

# Application Note: Integrating a Yaskawa AC Drive with EtherNet/IP<sup>™</sup> Option With AB ControlLogix / CompactLogix Programmable Controllers



### Contents

Introduction	. 3
Intended Audience	. 3
PLC Configuration	. 3
RSLinx Configuration	. 4
Studio 5000 (RSLogix 5000 for v20 and lower) I/O Configuration	. 4
To add the Yaskawa AC drive to the I/O configuration:	. 5
Enter the Module Properties for the Yaskawa AC drive:	. 7
Going online	. 9
PLC EXPLICIT MESSAGE SAMPLE	11
Configuring MSG block	12



## Introduction

The following document describes the configuration of Allen Bradley ControlLogix or CompactLogix PLCs for communicating to a Yaskawa drive with an EtherNet/IP option card. In this example, the information describes the use of the programming tools to configure and control the AC drive for operation, and defines the requirements for access to additional parameters in the drive. In general, it defines the I/O configuration requirements and PLC ladder used.

#### IMPORTANT! - DOCUMENT APPLICABILITY

This application example uses the Yaskawa F7 drive. Illustrations may not depict your specific Yaskawa drive. Other Yaskawa drives that may be used are A1000, P1000, V1000, Z1000, G7, P7, E7 or V7. Since each system application is typically different, the following may be accomplished in different ways using different Yaskawa AC drives. The basic principles shown herein can be built upon for specific system application requirements.

### **Intended Audience**

This document assumes that the reader is familiar with Yaskawa AC drives, EtherNet/IP and Ethernet technical terminology and operation, and with PLC programming.

## **PLC Configuration**

The following example describes the process of configuring a sample system with Studio 5000 (RSLogix 5000 for v20 and lower), used to program ControlLogix or CompactLogix PLCs and to control the Yaskawa AC drives. See Figure 1 for a diagram of the example system.



Figure 1 Example system.

Install the EtherNet/IP option on the drive as indicated in the option installation guide. (e.g. TOBPC73060058 for the A1000 drive.)

Apply power to the network components.



### **RSLinx Configuration**

Configure RSLinx by installing an EtherNet/IP driver as shown in Figure 2. As a guideline, select the function "Browse Local Subnet" when configuring the driver if the network is confined to the example system above.

	· Add New	
RS-232 DF1 devices		<u>H</u> elp
Ethernet devices		
Enternez/FPUrver 1784-KT/KX[D]/PKTX[D]/PCMK for DH+/DH-485 devices 1784-KTC[X] for ControlNet devices DF1 Folling Master Driver 1784-PCI for ControlNet devices 1784-PCI for ControlNet devices 1784-PCI for ControlNet devices 1784-PCI AIC+ Driver DF1 Slave Driver S-S 5D/SD2 for DH+ devices Virtual Backplane (SoftLogix58xx) DeviceNet Drivers (1784-PCD/PCIDS,1770-KFD,SDNPT drivers) PLC-5 (DH+) Emulator driver SLC 500 (DH485) Emulator driver SoftLogix6 driver Remote Devices via Linx Gateway	Status Stopped Running Running	Configure Startup <u>S</u> tart Stop <u>D</u> elete

Figure 2 EtherNet/IP driver configuration in RSLinx

### Studio 5000 (RSLogix 5000 for v20 and lower) I/O Configuration

To begin implementing the example system described and controlling the drive from the EtherNet/IP network:

- Configure the I/O in Studio 5000 (RSLogix 5000 for v20 and lower). Start Studio 5000 (RSLogix 5000 for v20 and lower) and begin a new project by selecting ->'File' and ->'New'.
- Select the correct PLC/Controller and system descriptions for the example system being created. See Figure 3.
- Click 'OK' to create the project database for the example system.

New Controller		×
Vendor:	Allen-Bradley	
Туре:	1769-L32E CompactLogix5332E Control	ОК
Revision:	13 💌	Cancel
	Redundancy Enabled	Help
Name:	Example_System	
Description:	Example System 1	
Chassis Type:	<none></none>	
Slot:	0	
Create In:	C:\RSLogix 5000\Projects	Browse

Figure 3 Example system "New Project"



#### To add the Yaskawa AC drive to the I/O configuration:

- Go to the I/O Configuration folder in the project tree and highlight the EtherNet/IP port used in the project (in this case, the EtherNet/IP port is the Local EtherNet/IP port on the 1769-L32E controller).
- Right click to enable the addition of a new I/O module to the project (in this case, the Yaskawa AC drive). See Figure 4.



Figure 4 Example system "Adding the New Module to the I/O configuration"

Application Note AN.AFD.09



• Select the 'ETHERNET-MODULE' option and click 'OK'.

Enter Search Text for Module 1	Clear Filters		Sh	ow Filters ≯
Catalog Number	Description	Vendor	Category	*
E1 Plus	Electronic Overload Relay Communications Interface	Allen-Bradley	Communication	
E121	Flowserve 208Vac/240Vac/325Vdc	Reliance Electric	DPI to EtherNet/IP	
E141	Flowserve 400Vac/480Vac/650Vdc	Reliance Electric	DPI to EtherNet/IP	
E151	Flowserve 600Vac/810Vdc	Reliance Electric	DPI to EtherNet/IP	
EtherNet/IP	SoftLogix5800 EtherNet/IP	Allen-Bradley	Communication	
ETHERNET-BRIDGE	Generic EtherNet/IP CIP Bridge	Allen-Bradley	Communication	
ETHERNET-MODULE	Generic Ethernet Module	Allen-Bradley	Communication	
ETHERNET-PANELVIEW	EtherNet/IP Panelview	Allen-Bradley	HMI	
FANUC CNC	EtherNet/IP CNC	FANUC Corporat	Specialty	
FANUC Robot	EtherNet/IP Robot	FANUC Robotic	Specialty	
ILX34-AENWG	1734 Wireless Ethernet Adapter, Twisted-Pair Media	Prosoft Technol	Communication	
IND560 Ethemet/IP	Scale Terminal	Mettler-Toledo	Communication	
IND780 Ethemet/IP	Scale Terminal	Mettler-Toledo	Communication	
In-Sight 1700 Series	Vision System	Connex Comorat	Communication	-
•				- F

Figure 5 Select module type (ETHERNET-MODULE)



#### Enter the Module Properties for the Yaskawa AC drive:

- 1. Name of device (e.g. F7, Conveyor\_1, Pump\_1, etc)
- 2. Description of the device
- 3. IP address for the drive
- 4. Assembly instances and size that will be used to communicate with the drive.
  - 4.1. Input Information from the drive to the PLC, e.g. assembly 71
  - 4.2. Output Information from the PLC to the drive, e.g. assembly 21
  - 4.3. Configuration Always 1 with a size of 0
- 5. For Comm Format, select "Data Int" (if not already selected)

New Module	and the second s	-		a	Farmer 1	×
Type: Vendor: Parent:	ETHERNET-MODULE Generic Allen-Bradley EIP_Card	c Ethernet Moo	dule			
1 Name: 2 Descriptio	F7 Dn: E7 Drive		Connection Parar	meters Assembly Instance:	Size:	
	110.000	4.1	Input:	71	2	
		4.2	Output:	21	2	🚖 (16-bit)
5 Comm Fo	ormat: Data - INT s / Host Name	4.3	Configuration:	1	0	(8-bit)
3 🔍 IP Ac	ddress: 192 . 168 . 1 .	20	Status Input:			÷
© Host	:Name:		Status Output:			
🔽 Open M	odule Properties		ОК	Car	ncel	Help

Figure 6 Module properties window

• Click "OK" to configure the "Requested Packet Interval (RPI)" rate.



• Enter the desired Request Packet Interval (RPI) time in ms and click "OK" to complete the I/O configuration. A RPI time of 100ms is generally recommended.

Module Properties Report: EIP_Card (ETHERNET-MODULE 1.1)	×
General Connection* Module Info	
Requested Packet Interval (RPI): 100.0 ms (1.0 - 3200.0 ms)	
Major Fault On Controller If Connection Fails While in Run Mode	
☑ Use Unicast Connection over EtherNet/IP	
Module Fault	
Status: Offline OK Cancel Apply Help	

#### Figure 7 RPI time in ms



Figure 8 Example system "Added Yaskawa Example Drive"



## Going online

- Download the project to the PLC and verify that the newly added AC drive is available and operating correctly by indications shown in the I/O configuration icon for the drive.
- Any error messages will display an error indication in the Module Fault area listed below the project tree.
- By highlighting the 'Controller Tags' in the project tree, it is possible to view the newly added Yaskawa AC drive.

👫 RSLogix 5000 - Example_System [1769-L32E]*						_ 0	×
File Edit View Search Logic Communications Tools	Window Help						
	<u> &amp; &amp; &amp; &amp;</u>		RQ				
Rem Run . Run Mode	Path: AB_ETHIP-1\192.168.1.50\Backp	plane\0*	<b>-</b> 品				
No Edits Battery DK	Horizon     Herican     Herican     Herican     Herican     Herican       Version     Version     Version     Version     Version     Version	)-   -(L)-   Input/Output 🔏 Co	npare				
Controller Example_System	🖉 Controller Tags - Example_Syst	em(controller)					
Controller Tags	Scope: Example_System(cor Shi	<sub>2W:</sub> Show All	💌 So <u>r</u> t: Ta	g Name			
Power-Up Handler	Tag Name 🛆	Value 🗲	Force Mask 🛛 🗲	Style	Туре	Description 🔺	
E Tasks		{}	{}		AB:ETHERNET_MODULE:C:0		
	-F7_Drive1_Ex1	{}	{}		AB:ETHERNET_MODULE_INT_4Byt		
Inscheduled Program	F7_Drive1_Ex:I.Data	{}	{}	Decimal	INT[2]		
E G Motion Groups	+-F7_Drive1_Ex:I.Data[0]	16#0094		Hex	INT		
Ungrouped Axes	+-F7_Drive1_Ex:I.Data[1]	2989		Decimal	INT		
Trends	F7_Drive1_Ex:0	{}	{}		AB:ETHERNET_MODULE_INT_4Byt		
E Data Types	-F7_Drive1_Ex:0.Data	{}	{}	Decimal	INT[2]		
H- Strings		16#0001		Hex	INT		
		3000		Decimal	INT		
H- 🙀 Module-Defined							
E I/O Configuration							
[1] 1769-L32E Ethernet Port LocalENB							
CompactBus Local							
				1			
	Monitor Tags / Edit Tags /						
Enter a tag value						7	11.

#### Figure 9 Example system Controller Tags

The assembly mapping will be as follows in Table 1.

In order to control the drive (after setting the drive parameters b1-01<sup>1</sup> and b1-02<sup>1</sup> to a value of '3: Option Card'), set the value of the *Drive Command Tag* labeled "F7\_Drive1\_Ex:O.Data[0]". **Note**<sup>1</sup>: Drive parameters n003=3 and n004=9 for V7 drives.



To access the frequency command to the drive, modify the value for the *Frequency Reference Command Tag*, labeled "F7\_Drive1\_Ex:O.Data[1]" corresponding to the example in this application note.

The associated response or monitor data from the drive is:

F7\_Drive1\_Ex:I.Data[0] = Drive Status,

F7\_Drive1\_Ex:I.Data[1] = Actual Speed.

Controller Tag Name (Example)	Assembly Data	Description
F7_Drive1_Ex:I:Data[0]	Assembly 71 (Bytes 1 & 2)	Drive Status Word: Bit 0: Faulted Bit 1: Warning Bit 2: Running Forward Bit 3: Running Reverse Bit 4: Drive Ready Bit 5: Controlling from Network Bit 6: Frequency Reference from Network Bit 7: At Speed Commanded Bit 8-15: Not Used
F7_Drive1_Ex:I:Data[1]	Assembly 71 (Bytes 3 & 4)	Actual Speed Example (3000 = 30.00 Hz), If (o1-03 = 4) for F7 or n035 for V7 drive. Speed Value is in RPM, (1750 = 1750 RPM)
F7_Drive1_Ex:O:Data[0]	Assembly 21 (Bytes 1 & 2)	Drive Command Word: Bit 0: Run Forward Command Bit 1: Run Reverse Command Bit 2: Fault Reset Bit 3: Not Used Bit 4: Not Used Bit 5: Network Control Bit 6: Network Frequency Reference Bit 7: Not Used Bit 8-15: Not Used
F7_Drive1_Ex:O:Data[1]	Assembly 21 (Bytes 3 & 4)	Commanded Speed Example (3000 = 30.00 Hz), If (o1-03 = 4) for F7 or n035 for V7 drive. Speed Value is in RPM, (1750 = 1750 RPM)

Table 1. Tag Mapping for the Example Drive

Additional AC drives in a system would be added in a similar fashion and can be accessed via the controller tags area.



## PLC EXPLICIT MESSAGE SAMPLE

The following is a sample of a PLC ladder logic that can be used to implement Explicit Message parameter access to the Yaskawa drive. The parameters are accessed from the CIP path associated with the parameter, available in the associated EtherNet/IP option technical manual.

In this example, the PLC will access:

- Class 102 (66H)
- Instance 1 (01H)
- Attribute 34 (22H)

This is analogous to the Output Frequency at which the drive is operating. In order to accomplish this, use a "Message" function in the PLC. See Figure 10 for an example of the ladder logic used.



In this example, the Message instruction is activated by a contact called "Msg\_Activate", which will request the drive in the example system to return the data from the specified path. The 'Message' function is configured based upon two dialog interfaces. The first allows the configuration of the data to define the message.

Application Note AN.AFD.09



### **Configuring MSG block**

To configure the MSG, you must provide the necessary information -

- Message Type CIP Generic (for explicit message)
- Service Type Get Attribute Single to retrieve information from the drive or Set Attribute Single to send information to the drive.
- Class, Instance and Attribute Path to the desired parameter
- Destination Controller tag where the information will be stored on the PLC for Get Attribute Single or sent out the drive for Set Attribute Single. e.g. Drive\_Speed

lessage Configuration - MSG1	x
Configuration Communication* Tag	
Message Type: CIP Generic	
Service Get Attribute Single	Source Element:
Service e (Hex) Class: 66 (Hex) Code:	Source Length: 0 (Bytes) Destination Drive_Speed
Instance: 1 Attribute: 22 (Hex)	New Tag
0.5-11-0.5-11-V/X	O Dave Developments 0
CEnable O Enable Waiting O Start	U Done Done Length: U
Error Uode: Extended Error Uode: Error Path: Error Text:	) 🔤 Timed Uut 🗢
ОК	Cancel Apply Help

Figure 12 Message Configuration for Explicit Messaging access to the Yaskawa EtherNet/IP Option, and Yaskawa AC drive parameters

• Path – Destination device, Yaskawa drive, that the PLC will be retrieving or sending information.

Configuration Communication*	Tag		
Path: F7_Drive1_Ex			Browse
F7_Drive1_Ex			
Communication Method		Destination	Link: 0 🚎
C CIP With Source L Source ID Source L	.ink: 0 🚊	Destination	Node: 0 🕀 (Octal)
Connected	🔽 Cache C	onnections 🦂	•
) Enable 🔾 Enable Waiting	Start	O Done	Done Length: 0
) Enable ① Enable Waiting ) Error Code: Exten ror Path: ror Text:	Start ded Error Code:	🔾 Done	Done Length: 0 ☐ Timed Out ←

Figure 13 Message Communication path to access the Yaskawa drive.

Application Note AN.AFD.09



Controller Tags - Example_Sys	tem(controller)			<u>_     ×</u>
Scope: Example_System(col 💌 S	h <u>o</u> w: Show All	💌 So <u>r</u> t: Ta	g Name 💌	
Tag Name 🛆	Value 🔸	Force Mask 💦 🔦 🗲	Style	Туре 🔺
	3005		Decimal	INT
	{}	{}		AB:ET
	{}	{}		AB:ET
□ -F7_Drive1_Ex:0	{}	{}		AB:ET
	{}	{}	Decimal	INT[2]
	1		Decimal	INT
	3000		Decimal	INT
Msg_Activate	1		Decimal	BOOL
	{}	{}		MESS.
				-
Monitor Tags / Edit Tags /	•			

Figure 14 "Drive\_Speed" Data Value Updated From the Message Access

The information and example shown here indicate how Yaskawa AC drives can be controlled by utilizing the EtherNet/IP option interface. The descriptions indicate how to configure, control and monitor the drives through a ControlLogix or CompactLogix PLC, and how to access other associated drive parameters through explicit messaging.



For questions or comments regarding this example, please feel free to contact Yaskawa America, Inc. For support please call: 1-800-YASKAWA.

USE OF TECHNICAL INFORMATION!

Technical content and illustrations are provided as technical advice to augment the information in manual, not supercede it. The information described in this document is subject to change without notice. Yaskawa assumes no responsibility for errors or omissions or damages resulting from the use of the information contained in any technical document. All warnings, cautions and product instruction for product use must be followed. Qualified personnel should carry out installation, operation and maintenance.

Application Note AN.AFD.09

Copyright Yaskawa America, Inc. ©2014

Revised: January 8, 2014