



Communication Processor Driver Documentation

Control & Information Protocol (CIP) Module

Author: Joe Teixeira
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Control & Information Protocol (Control & Information Protocol (CIP) Module

Overview

This document details the configuration interface for implementing a Liaison S3 or S5 Control and Information Protocol (CIP) over Ethernet/IP (EIP) module driver installation. This document assumes the reader is familiar with the Liaison's S3 and/or S5 communication processor configuration process. For more information refer to the configuration manual available in the support section of the website.

The Control & Information Protocol driver module, referred to as *CIP*, provides connectivity devices that support the CIP/EIP protocol. More information is available in the *CIP Common Specification, Release 1.0* and *Ethernet/IP Adaptation of CIP* reference manuals.

Functionality

The module driver's purpose is to obtain or provide tag data to or from a peer device on the network. Currently the module driver has been tested and validated with an Allen-Bradley Controllogix PLC, However the driver is compatible with or can quickly be made compatible with other CIP and EIP compatible devices.

<i>Command/Service</i>	<i>Code</i>	<i>Supported?</i>
Connected Data	0xB1	No
Unconnected Data	0xB2	Yes
UCMM Send Services	0x52	Yes
Read Data	0x4C	Yes
Write Data	0x4D	Yes
Set Attributes All	0x02	No
Get Attributes All	0x01	Yes
Set Single Property	0x50	Yes
Get Single Property	0x4F	Yes

Tags

CIP compatible devices may support some or all of a wide array of data types and structures. Different methods for accessing the same data exist. The *CIP* driver, currently, uses tag names to read/write data to from/to a device. This is not to be confused with the Pronghornⁱ Tag, as they maybe different. A Tag can represent any type of data. The following list defines the CIP data types supported. If a data type is required that is indicated as not being supported, please contact Liaison technical support to discuss an upgrade.

<i>Type</i>	<i>CIP</i>	<i>Pronghorn</i>	<i>Size</i>	<i>Supported?</i>
True/False	0x01	PHP	1 bit	Yes
Signed 8 bit	0x02	PHB	8 bits	Yes
Signed 16 bit	0x03	PHW	16 bits	Yes
Signed 32 bit	0x04	PHL	32 bits	Yes
Signed 64 bit	0x05		64 bits	No
8 bit	0x06	PHB	8 bits	Yes
16 bit	0x07	PHW	16 bits	Yes
32 bit	0x08	PHL	32 bits	Yes
64 bit	0x09		64 bits	No
32 bit Float	0x0a	PHF	32 bits	Yes
64 bit Float	0x0b		64 bits	No
Synchronous Time Info	0x0c			No
Date Info	0x0d			No
Time of Day	0x0e			No
Date and Time of Day	0x0f			No

ⁱ This name refers to the daemon that coordinates the communication functionality of the Liaison S3 and/or S5

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Type	CIP	Pronghorn	Size	Supported?
Character String (1 byte)	0x10	PHB	8 bits	Yes
bit string 8 bit	0x11	PHB	8 bits	Yes
bit string 16 bit	0x12	PHW	16 bits	Yes
bit string 32 bit	0x13	PHL	32 bits	Yes
bit string 64 bit	0x14		64 bits	No
Character String 2 bytes	0x15	PHW	16 bits	Yes
Duration (high resolution)	0x16		64 bits	No
Duration (long)	0x17		32 bits	No
Duration (short)	0x18		16 bits	No
Character String (N bytes)	0x19			No
Character String (1 byte + length)	0x1a		16 bits	No
Spec table 5-28	0x1b			No

Communication Interface

The CIP/EIP protocol uses any generic Ethernet hardware interface as a physical layerⁱⁱ medium. The CIP/EIP protocol primarily uses TCP/IP for the transportⁱⁱⁱ and network^{iv} layer functions. The Liaison S3 has a 10/100 Ethernet port as standard equipment. The S5 has dual 10/100 ports. On occasion a unit may be configured with supplementary Ethernet interface modules which may require the specification of additional parameters in the net.csv file.

ⁱⁱ Communication protocols are constructed in a specific order, not unlike a house with its foundation installed first, framing, roof, electrical, plumbing, etc... The foundation of any communication protocol is called the physical layer, which refers to the how a message is electrical encoded for transmission

ⁱⁱⁱ Divides data into communication-ready, network buffer-sized datagrams and tracks the delivery and order of the messages

^{iv} handles the addressing of packets

Network Configuration

The configuration of this module involves at least two files and sometimes three when user-defined functions are employed. The net.csv and map.csv files are used respectively for communication parameters and data mapping. A third file; the script.lua file, is used to create user-defined functions. Please refer to the configuration manual for more information. The succeeding tables outline the available parameters and their default values. Some of the parameters are standard to all Ethernet network modules, while others are particular to this module. Not specifying a particular parameter means that its default value will be used. Parameters may be listed in any order. The following table provides the communication parameters used in the net.csv file (network parameterization).

Name	Valid Range	Default	Description
Retries	0 – 9	1	The number of times to attempt a retransmit
Card	1 or 2	1	The Ethernet card being used. Typically only 1 Ethernet interface is installed.
TCP_Port	1024 – 65535	0xAF12	This is the TCP port number being used to communicate to another CIP/EIP device. ^v
Timeout	1 – 65000	1000	The number of milliseconds to wait for a reply to read/writes
Open_Interval	1 – 65000	60	The number of seconds to wait before re-attempting connection open

Errors

If the validation of any network configuration parameters fails, a **critical error** message will be placed in the logs and the network module will not start. The following is a list of critical messages that may be generated.

Msg ID	Mnemonic	Description
108	CRT_BAD_TCPPORT	Invalid TCP port (%d) Must be between 1024 and %d - The specified TCP port is out of range
101	CRT_BAD_CARDNO	Invalid card number (%d) Must be between 1 and %d - The specified card number must be 1 or 2
100	CRT_BAD_TIMEOUT	Invalid timeout value (%d) must be less than %d ms - The time value is out of range.

Mapping Configuration

Mappings^{vi} are found in a CSV^{vii} file named maps.csv which may be edited either through the Edit>Config>Map.csv menu selection in the Java application accessible through your browser, or by opening the file directly in Excel or other spreadsheet program. The spreadsheet program has the advantage of allowing a user to annotate a project extensively outside of the delimited areas, which effectively combines the configuration file and its documentation. The parameters listed only pertain to this module. Refer to the **Configuration Manual** for a list of the other common parameters used to configure a mapping. Most parameters have a default value that will be used if the parameter does not exist.

^v This must be 0xAF12 for CIP/EIP devices.

^{vi} a term referring to the definition of data source or destination within the network module and its corresponding data register location in the pronghorn database. A command that reads ten registers from a remote device and deposits them into internal pronghorn locations is a single mapping. Many mappings can be configured for each active network module

^{vii} comma separated values; a text file format common to spreadsheets for listing arrays of values. The delimited is usually a comma, although in some cases it is a semi-colon. Pronghorn automatically determines which by reading the first character of the file which in a properly configured file is always blank and thus stores only the delimiter type being used

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Name	Valid Range	Default	Description
IP	Host name ^{viii}	0	The IP or host name of the device being accessed
Tag	Name of Tag	null	Identifies the data name on the peer device

Errors

If the validation for a particular mapping configuration parameter fails, an error message will be placed in the logs and that particular mapping item will not be added to the internal mapping list. All other mappings that has passed validation will function normally.

Msg ID	Mnemonic	Description
9001	ERR_NO_HOSTNAME	Item %d, A valid host name or IP address must be specified - The IP was not specified or entered incorrectly.
9002	ERR_BAD_TAG	Item %d, Tagname missing or Invalid - The specified Tag was not entered correctly or is missing.
66	ERR_BAD_POLLTYPE	Map item %d has invalid Poll Command Type (%s) - The specified command is not valid
65	ERR_BAD_DATATYPE	Map item %d has invalid Data Type (%s) - The specified file type is not valid

^{viii}This is typically a dotted notation address (i.e. 192.168.1.1) or can optionally be a host name listed in the */etc/hosts* file.

Status Counters

This module driver maintains a set of status counters for recording the operational status of the module and the network.

<i>Msg ID</i>	<i>Mnemonic</i>	<i>Description</i>
9009	CNT_MSG_SENT	Number of Messages transmitted - Keeps track of the number packets sent
9010	CNT_MSG_RECV	Number of Messages received - Keeps track of the number of packets received
9011	CNT_CMD_SENT	Number of commands transmitted - Keeps track of the number of request sent
9012	CNT_CMD_RECV	Number of commands received - Keeps track of the number of request received
9013	CNT_REPLY_SENT	Number of replies transmitted - Keeps track of the number of command replies sent
9014	CNT_REPLY_RECV	Number of replies received - Keeps track of the number of command replies received
9015	CNT_ERR_SENT	Number of errors sent - Keeps track of the number of error replies sent
9016	CNT_ERR_RECV	Number of errors received - Keeps track of the number of error replies received
9017	CNT_RETRIES	Number of retries - Keeps track of the number of retransmits sent
9018	CNT_REPLY_TIMEOUTS	Response timeouts - Keeps track of the number of no responses
9019	CRD_CHAR_SENT	Number of characters transmitted - The number of bytes sent, which is kept track by the hardware interface
9020	CRD_CHAR_RECV	Number of characters received - The number of bytes received, which is kept track by the hardware interface

Other Messages

In the normal operation of this module certain types of message may appear in the logs. Refer to the **User Manual** for a list of the common messages that can be seen in the logs. In addition the following message may appear in the logs.

<i>Msg ID</i>	<i>Mnemonic</i>	<i>Description</i>
9003	ERR_NO_SESSION	Session not established with %s - Handshaking with the peer device not complete
9004	ERR_WRONG_LENGTH	Transaction length mismatch (actual=%d, expected=%d) - The number of bytes is not what was expected
9005	ERR_UNREAD	Error while processing unsolicited Read (%s, Addr=%s, Len=%d) - An error occurred for an unsolicited read request
9006	ERR_UNWRITE	Error while processing unsolicited Write (%s, Addr=%s, Len=%d) - An error occurred for an unsolicited write request
9007	NTC_RETRY	Retry #%d, due to error %d - A notice, identifying a retry attempt
9008	NTC_SESSION_ESTABLISHED	Session established with %s, connection ID=%d - Identifying handshaking with peer device complete

<i>Msg ID</i>	<i>Mnemonic</i>	<i>Description</i>
124	ERR_OBJ_NOT_FOUND	Object TnsList[0x%x] not found - Did not find the original transaction identifier

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<i>Msg ID</i>	<i>Mnemonic</i>	<i>Description</i>
124	ERR_OBJ_NOT_FOUND	Object Pending[0x%x] not found - Did not find the original PHDaemon request
73	ERR_NOT_HANDLED	Command/Type 0x%x not handled in this context - A command packet or type field is not supported
75	ERR_WRONG_RESPONSE	Unexpected Response 0x%x, s/b 0x%x - The response received is not what was expected
109	ERR_NETWORK	Network error rc=%d (0x%x) '%s' - An network exception packet was received
88	ERR_REQ_LENGTH	Request length not found (expected=%d, found=%d) - The specified address + length is out of range
62	ERR_BAD_LENGTH	Length too long (Identity, %d < %d > 0) - The response length, for the Identity command, is too long
111	ERR_NOT_OPEN	Resource not open '%s' - The connection to the specified IP or Host is not open
81	ERR_INP_TIMEOUT	Timed out waiting for input - The response to a request was not received