GE Digital Energy

UR Universal Relay Series

Revision 7.01 Release Notes

GE Publication Number: GER-4459

Overview

Summary

GE Multilin issues the UR 7.01 release that introduces improvements for general and protection functions in the UR Family. The features that were modified in this release are:

- Hardware
  - New and more Powerful Processor, Three independent Ethernet ports
- Distance Protection Systems – D30
  - Five Phase distance and five ground distance zones
- Generator Protection System – G60
  - Dedicated element for Breaker Failure
- Line Differential Systems – L90
  - Complete Distance, Line Differential Protection and Pilot Schemes capabilities
- Remedial Action System – N60
  - Two Additional PDC connections
- Transformer Protection System – T60
  - Six windings differential protection
  - Five distance zones for back-up protection
- Common Protection and Control Elements
  - Increased quantity of Synchro-check elements
  - Enhanced auto-reclose mode change
  - UR devices with current differential elements to support CT Failure
  - Additional pilot scheme element "POTT-1"
- Communications
  - New time synchronization protocol PTP - IEEE 1588 (2008)
- Synchrophasors
  - New multicast synchrophasor as per IEC61850-90-5
- New CyberSentry™
  - New "CyberSentry™ UR Level 1" delivers advanced cyber security functionality
- Events and Records
  - Extended memory for waveform capture enables recording of complex fault events

This document contains the release notes for the 7.01 release of the Universal Relay (UR) Family.

- Affected products: B30, B90, C30, C60, C70, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60
- Date of release: Dec 6th, 2012
- Firmware revision: 7.01

If uses have existing UR Family relays installed with older version of firmware, they can download and install this new firmware to benefit from the enhancements described in this release note. If the user does not require these new features and enhancements, no upgrading of the relays is required.

Products Affected

This release encompasses the following UR Family products:

- B30 Cost Effective Bus Differential System
- B90 Low Impedance Bus Differential System
- C30 Controller System
- C60 Breaker Protection System
- C70 Capacitor Bank Prot & Ctrl System
- D30 Line Distance Protection System
- D60 Line Distance Protection System
- F35 Multiple Feeder Protection System
- F60 Feeder Protection System
- G30 Generator & Transformer Protection System
- G60 Generator Protection System
- L30 Line Current Differential System
- L60 Line Phase Comparison System
- L90 Line Current Differential System
- M60 Motor Protection System
- N60 Network Stability and Synchrophasor Measurement System
- T35 Transformer Protection System
- T60 Transformer Protection System

Firmware Compatibility

The new version 7.01 firmware that is a part of this release is compatible with none of the previous UR series hardware versions. The new version 7.01 firmware runs on the new T, U and V type CPU modules only.

The use of the new 7.01 firmware requires the EnverVista UR Setup software to be version 7.0x or higher. GE Multilin suggests users to use the latest version available of UR Setup software.

FW 7.01 Release details

In the following enhancement descriptions, a revision category letter is inserted to the left of the description. Refer to the Appendix at the end of this document for a description of the categories displayed.

Hardware

N 701-1 **New and more powerful Central Processor Unit "CPU" for UR**

Applicable: B30, B90, C30, C60, C70, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60

The UR version 700 release introduces an upgraded processor to the UR Family of Protection and Control Devices. This new CPU module provides the extra processing capacity required to load UR devices with new and enhanced functionalities, which enable compliance to the latest market standards and customer requirements.

The new CPU module also delivers extended memory for records and three independent Ethernet ports. The three Ethernet ports have independent MAC and IP addresses, however, two of them can be configured to operate as the existing hot-stand by configuration for backward compatibility. Ethernet ports support either pluggable LC fiber or pluggable RJ-45 copper transceivers that can be replaced on the field. The following table shows description and availability of the new CPU modules.

CPU Type	Description	Availability
T	RS485 + three 100BaseFX Eth, Multimode, SFP with LC	Dec-14th-20112
U	RS485 + two 100BaseFx Eth, Multimode SFP with LC + one 100BaseT Eth, SFP w/RJ-45	Feb-2013
V	RS485 + three 100BaseT Eth, SFP w/RJ45	Feb-2013

UR Firmware version 7.00 runs on the new CPU modules only. The new CPU modules support UR firmware version 7.00 only.

Upgrading UR relays from previous versions to the firmware version 7.00 requires the CPU module to be replaced. Replacing other modules may also be required. For further details on the upgrade requirements, please contact GE Multilin's Customer Service Team

For further details on the new CPU modules, please refer to the UR Instruction manual and UR Setup Software

Distance Protection Systems – D30

E **Five Phase and Ground distance zones give the D30 enhanced selectivity for distance protection**

701-2

Applicable: D30

UR FW version 7.01 improves the D30's distance protection capabilities by adding extra phase and ground distance zones. The number of zones for phase and ground distance protection was increased from three to five.

The additional zones provide more selectivity to the D30 distance protection and also increases the range of line protection schemes the D30 can be applied to.

For further details on the additional phase and ground distance zones, please refer to the D30 Instruction manuals and UR Setup Software

Generator Protection System – G60

N **G60 to support dedicated Breaker Failure protection element 52BF**

701-3

Applicable: G60

UR FW version 7.00 provides the G60 Generator protection system a dedicated protection element for breaker failure. Previous to this FW version, implementing breaker failure functionality required manual flexlogic configuration, so supporting a dedicated breaker failure element simplifies and standardizes settings related to this functionality.

The breaker failure element added to the G60 shares the standard logic scheme and settings that have been applied to breaker failure elements across the UR family

For further details on this breaker failure element, please refer to the G60 Instruction manuals and UR Setup Software

Line Protection System – L90

N **Complete Line Protection and Control capabilities in a single device**

701-4

Applicable: L90

The UR FW version 7.00 provides the L90 Line Differential Protection system with complete distance protection capabilities which make the L90 a complete line protection and control system.

L90 devices with previous FW versions deliver limited distance and pilot scheme functionality only intended for backup protection. L90 with FW version 7.00 matches the distance protection and pilot scheme capabilities our specialized distance protection device D60 supports (5 phase and ground distance zones, complete set of pilot schemes, etc). Furthermore, the line current differential, line distance and pilot scheme elements can run simultaneously with no effect on the individual elements performance.

As a complete line protection and control system, the L90 allows end users specifying Line Differential as primary and Line distance as secondary protection, to use a single device to provide both protection

principles. This standardization enables dual redundancy (Primary and secondary devices running both line differential and line distance protection) and simplifies the protection scheme BOM.

For further details on the L90 Line Protection and Control System, please refer to the L90 Instruction manuals and UR Setup Software

Network Stability System – N60

E **Increased number of independent PDC connections**

701-5

Applicable: N60

The UR FW version 7.00 provides the N60 Network Stability and Synchrophasor Measurement System with two additional Phasor aggregators elements (for a total of four elements), which enables the N60 device to independently link with up to four PDC devices. Each phase aggregator element in the N60 device can connect to PDC devices via its TCP or UDP ports.

This enhancement enables N60 devices to individually stream data on each of the existing PMU elements.

For further details on the additional aggregator elements, please refer to the N60 Instruction manuals and UR Setup Software

Transformer Protection System – T60

E **The T60's five windings software option has been enhanced to support six windings**

701-6

Applicable: T60

UR FW version 7.00 enhances the multiple winding capabilities of the T60 Transformer Protection system by increasing the number of supported windings to six. Existing software option codes are not affected by this enhancement and are still valid with applicable FW versions

T60 devices with previous FW versions will still support the 5 windings software option.

Existing Software Option Code	FW Version	Description
20	5.70 to 6.01	5 windings (No Breaker Failure)
	7.00	6 windings (No Breaker Failure)
21	5.70 to 6.01	5 windings (No Breaker Failure) + EGD
	7.00	6 windings (No Breaker Failure) + EGD
22	5.70 to 6.01	5 windings (No Breaker Failure) + IEC61850
	7.00	6 windings (No Breaker Failure) + IEC61850
23	5.70 to 6.01	5 windings (No Breaker Failure) + EGD + IEC61850
	7.00	6 windings (No Breaker Failure) + EGD + IEC61850

For further details on this breaker six windings software option, please refer to the T60 Instruction manuals and UR Setup Software

E **T60's back-up protection capabilities has been enhanced to support Five Phase and Ground distance zones**

701-7

Applicable: T60

UR FW version 7.00 improves the T60's distance protection capabilities by adding extra phase and ground distance zones. The number of zones for phase and ground distance protection was increased from three to five.

For further details on the additional phase and ground distance zones, please refer to the T60 Instruction manuals and UR Setup Software

Common P&C Elements

E **Increased number of Synchro-check elements enables UR devices to fit synchro-check applications with more than two voltage sources**

701-8

Applicable: C60, D30, D60, F60, G30, G60, L30, L60, L90, N60, T60 with synch-check software option.

The UR FW version 7.00 increases the number of synchro-check elements UR devices support from two to four elements.

Complex system configurations like breaker and a half line terminal or residual voltage automatic transfer schemes, may require more than two synchro-check elements to provide optimal breaker close permissive, which traditionally leads end users to install additional single function devices, implement secondary voltage switching relays or try non-traditional wiring techniques. UR devices with FW version 7.00 deliver four independent synchro-check elements, which simplifies the synchro-check hardware requirements for those complex applications.

For further details on the four Synchro-check elements, please refer to the UR Instruction manuals and UR Setup Software.

E **The auto-reclose element has been enhanced to allow digital inputs switch the auto-reclose operating mode**

701-9

Applicable: C60, D30, D60, F35, F60, L30, L60, L90

UR FW version 7.00 improves the auto-reclose element by allowing end users to change the elements operating mode just by activating internal flex-operands (contact input, virtual input / output, remote input, etc.).

The auto-reclose element can have as many as four operating modes; each one of them has a new setting field ("Mode 1 Activation" to "Mode 4 activation") which supports internal flex-operands. Any of the auto-reclose operating modes will become active when the operand set to it is activated. To ensure proper performance, operating modes can only become active when reclose is not in progress. Furthermore, if more than one flex-operand is activated, they are ignored and the actual operating mode continues to be used

This kind of functionality is critical for end-users who change the auto-reclose operating mode based on a given external condition like the power system configuration, season of the year, etc.

For further details on the auto-reclose enhancements, please refer to the UR Instruction manuals and UR Setup Software

N **UR devices with current differential elements to support the CT Failure element**

701-10

Applicable: M60, G30, G60, T35, T60

The UR FW version 7.00 provides UR devices that support current differential protection elements with one CT Failure detection element per available current source.

The CT failure element is designed to detect problems with the current transformers used to supply current to the relay. This logic detects the presence of a zero-sequence current at the supervised source of current without a simultaneous zero-sequence current at another source, zero-sequence voltage, or some protection element condition.

These detection capabilities allow users to alarm and block the current differential protection when external conditions affecting the CT inputs may potentially generate a mis-operation. For instances an engineer who shorted the wrong CT input while carrying out tests may create the described condition.

For further details on the CT failure element, please refer to the UR Instruction manuals and UR Setup Software

N **New POTT element complements the UR pilot scheme capabilities**

701-11

Applicable: D60, L90

UR version 7.01 introduces the new "POTT1" element that allows for additional pilot scheme flexibility. The POTT1 pilot scheme element operates the same way the regular POTT scheme does, except for the hard-coded connections to phase and ground distance elements that were changed to allow users to choose directional elements, for example ground OC directional elements. This allows a user to apply the POTT1 scheme using solely directional elements to achieve better coordination, rather than mixing up distance and ground OC directional elements together.

This change applies to UR devices with FW version 7.01 or newer.

For further details on the new POTT1 element, please refer to the L90 or D60 Instruction manuals and UR Setup Software.

Communications

N 701-12 **New precision time protocol "PTP" (IEEE 1588) delivers high accuracy time synchronization over the substation LAN**

Applicable: B30, B90, C30, C60, C70, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60

The FW version 7.00 provides UR devices support to the new Precision Time Protocol specified in the IEEE 1588 (2008) standard.

PTP is a protocol that allows multiple clocks in a network to synchronize with one another. It provides synchronization accuracies better than 1 ns (which requires every component in the network to support very high end features not found in substation applications), however when operating over a generic Ethernet network, time error may amount to less than 1 µs over a 16-hop substation network.

Such a high time accuracy makes PTP an alternative to the traditional IRIG-B based time synchronization architecture. However, since PTP doesn't require dedicated wiring, it brings an important reduction of the time synchronization ownership cost.

The IEEE1588 PTP functionality requires the software option "B0 – IEEE1588"

For further details on the IEEE1588 PTP implementation, please refer to the UR Instruction manuals.

Synchrophasors

N 701-13 **New synchrophasor data stream capabilities as per IEC61850-90-5 enable multicast synchrophasors**

Applicable: D60, F60, G60, L30, L90, N60, T60

The UR FW version 7.00 introduces the new IEC61850-90-5 technical report implementation that defines how to stream synchrophasor data using the tools provided by the IEC61850 standard, which enables multicast synchrophasors.

Under IEEE C37.118 PMU devices must use a dedicated logical connection to serve synchrophasor data to PDC clients, so for one PMU device to report data to four PDCs, as many as four connections must be supported by the PMU device. This increases the communication architecture cost and requirements. By supporting IEC61850-90-5 UR devices with PMU capabilities can publish multicast synchrophasor data that would reach all PDC devices subscribing to it. This reduces the traffic of synchrophasor data on the WAN infrastructure and the multiple connection requirements on the PMU devices.

For further details on the IEC61850-90-5 implementation, please refer to the UR Instruction manuals.

CyberSentry™ UR

N **CyberSentry™ UR provides Cyber Security features that allow UR users to clear most of the NERC-CIP requirements for P&C devices.**

701-14

Applicable: B30, B90, C30, C60, C70, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60

CyberSentry™ enables UR devices to deliver full cyber security features that help customers to comply with NERC CIP and NITIR 7628 cyber security requirements through supporting the following core features:

Password Complexity: Supporting up to 20 alpha- numeric or special characters, UR v700 devices exceed NERC CIP requirements for password complexity as well as enforces compliance. Individual passwords per role are available.

Radius server support for remote authentication: Enables integration with centrally managed authentication and accounting of all user activities, and uses modern industry best practices and standards that meet and exceed NERC CIP requirements for authentication and password management. By supporting radius, multiple users can be created under a single role, each one of them with independent name and passwords. The Radius server can also be configured to periodically expire passwords and request users to set new ones. On password management, users and passwords for all UR devices in a substation can be remotely edited in a single session with the Radius server, which simplifies the process when users and password changes are required (especially in large substations) Role Based Access Control (RBAC): The new and advanced access functions provide users with five access roles (Administrator, Supervisor, Engineer, Operator and Observer). Each role has defined privileges and its own local password. Remote passwords are provided by the radius server.

Event Recorder (Syslog for SEM): Capture all cyber security related events within a SOE element (login, logout, invalid password attempts, remote/local access, user in session, settings change, FW update, etc), and then serve and classify data by security level using standard Syslog data format. This enables UR devices integration with established SEM (Security Event Management) systems.

As standard functionality UR v700 devices provide password complexity and five access roles. However, remote authentication via radius and Syslog support require the “A0 - CyberSentry™ UR level 1” software option.

For further details on the IEC61850-90-5 implementation, please refer to the UR Instruction manuals.

Events and Records

E 701-15 **Extended memory for oscillography enables wave form capture of complex fault events**

Applicable: B30, B90, C30, C60, C70, D30, D60, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60

The UR FW version 7.00 extends the memory assigned to oscillography events. The extended memory allows UR devices to record faults that have multiple fault stages in a single oscillography file (Eg. Evolving faults, auto-reclose events, long power swings, etc).

Below a configuration example that shows the oscillogaphy file extension

UR/Oscillography configuration	# modules / Settings	Range
Number of installed DSP modules	2	1 to 3
Sample Rate	64	8 to 64
Number of digital channels	32	1 to 64
Number of extra analog channels	8	0 to 16
File extension	**10,75 seconds**	1 to 244 depending on settings and number of DSP modules

For further details on the extended oscillography capabilities, please refer to the UR Instruction manuals.

UR Platform

Upgrade paths

It is our recommendation that all customers upgrade to the latest version of UR-series firmware to take advantage of the latest developments and feature enhancements. Firmware upgrades can be easily preformed using the EnerVista UR Setup software. This software can also convert settings files from an older version to the latest version and provides a Difference Report once the conversion has been completed. This Difference Report identifies new settings and additional information to assist the user during the upgrade.

Upgrade path for versions 4.00 and above

UR FW version 7.0x requires the new version 7.00 CPU module. Upgrading UR-series devices installed with firmware versions 4.xx, 5.xx or 6.xx, demands the existing CPU to be replaced with a version 7.00 CPU module.

Depending on the original order code and age of the relay, replacing additional modules might be required for upgrade

Upgrade path for revisions below version 4.00

For UR-series devices installed with versions of firmware below 4.00, new CPU and DSP modules must be obtained from GE Multilin to upgrade the relay to the version 7.00.

Depending on the original order code and age of the relay, replacing additional modules might be required for upgrade

Benefits of revision 7.01 and above:

The benefits of revision 7.01 and above are as follows:

- Support to latest market standards and requirements
  - IEEE 1588 – PTP for time synch
  - Three independent Ethernet ports
  - Ethernet ports with pluggable transceivers
  - CyberSentry™ Advanced Cyber Security features in line with industry standards (Radius, Syslog)
  - Multicast Synchrophasors in line with IEC61850-90-5
  - Connection to for PDC devices when reporting synchrophasor data on C37.118 – N60
  - Complete line protection (distance and line differential) in a single device – L90
  - Additional synchro check elements
  - CT Fail detection for all Current differential UR devices
  - Five distance zones for transformer protection
- Exceeds NERC-CIP password requirements
  - Up to 20 digits, Supports numbers, letters and special characters.

Appendix

Change categories

This document uses the following categories to classify the changes.

Table 1: Revision categories

Code	Category	Comments
N	New feature	A separate feature added to the relay. Changes to existing features even if they significantly expand the functionality are not in this category
G	Change	A neutral change that does not bring any new value and is not correcting any known problem
E	Enhancement	Modification of an existing feature bringing extra value to the application
D	Changed, incomplete or false faceplate indications	Changes to, or problems with text messages, LEDs and user pushbuttons
R	Changed, incomplete or false relay records	Changes to, or problems with relay records (oscillography, demand, fault reports, etc.)
C	Protocols and communications	Changes to, or problems with protocols or communication features
M	Metering	Metering out of specification or other metering problems
P	Protection out of specification	Protection operates correctly but does not meet published specifications (example: delayed trip)
U	Unavailability of protection	Protection not available in a self-demonstrating way so that corrective actions could be taken immediately
H	Hidden failure to trip	Protection may not operate when it should
F	False trip	Protection may operate when it should not
B	Unexpected restart	Relay restarts unexpectedly

The revision category letter is placed to the left of the change description.

GE Multilin technical support

GE Multilin contact information and call center for product support is shown below:

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