Operation on EtherNet/IP network using Rockwell ControlLogix PLC

CFW320-CETH

Application Note







CFW320-CETH EtherNet/IP Application Note

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Version	Revision	Description
-	R00	First edition

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1 DESCRIPTION

This application note is intended to provide a description of how to program a CFW320 frequency converter with accessory CFW320-CETH to communicate in EtherNet/IP network using Rockwell ControlLogix PLC.

This document is meant for trained personnel working with the described equipment and EtherNet/IP network installation, besides a good knowledge of automation and programmable logic controllers, in particular about Rockwell Automation software.

1.1 REFERENCE DOCUMENTS

This application note was developed based on the following documents and tools:

Document / Tool	Version	Source
CFW320 User's Manual	10008951055 / 00	WEG
Micro Mini Drives Programming Manual	10006257370 / 02	WEG
CFW320 Ethernet User's Guide	10009156409 / 00	WEG
Media Planning and Installation Manual - EtherNet/IP	PUB00148R0	ODVA
RSNetWorx for EtherNet/IP	21.00	Rockwell Automation
Studio 5000 PLC programming software	26.00	Rockwell Automation
WPS	3.0	WEG

1.2 ARCHITECTURE



1.3 CFW320

- Equipment: CFW320 version 1.00.
- Accessory: CFW320-CETH version 1.01.
- Programming tool: WPS version 3.00.

1.4 CONTROLLOGIX

- CPU: 1756-L71S version 32.012
- EtherNet/IP Scanner: 1756-EN2TR version 11.003
- Programming tools:
 - RSNetWorx For EtherNet/IP version 28.01
 - Studio 5000 Logix Designer version 33.00



1.5 PASSIVE NETWORK COMPONENTS

For passive network components - cables, ethernet switch - we recommend using certified components for industrial applications. Please refer to the product documentation for information about the proper network installation.



2 IP ADDRESS AND NETWORK CONFIGURATION

To allow communication among the devices, they need to have an compatible IP address configuration. It means the IP address must be at the same range, according to network mask. For this example, we will use the following IP addresses:

- Subnet mask: 255.255.255.0
- IP addresses: each device must have a different IP address.

```
PC: 192.168.0.2
```

ControlLogix: 192.168.0.71

CFW320: 192.168.0.11 (as described in Chapter 3 SERVER CONFIGURATION - CFW320 on page 9).

2.1 PC IP ADDRESS CONFIGURATION

To configure this options at Windows platform, go to "Network Connections" and open "Properties" of the desired Ethernet interface:

Local Area Connection Properties	
Maturativa	Internet Protocol Version 4 (TCP/IPv4) Properties
	General
Connect using:	You can get ID cettings assigned automatically if your patyook supports
Intel(R) PR0/1000 MT Network Connection	this capability. Otherwise, you need to ask your network administrator
Configure	For the appropriate IP settings.
This connection uses the following items:	Obtain an IP address automatically
Internet Protocol Version & (TCP//Pv6)	Use the following IP address:
✓ Internet Protocol Version 4 (TCP/IPv4)	IP address: 192.168.0.2
Link-Layer Topology Discovery Mapper I/O Driver	Subnet mask: 255 . 255 . 255 . 0
Link-Layer Topology Discovery Responder	
· · · · · · · · · · · · · · · · · · ·	 Obtain DNS server address automatically
* P	Use the following DNS server addresses:
I <u>n</u> stall <u>U</u> ninstall P <u>r</u> operties	Preferred DNS server:
Description	Alternate DNS server:
I ransmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication	
across diverse interconnected networks.	Validate settings upon exit
OK Cancel	OK Cancel

Figure 2.1: PC IP Address Configuration

2.2 CONTROLLOGIX IP ADDRESS CONFIGURATION

User can set IP Address for ControlLogix using Rockwell configuration tools. Check ControlLogix documentation to obtain information about how to perform this configuration.





Figure 2.2: ControlLogix IP Address Configuration



3 SERVER CONFIGURATION - CFW320

This section describes the main configurations for CFW320 frequency converter operation with accessory CFW320-CETH in EtherNet/IP network. Some of the described configurations are only available if CFW320-CETH accessory is properly installed.

Refer to the CFW320 programming manual for the necessary configurations related to other device functions, like motor configuration, protections, etc.

3.1 ETHERNET INTERFACE

For this application, the following configurations have been done via keypad to allow Ethernet communication to WPS:

- P850 IP Address Config: 0 (Parameters).
- P851 ... P854 IP Address: 192.168.0.11.
- P855 CIDR: 24 (255.255.255.0).
- P856 ... P859 Gateway: 0.0.0.0.



NOTE!

After changing these configurations, for the modification to be effective, the equipment must be turned off and then turned on again.

When communication configuration is done, it is also possible to create a WPS configuration and connect to it via Ethernet, to access the parameter list and configuration wizards:

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Image: Second Control	CFW320 (CFW320 v1.0X)	HMI Frequency Inverter Identification Gommand and References	P	Description Serial Address	Offline	Online	Minimum	Maximum 247	Factory settings	Unit	T	2
Image: Section of the sectin of the section of the section of the section of the	€ Program ⊕ Diagnostic	Gonnand did Kerelerices	P310 P311	0 Serial Baud Rate 11 Serial Bytes Config.	1: 19200 bits/s 1: 8 bits, even, 1		0: 9600 bits/s 0: 8 bits, no, 1	4: 76800 bits/s 5: 8 bits, odd, 2	1: 19200 bits/s 1: 8 bits, even, 1		UINT	
P316 Serial Interf. Status 0: Inactive 0: Inactive 2: Watchdog Error 0: Inactive UNT P680 Logical Status Run Commandia Run Commandia Pre Mode	🗄 😰 Wizards		P313 P314	Action for Communic. Error Serial Watchdog	1: Ramp Stop 0.0		0: Inactive 0.0	5: Cause Fault 999.0	1: Ramp Stop 0.0	s	UINT	
P683 Serial/USB Speed Ref. 0 -32763 32767 0 INT Ramp Enable General Enable JUIT P684 CO/DN/DP/ETH Control JOG Enable JOG Enable 0 65535 0 JUIT Remote 2nd Ramp 2nd Ramp 2nd Ramp 2nd Ramp P684 CO/DN/DP/ETH Speed Ref 0 65535 0 JUIT		⊕ 🖶 Communication ⊕ 🛃 SoftPLC	P680	Serial Interf. Status Logical Status 13-Bit Speed Serial/USB Control	0: Transchve 0: Run Command Pire Mode 2nd Ramp Config., Mode Alarm Running Enabled Fonvard JOG Remote Subvoltage Fourset O Ramp Enable General Enable Remote JOG Enable Remote Jod Ramp Enable General Enable Remote Jod Ramp Fault Beert	Run Command Fire Mode 2nd Ramp Config. Mode Alarm Running Enabled Forward JOG Remote Fault Ramp Enable General Enable General Enable Run Forward JOG Enable Remote 2nd Ramp Fault Brast	0: Inactive 0 -32768	2: Watchdog Error 65535 32767 65535	0: Inactive 0 0		UINT INT INT	
> P684 CO/DN/DP/ETH Control Ramp Enable General Enable Run Forward JOG Enable 2nd Ramp Fault Reset Ramp Enable General Enable Remote 2nd Ramp Fault Reset 65535 0 UINT			P683	Serial/USB Speed Ref.	0	rourreset	-32768	32767	0		INT	
			P684	CO/DN/DP/ETH Control	Ramp Enable General Enable Run Forward JOG Enable Remote 2nd Ramp Fault Reset	Ramp Enable General Enable Run Forward JOG Enable Remote 2nd Ramp Fault Reset	0	65535	o		UINT	
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Figure 3.1: WPS - Parameter list

3.2 LOCAL/REMOTE

CFW320 has two operation modes: local and remote. For each operation mode, it is necessary to define the source that it will use to receive commands, like start/stop, fault reset. For this application, considering CFW320-CETH accessory installed, the following control sources have been defined:

- Local: keypad will control CFW320 in local mode.
- Remote: CFW320-CETH will control CFW320 in remote mode.
- Local/Remote transition: the definition if the device is in local or remote mode will be controlled by CFW320-CETH commands (remote mode at power on).

Based on this, the following configurations have been programmed:

- P220 LOC/REM Selection Source: CO/DN/DP/ETH (REM). 0
- P222 REM Reference Selection: CO/DN/DP/ETH. 2
- P227 REM Run/Stop Selection: CO/DN/DP/ETH. 0
- P226 REM FWD/REV Selection: CO/DN/DP/ETH (FWD).
- P228 REM JOG Selection: CO/DN/DP/ETH.

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Parameter	Motor Control Commands and References	Speed Reference Ramps and Speed Limi	its Control Connections	^
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Main Signals of CFW320				
Basic Programming of CFW320	CO/DN/DP/ETH (REM)		Digital Input to LOC/REM Selection	
B. Motor Control				
Protections	LOCAL Situation	REMOTE Situation		
Applications		P222, PEM Pafarana Calastina		
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	HMI Keys	CO/DN/DP/ETH		
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	Forward	CO/DN/DP/FTH (FWD)		
	P335: LOC 10C Selection	D229: DEM TOC Selection	Disital Insult to 100	
	Not Used	CO/DN/DP/ETH		
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Figure 3.2: WPS - Local/Remote configuration

3.3 COMMUNICATION ERROR

For CFW320, the following events lead to error indication:

- When cyclic communication is active and it is interrupted.
- When cyclic communication is active and master is in "Run" mode, and them it goes to "Idle" mode.

For both situations, CFW320 will indicate A147 ou F247 (EtherNet/IP Communication Offline). It is important to define the action CFW320 will take in case of communication error. If CFW320 was running the motor via network command, CFW320 should also perform a general disable. Based on this, the following configurations have been programmed:

P313 Action for Communic. Error: 2 (General Disable).



3.4 I/O DATA CONFIGURATION

Choose assembly instance, to define data profile for control, status and speed variables, and also program additional parameters to read/write from/to device:

- Assembly instances: 100/150 (Manufacturer Specific Profile).
- Read parameters:

P004 - DC Link Voltage

P049 - Present Fault

Write parameters: no additional write parameters will be included to write area.

So the following parameters must be programmed:

- P871 EIP Data Profile: 100/150: 8 (Manufac. Speed + I/O).
- P872 Ethernet Read Word #3: 4 (P004)
- P873 Ethernet Read Word #4: 49 (P049)

Using such parametrization, the device has the following I/O data to communicate cyclically with master:

CFW320 Parameters at Read Area	Size	
P680 Logical Status	16-bit (2 bytes)	1
P681 13-Bit Speed	16-bit (2 bytes)	Total: 8 bytes
P004 DC Link Voltage	16-bit (2 bytes)	
P049 Present Fault	16-bit (2 bytes)]

CFW320 Parameters at Write Area	Size	
P684 CO/DN/DP/ETH Control	16-bit (2 bytes)	Total: 4 bytes
P685 CO/DN/DP/ETH Speed Ref	16-bit (2 bytes)	



4 MASTER CONFIGURATION - CONTROLLOGIX

Use Rockwell software to configure and program ControlLogix to communicate with CFW320. The main steps are described below.

4.1 RSNETWORX FOR ETHERNET/IP

4.1.1 Register EDS File

Use EDS Wizard to register EDS file for CFW320.

EtherNet/IP - RSNetWorx for EtherNet/IP	-	×
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		<u> </u>
Image: Top of the state of		>
Execute the Electronic Data Sheet installation wizard	Offline	

Figure 4.1: RSNetWorx For EtherNet/IP

Rockwell Automation's EDS Wizard			
		×	Kockwell Automation's EUS Wizard
Registration Electronic Data Sheet file(s) will be a	added to your system for use in Rockwell Automation applications.	V.	EDS File Installation Test Results This test evaluates each EDS file for errors in the EDS file. This test does not guarantee EDS file validity.
Register a gingle file C Register a gingle file Manuel: E-Waters weg/Desktop/EIP_CFW320_1 C+Waters weg/Desktop/EIP_CFW320_1 There is an icor file (ucc) with then this made will be associate	Look in subfolders V10X.eds Browse h the same name as the file(s) you are registering ad with the device.		⊡ Instalation Test Results □ ☑ c:\users\weg\desktop\ebp_d#x320_v10k.eds
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Rockwell Automation's EDS Wizard		×	Rockwell Automation's EDS Wizard
Change Graphic Image You can change the graphic image t	that is associated with a device.	V	You have successfully completed the EDS Wizard.
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Figure 4.2: RSNetWorx - Register EDS File

4.1.2 Scan Devices

With devices connected at configuration tool, it is possible to scan devices to find nodes for communication. For this example, EtherNet/IP scanner (1756-EN2TR) is present at address 192.168.0.71. It is possible to save this configuration and link it during ControlLogix configuration.



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Figure 4.3: RSNetWorx for EtherNet/IP - Online Identification

4.2 STUDIO 5000 LOGIX DESIGNER

Open Studio Rockwell 5000 software and create a new project. Select ControlLogix CPU, chassis and EtherNet/IP scanner, according to available hardware and firmware version.

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Figure 4.4: Studio 5000 Logix Designer - Create new project



4.2.1 Add New Module for Control Logix

Create a new scanner module for Ethernet interface and configure, as programmed in Section 2.2 CONTROLLOGIX IP ADDRESS CONFIGURATION on page 7.



Figure 4.5: Studio 5000 Logix Designer - Add new EtherNet/IP module

4.2.2 Add New Module for CFW320

Create a new CFW320 module for Ethernet interface, and configure the instance and I/O size, as programmed in Section 3.4 I/O DATA CONFIGURATION on page 11.



Figure 4.6: Studio 5000 Logix Designer - Add new CFW320 module

For this example, CFW320 will communicate 4 input words and 2 output words. Status and control data will follow the manufacturer specific profile. This must match the same configuration programmed at drive parameters.

4.2.3 Download and Monitor Configuration

With module created, device data should be available at Controller Tags. Using these tags, it is possible to view and edit online device I/O data, as well as creating a ladder logic to control and monitor the device.

Once the configuration is finished, download it to PLC in order to monitor CFW320 I/O data.



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Controller Fault Handler	▲ cfw320:11		{}	{}	_0355:CFW320_CETH	Standard	Pa
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MainProgram	 cfw320:11.Data[0] 		16#0400	Hex	~ INT	Standard	
 SafetyTask (20 ms) 	cfw320:11.Data[1]		0	Decimal	INT	Standard	
SafetyProgram	cfw320:11.Data[2]		507	Decimal	INT	Standard	
Unscheduled	cfw320:11.Data[3]		0	Decimal	INT	Standard	
Ungrouped Axes	▲ cfw320:01		{}	{}	_0355:CFW320_CETH	Standard	
Assets	✓ cfw320:O1.Data		{}	{} Decimal	INT[2]	Standard	
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Figure 4.7: Studio 5000 Logix Designer - Download

5 CONTROL AND MONITORING

Once network configuration is done, it is possible to control and monitor the device. The main steps are described below.

5.1 VIEW AND EDIT READ AND WRITE DATA

In on line mode, at controller tags, it is possible to check input and write output data directly at controller memory.



Figure 5.1: Read data, with highlight to the status word as described at CFW320 EtherNet/IP documentation

For inputs, as described in Section 3.4 I/O DATA CONFIGURATION on page 11, it is programmed to read the following information:

- cfw300:11.Data[0]: P680, value 5890 decimal (binary 0001 0111 0000 0010).
 - Bit 1 = 1 (run command).
 - Bit 8 = 1 (running).
 - Bit 9 = 1 (enabled).
 - Bit 10 = 1 (forward direction).
 - Bit 12 = 1 (at remote mode).
- cfw320:I1.Data[1]: P681, value 2049 (\approx 1/4 motor nominal speed).
- cfw320:I1.Data[2]: P004, value 505 (DC link voltage = 505V).
- cfw320:11.Data[3]: P049, value 0 (fault code = 0, no fault present).



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Tasks	▲ cfw320:I1.Data		{}	{}	Decimal	INT[4]	Standard	
MainTask	▶ cfw320:I1.Data[0]	2#0001_0111_0000_0010		Binary	INT	Standard	
SafetyTask (20 ms)	▶ cfw320:I1.Data[1]	2049		Decimal	INT	Standard	
SafetyProgram	▶ cfw320:I1.Data[2]	505		Decimal	INT	Standard	
Unscheduled	▶ cfw320:11.Data[31	0		Decimal	INT	Standard	
Motion Groups	✓ cfw320:01		{}	{}		0355:CFW320 CETH	Standard	
Assets	▲ cfw320:01.Data		{}	{}	Decimal	INT[2]	Standard	
he Logical Model	♦ cfw320:01.Data	[0]	2#0000 0000 0001 0111		Binary	√ INT	Standard	
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	Blt 2 Run Forward	0: run the motor I 1: run the motor I	n the opposite direction of the reference n the direction of the reference signal (fo	e signal (re prward)	verse)			
	Blt 3 JOG Enable	0: disable JOG fu 1: enable JOG fu	nction nction			ľ		
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	Blt 6 Reserved	-						
	Blt 7 Fault Reset	0: no function 1: If In fault state,	reset the fault					
	Bit 8 15 Reserved	-						

Figure 5.2: Write data, with highlight to the command word as described at CFW320 EtherNet/IP documentation

For output, as described in Section 3.4 I/O DATA CONFIGURATION on page 11, it is programmed to write the following information:

- cfw320:O1.Data[0]: P684, value 23 decimal (binary 0000 0000 0001 0111).
 - Bit 0 = 1 (ramp enable).
 - Bit 1 = 1 (general enable).
 - Bit 2 = 1 (run forward).
 - Bit 4 = 1 (remote).

• cfw320:O1.Data[1]: P685, value 2048 (\approx 1/4 motor nominal speed).

These tags can be used during PLC program to create a logic in order to monitor and control devices.

5.2 ACYCLIC REQUESTS

Besides monitoring status data and writing control data, it is possible to create acyclic requests to access other device parameters. In order to do that, a ladder logic to send acyclic messages is necessary. A "MSG" instruction will be used to send such request.

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Figure 5.3: Tags to control acyclic messages

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Figure 5.4: Program MSG instruction

Configure Service, Class, Instance and Attribute to address desired parameter. For this example, to read P100 (Acceleration Time)¹, it is necessary to program the following values:

- Service "Get Attribute Single" to read parameter.
- Class 100 (64 hex)
- Instance 2
- Attribute 100 (64 hex)

¹Use Manufacturer Specific Class table, described at Ethernet User's Guide, to know how to address entire parameter list.



Once it is programmed, in on line mode, it is possible to enable the block to send an acyclic request to read the parameter value.



Figure 5.5: Enable MSG instruction



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