Honeywell

Technical Information

Experion LX C300 EtherNet/IP Interface Specification

LX03-560-120

Release 120

February 2015, Version 1.0

Revision History

Revision	Date	Description
1.0	February, 2015	First release

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1. Product Introduction

1.1. Experion LX System

As a member of Honeywell's Experion family, Experion LX is specifically designed to meet the customer needs in mid-tier markets (Chemicals, Industrial Power, F&B, Bio-fuels, …), through integrating state-of-the-art technology from the award-winning Experion Process Knowledge System (PKS) with innovative design of Series 8 I/O modules and cabinets, validated wider range of COTS options, easier engineering and maintenance capabilities, and integrator-friendly programs and tools. Experion LX is the perfect platform for process, asset and business management, and enables customers to increase their profitability and productivity and accessibility to local support without sacrificing quality and reliability in an increasingly competitive environment.

1.2. Architecture Overview

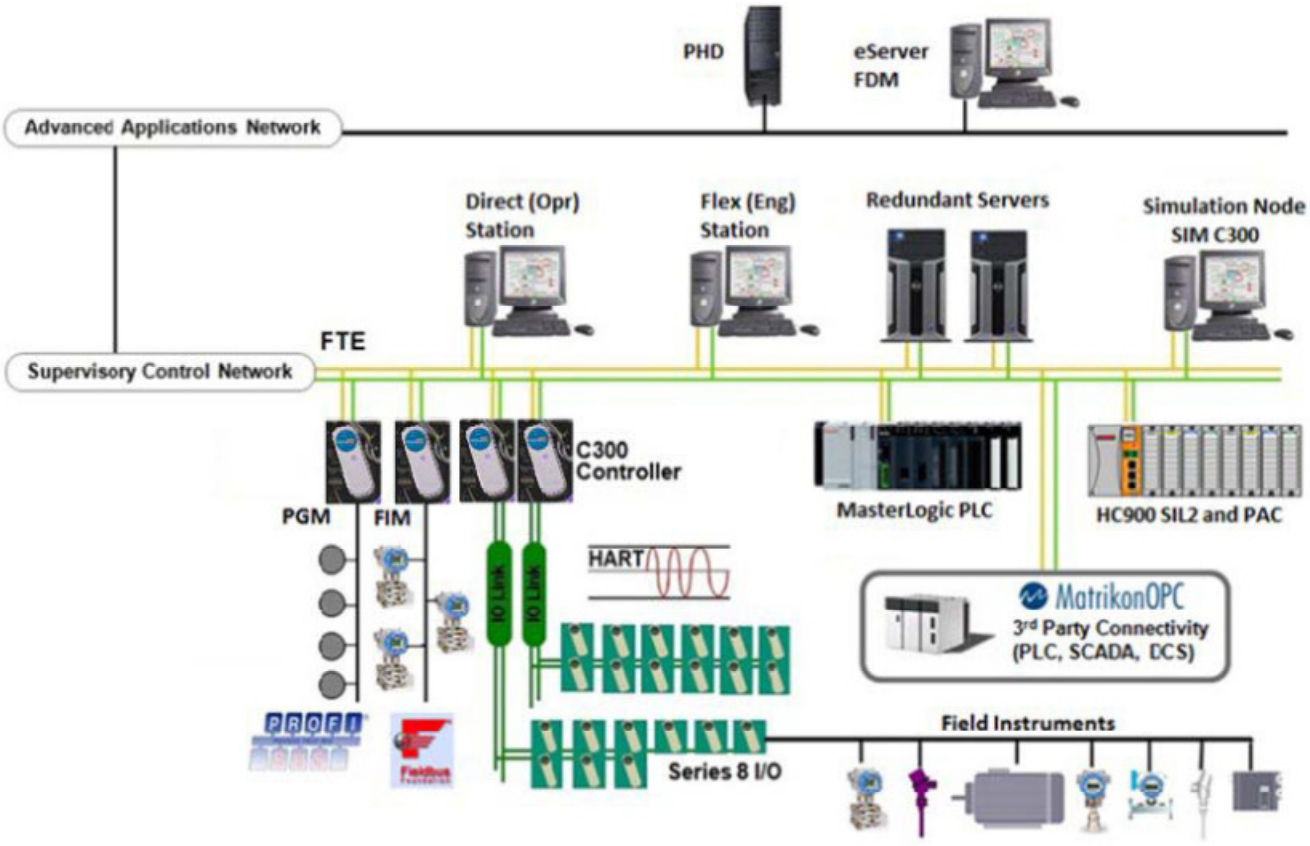

Figure 1. Sample Experion LX architecture

The Experion LX platform comprises many different integrated hardware and software solutions depending upon the needs of the application. This pictured architecture is a representation of many of the possible nodes that can be used in the Experion LX architecture. Note that the architecture is highly scalable and not all nodes are necessary or required.

1.3. What is EtherNet/IP?

Ethernet/IP™ was introduced in 2001 and today is one of the most developed, proven and complete industrial Ethernet network solutions available for industrial control and automation solutions. It enables real-time control and data acquisition for discrete applications, continuous process, safety, drive, motion, and applications requiring high availability. Ethernet/IP is applicable to factory automation, process automation, and is well suited for both batch and continuous operations.

Ethernet/IP is the name given to the Common Industrial Protocol (CIP™), as implemented over standard Ethernet (IEEE 802.3 and the TCP/IP UDP protocol suite). Ethernet/IP is a high-level industrial application layer protocol for industrial automation applications that uses the tools and technologies of traditional Ethernet. Ethernet/IP uses all the transport and control protocols used in traditional Ethernet including the Transport Control Protocol (TCP), the Internet Protocol (IP) and the media access and signaling technologies found in off-the-shelf Ethernet interfaces and devices.

Different device types (like I/O, drives, motor starters, valves, transmitters, bar code readers, etc.), from a large list of different vendors can be interfaced to the control system using ETHERNET/IP. This allows the user to satisfy a broad spectrum of process control needs using a single technology. The valuable information available in each Ethernet/IP device can be used to reduce time and effort during the project cycle and augment operations, and enable more effective maintenance during the life of the plant.

The Common Industrial Protocol (CIP™) encompasses a comprehensive suite of messages and services for the collection of automation applications—control, safety, synchronization, motion, configuration and information. Further, it allows users to integrate these manufacturing applications with enterprise-level Ethernet networks and the Internet.

In addition to Ethernet/IP, CIP has also been implemented over other network technologies such as DeviceNet™, ControlNet™, and CompoNet™.

EtherNet/IP™ and CIP™ are managed by ODVA. ODVA publishes *The EtherNet/IP Specification* and helps ensure compliance through conformance testing. More information is available at the ODVA website

WWW.ODVA.org

1.4. About The C300 Ethernet/IP Solution

1.4.1. C300

Starting in Experion LX R120, EtherNet/IP is implemented as a licensed option for the C300 controller. A single license is required (per C300 or redundant pair) that enables access and use of all Ethernet/IP features for that controller. An Ethernet/IP enabled C300 can communicate with Ethernet/IP compliant devices connected on Ethernet/IP networks. Data accessed from Ethernet/IP devices (reads and writes) can be used for control and indication.

The Ethernet/IP solution provides access to valuable device information to augment operations and enable more effective maintenance through the collection and reporting of Ethernet/IP device diagnostics. Diagnostics are automatically collected and propagated to the Experion LX Alarm/Event system.

1.4.2. Ethernet/IP Device - Data Access

The C300 can connect to compliant Ethernet/IP devices (I/O, Drives, MCCs, etc.) to access the usual process data (Analog Inputs, Analog Outputs, Discrete Inputs, and Discrete Outputs). This data is then easily implemented into the controller and logic scheme using the drag and drop functionality (and other engineering support tools and utilities) available in the Experion Control Builder application. Diagnostic information is also collected and reported against the Ethernet/IP device.

Summary of C300 to Ethernet/IP device data exchange:

- Ethernet/IP Device reads/writes … (Analog Inputs, Analog Outputs, Discrete Inputs, and Discrete Outputs)
- Ethernet/IP Device diagnostics … Automatically collected and reported to the Experion Alarm/Event Server
- ControlLogix Processor… Read/write data exchange using UDTs (User Defined *data* Type)

1.4.3. UDT (User Defined data Type) Feature

This Ethernet/IP feature provides effective and efficient support for UDTs that reside in Rockwell ControlLogix processors. Users programming ControLogix processors can create what are referred to as UDTs. These are user defined Tags assigned to blocks of data with structures and data formats that support some particular aspect of the PLC program. UDTs provide a very effective and efficient method for the C300 to communicate (read and write data) with the ControLogix PLC.

Users can create UDT tags in Control Builder that exactly match the data format of UDTs in the ControlLogix processor. These UDTs are then used in Control Modules to easily and efficiently communicate with their corresponding UDT in the ControlLogix processor. This provides an effective and efficient mechanism to transfer data between the C300 and the ControlLogix processor. UDTs can consist of arrays of different data types (numeric, discrete, string, float, etc.). In Control builder the various UDT data are made available by exposing pins on the UDT block.

Users can implement UDT data to create (PLC related) status/alert/diagnostic events. These events can then be propagated to the Experion Alarm/Event Server and the associated System Status display.

Note: UDT read/write data formats:

- Supported data types… Integer, Float, Boolean, String.
- Note: String write operations (C300 to ControlLogix) are not supported in (R430.1).

1.4.4. Experion LX HMI

The Ethernet/IP solution is fully supported by Experion LX Station. Ethernet/IP device data combined with the powerful features inherent in Station can be used to greatly augment operations by providing easy access to valuable information. Station converts device data into information through operator Custom Graphics, standard Ethernet/IP device displays, solution faceplates, and device Detail displays (just to mention a few).

Ethernet/IP device diagnostics are also collected and propagated to the Alarm/Event Server and appear on the System Status display. This quickly brings device abnormalities to the attention of the operator enabling them to react faster to conditions that could have a negative impact on the continued and safe operation of the process and plant.

1.4.5. Ethernet/IP Devices Validated with R120

The following devices are validated with the R120 release and have corresponding function blocks in CB:

Rockwell Armor point I/O, as follows:

Module	Type	Channels	Signal Type
1738-AENT	Adaptor	N/A	N/A
1738-IB4DM12	DI	4	Sinking 24 Vdc
1738-IB8M12	DI	8	Sinking 24 Vdc
1738-OB2EPM12	DO	2	24 Vdc
1738-OB8EM12	DO	8	24 Vdc
1738-OA2M12AC3	DO	2	120V ac, 220V ac
1738-OE2CM12	AO	2	(4-20 ma)
1738-OE4CM12	AO	4	(4-20 ma)
1738-IE2CM12	AI	2	(4-20 ma)
1738-IE4CM12	AI	4	(4-20 ma)
1738-IT2IM12	AI	2	TC, Milli-volt
1738-IR2M12	AI	2	RTD, resistance

Rockwell Armor Block I/O, as follows:

Module	Type	Channels	Signal Type
1732E-IB16M12DR	DI	16	with diagnostics
1732E-IF4M12R	AI	4	High Level Current/voltage
1732E-OF4M12R	AO	4	High Level Current/voltage
1732E-IT4IM12R	AI	4	T/C, MV
1732E-IR4IM12R	AI	4	RTD, resistance

Rockwell Power Flex 755 Drive

The 755 Power Flex drive is qualified.

Rockwell E3 and E3+ Solid-State Overload Relay

The E3 and E3+ relays are qualified with the Rockwell 193-DNENCATR Adapter. Models tested, E3 (592-EC1AC) and E3+ (193-EC2PB).

1.4.6. Generic Infrastructure and the Integration of New Ethernet/IP Devices

To allow for the addition of new Ethernet/IP devices without upgrading the Experion release, a “Generic Infrastructure” is part of Experion LX R120. Ethernet/IP devices (not listed above) must be integrated and tested by Honeywell.

Contact your Honeywell representative to request the integration and testing of a new Ethernet/IP device.

1.5. Ethernet/IP Architecture and Topology

1.5.1. Overview

Refer to Figure 2 for a simplified topology diagram of the C300 EtherNet/IP solution. As shown in this diagram, the EtherNet/IP network and connected Ethernet/IP devices are interfaced to Experion (and the C300) through a Tofino Firewall connected to a Level-2 FTE switch. As noted, Ethernet/IP Star, Linear Bus, and Ring topologies are supported.

A Tofino Firewall (loaded with the appropriate security software) must be used with the Ethernet/IP solution to protect the FTE network from cyber attacks that may originate on the Ethernet/IP network.

Important: As shown, the Ethernet/IP network must interface to the FTE network using the Yellow switch.

1.5.2. Hardware Requirements

The following summarizes the key hardware requirements for the Ethernet/IP solution:

1. EtherNet/IP is only supported in Experion LX high capacity topology
2. A DLink DES 3528 or Huawei Quidway S2326TP-EI-AC switch (and above) must be used as the Level-2 FTE switch that connects the Ethernet/IP network.
3. Only Rockwell **Stratix 8000** switches are qualified for use with the R120.1 Ethernet/IP solution.
4. A **Tofino Argon Security Appliance (Firewall)** FA-TSA-100 must be used to isolate the FTE network from the Ethernet/IP network. Appliance must be loaded with an **LSM** (Loadable Security Module) appropriate for use with ETHERNET/IP.

Note: For setup and configuration details refer to the Experion LX ***R120 Network and Security Planning Guide***

1.5.3. Solution Licensing

One license per C300 (or redundant C300 pair) is required to enable access to all R120 Ethernet/IP functions and features for the associated C300 (or redundant pair).

Ethernet/IP license model number …. **LX-EPLX01**

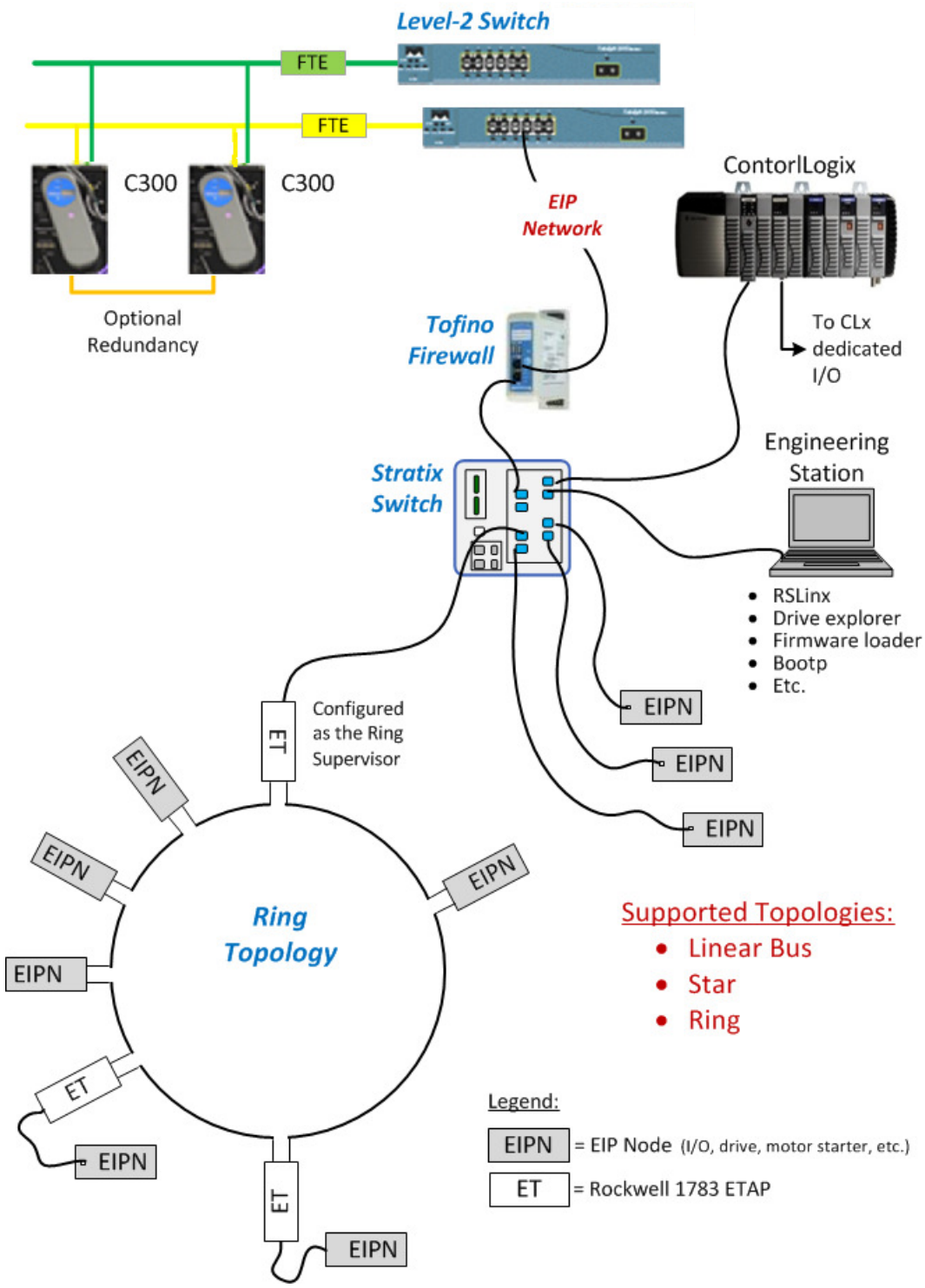
Level-2 Switch
FTE
FTE
C300
C300
Optional Redundancy
EIP Network
ContorlLogix
To CLx dedicated I/O
Tofino Firewall
Stratix Switch
Engineering Station
RSLinx
Drive explorer
Firmware loader
Bootp
Etc.
ET
Configured as the Ring Supervisor
EIPN
EIPN
EIPN
EIPN
EIPN
EIPN
EIPN
EIPN
ET
ET
EIPN
EIPN
Ring Topology
Supported Topologies:
Linear Bus
Star
Ring
Legend:
EIPN = EIP Node (I/O, drive, motor starter, etc.)
ET = Rockwell 1783 ETAP

Figure 2 – Simplified EtherNet/IP Topology Diagram

1.6. Solution Configuration within Control Builder

1.6.1. Control Builder

All control related configuration is completed within Experion LX CB (Control Builder). Ethernet/IP devices (I/O, Drives, motor starters, etc.) are easily added to the system using drag and drop techniques provided by CB and device-specific blocks created for the Ethernet/IP solution. Ethernet/IP device I/O is then available and can quickly and efficiently be utilized for control and logic using the Ethernet/IP I/O channel blocks contained in the CB Library. Solution Engineering is fully supported by the many engineering efficiency tools provided by Control Builder.

For details about solution configuration see the R120 **"Experion LX Control Building User's Guide".**

1.6.2. Additional Configuration Tools

Refer to Figure 2. As shown, additional engineering tools (provided by the associated device vendor) can be implemented on the Ethernet/IP network to perform more in-depth asset management beyond the scope of Control Builder.

2. Ethernet/IP Capacity, Rules, and Specifications

2.1. Ethernet/IP Configuration Rules

If one C300 is enabled for Ethernet/IP, the associated FTE Community is governed by the following rules:

1. Maximum number of FTE Nodes per Community is reduced from 330 FTE nodes to 200 FTE Nodes.
2. In addition to 200 FTE Nodes in item 1, the community can also have up to 200 Non-FTE Nodes. Non-FTE Nodes are things such as network printers, terminal servers, Martikon servers, etc.
3. The Non-FTE node IP address range is used to connect any Ethernet/IP nodes or ControlLogix processors to the C300. This limits the number of Ethernet/IP nodes to 200 minus any other nodes using this Non-FTE node address resource.
4. Optional C300 Controller redundancy is supported on a C300 that is EtherNet/IP-capable.
5. A Tofino Firewall configured to only allow Ethernet/IP communications must be connected between the C300 (level-2 FTE switch) and any Ethernet/IP Devices and/or ControlLogix PLCs.
6. Ethernet/IP communication is supported between a C300 and EtherNet/IP devices that are connected in a….
    a. Switched star topology.
    b. Linear bus topology.
    c. Ring topology.
7. When a ControlLogix PLC has dedicated I/O, this I/O should be connected on an isolated and separate downlink ENET card in the ControlLogix chassis. It should not be connected directly to the Stratix switch network.
8. Rockwell tools should be located on a separate PC connected directly to the Stratix switch.
9. The level-2 Cisco switch must be a model 2960 or higher.

2.2. Ethernet/IP Performance and Capacity

Description	Limit	Units
Maximum number of parameters per UDT (User Defined data Types)	64	Parameters[1]
Maximum size of a UDT (User Defined data Type)	256 write 480 read	bytes bytes
Maximum User Defined Tags (UDTs) per C300 to all ControlLogix PLCs combined	65	UDTs
Maximum end to end control latency for EtherNet/IP analog I/O loops (under steady state conditions)	500	milliseconds
Maximum end to end control latency for EtherNet/IP digital I/O loops (under steady state conditions)	250	milliseconds
Maximum number of writes per C300	65	65 parameter writes outstanding per C300
Maximum latency (time to read a tag from or write a tag to ControlLogix) for ControlLogix tag reads and writes under steady state conditions	500	milliseconds
Maximum number of non-FTE Nodes per FTE Community when using ETHERNET/IP[2]	200	Non-FTE Nodes
Maximum number of FTE Nodes per FTE Community when using ETHERNET/IP[3]	200	FTE Nodes
Maximum number of ControlLogix processors per C300 that can be connected for tag access	4	ControlLogix PLCs/C300
Maximum number of IP Addresses per C300 that can be connected with Ethernet/IP communications	70	IP Addresses
Maximum number of Devices per C300 that can be connected using Ethernet/IP communications	70	Ethernet/IP Devices
C300s (redundant or non-redundant) per cluster (any mixture of Ethernet/IP or non-Ethernet/IP C300s)	20	C300s
Console Stations per cluster when using Ethernet/IP	20	Console Stations
NOTES: 1. For arrayed parameters, each array element shall count as a parameter. 2. Ethernet/IP Nodes and Devices count against this limit. 3. Reduced from the standard 330 FTE Nodes per Community.		

2.3. C300 Loading

Use the calculations below to provide a high level estimate of the loading of the C300 due to the Ethernet/IP solution. This will provide a high level understanding for C300 CPU resources used to support the Ethernet/IP solution.

A more complete calculation that includes all other C300 loading items (like Series C I/O, Foundation Fieldbus, Control Modules, etc.) must be completed to determine the total % CPU used by the planned implementation.

2.3.1. Loading Due to I/O Modules

Use the calculation below to determine the loading of the C300 due to Ethernet/IP I/O modules.

$$\%\ \text{CPU Used} = \left(77 \frac{\#\ \text{of I/O Modules}}{\text{RPI (milli-seconds)}} \right) + 0.3$$

RPI = Requested Packet Interval (range 50 to 2000 ms)

Note: The RPI is a user entered value in the range.

2.3.2. Loading Due to 755 Drive or E3/E3+ Smart Relay

Use the calculation below to determine the loading of the C300 due to Drives and E3/E3+ Relays

$$\%\ \text{CPU Used} = \left(125 \frac{\#\ \text{of Drives and/or E3/E3+ Devices}}{\text{RPI (milli-seconds)}} \right) + 0.3$$

RPI = Requested Packet Interval (range 50 to 2000 ms)

Note: The RPI is a user entered value in the range.

2.3.3. Loading Due to UDT Tags

Calculating the UDT loading of the C300 can be complex due to the number of variables that need to be considered in the calculation. The following example is meant to provide general idea of the CPU processor resource consumed by UDTs. One key variable is the RPI (Requested Packet Interval) setting. This is a user entered value (50 to 2000 ms) for each UDT. As shown in the example below, longer RPI settings will use less C300 processing resources. Contact your Honeywell representative for more details.

For 40 UDTs reading messages 424 bytes in size and writing 35 parameters per second:
RPI = 250 mSec ….. uses 18% CPU
RPI = 1000 mSec ….. uses 13.25% CPU
RPI = 2000 mSec ….. uses 6.44% CPU

3. Model Numbers and Solution Licensing

3.1.1. C300 License

One license per C300 (or redundant pair) is required. Model Number **LX-EPLX01**

3.1.2. Tofino Firewall

A **Tofino Argon Security Appliance (Firewall)** must be used to isolate the FTE network from the Ethernet/IP network. Appliance must be loaded with an **LSM** (Loadable Security Module) appropriate for use with ETHERNET/IP.

For package options, ordering, and pricing details contact Frank Williams at Belden….
Frank.Williams@Belden.com

For general product information go to www.tofinosecurity.com

Component list:

- The Tofino Security Appliance (FA-TSA-100) ….. Required
- Loadable Security Modules (LSM) …… Required
- Software Licenses …… Required
- Tofino Central Management Platform (CMP) ….. Optional

3.1.3. Rockwell Stratix 8000 Switch

The Stratix 8000 switch with IOS firmware is used for connecting the EtherNet/IP-compatible I/O devices and the ControlLogix PLC to the C300 controllers.

For more information about Stratix 8000, refer to the ***R120 Network and Security Planning Guide***.

For more information
To learn more about Honeywell's products or solutions visit our website www.honeywellprocess.com or contact your Honeywell account manager.

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