

UR^{Plus} Series

Revision 1.83 Release Notes

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Overview

Summary

Release 1.83 of the UR^{Plus} series introduces product-specific and platform-wide enhancements. Highlights include:

- Hardware:
 - Options added to order a C90^{Plus} without AC modules (added in 1.80)
 - Support for peer-to-peer communication modules (added in 1.81)
 - Harsh-Environment Coating option added (added in 1.82)
- Protection and Control Elements:
 - Small Signal Oscillation Detection (added in 1.80)
 - Changes in Ground Directional elements (67N and 67_2) supervision logic (added in 1.83)
- Automation:
 - Fast Load Shedding Scheme (added in 1.80)
 - Load Shed df/dt enhanced with Basic Metering option (added in 1.82)
 - Automation FlexLogic timers enhanced (added in 1.83)
 - Synchrocheck Enhanced (added in 1.83)
- Security:
 - Support for alpha-numeric passwords as per the CIP-007-02 cyber security standard (added in 1.80)
- Communications:
 - Allow multiple clients to simultaneously pull Event Records (added in 1.82)
 - Allow multiple clients to simultaneously pull Fast Load Shed Records (added in 1.82)

This document contains the release notes to release 1.83 of the UR^{Plus} family.

- Affected products: C90^{Plus}, D90^{Plus}
- Date of release: Sept 30, 2010
- Firmware revision: 1.80
- Date of release: Jan 18, 2011
- Firmware revision: 1.81
- Date of release: Jul 8, 2011
- Firmware revision: 1.82
- Date of release: Jun 22, 2012
- Firmware revision: 1.83

For users with UR^{Plus} devices with firmware versions of 1.60 or older, a hardware upgrade may be required to migrate to the newer version.

For users with UR^{Plus} devices with firmware versions of 1.50 or older, careful consideration in regards to the UR^{Plus} Setup software must be taken into account to migrate to the new version. UR^{Plus} Setup software versions 1.7 and higher are NOT compatible with UR^{Plus} relays firmware versions 1.50 or older.

Contact the GE Digital Energy Customer Service team to ensure that the UR^{Plus} device is suitable, after which new firmware can be downloaded and installed. If the new features and enhancements are not required, then upgrading relay firmware is not necessary.

Products Affected

This release encompasses the following UR^{Plus} products:

- C90^{Plus} Automation Control System
- D90^{Plus} Line Distance Protection System

Firmware Compatibility

The version 1.83 firmware that is part of this release is compatible with the UR^{Plus} hardware version 1.70 and higher.

The use of the 1.83 firmware requires EnerVista UR^{Plus} Setup software version 1.80 or higher.

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

Protection and Automation Elements

E 183-1 **Changes in Ground Directional elements (67N and 67_2) supervision logic**

Applicable: C90^{Plus} and D90^{Plus}

The Ground Directional elements (67N and 67_2) supervision logic was changed from a fixed hardcoded value to the Voltage Cutoff setting, which is customer-adjustable.

Automation

E 183-2 **Automation Timers enhanced**

Applicable: C90^{Plus} and D90^{Plus}

The Automation Timers were enhanced to be re-triggerable. In previous versions, the timers acted like accumulators with infinite memory, for example if a timer was set with a pickup delay of 30s and the input to the timer was high for 25s and then dropped out, the timer asserted in 5 seconds when reapplied rather than timing for another 30 seconds.

E **Synchrocheck Logic enhanced in relation to option DV1 XOR DV2**

183-3

Applicable: C90^{Plus} and D90^{Plus}

The Synchrocheck Element was corrected to ensure that option DV1 XOR DV2 operates correctly, where it presented discrepancies in previous versions. No changes to other functionality.

Previous FW 1.82 Release Details

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

Hardware

N **Harsh-Environment Coating added as an option**

182-1

Applicable: C90^{Plus} and D90^{Plus}

It is possible to order an UR^{Plus} with or without a Harsh-Environment Conformal Coating, allowing the UR^{Plus} to be used in extreme environments.

Protection and Automation Elements

E **Frequency Rate of Change Load Shedding enhanced**

182-2

Applicable: C90^{Plus}

The Frequency Rate of Change element under Load Shedding was corrected for use with the Basic metering option.

Communications

E **Allow multiple clients to simultaneously pull Event Records or Fast Load Shed Reports**

182-3

Applicable: C90^{Plus} and D90^{Plus}

The trivial file transfer protocol (TFTP) server was expanded to allow multiple clients to simultaneously pull Event Records and Fast Load Shed Reports.

Previous FW 1.81 Release Details

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

Hardware

E **Support for peer-to-peer/inter-relay communication modules enhanced**
181-1

Applicable: C90^{Plus} and D90^{Plus}

The UR^{Plus} was redesigned to ensure that all inter-relay communications utilizing two channels G.703, two channels RS422, or two channels 850nm ST multimode laser are supported.

Previous FW 1.80 Release Details

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

Hardware

N **Options added to order a C90^{Plus} without AC modules**
180-1

Applicable: C90^{Plus}

It is possible to order a C90^{Plus} with or without an AC Module. When <AC Module> is chosen to be "X" and the <Automation> element is "S", or "E", the following order code elements are restricted to fewer choices:

- <Protection> = <"X|P"> P option provides Protection FlexLogic, FlexMatrix and Digital Counters but no protection elements (no AC Module)
- <Metering> = <"D">
- <Equipment Manager> = <"X|"S">, If "S" is selected, at least one of I/O Module must have inputs (type "A", "B", "C", "D", or "E")
- At least one of the <I/O Modules E-H>, or <I/O Module K> must not be defined as "X"

When no AC Module is ordered, the functions that require an AC Module are not available. The following table outlines the functions that are available when Fast Load Shedding Element (FLSE) is chosen or not. Functions that are available with those particular options are marked 'y' in the table:

Group	Sub-group	Function	No AC (FLSE)	Notes	No AC (No FLSE)	Notes
Protection	Prot Groups	Phase TOC				
		Phase IOC				
		Phase Directional				
		Neutral TOC				

		Neutral IOC				
		Neutral Directional				
		Ground TOC				
		Ground IOC				
		Neg Seq TOC				
		Neg Seq IOC				
		Neg Seq Directional				
		Phase OV				
		Neutral OV				
		Neg Seq OV				
		Auxiliary UV				
		Auxiliary OV				
		Phase UV				
		Sensitive Dir Power				
		Breaker Failure				
		Control	Setting Group Control			
			FlexMatrix	y		y
	VT Fuse Failure					
	Auto-reclose					
	Breakers				y	
	Breaker flash-over					
	Digital counters		y		y	
	Flex-curves					
	Protection I/O	VI	y		y	
		VO	y		y	
		CI	y		y	
		CO	y		y	
Shared Operands		y		y		
Prot FlexLogic	FlexLogic Equation	y		y		
	FlexLogic timers	y		y		
	Non-volatile latches	y		y		
	FlexElements	y	Depending on where the analog values come from	y		
Automation	BKR	Breaker Control			y	
		Breaker Interlocking			y	
	Disconne ct	Disconnect				y
		Disconnect Control				y
		Disconnect Interlocking				y

	Contro	Local-remote	y	y
		Synchrocheck		
		Selector switches	y	y
	Load Shed	Source		
		81U		
		27P		
		dF/dT		
		Fast Load Shed (FLS)	y	
	Aut Inputs/outputs	VI	y	y
		VO	y	y
		CI	y	y
		CO	y	y
		V Analogs	y	y
		Shared operands	y	y
Aut Logic	Aut Logic Equation Editor	y	y	
Equip. Manager	Breaker Arcing			
	Battery Monitor		y	
	Shared Operand		y	
FDR	Fault Report			
	Transient Record (oscillography)	y	y	
	Disturbance recorder	y	y	
	shared Operands	y	y	
Metering	Metering Source			
	PMU	PMU Reporting		
		One shot		
		Data logger	y	y
	Shared Operands			
Local HMI	Annunciator	y	y	
	Mimic Diagram	y	y	
	Metering Summary	y	y	
	User Prog Pushbutton	y	y	
	User Prog Pushbutton Ed	y	y	
	Display Properties	y	y	
Testing	Force CI	y	y	
	Force CO	y	y	
	PMU Test Values			

Configure Flex operand	y	y
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Protection and Automation Elements

N Small Signal Oscillation Detection

180-2

Applicable: C90^{Plus}

A new protection element called small signal oscillation detection was added to the product.

Modern power systems are increasingly interconnected to each other for the benefits of increased reliability, reduced operation cost, improved power quality, and reduced necessary spinning reserve. As such, some technical challenges also become apparent. One of these challenges is the inter-area low frequency oscillations that are a major threat to reliable operations of large-scale power systems. Inter-area oscillations not only limit the amount of power transfer, but also threaten system security and equilibrium, as they can lead to system instability and cascading outages. Therefore, it is essential to identify the characteristics of the inter-area oscillations, including oscillation frequency and damping ratio, so that proper action can be taken based on the results. This is required to improve the system damping and maintain stability in the power system. The C90^{Plus} can detect these inter-area oscillations and provide an alarm or even a trip signal to prevent a large-scale system disturbance.

The small signal oscillation detector element detects small signal oscillation of selected analogue quantities (real power or frequency only) on the interconnections between different power systems. There are two elements provided with a selectable frequency band of interest. Each element has two stages, one for alarm action and another for trip action. Small signal oscillations can be detected using local measurement only or local and remote measurements taken at approximately the same instance at some fixed rate (for example, 100 ms). In this case, the remote and local values can be summed and processed using a single-cycle Fourier filter. The magnitude of the low frequency signal (for example, in the range of 0.1 to 0.2 Hz) is compared with a threshold and after a specified time delay, a trip or alarm action is issued by the C90^{Plus}. Typical analogue quantities used for small signal oscillations include frequency and real power. The ground distance protection algorithm was modified to have an enhanced over-current supervision that incorporates a positive sequence restraint factor.

Note that there can be up to five remote measurements and the interval of measurements is fixed at 100 ms.

Automation

N Fast Load Shedding Element

180-3

Applicable: C90^{Plus}

A new automation element is added to support fast load shedding controls.

Fast load shedding is a remedial action scheme that in a contingency initiates shedding of loads as required to preserve system load/generation balance, thereby avoiding complete system collapse. A contingency here is the loss of one or more infeeds (local generators or incomers from the grid). Unlike undervoltage, underfrequency, or frequency rate of change load shedding schemes, fast load shedding schemes can initiate load shedding before the system frequency or system voltage declines, which in many cases is essential for maintaining system stability.

The physics of electrical systems forces the sum of the real power generated by local generation and the real power imported from the grid to precisely equal the sum of the real power consumed by the loads plus the amount of real power (if any) exported to the grid, at all times and at every instant. If a local generator is tripped or a grid incomer is lost, the physics forces additional power to be drawn from the remaining grid incomers and local generators to match the load. Increased power flow through an incomer can overload it,

causing it to trip and leading to cascading tripping and total collapse of the distribution system. Increased power flow out of a generator can cause it to slow and, if the prime mover cannot provide additional mechanical power rapidly enough, can lead to frequency collapse of the distribution system.

Fast load shedding prevents such system collapse by shedding the number of loads required to respect the amount of power that remaining infeeds can safely supply. Less critical loads are shed so that more critical loads are maintained, and the manufacturing process suffers the minimum impact possible.

A communication setting was added to the Network / HTTP configuration of the UR^{Plus} devices. The new setting allows customers to enable or disable the "Web Server Function." When set as enabled, customers can use web-browser software to visualize the UR^{Plus} device settings and actual values.

The scheme is based on the latest communication standards in IEC 61850 and GOOSE peer-to-peer communications, reaching speeds better than 20 ms from the time the change in load or generation is detected to the time that the contact is closed to open the circuitry to certain loads to load groups at the end device. The system speed depends on the Ethernet LAN capabilities in each case and the system size. Given that the fast load shedding scheme is extremely flexible and scalable, the times vary.

An aggregator versus a controller is used when the 70 infeeds per C90^{Plus} have been exhausted and more infeeds must be integrated into the fast load shedding scheme, allowing to system to easily expand and be scalable in case requirements change in the future.

Security

E Support for alphanumeric passwords as per the CIP-007-02 cyber security standard

180-4

Applicable: C90^{Plus} and D90^{Plus}

This enhancement allows the user to input numbers, characters, and punctuation in the password for the UR^{Plus} devices. There are no restrictions as to the mix or position of each character in a password and the total character count is limited to 12 per UR^{Plus} device.

This enhancement is fully compatible with previously set passwords, however, with a firmware upgrade, the password resets and must be re-entered.

Upgrade Paths

Customers can upgrade to the latest version of UR^{Plus} firmware to take advantage of the latest developments and feature enhancements. Firmware upgrades can be performed using the EnerVista UR^{Plus} 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 is complete. This Difference Report identifies new settings and additional information to assist the user during the upgrade.

Upgrade path for versions 1.70 and above

For UR^{Plus} devices having revision “B” CPU or firmware version 1.70 and above, the revision 1.70 release can be uploaded to the relay using the EnerVista UR^{Plus} Setup software.

The fourth character of the UR^{Plus} device serial number identifies the CPU revision. Revision “B” CPUs are identified with the letter “D.” The serial number can be seen on the device label or annunciator screen.

An example is

C90P-HE-PE03SSS-XHDAADCE01X

Serial Number: mp4d10000016

Upgrade path for revisions 1.60 and below

For UR^{Plus} devices that have another CPU revision or firmware versions 1.60 and below, contact GE Digital Energy customer service. Those units can require hardware updates to support newer FW versions.

Appendix

Change Categories

This document uses the following categories to classify improvements.

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, and so on)
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 can be taken immediately
H	Hidden failure to trip	Protection does not operate when appropriate
F	False trip	Protection operate when it is not appropriate
B	Unexpected restart	Relay restarts unexpectedly

GE Technical Support

GE contact information for product support is as follows:

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