

Application Note #1224:

GP-Pro EX to PowerFlex 525 via EtherNet/IP Implicit Messaging

Introduction

The Pro-face HMI family along with the GP-Pro EX development software, supports a wide range of communication protocols including ODVA Ethernet /IP. The Pro-face GP-Pro EX ODVA EtherNet/IP Explicit Messaging device driver (v1.14.04 and later) supports both Explicit and Implicit messaging.

EtherNet/IP defines three device classes based on network communication capabilities: Messaging Class, Adapter Class and Scanner Class. Each class supports a basic set of communications services, but may provide other optional services too.

- Explicit messaging connections are point-to-point general purpose transactions that can be used to reach any network-accessible items within a device. Explicit messaging uses TCP/IP services to transport messages. Examples of Messaging Class devices are Rockwell Micrologix PLCs, some legacy PLCs, and many operator interface and diagnostic applications.
- Adapter class products are targets of real-time I/O data connection requests from Scanner Class products. They receive Explicit message requests from all other classes of products. Examples are the Allen Bradley PowerFlex 525 drive and Wago 750 series I/O.
- Scanner Class devices are the originators of I/O data connection requests to Adapter Class products. These devices can also be originators of Explicit connection requests to or from other classes of products. Examples of Scanner class products are ControlLogix PLCs and the Pro-face GP-Pro EX ODVA EtherNet/IP Explicit Messaging device driver (v1.14.04 and later).

A single GP-Pro EX application can include a mixture of Explicit, Custom Explicit, and Implicit I/O messaging to the same device. The scope of this application note is to look at basic Implicit I/O connection to an Allen-Bradley PowerFlex 525 drive. For your convenience a completed sample project is provided. In your application you may choose to exchange additional data with a PowerFlex drive using Implicit and Explicit messaging.

Materials Needed to Run the Demo Project

- 1.) Proface GP-Pro EX Screen and Logic Editing software v4.02 or higher
- 2.) Pro-face GP-Pro EX ODVA EtherNet/IP Explicit Messaging device driver (v1.14.04 and later)
- 3.) Proface AGP3300 or other Ethernet Enabled Pro-face Display or Win GP
- 4.) Allen-Bradley PowerFlex 525 Embedded Ethernet VFD
- 5.) The PowerFlex 525 Embedded EtherNet/IP Adapter User Manual
- 6.) PowerFlex 520-Series Adjustable Frequency AC Drive User Manual

Configure the PowerFlex 525

To control a PowerFlex 520-Series drive from an HMI it should be configured and wired for 2-wire start-stop control. It can be configured to operate without a motor if you do not have one. Verify the drive is operational using the front panel before proceeding to the steps below.

By default, the PowerFlex Ethernet adapter is configured to accept an IP address, subnet mask, and gateway address from a BOOTP server. GP-Pro EX projects require connected devices to have a fixed IP address. Disable BOOTP and configure a fixed IP address, subnet mask, and gateway address.

A PowerFlex 525 drive can be configured for multiple combinations of control and reference sources such as front panel, terminal block, or EtherNet/IP. Various combinations of these settings are suitable to use with GP-Pro EX. However, to use the sample project the Start Source and Speed Reference parameters should be assigned to EtherNet/IP as indicated below.

Reference the PowerFlex 525 Embedded EtherNet/IP Adapter User Manual to set the following parameters in the drive:

C128 [EN Addr Sel] = 1 "Parameters" (disables BOOTP)
C129 [EN IP Addr Cfg 1] thru C132 [EN IP Addr Cfg 4] = Device IP address
C133 [EN Subnet Cfg 1] thru C136 [EN Subnet Cfg 4] = Subnet mask
C137 [EN Gateway Cfg 1] thru C136 [EN Gateway Cfg 4] = Gateway
P046 [Start Source 1] = 5 "EtherNet/IP"
P047 [Speed Reference 1] = 15 "EtherNet/IP"

Power cycle the drive to initialize the new Ethernet configuration.

Using the Sample GP-Pro EX Project

The sample project is ready for you to use. Depending on your Pro-face display model and your network a few minor modifications may be needed.

1. To change the display model open GP-Pro EX and go to Project > System Settings > Display. Click on Change Display and select your display Series and Model. Click change.
2. To enter the IP address of the PowerFlex in GP-Pro EX go to Project > System Settings > Device/PLC Click on the button with a PLC icon on it. Enter the PowerFlex IP address.
3. On the Pro-face display in the off-line mode set an IP address for the display within the same sub-net range as the drive.

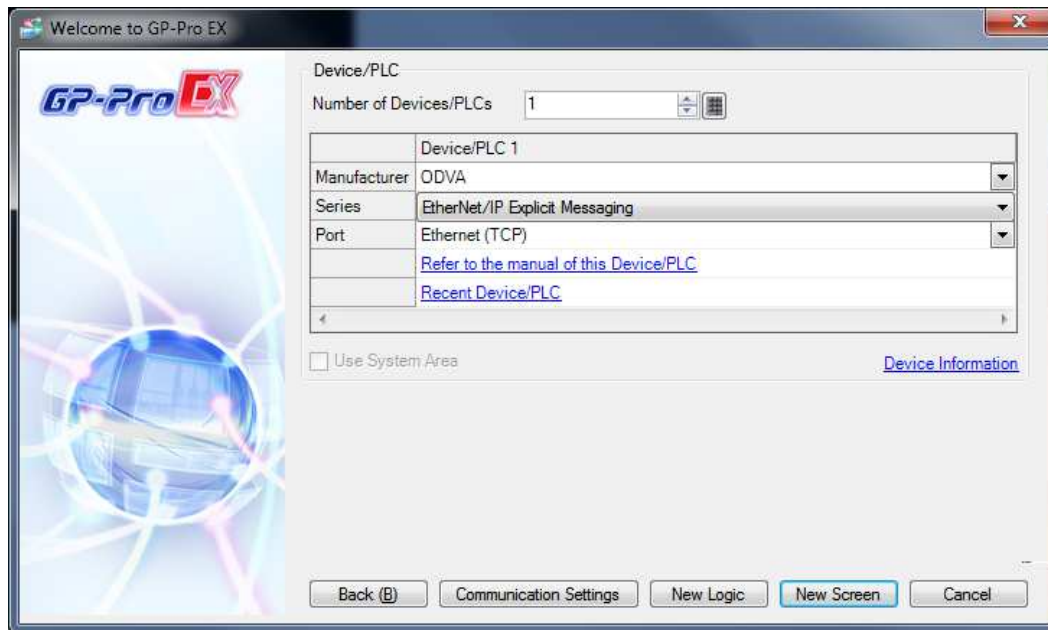
Then download the project to the Pro-face display. Connect a Pro-face HMI and the PowerFlex drive together with Ethernet cables and a hub/switch or with an Ethernet crossover cable.

EtherNet/IP Configuration in GP-Pro EX

When creating a project in GP-Pro EX, follow these steps to configure GP-Pro EX to connect to a PowerFlex 520 Ethernet enabled drive via Implicit messaging.

Note: The Implicit messaging feature requires GP-Pro EX v4.02 or later and ODVA EtherNet/IP Explicit Messaging device driver v1.14.04 and later.

1. When beginning a new project file select the Display Series and model. On the Device/PLC screen select ODVA. For the series select "EtherNet/IP Explicit Messaging".



2. Go to the "Device/PLC" tab
3. In the "Device Specific Settings" section click on the button with the PLC image on it. The dialog box should look like the image below.
4. Enter the IP Address of the PowerFlex drive.

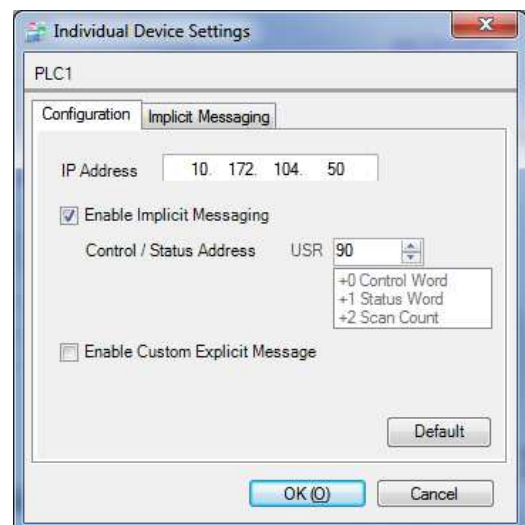
Implicit Messaging Configuration

5. Check the "Enable Implicit Messaging" dialog box.

Note: If this selection is missing please upgrade your ODVA PLC/Device driver.

6. The GP-Pro EX ODVA EtherNet/IP driver needs a small array of 3 words allocated in USR memory for Control/Status. For the sample project we used USR90.

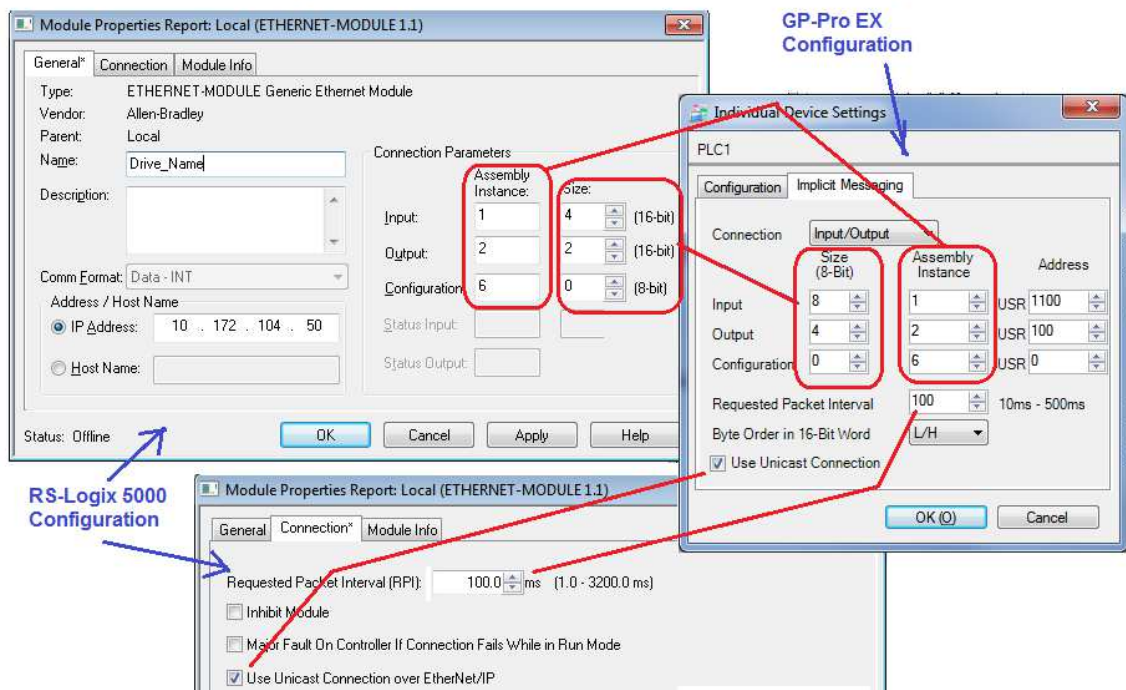
Tip: We do not recommend using the default address USR0 anywhere in a completed project.



- Click on the "Implicit Messaging" tab. To obtain entries for this tab refer to the device manufacturers' instructions for configuring their device as an Implicit generic I/O device.

Note: If the manufacturer offers instructions for configuring their device as a generic device in a ControlLogix class PLC the settings in GP-Pro EX will be very much the same. The Pro-face "Size" is bytes (8-Bit) so it is the number of (16-bit) words x 2.

Similarity Between RS-Logix Generic Ethernet Module Configuration and GP-Pro EX Configuration



- Enter the PowerFlex drive Input, Output, and Configuration Size and Assembly Instance information. Note that the correct Assembly Instance setting for each item is required even if the Size is 0. The sample project drive has this default I/O configuration:

	Size (8-bit)	Assembly Instance
Input	8	1
Output	4	2
Configuration	0	6

- Choose and enter the Addresses in GP-Pro EX where the I/O data exchanged with the drive will be located. For the sample project we chose USR1100 - USR1103 for Input data and USR 100 – USR 101 for output data. These addresses are used by GP-Pro EX to access the device I/O.

Start Implicit Messaging

Implicit messaging does not automatically start in the Pro-face display. In logic or scripting first set the appropriate initial values for the device outputs. Then start Implicit messaging. Set bit 0 of the first word of the Implicit messaging Control/Status Address to run Implicit Messaging. In the sample project the bit is USR9000. (USR90 bit 00).

Note: System variable [PLC1]#H_ScanOffControl turns on and off the entire device driver which is enabled by default. It is a different function than the Implicit Messaging Control Word.

Symbol Variables

Symbol Variables can simplify developing and debugging a GP-Pro EX project. User friendly names can be assigned to the drive I/O data as Symbol Variables.

Create Symbol Variables with names that correspond to the command and status, bit and word, names used in the PowerFlex manuals. Select either Bit Address or Word Address as appropriate for the data Type. The Address determined by the drive I/O image map in the drive manual plus the USR Address assigned earlier in the GP-Pro EX "Individual Device Settings".

Name	Type	Array	Count	Address	Retentiv
1 Normal_Stop	Bit Address	☐		[#INTERNAL]USR0010000	
2 Start	Bit Address	☐		[#INTERNAL]USR0010001	
3 Jog	Bit Address	☐		[#INTERNAL]USR0010002	
4 Clear_Fault	Bit Address	☐		[#INTERNAL]USR0010003	
5 Forward	Bit Address	☐		[#INTERNAL]USR0010004	
6 Reverse	Bit Address	☐		[#INTERNAL]USR0010005	
7 Force_Keypad_Control	Bit Address	☐		[#INTERNAL]USR0010006	
8 Speed_Reference	Word Address	☐		[#INTERNAL]USR00101	
9 Run_Ready	Bit Address	☐		[#INTERNAL]USR0110200	
10 Active	Bit Address	☐		[#INTERNAL]USR0110201	
11 Command_Direction_Status	Bit Address	☐		[#INTERNAL]USR0110202	
12 Actual_Direction_Status	Bit Address	☐		[#INTERNAL]USR0110203	
13 Accel_Status	Bit Address	☐		[#INTERNAL]USR0110204	
14 Decel_Status	Bit Address	☐		[#INTERNAL]USR0110205	
15 Fault	Bit Address	☐		[#INTERNAL]USR0110207	
16 At_Speed	Bit Address	☐		[#INTERNAL]USR0110208	
17 Speed_Feedback	Word Address	☐		[#INTERNAL]USR01103	

From:
The PowerFlex 525 Embedded
EtherNet/IP Adapter User Manual,
Chapter 4, Generic Profile

Generic Profile Example of I/O Image

Adapter Word and I/O			
Output Image (Write)	Required	Word 0	Logic Command
		Word 1	Reference
	Optional	Word 2	Datalink 1
		Word 3	Datalink 2
		Word 4	Datalink 3
Input Image (Read)	Required	Word 5	Datalink 4
		Word 6	Datalink 1
	Optional	Word 7	Datalink 2
		Word 8	Datalink 3
		Word 9	Datalink 4
		Word 10	Datalink 1
		Word 11	Datalink 2
		Word 12	Datalink 3

Only create Symbol Variables for functions that you wish to use in your project.

Create the screens

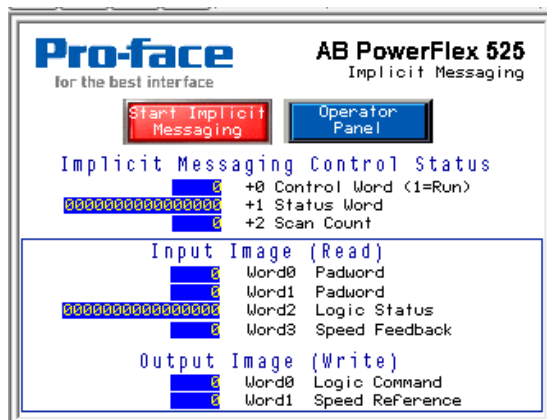
Only a simple script or logic rung is required to start Implicit Messaging in the Pro-face display. The PowerFlex drive does not require logic or scripting in GP-Pro EX for basic operation. Only a simple script or logic rung is required to start Implicit Messaging in the Pro-face display. Simply create the buttons and data displays you need for your project with Symbol Variables and download it to your Pro-face display.

About the Sample Project Screens

The sample project implements only the most basic connection to the drive.

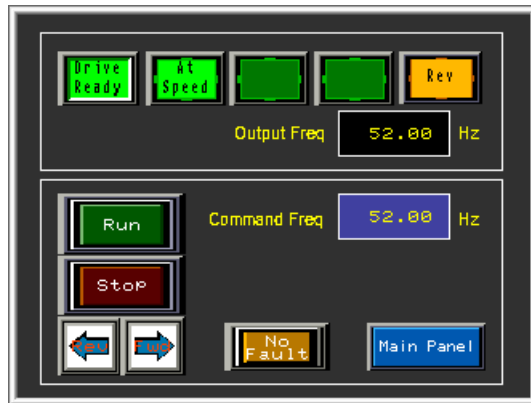
Screen B1; Main Panel

The first screen displays the Implicit Messaging control/status words and all data exchanged with the PowerFlex drive. On power up the data displays will all be zero and Implicit Messaging will be inactive. Press the red button to start Implicit I/O messaging.



Screen B2: Operator Panel

Demonstrates drive operation using EtherNet/IP Implicit I/O Messaging.



For more information on Pro-face and our full line of HMI, Operator Interface and Industrial PC products please visit our web site at www.profaceamerica.com.

For technical support email: support@profaceamerica.com or call: 800.289.9266.

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