

AMP	Title	LAR1C AMP BPCS Configuration Project C300 Controller Loading Calculations - Carson			By	Xenon OptumPCP	
	Rev.					B	
	Num	747002-LAR1C-AUT-CAL-0100	Project	747002	Date	31-Jan-23	
	Type	Calculation	Owner	Automation	Pages	9	

AUTOMATION MODERNIZATION PROGRAM

LOS ANGELES CARSON REFINERY

LAR1C AMP BPCS CONFIGURATION PROJECT C300 CONTROLLER LOADING CALCULATIONS - CARSON

Revision and Approvals					
Rev.	Date	Reason for Issue	Originated By	Checked By	Approved By
B	31-Jan-23	Issued for Approval	PS	RP	JTJ
A	9-Jan-23	Issued for Review	PS	RP	JTJ



Table of Contents

Section	Title	Page
1.0	Introduction	5
1.1	General	5
1.2	Purpose of Document	5
1.3	Basis of Design	5
2.0	Acronyms and Abbreviations	6
3.0	Reference Documentation	7
3.1	Codes and Standards	7
3.2	Project Documentation	7
4.0	Controller Loading	8
5.0	Controller Summary	9

List of Tables

Table No.	Title	Page
Table 2.1	Acronyms and Abbreviations	6
Table 3.1	Codes and Standards	7
Table 3.2	Project-Specific Reference Documentation	7

Executive Summary

For the Los Angeles Refinery Carson (LAR1C) Configuration project, the migration requirement is to implement four (4) Honeywell C300 controllers.

Three (3) controllers (LEDDIB-C300-25, REF2-C300-21, and REF2-C300-23) will be configured to service the hardwired I/O requirements, and one (1) controller (SRD-C300-27) will be configured to service the hardwired and all serial I/O requirements.

The controller loading calculations for these controllers (based on the module scan time of 500ms for AI & DI; scan time of 1000ms for AO, DO, & LLMUX; and scan time of 1,000ms for logic) are as follows:

- LEDDIB-C300-25 controller calculated loading is 28.4%
- REF2-C300-21 controller calculated loading is 31.0%
- REF2-C300-23 controller calculated loading is 29.4%
- REF2-C300-27 controller calculated loading is 36.9%

Based on the controller calculations, the controllers LEDDIB-C300-25, REF2-C300-21, REF2-C300-23, and REF2-C300-27 will be operating within ranges given in the AMP BPCS and SIS Loading Guidelines (AMP-GBL-AUT-GDL-0001 Rev. A1).



Revision History

Rev.	Description	Section
A	Issued for Review	All
B	Issued For Approval	---

Assumptions

No.	Description	Section
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Holds

No.	Description	Section
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1.0 Introduction

1.1 General

The Los Angeles Refinery Carson (LARC) facility is completing an Automation Modernization Program (AMP) to replace obsolete automation equipment and to migrate the existing functionality and operability to the Honeywell Experion Process Knowledge System (EPKS) platform.

The LAR1C project scope is to migrate and/or upgrade the existing functionality and operability of identified Basic Process Control System (BPCS) consoles and controllers as well as operator and engineering stations to comply with current industry standards and practices. The migration will be from the existing Honeywell High Performance Process Manager (HPM)¹, Application Module (AM) controllers, Process Manager Input/Output (PMIO) and Basic Controllers to new Honeywell Experion C300 controllers and Series C and Universal Input/Output (UIO) and (UIO-2). The migration of the existing 3rd-party device serial interfaces to the C300 controllers shall be via either Modbus TCP/IP using Peer Communication Data Interfaces (PCDI), Ethernet Interface Module (EIM) or EPKS Server Supervisory Control and Data Acquisition (SCADA) points and Human Machine Interface (HMI) screens migrated using HMI WebBuilder.

1.2 Purpose of Document

The purpose of this document is to provide the controller loading calculations for each C300 controller based on the hardware and software signal counts and their execution periods.

1.3 Basis of Design

I/O module and I/O connection counts are considered as per the I/O List (747002-LAR1C-AUT-IOA-0100). Typical CMs and CM execution periods are considered in these control loading calculation as per the AMP Experion C300 Configuration Specification (AMP-GBL-PM-SPC-0012).

¹The scope of the HPM migration is limited to specific functions if it is determined to provide a more robust solution of the other control loops migrating to the C300 controllers.

2.0 Acronyms and Abbreviations

Table 2.1 contains definitions of the acronyms and abbreviations used within this document:

Table 2.1. Acronyms and Abbreviations

Abbreviation	Description
AI	Analog Input
AM	Application Module
AMP	Automation Modernization Program
AO	Analog Output
Aux	Auxiliary
BPCS	Basic Process Control System
CB	Control Box (Basic Controller)
CL	Control Language
DI	Digital Input
DHP	Data Hiway Port
DO	Digital Output
EIM	Ethernet Interface Module
EPKS	Experion Process Knowledge System
HG	Highway Gateway
HLPIU	High-Level Process Interface Unit
HMI	Human Machine Interface
HPM	High Performance Process Manager
I/O	Input/Output
LAR	Los Angeles Refinery
LARC	Los Angeles Refinery Carson
LCN	Local Control Network
LEPIU	Low-Energy Process Interface Unit
LLPIU	Low-Level Process Interface Unit
NA	Not Applicable
MPC	Marathon Petroleum Corporation
PCDI	Peer Communication Data Interface
PMIO	Process Manager Input/Output
SCADA	Supervisory Control and Data Acquisition
TPS	Total Plant Solution
UIO	Universal Input/Output



3.0 Reference Documentation

3.1 Codes and Standards

Table 3.1 provides a list of codes and standards applicable to this document.

Table 3.1. Codes and Standards

Document Number	Rev	Title
AMP-GBL-PM-SPC-0012	A0	Experion C300 Configuration Specification

3.2 Project Documentation

Table 3.2 provides a list of project-specific reference documentation applicable to this document.

Table 3.2. Project-Specific Reference Documentation

Document Number	Rev	Title
LAR AMP BPCS Documentation		
LCN1 EBs Mar2022	1	AMP LARC EB Database (Backup taken on 25 Mar 2022 from LAR site)
LCN3 EBs Mar2022	1	AMP LARC EB Database (Backup taken on 25 Mar 2022 from LAR site)
747002-LAR1C-AUT-IOA-0100	1	LAR1 AMP BPCS Configuration Project I/O List - Carson



4.0 Controller Loading

LEDDIB-C300-25 Controller Loading		
Controller Load	28.4%	
Module Consideration		
Series C IO Modules	IOM Scan Rate (mS)	# IOMs
Digital Input (Redundant)	500	2
Digital Output (Redundant)	1000	0
Analog Input (Redundant)	500	7
Analog Output (Redundant)	1000	3
LLMUX	1000	0
Series C IO Channel Writes/Connections	CM Exec Period (mS)	# IOCs
AO Connections (Output writes)	1000	25
DO SO Connections	1000	0
Control Module & Block Consideration		
Typical Control Modules	CM Exec Period (mS)	Typical Modules
Small Analog Data Acquisition Module	1000	95
Regulatory Control Module	1000	68
Auxiliary Function Module	1000	2
Small Digital Data Acquisition Module	1000	41
Device Control Module	1000	2
Logic Control Module	1000	20
PCDI Device Blocks	1000	0

REF2-C300-21 Controller Loading		
Controller Load	31.0%	
Module Consideration		
Series C IO Modules	IOM Scan Rate (mS)	# IOMs
Digital Input (Redundant)	500	1
Digital Output (Redundant)	1000	1
Analog Input (Redundant)	500	17
Analog Output (Redundant)	1000	6
LLMUX	1000	0
Series C IO Channel Writes/Connections	CM Exec Period (mS)	# IOCs
AO Connections (Output writes)	1000	55
DO SO Connections	1000	0
Control Module & Block Consideration		
Typical Control Modules	CM Exec Period (mS)	Typical Modules
Small Analog Data Acquisition Module	1000	114
Regulatory Control Module	1000	60
Auxiliary Function Module	1000	17
Small Digital Data Acquisition Module	1000	24
Device Control Module	1000	0
Logic Control Module	1000	10
PCDI Device Blocks	1000	0

REF2-C300-23 Controller Loading		
Controller Load	29.4%	
Module Consideration		
Series C IO Modules	IOM Scan Rate (mS)	# IOMs
Digital Input (Redundant)	500	9
Digital Output (Redundant)	1000	1
Analog Input (Redundant)	500	0
Analog Output (Redundant)	1000	0
LLMUX	1000	5
Series C IO Channel Writes/Connections	CM Exec Period (mS)	# IOCs
AO Connections (Output writes)	1000	0
DO SO Connections	1000	11
Control Module & Block Consideration		
Typical Control Modules	CM Exec Period (mS)	Typical Modules
Small Analog Data Acquisition Module	1000	286
Regulatory Control Module	197	0
Auxiliary Function Module	1000	27
Small Digital Data Acquisition Module	1000	158
Device Control Module	1000	12
Logic Control Module	1000	10
PCDI Device Blocks	1000	0

SRD-C300-27 Controller Loading		
Controller Load	36.90%	
Module Consideration		
Series C IO Modules	IOM Scan Rate (mS)	# IOMs
Digital Input (Redundant)	500	2
Digital Output (Redundant)	1000	2
Analog Input (Redundant)	500	5
Analog Output (Redundant)	1000	2
LLMUX	1000	0
Series C IO Channel Writes/Connections	CM Exec Period (mS)	# IOCs
AO Connections (Output writes)	1000	11
DO SO Connections	1000	2
Control Module & Block Consideration		
Typical Control Modules	CM Exec Period (mS)	Typical Modules
Small Analog Data Acquisition Module	1000	173
Regulatory Control Module	1000	24
Auxiliary Function Module	1000	5
Small Digital Data Acquisition Module	1000	254
Device Control Module	1000	21
Logic Control Module	1000	10
PCDI Device Blocks	1000	4

Controller	Base Load	Series C IO	Logic	Total Load	PLC Load (Additional Load)
LEDDIB-C300-25	23.50%	1.60%	3.30%	28.4%	--
REF2-C300-21	23.50%	3.70%	3.80%	31.0%	--
REF2-C300-23	23.50%	2.20%	3.70%	29.4%	--
SRD-C300-27	23.50%	1.30%	12.10%	36.9%	--

5.0 Controller Summary

I/O Type	BPCS Total I/O	Series C I/O			
		LEDDIB-C300-25	REF2-C300-21	REF2-C300-23	SRD-C300-27
AI	251	73	140	0	38
AO	91	25	55	0	11
DI	238	19	18	167	34
DO	13	0	0	11	2
AI MUX	197	0	0	197	0
Total BPCS IO	790	117	213	375	85