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Smart Roadway Lighting
Smart City Connected Infrastructure

Solutions Guide

Summer 2024

www.tondo-iot.com

Smart Lighting Controls

Edge IQ: Fixture & Pole-Based Lighting and Sensor Control   Pages 7-10

Roadway lighting is the natural home for the Smart City network. Tondo's Edge IQ Smart Lighting controller is a fully-integrated lighting control, sensor controller, Bluetooth Mesh® outdoor area network controller, and cellular communications gateway. Edge IQ connects to Tondo's Cloud IQ management platform to form a city-wide wireless platform for Smart City enablement.

Cabinet Management

Cabinet IQ: Cabinet Management   Pages 11-16

Tondo's Cabinet IQ is a cabinet-installed electricity service quality analyzer, group lighting controller, billing-grade electricity meter, and analog/relay/digital control system. Cabinet IQ transforms legacy lighting in existing control cabinets into Smart City-enabled platforms for lighting, energy management, and digital/analog data acqusition and control use-cases.

Smart IQ Solutions

Smart IQ: Sensor, Camera, and Metering Solutions   Pages 17-20

Tondo's Smart IQ is a Smart City sensor platform that provides a range of out-of-the box and custom sensor solutions for a variety of use-cases. These include standards-based adaptive lighting control, and continuous monitoring for roadway conditions, environmental and weather applications, traffic flow, video, air and water quality, and monitoring of critical infrastructure health.

Cloud Management

Cloud IQ: Unified Smart City Management   Pages 21-22

Tondo's Cloud IQ provides a "single pane of glass" for controlling and monitoring the health and operations of all connected Smart City assets and data. Cloud IQ's Deep Learning AI supports analytics and automation for all controls and system data to simplify the complexity of managing Smart City devices and data.

Competitive Comparison

Tondo Competitive Comparison   Page 23-24

Compare Tondo's solutions with those of other Smart Lighting and Smart City solutions on the market today. See the Tondo difference in simplicity, cybersecurity, performance, scalability, flexibility, and investment protection.

Tondo Services

Tondo Services   Page 25

Tondo provides services for project management, custom solutions for our customers' Smart City use-cases, and customized analytics and reporting design. Tondo works with a variety of partners that include lighting systems integrators, design-build, lighting services, consulting firms, and lighting design consultancies.

Products and Services

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Price List

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Specification Guide

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About Tondo

About Tondo

The Tondo team boasts over 50 years of collective experience in the smart lighting and smart city domains, with deep expertise in integrating advanced technologies into urban infrastructure. Our background encompasses hardware and software engineering, project management, and systems integration, and building high-performance organizations.

Contact Tondo

Contact Tondo

Contact information for Tondo and our locations.

Driving Value for Roadway Lighting Design

For effective roadway lighting design, the mission is clear: to deliver safer, standards-compliant lighting that meets design specifications while maximizing operational efficiency.

In today's landscape, the bar has been raised—modern smart lighting systems must go beyond basic compliance to drive significant operational savings and support broader smart city initiatives.

Tondo Smart offers a comprehensive solution that not only meets these requirements but also sets a new standard for what is possible in roadway and area lighting. Together, we are stronger.

Driving Value: Safer, Standards-Compliant Lighting

Safety and Compliance: Tondo's solutions are engineered to ensure that your lighting designs fully comply with critical safety standards such as ANSI/IES RP-8, AASHTO, and FHWA. As you know, these standards are the backbone of safe, reliable roadway and area lighting, dictating everything from luminance levels to uniformity and visibility.

Tondo's Edge IQ and Cabinet IQ controllers are designed to simplify the management of lighting to these stringent guidelines, giving you confidence that your designs will be fully realized in real-world lighting operations.

Driving Value: Design Compliance

Beyond regulatory standards, Tondo's solutions allow for precise control and automation over lighting levels, ensuring that your designs are executed for your clients precisely as you direct. Whether you're addressing national, or specific municipal or state guidelines, Tondo's advanced control systems provide the flexibility and accuracy needed to achieve design compliance across a variety of projects.

Driving Value: Driving Operational Savings

Proven Energy Savings: Tondo's solutions have demonstrated significant energy savings through features like Adaptive Roadway Lighting and precise dimming controls. Tondo's integration of AI-driven analytics ensures that energy use is optimized in real-time, maximizing savings.

Reduced Maintenance Costs: By automating routine management tasks and providing real-time monitoring, Tondo's systems reduce the need for manual interventions and lower long-term maintenance costs.

Efficiency and Automation: Tondo's integration of AI-driven controls not only enhances energy efficiency but also streamlines the management of complex lighting environments. AI-automation of routine tasks, such as dimming and scheduling, reduces the need for manual intervention, allowing for more efficient use of resources and further operational savings.

Article: [Municipal Energy Savings and Smart City Enablement](#)
Article: [Smart Lighting Costs and Benefits](#)

Driving Value: A Platform for Smart City Enablement

Versatile Smart City Platform: Tondo's Smart Lighting solutions go beyond basic lighting control. They serve as an enablement platform for a wide array of smart city applications, including sensors, meters, cameras, and other control use-cases.

This versatility allows you to design lighting systems that not only enhance safety and efficiency but also support broader smart city objectives, from traffic management and environmental monitoring to public safety and infrastructure resilience.

Scalability and Integration: Tondo's solutions are fully scalable, making them suitable for projects of any size, from small municipal installations to large-scale state transportation networks. Furthermore, they are designed to integrate seamlessly with existing smart city infrastructures, ensuring that your designs can evolve and expand alongside future urban developments.

Driving Value: Operational Efficiency

Deep Learning AI: Unlike many competitors, Tondo's Cloud IQ platform leverages deep learning AI to deliver Adaptive Roadway Lighting. This advanced technology allows for real-time adjustments in lighting based on environmental and traffic data, ensuring that lighting is always optimized for safety and efficiency. Competitors often rely on more basic automation or preset schedules, which can lead to inefficiencies or missed opportunities for energy savings.

Integrated System Management: Tondo's solutions offer seamless integration between Edge IQ, Cabinet IQ, and Sensor IQ, all managed through Cloud IQ. This holistic approach contrasts with competitors who may offer fragmented systems that require separate management platforms, leading to potential inefficiencies and increased operational complexity.

Tailored Solutions: Tondo's ability to customize lighting profiles for different road types, traffic volumes, and environmental conditions provides a level of flexibility that many competitors cannot match. This customization ensures that each project is optimized for its specific needs.

Scalable for All Project Sizes: Whether for small municipal projects or expansive state-wide initiatives, Tondo's solutions are designed to scale seamlessly. Current solutions often face challenges in scaling without sacrificing performance or constraining use-cases to lighting-only solutions.

Ease of Use: Tondo provides a fully-managed technology platform, enabling its solutions to keep the "technology" behind the scenes so city and transportation authority operations teams, or lighting maintenance contractors can focus on actionable information. Installing Tondo's Smart Lighting controls cannot be simpler: Tondo provides automatic provisioning so that installation is fast, reliable, and secure.

Article: Simplifying Smart Lighting Installation: A Closer Look at Tondo's Edge IQ Controller

Driving Value: Smart City Enablement

Enablement Platform: Tondo's smart lighting solutions act as a foundation for a broad range of smart city applications, from environmental sensors to public safety enhancements. Tondo's ability to serve as a versatile platform sets it apart from other smart lighting solutions, making it a long-term value driver for cities looking to connect their smart city infrastructure.

Connecting Critical Infrastructure

Tondo's Smart Lighting solutions are not just about lighting—they form the backbone of a comprehensive smart city platform.

Here are a few key use cases that demonstrate how Tondo's solutions enable smart city applications:

Use Case: Electricity Quality Analytics and Metering with Smart Lighting

Tondo's Smart Lighting and Cabinet IQ controllers were deployed at Piraeus Port, Greece's largest port, to manage street lighting and utility consumption. The system automated the monitoring of electricity and water usage, replaced manual measurements with automated processes, and provided real-time data for operational efficiency.

Impact: The port saw significant improvements in energy efficiency and operational savings, underscoring Tondo's role in enabling smarter, more efficient industrial operations within a smart city context.

Article: Use Case: Managing Energy Quality, Fault Detection, and Consumption

Use Case: Driver Safety, Flash-Flood Detection and Early Warning

In partnership with the Israeli Ministry of Transportation, Tondo deployed flood warning sensors in a critical area prone to flooding, one that had earlier caused the deaths of two vehicle passengers. These sensors, integrated with Tondo's Cloud IQ platform, provide real-time data on precipitation and flood risks, enabling authorities to issue timely warnings and take preventative action, such as closing roads or deploying emergency services.

Impact: This system has enhanced public safety by reducing the risk of flood-related accidents on roadways, showcasing how Tondo's platform provides for critical infrastructure monitoring.

Article: Use Case: Driver Safety, Flash-Flood Detection, and Early Warning

Use Case: Cable and Electricity Theft Detection

Tondo's smart lighting controllers, combined with specialized sensors and AI analytics, were used to detect and prevent both cable and electricity theft along Israel's extensive roadway network. The system monitors for unusual patterns in energy consumption and alerts authorities when a potential theft is detected, triggering flashing lights to deter thieves and sending real-time alerts to security teams.

Impact: This implementation has saved Netivei Israel hundreds of thousands of dollars in lost infrastructure and electricity, while also improving response times to theft incidents, demonstrating Tondo's capability in enhancing public safety and protecting valuable infrastructure.

Article: Streetlight Wire Theft Detection
Article: Municipal Electricity Theft Detection

Conclusion

As a roadway and area lighting expert, your work is crucial in creating safer, more efficient urban environments.

Tondo's Smart Lighting solutions empower you to deliver on this promise, providing the tools and technologies necessary to design lighting systems that are not only compliant with standards but also drive significant operational savings.

Moreover, Tondo's solutions serve as a foundation for a wide range of smart city applications, enabling you to future-proof your designs and contribute to the broader vision of connected, intelligent cities.

Tondo Solution Overview

This section describes the key elements of Tondo's Streetlight Control and Smart City Infrastructure solutions that are hosted by Tondo's Edge IQ Controls and Cloud IQ CMS.

1 **Edge IQ** is the heart of the City's streetlighting controls solution, a controller plugging into standard sockets on each fixture, or installing inside poles or fixtures.

Edge IQ contains the world's most advanced lighting control technologies that include dual auto-sensing 0-10V and DALI-2 lighting control, DALI/D4i sensor control.

Each Edge IQ controller also contains an embedded 1mbps or optional 5mbps/10mbps LTE cellular cloud gateway that eliminates the need for external gateways that increase the complexity of installation and reduces points of failure.

Edge IQ supports dual LTE network support with automatic fail-over in the event of communications loss. Edge IQ uses the latest extended-range Bluetooth® 5.3 Mesh communications for energy-efficient wireless sensor connectivity and automatic data routing when LTE cellular signals are impaired.
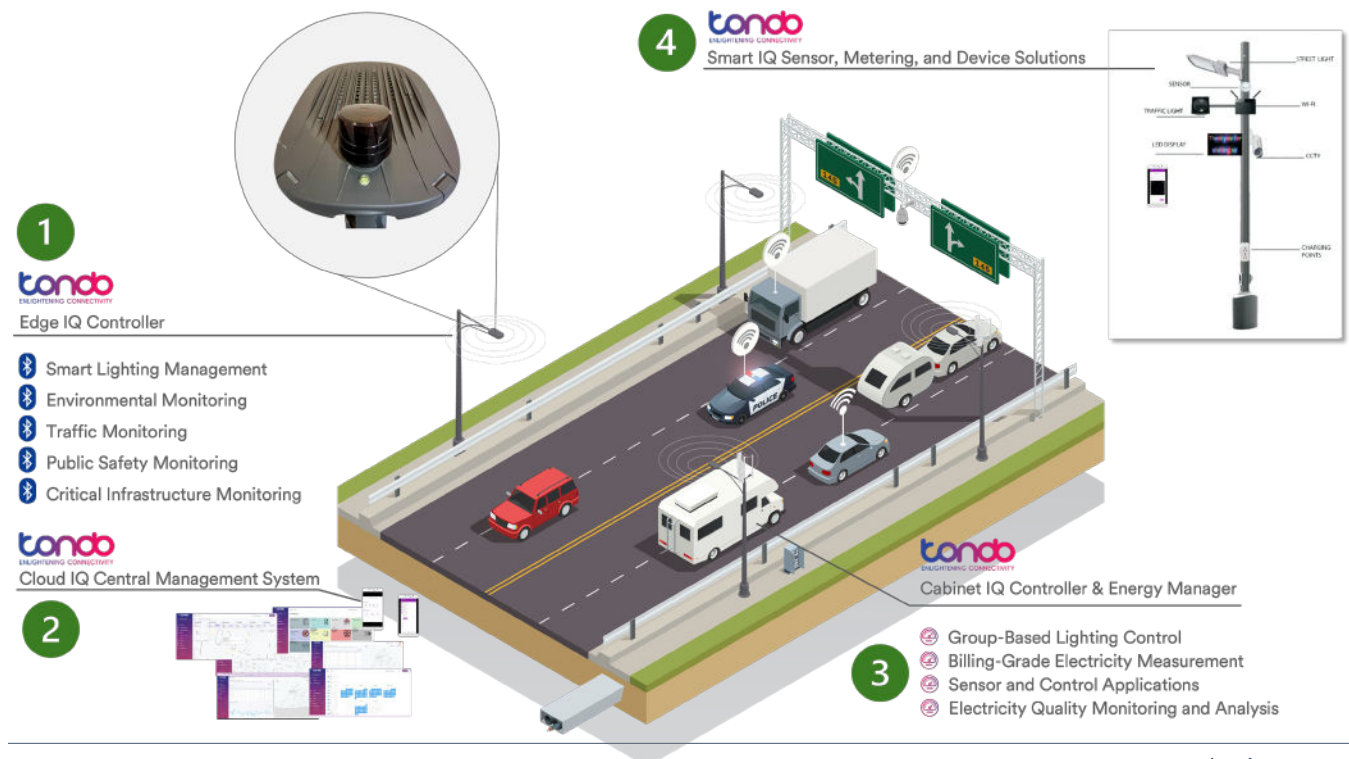
Edge IQ contains the world's most advanced transient surge protection compliant beyond ANSI 136.2 Category C with a 2400VA rated load to reduce controller failure rates in the field.

2 **Cloud IQ** is a high-security, modern, highly-scalable, Smart City decision and control platform. Cloud IQ includes a data-agnostic "data-lake" for consolidating all Streetlight Control and any other connected critical infrastructure data, a Deep Learning AI, and real-time scalable data processing design that will grow with the City..

Cloud IQ's Deep Learning AI manages the avalanche of Smart City data collected by the city, identifies anomalies that would otherwise go unnoticed, and provides cities with alerts and actionable insights that improve their operational effectiveness. Tondo's AI "manages the technology" so city teams can focus on their operational excellence.

3 Tondo's **Cabinet IQ** energy management and lighting control system is Tondo's "Swiss Army Knife" for advanced electricity analytics and electrical service diagnostics from the utility service point to the streetlight fixture. Cabinet IQ also includes revenue-grade electricity metering, and support for digital, analog, and relay control for connecting city infrastructure where wireless connections may not be practical.

4 Tondo's **Smart IQ** solutions are hosted by Edge IQ and Cabinet IQ controllers, and enable a wide range of Smart City solutions to affordably connect City critical infrastructure, and provide the City with cost-effective solutions to monitor infrastructure health in real-time.

4 Smart IQ Sensor, Metering, and Device Solutions

1 Edge IQ Controller

- Smart Lighting Management
- Environmental Monitoring
- Traffic Monitoring
- Public Safety Monitoring
- Critical Infrastructure Monitoring

Cloud IQ Central Management System

2

Cabinet IQ Controller & Energy Manager

3
- Group-Based Lighting Control
- Billing-Grade Electricity Measurement
- Sensor and Control Applications
- Electricity Quality Monitoring and Analysis

Edge IQ Controller

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Simplicity Works

Smart City enablement begins with a Smart Lighting-enabled wireless network.

Tondo's Edge IQ Smart Lighting controllers automate and remote lighting control for on-fixture and on-pole roadway and area lighting. Each Edge IQ forms a cybersecure, private Bluetooth Mesh® network for Smart City sensor and smart metering applications, with a built-in cellular connection back to Tondo's Cloud IQ central management system.

The Edge IQ can control an unlimited array of LED lighting drivers. Dimming is supported via 0V-10V and DALI™ lighting control protocols to deliver consistent, standards-based lighting that saves as much as 55% or more on your total lighting operating costs.

Edge IQ Features and Benefits

Standards-Based Lighting and Sensor Control

Edge IQ controllers are available for ANSI/NEMA C136.41 and Zhaga Book 18 socket types, with options for internal fixture and in-pole installation.

Lighting control is supported for 0-10V and DALI™ fixtures. Sensor connectivity is supported via Bluetooth Mesh® and DALI™ wirelessly, and via direct wire or fixtures with the new D4i auxillary socket.

Dimming is automated using Tondo's Deep Learning AI in the Cloud IQ CMS: we can monitor pedestrian and vehicle traffic and ensure delivery of safe lighting according to ANSI RP-8 and IEC EN13201, as well as adjust for city-specific practices and policies.

Integrated Smart City Wireless Network

Each Edge IQ controller contains a multi-protocol chipset with active Bluetooth Mesh®. We chose Bluetooth® 5.3 for its simplicity, reliability, low power requirements, long range capabilities up to 1.3km, and its open standard in use around the world.

Blazingly-Fast Cellular-to-Cloud Connectivity Included

Cellular connections enable information to flow to-and-from Tondo's Cloud IQ management system. Slow connections otherwise limit the support for connected Smart City applications.

The Edge IQ's on-board dual-SIM cellular gateway means there are no external network gateways to install or manage. Tondo's new high-speed cellular technology provides blazing fast throughput for up to 5mbps from fixture to cloud on **standard** LTE cellular networks - 5x or faster over most competitors!

Since Tondo's Cloud IQ includes your cellular data plan, there are no cellular plans for the city to manage. This means fewer installed devices, faster project deployment, zero network management - and lower costs.

Why Use Bluetooth Mesh *and* Cellular?

Cellular is ultimately where the data has to go to get back to Tondo's Cloud IQ CMS. And sometimes access to a cellular connection is simply unreliable, creating inaccessible dead spots for your Smart City controls.

By adding Bluetooth Mesh®, we can not only get around those dead spots, but we create a low-cost, high performance, standards-based platform for connecting energy-efficient wireless sensors, meters, and other devices.

Having Bluetooth Mesh® and high-speed LTE cellular provides you with the flexibility and enablement of your Smart City.

Unparalleled Infrastructure-Grade Cybersecurity

Each Edge IQ controller is a high-performance computing device protected by an ARM® Cryptocell® cryptographic accelerator and a Microchip ATECC608B Secure Element Hardware Security Module for key storage.

The Edge IQ uses hardware-based Root of Trust, Secure Boot, Secure Over-the-Air firmware updates, and manages self-generating, session and root keys in its secure key vault. This makes the Edge IQ controller resistant to cyberattacks that might otherwise compromise a human-managed software certificate management system commonly used elsewhere.

Advanced Energy Measurement

The Edge IQ provides revenue-grade ANSI C12.20 ±0.5% accuracy and ANSI C136.50/C136.52 energy control for each fixture. Energy management includes usage and demand, auditing, power limiting, load shedding, scheduling, daylight harvesting, and alerts to anomalies at each fixture. Edge IQ includes a permanent meter register to ensure meter integrity.

Jump to Pricing

Lighting Controls

Product Specifications

Specifying Edge IQ is easy: Edge IQ comes fully configured and calibrated - ready to install.

Simply choose the model for socketed, internal fixture, internal pole, or external pole installation.

Models

SC220-NEMA	ANSI/NEMA 136.41 socket
SC220-ZHAGA	Zhaga Book 18
SC220-POLE-INT-HV	Internal Pole Mount

Lighting Control

Driver Support	LED (2770W max. rated load)
Control Methods	Direct/Manual individual or group Automated individual or group • Fixed schedule • Astronomical clock • Daylight sensor override • AI-Adaptive Dimming
On-Off / Dimming	• Daylight sensor • Scheduled autonomous • Direct remote control
0-10V Dimming	• ANSI C136.10 0-10V • DALI™/DALI 2™
DALI™/DALI 2™ Compatibility	Master capability, 50mA bus supply
Dimming Type	Linear or logarithmic
Fixtures per Controller	• Supports up to 16 fixtures per DALI bus from a single controller • Ideal for multi-fixture pole configurations

Energy Metering

Compatibility	ANSI C12.20 ANSI C136.50 (socketed) ANSI C136.52 (internal pole)
Data Protection	Permanent non-volatile meter data registers
Metering Accuracy	±0.5% Class, Factory Calibrated

Communications

Controller-to-Controller	Bluetooth® 5.3 LE Bluetooth® Mesh
Sensor-to-Controller	Bluetooth® 5.3 LE Bluetooth® Mesh
Smartphone-to-Controller	Bluetooth® 5.3

Communications

Cellular Cloud Gateway Cellular Service Plans Included with Tondo Cloud IQ Subscription No External Gateways Required	• 1mbps uplink/downlink • Optional 10mbps downlink/ 5mbps uplink • Works on standard LTE cellular networks Multiple network support with auto-failover for resilient network connectivity
Location Services	• Bluetooth Beacon micro-positioning • GPS/GLONASS/BeiDou/ Galileo/QZSS (±3m accuracy)

Sensor Support

Sensor Connectivity	Bluetooth® 5.3 LE Bluetooth® Mesh 24V Digital I/O direct wire
Sensor Communication	DiiA D4i™ Part 351 24V Digital I/O
Internal Temperature Sensor	Internal, included
Ambient Daylight Sensor	Internal, included
Tilt and Vibration	Internal, included

Management and Field Configuration

Central Management System	Tondo Cloud IQ CMS
Field Deployment and Configuration	• Plug-and-Twist auto-activation without field configuration • Auto-configuration without field configuration • Autonomous astro-clock operation in the event of network disconnect • Auto-locating via GPS Tondo Mobile-IQ App • Included with CMS • Android compatible • Customizable asset management fields • Validate controller activation • Supports option for out-of-band controller testing and configuration • Supports all Tondo devices

Edge IQ Controller

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Cybersecurity

Cryptographic Protection	ARM® Cryptocell 310 Cryptoprocessor • Fully automated key and certificate management • Hardware Root-of-Trust • Secure Over-the-Air updates • Secure Access Control List • Secure Firmware protection • Secure Boot
Key Generation	• Unique Root Key for each device • Automatic Root Key regeneration • Unique Session Keys • Secure cryptographic operations without exposing Root Key
Key Storage	Microchip ATECC608B Cryptoauthentication Hardware Security Module (HSM) • True HSM key storage • Root and session keys used in cyptographic operations not exposed in firmware
Cryptographic Algorithm Support	ECDH/ECDSA Secure Remote Password Protocol (SRP) • Up to 3072-bit key size
	Elliptic Curve Cryptography • FIPS 186-4 and SEC 2 compliant curves • Koblitz curves up to 256 bits • Edwards/Montgomery curves
	RSA Public Key Cryptography • Up to 2048-bit key size PKCS#1 v2.1/v1.5
	AES Symmetric Encryption • FIPS 197 compliant • 128-bit key size • ECB, CBC, CMAC/CBC-MAC, CTR, CCM/CCM*

Cybersecurity

Cryptographic Algorithm Support	Hashing Functions • SHA-1, SHA-2 up to 256 bits Keyed-hash message authentication code (HMAC)
	Chacha20/Poly1305 Symmetric Encryption • 128- and 256-bit key size AEAD mode
	True Random Number Generator • NIST SP800-90B compliant • FIPS 140-2 compliant
	Pseudo Random Number Generator • NIST SP800-90A compliant

Physical and Environmental

Weight	245g
Circumference	83.9mm
Height	83.9mm
Ambient Temperature	-40°C to +85°C
Ingress Protection	IP66 Class per IEC 60529
Fire	Flame resistant per UL94
Impact Resistance	IK07 per IEC 62262

Power

| AC Input Voltage	90-480VAC, 50/60Hz, ± 10%
DC Output Voltage	24V DC, 2W
Power Consumption	< 1.5 watts @ 240V AC
Transient Protection	• 10Ka / 510 joules / 1.5kV
Relay	• 2770W max. fixture load • NC (Standard)
Measurement	• AC Voltage (RMS, average) • Current (RMS, average) • Power (RMS, average) • Power frequency • Power factor • Controller power load • Lighting circuit power load
Max. Fixture Wattage	2770W Max.

Warranty and Service

Standard	10 Year Device Replacement

Compliance

|	
Safety	IEC/UL
Communications	FCC
Fire	UL94 Flame retardant polycarbonate molding
Environmental	• RoHS (Restriction of Hazardous Substances) per 2011/65/EU & amendments
Lighting	• DALI™/DALI 2™ compatible • ANSI C136.10 • ANSI C136.41
Information Security	ISO 27001:2013 December 2022

Dimensional Drawings

Edge IQ - Socketed - Internal View
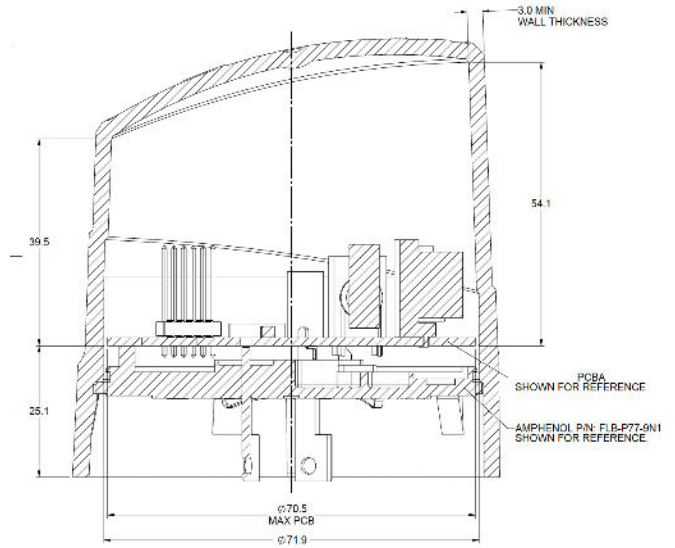
Edge IQ - Socketed - External View

Cabinet IQ Controller

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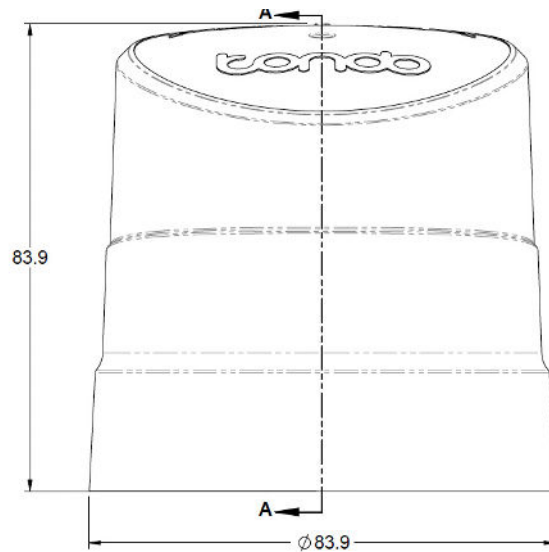
Cabinet IQ Overview

Tondo's Cabinet IQ provides lighting and utility cabinet advanced energy quality monitoring, cabinet-based lighting control, revenue-grade smart electricity metering, and a wide range of relay, digital, and analog control.

Cabinet IQ is well-suited for a wide range of use-cases:

- Advanced electricity quality monitoring
- Billing-grade ANSI C12.20 0.5 Class electricity metering
- Digital and analog data acqusition and control
- Mechanical and solid-state relay control
- Cabinet-based lighting control
- Time-of-Use electricity metering and billing-grade reporting with secure data logging

Together with Tondo's Cloud IQ Central Management System, Cabinet IQ provides a complete controls, metering, and electricity management solution.

Cabinet IQ Features and Benefits

Advanced Energy Management

Cities require their electric utility distributor to provide a consistently dependable quality of electricity to power their critical infrastructure. Unfortunately, this is not always the case.

Tondo's Cabinet IQ solution can alert cities to problems with the quality of service on the secondary system side of their line transformers that service their streetlights and other electrified city assets. This allows cities to diagnose problems faster, and know whether to dispatch their maintenance team or report a problem to their utility partners.

Smart Energy Metering and Electricity Quality Monitoring

Cabinet IQ's smart energy meter is a high-performance Class 0.5/0.5S accuracy revenue-grade, ANSI C12.20/IEC 62053-22 compliant energy monitoring and analysis system.

Together with Cabinet IQ can provide scheduling, energy management, and emergency control insights that include:

- Electricity theft
- Electrical wiring faults
- Secondary service failure
- Service breaker condition

The Cabinet IQ's Smart Energy Meter supports three-phase power metering, power quality analysis, and can be used for Time-of-Use residential, commercial, and industrial Smart Metering applications.

Cabinet IQ's energy management capabilities also include usage and demand, auditing and benchmarking, power limiting, load shedding, scheduling, and alerts to an array of anomalies, faults, and inefficiencies of monitored systems.

Solving Real-World Problems

Cabinet IQ supports the full range of Tondo's Smart IQ solutions that include:

- Vehicle lane monitoring, traffic counting
- Vehicle and license plate identification
- Pedestrian and cyclist traffic monitoring
- Ambient light level monitoring (lux)
- Roadway conditions (dry, rain, ice)
- Temperature, precipitation, wind, humidity, and UV
- Airborne particulates
- Noise levels
- Tank and vessel level monitoring
- Battery level monitoring
- Water flow (m³/s)
- Cabinet flood, fire (temp or ionization), or tampering

Based on the data Cabinet IQ collects, Tondo's Cloud IQ CMS deep machine-learning AI and analytics and data lake can provide cities with actionable intelligence, detecting patterns and anomalies in even the largest Smart City data sets.

(Jump to Pricing)

Cabinet IQ x Edge IQ: Working Together

Cabinet IQ is an ideal complement to Edge IQ controls.

When a lamp or driver goes bad, Edge IQ will tell you. However, when something goes wrong with the power from your utility service point, Cabinet IQ can provide enhanced insights by combining its data with the data captured by Edge IQ.

Cloud IQ's Deep Learning AI uses the combined data to identify anomalies such as electricity theft and wiring faults that cost cities enormous sums of money.

Group Lighting Control

Cabinet IQ is ideal for controlling lighting where socketed fixtures are not available, or where wireless connectivity may be impaired.

Tondo's Cloud IQ can store configuration and device operations profiles in Cabinet IQ and its standard 48-hour UPS can provide full operation in the event of loss of power.

Secure Encrypted Cellular Connection-to-Cloud

Each Cabinet IQ is connected to the Tondo Cloud IQ CMS using a private LTE cellular network.

Like the Edge IQ, Cabinet IQ's cybersecurity encrypts data in-flight using a uniquely-generated encryption key and an encrypted LTE network. Secure authentication is provided via Cabinet IQ's on-board hardware-based cryptoprocessor. Firmware updates are delivered via secure over-the-air connections via Tondo's Cloud IQ CMS.

High-Speed Cellular Connection-to-Cloud

The Cabinet IQ includes a high-speed LTE A cellular network gateway with speeds up to 300mbps. With Cabinet IQ's built-in gigabit Ethernet switch and ability to mount on the pole or in a lighting or utility cabinet, cities can enable high-bandwidth applications using high definition video on the pole.

Cloud IQ's integrated gateway means there are fewer devices to manage, no cellular plans to manage, faster project delivery, lower network complexity, and lower costs.

Resilience and Data Retention

Cabinet IQ includes an uninterruptable power supply that can power the system for a minimum of 48 hours. This will ensure that in the event of a power outage, the Cabinet IQ will continue to monitor and control connected critical systems.

Energy usage data is retained for a minimum of 365 days in the event of power loss.

Cabinet IQ Controller

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Product Specifications

Tondo provides Cabinet IQ as a fully-configured platform that automatically activates and connects to your Tondo Cloud IQ central management system.

Cabinet IQ is provided as two connected modules:

1. Cabinet IQ Communications module
2. Cabinet IQ Energy Management Module

Cabinet IQ comes pre-configured from Tondo, ready for installation on-pole or on-wall in its own IP67-rated cabinet, or DIN-rail mounted as two modules inside an existing cabinet.

Base Models

Cabinet IQ-DIN	DIN Mounted Components
Cabinet IQ-POL	IP67 Cabinet Enclosure

Lighting Control Features

Lamp Control	Fixture, string and circuit control via relay output. Monitoring via digital input.

Management and Field Configuration

Central Management System	Tondo Cloud IQ CMS
Scheduling Services	Dusk-to-Dawn AI-managed schedules Static scheduling Remote scheduling via CMS
Field Deployment	Tondo Cloud IQ CMS Tondo Mobile IQ App

Measurement and I/O

Digital I/O	1 x 5VDC 12 x 48/125/250VDC
Electromechanical Relay	4 x 250VAC / 30VDC / 5A
Solid-State Relay	0.15A/24VDC; 1 contact
Current Inputs (RMS)	1A secondary, 5A secondary, or 50A direct
I/O Communications	MODBUS RS-485 Serial
Ethernet	Gigabit Ethernet • Gigabit WAN x 1 • Gigabit Switch x 4

Network Connectivity

Sensor-to-Cabinet	• MODBUS RS-485 Serial • Dry Contact • Analog • USB

Network Connectivity

Gateway
(Cloud Backhaul)
	• LTE CAT-6
	  • up to 300Mb downlink
	  • up to 50Mbps uplink
	  • Dedicated cellular antenna
	  • Auto-switching dual SIM
	  • Secure private cellular network
	
	• Gigabit Ethernet
	  • Gigabit WAN x 1
	  • Gigabit Switch x 4

Internet Protocols	IPv4, IPv6, TCP, SSL, MQTT(S), HTTP(S), TLS, DNS, NTP
Location Services	GPS, GLONASS, BeiDou, Galileo and QZSS (±5m accuracy) Dedicated GPS/GNSS antenna

Cabinet IQ Energy Management

Energy Monitoring & Metering	Energy Metering • Accuracy Class 0.5%, 20mA-10A • Secure permanent meter log Energy Quality Monitoring • AC Voltage (RMS, Average) • Current (RMS, Average) • Power (RMS, Average) • Power Frequency • Power Factor • Controller Power Load • Lighting Circuit Power Load • Individual voltage & current harmonic spectrum • Harmonic angles up to 40th order harmonic • Voltage and current THD, TDD and K-Factor • Measurement range 15-480/828V AC (L-N/L-L) • Measurement frequency range 25-400 Hz
UPS Power Backup	• 48-hour UPS backup

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Device Controls

Product Specifications

Power

Communications Module

Input Voltage Range	• 9 - 50 VDC • Reverse polarity protection • Voltage surge/transient protection
Power Consumption	9W maximum
Fault Tolerance	• Dual cellular SIM with automatic failover • Astronomical clock for scheduled operations in the event of network disconnects • Time synchronization to cellular network • Real time clock • 12Ah 20A rated UPS with 48 hours of standby operation) • Onboard data storage for up to 290 days of no network connectivity

Electrical Metering and Monitoring

Power Supply	• 57.7-277VAC • 48-290VDC
Input Impedance	1MΩ
Input Over-voltage	• 1000VAC continuous • 2000VAC 1 second
Nominal Voltage	400/690V AC (L-N/L-L)
Galvanic Isolation	4000V AC (L-G) for 1 min.
Rated Current Inputs	Choice of any of one options: • 5A CT connection • 1A CT connection • Direct up to 63A • Remote CT (40mA)
Output Rating	0.15A/24V AC/DC
Accuracy	0.5% Class

Digital I/O and Relay

Galvanic Isolation	• 3000V AC 1 min between contacts and coil • 750V AC between open contacts
Output Rating	5A/250V AC; 5A/30V DC

Physical and Environmental

Communications

Weight	455g
Height	44.2mm
Width	115mm
Depth	95.1mm
Mounting	DIN rail or wall-mount options
Operational Temperature	-40°C to +75°C
Ingress Protection	IP30 Class
Relative Humidity	10% to 90% non-condensing
Impact Resistance	IK07 per IEC62262

Electrical Monitoring and Metering

Weight	533g
Height	90mm
Width	125mm
Depth	75mm
Mounting	EN50022 DIN rail
Operational Temperature	-25°C to 60°C
Ingress Protection	IP20 Class

Digital I/O and Relay

Height	95mm
Width	77mm
Depth	45mm
Mounting	Plug into EMM
Operational Temperature	-25°C to 60°C
Ingress Protection	IP20 Class

Certifications and Compliance

Base Configuration

Regulatory	• CE/RED • EAC • RoHS • WEEE
EMI	• Draft EN 301 489-1 V2.2.0 • Draft EN 301 489-19 V2.1.0 • Draft EN 301 489-52 V1.1.0
ESD	EN 61000-4-2:2009
RS	EN 61000-4-3:2006 + A1:2008 + A2:2010
EFT	EN 61000-4-4:2012
Surge	EN 61000-4-5:2014
CS	EN 61000-4-6:2014
DIP	EN 61000-4-11:2004

Cabinet IQ Controller

tondo
ENLIGHTENING CONNECTIVITY

Product Specifications

Certifications and Compliance

RF	• EN 301 908-1 V11.1.1 • EN 301 908-2 V11.1.1 • EN 301 908-13 V11.1.2 • EN303 413 V1.1.1
Safety	• EC 62368-1:2014 • EN 62368-1:2014 + A11:2017 • EN 50665:2017 • EN 62311:2008

Electrical Monitoring and Measurement

|	
Safety	• UL/IEC 61010-1 • UL 916
EM Emissions	• EN55022: 2010 Class A (CISPR 22) • FCC p.15 Class A mandatory
Environmental	• WEEE • RoHS per 2011/65/EU & amendments • EN/IEC 60068-2-1:2007
Energy Immunity	• IEC61000-4-2 • IEC61000-4-3 • IEC61000-4-4 • IEC61000-4-5 • IEC61000-4-6 • IEC61000-4-8
Energy Insulation	• IEC 62052-11 • IEC 62053-22
Electromagnetic/RF	• Draft EN 301 489-1 V2.2.0 • Draft EN 301 489-19 V2.1.0 • Draft EN 301 489-52 V1.1.0 • ESD: EN 61000-4-2:2009 • EFT: EN 61000-4-4:2012 • EN 301 908-1 V11.1.1 • EN 301 908-2 V11.1.1 • EN 301 908-13 V11.1.2 • EN303 413 V1.1.1
Surge	• EN 61000-4-5:2014 • CS: EN 61000-4-6:2014 • DIP: EN 61000-4-11:2004

Warranty and Service

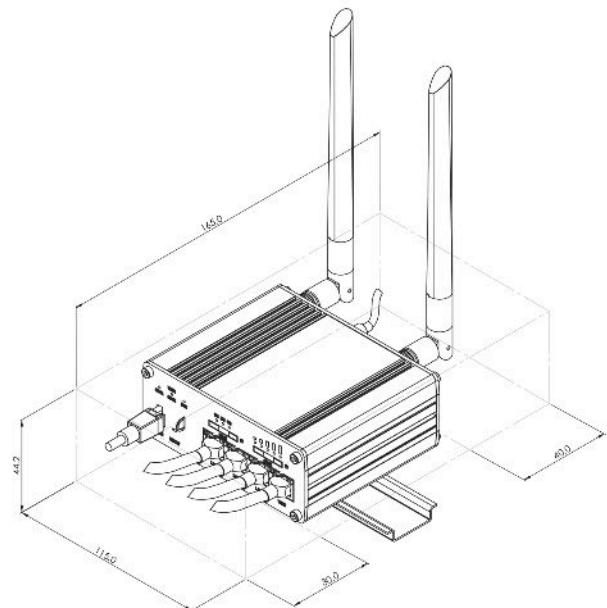|	
Standard	5 Year Component Replacement

Dimensional Drawings

Cabinet IQ Communications Module - Top
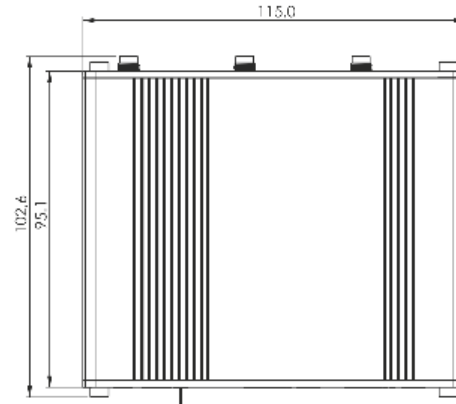
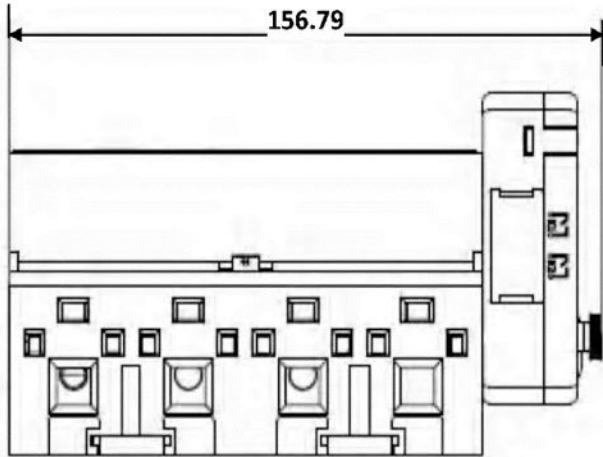**Cabinet IQ Communications Module - Side**
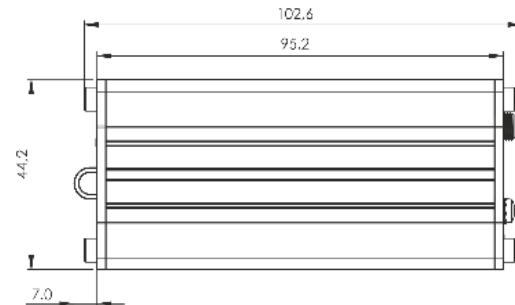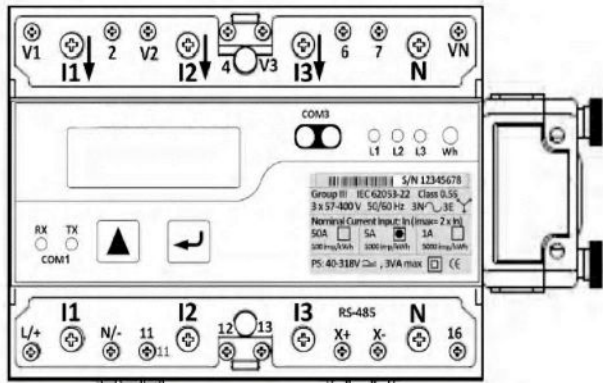

Cabinet IQ Communications Module - Isometric

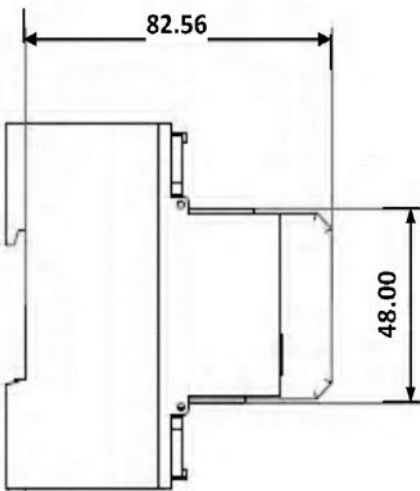## Dimensional Drawings

Cabinet IQ Energy Management and I/O Module - Top

Cabinet IQ Energy Management and I/O Module - Front

Cabinet IQ Energy Management and I/O Module - Side

Beyond Lighting: Smart IQ Solutions

Tondo's Smart IQ solutions support a limitless array of sensor solutions for nearly any use-case, both off-the-shelf and custom.

Using Tondo's universal IoT firmware platform, Smart IQ solutions share a common set of functional capabilities, such as communications, calendaring, power management, and cybersecurity.

This enables Tondo to create and deliver tailored sensor solutions for our customers in only a few weeks.

Smart IQ Solutions

Motion IQ: Presence and Adaptive Lighting

Motion IQ is an affordable motion detector that enables adaptive roadway and area lighting and maximizes lamp asset life.

Motion IQ also enables Tondo's deep learning AI to deliver adaptive lighting for roadway and area lighting according to ANSI/IEC RP-8 best practices. This ensures cities are delivering safe, efficent lighting while reducing their energy usage by as much as 60%.

Motion IQ connects to fixtures via a Zhaga Type B socketed interface or on the pole using Tondo's Zhaga connector pole mounting option.

Universal Sensor Platform

Tondo's Smart IQ uses Tondo's universal IoT firmware platform to deliver Tondo's Smart City sensor solutions.

This firmware provides sensors with a common technology platform for communications services, location services, high-efficiency power management, on-device data storage, a rules engine, task scheduling, and a common integration layer.

Our approach enables us to quickly adapt nearly any existing sensors for deployment on the Tondo Smart City network. Some of the solutions include:

- Adaptive roadway lighting
- Adaptive parking lot lighting
- Adaptive lighting for cyclist and pedestrian pathways
- Roadway and area flood sensing
- Vehicle traffic lane counting and identification
- Pedestrian and cyclist counting
- Weather monitoring
- Air quality monitoring

- Public emergency call button
- Public emergency lighting alerts
- Noise level monitoring
- Waste bin level sensing
- Rodent damage sensing
- Wastewater monitoring
- Cabinet flood, fire, and tampering sensing
- Outdoor fire and smoke sensing
- Emergency shelter management

If you have a sensor or device control use-case, Tondo will make it happen.

Beyond Data... to *Decisions*

Tondo's advanced Deep Learning platform in the core of Cloud IQ transforms collected data into actionable alerts and automation.

Tondo's flood control solution is one example: we don't just send an alert to a dashboard - we trigger traffic control systems to alert drivers to flash flood conditions that could cost lives.

For electricity theft, we trigger alerts and dispatch maintenance teams to remediate on-site, and saving one customer over $250,000 per year in energy costs.

At Tondo, our sensor and metering solutions go beyond just data collection to create operational efficiencies.

Product Description

Tondo's Adaptive Roadway Lighting Control works with Cloud IQ's Deep Learning AI to deliver safe lighting on-demand.

Tondo's AI uses predictive analytics to reduce the number of sensors required, reducing the overall costs of adaptive lighting solutions by 30% or more.

Base Models

|	
Motion IQ	Zhaga Book 18 Type B on fixture or pole

Features

Detection Zone	30m x 6m @ 5m
Effective Height	Up to 12m
Detection	• Pedestrians, runners, cyclists, or vehicles • Counting accuracy suitable for tracking
Lighting Control	DALI D4i
Counting Sensitivity	Discrete pass through mask area
Luminance Sensitivity	Continuous calibration to filter reflected light
Connectivity	Zhaga Book 18 Type B Socket
Ingress	• IP66 • IK07
Operating Temperature	-40°C to 65°C
Detection Temperature	-40°C to 32°C
Height	42mm
Diameter	79.7mm
Case Materials	Dome: HDPE & Polycarbonate Base: PBT
Current	• 25mA on startup • 6-8mA average operating • Powered from DALI™ bus on Tondo Edge IQ controller
Standards	• Zhaga Book 18 Editions 1, 2 and 3 • DiiA: Parts 351 • IEC 62386: Part 303, 101 and 103 • CE Marked • UL773 • IEC 61347-1 • IEC 61347-2-11
Vibration	5 to 500 Hz random levels at 4.9g per IEC 60512-6-4

Features

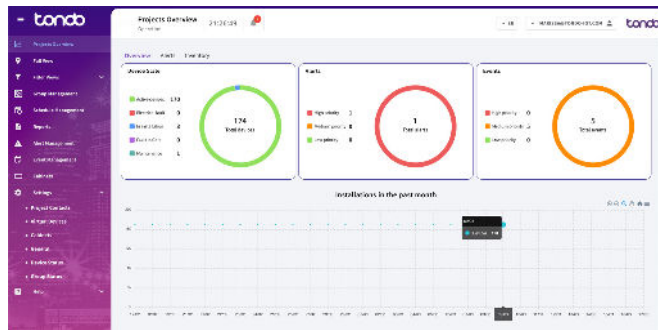|	
Mechanical Shock	30g per IEC 60512-6-3
Impact	2 joules per IEC 62262
Thermal Shock	-40 and 70°C er EIA-364-32
Humidity	25 and 65°C at 90 to 100% RH IEC 60512-11-12
Dry Heat	70°C per IEC 60512-11-9
Conducted Emissions	CISRP 15 / EN 55015 • 84µV to 74µV quasi-peak • 64µV to 74µV average
Radiated Emissions	CISRP 15 / EN 55015 • 30µV/m@30MHz to 230MHz • 37µV/m@230MHz to 300MHz

Dimensional Drawings
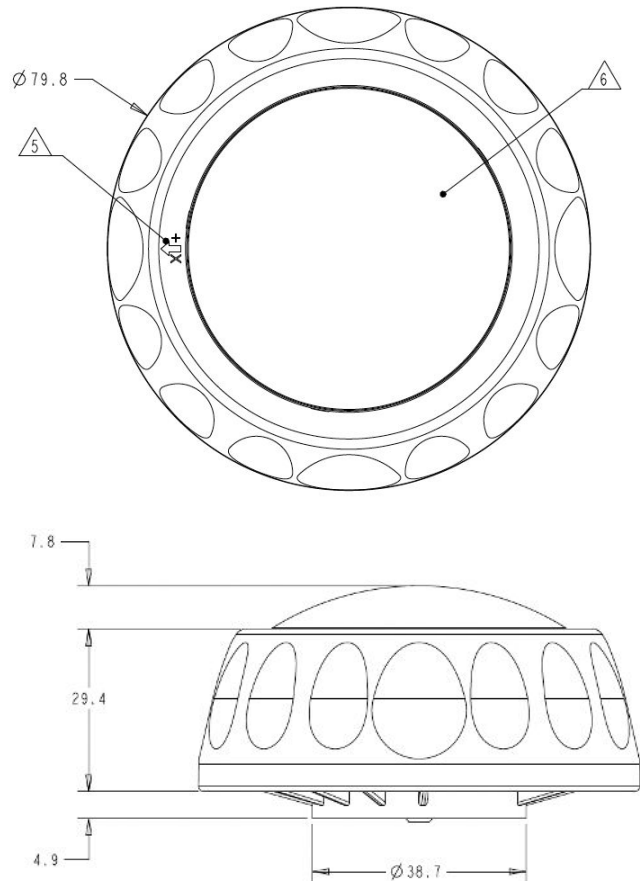
Cloud IQ CMS Overview

Transforming Urban Environments with Cloud IQ

Welcome to the forefront of Smart City evolution, where Tondo's Cloud IQ platform redefines how urban spaces harness the power of smart technology. Designed for directors of public works and those managing street and outdoor area lighting assets, Cloud IQ is your gateway to a safer, more efficient, and interconnected city.

Advanced Roadway Lighting Control

Illuminate the path to efficiency with Cloud IQ, delivering over a 55% improvement in streetlight operational efficiencies. Our platform ensures the delivery of safe, standards-compliant lighting exactly where and when it's needed, leveraging deep learning AI to simplify the complexities of urban lighting.
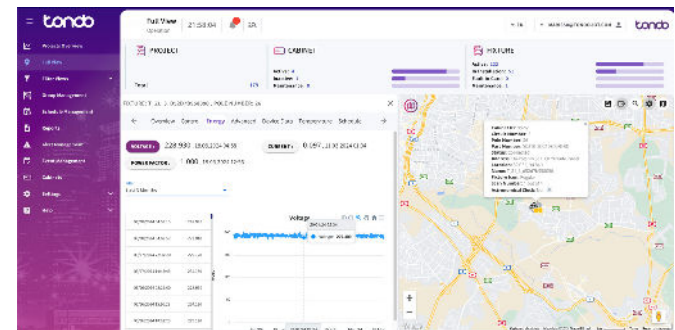
Connecting Critical Infrastructure

Bridge your city's foundational services — from water and sanitation to transportation and energy — with Cloud IQ. Our platform enables comprehensive monitoring and management, driving operational efficiencies and reducing connectivity costs by more than 50%, all through a communication platform built on the backbone of our Smart Lighting solutions.

## Transforming Data into Actionable Insights

Tondo's Cloud IQ does the data collection, analysis, and data management so you don't have to. Cloud IQ's robust Deep Learning AI and visualization technology transforms data into actionable insights, alerting teams to abnormal conditions and anomalies in real-time to console charts and dials, and critical events via SMS text messaging, email, or maintenance service applications used by the city or its contractors.

Advanced Energy Management

Take command of your city's energy narrative. Cloud IQ, in tandem with Cabinet IQ's sophisticated electricity analysis, monitors the quality of electrical service, identifying potential infrastructural threats before they occur. This proactive approach extends to all energy systems, making Cloud IQ a unified solution for city-wide energy management.

Sensors, Smart Meters, and More

Cloud IQ's agnostic design seamlessly integrates a broad spectrum of devices, from sensors and smart meters to SCADA use-cases, all through our innovative Edge IQ Bluetooth Mesh network or direct fixture connections. Third-party systems are effortlessly incorporated, enhancing Cloud IQ's deep learning AI with a rich dataset for unparalleled insight generation.
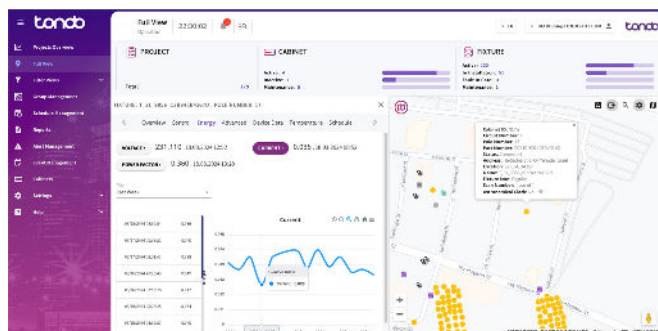
Zero Network Management

Experience the simplicity of an "invisible" network with Cloud IQ. We absorb the complexities of connectivity, ensuring all Edge IQ and Cabinet IQ devices communicate flawlessly, with no additional infrastructure or management required on your part. It's smart city technology, simplified.

AI Automation and Analytics

Empower your operations with AI-driven automation and analytics. Cloud IQ transforms vast urban data into actionable insights, optimizing city functions without overwhelming your teams. It's not just about data collection — it's about making that data work for you.

Simplifying Large Systems at Any Scale

Grow without boundaries. Cloud IQ's cloud-native infrastructure is designed to scale with your city, supporting the seamless addition of new technologies and devices. As your smart city expands, Cloud IQ grows with you, ensuring a sustainable, cost-effective future for urban management.

Tondo's User and Asset Group Management capabilities allow cities to group assets by type, location, and a variety of other attributes, and assign team members to specific asset types and geographies. This avoids team members from being overwhelmed with information outside their area of responsibility, greatly simplifying their work.

Simplifying Installation and Maintenance

All Tondo controllers are enabled with true plug-and-play activation. Socketed Edge IQ controls activate in less than a minute, significantly decreasing project timelines and costs.
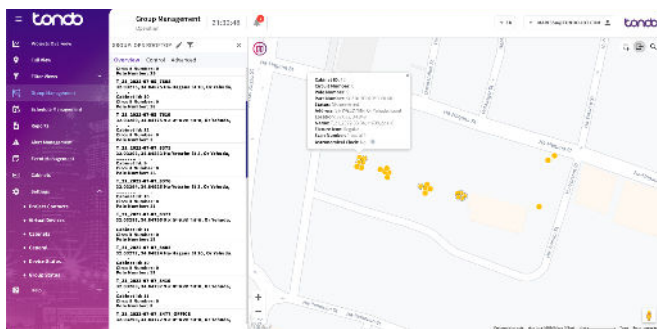
Each controller is securely matched at the time of manufacture to a city's Cloud IQ platform with unique strong cryptographic keys to ensure only authorized devices can connect.

Whether it is a first-time project deployment or tracking maintenance activities, Tondo's Cloud IQ provides real-time tracking of installation activities for controllers and connected devices by city teams or contractors. This allows cities to track operational efficiencies and anomalies, and know whether projects are on-schedule or require further attention.
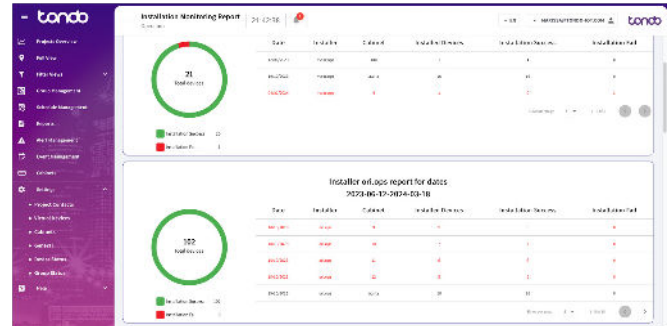
Tondo's Cloud IQ includes unlimited licenses for Mobile IQ, Tondo's field installation management app. Mobile IQ provides installers with confirmation of installation and operation in the field, and provides a secure testing application that can work at the top or the bottom of the pole.

Cloud IQ and Mobile IQ provide for unlimited custom asset fields to gather information on other field asset data such as the condition of the asset, the asset ID, or the area surrounding each asset, with any additional field notes.

Data can be fed back to city Open Data platforms like ArcGIS in real-time to support transparency initiatives, and automate the maintenance of city asset management data.

Unified Smart City Data

Say goodbye to data silos with Cloud IQ's advanced data lake architecture. Our platform collects and analyzes data from across your smart city ecosystem, offering a single, clear view of urban operations and unlocking new efficiencies across systems and use-cases.

Interoperability and Open Standards

Built on the bedrock of open source software and connectivity standards, Cloud IQ ensures your city remains agile and adaptable. With support for industry standards and an open REST API, we guarantee a future-proof foundation for your smart city initiatives.

Your Cloud or Ours

With Cloud IQ, the choice is yours. Host our platform on your own cloud to keep data under your control, or let us manage it on AWS for seamless, secure service. Either way, Cloud IQ adapts to meet your city's specific data sovereignty needs.

Transform your city with Cloud IQ by Tondo Smart — where smart city innovation meets operational excellence. Together, let's light the way to a brighter, smarter future.

Product Specifications

Tondo's Cloud IQ Central Management System is the world's first Deep Learning platform for Smart City lighting, sensors, cameras, smart meters, and controls. Customers may deploy Cloud IQ on Tondo's secure cloud or the Customer's own private cloud.

Hosting and Language Support

Host Platforms	• Azure Cloud (Default) • AWS
Languages	Multilingual

Cloud Connectivity

Cellular	• Included • Supported on all major networks • Private encrypted network • No data cap

User Interfaces

Types Supported	• Desktop/Laptop Browser • Tablet Browser
Browsers Supported	• Google Chrome • Apple Safari • Microsoft Edge

Access Control

Users	• Single Sign On • Microsoft Azure Active Directory • Multi-Factor Authentication • User-based and Role-based • Administrator or read-only • Constrain by CMS function
Groups	• Custom groups • Configuration or read-only access • Constrain by CMS function

Controller, Sensor, and Device Support

Controllers	• Tondo Edge IQ • Tondo Cabinet IQ
Sensors (Current)	Tondo Supplied • Unlimited use-cases
Cameras	Third Party Supplied • Public safety camera
Smart Meters	Third-Party Supplied • Smart electricity meter • Advanced electricity analytics
Actuators	Tondo Branded • Unlimited use-cases

Console Features

User Interface	• Full View Dashboard
	• Controller Dashboard
	• Cabinet Dashboard
	• Mobile Field App
	• Custom Thresholds
	• Google Map View
	• Visual Dials and Charts
	• Custom Filtering
	  • Geographic region
	  • Device type
	  • Device status
	  • Abnormal operation
	  • + more

Deep Learning AI	• AI-Adaptive[1] control • Abnormal operation • Predictive failure • Predictive lifecycle • Customizable use-cases • Over-the-Air Updates
Asset Data	• Custom fields • Automatic GPS Mapping • Manual override • Maintenance contract ID • Serial number • Asset tag • Manufacturer • Model • Lighting driver characteristics • Firmware version • IMSI cellular radio number • Connector type • Wiring gauge • Pole type • Pole condition • Manufacture date • Activation date • Installer reference • Rated lifecycle
Deployment Management	• Authorized device list • Project file attachments • Project contacts • Device installation reporting by installer, device, date, operating status, and location
System Notifications & Alerts	• Console • SMS text • Email
Lighting and Device Control	• Autonomous scheduled • AI Adaptive[1] control • Manual control • Automatic light curve analysis for 0-10V fixtures

Cloud IQ CMS

Console Features

Real Time Console View	• Fixture, cabinet, pole, sensor, meter, camera, switch
	• Branch circuit monitoring
	• Sensor data
	• Power factor
	• Wireless signal strength
	• Billing
	• Voltage and Current THD
	• 3-Phase demand monitor
	  • Voltage Max & THD
	  • Current Max & THD
	  • KW demand
	  • Demand Imbalance (V/I)
	  • V/I harmonics magnitude
	  • Angle

Reporting	• Electricity consumption • Asset inventory • Dayburner lighting • Abnormal operation • Device installation/removal • Device malfunction • Total operating hours • Time-of-use billing • Critical faults
Events and Alerts	• Custom thresholds • Device failure • Communication loss • Anomaly detection
Alert Communications	• CMS console • SMS text • WhatsApp • Webhooks • Email

Licensing

Cloud Host Options	• Microsoft Azure (Default) • AWS
Number of Users	Free Unlimited
Maximum Controllers	Unlimited; priced per controller
Maximum Sensors, Meters, & Devices	Unlimited; priced per device
Number of Cellular Networks	Supports two cellular plans: • One plan included • One additional available

Integrations

APIs	• RESTful • Any TALQ Compliant CMS
Notification Services	• Email • SMS • RESTful
Application Integrations	• Salesforce • Microsoft Dynamics CRM • Priority ERP

Cybersecurity

Data in Flight	• Encrypted • Private network backhaul
Data at Rest	Encrypted
Cloud Servers	• FIPS 140-2 Level 2 compliant key management
Controller-to-Cloud	Unique encryption keys on factory-provisioned controllers can connect to each customer's system. All others are rejected.
Controller-to-Sensor	• Cryptoprocessor and HSM-protected cryptographic operations • Authentication against secured Authorized Device List (ADL) in Tondo Cloud IQ
Browser-to-Cloud	• Multi-Factor Authentication • Single Sign-On (SSO) • Role- and user-based security
Mobile App-to-Cloud	• Multi-Factor Authentication • Role- and user-based security

Comparison Table

	Tondo Edge IQ	Itron SELC	Philips 781x	Acuity DTL DIN	Current ELWC	Ubicquia UbiCell	Dimonoff RME H3	Landis & Gyr	Quantela iSLC-3100-7P	Value
Automatic Plug & Play Configuration	✓		✓			✓				• No specialized installation skills • Lower deployment costs by up to 50%
Fully Managed Private Network	✓	Additional Cost		Additional Cost				Additional Cost	Additional Cost	• Reduce system complexity • Reduce operating costs by up to 10%
Central Management Software (CMS)	Tondo Cloud IQ CMS	Itron SLV CMS	Signify Interact CMS	Itron SLV CMS	Current LightGrid+ (Client-Server)	Ubicquia UbiVu CMS	Dimonoff SCMS	Landis & Gyr GridStream (Client-Server)	Itron SLV CMS	• Unified platform for all connected assets
AI & Deep Learning	✓									• Transforms data into valuable insights • Simplified management
Data Lake & Real-Time Processing	✓	✓		✓					✓	• Unified repository for Smart City data • AI/Deep Learning across all solutions
AI-Adaptive Roadway Dimming	✓									• Up to 30% lower electricity use • Standards-compliant lighting
Hardware Cryptographic Security Module	✓					✓				• Cybersecurity suitable for connected critical infrastructure
Dual 0-10V and DALI Lighting Control	✓		✓	✓	✓	✓		✓	✓	• Long-term investment protection • True off/zero power state
DALI-2 Lighting Control	✓	✓	✓	✓		✓	✓	✓		• Consistent lighting levels • Advanced lighting management
D4i Sensor Control	✓		✓		✓					• Integrated sensor control • Wider range of sensor solutions
Built-In Sensors	GPS Tilt/Vibration Photocell Astro-Clock	Photocell	GPS Tilt/Vibration Photocell Astro-Clock	GPS Option	GPS Option	GPS Tilt/Vibration Photocell Astro-Clock	GPS Photocell	GPS	GPS Astro-Clock Tilt Option	• Pole-down and pole-damage alerts • Autonomous lighting operations
Scalability	Unlimited	Gateway Limited	Unlimited (781x only)	Gateway Limited	CMS Limited	Unlimited	Gateway Limited	CMS & Gateway Limited	Gateway Limited	• Lower costs of future growth • Unlimited growth potential
Cellular Cloud Connectivity	1mbps or 10mbps at no additional cost	300kbps	1mbps	500kbps	1mbps	1mbps or 10mbps (option)	1mbps	200kbps	375kbps	• Unlimited, low-cost scalability for Smart City sensor & meter connectivity
Cellular Data Included	✓									• Lowers system complexity • Lower cost

Note: All reasonable efforts have been made to ensure the accuracy of the information in this table. However, Tondo does not warrant the information in the above table for accuracy, and provides it only as a guide for the City to perform its own due-diligence independent of the information described in this table.

	Tondo Edge IQ	Itron SELC	Philips 781x	Acuity DTL DIN	Current ELWC	Ubicquia UbiCell	Dimonoff RME H3	Landis & Gyr	Quantela iSLC-3100-7P	Value
Onboard Sensor Support	Bluetooth LE Bluetooth Mesh D4i Socketed Direct Wire		D4i Socketed	Direct Wire	Direct Wire	Direct Wire	Direct Wire		Direct Wire	• Lowers system complexity • Lower cost of Smart City sensor solutions
Customer Cloud Hosting	✅		✅				✅	✅		• Data sovereignty, privacy compliance
Installation Options	NEMA Zhaga Internal	NEMA Zhaga Internal	NEMA Zhaga Internal	NEMA Zhaga Internal	NEMA Internal	NEMA Internal	NEMA Zhaga Internal	NEMA	NEMA	• Flexible deployment options
Energy Metering	ANSI C12.20 ANSI C136.50 ANSI C136.52 Secure Log		ANSI C12.20	ANSI C12.20	ANSI C12.20	ANSI C12.20	ANSI C12.20		ANSI C12.20	• Accurate energy billing reconciliation • Metered electricity rate plan eligibility
Operating Voltage Range	90-480VAC	105-305VAC	105-305VAC	105-305VAC	120-277VAC	90-480VAC	110-480VAC	120-277VAC	100-277VAC	• Adapts to wide range of power conditions
Transient Protection	ANSI C136.2 Cat C 20kV/10kA	ANSI C136.2 Cat C 20kV/10kA	ANSI C136.2 Cat A 6kV/3kA	ANSI C136.2 Cat C 20kV/10kA	ANSI C136.2 Cat B 10kV/5kA	ANSI C136.2 Cat C 20kV/10kA	ANSI C136.2 Cat A 6kV/3kA		ANSI C136.2 Cat B 10kV/5kA	• Resistance to electrical anomalies • Reduce non-warranty field replacements
Operating Temperature	-40F to +158F	-40F to +158F	-40F to +158F	-40F to +158F	-40F to +122F	-40F to +158F	-40F to +158F	-40F to +140F	-40F to +158F	• Suitable for high ambient temperature conditions
Rated Load	2770W@ 120VAC 2400VA	1000W@ 120VAC 1800VA	472W@ 120VAC 480VA	1000W@ 120VAC 1800VA	1000W@ 120VAC 1500VA	1200W@ 120VAC 1800VA	840W@ 120VAC 840VA	718W@ 120VAC 720VA	990W@ 120VAC 1000VA	• Ability to support a wide range of fixture load specifications
Standard Warranty	10 Years	10 Years	Not Specified	10 Years	5 Years	5 Years	5 Years	Not Specified	2 Years	• Lower lifecycle cost
Country of Manufacture	Israel USA Option	Ireland	China	China	USA	Unknown	Canada	Not Specified	India	• Eligibility for IIJA/ BABA projects

Note: All reasonable efforts have been made to ensure the accuracy of the information in this table. However, Tondo does not warrant the information in the above table for accuracy, and provides it only as a guide for readers to perform their own due-diligence independent of the information described in this table.

Tondo
Services

ENLIGHTENING CONNECTIVITY

Tondo Services

Tondo provides a range of services to its partners and end-use customers that ensure the successful design, deployment, and outcomes for every project.

Tondo brings a wealth of experience from our successful delivery of dozens of projects, leveraging the knowledge from each engagement for the next.

Whether you are responsible for delivering a simple roadway controls project or fully-integrated lighting, sensor, camera, radar, and SCADA use-cases, Tondo can help you create a best-of-breed Smart City digital infrastructure.

Project Services

Project Design and Planning

Tondo can provide access to its most experienced team members that include project design review by our senior staff to ensure that every project plan is accurate and complete in scope.

We will work with our partners and end-use customers to factor in every possible variable and contingency, based on our decades of experience in delivering successful projects around the world.

Project Delivery

Tondo delivers its solutions through its licensed lighting construction services firm partners.

Through its partners, Tondo provides expert project management resources, technical support, and guidance on best practices.

Both remote and on-site services are available as requested. Having experienced Tondo resources for your team will reduce the risk of project timeline or budget failure.

Project Financing

Your Affordable Smart City

Tondo can provide complete Smart Lighting solutions financed from the project's measured energy savings. Cites will gain an immediate benefit of improved standards-based lighting safety and a reduction in GHG footprint.

Tondo can also provide its solutions through energy services contracts, or through its Smart City as a Service solution that provides Smart Lighting plus an array of other Smart City solutions in a single monthly operating expense.

Development Services

Tailor-to-Fit Smart City Enablement

Every city's vision is unique. Finding off-the-shelf solutions for every possible problem isn't always possible.

Tondo's culture can be summed up as, "Yes, we can."

Tondo's standards-based cloud software and firmware architectures enable us to cost-effectively tailor solutions to fit your requirements, while ensuring all devices remain supported as if they were off-the-shelf solutions.

If You Can't Find a Solution, Ask Us

Tondo's team is comprised of experts who have been in the Smart Lighting and Smart City enablement business from the very beginning. If you can't find a solution for your specific use-case, ask us.

If you need guidance to develop your project plan, reach out and we'll be happy to help you.

Smart Lighting and Smart City Solutions

Each controller, sensor, or device that is managed by Tondo's Cloud IQ CMS has a one-time Unit Price, and a monthly SaaS Price component.

All prices are listed in U.S. dollars.

Edge IQ Controllers — Jump to Specifications

Transform your city's lighting infrastructure with Tondo's Edge IQ Controller, designed for seamless integration with NEMA and Zhaga Type B fixture sockets.

For un-socketed fixture use-cases such as ornamental lighting, Tondo provides an internal option suitable for installation into most streetlight poles.

Enjoy energy savings of up to 60% over typical dusk-to-dawn control, while benefiting from our Adaptive Roadway Lighting that uses AI-driven automation to optimize lighting based on real-time data. With our cutting-edge technology, your city will shine safer, smarter, and more efficiently.

Part Number	Unit Price	Monthly SaaS Price
SC220-NEMA	$95.00	$2.00
SC220-ZHAGA	$75.00	$2.00
SC220-INT	$95.00	$2.00
Cellular Data Plan	n/a	included

Cabinet IQ Controllers — Jump to Specifications

Empower your city's infrastructure with Tondo's Cabinet IQ Controller, the ultimate solution for advanced energy management, advanced diagnostics, and lighting control for lighting cabinet-based installations.

Monitor electricity quality, manage electricity metering, and control groups of streetlights from a central platform. Tondo's Cabinet IQ ensures your city runs smoothly, with real-time insights and unparalleled operational efficiency.

Tondo's Cabinet IQ may be ordered for installation into existing lighting cabinets (DIN) or optionally pole-mounted (POL)

Part Number	Unit Price	Monthly SaaS Price
CABINET IQ-DIN	$3,300.00	$5.00
CABINET IQ-POL	$3,500.00	$5.00
Cellular Data Plan	n/a	included

Cloud IQ Central Management System

All controllers, sensors, energy meters, cameras, and other Smart City devices are secured and managed by Tondo's Cloud IQ Central Management System (CMS).

Tondo's Cloud IQ is designed to provide a clear, comprehensive dashboard view of all connected Smart City assets, and keeps the "technologies" and "analysis" under the covers so that operations teams stay focused on what they care about most.

Unlimited Cloud IQ user licenses are included in the Cloud IQ SaaS Price.

Adaptive Roadway Lighting — Jump to Specifications

Tondo's Adaptive Roadway Lighting controls automate the delivery of roadway lighting to ANSI/IES RP-8 standards, according to roadway classification and pedestrian traffic levels adjacent to the roadway.

Adaptive Roadway Lighting reduces over lighting for roadways up to 60% depending on the composition of a city's roadway classifications.

Adaptive Roadway Lighting

Part Number	Unit Price	Monthly SaaS Price
ADAPTIVE LIGHTING	$75.00	included
ADAPTER-ZHAGA	$50.00	n/a

Price
List

Smart City Solutions
Price List

tondo
ENLIGHTENING CONNECTIVITY

Smart IQ Solutions

Tondo's "Smart IQ Solutions" seamlessly extend and complement the capabilities of Edge IQ, Cabinet IQ, and Cloud IQ through a diverse array of connected hardware and advanced technologies.

These solutions encompass sensors, energy meters, cameras, and AI-driven software that integrate flawlessly into the Tondo network. By incorporating these Smart IQ Solutions, cities can achieve unprecedented levels of control, monitoring, and analytics for their smart infrastructure.

Smart IQ - Electricity Theft

Tondo's AI-based solution provides real-time monitoring and alerts for potential electricity theft, helping cities reduce losses and improve energy management.

Tondo's Smart IQ - Electricity Theft solution requires both the Edge IQ and Cabinet IQ controllers and is priced according to the total number of Edge IQ and Cabinet IQ controllers in use.

Part Number	Unit Price	Monthly SaaS Price
SMART IQ-ET	n/a	$1.00

Smart IQ - Wire Theft

Protect your city's infrastructure with this AI-based solution designed to detect and prevent wire theft, ensuring continuous service and reducing the high costs of repair.

Tondo's Smart IQ - Wire Theft solution requires both the Edge IQ and Cabinet IQ controllers and is priced according to the total number of Edge IQ and Cabinet IQ controllers in use.

Part Number	Unit Price	Monthly SaaS Price
SMART IQ-WT	n/a	$1.00

Smart IQ - Environmental Solutions

Create a healthier and more resilient urban environment with Tondo's Environmental Solutions. Our Air Quality and Weather Sensors provide real-time data to help you make informed decisions and improve urban living conditions.

From tracking pollution to monitoring weather patterns, our sensors are your key to a smarter, greener city.

Tondo's Smart IQ - Environmental solutions work with Tondo's Edge IQ or Cabinet IQ controllers.

Smart IQ - Air Quality Monitoring

Part Number	Unit Price	Monthly SaaS Price
SMART IQ-AQ	$2,800.00	$15.00
ADAPTER-ZHAGA	$50.00	n/a

Smart IQ - Weather Monitoring

Part Number	Unit Price	Monthly SaaS Price
SMART IQ-WM	$2,800	$15.00
ADAPTER-ZHAGA	$5.00	n/a

Smart IQ - Work Log Management

Streamline maintenance operations with Tondo's Work Log Management solution for Cloud IQ, allowing technicians to log work activities, schedule tasks, and track progress, all from a centralized platform and mobile app for technicians.

Tondo's Smart IQ - Work Log Management solution works with any or all of Tondo controllers, sensors, meters, cameras, and other connected devices on a Tondo network. Licenses are priced monthly for an unlimited number of licenses.

Part Number	Unit Price	Monthly SaaS Price
SMART IQ-WLM	n/a	$250.00

Smart IQ - Traffic Management

Optimize traffic flow and enhance road safety with Tondo's Traffic Management Solutions. Our Vehicle, Pedestrian, and Cyclist Counting Sensors provide accurate, real-time data to streamline urban mobility.

With these insights, cities can implement adaptive traffic control measures, reduce congestion, and ensure safer streets for all users.

Tondo's Smart IQ - Traffic Management solutions work with either Tondo's Edge IQ or Cabinet IQ controllers.

Smart IQ - Vehicle Counting

Part Number	Unit Price	Monthly SaaS Price
SMART IQ-VC	$2,500.00	$50.00
ADAPTER-ZHAGA	$50.00	n/a

Smart IQ - Pedestrian Counting

Part Number	Unit Price	Monthly SaaS Price
SMART IQ-PC	$75.00	$2.00
ADAPTER-ZHAGA	$50.00	n/a

Smart IQ - Cyclist Counting

Part Number	Unit Price	Monthly SaaS Price
SMART IQ-CC	$75.00	$2.00
ADAPTER-ZHAGA	$50.00	n/a

Smart IQ - Safe City

Enhance urban safety with Tondo's Safe City Solutions. Our Noise Sensors and Security Cameras provide comprehensive monitoring to detect and respond to potential threats quickly.

From public safety to incident management, our solutions offer cities the tools they need to create secure and resilient urban spaces.

Smart IQ - Noise Sensor

Part Number	Unit Price	Monthly SaaS Price
SMART IQ-VC	$250.00	$5.00
ADAPTER-ZHAGA	$50.00	n/a

Smart IQ - Security Camera

Part Number	Unit Price	Monthly SaaS Price
SMART IQ-PC	$550.00	$15.00
ADAPTER-ZHAGA	$50.00	n/a

Notes on Pricing:

1. Please note that the pricing does not include taxes or shipping costs. Any applicable taxes or shipping fees will be calculated and added to the final invoice separately

2. Please note that the prices listed are standard list prices. Pricing may vary depending on the quantity of units purchased and the scale of the project. For larger orders or solutions, we are pleased to offer customized pricing and potential discounts.

3. Please note that the prices listed in the pricing structure do not include installation costs. Installation fees will be determined separately based on the complexity of the deployment and the specific requirements of your project.

4. Technical specifications and detailed information for each solution can be found in the Tondo catalog. We encourage you to review the catalog for comprehensive details on product features, capabilities, and integration options.

5. Please be aware that the pricing provided does not include costs for training and implementation services. If training sessions or additional implementation support are required, these will be billed separately.

6. Cellular data plan pricing is priced separately for Tondo's Smart IQ - Security Camera solution, and dependent on the customer's required communications method.

Specifying Tondo Solutions

ENLIGHTENING CONNECTIVITY

Specifying Tondo Smart Roadway Lighting

Specifying Tondo Smart Roadway Lighting controls is easy. Here we will step you through the process.

In this example, we will consider a city with 5,000 streetlights, with 10% of those are ornamental un-socketed streetlights, and 350 lighting control cabinets. This city will also implement Tondo's Adaptive Roadway Lighting controls.

1 Select Controls for Socketed Fixtures

For each socketed fixture, order one (1) Edge IQ controller for your socket type - typically an ANSI/NEMA socket in North America:

Part Number	Quantity	Unit Price	Monthly SaaS Price	Extended Unit Price	Monthly SaaS Total
SC220-NEMA	4,500	$95.00	$2.00	$427,500	$9,000
SC220-INT	500	$95.00	$2.00	$47,500	$1,000
Cloud IQ User License	Unlimited	included	included	included	included
Cellular Data Plan	Unlimited	included	included	included	included
Totals				$475,000	$10,000

2 Select Optional Controls for Adaptive Roadway Lighting

The number of adaptive lighting sensors required is calculated based on the number of adaptive lighting sensors used for each roadway classification to statistically sample adjacent pedestrian traffic activity, within a 5% margin of error. It is not necessary to install sensors on every streetlight. Tondo can provide the calculations based on your specific city.

For example, a sample city might have the following roadway composition:

Roadway Classifications	Pedestrian Activity	Surface Classification	% Share of Roadway	Sensors Required
Freeway Class A	None	R1	11.3%	0
Freeway Class B	None	R1	0%	0
Expressway	High / Medium / Low	R4	0%	0
Arterial	High / Medium / Low	R3	20.9%	231
Collector	High / Medium / Low	R3	18.7%	194
Local	High / Medium / Low	R3	45.5%	347
Pathway	High / Medium / Low	Not Applicable	3.6%	0
Totals			100%	772

Specifying Tondo Solutions

Each Adaptive Roadway Lighting sensor requires a pole-mounted adapter facing the sidewalk. The total costs for adding Adaptive Roadway Lighting control is shown below:

Part Number	Quantity	Unit Price	Monthly SaaS Price	Extended Unit Price	Monthly SaaS Total
ADAPTIVE LIGHTING	772	$95.00	$2.00	$73,340	$1,544
ADAPTER-ZHAGA	772	$50.00	n/a	$38,600	n/a
Totals				$119,940	$1,544

3 Optional Cabinet-Based Energy Management

For advanced energy monitoring, analytics, electricity service diagnostics, and enabling AI-based solutions such as Electricity Theft and Wire Theft detection, cities can optionally add Tondo's Cabinet IQ controls to existing lighting control cabinets, or optionally choose to mount Cabinet IQ on selected poles. Here we will use the cabinet-mounted option for Cabinet IQ:

Part Number	Quantity	Unit Price	Monthly SaaS Price	Extended Unit Price	Monthly SaaS Total
CABINET IQ-DIN	350	$3,300	$5.00	$16,500	$1,750
Cellular Plan	350	n/a	included	included	included
Totals				$16,500	$1,750

☑ Done!

With these three easy steps, a complete Tondo Smart Lighting solution is specified and ready for installation by a licensed electrical contractor selected by the city.

A complete bill of materials is shown below:

Part Number	Quantity	Unit Price	Monthly SaaS Price	Extended Unit Price	Monthly SaaS Total
SC220-NEMA	4,500	$95.00	$2.00	$427,500	$9,000
SC220-INT	500	$95.00	$2.00	$47,500	$1,000
Cloud IQ User License	Unlimited	included	included	included	included
ADAPTIVE LIGHTING	772	$95.00	$2.00	$73,340	$1,544
ADAPTER-ZHAGA	772	$50.00	n/a	$38,600	n/a
CABINET IQ-DIN	350	$3,300	$5.00	$16,500	$1,750
Cellular Data Plan	Unlimited	included	included	included	included
Totals				$603,440	$13,294

Adding additional Smart IQ sensor or camera options is equally easy - simply add the part numbers and quantities of each Smart IQ solution required to your bill of materials.

If you would like a tailored cost-benefit analysis that includes a sample bill of materials for your project, we would be happy to provide that at no charge.

Tondo would be happy to assist you with design advice for our solutions - contact us for more information at sales@tondo-iot.com.

About Tondo

The Tondo Executive Team

Tondo Smart Ltd. was founded in 2016 and is based in Tel Aviv, Israel, with offices in Vancouver, Canada, and Seattle, USA. Tondo is a publicly-traded company on the Tel Aviv Stock Exchange (TASE: TNDO).

Tondo's solutions transform roadway and area lighting into a digital asset management platform that enables cities, parking management, and commercial property management firms to control, measure, and manage their critical infrastructure. Tondo helps deliver safety, improved operating efficiencies, and reduce the impact of urban growth on our planet.

Guy Saadi, CPA
Chief Executive Officer, Co-Founder

Guy Saadi is a digital communications expert, a graduate of Israel's 8200 Program, a former advisor to Israel's Prime Minister's Office, and the former Chief Financial Officer at a subsidiary of Dan Public Transportation.

Philip DesAutels, Ph.D.
Chief Product Officer

Dr. Philip DesAutels is an Internet of Things pioneer with IoT companies he helped found have been sold to Google and Verizon. Philip's experience includes Microsoft, The Linux Foundation, W3C and IBM

Gilad Babchuk
CEO & President, North America

Gilad Babchuk is a 4x CEO and serial entrepreneur with 30 years of global experience establishing, developing, and running impact organizations.

Micha Ben-Ezra
Chief Operating Officer, Co-Founder

Micha Ben Ezra is an expert in the field of outdoor and indoor lighting, electric utilities, and energy conservation programs, with over 30 years' in the wholesale electricity market.

Eliav Gnessin, M.Sc., BA Phys.
Chief Technology Officer, Co-Founder

Eliav Gnessin is a software and hardware design expert in mobile technologies, large-scale systems, embedded systems, Internet of Things (IoT), DevOps, Cloud software, Artificial Intelligence, and predictive algorithms.

Tali Kleinman, M.Soc
Vice President Sales & Marketing

Tali Kleinman is an expert in global-scale marketing and customer behavior. Served as Deputy CEO at Ipsos, one of the world's largest market research firms.

Marissa Wright, MBA
Chief Revenue Officer

Marissa Wright is a serial entrepreneur and angel investor with 40 years in technology marketing and sales leadership, and in 2002, co-founded Actenum Inc, an early AI software company.

Barak Ronen, CPA
Chief Financial Officer

Barak Ronen is a business planning and financial management expert. Barak is a former audit & compliance manager at PwC and Chief Financial Officer of Top Audio.

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