

UR^{Plus} Series

Version 1.87

Release Notes

GE Publication Number: GER-4777B
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Overview

This document contains the release notes for firmware 1.80 to 1.87 of the UR^{Plus} series.

Affected products: C90^{Plus}, D90^{Plus}

Date of release 1.80: 30 September 2010

Date of release 1.81: 18 January 2011

Date of release 1.82: 8 July 2011

Date of release 1.83: 22 June 2012

Date of release 1.84: 21 December 2015

Date of release 1.85: 4 November 2016

Date of release 1.86: 20 July 2017

Date of release 1.87: 3 May 2018

In the following descriptions, a category letter is placed to the left of the description. See the table near the end of this document for descriptions of the categories.

Firmware 1.80

Summary

Highlights include:

- Hardware:
 - Options added to order a C90^{Plus} without AC modules
- Protection and Automation Elements:
 - Small Signal Oscillation Detection
- Automation:
 - Fast Load Shedding Element
- Security:
 - Support for alphanumeric passwords as per the CIP-007-02 cyber security standard

Hardware

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

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 | Depending on where the analog values come from |
| | | | | | |
| Automation | BKR | Breaker Control | | | y |
| | | Breaker Interlocking | | | y |
| | | | | | |
| | Disconnector | Disconnect | | | y |
| | | Disconnect Control | | | y |
| | | Disconnect Interlocking | | | y |
| | Control | 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 Anologs | 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 |

Protection and Automation Elements

N 180-2 **Small Signal Oscillation Detection**

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 180-3 **Fast Load Shedding Element**

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.

Firmware 1.81

Summary

Highlights include:

- Hardware:
 - Support for peer-to-peer/inter-relay communication modules enhanced

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.

Firmware 1.82

Summary

Highlights include:

- Hardware:
 - Harsh-Environment Coating added as an option
- Protection and Automation Elements:
 - Frequency Rate of Change Load Shedding enhanced
- Communications:
 - Allow multiple clients to simultaneously pull Event Records or Fast Load Shed Reports

Hardware

N 182-1 Harsh-Environment Coating added as an option

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

It is possible to order a 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 182-2 Frequency Rate of Change Load Shedding enhanced

Applicable: C90^{Plus}

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

Communications

E 182-3 Allow multiple clients to simultaneously pull Event Records or Fast Load Shed Reports

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.

Firmware 1.83

Summary

Highlights include:

- Protection and Control Elements:
 - Changes in Ground Directional elements (67N and 67_2) supervision logic
- Automation:
 - Automation FlexLogic timers enhanced
 - Synchrocheck enhanced

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 hard-coded 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 30 seconds and the input to the timer was high for 25 seconds and then dropped out, the timer asserted in 5 seconds when reapplied rather than timing for another 30 seconds.

E 183-3 **Synchrocheck Logic enhanced in relation to option DV1 XOR DV2**

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.

Firmware 1.84

Summary

Highlights include:

- Hardware:
 - Harsh-Environment Coating option added to C90^{Plus}
- Automation:
 - Writing of automation/protection settings corrected
 - Self-reset of Virtual Inputs corrected
- Communications:
 - Assignment of DNP Paired Control Points improved

Hardware

N 184-1 **Harsh-Environment Coating added as an option**

Applicable: C90^{Plus}

Harsh-Environment Conformal Coating of the C90^{Plus} was correctly implemented, allowing the UR^{Plus} to be used in extreme environments. The D90^{Plus} is not affected because it is available with the Harsh-Environment Conformal Coating option.

Automation

U 184-2 **Writing of automation/protection settings corrected**

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

A potential race condition can occur when writing a large volume of logic to the UR^{Plus}, whereby not all settings are written to the UR^{Plus}, especially on slower communication connections between EnerVista UR^{Plus} Engineer or Setup and UR^{Plus} devices. This can lead to a freeze of outputs.

This firmware version corrects the issue.

C 184-3 **Correction of reset of Virtual Inputs when set to Self-Reset**

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

Virtual Inputs did not always engage for at least one protection pass (1 ms at 60 Hz) when resetting was set to Self-Reset.

This firmware version corrects the issue.

Communications

C 184-4 **Assignment of DNP Paired Control Points corrected**

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

The DNP paired points control function was not implemented correctly. The paired control points were only assigned to Automation FlexLogic and not to Protection FlexLogic, hence only used if the UR^{Plus} included Automation Logic.

This firmware version corrects the issue.

Firmware 1.85

Summary

Highlights include:

- Security:
 - Corrected behavior when passwords used

Security

C 185-1 Corrected behavior when passwords used

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

When passwords were being used, the UR^{Plus} firmware version 1.84 failed to prompt for a password prior to a settings change. An example is entering a remote setting password, waiting for access time-out, and rebooting relay, after which the software did not prompt for a password before a setting change.

Firmware version 1.85 fixes the behavior so that the password entry is required to make the settings change. Firmware versions 1.83 and 1.90 are unaffected.

Firmware 1.86

Summary

Highlights include:

- Security:
 - Changed password reset mechanism

Security

G Changed password reset mechanism

186-1

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

Prior to this release, when the user forgot the configured settings or command passwords, they contacted GE Customer Services and provided an encrypted password to retrieve the passwords.

With this revision, the encrypted passwords are removed. The user must contact GE Customer Service to recover their relays.

Firmware 1.87

Summary

Highlights include:

- Platform:
 - Corrected Annunciator display at startup for single LCD display

Platform

D **Corrected Annunciator display at startup for single LCD display** 187-1

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

Impacted firmware: All

Workaround: Changing a setting in the Annunciator after startup causes the relay to load the Annunciator panel.

A UR^{Plus} relay with a front panel having a single LCD display fails to display the Annunciator panel at startup. Relays with two LCD displays are not affected by this issue.

In the new release, this issue is fixed. The relay loads the Annunciator panel at startup.

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.

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

For users of 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 Grid Solutions 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.

Firmware Compatibility

Version 1.87 firmware of this release is compatible with the UR^{Plus} hardware version 1.70 and higher.

The use of the 1.87 firmware requires EnerVista UR^{Plus} Setup software version 1.80 or higher.

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 Grid Solutions customer service. Those units can require hardware updates to support newer FW versions. For revision 1.84, see the information earlier.

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 |

For further assistance

GE contact information for product support is as follows:

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