DNP3 Outstation Module

IC695EDS001-DF RX3i DNP3 Outstation Module

The PACSystems* RX3i DNP3 Outstation Module IC695EDS001 is an Ethernet-connected module which fits in the RX3i backplane and permits the RX3i to behave as an Outstation on the DNP3 network, where it may interact with up to eight DNP3 masters.

Module features include:

- Two auto-sensing RJ-45 Ethernet ports with LED indicators
  - Connects via Ethernet at 10BaseT or 100BaseTX
  - Internal network switch with Auto-negotiate, Sense, Speed, and crossover detection
  - Supports Linear (daisy-chained) and Star network configurations
  - TCP/IP and LLA protocols supported
  - One Ethernet MAC Address and one IP Address per module
  - Time synchronization to SNTP Time Server
  - Recessed Ethernet Restarts pushbutton to manually restart the Ethernet firmware without power-cycling the module.
- Dedicated RS-232 Station Manager Port for network supervision
- LED behavior same as ETM001
- DNP3 configuration via a single COMMREQ command
  - Data exchanges up to 12,072 points and 24,000 events supported
  - Eight DNP3 Objects supported: DI, DI w/time, DO, DO w/time, CROB, analog output values, time setting, and class polls
  - Multiple RX3i memory types may be utilized for DNP3 data exchange
  - Binary DI/DO
  - Analog (32-bit signed, 16-bit signed, or single-precision floating point)
  - Supports unsolicited data communications with DNP3 Master
  - Master IP Address and LLA Address White listing
- Compatible with those RX3i CPUs as noted on page 4, including redundant controllers
  - Up to 4 EDS001 per RX3i, as allowed by available power and slots
  - Module can be installed in any available RX3i main rack I/O slot
  - Module supports insertion into and removal from an RX3i backplane which is under power.
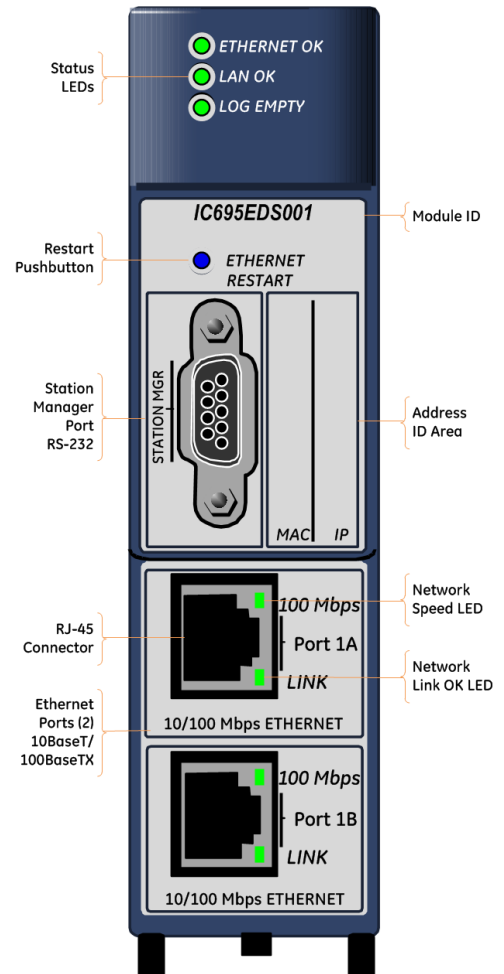 - Firmware upgrade via RX3i CPU using WinLoader software utility

Figure 1: EDS001 Features at a Glance

Current Release Information

Catalog Number	Firmware Version	Date	Comments
IC695EDS001-DF	6.43/1.50	Aug 2018	The firmware release provides cyber security enhancements and improvements in Ethernet performance. In addition, it also providers fixes for intermittent DNP3 communication failures and fix for addressing the issue of failure to establish connection on SOE port after a role switch in an HSB system.

Upgrade Kit: 41G2060-MS10-000-A5

This combines a compatible Ethernet Firmware Upgrade Kit and DNP3 Outstation Firmware Kit in one package.

Hardware ID	Catalog Number	Board ID	Board Revision
IC695EDS001 Ethernet DNP3	IC695EDS001-DF	EX4B1	41G1299-BA10-000-D3
Ethernet TCP Firmware ID	Version: 6.43 Build 29A1		
Ethernet Boot Firmware ID	Version: 3.71 Build 43A1		
Ethernet Toolkit Plugin3 -DNP3 Slave License	N/A		
Ethernet Toolkit Plugin2 -DNP3 Slave Application	Version: 150 (0xD303)		
Ethernet Programmable Parts	Part ID	Revision	
	PLD	44I725580-1401B	
	Flash Memory - U3	41G1299-FW10-000-A4	
	Flash Memory - U4	41G1299-FW10-001-A4	
	Microcontroller 405GPR –U66	41G1911-FW10-000-A0	

Release History

Catalog Number	Firmware Version	Date	Comments
IC695EDS001-DF	Firmware 6.43 /1.50	Aug 2018	Firmware version 6.43 provides the following enhancements: a. Security enhancements to harden the product against an attacker. b. Improvements to Ethernet configuration to improve Ethernet performance. c. Enhancements to improved network storm survivability Firmware version 1.50 provides a number of open problem resolutions, see "Problems Resolved by this Revision" section for details In addition, it also adds configuration parameter for enabling Extended DNP3 Keep Alive Timeout. This, when enabled, allows DNP3 sessions to ride through communications disturbances of up to 60 seconds in length.
IC695EDS001-DE	Firmware 6.41 /1.40	Mar 2017	This hardware release addresses a component obsolescence issue. There are no changes to form, fit, or function.
IC695EDS001-CE	Firmware 6.41 /1.40	Feb 2016	An enhancement was made to prevent the module from becoming unresponsive and requiring a power cycle if it was subjected to heavy network storm traffic.
IC695EDS001-CD	Firmware 6.31 /1.30 Boot 3.71	Dec 2015	This hardware release addresses an issue identified, where the module can unexpectedly go into firmware update mode (Ethernet OK, LAN OK, and Log Empty LEDs blink in unison). While in firmware update mode, the module is unresponsive to Ethernet traffic. There are no changes to form, fit, or function. This Firmware provides enhancements to configure the Event Buffer size separately for Digital Inputs (BI – Binary Inputs and BO – Binary Output status) and Analog Inputs (AI – Analog Inputs and AOS – Analog Output status) and also support specific DNP3 object variations. This also fixes issue with module going unexpectedly in firmware update mode, as part of the Web upgrade kit.
IC695EDS001-BC	1.20	Jul 2015	This firmware release fixes the issue related to IIN Bits indicating Class1 and Clas2 Data Available status to DNP3 Master. The firmware also corrects the control code for Close and Trip Control (Close=101) and (Trip =110) in the CROB Control DWORD to be consistent with description in User manual –Section 6.9.2.

IC695EDS001-BB	1.10	Apr 2015	Added a feature to support different control codes like PULSE ON/OFF, CLOSE, TRIP and LATCH ON/OFF for the CROB Control objects. This also enhanced the Quality functionality for ensuring that events are generated when quality is offline, and appropriate quality status is updated. This hardware release addresses a component obsolescence issue. There are no changes to form, fit, or function.
IC695EDS001-AA	1.00	Oct 2014	Initial release.

Functional Compatibility

Subject	Minimum Version Required
Programmer Version Requirements	Proficy* Machine Edition Logic Developer Release 8.5 SIM 7 or later.
Ethernet Firmware Version Requirements	Ethernet (ETM001) Primary Firmware Release 6.30 (Build: 41A1) Ethernet (ETM001) Boot Firmware Release 3.60 (Build: 45A1)
Module Hardware Requirements	The newly-released EDS001 firmware is compatible with original hardware (IC695EDS001-AA) and with new hardware (IC695EDS001-BB). *Note:* It is not compatible with IC695ETM001 hardware.
RX3i CPU version Requirements	CPU320/CPU315 Primary Firmware Release 8.05 CPE310/CPE305 Primary Firmware Release 8.05 CRU320 Primary Firmware Release 8.05 CPE330 Primary Firmware Release 8.45 (Other RX3i CPU/CPE models are not supported)

Problems Resolved by this Revision

Subject	ID code	Description
Intermittent DNP3 Communication drops over long runs with EDS module occasionally going to 2-5 or 3-5 LED Blink code and requiring a module Reset before resuming operation	DE4857/CS0207227	The firmware fixes the issue of intermittent DNP3 Communication Failures with the EDS modules occasionally going to 2-5 or 3-5 LED Blink mode and then requiring Module Reset before resuming operation. It is observed that when this issue occurs, the EDS module log shows multiple events with event types 8H, FH and 3H. Refer to the GFK-2911 for "PLC Access Wait time parameter" [19] in the COMMREQ configuration.
EDS card sends unsolicited responses only to the DNP3 Master with LLA address = Configured EDS LLA Address – 1)	DE4689/CS0151059	The firmware enhancement removes the constraint of EDS sending unsolicited responses only to a fixed DNP3 Master LLA address which is hardcoded to [EDS LLA Address -1]. Thus, if the DNP3 Master with a different LLA address (other than 'EDS LLA Address -1' is connected to EDS, it would reject these messages. For exammple, if the EDS LLA Address is configured as 2, then previously the EDS module sent unsolicited responses only to the Master with LLA address as 1. This constraint is removed in this version and the EDS now sends unsolicited responses only to the connected DNP3 Master LLA address, irrespective of its own configured LLA address. Refer to the GFK-2911 for details.
HSB Role Switch issue – Unable to establish DNP3 connection on SOE port after role switch	DE4434/CS0090032	The firmware enhancements implement a notification on a role switch event to ensure DNP3 communication on the SOE port are re-established after the role switch. Prior to this update,in HSB System on Role switch, the EDS DNP3 SOE port was not always able to restablish communication with the new active unit. This was due to the previous connection not being properly closed by an EDS module after role switch and some DNP3 Masters not issuing TCP-RST requests after TCP-SYN failures from the EDS modules.

New Features and Enhancements

Subject	Description
DNP3 Keep Alive feature	This firmware implements the Keep-Alive feature through a Configuration parameter – Bit 9 of the "Option Parameter Word [17]". If this feature is enabled by setting the bit 9 as '1', then EDS will wait for 60 seconds before sending Link status requests and if no DNP3 frames are received on the given session or there is no response from DNP3 Master, then the EDS will automatically disconnect the connection with the Master. Refer to the GFK-2911 for details.

Restrictions and Open Issues

Subject	ID code	Description
Byte Swap Error	00259269	During long runs for Object type 30, the Controller reference memory data reported in response to a poll request from the Master was intermittently observed to contain corrupted data. Data was being swapped between the high and low bytes.
White Listing of Master LLA	DE1839	The EDS001 module allows the establishment of a white list of allowed connections, both TCP/IP and LLA Master Station addresses. The parameters for this feature are such that they can be enabled independently. However LLA white listing is to be used **with** TCP/IP white listing, not by itself.
Multiple role switching causing 2-5 Blink code when EDS is configured for "Fixed Event Buffer" in an HSB system	DE4879	During multiple Role switches in an HSB system, the EDS module(s) for which the DNP3 COMMREQ Application is configured as "Linear Fixed Buffer" for event buffering goes to 2-5 Blink code exception. It is recommended to use "Circular Event Buffer" for event buffering, when used in HSB system with Redundant IP. The Option Parameter Word[17] Bit 12 in the COMMREQ configuration should be set to '1' to enforce the Circular event buffer, avoiding this issue.

Operational Notes

Subject	Description
Station Manager unresponsive	Station Manager can become unresponsive when there is high polling rate, or high point load on the EDS001 module.
Use of Redundant IP with the EDS001 in a CRU application	DNP3 is a connection oriented protocol, and during a role switch of a CRU controller the MAC Address of the Redundant IP will change, typically causing TCP/IP connections to be disrupted, then reconnected. It is likely that a DNP3 Master with a connection to an EDS001 module in this type of configuration will experience a connection change, causing the DNP3 data to be temporarily unavailable.
Use of SOE parameter with the EDS001 in a CRU application	It is not recommended that SOE be used in CRU applications, as, on a role switch, the EDS001 module can lose buffered events, or hold them for a future role switch.
Use of Master Set DNP3 Unsolicited mode with the EDS001 in a CRU application	It is not recommended that a Master use unsolicited mode with CRU applications, as, on a role switch, the EDS001 module can lose buffered events, or hold them for a future role switch. Also, on a role switch, the Master may not know to reissue the Unsolicited Enable command to the EDS001 module.
Synchronizing the LSI bits between CRU CPUs	In redundancy applications, synchronizing the LSI (LAN Status Interface) bits is not recommended, as it may cause the ST block that contains the COMMREQ setup to execute prematurely on a role switch. Independent bits, or Symbolic bits, should be used for the LSI data.
Using Point Push with Analog Data	Analog points, when pushed, will take on the default variance size specified by the COMMREQ parameter.

Additional Information

PACSystems RX3i User Manuals

PACSystems RX7i & RX3i TCP/IP Ethernet Communications User Manual	GFK-2224
PACSystems TCP/IP Ethernet Communications Station Manager Manual	GFK-2225
PACSystems RX3i DNP3 Outstation Module IC695EDS001 User Manual	GFK-2911
PACSystems RX3i DNP3 Outstation Module IC695EDS001 Quick Start Guide	GFK-2912
PACSystems RX3i Ethernet Module IC695ETM001 IPI	GFK-2332
PACSystems RX3i Ethernet DNP3 Outstation Module IC695EDS001 IPI	GFK-2333

User manuals, product updates and other information sources are available on the website, www.geautomation.com, under *Controllers and IO, RX3i Controllers*.

GE Automation & Controls Contact Information

Americas: 1-800-433-2682 or 1-434-978-5100

Global regional phone numbers are available on our website www.geautomation.com