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Firmware update release 1.3.6 for REX640 PCL4 protection and control relays

Scope

Update release 1.3.6 concerns REX640 PCL4 protection relays and HMIs.

To verify whether the update applies to the protection relay at hand, there are two things to check:

1. Product Connectivity Level (PCL) shall be PCL4. This information can be checked from LHMI, WHMI or from the product label. The PCL is a part of product composition code, as the example below shows.

REX640B10Nx + xxxx + COMx + PSMx + BIOx + **PCL4**

2. Relay firmware version is 1.3.5 or earlier. This can be checked from LHMI or from WHMI.

Following figures show how to locate the above-mentioned information from the LHMI Device Information page and from the WHMI Product Identifiers page. The LHMI Device Information page can be accessed by tapping the menu bar on upper part of the LHMI screen and locating the Device Information button from the lower left-hand corner of the screen. The relay Firmware version is referred as “SW version”. The “PCL” part of the composition code is pointed out as well.

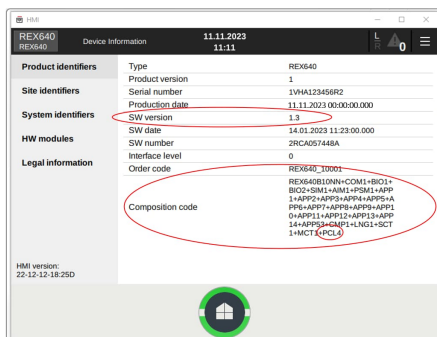


Fig 1. LHMI Device Information page

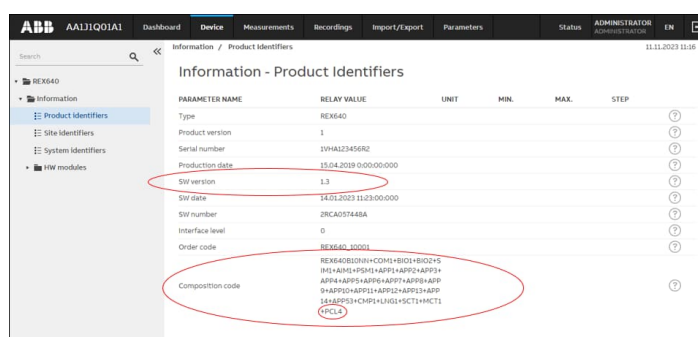


Fig 2. WHMI Product Identifiers page

Implemented usability improvements

The firmware update release includes usability and operational improvements. The following improvements have been implemented:¹

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Communication

- *SMV stream sender (IEC 61850-9-2LE) SMVSENDER* clock info state change consistency improved during PTP time synchronization clock source change. IEC61850-9-2 SMV sender smpSynch transient local/global state change improved and gmidentity update is synchronized with smpSynch update.
- *SMV stream sender (IEC 61850-9-2LE) SMVSENDER* function can now share Sampled measured values also from single phase connected *Phase and residual voltage preprocessing UTVTR* configurations.

Control

- *High speed bus transfer HSABTC (ANSI I<->O BT)* internal voltage configuration correction. This correction fixes internal voltage configuration so that now single phase-to-ground voltage can be used for bus transfer.
- *High speed bus transfer HSABTC (ANSI I<->O BT)* traveling time reset fix. Resolved the situation where maximum traveling time (1000ms) was reached and alarms were latched, but it was not possible to reset alarm until next transfer was made.
- User authorization correction for *Three-state disconnecter control P3SXSXI (ANSI29DS/GS)*. Resolving the issue where 'Operator' users were unable to control the *Three-state disconnecter (P3SXSXI)* in SBO-mode (select-before-operate) from LHMI, and received "Missing authority" message.

HMI

- Improvement to WHMI default parameter names when user defined naming (UDN) enabled. Enhanced the default UDN descriptions to improve clarity of UDN default text in the WHMI 'clear' page.

¹ The relay firmware update may also include some minor usability improvements not listed in this note.

Supervision

- Improved supervision and handling of XRIO and XML files.
In the event of an error during file handling, relay can now endure the exception and restore operation without restart.
- Password change of the user account via LHMI & WHMI has been enhanced.

Protection

- *Three-phase thermal protection for feeders, cables and distribution transformers T1PTTR (ANSI 49F) function correction addresses potentially distorted thermal calculation value during system restarts. This issue exists if Time constant setting is set greater than 3000s.*

Note: This firmware update impacts the nonvolatile memory content. During this update nonvolatile memory is partially reset and may lead to some data loss. Prior the FW update, user should consider storing possible fault records if necessary. Also possible operation counter values (e.g. CBXCBR, SSCBR, UDFCNT) are recommended to be checked and recorded in prior, as some counter values can be also manually restored via settings, in case accumulated counter values lost after update. Relay configuration settings, events, Load profile data, and Disturbance records remain without impact.

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Control

- *High speed bus transfer HSABTC (ANSI I<->O BT)* enhancements and corrections:
 - ACT_LKOUT input is ignored when transfer is running. LOCKOUT is activated after transfer is completed if lockout request is made during transfer.
 - BLOCK input is ignored when transfer is running.
 - Reversed decoupling functionality: Decoupling is executed only in case both involved circuit breakers are closed (intermediate and faulty states are not considered). Also decoupling is considered only after fast transfer (simultaneous or fast make-before-break).
 - *Decoupling delay* must be shorter than *Transfer wait time*. This is checked when settings are validated and if *Decoupling delay* is longer than *Transfer wait time* then settings are not accepted.
 - Traveling time alarm is activated also when maximum traveling time (1000ms) is reached.
 - Internal under voltage initiation is made also in case voltages drop to zero.
 - U_STDBY_FAIL output is activated only if transfer direction is defined. This avoids unnecessary event of U_STDBY_FAIL output when both breakers are open.

HMI

- WHMI session handling improvement. Previously Login to WHMI may have got failed and received message "Login failed: The maximum number of logged in users has been reached.". Now timeout logic of multiple user sessions are enhanced to clear all hanging WHMI sessions.

Monitoring

- *High speed bus transfer HSABTC (ANSI I<->O BT)* recorded data corrections:
 - Missing units for HSABTC recorded data added to LHMI and WHMI.
 - Recorded data time stamp after reboot fixed. Restart does not reset the timestamp anymore.
- *Synchronism and energizing check SECRSYN (ANSI 25)* monitored data improvement to LHMI and WHMI. FR_DIFF_MEAS shows values with four (4) decimals instead of earlier three (3) decimals.
- *Fault Recorder FLTRFRC (ANSI FR)* correction: User was not able to see differential and bias currents in Fault Recorder from other differential protections than LNPLDF even if LNPLDF was not in the configuration. Now selection of the source is based on which of the differential protections starts or operates first. If several fulfils this at the same time, then priority order decides.
- MMS protocol measurement data refreshing during MMS General Interrogation (GI) or integrity reporting improved, providing more accurate and recent measurement data in MMS report.
- Reporting correction for breakers (CBXCBR), disconnectors (DCXSWI and DCSXSWI) and earthing switches (ESXSWI and ESSXSWI). Resolving an issue where the XBCR.Pos.t / XSWI.Pos.t timestamp was reported incorrect during relay startup when the breaker/switch status inputs were in position state 00 (both POSOPEN and POSCLOSE false).

Protection

- *Extension to Frequency protection FRPFRQ (ANSI81)* functionalities. Additional (FRPFRQ1...12) setting possibility to enable/disable vector shift detection. Default setting for vector shift detection is enabled. When vector shift detection is disabled, this allows frequency protection function activation in cases when voltage signals are distorted. Additional setting is available only in LHMI and WHMI. i.e. it is not settable from PCM600.

Supervision

- Self-supervision error handling improvements in case multibit cache data error detected. By immediate self-recovery restart initiation and improved error logging.

Firmware update release 1.3.4 for relay

Communication

- Relay network IP address configuration writing improved.
Note that even relay network IP addresses are configurable by user, however restriction about colliding subnetwork settings according to Technical manual must be followed.
- *Time master supervision GNRLLTMS* behavior fixed. GNRLLTMS1 signals do not toggle anymore and follows correctly in case the PTP master is disconnected in PTP slave-only mode.
- Enhanced DNP3 Secure Authentication User Handling. This improves e.g. status management between usernames beginning with similar credentials.
- Improvement to data handling in situations where customer support data is exported several times via WHMI.
- Enhancements to IEEE 1588 v2 Precision Time Protocol (PTP) time synchronization. When using "PTP Slave-only" setting, then parameter values "PTP priority 1/2" are forced to 255 and ignoring user setting values. Note that in "PTP Slave-only" mode relay will not attempt to become the master when the GM clock is lost.

HMI

- The HOME button LED indication behavior has been enhanced to reflect acknowledged alarms more accurately.

Measurement

- *Phase current preprocessing ILTCTR7* and *ILTCTR8* measurement scaling harmonized with other ILTCTR instances to indicate primary format.
- *Frequency measurement FMMXU (ANSI f)* application configuration output F_INST mapping correction. Changed from dead banded value to instantaneous value.

Monitoring

- *High speed bus transfer HSABTC (ANSI I<->O BT)* recorded data correction. Third instance (HSABTC3) busbar voltage recorded data scaling has been corrected. (This had no impact for transfer functionality) Also added one more decimal to all recorded data for busbar voltage in local HMI for improved data clarity.
- Several event handling related enhancements:
 - Improved event list handling when using PCM600 Event Viewer tool.
 - Optimizing event storing by filtering out some unnecessary function event data that could reserve event storing capacity from other visible events. This ensures that storing of visible events are prioritized.
 - Number of stored event capacity corrected from 512 up to 1024.
 - Audit trail event handling enhancement.
 - Enhanced security event handling by improving event comparison for more accurate security event logging
 - Improved *Master trip TRPPTRC (ANSI 94/86)* deactivation event storing. Event about deactivation is now stored and visible in HMI event list also after restart of the relay.
 - Event reporting improved for unfiltered double point control objects in *IEC 60870-5-104 communication protocol (I5CLPRT)*. This requires also use of REX640 Connectivity Package 1.3.2 or later.

Protection

- *Touch voltage based earth-fault current protection IFPTOC (ANSI 46SNQ/59N)* correction to internal scaling factor of EF validity Min Curr setting for enhanced accuracy.

Firmware update release 1.3.3 for relay

Communication

- Incoming GOOSE dataset variation handling improved in situation when same APPID's are in use.

Control

- *Petersen coil controller PASANCR (ANSI 90)* function enhancement to prevent unnecessary event reporting when operating at low residual voltage levels.

Protection

- *Touch voltage based earth-fault current protection IFPTOC (ANSI 46SNQ/59N)* PEAK_IND output reset behavior in switch-onto-fault situation improved by removing unnecessary long reset delay.
- *Three-phase undervoltage protection PHPTUV (ANSI 27)* function internal energization check improvement for preventing unnecessary START signal when not all phases are connected.

Firmware update release 1.3.2 for relay

Control

- *Synchronism and energizing check SECRSYN (ANSI25)* Synchrocheck SYNC_OK activation at phase opposition fixed.

Earlier it was possible that SECRSYN function indicated that the two network parts were in synchronism (output SYNC_OK is high) even though the network parts were in full phase opposition (180 degrees apart). The false operation window was very narrow covering a range from 179,90 to 180,10 degrees.

For REX640 PCL4 applications where SECRSYN is used, it is advised to check existing control and protection schemes against the two following conditions:

- The circuit breaker close command is active continuously, resulting circuit breaker closing moment being solely dependent on the synchrocheck function operation.
- The two network parts can be in full phase opposition.

In case these two conditions are fulfilled simultaneously, it is strongly recommended to update to latest firmware at earliest convenience.

Protection

- *Three-phase thermal protection for feeders, cables and distribution transformers T1PTTR (ANSI 49F)* function precision improvement.
- *Directional earth-fault protection DEFxPDEF (ANSI 67G/N-1 51G/N-1, 67G/N-1 51G/N-2)* function angle calculation to reverse direction enhanced. Improvement prevents possible false operation if function is set to operate to "reverse" direction.

HMI

User Account Management (UAM) roles and rights to WHMI fault record access rectified.

Firmware update release 1.3.1 for relay

Communication

- *Protection communication supervision PCSITPC (ANSI PCS)* improvement by increased Ethernet packet buffer.
- DNP3 protocol Secure Authentication user management improvement
- IEC 61850 Quality bit behavior improved in measurement functions (MMXU) when frequency adaptivity is used. Earlier there was occasionally unnecessary "bad quality" notifications, and HMI measurement values shown in parenthesis ().

Control

- *Circuit breaker control CBXCBR* control function behaviour corrected. Previously SELECTED output remained active in remote mode when Select timeout was elapsed before CLOSE_ENAD conditions were met.

Engineering

- Engineering enhancement to Goose control block (GCB) configuration extended to check unique combination of APPID+MAC Address instead of only APPID.
 - * Minimum system requirements for engineering are;
 - Relay Firmware: REX640 1.3.1 or later
 - Connectivity package: REX640 1.3.1 or later
 - PCM600 2.12 + Hotfix 20230915 or later

Protection

- *High speed bus transfer HSABTC (ANSI I<->O BT)* improvement. Decoupling functionality enhanced for breaker intermediate state handling.

Supervision

- Improvement to self-supervision watchdog functionality by improved task scheduling and enhanced error handling.
- Disturbance recorder file handling improvement.
- Disturbance record storing strengthened when IEC60870-5-103 protocol in use.

Tools for updating the REX640 (PCL4) relay

Tools needed to update to SW version 1.3.6.

- PCM600 2.12 + Hotfix 20230915 or later
- REX640 Connectivity package 1.3.2 or later
- Relay Update file version 1.3.6 (REX640_ALL_Config_640_Version_1.3.6_2RCA057448G.cab)

Update procedure

Firmware updates represent an integral part of ABB's life cycle management of distribution protection and control relays. The updates ensure optimized usability throughout the relay's entire life cycle by offering the latest improvements. The ideal time for a firmware update would be at device commissioning, during periodical testing or during a maintenance break.

Please note that ABB will not be liable for any direct or indirect costs related to the firmware update procedure. The update procedure shall be performed at the sole responsibility of the possessor of the devices.

Glossary

Abbreviations and acronyms are spelled out in the glossary. The glossary also contains definitions of important terms.

APPID	Application identifier
CT	Current transformer
CVE	Common Vulnerabilities and Exposures
FW	Firmware
GCB	Goose Control Block
GI	MMS General Interrogation
GOOSE	Generic Object-Oriented Substation Event
HMI	Human-machine interface
HW	Hardware
LHMI	Local human-machine interface
MMS	Manufacturing message specification
PCL	Product Connectivity Level
PCM600	Protection and Control IED Manager – Software
PTP	Precision Time Protocol
SCADA	Supervision, control and data acquisition
SMV	Sampled measured values
SW	Software
UAM	User Account Management
UDN	User Defined Names
WHMI	Web human-machine interface
XML	Extensible markup language
XRIO	eXtended Relay Interface by OMICRON