GFK-2594C August 2013 PAC8000 8521-RT-DE RTU Controller

PAC8000 8588 Firmware release 2.14 DNP Control Package release 2.15 for PAC8000 8521-RT-DE (RTU) Controller

In this release of RTU firmware, the ability to store analog output events to persistent queue has been implemented.

Product Documentation

PAC8000 System Specification Datasheet Instruction Manual INM8521 PAC8000 RTU Supplementary Manual, GFK-2829 Product documentation can be downloaded from http://support.ge-ip.com.

Release Information

Release History

Version	Date	Comments
2.14	July 2013	Adds the ability to store analog output events to persistent queue
2.13	Feb. 2012	Provides support for hardware version 3.00
2.12	Dec. 2010	DNP performance enhancement and problems resolved. See GFK-2594A.
2.11	Sep. 2010	Refer to GFK-2594 for enhancements and problems resolved in release 2.11.

Upgrades

Release 2.14 RTU Controller Firmware is *not* intended for use on any 8521 controller not licensed as an RTU. This firmware is released for full production on the 8521-RT-DE controller.

End users can upgrade to version 2.14 from the controller running with version 2.13 or 2.12.

IO configuration and strategy downloaded with Workbench 8.4 SIM5 or later to an RTU controller with 02.14 firmware version is not valid on versions prior to 02.13 of RTU. A clean flash is required when reverting to previous versions of firmware.

Upgrade Kit

Updates are published to the Support site, <u>www.ge-ip.com/support</u>, as a ZIP file. Instructions for the firmware upgrade are provided in the 82A1739-PM01-001-B2.pdf document, which is included in the upgrade kit.

The upgrade kit for this release is part number 82A1762-MS10-000-A2.

Functional Compatibility

Release 2.14 RTU Controller Firmware is *not* intended for use on any 8521 Controller not licensed as a RTU.

Subject	Description
PAC8000 Workbench Version Requirements	Version 8.4 SIM5 or later of PAC8000 Workbench is recommended for programming the PAC8000 RTU controller.
DNP3 Control Package	This version of the PAC8000 firmware is compatible with DNP3 Control Package version 02.15.
ISaGRAF Control Package	This version of the PAC8000 firmware is compatible with ISaGRAF Control Package version 02.02.
Supported modules	For a list of modules supported by the RTU Controller, see page 12.

Problems Resolved in Release 2.14

Problem Resolved	Configuration	Description
Failed IO module is not recovered by controller	Simplex, Duplex	When module fails due to severe errors like corrupt configuration, corrupt railbus commands, diagnostic failures etc. controller detects module is in failed state, however does not attempt to recover failed module. This controller version attempts to recover failed module by sending communication reset commands.
IO COM light does not appear to work properly	Simplex, Duplex	As per controller data sheet, IO COM light is steady ON when IO communications are good, flashes indicating a fault, and is OFF when no IO communication is in use (no IO modules on railbus). However, in actual use, the IO COM light would flash randomly (1 or 2 times per minute) when no module was installed in slot 1. If a module is installed in slot 1, even if the module does not exist in the project configuration, the light seemed to be steady on. To make LED function meaningful, this release changes its operation as follows: ON: All railbus transactions performed within the last two seconds succeeded Flash: At least one railbus transactions performed within the last two seconds failed OFF: No railbus transactions have taken place within the last two seconds.
Saving retained variables while doing a strategy download may cause ISaGRAF to start incorrectly	Simplex, Duplex	The saving of retained variables is not allowed while a strategy download is active. Once a strategy download has been completed, if a pending retained variables request is active this will then be triggered. If the strategy download was "with
Saving retained variable while doing a strategy download may cause both controllers to go "off-line"		initialization" the initialized variables will be assigned to the appropriate Modbus registers and then saved. However, the strategy download is "without initialization" the new values will be saved.

Problem Resolved	Configuration	Description
Controller is applying failsafe values immediately after it losses communication with remote controller instead of waiting 2 times the configured scan rate	Simplex, Duplex	Whenever the controller loses communication with remote controller, it should wait 2 times configured scan rate, before applying failsafe values due to communication failure. If connection restores within 2 times the configured scan rate from the last valid Modbus response, the controller should not apply failsafe values. The controller was applying failsafe values as soon as communication to remote controller was lost. Build 2.14 fixes this issue. Whenever controller loses communication with remote controller, it waits for 2 times the configured scan rate from the last valid Modbus response. If no communication is restored in this period, controller takes the channels to the pre-configured failsafe values.
Controller aborts when breakpoint hits in ISaGRAF debugger	Simplex, Duplex	When breakpoint hits in ISaGRAF debugger, the controller stops due to ISaGRAF heartbeat failure. ISaGRAF Heartbeat monitoring feature is removed in this build to fix the issue.
8142-DO-DC module channel LED blinks even after removing line fault condition	Simplex, Duplex	A problem observed on 8142-DO-DC module in the following scenario. 8142-DO-DC channel failsafe state is configured as OFF. Line fault occurs on a particular channel. 8142-DO-DC module enters failsafe state. ** Line fault condition is removed on that particular channel. 8142-DO-DC module is taken out of failsafe state. In this scenario even though no line fault exists on that particular channel, it continues to report a line fault and the channel LED will be in blink state. ** Note: The module can enter failsafe state for several reasons. For example, if configured, HMI timeout can place all modules in failsafe state.
8142-DO-D C configuration parameters do not match between controller and module	Simplex, Duplex	When 8142-DO-DC module is configured, an event log message shows that "channel properties block" does not match between controller and 8142-DO-DC module. A message appears in event log similar to the one given below. CPB 1 is different 1 1 10 This issue is addressed in 02.14 firmware release. In combination with 02.14 controller firmware, it is required to use 01.04 version of 8142-DO-DC module firmware to have this issue resolved.

Problem Resolved	Configuration	Description
LAN A port locks up	Simplex, Duplex	The controller's LAN A port stops working when the network experiences heavy traffic, due to having two intra-LAN links in network. The only way to restore port operation is to reset the controller. This issue is corrected in this release.
SFC debug commands not working with 2.00 ISaGRAF control package	Simplex, Duplex	The Set Breakpoint, Clear Break Point and Clear Transition SFC debug commands do not work with ISaGRAF v2.00. Updated ISaGRAF and new build v2.02 resolves this issue.
Problem while downloading ISaGRAF executable	Simplex, Duplex	While downloading RTU firmware, if the ISaGRAF executable is different from the one that controller has, the controller sometimes stops working while installing new ISaGRAF executable. This issue is corrected in 02.14 release.
Modbus write coil request with value 0 fails	Simplex, Duplex	Controller is not generating the Modbus write command for Modbus coil write request with value 0. Due to this end user was not able to write coils with value 0. Build 02.14 resolves this issue and it makes sure the Modbus coil write requests are generated as per the user's request for both setting and resetting of the coil.

New Features and Enhancements in Release 2.14

The following features/enhancements are added to the RTU controller in release 2.14.

- 1. The ability to store "Analog Output events" (Object 42) is implemented. The variations supported are 2, 4, 5, 7. The default variation is 2.
- 2. Variation '3' is supported for Object 40 (Analog Output Status).
- 3. With older versions of RTU controller firmware (below 02.14), even if the controller does not contain any "Trusted Host Table", by default the 'automatic save retained variable' feature is enabled. From this version of controller firmware, 'automatic save retained variable' feature is disabled if no "Trusted Host Table" is downloaded to controller. If required, this feature can be enabled by selecting save retained variable option when downloading "Trusted Host Table".

Restrictions and Open Issues

Restriction/ Issue	Configuration	Description
A firmware upgrade/ downgrade sometimes fails in duplex system	Duplex	 While upgrading or downgrading firmware on a duplex system, sometimes the standby controller remains offline with firmware downloader tool showing the error message "Get NVM details control Package B." When this has occurred, follow either of the methods listed below. Press the Change State button on the standby controller. The standby controller will be properly synchronized with the master controller. OR Select the firmware version a second time from the firmware downloader tool and update firmware on the standby controller.
New, unconfigured RTU controller fails to sync with Master controller	Duplex	When a new RTU controller (without IP settings) is inserted next to the master controller running in simplex mode, the new controller, which is in BOOTP mode, fails to sync with Master controller. The event log will show the following message. "Abort due to MmuDtmLISR Data Address". When this happens, press the Change State button on the standby controller or power cycle it. The standby controller will get properly synchronized with the Master.
Standby offline due to "Refresh warm init took too long" following refresh or PQ rollover	Duplex	On rare occasions a "Refresh warm init took too long" event may occur after a persistent queue rollover (see the "Persistent Queue Rollover" operational note on page 9) or a refresh. When this occurs the standby will be unable to refresh with the master and will remain offline. If this problem occurs the IO Configurator should be used to do a clean flash of the "DNP Data Logging" on the master with the standby powered down. The standby should then be able to refresh successfully when powered on.
Standby offline due to CSC_CORRUPT for the persistent queue	Duplex	After power cycling the master, taking the standby from offline to online, or resetting the master via the xxx_AXE_Reset_Coil (8449) the new standby may occasionally fail to refresh and report a "Download Persistent Queue CSC_CORRUPT" event. When this occurs the standby will be unable to refresh with the master and will remain offline. If this problem occurs the IO Configurator should be used to do a clean flash of the "DNP Data Logging" on the master with the standby powered down. The standby should then be able to refresh successfully when powered on
Clean flash may cause controller abort	Simplex, Duplex	Occasionally a clean flash will result in an abort due to "RtosFree NU_Deallocate_Memory NU_INVALID_MEMORY". If this failure occurs a subsequent clean flash will succeed.
"DDA CRC Control Package A Vars Different" after firmware download	Duplex	Occasionally after firmware download, a "DDA CRC Control Package A Vars Different" event will be logged and the standby will go through an additional refresh. The second refresh will be successful.

Restriction/ Issue	Configuration	Description
Controller aborts due to ISaGRAF strategy too large	Simplex, Duplex	If the ISaGRAF strategy exceeds the maximum supported size the download will be rejected and an "ISaGRAF strategy too large" event is logged. When this occurs an attempt to clean flash may result in a controller abort due to "MmuDtmLISR Data Address invalid". The abort will occur on both controllers in a duplex system. Further attempts to clean flash should be successful. If this problem is encountered reduce the size of the ISaGRAF strategy, clean flash, and download the smaller strategy.
Refresh of standby fails due to "CSC_TIMEOUT"	Duplex	After power cycling the master, taking the standby from offline to online, or resetting the master via the xxx_AXE_Reset_Coil (8449) the new standby may occasionally fail to refresh and report a "Download Persistent Queue CSC_TIMEOUT" event. The second refresh will be successful.
After power cycle standby remains offline	Duplex	When retained variables are used a power cycle with a downtime close to the configured "Retained Variables Delay" may result in the standby remaining offline. The standby will report that it has newer retained variables than the master. If the problem occurs the IO Configurator should be used to do a clean flash of the standby with the master powered down. The standby should then be able to refresh successfully with the master. To avoid this configure the "Retained Variables Delay" to be a longer time than the "Warm Start Time" in the controller configuration.
DDA CRC NVMQ Pool mismatches after reset	Duplex	Power cycling both controllers may cause a "DDA CRC NvmQ pool different" event upon completion of the refresh. When this occurs the standby will be unable to refresh with the master. If the problem occurs the IO Configurator should be used to do a clean flash of the "DNP Data Logging" on the master with the standby powered down. The standby should then be able to refresh successfully when powered on.
Control relay output block pulse commands latch rather than pulse	Simplex, Duplex	Commands to pulse a DNP point on or off cause the point to latch that value rather than pulse. If a pulse is needed, consecutive latch commands can be used to manually generate a pulse.
Controller enters continuous reset	Duplex	On rare occasions in a duplex system after resetting the master via the xxx_AXE_Reset_Coil (8449) the new standby may enter into a continuous reset state. When this occurs the standby will be unable to refresh with the master and will remain offline. If this problem occurs the controller should be powered on in a simplex configuration with the Change State button held until power up completes. After the controller powers up the IO Configurator should be used to do a clean flash with all options selected. The standby should then be able to refresh successfully with the master.

Restriction/ Issue	Configuration	Description
Occasional standby abort following power cycle.	Duplex	On rare occasions power cycling a duplex system may result in the standby coming up in the failed state with an "Abort due to DmaFinish Copy". After this problem occurs resetting or power cycling the standby will allow it to successfully refresh with the master.
Rendezvous timeouts cause additional refresh with high cycle times	Duplex	In systems running high execution cycle times (>200ms) an additional refresh may occur after a power cycle due to a rendezvous timeout on the initial refresh. In this case a "Force standby, rendezvous timeout" event will be logged. The second refresh may be successful or the standby may be unable to refresh with the master and remain offline. To avoid the problem, the sustained execution cycle times should be maintained below 150ms.
Scan Overload Shutdown Time should not be set above 2 seconds	Simplex, Duplex	The Workbench programmer allows the "Scan Overload Shutdown Time" to be configured up to 10 seconds. The controller has a maximum execution cycle time of 2 seconds. Therefore, any values above 2 seconds have no effect.
Refresh fails after DNP channel is closed	Simplex, Duplex	After closing the DNP channel, restarting the standby will result in the subsequent refresh failing with DDA CRC errors or rendezvous timeouts. The subsequent refresh will be successful and the system will continue in duplex operation.
DDA CRC Timer Pool mismatches after master reset	Simplex, Duplex	In a duplex system power cycling or resetting the master may cause a "DDA CRC Timer pool different" event upon completion of the refresh. When this occurs the subsequent refresh will be successful and the system will continue in duplex operation.
Standby aborts after reset during Retained Variables save	Duplex	Resetting both controllers in a duplex pair while a Retained Variables save is in progress may result in the standby aborting on the subsequent powerup. After this problem occurs resetting or power cycling the standby will allow it to successfully refresh with the master.
Rendezvous timeout when opening DNP channel	Duplex	Occasionally a rendezvous timeout will occur when opening DNP channel. When this occurs the standby will remain offline. The standby can be commanded to exit offline by pushing the Change State button on the controller carrier or issuing a "Simulate Button Press" command via the Network Configurator utility.
Freeze counter command may cause standby to refresh	Duplex	After issuing a freeze counter command, if standby has to refresh with Master, then first refresh may fail with "DDA CRC Control Package A Vars different" message in event log. The second refresh will be successful.
ISaGRAF debugger allowed in protected mode	Simplex, Duplex	The controller allows the ISaGRAF debugger to connect when the controller is in protected mode. This connection should be blocked in protected mode.

Restriction/ Issue	Configuration	Description
Controller aborts when power cycled with no strategy and configuration	Simplex, Duplex	Powering up a controller with no strategy or configuration downloaded sometimes results in a controller abort. The event log will indicate "Abort due to MmuDtmLISR Data Address invalid" if this occurs. This issue has no impact on operation and can be ignored under these circumstances.
Object group 0 not supported	Simplex, Duplex	The RTU does not support DNP3 object group 0.
Invalid data when using packed discrete points in Modbus master	Simplex, Duplex	When the PAC8000 controller is used as a Modbus Master and an option other than "No Packing" is selected from the WorkBench, the controller could return erroneous Modbus values to the slave. The issue occurs only for discrete Modbus registers. Ensure that the "No Packing" option is selected if the PAC8000 controller is used as a Modbus Master.
Serial port lockout command not working on same port	Simplex, Duplex	A locked serial port cannot be unlocked through the same serial port. To unlock a serial port, connect through the other serial port and download IO configuration to unlock the port. If both serial ports are locked, it is required to establish Ethernet connection with the controller and download IO configuration to unlock the port. Optionally, the Network Configurator can be used to send a "Set Port Lockout" command to unlock the port over Ethernet.

Operational Notes

Operational Note	Description
Persistent Queue Rollover	The store-and-forward feature of the RTU uses 384k bytes of flash memory for non-volatile storage. This storage is referred to as the persistent queue. As DNP events are recorded and polled the persistent queue eventually fills and requires that space be reclaimed. This processing occurs automatically and is referred to as a persistent queue rollover. During a rollover stored events may be discarded if the number of un-polled events exceeds 2/3 of the persistent queue size. In this case a "Persistent Queue overflow - oldest entries overwritten" event will be logged.
Maximum Number of DNP Points	A maximum of 4096 DNP points are supported. By default all HMI tags are DNP points in the Workbench software. If maximum number of DNP points is reached tags can be set to inactive in the "Assign DNP Points to Classes" window in Workbench.
DNP Sample Rate	DNP points are sampled for change every execution cycle. Events are recorded every one second, however. Points changing that occur more frequently than once per second will be detected but not reported. This may also result in consecutive events with the same value when a point changes and then changes back to the original value. It should be noted that events are not recorded at exactly one second intervals. They are recorded during the execution cycle and therefore the maximum time between recorded events will be one second plus the execution cycle time.
Maximum DNP Event Rate through refresh	The maximum number of DNP events that can be handled during a refresh of the standby varies based with the execution cycle time. For execution cycle times of approximately 60ms this is 12 events per second. For execution cycle times of 250ms a sustained rate is 3 events per second. Higher rate of events may result in new DNP events being discarded. When this occurs "Persistent Queue Add Failure - Transaction Buffer Full" or "Persistent Queue Del Failure - Transaction Buffer Full" events are logged.
Maximum DNP Event Rate through PQ rollover	The maximum number of DNP events that can be handled during a persistent queue rollovers (see the "Persistent Queue Rollover" operational note on page 9) varies based with the execution cycle time. For execution cycle times of approximately 60ms this is 15 events per second. For execution cycle times of approximately 250ms this is 8 events per second. Higher rates of events may result in new DNP events being discarded. When this occurs "Persistent Queue Add Failure - Transaction Buffer Full" or "Persistent Queue Del Failure - Transaction Buffer Full" events are logged.
Clean flash of persistent queue	Doing a clean flash that includes cleaning "DNP data logging" will result in DNP events being discarded as well as new DNP events not being recorded for a short time (approximately 20 seconds).
Analog deadband	By default a fixed deadband of +/- 0.5 is applied to the scaled value for all analog object types. The deadband for each point can be set from a DNP master.

Operational Note	Description
Analog jitter	To prevent excessive DNP events analog inputs should be filtered. This can be achieved by setting the analog deadband through a DNP master (see above). This can also be achieved by using the filtering capability of the analog modules. See PAC8000 Workbench help for information.
Only use one method of time synchronization.	Only one method of time synchronization should be enabled on the controller. If using DNP3 time synchronization SNTP and PAC8000 to PAC8000 time synchronization should be disabled. To disable SNTP, simply do not configure time servers on the controller "Attributes" tab in the IO Configurator. To disablePAC8000 to PAC8000 time synchronization uncheck the "Act as Time Master" option on the controller "System" tab for all controllers on the network. Note that some DNP masters automatically synchronize time and do not allow this functionality to be disabled.
Self Addressing not supported	The RTU does not support DNP self address functionality.
DNP Events discarded during firmware download	Performing a firmware download will cause the persistent queue to be deleted and recreated. This will result in a loss of any stored DNP data.
DNP Events discarded during strategy download	Performing a strategy download will cause the persistent queue to be deleted and recreated. This will result in a loss of any stored DNP data.
Standby refresh with persistent queue	In systems with large execution cycle times (>200ms) refreshing a standby controller can take approximately 90 seconds to complete.
Flash wear for DNP event logging	The persistent queue that stores DNP events uses flash memory for non- volatile storage. Write and erase cycles will cause wear to the flash storage eventually causing the component to fail. Changes in class1 or higher DNP points cause changes to the persistent queue. Therefore large numbers of these points or frequent changes to these points will accelerate wear of the flash storage. If the flash component fails, the event log will contain "Flash sector xx write failed" or "Flash sector xx write timeout" events.
Maximum cycle times for RTU	Sustained cycle times above 250ms are not supported for the RTU.
DNP Qualifier 17 does not apply	Because all PAC8000 IO is at address 256 and above, qualifier 17 (8 bit addressing) does not apply and should not be used.
DNP cold and warm start not supported	The RTU does not support the cold and warm start DNP functions. A controller can be reset using the xxx_AXE_Reset coil (8449). This can be written via DNP if the point is mapped as a DNP point. This can also be done from application logic or written via Modbus. In duplex systems this will only reset the master controller.
Cannot set "Remote Supervisory Control"	The RTU does not support configuring "Remote Supervisory Control".

Operational Note	Description
DNP3 dynamic class assignment not supported	The RTU does not support dynamic DNP class assignment (DNP function code 22). DNP point classes must be statically assigned in the PAC8000 Workbench programming software. For more information see the "Assign DNP Points to Classes" topic in the PAC8000 Workbench help.
DNP communication loss during failover	During a failover from master to standby, communication with a DNP master will be lost unless the DNP master opens a new connection to the new master controller. With a redundant RTU, the DNP master should retry the connection if a communication loss occurs.
Duplication of events during failover	After a failover from Master to standby, controller may resend some of the events that it has already sent to DNP Master. When this occurs some of the events will have same time stamp and value as the old events. This will happen if the controller failover occurs while the RTU is waiting for a confirmation message from the DNP master. In this case the confirmation message will be lost, and the new Master controller will detect a confirmation message timeout and send the events again.
DNP master timeouts when failover occurs on RTU	If a DNP read or write is in progress when a failover occurs, the DNP request may not be responded to. This will cause the DNP master to detect a timeout for that request. Further behavior is dependent on the actions of the DNP master. If this occurs, the RTU will respond to further DNP requests.
RTU does not provide point data during refresh or persistent queue rollover	During the execution of a refresh or persistent queue rollover, the RTU will not provide data in response to a DNP master poll. The RTU will provide a valid response to these requests but no data will be in the reply. After completing the refresh or persistent queue rollover, DNP master polls complete as expected.

Supported Modules	on RTU Controller
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Module Type	Catalog No.	Description
Standard Modules	8101-HI-TX	8-channel, 4–20 mA with HART
	8102-HO-IP	8-channel, 4–20 mA with HART
	8103-AI-TX	8-channel, 4–20 mA
	8104-AO-IP	8-channel, 4–20 mA
	8105-TI-TC	4-channel, THC and mV
	8106-TI-RT	4-channel, RTD and Omega
	8109-DI-DC	8-channel, 24 V dc, isolated, sinking
	8110-DI-DC	8-channel, 24 V dc, non-isolated, module powered
	8111-DI-AC	8-channel, 115 V ac, isolated, sinking
	8112-DI-AC	8-channel, 115 V ac, non-isolated, module powered
	8113-DI-AC	8-channel, 230 V ac, isolated, sinking
	8114-DI-AC	8-channel, 230 V ac, non-isolated, module powered
	8115-DO-DC	8-channel, 2–60 V dc, non-isolated, module powered
	8116-DO-AC	8-channel, 20–265 V ac, non-isolated, module powered
	8117-DO-DC	8-channel, 2–60 V dc, isolated, unpowered
	8118-DO-AC	8-channel, 20–265 V ac, isolated, unpowered
	8119-VI-05	8-channel, 1–5 V
	8121-DI-DC	16-channel, 24 V dc, non-isolated, module powered
	8122-DI-DC	16-channel, 24 V dc, isolated, sinking
	8123-PI-QU	2-channel, pulse/quadrature input
	8125-DI-DC	32-channel, Switch/Proximity Detector Inputs, Module Powered
	8127-DI-SE	32-Channel Sequence Of Events, non-isolated, module powered
	8129-IO-DC	8-channel 24Vdc, non-isolated, powered inputs and outputs
	8132-AI-UN	8-channel, 4-20mA, Thermocouple, RTD and Voltage isolated, universal input
	8140-DI-AC	16-channel, 115 V ac, block-isolated, sinking
	8142-DO-DC	16-channel, 12-42 V dc, non-isolated, module powered
Intrinsic Safe Modules	8201-HI-IS	8-channel, 4–20 mA with HART
	8202-HO-IS	8-channel, 4–20 mA with HART
	8204-AO-IS	8-channel, 4–20 mA
	8205-TI-IS	8-channel, THC and mV
	8206-TI-IS	8-channel, RTD and Omega
	8215-DO-IS	4-channel, solenoid driver, IIC gas groups
	8223-PI-IS	2-channel, pulse/quadrature input
	8230-AI-IS	8-channel, 0-10V/potentiometer
	8220-DI-IS	16-channel, switch/proximity detector

Compliance Information

For detailed installation and operating procedures, refer to the Instruction Manual INM8521.