MITSUBISHI ELECTRIC
Changes for the Better

Automating the World

YOUR FAULT DETECTION & DIAGNOSTICS eBOOK:

Unlocking Building Energy Efficiency, Control, and Comfort at Portfolio Scale

With Mitsubishi Electric Iconics Digital Solutions

- **Real-time detection, diagnostics, and prioritization of equipment faults for faster issue resolution**
- **Intelligent energy management that delivers measurable savings and reduces maintenance costs**
- **Proactive maintenance for improved uptime and extended equipment life**
- **Seamless integration with building systems for unified monitoring and control**
- **Smarter, more sustainable operations supported by Mitsubishi Electric expertise**

Automating the World

Our Factory Automation business is focused on "Automating the World" to make it a better, more sustainable environment supporting manufacturing and society, celebrating diversity and contributing towards an active and fulfilling role.

SUSTAINABLE DEVELOPMENT GOALS

The Mitsubishi Electric Group is actively solving social issues, such as decarbonization and labor shortages, by providing production sites with energy-saving equipment and solutions that utilize automation systems, thereby helping towards a sustainable society.

Mitsubishi Electric is involved in many areas including the following:

Energy and Electric Systems
A wide range of power and electrical products from generators to large-scale displays.

Electronic Devices
A wide portfolio of cutting-edge semiconductor devices for systems and products.

Home Appliance
Dependable consumer products like air conditioners and home entertainment systems.

Information and Communication Systems
Commercial and consumer-centric equipment, products and systems.

Industrial Automation Systems
Maximizing productivity and efficiency with cutting-edge automation technology.

WHY THIS eBOOK?

If you're responsible for running buildings—whether you're a Facility Manager, part of a Sustainability or Energy team, or working in Real Estate and Asset Management—you're probably feeling the squeeze. Energy costs are climbing, regulations are getting tougher, and expectations for comfort, health, and sustainability have never been higher.

This eBook is here to help you cut through the noise—explaining what Fault Detection and Diagnostics (FDD) is, how it works, and how you can use it to reduce waste, improve comfort, and make smarter operational decisions across your entire portfolio.

You'll also see how the right FDD approach can deliver measurable ROI, streamline your team's workload, and help you meet your organization's ESG and operational goals without adding complexity.

WHY NOW?

1. **Systems are aging** - many buildings run on a patchwork of legacy equipment that's hard to monitor and optimize.
2. **ESG goals are non-negotiable** - boards, investors, and tenants expect action, proof, and progress.
3. **Costs are rising** - energy prices, maintenance expenses, and labour shortages are all hitting at once.

In the following pages, you and your team will learn how to use data more effectively, turning insights into smarter operational and business decisions. You'll explore the challenges building teams face today, see how FDD works in practice, and discover what it takes to scale from a single pilot site to an entire portfolio.

You'll also find real examples, practical tips, and proven strategies drawn from experience delivering FDD across some of the world's most complex buildings.

AUTHORS

Sam Walton
Industry Growth Manager – Smart Buildings

Mary Anne Ballouz
Content Marketing Manager

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REALIZING INTELLIGENT BUILDING OPERATIONS THROUGH FDD

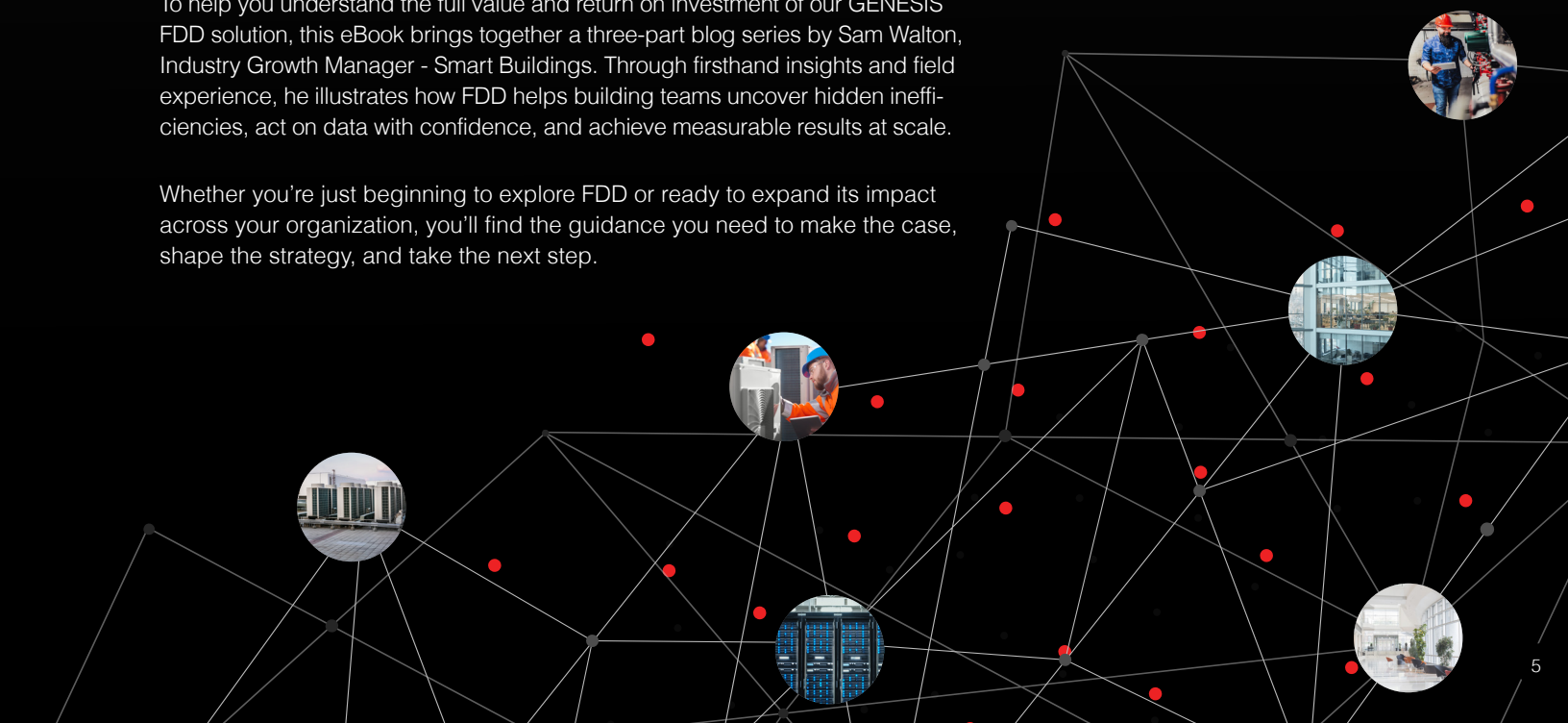
Operating and maintaining buildings today is more complex—and more mission-critical—than ever. Facility managers are under increasing pressure to improve energy efficiency, lower operational costs, and ensure occupant health and comfort—all while managing aging infrastructure and overextended, understaffed teams. In this environment, traditional tools and reactive maintenance strategies simply no longer suffice.

That's where Fault Detection and Diagnostics (FDD) from Mitsubishi Electric Iconics Digital Solutions comes in.

Powered by our advanced GENESIS software suite, our FDD technology is transforming how organizations manage their buildings—identifying issues earlier, diagnosing root causes automatically, and enabling proactive action across systems and sites. Whether the goal is to reduce energy waste, extend the life of HVAC equipment, or scale smarter operations across a growing portfolio, GENESIS provides the real-time insights and automation needed to stay ahead.

To help you understand the full value and return on investment of our GENESIS FDD solution, this eBook brings together a three-part blog series by Sam Walton, Industry Growth Manager - Smart Buildings. Through firsthand insights and field experience, he illustrates how FDD helps building teams uncover hidden inefficiencies, act on data with confidence, and achieve measurable results at scale.

Whether you're just beginning to explore FDD or ready to expand its impact across your organization, you'll find the guidance you need to make the case, shape the strategy, and take the next step.



// PART 1

HOW FDD SOFTWARE CONTINUES TO SOLVE BUILDING MANAGEMENT CHALLENGES

Managing buildings is no small feat. Facility managers, building engineers, and technicians face a whirlwind of responsibilities—from keeping equipment and systems humming to staying compliant with service-level agreements (SLAs), to walking the tightrope of occupant comfort and energy efficiency. It's a high stake, often low-budget, environment involving:

- **Wrestling with complex systems and huge amounts of data.**
- **Meeting stringent energy efficiency goals and regulatory reporting standards.**
- **Optimizing equipment performance and health across aging infrastructure.**
- **Coordinating in-house maintenance teams and third-party vendors.**
- **Scrambling to fix the most critical mechanical, electrical, and control system issues.**

While facility managers often expect their technicians to spend at least 80% of their time fixing things (aka getting stuff done), the reality is that if you ask your average field technician, they'll say they spend most of their time figuring out what broke and how to fix it.

And here's the kicker: many maintenance teams are understaffed or undertrained, lacking the expertise needed to navigate complex field issues found in control sequence problems, network faults, or legacy BMS quirks.

That's not to say that engineers don't have enough institutional knowledge. They do. Many engineers have an incredible sixth sense for spotting issues based on sound or observation—like saying "that valve should be partially open, not closed" or "that damper looks out of position."

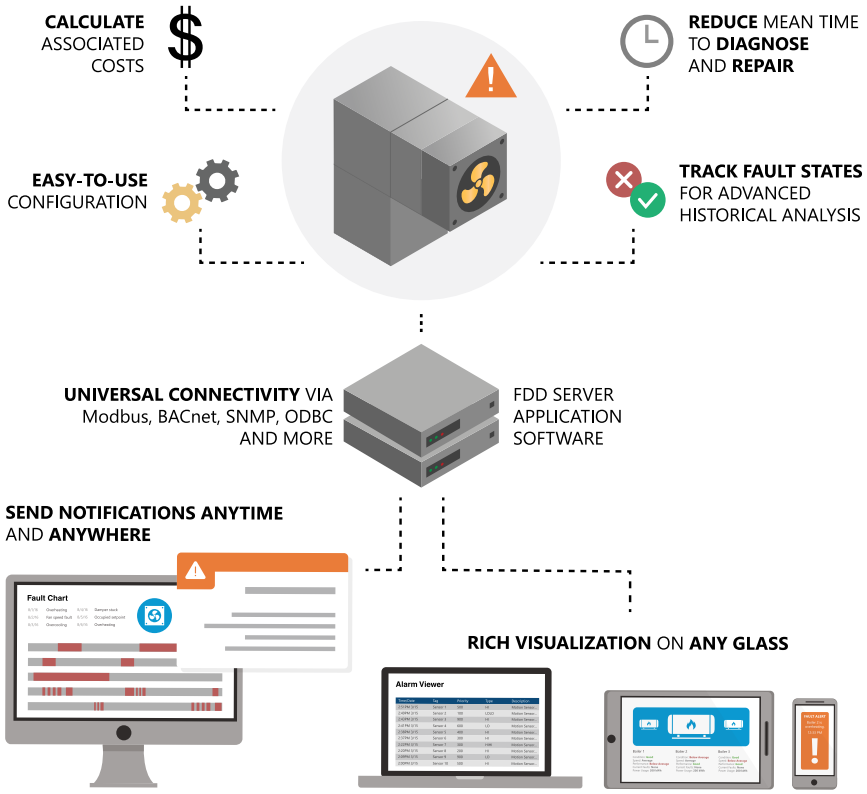
But intuition and knowledge sharing isn't a scalable strategy, especially in complex operations where signals are weak across a diverse portfolio of buildings.

SO, WHAT IS FAULT DETECTION AND DIAGNOSTICS (FDD) SOFTWARE?

Fault Detection and Diagnostics (FDD) software is a powerful tool designed to identify and diagnose inefficiencies or faults within a building's systems and equipment.

This technology covers physical equipment—think identifying chillers with low refrigerant charge, air handling units with a stuck damper, boilers with a failing pump—as well as software systems with inefficiencies and automation controllers with signal issues.

Unlike traditional building management systems (BMS), which tend to flag focused issues without much context, i.e., "alarm" when a setpoint has deviated from a preconfigured range, dedicated software tools for FDD take analysis multiple steps further. For example, these tools can:



DETECT: Identify anomalies in real time using advanced algorithms.

FDD goes beyond basic alarms by analyzing data to provide detailed insights. For instance, when a BMS alarm signals high discharge air temperature in an air handling unit (AHU), FDD identifies the make, model, and size of the unit and explains that the issue has persisted for 24 hours continuously.

DIAGNOSE: Pinpoint root causes, assess the impact, and provide suggested fixes.

This second "D" can assign costs to the fault, determine what other systems might be impacted by that fault, and provide additional meta data relevant to the fault. Continuing the example above, a message would look like this: The heating valve in the AHU is stuck open or leaking, affecting 3 zones on the 12th floor. This problem has wasted $120 in the last 24 hours.

DELIVER: Offer actionable insights.

This capability doesn't just provide cryptic error codes, but in some cases, can couple supervisory control actions to sequences, setpoints, and schedules, enabling necessary changes to be made remotely or generating focused work orders for field technicians to address. One such insight involves an automated work order to inspect and replace the valve if necessary and perform a manual override test to check valve movement.

Together, these capabilities turn raw building data into prioritized, actionable intelligence—empowering teams to fix the right problems faster, and with far greater impact.

WHAT ARE THE KEY FEATURES OF FDD SOFTWARE?

Data Integration and a Unified Data Model: FDD technology is usually coupled with a software layer that abstracts data from sensors, BMS data points, and equipment (e.g., HVAC, lighting, energy) into a centralized data model, often using standards like BRICK or Haystack.

- **Fault Detection:** FDD uses a customizable rules engine to identify inefficiencies or underperforming systems.
- **Diagnostics:** FDD pinpoints the root causes of issues and suggests corrective actions prioritized by comfort, energy, and cost.
- **Alerts and Notifications:** FDD delivers real-time updates to keep teams informed.
- **Actionable Insights:** FDD recommends steps to resolve faults and optimize operations.

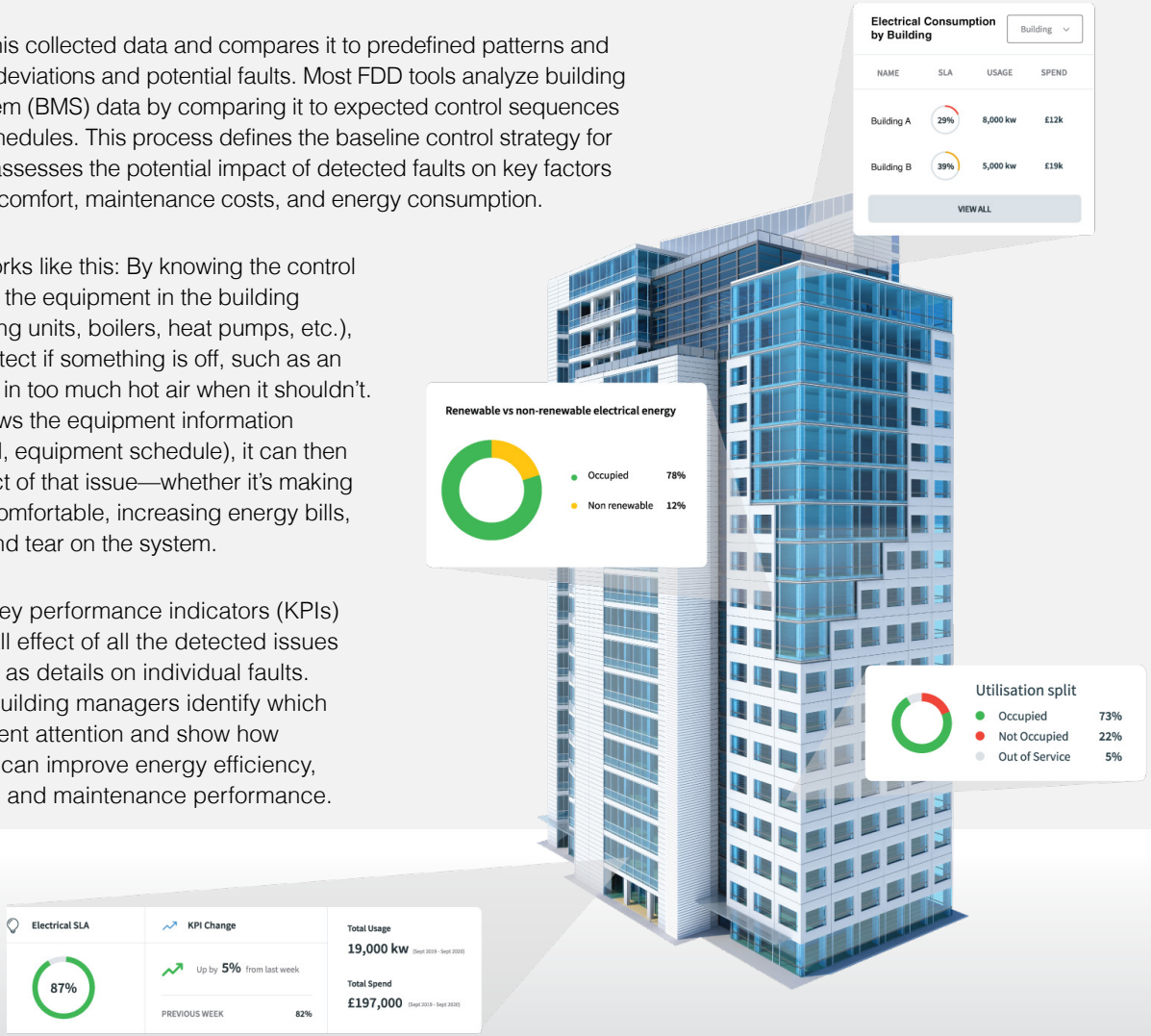
HOW DOES FDD WORK?

Buildings are full-to-the-brim with sensors that gather information on various parameters—temperature, humidity, pressure, and energy consumption. Most of this data is typically abstracted from polling BMS, metering, and lighting devices.

FDD aggregates this collected data and compares it to predefined patterns and models to identify deviations and potential faults. Most FDD tools analyze building management system (BMS) data by comparing it to expected control sequences and equipment schedules. This process defines the baseline control strategy for each system and assesses the potential impact of detected faults on key factors such as occupant comfort, maintenance costs, and energy consumption.

The technology works like this: By knowing the control rules and specs of the equipment in the building (chillers, air handling units, boilers, heat pumps, etc.), FDD can better detect if something is off, such as an economizer letting in too much hot air when it shouldn't. Because FDD knows the equipment information (size, make, model, equipment schedule), it can then estimate the impact of that issue—whether it's making the building less comfortable, increasing energy bills, or causing wear and tear on the system.

FDD will provide key performance indicators (KPIs) showing the overall effect of all the detected issues combined, as well as details on individual faults. These KPIs help building managers identify which issues require urgent attention and show how corrective actions can improve energy efficiency, occupant comfort, and maintenance performance.



WHO USES FDD?

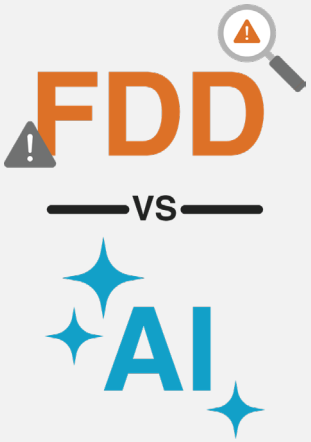
Fault Detection and Diagnostics (FDD) software delivers value across multiple roles within building operations—helping teams at every level work more efficiently and strategically.

From in-house technicians to external partners, FDD empowers a wide range of users to optimize building performance and contribute to smarter, more sustainable operations.

Operations and Maintenance Teams
Whether on-site or remote, FDD helps these teams monitor system performance and prioritize fixes.

Third-Party Service Providers
Mechanical, electrical, and commissioning agents can use FDD insights to enhance their services or streamline maintenance tasks.

Energy Managers and Sustainability Teams
FDD aids with measurement and verification (M&V) and tracks the effectiveness of energy conservation measures.



IS FAULT DETECTION AND DIAGNOSTICS (FDD) ARTIFICIAL INTELLIGENCE (AI)?

Yes and no. FDD is not AI in the way most industries would describe something like machine learning (the ability for machines to learn from data and improve over time without being explicitly programmed for every task). Instead, it's a form of AI typically referred to as "expert systems"—a type of AI that codifies domain-specific knowledge and industry know-how into highly specialized algorithms.

However, machine learning in FDD systems is on the up, accelerating deployments, reducing false positives (incorrectly identified faults when none exist) and duplicates, and enhancing diagnostic insights.

IS FDD A MAINTENANCE SILVER BULLET?

As with all forms of technology adoption, there is a significant element of change management involved in realizing the true power of FDD. Whether it's actually actioning the suggested fixes (FDD doesn't do it for you) or transitioning from schedule-based to preventive maintenance regimes based on data—changes in thinking and processes are required.

Different departments, including operations, asset management, IT, and sustainability, must be aligned. FDD should also integrate with existing operational workflows and systems such as Computer-Aided Facility Management (CAFM) and Computerized Maintenance Management System (CMMS) platforms to ensure seamless adoption.

HOW FDD SOFTWARE ADDRESSES BUILDING MANAGEMENT CHALLENGES

From data overload to equipment failure, building management comes with no shortage of challenges. Fault Detection and Diagnostics (FDD) software addresses these pain points head-on, providing intelligent, automated solutions that streamline operations and drive measurable results. Let's take a closer look.

1 SIMPLIFIES COMPLEX SYSTEMS AND DATA OVERLOAD

Challenge: Managers and operators struggle to extract actionable insights from vast amounts of building data.

FDD Solution:

- Aggregates data into a centralized platform for easy access.
- Filters out unnecessary information, highlighting critical issues.
- Provides interactive dashboards for enhanced visualization and analysis.

2 EASES TROUBLESHOOTING AND ISSUE RESOLUTION

Challenge: Valuable time wasted diagnosing faults and resources.

FDD Solution:

- Delivers operational visibility to quickly identify and resolve issues.
- Automates fault diagnostics, reducing manual troubleshooting efforts and enabling quicker fixes.

3 TACKLES INEFFICIENT ENERGY USE

Challenge: Energy waste from poor optimization and unnecessary equipment operation.

FDD Solution:

- Monitors energy consumption in real time.
- Detects inefficiencies (like simultaneous heating and cooling).
- Recommends adjustments to optimize usage and cut costs.

4 IMPROVES EQUIPMENT HEALTH VISIBILITY

Challenge: Unanticipated equipment failures that disrupt operations.

FDD Solution:

- Tracks equipment performance metrics to identify potential issues.
- Enables proactive maintenance to extend asset life.

5 REDUCES MAINTENANCE COSTS

Challenge: Reactive maintenance that leads to expensive repairs and unplanned downtime.

FDD Solution:

- Shifts to preventive maintenance by forecasting failures.
- Reduces emergency repairs and callouts.
- Eliminates the necessity of manual schedule-based inspections.

6 ENSURES OCCUPANT COMFORT

Challenge: Complaints about inconsistent temperatures or poor air quality.

FDD Solution:

- Monitors environmental factors like temperature, humidity, and air quality.
- Alerts operations teams of HVAC faults to prevent/reduce downtime before occupants are impacted.

7 MEETS SUSTAINABILITY & COMPLIANCE GOALS

Challenge: Adherence to energy standards and regulations.

FDD Solution:

- Tracks energy performance and verifies energy saved from detected faults to ensure compliance and optimize operations.
- Reduces carbon emissions through optimized resource use.

8 SUPPORTS UNDERSTAFFED & INEXPERIENCED TEAMS

Challenge: Limited staff and insufficient domain expertise that hinder building operations.

FDD Solution:

- Automates diagnostics to reduce dependency on manual intervention.
- Provides user-friendly interfaces and actionable recommendations for all skill levels.
- Codifies knowledge of experienced technicians and building operators for next generation workers.

9 SCALES ACROSS PORTFOLIOS

Challenge: Managing multiple buildings with inconsistent processes.

FDD Solution:

- Standardizes operations across locations.
- Enables remote monitoring and centralized decision-making.

By turning complexity into clarity, FDD helps facility teams overcome today's toughest operational hurdles—paving the way for more efficient, reliable, and scalable building performance.

HOW FDD ALLOWS FOR SMARTER, NOT HARDER WORK

Fault Detection and Diagnostics (FDD) is a proven solution to manage and operate buildings in a smarter way. FDD software has been revolutionizing building management for over a decade by serving as a digital assistant to field technicians, and becoming an indispensable tool in most carbon and energy reduction programs. In fact, a 2020 study of 6500 buildings by Berkeley National Laboratory and the US Department of Energy found that FDD saved the median organization $3 million annually, or 9% in energy savings.

Additionally, FDD paves the way for a shift from traditional reactive maintenance to a more proactive and preventive model. Instead of responding to issues after escalation, facility managers can identify and resolve problems in real time, enabling continuous performance improvement.

- Faster response times that minimize disruptions
- Lower operational costs through early detection and targeted maintenance
- Extended equipment lifespan for critical building systems

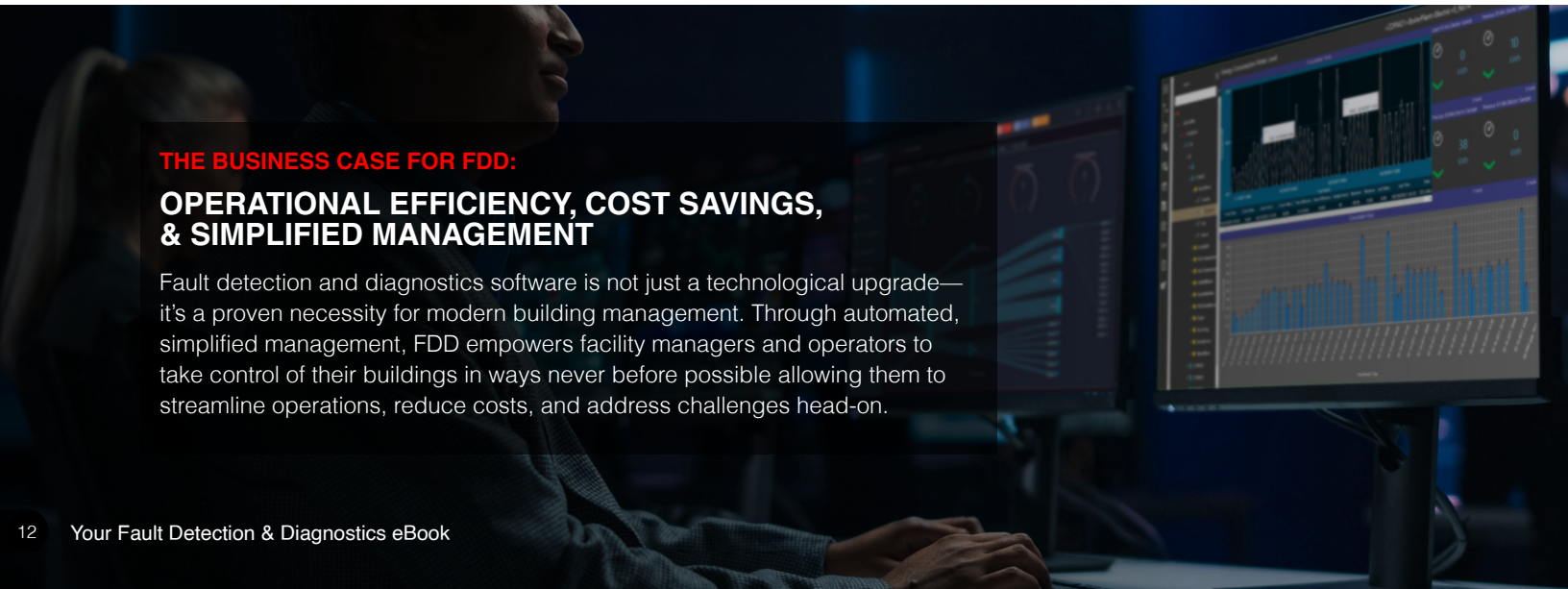
In turn, FDD brings enhanced occupant experience, sustainability, and workforce resiliency benefits too.

HOW FDD SOFTWARE SHIFTS MAINTENANCE FROM REACTIVE TO PROACTIVE

If you look at the tools maintenance teams typically use today, many of these are still based on manual processes and calendar-based schedules. A typical maintenance routine might involve a technician walking through a checklist to inspect cooling towers, chillers, boilers, air handlers, or VAV boxes—all to ensure each piece of equipment is operating as designed.

FDD technology changes the game by automating these checks. Instead of performing a handful of manual checks during a scheduled visit, FDD software runs thousands of checks per day, 365 days a year, flagging the worst-performing equipment in real time.

Embracing FDD marks a massive shift—from reacting to complaints or following manual routines to using an always-on system that surfaces insights proactively. Imagine knowing the top five issues for your chiller before even walking into the mechanical room.



THE BUSINESS CASE FOR FDD:

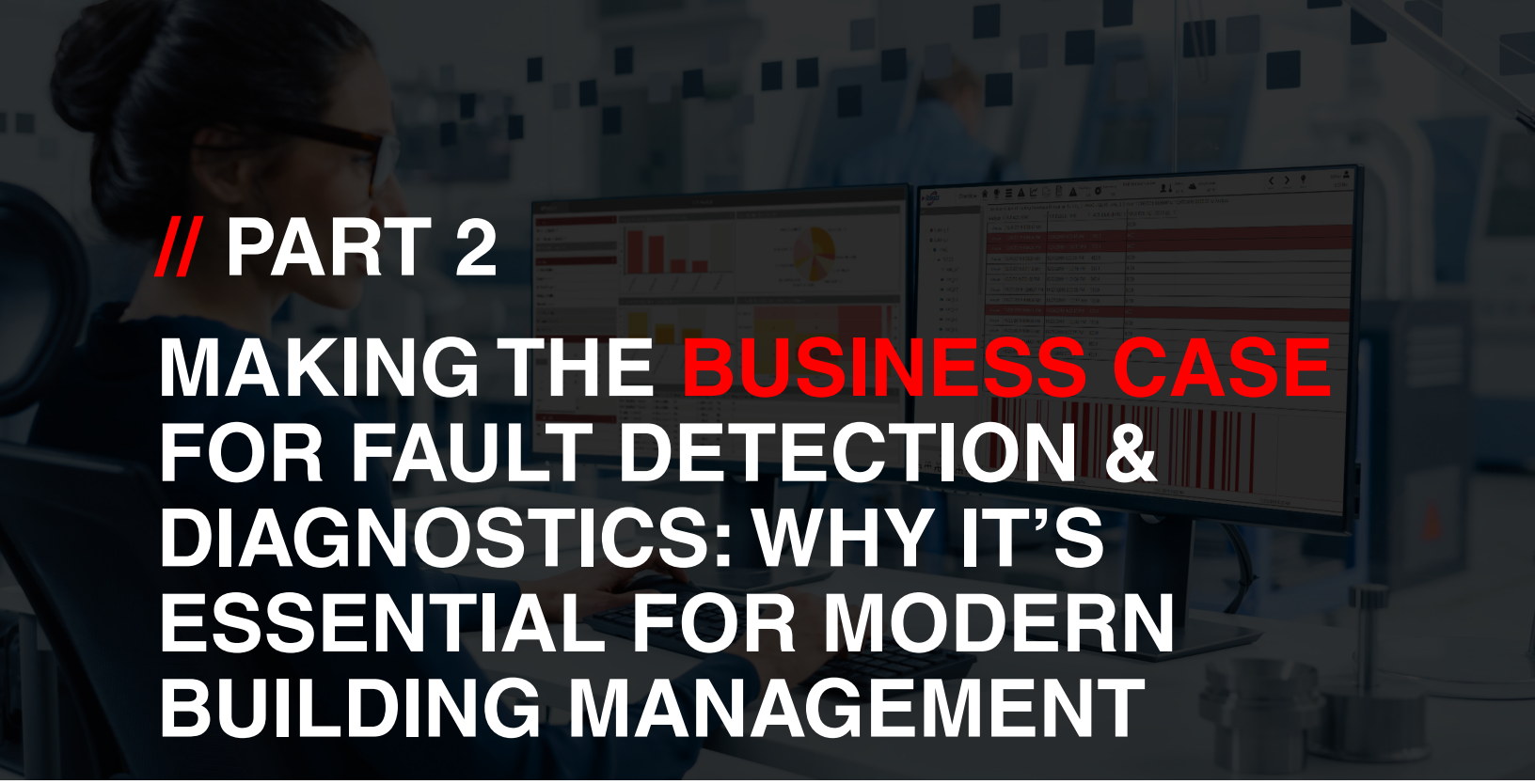
OPERATIONAL EFFICIENCY, COST SAVINGS, & SIMPLIFIED MANAGEMENT

Fault detection and diagnostics software is not just a technological upgrade—it's a proven necessity for modern building management. Through automated, simplified management, FDD empowers facility managers and operators to take control of their buildings in ways never before possible allowing them to streamline operations, reduce costs, and address challenges head-on.

Based on what we've seen so far, the GENESIS system will not only allow our team to pre-emptively fix the right issues at the right time, but it will enable us to do this based on the quantifiable impact unfixed faults will have on building performance and occupant comfort.

The combination of cloud-based AI technology and our engineering-prowess, will ensure that this great building is tuned to design-level standards, for a long time to come."

PETER BICKNELL, HEAD OF ENGINEERING FOR 22 BISHOPSGATE



// PART 2

MAKING THE BUSINESS CASE FOR FAULT DETECTION & DIAGNOSTICS: WHY IT'S ESSENTIAL FOR MODERN BUILDING MANAGEMENT

BEYOND THE BOTTOM LINE

// BUILDING THE BUSINESS CASE

1 ENERGY EFFICIENCY & COST SAVINGS

FDD isn't just another analytics tool; it's a proven way to cut energy waste, streamline building operations, and support ESG (environmental, social, and governance) goals. Whether it's referenced in ASHRAE's Handbook Guidance (Chapter 41, Section 2.1) or cited by energy consultants as "low-hanging fruit" in an energy management strategy, FDD gets results. The technology moves beyond reporting and portfolio-wide metrics to empower service professionals on the ground to prioritize and fix issues faster. In other words, they can get more done.

Extensive research backs its effectiveness. A recent study (Building Analytics Tool Deployment at Scale: Benefits, costs, and deployment practices), confirms that coupling Energy Information Systems (EIS) with Fault Detection and Diagnostics (FDD) is a proven strategy for sustained energy savings. By year two, organizations using FDD saw a median savings rise to 9%, as users became more adept at leveraging insights and embedding analytics-driven efficiency into their operations.

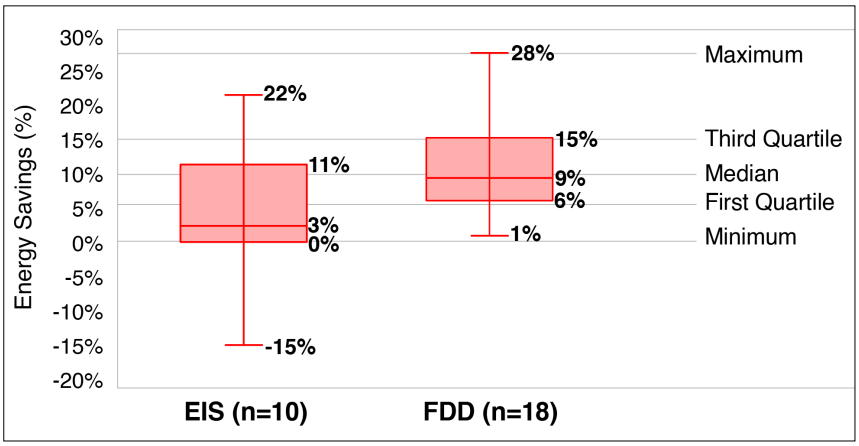


Figure 1. Second-year energy savings achieved by organizations using Energy Information Systems (EIS) and Fault Detection and Diagnostics (FDD), highlighting the median savings and cost benefits over time. Adapted from Lin et al. (2022).

Additionally, continuous measurement and verification (M&V) enable facility teams to track decarbonization progress, optimize building performance, and support carbon neutrality targets. For example, FDD can identify opportunities such as utilizing free cooling when outdoor temperatures allow or detecting frequent on/off cycling in a boiler—preventing premature equipment wear and inefficiencies.

Here are some proven ways FDD directly improves building performance:

Plant Operational Run Times:

Detects overextended equipment operation and optimizes runtime schedules—reducing HVAC energy use by up to 24% (U.S. Department of Energy). (2012, Energy Savings Modeling of Standard Commercial Building Re-tuning Measures: Large Office Buildings).

Simultaneous Heating & Cooling:

Detects conflicting zone commands that cause unnecessary energy use—cutting HVAC loads by 5–20%. Energy Engineering Vol 106, (2009, Simultaneous Heating and Cooling—The HVAC Blight).

Set Point Failures:

Detects discharge air temperature errors and triggers alerts before issues escalate—even a 2°C deviation can increase HVAC energy use by up to 10%. (Lin et al, 2016, Building energy information systems: synthesis of costs, savings, and best-practice uses).

FDD provides both direct savings (real-time alerts to correct control sequences) and indirect savings (reducing excessive cycling and runtime anomalies, extending equipment lifespan, and cutting down on costly repairs and premature replacements).

2 OPERATIONAL EFFICIENCY – MAINTENANCE-COST BENEFITS

Most buildings rely on scheduled maintenance—technicians perform manual checks at set intervals (weekly, monthly, quarterly). When they inspect, say, cooling towers, they follow a predefined A-B-C checklist (i.e., verify float valve operation, measure energy parameters, or clean the heat exchanger surfaces).

Rather than relying solely on manual inspections, FDD enables remote monitoring of HVAC, lighting, and metering systems. This capability minimizes unnecessary site visits, cutting fuel costs, and technician downtime while keeping maintenance teams focused on high-priority fixes. For teams that embrace this shift, the operational efficiencies gains can be enormous.

According to the US DOE O&M Best Practices Guide, Release 3.0, predictive maintenance delivers significant cost reductions and reliability improvements—far outweighing the initial investment.

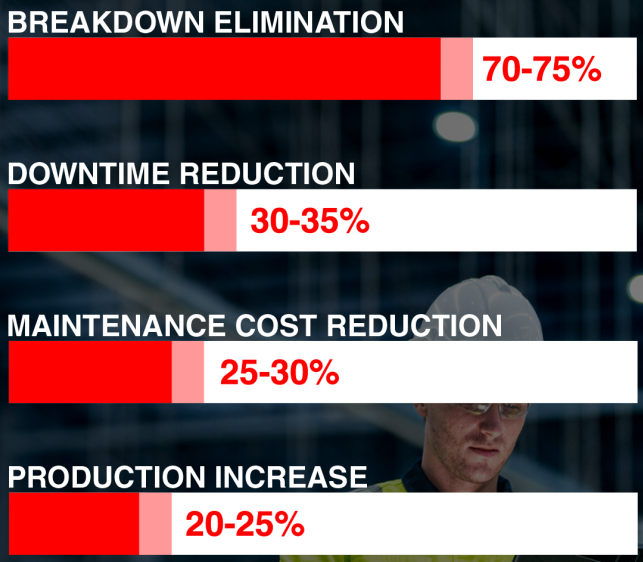


Figure 2. Graphic adapted from the U.S. DOE O&M Best Practices Guide, Release 3.0 (2010).

3 IMPROVED INDOOR ENVIRONMENTAL QUALITY (IEQ)

FDD ensures HVAC and lighting systems maintain optimal performance, directly impacting occupant comfort and health.

Consistent temperature control, better air quality, and reliable lighting systems enhance the overall building environment, leading to higher tenant satisfaction and productivity.

Example: In a large commercial skyscraper, an outside air damper on an air handling unit (AHU) stuck open during winter can draw in excessive unconditioned air, leading to temperature fluctuations, higher HVAC loads, and occupant discomfort. While a BMS may flag the damper issue, FDD goes further by:

- Diagnosing the root cause.
- Quantifying the energy impact of the heating system having to compensate (~3-4,000 kWh per day).
- Prioritizing the fault based on real-time conditions.

FDD AS A FUNCTIONAL TESTING TOOL (FTT) DURING COMMISSIONING PHASE & WARRANTY

Facility managers often face difficult decisions on whether to repair or replace aging equipment. FDD provides objective, data-driven insights on asset health, ensuring capital investments are made only when necessary. This way you can prioritize replacements based on actual degradation trends rather than arbitrary age-based schedules.

FDD isn't just for long-term maintenance though—it's a powerful tool for new buildings and retrofit projects as well. While its primary function is ongoing commissioning over a building's lifecycle, its ROI is just as strong in new developments. One major benefit—catching faults within the warranty period.

Example: In a newly opened 750,000 sq. ft. hospital, a high-efficiency AHU was installed to regulate airflow in critical care areas such as operating rooms and intensive care units. Within the first few months, FDD flagged an issue: the variable speed drive (VSD) on the supply fan was constantly running at full speed, even when demand was low.

While the BMS did not generate an alarm, FDD diagnosed the root cause—a faulty control logic sequence preventing the VSD from modulating properly. Because the issue was detected within the equipment's warranty period, the hospital:

- Avoided a $25,000 fan replacement cost.
- Ensured compliance with ventilation regulation.
- Prevented unnecessary energy waste amounting to 15,000 kWh per month.

Traditional commissioning typically verifies only 10% of building systems, leaving 90% untested. By comparing expected system performance with real-world fault trends, FDD ensures that contractors deliver fully functional systems, preventing post-handover disputes and costly rework.

A DAY IN THE LIFE: FACILITY MANAGEMENT WITH FDD

It's 6:00 AM on a cold Monday morning. Your office building hums to life after its 5:00 AM warm-up mode—fans ramp up, outside air dampers modulate, and the air handling unit starts at low speed.

Gone are the days of blindly ramping up HVAC, lighting, and ventilation at full tilt. Instead, an Automated Fault Detection and Diagnostics (AFDD) system ensures a smooth, data-driven start. Sensors throughout the building relay real-time conditions, ensuring optimal operation. No wasted energy. No unnecessary strain on equipment. Just a perfectly tuned system.

At the same time, in a digital control room a few miles away, building engineers and an operations team oversee tens, if not hundreds, of buildings in real time. FDD consolidates fault detection across every asset, ranking issues by severity and impact on energy, comfort, and cost.

Instead of individual site teams reacting to isolated alarms, a centralized maintenance hub can triage and dispatch engineers only where needed, thereby optimizing manpower and reducing site visits. The ability to identify widespread systemic issues, such as recurring sensor failures across multiple locations, allows for enterprise-level performance improvements.

This multi-site view ensures facilities teams are proactive rather than reactive, preventing failures at scale and driving efficiencies beyond what any single site could achieve alone.

OVERCOMING BARRIERS TO IMPLEMENTATION

If FDD is so effective, why don't all buildings have it? Excellent question. Here are the most common objections, and why these don't hold up:

"It's too complex." Modern FDD solutions integrate directly with existing BMS solutions and are designed for ease of use. You don't need to be a software engineer to configure or use a system designed for ease-of-use. While BMS offer extensive control capabilities, configuring analytics at scale can be complicated, proprietary, and noncompliant with modern accessibility guidelines. That's not usually the case with a supervisory control platform coupled with FDD.

"It's expensive." Typical implementation and annual costs for FDD are often cited around $0.12 per square foot, though actual figures can vary depending on the deployment model (cloud vs. on-premises), vendor pricing, and number of data points monitored. Industry benchmarks show the $0.12 figure as a reasonable estimate, but it's best viewed as a guideline rather than a fixed cost.

"It's just another management tool." FDD is not just another glorified BI tool—though some powerful FDD tools include that too. It's built for engineers—saving them time by automating routine checks and highlighting real issues before these become costly problems.

Fundamentally, FDD is about empowering change, starting within the control room and cascading outward.

// PART 3:

BEYOND THE PILOT: SCALING FAULT DETECTION & DIAGNOSTICS (FDD) ACROSS YOUR ENTIRE PORTFOLIO

Scaling FDD beyond a pilot unlocks game-changing operational value. Verdantix reports that energy and fault analytics deployed at scale can reduce portfolio-wide energy spend by 25–26%, and yield threefold ROI in the first year alone in large multi-site rollouts. Some portfolios have saved millions annually simply by spotting equipment misbehavior and acting early.

PORTFOLIO-LEVEL BENEFITS:

From reactive to proactive: Detect anomalies across every site before failures and escalate intelligently.

From one-off fixes to standardized efficiency: Apply proven rule logic across dozens—or hundreds—of buildings consistently.

From fragmented data to strategic insight: Benchmark performance across your estate, highlight underperformers, and drive capital where it matters most.

From isolated savings to enterprise value: Reduce breakdowns, extend equipment life, and improve comfort so that portfolio-level FDD becomes a cornerstone of operational resilience, ESG achievement, and strategic decision-making.

While the potential is huge, getting there isn't automatic. Many teams see impressive results in a pilot building; however, when it comes time to expand across a region or an entire global portfolio, they quickly discover that success doesn't scale on its own. Every building brings its own mix of legacy equipment, inconsistent naming conventions, and operational quirks. Consequently, that's where many deployments stall.

The following sections explore core challenges and solutions of portfolio-wide FDD and how the right smart building platforms can solve these. Spoiler alert: technology is only part of the equation. Operational adoption, data consistency, and change management are just as critical. So, let's dive in.

CORE CHALLENGE

1 DATA NORMALIZATION - THE FIRST (AND BIGGEST) HURDLE TO SCALING FDD

If your portfolio includes buildings from different eras with building management systems (BMSs) from multiple vendors, you're likely already facing a major FDD challenge: inconsistent data structures. Each system may use different tags, naming conventions, and formats for the same equipment, making it time-consuming to apply a unified set of FDD rules across all buildings.

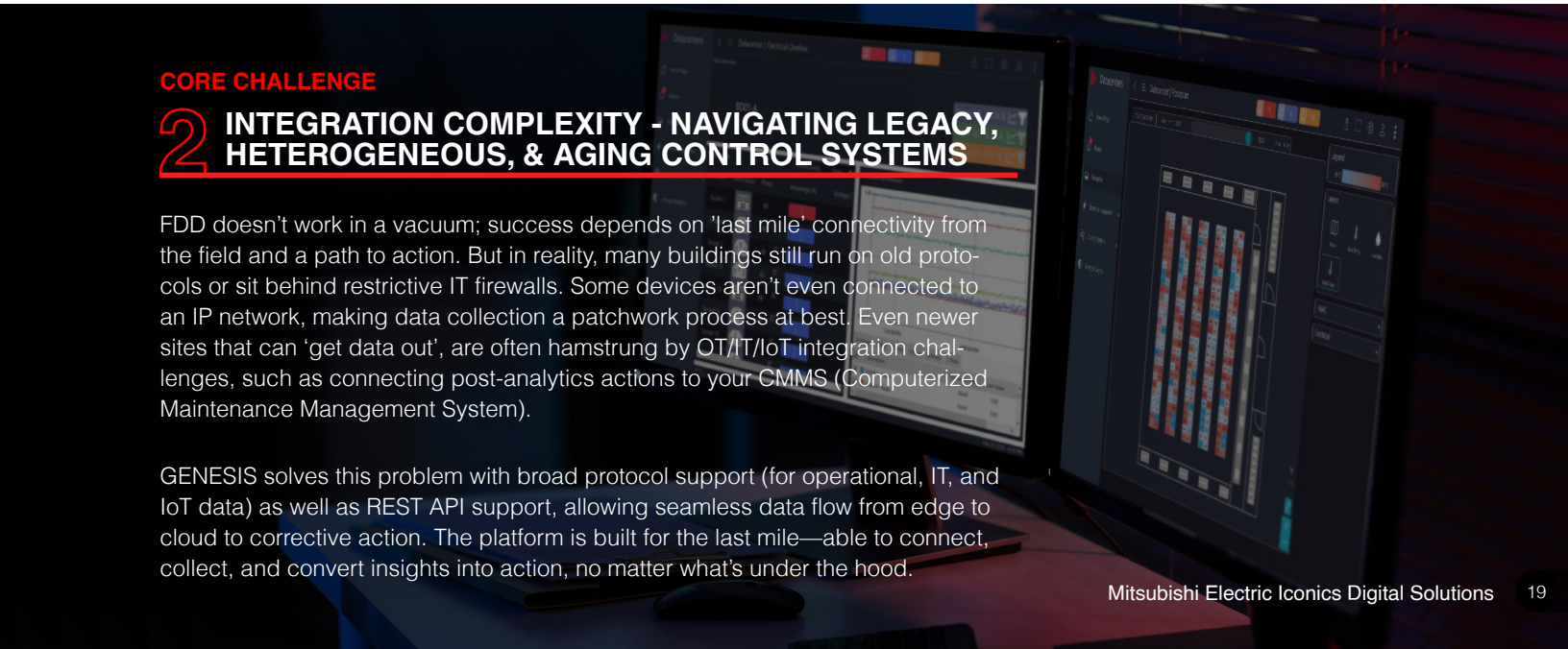
Compounding the issue, many sites lack standardized asset taxonomies—or ontologies—which define how equipment is structured, grouped, and related within a system. For example, a fan coil unit in one building might be labeled "FCU-1," while the same equipment in another building is labeled "FAN1."

Without clear metadata and consistent tagging, applying rule-based diagnostics at scale becomes a logistical nightmare. What's needed are naming standards that enable asset identification and ontologies that provide the context to understand how those assets relate to one another.

GENESIS helps overcome this challenge by supporting flexible asset hierarchies that mirror your portfolio's physical and functional structure—no matter how complex. Whether you're monitoring HVAC systems, lighting, or metering across floors, zones, or campuses, GENESIS aligns the data to match your operational reality.

Then there's the issue of data quality and sensor reliability. Faults triggered by miscalibrated sensors—typically for supply air temperature or airflow—as well as faulty data feeds or false positives are common. Inaccurate temperature readings, for instance, can generate unnecessary alarms or conceal real issues, ultimately degrading diagnostic accuracy.

GENESIS addresses this challenge with its ability to be configured for self-checking, comparing sensor readings against adjacent equipment, historical trends, and even external weather data. This contextual awareness helps identify false positives—such as distinguishing between an actual equipment fault and a miscalibrated sensor.



CORE CHALLENGE

2 INTEGRATION COMPLEXITY - NAVIGATING LEGACY, HETEROGENEOUS, & AGING CONTROL SYSTEMS

FDD doesn't work in a vacuum; success depends on 'last mile' connectivity from the field and a path to action. But in reality, many buildings still run on old protocols or sit behind restrictive IT firewalls. Some devices aren't even connected to an IP network, making data collection a patchwork process at best. Even newer sites that can 'get data out', are often hamstrung by OT/IT/IoT integration challenges, such as connecting post-analytics actions to your CMMS (Computerized Maintenance Management System).

GENESIS solves this problem with broad protocol support (for operational, IT, and IoT data) as well as REST API support, allowing seamless data flow from edge to cloud to corrective action. The platform is built for the last mile—able to connect, collect, and convert insights into action, no matter what's under the hood.

CORE CHALLENGE

3 MULTI-SITE MANAGEMENT - SCALABILITY ACROSS REGIONS & BUILDING TYPES

Deploying FDD across 50 or 100 buildings isn't just a technical challenge, it's an operational one too. Different regions may have different regulatory requirements, climate-driven operational needs, or organizational silos—all demanding degrees of flexibility from your analytics tool.

Some portfolios also face IT-imposed restrictions on cloud deployments, forcing teams to mix cloud-based and on-premises architectures. Some regions operate with centralized BMS teams; others rely heavily on local site engineers or third-party contractors.

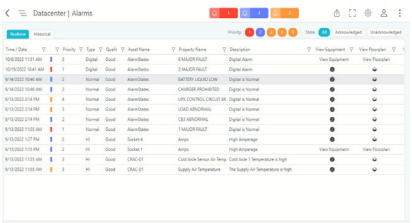
GENESIS supports this kind of real-world scaling with flexible deployment models—on-premises, cloud, or hybrid—and centralized oversight with localized control. Dashboards can be configured for enterprise or site-level visibility, helping teams stay aligned across diverse environments.

CORE CHALLENGE

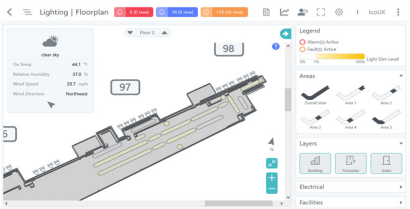
4 MANAGING ALERT FATIGUE & PRIORITIZATION

When FDD is first activated—especially in buildings with deferred maintenance—it's not unusual for facility teams to be flooded with alerts. Studies show that a typical commercial building can generate over 200 faults per month, making it difficult to prioritize, and risking alert fatigue.

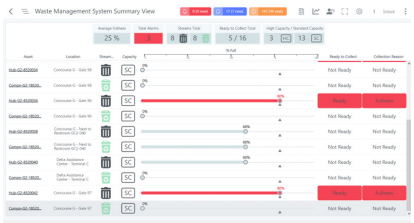
GENESIS helps cut through the noise with:



Fault Roll-Up Dashboards: Rather than treating every repeated fault as a separate event, GENESIS intelligently groups and ranks faults by frequency, duration, and impact—enabling teams to focus first on the most urgent and costly issues.



Cross-System Correlation: GENESIS can be configured for relationships between isolated HVAC alerts and faults across HVAC, lighting, and metering systems—enabling operators to pinpoint underlying patterns rather than chasing red herrings.



Root Cause Analysis: By linking faults to related sensor data and operational context, GENESIS helps teams pinpoint the true source of an issue—whether it's a faulty sensor, mechanical failure, or control logic error.

Together, these capabilities ensure that facility teams receive actionable insights, not just alarms—helping them to focus their time and resources where they matter most, instead of chasing noise.

CORE CHALLENGE

5 DRIVING ADOPTION - THE HUMAN SIDE OF FDD SCALING (PEOPLE, WORKFLOWS, & CULTURE)

Technology is only part of the equation—successfully scaling FDD also depends on user adoption and process alignment. In many organizations, facilities teams may initially view FDD as an added layer of oversight, rather than a tool designed to make their work more efficient.

GENESIS helps bridge this gap by offering:

User-Friendly Interfaces: With clear visualizations and intuitive dashboards, GENESIS makes fault detection insights accessible to everyone—from technicians to executives.

Training & Support: Scaling FDD effectively requires internal champions—individuals who understand the technology and can advocate for its value. This role may also be filled by a trusted partner or integrator, such as a third-party commissioning agent or FDD bureau. Our company supports this effort with extensive training resources, including an online library of how-to videos, in-person courses, and supplemental materials.

Seamless CMMS Integration: GENESIS integrates directly with existing Computerized Maintenance Management Systems (CMMS), ensuring faults can automatically flow into established work order systems. This direct integration eliminates redundant data entry and allows teams to take action within their existing workflows.

By combining intuitive tools, expert support, and seamless integration into daily workflows, GENESIS helps turn FDD from a perceived burden into a trusted ally—empowering teams to work smarter, not harder.

But as we have said, the success of FDD depends as much on ongoing commissioning and governance as it does on the tech. Establishing standard operating procedures, prioritizing high-value faults, and keeping humans in the loop are critical to long-term success.

SCALING FDD TAKES TECHNOLOGY, AND TRUST

Scaling FDD across a portfolio is about much more than just software deployment. Success depends on partnering with a team that understands the messiness of real buildings, the quirks of aging infrastructure, and the realities facing busy facilities teams. While no single tool can solve every challenge, Mitsubishi Electric Iconics Digital Solutions and our System Integrator (SI) Partner Community combine flexible, scalable technology with deep industry expertise to help customers navigate the complexities of multi-site FDD.

With GENESIS, companies gain a powerful technical foundation to centralize fault detection, streamline operations, and scale insights across all sites. For operators and integrators, our software delivers tangible benefits, including:

- Reduced configuration time on both the front and back end, accelerating deployment across portfolios.
- Dramatically less time spent digging through raw fault logs, thanks to dashboards that surface the most critical issues first.
- Customizable dashboards and reports that make multi-site management far more efficient.
- Flexible alignment with industry naming standards, communication protocols, and asset taxonomies, ensuring smoother integration with existing systems and future expansions.

This technology-plus-rapport approach turns what could be an overwhelming process into a collaborative journey—one that delivers smarter maintenance, lower costs, and greater efficiency across the entire portfolio.

And with Mitsubishi Electric, companies have a global partner network and a steadfast commitment to open standards to help them future proof their FDD strategy while maximizing the value of their technology investments.

So, if your FDD pilot worked, but you're stuck on the next step, don't start over. Scale up—with a platform that can handle the demands.

// PART 4:
RULE LIBRARIES
SAMPLE FAULTS

One of the greatest strengths of fault detection and diagnostics (FDD) software lies in its ability to apply proven rule libraries across diverse building systems. A rule library is a structured set of predefined logic statements that analyze building data against expected performance.

When deviations occur, the rules automatically flag conditions that compromise efficiency, safety, comfort, or compliance. By turning raw operational data into actionable insights, rule libraries make it possible to identify, prioritize, and address issues long before they escalate into costly problems.

To illustrate how these rules work in practice, the following examples highlight common types of faults and how FDD rules detect them.

HVAC EXAMPLE RULES: ENSURING EFFICIENT EQUIPMENT OPERATION

Heating, ventilation, and air conditioning (HVAC) systems are at the core of building performance. Even minor inefficiencies in air handling units (AHUs), variable air volume (VAV) boxes, or chillers can cause major energy waste and operational issues. Example rules include:

AHUs (Air Handling Units)
Detecting stuck dampers, faulty sensors, or improper economizer operation

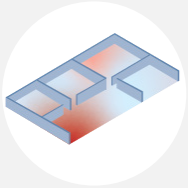
VAVs (Variable Air Volume systems)
Identifying simultaneous heating and cooling or airflow outside of setpoints

Chillers
Flagging suboptimal sequencing, loading issues, or inefficient part-load operation

These rules help ensure equipment operates at peak efficiency, reducing energy waste and prolonging asset life.

HUMAN IMPACT EXAMPLE RULES: PROTECTING OCCUPANT COMFORT & HEALTH

Beyond equipment, FDD safeguards the people inside the building. Rules in this category prioritize comfort, productivity, and health. Example rules include:



Occupied Zone Overheating
Detecting zones consistently above temperature thresholds during occupied hours

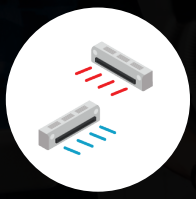
CO2 Build-Up
Identifying poor ventilation rates leading to unhealthy indoor air quality

Humidity Control Failures
Catching issues that contribute to discomfort or potential mold growth

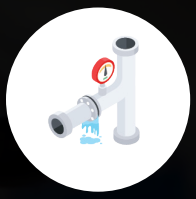
By addressing these human-centered impacts, FDD supports both occupant wellbeing and organizational productivity.

HIGH WASTE EXAMPLE RULES: ELIMINATING ENERGY & COST INEFFICIENCIES

High waste faults often result in unnecessary energy use and inflated utility bills. FDD rule libraries are designed to capture these costly inefficiencies early. Example rules include:



Simultaneous Heating & Cooling
Detecting zones where both systems run at once



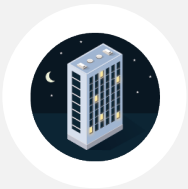
Leaking Valves or Dampers
Catching equipment that fails to fully close, wasting energy

Overridden Setpoints
Flagging manual overrides that increase consumption without being reset

Resolving these issues leads to measurable cost savings and reduced environmental impact.

SAFETY & COMPLIANCE EXAMPLE RULES: MAINTAINING STANDARDS & REDUCING RISK

In addition to efficiency and comfort, FDD strengthens operational safety and compliance with industry standards. Example rules include:

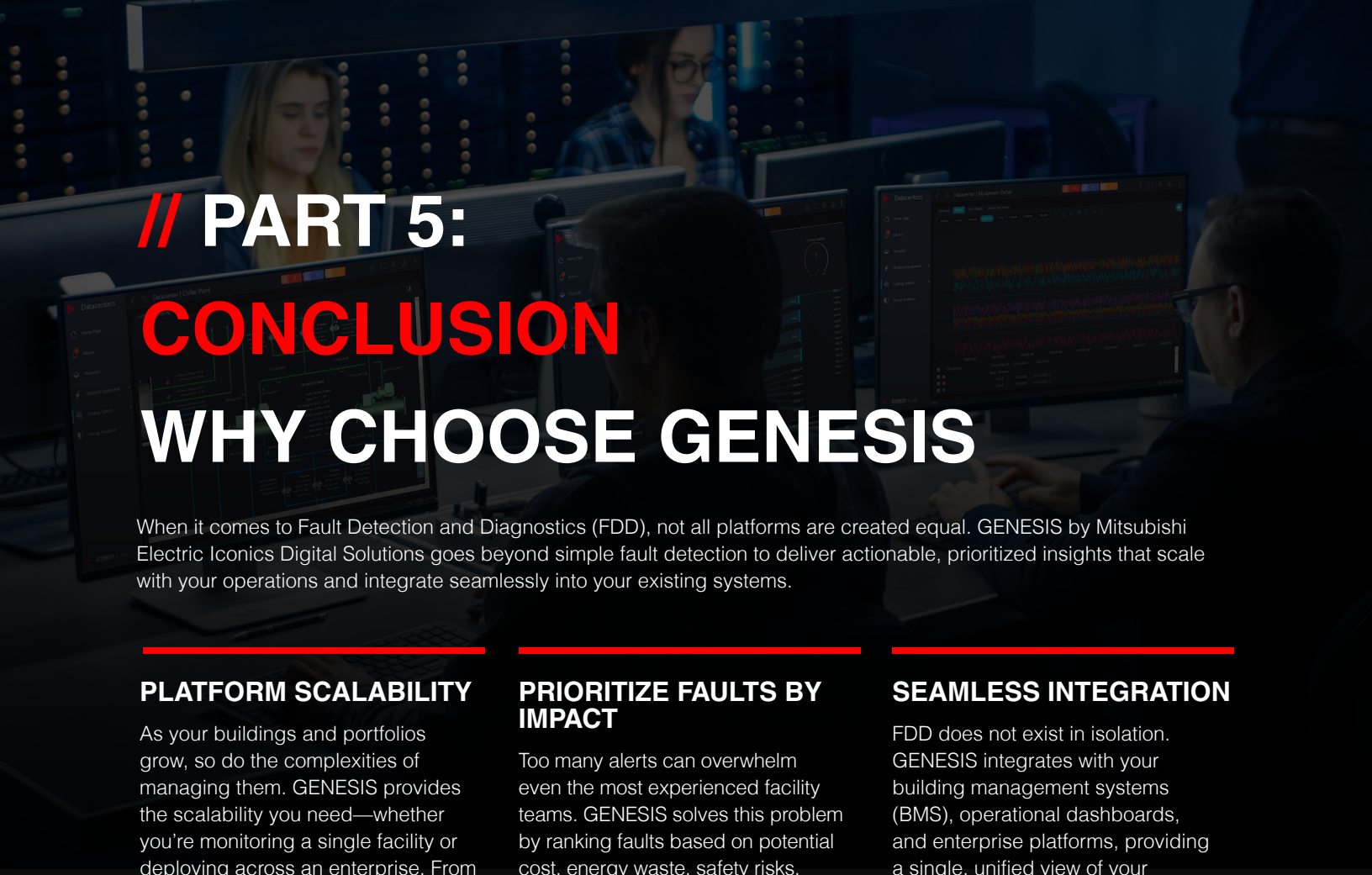


Out-of-Hours Operation
Identifying systems left running when buildings are unoccupied

BMS Override Detection
Detecting unauthorized manual changes to automation controls

Critical Alarm Monitoring
Ensuring life safety systems function as designed

These safeguards help organizations avoid violations, minimize liability, and protect both assets and occupants. Collectively, rule libraries enable FDD to transform everyday operations into actionable intelligence that drives energy efficiency, cost savings, comfort, and resilience.



// PART 5:
CONCLUSION
WHY CHOOSE GENESIS

When it comes to Fault Detection and Diagnostics (FDD), not all platforms are created equal. GENESIS by Mitsubishi Electric Iconics Digital Solutions goes beyond simple fault detection to deliver actionable, prioritized insights that scale with your operations and integrate seamlessly into your existing systems.

PLATFORM SCALABILITY

As your buildings and portfolios grow, so do the complexities of managing them. GENESIS provides the scalability you need—whether you're monitoring a single facility or deploying across an enterprise. From HVAC to lighting, across OT and IoT environments, GENESIS adapts to your requirements and evolves with your organization.

PRIORITIZE FAULTS BY IMPACT

Too many alerts can overwhelm even the most experienced facility teams. GENESIS solves this problem by ranking faults based on potential cost, energy waste, safety risks, and occupant comfort issues. This prioritization ensures your teams focus first on what truly drives performance and business outcomes—reducing downtime, avoiding wasted energy, and improving tenant satisfaction.

SEAMLESS INTEGRATION

FDD does not exist in isolation. GENESIS integrates with your building management systems (BMS), operational dashboards, and enterprise platforms, providing a single, unified view of your operations. From automated rules to custom reporting, integration ensures insights are accessible where and when you need these, without disrupting existing workflows.

MOVING FORWARD WITH YOUR SMART BUILDING FDD PROTECTION

Fault detection alone isn't enough—you need a platform that scales, prioritizes, and integrates, so you can act with confidence. GENESIS gives you the clarity to resolve high-impact issues first, the flexibility to grow with your operations, and the interoperability to align with your digital transformation strategy.

Explore GENESIS and visit our FDD solution page or reach out to our experts to start building your FDD strategy today.

Schedule a discovery session to explore what FDD can do for your building operations.

smartbuildings@iconics.com

MITSUBISHI ELECTRIC
Changes for the Better
MITSUBISHI ELECTRIC ICONICS DIGITAL SOLUTIONS

Creating Solutions Together.

Low-voltage Power Distribution Products

Transformers, Med-voltage Distribution Products

Power Monitoring and Energy Saving Products

Power (UPS) and Environmental Products

Compact and Modular Controllers

Servos, Motors and Inverters

Visualization: HMIs

Edge Computing Products

Numerical Control (NC)

Collaborative and Industrial Robots

Processing machines: EDM, Lasers

SCADA, analytics and simulation software

Mitsubishi Electric's product lineup, from various controllers and drives to energy-saving devices and processing machines, all help you to automate your world. They are underpinned by software, innovative data monitoring, and modelling systems supported by advanced industrial networking and Edgecross IT/OT connectivity. Together with a worldwide partner ecosystem, Mitsubishi Electric factory automation (FA) has everything to make IoT and Digital Manufacturing a reality.

With a complete portfolio and comprehensive capabilities that combine synergies with diverse business units, Mitsubishi Electric provides a one-stop approach to how companies can tackle the shift to clean energy and energy conservation, carbon neutrality and sustainability, which are now a universal requirement of factories, buildings, and social infrastructure.

We at Mitsubishi Electric FA are your solution partners waiting to work with you as you take a step toward the realization of sustainable manufacturing and society through the application of automation.
Let's automate the world together!

Note: not all products are available in all countries

ABOUT MITSUBISHI ELECTRIC ICONICS DIGITAL SOLUTIONS

Mitsubishi Electric Iconics Digital Solutions, headquartered in Foxborough, Massachusetts, is a global leader in industrial automation, smart and sustainable buildings, and digitalization software. Our advanced HMI, SCADA, and Smart Building solutions enable businesses to visualize, monitor, and optimize their most critical assets and spaces. With installations in over 100 countries and adoption by more than 70% of Global 500 companies, we drive operational efficiency and continuous improvement across industrial manufacturing, infrastructure, and built environment sectors. Backed by cutting-edge technology and deep industry expertise, we deliver flexible, scalable, and high-performance software solutions. As a testament to our excellence, Mitsubishi Electric Iconics Digital Solutions has been recognized as a seven-time winner of the Microsoft Partner of the Year award.

Mitsubishi Electric Iconics Digital Solutions Sales Offices

World Headquarters
2 Hampshire Street
Foxborough, MA, USA, 02035
+1 508 543 8600
info@iconics.com

Australia australia@iconics.com	**France** france@iconics.com	**Japan** japan@iconics.com	**Philippines** philippines@iconics.com	**UK** uk@iconics.com
Brazil brazil@iconics.com	**Germany** germany@iconics.com	**Malaysia** malaysia@iconics.com	**Singapore** singapore@iconics.com	**Vietnam** vietnam@iconics.com
Canada canada@iconics.com	**India** india@iconics.com	**Mexico** mexico@iconics.com	**South Korea** southkorea@iconics.com	
China china@iconics.com	**Indonesia** indonesia@iconics.com	**Middle East** middleeast@iconics.com	**Taiwan** taiwan@iconics.com	
Czech Republic czech@iconics.com	**Italy** italy@iconics.com	**Netherlands** holland@iconics.com	**Thailand** thailand@iconics.com	

MITSUBISHI ELECTRIC ICONICS DIGITAL SOLUTIONS, INC.

HEAD OFFICE: 2 Hampshire Street, Suite 300, Foxborough, MA 02035

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