



B90

BUS DIFFERENTIAL SYSTEM

Comprehensive and scaleable bus and breaker fail protection for LV, HV and EHV busbars.

KEY BENEFITS

- Easily meet stability requirements - sub-cycle trip time (average of 0.75 power cycle, maximum 1 power cycle)
- Dependable and secure - Performance backed up by many years of field experience
- Cost effective alternative to high impedance schemes
- Scaleable and expandable architecture to protect up to 24 feeders
- Engineered solution available - Use highly experienced Multilin application engineers to develop a busbar protection system
- Breaker Failure option
- Maintenance cost savings and simplification - Modular construction, common hardware, reduced stock of spare parts, plug & play modules
- Use high speed communications to reduce wiring and installation costs - Exchange inputs and outputs between relays to achieve relay-to-relay interaction
- Cost effective and flexible access to information - Multiple communication options and protocols
- Reduce installation space requirements through compact design - Multifunction device that integrates protection and control functions, programmable pushbuttons and status LEDs, communication interfaces
- Application flexibility - Multiple I/O options, programmable logic (FlexLogic™), modularity, customize to specific requirements
- Reduce system event analyzing time and cost - Sequence of event reports, oscillography, IRIG-B time synchronization
- Breaker monitoring - Monitor breaker conditioning through analog I/O, rich metering, and trip counters
- Embedded IEC 61850 Protocol - No external protocol converters required

APPLICATIONS

- Re-configurable multi-section busbar with up to 24 feeders (8, 16, 24 feeder configurations available)
- Single Bus, Double Bus (with transfer schemes), Triple Bus configurations

FEATURES

Protection and Control

- Multi-zone bus differential protection with restrained and unrestrained function
- Sub-cycle tripping time
- Fast and reliable CT saturation detection
- Check-zone functionality
- Dynamic Bus Replica
- Breaker failure protection
- End fault protection
- IOC and TOC
- Undervoltage function for supervision purposes

Communications

- Networking options - Ethernet-fiber (optional redundancy), RS422, RS485, G.703, C37.94
- Multiple protocols - IEC 61850, DNP 3.0 Level 2, Modbus RTU, Modbus TCP/IP, IEC 60870-5-104
- Direct I/O - Exchange of binary data between URs

Monitoring and Metering

- Isolator monitoring (up to 48) and alarming
- Metering - current, voltage, frequency
- Oscillography - 64 samples/cycle, up to 64 records
- Event Recorder - 1024 time tagged events, with 0.5 ms scan of digital inputs
- User Programmable Fault Reports

User Interface and Programming

- Front panel display and keypad for local access; RS232 port for local PC access
- User programmable local display, LEDs and pushbuttons
- Customize protection and control functions with FlexLogic™, FlexCurves™, and FlexElements™
- Includes EnerVista LaunchPad - Simple relay setup and programming
- Multi-language - French, Chinese, Russian option



Protection and Control

The B90 Bus Differential System provides fast and secure low impedance bus protection for reconfigurable LV, HV, and EHV busbars. Use one B90 to protect up to 8 feeders and use three or more B90s together in a centralized phase segregated architecture to protect up to 24 feeders. Many busbar applications such as single, double, triple, breaker-and-a-half with or without transfer bus are possible. The B90 is ideally suited in applications where high impedance schemes were typically used.

Bus Differential Protection

The B90 provides fast and secure low impedance bus protection with sub-cycle tripping time averaging 0.75 cycles. It incorporates patented algorithms that works with only 2ms of saturation free currents, and takes advantage of the high sampling rate of 64 samples per cycle to provide exceptional through-fault stability. Multiple phase-segregated zones of differential protection is available in the B90. The primary protection is based on differential and directional protection principles, and uses a dedicated CT

saturation mechanism for extra through-fault stability. This mechanism is capable of detecting saturation of CTs as quickly as two milliseconds into an external fault. With no CT saturation detected, the relay uses only the differential principle for faster operation.

Reduce overall system costs with the B90 since there is no need for dedicated, or interposing, CTs. The B90 includes advanced features, such as breaker failure, CT trouble detection, under-voltage supervision, and dynamic bus replica. Due to its extreme flexibility, which includes a CT ratio mismatch of up to 32:1 between terminals, the B90 is the ideal solution in a wide variety of bus differential applications. The B90 can be equipped with an optional redundant dual power supply for increased reliability in all critical protection applications.

Architecture

The B90 is based on a centralized phase-segregated architecture that does not rely on extensive communications between IEDs, an approach that increases overall reliability. This architecture allows for

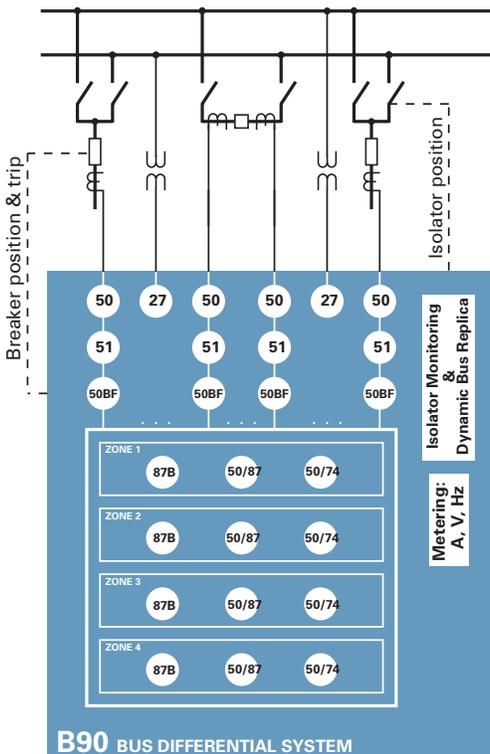
great flexibility and is scalable to any low impedance busbar protection application, all in a relatively small form factor.

Each unit in the system is capable of exchanging digital states quickly and reliably over a dedicated, redundant fiber optics connection. The B90 communication capability allows the user to distribute input and output contacts freely in various IEDs. The B90 protection system can incorporate as few as one unit and as many as five units to accommodate a wide range of applications. This scalability and flexibility allows for optimum hardware utilization with an overall lower system costs than was previously possible.

A single B90 configuration is available to protect up to 8 feeders. A more typical B90 configuration for non-re-configurable busbars without breaker fail protection consists of three URs. This configuration can protect up to 24 feeders. Each B90 in the system can also be configured to support multiple I/O configurations (up to 48 inputs and up to 18 outputs on each unit).

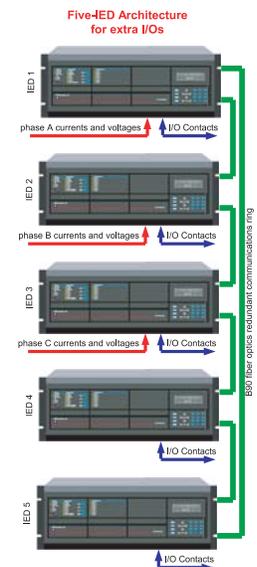
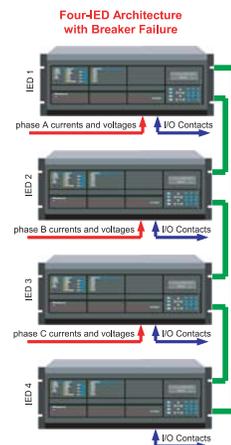
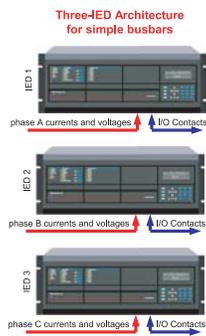
If breaker failure, isolator monitoring functions, and more I/O points are needed,

Functional Block Diagram



836752 A3.CDR

Typical B90 configurations.



836756 A1.CDR

ANSI DEVICE NUMBERS AND FUNCTIONS

| DEVICE NUMBER | FUNCTION |
|---------------|-------------------------------|
| 27 | Undervoltage |
| 50 | Instantaneous Overcurrent |
| 50/74 | CT Trouble |
| 50/87 | Unrestrained Bus Differential |
| 51 | Time Overcurrent |
| 50BP | Breaker Fail |

an additional B90 can be added into the system. A fifth unit can also be added for even more I/O capabilities.

The standard features offered by all URs, including multiple SCADA interface options, wide area network integration, multiple communication mediums and protocols, extensive offering of I/O options, put the B90 ahead of an average busbar relay, making it an ideal and economical solution for substation integration and automation.

Dynamic Bus Replica

The B90 provides a dynamic bus replica for each zone of differential protection. Built-in programmable logic removes the need for external auxiliary relays, and provides the ability to include or exclude currents dynamically from the differential zone. This allows the B90 to follow the actual busbar configuration with no external switching of CT circuits required. The B90 also avoids blind and overtripping spots in simple bus configurations. Reliability is increased and costs reduced by eliminating auxiliary relays that would otherwise be used for switching physical currents. The ability to monitor auxiliary switches and a contact discrepancy alarm, also provides increased security.

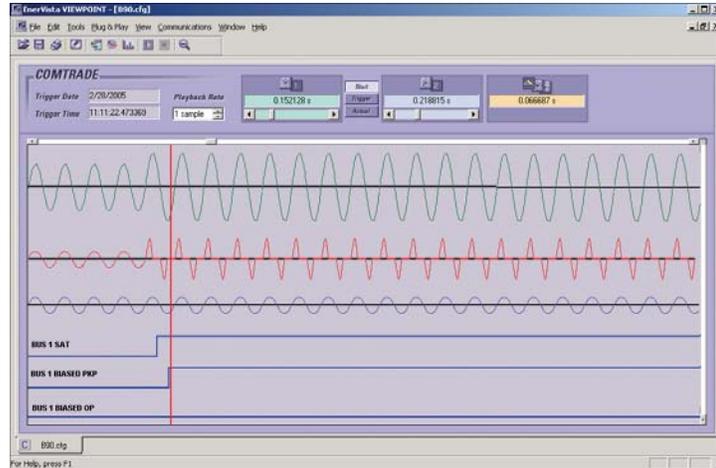
Breaker Failure Protection

Three-pole breaker failure (BF) protection is available. The B90 system provides for up to 24 BF elements that can respond to currents and/or auxiliary contacts. The current sensors with fast reset time and three separate settings for low-set, hi-set and supervision are implemented in the phase IEDs. The BF can be initiated internally from the busbar protection or externally via input contacts or communications. A re-trip function is also included.

Backup Protection

Backup protection is available with instantaneous and time overcurrent functions for each current input of the B90 system. For supervision purposes, an undervoltage function is also provided for each voltage input of the B90 system. The B90 can be used as a SCADA gateway for backup analog and/or high-impedance legacy products found in an existing installation.

- IOC Functions: One IOC function is incorporated for each CT input of the relay. Up to 24 IOCs are available for trip



Bus currents and important logic signals related to external fault. Despite very fast and severe CT saturation, the B90 remains stable.

supervision or other user-configurable applications.

- Backup Overcurrent Protection: One TOC function is incorporated for each CT input of the relay. Up to 24 TOCs are available for backup protection. The TOC function can use standard or user-programmable curves.
- Voltage Supervision: One undervoltage element is available per each VT input of the relay. This function may be used to supervise (release) the current-based protection functions for extra security.

End Fault Protection

Faults between a line-side CT and an open CB cannot be cleared by the bus protection. Moreover, the main bus differential protection must not respond to these faults. This requirement is accomplished by using a CB position for the dynamic bus replica image in order to terminate the zone on a CB rather than a CT if the CB is open. As a result, a dead-zone is created between the CT and CB. The End Fault Protection (EFP) feature is provided to detect faults in dead-zones. One EFP element is provided per each CT input. The element can be configured to trip a remote breaker via communications channels.

Check-Zone

The B90 provides for multiple zones of differential protection. One zone can be configured to encompass the entire busbar in order to act as a supervisory check zone for other zones of protection.

CT Trouble Monitoring

One CT trouble monitoring function is provided for each zone of differential protection. The element is a definite time TOC function responding to a differential current. The CT trouble element shall be used in conjunction with undervoltage supervision or a check zone.

Monitoring and Metering

The B90 includes comprehensive recording, metering, and monitoring functions that reduce the need for dedicated Digital Fault Recorders and Sequence of Event Recorders.

Troubleshooting is made easy with recording of differential and restraining currents, and other signals key to relay performance. High accuracy metering and fault recording of voltage and current on a per circuit basis are built into the relay as a standard feature. Current parameters are available as total waveform RMS magnitude, or as fundamental frequency RMS magnitude and angle (phasor).

Diagnostics features such as oscillography and event recording, combined with EnerVista software tools, significantly reduce troubleshooting time and simplify report generation in the event of a system fault.

Oscillography

Configure up to 64 oscillography channels to monitor any physical I/O point or internal digital and analog variables. The waveform traces and digital states provide a visual display of the busbar and operational data captured during specified triggered events. Sampling rates are up to 64 samples/cycle and 64 fault records can be stored on the unit.

Event Recorder

Capture the last 1024 events, with 0.5ms scan of digital inputs, to provide SOE recorder functionality. Consolidate the event records from multiple devices using EnerVista software tools and use the IRIG-B time synchronization feature to synchronize all events across a system of URs for even more accurate analysis and troubleshooting.

Isolator Monitoring

Each B90 provides up to 48 isolator monitoring functions. If more isolators are to be monitored an extra IED can be added. Both normally open and closed auxiliary contacts are used for isolator monitoring. Standard contact discrepancy logic is implemented to cope with invalid positions of the auxiliary switches. An acknowledgeable discrepancy alarm is produced that can be configured to block selected protection functions. Also, a signal is produced to block switching operations in the substation as long as the bus image

is not resolved by the B90. The bus image is refreshed every two power system cycles.

User Interface and Programming

The B90 front panel provides extensive local HMI capabilities. The local display is used for monitoring, status messages, fault diagnosis, and relay configuration. User configurable messages that combine text with live data, can be displayed when user defined conditions are met. A keypad is also provided for easy access and changes to relay settings.

Replace external indicator lights with 48 user programmable LEDs to display key status information. An additional 14 pre-programmed LEDs and custom LED labeling are available. Use the LEDs to provide a local visual status of the bus. For a typical B90 system, over 100 LEDs are available.

An RS232 port for local PC access is provided on the front panel for convenient access to the relay through EnerVista LaunchPad. The Ethernet port allows for even easier access to the relay over the network.

User-Programmable Push Buttons

Perform manual control, operate breakers, or lock out functions, with the user-programmable pushbuttons. Replace external switches and bi-stable relays by

using mechanically latching outputs controlled from the pushbuttons. The B90 can be ordered with 7 user programmable control pushbuttons (3 standard, 4 optional) and 12 large user-programmable push buttons (optional). The control action of each push button is fully programmable and its operation can be logged directly in the Sequence of Events recorder to enhance troubleshooting. The push buttons can be easily labeled for added clarity of functionality.

Multi-Language

The B90 supports multiple languages. French, Chinese, Russian language options are available on the local display, front panel, and EnerVista setup software, as well as the product instruction manual. Easily switch between English and an additional user selectable language on the local display.

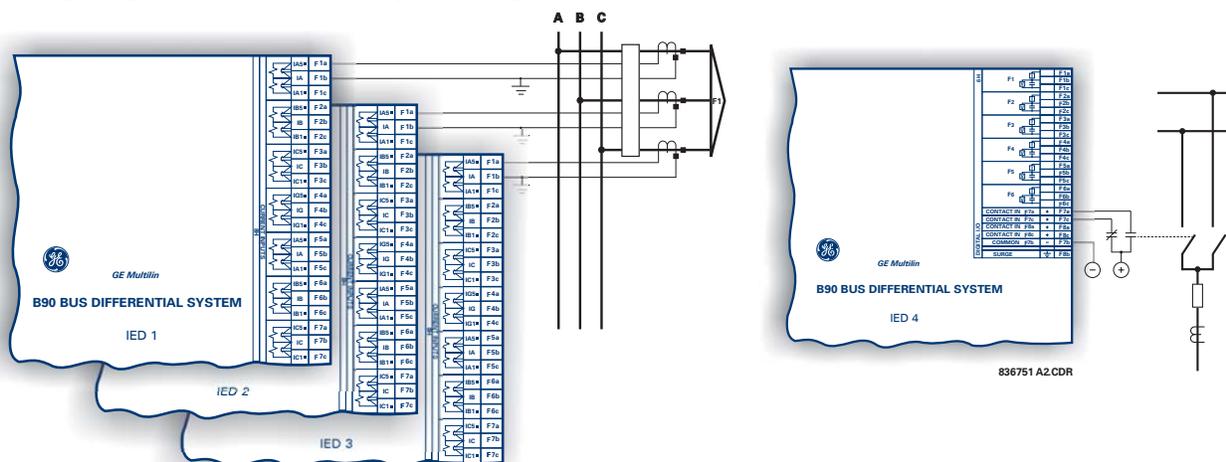
FlexLogic™, FlexCurves™

The B90 comes with powerful configuration and programming tools. These include:

- FlexLogic™: simplifies the programming and use of the B90 and enables powerful but flexible protection and control solutions
- FlexCurves™: define additional custom curve shapes

Typical Wiring

The B90 is a multi-IED protection scheme. Each IED may be ordered with different hardware components and must be wired accordingly. The following drawing illustrates the principles behind a typical B90 wiring.



Multiple Settings Groups

Six separate setting groups can be stored in the B90's non-volatile memory. An easy to use and fully programmable mechanism is provided to instantly switch the active settings. Multiple settings groups apply to all the protection elements.

Communications

The B90 supports a wide range of communication mediums and protocols to support new and existing communication infrastructures. Seamless, fast and secure inter-IED messaging with line, transformer, generator and other UR IEDs, reduces wiring and increases flexibility for breaker failure initialization, tripping and other applications.

Networking options include Ethernet-Fiber with optional redundancy and RS485 interfaces. With the advent of high-speed relay-to-relay communication LANs, performing inter-device control signaling via remote I/O over the LAN can eliminate a great deal of inter-device control wiring.

Protocols supported by the B90 include IEC61850, DNP 3.0, Modbus RTU, Modbus TCP/IP, and IEC60870-5-104. These protocols make it easy to connect to a utility automation system and are integrated into the B90, removing the need for external protocol converter devices.

Interoperability With Embedded IEC 61850 Protocol

IEC 61850 is the new international standard for information exchange and interoperability between intelligent devices within a substation. Use the B90 with IEC 61850 to lower the costs and simplify the engineering, commissioning, operating, and maintenance associated with substation protection and control applications. IEC 61850 is built on over 7 years of GE leadership in UCA 2.0 implementation.

IEC 61850 allows for the seamless connection of IEDs from multiple vendors. In addition to device interoperability, these protocols are designed to control the substation via a LAN instead of through discrete wiring to an RTU. Peer-to-peer communication over Ethernet enables distributed control with several IEDs and eliminates the need for an RTU to remote SCADA master. High-speed message

transfer eliminates the need for large and costly hard-wired interconnection.

Direct I/O Messaging

This feature allows for the exchange of binary information between a number of UR IEDs over a dedicated fiber (single or multimode), RS422, G.703 or C37.94 interface. No switching equipment is required as the IEDs are connected directly in a ring or redundant (dual) ring configuration.

EnerVista™

The EnerVista™ Suite is an industry leading set of software programs that will simplify every aspect of using the B90 relay. Tools to instantly monitor the status of the busbar and view the magnitude of any power quantities measured by the B90 relay are available. Also, the ability to analyze the cause of any faults using the powerful COMTRADE and the Sequence of Event viewers in the EnerVista™ UR Setup program is included with each relay.

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 all GE Multilin products. Also included is a document archiving system that will ensure that all manuals, application notes, and other necessary documentation are always up-to-date and available when needed.

Viewpoint Monitoring

Viewpoint Monitoring is a software application that will provide Monitoring, Control, Trending, Alarming and Fault Data Recording functionality needed for substation applications. This easy to use program can be configured to give complete visibility, control, and automated retrieving and archiving of all Event Records and Waveforms files from GE Multilin devices in minutes.

Viewpoint Maintenance

Viewpoint Maintenance is a set of tools designed specifically for individuals responsible for diagnosing faults, maintaining and troubleshooting GE Multilin devices after commissioning. With a single

click of the mouse, this software provides users with a simplified report that shows the cause of any power system faults or problems. This software will also enhance the security of the relay by providing reports that will document any changes have been made to the configuration of the devices.

Viewpoint Engineer

Viewpoint Engineer is a set of tools that will reduce the amount of time required to program, test and commission UR relays. The Graphical FlexLogic™ Editor will improve efficiency in programming UR's by combining the creating of control diagrams, documenting of logic, and programming of relays into one easy step. The Real-Time FlexLogic™ Analyzer will then simply commissioning and troubleshooting by displaying the status of each part of the equations as they change state.

EnerVista™ Integrator

EnerVista Integrator is the tool to use to send data that is measured by GE Multilin devices to new or existing HMI, SCADA, or DCS system. This software can greatly reduce the time required to integrate GE Multilin devices with the Energy Management or Plant Operations Systems. Also included is a tool that will detect any new Events or Waveform files created by all the relays and automatically save them into a permanent historical archive, which will give a station wide Sequence of Event record.

B90 Guideform Specifications

For an electronic version of the B90 guideform specifications, please visit: www.GEMultilin.com/specs, fax your request to 905-201-2098 or email to literature.multilin@ge.com.



Ordering

| Base Unit | B90 | * | ** | - | H | * | * | - | F** | H** | L** | N** | S** | U** | W** | | | | | | | | | | | | | |
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| CPU | E | G | H | | | | | | | | | | | | | For Full Sized Horizontal Mount Base Unit RS485 + RS485 RS485 + 10BaseF RS485 + Redundant 10BaseF | | | | | | | | | | | | |
| Software Options | | 0* | 1* | | | | | | | | | | | | | Without Breaker Failure With Breaker Failure (With Engineered Solution Only) 8-feeders, 4 1-phase zones 16-feeders, 4 1-phase zones 24-feeders, 4 1-phase zones 8-feeders, 4 1-phase zones, IEC61850 16-feeders, 4 1-phase zones, IEC61850 24-feeders, 4 1-phase zones, IEC61850 | | | | | | | | | | | | |
| Mount | | | | | H | | | | | | | | | | | Horizontal (19" rack) | | | | | | | | | | | | |
| User Interface | | | | | | C | P | A | B | D | G | R | S | | | English English with additional 4 small and 12 large programmable pushbuttons Chinese Chinese with additional 4 small and 12 large programmable pushbuttons French French with additional 4 small and 12 large programmable pushbuttons Russian Russian with additional 4 small and 12 large programmable pushbuttons | | | | | | | | | | | | |
| Power Supply | | | | | | | | | H | L | | | | | | 125 / 250 V AC/DC 24 - 48 V (DC only) | | | | | | | | | | | | |
| CT/VT DSP | | | | | | | | | 8F | 8H | 8K | 8F | 8H | 8K | 8F | Standard 4CT/4VT Standard 8CT Standard 7CT/1VT | | | | | | | | | | | | |
| Digital I/O | | | | | | | | | XX | No module 4 Solid State (No Monitoring) MOSFET Outputs 4 Solid State (Voltage w/opt Current) MOSFET Outputs 4 Solid State (Current w/opt Voltage) MOSFET Outputs 14 Form-A (No Monitoring) Latchable Outputs 8 Form-A (No Monitoring) Outputs 2 Form-A (Voltage w/ opt Current) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (Voltage w/ opt Current) & 4 Form-C Outputs, 4 Digital Inputs 8 Form-C Outputs 16 Digital Inputs 4 Form-C Outputs, 8 Digital Inputs 8 Fast Form-C Outputs 4 Form-A (Voltage w/ opt Current) Outputs, 8 Digital Inputs 6 Form-A (Voltage w/ opt Current) Outputs, 4 Digital Inputs 4 Form-C & 4 Fast Form-C Outputs 2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs 6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs 2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (No Monitoring) Outputs, 8 Digital Inputs 6 Form-A (No Monitoring) Outputs, 4 Digital Inputs 4 dcmA Inputs, 4 dcmA Outputs 8 RTD Inputs 4 RTD Inputs, 4 dcmA Outputs 4 dcmA Inputs, 4 RTD Inputs 8 dcmA Inputs | | | | | | | | | | | | |
| Transducer I/O (select a maximum of 3) | | | | | | | | | 5A | 4 dcmA Inputs, 4 dcmA Outputs 8 RTD Inputs 4 RTD Inputs, 4 dcmA Outputs 4 dcmA Inputs, 4 RTD Inputs 8 dcmA Inputs | | | | | | | | | | | | |
| Inter-Relay Communications (use U slot if redundant power supply option is chosen) | | | | | | | | | 2A | 2B | 7A | 7B | 7C | 7D | 7H | 7I | 7J | 7K | 7M | 7R | 7S | 7T | 7W | 73 | 75 | 76 | 77 | C37.94SM, 1300nm single-mode, ELED, 1 channel single-mode C37.94SM, 1300nm single-mode, ELED, 2 channel single-mode 820 nm, multi-mode, LED, 1 Channel 1300 nm, multi-mode, LED, 1 Channel 1300 nm, single-mode, ELED, 1 Channel 1300 nm, single-mode, LASER, 1 Channel 820 nm, multi-mode, LED, 2 Channels 1300 nm, multi-mode, LED, 2 Channels 1300 nm, single-mode, ELED, 2 Channels 1300 nm, single-mode, LASER, 2 Channels Channel 1 - RS422; Channel 2 - 1300 nm, multi-mode, LED G.703, 1 Channel G.703, 2 Channels RS422, 1 Channel RS422, 2 Channels 1550 nm, single-mode, LASER, 2 Channels Channel 1 - G.703; Channel 2 - 1550nm, Single-mode LASER IEEE C37.94, 820 nm, multimode, LED, 1 Channel IEEE C37.94, 820 nm, multimode, LED, 2 Channel |

Ordering Note: This order code is valid for the latest version of UR hardware and firmware version 4.0 and later. The older hardware and previous firmware versions are still available and may be ordered through the usual channels. In addition, upgrade kits are available for users who wish to take advantage of the features in the newer models.

Please see the GE Multilin On-Line Store (www.GEMultilin.com/onlinestore) for the most up to date ordering information.

Protocol Note: IEC 61850 replaces UCA 2.0 as of UR firmware version 4.4. For applications requiring the original UCA 2.0 protocol, please specify the pre-v4.4 UR firmware version at the time of ordering.

Accessories: Interactive UR Training CD-ROM available. Visit www.GEMultilin.com/trainingcd to order.

Engineered B90 solutions available: Please contact GE Multilin for more details.

