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COOPER POWER SERIES

Eaton helps utilities quickly replace legacy RTU systems

Contents

Powering Business Worldwide

The impact of a complete system replacement

Utilities are looking to replace legacy RTU systems with a more up-to-date, proven, secure and cost-effective solution. In doing so, they also seek to minimize substation service interruptions while simplifying the overall engineering and design effort.

The costs associated with the RTU system replacement should be a major concern for impacted utilities. These costs are summarized below:

- Engineering
  - Design, planning
  - Schematics and drawings modification
  - Acquisition of new equipment (gateway, I/O modules, potentially including incremental cabinets)
- Hardware and I/O wiring removal
- Installation of new equipment
- I/O wiring installation/replacement
- New system integration (each I/O, upstream integration, commissioning)
- Training requirements for the new system
- Substation outage time required to make the replacement

Utility requirements

The need for a smarter and more secure grid is driving the requirement for faster and more responsive equipment with ever-increasing numbers of intelligent electronic devices (IEDs). These devices require communication, integration and advanced automation solutions at the local substation level. As a result, utilities need solutions that address:

- Comprehensive support and management of all substation device types (IT equipment, computers, etc.)
- Secure management of IEDs that meet North American Electric Reliability Corporation Critical Infrastructure Protection (NERC CIP) requirements (configuration, firmware, password, remote access)
- Alarm management with remote capabilities
- Substation-wide automation capacity
- Redundancy capability (devices, links)
- Secure remote access to IEDs
- Secure supervisory control and data acquisition (SCADA) access and protocol support

Specific challenges related to the use of legacy RTU systems

Some legacy RTU designs are over 20 years old, with limited hardware capabilities and software that is no longer supported. These factors present numerous challenges for utilities. Consider the following limitations of some legacy RTU systems:

- No secure authentication or secure remote connections (NERC CIP compliance)
- No support for newer, more appropriate, communication protocols
- No local HMI capabilities
- No web access
- No non-operational data management (Sequence of Event (SOE), event files retrieval)
- Limited automation possibilities

Description of the GE D20 RTU and distributed I/O modules

The RTU system comes with a main chassis containing the central processing unit (CPU) board. The I/O capability of the system is formed with a combination of the following I/O boards: D20A, D20C, D20AC, D20S, D20K and D20KI. These I/O boards are connected to the main board via a high speed RS-485 link using a GE proprietary protocol.

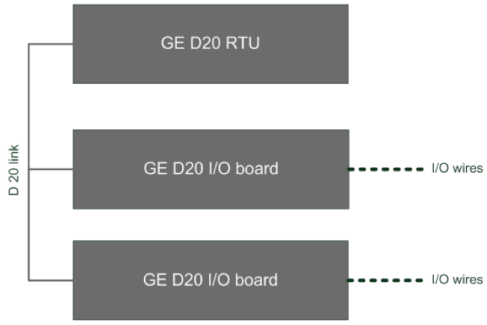


Figure 1. Example of a GE D20 RTU configuration

Eaton's solution for the GE D20 RTU upgrade

Eaton's flexible solution not only replaces the legacy RTU systems with minimal impact to engineering and operations, but also delivers best-of-class computational and communication capabilities. At the center of Eaton's replacement solution is the utility hardened and proven SMP family of substation automation products, which are used in thousands of utility applications worldwide: the SMP SG-4250 Gateway and the SMP I/O.

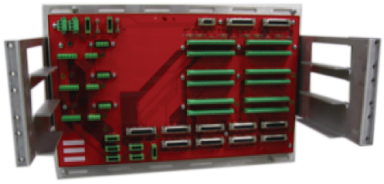
Eaton's SMP SG-4250 has a proven history in data acquisition and distribution automation applications, as a protocol conversion device and integration solution for secure IED remote access; it is designed for distributed automation.

The SMP I/O unit is a scalable, distributed I/O substation grade module. It is designed to work with the SMP SG-4250, which simplifies system setup and commissioning. The configuration tool from SMP SG-4250 provides a quick configuration wizard that detects SMP I/O configurations and automatically sets up all distributed network protocol (DNP3) indexes, default names and descriptions. This feature drastically simplifies I/O configuration and integration into the system.

Technical solution

Eaton's solution for the upgrade of the GE D20 RTU is to remove the RTU's main controller and all I/O boards (except the D20 KI interposer relays, when they are present) and replace them with:

- One (1) SMP SG-4250
- SMP I/O units to match the required GE D20 I/O functionality
- An Eaton RTU interface board used to connect existing I/O terminal blocks and SMP I/O units



Eaton's RTU interface board utilizes the legacy RTU I/O cabling so as to avoid the need to replace the I/O terminal blocks or disturb existing RTU field wiring. Disturbing aged field wiring is known to be highly problematic and can cause significant field installation man-hours and extend service interruptions. The connectors from the removed I/O boards are simply moved to the Eaton's RTU interface board, allowing the utilization of existing terminal cables and field wiring.

This hardware agnostic solution is adaptable to various D20 RTU system configurations and provides seamless field integration of the SMP I/O units and the SMP SG-4250 gateway.

Functionally, Eaton's SMP SG-4250 gateway simply polls information from the SMP I/O, using a standard DNP3 protocol over an Ethernet or RS-485 link, for use in local automation applications, local HMI functions or upstream control centers.

Figure 2 provides an example where GE D20 KI interposer relays are used. Note that other deployments may not use these relays or may also use different connectors. Eaton's solution will work, simply by adapting the required RTU interface board and the number of SMP I/O units.

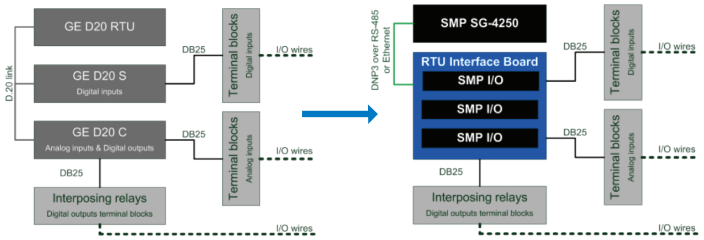


Figure 2. Example of an Eaton replacement solution mapped to a corresponding GE D20 setup

Comparison between a traditional replacement and Eaton's solution

The following table compares different impact areas related to replacement of the dated RTU system with a traditional solution versus Eaton's solution.

Table 1. Impacts of the replacement, traditional versus Eaton's solution

PHASE	REPLACEMENT IMPACT	TRADITIONAL SOLUTION	EATON'S SOLUTION	EXPLANATIONS FOR EATON'S SOLUTION
Engineering	Design and planning	Yes	Minimal	Pre-engineered solution ready
	System configuration	Yes	Minimal	SMP SG-4250 can import existing GE D20 configuration
Pre-deployment	Schematics	Yes	Minimal	Basic system drawing available from Eaton
	New equipment acquisition	Yes, all	Equipment only	Only SMP SG-4250, SMP I/Os and Interface board
Installation	Hardware and I/O removal	All	Only GE D20 boards	Eaton's solution keep the existing wiring in place
	New equipment	All	Equipment only	Only SMP SG-4250, SMP I/Os and Interface board
	Wiring	Yes	No	Eaton's solution adapts to existing system wiring
System integration	I/O configuration	Yes	Minimal	Seamless between SMP SG-4250 and SMP I/Os
	Commissioning	Yes	Simplified	Efficient Commissioning Tool part of the SMP Gateway HMI
	Upstream integration	Yes	Simplified	Large number of protocol supported
	Substation outage time	Important	Minimal	Reusing existing cabling
	Training	Yes	Yes	Eaton's SMP systems are intuitive and easy to learn

Solution costs

Eaton's solution is designed to reduce the cost of replacing the legacy RTU system. For utilities, it means:

- Easy installation:
  - Eaton's system fits into the GE D20 allocated space
  - Seamless integration of SMP I/O with the SMP SG-4250
- No rewiring to be done, which allows:
  - Very few changes in the schematics and drawings
  - No rewiring work (which is very costly, especially if the wires are not identified)
  - Shorter substation outage time
- Faster commissioning using:
  - Eaton's powerful SMP SG-4250 HMI base commissioning tool
  - Additional SMP troubleshooting features

Cost savings examples

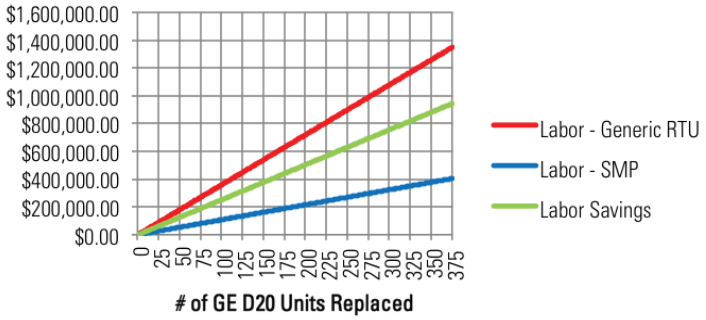


Figure 3. Example of labor costs and savings for up to 375 GE D20 RTU units' replaced

Eaton's replacement solution has been compared with a generic distributed RTU solution. Labor costs, which are mainly associated with rewiring the new system, represent the greatest portion of the RTU replacement expenses.

Figure 3 provides an example of the labor costs projected savings associated with Eaton's solution compared with a generic RTU solution for the replacement of 375 GE D20 RTU systems. In this example, an assumption was made that two (2) technicians were performing the replacement work, so the labor costs associated with the unit replacement are calculated only according to the technician's labor time.

We can see on the graph that Eaton's solution offers significant savings; each unit replacement using Eaton's solution saves 70 percent on installation time and labor costs. Nearly $1 million was saved in adopting the SMP SG-4250. This also means lower substation outage time and thus, even lower replacement costs.

Utility benefits

Installing an SMP SG-4250 Gateway in a substation – to replace a legacy RTU system – will also bring benefits:

- Short substation service interruption
- Fully supported hardware and software modules
- Use of open industry protocols
- No rewiring needed, significantly reducing the replacement cost
- Compliance with NERC CIP requirements by securing IEDs remote access and enhancing SCADA communication link
- Standard DNP3 communication between SMP I/O units and the SMP SG-4250 (with over 80 communication protocols supporting integration with other substation devices)
- Fast and easy integration of SMP IO configuration with the SMP SG-4250
- Plenty of expansion possibilities by simply adding distributed SMP I/O units that can be managed by the same SMP SG-4250 device
- Secure remote access for maintenance, data management system (DMS) and energy management system (EMS)
- Advanced HMI functionalities (local and remote via web browser)
- Efficient HMI integrated commissioning tool
- Complete redundancy scheme support
- IED event file management
- Programmable logic (automation function / IEC 61131 Soft PLC)
- Accurate time synchronization (IRIG-B, IEEE 1588 ready)

Conclusion

Some legacy RTU systems no longer meet today's standards, hence utilities are looking for a replacement solution. Apart from being innovative, high performing and flexible, the replacement solution must be cost-effective considering the large number of legacy RTU systems being replaced.

Eaton offers an effective solution in the SMP family of substation automation products, which can simplify a variety of RTU configurations, and advances substation security, communications and data management.

With Eaton's solution, utilities have the option to implement smarter and more secure substations with advanced technology, while minimizing substation service interruptions.

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