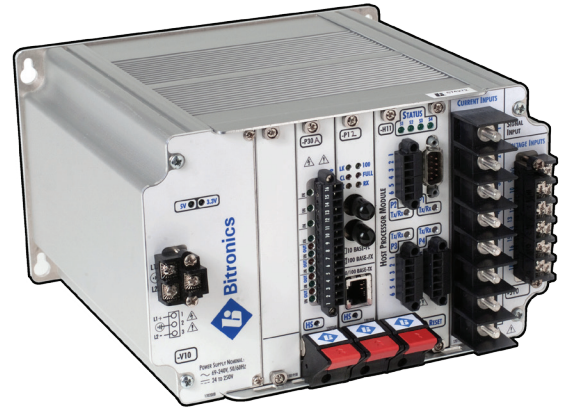


# Upgrade Legacy E/M Relay Substations

The Bitronics M871 fault recorder and measurement IED can add automation to legacy substations with electromechanical (E/M) relays. The Bitronics M871 provides a lower cost automation upgrade solution compared to a microprocessor relay upgrade.

## Upgrade Applications with the Bitronics M871

- Measure and report SCADA data to substation RTUs, or directly to SCADA. Measurements include instantaneous RMS for V, A, W and VARs, Peaks, Demands and Energy.
- Measure, record and report trends over time. Examples include feeder and transformer loading, and voltage fluctuation.
- Record and report Sequence of Events (SOE) to verify proper relay and apparatus operation.
- Calculate and report fault distance using the modified Takagi method.
- Calculate peak fault currents and report to SCADA.
- Meet all three parts of PRC-002: Sequence of Events (SOE), Fault Recording, and Dynamic Disturbance Recording (DDR).



Bitronics M871

## Key Bitronics M871 Features for Legacy Upgrade Applications

- Split Core CTs: eliminates outages and maintains high measurement accuracy.
- Flexible Communications: Ethernet copper or fiber and serial ports simplify interface to RTUs and to SCADA.
- Mounting Flexibility: Compact 3RU universal mount.
- Single Box Design: All functions in a single box.
- Offline Analysis Tools: Review fault records using the powerful Wavewin package.

## Lower Cost Compared to Microprocessor Relay Upgrade\*

### Install Microprocessor-Based Relays

Microprocessor relay purchase price	= \$3,000 - \$6,000
Total project cost in existing space	= \$18,000 to calculate, enter and test settings, configure and install
Control house expansion or new panel	= \$ unknown
Outages	= \$ unknown

### Install Bitronics M871 Series with Split Core Option

M871 with Split Core purchase price	= \$3,000 - \$4,000
Total project cost (with split core)	= \$6,000 to configure and install
Short term outages	= \$0

## Conclusion

Microprocessor relay replacement is 2.5x more expensive not including the cost of the outage

\*numbers provided by eastern US utility

## The Power of Bitronics Split Core CTs

The split core option of the Bitronics M871 enables retrofits to be performed without taking an outage. Unlike other split core solutions on the market, the Bitronics split core design preserves the same level of accuracy as hard wiring CT circuits. Typical application and wiring shown in Figures 1 and 2 below.

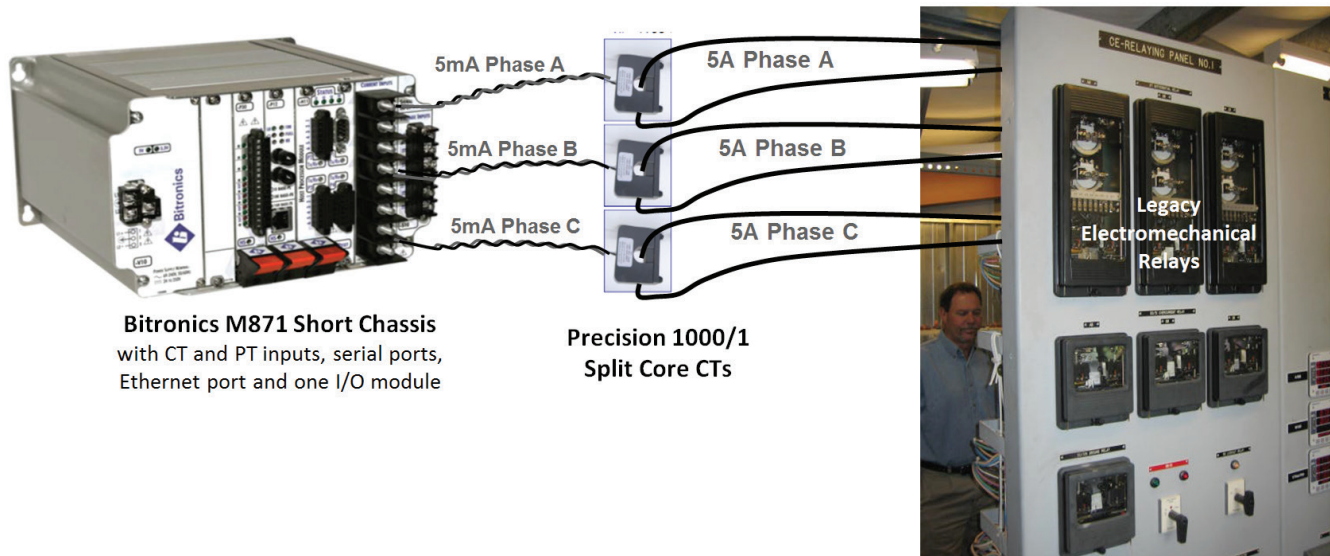


Figure 1: The three key element in a Bitronics automation upgrade: Bitronics M871, split core CTs and electromechanical relays

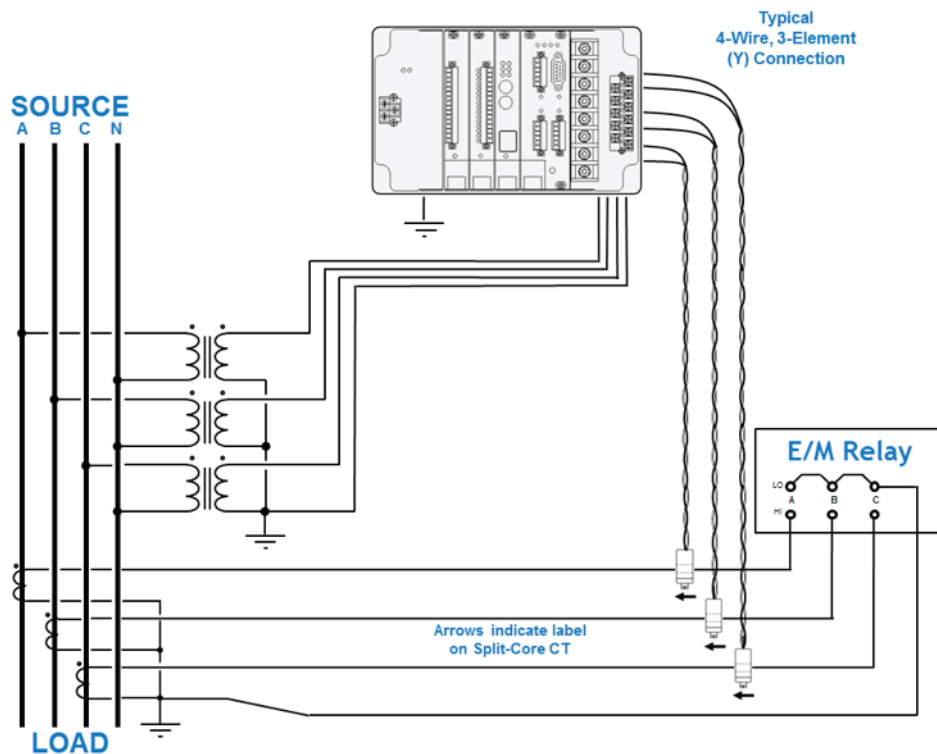
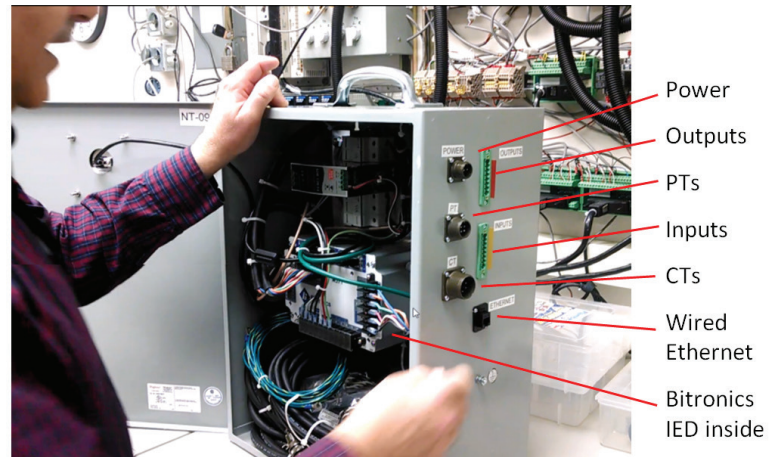


Figure 2: Bitronics M871 as typically wired into a 4-wire, 3-Element Y Relay Circuit

## User Application Examples

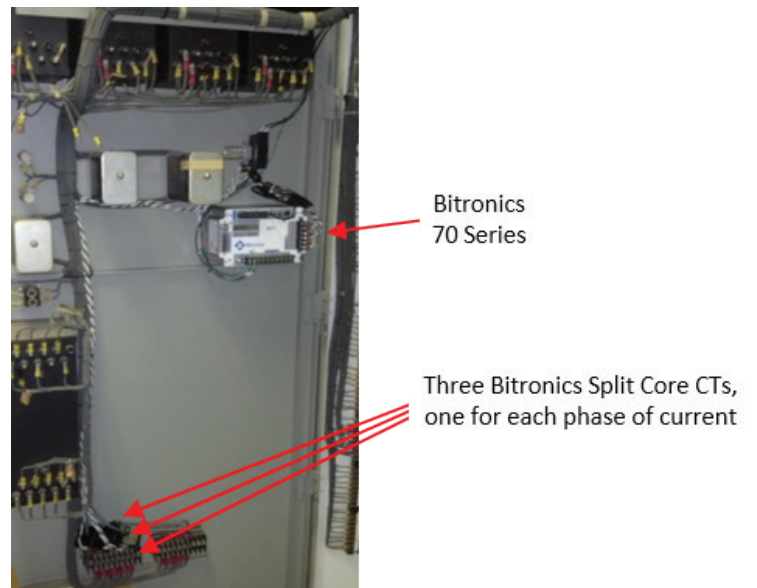
### Add Fault Location to E/M relay Substations

An eastern US utility retrofitted a fault location solution into over four dozen 69kV substations. The NovaTech System group designed and packaged the solution into a small panel that could be easily mounted and wired into existing circuits. Fault distance data is sent over either wired or wireless Ethernet back to SCADA. Video available further describing solution.



### Add SCADA Measurements and Recording to E/M Relay Substations

Bitronics metering and recording IEDs added to multiple energized substations at a mid-Atlantic US utility. The NovaTech Systems group installed the IEDs (one per feeder and transformer, up to 36 in larger subs) and ran fiber optic Ethernet to Orion RTU assemblies. Each Bitronics IED presents SCADA power system measurements to the RTU. IEDs are also ready to be configured for fault recording.



Inside E/M relay panel



Front of relay panel

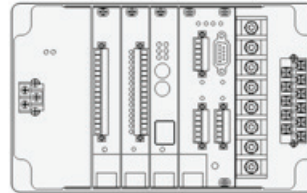
## Feature Summary

- One model for 2, 2½ or 3-Element systems with selectable CT and PT ratios
- ¼ to 1-cycle measurement update rate
- Wide input frequency range of 15-70 Hz
- Voltage and current accuracy better than 0.1% of reading
- 0.2% revenue-class energy measurement with S11, S12, or S1C signal input module
- Assignable Modbus registers and DNP3 analog points
- Simultaneous recording for all recorders
- Event triggering with logic includes hysteresis from any analog threshold value, rate-of-change of analog value, digital input, or “virtual” input (GOOSE message)
- IEC 61850 Compliant
- Automatic event notification
- DNP3 certified
- NERC PRC-002-2 compliant

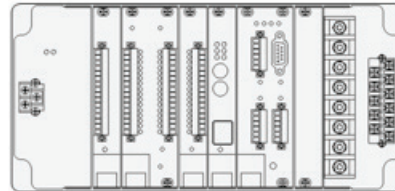
## Functional Summary

- Over 2000 high accuracy measurements
- Distance to fault measurements
- Supports multiple protocols simultaneously
- One set of 3-phase with neutral current inputs
- Two sets of 3-phase voltage inputs
- Battery voltage inputs
- Wide-range universal auxiliary power supply
- Two waveform recorders
- Two disturbance recorders
- Sequence of Events Recorder
- Nonvolatile memory for recording
- Optional digital inputs and digital outputs
- Optional transducer inputs
- One RS-232 and three configurable RS-232/RS-485 ports
- Optional Ethernet, copper or copper and fiber optic
- Other optional accessories are: M870D detached displays, Analog Output Converters and Modulated IRIG-B adapter
- Three modular chassis sizes

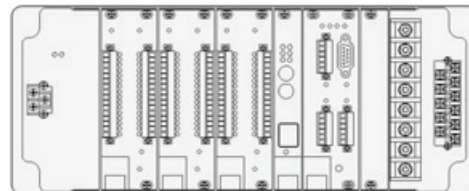
Small: 8.50" wide 3 cPCI slots  
Max I/O: 16 w/Ethernet, 24 w/o



Medium: 10.90" wide 5 cPCI slots  
Max I/O: 32 w/Ethernet, 40 w/o



Wide: 13.45" wide 6 cPCI slots  
Max I/O: 48 w/Ethernet, 56 w/o  
(18 I/O per RU)



All chassis: 5.20" (3U) high by 8.80" deep



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