EZLogic® 4.0
COMMUNICATION MANUAL

 BULLETIN NO. 751

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Getting Started

This guide is intended to detail the necessary steps to configure communications between EZLogic® 4.0 system and the Allen Bradley Programmable Logic Controller. Configuration should take place just after the SWD network has been commissioned and powered up.

EthernetIP is one of the multiple industrial protocols that can be configured to communicate EZLogic® 4.0 to a control system. Customers can select between several industrial protocols such as: ProfiNET, ProfiBUS, EtherCAT, CANOpen, Powerlink and Sercos.

Below is a list of abbreviations used in this document:
SWD: SmartWire-DT®
DZC: Dual Zone Controller
ZPA: Zero Pressure Accumulation
PLC: Programmable Logic Controller
AB: Allen Bradley
Hex: Hexadecimal
CRC: Cyclic Redundancy Check
PN: Part Number
ACE: Accumulation Control Engine
PC: Personal Computer

Prerequisites

When ready to connect to the system, gather the following:

- ☐ PC with SWD-Assist (Link: http://applications.eaton.eu/sdlc?LX=11&f1=1457&f2=1181&f3=1188)
- ☐ USB to RJ45 programming cable (Hytrol PN: 032.642) and required driver for the PC (easy USB driver)

Before to try to setup the communication between an AB PLC with EthernetIP capabilities and a SWD coordinator/Network Interface Module (NIM), verify the following:

- ☐ A valid SmartWire-DT® Project Configuration has been downloaded as Target Configuration to the Network Interface Module (Hytrol PN: 032.681).
- ☐ A physical network connection has been installed between the Network Interface Module and the control network
- ☐ User has been configured on SWD-Assist the Network Interface Module IP Address, Subnet Mask and Gateway IP Address. *For more information refer Hytrol manual SWD_EZLogic4.0_Config_EN_MN.pdf New SWD Network configuration 3c)*

ATTENTION: SmartWire-DT® can be used in applications with safety categories up to PL_d EN-ISO13849-1 and SIL2 as per EN-62061.

EZLogic® 4.0 communication

System architecture

EZLogic® 4.0 (network model - Hytrol PN: 032.601) functionality depends on the proper configuration of the SWD network system. The SMD network carries monitoring and control data between zone controllers and other network devices to execute the zone accumulation logic.

The EZLogic® 4.0 accumulation system runs over SWD network, consisting of a PLC controller, SWD Network Interface Module (NIM) (See Note 1). (Hytrol PN: 032.681) with gateway functions and SWD slave devices. SWD slave devices are dual zone controllers (DZC – Hytrol PN: 032.601), SWD field devices and SWD IO modules. See figure 1.

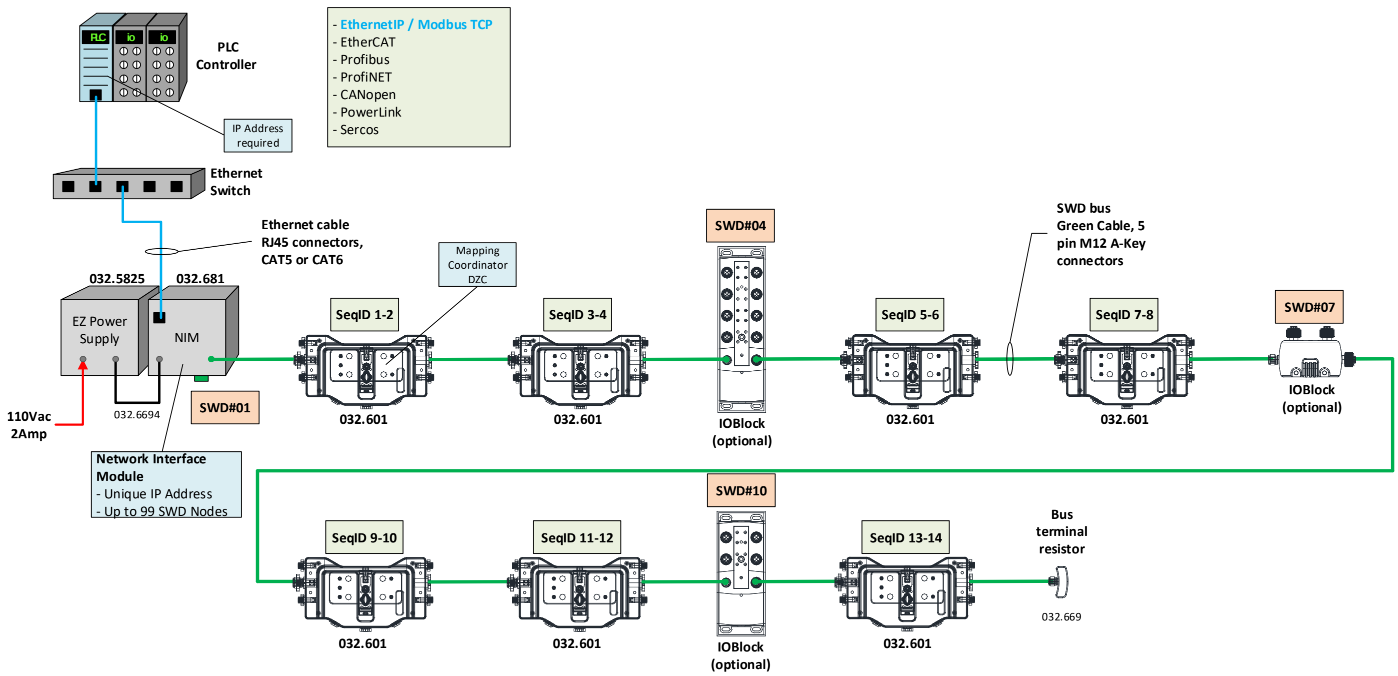

Figure 1: EZLogic® 4.0 network layout.

Note 1: For additional information about SWD Network Interface Module (NIM), refer Hytrol document H2-MN-H2-002.1.0_EZLogic4.0_SWD_ Configuration_EN.pdf

Data communication scheme

"The SWD bus allows cyclic and acyclic data transmissions between slave devices and a master controller or coordinator. The SWD protocol automatically configures all SWD slave devices. This includes address assignment and associated memory positions within the cyclic data transmission frame. The cyclic data frame is the primary data transfer vehicle on the SWD bus supporting a producer consumer data model."[1]

Cyclic Communications

"A cyclic data frame consists of a header marking the start of the frame, an output data assembly containing data distributed to devices, an input data assembly collected from devices and a CRC to validate the data marking the end of the frame."[2] See figure 2.

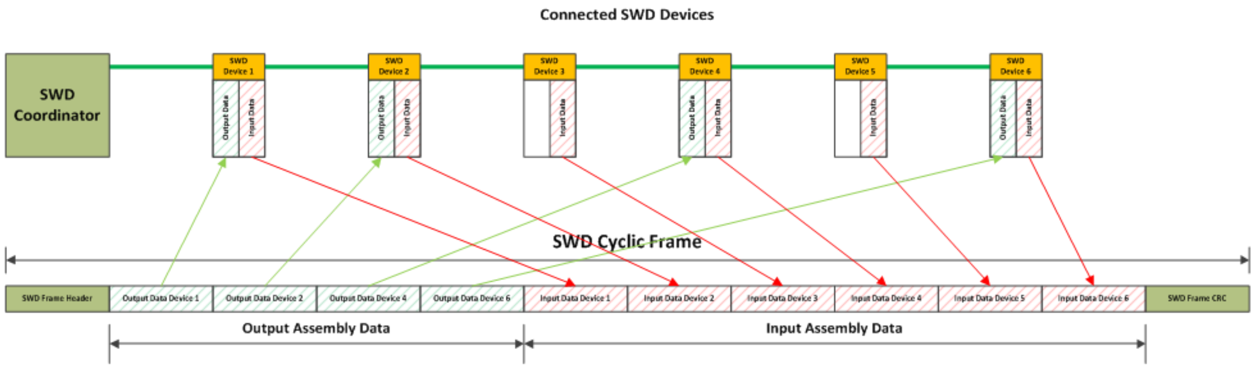

Figure 2: SWD Cyclic Frame.

Acyclic Communications

"Acyclic messages are explicit messages to an individual SWD device. Acyclic messages are used to transfer device specific data on an infrequent basis. Acyclic message services are confirmed message services. Acyclic messages are interlaced between cyclic data frames. An acyclic message is segmented into 6 individual frames for a completed message exchange. Each individual acyclic message frame is interlaced between cyclic data frames used for I/O data transfer. Excessive use of acyclic messaging will impact cyclic data transfer rates."[2]

Mapping Coordinator

For every EZLogic® 4.0 control network there is a DZC that works as a mapping coordinator. A mapping coordinator performs three operational functions and these are[2]:

- Scans the SWD bus and builds a map of all DZCs on the bus
- Distributes a map to all connected DZCs on the bus
- Successful map installation sets DZC_STAT bit (in cyclic data) enabling EZLogic operation in enabled ACEs

"The mapping coordinator is defined as the EZLogic PLUS module nearest the SWD coordinator. Once a module has determined that it is not the mapping coordinator, it waits for a map to be installed by the mapping coordinator. Once a module has determined it is the mapping coordinator, it reads the entire wire, then builds and installs a device specific map in each EZLogic PLUS module."[1]

Producer-Consumer Model

During data assembly on the SWD network communications only one device can transmit over the network at a specific time, introducing determinism and data scheduling by time frame package. Data profiles available for DZC communications take as point of reference the PLC, it means, that declared inputs and outputs should be identified from the PLC like this.

Inputs: 6 Byte			
Des.	**Meaning**	**Data type**	**Tag**
A_ALG_EN	Zone A - Control Algorithm - Enabled	BIT	EIPSWD:I.Data[3].0
B_ALG_EN	Zone B - Control Algorithm - Enabled	BIT	EIPSWD:I.Data[3].1
DZC_STAT	DZC Distributed Control Algorithm Active	BIT	EIPSWD:I.Data[3].2

a)

Outputs: 2 Byte			
Des.	**Meaning**	**Data type**	**Tag**
A_Q0_CMD	Zone A, Auxiliary Logic Input Signal Q0	BIT	EIPSWD:O.Data[1].0
A_Q1_CMD	Zone A, Auxiliary Logic Input Signal Q1	BIT	EIPSWD:O.Data[1].1
A_Q2_CMD	Zone A, Auxiliary Logic Input Signal Q2	BIT	EIPSWD:O.Data[1].2

b)

Figure 3: PLC data profile a) Inputs section; b) Outputs section

PLC cyclic communications configuration

Communications module setup

1. Open your base AB PLC program software.

2. At the bottom of section *Controller Organizer* pane look for the I/O Configuration folder / Ethernet, select and right click. Select *New Module…*See figure 4.

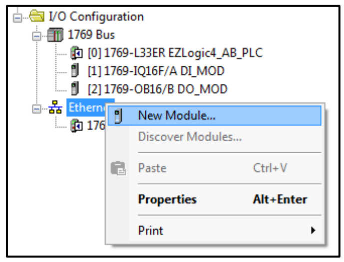

Figure 4: I/O Configuration Ethernet section

3. Look for and select the ETHERNET-MODULE *Generic Ethernet Module*, then click on Create:

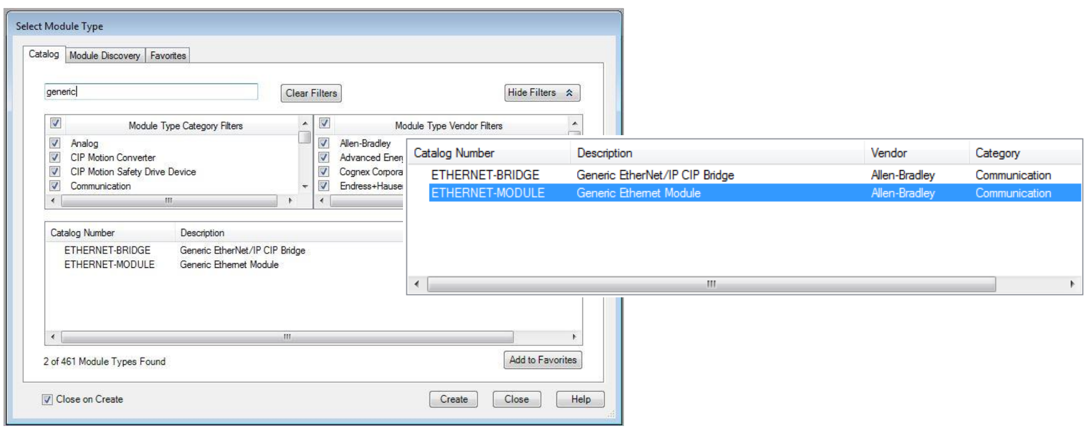

Figure 5: Generic Ethernet Module creation on RSLogix5000

4. Click on Create and a new screen will come up, then fill up the configuration screen with the proper configuration. See figures 6 and 7. For more information refer Hytrol manual *H2-MN-NP-002.1.0_EZLogic4.0_SWD_ Configuration_EN.pdf New SWD Network configuration sections 3a) to 3c)*:

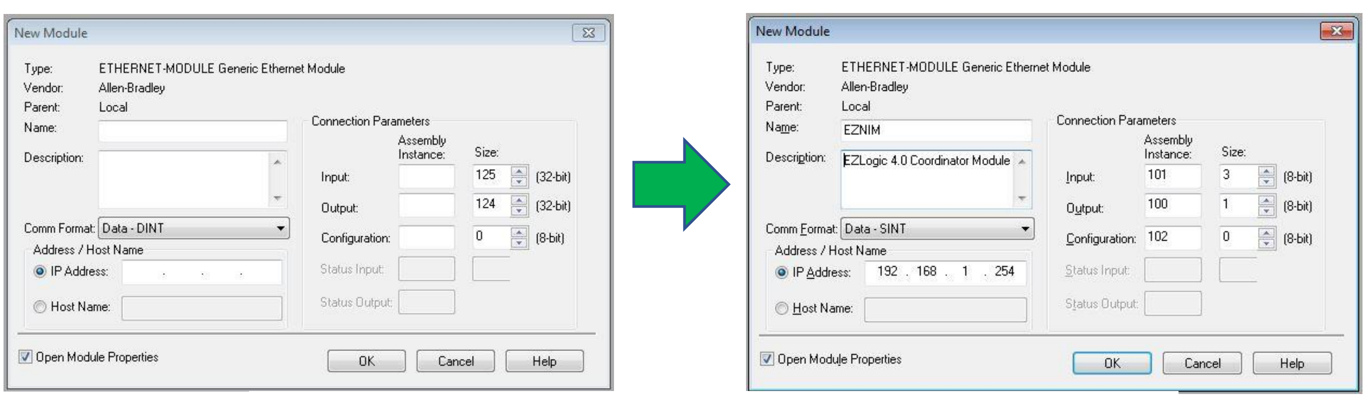

Figure 6: Generic Ethernet Module configuration on RSLogix5000

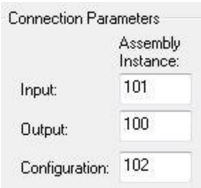

Figure 7: Generic Ethernet Module
Connection Parameters *Assembly Instance*:
Input: **101**
Output: **100**
Configuration: **102**

5. After a new module has been created on the Controller Organizer, it would look like this. See figure 8:

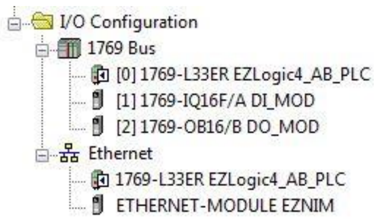

Figure 8: Generic Ethernet Module configured on RSLogix5000

6. Double click on the module recently created on the previous steps to verify that the General configuration tab settings are correct, match them against the values obtained from SWD-Assist:

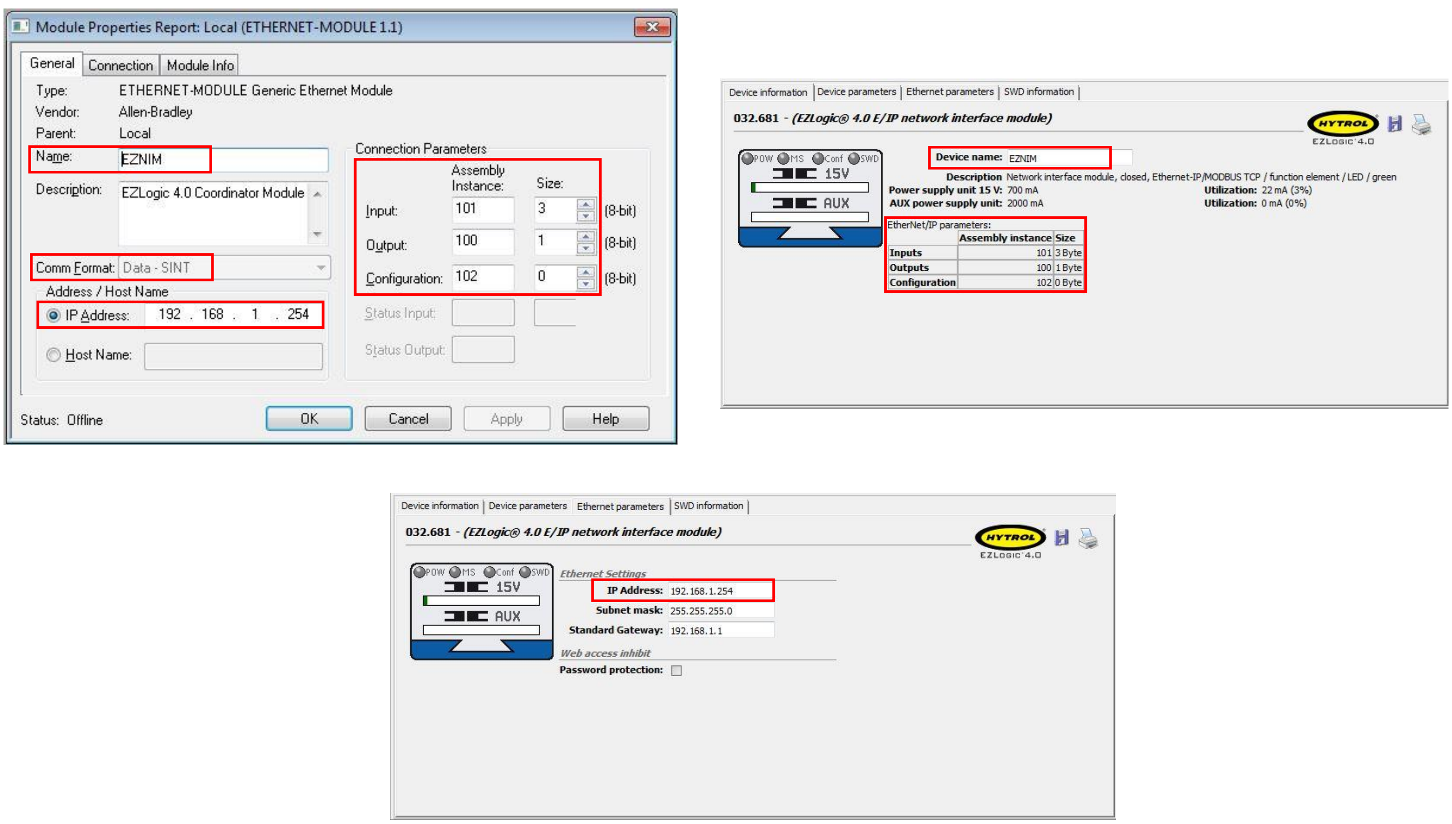

Figure 9: Module properties General tab configuration on RSLogix5000

7. Access the Connection configuration tab to configure the *Request Packet Interval (RPI)* and check box "*Use Unicast Connection over EtherNet/IP*". For additional information of how to set up this setting refer annex section Request Package Interval (RPI)

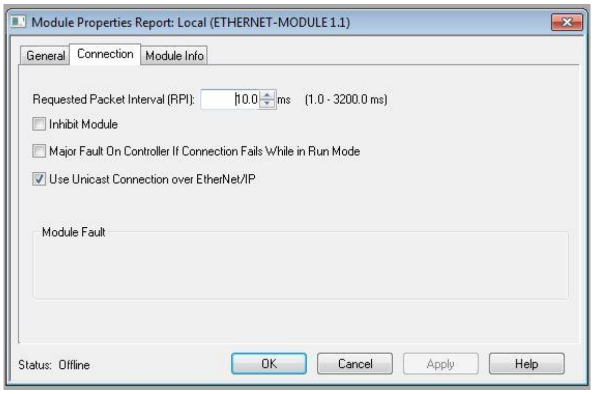

Figure 10: Module properties Connection tab configuration on RSLogix5000

8. Module Info tab gives additional information about configured module. If module is operating correctly should say Running.

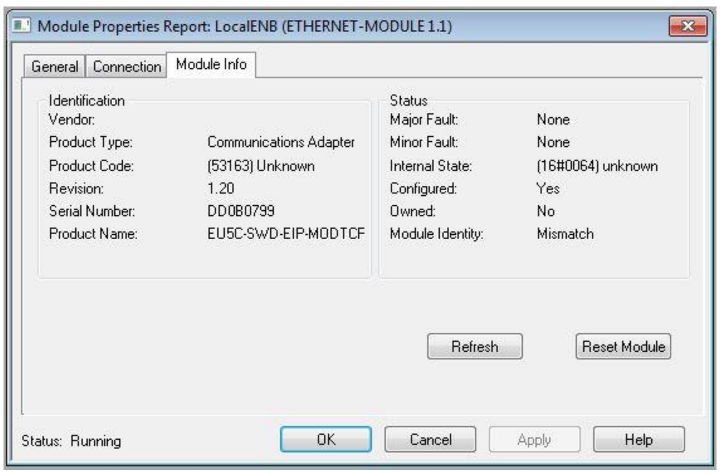

Figure 11: Module properties Module Info tab on RSLogix5000

PLC communications status monitoring

Monitoring Module Status

1. Program the next rung on your PLC program.

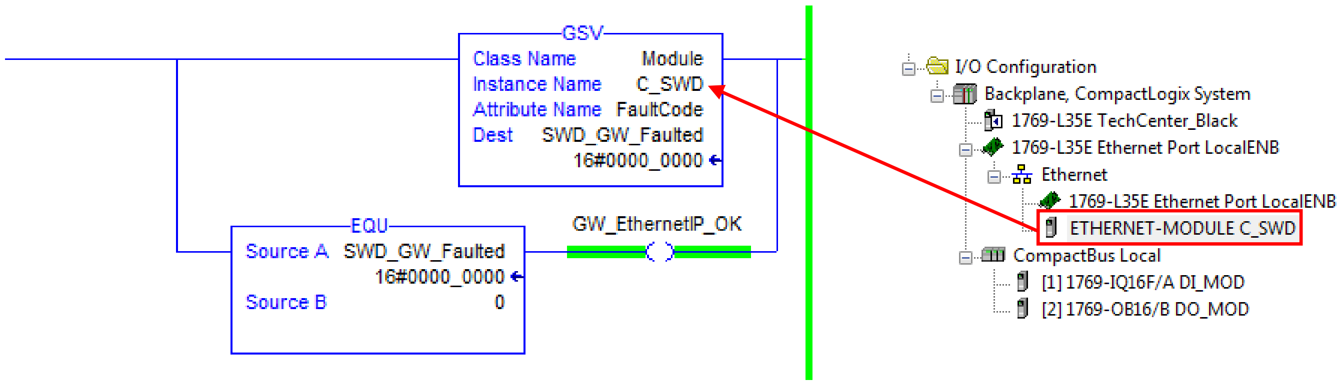

Figure 12: GSV Instruction on RSLogix5000

Instant Name: Match to the name of the SWD module configured on the controller organizer.

To detect a faulted condition on the EthernetIP-SWD communications module, the GSV instruction result should be different from zero.

Dest Code (Hexadecimal)	**Dest Code (Decimal)**	**Description**	**Troubleshooting recommended actions**
203	515	Connection time out	1. Confirm that the physical link between the PLC and the SWD NIM box has been attached properly 2. Confirm that data image sizes and IP address match between the module configuration on RSLogix software and SWD-Assist
204	516	Connection request error	Confirm that the RPI setting has been set properly.

Table 1: GSV Error Codes

2. The *I_DZC_STAT* is set initially in the DZC that self-identifies as the mapping coordinator (first to map DZC closest to the SWD NIM). All other DZCs on the network look for this bit to go high, then set their *I_DZC_STAT* bit high indicating the ZPA algorithm has been enabled in that DZC.

   DZC status bit suffix: *_I_DCZ_STAT* (Normal status ON=1)

   This bit is described as “DZC Distributed Control Algorithm Active” that reflects the state of the ZPA control algorithm. Status change of bit STAT does not happen immediately after power up, so it could be recommendable to program a permissive for the system running feedback until this bit has been turned on

3. For all SWD devices the *PRESENCE* (*_PRSNT*) bit could be monitored continuously by the PLC program:

SWD device presence bit *suffix*: ***_PRSNT*** (*Normal status ON=1*)

PLC acyclic communications configuration

"Explicit Messaging is used to transfer data that does not require continuous updates. With Explicit Messaging, you can configure and monitor a device's parameters on the network. When an explicit message is performed, by default no connection is made since it is an "unconnected" message. When timing of the message transaction is important, you can create a dedicated message connection between the controller and drive by checking the "Connected" box on the Communications tab message configuration screen during message setup. These message connections are in addition to the I/O connection. However, the trade-off for more message connections is decreased network performance. If your application cannot tolerate this, do not check the "Connected" box, which is recommended."

Message 1:

Configuration

Description = Write MSG instruction commands to "*open the communications channel*" between the AB PLC and the NIM.

Control Tag Name = MSG_Wrt_EthSWD_Set
Message Type = CIP Generic
Service Type = Set Attribute Single
Class = 0x65 Hex *(Constant)*
Instance = *SWD Device Address*
Service Code = 0x10 (*Set Attribute Single*)
Attribute = 0x71 Hex *(Constant)*
Source Length = 2 Bytes

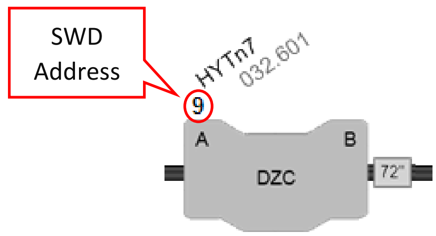

Figure 13: DZC SWD Node address

Source Element = MSG_ Ctrl_EthSWD[0]* – LSByte Data table to retrieve parameter (MSG_ Ctrl_EthSWD[1] MSByte), *see next table-*

Set source element tags to:

Section	*Decimal* Parameter LSByte - INT	*Hexadecimal* Parameter LSByte - INT	Array Data Length (SINT)
Performance	20_{10}	14_{16}	64
Diagnostic	21_{10}	15_{16}	3
Historical	22_{10}	16_{16}	64
Reset	23_{10}	17_{16}	64

Table 2: Data table reference code for Write MSG

(*) MSG_Ctrl_EthSWD is an INT memory array of 10 elements
MSG_ Ctrl_EthSWD[0]:= See table
MSG_ Ctrl_EthSWD[1]:= 0 (*zero*)

Communication

Path = *SWD_EthIP_Module_Name*

Message 2:

Description = <u>Read MSG</u> retrieves data from the specified table set up on Message 1
Control Tag Name = MSG_Rd_EthSWD_Data_ARRAY
Message Type = CIP Generic
Service Type = Get Attribute Single
Class = 0x65 Hex *(Constant)*
Instance = *SWD Device Node Address*
Service Code = 0x0e *(<u>Get Attribute Single</u>)*
Attribute = 0x72 Hex *(Constant)*
Destination Element: CR_EthSWD_dt_array[1]*
Instruction Outcome = Pull array data table out of a specific DZC#Instance, ex. DZC#3

(*) **CR_EthSWD_dt_array** is a SINT memory array of 100 elements

Message 3:

Description = <u>Read MSG</u> retrieves table length retrieved by Message 2
Control Tag Name = MSG_Rd_EthSWD_Data_LEN
Message Type = CIP Generic
Service Type = Get Attribute Single
Class = 0x65 Hex *(Constant)*
Instance = *SWD Device Address*
Service Code = 0x0e *(<u>Get Attribute Single</u>)*
Attribute = 0x73 Hex *(Constant)*
Destination Element= MSG_ Ctrl_EthSWD [2]
Instruction Outcome = length of data received by Message 2, see Table 2 for length values

Message 4:

Description= <u>Read MSG</u> if during data retrieving on message 2 there was a communication error, this message will retrieve an error code.
Control Tag Name = MSG_Rd_EthSWD_Data_ER
Message Type = CIP Generic
Service Type = Get Attribute Single
Class = 0x65 Hex *(Constant)*
Instance = *SWD Device Address*
Service Code = 0x0e *(<u>Get Attribute Single</u>)*
Attribute = 0x74 Hex *(Constant)*
Destination Element = MSG_Ctrl_EthSWD[3] and MSG_Ctrl_EthSWD [4]
Instruction Outcome = Error code result from reading operation by message 2

ANNEX

Requested Packet Interval (RPI)

Enter the requested rate of packet arrival (connection update rate). The connection is scheduled to move data to or from the module at least this often. The minimum and maximum RPI values are shown parenthetically to the right of the box/spin control.

The RPI is determined by the Owner Controller(s) of a module. If a Listen Only connection is established, the RPI for that connection **cannot be faster than** the fastest RPI configured for all owner controllers (for input modules), **or faster than** the RPI configured for the one owner controller (for output modules).

WARNING: Changing the RPI while online will temporarily disable the connection and may result in a loss of data.

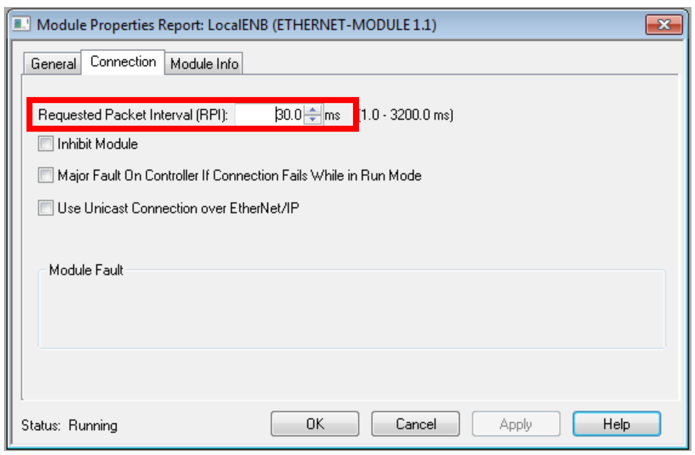

Figure 14: RPI configuration in RSLogix

Figure 15: SWD Assist SWD Baud rate setting

Importing tags from SWD-Assist software

Creating a PLC program for an EZLogic 4.0 conveyor system requires to import new tags into the PLC program configuration, every DZC and additional SWD devices over the network have a unique set of tags that could be imported. Follow the next procedure:

1. Open the SWD-Assist configuration file and go to Project on the main menu:

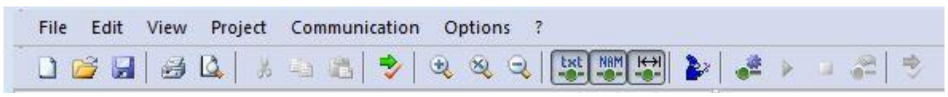

Figure 16: SWD Assist software main menu

2. Expand the Project's option:

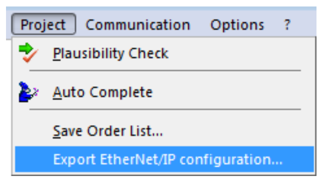

Figure 17: SWD Assist software Project's menu

3. A new screen will come up, then select a folder path and name to save the .CSV file with the new tag configuration. SWD-Assist will create a list of "Alias" tags names assembled by the name of the generic EthernetIP module and prefix tag names assigned automatically by SWD-Assist. See next figure:

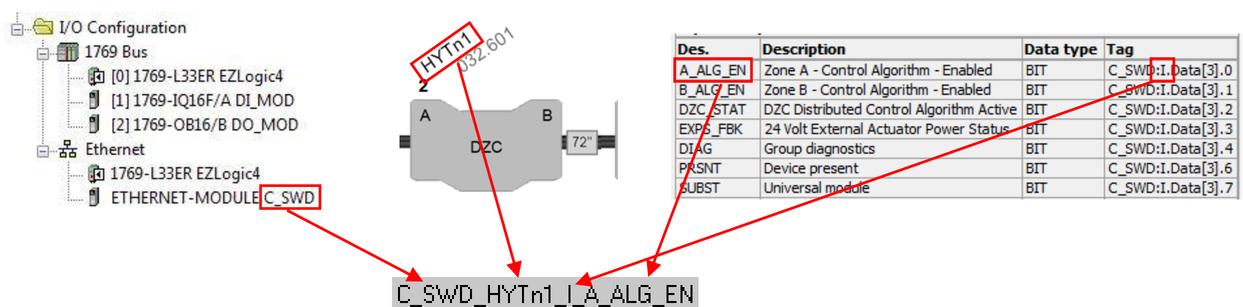

Figure 18: SWD Assist PLC tag name assembly

4. In RSLogix configuration software go to the Tools menu, then select option Import / Tags and Logic Comments…

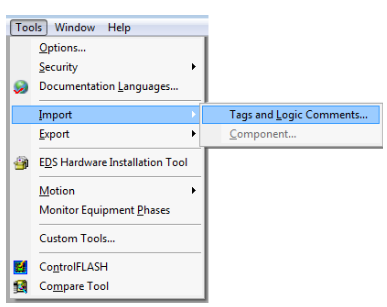

Figure 18: RSLogix tag list import command

5. Select the imported CSV file from SWD-Assist configuration software.
6. Verify configuration settings for importing the Collision Handling section. For non-advanced users it would be recommendable to keep the default configuration. See next figure:

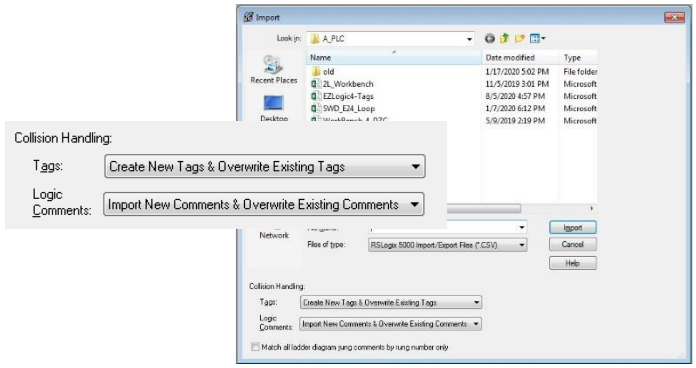

Figure 19: RSLogix tag list import subscreen

7. Click on Import and wait until tag downloading has finished. Verify importing results at the message pane on RSLogix.

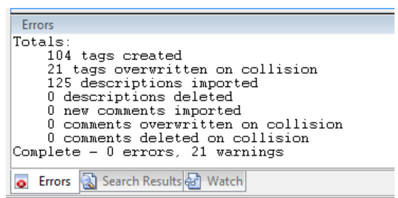

Figure 20: RSLogix tag list import results

8. Repeat this procedure as many times as the SWD network's configuration layout has been changed or a dual zone controller profile (1 or 2) has been updated.

ATTENTION: If SWD network has been modified (new DZC profile or new SWD device), SWD-Assist automatically will reassign alias names to the new base tag.

References

1. EZLogic® Plus CPD Project #17615, Arkansas Networked
   Functional Requirements Specification
   CS-1032 Product Specification Pistol Pete_021518.doc

2. EZLogic® 4.0 Application Note
   Steve Rees March 30, 2020

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