KEY BENEFITS

- Application flexibility - Multiple I/O options, programmable logic (FlexLogic™), modularity, specific customization
- Modular construction - Common hardware, reduced stock of spare parts, plug & play modules for maintenance cost savings and simplification
- Robust network security based on NERC enabling critical infrastructure protection through user command logging, and dual permission access control
- Complete IEC 61850 Process Bus solution providing resource optimization and minimizing total P & C life cycle costs
- Cost effective and flexible access to information - Multiple communication options and protocols
- Common platform - Reduced training time and drafting costs
- Use high speed communications to reduce wiring and installation costs - Exchange inputs and outputs between relays to achieve relay-to-relay interaction
- Reduce system event analyzing time and cost - Sequence of event reports, oscillography, data logging, IRIG-B time synchronization
- Enhanced CT/VT module diagnostics verifying analog signal integrity using an advanced algorithm ensuring reliability
- Ambient temperature monitoring with alarming when outside temperature exceeds upper thresholds
- Large HMI and annunciator for local monitoring & control

APPLICATIONS

- Generation, transmission, distribution, motor protection, monitoring, metering & control
- Utility substation and industrial plant automation
- Digital fault recording and sequence of event recording
- Predictive maintenance through data analysis and trending
- UR devices deliver advanced protection, control & automation capabilities
- URPlus delivers high-end solutions for complex protection, control & automation applications

FEATURES

Protection and Control
- Digital Inputs: up to 96 (UR) & 115 (URPlus), single case configuration
- Digital Outputs: up to 84 (UR) & 60 (URPlus), single case configuration
- Solid state outputs for fast tripping
- Transducer I/Os (RTD, dcmA)
- Dual power supply

Communications
- Networking interfaces – 100Mbit Fiber Optic Ethernet, RS485, RS232, RS422, G.703, C37.94
- Multiple Protocols - IEC 61850, DNP 3.0 Level 2, Modbus RTU, Modbus TCP/IP, IEC 60870-5-104, Ethernet Global Data (EGD)
- Direct I/O – (secure, high-speed exchange of data between URs for Direct Transfer Trip and I/O Extension applications)

IEC 61850 Process Bus Interface
- Robust communications with up to 8 HardFiber Bricks
- Seamless integration with existing D60 functions
- Redundant architecture for dependability and security

Monitoring and Metering
- Synchrophasors in select products
- Oscillography - up to 64 records
- Event Recorder - 1024 time tagged events, with 0.5ms scan of digital inputs
- DataLogger - up to 16 channels with user selectable sampling rate
- Fault Locator and User Programmable Fault Reports
- Breaker condition monitoring including breaker arcing current (I2t)
- Metering - current, voltage, power, power factor, frequency, voltage & current harmonics, Energy, Demand, Phasors, etc.

EnerVista™ Software
- State of the art software for configuration and commissioning Multilin products
- Graphical Logic Designer and Logic Monitor to simplify configuration and testing procedures
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista Integrator providing easy integration of data in the UR Family into new or existing monitoring and control systems
**UR & UR** Plus Family

**UR & UR** Plus Market Offerings

### Generation

**G60**
**Medium to Large Generators**

The G60 Generator Protection System provides comprehensive primary and backup protection for medium and large generators, including large steam and combustion turbines, combined-cycle generators and multi-circuit hydro units. The G60 includes advanced automation and communication capabilities, extensive I/O options, and powerful fault recording features that simplify postmortem analysis and minimize generator downtime.

Page 85

**G30**
**Combined Generator & Transformer Protection**

The G30 is a flexible system that can be used on small and medium generators, generator and step-up transformer arrangements or backup protection of large generators. Similar to the G60, the G30 also offers comprehensive protection and monitoring elements.

Page 93

### Transmission & Distribution

**D90** Plus
**Sub-cycle Distance Protection**

The D90 Plus is ideally suited for application on transmission lines where fast fault detection and small breaker failure margin are required. The D90 Plus allows transmission limits to be maintained or even increased while respecting the transient stability limits of the power system.

Page 225

**D60**
**Fully Featured Distance Protection**

The ideal solution for providing reliable and secure primary and backup protection of transmission lines supporting series compensation, teleprotection schemes, five Mho or Quad distance zones, three or single pole tripping, breaker and half with independent current inputs, phasor measurement units, and more.

Page 235

**D30**
**Backup Distance Protection**

The cost effective choice for the primary protection of sub-transmission systems or backup protection of transmission systems. Using FlexLogic elements, basic pilot schemes can be programmed. The D30 has complementary protection, control, communication, monitoring and metering functions that meet the toughest requirements of the market.

Page 243

**L90**
**Line Current Differential Protection**

Fast and powerful high-end phase-segregated line current differential protection system, suitable for MV cables, two or three terminal transmission lines having breaker and half and single or three pole tripping schemes.

Page 201

**L60**
**Line Phase Comparison Protection**

The L60 is an extremely fast line phase comparison system, suitable for two or three terminal transmission lines. This system is able to operate using Power Line Carrier or Fiber Optic communications.

Page 209

**L30**
**Sub-Transmission Line Current Differential Protection**

The L30 is a cost effective phase segregated line current differential system intended to provides primary protection for MV cables and two-three terminal sub-transmission lines or backup protection to transmission lines.

Page 217

**B90**
**Multiple Sections Low Impedance Busbar Protection**

Intended for large substations having complex-split Busbars schemes, the B90 is an advanced low impedance differential protection system that is able to support busbars with up to 24 breakers, and 4 protection zones.

Page 261

**B30**
**Low Impedance Busbar Protection**

The B30 is a cost effective-advanced protection system that fits Busbars with up to 06 circuits and two protection zone. The B30 provides advance elements like CT trouble, directional and CT saturation, breaker failure and voltage supervision that make the B30 an extremely fast and secure Busbar protection.

Page 269
Transmitter & Distribution (Continued)

F60
Feeder Protection with Hi-Z Fault Detection
Comprehensive feeder protection, control, advance communications, monitoring and metering in an integrated, economical, and compact package and more.
Page 301

F35
Multiple Feeder Protection
The F35 is a cost effective device for feeders primary protection. F35’s modular design allows customers to protect group of feeders as follow: independent current and voltage inputs, independent current and common voltage inputs or independent current inputs only.
Page 309

C70
Capacitor Bank Protection
The C70 is an integrated protection, control, and monitoring device for shunt capacitor banks. The current and voltage-based protection functions are designed to provide sensitive protection for grounded, ungrounded single and parallel capacitor banks and banks with taps.
Page 501

T60
Medium to Large Transformers
A fully featured transformer protection system suitable for power transformers of any size that require current differential function. The T60 provides automatic or user definable magnitude reference winding selection for CT ratio matching, and performs automatic phase shift compensation for all types of transformer winding connections.
Page 155

T35
Basic Transformer Protection, Multiple CTs
Basic transformer protection system capable of protecting a combined main power transformers and up to five feeders downstream. The T35 provides automatic or user definable magnitude reference winding selection for CT ratio matching, automatic phase shift compensation and allows users to remove all the zero-sequence current even for delta connected transformer windings.
Page 163

C90Plus
Breaker Automation and Controller
The C90Plus is a powerful logic controller designed to be used in substations environments and for the unique automation requirements of industrial and utility power systems. The C90Plus provides unmatched logic processing ability combined with a powerful math engine with deterministic execution of logic equations regardless of the configuration of the number of lines of logic.
Page 471

C60
Breaker Controller
The C60 Breaker Protection System is a substation hardened controller that provides a complete integrated package for the protection, control, and monitoring of circuit breakers; supporting dual-breaker busbar configurations such as breaker-and-a-half or ring bus schemes.
Page 479

Industrial & Network

M60
Motor Protection
The M60 Motor Protection System offers comprehensive protection and control solutions for medium to large sized three phase motors. The M60 provides superior protection, control, and diagnostics that includes thermal model with RTD and current unbalance biasing, stator differential, reverse and low forward power, external RRTD module, two speed motors, reduced voltage starting, broken rotor bar detection, and more.
Page 389

N60
Network Stability and Synchrophasor Measurement
This Network Stability and Synchrophasor Measurement System is intended to be used on load shedding, remedial action, special protection and wide area monitoring and control schemes. Like no one device before the N60 shares real time operational data to remote N60s so the system can generate intelligent decisions to maintain the Power System Operating.
Page 493
Overview

The Universal Relay (UR) is a family of leading edge protection and control products built on a common modular platform. All UR products feature high performance protection, expandable I/O options, integrated monitoring and metering, high-speed communications, and extensive programming and configuration capabilities. The UR forms the basis of simplified power management for the protection of critical assets, either as a stand-alone device or within an overall power automation system.

The UR is managed and programmed through EnerVista™ LaunchPad. This powerful software package, which is included with each relay, not only allows the setpoints of the relay to be programmed, but also provides the capability to manage setpoint files, automatically access the latest versions of firmware/documentation and provide a window into the substation automation system.

The UR can be supplied in a variety of configurations and is available as a 19-inch rack horizontal mount unit or a reduced size (¾) vertical mount unit. The UR consists of the following modules: power supply, CPU, CT/VT input/output, digital input/output, transducer input/output, inter-relay communications, communication switch and IEC Process Bus. All hardware modules and software options can be specified at the time of ordering.

Protection and Control

The UR incorporates the most complete and unique protection algorithms to provide unparalleled security and system uptime. The UR selector guide (in the following pages) lists all the protection elements found in each relay.

To support the protection and control functions of the UR, various types and forms of I/O are available (specific capabilities are model dependent). Supported I/Os include:

**CTs and VTs**

Up to 24 analog current transformer (CT) and voltage transformer (VT) signals can be configured to monitor AC power lines. Both 1 A and 5 A CTs are supported. Special function modules are available including: a CT module with sensitive ground input to provide ground fault protection on high-impedance grounded systems; and a high impedance fault detection module that provides fast and reliable detection of faults caused by downed conductors.

**Digital I/O**

Up to 96 digital inputs (with utility voltage rating up to 250V), and up to 64 digital outputs, are available and can be used to monitor and control a wide range of auxiliary equipment found within a substation or other protection application. Types of digital I/O cards include Trip rated Form-A, Form-C, Fast Form C, Latching and Solid State with or without dc voltage, current monitoring and isolated inputs (with auto burnish feature). Mechanically latching outputs can be used to develop secure interlocking applications and replace mechanical switches and lockout relays. Form A digital outputs have activation speeds of less than 4ms and both wet and dry contacts are supported.

Solid state output modules with high current breaking capability, fast tripping and reset time are ideal for direct tripping applications.

**Transducer I/O**

RTDs and DCmA cards are available to monitor system parameters such as temperature, vibration, pressure, wind speed, and flow. Analog outputs can be used for hardwired connections from the Controller to a SCADA system, to a programmable logic controller (PLC), or to other user interface devices (e.g. panel display).

Advanced Automation

The UR incorporates advanced automation features including powerful FlexLogic™ programmable logic, communication, and SCADA capabilities that far surpass what is found in the average protection relay. Each UR can be seamlessly integrated with other UR relays for complete system protection and control.

**FlexLogic™**

FlexLogic is the powerful UR-platform programming logic engine that provides the ability of creating customized protection and control schemes thereby minimizing the need, and the associated costs, of auxiliary components and wiring.

Using FlexLogic, the UR can be programmed to provide required tripping logic along with custom scheme logic for breaker control including interlocking with external synchronizers, transfer tripping schemes for remote breakers and dynamic setting group changes.
Scalable Hardware
The UR is available with a multitude of I/O configurations to suit the most demanding application needs. The expandable modular design allows for easy configuration and future upgrades.

- Multiple CT/VT configurations allow for implementation of many different schemes, including concurrent split-phase and differential protection
- Flexible, modular I/O covering a broad range of input signals and tripping schemes with trip rated Form-A, SSR, Form-C and mechanically latched relays
- Inter-relay communications module that enables the sharing of digital status and analog values between UR relays for control, fast tripping or teleprotection applications
- Types of digital outputs include trip-rated Form-A and Solid State Relay (SSR) mechanically latching, and Form-C outputs
- Form-A and SSR outputs available with optional circuit continuity monitoring and current detection to verify continuity and health of the associated circuitry
- IEC 61850 Process Bus delivering advanced protection and control capabilities while providing significant savings on the total life cost of electrical substations
- RTDs and DCmA inputs are available to monitor equipment parameters such as temperature & pressure

Monitoring and Metering
The UR includes high accuracy metering and recording for all AC signals. Voltage, current, and power metering are built into the relay as a standard feature. Current and voltage parameters are available as total RMS magnitude, and as fundamental frequency magnitude and angle.

Fault and Disturbance Recording
The advanced disturbance and event recording features within the UR can significantly reduce the time needed for postmortem analysis of power system events and creation of regulatory reports. Recording functions include:

- Sequence of Event (SOE)
  - 1024 time stamped events (UR Relays)
  - 8192 time stamped events (URPlus)
- Oscillography,
  - 64 digital & up to 40 Analog channels
- Data Logger, disturbance recording – 16 channels up to 1 sample / cycle
- Fault Reports
  - Powerful summary report of pre-fault and fault values

The very high sampling rate and large amounts of storage space available for data recording in the UR can eliminate the need for installing costly standalone recording equipment.

Advanced Device Health Diagnostics
The UR performs comprehensive device health diagnostic tests during startup and continuously at runtime to test its own major functions and critical hardware. These diagnostic tests monitor for conditions that could impact security and availability of protection, and present device status via SCADA communications and front panel display. Providing continuous monitoring and early detection of possible issues helps improve system uptime.

- Comprehensive device health diagnostic performed during startup
- Monitors the CT/VT input circuitry to validate the integrity of all signals

Communications
The UR provides advanced communications technologies for remote data and engineering access, making it easy and flexible to use and integrate into new and existing infrastructures. Direct support for fiber optic Ethernet provides high-bandwidth communications allowing for low-latency controls and high-speed file transfers of relay fault and event record information. The available redundant Ethernet option provides the means of creating fault tolerant communication architectures in an easy, cost-effective manner without the need for intermediary communication hardware.

The UR supports the most popular industry standard protocols enabling easy, direct integration into DCS and SCADA systems.
UR & URPlus Family

- IEC 61850
- DNP3.0 (serial & TCP/IP)
- Ethernet Global Data (EGD)
- IEC 60870-5-104
- Modbus RTU, Modbus TCP/IP
- SNTP, TFTP, HTTP

MultiLink UR Switch Module

In addition to providing high-speed connectivity directly to your Universal Relay, the MultiLink UR Switch module provides an additional 4 Fiber Ethernet ports, for connection to other relays in the system as well as upstream connectivity. It also provides 2 RJ-45 copper Ethernet ports which can be used to connect local devices such as PCs, meters, or virtually anything else in the system.

The UR Switch provides a simple way to add fully-managed Ethernet networking to your relays and devices without the need for additional hardware or a dedicated communications cabinet.

The UR Switch includes all the management and features that come with all MultiLink managed switches, and can be easily integrated into a network that has other Ethernet switches.

When used in a ring topology with other UR switch modules or MultiLink switches, the UR Switch can be configured to use MultiLink’s Smart RSTP feature to provide industry-leading network recovery for ring topologies, at a speed of less than 5ms per switch.

Interoperability with Embedded IEC 61850

Use the UR with integrated IEC 61850 to lower costs associated with system protection, control and automation. GE’s leadership in IEC 61850 comes from thousands of installed devices and follows on seven years of development experience with UCA 2.0.

- Back-up wired signals or replace expensive copper wiring between devices with direct transfer of data using GOOSE messaging
- Configure systems based on IEC 61850 and also monitor and troubleshoot them in real-time with EnerVista™ Viewpoint Engineer
- Integrate Multilin IEDs and generic IEC 61850-compliant devices seamlessly in EnerVista™ Viewpoint Monitoring

Direct I/O Messaging

Direct I/O allows for sharing of analog or high-speed digital information between multiple UR relays via direct back-to-back connections or multiplexed through a standard DS0 multiplexer channel bank. Regardless of the connection method, Direct I/O provides continuous real-time channel monitoring that supplies diagnostics information on channel health.

Direct I/O provides superior relay-to-relay communications that can be used in advanced interlocking, generation rejection and other special protection schemes.

- Communication with up to 16 UR relays in single or redundant rings rather than strictly limited to simplistic point-to-point configurations between two devices
- Connect to standard DS0 channel banks through standard RS422, G.703 or IEEE C37.94 interfaces or via direct fiber optic connections
- No external or handheld tester required to provide channel diagnostic information
Multi-Language
The UR supports English, French, Russian, Chinese and Turkish languages on the front panel, EnerVista™ setup software, and product manual. Easily switch between English and an additional language on the local displays without uploading new firmware.

HardFiber™ IEC 61850 Process Bus
The HardFiber Process Bus System represents a true breakthrough in the installation and ownership of protection and control systems, by reducing the overall labor required for substation design, construction, and testing. This innovative solution addresses the three key issues driving the labor required for protection and control design, construction and testing:

- Every substation is unique making design and drafting a one-off solution for every station
- Miles of copper wires needs to be pulled, spliced and terminated
- Time consuming testing and troubleshooting of thousands of connections must be performed by skilled personnel

The HardFiber System was designed to address these challenges and reduce the overall labor associated with the tasks of designing, documenting, installing and testing protection and control systems. By specifically targeting copper wiring and all of the labor it requires, the HardFiber System allows for greater utilization and optimization of resources with the ultimate goal of reducing the Total Life Cost (TLC) for protection & control.

EnerVista™ Software
The EnerVista Suite is an industry-leading set of software programs that simplifies every aspect of using the UR. The EnerVista suite provides all the tools to monitor the status of the protected asset, maintain the relay, and integrate information measured by the UR into DCS or SCADA monitoring systems. Convenient COMTRADE and Sequence of Events viewers are an integral part of the UR Setup software included with every UR relay, to carry out postmortem event analysis to ensure proper protection system operation.

EnerVista™ Launchpad
EnerVista Launchpad is a powerful software package that provides users with all of the setup and support tools needed for configuring and maintaining GE Multilin products. The setup software within Launchpad allows configuring devices in real-time by communicating using serial, Ethernet, or modem connections, or offline by creating setting files to be sent to devices at a later time.

Included in Launchpad is a document archiving and management system that ensures critical documentation is up-to-date and available when needed. Documents made available include:

- Manuals
- Application Notes and Support Documents
- Guideform Specifications

IEC 61850 protocol enables high-speed trip and control via the substation LAN without complex fixed wiring to many auxiliary devices.

FlexLogic™ Designer
FlexLogic allows for creating customized logic schemes to fit most protection and control applications.
Viewpoint Monitoring

Viewpoint Monitoring is a simple-to-use and full-featured monitoring and data recording software package for small systems. Similar to small SCADA systems, Viewpoint Monitoring provides a complete HMI package with the following functionality:

- Plug-&-Play Device Monitoring
- System Single-Line Monitoring & Control
- Annunciator Alarm Screens
- Trending Reports
- Automatic Event Retrieval
- Automatic Waveform Retrieval

Viewpoint Engineer

Viewpoint Engineer is a set of powerful tools that will allow the configuration and testing of UR relays at a system level in an easy-to-use graphical drag-and-drop environment. Viewpoint Engineer provides the following configuration and commissioning utilities:

- Graphical Logic Designer (Substation)
- Graphical System Designer
- Graphical Logic Monitor
- Graphical System Monitor (Substation)
- IEC 61850 Configurator

Viewpoint Maintenance

Viewpoint Maintenance provides tools that will create reports on the operating status of the relay, simplify the steps to download fault and event data, and reduce the work required for cyber-security compliance audits. Tools available in Viewpoint Maintenance include:

- Settings Security Audit Report
- Device Health Report
- Single-click Fault Data Retrieval

EnerVista™ Integrator

EnerVista Integrator is a toolkit that allows seamless integration of Multilin devices into new or existing automation systems. Included in EnerVista Integrator is:

- OPC/DDE Server
- GE Multilin Drivers
- Automatic Event Retrieval
- Automatic Waveform Retrieval

User Interface

The UR front panel provides extensive local HMI capabilities. The local display is used for monitoring, status messaging, fault diagnosis, and device configuration. User configurable messages that combine text with live data, can be displayed when user-defined conditions are met. Configurable LEDs allow status and alarm signaling (50 LEDs).

The URPlus has a colorful, graphical HMI that allows users to have local monitoring of status, values and control functionality.

The alarm annunciator panel provides the configuration of up to 256 signals (alarms and status) with full text description.

Power System Troubleshooting

The UR contains many tools and reports that simplify and reduce the amount of time required for troubleshooting power system events. Increase uptime and reduce loss of production.

Record the operation of the internal UR elements and external connected devices with 1ms time-stamped accuracy to identify the Sequence of Operation of station devices during faults and disturbances.

Analyze faults and disturbances using both analog and digital power system quantities.
**UR**<sup>plus</sup> Front panel with large color display and Annunciator panel

**Digital Alarm Annunciator**
- 256 customizable alarms in multiple pages
- Eliminates the need for separate annunciator

**Intuitive HMI**
- Customizable Bay diagrams for various applications
- Local control and status indication of breakers & disconnect switches
- Local/Remote control (20 programmable buttons)
- Fault, event, disturbance and transient reports

**Advanced Control**
- Customizable Bay diagrams for various applications
- Local control and status indication of breakers & disconnect switches
- Local/Remote control
- Fault, event, disturbance and transient reports

**UR**<sup>plus</sup> Dimensions

**Advanced Automation Controller**
- Built-in programmable logic engine
- Advanced Math, Boolean and Control operations

**Advanced Communications Capabilities**
- Up to three Ethernet ports
- IEC 61850, DNP3, MODBUS TCP/IP, IEC60870-5-104 protocols
- IEEE C37.118 synchrophasors over Ethernet

**Advanced Recorders**
- Eliminate the need for stand-alone disturbance recorders
- 128 samples/cycle, 1 min duration transient recorder
- Separate Dynamic disturbance recorder for recording long term events
- Synchrophasors PMU recording

**Front USB Port**
- High-speed local data transfer

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**UR**<sup>plus</sup> Front panel dimensions:
- 7.50" (190) high
- 18.31" (465) wide
- 18.86" (479) deep

**UR**<sup>plus</sup> Top panel dimensions:
- 9.80" (249) high
- 11.43" (290) wide
UR & URPlus Family

**Family Overview**

- Bright Annunciator with 62 LEDs
- Easy LED Labeling
- Large LCD Display & Keypad for local operation
- Secure Locking
- Optional 16 User-Programmable Pushbuttons
- 3 User Pushbuttons
- Local RS232 Port

**UR Enhanced front panel with large display, customizable LED Annunciator, and user Programmable Pushbuttons**

**UR Horizontal Dimensions**

- **HORIZONTAL FRONT VIEW**
  - 19.00” (483)
  - 7.00” (178)

- **HORIZONTAL TOP VIEW**
  - 8.97” (228)
  - 10.90” (277)
  - 9.80” (249)
  - 17.52” (446)

- brackets repositioned for switchgear mount.
UR Enhanced front panel - Vertical faceplate

- Secure Locking
- Large LCD Display
- Bright, Easy Labeling, LED Annunciator
- 3 User Pushbuttons
- Local RS232 Port
- Optional 6 User-Programmable Pushbuttons

UR Vertical Dimensions

Vertical Dimensions:
- 14.025" (356.2)
- 7.482" (190)
- 15.00" (381)
- 4.00" (101.6)
- 11.015" (279.781)
- 9.780" (248.4)
- 13.560" (344.4)
- 1.329" (33.76)
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<th>ANSI</th>
<th>B30</th>
<th>B90</th>
<th>C30</th>
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<td>Synchronism Check or Synchronizing</td>
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<td>Current Unbalance</td>
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</table>

*UR & URPlus Family*

**Family Overview**

- UR & URPlus Family
- www.GEDigitalEnergy.com

- Features
  - ANSI B30 B90 C30 C60 C70 C90 Plus D30 D60 D90 Plus
  - F35 F60 G30 G60

- Protection
  - Disturbance Detector
  - Mho Distance, Phase (No. of Zones) 21P
  - Mho Distance, Ground or Neutral Phase (No. of Zones) 21G/N
  - Quadrilateral Distance, Phase (No. of Zones) 21P
  - Quadrilateral Distance, Ground or Neutral (No. of Zones) 21G/N
  - Permissive Pilot Logic
  - Sub-Cycle Distance
  - Overexcitation Protection (V/Hz) 24
  - Synchronism Check or Synchronizing 25
  - Undervoltage, Phase 27P
  - Undervoltage, Auxiliary 27X
  - Stator Ground (3rd Harmonic) 27TN
  - Sensitive Directional Power 32S
  - Loss of Excitation – Based on Reactive Power 40Q
  - Loss of Excitation – Based on Impedance Element 40
  - Current Unbalance 46
  - Broken Conductor Detection 46BC
  - IOC, Negative Sequence 46/50
  - TOC, Negative Sequence 46/51
  - Current Directional, Negative Sequence 46/67
  - Reverse Phase Sequence Voltage 47
  - Thermal Model 49
  - Inadvertent/Accidental Energization 50/27
  - Motor Mechanical Jam
  - Motor Start Supervision
  - Motor Acceleration Time
  - User Programmable Curves
  - Breaker Failure 50BF
  - IOC, Phase 50P
  - IOC, Ground 50G
  - IOC, Neutral 50N
  - IOC, Sensitive Ground 50SG
  - High Impedance Fault Detection
  - TOC, Phase 51P
  - TOC, Ground 51G
  - TOC, Neutral 51N
  - TOC, Sensitive Ground 51SG
  - TOC, Voltage Restrained 51V
  - Overvoltage, Phase 59P
  - Overvoltage, Auxiliary 59A
  - Overvoltage, Neutral 59N
  - Negative Sequence Overvoltage 59-2
  - 100% Stator Ground Protection 64TN
  - Current Directional, Phase 67P
  - Current Directional, Neutral 67N
  - Current Directional, Negative Sequence 46/67
  - Power Swing Blocking 68
  - Out-of-Step Tripping 78
  - AC Reclosing (No. of Shots) 79
  - Switch on to Fault (Line Pickup) SOTF
  - Voltage Transformer Fuse Failure VTFF
  - Current Transformer Supervision 50/74
  - Load Encroachment Logic
  - Underfrequency 81U
  - Overfrequency 810
  - Anti-Islanding Protection / Frequency Rate of Change 81R
  - Lockout Functionality 86
  - Bus Differential 87B
  - Line Current Differential 87L
  - Ground Differential 87G
  - Stator Differential 87S
  - Group Differential 87T
  - Line Phase Comparison 87PC
  - Voltage Differential
  - Capacitor Bank Overvoltage
  - Neutral Voltage Unbalance
  - Automatic Voltage Regulation
  - Time of Day Control
  - Instantaneous Differential 50/87
  - Split Phase Protection
  - Line Current Differential Trip Logic
**UR Technical Specifications**

**PROTECTION**

**GROUND**
- Operating quantity: \( V_{\text{neutral,3}}/V_{\text{neutral,3}} + V_{\text{zero,3}} \)
- Pickup level: 0.00 to 1.50 pu in steps of 0.001
- Dropout level: 97 to 98% of pickup
- Level accuracy: ±0.5% of reading from 1.0 to 2.0 V
- Pickup delay: 0 to 600.00 s in steps of 0.01
- 3rd harmonic supervision level: 0.001
- Time accuracy: ±3 ms or ±20 ms, whichever is greater
- Dropout: time at 1.10 × pickup at 60 Hz
- Operate time: 0 to 100.00 s in steps of 0.01

**ACCELERATION TIME**
- Acceleration: 1.00 to 10.00 × FLA in steps of 0.01
- Accleration time: 0.00 to 180.00 s in steps of 0.01
- Operating mode: Definite Time, Adaptive

**ACCIDENTAL ENERGY**
- Operating condition: Overcurrent
- Arming condition: Undervoltage and/or Machine OFF
- Overcurrent: 0.00 to 3.00 pu in steps of 0.001
- Pickup level: 97 to 98% of pickup
- Level accuracy: ±0.5% of reading from 1.0 to 2.0 CT rating
- Dropout level: 102 to 103% of pickup
- Level accuracy: ±0.5% of reading from 10 to 20 V
- Time accuracy: ±0.000 to 3.000 pu in steps of 0.001

**UR & URPlus Family**
- 1 per CT bank with a minimum of 2 measures fault duration
- Accumulates breaker duty (I2t) and (whichever is greater)
- Time Dial = 0 to 600.00 in steps of 0.01

**UR & URPlus Technical Specifications**

**Assertion level:**
- Accuracy: ±0.5% or ±1% of rated, whichever is greater
- Pickup delay: 0 to 65.535 s in steps of 0.001
- Time accuracy: ±3% or ±4 ms, whichever is greater
- Operate time: 0 to 65.535 s in steps of 0.001

**BROKER ARCING CURRENT**
- Principle: Accumulates breaker duty (I2t) and measures fault duration
- Initiation: Programmable per phase from any Logic, operand
- Compensation for auxiliary relays: 0 to 65.355 s in steps of 0.001
- Alarm threshold: 0 to 50000 kA-2cycle in steps of 1
- Fault duration accuracy: ±0.25 of a power cycle
- Availability: 1 per CT bank with a minimum of 2

**BREAKER FAULTRZ**
- Mode: 1-pole, 3-pole
- Current supervision: phase, neutral current
- Current supervision pickup: 0.00 to 3.00 pu in steps of 0.001
- Pickup supply: 97 to 98% of pickup
- Current supply accuracy: ±0.1 to 2.0 × CT
- Dropout level: 0.75% of reading or ±2% of rated (whichever is greater)
- Pickup delay: 0 to 2 × CT rating
- Timing accuracy: ±1% of reading

**BREAKER FLASHOVER**
- Operating quantity: Phase current, voltage and voltage difference across the interconnection part of the relay. See output contacts specifications for estimation of the total response time for a particular application. The operating times are average times including variables such as fault inception angle or type of a voltage source (magnetic VIs and CVIs)

**GROUNDE DISTANCE OPERATING TIME CURVES**
- The operating times are response times of a microprocessor application. The operating times are average times including variables such as fault inception angle or type of a voltage source (magnetic VIs and CVIs)

**LINE CURRENT DIFFERENTIAL**
- Application: 2 or 3 terminal line, series compensated line, tapped line, with 5% current supervision
- Pickup level: 0.20 to 4.00 pu in steps of 0.01
- Time accuracy: ±3% or ±4 ms, whichever is greater
- Slope: 1: 1 to 60.00 sec. in steps of 0.1
- Slope: 2: 1 to 70.00
- Breakpoint between slopes: 0.00 to 20.00 pu in steps of 0.1
- Operating Time: 1 to 1.5 power cycles duration
- Asymmetrical channel delay compensation
- Using GPS

**LINE CURRENT DIFFERENTIAL TRIP LOGIC**
- BTL trip: Adds security for trip decision; creates 1 and 3 pole trip logic; Engaged Direct Transfer Trip (1 and 3 pole) remote L90
- CT Trip (CT mismatch factor): 0.00 to 180.00 s in steps of 0.01
- DS: Direct Transfer Trip (1 and 3 pole) remote L90
- DT: Security for ring bus and 1/4 breaker configurations
- Open pole detector: Security for sequential and evolving faults

**LINE PICKUP**
- Phase IOC: 0.000 to 30.00 pu
- UnderVoltage pickup: 0.000 to 30.00 pu
- Overvoltage delay: 0.000 to 65.535 s

**LOSS OF EXCITATION**
- Responsibly: Positive-sequence quantities
- Minimum voltage: 0.000 to 3.00 pu in steps of 0.001
- Reach (sec, W): 0.02 to 250.00 in steps of 0.01
- Impedance accuracy: ±5%
- Angle: ±5 to 90° in steps of 1
- Angle accuracy: ±2.5° in steps of 1
- Pickup delay: 0 to 65.535 s in steps of 0.001
- Reach accuracy: ±3% in steps of 0.001
- Reach accuracy: ±1.5% or ±4 ms, whichever is greater
- Time accuracy: ±3% or ±4 ms, whichever is greater
- Operate time: < 30 ms at 60 Hz

**LIGHTNING PROTECTION**
- Phase: ±1.5% or ±4 ms, whichever is greater
- Current supervision: ±1.5% of rated
- Level accuracy: ±1.5% of rated (whichever is greater)
- Pickup level: 0 to 65.535 s in steps of 0.001
UR Technical Specifications

**Neutral DIRECTIONAL OVERCURRENT**

- **Operating condition:** Phase overcurrent
- **Arming condition:** Motor starting
- **Pickup level:** 0.00 to 1.00 pu in steps of 0.01
- **Dropout level:** 97 to 98% of pickup
- **Level accuracy:** ±0.5% of reading or ±0.5% of rating at > 2.0 × CT rating
- **Time delay:** ≤ 40 ms at 3 × Pickup + 3% or 4 ms (whichever is greater)

**Directional supervision:**

<table>
<thead>
<tr>
<th>Type</th>
<th>Angle range</th>
<th>Time delay</th>
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</thead>
<tbody>
<tr>
<td>Phasor</td>
<td>0 to 90° in steps of 1</td>
<td>≤ 40 ms</td>
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<tr>
<td>ACB</td>
<td>0 to 90° in steps of 1</td>
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</tr>
</tbody>
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**Phase DIRECTIONAL OVERCURRENT**

- **Operating condition:** Phase overcurrent
- **Arming condition:** Motor starting
- **Pickup level:** 0.00 to 1.00 pu in steps of 0.01
- **Dropout level:** 97 to 98% of pickup
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</tr>
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</table>

**Neutral NEUTRAL OVERVOLTAGE**

- **Operating condition:** Phase overcurrent
- **Arming condition:** Motor starting
- **Pickup level:** 0.00 to 3.00 pu in steps of 0.01
- **Dropout level:** 97 to 98% of Pickup
- **Level accuracy:** ±0.5% of reading from 10 to 200 V
- **Time delay:** ≤ 40 ms at 3 × Pickup + 3% or 4 ms (whichever is greater)

**Directional supervision:**

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<thead>
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</thead>
<tbody>
<tr>
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<td>30 to 90° in steps of 1</td>
<td>≤ 30 ms</td>
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<tr>
<td>ACB</td>
<td>30 to 90° in steps of 1</td>
<td>≤ 30 ms</td>
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**Phase NEUTRAL OVERVOLTAGE**

- **Operating condition:** Phase overcurrent
- **Arming condition:** Motor starting
- **Pickup level:** 0.00 to 3.00 pu in steps of 0.01
- **Dropout level:** 97 to 98% of Pickup
- **Level accuracy:** ±0.5% of reading or ±0.5% of rating at > 2.0 × CT rating
- **Time delay:** ≤ 40 ms at 3 × Pickup + 3% or 4 ms (whichever is greater)

**Directional supervision:**

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</tr>
<tr>
<td>ACB</td>
<td>30 to 90° in steps of 1</td>
<td>≤ 30 ms</td>
</tr>
</tbody>
</table>

**Voltage supervision**

- **Pickup level:** 0.00 to 600.00 s in steps of 0.01
- **Dropout level:** 0.00 to 600.00 s in steps of 0.01
- **Level accuracy:** ±0.5% of reading or ±1% of rated (whichever is greater)
- **Time delay:** ≤ 40 ms at 3 × Pickup + 3% or 4 ms (whichever is greater)

**Phase/Polarized Compensation applications:**

- **Phase/Polarized Compensation:**
  - Positive: ±3% or ±2° (whichever is greater)
  - Negative: ±3% or ±2° (whichever is greater)

**Phase/Polarized DIRECTIONAL OVERCURRENT**

- **Operating condition:** Phase overcurrent
- **Arming condition:** Motor starting
- **Pickup level:** 0.00 to 3.00 pu in steps of 0.01
- **Dropout level:** 97 to 98% of Pickup
- **Level accuracy:** ±0.5% of reading or ±1% of rating (whichever is greater)
- **Time delay:** ≤ 40 ms at 3 × Pickup + 3% or 4 ms (whichever is greater)

**Directional supervision:**

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<tr>
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<td>≤ 30 ms</td>
</tr>
</tbody>
</table>

**Phase/Polarized DIRECTIONAL OVERVOLTAGE**

- **Operating condition:** Phase overcurrent
- **Arming condition:** Motor starting
- **Pickup level:** 0.00 to 3.00 pu in steps of 0.01
- **Dropout level:** 97 to 98% of Pickup
- **Level accuracy:** ±0.5% of reading or ±1% of rating (whichever is greater)
- **Time delay:** ≤ 40 ms at 3 × Pickup + 3% or 4 ms (whichever is greater)

**Directional supervision:**

<table>
<thead>
<tr>
<th>Type</th>
<th>Angle range</th>
<th>Time delay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phasor</td>
<td>30 to 90° in steps of 1</td>
<td>≤ 30 ms</td>
</tr>
<tr>
<td>ACB</td>
<td>30 to 90° in steps of 1</td>
<td>≤ 30 ms</td>
</tr>
</tbody>
</table>

**Voltage supervision**

- **Pickup level:** 0.00 to 600.00 s in steps of 0.01
- **Dropout level:** 0.00 to 600.00 s in steps of 0.01
- **Level accuracy:** ±0.5% of reading or ±1% of rated (whichever is greater)
- **Time delay:** ≤ 40 ms at 3 × Pickup + 3% or 4 ms (whichever is greater)

**Phase/Polarized DIRECTIONAL CURRENT**

- **Operating condition:** Phase overcurrent
- **Arming condition:** Motor starting
- **Pickup level:** 0.00 to 3.00 pu in steps of 0.01
- **Dropout level:** 97 to 98% of Pickup
- **Level accuracy:** ±0.5% of reading or ±1% of rating (whichever is greater)
- **Time delay:** ≤ 40 ms at 3 × Pickup + 3% or 4 ms (whichever is greater)

**Directional supervision:**

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**Phase/Polarized DIRECTIONAL VOLTAGE**

- **Operating condition:** Phase overcurrent
- **Arming condition:** Motor starting
- **Pickup level:** 0.00 to 3.00 pu in steps of 0.01
- **Dropout level:** 97 to 98% of Pickup
- **Level accuracy:** ±0.5% of reading or ±1% of rating (whichever is greater)
- **Time delay:** ≤ 40 ms at 3 × Pickup + 3% or 4 ms (whichever is greater)
UR Technical Specifications

PROTECTION

POWER SWING DETECT
- Functions: Power swing block, Out-of-step trip
- Characteristic: Min or Quad
- Measured impedance: Passive-sequence
- Blocking/tripping modes: 2-step or 3-step
- Tripping mode: Current supervision
- Current supervision: Early or Delayed
- Pickup level: 0.05 to 30.00 pu in steps of 0.001
- Dropout level: 97 to 98% of Pickup
- Fwd/reverse reach (Sec. VI): 0.10 to 5000.00W in steps of 0.001
- Left and right blinders (Sec. VI): 0.10 to 5000.00W in steps of 0.001
- Impedance accuracy: ±5%
- Fwd/reverse angle imbalances: 40° in steps of 1
- Angle accuracy: ±2°
- Characteristic limit angles: ±40° to 140° in steps of 1
- Timers: 0.000 to 65.535 s in steps of 0.001
- Timing accuracy: ±0.00% or ±4 ms, whichever is greater
- Rate of Change of Frequency:
  - df/dt trend:
    - (increasing, decreasing, bi-directional)
    - 0.10 to 15.00 Hz/s in steps of 0.001
  - df/dt pickup level:
    - 96% of pickup
  - df/dt dropout level:
    - 80% ±3% or 35% of pickup, whichever is greater
  - Overvoltage supp.: 0.10 to 3.00 pu in steps of 0.001
  - Overcurrent supp.: 0.00 to 3.00 pu in steps of 0.001
  - Pickup delay:
    - 0 to 65.535 s in steps of 0.001
  - Relay delay:
    - 0 to 65.535 s in steps of 0.001
  - Time accuracy:
    - ±0.00% or ±4 ms, whichever is greater
- 95% settling time for df/dt:
  - Operate time:
    - at 2x pickup: 12 cycles
    - at 3x pickup: 8 cycles
    - at 5x pickup: 6 cycles

RESTRICTED GROUND FAULT
- Pickup time: 0.000 to 30.00 pu in steps of 0.001
- Dropout: 97 to 98% of Pickup
- Slope: 0 to 100% in steps of 1%
- Pickup delay:
  - at 0.00 pu: 0 to 60.00 s in steps of 0.01
  - at 0.01 pu: 0 to 60.00 s in steps of 0.01
- Operate time:
  - <1 s (for system cycle SENSITIVE DIRECTIONAL POWER
- Measured power:
  - 3-phase, true RMS
- Number of stages:
  - 2
- Characteristic angle:
  - ±35° in steps of 1
- Calibration angle:
  - 0.00 to 0.95° in steps of 0.05
- Minimum power:
  - 0.001 to 1.20 pu in steps of 0.001
- Pickup level accuracy:
  - ±1.0% or ±0.001 pu, whichever is greater
- Hysteresis:
  - 2% or 0.001 pu, whichever is greater
- Pickup delay:
  - 0 to 600.00 s in steps of 0.01
- Time accuracy:
  - ±0.00% or ±4 ms, whichever is greater
- Time delay:
  - 50 ms

SPILT PHASE PROTECTION
- Operating quantity:
  - split phase CT current biased by generator load current
- Pickup level:
  - 0.000 to 1.50 pu in steps of 0.001
- Dropout:
  - 97 to 98% of pickup
- Level accuracy:
  - ±0.5% of reading or ±1% of rated whichever is greater
- Pickup delay:
  - 0 to 65.535 s in steps of 0.001
- Time accuracy:
  - ±3% of a cycle, whichever is greater
- Time delay:
  - <5 cycles at 1.0 x pickup at 60Hz

STATOR DIFFERENTIAL
- Pickup:
  - 0.050 to 1.00 pu in steps of 0.001
  - 1 to 100% in steps of 1
  - 1.00 to 1.50 pu in steps of 0.01
  - 1.50 to 30.00 pu in steps of 0.01
- Level accuracy:
  - ±2%

SYNCHROCHECK
- Max voltage difference:
  - 0 to 400000 V in steps of 1
- Max angle difference:
  - 0 to 100° in steps of 1
- Max freq. difference:
  - 0 to 2.00 Hz in steps of 0.01
- Hysteresis for max freq. diff.:
  - 0 to 0.10 Hz in steps of 0.01
- Dead source function:
  - None, LV1 & LV2, DV1 & LV2, DV2 & LV2, DV1 & DV2, DV1 & DV2 & LV, Live & D-Dead

THERMAL MODEL
- Thermal overload curves:
  - Standard Curve Time: 0.00 to 600.00 s in steps of 0.01
- Multiplier:
  - Thermal Overload: pu = overload factor x FLA
- Pickup:
  - 0.00 to 1.50 in steps of 0.001
- Standard Curve Overload:
  - Trip time =
    \[ \text{TD} = \frac{0.0253037 \times f_{\text{load}}}{f_{\text{rated}}} = 0.0253037 \times f_{\text{load}} \]
- Motor Rated Voltage:
  - Thermal Motor Biasing:
  - Thermal Model Update Rate:
  - Stopped/Running:
  - Time Cool Constants:
  - Exponential:

HOT/COLD Safe Stall
- Ratio:
  - 0.01 to 1.00 in steps of 0.01
- Current Accuracy:
  - Per phase current inputs
- Current Source:
  - True RMS
- Timing Accuracy:
  - ±0.00% or ±2% whichever is greater
- Timing Accuracy for Voltage Dependent Overload:
  - ±100 ms or ±4 ms, whichever is greater
- Dropout level:
  - Voltage:
    - ±0.00% or ±0.025 pu, whichever is greater
- Pickup Delay:
  - Definite time (t) to 600.00 s in steps of 0.01, inverse time, or FlexCurve™
- Level Accuracy:
  - ±0.00% or ±4 ms, whichever is greater
- Operate Time:
  - <30 ms at 60 Hz

VOLT PER HERTZ
- Voltage:
  - Phasor only
- Pickup level:
  - 0.00 to 1.40 in steps of 0.01 pu/VHz
- Dropout level:
  - 0.97 to 99% of Pickup
- Time accuracy:
  - ±0.00% or 0.95° in steps of 0.01
- Dropout delay:
  - 0.000 to 0.01 s in steps of 0.01
- Timing accuracy:
  - ±0.00% or ±4 ms, whichever is greater

VT FUSE FAIL
- Monitored parameters:
  - V2, V1, V1, L
- TIMETRIC ZERO-SEQUENCE DIRECTIONAL
- Measured Power:
  - Zero-Sequence
- Number of Elements:
  - 2
- Characteristic Angle:
  - ±360° in steps of 1
- Minimum Power:
  - 0.000 to 1.25pu in steps of 0.001
- Pickup Level Accuracy:
  - ±1% or 0.000 pu, whichever is greater
- Pickup Delay:
  - 0.000 to 65.535 s in steps of 0.01
- Inverse Time Multiplier:
  - 0.01 to 2.00 s in steps of 0.01
- Time Accuracy:
  - ±0.00% or ±4 ms, whichever is greater

MONITORING
- Data Logger:
  - 1 to 16
- Parameters:
  - Any available analog actual value
- Sampling rate:
  - 15 to 3600000 ms in steps of 1
- Trigger:
  - Any FlexLogic™ operand
- Mode:
  - Continuous or Triggered
- Storage capacity:
  - (IN) is dependent on memory
- 1-second rate:
  - 01 channel for NN days
- 60-minute rate:
  - 01 channel for NN days
- EVENT RECORDER
- Capacitor events:
  - 1024 events
- Time-tag:
  - ±1 microsecond
- Trigger:
  - Any element pickup, dropout or operation of Digital input change of state (Digital output change of state event)

Data storage:
- In non-volatile memory
- Fault Locator
- Method:
  - Single-ended
- Maximum accuracy:
  - Fault resistance is zero or fault current is from all line terminals in phase ±0.01% or ±0.025 pu
- Relay accuracy:
  - ±0.025 pu
- Worst-case accuracy:
  - ±0.01% or ±0.025 pu

HIGH-IMPEDANCE FAULT DETECTION (HIFD)
- Detections:
  - Arc Suspected, Arc Detected, Down Conductor, Phase Identification

OSCILOGRAPHY
- Maximum records:
  - 64
- Sampling rate:
  - 64 samples per power cycle
- Triggers:
  - Any element pickup, dropout or operation
- Digital input change of state (Digital output change of state event)
- Any FlexLogic™ operand
- FlexCurve Equation
- AC input channels
- Element state
- Digital input state
- Digital output state
- Data storage:
  - In non-volatile memory

USER-PROGRAMMABLE FAULT REPORT
- Number of elements:
  - 2
- Pre-fault trigger:
  - Any FlexLogic operand
- Fault trigger:
  - Any FlexLogic operand
- Recorder quantities:
  - 32 (any FlexLogix value)
**UR Technical Specifications**

### Monitoring

**Phase Measurement Unit**
- Output format: per IEEE C37.110 standard
- Number of channels: 14 synchronousphasors, 16 analogs, 16 digital
- TVE total vector error: <16
- Triggering: frequency, voltage, current, power, rate of change of frequency, user-defined
- Reporting rate: 1, 2, 10, 15, 20, 25, 30, 50, 60 or 120 times per second
- Number of clients: One over TCP/IP port, two over UDP/IP ports
- TAC ranges: As indicated in appropriate specifications sections
- Network reporting: 16-bit integer or 32-bit IEEE floating point numbers
- Network reporting style: Rectangular (real and imaginary) or polar (magnitude and angle coordinates)
- Compensation: -30° to 180° in steps of 30° (current and voltage components)
- Mode of operation: Normal and test
- PMU Recording: 46 configurable channels (14 synchronousphasor, 16 digital), 16 analogs

### metering

**RMS CURRENT: PHASE, NEUTRAL, AND GROUND**
- Accuracy at: 0.1 to 2.0 x CT rating: ±0.25% of reading or ±0.1% of whichever is greater
- > 2.0 x CT rating: ±1.0% of reading
- RMS Voltage Accuracy: ±0.5% of reading from 10 to 100% of rated voltage

**Real Power (Watts)**
- Accuracy: ±1.0% of reading at -0.0 ≤ PF ≤ 0.8 and 0.8 ≤ PF < 1.0

**Reactive Power (VARs)**
- Accuracy: ±1.0% of reading at -0.2 < PF ≤ 0.2

**Apparent Power (VA)**
- Accuracy: ±1.0% of reading

**Watt-Hours (Positive and Negative)**
- Range: ±0 to 2 x 10^9 MWh
- Parameters: 3-phase only
- Update rate: 50 ms

**Var-Hours (Positive and Negative)**
- Accuracy: ±0.2% of reading
- Range: ±0 to 2 x 10^9 Mvarh
- Parameters: 3-phase only
- Update rate: 50 ms

**Current Harmonics**
- Harmonics: 2nd to 25th harmonic: per phase, displayed as a % of f1 (fundamental/frequency/phasor) THD per phase, displayed as a % of f1
- Accuracy: Harmonics: 1. T1 = 0.4pu (0.20% + 0.035% / harmonic) of reading or 0.15% of whichever is greater 2. T2 = 0.4pu, as above plus ±% of f1
- THD: 1. FL 0.4pu (0.25% + 0.035% / harmonic) of reading or 0.20% of whichever is greater 2. FL = 0.4pu, as above plus ±% of f1

### Demand

**Measurements**
- Phases A, B, and C present and maximum measured currents
- 3-Phase Power (P, Q, and S) present and maximum measured currents
- ±2.0 Hz
- ±0.02 Hz
- ±0.05 Hz

### Voltage Harmonics

- Harmonics: 2nd to 25th harmonic: per phase, displayed as a % of f1 (fundamental/frequency/phasor) THD per phase, displayed as a % of f1
- Accuracy: Harmonics: 1. FL = 0.4pu (0.20% + 0.035% / harmonic) of reading or 0.15% of whichever is greater 2. FL = 0.4pu, as above plus ±% of f1
- THD: 1. FL = 0.4pu (0.25% + 0.035% / harmonic) of reading or 0.20% of whichever is greater 2. FL = 0.4pu, as above plus ±% of f1

### User-Programmable Elements

**Control Pushbuttons**
- Number of pushbuttons: 3 (standard or 16-laptope) drive FlexLogic operates
- Operation: FLEXCURVE
- Number: 4 (A through D)
- Reset points: 40 (0 through 1 of pickup)
- Operating points: 80 (0 through 20 of pickup)
- Time delay: 0 to 65535 ms in steps of 1

**FLEX Elements**
- Number of elements: 8 or 16
- Operating signal: any analog actual value, or two values in differential mode
- Operating signal mode: Signed or Absolute Value
- Operating model: Level, Delta
- Comparator direction: Over, Under
- Comparator levels: -0.000 to 30,000.00 in steps of 0.001
- Delta at: 0.1 to 50.0% in steps of 0.1
- Pickup & dropout delay: 0.000 to 65,535 s in steps of 0.001

**FLexModeSTM**
- Number: up to 256 logical variables grouped under 16 Modbus addresses
- Programmability: any logical variable, contact, or virtual input

**LED Test**
- Initialization: As input from digital input or user-programmable condition
- Operating mode: 1 digital
- Selector Level: Over, Under
- Comparator levels: 0.000 to 30,000.00 in steps of 0.001
- Delta at: 0.1 to 50.0% in steps of 0.1
- Pickup & dropout delay: 0.000 to 65,535 s in steps of 0.001

**Non-Volatile Latches**
- Type: Set/dominant or Reset/dominant
- Number: 16 (individually programmed)
- Stored in non-volatile memory
- Execution sequence: As input prior to protection, control, and FlexLogic

**Selector Switch**
- Number of elements: 2
- Selecting mode: 1 to 7 in steps of 1
- Responding to: Time-out or Acknowledge
- Time-out timer: 3.0 to 60.0 s in steps of 0.1
- Power-up mode: restore from non-volatile memory or synchronize to a 3-bit control input

**User-Definable Displays**
- Number of displays: 16
- Lines of display: 2
- 20 alphanumeric characters
- Parameters: up to 5, any Modbus register address
- Invoking and scrolling: keystyped, or any user-programmable condition, including pushbuttons

**User-Programmable Leds**
- Number: 40 plus Trip and Alarm
- Programmability: from any logical variable, contact, or virtual input
- Reset mode: Self-reset or Latched

**User-Programmable Pushbuttons (Optional)**
- Number of pushbuttons: 12
- Mode: Self-Reset, Latched
- Display message: 2 lines of 20 characters
- 8-Bit Switch
- Number of elements: 6
- Input signals: any 2-Bits integers via FlexLogicTM operand
- Control: Response time: ±0.002 to 4.60 × CT rating RMS

### Inputs

**Accuracy**
- CT rated primary: 4 to 50000 A
- CT rated secondary: 1 or 5 A by connection
- Nominal frequency: 50 to 65 Hz
- Relay burden: <0.2 VA at rated secondary
- Conversion range: 0.02 to 46 × CT rating RMS
- Symmetrical
- Sensitive Ground/Hi-Z CT module: 0.002 to 46 × CT rating RMS
- Symmetrical
- Current withstand: 20 ms at 250 times rated current
- 1 sec, at 100 times rated current
- Continuous at 3 times rated current

**AC Voltage**
- VT rated secondary: 50 to 400 V
- VT ratio: 1.0 to 2400.000
- Nominal frequency: 150 Hz
- Relay burden: ±0.25 VA at 120 V
- Conversion range: 1 to 275 V
- Voltage withstand: continuous at 260 V to neutral

**Contact Inputs**
- Dry contacts: 1000 maximum
- Wet contacts: 300 V DC maximum
- Selectable threshold: 17, 33 V, 84 V, 166 V
- Contacts Per: ±10%
- Common Return: ±1 ms
- Deobounce time: 0.0 to 16.0 ms in steps of 0.5
- Continuous Current: 3mA (when energized)
- Dropout:

**Contact Inputs with Auto-Burnishing**
- Dry contacts: 1000 maximum
- Wet contacts: 300 V DC maximum
- Selectable threshold: 17, 33 V, 84 V, 166 V
- Contacts Per: ±10%
- Common Return: ±1 ms
- Deobounce time: 0.0 to 16.0 ms in steps of 0.5
- Continuous Current: 3mA (when energized)
- Dropout:

**Auto-Burnish Impulse**
- Duration of Auto-Burnish Impulse: 50 to 70 mA
- Current: 25 to 50 ms

**Input Impedance**
- Range: ±0 to 10 mA
- Accuracy: ±0.2% of full scale
- FLEXLOGICTM
- Operate points:

### Direct Inputs

- Number of input points: 32
- No. of remote devices: 16
- Default states on loss of comm.: No, Off, Latched, Off, Latest
- Ring configuration:
- Data rate: 120 kbps
- CRC:
- CRC alarm:
- Responding to:
- Message monitoring count:
- Alarm threshold: 1 to 1000 in steps of 1
- Unreturned message alarm:
- Responding to:
- Rate of unreturned messages in ring configuration:
- Monitoring message count:
- Alarm threshold: 1 to 1000 in steps of 1
- RIO & BPK

### Pulse Modulation

- Pulse Modulation: 10 V to 100 V
- DC shift: TTL
- Input impedance: 22 kW
- Isolation: 600 V
- Remote INPUTS (IEC 61850 GSSE)
- Number of input bit pairs: 32, configured from 64 incoming points
- Number of remote devices: 16
- Default states on loss of comm.: Off, Latched, Latest
- RD Inputs

### Types

- 3-wire:
- 100 Ohm Platinum, 100 Ohm, 100 Ohm Nickel, 101 Ohm Copper
- Sensing current:
- Range:
- Accuracy:
- Isolation:
### Outputs

**Control Power External Output**
- **Input/Output Contact Input**
  - Capacity: 100 mA DC at 48 V DC
  - Isolation: ±500 Vp-p
- **DCMA Outputs**
  - Range: -1 to 1 mA, 0 to 1 mA, 4 to 20 mA
  - Max. load resistance: 12 kΩ for -1 to 1 mA range
  - 12 kΩ for 0 to 1 mA range
  - 600 to 4 mA range
  - Accuracy: ±0.75% of full-scale for 0 to 1 mA range
  - ±0.5% of full-scale for -1 to 1 mA range
  - ±0.75% of full-scale for 0 to 20 mA range
- 99% Settling time to 100 ms

**SOLID-STATE OUTPUT RELAY**
- **User Output Points:**
  - **Control Mode:**
    - **Carry Continuous:**
    - **Make and Carry for 0.2 s:**

**LATCHING RELAY**
- **Maximum Load:**
- **Amplitude:**
- **Make and Carry:**
- **Max Optical Output Power:**
  - 20 dB
- **Receiver Sensitivity:**
  - -30 dBm
- **Typical Distance:**
  - 1.65 km

**SOLID-STATE OUTPUT RELAY**
- **User Output Points:**
  - **Control Mode:**
    - **Carry Continuous:**
    - **Make and Carry for 0.2 s:**

**LATCHING RELAY**
- **Maximum Load:**
- **Amplitude:**
- **Make and Carry:**
- **Max Optical Output Power:**
  - 10 dB
- **Receiver Sensitivity:**
  - -30 dBm
- **Typical Distance:**
  - 1.65 km

**INTER-RELAY COMMUNICATIONS**
- **Max Optical Output Power:**
  - 20 dB
- **Receiver Sensitivity:**
  - -30 dBm
- **Typical Distance:**
  - 1.65 km

**COMMUNICATIONS**
- **RS-232, RS-485, 10Base-T, 100Base-TX, 100Base-FX**
- **Protocols:**
  - **IC 61580**
  - **DNP 3.0**
  - **Modbus**
  - **TCP/IP**
  - **E-MAI**
  - **EGD**

**LINK POWER BUDGET**
- **Power Consumption:**
  - 10 W
- **Voltage Loss Hold-up:**
  - 50 ms
- **Voltage Supply:**
  - 24 V DC
- **Power Consumption:**
  - 10 W

**MAXIMUM OPTICAL INPUT POWER**
- **Emitter, Fiber Type:**
  - **Distance:**
    - 820 nm LED, Multimode: 3.8 km
    - 1300 nm LED, Multimode: 6.6 km
    - 1300 nm Laser, Singlemode: 10.5 km

**Typical Link Distance**
- **Emitter Type:**
  - 820 nm LED Multimode: 1.65 km
  - 1300 nm LED Multimode: 3.8 km
  - 1300 nm Laser, Singlemode: 6.6 km

**THermal**
- **Products go through an environmental test based upon an accepted quality level (AQL) sampling process.**
  - **Temperature:**
    - Cold: 60 degrees C
    - Dry Heat: 60 degrees C

**Electrostatic Discharge**
- **Impedance:**
  - ESD 61000-4-2
  - IEC 61000-4-3

**Vibration Test**
- **Impedance:**
  - IEC 60068-2-3

**Humidity/Noncondensing**
- **Impedance:**
  - IEC 60068-2-3

**Altitude**
- **Impedance:**
  - Up to 2000 m

**Installation Category**
- **Impedance:**
  - UL Listed for the USA and Canada

Manufatured under an ISO9000 registered system.