Honeywell

Technical Information

ExperionPKS C300 Controller Capacity

EP03-300-511

[Keywords]

July 2019, Version 1

Revision History

Revision	Date	Description
1	July 16, 2019	Initial version – R511 release

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1.0 Product Introduction

1.1 Experion System

The Experion® Process Knowledge System (PKS) is Honeywell's unified control system for process, business, and asset management that helps industrial manufacturers increase their profitability and productivity. Experion takes customers well beyond distributed control system (DCS) functionality with an advanced automation platform solution and innovative application integration to improve business performance and peace of mind.

Refer to the "**Experion CEE-based Controllers and I/O Overview" (**document number **EP03-290-xxx**) for prerequisite information. This document is written with the expectation that the reader understands the information and concepts covered in the overview document.

1.2 Architecture Overview

The ExperionPKS 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 utilized in the ExperionPKS architecture. Note that the architecture is highly scalable and not all nodes are necessary or required.

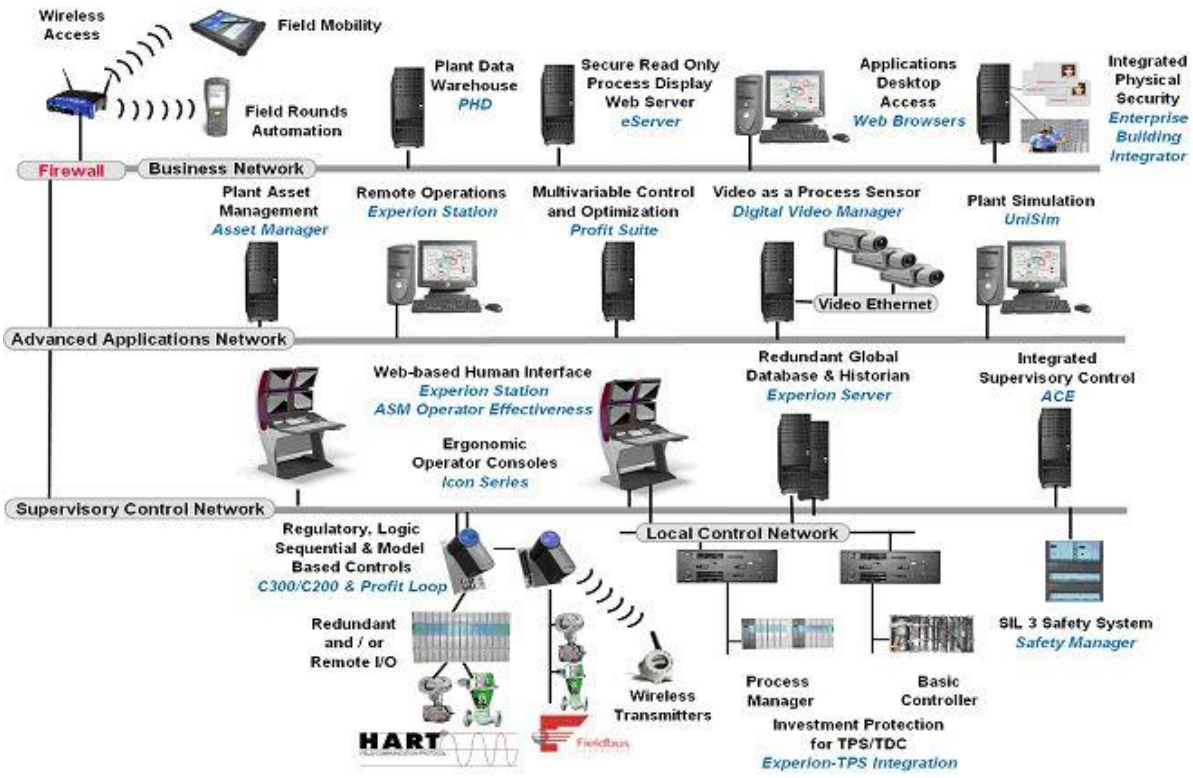

Figure 1 - Sample Experion Architecture

1.3 Experion Controller Overview

Honeywell offers multiple ExperionPKS controllers, ranging from embedded controller platforms with dedicated IO hardware to PC based control environments for supervisory control tasks or simulation. They all support one or more different network types to integrate the controllers with the ExperionPKS Server. They share a common Control Execution Environment (CEE) software infrastructure and a common builder tool. Together with the different station types, they form the ExperionPKS system. This specifications document provides details specifically related to the ExperionPKS C300 controller.

2.0 Control Capacity and Performance

2.1 Controller Definitions

In the following sections of this document the generic term “Controller” is used to reference various capacity and performance limits. Unless specifically noted differently, the following table defines what is meant by the term “Controller” when the specific controller type is not mentioned:

Non-Redundant Controllers:	Redundant Controllers:
1 **C300** connected via FTE to a pair of CF9s (Yellow & Green) which are then connected to the L1 FTE Control Network	2 **C300s** configured as redundant pair connected via FTE to the same pair of CF9s (Yellow & Green) which are then connected to the L1 FTE Control Network
1 **SIM-C300** configured in an SCE computer and connected to the simulation network[1]	
Note 1 SIM-C300 also count against Peer-Peer limits when it is configured for P2P communications with “On-line” controllers.	

2.2 Control Network Capacity

The following Table specifies FTE network capacity limits.

FTE	Capacity
Supervisory Networks per Experion Server:	1 redundant network serviced by 1 or more redundant or non-redundant EPKS Servers up to the max FTE Nodes allowed per FTE Community [1]-2
Maximum Number of Nodes allowed:	330 FTE Nodes per FTE Community [1] - 1
Ethernet (non-FTE) Connections	200
Controllers per Server	Up to **60** Redundant or Non-Redundant [1] – 3,4
Foundation Fieldbus Interface (FIM2/FIM4/FIM8)	Supported, see FOUNDATIONTM Fieldbus Performance Limits
Transmission Rate	100 Mbits/sec 10 Mbits/sec for FTEBs

Notes [1] for FTE Ethernet:

1. When any FTEB or C300-20ms is present in the FTE Community, or if EtherNet/IP™ (EIP) is being deployed by one or more C300s in the FTE Community, the limit is 200 FTE Nodes.
2. SCADA connected PLCs can still be connected via ControlNet/PCIC when C200s, C200Es, or C300s reside on the FTE Supervisory Control Network.
3. SCADA PLCs do not count as “Controllers” against this limit on FTE
4. 60 controllers in any combination of CEE based Controllers (C200, C200E, C300, UOC, vUOC) and/or CDA-capable controllers (Safety Managers (Max 20), and/or PMD Field Controllers (Max 25), and/or EHPMs (defined in Section 16.3 EHPM Capacities)

Table 2.2

2.3 C300 Capacity and Performance

2.3.1 C300 Configuration Options

C300 Configuration Options		
	50 ms CEE	**20 ms CEE[4]**
Control Networks Supported	FTE only [1]	FTE only [1]
Supported C300 Models [6, 7]	CC-PCNT01 CC-PCNT02	CC-PCNT01 CC-PCNT02
Device Index Configuration	Between 1 and 510	Between 1 and 510
IOTA Size	6 inches	6 inches
Number of I/O Links Supported	2	2
I/O Link Speeds Available	375 Kbaud (PMIO Link) 750 Kbaud (Series C IO Link)	750 Kbaud (Series C IO Link) ***375 Kbaud (PMIO Link) is not supported***
Base Execution Periods Supported	50 ms	20 ms (optional)[4]
Redundancy Supported	Yes	Yes
Remote – Non-Series C I/O Supported	Yes – PM I/O or Series A I/O [3]	No – Only Series C I/O supported with limited capacities.
I/O Module Execution Period	50 ms	20 ms
Configurable Values for CM/SCM/RCM Execution Periods [5]	50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 300000, 60000 ms.	20, 40, 80, 200, 400, 800 ms. *CMs Only – SCM/RCM/MR not supported*
Configurable Values of Peer Update Rates (period). *Defines the period at which data is updated for all 'pull/get' requests for peer data required by all blocks within a CEE.*	100, 200, 500, 1000 ms.	100, 200, 500, 1000 ms.
C300 Time Source	SNTP, PTPv2	SNTP, PTPv2
SNTP Update Period	1 minute	1 minute
GPS Time Support[2]	No	No
PTP Update Period	30 seconds	30 seconds

Note 1 – Currently, every C300 must be connected to a Control Firewall

Note 2 – A GPS connector is available on the IOTA, but it is not supported until a future release.

Note 3 –C300 20ms supports only Series C I/O.

Note 4 – Requires separately loaded Firmware Version and License. C300 20 ms CEE may ONLY be used for Honeywell Turbine Control Solution (TMCS) in R410.1.

Note 5- Slower execution periods are supported for Profit Controller Block only

Note 6- C300 controller CC-PCNT02 replaces CC-PCNT01 for new installations and field replacements.

Note 7- C300 controller must use CC-PCNT02 model with extended functionality firmware image for C300 extended functionalities (EIM, Profit Controller)

2.3.2 C300 Redundancy

C300 Redundancy Specifications		
	50 ms CEE	**20 ms CEE[4]**
C300 Function Block Redundancy Configuration Selection:	"Module is Redundant"	"Module is Redundant"
Number of IOTAs used for Redundant C300	2	2
Redundant Device Index Configuration	Device Index = n, where n is an odd value Partner Device Index = n+1	Device Index = n, where n is an odd value Partner Device Index = n+1
Redundancy Cable Medium	Ethernet STP	Ethernet STP
Redundancy Cable Lengths	36, 48, 60, 84 inches	36, 48, 60, 84 inches
Control Processing Switchover Interruption Time[1,2]	500 ms	200 ms
Initial Synchronization Time (from Sync Start to Completion)	240 seconds	240 seconds
Maximum Elapsed Time Between Commanded Switchover and Completion of Initial Synchronization	500 seconds	500 seconds
Maximum Elapsed Time Between Switchover Due to Power Cycle of the Primary and Completion of Initial Synchronization	500 seconds	500 seconds
Maximum OPM Control Freeze time	20 seconds	20 seconds
Note 1 – Dual I/O Link failures may cause longer interruption times in the order of several seconds. Note 2- With Direct or Through EIM- C300-EtherNet/IP™ configuration, control processing switchover interruption time may go up to 2.5 seconds during C300 Switchover.		

2.3.3 C300 Communication Performance

C300 Communications Performance		
Definitions: *PPS = Average Parameters Per Second* *PPM = Average Parameters Per Minute* *EPS = Average Array Elements Per Second*	**C300**	
Overall Data Access Performance	**50 ms CEE**	**20 ms CEE**
Maximum Total Parameter Access Response Rate *(Includes all Server Data Requests, Console Station Data Requests, and peer communications including other ACEs, C200s, C300s, SIM-C200s, SIM-C300s, SIM-ACEs, and FIMs)* [13]	2500 PPS	700 PPS
Display Data Access Capacity	**50 ms CEE**	**20 ms CEE**

C300 Communications Performance		
Maximum Total Subscribed Parameters per C300 *(Includes all Server Data Requests + Console Station Data Requests))* [13]	4000	4000
Request/Response Data Access Performance	**50 ms CEE**	**20 ms CEE**
Max Request/Response Parameter Access Rate *(Includes all Slow Server Data Requests, e.g. Greater than 10 sec OPC data, Slow History, Data Writes, etc.)*	3000 PPM Read 1500 PPM Write	750 PPM Read 375 PPM Write
Peer-to-Peer Performance	**50 ms CEE**	**20 ms CEE**
Maximum Initiator Pull/Get Subscribe Rate to all target nodes. (incoming data) [7]	1000 PPS	250 PPS
Maximum Target Publish Rate to Pull/Get Subscriptions from all initiator nodes. (outgoing data) [8]	1000 PPS	250 PPS
Peer-to-Peer Subscription Capacity / Update Rate	**50 ms CEE**	**20 ms CEE**
Total Maximum C300 peer capacity per update rate choices	100 @ 100 ms 200 @ 200 ms 500 @ 500 ms 1000 @ 1 sec	25@ 100 ms 50 @ 200 ms 125 @ 500 ms 250 @ 1 sec
Maximum C300 peer capacity for non-CEE parameter references (Includes peer references to SM, PMD FC, EHPM, and Server Point parameters and is included in the total limit for the row above)	500 parameters	NA
Push/Store Request Capacity	**50 ms CEE**	**20 ms CEE**
Maximum number of Push/Store Requests to all target nodes and local IOLink EEs, in progress simultaneously	800	800
Maximum number of Push/Store Requests initiated in a single CEE execution cycle	200	200
Push/Store Request Performance	**50 ms CEE**	**20 ms CEE**
Maximum Push/Store Request Rate to all target nodes and local IOLink EEs[2]	50 PPS	12 PPS
Maximum Response Rate to Push/Store Requests from all initiator nodes[2]	50 PPS	12 PPS
Whole Array Capacity	**50 ms CEE**	**20 ms CEE**
Max Array Size for Whole Array Transfer	8K bytes (1000 float64s)	8K bytes (1000 float64s)
Initiator's Max Whole Array Connection References	25	25
Responder's Max Whole Array Connections (from all peers using pub-sub)	15	15
Initiator's Max Whole Array Connection References (to all peers using request/response)	5	5

C300 Communications Performance		
Responder's Max Whole Array Connections (to all peers using request/response)	5	5
Peer-Peer Whole Array Transfer Performance	**50 ms CEE**	**20 ms CEE**
Max Initiator Whole Array Request Rate (to all peers)	2500 EPS	600 EPS
Max Target Node Response Rate to Whole Array Pull/Get Requests *(from all initiator nodes)*	1500 EPS	350 EPS
Initiator Whole Array Push/Store Rate	1000 EPS	250 EPS
Target Node Whole Array Response Rate to Push/Store Requests *(from all initiator nodes)*	1000 EPS	250 EPS
Peer-to-Peer Capacity	**50 ms CEE**	**20 ms CEE**
Peer Connection Units (PCUs) [2, 9] *(Number of remote CEEs that this C300 can initiate a peer connection with)*	30[3] *(Includes total of all other UOC/vUOC, ACEs, SIM-ACEs, C200s, C200Es, C300s, LIOMs, SIM-CXXXs, IOLIMs, Server Peers, SMs, WDMs, and/or Primary FIMs)*	5[3] *(Includes total of other UOC/vUOC,ACEs, SIM-ACEs, C200s, C200Es, C300s, SIM-C200s, SIM-C200Es, SIM-C300s)*
Peer-to-Peer Capacity using Exchange FB	**50 ms CEE**	**20 ms CEE**
Maximum Number of REQUEST blocks per C300	32	Not Supported
Maximum Number of RESPONSE blocks per C300	32	Not Supported
Maximum Number of Target Devices for REQUEST blocks per C300 [4]	8	Not Supported
Maximum Number of Remote Initiating Devices for RESPONSE block data per C300	8	Not Supported
Maximum Request Rate using Exchange blocks to all target nodes[11]	500 PPS	Not Supported
Maximum Response Rate to Exchange Requests from all initiator nodes [11]	500 PPS	Not Supported
PCDI Capacity and Performance	**50 ms CEE**	**20 ms CEE**
Maximum Number of Modbus TCP devices [5,10] (represented by PCDI Master blocks)	8	3
Maximum Number of Serial Modbus Devices per Gateway	16	3
Maximum Number of Serial Modbus Devices per C300 (8 * 16 of above two specifications)	128	3
Maximum Number of PCDI Request blocks assigned to a PCDI Master block	64	8

C300 Communications Performance		
Maximum Number of PCDI Request block messages per second – includes both Reads and Write [6] (maximum size 256 byte messages assumed)	250	30
Process Data Access (PDA) Capacity and Performance	**50 ms CEE**	**20 ms CEE**
Maximum number of PGM PDA connections per C300	4	Not Supported
Maximum number of Decentralized Periphery (DP) networks per C300	8	Not Supported
Maximum number of PIOMB blocks per C300 Controller [12]	640 Decentralized Periphery (DP) devices	Not Supported
Maximum number of Process Data Collection (PDC) messages per second – includes both Reads and Write (maximum size 256 byte messages assumed)	2500 PDC messages per second	

Note 2 – Exchange Peer-Peer does not count against this limit.

Note 3 – There are 31 connections reserved for Peer-Peer in the C300. 1 connection is reserved for Internal C300 use-only, leaving 30 connections available for User P2P configurations.

Note 4 – 1 DHRIO Module only counts as 1 Target Device even when communicating with multiple PLCs on either of the two DH+ networks per DHRIO.

Note 5 – Redundant devices that use two PCDI Master blocks count as only one device. Secondary test messages do count in the messages per second for C300 performance estimation.

Note 6 – PCDI impact on C300 performance can be estimated with the C300 Performance Model worksheet (see section 2.3.4); important factors are number of PCDI Master blocks, number of PCDI Request block messages per second, and message data size.

Note 7 – Incoming peer data benefits from the RBE (Report by Exception) comparisons done at the data source, so only changed parameters contribute to the incoming PPS load.

Note 8 – Outgoing peer data capacity is defined/measured before the RBE (Report by Exception) comparisons are done, so all parameters requested as peer data contribute to the outgoing PPS load, whether they are changing or not and sent over the network or not.

Note 9 – CDA Peer connection to a redundant SM consumes 2 PCUs.

Note 10 – PCDI Licenses per Server is limited to 256 total PCDI Device Blocks for all C300s and ACEs combined.

Note 11 - Float, integer, or BOOLEAN values configured constitute one parameter

Note 12- Number of PIOMB blocks that can be instantiated or loaded to the C300 is limited by the C300 CEE memory, and CPU.

Note 13- Overlap between controller CDA peer and display responder requests was removed for C300v2 and C300E in R510 release to prevent loss of peer communication during high display subscriptions from process operational displays.

2.3.4 C300 Processing and Memory Capacity Model

The C300 Processing and Memory Capacity Model has been developed to identify the major factors that influence the performance of the C300 Controller.

2.3.4.1 C300 Processing

The Figures below provides a simplified view of C300 Controller CPU usage. CPU in the C300 Controller is primarily used for three purposes – executing control strategies, communicating with the IO Links, and communicating with other entities outside the C300, such as peer nodes and displays.

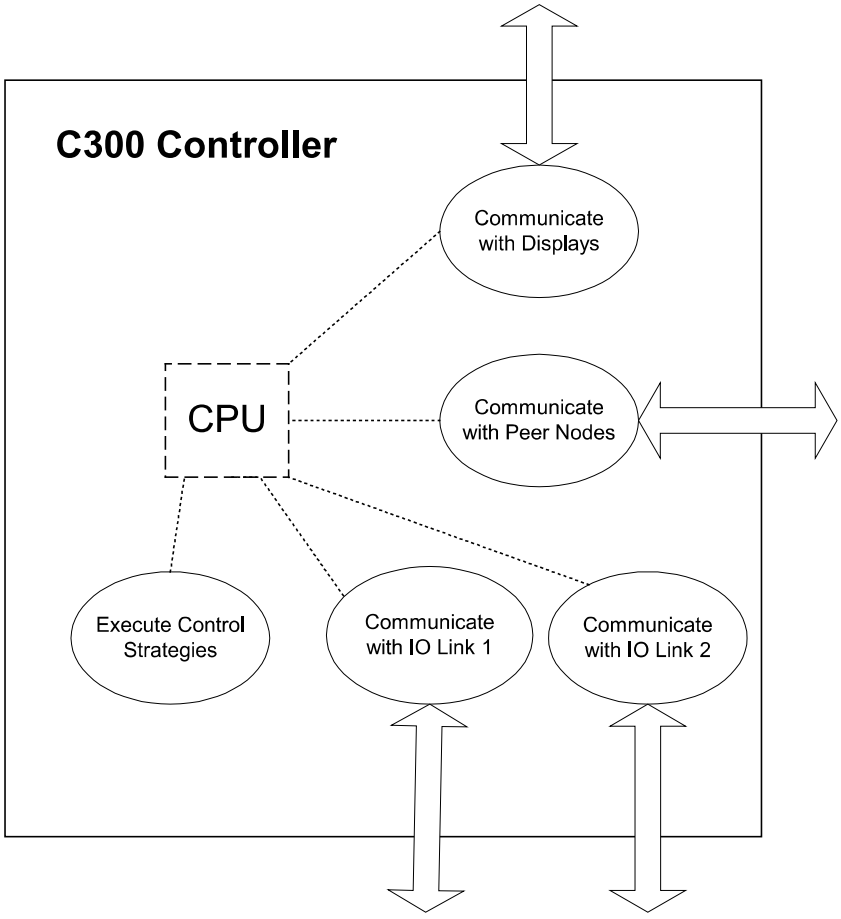

Figure 2.3.4.1 - C300 CPU Usage

The key specification for C300 performance is as follows.

- C300 – 50ms has **5500 XUs available** for user Control, IO, and Communication needs
- C300 – 20ms has **5000 XUs available** for Control, IO, and Communications needs, although various operations and strategy configurations will contribute added XU weights to the calculations in this higher speed CEE (See note below)

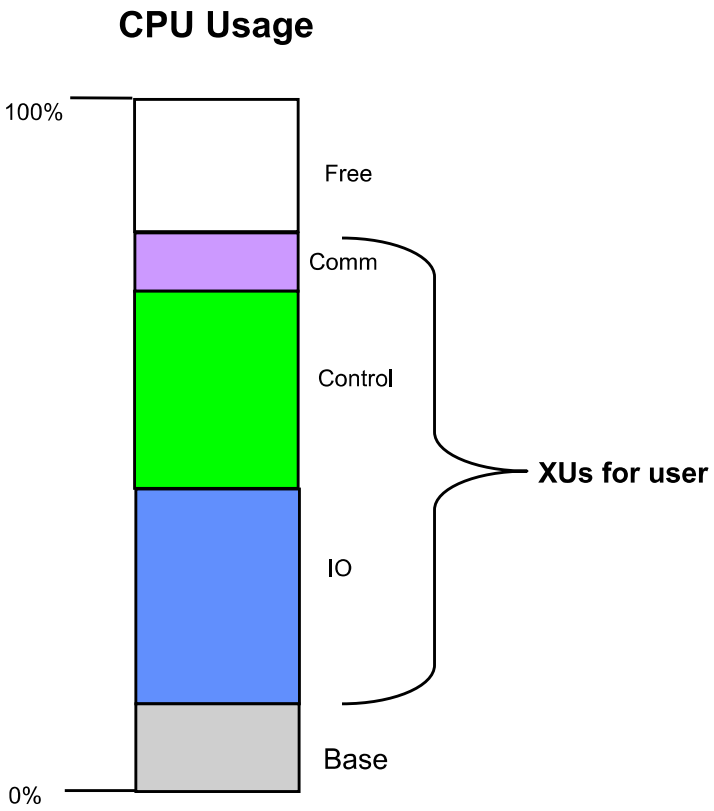

Figure 2.3.4.1 - C300 XUs Available to User

2.3.4.2 C300 Control

Control requirements of a C300 are estimated in PUs, using a PU estimation spreadsheet similar to those used for C200 and ACE. The definition of a PU (see Section 1.4) does not change with the introduction of C300, because the PU definition is platform independent. C300 PU specifications are provided for the same set of typical module types (e.g. Small Analog Data Acquisition CM, Regulatory Control CM, Device Control CM, etc.) as already documented for C200 and ACE.

PU specifications are not provided for Series C IO Modules and PM IO Modules, because the IO Module execution for these IO types is not part of CEE. Processing load attributed to the execution of Series C IO Modules and PM IO Modules is accounted for in the IO component of C300 CPU usage.

2.3.4.3 C300 IO

Performance testing has determined that the following factors have the greatest influence on the amount of CPU used to support and communicate with IO.

- IO Link 1 Type – PM IO, Series C IO, or None
- IO Link 2 Type – PM IO, Series C IO, or None
- IO Link 1 LUs – estimated from LU estimation sheet
- IO Link 2 LUs – estimated from LU estimation sheet
- Number of FTEB supported IO modules

The C300 performance model estimates the XUs required to support IO, when provided with estimates for the above factors.
The LU estimation worksheet contains all the details needed to estimate the LUs associated with a given IO Link and its complement of PM IOPs or Series C IOMs. To summarize, the number of LUs is dependent on the following items.

- Link Type - PM IO or Series C IO
- Number of IO Modules, and for each its type (AI, AO, DI, DO, etc.), scan rate, and redundancy configuration
- Number of AO connections – quantity and rate
- Number of DO connections – quantity and rate
- Number of SCM reads and writes per second of IO Link data

2.3.4.4 C300 Communication

Performance testing has determined that the following factors have the greatest influence on the amount of CPU used to communicate with peer nodes and displays. A conscious effort has been made to keep the number of input factors to a minimum to keep the C300 performance model as simple as possible while maintaining its usefulness and accuracy. The model has been refined to the point that only these major factors need be input to the spreadsheet. The XUs required to support the specified communications are calculated automatically from these inputs.

- # of Peer Connections (node type is not critical) – nodes considered as peers include C300, C200, ACE, FIM4
- # of Console Stations associated with Experion Server/cluster
- # of Parameters per second for display throughput
- # of Messages per second
    - # Messages/second is calculated from the number of Exchange blocks, Push block stores, and SCM block stores that initiate and respond to requests

The number of Notifications per second generated by a C300 is an example of a factor not included in the model because it is not significant when compared to the other factors listed above.