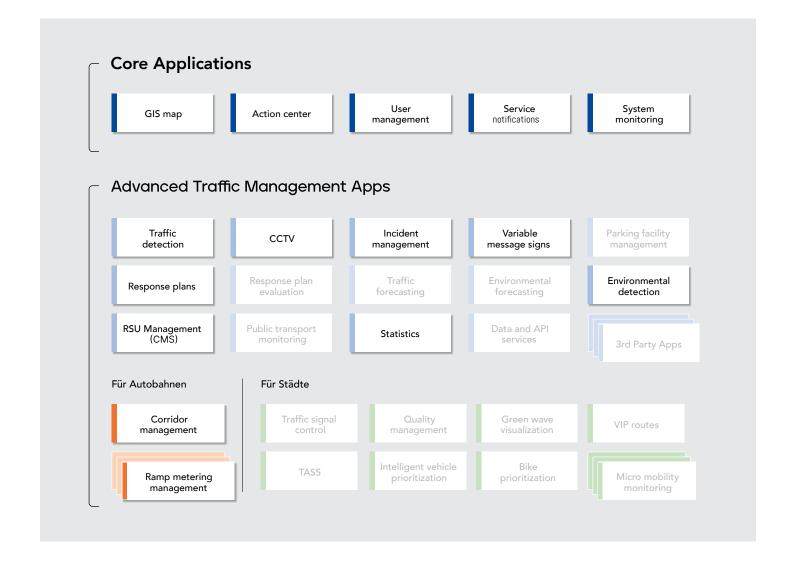
Core Applications

GIS map	Action center	User management	Service notifications	System monitoring

Advanced Traffic Management Apps

Traffic detection	CCTV	Incident management	Variable message signs	Parking facility management
Response plans	Response plan evaluation	Traffic forecasting	Environmental forecasting	Environmental detection
RSU Management (CMS)	Public transport monitoring	Statistics	Data and API services	3rd Party Apps

Für Autobahnen

Corridor management
Ramp metering management

Für Städte

Traffic signal control	Quality management	Green wave visualization	VIP routes
TASS	Intelligent vehicle prioritization	Bike prioritization	Micro mobility monitoring

Sitraffic Symphony
The next generation traffic management platform

Highway Traffic Management

Maximize freeway capacity with Sitraffic Symphony.

Support smooth traffic flow with dynamic lane signs and ramp metering. With Sitraffic Symphony, the operators benefit from intuitive workflows developed together with our users worldwide. This means that operators have an extensive overview of the entire traffic network and can take action proactively, even in the event of traffic disruptions and extraordinary events.
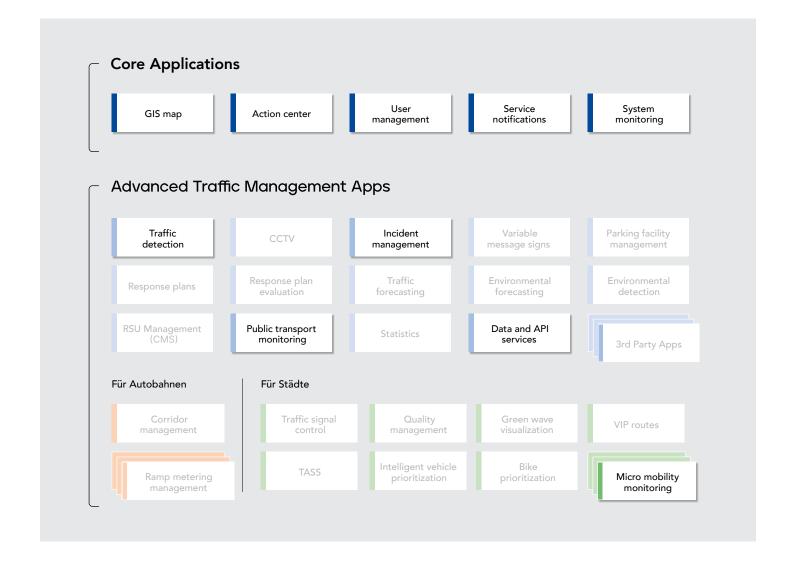
Core Applications

| GIS map | Action center | User management | Service notifications | System monitoring |

Advanced Traffic Management Apps

Traffic detection	CCTV	Incident management	Variable message signs	Parking facility management
Response plans	Response plan evaluation	Traffic forecasting	Environmental forecasting	Environmental detection
RSU Management (CMS)	Public transport monitoring	Statistics	Data and API services	3rd Party Apps

Für Autobahnen

- Corridor management
- Ramp metering management

Für Städte

| Traffic signal control | Quality management | Green wave visualization | VIP routes |
| TASS | Intelligent vehicle prioritization | Bike prioritization | Micro mobility monitoring |

Sitraffic Symphony
The next generation traffic management platform

Western Systems

YUNEX TRAFFIC

Multimodal Traffic Management

Monitor all transport modes and increase collaboration.

Sitraffic Symphony supports multimodal traffic management that includes all modes of transport such as rail, bus and other mobility services (e.g. micro or shared services). Our system acts as a collaborative platform for infrastructure operators and mobility providers combining data from different systems to create a holistic visualization of the current traffic situation, events, road works and incidents. This allows taking proactive measures to improve traffic flow while reducing reaction times to incidents.

Core Applications

GIS map	Action center	User management	Service notifications	System monitoring

Advanced Traffic Management Apps

Traffic detection	CCTV	Incident management	Variable message signs	Parking facility management
Response plans	Response plan evaluation	Traffic forecasting	Environmental forecasting	Environmental detection
RSU Management (CMS)	Public transport monitoring	Statistics	Data and API services	3rd Party Apps

Für Autobahnen

Corridor management
Ramp metering management

Für Städte

Traffic signal control	Quality management	Green wave visualization	VIP routes
TASS	Intelligent vehicle prioritization	Bike prioritization	Micro mobility monitoring

Hamburg drives ahead

Sitraffic Symphony enables many use cases in addition to classic traffic management and traffic light control. Hamburg's operational traffic management consists of many different organizations with their own specialized applications. Communication is partly manual, coordination is complex. For Hamburg's new "Traffic Information Management System" (TIMS), a couple of our Sitraffic Symphony apps are used to facilitate cooperation between different organizations. The web-based application coordinates operations and control centers so that urban traffic management can succeed smoothly, in a resource efficient manner and in real time.

Achieve ambitious goals with Sitraffic Symphony

The city's decision-makers had high expectations of the new solution: it should provide more transparency and simplified information exchange, but also enable shorter incident response times and proactive action. More efficient workflows, better communication and mutual data exchange were also desired.

Collaborative platform, for all relevant city stakeholders

TIMS integrates traffic-relevant data via multiple interfaces and transforms it into a unified, cross-organizational picture of current traffic, including events, road works and incidents. Visualized information on a common map helps traffic operators and managers to quickly identify disruptions and initiate measures.
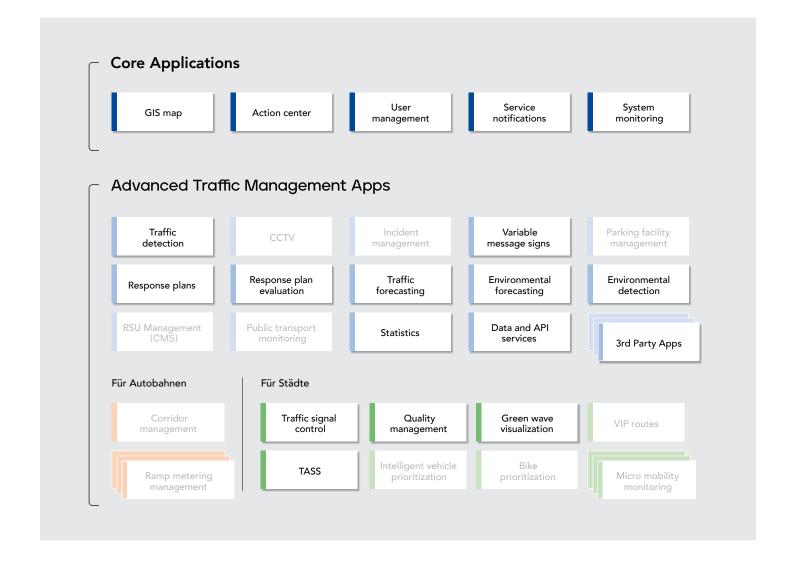
Environmental Traffic Management

Reduce traffic emissions preventively through active traffic management.

With Sitraffic Symphony, cities are able to prevent high immission values and comply with air quality standards at hot spots. This is achieved through immission modeling and forecasting for a comprehensive immission overview, even without physical detectors in the field. Sitraffic Symphony also enables the proactive detection of critical immission situations for effective traffic management in order to avoid limit violations.

Core Applications

| GIS map | Action center | User management | Service notifications | System monitoring |

Advanced Traffic Management Apps

Traffic detection	CCTV	Incident management	Variable message signs	Parking facility management
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Für Autobahnen

| Corridor management |
| Ramp metering management |

Für Städte

| Traffic signal control | Quality management | Green wave visualization | VIP routes |
| TASS | Intelligent vehicle prioritization | Bike prioritization | Micro mobility monitoring |

Sitraffic Symphony
The next generation traffic management platform

Connected Vehicles

Increase road safety with modern V2X technology.

Sitraffic Symphony supports seamless communication with connected vehicles thanks to numerous integrated functionalities. This extends the reach of your traffic management and supports mobility participants with up-to-date data on the traffic situation. Roadside units of different manufacturers can be used to send hazard warnings directly to vehicles and the drivers to decrease response times.

Core Applications

GIS map	Action center	User management	Service notifications	System monitoring

Advanced Traffic Management Apps

Traffic detection	CCTV	Incident management	Variable message signs	Parking facility management
Response plans	Response plan evaluation	Traffic forecasting	Environmental forecasting	Environmental detection
RSU Management (CMS)	Public transport monitoring	Statistics	Data and API services	3rd Party Apps

Für Autobahnen

Corridor management
Ramp metering management

Für Städte

Traffic signal control	Quality management	Green wave visualization	VIP routes
TASS	Intelligent vehicle prioritization	Bike prioritization	Micro mobility monitoring

Western Systems

YUNEX TRAFFIC

Parking Guidance

Reduce parking related traffic and increase efficiency of your parking facilities.
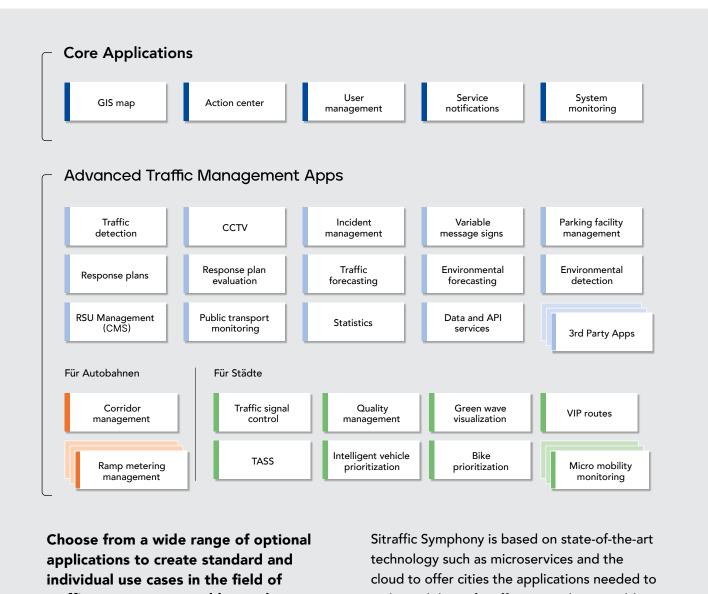
Guide vehicles and drivers to free parking spaces more quickly. Your city benefits twice from this: with less traffic looking for a parking space and better utilization of parking facilites. Monitoring tools and automatic reports help monitoring and managing all connected parking lots and multi-storey car parks creating transparency with real-time information.

Core Applications

GIS map	Action center	User management	Service notifications	System monitoring

Advanced Traffic Management Apps

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Für Autobahnen

Corridor management
Ramp metering management

Für Städte

Traffic signal control	Quality management	Green wave visualization	VIP routes
TASS	Intelligent vehicle prioritization	Bike prioritization	Micro mobility monitoring

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YUNEX TRAFFIC

Tailored to your city

Core Applications

GIS map	Action center	User management	Service notifications	System monitoring

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Für Autobahnen

Corridor management
Ramp metering management

Für Städte

Traffic signal control	Quality management	Green wave visualization	VIP routes
TASS	Intelligent vehicle prioritization	Bike prioritization	Micro mobility monitoring

Choose from a wide range of optional applications to create standard and individual use cases in the field of traffic management and beyond.

Sitraffic Symphony is based on state-of-the-art technology such as microservices and the cloud to offer cities the applications needed to make mobility safe, efficient, and sustainable. All Symphony solutions come with a set of core applications to ensure system usability security.

Western Systems

YUNEX TRAFFIC

Sitraffic Symphony
The next generation traffic management platform

Core applications

GIS map
Every system includes a map that shows ITS devices, traffic data, parking facilities, public transportation lines, incidents, and more. Additional map layers from 3rd party sources can be added to increase the amount of data available to operators. The map also serves as the central access point for visualizing traffic conditions and operating ITS devices, helping operators increase their situational awareness and reduce their workflow times.

Action center
The action center is used to notify operators of critical situations or to request operators to make a decision. The action center can, for example, be used to alert the operator to newly detected incidents. Response plans can also send notifications to operators and allow them to choose between options directly from the notification.

User management
The user management application provides users with access to the system and regulates their ability to view or perform certain actions. Administrators can, for example, limit operators to use devices in only certain parts of the network. Administrators can also check for unauthorized access attempts, set password rules, and integrate identity providers like Active Directory.

Service notifications
The service notifications application is used to send out e-mail, SMS and fax notifications in response to device or system errors. The contents of the service notifications can be defined in advance to include all necessary details needed by maintenance crews or system administrators to respond and troubleshoot quickly.

System monitoring
Administrators can use the system monitoring application to check the health and performance of the overall system. Use this application to track resource usage, network communications, and send out alerts.

Advanced Traffic Management Apps

Sitraffic Symphony offers various optional applications to reflect both classic and innovative traffic management use cases.

Traffic detection
The traffic detection application is used to integrate traffic detectors and collect traffic data. It also processes a range of raw and aggregated data to carry out plausibility checks, provide data visualizations, and, if required, generate replacement values for traffic control.

CCTV
The CCTV application is used to control, monitor, and manage CCTV cameras. An intuitive user interface design allows operators to navigate between, view, and operate multiple CCTV cameras efficiently using workflows optimized for high-stress situations, such as during incident management.

Incident management
Operators can use the incident management application to manage collisions, roadworks, or events. Operators can also track first responders and distribute incident information using SMS, e-mail, and social media posts. The incident management module also supports V2X functionalities natively, allowing operators to forward in-vehicle warnings directly and automatically from the incident management application.

Variable message signs
The variable message signs application is used to control, monitor, and manage a range of signs ranging from prism signs to full-matrix full-color LED displays. This application provides optimized workflows that allow operators to activate signs quickly in the event of an incident or schedule sign group displays in preparation for large stadium events.

Parking facility management
The parking facility management application is used to record parking occupancy data, opening times, and status of different parking facilities to provide efficient parking guidance. Parking information can be used to generate reports and can also be displayed on dedicated parking signs as well as full-matrix variable message signs.

Response plans
The response plans application is used to automate and coordinate ITS device operations based on a variety of inputs, including traffic data, environmental sensor data, time of day, and system statuses. For instance, this power application can be used to automate traffic management for tunnel closures, reroute traffic around events, or reduce vehicle emissions in the city center.

Response plan evaluation
With the response plan evaluation application powered by Aimsun, operators can simulate the effects of traffic management strategies before they are deployed. Operators can define and simulate different scenarios, each containing different response plans, and simulate those scenarios using a calibrated traffic model that also considers real-time data. Using the resulting performance indicators for each scenario, operators can activate the most appropriate scenario and even proactively address critical situations before they occur.

Traffic forecasting
The traffic forecasting application allows the system to forecast traffic conditions in the near future. Operators continuously receive forecasts for the next 15, 30, 45 and 60 minutes and can visualize these forecasts both on the map and as detailed information in individual roadway segments.

Environmental forecasting
The environmental forecasting add-on allows the system to predict air quality in the near future using historical and real-time environmental data, historical and real-time traffic data, as well as forecasted traffic data. Forecasts can be visualized on the map and as detailed measurement values. Air quality forecasts can also be used to evaluate and control response plans.

Environmental detection
The environmental detection application integrates weather and environmental sensors as well as full RWIS (Roadside Weather Information System)

installations. Measurement data can be visualized on the map or used to trigger response plans in response to severe weather or environmental conditions.

RSU Management (CMS)

The RSU management application allows the system to communicate with and manage roadside units (RSU). This enables, for example, the incident management application to forward incident information as V2X messages for in-vehicle displays, such as DENMs (Decentralized Environmental Notification Messages) and TIMs (Traveler Information Messages). It also manages forwarding of IVIMs (Infrastructure to Vehicle Information Messages) and allows using RSUs as virtual detectors through collection of traffic data for further use in response plans, reporting, and traffic control.

Public transport monitoring

The public transport monitoring application allows operators to integrate public transport line performance in traffic management workflows to enable true intermodal traffic management, especially during incident situations. Visualize public transport stops and lines, vehicle delays, and even be alerted by stops that serve lines that exceed their delay thresholds.

Statistics

The statistics module offers comprehensive options for the statistical analysis of data from all connected sensor types. Statistical reports include lists and graphs such as peak hour patterns, fundamental traffic diagrams, and daily or yearly time graphs of traffic demand fluctuations. Reporting can also be generated automatically at regular intervals.

Data and API services

Our mission is to enable our customers to take full advantage of the system, including the data as well as the functionalities that it provides. Through our integrated data platform and API services, customers can use standard as well as custom APIs to develop their own solutions and applications or integrate BI-tools, whether it involves specialized incident reporting, providing data for mobile apps, or posting traffic information on traveler information websites.

For Highways

Corridor management

The corridor management module simplifies coordinated ITS operations involving a high number of ITS devices. Especially useful in active traffic management scenarios, the corridor management module shows detailed device operational states, including signs, detectors, ramp meters and gates, on top of a simplified diagram representing the roadway geometry. If lane control signs are involved, sign operations can take advantage of built-in and configurable logic to automatically determine the most suitable lane-use display to save operators' time.

Ramp metering management

The ramp metering management module allows operators to monitor ramp metering operations, send commands, and calibrate ramp metering parameters. The system is designed to integrate multiple types of ramp metering systems at a time. Ramp meters can also be viewed in the schematic views module, which provides a simplified view of the roadway geometry and widgets that show detailed device operational states, including variable message signs, ramp meters, detectors and gates.

For Cities

Traffic signal control

Control and manage traffic signals using standard interfaces, such as OCIT, Canto and TMDD. Signal plans and operational modes can be changed manually by the operator or automatically by response plans which consider a wide range of data, ranging from air quality to Bluetooth detector counts.

Quality management

The quality management module monitors traffic signal switching states and parameters such as waiting times for pedestrian or vehicles upon green requests, as well as travel times of public transport vehicles. Values exceeding preset thresholds indicate a drop in the quality of a traffic signal system. This module makes it possible to carry out detailed quality analyses and initiate targeted improvement measures.

Green wave visualization

Green wave visualizations show the signaling states of individual signals, including coordinated green phases (green waves). With these visualizations and the archived data, operators can quickly check coordination status and perform more detailed analysis if required.

VIP routes

The emergency vehicle routing function allows the user to display, start and monitor the operational routes of first responder vehicles. If a route has been activated across the required intersections, the start and end times of the green phases are switched accordingly for each intersection.

TASS

Based on pre-defined optimum signal plans for a specific recurrent traffic situation, the Traffic-Actuated Signal plan Selection (TASS) selects the right signal plan to meet current conditions. TASS uses a rule-based system and threshold values to identify the situation and then activates the corresponding signal plan.

Intelligent vehicle prioritization

Integration with Sitraffic Stream allows emergency and public transport vehicles to receive a prioritized green signal at intersections. Expensive field hardware installations belong in the past, since Stream uses a combination of satellite navigation and on-board units in vehicles, which trigger a virtual sensor that reports the location of the vehicles to the traffic control system. From there, the vehicle receives a green light as it approaches the intersection. For connected vehicles prioritization is also possible through V2I communication (ETSI and SAE) protocols via RSUs.

Bike prioritization

Accelerate the transition to sustainable mobility with the SiBike app, which extends the green phase to accommodate bicyclists. The app determines the location, speed, and direction using GPS. When the bicyclist passes a virtual sensor

Sitraffic Symphony
The next generation traffic management platform

the location is reported to the traffic control system which then extends the green phases of intersections in a green wave to accommodate cyclists.

Micro mobility monitoring
Monitor fleets of different mobility providers, for example to identify hotspots in urban areas and where the vehicles are parked. The vehicles can be visualized and monitored individually and aggregated, e.g. via heat maps. Underlying data is pro - cessed anonymously.

Technical Specifications

Core applications
GIS map
Action Center
User management
Service notifications
System monitoring

Advanced Traffic Management Apps
Traffic detection
CCTV
Incident management
Variable message signs
Parking facility management
Response plans
Response plan evaluation
Traffic forecasting
Environmental forecasting
Environmental detection
RSU Management (CMS)
Public transport monitoring
Statistics
Data and API services

For Highways
Corridor management
Ramp metering management

For Cities
Traffic signal control
Quality management
Green wave visualization
VIP routes
TASS
Intelligent vehicle prioritization
Bike prioritization
Micro mobility monitoring

Interfaces
OCPI
Canto
TMDD

OCIT
BEFA
NTCIP
TLS
VDV
TMC
DATEX II
Custom

Deployment type
Cloud
On-premises

Additional Features
Multi-tenant support
Multi-screen support
Single Sign-on
User session administration

YUNEX TRAFFIC STRATOS OUTSTATION

NEMA Controller Adaptor for SCOOT

Utilize SCOOT with Non-Yunex Traffic Controllers

The Yunex Traffic Stratos Outstation is a powerful new platform for use with traditional SCOOT Urban Traffic Control systems. Using the latest ARM processor technology, this small, compact unit enables deployment of SCOOT in regions with non-Yunex Traffic NEMA TS1 or TS2 Type 2 traffic controllers.

Unlock the Benefits of SCOOT without Yunex Traffic Controllers

UTMC Type 2 (UG405) MIB Implementation
Supports the latest UG405 protocol which 'time-stamps' all data exchanged between the SCOOT UTC and the Outstation, ensuring a solution with high communications latency tolerance.

Third-Party Controller Support
Interface options include direct manual connection to the cabinet or via a Yunex Traffic Y-Cable. The rugged Y-Cable seamlessly connects to the ABC connectors of the controller and the cabinet.

Web-based Interface
A fully 'web-based' UI, enables a more efficient interaction with the unit and reduces potential training costs. The web presentation is identical, whether accessed locally or via the central system.

Freestanding 3U Box
The 3U Outstation includes Central Processing Unit and two I/O cards offering 16 solid state outputs and 48 inputs used for control bits, reply bits and detector inputs in NEMA controllers.

Remote Download Option
The OSS is an optional management tool that maximizes the benefits of the Stratos Outstation and its inclusion in the overall system topology.

Simple. Compact. Powerful.

- Future-proof platform – easily updatable to support new SCOOT functionality

- Wide range of NEMA TS1 and TS2 Type 2 controller and detection technology compatibility

- Fully web-based user interface

- Efficient management of Outstation firmware and configurations

- Wide range of communication options

Yunex Traffic SiBike

Improving Traffic by Keeping Cyclists Moving

YUNEX TRAFFIC SITRAFFIC SIBIKE

Improving Traffic by Keeping Cyclists Moving

Overview

Optimizing the mobility of cyclists can help counteract the rising emissions and high traffic volumes affecting many cities today. Yunex Traffic Sitraffic SiBike, the 'green wave' for cyclists, helps create a cost-effective and 'green' solution. With the help of a smartphone application, cyclists are given priority traffic lights, reducing car traffic, noise and air pollution.

How It Works

The cyclist carries a smartphone with the SiBike app installed. The app uses GPS to determine the cyclist's location and speed.

When a cyclist passes a virtual trigger point the app reports this to a traffic control center.

The control center sends the corresponding command to the traffic light controller.

When the cyclist approaches, the traffic light automatically turns to green or the ongoing green phase is extended.

Benefits

Personalized, cost-effective solution to improve your community's quality of life and help create a 'green city'.

Simple implementation, requires no construction or hardware changes – existing controllers can be used.

Reduces car traffic, noise and pollutant emissions.

Makes fast-cycling lanes and cycling highways even more attractive.

Currux Vision

Autonomous AI systems for smart infrastructure

Currux Vision

AI ENABLED SOLUTIONS FOR TRAFFIC MONITORING & ENFORCEMENT

AI ENABLED SOLUTIONS FOR TRAFFIC MONITORING & ENFORCEMENT

Fully Integrated AI Hardware / Software Solution For Detection, Analytics And Incident Detection

Currux Vision uses the latest in AI, machine learning, and computer vision to design and deploy edge-based autonomous AI systems for smart infrastructure. Currux Vision SmartCity ITS is used by DOTs and municipalities throughout the U.S. and has processed billions of traffic data points. Their fully integrated platform works with any camera, high and low resolution, and securely and rapidly operates within an agency's network. Additionally, the ease of installation and operation, powerful and flexible back-end capabilities, and attractive price point are key differentiators.

Counting, Classification, Occupancy And Speed By Lane

Accurately (95%+) detects and classifies in real time cars, light and heavy trucks, buses, motorcyclists, bicyclists and pedestrians. Measures speed of every object with +/- 2 mph accuracy.

Automatically Detects And Reports

Stopped Traffic   Wrong Direction   Stop Sign Violations   Crosswalk Violations   Commercial Vehicle Alert   Speeding   Near Miss   Red Light Violations

Western Systems

CURRUX VISION
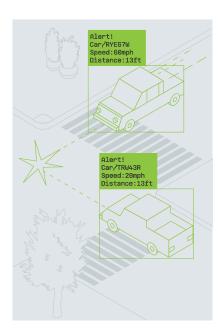
AI ENABLED SOLUTIONS FOR TRAFFIC MONITORING & ENFORCEMENT

Traffic Safety Analytics

Currux Vision predicts trajectories, speed and distance of cars, and pedestrians to inform customers about potential accidents and danger zones.

Traffic safety data is presented in reports and real-time Near Miss notifications are issued.

Alert!
Car/RYE67W
Speed:60mph
Distance:13ft

Alert!
Car/TRW43R
Speed:20mph
Distance:13ft

Alert!
Pedestrian
Speed:0,4mph
Distance:6ft

Alert!
Truck/REW43R
Speed:60mph
Distance:6ft

Alert!
Bicyclist
Speed:15mph
Distance:6ft

Alert!
Pedestrians
Speed:0,3mph
Distance:6ft

Sends Real Time Alerts And Automatically Activates Signs, Gates Etc

Alerts and notifications can be sent via email or text messaging.

Event:
Stopped traffic

Camera:
Crossroad camera

Event:
Wrong way

Camera:
Crossroad camera

Event:
High speed

Camera:
Crossroad camera

Vihicle Type:
Light truck

Created at:
17 Jun. 2020/12:45

Speed/Limit:
65/45mph

Speed: 60mph / SUV

Currux Vision's ITS / Smart City platform provides the following functionality:

NTCIP Detection
- Veh Calls by category (car, light truck, heavy truck, bus, motorcycle)
- Ped Calls by category (pedestrians and bicyclists)
- Ped and Bike extension calls while in the crosswalk

SDLC Detection
- Unlimited number of detection zones
- SDLC calls can be placed from inside the cabinet or remotely (via network switch)
- Accurate Vehicle, Ped and Bike detection

Standard Analytics Reports
- Counts by lane by category
    - Car
    - Light truck
    - Heavy truck
    - Bus
    - Motorcycle
    - Pedestrian
    - Bicyclist

- Speed and average speed by lane

Advanced Traffic Analytics Reports
- Lane Occupancy
- Queue length
- Counts by lane
- Wait times
- Stop counts

Western Systems

CURRUX VISION

- Average speed by lane
- 85th Percentile speed by lane
- Speed distribution
- Passing time
- Free flow time
- Free flow / passing time ratio
- Time gap
- Arrivals on Green
- Level of Service
- Total Delay
- Purdue Diagram
- 30 minutes to 180 minutes time bins
- Reports can be generated in real time and viewed in browser
- Reports can be exported in PDF and Excel

Turn Count Analytics Reports
- Intersection level counts by turn movement and vehicle class
- Crosswalk ped and bike counts by approach
- 5 to 60 minutes time bins
- Reports can be generated in real time and viewed in browser
- Reports can be exported in PDF and Excel

Traffic Safety / Near Misses Analytics and Reports
- Heat map of vehicle, pedestrian and bicyclist conflict areas
- Near Miss Detection based on Time to Collision threshold
- Near Miss trajectories and heat maps
- Headway Monitoring Time by lane
- Time to Collision Monitoring by lane
- Aggressive acceleration and breaking monitoring by lane
- Reports can be generated in real time and viewed in browser
- Reports can be exported in PDF and Excel

Real Time Notifications with Photo / Video Evidence

- Automatically detects events of interest with logs of Type of Event, Camera, Type of Vehicle, Date and Time, Photo / Video evidence for each occurrence:
    - Speeding
    - Red light violation
    - Crosswalk Violation
    - Wrong direction
    - Slow traffic
    - Stopped traffic
    - Stopped car / Double Parked Car / Illegally Parked Car
    - Queue detection
    - Pedestrian detection
    - Heavy truck detection
    - Double line crossing
    - Stop sign violation
    - Bus lane encroachment
    - False/Missed Detection Call

- Notifications can be viewed inside SmartCity UI and / or be sent by email/text
- Summary reports can be generated in real time and viewed in browser with Standard Analytics Reports
- Reports can be exported in PDF and Excel

Automated Report Generation and Distribution
- System can be programed to automatically generate and send by email the selected reports
- Applies to Standard, Advanced Traffic Analytics, Turn Count Analytics and Safety Reports

- User can select report type and distribution frequency (daily, weekly, monthly)

Adaptive / Traffic Light Optimization System
- Single intersection and corridor level adaptive system trains on data collected by Currux Vision (queue length, delay times, counts, speed)
- The model can be trained on data for the previous day, week, month
- Automatically calculates intersection split times in under 30 seconds to reduce the total delay at the intersection
- 10 minutes to 4 hours split time table update frequency
- Model differentiates between weekdays and weekend
- Weighting can be applied to various approaches
- System can either recommend the new split times or automatically upload the calculated split times to the controller using NTCIP
- System can automatically recalculate split times daily, weekly, monthly to capture the latest changes in traffic patterns and upload them to the controller

Notifications are received and stored inside the user interface, and additionally can be sent via email, text and API.

Virtual/Web/USB Relay Activation
- Built in system to connect to and program IP and USB relays
- Can be programed to activate a port by a camera detecting an event of interest (eg., wrong direction, pedestrian, speeding etc)

AI + Model Training Services

- AI convolutional neural networks get better over time as users collect intersection specific data and use it to retrain AI models for the target intersection

- The benefit is increasingly accurate detection and classification models that can approach 98-99% accuracy
- This service is recommended for enhanced Near Miss, Speeding Vehicle, Wrong Way driver and other safety related features
- AI+ training service is an annual service where Currux Vision continuously improves the AI models for a specific intersection/camera location and deploys new models remotely to the GPU servers
- Includes 3 model retraining sessions per year and free upgrades to new generation of AI models
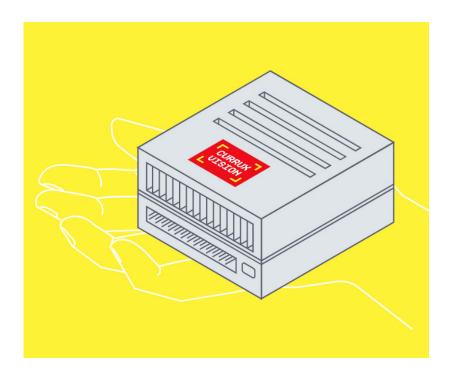
Streamer – Currux Vision software for streaming pre-recorded videos

- For customers that record videos and would like to analyze them after the fact, Currux Vision built a custom software called the Streamer
- Streamer allows to stream any locally saved MP4 video into Currux Vision SmartCity ITS program with several clicks
- Streamer requires at the minimum the SmartCity ITS Standard or higher software/hardware package to operate

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CURRUX VISION

Hardware
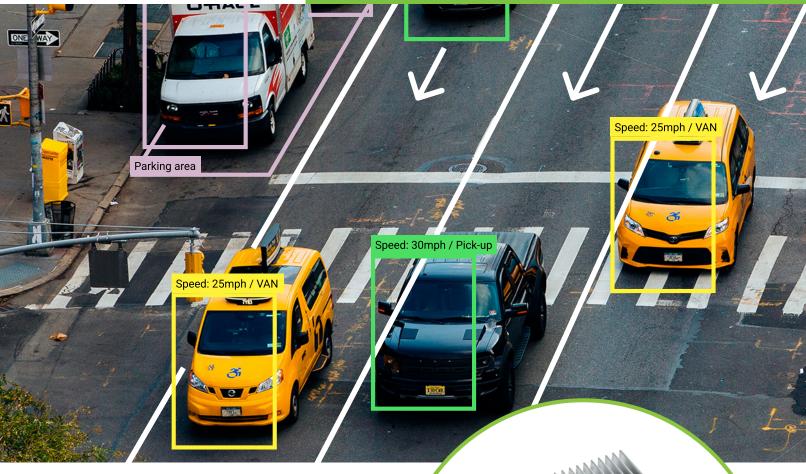
- Currux Vision provides a plug and play GPU server that has our software preinstalled. Server requires only power and network connection to operate.
- Server can be installed in the traffic cabinet, TMC or office
- Server receives video via RTSP or HTTP. Video cameras are not provided.
- Each server can support up to 4 video cameras for real time video processing.
- Each server is limited to 8 unique camera licenses. Additional camera licenses are available to purchase.
- A server rack mounting bracket is provided.
- 1-year limited warranty is included with 3-year extended warranty available to purchase.

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CURRUX VISION

SMART CITY AI-VISION GPU SERVER COMPUTER VISION AI SYSTEM

ONE WAY

Parking area

Speed: 25mph / VAN

Speed: 30mph / Pick-up

Speed: 25mph / VAN

- Based on state of the art GPU Accelerator
  Eight Core Processor

- Linux Operating System
  Small Size 6" x 5" x 3.5"

- Low energy Consumption
  Support for up to four video streams

- Rack mountable
  Standalone operation with auto restart

Technical Specifications

AI-Vision GPU Server	
GPU	NVIDIA 512-Core Volta GPU with Tensor Cores
CPU	8-Core ARM v8.2 64-Bit CPU, 8 MB L2 + 4 MB L3
Memory	32 GB 256-Bit LPDDR4x Memory / 137 GB/s
Storage	32 GB eMMC 5.1; Optional Storage of Up To 500 GB

Interface	
Ethernet	2 Ethernet (1Gb/100 Base-T) RJ-45 Connector
HDMI	1920x1080 to Video monitor for setup
Optional SDLC, BNC and IO Relay	SDLC DB15 connector; 4 BNC Analog Camera Inputs; 5 IO Relay (NO/NC)

Specifications	
Temperature	-34° Celsius to +74° Celsius
Power	12VDC -10W/15W
Dimensions	4.1"(W)x4.1"(L)x2.5"(H)

Approvals	
FCC	This device complies with part 15 of the FCC Rules
c UL US	UL listed Product Logo for Jetson AGX Vavier Developer Kit, model name P2972
c RU US	UL Recognized Component Logo for Embedded System Module, model number P2888 for Jetson AGX Xavier
Industry Canada (IC) CAN ICES-3(B)/NB<-2(B)	This device complies with Industry Canada license-exempt RSS standart(s)
CE	This device bears the CE mark accordance with following directives: • Electromagnetic Compatibility Directive 2014/30/EU • Low Voltage Directive 2014/35/EU • RoHS Directive 2011/65/EU

Network	
Ethernet	2- RJ-45 (10/100Base-T)
Protocols	IPv4, HTTP, RTSP/RTP/RTCP, TCP/UDP, 802&1x
Interoperability	ONVIF, CGI
Streaming Method	Unicast
Max. User Acess	10 Users
Edge Storage	Local PC for setup Mirco SD cards
Web Viewer	<Edge, Chrome, Mozilla
Web Language	English

SMART CITY AI-VISION GPU SERVER COMPUTER VISION AI SYSTEM

INRIX

Unlock the Power of Big Data to Make an Impact

Western Systems

INRIX

AI TRAFFIC

Using artificial intelligence to deliver the most precise & actionable traffic data

Traffic information is essential, but only useful if timely & accurate

When it comes to navigating traffic, there are certain realities we just accept: the sudden stop-and-go traffic that doesn't appear in our navigation device, but that somehow, we end up stuck in… the ETA that's more of just a ballpark…. the surprise closure of a freeway on-ramp.

We have long accepted all this as simply "the way things work." But that's about to change.

INRIX AI Traffic™ represents a quantum leap forward for traffic intelligence networks. It leverages artificial intelligence to deliver the most precise and actionable traffic information to date.

With AI Traffic, drivers get to their destinations faster and with less stress, businesses can make smarter decisions, and cities gain the knowledge they need to promote public safety and future-proof their roadways.

MOST ACCURATE ETAS

INRIX AI Traffic ensures you will always arrive at their destination on time — plain and simple.

INSTANTANEOUS UPDATES

From roadwork to accidents to everyday congestion — INRIX will always keep you safe & one step ahead of traffic.

LANE BY LANE PRECISION

So precise that it can even determine the speed of traffic in different lanes - never get stuck in the slow lane again!

COVERS ALL ROADS

With the ability to calculate speeds for any road in the world, INRIX has you covered wherever you go!

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INRIX®

AI TRAFFIC

Using artificial intelligence to deliver the most precise & actionable traffic data

INRIX AI Traffic Works Smarter & Faster to Help You Conquer Traffic

FOR CITIES / ROAD AUTHORITIES

Transportation professionals need timely, accurate traffic data to manage congestion– but existing solutions fall short.

▶ **Lane-By- Lane Precision**
Get data to answer questions like:
- Are left turn lanes long enough to prevent backups?
- Are Express/HOV lanes efficiently reducing traffic?
- Are my signals timed correctly?

▶ **Gain Holistic Understanding**
Make more informed decisions about every square foot of roadway under your jurisdiction.

▶ **Keep Roads Safer**
Dispatch emergency vehicles more effectively and alert drivers to hazardous conditions with instantaneous information.

FOR AUTOMAKERS

Drivers rely on technology now more than ever— but still end up stuck in traffic without timely & accurate traffic data.

▶ **Most Accurate ETAs To Save Time**
Drivers will have peace of mind knowing that they'll always arrive on time.

▶ **Keep Drivers Safe & Moving**
Conditions are updated multiple times a minute helping drivers react to changes faster.

▶ **Lane-By Lane Speeds**
Empower drivers to know exactly when to switch out of a turning lane, or into an Express/HOV lane, so they don't get stuck in traffic.

▶ **Better Routes, All Roads Covered**
Total coverage translates to more routing options and higher driver confidence in the route that's recommended to them.

FOR ENTERPRISE

Companies need reliable data to make good business decisions but comprehensive mobility data is rare.

▶ **Get Drivers There On Time**
Fleet customers can get drivers to their destinations faster and more safely.

▶ **Better Site Selection**
Gain a holistic understanding of traffic patterns in the area before selecting an optimal site.

▶ **Maximize Advertising Spend**
Advertisers can get more eyes on their message with more precise data analysis.

▶ **Efficient Pick-ups/Drop-offs**
With spot-on ETAs, delivery and ridesharing services can ensure a better, more reliable customer experience.

AI TRAFFIC
Using artificial intelligence to deliver
the most precise & actionable traffic data

Western Systems

INRIX

We Pioneered Smart Mobility & Just Revolutionized It With INRIX AI Traffic

INRIX has long been the pioneer in smart mobility. We were the first company to launch a crowd-sourced traffic network, then improved it by creating the first map-agnostic traffic solution to provide more granular content. Now we've taken traffic intelligence to the next level by launching the first traffic solution built on artificial intelligence — laying the foundation to improve mobility across the globe.

With the world changing faster by the minute, we finally have a traffic solution that can keep up.

Taking the "E" Out of ETAs

Drivers will have peace of mind knowing that they'll arrive at their destination on time.

Stay Moving & Safe With Instant Updates

Road conditions are updated instantaneously to always keep drivers one step ahead.

Never Get Stuck in the Slow Lane Again

Precise enough to pinpoint the speed of traffic in different lanes helping users make better decisions.

We Cover all Roads, Not Just the Busiest Ones

2006

London

1.9 Million Miles Covered

INRIX Launches the 1st Crowdsourced Traffic Network

2013

London

4 Million Miles Covered

INRIX Expands Granularity With 1st TMC Alternative: XD Traffic

2019

London

All Roads Covered

INRIX Launches 1st Deep Learning Traffic Solution: AI Traffic

To be truly useful, traffic data needs to cover all available roads, not just the busiest ones. Today, most traffic data services cover only major roads and the most important secondary roads, leaving blind spots, missing coverage for ramps, interchanges and other roads altogether. INRIX now covers every road — from interstates to intersections, country roads to neighborhoods.

By looking at the totality of traffic, INRIX is better equipped to efficiently get drivers where they need to go.

AI TRAFFIC

Using artificial intelligence to deliver the most precise & actionable traffic data

Western Systems

INRIX

INRIX Is Improving Mobility by Connecting Cars, People and Cities

INRIX, a global leader of connected car services and transportation analytics, is making transportation more intelligent. By leveraging vehicle connectivity, inter-modal routing, advanced parking management, dynamic data for city planning, and traffic flow optimization, we make it safer, cleaner, more convenient and more enjoyable for people to get to where they need to go.

As a leading traffic intelligence platform, INRIX delivers smart technology, data and analytics to help improve urban mobility. We believe in the power of partnership to solve the toughest transportation challenges and work across the ecosystem with automakers, governments, mobile operators, developers, advertisers and enterprises, large and small, to help move people, cities and business forward.

Access Systemwide Traffic Signal Insights Without Investing in Equipment

Signal Analytics helps transportation agencies assess and improve traffic signal performance throughout the entire network without the need for costly physical equipment or manual data collection.

Poorly timed signals impact everything from urban congestion to air pollution to safety. Conventional approaches are either cost prohibitive or don't provide fresh, fast, or reliable insights systemwide. Traditional attempts to qualify and reduce unnecessary delays at intersections typically require the installation of expensive hardware and conducting extensive field-work. These efforts usually only cover a fraction of a city's intersections and even worse, they don't paint a complete picture of current issues and trends.

INRIX® Signal Analytics helps transportation professionals better manage systemwide traffic signal performance by working smarter, not harder. The powerful cloud-based application uses anonymous connected vehicle data to assess and help improve signalized intersection and corridor performance. Because the data originates from high frequency GPS waypoints transmitted to the cloud, Signal Analytics is readily available, scalable, and cost-effective.

Agencies can now easily identify, rank, and prioritize intersection signal projects to achieve maximum impact on traffic flow, all without leaving their desks and at a fraction of the cost of conventional hardware equipment.

Key Benefits at a Glance

- Continuously monitor every movement in your network without investing in equipment
- Identify performance issues without ever leaving your desk
- Take proactive actions based on deep analysis and reliable performance trends
- Make cities more livable with better traffic flow, improved air quality, and safer intersections

Use Cases

- Identify where signal retiming needs are most urgent
- Rank intersections by their chosen performance metric to prioritize traffic signal projects most effectively
- Quantify the impact of traffic signal management strategies
- A quick and accurate way to test new signal strategies
- Adopting TSMO strategies for traffic signals
- Understand the reliability and performance of a corridor at various times

Make your transportation network as efficient as possible with INRIX Signal Analytics

Signal Analytics display of intersections in Austin, TX during a special event, where significant delay is visualized.

Continuously monitor every movement in your network without investing in equipment

Signal Analytics creates a virtual infrastructure by continuously collecting connected car data across the entire network and provides accurate metrics for every movement and every intersection at a fraction of the cost of hardware-based solutions.

Signal Analytics display of intersections in Austin, TX. Each intersection can be selected to reveal detailed metrics at the movement level.

Identify performance issues without ever leaving your desk

By transforming trillions of data points into detailed and transparent metrics and trends, Signal Analytics helps agencies quickly answer almost any intersection- and corridor-related question to prioritize traffic signal projects and make meaningful improvements.

CATT Lab Signal Analytics in Austin, TX, where custom intersection reports for desired dates and time periods can be performed.

Take proactive actions based on deep analysis and reliable performance trends

Whether you need to reduce delays for just a few signals or improve performance throughout your entire network, Signal Analytics provides functional summaries, detailed daily reports, and data visualizations at the click of a button so you can immediately take action rather than waiting for residents to complain.

Signal Analytics dashboard view can be used to understand if the network is improving and where there are potential opportunities to make intersections and corridors perform better.

Make cities more livable

Poorly timed traffic signals often lead to longer commutes, increased energy use and air pollution, and more crashes. Signal Analytics provides a costeffective way for agencies to assess and improve traffic signal performance systemwide so they can significantly improve traffic flow, reduce greenhouse gas emissions, and create safer intersections.

Key Metrics and Features

Signal Analytics provides agencies with the powerful insights they need to identify and solve performance issues at scale in a cost-effective way.

Key Metrics

Delay
The extra time required at an intersection due to slowing attributed to the signal compared to measured free-flow speeds.

Level of service
A qualitative measure describing operational conditions within a traffic stream, based on average control delay.

Arrival on Green
The percent of vehicles at the intersection without a stop recorded.

Split Failures
The number of occurrences of a green light failing to meet vehicle volume demand, resulting in a vehicle stopping more than once at a traffic light.

Turning Movements
The number of observed vehicles making left or right turns and through movements at the intersection for a chosen time period.

Travel Time
The distribution of travel time for each movement at each intersection approach.

Approach Speed
The speed distribution of vehicles directly before the intersection.

Key Features

Intersection Analysis Module
Powered by CATT Lab, this module allows you to dig deeper with a custom inspection of an intersection, such as running reports to determine when intersections are under performing or before and after reports to determine if a problem was solved.

Corridor Metrics
Understand and analyze the reliability and performance of corridors at various times of the day. Signal Analytics makes it easy to define the beginning and end of corridors you are interested in.

Self-Serve
Easily identify and select intersections and corridors using an interactive map.

Daily Reports
Customizable daily reports provide details on the subscribed intersections & corridors, highlighting key metrics, problems, and trends along with visual infographics.

Interactive Dashboard
Easy-to-use dashboard includes every metric needed to understand intersection performance, including control delay, split failures, turn ratio, volume, and more.

Virtual Infrastructure
Massive amounts of anonymous vehicles data enables granular insights without relying on expensive hardware or fieldwork.
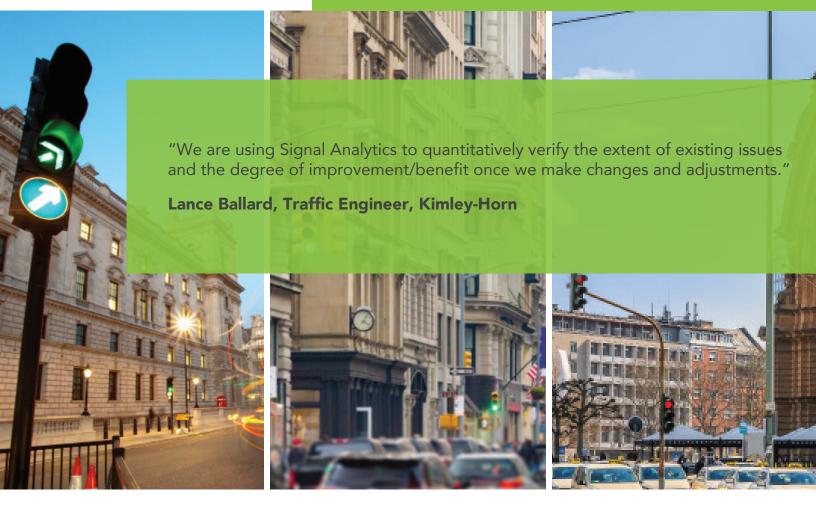
Easy -To-Use
An intuitive and easy-to-use cloud-based application that doesn't require IT resources or data scientists to gain insights.

SIGNAL ANALYTICS™
Powered by CATT Lab

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> "We are using Signal Analytics to quantitatively verify the extent of existing issues and the degree of improvement/benefit once we make changes and adjustments."
>
> **Lance Ballard, Traffic Engineer, Kimley-Horn**

Data You Can Trust

Signal Analytics uses over 130 million vehicle intersection crossings per week covering approximately 240,000 intersections (and growing) to provide granular insights and leverages detector-based signal analytics platforms to validate and improve the parameters.

- GPS point data used in Signal Analytics is updated every 5 seconds or less
- Results are generated at 15-minutes granularity at intersection, approach, movement, and corridor level
- Complete detail and transparency of metrics and trends are provided

INRIX enables smarter mobility by empowering cities, people, and businesses with the best data, tools, and insights to make movement smarter, safer, and faster. As a leader in mobility data and location intelligence for more than 15 years, INRIX helps world class organizations make calculated decisions about the world around them. INRIX turns 36B+ mobility data points into insights for some of the most innovative public sector agencies, automakers, and businesses so they can deliver better products and services to their customers and constituents.

INRIX is a leading Mobility & Location Based Platform Globally
- INRIX captures 120M trips per day in the US (1 out of every 7 miles driven in US)
- Insights are sourced from 145+ countries
- 36B+ real-time data points collected each day, 25M+ every minute
- 2T+ KM of vehicle trip data representing 35B+ driving hours

TRIPS PLUS

Connected Vehicle Insights for Faster, Smarter Investment Decisions

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INRIX Trips Plus is an all-in-one, easy to use, and tickerized geolocation alternative dataset that helps investors analyze the companies they care about and produce alpha for their portfolio.

Geolocation is one of the hottest and most interesting alternative data verticals in the market today. However, complexity associated with sourcing and managing the data as well as the amount of manual work that's often required can make leveraging disparate datasets challenging for investment managers.

Trips Plus is a first-to-market, all-in-one geolocation dataset solution that helps investment managers better predict earnings for both public and privately owned companies, identify trading opportunities, and generate alpha for their portfolio.

Trips Plus combines connected vehicle data (passenger car and trucking data) from INRIX Trip Analytics with US POI data to provide a seamless experience that leaves more time for analysis. No more drawing polygons, acquiring an additional dataset, managing separate contracts, or marrying disparate datasets together.

Imagine getting easy access to car and/or truck traffic data to and from locations for the tickers you care about and without all the data gymnastics that most alt datasets require! With Trips Plus, you can gain insights into consumer trends to locations such as theme parks, casinos, restaurants, hotels, retail, and more ahead of earnings. You can also analyze fleet/truck activity around places like manufacturing facilities, warehouses, distribution centers and seaports, and get that "edge" you have been seeking.

Key Benefits at a Glance

- First to market, all-in-one mobility dataset that's easy to ingest

- Generate unique investment insights to optimize your strategies

- Customize your reports and further refine your analysis

- Leverage one of the most dense and precise geolocation datasets on the market with 14% of all US vehicle miles traveled (VMT) covered

Use Cases
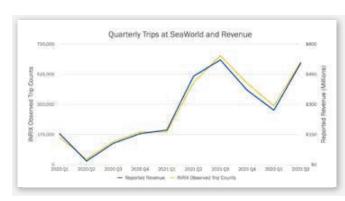
- Generating mobility insights based on vehicle traffic to help find economic signals

- Leverage tickers across Industry sector portfolios for leading indicators

- Track both passenger and truck movement across locations that matter most to you

- Private equity due diligence for evaluation sprint: fast turnaround and data delivery for ad-hoc requests

- Identify trends by time of day, day of week, month, season, and year

- Take proactive actions based on deep analysis and reliable mobility trends

TRIPS PLUS

Connected Vehicle Insights for Faster, Smarter Investment Decisions

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INRIX
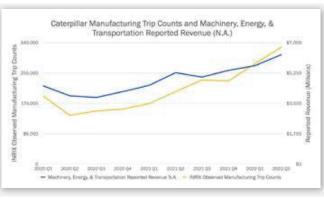
All-in-One Connected Vehicle and POI Dataset for Better and Faster Earnings Predictions

Quarterly Trips at SeaWorld and Revenue

0.99
Correlation Factor

Theme parks feature large parking lots to accommodate visitors, delivery trucks, and employees' vehicles. As such, connected vehicle data can provide valuable insights into the activity level of theme parks and help investors better predict earnings.

Caterpillar Manufacturing Trip Counts and Machinery, Energy, & Transportation Reported Revenue (N.A.)

0.96
Correlation Factor

Analyzing the correlation between vehicle movement at industrial sites and reported revenue with Trips Plus shows that activity level can be a strong predictor of future earnings.

Key Features

- Trips Plus covers 450+ stock symbols, 7,400+ brands, and 12M+ US POIs. Other POI attributes allow you to further segment your analysis by location name, brand, and NAICs categories

- Connected vehicle data, vehicle classes (passenger and fleet), and footfall data from mobile devices

- Accurate, precise, and fresh POI data that has been cleaned, de-duped, and ready to use

- Each trip visit to each location associated with a publicly traded company is associated with a stock symbol, along with Committee on Uniform Securities Identification Procedures (CUSIPs) and International Securities Identification Number (ISINs), which makes it easy to merge the data with your existing datasets

- Reports available either at aggregated trip counts level, or granular individual trips mapped to POIs for greater transparency

- Easily access streamlined reports for specific stock symbols across all US locations with an easy plug into AWS S3

- Flexible subscription model to only access and pay for the vehicle movements that are relevant to your portfolio: subscribe to just specific tickers, industry segments, or locations

- Analyze privately-owned businesses to identify new PE investments, track current holdings, or even analyze possible fixed income ideas

Location intelligence for faster, smarter business decisions

Location Analytics provides comprehensive location-based insights to help businesses easily make more confident, calculated decisions to improve profitability.

Business professionals are faced with challenging questions every day that data can help answer, but making sense of it all can be expensive, time consuming, and difficult. As a result, many organizations struggle to gain strategic insights from data and are left guessing, which can significantly impact their bottom line.

INRIX IQ Location Analytics is a powerful new location intelligence application that makes it easy for professionals to make data driven decisions to grow their business, maximize return on investment, or better serve constituents. Location Analytics does this by bringing together a variety of high-quality mobility, demographic, behavioral, and commercial datasets, with the ability to import your own location data as well. It all comes together in one easy-to-use, cloud-based application that effortlessly integrates with your existing workflow.

Location Analytics empowers organizations with detailed insights on any location to make decisions smarter and faster—whether it's deciding where to open a new location, making the right investments to maximize portfolio growth, or identifying ways to better serve the wider community.

Key Benefits at a Glance

- Easily Find and Compare the Locationsthat Matter to You

- Get Comprehensive Mobility Insightsfor Any Location

- View All Your Mobility Data in OneSingle Place

- Easy to Use, Cost-Effective CloudBased Solution

Use Cases

Retail: Brick and mortar businesses like retailers and restaurants can easily analyze current or prospective locations to stay one step of ahead of the competition.
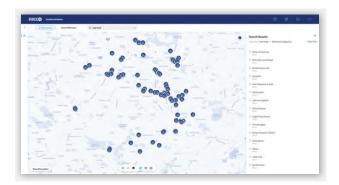
Financial Services: Understanding mobility trends provides hedge funds and investors with unique insights into the health of an industry, an individual company, or even an individual location.

Cities: Location intelligence can help cities streamline urban planning, improve accessibility and utilization of public services, and conduct greener projects for more livable cities.
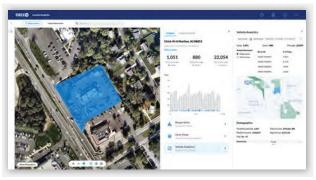
LOCATION ANALYTICS

Make INRIX Location Analytics Work for Your Organization
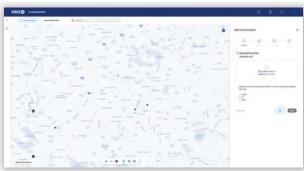
Easily Find & Analyze Any Location You're Interested In

Whether you are looking for a new business location or interested in learning about business activity for specific locations, Location Analytics' powerful search function lets you quickly find the locations you are interested in and compare them immediately.
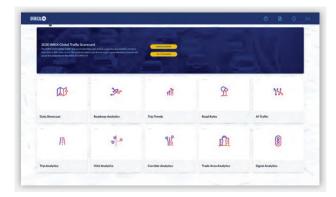
Eliminate the Guesswork with Powerful Location Based Insights

Making informed business decisions requires you have access to the data that matters to you. Location Analytics eliminates the need for guesswork, providing in-depth information for the locations you care about, evaluating each of their key metrics, and automatically surfacing the insights you want.

Save Time and Boost Efficiency with Easy Data Integration

Utilizing different platforms for viewing multiple data sources can be time consuming and increases the risk of errors. Location Analytics' data integration capabilities make it easy to get a unified view of all your mobility data to produce deep, actionable insights.

Focus on Your Business, Not on Technology

Getting results from data science should be quick and affordable. Location Analytics is a fully hosted solution that takes the hassle of managing data, software, and IT infrastructure off your plate and lets you focus on what matters most—your business.

Top Features

An easy-to-use solution that empowers businesses to make smarter, faster decisions by providing powerful insights into the movement of people, vehicles, and goods to, from, and around locations.

Searchable Points-of-Interest (POIs): Location Analytics comes pre-loaded with highly precise and relevant POIs that can be searched and filtered by type, location, etc. and you can even import your own locations.

Customizable Locations: Unlike other offerings that are limited to only giving you data linked to proprietary POIs, we let you specify the exact geographic boundaries you want data from with an easy-to-use drawing tool to cover a wide variety of uses cases.

Demographic Details: Trips are matched to their origin neighborhood at the census block level. This makes it easy to characterize trip travel distances and trade areas associated with each location, as well as to match visits to demographics data.

Vehicle Trip Details: Get details on how many vehicles stopped and started inside the location boundary, how many went through, where they came from, and where they went.
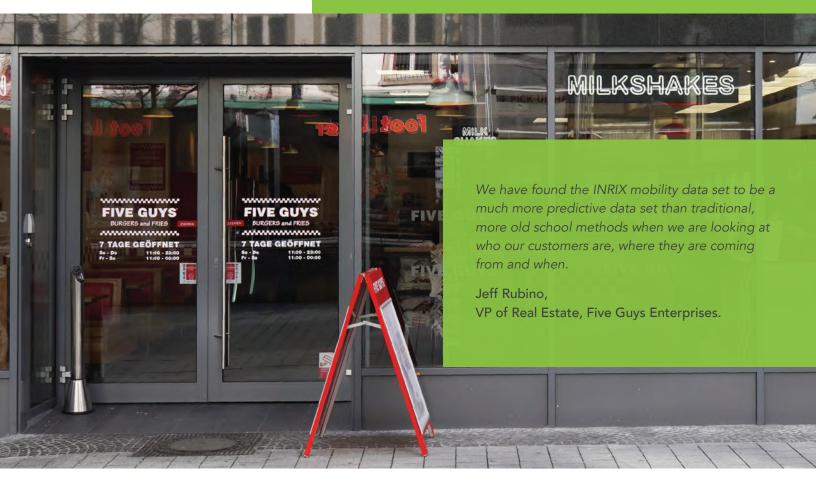
Drive Time Polygons: Drive time polygons predict distance in minutes rather than miles, helping retailers determine the accessibility of store locations. Analyze drive times by day of week, time of day, and length of journey.

People Visits Details: Access anonymized mobile location intelligence data to better understand who your customers are, where they come from, and when they are visiting the most.

Flexible Platform: Use the API to access Visits data and bulk Trips reports to conduct custom analysis beyond the standard reports provided by Location Analytics.

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> *We have found the INRIX mobility data set to be a much more predictive data set than traditional, more old school methods when we are looking at who our customers are, where they are coming from and when.*
>
> Jeff Rubino,
> VP of Real Estate, Five Guys Enterprises.

INRIX enables smarter mobility by empowering cities, people, and businesses with the best data, tools, and insights to make movement smarter, safer, and faster. As a leader in mobility data and location intelligence for more than 15 years and trusted by the site selection industry, INRIX helps world class organizations make calculated decisions every day based on a deep understanding of the world around them. INRIX collects 36B+ mobility data points and makes them available to some of the most innovative public sector agencies, automakers, and businesses so they can deliver better products and services to their customers and constituents.

INRIX is the Largest Mobility & Location Based Platform Globally
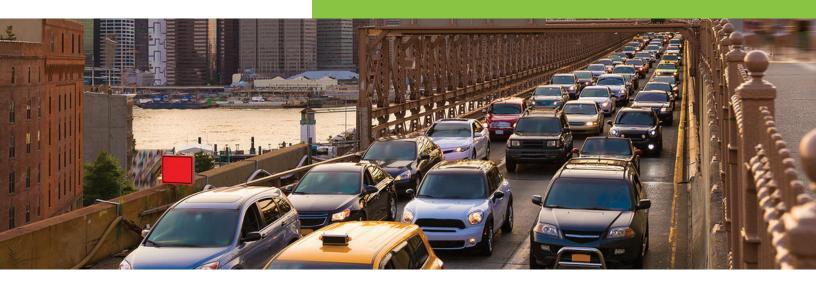
- INRIX captures 120M trips per day in the US (1 out of every 7 miles driven in US)

- 145+ global countries that data is sourced from

- 36B+ real-time data points collected each day, 25M+ every minute

- 2T+ KM of vehicle trip data representing 35B+ driving hours

- 15+ years of historical data in proprietary database

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PM3 ANALYTICS

REPORTING & TARGET-SETTING MADE EASY

Key Dates in 2018

5/20
State DOTs submit 1st Performance Period targets

6/15
State DOTs submit 2017 PM3 data to HPMS

8/2
State DOTs submit hourly traffic volume estimates methodology for PHED calculations

10/1
State DOT Baseline Performance Report and MPO CMAQ Performance Plans (where applicable)

11/16
MPOs submit 1st Performance Period targets to respective state DOTs

EVERY STATE DOT AND MPO HAS SEVERAL NEW RESPONSIBILITIES with the May 2017 federal rule regarding congestion and freight system performance reporting requirements ("PM3"). FHWA has made the NPMRDS travel time dataset created and delivered by the INRIX/UMD CATT Laboratory team available to DOTs and MPOs at no cost. Still, there is much to do to translate this dataset to meet the PM3 reporting requirements.

INRIX and the UMD CATT Laboratory have extended our partnership beyond generating NPMRDS V2 datasets to offering tools and additional datasets that simplify PM3 target-setting, tracking, and reporting. We are offering highly cost-effective solutions for meeting near-term deadlines as well as ongoing reporting. The first PM3 performance period is 5 years in length, and these tools will be available and useful from day one through the entire period.

UNIQUE ADVANTAGES:

▶ Cloud-based service available agency wide from day 1 (data and tools)

▶ Delivered by the INRIX/UMD team providing the official NPMRDS Dataset and network

▶ Quickest possible access to NPMRDS formatted data, with data back to 2016 pre-loaded

▶ FULL TMC-network data options to increase the value of the available tools across a larger road network

▶ Access to a network of peer agencies via user group

Join dozens of states and over 100 MPOs already using these tools for PM3 reporting & analytics.

425.438.1133 | Info@WesternSystems-Inc.com | www.WesternSystems-inc.com

PM3 ANALYTICS
REPORTING & TARGET-SETTING MADE EASY

Choose from Three Service Options:

▶ **PM3 ANALYTICS—BASIC** provides UMD tools and INRIX data necessary to set and track targets for the LOTTR, TTTR and PHED performance measures. It includes the ability to upload speed limits to calculate PHED where applicable and tools to export data for insertion into HPMS per FHWA guidance. Thirteen months of backfill data (from January 2016 through January 2017) for the NMPRDS/NHS road network is included—and is only available from INRIX/UMD —providing two complete years of consistent NPMRDS-formatted data for trend analysis and more informed target-setting.

▶ **PM3 ANALYTICS—PLUS** adds several UMD analysis and visualization modules to allow for full-scale utilization of NPMRDS data. The datasets will be updated weekly or more frequently, as opposed to the standard monthly updates, enabling quicker access to data to conduct analyses.

▶ **PM3 ANALYTICS—PREMIUM** builds on 'Plus' by adding additional INRIX data in two ways: (1) providing NPMRDS data against the full national TMC network to roughly double the size of the roadway network available for analysis, and (2) adding the traditional 1-minute INRIX traffic data archive from January 2015 forward. This provides full analytics capabilities across the complete TMC network.

INTERACTIVE PM3 MAPS & GRAPHS

ROAD COVERAGE OPTIONS

NPMRDS/ NHS Network

Full TMC Network

FEATURES	PM3 Analytics Service Options			
	Baseline*	Basic	Plus	Premium
Road Network	NPMRDS/NHS Network	NPMRDS/NHS Network	NPMRDS/NHS Network	+ Full TMC Network
Date Range	From February 1, 2017 (NPMRDS V2 Format)	+ From January 1, 2016 (NPMRDS V2 Format)	From January 1, 2016 (NPMRDS V2 Format)	From January 1, 2016 (NPMRDS V2 Format); + From January 1, 2015 (INRIX 1-minute archive)
Tools	Data Downloader	Data Downloader + PM3 Reporting/ Analysis	Data Downloader PM3 Reporting/Analysis + Probe Data Analytics Suite	Data Downloader + PM3 + Reporting/Analysis + Probe Data Analytics Suite

* No cost to State DOTs, MPOs, & their contractors when signing the NPMRDS V2 DSA

PM3 ANALYTICS
REPORTING & TARGET-SETTING MADE EASY

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INRIX

Capabilities by Service Option:

FEATURES	PM3 Analytics Service Options			
	Baseline*	Basic	Plus	Premium
0. Access NPMRDS V2 Data:				
Road selection by road, region, TMC list/set, or from a map	✖	✖	✖	✖
Date range selection	✖	✖	✖	✖
Data output selection	✖	✖	✖	✖
NPMRDS V2 data from February 2017 forward (~400K segments, 480K directional miles)	✖	✖	✖	✖
NPMRDS V1 data from October 2011 through January 2017**	✖	✖	✖	✖
Off-line processing & email notification when data request ready for downloading	✖	✖	✖	✖
Maintenance of download requests for re-running and re-downloading	✖	✖	✖	✖
1. Calculate NPMRDS-Based PM3 Performances Measures in FHWA Format:				
Level of Travel Time Reliability (LOTTR) ¾ Interstates		✖	✖	✖
Level of Travel Time Reliability (LOTTR) ¾ Non-Interstates		✖	✖	✖
Truck Travel Time Reliability (TTTR) Index		✖	✖	✖
Person Hours of Excessive Delay (PHED) for applicable MPAs		✖	✖	✖
Uploading of agency-provided speed limit data for PHED measure		✖	✖	✖
Documented PHED hourly traffic volume estimates methodology		✖	✖	✖
2. Visualize MAP-21 PM3 Performance Measures on Dashboards & Displays:				
Interactive maps and graphs		✖	✖	✖
Auto-generated FHWA compliance reports		✖	✖	✖
Addition of NPMRDS V2 consistent data from January 2016 through January 2017 for accurate trending & target setting		✖	✖	✖
3. Visualize Broader Range of Metrics for Corridors, Routes, & User-Defined Dates:				
Congestion Scan (location, duration, and severity of congestion)			✖	✖
Animated Trend Maps (comparing date ranges)			✖	✖
Performance Summary Statistics (Travel Times, TTI, PTI, BTI, etc.)			✖	✖
Performance Summary Charts (Travel Times, TTI, PTI, BTI, etc.)			✖	✖
User Delay Cost Calculations (leveraging day/time volume estimates)			✖	✖
Bottleneck Ranking (identifying & quantifying congestion for project justification)			✖	✖
4. Visualize Broader Range of Historical Metrics on Full TMC Network (Including Real-Time/Recent Data):				
Full TMC Network NPMRDS V2 formatted data from January 2016				✖
Full TMC Network INRIX 1-minute speed archive from January 2015				✖
Region Explorer (real-time & point-in-time bottlenecks, incidents, & weather)				✖
Dashboards for point-to-point travel times, bottlenecks, & more				✖
5. Utilize Additional RITIS Real-Time TSMO Tools (Integrate Sensor & Incident Feeds):*				
Integration of Agency Incident/Event data & ITS devices (DMS, CCTV, etc.)				✖
Work Zone Performance Monitoring				✖
Situational Awareness Maps (integrating DOT & non-DOT data across borders)				✖
Multi-Agency Collaborative Decision Support Tools				✖
Incident After Action Review Tools				✖
Incident Timelines				✖

* No cost to State DOTs, MPOs, & their contractors when signing the NPMRDS V2 DSA (go to NPMRDS.RITIS.ORG)
** Available to State DOTs, MPOs, & their contractors if an NPMRDS V1 DSA was executed
*** Feed integration may require extra fees depending on complexity

MH Corbin

Informed drivers, safer highways

Western Systems
Innovative Transportation Solutions

MH CORBIN

CONNECT:ITS

All-in-one transportation management alert system.

Western Systems

MH CORBIN

○ GATHER

◎ ANALYZE

○ COMMUNICATE

19" Rack mounted

Din rail mounted

The CONNECT:ITS System from MH Corbin is engineered to be a simple to use, scalable and low power advanced roadside information system. Using data from both MH Corbin and popular third party sensors, algorithms compute changing roadway conditions in real time. Data is then sorted and distributed to your existing messaging network of HAR systems, dynamic message signs and flashing beacon systems. Additional outputs can also be used to send data to in-vehicle warning systems via DSRC.

The CONNECT:ITS System is the right tool to communicate advanced warnings in real time. Potential applications for the CONNECT:ITS include but are not limited to: bridge deck icing, low visibility, curve warning, over-height vehicle detection and wrong way detection. The CONNECT:ITS System can also be scaled up or down for a customized solution based on specific application needs.

65 Speed Detection	Vehicle Data	High Winds	Pavement Conditions	Low Visibility

CONNECT:ITS SYSTEM

V2I Communication	Text & Email Alerts	Highway Advisory Radio	Dynamic Message Signs	Flashing Beacons

Quick Facts

- Roadside decision making
- Completely customizable
- More cost effective than bigger systems
- Handles environmental, traffic and pavement data
- Decision support system utilizing python scripting
- Communication via DSRC
- NTCIP Compliant
- NEMA TS-2 2016

CONNECT:ITS
All-in-one transportation management alert system.

Western Systems

MH CORBIN

TECHNICAL SPECIFICATIONS

Interface, Ports	CONNECT:ITS 19	CONNECT:ITS DIN
REMOTE CONTROL	Web Interface	Web Interface
LEDs	Power, SBC, HDD, Heartbeat	Power, SBC, HDD, Heartbeat
POWER	12V	10V-36V, 6W not including sensors
CONNECTORS	Ethernet (2), USB (2), RS-232 (2), RS-485 (2)	Ethernet (2), USB (2), RS-232 (2), RS-485 (4), digital out (2), analog input (2), HDMI (1) audio in, audio out
ANTENNA	Cellular, GPS, pavement sensors	Cellular, GPS, pavement sensors, satellite

Computing		
PROCESSOR	Intel	Intel
MEMORY	4GB minimum	4GB minimum
STORAGE	8GB minimum	16GB minimum
OPERATING SYSTEM	Linux	Linux

Physical		
DIMENSIONS	16.5 x 10 x 3.5 in. 19 in.	6 x 5 x 3 in.
MOUNTING	Rack	Din Rail or shelf
WEIGHT	10.2 lbs	1.6 lbs
OPERATING TEMP	-29°F to 165°F (-34°C to 74°C)	-29°F to 165°F (-34°C to 74°C)
HUMIDITY	Up to 95% RH	Up to 95% RH
TESTING	NEMA TS-2 2016	NEMA TS-2 2016

CAPABILITIES

SENSOR INPUT OPTIONS
- Radar based vehicle detectors
- Non-Invasive pavement sensor
- Precipitation/visibility sensors
- VX21 wireless pavement sensor
- All-in-one weather sensors
- Speed Sensors
- CCTV with analytics

DESTINATIONS
- Highway Advisory Radio
- Dynamic Message Signs
- Variable Speed Limit Signs
- Email/text alerts
- In-vehicle alerts via DSRC
- Traffic Management Centers/ ATMS

NC350 BLUESTAR

Provides vehicle count, classification, speed & length data.

○ **GATHER**

○ ANALYZE

○ COMMUNICATE

The NC350 BlueStar Portable Traffic Analyzer with Bluetooth™ Technology from MH Corbin provides the accurate measurements of vehicle count, speed, and vehicle length. The NC350 BlueStar Portable Traffic Analyzer sensor is placed directly in the traffic lane to measure data, and can be installed and removed quickly and easily without damage to the road surface.

The NC 350 BlueStar Portable Traffic Analyzer is designed to survey traffic on a roadway, bridge, parking garage, or construction area. Because the analyzer can communicate wirelessly via Bluetooth, traffic data can be retrieved & downloaded without removing the analyzer from the road.

Data is easily assessed using Highway Data Management (HDM) software, where it can be presented in the form of reports, charts and graphs.

Accurate Counts

Ultra Portable

Wireless Communication

Quick Facts

- Communicates wirelessly via Bluetooth™ Technology
- Can be installed and removed in minutes
- Inconspicuous design blends in with road surface
- Individual vehicle recording allows infinite binning capabilities
- Durable extruded aluminum housing
- Long-life, rechargeable, Lithium-Ion battery
- Easy to use software for viewing data
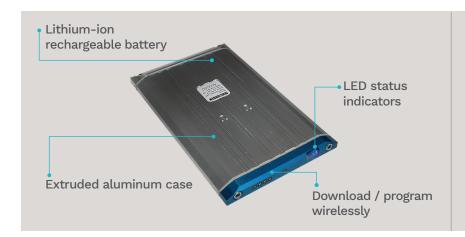
NC350 BLUESTAR
Provides vehicle count, classification, speed & length data.

NC350 BLUESTAR FEATURES

Lithium-ion rechargeable battery

LED status indicators

Extruded aluminum case

Download / program wirelessly

- Up to 21 days per charge
- Utilizes GMR magnetic sensor to detect vehicle structure
- Sealed and potted design eliminates water intrusion
- Inconspicuous design blends in with road surface
- Can be installed and removed in minutes

NC350 BLUESTAR TECHNICAL SPECIFICATIONS

Technical Data

DIMENSIONS
181 x 118 x 13 mm / 7.125 x 4.625 x 0.5 in

ULTIMATE BEARING STRENGTH
88.000 psi (607 Mpa)

WEIGHT
0.59 Kg / 1.3 lb

POWER
3.0VDC to 4.2VDC

OPERATING TEMPERATURE RANGE
-20° – 60° C/-4° – 140° F

OPERATING HUMIDITY RANGE
0–100% RH

Accuracy

LENGTH
±4 ft, 90% of vehicles

SPEED
±4 mph, 90% of vehicles

COUNT
± 1%, 95% of vehicles

DETECTION
Vehicles from 5 – 120 mph

CAPACITY
300,000 vehicles or 21 days

Performance Data

SENSOR TYPE
GMR Magnetic chip

MEMORY
Micro Serial Flash: 3MB

INTERFACE/COMMUNICATIONS
USB or Bluetooth

VALUES
Metric / Imperial

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MH CORBIN

CBC 7000
Monitor and control warning systems on-site and remotely.

The CBC family of Flashing Beacon Controllers from MH Corbin are designed for easy programming and monitoring of extinguishable message signs and flashing beacon warning systems.

An on-board LCD screen allows for quick on-site diagnostics and easy setup. The Controller provides confirmation including current draw of the interval flasher and 120 VAC relay for confirmation the EMS is lit and the beacons are flashing.

Setup involves connecting the leads from the beacons to the designated connector position. The Controller also contains multiple analog inputs so the user can remotely monitor such things as battery voltage and solar charge status.
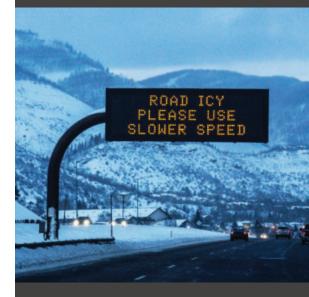
Quick Facts

- Control beacons, dynamic message signs, variable speed limit signs

- Built-in python scripting engine allows for roadside decision making

Flashing
Beacons

Dynamic
Message Signs

65
Variable Speed
Limit Signs

CBC 7000
Monitor and control warning systems on-site and remotely.

CBC 7000 CAPABILITIES

- Built-in web interface (CBC-7000)
- Supports SNMP and REST API (CBC-7000)
- Ethernet, cellular, SMS or analog communication
- Small form factor
- Low current draw, 12V solar friendly
- Local/Remote control

- Controller status via on-board LCD screen
- Integrates with MH Corbin Platinum Software
- Closed-loop feedback of EMS and LED lamp status

CBC 7000 TECHNICAL SPECIFICATIONS

Interface, Ports

REMOTE CONTROL
Web Interface

LEDs
Power, SBC, HDD, Heartbeat

POWER
10V-36V, 6W (not including sensors)

CONNECTORS
Ethernet (2), USB (2), RS-232 (2), RS-485 (4), Digital Out (2), Analog In-put (2), HDMI (1), Audio In, Audio Out

ANTENNA
Cellular, GPS, Pavement sensors, Satellite

Computing

PROCESSOR
Intel

MEMORY
4GB minimum

STORAGE
16GB minimum

OPERATING SYSTEM
Linux

Physical

WEIGHT
1.6 lbs.

DIMENSIONS
6 x 5 x 3 in

MOUNTING
Din Rail or shelf

OPERATING TEMP
-29°F to 165°F (-34°C to 74°C)

HUMIDITY
Up to 95% RH

Western Systems

MH CORBIN

VX 21
Measure road surface temperature and detect moisture.

○ **GATHER**

○ ANALYZE

○ COMMUNICATE

The VX 21 Wireless Pavement Sensor from MH Corbin is a fully sealed and potted device used to measure the true road surface and subgrade temperatures. The sensor can also detect the presence of moisture and road salt on the roadway and is fully compatible with MH Corbin HARWIS Stations.

The VX 21 Sensor can be used as an add-on sensor in your existing RWIS/HARWIS stations or deployed as an independent system that can be installed almost anywhere. The stand-alone VX 21 Sensor System consists of up to nine VX 21 Sensors, an enclosure, VXMS radio module, cellular modem and a sealed battery. The data is transmitted and viewed using easy-to-use web-based software from any internet-ready device.

Road Temperature

Road Moisture

Anti-Icing Chemicals
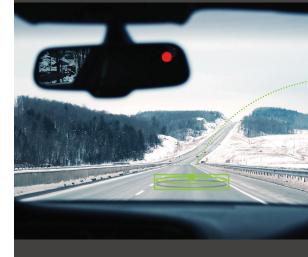
Quick Facts

- Completely sealed from water intrusion
- Solid state device
- Wireless
- Two different temp readings (surface and subsurface) to greatly enhance pavement forecasting
- Quick install

Available Models

- VX 21-1
- VX 21-2
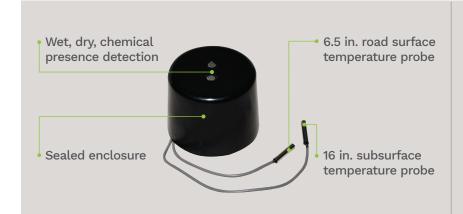
VX 21
Measure road surface temperature and detect moisture.

VX 21 FEATURES

Wet, dry, chemical presence detection

Sealed enclosure

6.5 in. road surface temperature probe

16 in. subsurface temperature probe

- Accurately measures road surface temperature, wet/dry, subsurface temperature, anti-icing chemical presence
- 5 - 7 year battery life
- Sealed and potted design eliminates water intrusion
- Up to 600' communication distance
- Can be used as an add-on sensor for RWIS system

VX 21 TECHNICAL SPECIFICATIONS

Technical Data

DIMENSIONS
102 x 73 mm/4 x 2.875 in

CONDITIONS MEASURED
Wet/Dry/Chemical

INTERFACE/COMMUNICATIONS
915MHz RF

POWER
3.7VDC 38ahr Battery Pack

OPERATING TEMPERATURE RANGE
-40° – 80° C/-40° – 176 F

OPERATING HUMIDITY RANGE
0–100% RH

Road Surface Temp

PRINCIPLE
Digital/Microcontroller

MEASURING RANGE
-55° – 125° C/-67° – 257° F

ACCURACY
±0.5°C/±0.9°F

RESOLUTION
12 bit

Subsurface Temp

PRINCIPLE
Digital/Microcontroller

MEASURING RANGE
-55° – 125° C/-67° – 257° F

ACCURACY
±0.5°C/±0.9°F
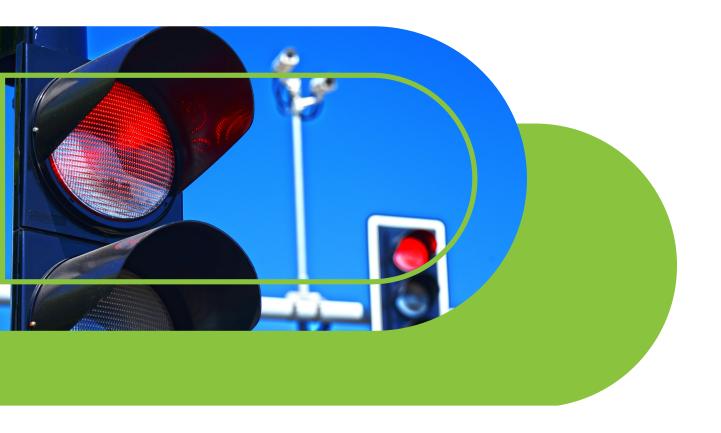
RESOLUTION
12 bit

Sensors and Cameras

Ready to Transform Your Traffic Flow? Embrace the Power of Sensors and Cameras Today!

Costar HD COHU

Ensure Safety and Security in Transportation and Critical Infrastructure

Western Systems

COSTAR HD

3430HD SERIES FIXED BARREL CAMERA
3MP 33x Zoom Surveillance System

Advanced Optics
- Superior 3MP image quality
- 33x optical, 16x digital zoom
- Image defog analytic
- Wide dynamic range
- Backlight compensation
- Flexible exposure adjustments
- 3D noise reduction
- Image rotation adjustments

Rugged Construction
- Built-in electrical transient/surge protection to CISPR 24 levels
- IP68 ingress protection
- Wide operating temperature range
- Faceplate heater blanket

Flexible Installation and Interoperability
- ONVIF Profile S, G, and T Support
- Power over Ethernet
- H.265, H.264, and MJPEG encoding
- Three individually configurable video streams
- Web server configuration, operation and viewing
- Single Cat5e cable installation
- Wall, pole and corner mounting bracket options

ONVIF | **S G T** **IP68** **PoE**

NDAA Compliant

CostarHD's series 3430HD fixed camera system combines crystal clear HD image quality, bandwidth efficient H.265 compression and IP68 protection delivering the CostarHD quality and performance you expect!

The 3430HD provides full 3MP imaging with 33x optical zoom, delivering full frame rate HD images over the entire zoom range for cost-effective surveillance applications.

True day/night technology using a removable IR cut filter produces exceptional low-light sensitivity down to 0.0005 fc.

The 3430HD includes advanced imaging processing capabilities such as 3D noise reduction, flexible exposure mode settings, wide dynamic range, white balance along with defog image processing, which enhances video performance in foggy and hazy conditions encountered in surveillance and traffic monitoring applications.

The 3430HD delivers up to three video streams with configurable settings, including H.265, H.264, or MJPEG codec, image resolution, frame rate, bit rate and mode (CBR or VBR).

The 3430HD provides a full-function web server interface, allowing complete administrative and operator control capabilities. Administrative features include configuring network settings, user password assignments, setting video streaming properties, configuring camera imaging properties, assigning camera ID labels and much more.

The 3430HD is designed to operate in harsh environments with an IP68 purged and pressurized enclosure system. This eliminates the effects of water intrusion, pollutants and corrosives.

CostarHD delivers years of clean, reliable images and backs it with a world class three-year warranty.

CAMERA

Sensor	1/2.8" CMOS
Scanning	Progressive
Resolution	2304 x 1296
Frame Rate	60 fps
Camera Format	Day/Night (IR Cut Filter)
Day/Night Modes	Auto, Color, B/W
Day/Night Sens.	High, Med., Low, Ultra Low
S/N Ratio	>50 db

SENSITIVITY - SCENE @ F1.6, AGC ON

Color, Max Sens	0.001 lux F1.5, 50IRE
B/W, Max Sens	0.0005 lux F1.5, 50IRE

OPTICS

Zoom Lens	33x, 4.5 mm to 148 mm
Digital Zoom	16x
Aperture	f/1.5 ~ f/4.0
HAFOV	62.9° ~ 6.7°
Focus	Auto/Manual (Near, Far)
Focus Scene	Normal, long distance
Iris	Automatic

IMAGE PROCESSING

Defog Mode	Off/On (level adjustment)
Dynamic Range	120 dB Off/On (level setting)
Back Light Comp	Off/On (level setting)
Shutter (AES) (1/6 ~ 1/10,000s)	Auto/Manual
Slow Shutter	Off/On (1/15 ~ 1/6) with limit
WB Modes	Auto, Auto 2, fine tune, sodium, outdoor, locked
AGC	Adjustable
Noise Reduction	3D
Image Orientation	90° clockwise and counter-clockwise, 180°, Mirror/Flip

IP STREAM

Video Streams	Three, independently configurable
Video Codec	H.265, H.264, MJPEG
Video Protocols	RTSP/RTP/UDP RTSP Multicast
Video Resolution	3MP, 1080p, 720p, D1, 2CIF, CIF
Video Frame Rate	Up to 60 per second
Video Data Rate	128 Kbps to 16 Mbps
Video Rate Cntrl	Variable or Constant Bit
I Frame Interval	5 ~ 250

NETWORK INTERFACE

Network Format	802.3u 100Base-T, MDI-X auto-sensing, full duplex
IP Addressing	Static or DHCP
Network Protocol	TCP, UDP, IPv4, IGMP, ICMP, DNS, DHCP, RTP, RTSP, NTP, HTTP, HTTPS, ARP, FTP Telnet
Media Players	VLC, Quick Time or any media player compliant with RFC 2326, 3984, 3550, 2435, ISO/IEC 13818-1
ONVIF Camera Protocols	Profile S, G, and T
Security	RTSP Authentication
User Types	Administrator, Common user
Maintenance	File upload over network using camera web server interface, Reboot

ON SCREEN DISPLAY (OSD)

OSD Capacity	Up to 4 OSD Elements can be selected for display on video
OSD Elements	Camera Title, Date/Time, Zoom, Picture ID
OSD Characters	ASCII set, Up to 35 characters per element
OSD Size	Small, Medium or Large
OSD Color	White
Position	Left, Right, or Custom (Each element is positioned using x, y coordinates)

PRIVACY MASKS

Capacity	Up to 4 Rectangular Masks
Color	Black

ELECTRICAL

Input Voltage	PoE Power
Power	15 watts max. 5 to10 watts with heater OFF
Transient/Surge	CISPR 24
Connector	18 pin MS Type

MECHANICAL

Weight	4.5 lbs (2.04 kg)
Dimensions	Refer to diagram below
Construction	Powder coated aluminum
Sunshield	Included as standard
Mounting	Holes Two 1/4-20 UNC, 2.45" apart
Faceplate	Glass

ENVIRONMENTAL

Protection Rating	IP68, Purged + Pressurized at factory.
Salt Fog	MIL-STD-810G, Method 509.5 Procedure I
Humidity	0 to 100%
Heater	Faceplate heater blanket, 5 Watts
Operating Temp	-40°F to 149°F (-40°C to 65°C) continuously, and up to 165F (74°C) for 24 hours. Complies with Nema TS 2 para. 2.2.7.5
Wind Survivability	Up to 150 mph - 120 mph for 45 minutes - 150 mph for 15 minutes

CERTIFICATIONS
FCC Class A, CE, RoHS

ACCESSORIES

Cables
MS/RJ45 Pigtail (45")	8196401-001
6" adapter to 3930HD	ER8196401

Mounts
Wall	7412011-002
Pole Mount	8189-0

Power Supplies
PoE Hi-Temp	7412007-003
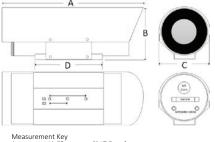
ORDERING MODEL NUMBERS

3432-4000	IP68 3MP 33x camera with 16x digital zoom, PoE power
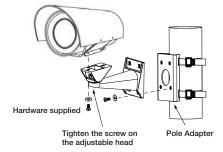
CAMERA DIMENSIONS

Measurement Key
A =	12.5"	[317.5mm]
B =	5.25"	[133.35mm]
C =	5.5"	[139.7mm]
D =	5.0"	[127mm]
E1 =	2.5"	[63.5mm]
E2 =	1.38"	[35mm]

WALL MOUNT INSTALLATION

Hardware supplied

Tighten the screw on the adjustable head

POLE MOUNT INSTALLATION

Hardware supplied

Tighten the screw on the adjustable head

Pole Adapter

Western Systems

COSTAR HD

3490HD SERIES
H.264 Dual Channel Night-Vision Camera

ONVIF® | S

Advanced Night Vision Performance

- ASi uncooled micro bolometer technology
- 384 x 288 and 640 x 480 resolution, 17um FPA options
- Superior thermal sensitivity of 40 mK
- Flexible lens options to suite application and budget requirements
- Long range detection out to 4km

Superior Daytime Imaging

- Visible spectrum daytime color camera available on 3492-2x00 models
- HD 1280 x 720 image quality
- Autofocus, wide view optics
- Supports daytime thermal imaging for improved situational awareness

Rugged Construction

- Wide operating temperature range, -40°C to 75°C, per Nema TS-2 Test Profile figure 2.1
- Durable IP66 ingress protection
- 2 year standard warranty

Installation and Interoperability

- ONVIF Profile S
- H.264 Base/Main/High profiles and MJPEG encoding
- Web server configuration, operation and viewing
- Single CAT5e/CAT6 cable with PoE+
- Wall, pole mounting options

Embedded Analytics

- Real-time scene analysis
- User defined region of interest
- Fence line filters
- Object direction filters
- Learning tagrets capabilities

CostarHD 3490HD series is a state of the art observation system, boasting an incredibly easy installation with day and night capabilities and a dedicated software development kit for full seamless third party integration.

The 3490HD series of cameras is a broad portfolio of high performance outdoor rated cameras for 24/7 perimeter surveillance, observation, and monitoring of critical infrastructure and sensitive sites.

Equipped with thermal and visible-light channels for day and night surveillance, the 3490HD series meets global ONVIF standards to ensure interoperability of hardware and software products for easy integration to both existing and new infrastructures, regardless of manufacturer.

The 3490HD series is designed for supporting embedded video analytics, enabling enhanced security and surveillance solutions by providing all in one camera.

Activating the analytics functionality provides real time alerts based on user defined rules.

The 3490HD series Video Analytics is accurate and is capable of monitoring and analyzing human, vehicle or a pre-learned object per view.

The 3490HD series of cameras are ruggedly designed to withstand the harshest weather and environmental conditions, including rain, direct sunlight, high humidity, dust, heat, and cold.

CostarHD delivers years of clean, reliable images and backs it with a world class two-year warranty.

Western Systems

COSTAR HD

3490HD SERIES
H.264 Dual Channel Night-Vision Camera

NIGHT-VISION THERMAL CAMERA

Detector	ASi Uncooled Microbolometer
Pixel Size	17µm
Spectral Band	7.5 - 14 µm
Sensitivity (NEdT)	40 mK
Image Resolution	640 x 480 (VGA) or 384 x 288 model dependent
Pallettes	Black hot, white hot, 3 color palettes
Frame Rate	25Hz or 9Hz
Properties	Polarity, NUC, Image Flip, Image Rotation & Digital Zoom

THERMAL OPTICS OPTIONS

Options	8.5mm, 14mm, 19mm, 25mm, 35mm, 50mm, 60mm
Lens Type	Athermalized, Hard Carbon
Focus Type	Factory set to Infinity

DAY-TIME VISIBLE CAMERA*

Sensor	1/4" CMOS
Resolution	1280 x 720 (HD)
S/N Ratio	>36 db
Lens	3.5mm fixed focal
Aperture	f1.4
AFOV	54° x 41°
Focus	Auto

* Avaialble on 3492-2x00 Models Only

IP STREAM

Video Streams	2
Video Codec	H.264, MJPEG
Video Protocols	RTSP Unicast, Multicast
Video Resolution	
- Visible Camera	1280 x 720, 640 x 480
- Thermal Camera	640 x 480 or 384 x 288

NETWORK INTERFACE

Network Format	802.3u 100Base-T, MDI-X auto-sensing, full duplex
Network Protocol	TCP, UDP, IPv4, ICMP, DNS, IGMPv2/v3, RTP, RTSP, HTTP[S], SOAP SSL/TLS
ONVIF	Profile S

ANALOG INTERFACE

Format	NTSC or PAL

DIGITAL I/O INTERFACE

Digital Circuits	One input, dry contact

ANALYTICS

Analysis	On board based on the raw video data.
Learning	Self-scene
Configuration	Real-time scene analysis and alarms based on user definable parameters
Region of Interest	Up to 15 per scene
Fences	Up to 15 per scene
Direction	Entrance/detection can be defined by the operator
Learning targets	Human, vehicle, other object
Object Size	Minimum target size for detection is 6x4 (HxW) pixels

ELECTRICAL

Input Voltage	PoE+ or 12-32Vdc
Power	Up to 25.5w
Transient/Surge	Certified to CISPR 24 levels
Emmissions	Certified to CISPR 22 levels

MECHANICAL

Weight	6.94 lbs (3.2 kg)
Dimensions	7.95" (L) x 5.32" (W) x 6.65" (H) 202mm (L) x 135mm (W) x 169mm (H)

ENVIRONMENTAL

Ingress Protection	IP66
Operating Temp	-40°C to 75°C Per Nema TS-2 Test Profile figure 2.1

EMC CERTIFICATIONS
CE, FCC Class A Part 15B

ACCESSORIES

Mounts

Wall	892013
Pole Adapter	892037 (requires 892013)

Power Supplies

7412007-003	110/220vac IP50, -34 to 74C, PoE+

WARRANTY
Two (2) years. Details available at; www.costarhd.com/Support/Warranty

3940HD Models			Maximum Range Values in Meters					
			Human			Vehicle		
Ordering Model	Lens Option	HAFOV	ID	REC	DET	ID	REC	DET
3492-1100	8.5mm	43.5^0	42	83	250	96	192	575
3492-1200	14mm	25.7^0	69	137	412	158	316	947
3492-1300	19mm	19.3^0	92	186	559	214	428	1,285
3492-1400	25mm	14.8^0	123	245	735	282	564	1,591
3492-1500	35mm	10.6^0	172	343	1,029	396	789	2,368
3492-1600	50mm	7.5^0	245	490	1,471	564	1,127	3,382
3492-1700	60mm	6.2^0	294	588	1,765	676	1,353	4,059
3492-2100	8.5mm	73.2^0	42	83	250	96	192	575
3492-2200	14mm	42.1^0	69	137	412	158	316	947
3492-2300	19mm	33.2^0	93	186	559	214	428	1,285
3492-2400	25mm	24.2^0	123	245	735	282	564	1,691
3492-2500	35mm	17.6^0	172	343	1,029	395	789	2,368
3492-2600	50mm	12.4^0	245	490	1,471	564	1,127	3,382
3492-2700	60mm	10.3^0	294	588	2,002	576	1,353	4,059

ID = 12 pixels through critical dimension
REC = 6 pixels through critical dimension
DET= 2 pixels through critical dimension

Critical Dimension of Subject
Human = 1.8m x 0.6m
Vehicle = 2.3m x 2.3m

Note: Ideal atmospheric and scene conditions assumed

Western Systems

COSTAR HD

RISE 4220HD SERIES WITH COMMAND CORE+™
H.264/H.265 High-Definition, IP68 Dome Positioning System

IP68 Protection with Lifetime Warranty on Moisture Ingress

COSTAR HD RISE

ONVIF | S T   NTCIP™   **FDOT APL Approved**

HYBRID ANALOG & IP   CE   NEMA National Electrical Manufacturers Association

🇺🇸 **Made in the USA & NDAA Compliant**

Advanced Optics
- Superior 1080p60 image quality
- Powerful 30x optical zoom with 12x digital zoom (360x total)
- Extreme low-light sensitivity of 0.00008 fc
- Image defog/dehaze analytics
- Electronic image stabilization (EIS)
- Superior Wide Dynamic Range of 130db

Rugged Construction
- Designed Specifically for the ITS market
- Operates in hurricane force winds
- Built-in electrical transient/surge protection to CISPR 24 levels
- Precision positioning of 0.1°
- Pressurized IP68 ingress protection
- NEMA® TS2 temperature, -40°C to 75°C
- Lifetime Warranty on moisture ingress into camera head enclosure

Command Core+™ Action Engine
- Automated camera responses
- Preset/Tour activations
- Digital I/O triggers and actions
- Image snapshots with FTP/EMAIL delivery
- Built-in Configuration Wizards

Installation and Interoperability
- ONVIF® Profile S and T compliant
- NTCIP 1205 compliant
- Hybrid IP/analog video-serial PTZ operation
- H.264, H.265 and MJPEG encoding
- Web server configuration, operation and viewing
- Inverted mounting capability
- Single CAT5e cable with PoE++
- Presets, tours, sectors and privacy zones
- LDAP, RADIUS, TACACS+ user authentication

Intelligent ITS Video Analytics:
- Vehicle Detection, Count and Speed, % Change of Speed (Included as standard feature in all models)
- Vehicle Classification*
- Traffic Incident Detection* (Stopped Vehicle, Wrong Way Direction)
- Pedestrian Detection*

CostarHD's RISE 4220HD dome positioning system combines crystal clear HD image quality, bandwidth efficient H.265 or H.264 compression, smooth variable speed positioning and IP68 protection delivering the CostarHD quality and performance you expect!

The RISE 4220HD provides full 1080p imaging with 30x optical zoom, delivering full frame rate HD images over the entire zoom range for very cost effective long-range surveillance applications.

The quality of RISE 4220HD HD zoom optics far exceeds realized magnification range and magnification of 36x optics advertised in other products.

True day/night technology using a removable IR cut filter produces exceptional low light sensitivity down to 0.00008 fc.

For installations subject to wind or vibration, electronic image stabilization assures steady, clear images.

The RISE 4220HD includes defog/dehaze image processing, enhancing video performance in foggy and hazy conditions encountered in surveillance and traffic monitoring applications.

The RISE 4220HD includes variable hi-speed pan and tilt drive, with 360° continuous pan and +10° to -90° tilt. Fast positioning speeds result in 180° movements in less than 1.5 seconds.

Providing multiple video stream profiles, the RISE 4220HD delivers up to 4 or more independently configured H.265/H.264/MJPEG streams.

The RISE 4220HD provides a full function web server, allowing complete administrative and operator control capabilities.

The RISE action engine generates automated system responses to input triggers including date/time schedules and repetitive timers that can activate output actions including presets, image snapshots with FTP/EMAIL uploads, OSD displays and digital outputs.

The RISE 4220HD is designed to operate in harsh weather with its IP68 enclosure protection. This eliminates the effects of water intrusion, pollutants and corrosives.

CostarHD delivers years of clean, reliable images and backs it with a world class three-year warranty.

CAMERA

Sensor	1/2.8" Exmor R CMOS
Scanning	Progressive
Resolution	1,920 x 1,080 (1080p)
Capture Rate	60 fps
Camera Format	Day/Night (IR Cut Filter)
S/N Ratio	>50db

SENSITIVITY

Standard	(f1.6, 1/30, 50 IRE)
Color	0.01 lux (0.001 fc)
B/W	0.0015 lux (0.00015 fc)
Digital Slow Shutter	(f1.6, 1/3, 30 IRE)
Color	0.0013 lux (0.00013 fc)
B/W	0.0008 lux (0.00008 fc)

OPTICS

Zoom Lens	30x, 4.3 to 129mm
Aperture	f1.6 -> f4.7
HAFOV	63.7° to 2.1° @ 1920x1080
Focus Modes	Auto/Manual [Near/Far], Normal, Interval, Zoom Trigger
Focus Sensitivity	Normal/Low
Iris	Auto/Manual [Open/Close]
Lens Speed	Three [Slow, Medium, Fast]
Digital Zoom	12x, Off/On [Depth]

IMAGE PROCESSING

Day/Night Mode	Auto, Color, B/W
Exposure Mode	Auto/Manual
Back Light Comp	Off/On
Shutter	Auto/Manual [1/1 -> 1/10,000 - 22 step]
Digital Slow Shutter	Off/On [1/30->1/1] with Limit Setting
Defog Mode	Off/On/Auto [Defog Strength]
Image Stabilization	Off/On
Dynamic Range	130db, On/Off [Normal, Enhanced]
White Balance	Auto, Indoor, Outdoor, ATW, Sodium Vapor (Fix/Auto/Outdoor Auto)
AGC	1 to 48db, Adjustable
Noise Reduction	Off, 2D[NR Level], 3D [NR Level]

IP STREAM

Video Streams	4 independently configurable dependent on available processing budget
Video Codec	H.264 [M, H]/H.265 [M], MJPEG
Video Protocols	RTSP/RTP RTSP Interleave HTTP Tunneling RTP Multicast
Video Resolution	1080p, 720p, D1 (NTSC and PAL), VGA, CIF, QVGA
Video Frame Rate	Up to 60 fps, 30 fps default
Video Data Rate	64Kbps to 8Mbps
Video Rate Cntrl	CBR, VBR
Video GOV	1 to 600, 30 default
Video Latency	Four frames (0.133 sec.)
Video Trans.	99.999% error free

NETWORK INTERFACE

Network Format	802.3u 100Base-T, MDI-X auto-sensing, full duplex
Network Protocol	TCP, UDP, IPv4, ICMP, DNS, IGMPv2/v3, DHCP, RTP, RTSP, RTCP, NTP, HTTP, SOAP, HTTPS, ARP, FTP, SMTP, SNMP v1|2|3, TLS, SSL, AES, SMTP, QoS, NTCIP, Telnet, 802.1X, ONVIF Profile S and T, TACACS+, LDAP, Radius, LLDP
Media Players	VLC, Quick Time or any media player compliant with RFC 2326, 3984, 3550, 2435, ISO/IEC 13818-1
ONVIF	Profile S and T
Camera Protocols	ONVIF Profile S and T, NTCIP 1205, CohuT, CohuHD legacy, FAST, Pelco D
Security	4 Levels: Admin, Operator, User, Anonymous [User Name + Password], Digest Authentication, Centralized Authentication
Updates	File upload over network using camera web server interface
Configurations Memory	Stored in Non-Volitile
Browsers	Edge, Firefox, Chrome

DIGITAL I/O INTERFACE

Digital Circuits	Two digital I/O circuits, user defined as either input or output

ANALOG INTERFACE

Video Format	EIA-170A/RS-330 NTSC or PAL Video Format, 1 Volt^{P-P}, 75 ohm output impedance
Serial Data PTZ	EIA RS422, Software configurable over IP for full/half duplex, 1,200 to 115k baud, data, stop and parity bit configurations.
Protocols	CohuHD Legacy, Pelco D/P, Ultrak, NTCIP 1205, A/D, FAST, Javelin

VIDEO ANALYTICS (VA)

ITS Standard	Included in all models. Vehicle Detection, Count and Speed, % Change of Speed, Multiple View Analytics/PTZ Presets
ITS Advanced*	Includes **ITS Standard** plus Vehicle Classification, Traffic Incident Detection, Stopped Vehicle, Wrong Way Direction
ITS Pedestrian Detection*	Includes **ITS Standard** plus Pedestrian Detection
VA Notifications	ONVIF Events, SNMP Traps, Command Core+ Action

	Engine Output, CSV Files, Web Interface Display
SNMP Traps	Vehicle Detected, Wrong Way Vehicle, Incident, Stopped Vehicle, Speed Change

COMMAND CORE+ ACTION ENGINE

Input Triggers	Digital input, FTP error, Valid or invalid login, Tour stopped, Timer, Scheduler, Video Analytic Event, Preset reached, PTZ moved, Maintenance, User command
Output Actions	Digital Output, Activate Wiper, FTP Image, Send Email, Send Text, Start Preset or Tour, Display OSD Message, Timer/Scheduler On/Off Mode Control, Delay, Reset System, Clear Analytics Stats
Trigger Queuing	User selectable mode. Processes output actions by trigger priority, first in, or last in.
Servers	Multiple FTP and EMAIL servers can be configured for use by camera system

ON SCREEN DISPLAY (OSD)

OSD Capacity	Up to 7 OSD Elements can be selected for display on video
OSD Elements	Text, Preset, Position, Compass, Date/Time, Sector, Maintenance, Action Event
OSD Characters	Up to 40 characters per text element
OSD Size	Adjustable from 12, 18, 24, 30, 36, 42, 48, 54, 60, 72, 84 or 96 pt. size
OSD Color	White, Black, Green, Red, Blue
OSD Transparancy	Adjustbale from 0-100%
OSD Background	Transparant, Black
OSD Location	Upper Right/Left, Lower Right/Left, Center, Custom
Banner Display	On/Off, Top/Bottom, 4 OSD elements
Logo Display	BMP, GIF, JPEG, PNG Format, [x,y] position, Transparency

PRIVACY MASKS

Capacity	Up to 24 rectangular masks, displayed on 8 places per screen simultaneously.
Color	User selectable
Mask Interlock	Mask positions and size are scaled and interlocked with PTZ movements

* License Fee Required

POSITIONING DRIVE

Pan/Azimuth Range	360° continuous rotation
Tilt/Elevation Range	+10° to -90°, 200° total
Preset Speed	Peak speed of 300°/sec 180° movement < 1.5 Seconds
Manual Speed	0.1° to 80°/second
Speed Resolution	> 64 Variable speed levels
Repeatability	+/- 0.1°
Resolution	+/- 0.1°
Presets	Up to 256, Includes pan, tilt, zoom, focus, preset ID, I/O output state
Tours	Up to 256, Includes presets with dwell, speed, direction and recurrence properties.
Auto Park	Returns to a preset or tour after timer expires, Timer Value [Off, 1 Minute to 999 Hours]
Features	Auto focus/iris on PTZ, Proportional PTZ, Video freeze on preset, High wind/vibration mode, Set north calibration,

ELECTRICAL

Input Voltage	PoE+, PoE++ or 24VAC/DC Model Dependent
Power	PoE++ and 24VAC/DC 20W, 60w with heater ON PoE+ 20W, 25.5W with heater ON
Voltage Range	NEMA standard TS 2-2003 section 2.2.7 tests C thru H
Transient/Surge	Certified to CISPR 24 levels
Emmissions	Certified to CISPR 22 levels

MECHANICAL

Weight	12.5lbs (5.7kg) Camera 16.5lbs (7.5kg) Shipping
Dimensions	Refer to dimensional diagram 15"x15"x15" Shipping (381 x 381x 381 mm)
Construction	Powder Coated aluminum
Sunshield	Included as standard
Color	Light Gray Cardinal Coating T241-GR142
Dome window IK10	Nylon, Optically Correct Camera System except dome window is IK10

ENVIRONMENTAL

Protection Rating	IP68, Pressurized with Dry Nitrogen, 3.5 psi. Water immersion at 1m for 24 hours with no water ingress. Lifetime warranty on moisture ingress.
Operating Temp	PoE++ and 24VAC/DC Models -40°F to 165°F (-40°C to 75°C) Per NEMA TS2, para 2.2.7

	4228-1000 PoE+ Model -4°F to 165°F (-20° to 75°C)
Internal Heaters	Two DC resistive heater assemblies, software controlled, to maintain internal heat for operation down specified operating temperatures above.
Relative Humidity	Operation from 0-100%
Vibration	Per NEMA TS2 para. 2.2.8. 5-30Hz sweep @ 0.5g applied in each of 3 mutually perpendicular planes.
Shock	Per NEMA TS2 para. 2.2.9. 10g applied in each of 3 mutually perpendicular planes
Corrosion	MIL-STD-810G, Method 509.5, Paragraph 4.5.2, ANSI NCSL Z540-1, ISO 17025:2005
Wind Survivability	Up to 150mph - 120 mph for 45 minutes - 150 mph for 15 minutes
MTBF	330,000 hours, based on HALT Steady State Field MTBF calculations

EMC CERTIFICATIONS

CE, FCC Part 15B, RoHS
AS/NZS CISPR 22:2009+A1:2010
CAN/CSA-CISPR 22-10
EN 55022:2010+AC: 2011
EN 55024:2010
EN 61000-3-2:2006 +A1:2009+A2:2009
EN 61000-3-3:2013
EN 61000-4-2: 2009
EN 61000-4-3: 2006 +A1:2008 +A2:2010
EN 61000-4-4: 2004
EN 61000-4-5: 2006
EN 61000-4-6: 2009
EN 61000-4-8: 2010
EN 61000-4-11: 2004

ACCESSORIES

Mounts

Wall	7411420-001
Pole	8518-2

Field Cables

CAT5e Cables	8194602-xxx [where xxx = 025, 055, 100, 150, 200, 250, 300, 328] denoting cable length in feet. Includes RJ45 connectors at each end of cable.

Power Supply

7412007-003	PoE++, 60W, 110/220VAC Input, IP50, -40 to 74°C, Surface Mount
7412007-004	PoE++, 60W, 12-48VDC Input, IP50, -40 to 74°C, DIN Rail
7411543-010	24VAC, 100VA, 110/220VAC, IP66, -34 to 74°C

PD-9501GO-ET	Outdoor IP67 Rated PoE++ Power Supply, Surface Mount, -40 to 65°C

RJ45 Coupler

7610203-002	CAT5/6 RJ45 IP67 Coupler

Ethernet Surge Protection

7412009-001	Outdoor IP67 rated ethernet/PoE++ surge protection device

WARRANTY

Lifetime warranty on dome enclosure moisture ingress. Three (3) years on camera and positioner system.

ORDERING INFORMATION

4220-1000-03	RISE IP68 Dome Camera System with 1080p 30x camera, H.264/H.265 IP encoder, pan/tilt positioner and IP68 enclosure system. 60W PoE++ power. Includes a 45" RJ45 male pigtail and ITS Standard Analytics.
4224-1000-03	RISE IP68 Dome Camera System with 1080p 30x camera, H.264/H.265IP encoder, pan/tilt positioner and IP68 enclosure system. 24Vac/dc power. Includes 18 pin MS connector and ITS Standard Analytics.
4228-1000-03	RISE IP68 Dome Camera System with 1080p 30x camera, H.264/H.265 IP encoder, pan/tilt positioner and IP68 enclosure system. 25.5 W PoE+ power. Includes a 45" RJ45 male pigtail and ITS Standard Analytics.

OPTIONAL ITS ANALYTICS

R-ITS-ADV	Advanced ITS Analytics: Provides ITS Standard Features PLUS Vehicle Size Classification, Incident Detection, Stopped Vehicle, Wrong Way Direction.
R-ITS-PED	Pedestrian Detection: Provides ITS Standard Features PLUS Pedestrian Detection.
R-ITS-ADP	Advanced ITS + Pedestrian: Provides ITS Standard Features PLUS Advanced ITS and Pedestrian Detection Features.

DIMENSIONS

Dimensions	L1	L2	L3	L4
Inches	14.3	11.7	11.4	7.0
Millimeters	363.2	297.2	289.6	177.8

RJ45 PIGTAIL INCLUDED

CONNECTOR (MAIN)
1310230−212
1310216−013

7610201−001

5.0 MIN

ETHERNET
RJ45
1310636−008
1310637−008

ETHERNET

45.0 ±1.5

Western Systems

COSTAR HD

**Lifetime Warranty
Camera Head Moisture Ingress
IP68 Protection**

Onvif® | S T   NTCIP™   **FDOT APL Approved**

HYBRID ANALOG & IP   CE   NEMA National Electrical Manufacturers Association

🇺🇸 Made in the USA & NDAA Compliant

Advanced Optics
- Superior 1080p60 image quality
- Powerful 30x optical zoom with 12x digital zoom (360x total)
- Extreme low-light sensitivity of 0.00008 fc
- Image defog/dehaze analytics
- Electronic image stabilization (EIS)
- Superior Wide Dynamic Range of 130db

Rugged Construction
- Designed Specifically for the ITS market
- Operates in hurricane force winds
- Built-in electrical transient/surge protection to CISPR 24 levels
- Precision positioning of 0.05°
- Pressurized IP68 Camera Head
- NEMA® TS2 temperature, -40°C to 75°C
- Lifetime Warranty on moisture ingress into camera head enclosure

Command Core+™ Action Engine
- Automated camera responses
- Preset/Tour activations
- Digital I/O triggers and actions
- Image snapshots with FTP/EMAIL delivery
- Built-in Configuration Wizards

Installation and Interoperability
- ONVIF® Profile S and T compliant
- NTCIP 1205 compliant
- Hybrid IP/analog video-serial PTZ operation
- H.264, H.265 and MJPEG encoding
- Web server configuration, operation and viewing
- Inverted mounting capability
- Single CAT5e or CAT6 cable with PoE++
- Presets, tours, sectors and privacy zones
- LDAP, RADIUS, TACACS+ user authentication

Intelligent ITS Video Analytics:
- Vehicle Detection, Count and Speed, % Change of Speed (Included as standard feature in all models)
- Vehicle Classification*
- Traffic Incident Detection* (Stopped Vehicle, Wrong Way Direction)
- Pedestrian Detection*

CostarHD's 4260HD camera positioning system combines crystal clear HD image quality, bandwidth efficient H.264/H.265 compression, smooth variable speed positioning and IP68 protection delivering the CostarHD quality and performance you expect!

The 4260HD provides full 1080p60 imaging with 30x optical zoom, delivering full frame rate HD images over the entire zoom range for very cost effective long-range surveillance applications.

True day/night technology using a removable IR cut filter produces exceptional low light sensitivity down to 0.00008 fc.

For installations subject to wind or vibration, electronic image stabilization assures steady, clear images.

The 4260HD includes defog/dehaze image processing, enhancing video performance

in foggy and hazy conditions encountered in surveillance and traffic monitoring applications.

The 4260HD includes variable hi-speed pan and tilt drive, with 360° continuous pan and 360° tilt. Fast positioning speeds result in 180° movements in less than 2 seconds.

Providing multiple video stream profiles, the 4260HD delivers up to 4 independently configured H.264/H.265/MJPEG streams as well as analog video output with serial RS422 camera PTZ control.

Use of the IP and analog output allows integration with analog systems today while providing a smooth transition to HD Video over IP tomorrow.

The 4260HD provides a full function web server using HTML5, allowing complete administrative, live video and operator control capabilities. Administrative features

include configuring network settings, user password assignments, setting video streaming properties, configuring camera imaging properties, defining presets and tours and assigning camera ID labels.

The RISE action engine generates automatic system responses to input triggers including digital inputs, date/time schedules and repetitive timers that can activate output actions including presets, image snapshots with FTP/EMAIL uploads, OSD displays and digital outputs.

The 4260HD is designed to operate in harsh weather with its purged and pressurized IP68 enclosure protection. This eliminates the effects of water intrusion, pollutants and corrosives.

CostarHD delivers years of clean, reliable images and backs it with a world class three-year warranty.

WesternSystems

COSTAR HD

CAMERA

Sensor	1/2.8" Exmor R CMOS
Scanning	Progressive
Resolution	1,920 x 1,080 (1080p)
Capture Rate	60 fps
Camera Format	Day/Night (IR Cut Filter)
S/N Ratio	>50db

SENSITIVITY

Standard	(f1.6, 1/30, 50 IRE)
Color	0.01 lux (0.001 fc)
B/W	0.0015 lux (0.00015 fc)
Digital Slow Shutter	(f1.6, 1/3, 30 IRE)
Color	0.0013 lux (0.00013 fc)
B/W	0.0008 lux (0.00008 fc)

OPTICS

Zoom Lens	30x, 4.3 to 129mm
Aperture	f1.6 -> f4.7
HAFOV	63.7° to 2.1°
Focus Modes	Auto/Manual [Near/Far], Normal, Interval, Zoom Trigger
Focus Sensitivity	Normal/Low
Iris	Auto/Manual [Open/Close]
Lens Speed	Three [Slow, Medium, Fast]
Digital Zoom	12x, Off/On [Depth]

IMAGE PROCESSING

Day/Night Mode	Auto, Color, B/W
Exposure Mode	Auto/Manual
Back Light Comp	Off/On
Shutter	Auto/Manual [1/1 -> 1/10,000]
Digital Slow Shutter	Off/On [1/30->1/1] with Limit Setting
Defog Mode	Off/On/Auto [Defog Strength]
Image Stabilization	Off/On
Dynamic Range	130db, On/Off [Normal, Enhanced]
White Balance	Auto, Indoor, Outdoor, ATW, Sodium Vapor (Fix/Auto/Outdoor Auto)
AGC	14 to 50db, Adjustable
Noise Reduction	Off/2D[NR Level]/3D [NR Level]

IP STREAM

Video Streams	4 independently configurable dependent on available processing budget
Video Codec	H.264 [M, H]/H.265 [M], MJPEG
Video Protocols	RTSP/RTP RTSP Interleave HTTP Tunneling RTP Multicast
Video Resolution	1080p, 720p, D1 (NTSC and PAL), VGA, CIF, QVGA
Video Frame Rate	Up to 60 fps, 30 fps default
Video Data Rate	64Kbps to 8Mbps
Video Rate Cntrl	CBR, VBR
Video GOV	1 to 600, 30 default

Video Latency	Four frames (0.133 sec.)
Video Trans.	99.999% error free

NETWORK INTERFACE

Network Format	802.3u 100Base-T, MDI-X auto-sensing, full duplex
Network Protocol	TCP, UDP, IPv4, ICMP, DNS, IGMPv2/v3, DHCP, RTP, RTSP, RTCP, NTP, HTTP, SOAP, HTTPS, ARP, FTP, SMTP, SNMP v1|2|3, TLS, SSL, SMTP, QoS, NTCIP, Telnet, 802.1X, ONVIF Profile S and T, TACACS+, LDAP, Radius, LLDP
Media Players	VLC, Quick Time or any media player compliant with RFC 2326, 3984, 3550, 2435, ISO/IEC 13818-1
ONVIF	Profile S and T
Camera Protocols	ONVIF Profile S and T, NTCIP 1205, CohuT, CohuHD legacy, FAST, Pelco D
Security	4 Levels: Admin, Operator, User, Anonymous [User Name + Password], Digest Authentication, Centralized Authentication
Updates	File upload over network using camera web server interface or OptiCore
Configurations	Stored in Non-Volatile Memory
Browsers	Edge, Firefox, Chrome

DIGITAL I/O INTERFACE

Digital Circuits	Four digital I/O circuits, user defined as either input or output

ANALOG INTERFACE

Video Format	NTSC or PAL
Serial PTZ	RS422, full/half duplex, 1,200 to 115k baud adjustment, data, stop and parity bit configuration.
Protocols	CohuHD Legacy, Pelco D/P, Ultrak, NTCIP 1205, A/D, FAST, Javelin

VIDEO ANALYTICS (VA)

ITS Standard	Included in all models. Vehicle Detection, Count and Speed, % Change of Speed, Multiple View Analytics/PTZ Presets
ITS Advanced*	Includes **ITS Standard** plus Vehicle Classification, Traffic Incident Detection, Stopped Vehicle, Wrong Way Direction
ITS Pedestrian Detection*	Includes **ITS Standard** plus Pedestrian Detection

VA Notifications	ONVIF Events, SNMP Traps, Command Core+ Action Engine Output, CSV Files, Web Interface Display
SNMP Traps	Vehicle Detected, Wrong Way Vehicle, Incident, Stopped Vehicle, Speed Change

COMMAND CORE+ ACTION ENGINE

Input Triggers	Digital input, FTP error, Valid or invalid login, Tour stopped, Timer, Scheduler, Video Analytic Event, Preset reached, PTZ moved, Maintenance, User command
Output Actions	Digital Output, Activate Wiper, FTP Image, Send Email, Send Text, Send Text with Image, Start Preset or Tour, Display OSD Message, Timer and Scheduler On/Off Mode Control, Delay, Reset System, Clear Analytics Stats
Trigger Queuing	User selectable mode. Processes output actions by trigger priority, first in, or last in.
Servers	Multiple FTP and EMAIL servers can be configured for use by camera system

ON SCREEN DISPLAY (OSD)

OSD Capacity	Up to 8 OSD Elements can be selected for display on video
OSD Elements	Text, Preset, Position, Compass, Date/Time, Sector, Maintenance, Action Event
OSD Characters	Up to 40 characters per text element
OSD Size	Adjustable from 12, 18, 24, 30, 36, 42, 48, 54, 60, 72, 84 or 96 pt. size
OSD Color	White, Black, Green, Red, Blue
OSD Transparency	Adjustable from 0-100%
OSD Background	Transparent, Black
OSD Location	Upper Right/Left, Lower Right/Left, Center, Custom
Banner Display	On/Off, Top/Bottom, 4 OSD elements
Logo Display	BMP, GIF, JPEG, PNG Format, [x,y] Position, Transparency

* License Fee Required

PRIVACY MASKS

Capacity	Up to 24 rectangular masks, displayed on 8 places per screen simultaneously.
Color	Two colors
Mask Interlock	Mask positions and size are scaled and interlocked with PTZ movements

POSITIONING DRIVE

Pan Range	360° continuous rotation
Tilt Range	350°
Preset Speed	Peak speed of 120°/sec 180° movement < 2 seconds
Manual Speed	0.05° up to 90°/second
Tracking Speed	0.05° up to 90°/second
Speed Resolution	Up to 100 variable speeds
Repeatability	+/- 0.05°
Resolution	+/- 0.05°
Presets	Up to 256, Includes pan, tilt, zoom, focus, preset ID, I/O output state
Tours	Up to 256, Includes presets with dwell, speed, direction and recurrence properties
Auto Park	Returns to a preset or tour after timer expires, Timer Value [Off, 1 Minute to 999 Hours]
Features	Auto focus/iris on PTZ, Proportional PTZ, Video freeze on preset, High wind/vibration mode, Set/Clear north calibration, Inverted mounting mode

ELECTRICAL

Input Voltage	PoE++, 24VAC/DC or 120VAC, model dependent
Power	Typical 30W, up to 60W with heaters ON
Voltage Range	PoE++ and 120VAC - NEMA standard TS 2-2003 section 2.2.7 tests C thru H 24Vac, 18VAC to 28VAC at camera connector 24VDC, 20VDC to 28VDC at camera connector
Transient/Surge	Certified to CISPR 24 levels
Emissions	Certified to CISPR 22 levels
Pigtail Cable(s)	Approx. 24"

MECHANICAL

Weight	21.5 pounds (9.75 kg maximum
Dimensions	Refer to dim. diagram
Construction	Powder coated aluminum
Faceplate	Optically Correct Glass
Faceplate Wiper	Model Dependent, [On/Off, Dwell, Time Out Settings]
Sunshield	Included as standard
Inverted Mounting	Yes. Software selectable
Connectors	RJ45, AMP, MS, Model dependent
Color	Light Gray Cardinal Coating T241-GR142

ENVIRONMENTAL

Protection Rating	Camera - IP68, Pressurized with Dry Nitrogen, 3.5 psi. Positioner Body - IP66
Operating Temp	-40° to 167°F (-40° to 75°C) Per NEMA TS2 2.2.7
Heaters	Heaters are software controlled for managing proper internal temperature of camera system. The faceplate heater is ITO coated glass designed to maintain outer faceplate surface temperature above 32° (0°C) down to -4° (-20°C)
Humidity	0 to 100%, condensing
Vibration	Per NEMA TS2 para. 2.2.8. 5-30Hz sweep @ 0.5g applied in each of 3 mutually perpendicular planes.
Shock	Per NEMA TS2 para. 2.2.9. 10g applied in each of 3 mutually perpendicular planes
Corrosion	MIL-STD-810G, Method 509.5, Paragraph 4.5.2, ANSI NCSL Z540-1, ISO 17025:2005
Impact Rating	IK10
MTBF	251,000 hours, based on HALT Steady State Field MTBF calculations

CERTIFICATIONS

FCC Part 15B Class A
CE, RoHs
EN 55022: 2010+AC: 2011
AS/NZS CISPR 22:2009 +A1:2010
CAN/CSA-CISPR 22-10
EN 55024: 2010
EN 61000-3-2: 2006+A1:2009+A2:2009
EN 61000-3-3: 2013
SASO (Pending)

ACCESSORIES

Mounts

Pedestal	7411542-001, 7411444-001, 7411444-002, 7411444-003, or 7411444-004
Wall	8425-7
Pole	8503-0
7.0" BC Plate	8481-9

IP Field Cables

CAT5e Cables	8194603-xxx [where xxx = 025, 055, 100, 150, 200, 250, 300, 328] denoting cable length in feet. Includes RJ45 connectors at each end of cable.

Accessory Cables
CA277, CA278 Series

Power Supply

7412007-003	PoE++, 60W, 110/220VAC IP50, -34 to 74°C
7411543-010	24Vac, 100VA, 110/220VAC, IP66, -34 to 74°C
7412007-004	PoE++, 60W, 12-48VDC Input, IP50, -40 to 74°C, DIN Rail
PD-9501GO-ET	Outdoor IP67 Rated PoE++ Power Supply, Surface Mount, -40 to 65°C

RJ45 Coupler

7610203-002	CAT5/6 RJ45 IP67 Coupler

RJ45 IP67 Coupler, p/n 7610203-002. CAT5e/6/6a shielded cable with a 6mm or 8.2 mm O.D. is required for waterproofing

Ethernet Surge Protection

7412009-001	Outdoor IP67 rated ethernet/PoE++ surge protection device

WARRANTY

Three (3) years on camera and positioner system. Lifetime warranty on camera enclosure moisture ingress.
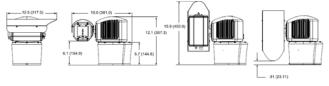
PIGTAIL CONFIGURATIONS

RJ45 Connector Pin Outs

Pin	Function	
	Pinout A	Pinout D
1	ETHERNET TX+, POE++ [-]	ETHERNET TX+
2	ETHERNET TX-, POE++ [-]	ETHERNET TX-
3	ETHERNET RX+, POE++ [+]	ETHERNET RX+
6	ETHERNET RX-, POE++ [+]	ETHERNET RX-
5	POE++ [+]	N/C
4	POE++ [+]	N/C
7	POE++ [-]	N/C
8	POE++ [-]	N/C
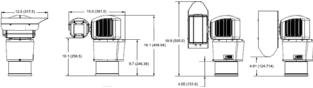
Prepped Accessory Cable

Prepped Wires	Function	
	Pinout B	Pinout E
ORN	DIO 1	DIO 1
WHT/BLK	DIO 2	DIO 2
RED/GRN	DIO 3	DIO 3
BLU	DIO 4	DIO 4
YEL	N/A	N/A
BRN	I/O COMMON	I/O COMMON
WHT (26 AWG)	RS422 RX+	RS422 RX+
BLK (26 AWG)	RS422 RX-	RS422 RX-
RED (26 AWG)	RS422 TX+	RS422 TX+
GRN (26 AWG)	RS422 TX-	RS422 TX-
COAX VIDEO (WHT)	ANALOG VIDEO OUTPUT	ANALOG VIDEO OUTPUT
COAX SHIELD (BLK)	ANALOG VIDEO SHIELD	ANALOG VIDEO SHIELD
BLK (22 AWG)	N/C	24 VAC
WHT (22 AWG)	N/C	24 VAC

MS Cable

MS Connector	Function					
	Pinout C	Pinout F	Pinout G	Pinout H	Pinout I	Pinout M
C	DIO 1	DIO 1	DIO 1	DIO 1	DIO 1	POE++ [-]
K	DIO 2	DIO 2	DIO 2	DIO 2	DIO 2	POE++ [-]
J	DIO 3	DIO 3	DIO 3	DIO 3	DIO 3	DIO 1
P	I/O COMMON	I/O COMMON	I/O COMMON	I/O COMMON	I/O COMMON	DIO 2
M	RS422 RX+	RS422 RX+	RS422 RX+	RS422 RX+	RS422 RX+	RS422 RX+
N	RS422 RX-	RS422 RX-	RS422 RX-	RS422 RX-	RS422 RX-	RS422 RX-
S	RS422 TX+	RS422 TX+	RS422 TX+	RS422 TX+	RS422 TX+	RS422 TX+
R	RS422 TX-	RS422 TX-	RS422 TX-	RS422 TX-	RS422 TX-	RS422 TX-
L	ANALOG VIDEO OUTPUT	ANALOG VIDEO OUTPUT	ANALOG VIDEO OUTPUT	ANALOG VIDEO OUTPUT	ANALOG VIDEO OUTPUT	ANALOG VIDEO OUTPUT
A	ANALOG VIDEO SHIELD	ANALOG VIDEO SHIELD	ANALOG VIDEO SHIELD	ANALOG VIDEO SHIELD	ANALOG VIDEO SHIELD	ANALOG VIDEO SHIELD
B	N/A	24 VAC	24 VAC	N/C	N/C	POE++ [+]
T	N/A	24 VAC	24 VAC	120 VAC LO	120 VAC LO	POE++ [+]
G	CHASSIS	CHASSIS	CHASSIS	CHASSIS	CHASSIS	CHASSIS
U	N/C	N/C	N/C	120 VAC HI	120 VAC HI	I/O COMMON
H	N/C	N/C	ETHERNET RX-	ETHERNET RX-	N/C	ETHERNET RX-
D	N/C	N/C	ETHERNET TX+	ETHERNET TX+	N/C	ETHERNET TX+
E	N/C	N/C	ETHERNET TX-	ETHERNET TX-	N/C	ETHERNET TX-
F	N/C	N/C	ETHERNET RX+	ETHERNET RX+	N/C	ETHERNET RX+

DIMENSIONS FOR 4261 THROUGH 4266 MODELS
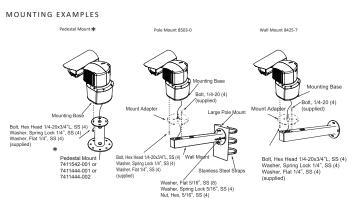
DIMENSIONS FOR 4267 THROUGH 426B MODELS

MODEL INDEX CONFIGURATION

Product Series
426   RISE 4260HD Series IP68 Camera Positioner

Power/Pigtail Options
1   PoE++ Power, RJ45 Pigtail
2   PoE++ Power, RJ45 Pigtail, Accessory Pigtail
3   PoE++ Power, RJ45 Pigtail, MS Conn. Accessory Pigtail
4   24 VAC Power, RJ45 Pigtail, Accessory Pigtail, Wires
5   24 VAC Power, RJ45 Pigtail, Accessory Pigtail, MS Conn.
6   24 VAC Power, MS Connector Pigtail
7   120VAC Power, MS Connector Pigtail, Helios Pinout
8   120VAC Power, MS Connector Pigtail, RJ45 Whip, i-Series Pinout
9   120VAC Power, AMP Connector Pigtail, RJ45 Whip, i-Series Pinout
A   120VAC Power, AMP Connector Pigtail, Helios Pinout
B   120VAC Power, AMP Connector Pigtail, Caltrans D11 Pinout
C   PoE++ Power, 10ft RJ45 Pigtail
D   PoE++ Power, RJ45 Pigtail, 3" Pedestal Mount
E   PoE++ Power, 52in RJ45 Pigtail
F   PoE++ Power, MS Connector Pigtail
G   PoE++ Power, 50ft RJ45 Pigtail
-    **Model Number Separator**

Camera Options
1   HD 1080p 30x Camera Module

Housing Options
0   None
1   Faceplate Wiper

Software Options
0   None

Unassigned
0   None
-    **Model Number Separator**

Accessory Kits
0000   None
0001   Contact Factory
0002   Contact Factory
0003   Contact Factory
0004   Contact Factory
-    **Model Number Separator**
03   RISE III

EXAMPLE: 4261-1100-0000-03

OPTIONAL ITS ANALYTICS

R-ITS-ADV   Advanced ITS Analytics: Provides ITS Standard Features PLUS Vehicle Size (Classification), Incident Detection, Stopped Vehicle, Wrong Way Direction.

R-ITS-PED   Pedestrian Detection: Provides ITS Standard Features PLUS Pedestrian Detection.

R-ITS-ADP   Advanced ITS + Pedestrian: Provides ITS Standard Features PLUS Advanced ITS & Pedestrian Detection Features.

OPTIONAL CAT6 PIGTAIL

CAT6-UPG-1   CAT6 Pigtail Option: Replaces CAT5e pigtail with CAT6 pigtail. For use with 4261 models. Installed at the factory.

MOUNTING EXAMPLES

Pedestal Mount ✱

Pole Mount 8503-0

Wall Mount 8425-7

Mounting Base

Bolt, Hex Head 1/4-20x3/4"L, SS (4)
Washer, Spring Lock 1/4", SS (4)
Washer, Flat 1/4", SS (4)
(supplied)

✱ Pedestal Mount
7411542-001 or
7411444-001 or
7411444-002

Mount Adapter

Bolt, 1/4-20 (4)
(supplied)

Large Pole Mount

Bolt, Hex Head 1/4-20x3/4"L, SS (4)
Washer, Spring Lock 1/4", SS (4)
Washer, Flat 1/4", SS (4)
(supplied)

Wall Mount

Stainless Steel Straps

Washer, Flat 5/16", SS (8)
Washer, Spring Lock 5/16", SS (4)
Nut, Hex, 5/16", SS (4)

Mounting Base

Bolt, 1/4-20 (4)
(supplied)

Mount Adapter

Bolt, Hex Head 1/4-20x3/4"L, SS (4)
Washer, Spring Lock 1/4", SS (4)
Washer, Flat 1/4", SS (4)
(supplied)

MOUNTING BOLT PATTERN

4x Ø.201(5.1) THRU
1/4-20 UNC THRU
(at 90°)

Ø 4.75 (120.6)

CLEARANCE

R11.35 (288.3)
Clearance radius from
the center of the base mount

10.2 (259.1)   4.8 (121.9)

7.5 (190.5)

Western Systems

COSTAR HD

RISE 4290HD SERIES WITH COMMAND CORE+™

H.264 Dual Spectrum Night-Vision Positioning System

**Lifetime Warranty
Camera Head Moisture Ingress**

2017 WINNER GSN Government Security News Homeland Security Awards

Command Core™ Action Engine

- Automated camera responses
- Preset/Tour activations
- Digital I/O triggers and actions
- Image snapshots with FTP/EMAIL delivery
- Built-in Configuration Wizards
- Three trigger queuing modes

Superior Visible Imaging and Optics

- Superior 1080p image quality
- Powerful 30x optical zoom with 12x digital zoom (360x total)
- Image defog/dehaze analytics
- Electronic image stabilization (EIS)
- Dark scene enhanced intensity
- Bright source whiteout reduction

Rugged Construction

- Operates in hurricane force winds
- Built-in electrical transient/surge protection to CISPR 24 levels
- Precision positioning of 0.05°
- Factory purged and pressurized IP68 protection
- Integrated faceplate wiper option
- Inverted mounting capability
- Lifetime Warranty on moisture ingress into camera head enclosures.

Advanced Night Vision Performance

- LWIR 8-14μm or MWIR 1-5.4μm spectrum
- Cooled & Uncooled options available
- Up to 640 x 480 resolution, 15μm pixel pitch
- Up to 14.5x 48-700mm continuous zoom thermal optics
- Auto-focus On-Demand (zoom/dual FoV options only)
- Syncronized optical zoom views

Installation and Interoperability

- ONVIF Profile S, NTCIP 1205
- Hybrid IP/analog video-serial PTZ operation
- H.264 Base/Main/High profiles and MJPEG encoding
- Web server configuration, operation and viewing
- Pendent, wall, pole mounting options
- Built-In Setup Configuration wizards

CostarHD's 4290HD dual spectrum positioning system is the latest addition to CostarHD's RISE family of products, combining crystal clear HD visible spectrum imaging along with standard resolution LWIR or MWIR night vision imaging for delivering unmatched performance at an affordable price.

The 4290HD visible spectrum camera provides full 1080p imaging with 30x optical zoom, delivering full frame rate HD images over the entire zoom range for very cost effective long-range surveillance applications.

The visible camera provides defog/dehaze image processing, enhancing video performance in foggy and hazy conditions encountered in surveillance and traffic monitoring applications.

The 4290HD night vision camera offers uncooled VOx 640x480 LWIR FPA detectors with continuous 6x zoom, dual FoV or fixed focal length hard carbon coated lenses, as well as a Cooled MWIR InSb IDCA microbolometer with 640x480 resolution and a continuous 14.5x zoom lenses.

The 4290HD thermal imaging delivers high quality video, even in extreme conditions such as total darkness, smoke, atmospheric haze or dust, rain, light foliage, and most types of fog.

The 4290HD includes variable hi-speed pan and tilt drive, with 360° continuous pan and 360° tilt. The high-torque motor and gearing design ensures the positioner maintains position in high shock, vibration and hurricane force winds.

Providing multiple video stream profiles, the 4290HD delivers up to 5 or more independently configured H.264/MJPEG streams as well as analog video output with serial RS422 camera PTZ control.

Simultaneous streaming of both visible and thermal camera images provides operator viewing and assessment of both spectrums for detection and identification of camera scene information.

The 4290HD provides a full function web server, allowing complete administrative and operator control capabilities. Administrative features include configuring network settings,

user password assignments, setting video streaming properties, configuring camera imaging properties, defining presets and tours and assigning camera ID labels.

The 4290HD is designed to operate in harsh weather with its purged and pressurized IP68 enclosure protection. This eliminates the effects of water intrusion, pollutants and corrosives.

CostarHD delivers years of clean, reliable images and backs it with a world class warranty.

CAMERA

Sensor	1/2.8" CMOS
Scanning	Progressive
Resolution	1,920 x 1,080
	640 x 360 @ 3x dig. zoom
Digital Formats	YUV 4:2:2 SMPTE 274M, BT.709, BT.1120, 1080p, 1080i, 720p
Frame Rate	30fps
Camera Format	Day/Night (IR Cut Filter)
Day/Night Modes	Auto, Color, B/W
S/N Ratio	>50db

SENSITIVITY

Standard	(F1.4, 1/30, 30IRE)
Color	0.25lux (0.025fc)
B/W	0.024lux (0.0024fc)
Digital Slow Shutter	(F1.4, 1/2, 30IRE)
Color	0.015lux (0.0015fc)
B/W	0.0015lux (0.00015fc)

OPTICS

Zoom Lens	30x, 4.4 to 132mm effective 264mm with 2x digital zoom
Aperture	F1.4 -> F4.6
HAFOV	63.4° to 2.1° @ 1920x1080 63.4° to 0.7° @ 640 x 360
Focus	Auto/Manual [Near, Far]
Focus Search	Normal, Bright, Point Source
Focus Sensitivity	Low, Normal, High
Iris	Auto/Manual [Open/Close]
Lens Speed	Three [Slow, Medium, Fast]
Digital Zoom	12x, Off/On [Depth]

VISIBLE IMAGE PROCESSING

Defog Mode	Off/Auto/Manual [3 Levels, Strength and Color Adj.]
Image Stabilization	Off/On
Enhanced Intensity	Off, Enhanced, Whiteout Reduction
Dynamic Range	>90dB Off/On [3 Levels, Normal, Combo, Contrast]
Back Light Comp	Off/On [Level Setting]
Shutter (AES)	Auto/Manual [1/2 -> 1/30,000]
Slow Shutter	Off/On [1/15->1/2] with Limit Setting
White Balance	Auto/Manual [Red/Blue Adjustment]
(WB) Modes	Normal, Mercury, Sodium Vapor
AGC	1 to 48db, Adjustable
Sharpness	Soft, Normal, Sharp, Sharpest
Noise Reduction	Normal, Medium, Strong, Fixed

THERMAL CAMERA

Uncooled Detector

Detector	VOx Uncooled Microbolometer
Image Resolution	640 x 480
Pixel Size	17µm

Spectral Band	8 - 12µm
Sensitivity (NEdT)	<50mK @ F1.0
Frame Rate	30Hz or 9Hz

Cooled Detector

Detector	InSb Cooled Microbolometer
Image Resolution	640 x 480
Pixel Size	15µm
Spectral Band	3 - 5µm
Sensitivity (NEdT)	<25mK @ F1.0
Frame Rate	30Hz or 9Hz

THERMAL IMAGE PROCESSING

Digital Zoom	Up to 12x
Image	Polarity, NUC, Image flip, Auto/Manual gain [Level]
Palettes	Color and B/W selections

THERMAL OPTICS

6x Zoom

Focal Range	25-150mm, 6x, F1.6
HAFoV	25.2° to 4.2°
Lens Type	Athermalized, Hard Carbon
Focus Type	On-Demand Auto Focus, Manual [Near/Far]

4x Zoom

Focal Range	26-105mm, 4x, F1.6
HAFoV	23.6° to 5.9°
Lens Type	Athermalized, Hard Carbon
Focus Type	On-Demand Auto Focus, Manual [Near/Far]

Dual FoV

Focal Range	45/135mm Dual FoV, F1.6
HAFoV	14.3°/4.6°
Lens Type	Athermalized, Hard Carbon
Focus Type	One-Shot Auto Focus, Manual [Near/Far]

Fixed FoV

Focal Range	25mm, 50mm, or 100mm, F1.6	
HAFoV	17.6°	[25mm]
	12.4°	[50mm]
	6.2°	[100mm]
Lens Type	Athermalized, Hard Carbon	
Focus Type	Fixed	

Cooled

Focal Range	48-700mm, 14.5x, F5.5
HAFoV	11.4 ° to 0.8°
Lens Type	Hard Carbon
Focus Type	On-Demand Auto Focus, Manual [Near/Far]

IP STREAM

Video Streams	5 or more video streams dependent on available processing budget

Video Codec	H.264 Base, Main and High Profiles, MJPEG
Video Protocols	RTSP/RTP RTSP/RTP Interleave HTTP Tunneling RTP Multicast
Video Resolution	1080p, 720p, D1 [Visible] D1, VGA, CIF [Thermal]
Video Frame Rate	1 to 30 fps, 30 fps default
Video Data Rate	256Kbs to 8Mbs
Video Rate Cntrl	Variable or Constant
Video GOV	1 to 600, 30 default
Video Latency	Four frames (0.133 sec.)
Video Trans.	99.999% error free

ANALOG INTERFACE

Video Format	NTSC or PAL
Serial PTZ	RS422, full/half duplex, 1,200 to 115k baud adjustment, data, stop and parity bit configuration.
Protocols	CohuHD Legacy, Pelco® D, Ultrak, NTCIP 1205, A/D, FAST, Javelin

NETWORK INTERFACE

Network Format	802.3u 100Base-T, MDI-X auto-sensing, full duplex
Network Protocol	TCP, UDP, IPv4, ICMP, DNS, IGMPv2/v3, DHCP, RTP, RTSP, RTCP, NTP, HTTP, SOAP, HTTPS ARP, FTP, SMTP, SNMP/NTCIP, Telnet. ONVIF Profile S
Media Players	VLC, QuickTime®, or any media player compliant with RFC 2326, 3984, 3550, 2435, ISO/IEC 13818-1
ONVIF	Profile S
Camera Protocols	ONVIF, NTCIP 1205, CohuT, CohuHD legacy
Security	4 Levels: Admin, Operator, User, Anonymous [User Name + Password], Digest Authentication
Updates	File upload over network using camera web server interface
Configurations	Stored in Non-Volitiale Memory
Browsers	Internet Explorer® 11

DIGITAL I/O INTERFACE

Digital Circuits	Four digital I/O circuits, user defined as either input or output

COMMAND CORE ACTION ENGINE

Input Triggers	Digital input, FTP error, Valid or invalid login, Tour stopped, Timer, Scheduler, Preset reached, PTZ moved, Maintenance, User command

Output Actions	Digital output, Activate wiper, FTP image, Send Email, Send Text, Start Preset or Tour, Display OSD message, Timer/Scheduler On/Off mode control, Delay, Reset system
Trigger Queuing	User selectable mode. Processes output actions by trigger priority, first in, or last in.
Servers	Multiple FTP and EMAIL servers can be onfigured for use by camera system

ON SCREEN DISPLAY (OSD)

OSD Capacity	Up to 7 OSD Elements can be selected for display on video
OSD Elements	Text, Preset, Position, Compass, Date/Time, Sector, Maintenance, Action Event
OSD Characters	Up to 40 characters per text element
OSD Size Adjustable	from 12, 18, 24, 30, 36, 42, 48, 54, 60, 72, 84 or 96 pt. size
OSD Color	White, Black, Green, Red, Blue
OSD Transparancy	Adjustbale from 0-100%
OSD Background	Transparant, Black
OSD Location	Upper Right/Left, Lower Right/Left, Center, Custom
Banner Display	On/Off, Top/Bottom, 4 OSD elements
Logo Display	BMP, JPEG, GIF Format, [x,y] position, Transparancy

PRIVACY MASKS
VISIBLE CAMERA ONLY

Capacity	Up to 8 Rectangular Masks.
Color	Red, orange, green, blue, purple, grey
Blur	Solid, fine, medium or coarse pixelated
Opacity	25, 50 or 75%
Brightness	4 levels of adjustment

POSITIONING DRIVE

Pan Range	360° continuous rotation
Tilt Range	360°
Preset Speed	Peak speed of 120°/sec 180° movement < 3 seconds
Manual Speed	0.1° to 45°/second
Speed Resolution	> 64 Variable speed levels
Repeatability	+/- 0.05°
Resolution	+/- 0.05°
Presets	Up to 256, Includes pan, tilt, zoom, focus, preset ID, I/O output state
Tours	Up to 256, Includes presets with dwell, speed, direction and recurrence properties

Auto Park	Returns to a preset or tour after timer expires, Timer Value [Off, 1 Minute to 999 Hours]
Features	Auto focus/iris on PTZ, Proportional PTZ, Video freeze on preset, High wind/vibration mode, Set north calibration, Inverted mounting mode, Syncronized visible/thermal zoom lens FoV mode

ELECTRICAL
Uncooled

Input Voltage	PoE++, 24VDC/AC or 120VAC, model dependent
Power	30W, up to 60W with heaters ON
Voltage Range	NEMA standard TS 2-2003 section 2.2.7 tests C thru H
Transient/Surge Emmissions	Certified to CISPR 24 levels Certified to CISPR 22 levels
Pigtail Cable(s)	Approx. 24"

Cooled

Input Voltage	24VDC/AC
Power	40W, up to 60W with heaters ON

MECHANICAL

Weight	35lbs (15.9 kg) (fixed lens)
Dimensions	Refer to next page
Shipping	44lbs (20kg)
Construction	Powder Coated aluminum
Faceplate	Visible camera, optically correct glass. Thermal camera, hard carbon coated germanium
Faceplate Wiper	Visible Camera, [On/Off, Dwell, Time Out Settings]
Sunshield	Included as standard
Inverted Mounting	Yes, Software selectable
Connectors	RJ45, AMP, MS, Model dependent
Color	Desert Tan
IK10+	Camera System except optics faceplates.

ENVIRONMENTAL

Ingress Protection	Visible Camera - IP68, Pressurized with Dry Nitrogen, 3.5 psi.; Uncooled Thermal Camera - IP67; Cooled Thermal Camera - IP68; Positioner Body - IP66
Humidity	Up to 100%
Operating Temp	**Uncooled** NEMA TS2 para. 2.2.7 -40°F to 167°F (-40°C to 75°C), -22°F (-30°C) Cold Start

	Cooled -29°F to 131°F (-34°C to 55°C), -22°F (-30C) Cold Start
Vibration	Per NEMA TS2 para. 2.2.8. 5-30Hz sweep @ 0.5g applied in each of 3 mutually perpendicular planes.
Shock	Per NEMA TS2 para. 2.2.9. 10g applied in each of 3 mutually perpendicular planes
Wind Survivability	Up to 150 mph - 120 mph for 45 minutes - 150 mph for 15 minutes

EMC CERTIFICATIONS

CE, FCC Part 15B, RoHS
AS/NZS CISPR 22:2009+A1:2010
CAN/CSA-CISPR 22-10
EN 55022:2010+AC: 2011
EN 55024:2010
EN 61000-3-2:2006+A1:2009+A2:2009
EN 61000-3-3:2013
EN 61000-4-2: 2009
EN 61000-4-3: 2006 +A1:2008 +A2:2010
EN 61000-4-4: 2004
EN 61000-4-5: 2006
EN 61000-4-6: 2009
EN 61000-4-8: 2010
EN 61000-4-11: 2004
SASO (Pending)

ACCESSORIES
Mounts

Pedestal	7411542-001
Wall	8425-7
Pole	8503-0
Corner	8503-1 (discontinued)
Parapat	8503-2 (discontinued)
7.0" BC Plate	8481-9

CAT5e Cables

8194602-xxx [where xxx = 025, 055, 100, 150, 200, 250, 300, 328] denoting cable length in feet. Includes RJ45 connectors at each end of cable.

Accessory Cables

CA277, CA278 Series

Power Supplies

7412007-003	PoE++, 60W, 110/220VAC IP50, -34 to 74°C
7411543-010	24VAC, 100VA, 110/220VAC, IP66, -34 to 74°C

WARRANTY

Three (3) years on camera and positioner system. One (1) year on cooled thermal imager. Lifetime warranty on camera head enclosure moisture ingress.

PIGTAIL CONFIGURATIONS (24" PIGTAILS)
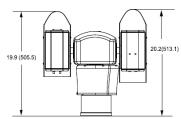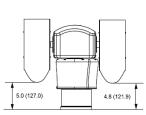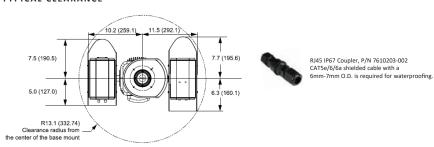
| 4291-xxxx | 4292-xxxx | 4293-xxxx | 4294-xxxx | 4295-xxxx | 4296-xxxx | 4297-xxxx | 4298-xxxx | 4299-xxxx |

RJ45 Pigtail

RJ45 Pigtail / Accessory Pigtail Prepped Wires

RJ45 Pigtail / Accessory Pigtail MS Connector

RJ45 Pigtail / Accessory Pigtail Prepped Wires

RJ45 Pigtail / Accessory Pigtail MS Connector

Accessory Pigtail MS Connector

Accessory Pigtail MS Connector

RJ45 Pigtail / Accessory Pigtail MS Connector

RJ45 Pigtail / Accessory Pigtail AMP Connector

4291-XXXX THRU 4296-XXXX DIMENSIONS

11.5 (292.1)   5.7 (144.8)   6.1 (154.9)   12.2 (309.9)   12.1 (307.3)   5.4 (137.2)   15.9 (403.9)   16.2 (411.5)   1.0 (25.4)   .8 (20.3)

4297XXXX THRU 4299-XXXX DIMENSIONS

9.7 (246.4)   15.5 (393.7)   10.1 (256.5)   4.0 (101.6)   16.2 (411.5)   16.1 (408.9)   9.4 (238.8)   19.9 (505.5)   20.2 (513.1)   5.0 (127.0)   4.8 (121.9)

TYPICAL CLEARANCE

10.2 (259.1)   11.5 (292.1)   7.5 (190.5)   7.7 (195.6)   5.0 (127.0)   6.3 (160.1)

R13.1 (332.74) Clearance radius from the center of the base mount

RJ45 IP67 Coupler, P/N 7610203-002 CAT5e/6/6a shielded cable with a 6mm-7mm O.D. is required for waterproofing.

ORDERING INFORMATION (EX. 4291-1A10-GY)

Model Structure	Option #	Option Description
Product Series	429	RISE 4290HD Series Dual Spectrum Camera Positioner
Power and Connection Options	1	PoE++ Power, RJ45 Pigtail
	2	PoE++ Power, RJ45 Pigtail, Accessory Pigtail
	3	PoE++ Power, RJ45 Pigtail, MS Conn. Accessory Pigtail
	4	24 VAC Power, RJ45 Pigtail, Accessory Pigtail, Wires
	5	24 VAC Power, RJ45 Pigtail, Accessory Pigtail, MS Conn.
	6	24 VAC Power, MS Connector Pigtail
	7	120VAC Power, MS Connector Pigtail, Helios Pinout
	8	120VAC Power, MS Connector Pigtail, RJ45 Whip, i-Series Pinout
	9	120VAC Power, AMP Connector Pigtail, RJ45 Whip, i-Series Pinout
	A	24VAC AND 24VDC Power, RJ45 Pigtail, Accessory Pigtail, Cooled Versions
	B	120VAC Power, RJ45 Pigtail, Accessory Pigtail, Cooled Versions
	-	**Model Number Separater**
Visible Camera Options	1	HD 1080p 30x Camera Module with Wiper
Thermal Camera Options	1	640 x 480 30Hz LWIR, 45/135mm 3x Mag Dual Field of View Lens
	2	640 x 480 30Hz LWIR, 25 to 150mm Zoom Lens
	3	640 x 480 30Hz LWIR, 25mm Fixed Lens
	4	640 x 480 30Hz LWIR, 50mm Fixed Lens
	5	640 x 480 9Hz LWIR, 45/135mm 3x Mag Dual Field of View Lens
	6	640 x 480 9Hz LWIR, 6x, 25 to 150mm Zoom Lens
	7	640 x 480 9Hz LWIR, 25mm Fixed Lens
	8	640 x 480 9Hz LWIR, 50mm Fixed Lens
	9	640 x 480 30Hz LWIR, 100mm Fixed Lens
	A	640 x 480 30Hz LWIR, 26-105mm Zoom Lens
	B	640 x 480 9Hz LWIR, 100mm Fixed Lens
	C	640 x 480 9Hz LWIR, 26-105mm Zoom Lens
	D	640 x 480 30hz MWIR, 48-700mm Zoom Lens
	-	**Model Number Separater**
Options	1	None
Unavailable	0	Future
	-	**Model Number Separater**
Color	GY	CohuHD Gray
	DS	Desert Sand

MOUNTING EXAMPLES

Pedestal Mount

Mounting Base

Bolt, Hex Head 1/4-20x3/4"L, SS (4) Washer, Spring Lock 1/4", SS (4) Washer, Flat 1/4", SS (4) (supplied)

Pedestal Mount 7411542-001 or 7411444-001 or 7411444-002

Pole Mount 8503-0

Mounting Base

Bolt, 1/4-20 (4) (supplied)

Mount Adapter

Large Pole Mount

Bolt, Hex Head 1/4-20x3/4"L, SS (4) Washer, Spring Lock 1/4", SS (4) Washer, Flat 1/4", SS (4) (supplied)

Wall Mount

Stainless Steel Straps

Washer, Flat 5/16", SS (8)

Wall Mount 8425-7

Mounting Base

Bolt, 1/4-20 (4) (supplied)

Mount Adapter

Bolt, Hex Head 1/4-20x3/4"L, SS (4) Washer, Spring Lock 1/4", SS (4) Washer, Flat 1/4", SS (4) (supplied)

Western Systems

COSTAR HD

RANGE TARGET CRITERIA

Identification = Minimum of 12 pixels through critical dimension
Recognition = Minimum of 6 pixels through critical dimension
Detection = Minimum of 2 pixels through critical dimension
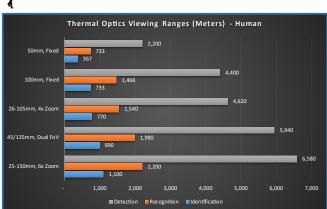
Critical Dimension of Subject (square root of subjects H x W)
Human = 1.8m x 0.6m
Vehicle = 2.3m x 2.3m

Note: Ideal atmospheric and scene conditions assumed

Thermal Optics Viewing Ranges (Meters) - Human

	Detection	Recognition	Identification
50mm, Fixed	2,200	733	367
100mm, Fixed	4,400	1,466	733
26-105mm, 4x Zoom	4,620	1,540	770
45/135mm, Dual FoV	5,940	1,980	990
25-150mm, 6x Zoom	6,580	2,200	1,100

Thermal Optics Viewing Ranges (Meters) - Vehicle

	Detection	Recognition	Identification
50mm, Fixed	4,795	1,598	800
100mm, Fixed	9,588	3,196	1,598
26-105mm, 4x Zoom	10,068	3,356	1,678
45/135mm, Dual FoV	12,944	4,315	2,157
25-150mm, 6x Zoom	14,382	4,794	2,397

30x Visible Optics Viewing Range (Meters)

	Vehicle	Human
Detection	54,242	24,890
Recognition	18,080	8,295
Identification	9,040	4,150

HIGH TEMPERATURE 75W POE++ SUPPLY

For use with CostarHD PoE++ Products

Rugged Construction

- 75 watt, 55 VDC PoE++ power delivery
- High-Temperature operation up to 74°C
- Wide 100-240VAC input range
- Up to 90% humidity

Interoperability

- Supports IEEEE802.3af/at and LTEPoE++
- 10/100/1000BaseT ethernet
- RoHS compliant
- MTBF 100,000's @ 25°C
- Compact design, high power low cost
- Convenient mounting tabs for quick installation

The CostarHD 7412007-003 is a high power, high operating temperature PoE mid span injector for use with CostarHD PoE++ products.

The 7412007-003 delivers 55VDC at up 75 watts over 4 pairs with data speeds up to 1000BaseT.

The 7412007-003 provides maximum installation interoperability with its wide input voltage range of 100VAC to 230VAC, while providing PoE power for devices compliant with 802.3af/at, LTEPoE++ and 10/100/1000BaseT network environments.

Designed to withstand high operating temperature environments, the 7412007-003 supplies up to 65 watts at 74°C, delivering sufficient power for RISE platform camera systems.

At lower temperatures, when camera heaters are active, the unit can deliver up to 75 watts of power if needed.

Certified for RoHS, WEE, CE, FCC, the 7412007-003 provides 100,000 hours MTBF reliability.

CostarHD delivers years of clean, reliable operation and backs it with a world class two year warranty.

Western Systems

COSTAR HD

POE POWER OUTPUT

Power Pins	4/5 (+), 7/8 (-) and 3/6 (+), 1/2 (-)
Data Rate	10/100/1000Mbps
Output Voltage	55VDC
Output current	1.36A
Input voltage	100-240VAC
AC current input	1.5A minimum
AC Hz	50/60hz

ENVIRONMENTAL

Operating temp	-40°F to 165°F (-40°C to 74°C) TS-2 profile
Power vs Temp	Refer to temperature profile
Elevation	Up to 3048 meters
Humidity	90% maximum, non-condensing

CONNECTORS AND INDICATORS
Refer to diagram

MECHANICAL

Dimensions	4.7" x 7.9" x 1.6" (128mm x 202mm x 41mm)
Weight	1.6 lbs. (760g)

STANDARDS
IEEE802.3 10BaseT Ethernet
IEEE802.3u 100BaseT Ethernet
IEEE802.3ab 1000BaseT Ethernet
Support IEEE802.af/at and LTEPoE++
RoHS compliant
WEEE compliant
CE
FCC part 15, class B
EN55022 class B
MTBF 100,000 @ 25°C
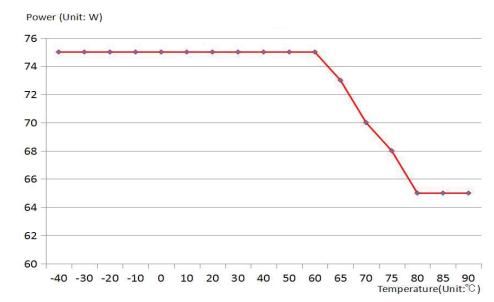
ORDERING INFORMATION
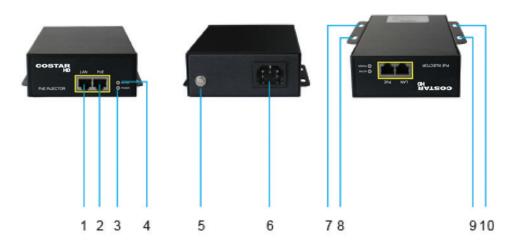
7412007-003	High power, high temperature PoE++ mid span injector for CostarHD PoE++ products. Includes AC power cord (US)

POWER DELIVERY VS TEMPERATURE PROFILE

Power (Unit: W) vs Temperature (Unit: °C)

1. LAN data input port
2. PoE power/network port
3. Power LED indicator
4. Load indicator
5. AC protective ground lug
6. AC power input
7-10. Install Holes

WesternSystems

COSTAR HD

Mounting Brackets and Kits by Product Series

Product Series	Mounting Bracket Ordering Number			
	Wall Mount	Pole Mount	Pedestal Mount	Adapter, 4.75" to 7"
4220HD Series Domes	7411420-001	8518-2	N/A	N/A
4260HD Series Positioners	8425-7	8503-0	7411444-001 or 002	7411444-003 or 004
4290HD Series Positioners	8425-7	8503-0	7411444-001 or 002	7411444-003 or 004
3430HD Series Fixed Barrels	7412011-002	8189-0	N/A	N/A
3440HD Series Multi-Sensor Domes	7411420-001	8518-2	N/A	N/A
3490HD Series Fixed Thermal	7412029-001	8180502-001	N/A	N/A
8800HD Series Positioners	7412016-001	8186-0	None	None

Mounting Kits and Included Brackets

Configured Mounting Kits	Mounting Kit	Associated Brackets inlcuded in Mounting Kit		
4220HD/3440HD Pole Mount	8518-2	7411420-001	8188275-002	
4260HD/4290HD Wall Mount	8425-7	7411417-001	7411418-001	
4260HD/4290HD Pole Mount	8503-0	7411417-001	7411418-001	8188275-002
3430HD Pole Mount	8189-0	7412011-002	7412012-001	
3490HD Series Pole Mount	8180502-001	7412029-001	7412029-002	
8800HD Pole Mount	8186-0	7412016-001	7412017-001	

Mounting Bracket Specifications

Bracket	Construction	Corrosion Protection	Paint/Finish	Load Capacity
7411420-001	Aluminum	Chem Film, Alodine	Powder Coat, Textured Light Grey	75 lbs
8518-2	Aluminum	Chem Film, Alodine	Powder Coat, Textured Light Grey	60 lbs
8425-7	Aluminum	Chem Film, Alodine	Powder Coat, Textured Light Grey	75 lbs
8503-0	Aluminum	Chem Film, Alodine	Powder Coat, Textured Light Grey	60 lbs
7411444-xxx	Aluminum	Chromate, Type II Class 1A	Powder Coat, Cardinal T241-GR142	75 lbs
7412011-002	Aluminum	Chem Film, Alodine	Powder Coat, Cardinal T241-GR142	30 lbs
8189-0	Aluminum	Chem Film, Alodine	Powder Coat, Cardinal T241-GR142	25 lbs
7412029-001	Aluminum	Non-Corrosive Aluminum	Epoxy Polyester Powder Coat	55 lbs
8180502-001	Aluminum	Non-Corrosive Aluminum	Epoxy Polyester Powder Coat	55 lbs
7412016-001	Aluminum	Chem Film, Alodine	Powder Coat, Textured Light Grey	300 lb
8186-0	Aluminum	Chem Film, Alodine	Powder Coat, Textured Light Grey	150 lb
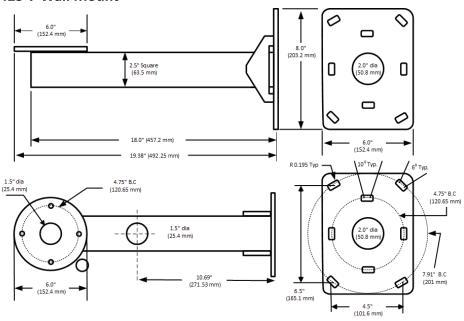
COSTARHD MOUNTING BRACKETS
Mounting Accessories for CostarHD Positioners, Domes and Barrels
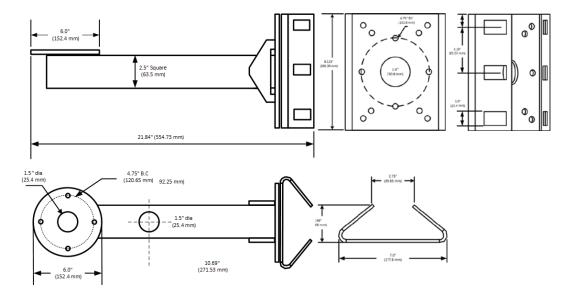
Mounting Bracket Drawings and Dimensions

8425-7 Wall Mount

8503-0 Pole Mount
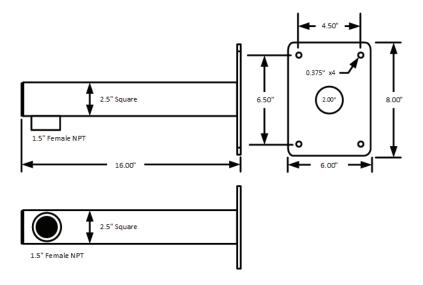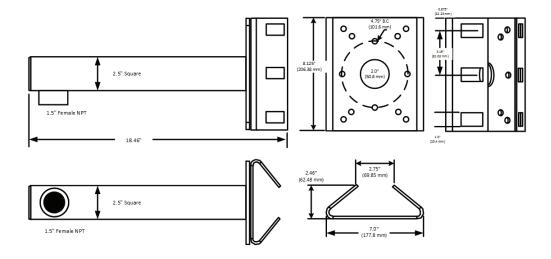
7411420-001 Wall Mount

4.50"
0.375" x4
6.50"
2.00"
8.00"
6.00"
2.5" Square
1.5" Female NPT
16.00"
2.5" Square
1.5" Female NPT

8518-2 Pole Mount

0.875" (22.23 mm)
4.75" B.C (101.6 mm)
8.125" (206.38 mm)
3.19" (81.03 mm)
2.0" (50.8 mm)
1.0" (25.4 mm)
2.5" Square
1.5" Female NPT
18.46"
2.5" Square
1.5" Female NPT
2.46" (62.48 mm)
2.75" (69.85 mm)
7.0" (177.8 mm)

COSTARHD MOUNTING BRACKETS
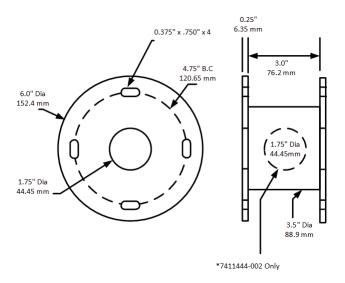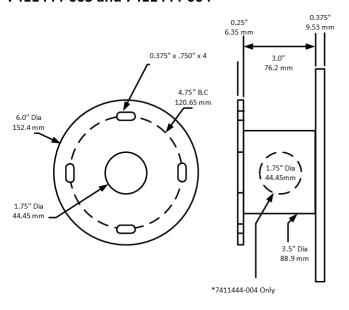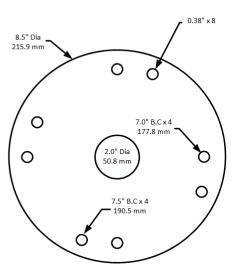
Mounting Accessories for CostarHD Positioners, Domes and Barrels

7411444-001 and 7411444-002

0.375" x .750" x 4
4.75" B.C 120.65 mm
6.0" Dia 152.4 mm
1.75" Dia 44.45 mm
0.25" 6.35 mm
3.0" 76.2 mm
1.75" Dia 44.45mm
3.5" Dia 88.9 mm
*7411444-002 Only

7411444-003 and 7411444-004
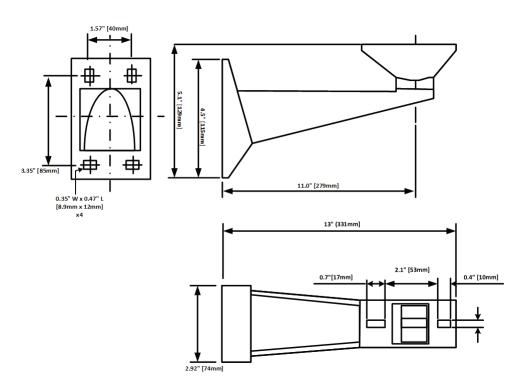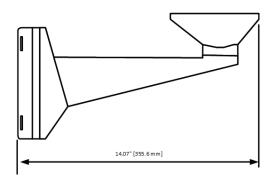
0.375" x .750" x 4
4.75" B.C 120.65 mm
6.0" Dia 152.4 mm
1.75" Dia 44.45 mm
0.25" 6.35 mm
0.375" 9.53 mm
3.0" 76.2 mm
1.75" Dia 44.45mm
3.5" Dia 88.9 mm
*7411444-004 Only
8.5" Dia 215.9 mm
0.38" x 8
7.0" B.C x 4 177.8 mm
2.0" Dia 50.8 mm
7.5" B.C x 4 190.5 mm

7412011-002 Wall Mount

1.57" [40mm]
5.1" [129mm]
4.5" [115mm]
3.35" [85mm]
0.35" W x 0.47" L [8.9mm x 12mm] x4
11.0" [279mm]

13" (331mm)
0.7"[17mm]
2.1" [53mm]
0.4" [10mm]
2.92" [74mm]
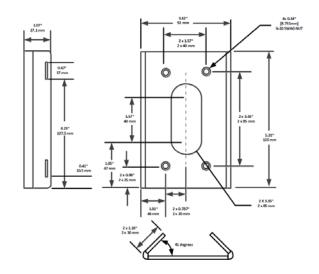
8189-0 Pole Mount Bracket Set

14.07" [355.6 mm]

7412012-001 Pole Adapter
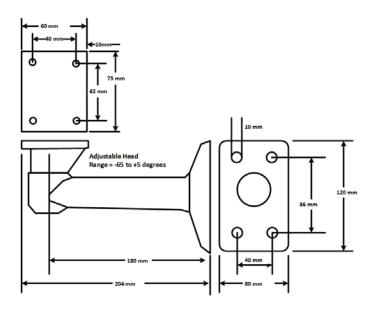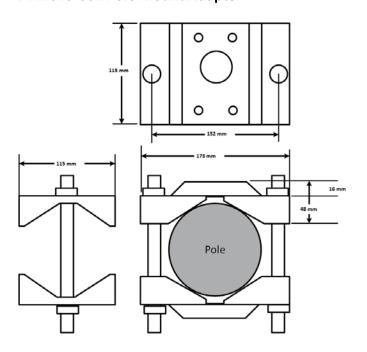
1.07" 27.1 mm
0.67" 17 mm
4.23" 107.5 mm
0.41" 10.5 mm
3.63" 92 mm
2 x 1.57" 2 x 40 mm
4x 0.34" [8.731mm] ¼-20 SWAG NUT
1.57" 40 mm
2 x 3.35" 2 x 85 mm
5.31" 135 mm
1.85" 47 mm
2 x 0.98" 2 x 25 mm
1.81" 46 mm
2 x 0.787" 2 x 20 mm
2 X 3.35" 2 x 85 mm
2 x 1.18" 2 x 30 mm
45 degrees

COSTARHD MOUNTING BRACKETS

Mounting Accessories for CostarHD Positioners, Domes and Barrels
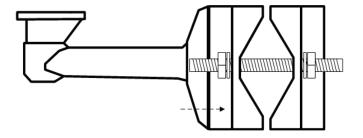
7412029-001 Wall Mount

7412029-002 Pole Mount Adapter

8180502-001 Pole Mount Kit
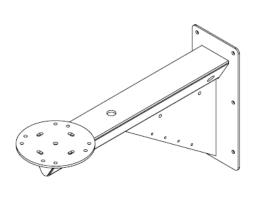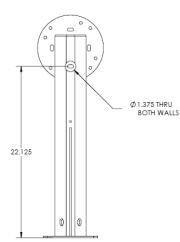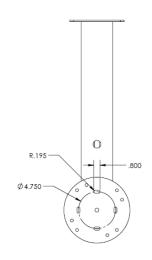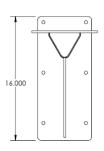
Western Systems

COSTAR HD

7412016-001

Ø1.375 THRU BOTH WALLS

22.125

R.195

.800

Ø4.750

16.000

(28.750)

(Ø8.50)

(4.04)

7412017-001

11.000

5.500

9.250

Ø2.000

21.50

2X 10.00

8" POLE, U-BOLT PATTERN

6" POLE, U-BOLT PATTERN

4" POLE, U-BOLT PATTERN

4X CUTOUT FOR STRAP

PLUG WELD, GRIND FLUSH

4X U-BOLT

4" POLE
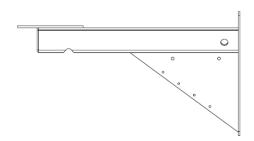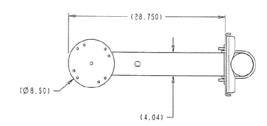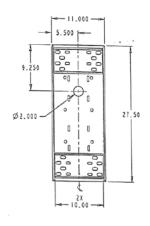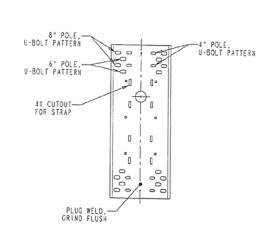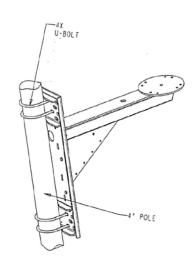
TKH Siqura

Smart electronic security, safety and parking systems

PD910

3 MP high-speed PTZ camera with 40x zoom, IR

PD910

3 MP high-speed PTZ camera with 40x zoom, IR

DESCRIPTION

The PD910 is a 3-megapixel IP outdoor PTZ camera. A powerful high-grade 40x optical zoom lens ensures sharp and clear images over a wide range. Built-in IR for zero lux operation. The high-speed pan, tilt, and zoom mechanism and auto-focus give instantaneous and stable focused images. Due to its unique servo feedback control the camera will always maintain its original (PT) position. When forced away from its original position the camera will return immediately.

FEATURES

1/2.8 inch Progressive scan CMOS imager

Quad stream H.264, H.265 and MJPEG

3MP @ 30 fps HDR

40x optical zoom, 10x digital zoom

20° tilt above horizon without optical distortion

IEEE 802.1x, TACACS+ user authentication

NEMA TS-2

120 dB WDR (HDR)

Supports EIS

Built-in IR illumination up to 200 m

PT servo feedback

ONVIF Profile S, G, and T

Western Systems

TKH GROUP | TKH SECURITY

Description

The PD910 is a 3MP intelligent IP outdoor high-speed PTZ camera with built-in IR-illumination and 40x optical zoom. The absence of the dome-cover eliminates problems like optical distortion, IR scattering, or sun glare due to dirt or water on the bubble.

PT Servo feedback

The PD910 pan and tilt motors are controlled by servo feed back, keeping track of the PTZ position at all times. No more drifting PTZ head due to shocks, vibration or vandalism. When the head is forced from its position, it will return immediately.

Multi-stream high definition

The integrated camera has multi-stream capability for simultaneous streaming of H.265, H.264 or MJPEG. Up to 4 combinations of resolutions and frame rates can be configured to satisfy different live viewing and recording scenarios.

Open standards

Multiple options are available to easily integrate the PD910 to a video management system. In support of open standards, the PD910 is compliant with a range of VMS's, it supports ONVIF (Profiles S, G, and T) and the Siqura API.

Power source choices

The PD910 can be powered with 24 Vdc, 24 Vac or over the network with Hi-PoE sources. (802.3bt Type 3: max 60 W)

PD910

3 MP high-speed PTZ camera with 40x zoom, IR

Camera

Image sensor	1/2.8" Progressive scan CMOS
Effective pixels	2065x1553
Min. illumination	0.04 lux Color, 0.002 lux B/W (F/1.6)
Shutter speed	1 to 1/10,000 sec
Day/Night	IR-cut filter
Lens	40x zoom
IR Illumination	850 nm
IR illumination distance	200m
Iris	P-iris and auto-iris
Focal length	4.3mm to 170 mm (F/1.6)
Horizontal field of view	64° (W) to 1.6° (T)
Lens material	High-grade optical glass

PTZ

Pan range	360° Continuous rotation
Tilt range	-20° to +90°
Tilt travel	-20° to +200° (Mechanical Flip)
Number of presets	256
Pan speed	0.1°/s to 300°/s
Tilt speed	0.1°/s to 300°/s
Preset accuracy	0.16°
Features	Speed by zoom
Sequence Scan	8
Cruise Scan	8
Autopan	4
Body material	Aluminum alloy, ABS
Internal demister/heater	Standard

Image control

Dynamic range (WDR)	120 dB, dual exposure HDR
White balance	Auto, ATW, Manual, One push
Image settings	Contrast Brightness Saturation Hue Sharpness
SNR	Better than 54dB
Noise reduction	3DNR, 2DNR, Color Low, mid, high (w/ Motion Compensation)
Image Stabilization	Yes (Digital)
Digital zoom	10x
Text and picture overlay	Compass, date & time, 4x line (40 characters each), preset title, image, image transparency
Privacy masks	16
Image rotation	90°, 180°, 270° rotation

Western Systems

PD910

3 MP high-speed PTZ camera with 40x zoom, IR

Specs

Image control	

Video	
Video compression	H.265, H.264 (main or high profile); MJPEG
Number of compression instances	Any combination of H.265 or H.264 streams with possibly one MJPEG stream.
Supported resolutions	2065x1553 (3MP); 1080p30,1280x1024; 720p30; 1024x768; 800x600; 720x576(D1); 640x480 (VGA); 352x288 (CIF)

Max streaming (H264/H265/MJPEG)				
60fps	2048x1536	1280x720		
60fps	2048x1536	800x600	720x480	352x240
30fps	2048x1536	1920x1080	1280x1024	1280x1024
30fps (dual shutter WDR)	2048x1536	1920x1080	1280x1024	720x480
Compression bit rate control	Constant bit rate (CBR), variable bit rate (VBR), Low bit rate (LBR)			
Number of video output streams	Up to 20 (RTSP)			
Total output data rate (max)	60 Mb/s			
Video frame rate	1 to 60 fps, 1 to 50 fps			
Analog video output	PAL/NTSC (BNC)			

Audio	
Audio compression	G.711, G.726, AAC, LPCM
Audio Input	Line in
Audio Output	Line out

Data	
Serial port	RS-485, 2-wire
Protocols	Pelco D, Pelco P
Connector type	Terminal block

Analytics	
Loitering Detection*	Enter and loiter in a user-defined region
Intrusion Detection*	Enter in a user-defined region
Wrong Direction*	Cross a user-defined unidirectional or bidirectional
Event detections	Motion Detection, Audio detection*, Abandoned Object*, Object Removal*, Camera Sabotage*
Event Triggers	External Input, Analytics, Network Failure Detection, Periodical Event, Manual Trigger
*Offer by request	
Autotracking	Support

Network	

Western Systems

PD910
3 MP high-speed PTZ camera with 40x zoom, IR

Specs

Network	
Local storage	SDHC/SDXC up to 512 GB;
Network storage	NAS (Support NFS, SMB/CIFS)
Protocols	IPv4/IPv6 (ICMP), HTTP, HTTPS (TLS1.2), 802.1x, Qos, FTP, SMTP(SSL), UPnP,
	SNMP(v1/v2/v3/Traps), DNS, DDNS, NTP, RTSP, RTCP, RTP/UDP, TCP/IP, IGMP(v2/v3),
	DHCP, PPPoE, Pelco D (TCP/UDP), Diamond (TCP/UDP), NTCIP (TCP/UDP), TACACS+
Security	User authentication, TACACS+, Syslog, Digest authentication (RTSP, HTTP),
	HTTPS encryption (TLS1.2); IEEE 802.1x port-based network access control, IP filtering
Standard	ONVIF (Profile S, Profile G, Profile T), Siqura API
Web browser	IE 9, 10 and 11; limited support for Edge, Chrome, Firefox
Network interface	10/100 Mb (RJ45)

Environmental	
Ingress protection level	IP66
Impact rating casing	IK10
Overvoltage protection	Lightning Protection, Surge Protection and Voltage Transient Protection
Ambient temperature (NEMA TS-2)	-40 °C to +74 °C (-40 °F to +165 °F)
Relative humidity	5 to 100%
MTBF (@40°C)	>130,000 h
Vibration (NEMA TS-2)	5 to 30 Hz, 0.5 g during 1 h. (x, y, and z)
Shock (NEMA TS-2)	10 g (x, y, and z)
Max wind velocity	225 km/h (150 mph)
Power supply	24 Vdc, 24 Vac, UPoE
Power consumption	Max. 48 W

Mechanical	
Interfaces	
- Ethernet	RJ45
- Alarm in / out	4x / 2x Terminal Block
- 24Vac/dc	Terminal Block
- Audio in / out	Terminal Block
- Video out	BNC Connector
- RS485	Terminal Block
Dimensions	diameter 207.4 x 300.4 mm with Sunshield
Weight	3.8 kg
Color	RAL 9003 (signal white)

Ordering information	
PD910	3 MP high-speed PTZ camera with 40x zoom, IR
WM27	Wall mount, for PD9x0
CM27	Ceiling mount 25cm for PD9x0

PD910

3 MP high-speed PTZ camera with 40x zoom, IR

Specs
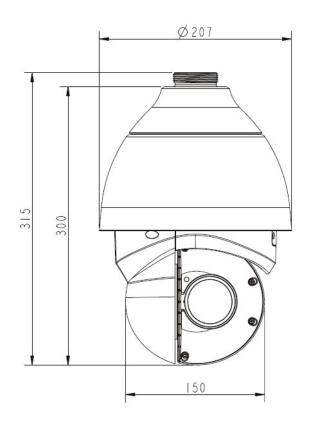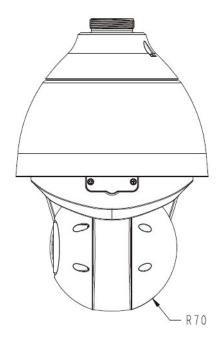
Ordering information	
CM27A	Extension 25cm for CM27
WM12	Wall mount for PD110x and PD9x0 PTZ dome series
WM12B	Wall mount incl. junction box for PD110x and PD9x0 series
WM16	Gooseneck bracket for PD110x and PD9x0 PTZ dome series
WM17	Corner mount for PD110x and PD9x0 PTZ dome series
WM17B	Corner mount incl. junction box for PD110x and PD9x0 series
PM06	Pole mount, for PD9x0-series, 1100-series
PM07	Pole mount for PD110x and PD9x0 PTZ dome series
PM07B	Pole mount incl. junction box for PD110x and PD9x0 series
PM08	Parapet wall mount for PD110x and PD9x0 PTZ dome series
PTM02	Bracket adapter for PD9x0 series
CM11	Ceiling mount for PD110x and PD9x0 PTZ dome series
CM12	Ceiling mount for PD110x and PD9x0 PTZ dome series, 50 cm
CM15	Ceiling mount for PD110x and PD9x0 PTZ dome series, 25 cm

DIMENSIONS IN MM

BL950

5MP Bullet Camera, 2.7-12mm motorized lens, H.265/H.264, IR

D E S C R I P T I O N

The BL950 is a robust outdoor bullet camera with built-in IR illumination providing clear images under any lighting condition. The camera has multi-stream capabilities for simultaneously streaming of H.265/H.264/MJPEG. Multiple combinations of resolution and frame rate can be configured. To have a secured network environment, BL950 is capable of streaming out by HTTPS protocol.

F E A T U R E S

Max 2560x1920 Resolution

5MP 30fps, 1080p 60fps

Quad stream H.264, H.265 and MJPEG

Secured Streaming

Embedded Video analytics

Built-In Gyro, EIS

Bi-directional Audio

Built-in IR illuminator

ONVIF Profile S, G, T, M

IP66, IK10 vandal proof

BL950

5MP Bullet Camera, 2.7-12mm motorized lens, H.265/H.264, IR

Camera

Image Sensor	1/2.7" Progressive CMOS
Effective pixels	2720x1976 (5MP)
Minimum scene illumination	Color: 0.08lux, B/W: 0.008 lux, 0lux with
	IR illumination on, F1.6, 30IRE, 1/1 shutter speed
Shutter Speed	1 sec. to 1/30,000 sec.
Lens	Motorized 2.7 to 12mm, F/1.6, P-iris
Field of View	31.5° to 102.1° horizontal, 22.7° to 70.3° vertical
Focus Control	Autofocus
Slow Shutter	Supported
Day/Night	Automatic IR-cut Filter

Video

Video Compression	H.265 (Main Profile) / H.264 (High Profile/Main Profile) / MJPEG			
Max. Resolution	2560x1920 30fps(WDR Pro on), 1920x1080 60fps (WDR Pro off)			
Supported Resolution	2560x1920 (5MP); 2592x1944, 2688x1512,1920x1080, 1280x1024,			
	1280x720, 1360x768, 640x360, 480x272			
Frame Rate	25/30fps, 50/60fps			
Number of simultaneous streams	Quad streams			
Video Bitrate	64 Kbps 20 Mbps			
30fps	2688x1944	720x480	640x480	352x240
30fps	2688x1944		1024x768	
60fps(Shutter WDR OFF)	1920x1080		1280x720	
Bitrate Control	Constant bit rate (CBR), variable bit rate (VBR), Smart bitrate			
Number of video output streams	Up to 10 (RTSP)			
Total Output Data	51.2Mb/s			
Video output	1 Vp-p; 2-pin to BNC patch cable (For test/installation only)			
Region of interest	Support			

Image

Wide dynamic range	120dB
White Balance	Auto, Fixed, Manual
Image Setting	Saturation, Brightness, Contrast, Sharpness, Backlight Compensation,
	Highlight Compensation, WDR, Exposure control, Gain, Defog
Day/Night Switch	Auto/Scheduled/Triggered by Alarm In
Image Enhancement	3DNR, Defog
Image Stabilization	Yes, Built-in Gyro
Digital Zoom	10x
Image Rotation	90°, 180°, 270° rotation
Text and picture overlay	Date, time, Preset title
Privacy mask	Support

Analytics

Smart Analytics	Abandoned Object, Intrusion Detection, Camera Sabotage

Western Systems

BL950

5MP Bullet Camera, 2.7-12mm
motorized lens, H.265/H.264, IR

Specs

Analytics	
	Wrong Direction, Loitering Detection, Object Counting
	Object Removal, Stopped Vehicle
Event detections	External Input, Periodical Event, Tampering, Audio Detection,
	Manual Trigger, System boot, recording notification
Event Action	Alarm output, Record video clip to NAS/SD card, Send alarm message
	and image by E-mail/FTP, Send HTTP notification

Audio	
Capability	Two-way stereo audio
Audio Interface	1x 3.5 mm audio in (line in) ; 1x 3.5 mm audio out interface
Compression	G.711, G.726, AAC, LPCM

Alarm	
Input	2x
Output	1x
Operational modes	Motion detection, Tampering alarm, Alarm I/O

Network	
Communication Interface	10/100 Mb (RJ45)
Network protocols	IPv4/IPv6, HTTP, HTTPS (TLS1.2), 802.1x, Qos, FTP, SMTP(SSL), UPnP, SNMP,
	DNS, DDNS, NTP, RTSP, RTCP, RTP/UDP, TCP/IP, IGMP(v2/v3), DHCP, PPPoE,
	SSL/TLS, ONVIF Profile S/G/T/M, Siqura Protocol
Security	User authentication, Syslog, Digest authentication (RTSP, HTTP), HTTPS
	encryption (TLS1.2), IEEE 802.1x port-based network access control, IP filtering
	Signed firmware, Secured bootup
Web Viewer	Internet Explorer 11, Microsoft Edge, Google Chrome, Mozilla Firefox

General	
Protection Level	IP66, IK10(including glass)
Material	Die cast aluminum and Plastic
Edge Storage	Built-in micro SD/SDHC/SDXC slot, up to 512 GB
Power	24 VAC, 12 VDC, PoE (IEEE 802.3af class 0)
Power Consumption (incl. heater)	max. 13.19 W @ 24 VAC
	max. 15.25 W @ 12 VDC
	max. 12.90 W @ PoE
IR illumination	850nm IR LEDs, 50m IR Viewable Length
Operating temperature	-55°C~60°C(-67°F~140°F)
Relative Humidity	10% to 90%, no condensation
Dimensions(camera body)	diameter105x234 mm
Weight	1.28kg
Colour	RAL 9003 (Signal white)

Ordering Information

Specs
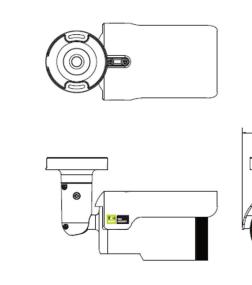
Ordering Information	
BL950	5MP Bullet camera, 2.7-12mm motorized, H.265/H.264/MJPEG, P-iris, IR, IK10, IP66
JB07/BL	Junction box for BL8xx and BL9x0
PM09B/BL	Pole mount junction box for BL8xx and BL9x0
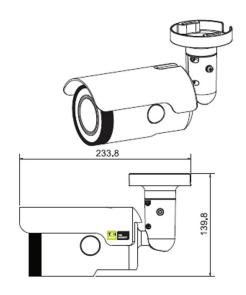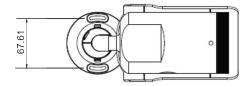
D I M E N S I O N   I N   M M

PD950

5MP intelligent IP outdoor PTZ camera
40x zoom, IR, Wiper

PD950

5MP intelligent IP outdoor PTZ camera 40x zoom, IR, Wiper

DESCRIPTION

The PD950 is a 5-megapixel IP outdoor PTZ camera. A powerful high-grade 40x optical zoom lens ensures sharp and clear images over a wide range. Built-in IR for zero lux operation. The high-speed pan, tilt, and zoom mechanism and auto-focus give instantaneous and stable focused images. Due to its unique servo feedback control the camera will always maintain its original (PT) position. When forced away from its original position the camera will return immediately.

FEATURES

1/2.7 inch Progressive scan CMOS imager

Quad stream H.264, H.265 and MJPEG

Max 5MP 30fps, 1080p 60fps

40x optical zoom, 10x digital zoom

20° tilt above horizon without optical distortion

Secured Streaming, IEEE 802.1x authentication

120 dB WDR (HDR)

Built-In Gyro, EIS

PT servo feedback, built-in Wiper

ONVIF Profile S, G, T, M

PD950

Multi-stream high definition
The camera has the capability to stream simultaneous 4 video streams in H.265, H.264 and MJPEG. Multiple combinations of encoding, resolution and frame rate can be configured to satisfy different live viewing and recording scenarios. Each selected resolution-frame rate combination can be freely set to a stream number. Also, the optimized encoding H.265/HEVC streaming provides the clear images with less transmission bandwidth and storage capacity required.

Open standards
Multiple options are available to easily integrate the PD950 to a video management system. In support of open standards, the PD950 is compliant with a range of VMS's, it supports ONVIF (Profiles S, G, T, M) and the Siqura API.

PT Servo feedback
The PD950 pan and tilt motors are controlled by servo feedback, keeping track of the PTZ position at all times. No more drifting PTZ head due to shocks, vibration or vandalism. When the head is forced from its position, it will return immediately.

Power source choices
The PD950 can be powered with 24 Vac or over the network with PoE++ (802.3bt) sources.

PD950

5MP intelligent IP outdoor PTZ camera
40x zoom, IR, Wiper

Camera	
Image Sensor	1/2.7 " Progressive CMOS
Effective pixels	2720x1976 (5MP)
Minimum scene illumination	Color: 0.197lux, B/W: 0.151 lux, 0lux with IR illumination on, F1.6
Shutter Speed	1 sec. to 1/10,000 sec.
Lens	40x, 4.3-170mm, Piris, F1.6
Field of view	1.8° to 64.5° horizontal, 1.4° to 48.6° vertical
Focus Control	Autofocus
Slow Shutter	Supported
Day/Night	Automatic IR-cut Filter

PTZ	
Pan range	360° Continuous rotation
Tilt range	-20° to +90°
Tilt travel	-20° to +200° (Mechanical Flip)
Number of presets	256
Pan speed	0.1 ~ 200°/s
Tilt speed	0.1 ~ 200°/s
Preset accuracy	0.16°
Functions	Sequence Scan, Cruise Scan, Auto pan, Image Freeze, sets new pan 0°,
	Speed by Zoom, Azimuth
Smart Tracking	Manual, event, schedule, Auto-tracking

Video	
Video Compression	H.265 (Main Profile) / H.264 (High Profile/Main Profile) / MJPEG
Max. Resolution	2688x1944 30fps(WDR Pro on), 1920x1080 60fps (WDR Pro off)
Supported Resolution	2688x1944 (5MP), 2560x1920 (5MP), 1920x1080, 1280x1024, 1280x720,
	1360x768, 800x600, 640x360, 480x272
Frame Rate	25/30fps, 50/60fps
Number of simultaneous streams	Quad streams

Max. Streaming	
30fps (dual shutter WDR)	2688x1944:1280x720
Bitrate Control	Constant bit rate (CBR), variable bit rate (VBR), Smart bitrate
Number of video output streams	Up to 10 (RTSP)
Video output	1 Vp-p; 2-pin to BNC patch cable (For test/installation only)
Region of interest	Support

Image	
Wide dynamic range	120dB
White Balance	Auto (normal, wide, all), Smart, One push, Smart Touch, Manual
Image Setting	Saturation, Brightness, Contrast, Sharpness, Backlight Compensation,
	Highlight Compensation, WDR, Exposure control, Gain, Defog
	Auto Iris, AGC

Western Systems

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PD950

5MP intelligent IP outdoor PTZ camera
40x zoom, IR, Wiper

Specs

Image	
SNR	>52dB
Day/Night Switch	Auto/Scheduled/Triggered by Alarm In
Image Enhancement	2DNR, 3DNR, ColorNR
Image Stabilization	Gyro, support
Digital Zoom	10x
Image Rotation	90°, 180°, 270° rotation
privacy masks	16x, Color & Mosaic
Text and picture overlay	Date & time, 3x line (54 characters each), Preset title, Image,
	Image transparency, Text string, Zoom ratio, Compass and Azimuth

Analytics	
Smart Analytics	Abandoned Object, Intrusion Detection, Camera Sabotage
	Wrong Direction, Loitering Detection, Object Counting
	Object Removal, Stopped Vehicle, Face Detection
	Face Recognition, License Plate Recognition
Event detections	External Input, Periodical Event, Tampering, Audio Detection, Manual Trigger,
	Recording Notification
Event Action	Alarm output, Record video clip to NAS/SD card, Send alarm message and image
	by E-mail/FTP, Send HTTP notification

Audio	
Capability	Two-way stereo audio
Audio Interface	1x 3.5 mm audio in (line in) ; 1x 3.5 mm audio out interface
Compression	G.711, G.726, AAC, LPCM

Data	
Serial port	RS485
Protocols	Pelco-D, Pelco-P, Diamond protocol

Alarm	
Input	4x
Output	2x
Operational modes	Cell-based motion detection, Network Failure Detection, Tampering alarm, Alarm I/O

Network	
Communication Interface	10/100/1000 Mb (RJ45)
Network protocols	IPv4/IPv6, HTTP, HTTPS (TLS1.2), 802.1x, Qos, FTP, SMTP(SSL), UPnP,
	SNMP(v1/v2/v3/Traps), DNS, DDNS, NTP, RTSP, RTCP, RTP/UDP, TCP/IP, IGMP(v2/v3),
	DHCP, PPPoE, SSL/TLS, Pelco D (TCP/UDP), Diamond (TCP/UDP), NTCIP (TCP/UDP),
	ONVIF Profile S/G/T/M, Siqura Protocol
Security	User authentication, Syslog(SSL/TLS), Digest authentication (RTSP, HTTP), HTTPS
	encryption (TLS1.2); IEEE 802.1x port-based network access control, IP filtering,
	Brute attack protection

Western Systems

PD950

5MP intelligent IP outdoor PTZ camera
40x zoom, IR, Wiper

Specs
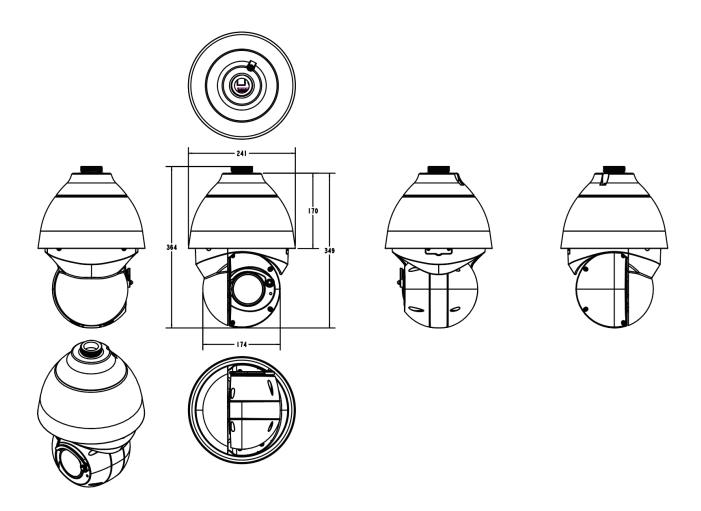
Network	
Web Viewer	Internet Explorer 11, Microsoft Edge, Google Chrome, Mozilla Firefox

General	
Protection Level	IK10, IP66
Material	Aluminum alloy(ABS) and Plastic
Edge Storage	Built-in micro SD/SDHC/SDXC slot, up to 512 GB
Power	AC24V, PoE (IEEE 802.3bt type 3 class 6)
Power Consumption	Max. 51W (PoE), Max 78W (24VAC)
	Heater: 10W
	Lamps: 18W (PoE), 20W (24VAC)
	Wiper: 1W
IR illumination	200 meters, 850nm IR LEDs
Wiper	Built-in
Overvoltage protection	Lightning Protection, Surge Protection and Voltage Transient Protection
Ambient temperature (NEMA TS-2)	-40 °C to +74 °C (-40 °F to +165 °F)
Relative humidity	5 to 100%
MTBF (@40°C)	>130,000 h
Vibration (NEMA TS-2)	5 to 30 Hz, 0.5 g during 1 h. (x, y, and z)
Shock (NEMA TS-2)	10 g (x, y, and z)
Max wind velocity	225 km/h (150 mph)
Dimensions(camera body)	diameter241x349 mm with Sunshield
Weight	6.1 kg
Colour	RAL 9003 (Signal white)

Ordering Information	
PD950	5MP intelligent IP outdoor PTZ camera 40x zoom, IR, Wiper
WM27	Wall mount, for PD9x0
CM27	Ceiling mount 25cm for PD9x0
CM27A	Extension 25cm for CM27
WM12	Wall mount for PD110x and PD9x0 PTZ dome series
WM12B	Wall mount incl. junction box for PD110x and PD9x0 series
WM16	Gooseneck bracket for PD110x and PD9x0 PTZ dome series
WM17	Corner mount for PD110x and PD9x0 PTZ dome series
WM17B	Corner mount incl. junction box for PD110x and PD9x0 series
PM06	Pole mount, for PD9x0-series, 1100-series
PM07	Pole mount for PD110x and PD9x0 PTZ dome series
PM07B	Pole mount incl. junction box for PD110x and PD9x0 series
PM08	Parapet wall mount for PD110x and PD9x0 PTZ dome series
PTM02	Bracket adapter for PD9x0 series
CM11	Ceiling mount for PD110x and PD9x0 PTZ dome series
CM12	Ceiling mount for PD110x and PD9x0 PTZ dome series, 50 cm
CM15	Ceiling mount for PD110x and PD9x0 PTZ dome series, 25 cm

Western Systems

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XCU FUSION 2SM

316L stainless-steel intelligent dual imager camera with singlemode fiber

XCU FUSION 2SM

316L stainless-steel intelligent dual imager camera with singlemode fiber

DESCRIPTION

Rugged dual imaging camera for demanding environments. Utilizing both thermal imaging and a visible light in one single camera, its applications are endless: from perimeter surveillance, fire detection up to incident monitoring in traffic. The XCU and its accessories are double protected against corrosion; they are entirely made of powder-coated stainless-steel (316L). The housing is hermetically sealed against water and dust, which makes it ideal for harsh environments like traffic, tunnels, marine, offshore, heavy industry, waste management, etc. The direct-to-fiber connection makes it suitable to cover long distances and less susceptible for interferences.

FEATURES

Dual imager: 10x zoom Full-HD + Uncooled thermal imager

Compact, robust, and corrosion free

powder-coated 316L stainless steel housing

100Mb/s duplex single mode fiber

Plug & Play

Nano glass optical window

Water and dust tight: IP66 & IP67

ONVIF Profile S

Description

The XCU Fusion is designed to operate in harsh and aggressive environments. Typical applications are found in the heavy industry, traffic, tunnels, waterways, waste treatment and even in the salty environment of the marine. The XCU Fusion combines a full-HD ultra-low light imager with an uncooled thermal imager for both day and night vision.

Plug & Play
Installing and commissioning IP cameras has become child's play. The XCU Fusion click's into place with its versatile mounting accessories and is operational by plugging in the external connector. No need to open the unit; all connections can be prepared in advance.

Integrated 10x zoom visible HD camera
The XCU Fusion is fitted with a full-HD 2 Mpixel camera. Its 10x optical zoom offers an ideal coverage of the scene from almost any viewpoint. The viewing angle ranges from 54° up to 4.9°. Remote focus assist, a full set image enhancement tools and its ultra-low light performance makes this a versatile camera for a range of applications.

Integrated thermal camera
The XCU Fusion is also fitted with a highly sensitive uncooled microbolometer for thermal imaging. It detects temperature differences as small as 50 mK and can spot heat sources invisible to the naked eye. When the darkness obscures the vision of the optical imager, the thermal camera gives a clear over view of what's going on.

Multi-streaming and multi-casting
The XCU Fusion has multi-streaming capabilities for simultaneous transmission of one or more H.264 streams combined with MJPEG. This guarantees interoperability with existing VMS systems. Multiple combinations of resolution and frame rate can be configured to satisfy different live viewing and recording scenarios. In addition, multi-casting is supported for complex, multi-user video networks.

XCU FUSION 2SM

316L stainless-steel intelligent dual imager camera with singlemode fiber

Open standards

Out of the box, the XCU Fusion integrates with the common VMS systems. Being ONVIF Profile S compliant, the camera is supported without having a dedicated driver. When dedicated software or driver is needed the camera offers a comprehensive HTTP API. This specifically enables deployment in projects with custom requirements.

Built-in video analysis

The XCU Fusion series offers on-board analytics, such as FlameGuard™ for flare monitoring or fire/hotspot detection and FenceGuard™ for intrusion detection or virtual fences. Their applications are endless.

Direct to fiber connection

The XCU Fusion 2SM is fitted with an Ethernet over fiber connection. With it it can span distances up to 30 km over duplex single mode fiber (OS1) without the problems of radio interference or power surges. On top of that fiber connections are hard to hack and therefor much more secure that CAT5 or CAT6 connections.

Camera housing	
Body material	316L stainless steel
Finishing	Powder coated (RAL9016)
Sunshield	Optional (316L powder coated, RAL9016)
Heater/Demister	Standard
Ingress protection	IP66, IP67
Corrosion Class	C5 (ISO 12944)
Impact rating casing	IK10
Solar radiation test	MIL-STD-810, method 505.4 (p.4)
Shock test (transportation)	MIL-STD-810, method 516.5
Vibration (IEC 50068-2-6)	10 Hz to 150 Hz, 0.5g, all 3 axes, 1 oct/min, 1 sweep
Max wind velocity	240 km/h (150 mph)
Operating temperature	-34 °C to +74 °C (-29 °F to 165 °F) - per Nema TS-2
- Continuous (sheltered, air temp)	-30 °C to +55 °C (-22 °F to 131 °F)
- Cold start	-30°C (-22 °F)
Relative Humidity	5% to 100%
Dry heat test	+75 °C, 24 hours
Weight	5 kg

Optical Imager	
Lens	10x zoom, 5.1 to 51 mm, F/1.6 to F/1.8
Horizontal field of view	54° (W) to 4.9°(T)
Lens type	motorized zoom
Features	BLC, HLC, auto/manual white balance, noise reduction, defog
Digital image stabilizer	Yes
Exposure	Auto/Manual/Shutter priority/Iris priority
Day/Night (IR-cut filter)	Auto/Manual
Focus	Auto/Manual/Push-to-focus

Thermal imager (TxxSx)						
Imager	uncooled micro-bolometer					
Pixel pitch	17 µm					
Resolution						
- Txx-S6 or Txx-F6	640x512					
- Txx-S3	366x256					
Focal length (xx=)	7.5mm	9 mm	13 mm	19 mm	25 mm	35 mm
- Field of view 640x512 (S6)	90°x69°	69°x56°	45°x37°	32°x26°	25°x20°	18°x14°
- f-number	f/1.4	f/1.4	f/1.25	f/1.25	f/1.1	f/1.5
- Field of view 366x256 (S3)	45°x35°	35°x27°	25°x19°	17°x13°	13°x10°	9.3°x7.1°
- f-number	f/1.4	f/1.25	f/1.25	f/1.25	f/1.1	f/1.5
Spectral bandwidth	7.5 µm to 13.5 µm (LWIR)					
Max frame rate						
- TxxSx version	8.3/7.5 fps					
- TxxFx versions	25/30 fps					

Specs

Thermal imager (TxxSx)	
Sensitivity (NEdT)	50 mK @ f/1.0
Time to image	less then 60 s
Digital zoom	No
Color palette	10 selectable color palettes with freely adjustable temperature thresholds

Video stream	
Number of streams	2x streams for optical image and 2x streams for thermal image
Aspect ratio	16:9, 16:10, 5:4, 4:3 (cropped, no scaling, one setting for both sensors)
Compression algorithm(s)	H.264 BP/MP/HP (H.264/MPEG-4 AVC), MJPEG

Supported output resolutions	
- Optical image	1920x1080; 1280x1024; 1280x720; 720x576; 704x576; 640x480;
	480x576, 352x576; 704x288; 352x288; 320x240; 176x144
- Thermal image	Output images are up or down scaled
	720x576; 704x480; 704x240; 640x512, 352x288; 336x256, 176x120
- Combined optical/thermal	Side-by-side, Thermal Picture-In-Picture in Optical image
Compression bit rate control	Variable bit rate (VBR)
Output bit rate (per H.264 stream)	Up to 6Mb/s
Number of video output streams	Up to 20 (RTSP) per input
Total output data rate (max)	50Mb/s
Video overlay	3x Text, 1x bitmap (BMP, GIF) in both optical and thermal image

Analytics	
FenceGuard	Intrusion detection. Free form zones or detection lines
- Detection line	Touch, Cross (directional sensitive), Cross
- Detection zone	Touch, Enter, Inside, Exit
FlameGuard	Hotspot detection in two zones or Flare-on, Flare-off and Flare-too-large monitoring
- Measuring range	-40°C to 550°C
- Accuracy	+/- 20 °C (T 100 °C)
- Improved accuracy (-R1)	+/- 5 °C (T 100 °C; +/- 2°C typical
Event time	0 to 10 s
Event output	generic ONVIF, SPI

Electrical	
Supply voltage	24 Vac 50/60 Hz or 24 Vdc (Galvanic isolated)
Power consumption	12 W heater off; 15 W heater on
Power connector	3-pin 7/8" Conec
Network connector	Conec IP67 Dual LC

Network	
Interface(s)	100 Mb duplex singlemode Ethernet, Dual LC, 30 km
Protocols	IPv4, TCP/IP, UDP, RTP, RTSP, HTTP, HTTPS, ICMP, FTP, SMTP, DHCP, UPnP,
	IEEE 802.1x (EAP-MD5 or EAP TLS), IGMP, SNMP, QoS, ONVIF, TLS1.2, NTCIP-1205

Western Systems

Specs
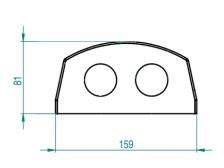
Network	
Password levels	Viewer, Operator and Administrator
Supported browsers	Edge, Chrome, Firefox, Safari
User accounts	20

Ordering information	
XCU-F T75S3-2SM	XCU Fusion 316L dual imager, 2MP 10x, 366 45° 8.3fps, 2SM
XCU-F T09S3-2SM	XCU Fusion 316L dual imager; 2Mp 10x, 366 35° 8.3fps, 2SM
XCU-F T13S3-2SM	XCU Fusion 316L dual imager; 2Mp 10x, 366 25° 8.3fps, 2SM
XCU-F T19S3-2SM	XCU Fusion 316L dual imager; 2Mp 10x, 366 17° 8.3fps, 2SM
XCU-F T25S3-2SM	XCU Fusion 316L dual imager; 2Mp 10x, 366 13° 8.3fps, 2SM
XCU-F T35S3-2SM	XCU Fusion 316L dual imager; 2Mp 10x, 366 9° 8.3fps, 2SM
XCU-F T75S6-2SM	XCU Fusion 316L dual imager; 2Mp 10x, 640 90° 8.3fps, 2SM
XCU-F T09S6-2SM	XCU Fusion 316L dual imager; 2Mp 10x, 640 69° 8.3fps, 2SM
XCU-F T13S6-2SM	XCU Fusion 316L dual imager; 2Mp 10x, 640 45° 8.3fps, 2SM
XCU-F T19S6-2SM	XCU Fusion 316L dual imager; 2Mp 10x, 640 32° 8.3fps, 2SM
XCU-F T25S6-2SM	XCU Fusion 316L dual imager; 2Mp 10x, 640 25° 8.3fps, 2SM
XCU-F T35S6-2SM	XCU Fusion 316L dual imager; 2Mp 10x, 640 18° 8.3fps, 2SM
XCU-F T75F6-2SM	XCU Fusion 316L dual imager; 2Mp 10x, 640 90° 30fps, 2SM
XCU-F T09F6-2SM	XCU Fusion 316L dual imager; 2Mp 10x, 640 69° 30fps, 2SM
XCU-F T13F6-2SM	XCU Fusion 316L dual imager; 2Mp 10x, 640 45° 30fps, 2SM
XCU-F T19F6-2SM	XCU Fusion 316L dual imager; 2Mp 10x, 640 32° 30fps, 2SM
XCU-F T25F6-2SM	XCU Fusion 316L dual imager; 2Mp 10x, 640 25° 30fps, 2SM
XCU-F T35F6-2SM	XCU Fusion 316L dual imager; 2Mp 10x, 640 18° 30fps, 2SM
	Add -R1 (e.g., XCU-F T09F6R1-2SM) for improved accuracy

Mounting accessories	
XCUWM01	XCU 316L Wall/Pole mount with swivel, RAL9016
XCUCM01	XCU 316L Rugged ceiling mount, RAL9016
XCUSW01	XCU 316L Swivel mount (swivel only), RAL9016

Cable connectors	
XCUCNC-PWR01	XCU IP67 power connector straight, cable part (included)
XCUCNC-2SM	XCU IP67 SM fiber connector straight, cable part (included)

XCU FUSION 2SM
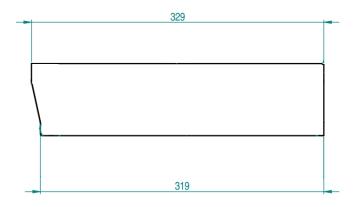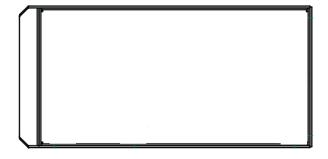
316L stainless-steel intelligent dual imager camera
with singlemode fiber

DIMENSIONS IN MM
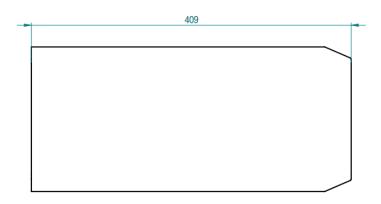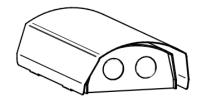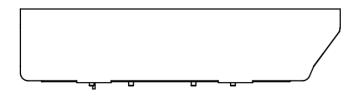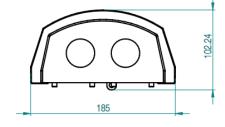
Western Systems

WITH SUNSHIELD. DIMENSIONS IN [MM]

409

102.24

185

366x256: Detect, Recognize, and Identify

Focal length	Identify	recognize	detect
35 mm	194	387	775
25 mm	133	276	553
19 mm	105	211	422
13 mm	71	142	284
9 mm	50	100	200
7.5 mm	38	76	152

[m]

PID detection with 336x256 module - 6m high pole

	35 mm	25 mm	19 mm	13 mm	9 mm	7.5 mm
D1 [m]	44	32	24	16	11	8
D @ 4p [m]	387	276	211	142	100	76

XCU FUSION 2SM

316L stainless-steel intelligent dual imager camera with singlemode fiber

640x512: Human Detect (2p), Recognize (4p), and Identify (8p)

Lens	Identify	Recognize	Detect
35 mm	189	379	758
25 mm	135	271	541
19 mm	105	209	418
13 mm	72	145	290
9 mm	44	87	175
7.5 mm	30	60	120

Identify ▪ recognize ▪ detect ► [m]

PID detection with 640x512 module - 6m high pole

Lens	D1	D @ 4p
7.5 mm	2	60
9 mm	4	87
13 mm	8	145
19 mm	12	209
25 mm	16	271
35 mm	23	379

	35 mm	25 mm	19 mm	13 mm	9 mm	7.5 mm
▪ D1 [m]	23	16	12	8	4	2
▪ D @ 4p [m]	379	271	209	145	87	60

XCU FUSION 2SM

316L stainless-steel intelligent dual imager camera with singlemode fiber

Chart 1 (Thermal resolution: 640x512)

Legend: Flare height 5 m · Flare height 10 m · Flare height 20 m · Flare height 30 m

Y-axis: Distance in metres (0–300)

4:3 thermal image — H, 1/2H, V

Lens	Flare 5 m	Flare 10 m	Flare 20 m	Flare 30 m
7.5 mm	7	15	29	44
9 mm	9	19	38	56
13 mm	15	30	60	90
19 mm	22	43	87	130
25 mm	28	57	113	170
35 mm	41	81	163	244

Flare= 1/2 image height
Thermal resolution:640x512

Chart 2 (Thermal resolution: 336x256)

Legend: Flare height 5 m · Flare height 10 m · Flare height 20 m · Flare height 30 m

Y-axis: Distance in metres (0–600)

4:3 thermal image — H, 1/2H, V

Lens	Flare 5 m	Flare 10 m	Flare 20 m	Flare 30 m
7.5 mm	16	32	63	95
9 mm	21	42	83	125
13 mm	30	60	120	179
19 mm	44	88	176	263
25 mm	57	114	229	343
35 mm	81	161	322	484

Flare= 1/2 image height
Thermal resolution: 336x256

XCU FUSION 2SM
316L stainless-steel intelligent dual imager camera with singlemode fiber

FlameGuard: Hotspot detection at a waste management site
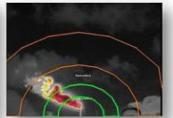
Flame Guard: Fire detection in a machine room

FenceGuard: Perimeter intrusion detection

Fire detection, hot-spot and flare monitoring

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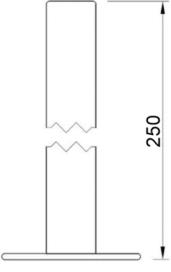
CM01
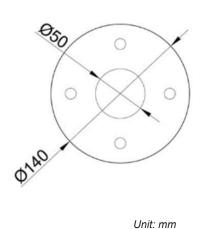
Ceiling mount, straight tube, 25cm

Technical specifications

Material	Iron
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	250 x Ø50 mm (9.8 x Ø2.0 in)
Weight	1.0 kg (2.2 lbs)

Box content

250

Ø50

Ø140

Unit: mm

Western Systems

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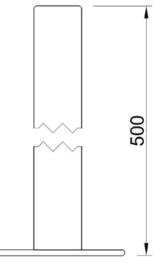
CM02
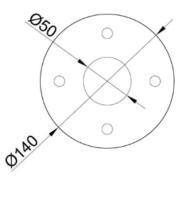
Ceiling Mount, Straight Tube, 50cm

Technical specifications	
Material	Iron
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	500 x Ø50 mm (19.7 x Ø2.0 in)
Weight	1.0 kg (2.2 lbs)
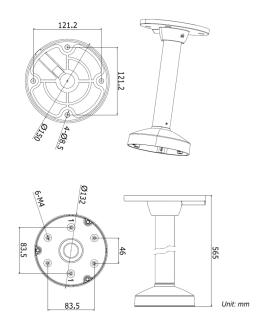
Box content

500

Ø50

Ø140

Unit: mm

CM08

Ceiling mount for FD1103M1-I and FD1104FR

Technical specifications	
Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	565 x Ø150 mm (22.24 x Ø5.91 in)
Weight	1.9 kg (4.2 lbs)

Box content
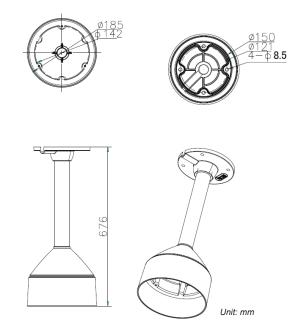
Unit: mm

CM09

Ceiling mount for FD1103M1-EI

Technical specifications	
Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	676 x Ø185 mm (26.6 x Ø7.28 in)
Weight	2.15 kg (4.7 lbs)

Box content
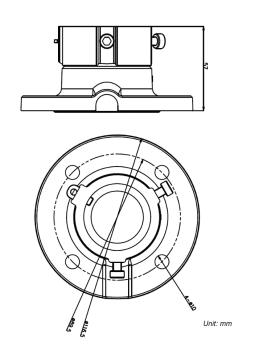
ø185
ø142

ø150
ø121
4−ø8.5

676

Unit: mm

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CM11

Ceiling mount for PD1100-series and PD9x0-series PTZ Dome

Technical specifications	
Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	57 x Ø117 mm (2.24 x Ø4.6 in)
Weight	0.38 kg (0.84 lbs)

Box content

Unit: mm

CM12
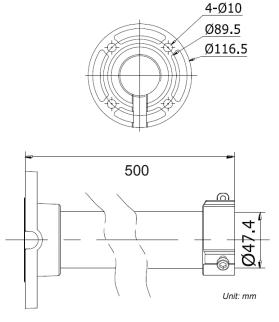
Ceiling mount for PD1100-series and PD9x0-series PTZ Dome, 50 cm

Technical specifications	
Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	500 x Ø117 mm (19.7 x Ø4.6 in)
Weight	0.96 kg (2.1 lbs)

Box content

4-Ø10
Ø89.5
Ø116.5

500

Ø47.4

Unit: mm
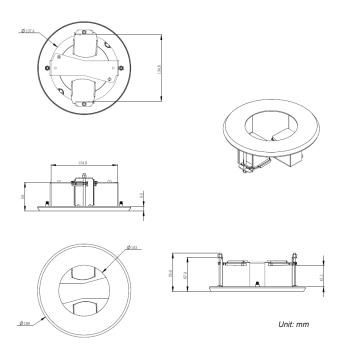
CM13 / FD

Flush mount kit for FD800, FD910 and FD980 series

Technical specifications	
Material	Steel
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø189 x 76 mm (Ø7.4 x 3.0 in)
Weight	0.8 kg (1.76 lbs)

Unit: mm

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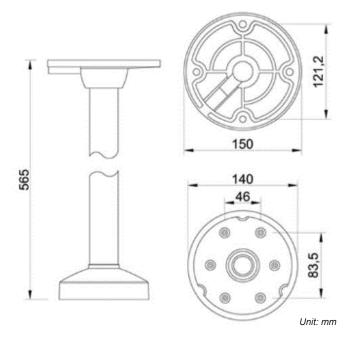
CM14

Ceiling mount for FD100x

Technical specifications	
Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø150 x 565 x Ø140 mm (Ø5.9 x 22.2 x Ø5.5 in)
Weight	1.9 kg (4.2 lbs)

121,2

150

565

140

46

83,5

Unit: mm

CM15
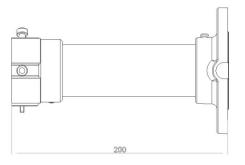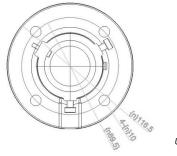
Ceiling mount for PD1100-series and PD9x0-series PTZ Dome, 25 cm

Technical specifications	
Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø117 x 250 mm (Ø4.6 x 9.8 in)
Weight	0.6 kg (1.3 lbs)

200

(n)116.5

4-(n)10

(n)89.5

Unit: mm

CM16
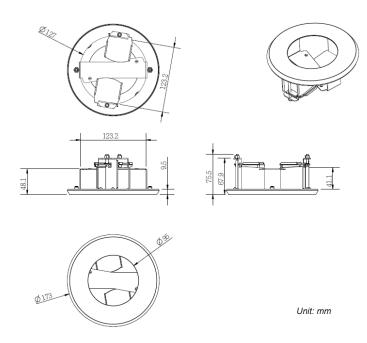
Flush mount kit for FD360

Technical specifications	
Material	Steel
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø173 x 76 mm (Ø6.8 x 3.0 in)
Weight	0.54 kg (1.19 lbs)

Box content

Unit: mm

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CM17
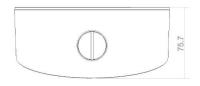
Angled ceiling mount for FD1103M1-EI
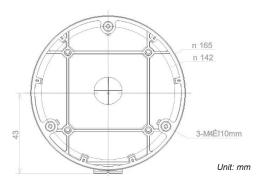
Technical specifications

Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø165 x 76 mm (Ø6.5 x 2.99 in)
Weight	0.425 kg (0.94 lbs)

Box content

75.7

n 165
n 142

43

3-M4↧10mm

Unit: mm
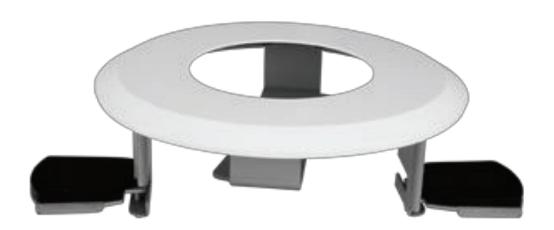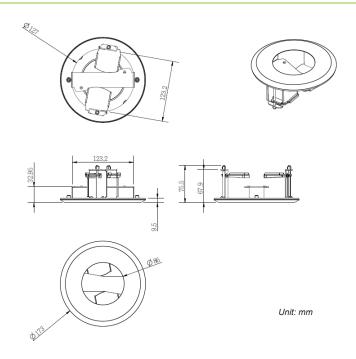
CM18

Flush mount for indoor fixed dome IFD800

Technical specifications	
Material	Steel
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø173 x 76 mm (Ø6.8 x 3.0 in)
Weight	

Ø127
123.2
123.2
32.95
9.5
75.5
67.9
Ø86
Ø173

Unit: mm
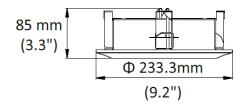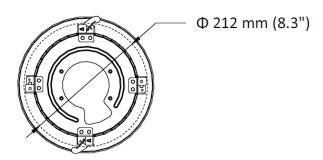
CM19

Flush mount for PD1022Z3-EI and PD1022

Technical specifications

Material	Steel
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø233 x 85 mm (Ø9.2 x 3.3 in)
Weight	640 g (1.4 lb)

85 mm (3.3")

Φ 233.3mm (9.2")

Φ 212 mm (8.3")
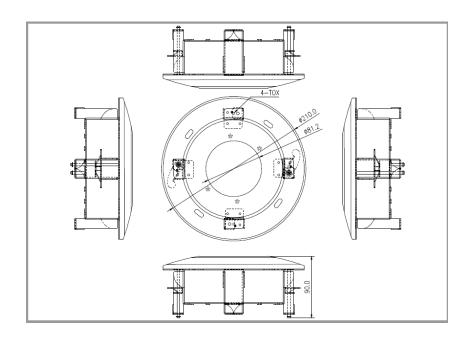
CM20

Flush-mount for FD1004M1
(needs additional top ring CM20TR)

Technical specifications	
Material	Steel
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø210 x 90mm
Weight	640 g (1.4 lb)
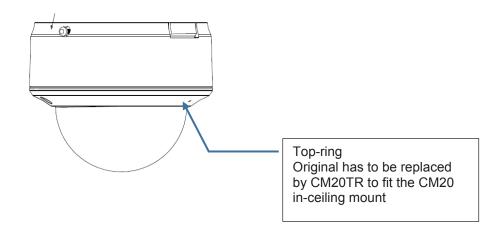
CM20TR

Top-ring for CM20 FD1004
(Addition to CM20)

Top-ring
Original has to be replaced
by CM20TR to fit the CM20
in-ceiling mount

Technical specifications	
Material	Aluminum alloy
Colour	RAL 9003 (signal white)

MOUNTS
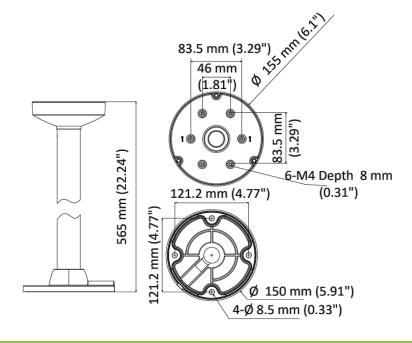
CM21

Ceiling pendant mount for FD2002M1/2005M1

Technical specifications	
Material	Aluminum Alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø 155 mm × 565 mm (6.1" × 22.24")
Weight	650 g (1.4 lb.)

83.5 mm (3.29")
46 mm (1.81")
Ø 155 mm (6.1")
83.5 mm (3.29")
6-M4 Depth 8 mm (0.31")
565 mm (22.24")
121.2 mm (4.77")
121.2 mm (4.77")
Ø 150 mm (5.91")
4-Ø 8.5 mm (0.33")
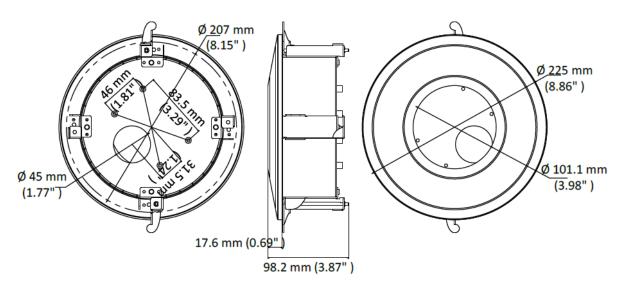
CM22

In-Ceiling mount for FD2002M1/2005M1

Technical specifications	
Material	Steel and ABS
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø 225 mm × 98.2 mm (8.86" × 3.87")
Weight	700 g (1.54 lb.)
Max load	3 kg (6.6 lb.)
Note	The mount should be installed on the flat ceiling The ceiling must be capable of supporting over 3 times as much as the total weight of the camera and the mount

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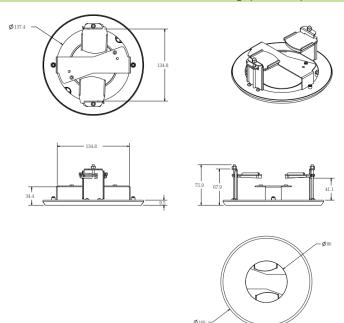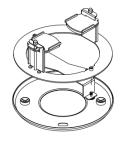
CM23

In-Ceiling mount for FD360v2

Technical specifications	
Material	Steel
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø189 x 76 mm (Ø7.4 x 3.0 in)
Weight	0.8kg (1.76lbs)

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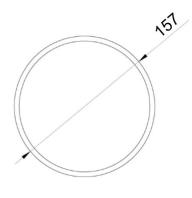
DC09

Dome cover, transparent, vandal proof, for HSD8x0 cameras, 6.2"

Technical specifications

Material	Polycarbonate
Colour	Transparent
Dimensions (H x W x D)	125 x Ø157 mm (4.9 x Ø6.2 in)
Weight	0.2 kg (0.44 lbs)

Box content

157

125

Unit: mm
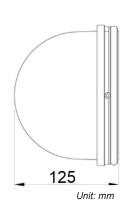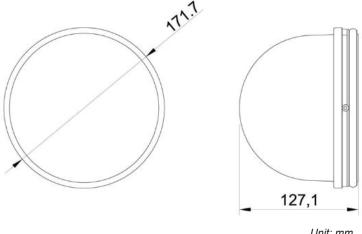
DC09C-R

Dome cover, transparent, vandal proof, rain wash, for HSD820 cameras, 6.8"

Technical specifications	
Material	Polycarbonate
Colour	Transparent
Dimensions (H x W x D)	127 x Ø172 mm (5.0 x Ø6.8 in)
Weight	0.165 kg (0.36 lbs)

171.7

127,1

Unit: mm

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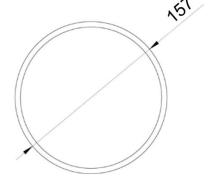
DC19
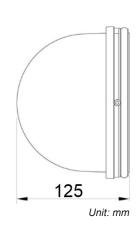
Dome cover, smoked, vandal proof, for HSD8x0 cameras, 6.2"

Technical specifications

Material	Polycarbonate
Colour	Smoked
Dimensions (H x W x D)	125 x Ø157 mm (4.9 x Ø6.2 in)
Weight	0.2 kg (0.44 lbs)

Box content

157

125

Unit: mm

DC21C-R

Dome cover, transparent, vandal proof, rain wash, for FD8xx cameras, 5.9"

Technical specifications	
Material	Polycarbonate
Colour	Transparent
Dimensions (H x W x D)	92 x Ø151 mm (3.6 x Ø5.9 in)
Weight	0.05 kg (0.11 lbs)

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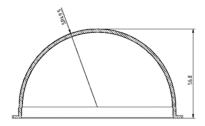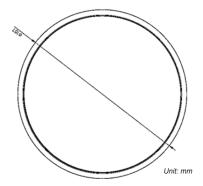
DC30S

Dome cover, smoked, vandal proof, for FD100x, 3.9"

Technical specifications	
Material	Polycarbonate
Colour	Smoked
Dimensions (H x W x D)	58 x Ø107 mm (2.3 x Ø4.2 in)
Weight	0.15 kg (0.33 lbs)

Unit: mm
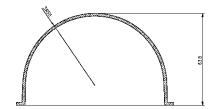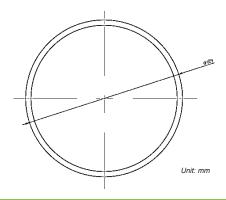
DC31S

Dome cover, smoked, vandal proof, for the FD1103, 4.0"

Technical specifications	
Material	Polycarbonate
Colour	Smoked
Dimensions (H x W x D)	64 x Ø109 mm (2.5 x Ø4.3 in)
Weight	0.04 kg (0.09 lbs)

Unit: mm
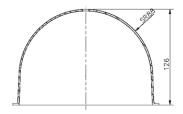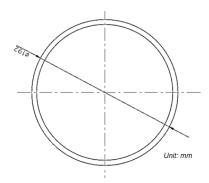
DC32S

Dome cover, smoked, vandal proof, for the PD1103Z2-E, 7.6"

Technical specifications	
Material	Polycarbonate
Colour	Smoked
Dimensions (H x W x D)	126 x Ø192 mm (5.0 x Ø7.6 in)
Weight	0.16 kg (0.35 lbs)

Unit: mm
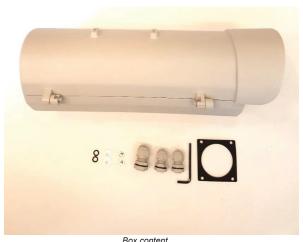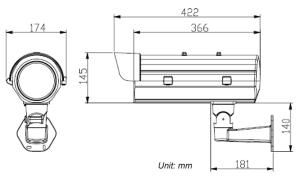
HSG02LV

Outdoor housing for a fixed box camera, heater/blower, 90-230 V

Technical specifications	
Housing	Fixed camera housing; heater/blower, IP67
Power	24 Vac, 24 Vdc, 90 - 260 Vac
Power consumption - 24 Vac, 24 Vdc	35 W (excl. camera)
Power consumption - 90 - 260 Vac	40 W (excl. camera)
Operating temperature	-30 °C to +75 °C (-22 °F to +167 °F)
Material	Aluminum
Dimensions (H x W x D)	145 x 174 x 422 mm (5.7 x 6.8 x 16.6 in)
Weight	2.9 kg (6.4 lbs)

Box content

Unit: mm
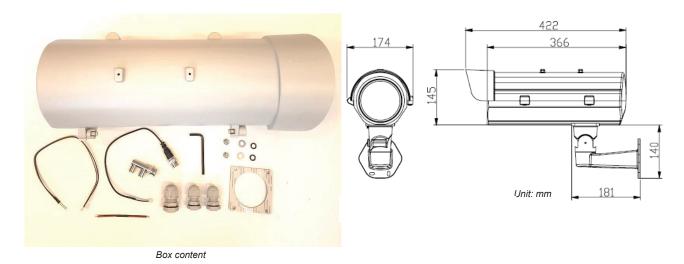
HSG03LV

Outdoor housing for a fixed box camera, IR illuminator, heater/blower, 90-230 V

Technical specifications	
Housing	Fixed camera housing; IR illuminator; heater/blower; IP67
Power	24 Vac, 24 Vdc, 90 - 260 Vac
Power consumption - 24 Vac, 24 Vdc	35 W (excl. camera)
Power consumption - 90 - 260 Vac	40 W (excl. camera)
Operating temperature	-30 °C to +50 °C (-22 °F to +122 °F)
Material	Aluminum
Dimensions (H x W x D)	145 x 174 x 422 mm (5.7 x 6.8 x 16.6 in)
Weight	3.1 kg (6.8 lb)

Box content

Unit: mm

Western Systems

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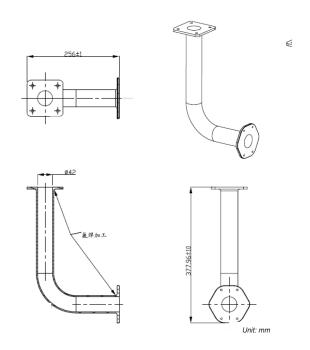
HSG/CEILING

Ceiling mount, fixed camera housing

Technical specifications	
Material	Aluminum
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	359 x 437 mm (14.1 x 17.2 in)
Weight	2.5 kg (5.51 lbs)

256±1

Ø42

377.96±10

Unit: mm
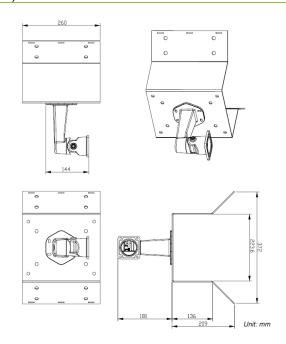
HSG/CORNER

Corner mount, fixed camera housing

Technical specifications

Material	Aluminum
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	377 x 260 x 179 mm (14.84 x 10.24 x 7.05 in)
Weight	1.0 kg (2.2 lbs)

Unit: mm

HSG/POLE
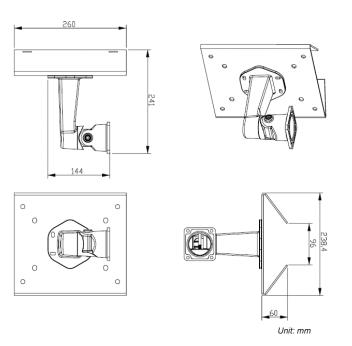
Pole mount, fixed camera housing

Technical specifications	
Material	Aluminum
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	240 x 260 x 60 mm (9.45 x 10.24 x 2.35 in)
Weight	1.0 kg (2.2 lbs)

Box content

Unit: mm

HSG/SUN

Sun shield, fixed camera housing

Technical specifications	
Material	Aluminum
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	425 x 181 x 73 mm (16.73 x 7.11 x 2.87 in)
Weight	380 g (0.84 lbs)

Box content

Western Systems

TKH GROUP | TKH SECURITY
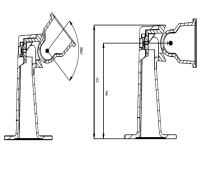
HSG/WALL
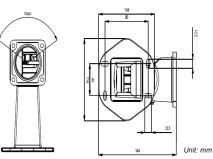
Wall mount, fixed camera housing

Technical specifications	
Material	Aluminum
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	181 x 140 x 114 mm (7.1 x 5.5 x 4.5 in)
Weight	0.6 kg (1.32 lbs)

Box content

Unit: mm
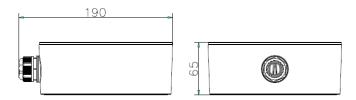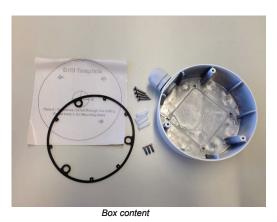
JB01
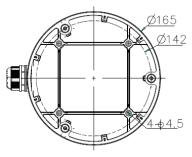
Junction box for the FD1103M1-EI

Technical specifications	
Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	65 x Ø165 mm (2.56 x Ø6.50 in)
Weight	0.5 kg (1.0 lbs)

190

65

Box content

Ø165
Ø142
4-φ4.5
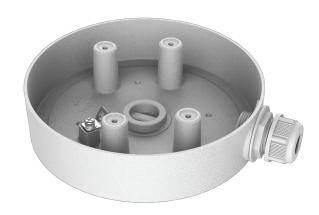
Unit: mm
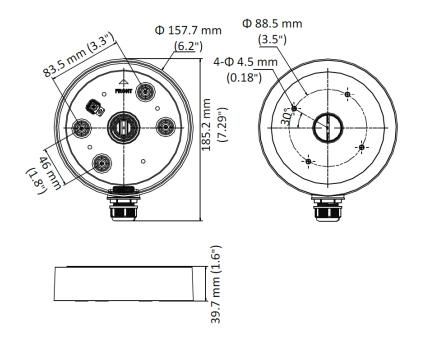
JB02

Junction box for PD1022Z3-EI and PD1022

Technical specifications	
Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø158 x 40 mm (Ø6.2 x 1.6 in)
Weight	0.45 kg (1.0 lbs)

Φ 157.7 mm (6.2")

Φ 88.5 mm (3.5")

83.5 mm (3.3")

4-Φ 4.5 mm (0.18")

185.2 mm (7.29")

30°

46 mm (1.8")

39.7 mm (1.6")

JB05
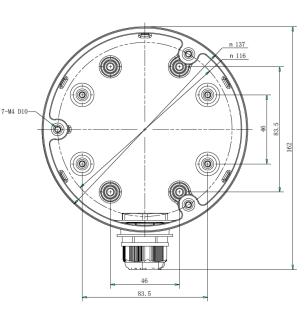
Junction box for the FD1103M1-I and FD1004M1-EI

Technical specifications

Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	42 x Ø137 mm (1.65 x Ø5.39 in)
Weight	0.3 kg (0.6 lbs)

Box content

n 137
n 116

7-M4 D10

46
83.5
162
46
83.5
42

Unit: mm

JB06

Junction box for the BL1004F4-EI and BL2002F4-EI
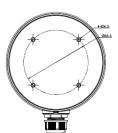
Technical specifications	
Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	53 x Ø137 mm (2.1 x Ø5.39 in)
Weight	0.527 kg (1.16 lbs)

Box content

Unit: mm
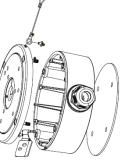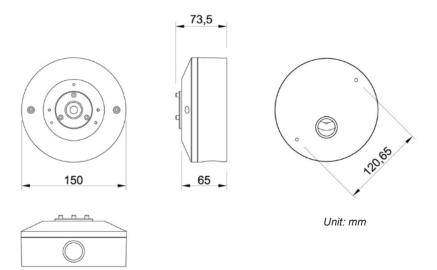
JB07 / BL

Junction box for the BL8xx and BL980

Technical specifications	
Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø150 x 65 mm (Ø5.9 x 2.6 in)
Weight	0.67 kg (1.5 lbs)

73,5

150

65

120,65

Unit: mm

PM01

Bracket, pole mount, thin
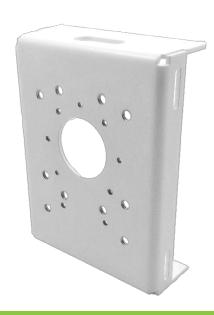
Technical specifications	
Material	Steel
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	232 x 136 x 60 mm (9.1 x 5.4 x 2.4 in)
Diameter	112 – 130 mm (4.4 – 5 in)
Weight	0.7 kg (1.6 lbs)
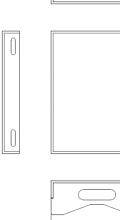
PM01 SAE304

Bracket, Pole Mount, Stainless Steel 304

Technical specifications

Material	Stainless steel
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	180 x 135 x 50 mm (7.1 x 5.3 x 2.0 in)
Diameter	100 – 200 mm (3.9 – 7.9 in)
Weight	2.9 kg (6.4 lbs)

Box content

Unit: mm
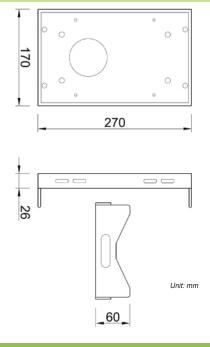
PM02

Bracket, pole mount, wide

Technical specifications

Material	Steel
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	270 x 170 x 60 mm (10.6 x 6.7 x 2.4 in)
Diameter	112 – 140 mm (4.4 - 5.5 in)
Weight	1 kg (2.2 lbs)

Box content

170

270

26

60

Unit: mm

MOUNTS
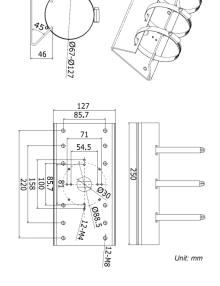
PM06

Pole mount for the PD9x0-series and 1100-series

Technical specifications	
Material	Aluminum alloy & Steel
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	127 x 46 x 250 mm (5.00 x 1.81 x 9.84 in)
Diameter	Ø67 - 127 mm (Ø2.64 - 5.00 in)
Weight	1.2 kg (2.7 lbs)

Box content

Unit: mm
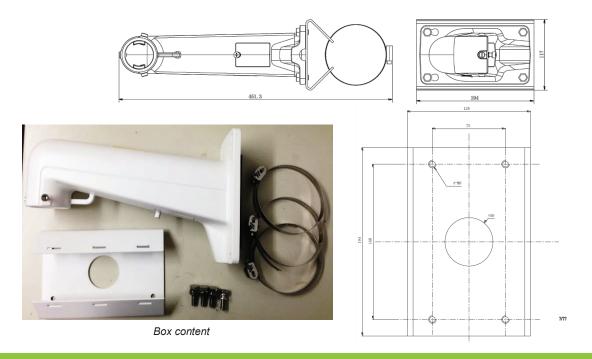
PM07

Pole mount + wall mount for PD1100-series and PD9x0-series PTZ Dome

Technical specifications

Material	Aluminum alloy & Steel
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	117 x 194 x 451 mm (4.61 x 7.64 x 17.76 in)
Diameter	67 - 127 mm (2.64 - 5.00 in)
Weight	2.0 kg (4.5 lbs)

Box content

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PM07B
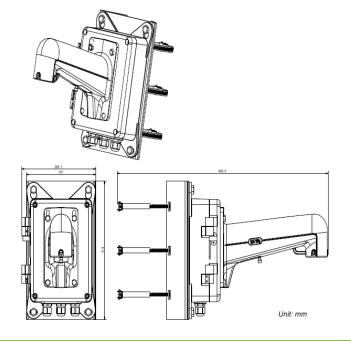
Pole mount + wall mount + junction box for PD1100-series and PD9x0-series

Technical specifications

Material	Aluminum alloy & Steel
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	210 x 314 x 601 mm (8.27 x 12.36 x 23.66 in)
Diameter	100 - 200 mm (3.94 - 7.87 in)
Weight	6.8 kg (15.0 lbs)

Box content

Unit: mm
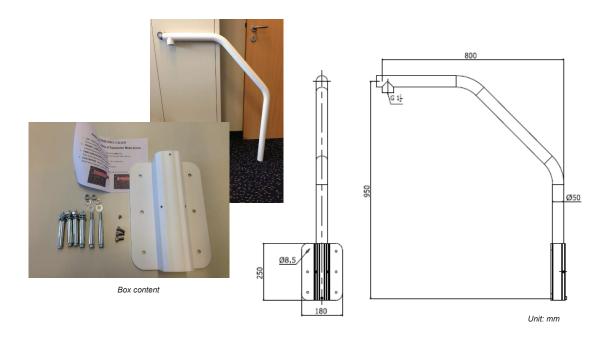
PM08

Parapet pole mount for PD1100-series and PD9x0-series PTZ Dome

Technical specifications

Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	180 x 950 x 800 mm (7.09 x 37.40 x 31.50 in)
Weight	2.9 kg (6.4 lbs)

Box content

800

G 1½

950

Ø50

250

Ø8,5

180

Unit: mm

PM09B / BL
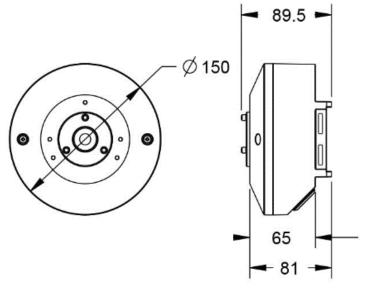
Pole mount junction box for BL8xx and BL980

Technical specifications	
Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø150 x 81 mm (Ø5.9 x 3.2 in)
Weight	0.73 kg (1.6 lbs)

Unit: mm
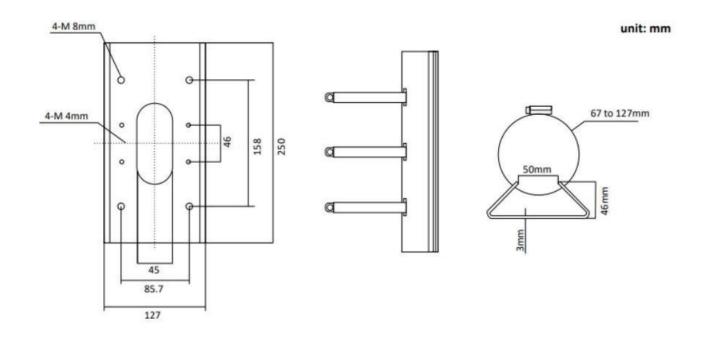
PM10

Pole mount for BL/FD-2002 and BL/FD-2005 series cameras

Technical specifications	
Material	Stainless steel
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	127 x 46 x 250mm
Weight	1205g

unit: mm

4-M 8mm

4-M 4mm

46
158
250

45
85.7
127

67 to 127mm

50mm

46mm

3mm
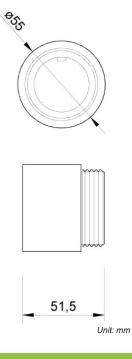
PTM01

Bracket, Adapter, G 1.5 Inch

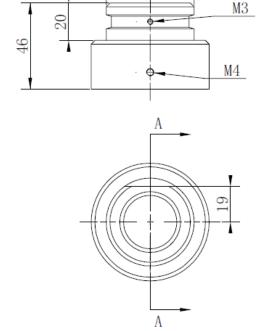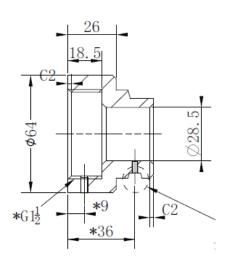| Technical specifications	
Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø55 x 52 mm (Ø2.2 x 2.0 in)
Weight	0.1 kg (0.22 lbs)

Box content

Ø55

51,5

Unit: mm

PTM02

Threaded Adapter, G 1.5 Inch for PD9x0 series

Technical specifications	
Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø65 x 46 mm
Weight	0.1 kg (0.22 lbs)
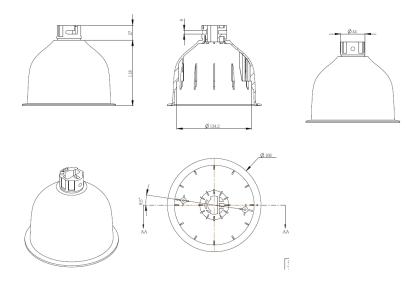
TA01 / FD

Tube adapter/pendant mount for the FD8xx, FD910 and FD980 series

Technical specifications

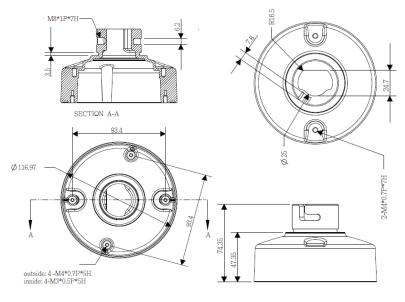|	
Material	Plastic
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	145 x Ø167 mm (5.7 x Ø6.6 in)
Weight	0.22 kg (0.48 lbs)

Unit: mm

TA02

Tube adapter for the FD360

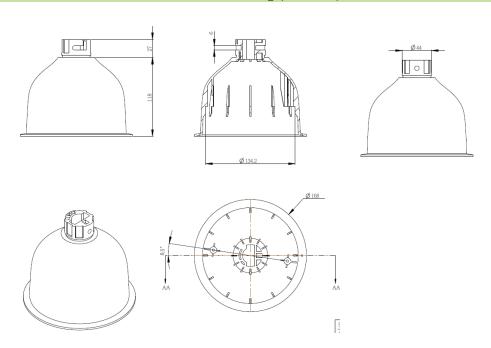| Technical specifications	
Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø117 x 63 mm (Ø4.6 x 2.5 in)
Weight	0.2 kg (0.44 lbs)

M8*1P*7H
6.2
3.5
SECTION A-A

R16.5
7.8
24.7
Ø25
2-M4*0.7P*7H

Ø116.97
93.4
93.4
A
A
outside: 4 -M4*0.7P*5H
inside: 4-M3*0.5P*5H

74.35
47.35

Unit: mm

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TA03

Tube adapter for the FD360v2, FD910 and FD980

Technical specifications

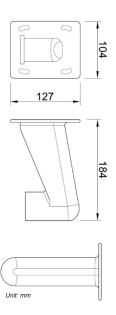|	
Material	Plastic
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	145 x Ø167 mm (5.7 x Ø6.6 in)
Weight	0.35 kg (0.77 lbs)

WM01A

Bracket, Wall Mount, Short, with gasket kit

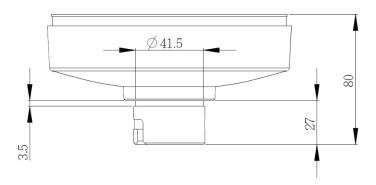| Technical specifications	
Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	184 x 104 x 127 mm (7.24 x 4.09 x 5.0 in)
Weight	0.6 kg (1.3 lbs)

104

127

184

Unit: mm

WM02FD-SFP

Tube adapter/pendant mount for FD820 with SFP

Technical specifications	
Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	
Weight	

Ø 41.5
80
27
3.5
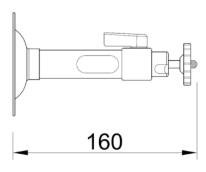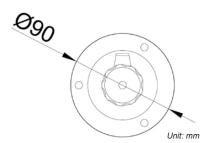
WM04A

Wall mount, Indoor, box camera

Technical specifications	
Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø90 x 160 mm (Ø3.54 x 6.3 in
Weight	0.2 kg (0.44 lbs)

160

Ø90

Unit: mm
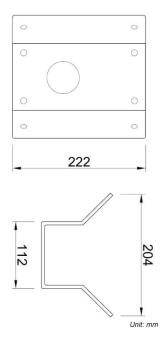
WM05

Bracket, Wall Mount, Corner Plate

Technical specifications	
Material	Steel
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	222 x 204 x 117 mm (8.7 x 8 x 4.6 in)
Weight	2 kg (4.4 lbs)

222

112

204

Unit: mm
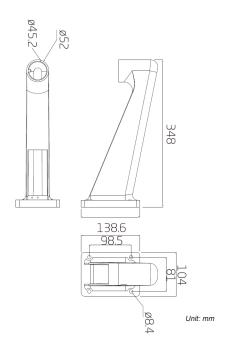
WM07A

Bracket, Long Wall Mount, with gasket

Technical specifications	
Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	348 x 104 x 139 mm (13.7 x 4.1 x 5.5 in)
Weight	1.5 kg (3.3 lbs)

ø45.2   ø52

348

138.6

98.5

104

81

ø8.4

Unit: mm
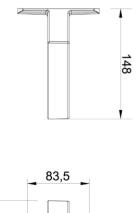
WM09

Wall mount for IFD822/FD360E

Technical specifications	
Material	Plastic
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	117 x 110 x 148 mm (4.6 x 4.3 x 5.8 in)
Weight	0.14 kg (0.3 lbs)
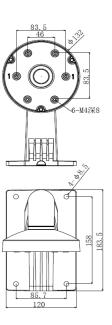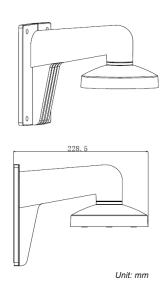
Box content

110

148

83,5

116,9

Unit: mm

Western Systems

WM10

Wall mount for FD1103M1-I and FD1104FR

Technical specifications

Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø132 x 184 x 229 mm (Ø5.20 x 7.24 x 9.02 in)
Weight	0.7 kg (1.5 lbs)

Box content

Unit: mm

WM10B
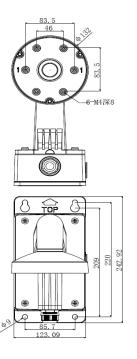
Wall mount + Junction box for FD1103M1-I and FD1104FR
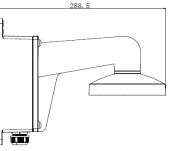
Technical specifications

Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø132 x 243 x 289 mm (Ø5.20 x 9.57 x 11.38 in)
Weight	1.5 kg (3.3 lbs)
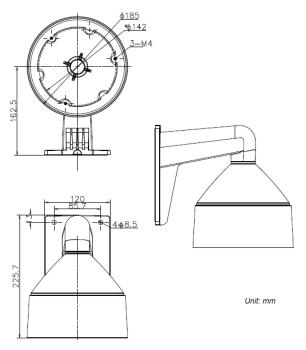
Box content

Unit: mm

MOUNTS

WM11

Wall mount for FD1103M1-EI

Technical specifications

Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	255 x 226 x Ø185 mm (10.04 x 8.89 x Ø7.28 in)
Weight	1.6 kg (3.4 lbs)

Box content

φ185
*φ142
3–M4
162.5

120
85.7
4⊕8.5
225.7

Unit: mm

Western Systems

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WM11B
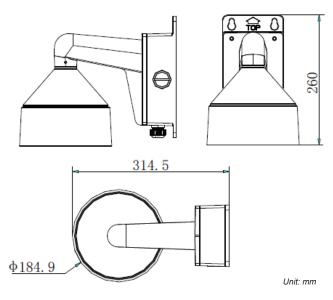
Wall mount + junction box for FD1103M1-EI

Technical specifications

Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	315 x 260 x Ø185 mm (12.40 x 10.24 x Ø7.28 in)
Weight	2.1 kg (4.5 lbs)
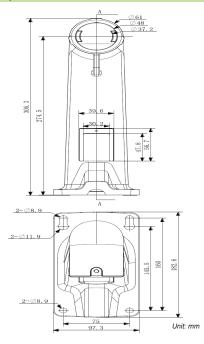
260

314.5

Φ184.9

Box content

Unit: mm

MOUNTS

WM12

Wall mount for PD1100-series and PD9x0-series PTZ Dome

Technical specifications

Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	97 x 183 x 306 mm (3.8 x 7.2 x 12 in)
Weight	1.1 kg (2.3 lbs)

Box content
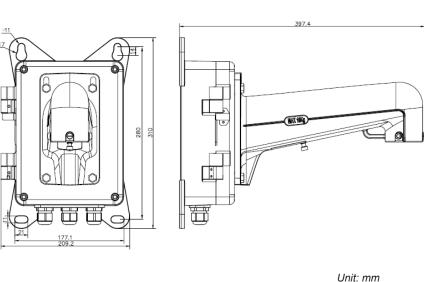
Unit: mm

WM12B

Wall mount + junction box for PD1100-series and PD9x0-series PTZ Dome

Technical specifications

Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	104 x 155 x 311 mm (4.09 x 6.10 x 12.2 in)
Weight	3.2 kg (7.1 lbs)

Box content

Unit: mm

MOUNTS

WM14

Corner mount for 1103-series and FD1104FR

Technical specifications	
Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	126 x 105 x 250 mm (4.96 x 4.13 x 9.84 in)
Weight	2.0 kg (4.3 lbs)

Box content

Unit: mm
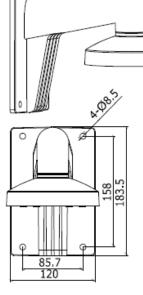
WM15
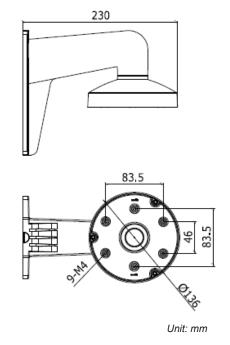
Wall mount for FD1000-series

Technical specifications

Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø136 x 184 x 230 mm (Ø5.35 x 7.22 x 9.1 in)
Weight	0.7 kg (1.54 lbs)

Box content

230

4-Ø8.5

158
183.5

85.7
120

83.5

9-M4

46
83.5

Ø136

Unit: mm

TKH GROUP | TKH SECURITY

WM15B
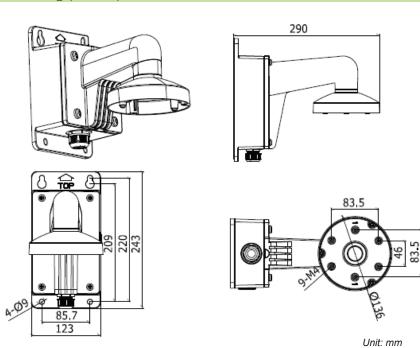
Wall mount + junction box for FD1000-series

Technical specifications	
Material	Aluminum alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø136 x 243 x 290 mm (Ø5.35 x 9.56 x 11.4 in)
Weight	1.5 kg (3.3 lbs)

Box content

Unit: mm
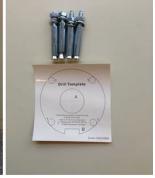
WM16

Gooseneck mount for PD1100-series and PD9x0-series PTZ Dome

Technical specifications

Material	Aluminum alloy & Steel
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	455 x 130 x 842 mm (17.92 x 5.13 x 33.13 in)
Weight	6.4 kg (14.2 lbs)

Box content

Φ56

841.5

46.5

455.2

70.7

Φ11

70.7

Φ130.4

Unit: mm

MOUNTS
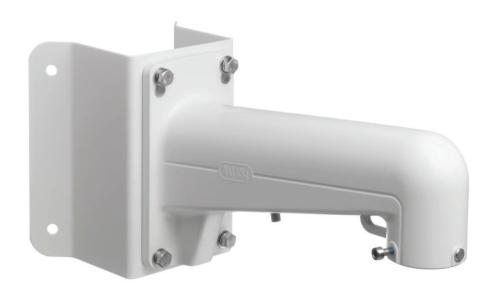
WM17
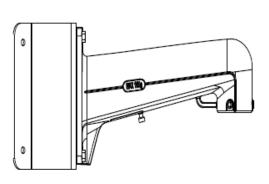
Corner mount + wall mount for PD1100-series and PD9x0-series PTZ Dome

Technical specifications
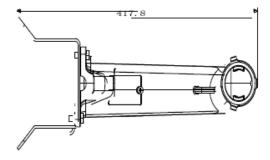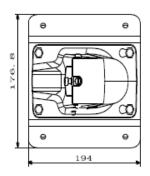
Material	Aluminum alloy & Steel
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	177 x 194 x 418 mm (6.97 x 7.64 x 16.46 in)
Weight	2.8 kg (6.2 lbs)

Box content

176.8

194

417.8

Unit: mm

MOUNTS
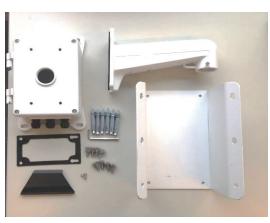
WM17B
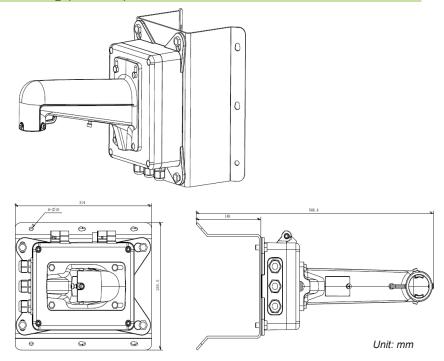
Corner mount + wall mount + junction box for PD1100-series and PD9x0-series PTZ Dome

Technical specifications

Material	Aluminum alloy & Steel
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	256 x 314 x 546 mm (10.08 x 4.49 x 21.50 in)
Weight	8.4 kg (18.5 lbs)

Box content

Unit: mm
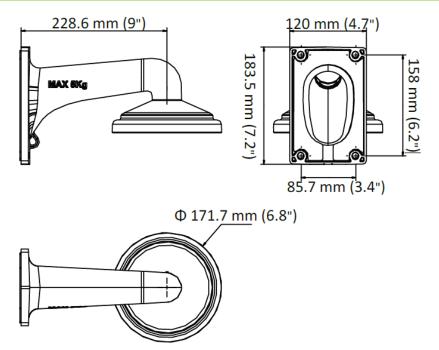
WM18

Wall mount for PD1022Z3-EI and PD1022

Technical specifications

Material	Aluminium alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø172 x 158 x 229 mm (Ø6.8 x 6.2 x 9.0 in)
Weight	1.1 kg (3.6 lbs)

228.6 mm (9")

MAX 5Kg

120 mm (4.7")

183.5 mm (7.2")

158 mm (6.2")

85.7 mm (3.4")

Φ 171.7 mm (6.8")
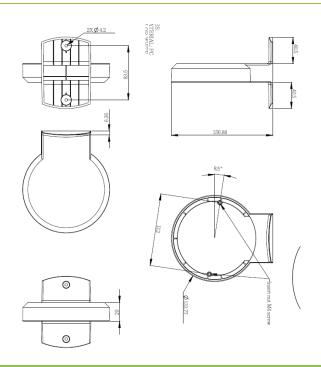
WM19 / FD

Wall mount for FD8xx, FD910 and FD980 series

Technical specifications	
Material	Plastic
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	110 x 157 x Ø134 mm (4.3 x 6.2 x Ø5.3 in)
Weight	
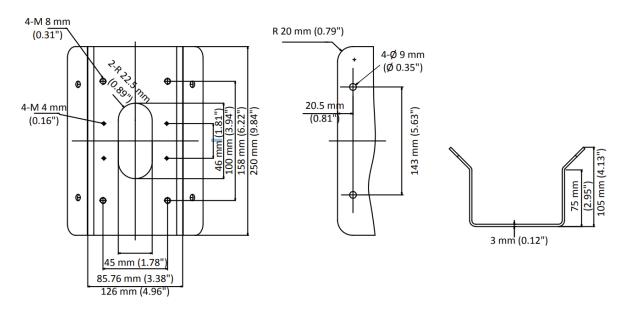
WM20

Corner mount for BL/FD-2002-series and BL/FD-2005 cameras

Technical specifications

Material	Stainless Steel
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	250 mm × 126 mm × 105 mm (9.84" × 4.96" × 4.13")
Weight	2280 g (5.03 lb.)
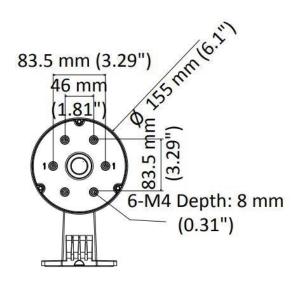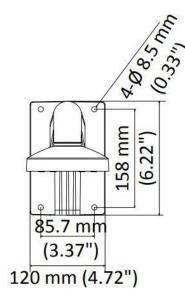
WM21
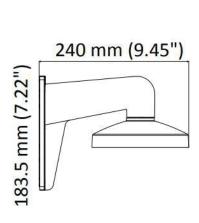
Wall mount for FD2002M1 and FD2005M1

Technical specifications	
Material	Aluminum Alloy
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	Ø 155 mm × 183.5 mm × 240 mm (6.1" × 7.22" × 9.45")
Weight	650 g (1.4 lb.)

83.5 mm (3.29")
46 mm (1.81")
Ø 155 mm (6.1")
83.5 mm (3.29")
6-M4 Depth: 8 mm (0.31")

4-Ø 8.5 mm (0.33")
158 mm (6.22")
85.7 mm (3.37")
120 mm (4.72")

240 mm (9.45")
183.5 mm (7.22")
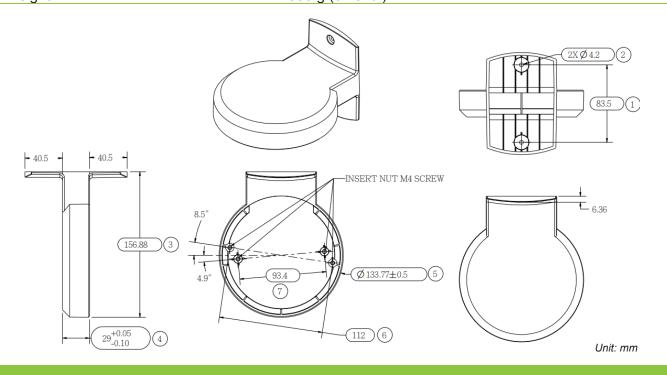
WM22

Wall mount for FD360v2, FD910 and FD980

Technical specifications

Material	Plastic
Colour	RAL 9003 (signal white)
Dimensions (H x W x D)	110 x 157 x Ø134 mm (4.3 x 6.2 x Ø5.3 in)
Weight	330 g (0.73 lb.)

2X Ø 4.2 (2)

83.5 (1)

40.5   40.5

156.88 (3)

INSERT NUT M4 SCREW

8.5°

4.9°

93.4 (7)

Ø 133.77±0.5 (5)

6.36

29 +0.05 -0.10 (4)

112 (6)

Unit: mm

Hanwha

Proven technology. Unrivaled performance. Trusted partner.

Key Features

- Motorized PTRZ support
- Maximum 60fps@2MP(H.265, H.264)
- 3~6mm(2x) motorized varifocal lens
- H.265, H.264, MJPEG codec, Multi streaming
- Video analytics, WiseStream II
- IP66, IK10, NEMA4X

PNM-9084QZ1
2MP x 4CH PTRZ Multi-directional Camera

Specifications

Video

Imaging Device	1/2.8" CMOS x 4CH
Resolution	1920x1080, 1280x1024, 1280x960, 1280x720, 1024x768, 800x600, 800x448, 720x576, 720x480, 640x480, 640x360, 320x240
Max. Framerate	H.265/H.264: Max. 60fps/50fps(60Hz/50Hz) MJPEG: Max. 30fps/25fps(60Hz/50Hz)
Min. Illumination	Color: 0.04lux(F2.2, 1/30sec) BW: 0.004lux(F2.2, 1/30sec)

Lens

Focal Length (Zoom Ratio)	3~6mm(2x) motorized varifocal
Max. Aperture Ratio	F2.2(Wide)-F3.1(Tele)
Angular Field of View	H: 107(Wide)~56.3(Tele) / V: 57(Wide)~31.5(Tele) / D: 126(Wide)~64.3(Tele)
Min. Object Distance	0.5m(1.64ft)
Focus Control	Simple focus
Lens Type	Fixed iris

Pan / Tilt / Rotate

Pan / Tilt / Rotate Range	Remote adjustment (Max. 200cycles) 0~360 / 0~73 / 0~90

Operational

Camera Title	Displayed up to 85 characters
Day & Night	Auto(ICR)
Backlight Compensation	BLC, HLC, WDR, SSDR
Wide Dynamic Range	120dB
Digital Noise Reduction	SSNR V
Digital Image Stabilization	Support
Defog	Support
Motion Detection	8ea, 8point polygonal zones
Privacy Masking	32ea, polygonal zones - Color: Grey, Green, Red, Blue, Black, White - Mosaic
Gain Control	Low / Middle / High
White Balance	ATW / AWC / Manual / Indoor / Outdoor
LDC	Support
Electronic Shutter Speed	Minimum / Maximum / Anti flicker (2~1/12,000sec)
Video Rotation	Flip, Mirror
Analytics	Defocus detection, Directional detection, Fog detection, Face detection, Motion detection, Appear/Disappear, Enter/Exit, Loitering, Tampering, Virtual line, Audio detection
Alarm I/O	Input 1ea / Output 1ea
Alarm Triggers	Analytics, Network disconnect, Alarm input
Alarm Events	File upload via FTP and e-mail Notification via e-mail SD/SDHC/SDXC at event triggers Alarm output Handover

Audio In	Selectable(mic in/line in) Supply voltage: 2.5VDC(4mA), Input impedance: 2K Ohm
Audio Out	Line out, Max.output level: 1Vrms

Network

Ethernet	Metal shielded RJ-45(10/100/1000BASE-T)
Video Compression	H.265/H.264: Main/Baseline/High, MJPEG
Audio Compression	G.711 u-law /G.726 G.726(ADPCM) 8KHz, G.711 8KHz G.726: 16Kbps, 24Kbps, 32Kbps, 40Kbps AAC-LC: 48Kbps at 16KHz
Smart Codec	Manual(5ea area), WiseStream II
Bitrate Control	H.264/H.265: CBR or VBR MJPEG: VBR
Streaming	Unicast(20 users) / Multicast Multiple streaming(Up to 10 profiles)
Protocol	IPv4, IPv6, TCP/IP, UDP/IP, RTP(UDP), RTP(TCP), RTCP,RTSP, NTP, HTTP, HTTPS, SSL/TLS, DHCP, FTP, SMTP, ICMP, IGMP, SNMPv1/v2c/v3(MIB-2), ARP, DNS, DDNS, QoS, PIM-SM, UPnP, Bonjour, LLDP
Security	HTTPS(SSL) Login Authentication Digest Login Authentication IP Address Filtering User access log 802.1X Authentication(EAP-TLS, EAP-LEAP)
Application Programming Interface	ONVIF Profile S/T SUNAPI(HTTP API) Wisenet open platform

General

Webpage Language	English, Korean, Chinese, French, Italian, Spanish, German, Japanese, Russian, Swedish,, Portuguese, Czech, Polish, Turkish, Dutch, Hungarian, Greek
Edge Storage	Micro SD/SDHC/SDXC 4slot 256GB(each CH)
Memory	5GB RAM, 1280MB Flash

Environmental & Electrical

Operating Temperature / Humidity	-40°C~+55°C(-40°F~+131°F) / Less than 90% RH *Start up should be above at -35C
Storage Temperature / Humidity	-50°C~+60°C(-58°F~+140°F) / Less than 90% RH
Certification	IP66, IK10, NEMA4X
Input Voltage	HPoE
Power Consumption	Max. 33W, Typical 20W

Mechanical

Color / Material	White / Aluminum
RAL Code	RAL9003
Product Dimensions / Weight	Ø251x116.5mm / 3Kg
Compatible Conduit hole / Gangbox	3/4"

DORI (EN62676-4 standard)

Detect (25PPM/ 8PPF)	Wide: 28.4m(11.18ft) / Tele: 71.8m(28.27ft)
Observe (63PPM/ 19PPF)	Wide: 11.4m(4.49)ft) / Tele: 28.7m(11.30ft)
Recognize (125PPM/ 38PPF)	Wide: 5.7m(2.24ft) / Tele: 14.4m(5.67ft)
Identify (250PPM/ 76PPF)	Wide: 2.8m(1.10)ft) / Tele: 7.8m(3.07ft)
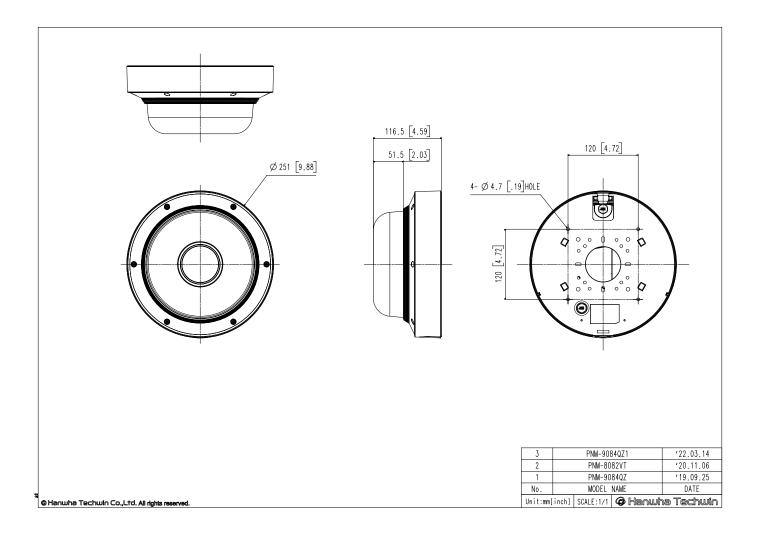
CAD

Unit: mm [inch]

Ø 251 [9.88]

116.5 [4.59]
51.5 [2.03]

120 [4.72]

4- Ø 4.7 [.19] HOLE

120 [4.72]

3	PNM-9084QZ1	'22.03.14
2	PNM-8082VT	'20.11.06
1	PNM-9084QZ	'19.09.25
No.	MODEL NAME	DATE
Unit:mm[inch]	SCALE:1/1	Hanwha Techwin

Key features

- Focal length: 4ch: 3.3~5.7mm(1.7x) motorized varifocal,

  PTZ: 4.25~170mm(40x) zoom (digital 32x, total 1280x zoom)

- H.265, H.264, MJPEG codec supported

- Multiple streaming (4ch: up to 3 profiles, PTZ: up to 10 profiles)

- Day & Night (ICR), WDR (4ch:120dB, PTZ: 150dB)

- Micro SD/SDHC/SDXC 2slot 1TB

- IR viewable length (4ch: 30m, PTZ: WiseIR 200m)

- Digital Noise Reduction: SSNRV, WiseNR

- IP66, IP67, IK10 NEMA4X

Spec Display Name	4CH camera	PTZ
Video		
Imaging Device	1/2.8" CMOS	
Resolution	3840x2160, 3328x1872, 3072x1728, 2592x1944, 2688x1520, 1920x1080, 1600x1200, 1280x1024, 1280x960, 1280x720, 1024x768, 800x600, 800x448, 720x576, 720x480, 640x480, 640x360, 320x240	1920x1080, 1280x1024, 1280x960, 1280x720, 1024x768, 800x600, 800x448, 720x576, 720x480, 640x480, 640x360, 320x240
Max. Framerate	(TBD) H.265/H.264: 4K Max. 20fps/16.7fps(60Hz/50Hz) MJPEG: 4K Max. 20fps/16.7fps(60Hz/50Hz)	H.265/H.264: 2MP Max. 60fps/50fps(60Hz/50Hz) MJPEG: 2MP Max. 30fps/25fps(60Hz/50Hz)
Min. Illumination	(TBD) Color: 0.16Lux(F1.5, 1/30sec, 30IRE) BW: 0.016Lux(F1.5, 1/30sec, 30IRE), 0Lux(IR LED on)	Color: 0.05Lux(F1.6, 1/30sec, 30IRE) BW: 0.005Lux(F1.6, 1/30sec, 30IRE), 0Lux(IR LED on)
Lens		
Focal Length (Zoom Ratio)	3.3~5.7mm(1.7x) motorized varifocal	4.25~170mm(40x) zoom (digital 32x, total 1280x zoom)
Max. Aperture Ratio	F1.5(Wide)~F1.9(Tele)	F1.6(Wide)~F4.95(Tele)
Angular Field of View	H: 110.1˚(Wide)~57.1˚(Tele) V: 55.9˚(Wide)~31.6˚(Tele) D: 138.3˚(Wide)~66.1˚(Tele)	H: 65.66˚(Wide)~1.88˚(Tele) V: 39.40˚(Wide)~1.09˚(Tele)
Min. Object Distance	(TBD) Wide: 1.3m / Tele: 3.3m	3m(9.84ft)
Focus Control	Simple focus, manual	Oneshot AF, Focus save
Lens Type	Fixed iris	DC auto iris
Pan / Tilt / Rotate		
Pan / Tilt / Rotate Range	(TBD) Remote adjustment (Max. 200cycles) (PTRZ) +/-90° (TBD) / 0~90˚ / 0~90˚"	-
Pan Range	-	360˚ Endless
Pan Speed	-	Max. 700˚/sec, Manual: 0.024˚/sec~250˚/sec
Tilt Range	-	110˚(-20˚~90˚)
Tilt Speed	-	Max. 500˚/sec, Manual: 0.024˚/sec~250˚/sec
Rotate Range	-	-
Sequence	-	Preset(300ea), Swing, Group(6ea), Trace, Tour, Auto Run, Schedule
Preset Accuracy	-	Up to ±0.1˚, Pan/Tilt correction
Operational		
Camera Title	Displayed up to 85 characters	
Direction Indicator	-	Support
Day & Night	Auto(ICR)	
Backlight Compensation	BLC, WDR, SSDR	BLC, HLC, WDR, SSDR
Wide Dynamic Range	WDR(120dB)	WDR(150dB)
Digital Noise Reduction	SSNRV, WiseNR	
Digital Image Stabilization	-	Support
Defog	Support(TBD)	Support

Motion Detection	8ea, 8point polygonal zones	
Privacy Masking	6ea, 4point quadrangle zones - Color: Grey/Black/White	32ea, 4point quadrangle zones - Color: Grey/Green/Red/Blue/Black/White / Mosaic
Gain Control	Low / Middle / High	
White Balance	ATW / AWC / Manual / Indoor / Outdoor	
LDC	Support	-
Electronic Shutter Speed	Minimum / Maximum / Anti flicker(2~1/12,000sec) Auto prefer shutter control(Based on AI engine)	
Video Rotation	Flip, Mirror, Hallway view(90°)	Flip, Mirror

Analytics	Classified object type: Person/Face/Vehicle/License plate
	Attributes: Vehicle(Type: car/bus/truck/motorcycle/bicycle)
	Support Bestshot
	Analytics events based on AI engine
	- Object detection, Virtual line(Crossing/Direction),
	  Virtual area(Loitering/Intrusion/Enter/Exit)
	  Analytics events
	- Defocus detection, Motion detection, Tampering,
	  Virtual area(Appear/Disappear)
	 * Support Audio detection, Sound classification via optional
	SPM-4210 I/O box
		Directional detection, Fog detection, Face detection, Motion detection, Appear/Disappear, Enter/Exit, Loitering, Tampering, Virtual line, Shock detection
		* Audio detection, Sound classification(with NW I/O Box)

Alarm I/O	* Alarm In/Out (with NW I/O Box)	
Alarm Triggers	Analytics, Network disconnect, Alarm input(with NW I/O Box)	
Alarm Events	When alarm trigger occurred - File upload(image): e-mail/FTP - Notification: e-mail - Recording: SD/SDHC/SDXC or NAS recording at event triggers - Alarm output(with NW I/O Box) - Handover(PTZ preset, Send message by HTTP/HTTPS/TCP) - Audio clip playback(with NW I/O Box)	
Audio In	*with NW I/O Box	
Audio Out	*with NW I/O Box	
IR Viewable Length	20m(65.62ft) (nice to have 30m)	WiseIR 200m(656.17ft)
Water Removal	-	Support(Spinning dry)
Auto Tracking	-	Object auto tracking(Person/Vehicle), Target lock tracking
Network		
Ethernet	Metal shielded RJ-45(10/100/1000BASE-T)	Metal shielded RJ-45(10/100BASE-T)
Video Compression	H.265/H.264: Main/High, MJPEG	H.265/H.264: Main/Baseline/High, MJPEG
Smart Codec	Manual(5ea area), WiseStream Ⅱ, WiseStream Ⅲ (Based on AI engine)	
Video Quality Adjustment	H.264/H.265: Target bitrate level control MJPEG: Target bitrate level control	
Bitrate Control	H.264/H.265: CBR or VBR / MJPEG: VBR	
Streaming	Unicast(10 users) / Multicast Multiple streaming(Up to 3 profiles)	Unicast(20 users) / Multicast (128 user) Multiple streaming(Up to 10 profiles)
Protocol	IPv4, IPv6, TCP/IP, UDP/IP, RTP(UDP), RTP(TCP), RTCP,RTSP, NTP, HTTP, HTTPS, SSL/TLS, DHCP, FTP, SMTP, ICMP, IGMP, SNMPv1/v2c/v3(MIB-2), ARP, DNS, DDNS, QoS, PIM-SM, UPnP, Bonjour, LLDP, SRTP""IPv4, IPv6, TCP/IP, UDP/IP, RTP(UDP), RTP(TCP), RTCP,RTSP, NTP, HTTP, HTTPS, SSL/TLS, DHCP, FTP, SMTP, ICMP, IGMP, SNMPv1/v2c/v3(MIB-2), ARP, DNS, DDNS, QoS, PIM-SM, UPnP, Bonjour, LLDP, SRTP	
Security	TPM 2.0 (FIPS 140-2 level 2) (Preferred FIPS 140-3) / HTTPS(SSL) login authentication / Digest login authentication / IP address filtering / User access log / 802.1X authentication(EAP-TLS, EAP-LEAP, EAP-PEAP MSCHAPv2) / Device certificate(Hanwha Techwin Root CA, pre-installed) / Secure by default certificate / Secure OS/Boot/ Storage, Verify firmware forgery	

PNM-C34404RQPZ
5CH AI multi-directional camera

Application Programming Interface	ONVIF Profile S/T/M ONVIF Profile G (TBD) SUNAPI(HTTP API)	ONVIF Profile S/T/G/M (TBD) SUNAPI(HTTP API) Wisenet open platform
General		
Webpage Language	English, Korean, Chinese, French, Italian, Spanish, German, Japanese, Russian, Portuguese, Czech, Polish, Turkish, Dutch, Hungarian, GreekEnglish, Korean, Chinese, French, Italian, Spanish, German, Japanese, Russian, Portuguese, Czech, Polish, Turkish, Dutch, Hungarian, Greek	
Edge Storage	(TBD) Micro SD/SDHC/SDXC 2slots 2TB (1TB x 2)	Micro SD/SDHC/SDXC 2slot 1TB (512MB X 2)
Memory	8GB RAM, 512MB Flash (TBD)	4GB RAM, 512MB Flash
Environmental & Electrical		
Operating Temperature / Humidity	-40°C ~ +55°C(-40°F ~ +131°F) +74°C(+165°F)(MAX) based on NEMA-TS 2(2.2.7) * Start up should be done at above -30°C 0 ~ 95% RH(non-condensing)"	
Storage Temperature / Humidity	-50°C ~ +60°C(-58°F ~ +140°F) / 0 ~ 90% RH	
Certification	IP66/IP67, IK10, NEMA4X	
Input Voltage	HPoE(IEEE802.3bt type 4, Class 8) + WisePower	
Power Consumption	(TBD) HPoE: Max **.**W, typical **.**W	
Mechanical		
Color / Material	White / Aluminum Hard-coated dome bubble - PTZ only	
RAL Code	RAL9003	
Product Dimensions / Weight	PNM-9322VQP design with XNP-6400R PTZ (TBD) Weight of the camera + SBP-156HMW = 10kg or lessPNM-9322VQP design with XNP-6400R PTZ (TBD)	
Certifications & Standards		
EMC	EN 50121-4 FCC 47 CFR 15 Subpart B Class A ICES-3(A)/NMB-3(A) CE/UKCA - EN 55032 Class A, EN 50130-4, EN 61000-3-2, EN 61000-3-3 VCCI CISPR 32 Class A RCM AS/NZS CISPR 32 Class A KS C 9832 Class A , KS C 9835	
Safety	UL 62368-1, CAN/CSA C22.2 NO. 62368-1 / IEC 62471	
Environment	EN IEC 63000 / IEC 60529 IP66/IP67, IEC 62262 IK10 / NEMA 250 type 4X"	
DORI (EN62676-4 standard)		
Detect (25PPM/ 8PPF)	Wide: 200.1m(656.40ft) / Tele: 583.4m(1913.89ft)	Wide: 59.5m(195.3ft) / Tele: 2340.4m(7678.4ft)
Observe (63PPM/ 19PPF)	Wide: 80.0m(262.56ft) / Tele: 233.3m(765.56ft)	Wide: 23.8m(78.1ft) / Tele: 936.2m(3071.4ft)
Recognize (125PPM/ 38PPF)	Wide: 40.0m(131.28ft) / Tele: 116.7m(382.78ft)	Wide: 11.9m(39.1ft) / Tele: 468.1m(1535.7ft)
Identify (250PPM/ 76PPF)	Wide: 20.0m(65.64ft) / Tele: 58.3m(191.39ft)	Wide: 6.0m(19.5ft) / Tele: 234.0m(767.8ft)

XNF-9013RV

12MP AI IR Fisheye Camera

Western Systems

Hanwha Techwin

Key Features

• AI technology
- Classified object type: Person/Face/Vehicle/License plate
- Support Detection Shot
- Object detection-Virtual line (Crossing/Direction), Virtual area
(Loitering/Intrusion/Enter/Exit)
• Stereographic type fisheye lens
• Improved image quality
- extreme WDR (2MP@60fps) by scene Analysis and Local contrast enhancement
- WiseNR II , Auto prefer shutter control based on AI
• Resolution/Framerate
- Original view-Max.30fps/25fps@3008x3008 (60Hz/50Hz)
- Double panorama-Max.30fps/25fps@3584x1792 (60Hz/50Hz)
- Single panorama-Max.30fps/25fps@3584x896 (60Hz/50Hz)
• WiseStreamIII based on AI
• Next level cybersecurity
- Device Certificate (Root CA, pre-installed)
- TPM 2.0 (FIPS 140-2 certified), Secure OS/boot/storage, Verified FW forgery
• Adjustable IR distance with WisePower : PoE+mode-13m, PoE mode-8m
• Mirco SD/SDHC/SDXC 2 slot: Max. 1TB (512GBx2ea)
• Reinforced durability
- IP66, NEMA4X, IK10, Metal shielded RJ-45
- Hard-coated dome bubble
• Additional accessories
- Black Skin Cover (SBC-160BF), Tilted wall mount (SBP-160TMW1)

Compatible Accessories (Optional)

SBC-160BF

XNF-9013RV
12MP AI IR Fisheye Camera

Western Systems

Hanwha Techwin

Specifications

Video

Imaging Device	1/2.3" 12MP CMOS
Resolution	Original view(1:1): 3008x3008~480x480, Double panorama(2:1): 3584x1792~640x320, Single panorama(4:1): 3584x896~640x160, Quad view: 3584x2688~640x480, Q1/Q2/Q3/Q4(4:3): 1792x1344~640x480
Max. Framerate	H.265/H.264: Original view–Max.30fps/25fps@3008x3008(60Hz/50Hz), Double panorama–Max.30fps/25fps@3584x1792(60Hz/50Hz) Single panorama–Max.30fps/25fps@3584x896(60Hz/50Hz) MJPEG: Max.30fps/25fps@1080x1080(60Hz/50Hz)
Min. Illumination	Color: 0.39 Lux (F2.2, 1/30sec), BW : 0Lux(IR LED on)
Video Out	CVBS : 1.0 Vp-p / 75Ω composite, 720x480(N), 720x576(P), for Installation USB: Micro USB Type B, 1280x720 for installation

Lens

Focal Length (Zoom Ratio)	1.08mm fixed focal
Max. Aperture Ratio	F2.2
Angular Field of View	H: 187 / V: 187 / D: 187
Min. Object Distance	0.5m(1.64ft)
Focus Control	Simple focus

Pan / Tilt / Rotate

Pan / Tilt / Rotate Range	Lens Rotation

Operational

Camera Title	Displayed up to 85 characters
Day & Night	Auto(ICR)
Backlight Compensation	BLC, HLC, WDR, SSDR
Wide Dynamic Range	extremeWDR (120dB)
Digital Noise Reduction	WiseNR II (Based on AI engine), SSNR V
Motion Detection	8ea, 8point polygonal zones
Privacy Masking	32ea, polygonal zones - Color: Grey/Green/Red/Blue/Black/White - Mosaic
Gain Control	Off / Max Gain / Manual
White Balance	ATW / Narrow ATW / AWC / Manual / Indoor / Outdoor
Electronic Shutter Speed	Minimum / Maximum / Anti flicker (1/5~1/12,000sec) Prefer shutter control(Based on AI engine)
Video Rotation	Flip, Mirror
Analytics	- Analytics events based on AI engine : Object detection (Person/Face/Vehicle/License plate), IVA (Virtual line/Area, Enter/Exit, Loitering, direction, Appear/Disappear, intrusion) - Analytics events : Defocus detection, Motion detection, Tampering, Fog detection, Audio detection, Sound classification

Business Intelligence	Based on AI engine : People counting, Queue management, Heatmap
Alarm I/O	2 configurable I/O ports
Alarm Triggers	Analytics, Network disconnect, Alarm input
Alarm Events	File upload via FTP and e-mail Notification via e-mail SD/SDHC/SDXC or NAS recording at event triggers Alarm output PTZ Preset Handover Audio playback
Audio In	Selectable(mic in/line in/built-in mic) Supply voltage: 2.5VDC(4mA), Input impedance: 2K Ohm
Audio Out	Line out, Max. output level: 1Vrms
IR Viewable Length	Wise IR, PoE : 8m(26.25ft), PoE+ : 13m(42.65ft)

Network

Ethernet	Metal shielded RJ-45(10/100BASE-T)
Video Compression	H.265/H.264: Main/Baseline/High, MJPEG
Audio Compression	G.711 u-law /G.726 Selectable G.726(ADPCM) 8KHz, G.711 8KHz G.726: 16Kbps, 24Kbps, 32Kbps, 40Kbps AAC-LC: 48Kbps at 16KHz
Smart Codec	Manual(5ea area), WiseStream , WiseStream (Based on AI engine)
Bitrate Control	H.264/H.265: CBR or VBR MJPEG: VBR
Streaming	Unicast(20 users) / Multicast Multiple streaming(Up to 10 profiles) Up to 5 virtual channel support
Protocol	IPv4, IPv6, TCP/IP, UDP/IP, RTP(UDP), RTP(TCP), RTCP,RTSP, NTP, HTTP, HTTPS, SSL/TLS, DHCP, FTP, SMTP, ICMP, IGMP, SNMPv1/v2c/v3(MIB-2), ARP, DNS, DDNS, QoS, UPnP, Bonjour, LLDP, SRTP (TCP, UDP Unicast)
Security	HTTPS(SSL) Login Authentication Digest Login Authentication IP Address Filtering User access log 802.1X Authentication(EAP-TLS, EAP-LEAP) Device Certificate(Hanwha Techwin Root CA)
Application Programming Interface	ONVIF Profile S/G/T/M SUNAPI(HTTP API) Wisenet open platform

General

Webpage Language	English, Korean, Chinese, French, Italian, Spanish, German, Japanese, Russian, Swedish,, Portuguese, Czech, Polish, Turkish, Dutch, Hungarian, Greek
Edge Storage	Micro SD/SDHC/SDXC 2slot 1TB(512GBx2)
Memory	4096MB RAM, 512MB Flash

Environmental & Electrical

Operating Temperature / Humidity	-40°C ~ +60°C (-40°F ~ +140°F) / Less than 95% RH POE+ Mode 55°C (Hysteresis 5°C) Wise IR 8m(26.25ft)
Storage Temperature / Humidity	-50°C ~ +60°C(-58°F ~ +140°F) / Less than 95% RH
Certification	IP66, IK10, NEMA4X
Input Voltage	PoE(IEEE802.3af, Class3), PoE+, 12VDC
Power Consumption	PoE: Max 12.95W, typical 9.4W, 12VDC: Max 12.9W, typical 9.0W PoE+: Max 23.0W, typical 9.4W, 12VDC: Max 22.0W, typical 9.0W

Mechanical

Color / Material	White / Aluminum, Hard-coated dome bubble

RAL Code	RAL9003
Product Dimensions / Weight	Ø160x72mm(6.23x2.84"), 1,170g (2.58lb)
Hanging Mount (Dome)	SBP-167HMW
Skin Cover	SBC-160BF

Certifications & Standards

EMC	FCC 47 CFR 15 Subpart B Class A ICES-3(A)/NMB-3(A) CE/UKCA - EN 55032 Class A, EN 50130-4, EN 61000-3-2, EN 61000-3-3 VCCI CISPR 32 Class A RCM AS/NZS CISPR 32 Class A KS C 9832 Class A , KS C 9835
Safety	UL 62368-1, CAN/CSA C22.2 NO. 62368-1 IEC/EN 62471
Environment	IEC/EN 63000 IEC 60529 IP66, IEC 62262 IK10 NEMA 250 type 4X

DORI (EN62676-4 standard)

Detect (25PPM/ 8PPF)	34.9m(114.49ft)
Observe (63PPM/ 19PPF)	13.9m(45.60ft)
Recognize (125PPM/ 38PPF)	7.0m(22.96ft)
Identify (250PPM/ 76PPF)	3.5m(11.48ft)

CAD

Unit:mm [inch]

Ø 160 [6.3]

Ø 88 [3.46]

46 [1.81]

85.25 [3.36]

83.5 [3.29]

85 [3.35]

72 [2.83]

2.16

54.81 [2.16]

A2

3		
2		
1	XNF-9013RV	'22.04.12
No.	MODEL NAME	DATE
Unit:mm[inch]	SCALE:1/1	Hanwha Techwin

FC | c UL us LISTED | CE | EHC

Key Features

• 2MP resolution
• 4.25~170mm (40x) zoom (digital 32x, total 1280x zoom)
• Day & Night (ICR), extreme WDR, DIS (Built-in gyro sensor)
• Intelligent Analytics, Object auto tracking (Person/Vehicle), Target lock tracking
• H.264, H.265, MJPEG codec, WiseStream II
• IP66, IK10, NEMA4X, NEMA-TS 2 (2.2.8, 2.2.9)
• PTZ PLUS Design applied (Compact, Lighter, Simple cabling)

Compatible Accessories (Optional)

| SBP-300WMW | SBP-156HMW | SBP-156KMW | SBP-156WMW | SBP-156CMW | SBP-156LMW | SPM-4210 |

| SBP-300WMW1 | SBP-300PMW | SBP-300KMW | SBP-300LMW | SBP-300BW | SBP-300CMW |

XNP-6400
2MP Network 40x PTZ Camera

Video

Imaging Device	1/2.8" CMOS
Resolution	1920x1080, 1280x1024, 1280x960, 1280x720, 1024x768, 800x600, 800x448, 720x576, 720x480, 640x480, 640x360, 320x240
Max. Framerate	H.265/H.264: Max. 60fps/50fps(60Hz/50Hz) MJPEG: Max. 30fps/25fps(60Hz/50Hz)
Min. Illumination	Color: 0.05Lux(F1.6, 1/30sec) BW: 0.005Lux(IR LED On)

Lens

Focal Length (Zoom Ratio)	4.25~170mm(40x) zoom (digital 32x, total 1280x zoom)
Max. Aperture Ratio	F1.6(Wide)~F4.95(Tele)
Angular Field of View	H: 65.66°(Wide)~1.88°(Tele) / V: 39.40°(Wide)~1.09°(Tele)
Min. Object Distance	3m(9.84ft)
Focus Control	Oneshot AF, Focus save
Lens Type	DC auto iris

Pan / Tilt / Rotate

Pan Range	360° Endless
Pan Speed	Max. 700°/sec, Manual: 0.024°/sec~250°/sec
Tilt Range	110°(-20°~90°)
Tilt Speed	Max. 500°/sec, Manual: 0.024°/sec~250°/sec
Sequence	Preset(300ea), Swing, Group(6ea), Trace, Tour, Auto Run, Schedule
Preset Accuracy	Up to '±0.1°, Pan/Tilt correction

Operational

Camera Title	Displayed up to 85 characters
Direction Indicator	Support
Day & Night	Auto(ICR)/Color/BW/Schedule
Backlight Compensation	BLC, HLC, WDR, SSDR
Wide Dynamic Range	Extreme WDR(150dB)
Digital Noise Reduction	SSNR V
Digital Image Stabilization	Support(built-in gyro sensor)
Defog	Support
Motion Detection	8ea, 8point polygonal zones
Privacy Masking	32ea, polygonal Support - Color: Grey/Green/Red/Blue/Black/White - Mosaic
Gain Control	Low / Middle / High
White Balance	ATW / AWC / Manual / Indoor / Outdoor
Electronic Shutter Speed	Minimum / Maximum / Anti flicker (2~1/12,000sec)
Video Rotation	Flip, Mirror

Analytics	Directional detection, Fog detection, Face detection, Motion detection, Appear/Disappear, Enter/Exit, Loitering, Tampering, Virtual line, Shock detection * Audio detection, Sound classification(with NW I/O Box)
Alarm Triggers	Analytics, Network disconnect * Alarm input(with NW I/O Box)
Alarm Events	File upload via FTP and e-mail Notification via e-mail SD/SDHC/SDXC or NAS recording at event triggers PTZ Preset Handover * Alarm output(with NW I/O Box)
Water Removal	Support(Spinning dry)
Auto Tracking	Object auto tracking(Person/Vehicle), Target lock tracking
Network	
Ethernet	Metal shielded RJ-45(10/100BASE-T)
Video Compression	H.265/H.264: Main/Baseline/High, MJPEG
Smart Codec	Manual(5ea area), WiseStream II
Bitrate Control	H.264/H.265: CBR or VBR MJPEG: VBR
Streaming	Unicast(20 users) / Multicast (128 user) Multiple streaming(Up to 10 profiles)
Protocol	IPv4, IPv6, TCP/IP, UDP/IP, RTP(UDP), RTP(TCP), RTCP,RTSP, NTP, HTTP, HTTPS, SSL/TLS, DHCP, FTP, SMTP, ICMP, IGMP, SNMPv1/v2c/v3(MIB-2), ARP, DNS, DDNS, QoS, PIM-SM, UPnP, Bonjour,LLDP, SRTP
Security	HTTPS(SSL) Login Authentication Digest Login Authentication IP Address Filtering User access log 802.1X Authentication(EAP-TLS, EAP-LEAP) Device certificate(Hanwha Techwin Root CA)
Application Programming Interface	ONVIF Profile S/G/T SUNAPI(HTTP API) Wisenet open platform
General	
Webpage Language	English, Korean, Chinese, French, Italian, Spanish, German, Japanese, Russian, Swedish, Portuguese, Czech, Polish, Turkish, Dutch, Hungarian, Greek
Edge Storage	Micro SD/SDHC/SDXC 2slot 1TB
Memory	4GB RAM, 512MB Flash
Environmental & Electrical	
Operating Temperature / Humidity	-40°C~+55°C(-40°F~+131°F) / Less than 95% RH(Non-condensing) Maximum Temperature based on NEMA-TS 2(2.2.7) : +74°C(+165°F)
Storage Temperature / Humidity	-50°C~+60°C (-58°F~+140°F) / Less than 95% RH(Non-condensing)
Certification	IP66, IK10, NEMA4X, NEMA-TS 2(2.2.8, 2.2.9)
Input Voltage	PoE+(IEEE802.3at, Class4)
Power Consumption	Typical 20W, Max 25W
Mechanical	

Color / Material	Body : White / Aluminum Head : Black / Polycarbontate Hard-coated dome
RAL Code	White: RAL9003 / Black: RAL9005
Product Dimensions / Weight	Ø158x293.3mm(6.22x11.55") / 3.2Kg(6.17lb)

DORI (EN62676-4 standard)

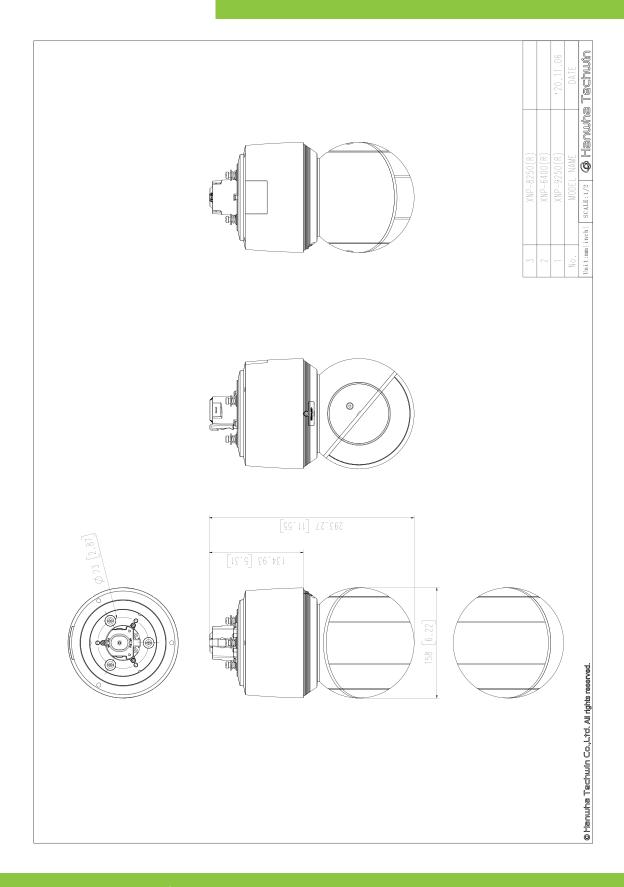|	
Detect (25PPM/ 8PPF)	Wide: 59.5m(195.3ft) / Tele: 2340.4m(7678.4ft)
Observe (63PPM/ 19PPF)	Wide: 23.8m(78.1ft) / Tele: 936.2m(3071.4ft)
Recognize (125PPM/ 38PPF)	Wide: 11.9m(39.1ft) / Tele: 468.1m(1535.7ft)
Identify (250PPM/ 76PPF)	Wide: 6.0m(19.5ft) / Tele: 234.0m(767.8ft)

• The lastest product information / specification can be found at hanwha-security.com
• Design and specifications are subject to change without notice.
• Wisenet is the proprietary brand of Hanwha Techwin, formerly known as Samsung Techwin.

No.			MODEL NAME	SCALE:1/2	DATE
1		XNP-9250(R)			
2		XNP-6400(R)			'20.11.06
3		XNP-8250(R)			

Unit:mm[inch]

© Hanwha Techwin

293.27 [11.55]

134.93 [5.31]

158 [6.22]

φ 73 [2.87]

Communications and Network

Enhance Control, Monitoring, and Coordination. Get in touch with us to Strengthen Your Traffic Infrastructure

Intuicom

Leader in ruggedized wireless solutions

AXIOM

Multi-Featured, Multi-Frequency Broadband Solution

Features

- Our full featured radio with top performing speeds and features
- 5 GHz and 2.4 GHz options
- Single and dual radio units
- Integrated and external antenna configurations
- Range 20+ miles (LOS)
- Integrated GPS for geolocation
- PoE+ (802.3at) compatible
- RSSI/Power/Reset panel
- Compatible with industry standards as well as offering proprietary protocols
- Channel widths from 5 MHz to 80 MHz
- Each unit is a complete kit - includes heavy-duty mounting hardware, PoE, and 50 meters CAT5E cable
- Compatible with Broadband Pro 5 Network Management Software

Intuicom continues its best-in-class tradition of wireless solutions with the AXIOM™ line of broadband products. This advanced wireless solution provides industry-leading security, extended range, and the highest throughput demanded by today's bandwidth intensive applications. Other standard features include an embedded GPS for positioning and RSSI/Power/Reset panel.

Secure: AES encryption, advanced IP filtering, WPA2, multilevel authentication, user access and MAC Access Control provide the user with the tools to ensure the highest level of data integrity and protection against malicious attacks.

Flexible: Implementing dynamic modulation techniques, auto-optimizing bandwidth allocation the AXIOM delivers the performance demanded by today's wireless applications. AXIOM offers this performance in combination with additional frequency choices and configurations to provide a broad array of solutions.

Network Management Made Easy: With Intuicom's Broadband Pro™ software, configuring your wireless network has never been easier. Intuicom's drag and drop configuration makes getting operational a straightforward process, while a variety of real-time network monitoring and reporting tools provide the means to optimize and manage your network. All of this allows users to easy visualize, manage, optimize, and monitor your communication network.

Applications

- Video Surveillance
- Traffic and Transportation Control
- Energy Production
- Water and Wastewater Systems
- Agriculture
- Pipeline Monitoring and Leak Detection
- Electrical Utility Applications
- Automation and Control Solutions

AXIOM

Multi-Featured, Multi-Frequency Broadband Solution

SPECIFICATIONS

Specification	Description			
General				
	Integrated Unit	**External Antenna Unit**	**Dual Unit - Integrated**	**Dual Unit - External Antennas**
Size	10.4" x 10.4" x 3.7"	8.7" x 10.0" x 3.3"	10.4" x 10.4" x 3.7"	8.7" x 10.0" x 3.3"
Weight	3.9 lbs.	3.4 lbs.	3.9 lbs.	4.4 lbs.
LED Indicators	RSSI/Power/Reset	RSSI/Power/Reset	RSSI/Power/Reset	RSSI/Power/Reset
Number of Radio units	1	1	2	2
Antenna included	20dBi Panel	n/a	20dBi Panel	n/a
Antenna connector	n/a	2 - type N (f)	2 - type N (f)	4 - type N (f)
Temperature rating	-40º to 75ºC	-40º to 75ºC	-40º to 75ºC	-40º to 75ºC

Wireless Interface

Frequency Range**	5.1-5.8 GHz or 2.4-2.48 GHz**
Peak Transmit Power*	27-30 dBm (w/o antenna)
Receive Sensitivity	-96 dBm to -72dBm
Channel Widths	5/10/20/40/ 80 MHz
Modulations	OFDM, BPSK, QPSK, 16-QAM, 64-QAM
Protocols*	802.11 a/b/g/n/ac & proprietary
Data Rates*	up to 866 Mbps in 802.11ac up to 300 Mbps in 802.11n up to 54 Mbps in 802.11a/b/g

Security

- 802.11i WPA-PSK - 802.11i WPA2-PSK - 802.11i WPA-EAP - 802.11i WPA2-EAP - 802.11i TKIP - 802.11i AES-CCM	- 802.11i 802.1X - 802.11i -RSN - Radius Authentication - MAC Access Control List - 128-bit/256-bit AES - Encryption

IEEE Standards & Features

- 802.11e WMM and QOS - 802.11h DFS and TPC - 802.1d Ethernet Bridging - 802.1p Traffic Prioritization - 802.1q VLAN - 802.1s Spanning Tree - 802.1w Rapid Spanning Tree - 802.3ab Gigabit Ethernet - 802.3ac Extended Frame Size for 802.1q & 802.1p support - 802.3ad Link Aggregation/Port Bonding/Port Tracking - 802.3i 10 Mbps Ethernet - 802.3u 100 Mbps Ethernet and Auto-Negotiation - 802.3x Full Duplex and Flow Control	- 802.1ad Service Tags - IGMP Internet Group Management - Protocol v1, v2 - OSPF - FTP/TFTP - HTTP - Telnet - Syslog - Routing - Firewall/NAT - NTP - SSH - SNMP - VPN - DHCP Client/Server

Wireless Regulatory Approvals
- FCC Part 15.247
- Industry Canada RSS-210
- RoHS Compliant

Broadband Pro Network Management Software
- Complete set of visual management tools including spectrum analyzer, bandwidth testing, data statistics and more
- Real-Time Mapviews provide network-wide performance status
- Live Link Status displays both sides of the radio link by CCQ, throughput, and other parameters
- Access to Configuration Parameters from any Network Views
- Intuicom's unique Drag & Drop tool simplifies on-boarding new nodes
- Complete Network Customization & Control - With BroadBandPro 5, you can filter your network by radio name, IP address, station roles, access point roles, and every other combination possible
- Wireless and Data Statistics Monitoring displays in real time
- The Alarm Center provides a comprehensive status and analysis report of the entire wireless network
- Event Logging Dashboard monitors your complete network health on a single screen
- Advanced Reporting features provide for extensive graphic and tabular reports for all units across the network

SPECIFICATIONS SUBJECT TO CHANGE

Intuicom Broadband Radios require professional installation
* Wireless Protocols, Transmit Power, and Data Rates are frequency dependent.
** Band availability is subject to country regulations.

AXIOM units can be ordered in several variations:

- Standard Data Rates or AC rates
- Integrated or External Antennas
- 5 GHz or 2.4 GHz
- Single or Dual units

Western Systems

Intuicom ®

GIGABIT 1

Introducing . . . **GIGABIT 1**

Large portions of both developed and especially developing economies remain underserved in an ongoing pandemic that makes real broadband more essential than ever. Copper-based fixed access networks are increasingly exhausted. Efforts to improve supply with fiber have been throttled by prohibitively high costs and installation complications. Wireless alternatives continue to fail in the face of the significant technical challenges in fiber class fixed access, including pervasive obstructions, spectrum scarcity, interference, changing conditions, and unworkable deployment models.

Tarana innovation has solved all these problems. Our Gigabit 1 platform (G1) is powered by the results of more than ten years of focused R&D, and crafted from its custom silicon up to its cloud-based service automation with a completely fresh approach to fixed wireless. Extensively validated by tier-1 operators and well proven in mass-scale networks, our fundamental advances in multi-radio performance completely transform the economics of delivering gigabit-class access.

**Fast broadband
is more essential than ever.**

Getting it to the home is hard.

We've made it easy.

- **Fiber quality**
- **In free, unlicensed spectrum**
- **At massive scale**

Tarana G1 System Specifications

Radio Network Elements		BN: Base Node
		RN: Residential Node
Topology		Scheduled, concentrated multi-point
Maximum # of Users	Per BN	256
	Per Site	1024 (4BNs)
Channel Bandwidth	BN	80 MHz (2 x 40MHz)
	RN	80 MHz (2 x 40MHz)
Aggregate Throughput (UL + DL)	Per Link	800 Mbps
	Per BN	2.4 Gbps
	Per Site	9.6 Gbps (4 BNs)
Duplexing		TDD
Downlink/ Uplink Ratio		Configurable 2:1 or 4.5:1 (network-wide)
Modulation		QPSK 1/2 to 256 QAM 7.35/8 UL/DL
MIMO Streams Per Link		1x1, 2x2
MU-MIMO Streams at Aggregation Point		6 MU-MIMO streams per BN
		24 MU-MIMO streams per site
Spectral Efficiency		30 bps/Hz per BN75 - 90 bps/Hz per band, configuration dependent
Range (full rate, frequency dependent)	NLoS	up to 3 km (Note. This depends on vertical asset height, frequency band, morphology, and target cell-edge data rate.)
	LoS	up to 15 km (likewise)
Recommended Frequency Reuse Factor		Universal frequency reuse (k = 1)
		Enabled by advanced self-interference cancellation
Form Factor	BN	Outdoor micro enclosure (fully-integrated antenna, RF, and baseband) 4 BNs for 360° coverage
	RN	Outdoor, single enclosure (fully-integrated antenna, RF, and baseband)
Beamforming		Auto-convergent, retro-directive
Interference Management		Self-interference cancellation, Advanced Burst Interference Cancellation (ABIC)
Scheduler		Advanced 4D frame-based scheduling
Frequency Support		3.550-3.700 GHz (US CBRS)
		5.150-5.250 GHz (FCC/ISED)
		5.725-5.850 GHz (FCC/ISED)
Latency (1-way avg)		< 5 msec
Model Number	BN 5GHz	G1-BN5AS1002
	BN CBRS (Cat B)	G1-BN3AS1001
	RN 5GHz	G1-RN5AS1002
	RN CBRS (Cat B)	G1-RN3AS1001
Compliance		RSS-247, FCC 15E, FCC Part 96, WINFF-TS-0122
Safety		IEC 62368-1, IEC 60529, IEC 60950-1, IEC 60950-22
Tarana Cloud Suite		Scalable Microservices based multi-tenant network management
		Zero-touch provisioning and control of radios with streaming telemetry
		Firmware and configuration management
		24x7x365 KPI monitoring and management
		Fault management and historical events
		Network Analytics
		SAS-Domain Proxy
		Northbound Rest-API for Customer and operator portal (B/OSS)
Interfaces	BN	Dual 10-Gbps SFP+ and one 1-Gbps data interfaces Additional 1 Gbps mgmt Ethernet interface. -48V DC Power
	RN	1 Gbps Ethernet interface, with PoE support
HxWxD (inches)	BN	16.4 x 21.2 x 4.6 in.
	RN	11 x 12.5 x 3 in.
Weight (lb.)	BN	42 lbs.
	RN	7 lbs.
Power Consumption (Typical)	BN	275W
	RN	35W
Mounting	BN	Saddle clamp, band clamps for pole mount (2-3/8" - 5" OD)
	RN	Band clamp for pole mount (1.5" - 2.5" OD)

BBX

Secure, Flexible Broadband Connectivity in Multiple Frequencies

Western Systems

Intuicom®

Features

- 5 GHz and 2.4 GHz options
- Single and dual radio units
- Integrated and external antenna configurations
- Range 20+ miles (LOS)
- RSSI/Power/Reset panel
- Data rates from 54 Mbps to 866 Mbps
- Compatible with industry standards as well as offering proprietary protocols
- Channel widths from 5 MHz to 80 MHz
- Each unit is a complete kit - includes heavy-duty mounting hardware, PoE, and 50 meters CAT5E cable
- Compatible with Broadband Pro 5 Network Management Software

The Intuicom BBX product family provides connectivity and remote access through a family of robust and secure products that have proven themselves across industries, environments and markets. The BBX products work under the harshest conditions in variety of configurations and frequency band options.

Secure: AES encryption, advanced IP filtering, WPA2, multilevel authentication, user access and MAC Access Control provide the user with the tools to ensure the highest level of data integrity and protection against malicious attacks.

Flexible: Implementing dynamic modulation techniques, auto-optimizing bandwidth allocation the BBX delivers the performance demanded by today's wireless applications. BBX offers this performance in combination with additional frequency choices and configurations to provide a broad array of solutions.

Network Management Made Easy: With Intuicom's Broadband Pro™ software, configuring your wireless network has never been easier. Intuicom's drag and drop configuration makes getting operational a straightforward process, while a variety of real-time network monitoring and reporting tools provide the means to optimize and manage your network. All of this allows users to easy visualize, manage, optimize, and monitor your communication network.

Applications

- Video Surveillance
- Traffic and Transportation Control
- Energy Production
- Water and Wastewater Systems
- Agriculture
- Pipeline Monitoring and Leak Detection
- Electrical Utility Applications
- Automation and Control Solutions

BBX

Secure, Flexible Broadband Connectivity in Multiple Frequencies

SPECIFICATIONS

Specification	Description			
General				
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Weight	3.9 lbs.	3.4 lbs.	3.9 lbs.	4.4 lbs.
LED Indicators	RSSI/Power/Reset	RSSI/Power/Reset	RSSI/Power/Reset	RSSI/Power/Reset
Number of Radio units	1	1	2	2
Antenna included	20dBi Panel	n/a	20dBi Panel	n/a
Antenna connector	n/a	2 - type N (f)	2 - type N (f)	4 - type N (f)
Temperature rating	-40º to 75ºC	-40º to 75ºC	-40º to 75ºC	-40º to 75ºC

Wireless Interface

Frequency Range**	5.1-5.8 GHz or 2.4-2.48 GHz**
Peak Transmit Power*	27-30 dBm (w/o antenna)
Receive Sensitivity	-96 dBm to -72dBm
Channel Widths	5/10/20/40/ 80 MHz
Modulations	OFDM, BPSK, QPSK, 16-QAM, 64-QAM
Protocols*	802.11 a/b/g/n/ac & proprietary
Data Rates*	up to 866 Mbps in 802.11ac up to 300 Mbps in 802.11n up to 54 Mbps in 802.11a/b/g

Security

- 802.11i WPA-PSK - 802.11i WPA2-PSK - 802.11i WPA-EAP - 802.11i WPA2-EAP - 802.11i TKIP - 802.11i AES-CCM	- 802.11i 802.1X - 802.11i -RSN - Radius Authentication - MAC Access Control List - 128-bit/256-bit AES - Encryption

IEEE Standards & Features

- 802.11e WMM and QOS - 802.11h DFS and TPC - 802.1d Ethernet Bridging - 802.1p Traffic Prioritization - 802.1q VLAN - 802.1s Spanning Tree - 802.1w Rapid Spanning Tree - 802.3ab Gigabit Ethernet - 802.3ac Extended Frame Size for 802.1q & 802.1p support - 802.3ad Link Aggregation/Port Bonding/Port Tracking - 802.3i 10 Mbps Ethernet - 802.3u 100 Mbps Ethernet and Auto-Negotiation - 802.3x Full Duplex and Flow Control	- 802.1ad Service Tags - IGMP Internet Group Management - Protocol v1, v2 - OSPF - FTP/TFTP - HTTP - Telnet - Syslog - Routing - Firewall/NAT - NTP - SSH - SNMP - VPN - DHCP Client/Server

Wireless Regulatory Approvals

- FCC Part 15.247
- Industry Canada RSS-210
- RoHS Compliant

Broadband Pro Network Management Software

- Complete set of visual management tools including spectrum analyzer, bandwidth testing, data statistics and more
- Real-Time Mapviews provide network-wide performance status
- Live Link Status displays both sides of the radio link by CCQ, throughput, and other parameters
- Access to Configuration Parameters from any Network Views
- Intuicom's unique Drag & Drop tool simplifies on-boarding new nodes
- Complete Network Customization & Control - With BroadBandPro 5, you can filter your network by radio name, IP address, station roles, access point roles, and every other combination possible
- Wireless and Data Statistics Monitoring displays in real time
- The Alarm Center provides a comprehensive status and analysis report of the entire wireless network
- Event Logging Dashboard monitors your complete network health on a single screen
- Advanced Reporting features provide for extensive graphic and tabular reports for all units across the network

SPECIFICATIONS SUBJECT TO CHANGE

Intuicom Broadband Radios require professional installation
* Wireless Protocols, Transmit Power, and Data Rates are frequency dependent.
** Band availability is subject to country regulations.

BBX units can be ordered in several variations:

- Standard Data Rates or AC rates
- Integrated or External Antennas
- 5 GHz or 2.4 GHz
- Single or Dual units

Western Systems

Intuicom®

XC400 Industrial IoT LTE Router

Industrial Cellular Connectivity with I/O and MQTT Support

Features

- Cellular 3G/4GLTE CAT4 router
- Compact industrial enclosure, IP30, with DIN rail mount for easy integration
- Dual SIM card support with Failover
- 2 Ethernet, RS-232/RS-485 serial, 2 digital inputs and 2 digital outputs
- IPSEC, OpenVPN Client & Server, L2TP, GRE supported
- Modbus RTU-ASCII-TCP, MQTT and Sparkplug B support
- Support multiple VPN tunnels, Port Forward and DMZ
- 2 x Internal serial server
- Industrial input power range of 9 to 48 VDC
- SMS notification and control
- WAN/LAN Fallback for redundant networks
- 2 x 10/100M LAN/WAN ports
- Enhanced security

Intuicom's XC400™ is a feature-rich industrial router that delivers LTE connectivity demanded in mission critical applications. Designed to provide the crucial link to your remote devices and provide Industrial Internet of Things (IIoT) connectivity, the XC400 provides secure, robust communications across a broad variety of equipment and applications.

In today's industrial world, the secure connectivity of your networks and devices has never been so important. The XC400 LTE router supports advanced security including Firewall, VPN, MAC filtering, and more to deliver secure, fast, reliable, and simple ways to enable devices for remote monitor and control of industrial plant/equipment and automation applications

Today's industrial environments call for more connectivity options than just an Ethernet port. Supporting a variety of interfaces that include dual Ethernet, RS232 and RS485 serial and discrete I/O, the XC400 is a robust industrial grade solution for your connectivity needs. Additional functionality is available through our library of applications that can be securely incorporated to expand functionality. Protocol translations, DNP3, Modbus RTU-ASCII-TCP with Sparkplug B and more are available on-board, simplifying overall deployment.

Applications

- Traffic Control & ITS
- Industrial Automation
- Factory Automation
- Security/Surveillance
- Oil & Gas Production
- Utilities
- Water/Wastewater
- Energy Development & Management

XC400 Industrial IoT LTE Router
Industrial Cellular Connectivity with I/O and MQTT Support

SPECIFICATIONS

Specification	Description
Cellular	
Frequency 4G LTE (FDD)	1900(B2), AWS(B4), 850(B5), 700(B12), 700(B13), 700(B14), 1700(B66), 600(B71)
Frequency 3G (WCDMA)	1900(B2), AWS(B4), 850(B5)
Data Rate-Peak D/L	CAT4, 150 Mbps
Data Rate-Peak U/L	CAT4, 50 Mbps
Approvals* - Regulatory	FCC, IC
Approvals* - Carrier	Verizon, PTCRB (ATT, T-Mobile, Telus, and more)
SIM	2 x SIM slots, 1.8V / 3V (standard size) Failover/Auto-switch: data, no network, connect fail
GNSS (Optional)	
Networks	GPS, GLONASS, Galileo, BDS, QZSS
Interfaces	
Ethernet	RJ45 (2), 1 x WAN, 1 x LAN, or 2 x LAN; Auto 10/100Mbps
RS-232	2-wire interface (TX and RX) Terminal Block (300-115200bps)
RS-485	2-wire interface (TX and RX) Terminal Block (300-115200 bps)
Discrete Input/Output	2-Digital Inputs, 2-Digital Outputs Max Voltage 36 VDC Isolation 3kVDC or 2KVrms
LEDs	SYS, NET, USR, RSSI x 3
Reset Button	Reset/Restore to Factory Defaults
Antennas	
Cellular	2 x SMA Female, Diversity switched Main/AUX
GNSS (Optional)	1 x SMA Female (50 Ohm Impedence)
Hardware	
Size	4.2" x 4.2" x 1.6" (106mm x 106mm x 40mm)
Housing	IP30 rated, powder coated metal
Mounting	Din Rail
Operating Temperature	-40 to +158 °F (-40 to +75 °C)
Operating Humidity	5-95% non-condensing
Weight	0.8 lbs. (375 g)

Specification	Description
Power	
Nominal Supply	9-48 VDC (under/over voltage protection)
Idle Current draw	150 mA @ 12 VDC
TX Current draw	450 mA Peak @ 12 VDC
Power Connection	Terminal Block (locking)
Protocols And Configuration	
User Configuration	Webpage
Configurable Parameters	Network connection, tunnelling protocol, security, gateway protocols, LAN configuration
Network Protocols	TCP, UDP, IPv4, ICMP, NTP, DNS, HTTP, HTTPS, ARP, PPPoE, DHCP, IP Passthrough, VRRP
Industrial Protocols	Modbus RTU-ASCII-TCP, MQTT SparkplugB
Firewall	Flexible access control of TCP, UDP, ICMP packets, MAC address filter
VPN	OpenVPN: client/server up to 5 connections GRE: Layer2/3, up to 5 GRE tunnels IPsec: IKEv1, IKEv2, up to 5 IPsec tunnels
Applications	Additional applications available (max of 5): Modbus to DNP3; IEC101 to IEC104; DLMS to IEC104; email notification, SNMP, L2TP, dynamic routing, and many more. Please contact Intuicom for details
SMS	SMS Configuration, SMS Gateway, SMS Notification on input/outputs or events

Dimensions:

SPECIFICATIONS SUBJECT TO CHANGE

***All approvals are either granted or in progress. Contact us for the latest approval status.**

Actelis

Modernize. Digitize. Protect.

ML684D

All-In-One Industrial Ethernet Switch and Extender

The ML684D Industrial Ethernet Switch and Extender from Actelis® is a small form factor Add-Drop unit enabling the delivery of symmetrical high-speed Ethernet services over existing copper and fiber infrastructure. Up to 60 Mbps of symmetrical Ethernet traffic over copper and 1 Gbps over fiber.

Designed for Industrial, utility and traffic applications, The ML684D takes in two fiber ports and/or four copper pairs and allows them to be split into two directions, east and west, thereby allowing multiple nodes to be connected over copper or fiber in a linear chain, RSTP/STP mesh or ERPSv2 ring configuration. Each node has full switching capabilities and can drop and add Ethernet traffic at each location while transferring the rest of the traffic through.

The ML684D offers extremely small factor and DIN rail mounting for flexible deployment within utilities, traffic and industrial cabinets. With its superior performance, extensive functionality, high robustness and reliability, the ML684D Ethernet switch offers rapid service delivery and allows for complete utilization of the existing network infrastructure.

Interoperable with any standard Ethernet switch, router or hub ML684D devices seamlessly integrate into any Ethernet network. Equipped with six 10/100Base-T Ethernet interfaces and two 100/1000Base-FX Small Form Factor (SFP) port, the ML684D allows assignment of a service or a customer per port.

The ML684D is a hardened and robust Ethernet switch with redundant power inputs, designed for deployment in harsh environments. It complies with NEMA 4 extended temperature requirements and K.20/K.21/K.45 for extended protection against overvoltages and over-currents.

Powered by Actelis Networks' award-winning, patented EFMplus™ technology, the rate, reach and reliability are increased significantly using advanced Dynamic Spectrum Management (DSM) techniques. This technology provides the best rate/reach performance, most resilient fiber-quality transmission while ensuring high reliability.

Actelis has comprehensive mechanisms that include high level authentication and advanced encryption capabilities. The segmented and scrambled Ethernet packets are disseminated over multiple transmission conduits and include sophisticated filtering and access control using layer 2 processes. Actelis ML684D offers an all-embracing level of security initiating from the physical layer through switching and up to the management and access layers. This gives you a significantly strong and resilient solution and enables transmissions which have the highest level of immunity with notably lower vulnerability to hacking attempts.

The ML684D provides 802.1q VLAN-aware wire-speed bridging, double tagging (VLAN stacking) for end-user VLAN transparency, L2 (Ethernet priority), L3 (ToS/Diff-Serv) classification with four traffic classes, ERPSv2, RSTP/STP, Link Aggregation, LLCF (Link Loss Carrier Forward), bandwidth monitoring, Multicast/Broadcast limiting, as well as IGMP bandwidth snooping for video distribution applications.

The ML684D provides proactive and dynamic tools for enhanced trouble shooting and monitoring capabilities. Advanced Carrier-class EFM OAM, including 802.3ah, CFM (802.1ag) and Y.1731 (ITU), are incorporated, offering both physical link as well as service level end-to-end advanced troubleshooting mechanisms.

The MetaASSIST™ View graphical craft application and the MetaASSIST EMS multi-platform Element Management System offer in- and out-of-band management of the ML684D. Management protocols include standard TL1 command line interface and SNMP using standard MIBs for seamless integration with third-party Network Management Systems (NMS).

Highlights

- Support for two High Speed Copper Links
- Small form factor, no fan, DIN railing
- Environmentally hardened
- Enhanced Security - Low vulnerability to hacking
- IEEE 802.3ah Ethernet in the First Mile (EFM) 2Base-TL Solution
- CE 1.0
- Rapid Service Deployment
- Superior Rate, Reach & Reliability
- Low Delay and Jitter for Voice and Video Transmission
- Carrier-Class OAM
- Worldwide Spectral Compliancy
- FCC, UL, CE, NEMA 4

Applications

- Telemetry
- IP-based Traffic Controllers
- Smart Grid Sensors
- Dynamic Message Signs
- HD Video Cameras & Streaming
- Vehicle Detection
- Smart Parking
- Emergency Response
- Supports & Complements City Wi-Fi Access

ML684D

All-In-One Industrial Ethernet Switch and Extender

Specifications

Interfaces

Ethernet (Network/User) - 8 port switch
- **10/100Base-T:** 6 ports, Connector: RJ45, Auto-MDIX
- **100/1000Base-FX:** 2 ports **Connector:** SFP Based, MSA compliant

High Speed Link (HSL) - Bonded copper pairs
- **Protocol:** IEEE 802.3ah 2Base-TL
- **Line code:** ITU-T G.991.2 rev. 2
- **Number of copper pairs:** 4, **Connector:** RJ45 x 2
- **Number of HSLs:** 1 HSL- up to 4 pairs, 2 HSLs- east/west, 2 pair each
- **Bandwidth per HSL:** 1 HSL - up to 60 Mbps; 2 HSLs up to 30Mbps
- **End-to-end Delay:** 2-4 ms (typical)
- **Spectral Compliance:** ITU-T G.991.2 annex A, B, F, G, ETSI TS 101 524 annex E, ANSI T1.417, T1.426, Per-country regulatory compliant spectral modes
- **Sealing Current:** 48 VDC/1.5mA nominal (sink)

Management (Out-of-Band)
- **10/100Base-T Connector:** RJ45, Auto-MDIX
- **Craft:** EIA RS-232 (DCE) **Connector:** RJ45

Alarm Contacts
- Terminal Block, 2 Input, 1 Output

LAN Protocols
- **Dynamic Bridging:** IEEE 802.1, 8K MAC addresses
- **Discovery Mechanisms:** LLDP
- **VLAN Tagging:** IEEE 802.1Q
- **Double Tagging:** Q-in-Q
- **RSTP, STP:** IEEE 802.1d
- **ERPSv2:** G.8032 ERPSv2
- **Link Aggregation:** IEEE 802.3ad
- **Provider Bridge:** IEEE 802.1ad
- **IGMP snooping:** IGMP V1/V2
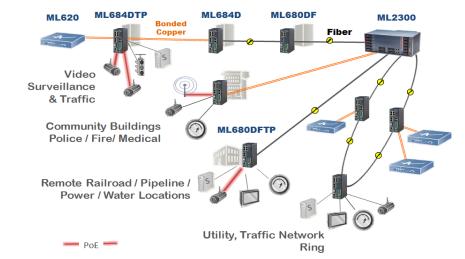- **OAM:** IEEE 802.3ah clause 57 (EFM OAM), IEEE 802.1ag, ITU Y.1731, Ethernet loopback with MAC swap

Advanced Service Provisioning and Traffic Management

Quality of Service
- **Classes of Service:** 4
- **Scheduler:** WFQ, SP
- **Classification:** L2 802.1p/Q priorities, L3 ToS/Diff Serv

Management Applications
- **EMS**: MetaASSIST EMS
- **Craft GUI**: MetaASSIST View

Management Protocols
- **SNMP:** SNMP V3, V2C, V1
- **IP addresses:** IPV4 and IPV6
- **Command Line Interface:** TL1, CLI
- **Remote Access:** Telnet
- **Secure Access (option):** SSH v2
- **Time Synchronization:** SNTP v3
- **Web Access:** HTTP
- **File transfer:** FTP, TFTP
- **IEEE 802.3ah EFM OAM:** Dying Gasp
- **User Authentication:** RADIUS and/or local passwords

Front Panel Indicators (LEDs)
- **Status**
- **Alarm**
- **MLP per modem/pair**
- **ACT (Activity) per Ethernet port**
- **LNK (Link) per Ethernet/HSL port**
- **Power A / Power B**

Physical
- **Dimensions: Height:** 5.95" / 151 mm, **Depth:** 5.1" / 130 mm, **Width:** 2.3" / 58 mm
- **Weight:** 1.76 lbs / 0.8 kg
- **Mounting**: Din Rails, Wall Mount Design for top hat rail EN 50022 – 35 × 7.5, or 35 × 15 - type O / type Omega (Ω)
- **Power**

Power
- DC (integrated): -24/-48 VDC (20 to 57V), 9 Watt P/N 501RG0230 - Redundant dual inputs P/N 501RG0220 - Single input
- AC (external): 90-264 VAC

Environmental
- **Operating Temp.** -40° to +74°C
- **Storage Temp.** -40° to +75°C
- **Relative humidity:** Up to 95%, non condensing

Regulatory Approval/Certifications

Metro Ethernet Forum
- CE 1.0 - MEF 9, 14

Safety
- UL 60950, CSA C22.2 60950
- EN 60950, IEC 60950

EMI(Emission):
- FCC Part 15 Class A
- ICES-003 Class A
- ETSI EN 300 386 Class A
- ETSI ETS 300 132-2
- EN 55022 Class A
- EN50155 (48 VDC), IEC60571 (48 VDC)

EMS (Immunity):
- EN 300 386 level 3 ESD,Surge, EFT level 2 or 3
- EN 61000 - Level 3: 4-2 (ESD), 4-3 (RS), 4-4 (EFT), 4-5 (Surge), 4-6 (CS)
- EN 61000-4-8
- ITU-T K.20, K.21, K.45

CE
- EMC and Safety

Environmental
- ETSI ETS 300 019
- NEMA 4 Thermal

ML690E
Aggregation Unit

Western Systems

Actelis Networks™

The ML690E Ethernet Aggregation Unit from Actelis® is an advanced intelligent Ethernet service delivery unit. Using the existing copper network, the ML690E can support up to 16 pairs / 4 HSLs and up to 230 Mbps of symmetrical Ethernet traffic at fiber quality over existing voice-grade copper. ML690E has two optional SFP interfaces supporting 100/1000Base-FX ports. It offers CE 2.0 services on all its ports - both copper and fiber.

The ML690E Aggregation unit can be deployed in a Multi-Point topologies with Actelis' ML600/E Ethernet Access Devices. ML690E uplink can be fiber or bonded copper - copper when connected to Actelis Ethernet aggregation switches ML230/ML2300 or fiber when connected to any standard Ethernet switch including ML230/2300 units. With its superior performance, extensive functionality and low cost, the ML690E offers immediate CE 2.0 service delivery, and allows for further utilization of the existing network infrastructure.

The ML690E is interoperable with any standard Ethernet switch, router or hub. Compliant with Metro Ethernet Forum (MEF) CE 2.0 specifications, ML690E seamlessly integrates into carrier Ethernet networks. Equipped with four 10/100/1000Base-T Ethernet interfaces and two optional 100/1000Base-FX Small Form Factor (SFP) ports, the ML690E allows assignment of a service or a customer per port. DS3/E3 uplinks can be used to connect to legacy networks instead of the 100/1000Base-FX SFPs.

Service providers utilizing the ML690E intelligent can offer up to four CE 2.0 based services with comprehensive bandwidth control and traffic management features. The ML690E's flexible service provisioning using Ethernet Virtual Connections (EVCs), along with its advanced mapping and Hierarchical Quality of Service (H-QoS) capabilities, allows carriers to maximize the efficiency of the access bandwidth on all their ports and configurations. Service Level Agreements (SLAs) can be easily enforced per each subscriber enabling service providers to safely aggregate multiple services or multiple subscribers, on the same Ethernet access uplink. For higher density two ML690E can be stacked in one RU 19" sleeve.

ML690E provides 802.1q VLAN-aware wire-speed bridging, double tagging (VLAN stacking) for end-user VLAN transparency, VLAN translation, L2, L3 and L4 classification with eight traffic classes, RSTP/STP, ERPS, bandwidth monitoring, Multicast/Broadcast limiting, as well as IGMP snooping for video distribution applications.

Powered by Actelis' award-winning, patented EFM*plus*™ technology, the rate, reach and reliability are increased significantly using advanced Dynamic Spectrum Management (DSM) and Dynamic Rate Boost (DRB) techniques. EFM*plus* technology provides the best rate/reach performance and most resilient fiber-quality transmission, ensuring carrier-class reliability. When combined with Actelis' industry-leading XR239 EFM Repeaters, these technologies can extend reach even further.

The ML690E provides proactive and dynamic tools for enhanced trouble shooting and monitoring capabilities. Advanced Carrier-class OAM, including EFM OAM per 802.3ah , CFM (802.1ag) and , Y.1731 are supported by the product, offering both physical link as well as service level end to-end advanced troubleshooting mechanisms.

The ML690E can be managed In- and Out-of-Band by the MetaASSIST™ View graphical craft application and via the multi-platform Element Management System, MetaASSIST EMS. The management protocols include standard command line interface, Telnet and SNMP using standard MIBs for seamless integration with third-party Network Management Systems .

Highlights

- Standards-based IEEE 802.3ah Ethernet in the First Mile (EFM) 2Base-TL transport
- MEF CE 2.0 compliant,
- H-QoS
- Rapid Service Deployment
- Superior Rate, Reach & Reliability
- Low Delay and Jitter for Voice and Video Transmission
- Carrier Class OAM, including Y.1731, CFM, EFM OAM
- Hardened, Extended Temp to +74^{0}C
- Worldwide Spectral Compliancy
- NEBS, FCC, UL, CE
- Environmentally Hardened

Applications

- Transparent LAN Service
- Fast Internet Access
- Metro Ethernet Extension
- Private Campus Network Intra-Connection
- MDU/MTU Backhaul
- DSLAM Backhaul
- WiFi and Cellular Backhaul (Radio Access Network)
- Leased Lines Replacement

Markets Served

- ILECs, CLECs, IOCs, PTTs, and Alternative Carriers
- Federal, State and Local Government Agencies
- Education, Health Care, Utilities, and Private Campuses

ML690E Aggregation Unit

Specifications

Interfaces

Ethernet (Network/User)
- **10/100/1000 Base-T:** 4 ports
  Connector: RJ45, Auto-MDIX
- **100/1000Base-FX:** 2 ports (option)
  Connector: SFP based, MSA compliant

High Speed Link (Bonded Copper Pairs)
- **Number of HSLs:**
  CO unit: 1xHSL or up to 4xHSL
  CPE unit : 1xHSL
  Mixed (Drop&Cont): 1x-R HSL +3x-O HSL
- **Protocol:** IEEE 802.3ah 2Base-TL
- **Line code:** ITU-T G.991.2 rev. 2
- **Bandwidth per HSL:** 1-230 Mbps (symmetrical)
  up to **15 Mbps per pair** , bonding up to 16 pairs
- **Number of Copper Pairs per unit:** 8 or 16
- **Copper Pairs per HSL:** 1-16 / 1-8 (per model type)
  Connector: RJ45 (per modem/pair) ML698ES,
  2 modems/pairs per connector with ML6916ES
- **Line code:** ITU-T G.991.2 rev. 2
- **End-to-end Delay:** 2-4 ms (typical)
- **Spectral Compliance:** ITU-T G.991.2 annex A, B, F,
  G, ETSI TS 101 524 annex E, ANSI T1.417, T1.426
  Per-country regulatory compliant spectral modes
- **Spectral Friendliness**:
  Dynamic Spectral Shaping (DSS)
- **Cross-talk Cancellation:**
  Dynamic Rate Boost (DRB)
- **Sealing Current** 48 VDC/1.5 mA nominal

Management (Out-of-Band)
- **10/100Base-T Connector:** RJ45, Auto-MDIX
- **Craft EIA RS-232 (DCE) Connector:** DB9

Ethernet Bridge Features
- **Bridging:** IEEE 802.1q
- **Forwarding Database size:** 16K MAC addresses
- **MTU:** 1518 – 2048 Bytes (configurable per system)
- **TPID:** up to 4 settable per inner/outer tag
- **Aging:** Configurable
- **MAC Limiting and Filtering**
- **Multicast/Broadcast Control**
- **Port based VLAN Stacking (**Q-in-Q)
- **Conditional VLAN Stacking**
- **VLANs: 4K,** supports **VLAN translations**
- **RSTP, STP:** IEEE 802.1d
- **Link Aggregation:** IEEE 802.3, L2/L3 balancing
- **Provider Bridges:** IEEE 802.1ad
- **LLDP**: IEEE 802.1ab
- **IGMP Snooping:** RFC 4541, V1/V2 RFC 1112/2236

- **ERPS:** ITU-T G.8032
- **EFM OAM:** IEEE 802.3ah clause 57 inc. Dying Gasp
- **CFM/MEF OAM:** IEEE 802.1ag , ITU Y.1731

Quality of Service Features
- **Classes of Service** (queues per port): 8
- **Two Levels Hierarchical Scheduler (H-QOS),** up to
  64 queues per port, WFQ, SP, Hybrid
- **Bandwidth Control:** 32 profiles, 2 rate, 3 color
  metering (CIR, CBS, EIR, EBS)
- **EVCs:** 32 Services
- **Classification:** 128 rules (Port/VLAN/L2 L3/L4)
- **Shaping:** per queue/port
- **Color Mode Awareness** by COS or DEI
- **CoS Marking**: by COS or DEI, per Service

Management

Applications
- **EMS:** MetaASSIST EMS
- **Craft GUI:** MetaASSIST View

Protocols
- IPV4 and IPV6
- **DHCP Client:** RFC 2132
- **ACS Client, CWMP:** TR-069
- **Command Line Interface:** TL1, CLI
- **Remote Access:** Telnet
- **SNMP:** V3, V2C, V1
- **Radius Authentication:** RFC 2865
- **Secure Access (option):** SSH v2
- **Time Synchronization:** SNTP v3
- **Web Access**: HTTP
- **File transfer:** FTP, TFTP
- **Syslog:** RFC 3164

Front Panel Indicators (LEDs)
- **Power**
- **Status**
- **Alarm**
- **MLP** per modem/pair
- **ACT** (Activity) - per Ethernet port
- **LNK** (Link) per Ethernet/HSL port

Alarm Contacts
- **Terminal Block:** 2 Input, 1 Output Physical

Physical
- **Dimensions Height:** 1.6" / 40 mm (1U)
  Depth: 11.0" / 280 mm, **Width**:8.4" / 213 mm
- **Weight:** 3.75 lbs / 1.7 Kg
- **Mounting Rack:** 2 units in 19", 23" or ETSI racks
  Desktop, Wall Mount
- **Power**
  DC: 24/48 Vdc nominal (20-60 Vdc range),
  24 Watt
  AC: 90-264 VAC, 47-63 Hz, up to 30 Watt

Environmental
- **Operating Temp:** -40° to +74°C
- **Storage Temp:** -40° to +74°C
- **Relative humidity:** Up to 95%, non-cond.

Regulatory and Compliance

Metro Ethernet Forum
- CE 2.0

Safety
- UL 60950, CSA C22.2 60950
- EN 60950-1, IEC 60950-1

EMC
- FCC Part 15 Class
- ICES-003 Class B
- ETSI EN 300 386 Class B
- ETSI ETS 300 132-2
- ITU-T K.20, K.21

NEBS
- Designed for GR-1089-CORE, GR-63-CORE

CE
- EMC and Safety

Environmental
- GR-63-CORE
- ETSI ETS 300 019

ML2410X Series

Ruggedized 28/8 Ports Managed Ethernet Switch

- **High Density Managed 10G switch** – 36 ports

- **Industrial Design** - Harsh environments, wide temperature range compact IP30

- **Flexible Network Redundancy** - RSTP, MSTP, ERPS, LACP

- **Advanced Traffic Management** - QoS- CoS/DSCP, WRR/SPQ Queuing, Storm Protection

- **L2 wire speed switching , 12K Jumbo frames**

- **Multicasting - IGMP Snooping** - v1/v2/v3, up to 4096 groups

- **Advanced Security:** IEEE 802.1x, RADIUS & TACACS+

- **SNMP** v1/v2c/v3

- **Easy Deployment / Configuration** - USB storage, configuration-free replacement

- **Industrial automation protocols** Ethernet/IP and Modbus TCP

- **Superior Reliability and Availability**

Specifications

Interfaces

Ethernet (Network/User) -
- **1/10G Base-X:** 4 ports
  Connector: SFP/SFP+, MSA compliant
- **100/1000Base-FX:** 24 ports
  Connector: SFP, MSA compliant
- **10/100/1000Base-T:** 8 ports
  Connector: RJ45, Auto-MDI/MDI-X

Management (out-of-band)
- **Console**/**Craft:** RS-232
  Connector: RJ-45
- **Storage**- Firmware update, configuration backup, restore, boot up and syslog
  Connector: USB 2.0

Alarm Contacts
- Terminal Block, 1 input, 1 output

Reset Button
- Multiple functions reset button

Protocols

Ethernet operating mode:
　Store & forward, L2 wire-speed/non-blocking

Standards
- IEEE 802.3 10BaseT
- IEEE 802.3u 100BaseTX
- IEEE 802.3ab 1000BaseT
- IEEE 802.3z 1000BaseX
- IEEE 802.3ae 10GBase over Fiber
- IEEE 802.3x Flow Control
- IEEE 802.3az Energy-Efficient Ethernet
- IEEE 802.3ad/802.1AX LACP
- IEEE 802.1D Spanning Tree Protocol
- IEEE 802.1w Rapid STP
- IEEE 802.1s Multiple STP
- ITU-T G.8032 / Y.1344 ERPS
- IEEE 802.1Q VLAN Tagging
- IEEE 802.1ad Stacked VLANs
- IEEE 802.1p Class of Service
- IEEE 802.1X Network Authentication
- IEEE 802.1AB LLDP
- IEEE 1588 PTP

WesternSystems

Actelis
N e t w o r k s ™

Switch Properties

- Switch Fabric - 144 Gbps
- Priority Queues- 8 Queues
- Jumbo Frame- 12288 bytes
- MAC Table Size- 32K
- Packet Buffer- 32Mbits
- VLAN Table Size- 4094
- IGMP Group- 4096
- ACL Group- 4096

Advanced Capabilities

- **Network Redundancy** - RSTP, MSTP, G.8032 ERPSv2, Port Trunking (LACP)
- **QoS-** CoS, DSCP, WRR/SPQ Queuing, Storm Protection; Filter- 802.1Q VLAN, Q-in-Q, IGMP Snooping v1/v2/v3, IGMP Querier, Independent VLAN Learning
- **Security**- 802.1X, RADIUS, TACACS+, SSL, SSH, ACL
- **Diagnostics -** RMON, SNMP Inform/Trap, Syslog, SMTP, Port Mirroring, LLDP, RSPAN
- **Configuration** - DHCP Server/Client, Relay Option 82, TFTP, USB
- **Time Sync.-** NTP, IEEE 1588v2 OC (Software Timestamp), TC (Hardware Timestamp)
- **Management** - IPv4, IPv6, Web, Telnet, Serial Console, CLI, SFTP, SNMP v1/v2c/v3
- **Industrial Profiles-** Ethernet/IP, Modbus TCP, Profinet

Management Applications

- **EMS**: MetaASSIST EMS

Front Panel Indications (LEDs)

- **Unit level LEDs -**
  PWR1, PWR2, Fault, Ring Master, Ring State
- **Port level LEDs -**
  Link/Active with highest speed(Green), low speed(Amber)

Physical

Dimensions :

Height: 1.7" / 44 mm,
Depth: 13" / 331 mm,
Width: 17.3" / 440 mm
- **Weight:** 10.6 lbs / 4.8 kg
- **Mounting**: Rack mounting

Power

- **Operation Voltage**- 12-48VDC, 90~264VAC, redundant dual inputs - various models
  Connection: AC socket, DC 4-pin terminal block
- **Power Consumption** - 1.67A@24VDC
- **Protection -** Overload Current Protected, Reverse Polarity Protected

Environmental

- **Operating Temp.** -40° to +75°C (-40°F- 167°F)
  *For 10G SFP+: -40°C - 60°C (32°F - 140°F)
- **Storage Temp.** -40° to +85°C (-40°F ~ 185°F)
- **Relative humidity:** Up to 95%, non condensing

Regulatory Compliance/Certifications

Safety
- UL 60950-1/62368

Hazardous Locations
- UL/cUL Class I, Division 2, Groups A, B, C, and D

EMC/EMI
- FCC Part 15 subpart B class A, EN55032 Class A
- IEC 61000-4-2, -3, -4, -5, -6 -8

CE
- EMC and Safety

Vibration, shock & free-fall
- IEC 60068-2-6, -27, -32

RoHS (Green)
- RoHS (Pb free) compliant

Pb
RoHS 6
COMPLIANT

ML510Dx

Advanced Managed Industrial
Ethernet Switch, 14 Ports

Preface

Scope

This document provides an overview on DIN-Rail type managed Gigabit Ethernet switches. It contains:

- Descriptive material about the Hardware Installation Guide.

- Descriptive material about the Application Guide.

Audience

The guide is intended for system engineers or operating personnel who want to have a basic understanding.

Safety Instructions

When a connector is removed during installation, testing, or servicing, or when an energized fiber is broken, a risk of ocular exposure to optical energy that may be potentially hazardous occurs, depending on the laser output power.

The primary hazards of exposure to laser radiation from an optical-fiber communication system are:

- Damage to the eye by accidental exposure to a beam emitted by a laser source.

- Damage to the eye from viewing a connector attached to a broken fiber or an energized fiber.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Documentation Conventions

The following conventions are used in this manual to emphasize information that will be of interest to the reader.

Danger — The described activity or situation might or will cause *personal injury*.

Warning — The described activity or situation might or will cause *equipment damage*.

Caution — The described activity or situation might or will cause *service interruption*.

Note — The information supplements the text or highlights important points.
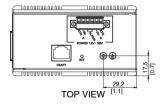
Overview

Overview

The switch delivers high quality, wide operation temperature range, extended power input range and advanced VLAN & QoS features. It's ideal for harsh environments and mission critical applications.

ML510Dx
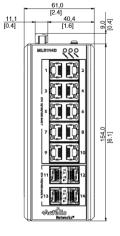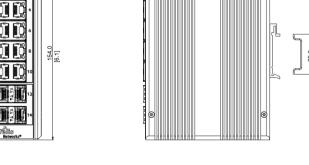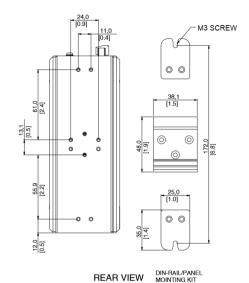## Advanced Managed Industrial Ethernet Switch, 14 Ports

Appearance

Managed series

TOP VIEW

17,5 [0.7]

29,2 [1.1]

FRONT VIEW

61,0 [2.4]

11,1 [0.4]   40,4 [1.6]   9,0 [0.4]

154,0 [6.1]

SIDE VIEW

108,3 [4.3]

33,5 [1.3]   24,1 [0.9]

35,0 [1.4]

REAR VIEW

24,0 [0.9]

11,0 [0.4]

61,0 [2.4]

13,1 [0.5]

55,9 [2.2]

12,0 [0.5]

DIN-RAIL/PANEL MOUNTING KIT

M3 SCREW

38,1 [1.5]

48,0 [1.9]

172,0 [6.8]

25,0 [1.0]

35,0 [1.4]

Technical Specifications

Ethernet		
Copper RJ45 Ports	10/100/1000 Mbps speed auto-negotiation MDI/MDIX Auto-crossover	
SFP (pluggable Ports)	100/1000Base SFP slot	
Fiber port connector	LC typically for fiber (depends on SFP module)	
Power	**Managed series**	**PoE managed series***
Power input	Redundant Input Terminals; Reverse power protection[1]	
Input voltage range	12-58 VDC	12-58 VDC with PoE (802.3af): 46-58 VDC with PoE (802.3at): 54-58 VDC
Maximum Power consumption	17 Watts	Without PoE: 18.7 Watts With PoE: 265 Watts
Environmental and Compliances		
Operating temperature	-40 to +75°C (cold startup at -40°C)	
Storage temperature	-40 to +85°C	
Humidity	5 to 95% RH (non-condensing)	
Mechanical	**Managed series**	**PoE managed series**
Ingress protection	IP30	
Dimension) (without DIN rail clip)	154 (H) x 109 (D) x 60 (W) mm 6.06 (H) x 4.3 (D) x 2.36 (W) inch	154 (H) x 128 (D) x 77 (W) mm 6.06 (H) x 5.03 (D) x 3.03 inch
Weight	1110g / 2.44 lb. (Max)	1410g / 3.11 lb. (Max.)
Installation option	DIN-Rail mounting, Wall mounting	

- PoE is not supported as part of this release
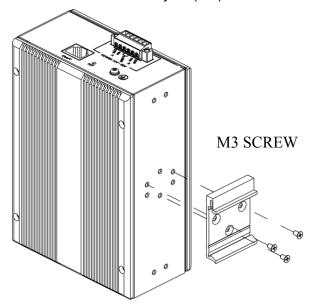
Equipment Mounting

DIN-Rail Mounting

Mounting step:

1. Screw the din-clip with screws in the accessory kit (M3).

M3 SCREW

2. Hook the unit onto the din-rail.
3. Push the bottom of the unit towards the din-rail until it locks in place.
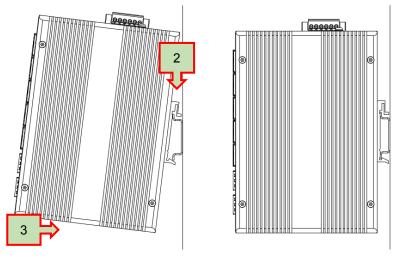
Figure 1 DIN-Rail Mounting

Wall Mounting

Mounting steps:

1. Screw the wall-mount brackets with screws in the accessory kit(M3).
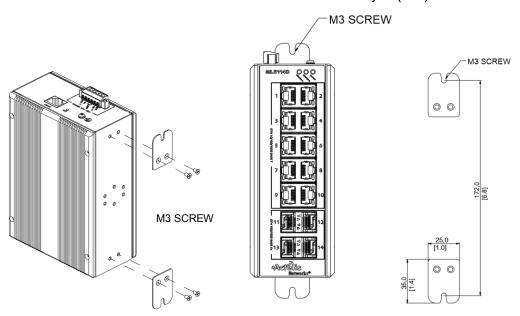
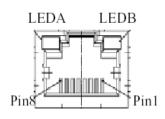

Figure 2 Illustration of Wall Mounting

Connecting the Ethernet Interface (RJ45 Ethernet)

The switch provides two types of Ethernet interfaces: electrical (RJ45) and optical (SFP) interfaces.

Connecting the Ethernet interface via RJ45:

- To connect the switch to a PC, use straight-through or cross-over Ethernet cables,

- To connect the switch to an Ethernet device, use UTP (Unshielded Twisted Pair) or STP (Shielded Twisted Pair) Ethernet cables.

The pin assignment of RJ-45 connector is shown in the following figure and table.

Pin	Assignment	PoE Assignment (for PoE Managed series only)
1,2	T/Rx+,T/Rx-	Positive VPort
3,6	T/Rx+,T/Rx-	Negative VPort
4,5	T/Rx+,T/Rx-	X
7,8	T/Rx+,T/Rx-	X

Connecting the Ethernet Interface (Fiber, SFP)

For both 100/1000 Mbps fiber speed connections, the SFP slots are available. The SFP slot accepts the fiber transceivers that typically have an LC connector.

The fiber transceivers have options of multimode, single mode, long-haul or special-application transceivers.

Fiber optics cable with LC duplex connector

Connect the optical fiber to the SFP socket

⚠️ ***DANGER:***

Never attempt to view optical connectors that might be emitting laser energy.

Do not power up the laser product without connecting the laser to the optical fiber and putting the cover in position, as laser outputs will emit infrared laser light at this point.
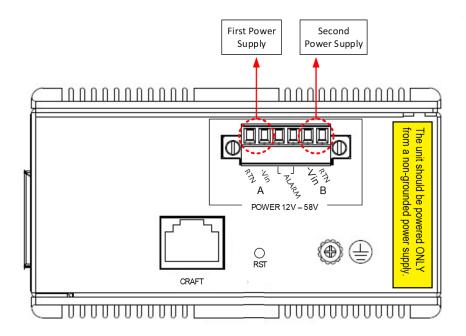
Power Connection

The switch can be powered from two power supplies (input range 12V – 58V). Insert the positive and negative wires into V+ and V- contacts on the terminal block respectively and tighten the wire-clamp screws to prevent the wires from being loosened.

Note: The DC power should be connected to a well-fused power supply.

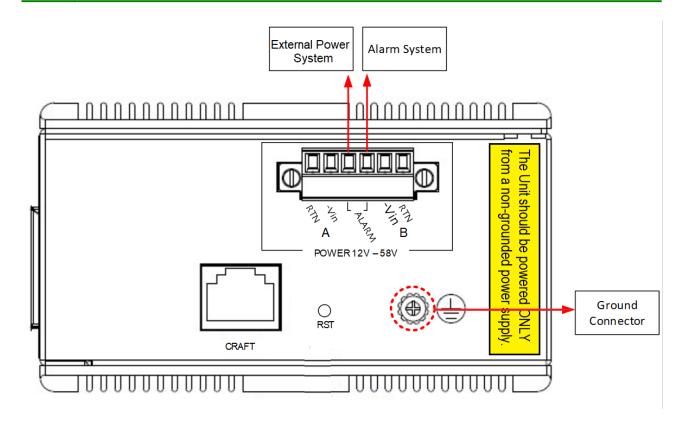Warning: The power supply needs to be ungrounded. Using a grounded power supply may damage the unit

Alarm Relay and Ground

The alarm relay output contacts are in the middle of the DC terminal block connector as shown in the figure below.

The alarm relay out is "Normal Open", and it will be closed when detected any predefined failure such as power failures or Ethernet link failures.

The relay output with current carrying capacity of 0.5A @ 24 VDC.

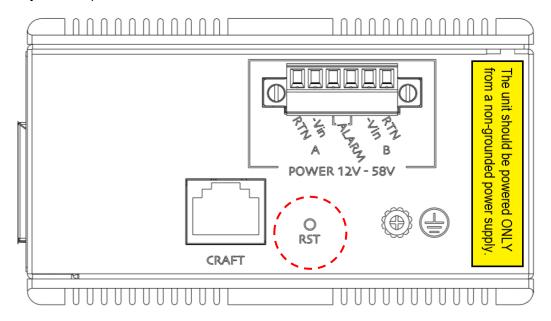Note: As per Safety requirements the ML510D/DP MUST be grounded.

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Ethernet Switch, 14 Ports

SYSTEM RESET

The RST button is provided to reboot the system without the need to remove power. Under normal circumstances, you will not have to use it. However, or rare occasions, the switch may not respond; then you may need to push the RST button.
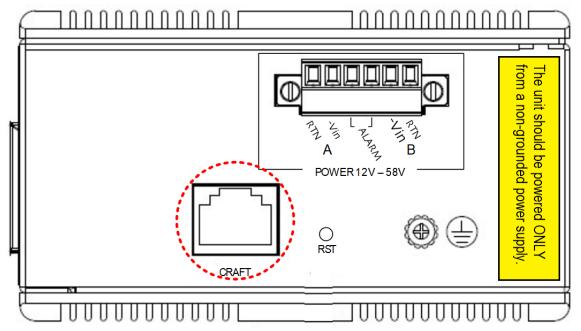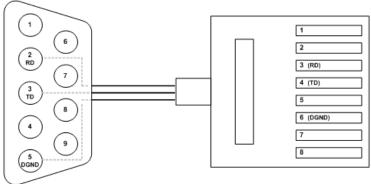
Craft Connection

The Craft port is for local management by using a terminal emulator or a computer with terminal emulation software.

- DB9 connector connect to computer COM port

- Baud rate: 9600bps

- 8 data bits, 1 stop bit

- None Priority

- None flow control

To connect the host PC to the craft port, a RJ45 (male) connector-to-RS232 DB9 (female) connector cable is required. The RJ45 connector of the cable is connected to the CID port of ML510Dx; the DB9 connector of the cable is connected to the PC COM port. The pin assignment of the craft cable is shown below:

Web Interface Initialization (Optional)

Web Browser Support

IE 7 (or newer version) with the following default settings is recommended:

Language script	Latin based
Web page font	Times New Roman
Plain text font	Courier New
Encoding	Unicode (UTF-8)
Text size	Medium

Firefox with the following default settings is recommended:

Web page font	Times New Roman
Encoding	Unicode (UTF-8)
Text size	16

Google Chrome with the following default settings is recommended:

Web page font	Times New Roman
Encoding	Unicode (UTF-8)
Text size	Medium

Connect, Login to, and Configure the ML510Dx

1. Connecting to the Ethernet port (RJ45 Ethernet port) of the ML510Dx.

2. Factory default IP: **192.168.1.1**

3. Login with default account and password.
   Username: admin
   Password: (none)

4. Change the IP via web

Step.1 Go to Configuration → System → IP → IP Interfaces
Step.2 Specify IPv4 Address and IPv4 Mask Length
Step.3 Go to Configuration → System → IP → IP Routes
Step.4 Click "Add Route"
Step.5 Specify Network (0.0.0.0), Mask Length (0), and Gateway IP address
Step.6 Click "Save"

For Example:
Step.1 Go to Configuration → System → IP → IP Interfaces
Step.2 Specify IPv4 Address 10.1.51.141 and IPv4 Mask Length 16

IP Interfaces

Delete	VLAN	DHCPv4				IPv4		E
		Enable	Fallback	Current Lease	Address	Mask Length	
☐	1	☐	60		10.1.51.141	16	

Add Interface

Step.3 Go to Configuration → System → IP → IP Routes
Step.4 Click "Add Route"
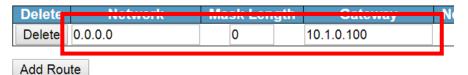
IP Routes

Delete	Network	Mask Length	Gateway	N

Add Route

Step.5 Specify Network 0.0.0.0, Mask Length 0, and Gateway 10.1.0.100

IP Routes

Delete	Network	Mask Length	Gateway	N
Delete	0.0.0.0	0	10.1.0.100	

Add Route

Step.6 Click "Save"

Save Reset

CLI Initialization & Configuration (Optional)

1. Connecting to the Ethernet port (RJ45 Ethernet port) of the ML510Dx

2. Key-in the command under Telnet: **telnet 192.168.1.1**

3. Login with default account and password
   Username: admin
   Password: (none)

4. Change the IP with commands listed below:

   CLI Commands:

   ```
   enable
   configure terminal
   interface vlan 1
   ip address IP address + MASK
   exit
   ip route 0.0.0.0 0.0.0.0 + Gateway IP address
   exit
   ```

   For Example:
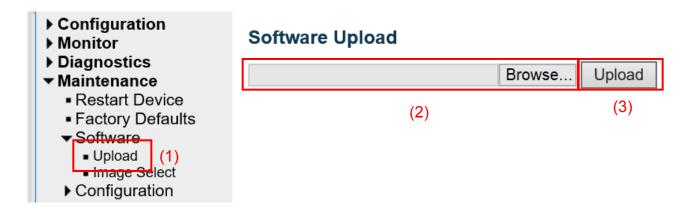
   ```
   enable
   configure terminal
   interface vlan 1
   ip address 10.1.51.141 255.255.0.0
   exit
   ip route 0.0.0.0 0.0.0.0 10.1.0.100
   exit
   ```

Up/Downgrade Software

1. In Web UI, go to "Maintenance→Software→Upload" page.

2. Select software file, and click "Upload" button.

3. After starting to upload software to device, please don't cold/warm start device and wait it auto reboot, then upgrade finished.

Reset to Default and Save Configure

Configuration via CLI command

To see what current interface and IP address is:

If manager want to reset the configuration to default but keep management IP setting.

(1) Please execute this command: reload defaults keep-ip

(2) Check interface VLAN and IP address, confirm only management IP setting kept.

(3) Execute this command: copy running-config startup-config

```
# reload defaults keep-ip
% Reloading defaults, attempting to keep VLAN 1 IP address. Please stand by.
% If need reboot must wait for 3~5 seconds.
#
# show int vlan 1
VLAN1
   LINK: 00-11-22-dd-0c-01 Mtu:1500 <UP BROADCAST RUNNING MULTICAST>
   IPv6: fe80:2::211:22ff:fedd:c01/64 <ANYCAST TENTATIVE AUTOCONF>
   IPv4: 192.168.0.1/24 192.168.0.255
# show int vlan 200
% VLAN interface 200 does not exist.
#
# show vlan
VLAN  Name                              Interfaces
----  --------------------------------  ----------
1     default                           Gi 1/1-14

#
# show int vlan 1
VLAN1
   LINK: 00-11-22-dd-0c-01 Mtu:1500 <UP BROADCAST RUNNING MULTICAST>
   IPv6: fe80:2::211:22ff:fedd:c01/64 <ANYCAST TENTATIVE AUTOCONF>
   IPv4: 192.168.0.1/24 192.168.0.255
#
# copy running-config  startup-config
```

If manager want to reset the all configuration to default completely

(1) Please execute this command: reload defaults

(2) Check interface VLAN and IP address, confirm they all change to default setting.

(3) Execute this command: copy running-config startup-config

```
# reload defaults
% Reloading defaults. Please stand by.
% If need reboot must wait for 3~5 seconds.
# show int vlan 1
VLAN1
   LINK: 00-11-22-dd-0c-01 Mtu:1500 <UP BROADCAST RUNNING MULTICAST>
   IPv4: 192.0.2.1/24 192.0.2.255
   IPv6: fe80:2::211:22ff:fedd:c01/64 <ANYCAST TENTATIVE AUTOCONF>
# show vlan
VLAN  Name                              Interfaces
----  --------------------------------  ----------
1     default                           Gi 1/1-14

# copy running-config  startup-config
Building configuration...
% Saving 1357 bytes to flash:startup-config
% If need reboot must wait for 3~5 seconds.
#
```
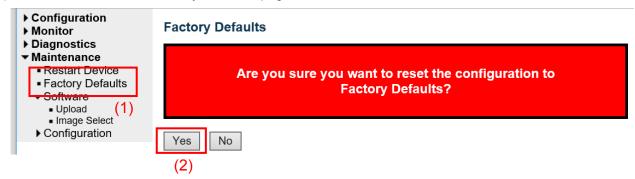
Configuration via WEB UI

If manager want to reset the configuration to default but keep management IP setting

(1) Go to "Maintenance"→"Factory Defaults" pagination to Click "Yes" button.
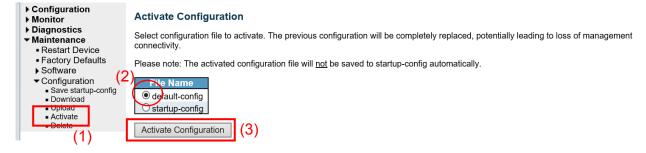
(2) Go to "Maintenance"→ "Configuration"→"Save startup-config" pagination, then click "Save Configuration" button, then reset successfully.

If manager want to reset the all configuration to default completely

(1) Go to "Maintenance"→ "Configuration"→"Activate" pagination to select "default-config", then click "Activate Configuration" button

(2) Change PC's IP address belong to 192.0.2.X networks.

(3) Change WEB's IP be 192.0.2.1(default IP) to login DUT's Web UI.

(4) Go to "Maintenance"→ "Configuration"→"Save startup-config" pagination, then click "Save Configuration" button, then reset successfully.

> ▸ **Configuration**
> ▸ **Monitor**
> ▸ **Diagnostics**
> ▾ **Maintenance**
>   ▪ Restart Device
>   ▪ Factory Defaults
>   ▸ Software
>   ▾ Configuration
>   ▪ Save startup-config
>   ▪ Download
>   ▪ Upload
>   ▪ Activate
>   ▪ Delete

Save Running Configuration to startup-config

Please note: The generation of the configuration file may be time consuming, depending on the amount of non-default configuration.

[Save Configuration]

LED STATUS INDICATIONS

Table 1 LED Status Indicators

LED Name	Indicator /color	Condition
P1	On Green	P1 power line has power
	Off	P1 power line disconnect or does not have supply power
P2	On Green	P2 power line has power
	Off	P2 power line disconnect or does not have supply power
Alarm	On Red	Alarm event occurs
	Off	No alarm
Copper port Link/Act	On Green	Ethernet link up but no traffic is detected
	Flashing Green	Ethernet link up and there is traffic detected
	Off	Ethernet link down
Copper port Speed	On Yellow	A 100 Mbps or a 1000Mbps connection is detected
	Off	No link or a 10 Mbps connection is detected
SFP port Link/Act	On Green	Ethernet link up
	Off	Ethernet link down
SFP port Speed	On Yellow	SFP port speed 1000Mbps connection is detected.
	Off	No link or a SFP port speed 100Mbps connection is detected
PoE managed series only *		
RR (Ring Role)	On Green	One of 3 Ring group is enabled and is Master role.
	Off	Ring is slave role
RS (Ring Status)	On Green	Ring fail happen and detected
	Off	No ring fail detected
PoE	On Yellow	PoE is detected
	Off	No link

- PoE devices are not supported as part of this release
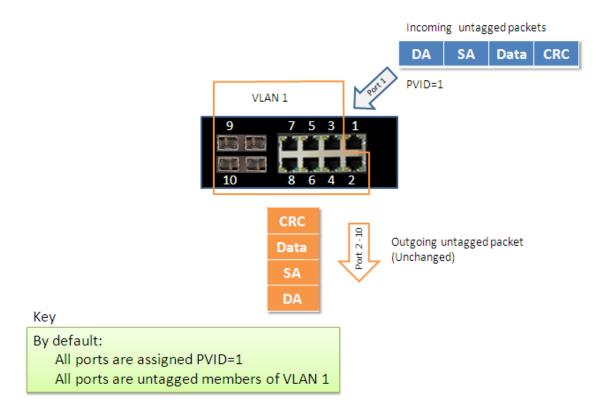
VLAN Application Guide

This part describes how to configure Virtual LANs (VLANs) in the switch. The switch supports up to 2048 VLANs. Ports are grouped into broadcast domains by assigning them to the same VLAN. Frames received in on VLAN can only be forwarded within that VLAN, and multicast frames and unknown unicast frames are flooded only to ports in the same VLAN.

Example 1: Default VLAN Settings

Each port in the switch has a configurable default VLAN number, known as its PVID. This places all ports on the same VLAN initially, although each port PVID is configurable to any VLAN number between 1 and 4094.

The default configuration settings for switch have all ports set as untagged members of VLAN 1 with all ports configured as PVID=1. In default configuration example shown in the following figure, all incoming packets are assigned to VLAN 1 by the default port VLAN identifier (PVID=1).

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Advanced Managed Industrial
Ethernet Switch, 14 Ports

Example 2: Port-based VLANs

When the switch receives an untagged VLAN packet, it will add a VLAN tag to the frame according to the PVID setting on a port. As shown in the following figure, the untagged packet is mark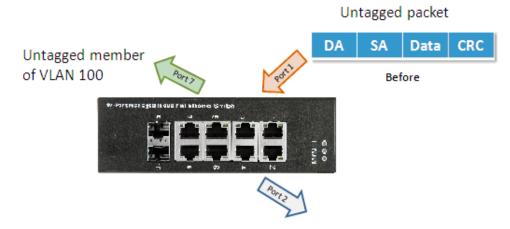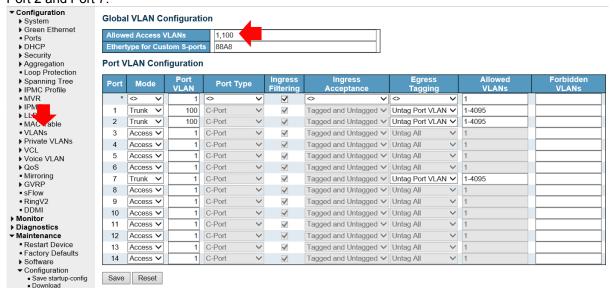ed (tagged) as it leaves the switch through Port 2, which is configured as a tagged member of VLAN100. The untagged packet remains unchanged as it leaves the switch through Port 7, which is configured as an untagged member of VLAN100.

Configuration:

Step1. Go to Configuration -> VLANs -> Port VLAN configuration and configure PVID 100 on Port 1, Port 2 and Port 7.

Global VLAN Configuration

Allowed Access VLANs	1,100
Ethertype for Custom S-ports	88A8

Port VLAN Configuration

Port	Mode	Port VLAN	Port Type	Ingress Filtering	Ingress Acceptance	Egress Tagging	Allowed VLANs	Forbidden VLANs
*	<>	1	<>	☑	<>	<>	1	
1	Trunk	100	C-Port	☑	Tagged and Untagged	Untag Port VLAN	1-4095	
2	Trunk	100	C-Port	☑	Tagged and Untagged	Untag Port VLAN	1-4095	
3	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
4	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
5	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
6	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
7	Trunk	1	C-Port	☑	Tagged and Untagged	Untag Port VLAN	1-4095	
8	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
9	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
10	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
11	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
12	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
13	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
14	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	

Save   Reset

- ▼ **Configuration**
  - ▶ System
  - ▶ Green Ethernet
  - ▶ Ports
  - ▶ DHCP
  - ▶ Security
  - ▶ Aggregation
  - ▪ Loop Protection
  - ▶ Spanning Tree
  - ▶ IPMC Profile
  - ▶ MVR
  - ▶ IPMC
  - ▶ LLDP
  - ▪ MAC Table
  - ▪ VLANs
  - ▶ Private VLANs
  - ▶ VCL
  - ▶ Voice VLAN
  - ▶ QoS
  - ▪ Mirroring
  - ▶ GVRP
  - ▪ sFlow
  - ▪ RingV2
  - ▪ DDMI
- ▶ Monitor
- ▶ Diagnostics
- ▼ Maintenance
  - ▪ Restart Device
  - ▪ Factory Defaults
  - ▶ Software
  - ▼ Configuration
    - ▪ Save startup-config
    - ▪ Download

Step2. Select Configuration -> VLAN -> Static VLAN. Create a VLAN with VLAN ID 100. Enter a VLAN name in the **Name** field.

Step3. Assign VLAN tag setting to or remove it from a port by toggling the check box under an individual port number. The tag settings determine if packets that are transmitted from the port tagged or untagged with the VLAN ID. The possible tag settings are:
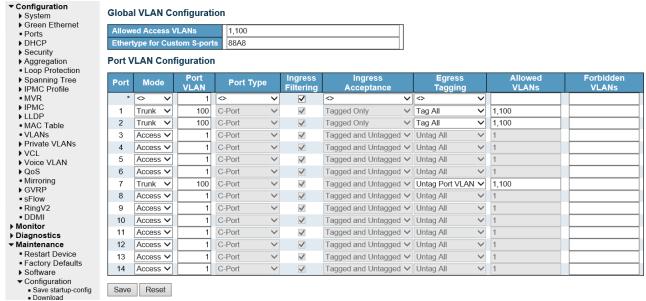
Tag All	Specifies that the egress packet is tagged for the port.
Untag port vlan	Specifies that the egress packet is untagged for the port.
Untag All	Specifies that all frames, whether classified to the Port VLAN or not, are transmitted without a tag.

Here we set tagged VLAN100 on Port 1 and Port 2, untagged VLAN100 on Port7.

Configuration
- System
- Green Ethernet
- Ports
- DHCP
- Security
- Aggregation
- Loop Protection
- Spanning Tree
- IPMC Profile
- MVR
- IPMC
- LLDP
- MAC Table
- VLANs
- Private VLANs
- VCL
- Voice VLAN
- QoS
- Mirroring
- GVRP
- sFlow
- RingV2
- DDMI
Monitor
Diagnostics
Maintenance
- Restart Device
- Factory Defaults
- Software
- Configuration
  - Save startup-config
  - Download

Global VLAN Configuration

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Ethertype for Custom S-ports	88A8

Port VLAN Configuration

Port	Mode	Port VLAN	Port Type	Ingress Filtering	Ingress Acceptance	Egress Tagging	Allowed VLANs	Forbidden VLANs
*	<>	1	<>	☑	<>	<>		
1	Trunk	100	C-Port	☑	Tagged Only	Tag All	1,100	
2	Trunk	100	C-Port	☑	Tagged Only	Tag All	1,100	
3	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
4	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
5	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
6	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
7	Trunk	100	C-Port	☑	Tagged and Untagged	Untag Port VLAN	1,100	
8	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
9	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
10	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
11	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
12	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
13	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
14	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	

Save   Reset

Step4. Transmit untagged unicast packets from Port 1 to Port 2 and Port 7. The switch should tag it with VID 100. The packet has access to Port2 and Port 7. The outgoing packet is stripped of its tag to leave Port 7 as an untagged packet. For Port 2, the outgoing packet leaves as a tagged packet with VID 100.

Step5. Transmit untagged unicast packets from Port 2 to Port 1 and Port 7. The switch should tag it with VID 100. The packet has access to Port1 and Port 7. The outgoing packet is stripped of its tag to leave Port 7 as an untagged packet. For Port 1, the outgoing packet leaves as a tagged packet with VID 100.

Step6. Transmit untagged unicast packets from Port 7 to Port 1 and Port 2. The switch should tag it with VID 100. The packet has access to Port1 and Port 2. For Port 1 and Port 2, the outgoing packet leaves as a tagged packet with VID 100.

Step7. Repeat step 4 using broadcast and multicast packets.

CLI Command:

```
vlan 1
vlan 100

interface GigabitEthernet 1/1
switchport access vlan 100
switchport trunk native vlan 100
switchport trunk allowed vlan 1,100
switchport trunk vlan tag native
switchport mode trunk
exit
interface GigabitEthernet 1/2
switchport access vlan 100
switchport trunk native vlan 100
switchport trunk allowed vlan 1,100
switchport trunk vlan tag native
switchport mode trunk
exit
interface GigabitEthernet 1/7
switchport access vlan 100
switchport trunk native vlan 100
switchport trunk allowed vlan 1,100
switchport mode trunk
exit
```
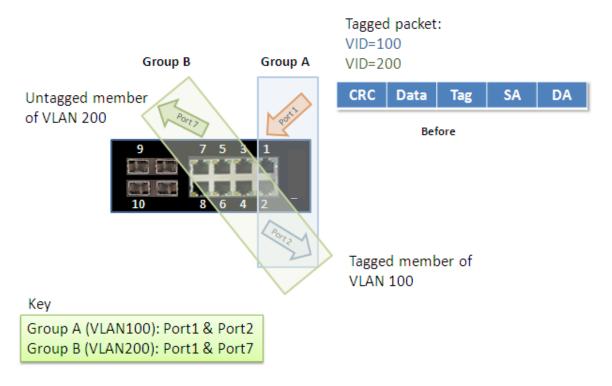
Example 3: IEEE 802.1Q Tagging

The switch is able to construct layer-2 broadcast domain by identifying VLAN ID specified by IEEE 802.1Q. It forwards a frame between bridge ports assigned to the same VLAN ID and can set multiple VLANs on each bridge port.

In the following figure, the tagged incoming packets are assigned directly to VLAN 100 and VLAN 200 because of the tag assignment in the packet. Port 2 is configured as a tagged member of VLAN 100, and Port 7 is configured as an untagged member of VLAN 200. Hosts in the same VLAN communicate with each other as if they in a LAN. However, hosts in different VLANs cannot communicate with each other directly.

In this case:
1. The hosts from Group A can communicate with each other.
2. The hosts from Group B can communicate with each other.
3. The hosts of Group A and Group B can't communicate with each other.
4. Both the Group A and Group B can go to Internet through the switch.
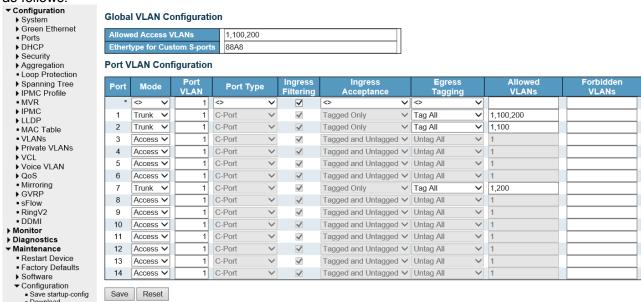
Configuration:

Step1. Go to C configuration -> VLANs -> Port VLAN configuration page specify the VLAN membership as follows:

Configuration
- System
- Green Ethernet
- Ports
- DHCP
- Security
- Aggregation
- Loop Protection
- Spanning Tree
- IPMC Profile
- MVR
- IPMC
- LLDP
- MAC Table
- VLANs
- Private VLANs
- VCL
- Voice VLAN
- QoS
- Mirroring
- GVRP
- sFlow
- RingV2
- DDMI
- Monitor
- Diagnostics
- Maintenance
  - Restart Device
  - Factory Defaults
  - Software
  - Configuration
    - Save startup-config
    - Download

Global VLAN Configuration

Allowed Access VLANs	1,100,200
Ethertype for Custom S-ports	88A8

Port VLAN Configuration

Port	Mode	Port VLAN	Port Type	Ingress Filtering	Ingress Acceptance	Egress Tagging	Allowed VLANs	Forbidden VLANs
*	<>	1	<>	☑	<>	<>		
1	Trunk	1	C-Port	☑	Tagged Only	Tag All	1,100,200	
2	Trunk	1	C-Port	☑	Tagged Only	Tag All	1,100	
3	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
4	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
5	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
6	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
7	Trunk	1	C-Port	☑	Tagged Only	Tag All	1,200	
8	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
9	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
10	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
11	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
12	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
13	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
14	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	

Save   Reset

Step2. Transmit unicast packets with VLAN tag 100 from Port 1 to Port 2 and Port 7. The switch should tag it with VID 100. The packet only has access to Port2. For Port 2, the outgoing packet leaves as a tagged packet with VID 100.

Step3. Transmit unicast packets with VLAN tag 200 from Port 1 to Port 2 and Port 7. The switch should tag it with VID 200. The packet only has access to Port7. The outgoing packet on Port 7 is stripped of its tag as an untagged packet.

Step4. Transmit unicast packets with VLAN tag 100 from Port 2 to Port 1 and Port 7. The switch should tag it with VID 100. The packet only has access to Port1. For Port 1, the outgoing packet leaves as a tagged packet with VID 100.

Step5. Transmit unicast packets with VLAN tag 200 from Port 7 to Port 1 and Port 2. The switch should tag it with VID 200. The packet only has access to Port1. The outgoing packet on Port 1 will leave as a tagged packet with VID 200.

Step6. Repeat the above steps using broadcast and multicast packets.

CLI Command:

```
vlan 100
vlan 200

interface GigabitEthernet 1/1
switchport access vlan 100
switchport trunk allowed vlan 1,100,200
switchport trunk vlan tag native
switchport mode trunk
exit
interface GigabitEthernet 1/1
switchport access vlan 100
switchport trunk allowed vlan 1,100
switchport trunk vlan tag native
switchport mode trunk
exit

interface GigabitEthernet 1/7
switchport access vlan 100
switchport trunk allowed vlan 1,200
switchport trunk vlan tag native
switchport mode trunk
exit
```

Security Application Guide

ACL function supports access control security for MAC address, IP address, Layer4 Port, and Type of Service. Each has five actions: Deny, Permit, Queue Mapping, CoS Marking, and Copy Frame. User can set default ACL rule to Permit or Deny. To get more clearly for these ACL function, see following table.

Default ACL Rule	Actions				
	Deny	Permit	Queue Mapping	CoS Marking	Copy Frame
Permit	(a)	(b)	(c)	(d)	(e)
Deny	(f)	(g)	(h)	(i)	(j)

Brief descriptions of the above table:
  (a): Permit all frames, but deny frames set in ACL entry.
  (b): Permit all frames.
  (c): Permit all frames, and to do queue mapping of the transmitting frames.
  (d): Permit all frames, and to change CoS value of the transmitting frames.
  (e): Permit all frames, and to copy frame which set in ACL entry to a defined GE port.
  (f): Deny all frames.
  (g): Deny all frames, but permit frames set in ACL entry.
  (h): Deny all frames.
  (i): Deny all frames.
  (j): Deny all frames, but to copy frame which set in ACL entry to a defined GE port.

Case 1: ACL for MAC address

For MAC address ACL, it can filter on source MAC address, destination MAC address, or both. When it filters on both MAC address, packets coincident with both rules will take effect. In other words, it does not do filter if it only coincident with one rule.

If user want to filter only one directional MAC address, the other MAC address just set to all zero. It means don't care portion. Besides MAC address, it also supports VLAN and Ether type for filter additionally. Certain VLAN or Ether type under these MAC address will take effect. If user doesn't care VLAN or Ether type, he can just set to zero values. Following are examples about the above table:

● **Case 1: (a)**

User can set default ACL Rule of GE port as "Permit", then to bind a suitable profile with "deny" action for ACL. It means GE port can pass through all packets but not ACL entry of the profile binding.
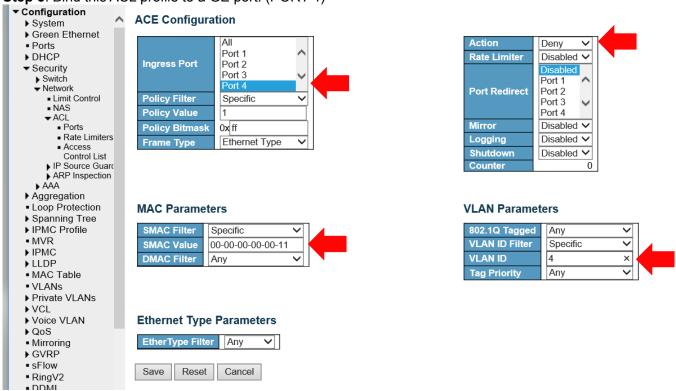
◎ One directional MAC address with one VLAN deny filtering.

Step 1: Create a new ACL Profile. (Profile Name: DenySomeMac)

**Step 2:** Create a new ACL Entry rule under this ACL profile. (Deny MAC: 11 and VLAN: 4)
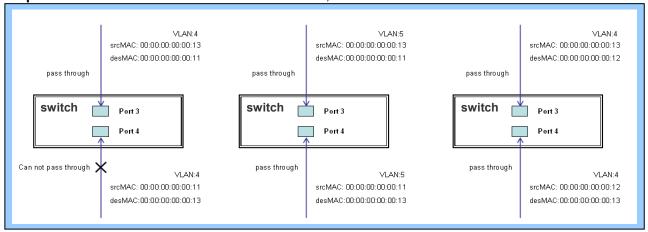
Step 3: Bind this ACL profile to a GE port. (PORT-4)

Step 4: Send frames between PORT-3 and PORT-4, and see test result.

CLI Command:
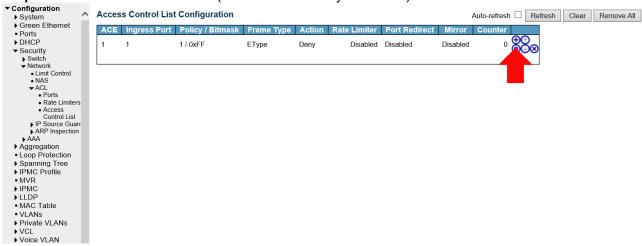
```
access-list ace 1 ingress interface GigabitEthernet 1/4 policy 1 vid 4
frametype etype smac 00-00-00-00-00-11 action deny
exit
interface GigabitEthernet 1/3
  switchport trunk allowed vlan 4,5
  switchport trunk vlan tag native
!
interface GigabitEthernet 1/4
  switchport trunk allowed vlan 4,5
  switchport trunk vlan tag nativevlan 4
exit
```
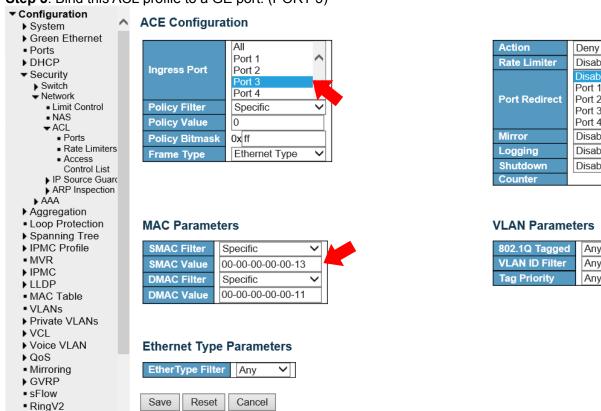
◎ Two directional MAC address with all VLAN deny filtering.

Step 1: Create a new ACL Profile. (Profile Name: DenySomeMac)

Step 2: Create a new ACL Entry rule under this ACL profile. (Deny SrcMAC: 13 and DesMAC: 11)

Step 3: Bind this ACL profile to a GE port. (PORT-3)

Step 4: Send frames between PORT-3 and PORT-4, and see test result.
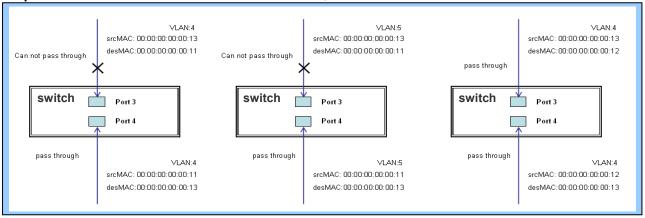
CLI Command:

```
access-list ace 2 ingress interface GigabitEthernet 1/3 policy 0 frametype etype smac
00-00-00-00-00-13 dmac 00-00-00-00-00-11 action deny
exit
interface GigabitEthernet 1/3
  switchport trunk allowed vlan 4,5
  switchport trunk vlan tag native
!
interface GigabitEthernet 1/4
  switchport trunk allowed vlan 4,5
  switchport trunk vlan tag nativevlan 4
exit
```

- **Case 1: (b)**

This case acts as no ACL function. It means all frames will pass through.

- **Case 1: (c)**

User can set default ACL Rule of GE port as "Permit", then to bind a suitable profile with "Queue Mapping" action for some ACL function. It means GE port can do queue mapping 0~7 of the frame received from this port.

- **Case 1: (d)**
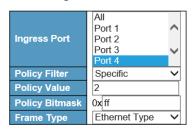
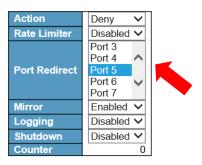User can set default ACL Rule of GE port as "Permit", then to bind a suitable profile with "CoS Marking" action for some ACL function. It means GE port can remark CoS of the VLAN frame received from this port.
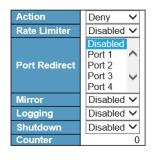
◎ One directional MAC address with CoS Marking action. (one VLAN, and don't care Ether Type)

Step 1: Create a new ACL Profile. (Profile Name: CoSMarkingTest)

Step 2: Create a new ACL Entry rule under this ACL profile.
    (Filter SrcMAC: 11 and VLAN ID: 4 frame to CoS: 2)
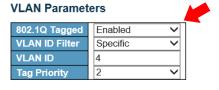
Step 3: Bind this ACL profile to a GE port. (PORT-4)

ACE Configuration

Ingress Port	All / Port 1 / Port 2 / Port 3 / **Port 4**
Policy Filter	Specific
Policy Value	2
Policy Bitmask	0x ff
Frame Type	Ethernet Type

Action	Deny
Rate Limiter	Disabled
Port Redirect	Disabled / Port 1 / Port 2 / Port 3 / Port 4
Mirror	Disabled
Logging	Disabled
Shutdown	Disabled
Counter	0

MAC Parameters

SMAC Filter	Specific
SMAC Value	00-00-00-00-00-11
DMAC Filter	Any

VLAN Parameters

802.1Q Tagged	Enabled
VLAN ID Filter	Specific
VLAN ID	4
Tag Priority	2
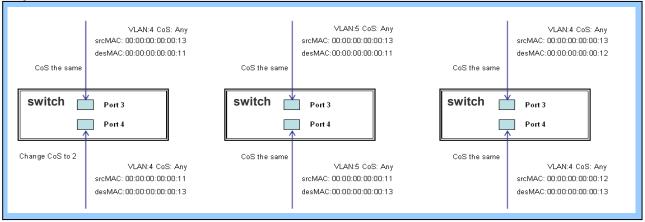
Ethernet Type Parameters

EtherType Filter	Any

Save   Reset   Cancel

Step 4: Send frames between PORT-3 and PORT-4, and see test result.

CLI Command:

```
access-list ace 1 next 2 ingress interface GigabitEthernet 1/4 policy 1 vid 4 frametype etype
smac 00-00-00-00-00-11 action deny
exit
interface GigabitEthernet 1/3
  switchport trunk allowed vlan 4,5
  switchport trunk vlan tag native
!
interface GigabitEthernet 1/4
  switchport trunk allowed vlan 4,5
  switchport trunk vlan tag native
exit
```
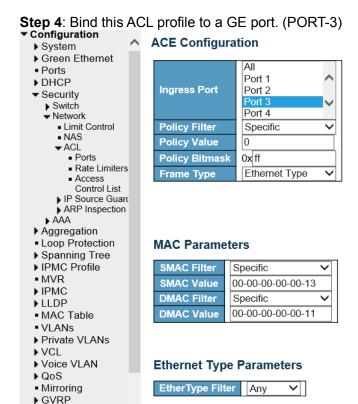
● **Case 1: (e)**

User can set default ACL Rule of GE port as "Permit", then to bind a suitable profile with "Copy Frame" action for mirror analyzer used. It means the system will copy frames from binding GE Port to analyzer port.

◎ Two directional MAC address with Copy Frame action.
    (Don't care VLAN ID, Ether Type)

Step 1: Create a new ACL Profile. (Profile Name: CopyFrameTest)

Step 2: Create a new ACL Entry rule under this ACL profile. (SrcMAC: 13 and DesMAC: 11)

Step 3: Set analyzer port to enable and mirror analyzer port.
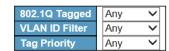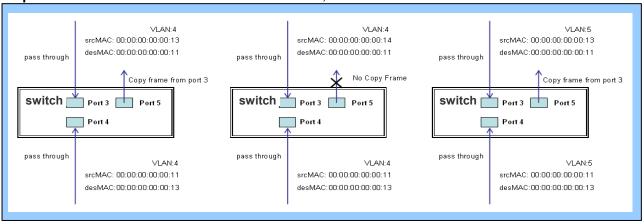
Step 4: Bind this ACL profile to a GE port. (PORT-3)

Step 5: Send frames between PORT-3 and PORT-4, and see test result.

CLI Command:

```
access-list ace 2 next 3 ingress interface GigabitEthernet 1/3 policy 0 frametype etype smac 00-
00-00-00-00-13 dmac 00-00-00-00-00-11 action deny mirror redirect interface GigabitEthernet
1/5
exit
interface GigabitEthernet 1/3
  switchport trunk allowed vlan 4,5
  switchport trunk vlan tag native
!
interface GigabitEthernet 1/4
  switchport trunk allowed vlan 4,5
  switchport trunk vlan tag native
exit
```

- **Case 1: (f)**

This case means all frames will not pass through.

- **Case 1: (g)**
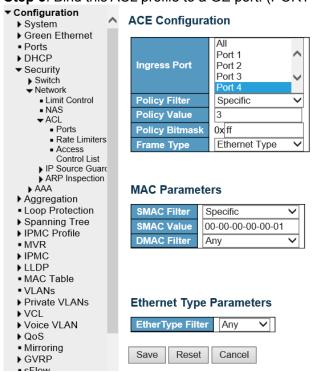
User can set default ACL Rule of GE port as "Deny", then to bind a suitable profile with "Permit" action for ACL. It means GE port cannot pass through all packets but ACL entry of the profile binding.

◎ One directional MAC address with one VLAN permit filtering.

Step 1: Create a new ACL Profile. (Profile Name: AllowSomeMac)

Step 2: Create a new ACL Entry rule under this ACL profile. (Allow MAC: 11 and VLAN: 4)

Step 3: Bind this ACL profile to a GE port. (PORT-4)

Step 4: Send frames between PORT-3 and PORT-4, and see test result.

CLI Command:

```
access-list ace 4 ingress interface GigabitEthernet 1/4 policy 3 tag tagged vid 4 frametype etype
smac 00-00-00-00-00-11
exit
  interface GigabitEthernet 1/3
  switchport trunk allowed vlan 4,5
  switchport trunk vlan tag native
!
interface GigabitEthernet 1/4
  switchport trunk allowed vlan 4,5
  switchport trunk vlan tag native
exit
```
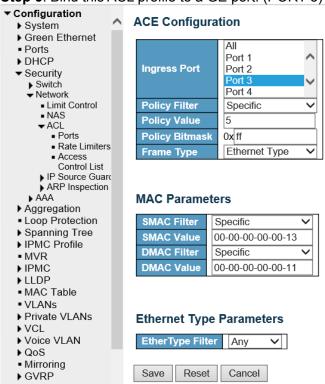
◎ Two directional MAC address with all VLAN permit filtering.

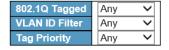**Step 1**: Create a new ACL Profile. (Profile Name: AllowSomeMac)

Step 2: Create a new ACL Entry rule under this ACL profile. (Allow SrcMAC: 13 and DesMAC: 11)

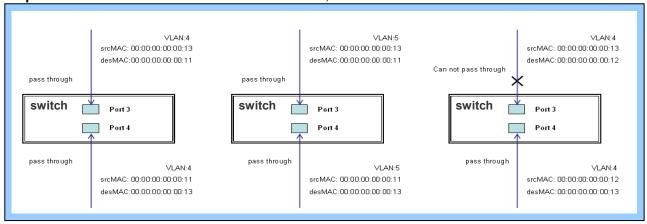**Step 3**: Bind this ACL profile to a GE port. (PORT-3)

Step 4: Send frames between PORT-3 and PORT-4, see test result.

CLI Command:

```
access-list ace 5 ingress interface GigabitEthernet 1/3 policy 5 frametype etype smac 00-00-00-00-
00-13 dmac 00-00-00-00-00-11
exit
interface GigabitEthernet 1/3
  switchport trunk allowed vlan 4,5
  switchport trunk vlan tag native
!
interface GigabitEthernet 1/4
  switchport trunk allowed vlan 4,5
  switchport trunk vlan tag native
exit
```

- **Case 1: (h)**

Because the default ACL Rule of GE port is "Deny", Queue Mapping action has no sense. We do not do this case.

- **Case 1: (i)**

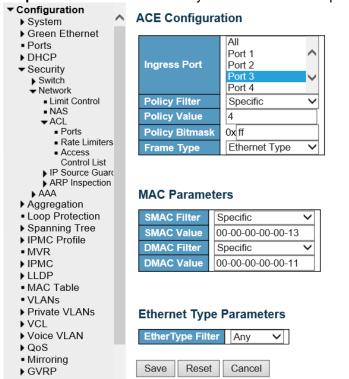Because the default ACL Rule of GE port is "Deny", CoS Marking action has no sense. We do not do this case.

- **Case 1: (j)**

User can set default ACL Rule of GE port as "Deny", then to bind a suitable profile with "Copy Frame" action for mirror analyzer used. It means the system will copy frames from binding GE Port to analyzer port. There is no frame received from the denied GE port but the mirror analyzer port.

◎ One directional MAC address with Copy Frame action. (Don't case VLAN, Ether Type)
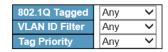
Step 1: Create a new ACL Profile. (Profile Name: CopyFrameTest)

Step 2: Create a new ACL Entry rule under this ACL profile. (SrcMAC: 13 and DesMAC: 11)

Step 3: Bind this ACL profile to a GE port. (PORT-3)

Step 4: Set analyzer port to enable and mirror analyzer port.

Step 5: Send frames between PORT-3 and PORT-4, see test result.

CLI Command:

```
access-list ace 5 next 6 ingress interface GigabitEthernet 1/3 policy 5 frametype etype smac 00-00-
00-00-00-13 dmac 00-00-00-00-00-11
Exit
monitor destination interface GigabitEthernet 1/5
monitor source cpu both
exit
interface GigabitEthernet 1/3
  switchport trunk allowed vlan 4,5
  switchport trunk vlan tag native
!
interface GigabitEthernet 1/4
  switchport trunk allowed vlan 4,5
  switchport trunk vlan tag native
exit
```

Case 2: ACL for IP address

For IP address ACL, it can filter on source IP address, destination IP address, or both. It also supports to set IP range ACL. When it filters on both IP address, packets coincident with both rules will take effect. In other words, it does not do filter if it only coincident with one rule.

If user want to filter only one directional IP address, the other IP address just set to all zero. It means don't care portion. Besides IP address, it also supports Protocol for filter additionally. (TCP=6, UDP=17, etc.) Certain Protocol under these IP addresses will take effect. If user doesn't care Protocol, he can just set to zero value. The detail testing, please refer to MAC ACL above.

Case 3: ACL for L4 Port

For Layer4 port ACL, it can filter on (1) source IP address, (2) source L4 port, (3) destination IP address, (4) destination L4 port, and (5) UDP or TCP Protocol. User can select to filter on (1)~(4) for all or some specific values, but it should select exact one Protocol from UDP or TCP.

When it filters on both directional IP address and L4 port, packets coincident with both rules will take effect. In other words, it does not do filter if it only coincident with one rule.
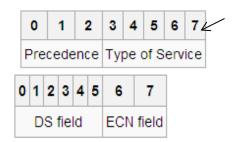
If user wants to filter only one directional IP address or L4 port, the other IP address and L4 port just set to all zero. It means don't care portion. The detail testing, please refer to MAC ACL above.

Case 4: ACL for ToS

For Type of Service (ToS) ACL, it can filter on (1) source IP address with ToS type , or (2) destination IP address with ToS type, or (3) both, or (4) both not (just filter ToS). When it filters on both IP address, packets coincident with both rules will take effect. In other words, it does not do filter if it only coincident with one rule.

If user want to filter only one directional IP address, the other IP address just set to all zero. It means don't care portion. The detail testing, please refer to case 1 MAC ACL above.

Valid Values: Precedence: 0~7, ToS: 0~15, DSCP: 0~63

0	1	2	3	4	5	6	7
Precedence			Type of Service				

0	1	2	3	4	5	6	7
DS field						ECN field	

This value (7) is reserved and set to 0.
Ex: Pre (001) means 1
      Pre (100) means 4
      ToS (00010) means 1
      ToS (10000) means 8
      DSCP (000001) means 1
      DSCP (100000) means 32
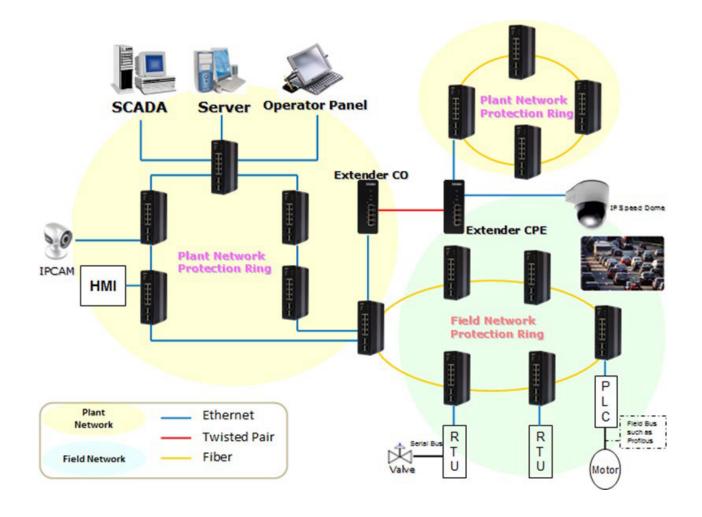
Ring Version 2 Application Guide

To have a reliable network is very important to Ethernet applications, especially in Industrial domain. The switch provides a mini-second grade failover ring protection; this feature offers a seamless working network even if encountering some matters with connections. It is able to be applied by Ethernet cable and Fiber.
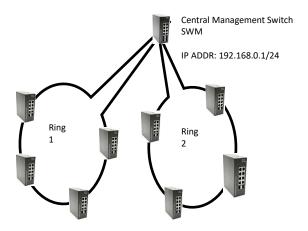
Ring Version 2 Feature

Group 1 - It support option of ring-master and ring-slave.
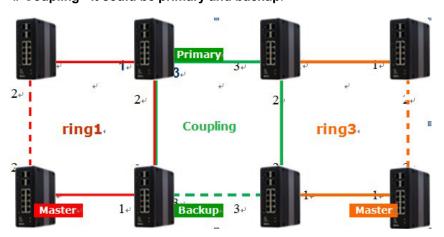
Ring - it could be master or slave.

When role is ring master, one ring port is forward port and another is block port. The block port is redundant port. It is blocked in normal state.

When role is ring/slave, both ring ports are forward port.

Group 2 - It support configuration of the ring, coupling and dual-homing.

Ring - it could be master or slave.

Coupling - it could be primary and backup.
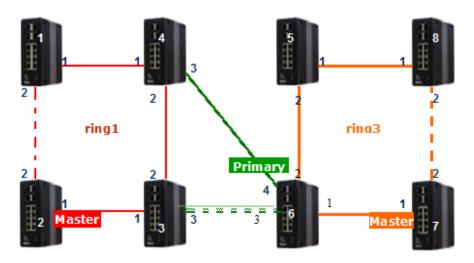
When role is coupling/primary, only it need configure one ring port named primary port.

When role is coupling/backup, only it need configure one ring port named backup port. This backup port is redundant port. In normal state, it is blocked.
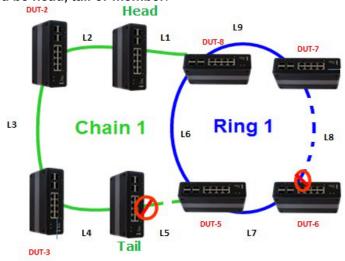
 # Dual-Homing

   # When role is dual-homing, one ring port is primary port and another is backup port. This backup port is redundant port. In normal state, it is blocked.

Group 3 - It support configuration of the chain and balancing-chain.

 # Chain - it could be head, tail or member.

   # When role is chain/head, one ring port is head port and another is member port. Both ring ports are forwarded in normal state.
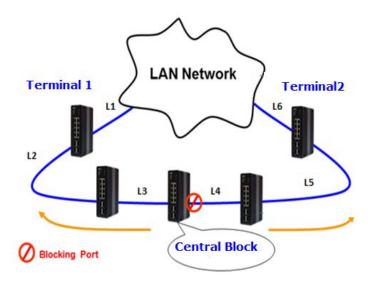
   # When role is chain/tail, one ring port is tail port and another is member port. The tail port is redundant port. It is blocked in normal state.

   # When role is chain/member, both ring ports are member port. Both ring ports are forwarded in normal state.

 # Balancing Chain - it could be central-block, terminal-1/2 or member.

When role is balancing-chain/central-block, one ring port is member port and another is block port. The block port is redundant port. It is blocked in normal state.

When role is balancing-chain/terminal-1/2, one ring port is terminal port and another is member port. Both ring ports are forwarded in normal state.

When role is balancing-chain/member, both ring ports are member port. Both ring ports are forwarded in normal state.

Note 1 - It must enable group1 before configure group2 as coupling.
Note 2 - When group1 or group2 is enabled, the configuration of group3 is invisible.
Note 3 - When group3 is enabled, the configuration of group1 and group3 is invisible.

How to Configure Ringv2

Configuration (Console)

To configure the ring protection in the switch,

1. Login "**admin**" account in console

2. Go to Configure mode by "**configure terminal**"

3. Go to configure ring protection group by command "**ringv2 protect group1**"

4. Before configure, must disable ring protection status by command "**mode disable**"

5. Start to set all necessary parameter:

   - Node 1 and Node 2, choose the ports that you connect with other switch

   - For example, choose PORT-1 and PORT-2 that means PORT-1 is one of the ports connected with other switch, so is PORT-2.

   - Then choose one of ring connection devices be "Master" which you can accept the "Node 2 port" be blocking port.

     node1 interface GigabitEthernet 1/1
     node2 interface GigabitEthernet 1/2
     role ring-master

   - Configure finish, must enable ring protection status by command "**mode enable**"

⚠️ **Note:**

Please pay attention on the status of "Previous Command Result" after every action.

---

configure terminal
ring protect group1

mode disable
node1 interface GigabitEthernet 1/1
node2 interface GigabitEthernet 1/2
role ring-master
mode enable

exit
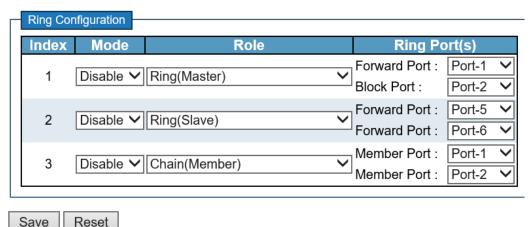
Configuration (Web UI)

This document is the introduction of the Industrial Ethernet Switch Software Spec for Ringv2.
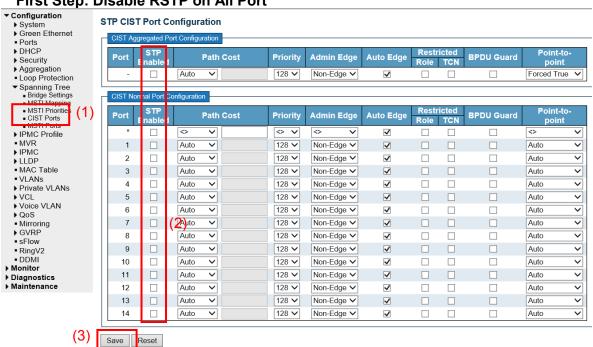
In current design, one device supports 3 ring index, including Ring & Chain (single ring, dual ring, coupling, dual-homing, chain, and balancing-chain.)

RingV2 Configuration

Ring Configuration

Index	Mode	Role	Ring Port(s)	
1	Disable	Ring(Master)	Forward Port :	Port-1
			Block Port :	Port-2
2	Disable	Ring(Slave)	Forward Port :	Port-5
			Forward Port :	Port-6
3	Disable	Chain(Member)	Member Port :	Port-1
			Member Port :	Port-2

Save   Reset

Note 1 - It must enable group1 before configure group2 as coupling.
Note 2 - When group1 or group2 is enabled, the configuration of group3 is invisible.
Note 3 - When group3 is enabled, the configuration of group1 and group3 is invisible.

First Step: Disable RSTP on All Port
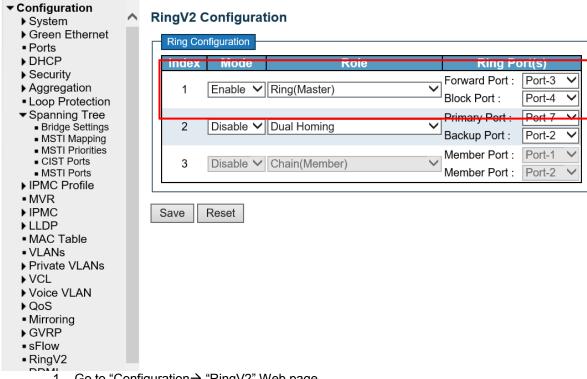
1. Go to "Configuration→Spanning Tree→ CIST ports" Web page
2. Do not enable STP.
3. Click "Save" bottom
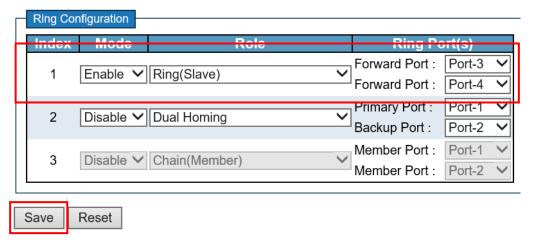
Ring Master

RingV2 Configuration

Ring Configuration

Index	Mode	Role	Ring Port(s)	
1	Enable	Ring(Master)	Forward Port :	Port-3
			Block Port :	Port-4
2	Disable	Dual Homing	Primary Port :	Port-7
			Backup Port :	Port-2
3	Disable	Chain(Member)	Member Port :	Port-1
			Member Port :	Port-2

Save   Reset

1. Go to "Configuration→ "RingV2" Web page
2. Enable Index1, and Select Role as Ring(Master)
3. Select one port as a "Forward Port", another is "Block Port"

Ring Slave

RingV2 Configuration

Ring Configuration

Index	Mode	Role	Ring Port(s)	
1	Enable	Ring(Slave)	Forward Port :	Port-3
			Forward Port :	Port-4
2	Disable	Dual Homing	Primary Port :	Port-1
			Backup Port :	Port-2
3	Disable	Chain(Member)	Member Port :	Port-1
			Member Port :	Port-2

Save   Reset

1. Go to "Configuration→ "RingV2" Web page
2. Enable Index1, and Select Role as Ring(Slave)
3. Select two ports as "Forward Port".
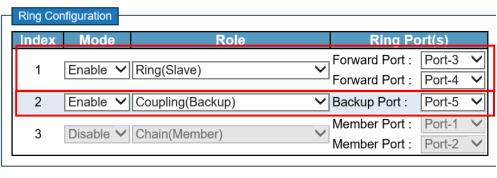
Coupling Primary

RingV2 Configuration

Ring Configuration

Index	Mode	Role	Ring Port(s)	
1	Enable	Ring(Slave)	Forward Port :	Port-3
			Forward Port :	Port-4
2	Enable	Coupling(Primary)	Primary Port :	Port-6
3	Disable	Chain(Member)	Member Port :	Port-1
			Member Port :	Port-2

[Save] [Reset]

1. Go to "Configuration→ "RingV2" Web page
2. Enable Index1, and Select Role as Ring(Slave)
3. Select two ports as "Forward Port".
4. Enable Index2, and Select Role as "Coupling(Primary)"
5. Select one port as a "Primary Port".
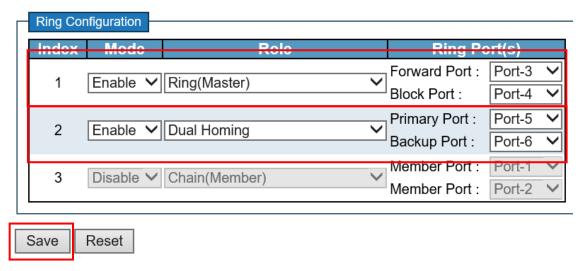
Coupling Backup

RingV2 Configuration

Ring Configuration

Index	Mode	Role	Ring Port(s)	
1	Enable	Ring(Slave)	Forward Port :	Port-3
			Forward Port :	Port-4
2	Enable	Coupling(Backup)	Backup Port :	Port-5
3	Disable	Chain(Member)	Member Port :	Port-1
			Member Port :	Port-2

[Save] [Reset]

1. Go to "Configuration→ "RingV2" Web page
2. Enable Index1, and Select Role as Ring(Slave)
3. Select two ports as a "Forward Port".
4. Enable Index2, and Select Role as "Coupling(Backup)"
5. Select one port as a "Backup Port".
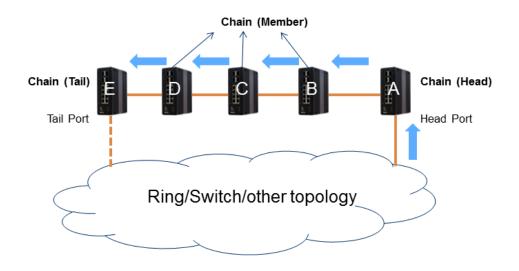
Dual-Homing

RingV2 Configuration

Ring Configuration

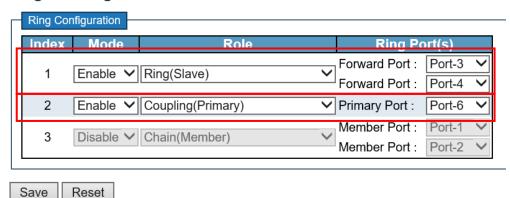| Index	Mode	Role	Ring Port(s)	
1	Enable ▼	Ring(Master) ▼	Forward Port :	Port-3 ▼
			Block Port :	Port-4 ▼
2	Enable ▼	Dual Homing ▼	Primary Port :	Port-5 ▼
			Backup Port :	Port-6 ▼
3	Disable ▼	Chain(Member) ▼	Member Port :	Port-1 ▼
			Member Port :	Port-2 ▼

[Save] [Reset]

1. Go to "Configuration→ "RingV2" Web page
2. Enable Index1, and Select Role as Ring(Slave)
3. Select two ports as a "Forward Port".
4. Enable Index2, and Select Role as "Dual Homing"
5. Select one port as a "Primary Port, and the other is "Backup Port".
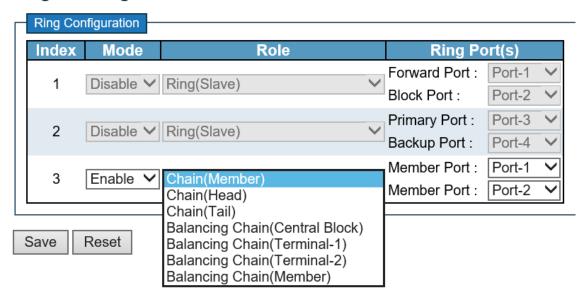
Chain Configuration

Chain - Member
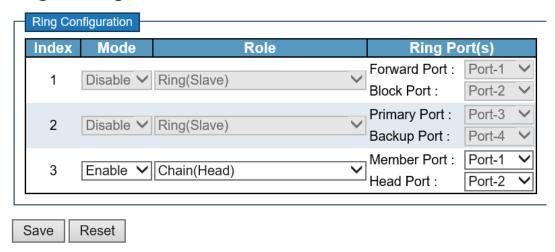
RingV2 Configuration

1. Go to "Configuration→ "RingV2" Web page
2. Disable Index1 and Index2, then enable Index3
3. Select Role to "Chain(Member)"
4. Select two member ports for this chain member switch.
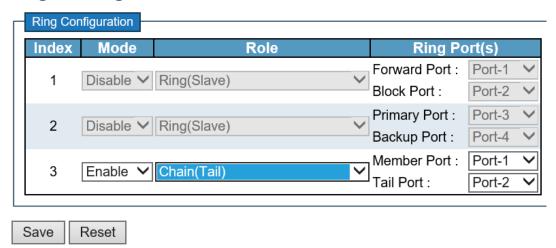
Chain - Head

RingV2 Configuration

Ring Configuration

Index	Mode	Role	Ring Port(s)	
1	Disable ∨	Ring(Slave) ∨	Forward Port :	Port-1 ∨
			Block Port :	Port-2 ∨
2	Disable ∨	Ring(Slave) ∨	Primary Port :	Port-3 ∨
			Backup Port :	Port-4 ∨
3	Enable ∨	Chain(Head) ∨	Member Port :	Port-1 ∨
			Head Port :	Port-2 ∨

Save   Reset

1. Go to "Configuration→ "RingV2" Web page
2. Disable Index1 and Index2, then enable Index3
3. Select Role to "Chain(Head)"
4. Select a member port and a head port for this chain head switch.

Chain - Tail

RingV2 Configuration

Ring Configuration

Index	Mode	Role	Ring Port(s)	
1	Disable ∨	Ring(Slave) ∨	Forward Port :	Port-1 ∨
			Block Port :	Port-2 ∨
2	Disable ∨	Ring(Slave) ∨	Primary Port :	Port-3 ∨
			Backup Port :	Port-4 ∨
3	Enable ∨	Chain(Tail) ∨	Member Port :	Port-1 ∨
			Tail Port :	Port-2 ∨

Save   Reset

1. Go to "Configuration→ "RingV2" Web page
2. Disable Index1 and Index2, then enable Index3
3. Select Role to "Chain(Tail)"
4. Select a member port and a tail port for this chain tail switch.
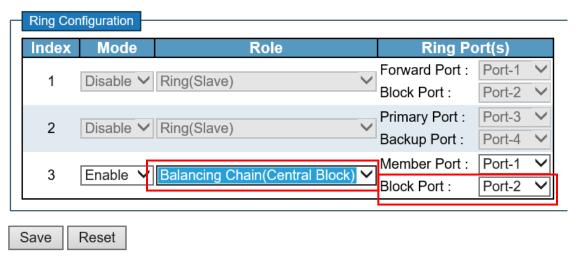
Balance Chain Configuration

## Balance Chain – Central Block

1. Go to "Configuration→ "RingV2" Web page
2. Disable Index1 and Index2, then enable Index3
3. Select Role to "Balancing Chain(Central Block)"
4. Select a member port and a block port for this central block switch.

Balance Chain –Terminal-1 and -2

RingV2 Configuration

Ring Configuration

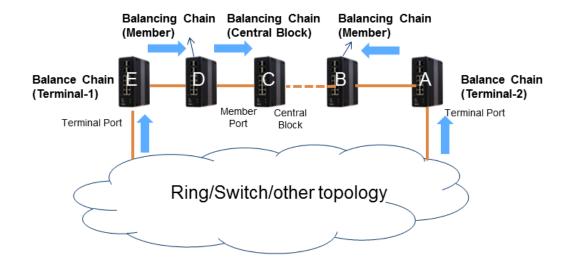| Index	Mode	Role	Ring Port(s)	
1	Disable ∨	Ring(Slave) ∨	Forward Port : Port-1 ∨	Forward Port : Port-2 ∨
2	Disable ∨	Ring(Slave) ∨	Forward Port : Port-3 ∨	Forward Port : Port-4 ∨
3	Enable ∨	Chain(Member) Chain(Head) Chain(Tail) Balancing Chain(Central Block) Balancing Chain(Terminal-1) Balancing Chain(Terminal-2) Balancing Chain(Member)	Member Port : Port-1 ∨	Member Port : Port-2 ∨

Save   Reset

1. Go to "Configuration→ "RingV2" Web page
2. Disable Index1 and Index2, then enable Index3
3. Select Role to "Balancing Chain(Terminal-1 or -2)"
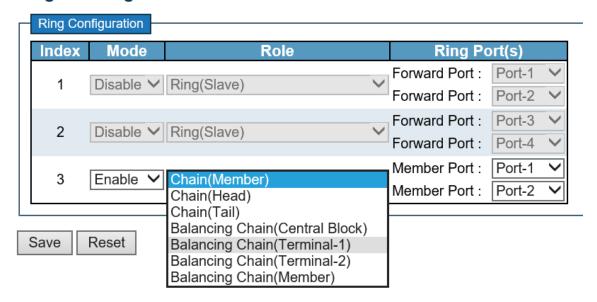4. Select a member port and a terminal port for this balancing chain terminal switch.

QoS Application Guide

Quality of Service (QoS) features allow you to allocate network resources to mission-critical applications at the expense of applications that are less sensitive to such factors as time delays or network congestion. You can configure your network to prioritize specific types of traffic, ensuring that each type receives the appropriate Quality of Service (QoS) level.

SP/SPWRR

The KGS can be configured to have 8 output Class of Service (CoS) queues (Q0~Q7) per port, into which each packet is placed. Q0 is the highest priority Queue. Each packet's 802.1p priority determines its CoS queue. User needs to bind VLAN priority/queue mapping profile to each port, for every VLAN priority need assign a traffic descriptor for it. The traffic descriptor defines the shape parameter on every VLAN priority for Ethernet interface. Currently KGS supports Strict Priority and SP+WRR(Weighted Round Robin) scheduling methods on each port. Please find the detail reference on user manual.

Default Priority and Queue mapping as below:

Priority0	Priority1	Priority2	Priority3	Priority4	Priority5	Priority6	Priority7
Queue0	Queue1	Queue2	Queue3	Queue4	Queue5	Queue6	Queue7
SPQ	SPQ	SPQ	SPQ	SPQ	SPQ	SPQ	SPQ

Application Examples

Following we provide several examples for various QoS combinations and you can configure QoS using the Web-based management system, CLI (Command Line Interface) or SNMP.
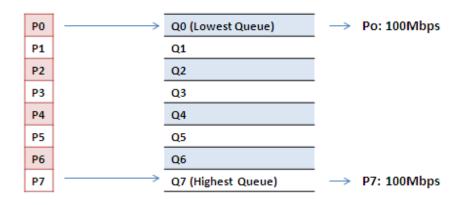
Example 1: SPQ without Shaping (Default profile)
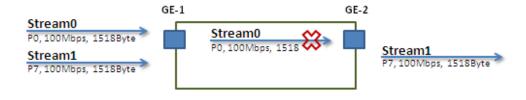
We send 2 Streams (Stream0, Stream1) from PORT-1 to PORT-2. Both 2 Streams each have 100Mbps. Stream0 includes VLAN Priority0, Stream1 includes VLAN Priority7. Set PORT-2 link speed to 100Mbps.

Expected Result:

We expect PORT-2 only can receive 100Mbps of Stream1, and Stream0 will be discarded. This case will help user to know how SPQ works on the switch.

Gigabit port VLAN Priority & Queue mapping:

- **Stream0 :**
  Dst Mac : 00:00:00:00:20:01
  Src Mac : 00:00:00:00:10:01
  Vlan : 100
  Vlan prio : 0
  Send rate : 100Mbps
  Packet length: 1518bytes

- **Stream1**:
  Dst Mac : 00:00:00:00:20:02
  Src Mac : 00:00:00:00:10:02
  Vlan : 100
  Vlan prio : 7
  Send rate : 100Mbps
  Packet length: 1518bytes

Web management:

Step1. Go to Configuration -> Ports -> set port 2 link speed to 100Mbps full duplex.

Step2. Select Configuration -> VLANs ->Create a VLAN with VLAN ID 100. Enter a VLAN name in the **Name** field. Here we set tagged VLAN100 on PORT-1 and PORT-2.

Global VLAN Configuration

Allowed Access VLANs	1,100
Ethertype for Custom S-ports	88A8

Port VLAN Configuration

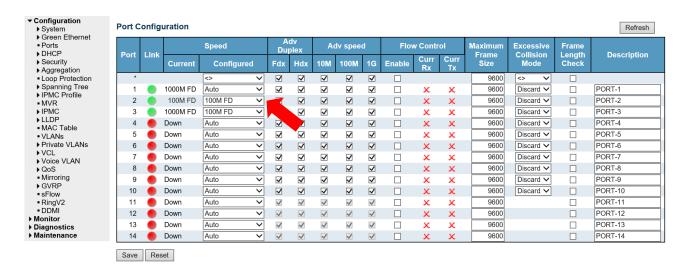| Port	Mode	Port VLAN	Port Type	Ingress Filtering	Ingress Acceptance	Egress Tagging	Allowed VLANs	Forbidden VLANs
*	<>	1	<>	☑	<>	<>	1	
1	Trunk	100	C-Port	☑	Tagged Only	Tag All	1,100	
2	Trunk	100	C-Port	☑	Tagged Only	Tag All	1,100	
3	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
4	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
5	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
6	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
7	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
8	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
9	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
10	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
11	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
12	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
13	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
14	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	

Save Reset

ML510Dx
Advanced Managed Industrial Ethernet Switch, 14 Ports

CLI configuration command:

```
interface GigabitEthernet 1/1
  switchport trunk native vlan 100
  switchport trunk allowed vlan 1,100
  switchport trunk vlan tag native
  switchport mode trunk
!
interface GigabitEthernet 1/2
  switchport trunk native vlan 100
  switchport trunk allowed vlan 1,100
  switchport trunk vlan tag native
  switchport mode trunk
```

ML510Dx
Advanced Managed Industrial
Ethernet Switch, 14 Ports

WesternSystems

Actelis
N e t w o r k s™
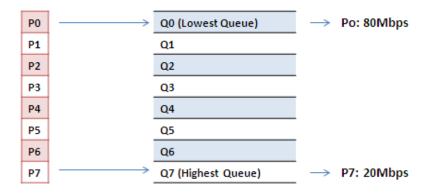
Example 2: SPQ with Shaping

We send 2 Streams (Stream0, Stream1) from port1 to port-2. Both 2 Streams each have 100Mbps. Stream0 includes VLAN Priority0, Stream1 includes VLAN Priority7. Stream3 and Stream4 only for learning which make sure the traffic are not flooding.

Expected Result:

We expect PORT-2 only can receive 20Mbps of Stream1, and 80Mbps of Stream0. This case will help user to know how SPQ works on the SWITCH.

VDSL port VLAN Priority & Queue mapping:

- **Stream0 :**
  Dst Mac : 00:00:00:00:20:01
  Src Mac : 00:00:00:00:10:01
  Vlan : 100
  Vlan prio : 0
  Send rate : 100Mbps
  Packet length: 1518bytes

- **Stream1**:
  Dst Mac : 00:00:00:00:20:02
  Src Mac : 00:00:00:00:10:02
  Vlan : 100
  Vlan prio : 7
  Send rate : 100Mbps
  Packet length: 1518bytes

- **Stream3 : (for Learning)**
  Dst Mac : 00:00:00:00:10:01
  Src Mac : 00:00:00:00:20:01
  Vlan : 100
  Vlan prio : 0
  Send rate : 10Mbps
  Packet length: 1518bytes

- **Stream4 : (for Learning)**
  Dst Mac : 00:00:00:00:10:02
  Src Mac : 00:00:00:00:20:02
  Vlan : 100
  Vlan prio : 0
  Send rate : 10Mbps
  Packet length: 1518bytes

Web management:

Step1. Go to Configuration -> Qos→ Port Shaping, to create a Qos profile on Port-2.

▼ Configuration
  ▶ System
  ▶ Green Ethernet
  ▪ Ports
  ▶ DHCP
  ▶ Security
  ▶ Aggregation
  ▪ Loop Protection
  ▶ Spanning Tree
  ▶ IPMC Profile
  ▪ MVR
  ▶ IPMC
  ▶ LLDP
  ▪ MAC Table
  ▪ VLANs
  ▶ Private VLANs
  ▶ VCL
  ▶ Voice VLAN
  ▼ QoS
    ▪ Port Classification
    ▪ Port Policing
    ▪ Queue Policing
    ▪ Port Scheduler
    ▪ Port Shaping
    ▪ Port Tag Remarkin
    ▪ Port DSCP
    ▪ DSCP-Based QoS
    ▪ DSCP Translation
    ▪ DSCP Classificatio
    ▪ QoS Control List
    ▪ Storm Policing
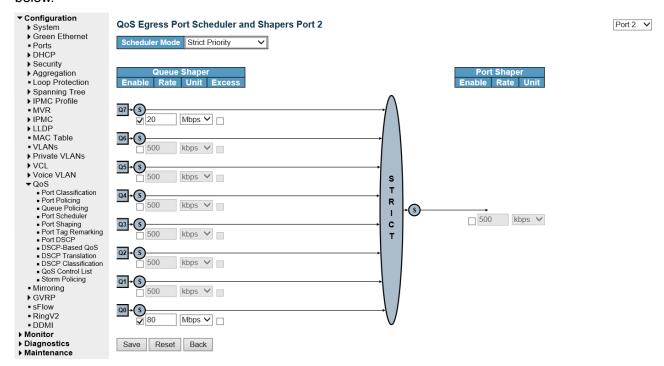
QoS Egress Port Shapers

Port	Shapers								
	Q0	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Port
1	-	-	-	-	-	-	-	-	-
2	80 Mbps	-	-	-	-	-	-	20 Mbps	-
3	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-

Step2. Select schedule mode be ""Strict Priority" and set shaping rate for queue 0 and queue 7 as below.

CLI configuration command:
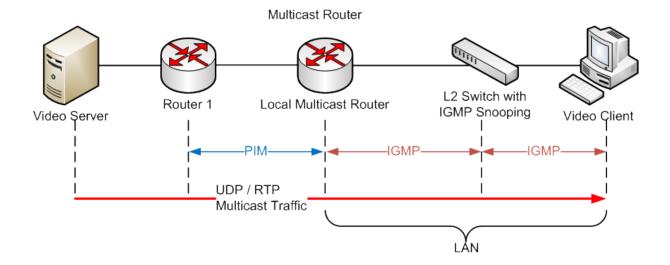
```
interface GigabitEthernet 1/2
  switchport trunk native vlan 100
  switchport trunk allowed vlan 1,100
  switchport trunk vlan tag native
  switchport mode trunk
  qos queue-shaper queue 0 80000
  qos queue-shaper queue 7 20000
```

IGMP Application Guide

IGMP is an acronym for **I**nternet **G**roup **M**anagement **P**rotocol. It is a communications protocol used to manage the membership of Internet Protocol multicast groups. IGMP is used by IP hosts and adjacent multicast routers to establish multicast group memberships. It is an integral part of the IP multicast specification, like ICMP for unicast connections. IGMP can be used for online video and gaming, and allows more efficient use of resources when supporting these uses.
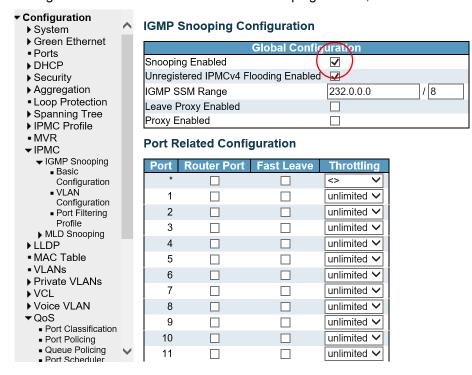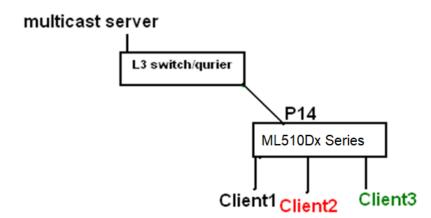
Example 1:

If administrator every client could get multicast stream, just go to "Configuration➔IPMC➔Basic Configuration" to select the check box of "Snooping Enable", then success.

Configuration
- System
- Green Ethernet
- Ports
- DHCP
- Security
- Aggregation
- Loop Protection
- Spanning Tree
- IPMC Profile
- MVR
- IPMC
  - IGMP Snooping
    - Basic Configuration
    - VLAN Configuration
    - Port Filtering Profile
  - MLD Snooping
- LLDP
- MAC Table
- VLANs
- Private VLANs
- VCL
- Voice VLAN
- QoS
  - Port Classification
  - Port Policing
  - Queue Policing
  - Port Scheduler

IGMP Snooping Configuration

Global Configuration	
Snooping Enabled	☑
Unregistered IPMCv4 Flooding Enabled	☑
IGMP SSM Range	232.0.0.0 / 8
Leave Proxy Enabled	☐
Proxy Enabled	☐

Port Related Configuration

Port	Router Port	Fast Leave	Throttling
*	☐	☐	<>
1	☐	☐	unlimited
2	☐	☐	unlimited
3	☐	☐	unlimited
4	☐	☐	unlimited
5	☐	☐	unlimited
6	☐	☐	unlimited
7	☐	☐	unlimited
8	☐	☐	unlimited
9	☐	☐	unlimited
10	☐	☐	unlimited
11	☐	☐	unlimited

Example 2:

(1) Go to "Configuration➔IPMC➔Basic Configuration" to select the check box of "Snooping Enable"
(2) Un-select the check box of "Unregistered IPMCv4 Flooding Enabled"
(3) If Multicast stream is from L3 switch, then the uplink port have to be "Router Port"
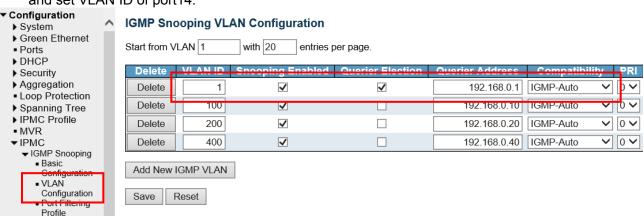
Notice: If an aggregation member port is selected as a router port, the whole aggregation will act as a router port.
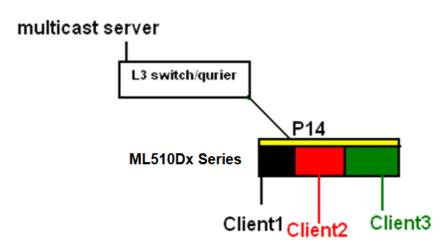
(4) Go to "Configuration→IPMC→VLAN Configuration" to select the check box of "Snooping Enable" and set VLAN ID of port14.

Example 3:

In this scenario, these clients belong to multiple VLANs, you have to create more one VLAN to be the agent for all client VLANs.
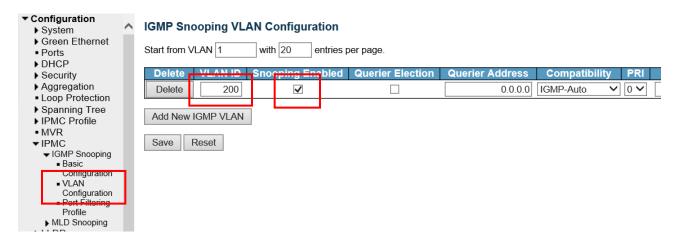
(1) To create a VLAN: go to "Configuration→VLANs→Allow Access VLANs", then set port 14 be vlan200 member port.

Global VLAN Configuration

Allowed Access VLANs	1,100,200,300,400
Ethertype for Custom S-ports	88A8

Port VLAN Configuration

| Port	Mode	Port VLAN	Port Type	Ingress Filtering	Ingress Acceptance	Egress Tagging	Allowed VLANs	Forbidden VLANs
*	<>	1	<>	☑	<>	<>	1	
1	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
2	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
3	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
4	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
5	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
6	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
7	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
8	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
9	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
10	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
11	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
12	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
13	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	
14	Access	1	C-Port	☑	Tagged and Untagged	Untag All	1	

Save   Reset

(2) Go to "Configuration→IPMC→VLAN Configuration" to select the check box of "Snooping Enable" and set VLAN ID of port14.

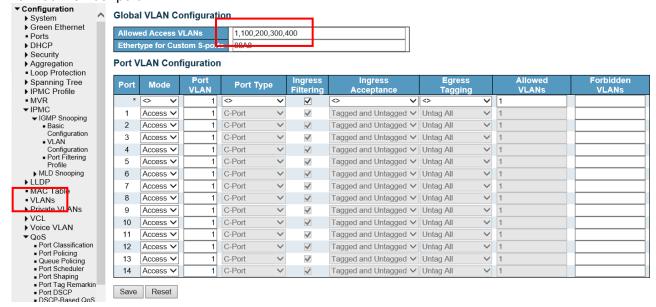(3) If there is no querier on the L3 switch, you have to select "Querier Election", and set the "Querier Address ", the IP address is in the same network as uplink interface.
(4) Select the IGMP version as server.
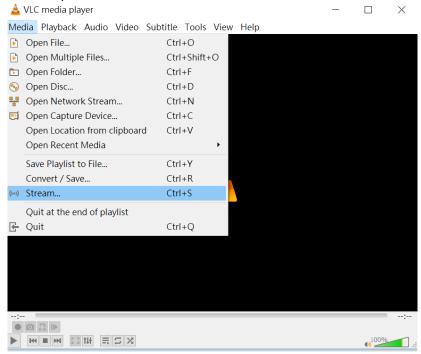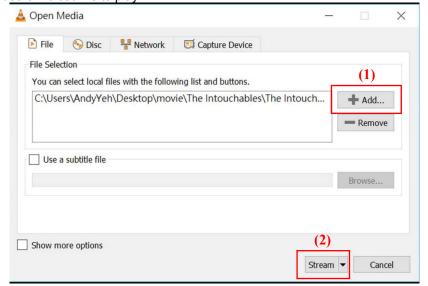
How to Configuration VLC

VLC Configure on IGMP Server

(1) In «Media» area of top tool bar to select "Stream"
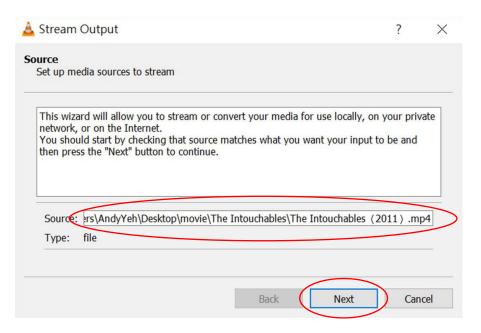
(2) Select a video or voiced file to play
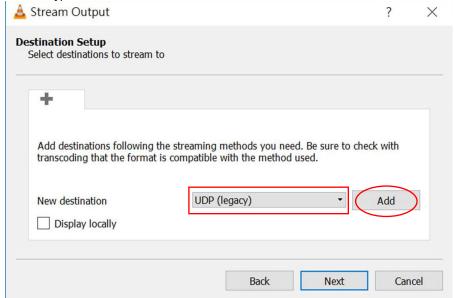
(3) Confirm the file is right, then click "Next" twice.

(4) Select stream type as "UDP" and click "Add" button.
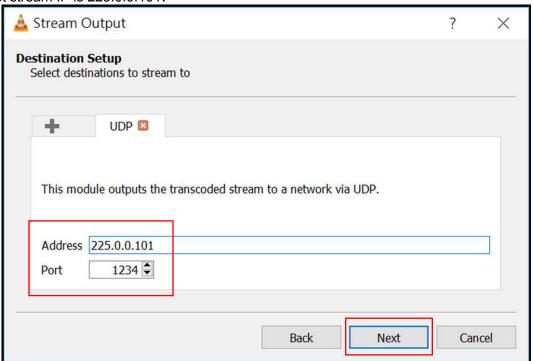
(5) Set stream IP, the range is 224.0.0.1 to 239.255.255.254, and protocol port is 1234.

ML510Dx

Advanced Managed Industrial
Ethernet Switch, 14 Ports

Western Systems
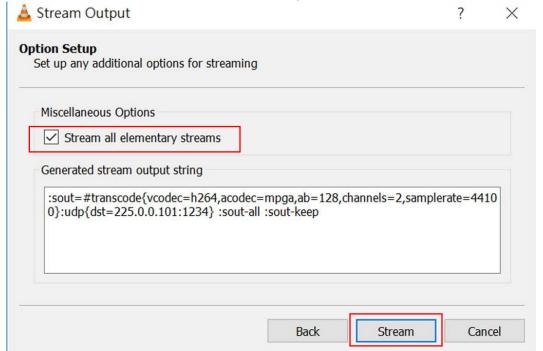
Actelis
N E T W O R K S™

Here I set stream IP is 225.0.0.101.

(6) Select "Sort out all stream" and click "Stream" button, then the stream start to send to switch.
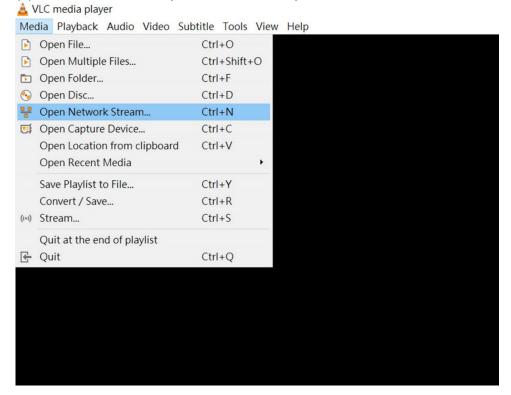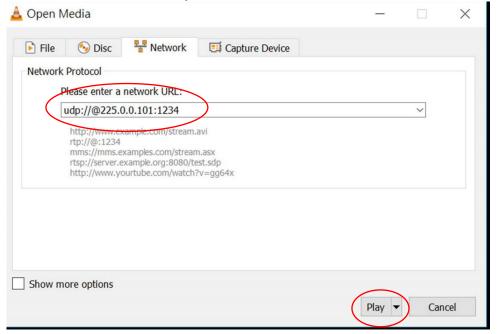
VLC Configure on IGMP Client

(1) In «Media » area of top tool bar to select open network stream

(2) Set the stream IP and protocol port as previous setting on server, the protocol type is "UDP", the format should as below circle, then click "PLAY" button.

Western Systems

Actelis
N e t w o r k s™
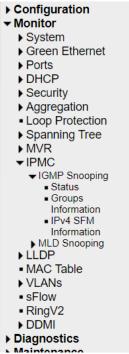
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Ethernet Switch, 14 Ports

Back to management switch,

Go to "Monitor→ IPMC→ Groups Information", you will see the stream IP in the table.

Configuration
Monitor
▸ System
▸ Green Ethernet
▸ Ports
▸ DHCP
▸ Security
▸ Aggregation
▪ Loop Protection
▸ Spanning Tree
▸ MVR
▾ IPMC
  ▾ IGMP Snooping
    ▪ Status
    ▪ Groups Information
    ▪ IPv4 SFM Information
  ▸ MLD Snooping
▸ LLDP
▪ MAC Table
▸ VLANs
▪ sFlow
▪ RingV2
▸ DDMI
Diagnostics
Maintenance

IGMP Snooping Group Information

Start from VLAN `1` and group address `224.0.0.0` with `20` entries per page.

VLAN ID	Groups	Port Members													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	225.0.0.101	✓														

802.1x Authentication Application Guide

Introduction of 802.1x authentication function

IEEE 802.1x derives keys which can be used to provide per-packet authentication, integrity and confidentially. Typically use along with well-known key derivation algorithms (e.g. TLS, SRP, MD5-Challenge, etc.). In our industrial switch, we support 802.1x authentication function per port (port1~port10). You should enable 802.1x function of the system, and choose ports and type you want to apply. If the switch enable 802.1x authentication control for certain Ethernet port, this port should be authenticated before using any service from the network. Please see the following description.

802.1x Timer in the switch

Item	Parameter (sec)	Description
1	ReAuth Period	The switch will restart authentication after each Reauth-Period when authentication success and ReAuth option is enabled
2	Quiet Period	The switch will wait QuietPeriod to restart authentication process again when authentication failed in previous time.
3	Tx Period	The switch will send EAP-request to Supplicant every TxPeriod when authentication is running and Quiet Period is not running.
4	Supplicant Timeout	The switch will wait SupplicantTmeout to receive response from Supplicant.
5	Server Timeout	The switch will wait ServerTimeout to receive response from RADIUS server.

Configuration in RADIUS Server

Step 1: Prepare a Linux PC with RADIUS server installed.
Step 2: Edit secret key for Radius server.
> **Setting:**

```
client 20.20.20.0/24 {
        secret = a1b2c3d4
}
```
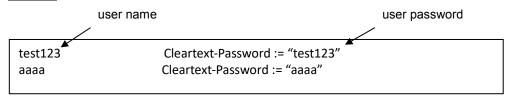
The secret in the switch should be the same with this one.

Step 3: Edit user name and password for supplicant to authenticate with server.

Setting:

user name   user password

```
test123                 Cleartext-Password := "test123"
aaaa                    Cleartext-Password := "aaaa"
```

Step 4: Set a static IP address for this Radius Server.

Setting: 20.20.20.20
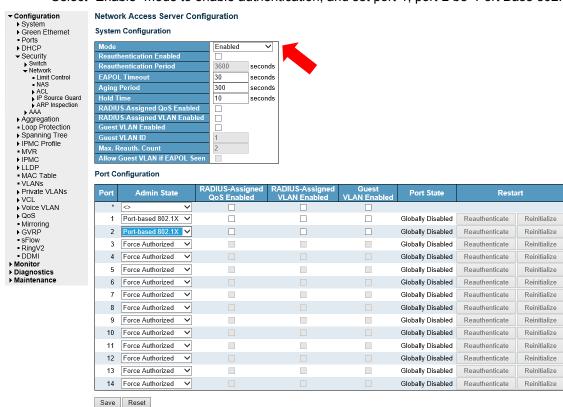
Step 5: Start Radius Server

Example

Here we take an example of 802.1x Authentication via the switch to be authenticated by RADIUS server. In a basic example, we take port 1 as a testing port which enables 802.1x in the switch.

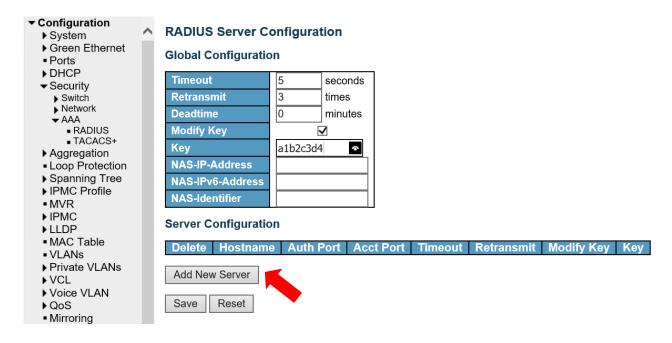With default configuration, use the following Web UI setting .

Step1. Go to Configuration -> Security -> Networks -> NAS.
Select "Enable" mode to enable authentication, and set port-1, port-2 be "Port Base 802.1x".

Network Access Server Configuration

System Configuration

Mode	Enabled
Reauthentication Enabled	☐
Reauthentication Period	3600 seconds
EAPOL Timeout	30 seconds
Aging Period	300 seconds
Hold Time	10 seconds
RADIUS-Assigned QoS Enabled	☐
RADIUS-Assigned VLAN Enabled	☐
Guest VLAN Enabled	☐
Guest VLAN ID	1
Max. Reauth. Count	2
Allow Guest VLAN if EAPOL Seen	☐

Port Configuration

Port	Admin State	RADIUS-Assigned QoS Enabled	RADIUS-Assigned VLAN Enabled	Guest VLAN Enabled	Port State	Restart	
*	<>	☐	☐	☐			
1	Port-based 802.1X	☐	☐	☐	Globally Disabled	Reauthenticate	Reinitialize
2	Port-based 802.1X	☐	☐	☐	Globally Disabled	Reauthenticate	Reinitialize
3	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate	Reinitialize
4	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate	Reinitialize
5	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate	Reinitialize
6	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate	Reinitialize
7	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate	Reinitialize
8	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate	Reinitialize
9	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate	Reinitialize
10	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate	Reinitialize
11	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate	Reinitialize
12	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate	Reinitialize
13	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate	Reinitialize
14	Force Authorized	☐	☐	☐	Globally Disabled	Reauthenticate	Reinitialize

Save Reset

Configuration
- System
- Green Ethernet
- Ports
- DHCP
- Security
  - Switch
  - Network
    - Limit Control
    - NAS
    - ACL
    - IP Source Guard
    - ARP Inspection
  - AAA
- Aggregation
- Loop Protection
- Spanning Tree
- IPMC Profile
- MVR
- IPMC
- LLDP
- MAC Table
- VLANs
- Private VLANs
- VCL
- Voice VLAN
- QoS
- Mirroring
- GVRP
- sFlow
- RingV2
- DDMI
- Monitor
- Diagnostics
- Maintenance

Step1. Go to Configuration -> Security -> AAA -> Radius.
Click "Add New Server", Input "20.20.20.20" for server, and "a1b2c3d4" for secret key.
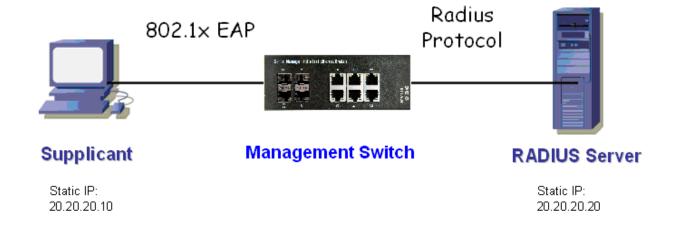Then click "Save" button.

▼ Configuration
- ▸ System
- ▸ Green Ethernet
- ▪ Ports
- ▸ DHCP
- ▼ Security
  - ▸ Switch
  - ▸ Network
  - ▼ AAA
    - ▪ RADIUS
    - ▪ TACACS+
- ▸ Aggregation
- ▪ Loop Protection
- ▸ Spanning Tree
- ▸ IPMC Profile
- ▪ MVR
- ▸ IPMC
- ▸ LLDP
- ▪ MAC Table
- ▪ VLANs
- ▸ Private VLANs
- ▸ VCL
- ▸ Voice VLAN
- ▸ QoS
- ▪ Mirroring

RADIUS Server Configuration

Global Configuration

Timeout	5	seconds
Retransmit	3	times
Deadtime	0	minutes
Modify Key	☑	
Key	a1b2c3d4 👁	
NAS-IP-Address		
NAS-IPv6-Address		
NAS-Identifier		

Server Configuration

Delete	Hostname	Auth Port	Acct Port	Timeout	Retransmit	Modify Key	Key

Add New Server

Save   Reset

CLI Command:

```
Configure ter
interface vlan 1
ip address 20.20.20.120 255.0.0.0
exit
exit
radius-server host 20.20.20.20 timeout 5 retransmit 3 key a1b2c3d4
dot1x re-authentication
dot1x system-auth-control
interface GigabitEthernet 1/1
dot1x port-control auto
```

ML510Dx
Advanced Managed Industrial Ethernet Switch, 14 Ports

Configuration

Supplicant's NIC Setting

Step 1: Configure a static IP address 20.20.20.10 and net mask 255.255.255.0 for supplicant.

(If there is a DHCP server to assign IP address for supplicant, this step can be ignored.)

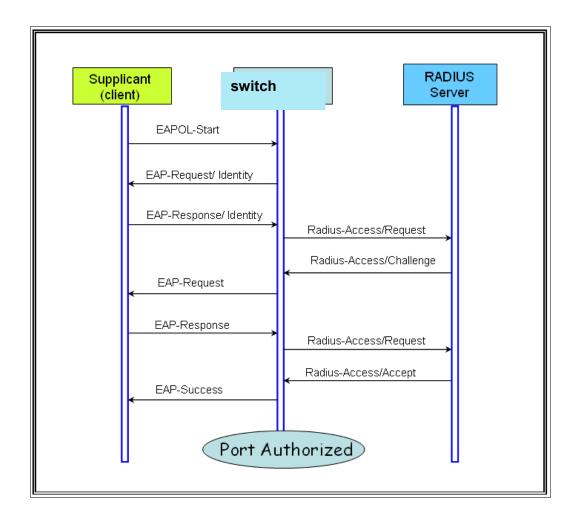Step 2: Select the IEEE802.1x Authentication Enable check box, then to configure EAP type to MD5-Challenge.

After setting this function in NIC, supplicant should enter a correct pair of account and password in order to use this Ethernet port service from the switch.

Authentication Behavior

Supplicant should pass authentication process in order to use any service. After supplicant enters correct account and password which stored in RADIUS server, it can be authenticated successfully. The authentication process is as following.

Power over Ethernet (PoE) Application Guide (for PoE managed models only)

The PoE series switches support PoE function for connected powered device. The operation mode contains 802.3af (15.4W), 802.3at (30W), and 802.3at with 4 pair used (60W). 60 watt only can be applied for port 1 and 2. Each port has 5 classes for selection, class 0~4. And, total power budget of the system is up to 240 watt.

For power management friendly use, it supports power scheduler for each PoE port. Each time interval is 30 minutes from Sunday to Saturday. Customer can select which interval to set PoE on or PoE off. It also supports PoE reset function to power off, then power on the PoE function on a port at certain time. Maximum five time can be created in a week.

Reserved Power Determination

Power Over Ethernet Configuration

Reserved Power determined by	◉ Class	○ Allocation	○ LLDP-MED
Power Management Mode	○ Actual Consumption	◉ Reserved Power	

There are three modes for configuring how the ports/PDs may reserve power.

1. Class mode:
In this mode each port automatically determines how much power to reserve according to the class the connected PD belongs to, and reserves the power accordingly. Five different port classes exist and one for 4, 7, 15.4 or 30 Watts.

2. Allocated mode:
In this mode the user allocates the amount of power that each port may reserve.
The allocated/reserved power for each port/PD is specified in the Maximum Power fields.

3. LLDP-MED mode:
This mode is similar to the Class mode expect that each port determine the amount power it reserves by exchanging PoE information using the LLDP protocol and reserves power accordingly. If no LLDP information is available for a port, the port will reserve power using the class mode

Note:
For all modes: If a port uses more power than the reserved power for the port, the port is shut down.

Power Management Mode

Power Over Ethernet Configuration

Reserved Power determined by	⦿ Class	○ Allocation	○ LLDP-MED
Power Management Mode	○ Actual Consumption	⦿ Reserved Power	

There are 2 modes for configuring when to shut down the ports:

1. **Actual Consumption:**
   In this mode the ports are shut down when the actual power consumption for all ports exceeds the amount of power that the power supply can deliver or if the actual power consumption for a given port exceeds the reserved power for that port. The ports are shut down according to the ports priority. If two ports have the same priority the port with the highest port number is shut down.

   Port Priority: Critical > High > Low.
   When priorities are the same, low number of the port has higher priority.

2. **Reserved Power:**
   In this mode the ports are shut down when total reserved powered exceeds the amount of power that the power supply can deliver. In this mode the port power is not turned on if the PD requests more power than available from the power supply.

Other Setting Parameter

PoE Power Supply Configuration

Primary Power Supply [W]
240

PoE Port Configuration

Port	Mode	Operation	4Pairs	Priority	Maximum Power [W]
*	<>	<>	<>	<>	15.4
1	Disable	802.3af	Disable	Low	15.4
2	Disable	802.3af	Disable	Low	15.4
3	Disable	802.3af	Disable	Low	15.4
4	Disable	802.3af	Disable	Low	15.4
5	Disable	802.3af	Disable	Low	15.4
6	Disable	802.3af	Disable	Low	15.4
7	Disable	802.3af	Disable	Low	15.4
8	Disable	802.3af	Disable	Low	15.4

1. **PoE Power Supply**
   For being able to determine the amount of power the PD may use, it must be defined what amount of power a power source can deliver. Valid values are in the range 0 to 240 Watts.

2. **PoE Mode**
   The PoE Mode represents the PoE operating mode for the port.
   Disable : PoE disabled for the port.
   Enable : Enables PoE for the port.
   Schedule : Enables PoE for the port by scheduling.

3. **Operation Mode**
   The Operation Mode represents the PoE power operating protocol for the port.
   802.3af : Sets PoE protocol to IEEE 802.3af.
   802.3at : Sets PoE protocol to IEEE 802.3at.

4. **4 Pair**
   The 4Pairs represents the 60W power supply for the port.
   The option is only available when following rules are applied.
   - High power switch model supports.
   - Only port1 or port2 supports.
   - Current operation mode is 802.3at.
   Enable : Enable 4Pairs to support 60W.
   Disable : Disable 4Pairs to limit 30W of power.

5. **PoE Priority**
   The Priority represents the ports priority. There are three levels of power priority named Low, High and Critical.
   The priority is used in the case where the remote devices require more power than the power supply can deliver. In this case the port with the lowest priority will be turn off starting from the port with the highest port number.

6. **Maximum Power**
   The Maximum Power value contains a numerical value that indicates the maximum power in watts that can be delivered to a remote device.
   For port support 4Pairs mode, the maximum allowed value is 60 W; others are 30 W.
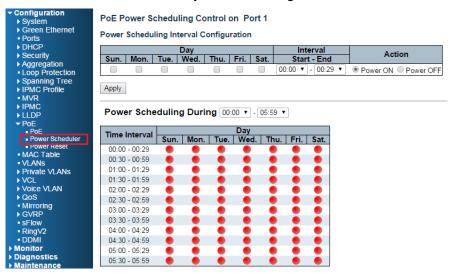
PoE Power Scheduling & Reset

The power scheduling is used to control the power alive interval on PoE port. It is allowed to set the specific interval to schedule power on/off in one week.

The current scheduling state is displayed graphically during the week. Green indicates the power is on and red that it is off. Directly changes checkmarks to indicate which day are members of the time interval. Check or uncheck as needed to modify the scheduling table.

1. **Day**
   Checkmarks indicate which day are members of the set. From Sunday to Saturday.
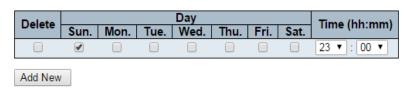
2. **Interval**
   Start - Select the start hour and minute. End - Select the end hour and minute.
   There are 48 time interval one day. Each interval has 30 minutes.

3. **Action**
   Power On - Select the radio button to apply power on during the interval.
   Power Off - Select the radio button to apply power off during the interval.

4. **PoE Power Reset**
   The entry is used to control the power reset time on PoE port.
   It is allowed to create at maximum 5 entries for each PoE port.

Example 1

1. **Parameter Setting:**
   Reserved Power determined: Class
   Power Management Mode: Actual Consumption
   Primary Power Supply: 6W

2. **Test Port**
   Port 1: 802.3at with critical priority
   Port 2: 802.3af with high priority
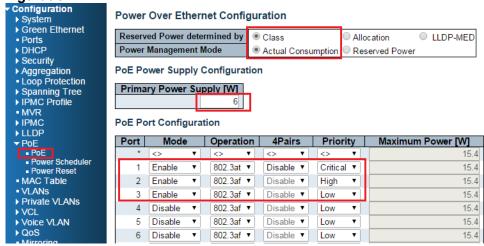   Port 3: 802.3af with low priority

3. **PD Power Consumption**
   Port 1: 1.3 watt (PoE Splitter)
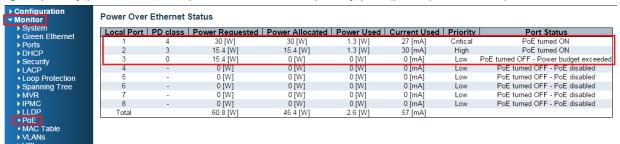   Port 2: 1.3 watt (PoE VoIP Phone)
   Port 3: 3.8 watt (PoE WiFi AP)

4. **Web Configuration**

Power Over Ethernet Configuration

Reserved Power determined by	● Class	○ Allocation	○ LLDP-MED
Power Management Mode	● Actual Consumption	○ Reserved Power	

PoE Power Supply Configuration

Primary Power Supply [W]
6

PoE Port Configuration

Port	Mode	Operation	4Pairs	Priority	Maximum Power [W]
*	<>	<>	<>	<>	15.4
1	Enable	802.3at	Disable	Critical	15.4
2	Enable	802.3af	Disable	High	15.4
3	Enable	802.3af	Disable	Low	15.4
4	Disable	802.3af	Disable	Low	15.4
5	Disable	802.3af	Disable	Low	15.4
6	Disable	802.3af	Disable	Low	15.4

5. **Test Result**
   PoE port status can be monitored by Web: Monitor→PoE
   In the following table, it can be seen if system budget is not enough for all PoE device, port with higher priority port will be feed power first. The last priority port (port 3) will not be powered.

Power Over Ethernet Status

Local Port	PD class	Power Requested	Power Allocated	Power Used	Current Used	Priority	Port Status
1	4	30 [W]	30 [W]	1.3 [W]	27 [mA]	Critical	PoE turned ON
2	3	15.4 [W]	15.4 [W]	1.3 [W]	30 [mA]	High	PoE turned ON
3	0	15.4 [W]	0 [W]	0 [W]	0 [mA]	Low	PoE turned OFF - Power budget exceeded
4	-	0 [W]	0 [W]	0 [W]	0 [mA]	Low	PoE turned OFF - PoE disabled
5	-	0 [W]	0 [W]	0 [W]	0 [mA]	Low	PoE turned OFF - PoE disabled
6	-	0 [W]	0 [W]	0 [W]	0 [mA]	Low	PoE turned OFF - PoE disabled
7	-	0 [W]	0 [W]	0 [W]	0 [mA]	Low	PoE turned OFF - PoE disabled
8	-	0 [W]	0 [W]	0 [W]	0 [mA]	Low	PoE turned OFF - PoE disabled
Total		60.8 [W]	45.4 [W]	2.6 [W]	57 [mA]		

Example 2

1. **Parameter Setting:**
   Reserved Power determined: Allocation
   Power Management Mode: Reserved Power
   Primary Power Supply: 138 W   (> all port reserved power)

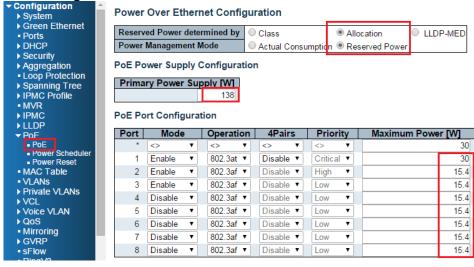2. **Port Maximum Power**
   Port 1: 30 W
   Port 2~ Port8: 15.4 W
   Total: 137.8 W

3. **PD Power Consumption**
   Port 1: 1.3 watt (PoE Splitter)   Port 2: 1.3 watt (PoE VoIP Phone)
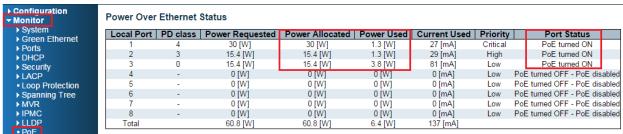   Port 3: 3.8 watt (PoE WiFi AP)

4. **Web Configuration**

5. **Test Result**
   PoE port status can be monitored by Web: Monitor→PoE
   Since power has reserved for each port in advance, each powered device can use power budget of its corresponding port without exceed its maximum power.

Ubiquia
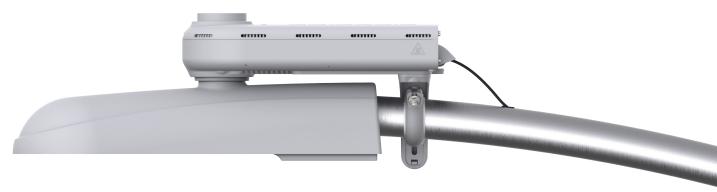
Intelligent Infrastructure That's Easy to Deploy and Monitor

Western Systems

ubicquia®

UBIHUB AP6
Industry's First Streetlight WiFi 6 Access Point

Accelerating the deployment of high-speed public WiFi for cities of all sizes, UbiHub WiFi provides multiple backhaul options and cloud-based management, making cities smarter, safer and more connected.

Unique Features

- New Qualcomm WiFi 6 tri-band chipset
- Up to 6Gbps bandwidth for clients
- Fastest wireless network performance w/ 4x throughput of existing solutions
- Integrated smart streetlight controller
- Ethernet, Fiber and DOCSIS backhaul options
- Plug & Play, installs in minutes

Advanced Light Control, Monitoring & Metering

Public WiFi

Sensors & Applications

Compatible with 360M+ Streetlights Worldwide

UBIHUB AP6
Industry's First Streetlight WiFi 6 Access Point

Integrates seamlessly with existing streetlight infrastructure

WiFi 6 Access Point
• Efficiently manage up to 1024 client connections
• Tri-band (2x5GHz, 1x2.4GHz) 4x4 MU-MIMO
• 12 integrated omni-directional antennas

Mesh Network
• Mesh up to 4 units per ISP connection
• Dynamic load balancing of mesh network
• Dedicated 5GHz radio for max mesh bandwidth

Cloud Management
• OTA updates and maintenance releases
• UbiVu platform used to manage and visualize assets
• Advanced WiFi and lighting controls
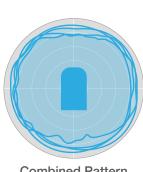
Simplified Installation
• Powered through the readily available NEMA socket
• Install assist app
• Less than 15-minute installation time

Unique Antenna Design

UbiHub's 12 integrated antennas allow the maximum coverage possible from a WiFi and mesh offering standpoint. These antennas reduce the effect of RF interference on every device that is connected to the access point. Their high performance dual-band and omnidirectional transmission ensures real-time capability to support high device density settings.
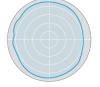
Combined Pattern

5.0 GHz Azimuth   5.0 GHz Elevation

2.4 GHz Azimuth   2.4 GHz Elevation

Cloud Managed Platform

UbiVu

The UbiHub WiFi access points are managed by UbiVu which sits in the cloud. UbiVu is the one-stop-shop integrated dashboard to manage and visualize all Ubicquia products.

UbiVu Offers

• OTA firmware updates
• Reports and configuration set-up
• Remote troubleshooting
• User access management
• Overall map of deployment with hierarchical device view
• Alert setting functionality
• Overview of key performance metrics and status

Node Activator App

• Scan the device label for fast installation in minutes
• Connects to UbiVu and registers the device
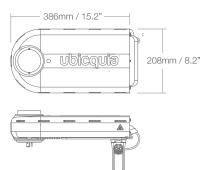• On-site confirmation of basic UbiHub functionalities to limit visits to the pole

The Node Activator App is available from the Google Play Store on any tablet or cellphone to streamline device installation.

Low profile form factor for improved wind performance and low street visibility

386mm / 15.2"

208mm / 8.2"

70mm / 2.75"

UBICELL
Smart Street Lighting Control

Smart Street Lighting Controls that Deliver Significant Savings

Advanced Light Control, Monitoring & Metering

Sensors & Applications

The Ubicquia UbiCell smart lighting solution brings real-time control and visibility to your street light assets. Its remote sensing and communication technology alerts you immediately to lighting problems such as a day burners, outages, or ballast failures.

The UbiCell also offers advanced control capabilities. Users can group lights by location, set custom on/off schedules, and create dimming profiles that extend the life of LED fixtures.

This valuable insight enables cities and utilities to reduce the cost of managing and operating streetlights by up to 40%, while providing customers with unparalleled service.

DEPLOYMENT AS EASY AS ONE, TWO, THREE

The UbiCell is purposefully designed for ease of deployment. It connects directly to a standard NEMA socket and is compatible with over 360 million streetlights worldwide including LED, HID and HPS luminaires.

The node is self-commissioning and communicates over LTE cellular to UbiVu®, our cloud-based software asset management platform. There is no need to build a separate network. The UbiCell leverages existing mobile infrastructure that is proven to be reliable and secure.

Within minutes, you get location and health metrics for all your lighting assets.

By combining the UbiCell lighting control node, a hardened LTE communication network, and the UbiVu platform, cities and utilities get complete visibility and control across the service territory.

With the UbiCell smart street lighting solution you receive:

• Energy and O&M savings
• 360° asset management
• Intuitive cloud management platform
• Simple and fast deployment more efficient

Start your journey to a and robust street lighting system with UbiCell.

UBICELL
Smart Street Lighting Control

Western Systems

ubicquia®

Tangible Benefits for Cities and Utilities

$

Energy and O&M Savings
- 20-40% reduction in energy costs
- Identify day burners and dim lights during off-peak hours
- Extend the life of LED fixtures by up to 30% through intelligent dimming
- Eliminate unnecessary truck rolls with real-time fault and outage alerts

360°

360° Asset Management
- Detailed fixture and pole information
- GIS integration with accurate GPS location information
- Real-time tilt, knock-down and power quality status
- Revenue-grade metrology for accurate billing

Intuitive Cloud Management
- Top-down view of streetlight assets with filtering capabilities
- Organize assets by group for mass control
- Unlimited number of on/off/dimming schedules and threshold alerts
- Detailed reporting and analytics

Simple and Fast Deployment
- Installs in seconds and data in minutes
- Compatible with 360 million streetlights
- Immediate node visibility via cellular connectivity
- Foundation of the Smart City: easily add air quality monitors, cameras and other sensors

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Smart Street Lighting Control

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ubicquia

Use Cases That Go Beyond Illumination

Improve Customer Satisfaction

With a real-time view of lighting assets, cities and utilities now can proactively address most lighting problems before a customer calls.

Active Street Light Control

Operators get complete control over their streetlight assets and can remotely set dimming levels, create customized on/off schedules, develop analytical reports and more.

Optimize Asset Management

Get a top-down visualization of your deployed lighting assets and actively monitor the fixture and pole health including tilt, vibration, and po\wer quality status.

Remote Grid Monitoring

Grid operators can use streetlight monitoring and control to identify momentary outages, see voltage sag/swells and initiate a demand response event.

Build a Solid Smart City Foundation

Communities are leveraging smart lighting networks to support other intelligent devices—bringing a strategic approach to smart city initiatives.
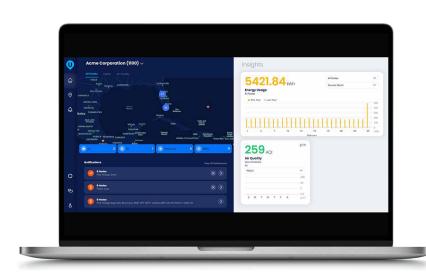
Positive Environmental Impact

Reduce your carbon footprint and make the world a better place by extending the life of streetlights, lowering energy consumption, and eliminating truck rolls.

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Smart Street Lighting Control

FLEXIBLE & INTUITIVE DATA MANAGEMENT

The UbiVu cloud-based management system, allows cities and utilities to provision, manage, and operate a variety of smart devices through a single pane of glass platform. APIs are also available, allowing this rich data to integrate into other software platforms.

With UbiVu, you receive:

- Over-the-air firmware updates
- Customizable reports and configurations
- Remote troubleshooting
- User access management
- Deployment map with hierarchical device view
- Alert and thresholds settings
- Key performance metrics

Reporting capabilities are constantly being evaluated and updated to solve our customer's needs. Receive reports on:

- All node details
- Power usage
- Alert notifications
- Active alerts report
- Schedule updates & transactions
- Light state
- Device burn hours
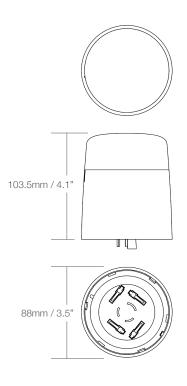- Momentary outage report
- Thresholds
- Audit reports

UBICELL
Smart Street Lighting Control

SPECIFICATIONS

103.5mm / 4.1"

88mm / 3.5"

SPECIFICATIONS

Dimensions	103.5mm x 88mm
Weight	375g
Color/Housing	Multiple colors
Housing Material	UV stabilized, outdoor rated and flame resistant polymer
Enclosure Sealing	IP66
Operating Temperature Range	-40C to +70C
Voltage Range	120-480 V
Surge Rating	20 kV/10 kA Type C
Average Power Consumption	1 W Typical
Impact Rating	IK08
Security	AES 128/256-bit encryption, Trust M security
Lamp On/Off	Photocell control, automated and astronomical scheduling w/adjustable offsets
Dimming Control	Auto select: 0-10V, DALI, DALI2
WARRANTY	5-Year Warranty Optional 10-Year

COMMUNICATIONS

Modem	Cat 1 LTE
Reporting Frequency	Programmable
Network Protocol	IPV4 and IPV6 compliant
External Sensor Interface	Pins 6 & 7 using DALI/DALI2

POWER METERING

Metering Accuracy	+/- 0.5%, optical infrared pulse verification
Load Switching	10A
Line Voltage	90V to 506V (50/60Hz)
Power	Active power with PF
Energy Consumption	kWh

ANALYTICS

Data	Storage and query of metering data
History and Reporting	Event log, details and time stamp. Available daily/weekly/monthly
Life Cycle Tracking	Cycle count, burn hours

CERTIFICATIONS & COMPLIANCES

Metrology	ANSI C136.5-C12.20
Safety	UL773*
FCC	Part 15, Subpart B, Class B

FEATURE HIGHLIGHTS

- Public or private LTE
- Data transfer speeds up to 100MB/s*
- OTA firmware upgrades
- Voltage sag/swell detection
- Impact & tilt detection (0 to 90° with 1° resolution and knock down alarm)
- Triac assisted relay
- Circuit switch prediction
- Power loss detection w/last gasp notification

UBISMART AQM+
Advanced Air Quality and Noise Monitor

Western Systems

ubicquia ®

Air quality and noise monitor sensor is designed for integration with existing utility infrastructure and Ubicquia's advanced streetlight controller platform. UbiSmart AQM+ measures, monitors and analyzes local data to track environmental trends in your city.

Keep your city's health in check, with UbiSmart Air Quality Monitoring+ that simply installs and seamlessly integrates with your existing infrastructure.

High Accuracy Sensors
- Temperature (T)
- Pressure (P)
- Humidity (RH)
- Ozone (O3)
- Nitrogen Dioxide (NO2)
- Sulfur Dioxide (SO2)
- Carbon Monoxide (CO)
- PPM (PM1, PM2.5, PM10)
- Noise Level (dB)

Unique Features
- Tracks including temperature and humidity
- Data and power delivered via DALI-2

Sensors & Applications

Key Features

Single screw attachment for quick mounting

High accuracy microphone for capturing street level noise

Sealed Connector

Housing designed in high performance UV resistant plastic for durability in harsh environments

Openings for mounting with screws or banding

Protected Intake and Exhaust for proper air flow

ubicquia

UP

UBISMART AQM+
Advanced Air Quality and Noise Monitor

Make your city smarter, safer and more connected

Operations & Maintenance
- Real-time Air Quality Index
- Auto calibration
- Weather resistant enclosure
- Zero cost maintenance
- Low cost SaaS

Simplified Installation
- Simple 4 step pole install process
- Installs in minutes
- Auto-provisions on power-up
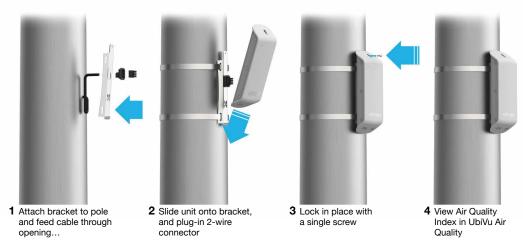- Fits on ANY pole
- Easy to replace
- Out-of-reach on pole

Sensor Data
- DALI-2 power and data
- Data access via UbiVu or API
- Data easily shared with 3rd parties
- Installs in less than 15 mins

Advanced Design
- Sleek and unobtrusive design
- Rugged tamper resistant case
- Reduced water ingress
- IP44 rating

Simple plug and play installation

1 Attach bracket to pole and feed cable through opening…

2 Slide unit onto bracket, and plug-in 2-wire connector

3 Lock in place with a single screw

4 View Air Quality Index in UbiVu Air Quality

Note: Ubicell device must be installed with UbiSmart AQM+

Backup & Power Solutions

Enhance Control, Monitoring, and Coordination. Get in touch with us to Strengthen Your Traffic Infrastructure

HyMax

Green. Reliable. Safe. Days of backup power for intersections

HyMax™
BY WESTERN SYSTEMS

HyMax Fuel Cell Technology

Backup Power for Critical Intersections

Why Fuel Cell Power?

Long-Lasting Backup Power for Critical Intersections

- Fuel Cells can provide days to weeks of continuous runtime for evacuation routes, critical intersections/interchanges, and remote locations.

- Fuel Cells can provide unlimited runtime in an outage. As long as hydrogen is available, the fuel cell will continue to make DC power.

Green Power Generator

- Fuel Cells produce DC power with no combustion. It is a chemical reaction between hydrogen gas and oxygen in the presence of a catalyst. The only by-product is warm/moist air.

- Fuel Cells are certified as zero-emissions power generators by The California Air Resources Board.

Fuel Cells Vs. Batteries & Generators

- Fuel Cells provide days versus hours of runtime.

- Extreme weather temperatures can greatly reduce battery life and capacity.

- Generators are big, noisy, and produce harmful emissions.

- Frequent refueling is needed to keep the portable generators running.

Contact Western Systems to Learn More

- 425.438.1133
- Info@westernsystems-inc.com
- www.westernsystems-inc.com

HyMax™
BY WESTERN SYSTEMS

Are your Intersections Ready for a Power Outage?

A dark intersection can be a real challenge. Not only does it impede traffic flow, but it also creates significant safety concerns for drivers and pedestrians. For most agencies, it's not a question of if an intersection is going to go dark but when. Whether it's from rolling blackouts, the aging U.S. grid, wildfires, wind, snow, or other factors, it's important to prepare for outages with reliable and clean backup power.

Keep Intersections Safe with Reliable Backup Power

HyMax fuell cell technology is built to the highest standards, delivering reliable, clean and cost-effective backup power solutions. It has been proven over a wide spread of global deployments across multiple sectors and in all types of climates.

Front Closed   Front Opened   Side Closed

Fuel Cell

332S
Fuel Storage

Optional
BBS Cabinet

The HyMax Advantage

Extended Run Time
Designed to power intersections for 5 days and beyond.

Easy Maintenance
Re-fill in place, no inventory, preventive maintenance simplified.

Small Footprint
The cabinet has a smaller physical footprint than traditional fuel cells or other backup power solutions.

Green Energy Source
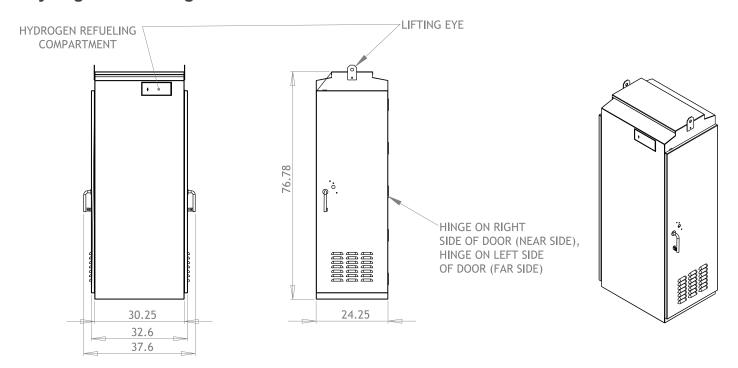Fuel cells are certified by the California Air Resources Board as zero-emission power generators.

Quiet Operation
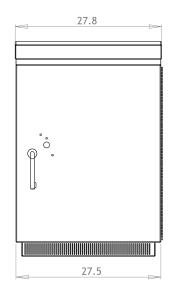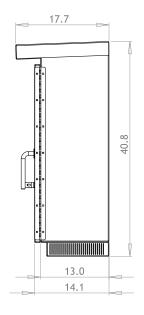With no moving parts, there's no hum or noise from the fuel cell cabinet.

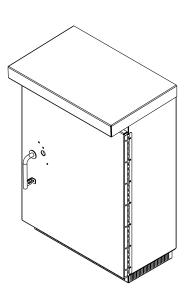# Dimensional Drawings for Caltrans 332S Fuel Storage Cabinet and NEMA Fuel Cell Enclosure

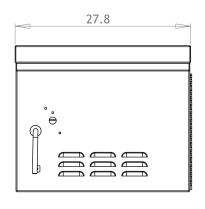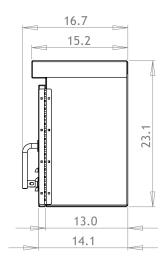## 332 Hydrogen Fuel Storage Cabinet

HYDROGEN REFUELING COMPARTMENT

LIFTING EYE

76.78

HINGE ON RIGHT SIDE OF DOOR (NEAR SIDE), HINGE ON LEFT SIDE OF DOOR (FAR SIDE)

30.25
32.6
37.6

24.25

NEMA Fuel Cell Enclosure

27.8

17.7

40.8

27.5

13.0
14.1
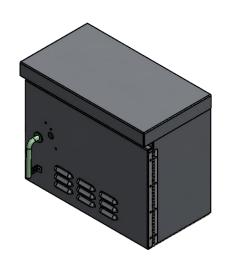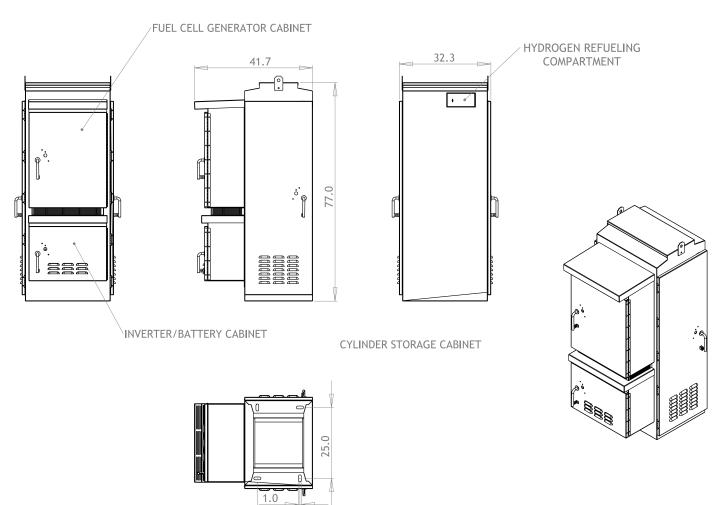
UPS/BBS Enclosure (Optional)

27.8

16.7
15.2
23.1
13.0
14.1

FUEL CELL GENERATOR CABINET

41.7

77.0

32.3

HYDROGEN REFUELING COMPARTMENT

INVERTER/BATTERY CABINET

CYLINDER STORAGE CABINET

25.0

1.0

15.0

HyMax™
BY WESTERN SYSTEMS

1.1KW FUEL CELL WITH CALTRANS 332S FUEL STORAGE CABINET

- Ideal for critical traffic signal intersections and ITS loads up to 1100 W
- Small footprint with industry first vertical mounted fuel cell chassis
- Days to weeks of runtime at an affordable price
- Quiet and clean, green power with zero emissions
- Seamlessly integrates with existing site BBS
- NEMA enclosures for fuel cell and BBS

Front Closed   Front Opened   Side Closed

Fuel Cell

Optional BBS Cabinet

332S Fuel Storage

Dimensions (w x d x h)	24" W x 30" D x 77" H
Overall Dimensions	37" W x 30" D x 77" H
Weight (fuel cell chassis)	63 lbs. / 28.57 kg
Rated net power	1,100 watts
Rated current	46A @24 VDC / 23A @ 48VDC
DC voltage	24 or 48 VDC nominal
Fuel composition	Standard industrial grade hydrogen (99.95%)
Supply pressure to unit	10 psig / 69 KPag / 0.69 bar
Fuel consumption	13.4 slpm @ 1,000 watts
Hydrogen storage capacity	54 kWh (modular storage solutions available from 8kWh to 300kWh)
Ambient temperature	-40°F to 122°F / -40°C to 50°C
Relative humidity	0 to 95% non-condensing
Altitude	-197 ft to 13,800 ft / -60m to 4,206m
Location	Outdoors
Safety compliance	CSA (excludes fuel wing*), NEBS
Water emissions	Max. 25mL / kWh
Noise	65 dBA @ 4.92 ft /1.5m when ducted outside
Remote monitoring/control	System configuration & status / historical & operational data
Communications	Standard: USB / dry contact / Ethernet / SNMP / web interface
	Optional: Wireless modem – CDMA / GSM / Ethernet switch / front panel display

*hydrogen fuel is not within the purview of CSA

More:
Cabinets, Signs, Bracket, Poles, Mounts

Signal & Hardware Equipment

SIGNS

Enhance safety and efficiency on the roads with our innovative Signal and Hardware Equipment.

Explore more

TRAFFIC SIGNAL HARDWARE

Our Signal and Hardware Equipment is reliable, rugged and exceeds prescribed specifications.

Explore more

CABINETS

Our partners are industry leaders who specialize in design, engineering and manufacturing of durable and reliable products. These partners share our values and commitment to providing superior material and service.

Explore more

Embrace innovation for a better tomorrow!

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