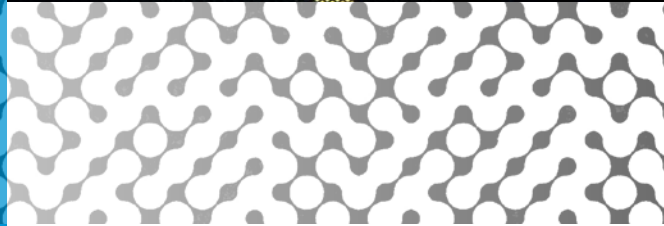
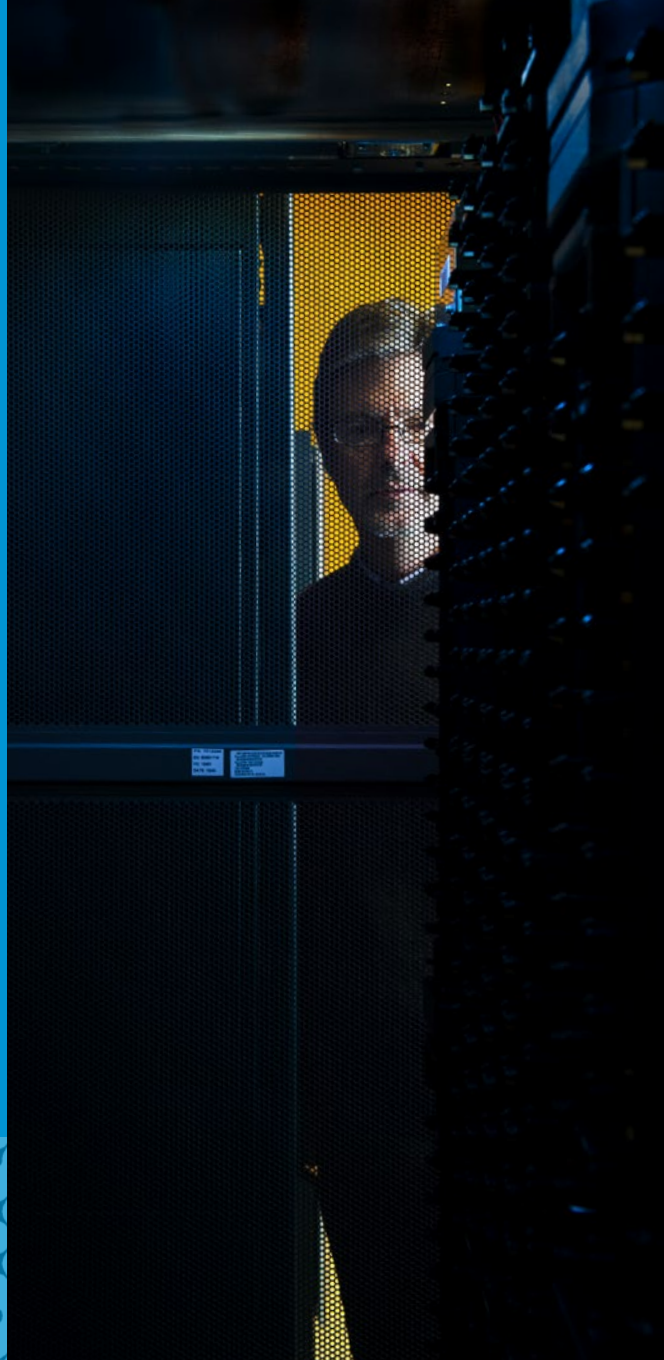


ADDING INTELLIGENCE AND SECURITY TO PHYSICAL INFRASTRUCTURE

>> By Marc Cram, BSEE, CDCD



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EXECUTIVE OVERVIEW

Cities, hospitals, universities, and businesses of all types currently face a decision to either modernize existing infrastructure with an overlay of new IoT equipment or rip and replace existing equipment in its entirety.

In these situations, many managers seek creative ways to extend the life of what they have already deployed while also trying to be forward compatible with future platforms.

Balancing the needs of the teams responsible for building, owning, and operating infrastructure such as IT, facilities, networking, and security is a delicate task filled with technical and financial challenges.

In these environments, flexible solutions to remotely monitor and manage remote, unstaffed facilities and a layer of onsite infrastructure sensor intelligence are needed.

INTRODUCTION

The world appears to be on a long-term path toward mass urbanization. Most outlooks, including that of the United Nations, predict that by 2030 more than 50% of the world's population will live in cities. Given that, many cities have declared that they will become "smart cities" that seek to improve citizens' quality of life through increased digitalization of services and open access to data. Data and regulation will be used to make these smart cities greener and safer.

Government offices throughout these cities deploy an increased number of security cameras to show wildlife in its native habitat, watch pedestrians, evaluate vehicular traffic flow, and supervise mass transit. Streets have embedded sensors collecting data on vehicular speeds and open parking spaces. Even the city-developed mobile apps can detect or report everything from potholes on the roads to trash on the sidewalk. Electric vehicle chargers are being installed in parking spaces throughout these cities and are available by reservation through smartphone applications. All these applications require the support of compute power coming from data centers or distributed edge computing locations.

The current thinking around computing continues to evolve its approach to delivering functionality. Once popular central mainframes gave way to distributed computing in the form of personal computers and departmental servers.

Then along came the public cloud concept of running massive numbers of servers from large data center locations and the transition of many new workloads going to the likes of AWS, Microsoft Azure, and Google Cloud facilities located near inexpensive power generation and high-speed fiber connections. The advent of 5G wireless and widespread bandwidth availability has the IT industry buzzing with the promises of low latency applications delivered over a combination of edge computing platforms and high-speed cellular data communications.

The transitions in approach to IT architecture and the ongoing proliferation of new computing locations can cause difficulties for those responsible for the IT infrastructure itself, namely the facilities personnel where the equipment is housed and the security team responsible for the equipment's physical security in those facilities. In some cases, these same people are also responsible for things outside of the typical IT sphere, like distributed antenna systems, HVAC systems, lighting, conference rooms, and telecom infrastructure.

This paper explores three scenarios requiring remote monitoring and their respective solutions that provide intelligence for use by IT, facilities, and security-focused personnel.

SCENARIO 1

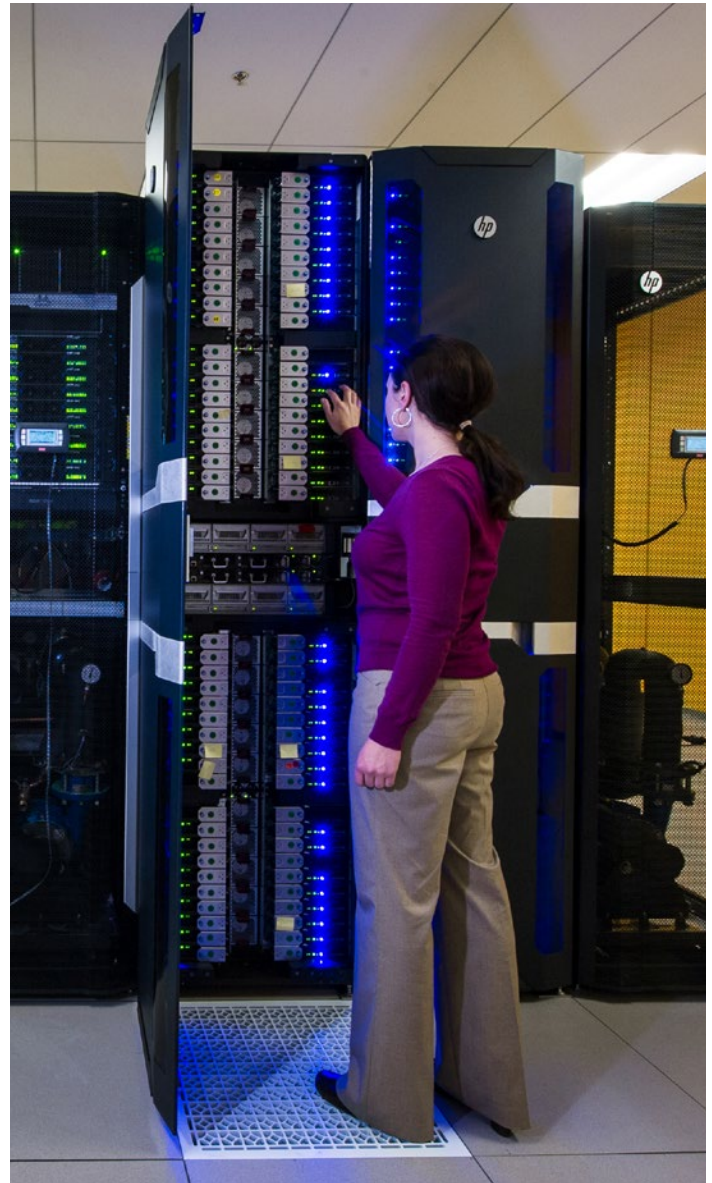
ADDING MODERN INTELLIGENCE TO LEGACY INFRASTRUCTURE

In this scenario, Legacy Infrastructure is IT racks built out years ago and deployed inside of an environment that was initially devoted to a single department or user community. For instance, a city traffic control center, a university research lab, a gas station chain, fast food restaurants, or department stores.

These spaces housing the IT gear or racks need to be repurposed into a multi-department, multi-tenant, or multi-user data center that is frequently accessed by the respective users. As the environment is repurposed, new challenges arise, such as how to improve access control, implement more granular environmental controls, and ensure uptime for everyone making use of the facility.

How do you transition to an intelligent infrastructure? Listed here is some of the technology you may need:

- Cage level and individual rack access control via secure door locks
- Support of in rack temperature, humidity, smoke detection, door open/close card reader locks
- Support for sensors outside the rack — temperature, humidity, floor leak detection, differential air pressure across perforated floor tiles and AC air filters
- Support for Logitech USB cameras to enable manual identity verification at the cage and rack levels
- API and SNMP support for the collection and management of sensor data and alarms
- Support for a wide variety of DCIM and BMS tools



TIPS WHEN CHOOSING REMOTE MANAGEMENT SOLUTIONS

Things to look for in any solution you choose:

- IP-based connectivity
- Dual power in-feeds going to dual power supplies
- Mounting flexibility (0U, 1U, etc.)
- Product reliability/warranty
- Low maintenance and product longevity
- API support
- Ease of use, both locally and remotely
- Global design support and technical support

SCENARIO 2

MANAGING COMPLEX URBAN INSTALLATIONS

Remote infrastructure cabinets that support cities are now being used to support multipurpose applications within those cities. They house a diverse set of systems with varying tolerances for environmental specs, power requirements, and access / control needs.



The enclosure may service a wide array of applications, including:

- Traffic light and crosswalk controls
- City traffic cam connections
- Parking system sensor interfaces
- EV Charging reservation system with POS
- Public kiosk data delivery gateway
- Public Wi-Fi access point
- Gunshot detection system gateway
- Shared equipment for 5G carriers
- Air quality monitoring system gateway
- Copper or fiber patch panels

Listed are some of the suggested tools for successful management and maintenance of these city installations:

- Dry contact closure sensing on the outer door position
- USB camera to manually ID personnel accessing enclosure matches access card
- Temperature and humidity sensors to ensure the cabinet and equipment therein is operating within parameters
- Remote power measurement and management
- Flexible power sourcing — AC or DC power
- API and SNMP support for the collection and management of sensor data and alarms
- Floor moisture sensor for shelter leaks, flooding, or AC condensation

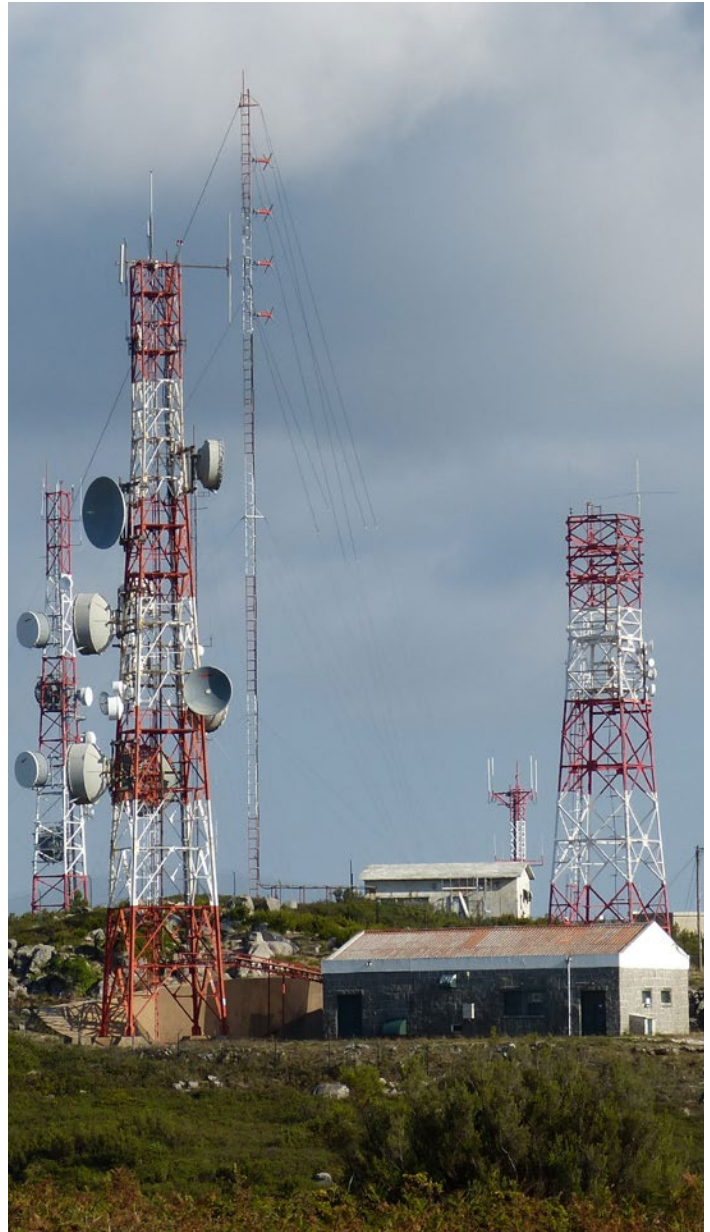
SCENARIO 3

ENSURING PHYSICAL SECURITY AND ENVIRONMENTAL HEALTH FOR DISTANT LOCATIONS

Property managers and technicians who manage any remote location need to be able to check on the condition of assets at locations across the country and the globe in real-time. The consistent monitoring for mother nature environmental factors, and human interference at remote locations is key to uptime in these environments.

Needs for environmental monitoring:

- Dry contact closure sensing on the outer door position
- USB camera to manually ID personnel accessing enclosure matches access card
- Temperature and humidity sensors to ensure the cabinet and equipment therein is operating within parameters
- Floor moisture sensor for shelter leaks, flooding, or AC condensation
- Ties to UPS and generator output for uptime status
- Remote power measurement and management
- Flexible power sourcing — AC or DC power
- Data accessible through a web interface and API for the presentation of multiple locations on a single pane of glass



SOLVING THE PROBLEMS GENESIS OF THE SMART RACK CONTROLLER

First conceived as a complement to the PX® line of intelligent data center power distribution units (PDUs) from Raritan, the Smart Rack Controller (SRC) leverage the knowledge and design expertise that come from working for over twenty years in the data center market. The idea for the SRC is to provide intelligence in the IT cabinet or remote enclosure for those installations where remotely managed PDUs were not implemented (legacy installations) or not desirable.

Raritan's SRC is an intelligent sensor management solution that serves as a central connection point for environmental monitoring, asset location, physical access, and other monitoring and security sensors. It addresses the gaps in instrumenting a facility or data center by providing an all-in-one stand-alone intelligent device that collects and delivers real-time actionable data about your facility without needing to change the configuration of existing power distribution or IT infrastructure.

The SRC family of products delivers a myriad of additional data points for the data center operator beyond the standard temperature and humidity at the rack level. Sensors are available to measure differential air pressure, floor moisture (leak sensor), vibration, proximity (through PIR), the status of dry contact closures, and perform asset tracking. In addition, the SRC supports the interface of smoke detectors via dry contact closure interface, Logitech USB cameras, and remote IT door lock card readers for access control.

Features of the SRC Family

- Xerus Technology Platform
- API access to the sensor data provided by the controller
- Works with all major DCIM tools
- LUA Scripting support
- SNMP v3, TLS 1.2
- Built-in multi-color LCD display
- USB for Wi-Fi dongle
- 10/100/1000 Ethernet
- RS-232/RS-485
- Local configuration through USB key, USB-attached cell phone, or locally attached PC
- Remote configuration and update via TFTP or DCIM tool
- Daisy-chain support of Raritan and Legrand sensors via standard Cat5/Cat6
- SNMP traps and alerts based on sensor readings
- Multiple power options — 48VDC, 120VAC, 208VAC 1-phase
- Dual power inputs going into dual power supplies for uptime and redundancy
- 19" rack mountable, with easy installation in 1U or 0U

THE SRC FAMILY CONSISTS OF FOUR MODELS, FROM THE ENTRY LEVEL SRC-0100 UP TO THE FEATURE-RICH SRC-0800

SRC-0100



Our entry model, the SRC-0100, contains all the functionality listed in "Features of the SRC Family." This is for those installations that primarily need the environmental monitoring capabilities of the SRC and its array of available sensors.

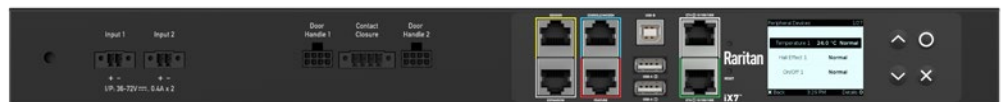
SRC-0102



Based on the SRC-0100, the SRC-0102 has the same functionality and adds an embedded door lock (SmartLock™) controller internally to the unit. Perfect for those wanting to monitor and manage single infrequently visited rack locations and small remote enclosures that may be operating on the limits of the environmental specifications of the equipment contained therein.

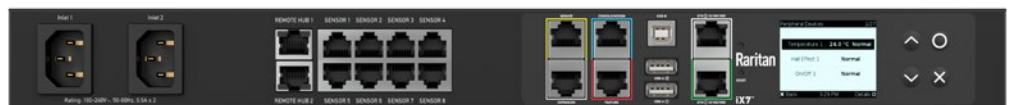
- Embedded DX2-DH2C2 (SmartLock Door Controller)
- Can support 4x door handles total (2x with embedded controller, 2x with additional/optional controller)
- Integrated dual contact closure for use with an optional door position sensor (magnetic contacts)

SRC-0103



The SRC-0103 is a -48VDC powered version of the SRC-0102. The C14 power inputs of the SRC-0102 are replaced with a pair of 2-pole input terminal blocks that take power from a -48V input source. Otherwise, the features and functionality are identical to the SRC-0102. This device is useful for remote telecommunication facilities having -48VDC power infrastructure in them, for example cell towers and cable TV huts.

SRC-0800



With up to eight (8) sensor ports in the SRC-0800 supporting up to 12 daisy-chained sensors per port, the SRC-0800 is capable of providing sensor data for an entire row of data center cabinets or acting as a supplemental/secondary set of inputs to most building environmental control systems. The SRC is well-suited for use by the colocation facility provider looking to deliver services as well as the colocation tenant looking for a degree of security and certainty that the facility is delivering on its SLAs.

The SRC-0800 is also a great candidate for modular data center applications consisting of 6 to 18 racks per module. With its support for remotely operated door locks, smoke detectors (must be equipped with dry contact outputs), floor moisture sensors, USB cameras, differential air pressure, airflow, dry contact closures, temperature and humidity sensors, the SRC is the one solution capable of integrating all of the critical data points for ensuring the physical security and efficient environmental operation of a containerized data center.

- iX7 controller
- 8 full powered sensor ports — Each port can support 2x door handles and multiple sensors
- Can support 16x door handles (8 cabinets) in the standard configuration
- 2 remote hub ports — New I/O port on Raritan products, these ports are compatible with the forthcoming “Remote Extension Hub” (DX2-REMHUB) capable of extending sensors up to 150 ft (50m) away from the SRC device

SUPPORTED SENSOR TYPES

The SRC, Raritan, Server Technology (PRO3X and later), and Legrand branded intelligent PDUs all support a common set of sensors. These sensors interface to the SRC via standard Cat5/Cat6 patch cords, and up to 12 sensors can be daisy-chained together to a single sensor port on the SRC. This gives the installer greater ease of flexibility for the placement of the sensors and the ability to replace damaged cords.

Available sensor types include:

- Temperature, humidity, combination temperature + humidity
- Floor moisture/water leak detectors
- Air velocity, differential air pressure
- Vibration
- PIR proximity/motion
- Dry contact closures
- Door locks, door locks with embedded card readers

In addition, the SRC can support these third-party products as well:

- Smoke detectors with dry contact closure outputs
- Logitech USB camera

ALL AVAILABLE SENSORS

Temperature SmartSensor (DX2-T1)

Single temperature sensor, field replaceable sensor module, RJ-45 connector.

Temperature and Humidity SmartSensor (DX2-T1H1)

Single combo temperature and humidity sensor, field replaceable sensor modules, RJ-45 connector.

Temperature and Humidity SmartSensor Kit (DX2-T2H2)

Dual combo temperature and humidity sensors, field replaceable sensor modules, RJ-45 connector.

Temperature and Humidity SmartSensor Kit (DX2-T3H1)

Three temperature sensors, middle sensor supporting humidity (four sensors total in three housings), field replaceable sensor modules, RJ-45 connector.

Airflow SmartSensor (DX2-AF1)

Numeric sensor with RJ-45 connector, designed to monitor presence of hot and cold air.

Differential Air Pressure SmartSensor (DX2-T1DP1)

Differential air pressure sensor with RJ-45 connector, designed to monitor two air pressures in separate locations such as the air pressure on either side of a thermal curtain separating a cold aisle from a hot aisle or above and below a raised floor or overhead plenum.

Water Floor SmartSensor (DX2-WSF-KIT)

Floor water/leak sensor and a contact closure sensor for detecting water or water and glycol leaks. Reliably warns of water leaks at critical points below a raised floor. Available in 35/70/100 mm.

Rope Water SmartSensor (DX2-WSC-KIT)

rope water/leak sensor and a contact closure sensor for detecting water or water and glycol leaks. Detect leaks anywhere along the length of this flexible cable and report the position on the cable. Wrap around a rack with in-row cooling. Available in 35/70/100 mm.

Contact Sensor (DX-PD2C5)

Two active dry contacts powered by 12V to support door locks. Normally Closed (NC) or Normally Open (NO) contact closures which require customer-provided NC or NO switches, e.g. door open/close, smoke present/absent, etc. RJ-45 connector. (Not supported by DPX, PX or PX2 models).

Contact Closure SmartSensor (DX2-CC2)

2 Contact Closure Sensors for connection and management third-party sensors. (smoke, sound, etc.)

Proximity and Motion Sensor (DX-PIR)

Digital proximity sensor which detects motion around a cabinet, RJ-45 connector (Not supported by DPX, PX or PX2 models).

Vibration Sensor (DX-VBR)

Vibration sensor which detects acceleration along three axes (x, y, z). RJ-45 connector.

Sensor Hub (DPX2-ENVHUB4)

Four-port (1x4) hub to expand RJ-45 sensor ports, comes with mounting bracket.

Remote Hub (DPX2-REMHUB4)

Four-port (1x4) hub to expand the length of RJ-45 sensor ports, comes with mounting bracket. Can only be used with (SRC-0800).

SCENARIO 1 SOLVED

ADDING MODERN INTELLIGENCE TO LEGACY INFRASTRUCTURE

In one instance, a university medical school needed to bring its IT infrastructure up to HIPAA compliance.

Legrand replaced the IT cabinet doors with modern smart swing handles with integrated card readers and remotely controlled locks. By connecting the door locks to the iX7 controller found in the SRC and the PX3 family of Raritan intelligent PDUs the school was able to implement rack level access control that matched up to the badge reader access of the data center hall. This enabled the school to log and control access to each individual cabinet while re-using their existing cabinets, thus avoiding the effort of racking and stacking systems into new cabinets. Temperature and humidity are also now able to be tracked, and the rack doors have a secondary status sensor for open/closed status done via dry contact closure.



Raritan

Item	Model
Smart Rack Controller	SRC-0102 per cabinet or SRC-0800 per row/cage
Expansion Sensor Hub	DX2-ENVHUB4 or DX2REMHUB for SRC-0800
Temperature and Humidity SmartSensor	DX2-T1H1 for front and back of every cabinet
Airflow SmartSensor	DX2-AF1 for cold aisles
Differential Air Pressure SmartSensor	DX2-T1DP1 for across air filters of AC, racks, perforated floor tiles, etc.
Rope Water SmartSensor	DX2-WSC-KIT for water leak detection
Standard Smart-Lock Solution	Intelligent locking door handle with card reader
Contact Closure SmartSensor	DX2-CC2 dry contact closure for rack doors

Sunbird

Item	Description
Power IQ Software	Data Center Infrastructure Management software

Legrand

Item	Model
Cabinet	Legrand LX or T-Series cabinet

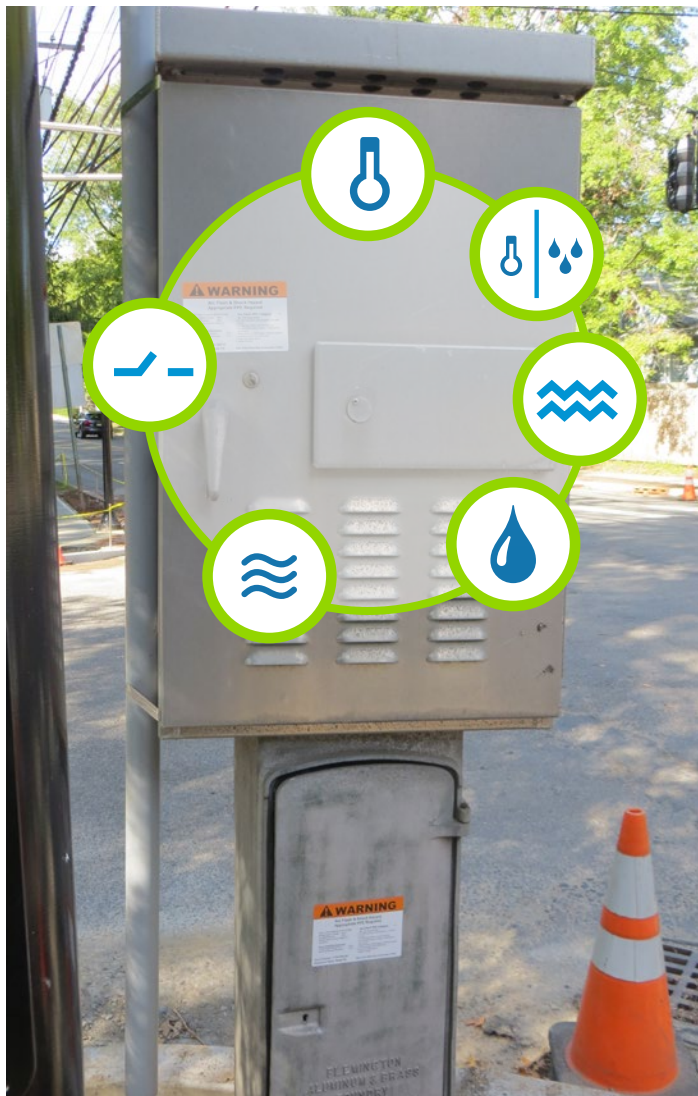
Third Party

Item	Model
Smoke Detection	Connected to DX2-CC2 outputs

SCENARIO 2 SOLVED

MANAGING COMPLEX URBAN INSTALLATIONS

The city street corner can be full of surprises. Hidden inside the ground-mounted pedestal enclosures often found near busy intersections can be a veritable treasure trove of modern IT infrastructure. A variety of systems may be located inside, ranging from traffic light and crosswalk controllers to general purpose industrial PCs dedicated to acting as gateways for traffic cameras, parking systems, public Wi-Fi, air quality monitors, and so forth. Many of these enclosures have some amount of ventilation or cooling systems present to keep all the electronics operating within their specified environmental limits. In this environment, it is crucial to have a highly reliable or even redundant system. This is a perfect setting for the SRC-0102 and SRC-0103 products.



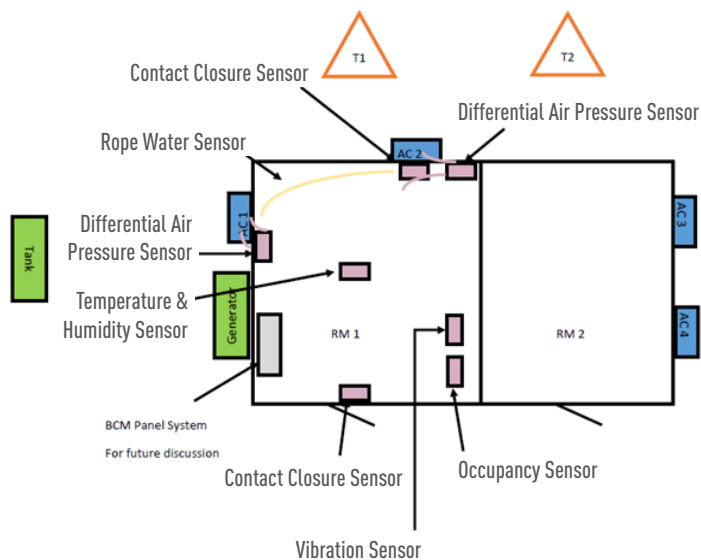
Raritan

Item	Model
Smart Rack Controller	SRC-0102 or SRC-0103
Temperature & Humidity	DX2-T1H1
Floor moisture	DX2-WS1 DPX-WSC-35-KIT
Vibration Sensor	DX-VBR on floor
Dry contact closure	DX2-CC2 on door
Air Flow	DX2-AF1 (on air intake)
Sensor Hub	DX2-ENVHUB4

SCENARIO 3 SOLVED

ENSURING PHYSICAL SECURITY FOR DISTANT LOCATIONS

Many kinds of remote infrastructures are deployed with shelters full of electronic hardware associated with them, such as commercial radio and TV broadcast towers, macro cell phone towers, cable TV distribution points, and telecom distribution points. The SRC-0102 and SRC-0103 are well suited to these installations.



Raritan

Item	Model
Occupancy Sensor	DX2-PIR
Differential Air Pressure SmartSensor	DX2-T1DP1
Contact Closure SmartSensor	DX2-CC2
Temp and Humidity SmartSensor	DX2-T1H1
Rope Water SmartSensor	DX2-WSC-100-KIT
Vibration Sensor	DX2-VBR
Sensor hub	DX2-ENVHUB4
Smart Rack Controller	SRC-0102 SRC-0103
Intelligent PDU	PX3-5145R
KVM-over-IP Switch	DKX3-808

Legrand

Item	Model
Cabinet	LX or T-Series Cabinet

CONCLUSION

Needs change over time. Whether you add a new layer of intelligence to existing infrastructure or elect to rip and replace with something completely new, it makes sense to implement more data collection and intelligence to facilitate remote operation and troubleshooting going forward. This applies to data centers, edge computing sites, 5G wireless, and remotely operated radio, TV, and telecommunications sites.

Adding sensors and the Smart Rack Controller to your build-out plans is one essential means of implementing the monitoring and access controls you need to ensure the physical security and uptime of your most demanding customers and your critical infrastructure.

BEYOND THE SMART RACK CONTROLLER AND SENSORS

Legrand's Data, Power & Control (DPC) division is a broad-based manufacturer of products suited to data centers and remotely managed locations such as 4G/5G macro cell towers, commercial radio towers, retail stores, restaurant chains, IoT and edge compute installations of all kinds.

Our offering includes:

- Intelligent rack PDUs
- Overhead Busway
- Racks and enclosures
- Cooling and containment
- Copper connectivity
- Fiber connectivity
- KVM Remote Access

WHY RARITAN

Raritan, a brand of Legrand, is a global leader in intelligent rack PDUs, KVM switches, and other data center infrastructure monitoring and management solutions. Raritan's innovations improve the reliability, efficiency, and intelligence of data centers and server rooms around the globe — including those of the top Fortune 500 companies, such as Cisco, Dell, Google, HP, IBM, Intel, and Microsoft.