Software Manual

LMD Ethernet TCP/IP

Ethernet TCP/IP Fieldbus Manual

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EtherNet/IP™

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Novanta IMS

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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed. Failure to use Novanta IMS software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

For information on the availability of products, go to https://novantaims.com/

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Safety Information

Important Information

NOTICE Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a “Danger” or “Warning” safety label or message indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert of potential personal injury hazards. Obey all safety messages and labels that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result** in death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result** in death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

CyberSecurity Standards and Certification

Novanta IMS follows local regulations and uses additional industry established frameworks to conform to cyber security standards. Novanta IMS also takes an active part in the evolution of today’s industrial cyber security standards, contributing to these standards and frameworks.

In accordance with US California Senate Bill No. 327, and under direct guidance from Novanta IMS, Novanta IMS has implemented a level of cyber-secure protection in the Ethernet-based LMD product line in order to protect these devices from outside cyber attacks. By choosing to disable these features, the customer is acknowledging their acceptance of potential unauthorized outside access.

Qualification of Personnel

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Novanta IMS for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

Intended Use

The product may only be used in compliance with all applicable safety regulations and directives, the specified requirements, and the technical data.

Prior to using the product, perform a risk assessment in view of the planned application. Based on the results, the appropriate safety measures must be implemented.

Since the product is used as a component in an entire system, ensure the safety of persons by means of the design of this entire system (e.g., machine design).

Operate the product only with the specified cables and accessories. Use only genuine accessories and spare parts. The product must NEVER be operated in explosive atmospheres (e.g., hazardous locations, Ex areas).

Any use other than the use explicitly permitted is prohibited and can result in hazards.

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel.

Product Related

When the system is started, the drives are usually out of the operator's view and cannot be visually monitored.

⚠ DANGER

UNINTENDED CONSEQUENCES OF EQUIPMENT OPERATION

Only start the system if there are no persons in the zone of operation.

Failure to follow these instructions will result in death or serious injury.

Drives may perform unintended movements because of incorrect wiring, incorrect parameter settings, incorrect data, or other errors. Further, interference (e.g., electromagnetic interference (EMI)) may cause unpredictable responses in the system.

⚠ WARNING

UNINTENDED MOVEMENT

- Carefully install the wiring in accordance with the electromagnetic compatibility (EMC) requirements.
- Do not operate the drive system with unknown parameter settings or data.

Failure to follow these instructions can result in death or serious injury.

The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop, overtravel stop, power outage, and restart.

⚠WARNING

LOSS OF CONTROL

- Separate or redundant control paths must be provided for critical functions.
- System control paths may include communication links. Consideration must be given to the implication of unanticipated transmission delays or failures of the link.
- Observe all accident prevention regulations and local safety guidelines. [1]
- Each implementation of the product must be individually and thoroughly tested for proper operation before being placed into service.

Failure to follow these instructions can result in death or serious injury.

1 For USA: Additional information, refer to NEMA ICS 1.1 (latest edition), “Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control” and to NEMA ICS 7.1, (latest edition), “Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable-Speed Drive Systems”

Drives may perform unintended movements due to mechanical damage to connectors. Mechanical damage to the connectors may cause erratic or uncontrolled operation. Installation with a bent or broken mounting flange, motor shaft, or misaligned coupling may cause unintended behavior and possible destruction of system components as a result.

⚠WARNING

LOSS OF CONTROL, ERRATIC OPERATION AND DESTRUCTION OF MECHANICS

- Do not drop product.
- Leave product in protective packaging until ready for use.
- Carefully inspect connectors prior to installation in a system for mechanical damage.
- Carefully inspect motor shaft and ensure shaft rotates freely without binding.

Failure to follow these instructions can result in death or serious injury.

Opening LMD heat sinks can affect factory-set encoder alignment and impact Hybrid Motion Technology (hMT) performance. Tamper seals are used to ensure factory hardware settings remain unaltered and match the encoder alignment set during the manufacturing process. If a seal is broken, the LMD product warranty is void.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Do not open the LMD housing for any reason.
- Contact a Novanta IMS service representative if the product exhibits unexplained, erratic, or incorrect operation.

Failure to follow these instructions can result in death or serious injury.

When working on the wiring, inserting or removing connectors may cause unintended behavior and possible destruction of the system components.

⚠CAUTION

UNINTENDED BEHAVIOR AND DESTRUCTION OF SYSTEM COMPONENTS

Remove all power before working on the wiring.

Failure to follow these instructions can result in injury or equipment damage.

Radial (side) loading or axial (thrust) impacts on the shaft may result in premature bearing failure.

NOTICE

EXCESSIVE RADIAL OR AXIAL LOADS

- Do not place unsupported radial or side loads on motor shaft.
- Do not allow the shaft to be subject to impact forces or otherwise struck by external objects.

Failure to follow these instructions can result in equipment damage.

Source Documents and Software

The information provided in this manual supplements, but is not a substitute for, the product hardware manual.

Product Manuals

The latest versions of the manuals are available for download from:

https://novantaims.com/dloads/product-literature/manuals-3/

Applicable manuals for LMD Ethernet products are:

- LMD MCode Programming and Software Reference Manual (LMD-MCODE)
- LMD MODBUS/TCP Fieldbus Manual (LMD-MODBUS)
- LMD Profinet Fieldbus Manual (LMD-PROFINET)
- LMD Software Suite Manual (LMD-SWSUITE)
- LM42 Ethernet TCP/IP with Pluggable Connectors (LMDE42)
- LM42 Ethernet TCP/IP with M12 Circular Connectors (LMDE42IP)
- LM57/LM85 Ethernet TCP/IP with Pluggable Connectors (LMDE57-85)
- LM57/LM85 Ethernet TCP/IP with M12 Circular Connectors (LMDE57-85IP)

Source EDS Files

For easier engineering, Electronic Datasheet Files and product master data are available for download from: https://novantaims.com/dloads/firmware/

Graphic User Interface Software

For easier configuration, a Graphic User Interface (GUI) is available for use with LMD products. The LMD Software Suite is available for download from:
https://novantaims.com/dloads/user-interface-software/

Further Reading

User Association

Open DeviceNet Vendor Association (ODVA)
https://www.odva.org/

The following is a list of recommended literature for additional information:

- The CIP Networks Library Volume 1 Common Industrial Protocol
- The CIP Networks Library Volume 2 DeviceNet Adaptation of CIP
- The CIP Networks Library Volume 3 DeviceNet Adaptation of CIP
- The Common Industrial Protocol (CIP) and the Family of CIP Networks

Standards and Terminology

The technical terms, terminology, symbols, and the corresponding descriptions in this manual, or that appear in or on the products themselves, are generally derived from the terms or definitions of international standards.

In the area of functional safety systems, drives, and general automation, this may include, but is not limited to, terms such as safety, safety function, safe state, fault, fault reset, malfunction, failure, error, error message, dangerous , etc.

Among others, these standards include:

- IEC 61800 series: “Adjustable speed electrical power drive systems”
- IEC 61158 series: “Industrial communication networks - Fieldbus specifications”
- IEC 61784 series: “Industrial communication networks - Profiles”
- IEC 61508 series: “Functional safety of electrical/electronic/programmable electronic safety-related systems”

Writing Conventions and Symbols

Bulleted Lists

The items in bulleted lists are sorted alphanumerically or by priority. Bulleted lists are structured as follows:

- Item 1 of bulleted list
- Item 2 of bulleted list
  - Subitem for 2
  - Subitem for 2
- Item 3 of bulleted list

Making Work Easier

Information on making work easier is highlighted by this symbol:

Sections highlighted this way provide supplementary information on making work easier.

Parameters

Parameters are shown as follows

RC Motor Run Current

Units of Measure

Measurements are given in both imperial and metric values. Metric values are given in parenthesis.

Examples:

1.00 in (25.4 mm)
100 oz-in (70.6 N-cm)

Website Directory

NOTE: Direct links are subject to change as website updates occur. Each of the websites below can also be accessed through menu options on the Novanta IMS Main Page:
https://novantaims.com/

Downloads:
https://novantaims.com/dloads/

Resources:
https://novantaims.com/resources/

Certifications and Listing Information:
https://novantaims.com/dloads/certificationssustainability/

Contact and Support:
https://novantaims.com/contacts/

CyberSecurity Information:
https://novantaims.com/all-products/cybersecurity/

Knowledge Based Solutions:
https://knowledge.imshome.com/s/

Chapter 1
Introduction to Ethernet/IP

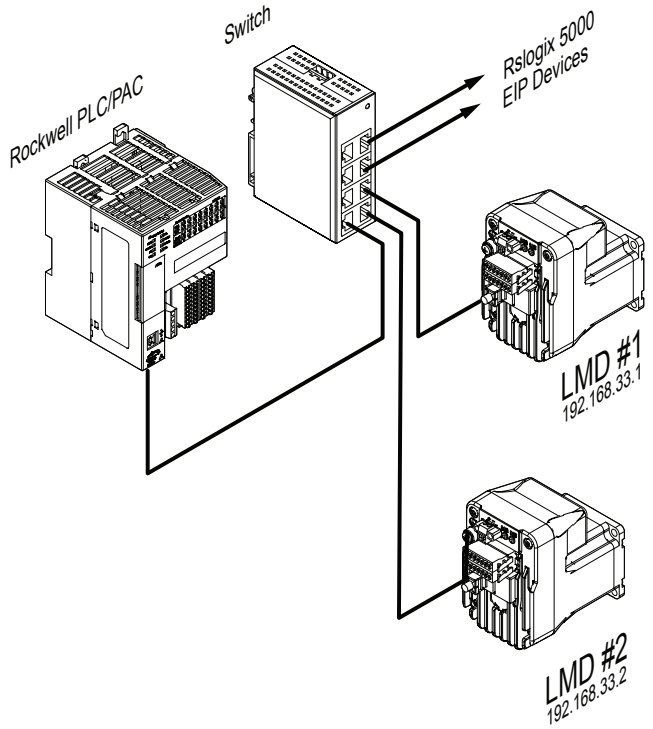
What's in this Chapter?

This chapter includes the following topics:

Ethernet/IP is a fieldbus based on Transmission Control Protocol (TCP) and User Datagram Protocol (UDP). Ethernet/IP is an extension of the Ethernet that incorporates Common Industrial Protocol (CIP) as an application layer for automation applications. This establishes the Ethernet to be suited for industrial control and allows products from different manufacturers can be networked without requiring a special interface adaptor. The majority of the required network components correspond to the Ethernet components used in ethernet applications.

Fieldbus Devices on the Ethernet/IP Network

Different products with an Ethernet/IP interface can be operated in the same fieldbus. Ethernet/IP provides a common basis for interchanging commands and data between the network devices.



Ethernet/IP Technology

Ethernet/IP devices are based on the same technology as devices on Ethernet networks in ethernet applications. Many components from the existing network can be used. However, industrial switches are suggested for time-critical applications.

Data Security

The larger the network, the greater the risk of unauthorized external access. The operator of the local network must take appropriate measures to prevent unauthorized access. Contact your network administrator prior to commissioning the product.

Basics

The Open Devicenet Venders Association (ODVA) is in charge of the specifications for the Ethernet/IP network and Ethernet/IP data terminal equipment. Additional information is available from the ODVA website:

http://www.odva.org

Number of Nodes

Theoretically, the number of nodes in an Ethernet/IP network is unlimited. Subnet size and whether or not a CIP router is used are factors in node number limitations. For example, 254 nodes are possible in a class C subnet.

Cable Length

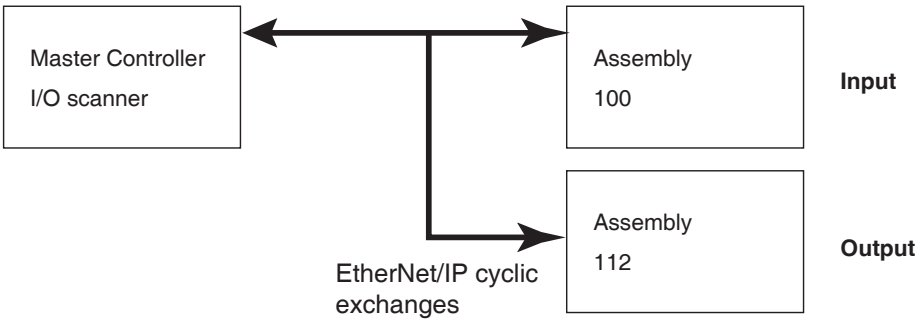
The maximum cable length between Ethernet/IP terminal points is 328.1 ft (100 m). Cable length between infrastructure components is limited to 295.3 ft (90 m).
Interference in industrial environments may require the use of shorter cables.

Drive Profiles

The product supports the following drive profiles:
- “Drive Profile LMD”

Communication Means

The product supports the following communication means:



The product identifies itself as CIP “Generic Device” (Device Type = 0h).

Data Link Layer

The Ethernet/IP data link layer uses the transmission mechanisms as per IEEE 802.3 Standard Ethernet Specification (edition 2002). This makes it possible to use a wide selection of available Ethernet components.

Physical Layer

Information provided via the International Electrotechnical Commission (IEC), American National Standards Institute (ANSI), Telecommunications Industry Association (TIA), and Environmental Impact Assessment (EIA) specify minimum requirements for ambient conditions, cabling, and connectors. Refer to these standards for additional information for minimum requirements for industrial Ethernet/IP applications.
- RJ-45 connectors are used for Industrial Ethernet/IP.
- Shielded or unshielded CAT5 or CAT6 cables can be used for Industrial Ethernet/IP.
- Copper media can only be used for distances up to 328.1 ft (100 m).

Terms: Object Class, Instance, Attribute, Service

The Ethernet/IP approach is object-oriented.

- CIP defines object classes.
- One or more instances (objects) can be derived from such object classes.
- The attributes of an object class or the instance derived from it contain the various parameters.
- Services are actions that are possible with these attributes.

Example:

Class	Instance	Attribute ID	Description	MCode
0x64	0x01	0x01	Reset enable	CE

CIP Object Model

Refer to “Object Model” on page 17 for information.

Communication Model

Ethernet/IP uses the producer-consumer communication model. All nodes check the bus for a data packet with the Identifier they support.. Data packets sent by producers can only be received by the consumers with the same identifier as the packets.

Groups of Connections

Ethernet/IP is a connection-oriented network. Connections must be established and managed between two nodes. There are 4 connection groups with different priorities:

Group 1	Top-priority process data (highest priority)
Group 2	For simple master-slave connections
Group 3	For Explicit Messages
Group 4	Reserved group (lowest priority)

Electronic Data Sheet (EDS)

An EDS file is an ASCII file that contains device-specific and vendor-specific descriptions of all parameters for a device, as well as the fieldbus-specific communication parameters. An EDS file is required for commissioning.

Encapsulation

Ethernet/IP is based entirely on existing TCP/IP and UDP/IP technologies that are used without any modification. TCP/IP is used for the transmission of Explicit Messages while UDP/IP is used for I/O Messaging.

Messaging and Message Types

Ethernet/IP uses two types of messaging: Explicit Messaging and Implicit (I/O data) Messaging. Ethernet/IP defines several message types for communication. The product described here uses the “Explicit Message” and “Implicit Message” message types.

Explicit Messages

Explicit Messaging are point-to-point connections between two network nodes that are used for transactions of the type request - response. These connections are used to address parts of a device which are accessible via the network. The data field of Explicit Messages contains both protocol data and application-specific commands.

Implicit Messages

Implicit Messages, also referred to as I/O Messages, are transmitted via UDP/IP. Implicit Message connections are often established as One-to-Many relationships in the producer-consumer Multicast model of Ether-Net/IP.

The data fields of I/O Messages contain no protocol information, only time-critical I/O data. Implicit Messages are smaller than Explicit Messages, allowing for faster processing. These messages are used to transport application-specific I/O data over the network at regular intervals. The meaning of the data is pre-defined at the time the connection is established. Implicit Messages can contain assemblies of several parameters that can be transmitted in a single message. The parameters for configuring Ethernet/IP communication are described in the Ethernet TCP/IP Configuration Utility section of the LMD Software Suite (LSS) manual.

Command Processing: Transmit and Receive Data

The master sends a command to the drive system (slave) to execute a motion command, activate functions or request information from the slave. The slave executes the command and acknowledges it with a response message that may contain an error message if an error occurred.

The master device can send new commands as soon as it has received acknowledgement concerning the current command. Acknowledgement information and error messages are included in the transmitted data in bit-coded form.

The master must then continuously monitor for completion of the processing command by evaluating the acknowledgment from the slave.

I/O messages are not acknowledged from the slave.

Communication via Explicit Message

An Explicit Message (Ethernet/IP-specific or vendor-specific) is used to read or write an individual parameter.

The parameter is accessed by means of Class Instance Attribute, as per CIP.

Communication via Implicit Messages

An I/O Message is used for realtime exchange of process data. I/O messages lend themselves for motion commands. Transmission is very fast because the data is sent without administration data and a transmission acknowledgement from the recipient is not required.

The master can control the operating states of the slave by means of I/O Message. For example, enable and disable the power stage, trigger a “Quick Stop”, reset errors, or activate operating modes.

Changing operating states and activating operating modes must be done separately. An operating mode can usually only be activated if the operating state is already “Operation Enabled”.

A new operating mode can only be activated when the motor is at a standstill.

Output, Input

Output and Input refer to the direction of data transmission from the perspective of the master.

- Output: Commands from the master to the slave (originator to target).
- Input: Status messages from the slave to the master (target to originator).

Assembly

I/O Messages contain a collection (Assembly) of different parameters that are transmitted with a single message.

The following Assemblies are defined for Ethernet/IP:

- Output Assembly, instance 112
- Input Assembly, instance 100

Polled I/O Connection

The Assemblies are used in a Polled I/O Connection . A Polled I/O Connection is initiated by the master with a Poll Command. The Slave responds with a Poll Response.

Hardware Installation

⚠WARNING

SIGNAL AND DEVICE INTERFERENCE

Signal interference can cause unexpected responses of device.

- Install the wiring in accordance with the EMC requirements.
- Verify compliance with the EMC requirements.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

For information on installation of the device and connecting to the fieldbus, refer to the product's hardware manual.

Configuration

Configuring LMD Ethernet devices is accomplished through the LSS, available for download from: https://novantaims.com/dloads/

NOTE: For Ethernet/IP and Profinet applications, Echo Mode (EM) defaults to option 2 and immediate commands entered via the Motion Control Interface will not be visible. For additional information on Echo Mode, refer to the LMD MCode Manual, available for download from: https://novantaims.com/dloads/product-literature/manuals-3/

Chapter 2
Object Model

What's in this Chapter?

This chapter includes the following topics:

Data Types Used in this Object Model

Data Types Identification	
Data Type	**Description**
SINT	Signed 8-bit integer
INT	Signed 16-bit integer
DINT	Signed 32-bit integer
USINT	Unsigned 8-bit integer
UINT	Unsigned 16-bit integer
UDINT	Unsigned 32-bit integer
STRING	Character string (1 byte per character)
SHORTSTRING*nn*	Character string (1 byte in length; up to *nn* characters)
BOOL	1 bit
BYTE	Bit string (8-bits)
WORD	Bit string (16-bits)
DWORD	Bit string (32-bits)
REAL	IEEE 32-bit single precision floating point

Identity Object (01_h – 1 Instance)

The following tables contain the attribute, status, and common services information for the identity object.

Identity Object (01h – 1 instance)					
Instance	**Attribute ID**	**Name**	**Data Type**	**Data Value**	**Access Rule**
0x00	0x01	Revision	UINT	1	Get
0x01	0x01	Vendor number	UINT	243	Get
	0x02	Device type	UINT	43	Get
	0x03	Product code number	UINT	15362	Get
	0x04	Product major revision Product minor revision	USINT USINT	02 22	Get
	0x05	Status	WORD	See Table 7.4	Get
	0x06	Serial number	UDINT	Unique 32 bit value	Get
	0x07	Product name	SHORTSTRING32	LMD	Get

Identity Object's Common Services			
Service Code	**Implemented for:**		**Service Name**
	Class Level	**Instance Levels**	
0x05	No	Yes	Reset
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

Identity Object Attribute 0x05 (Status)

This attribute represents the current status of the entire device. Its value changes as the state of the device changes. The status attribute is a WORD, with the following bit definitions:

15 ... 12	11	10	9	8	7 ... 4	3	2	1	0
Rsrvd	Maj UF	Maj RF	Min.UF	Min. RF	Ext Stat	Rsrvd	Config	Rsrvd	Owned

Bit Definitions for Status Instance Attribute of Identity Object		
Bit(s)	**Name**	**Meaning**
0		1 indicates the device (or an object within the device) has an owner. Within the Master/Slave paradigm the setting of this bit means that the Predefined Master/ Slave Connection Set has been allocated to a master.
1		Reserved, always 0
2	Configured	1 indicates the application of the device has been configured to do something different than the “out–of–box” default. This shall not include configuration of the communications.
3		Reserved, always 0
4 – 7	Extended Device Status	Vendor–specific or as defined by table below. The EDS shall indicate if the device follows the public definition for these bits using the DeviceStatusAssembly keyword in the [Device] section of the EDS. If these bits are vendor specific then they shall be enumerated in the EDS using the Assembly and Parameter sections.
8	Minor Recoverable Fault	1 indicates the device detected a problem with itself, which is thought to be recoverable. The problem does not cause the device to go into one of the faulted states.
9	Minor Unrecoverable Fault	1 indicates the device detected a problem with itself, which is thought to be unrecoverable. The problem does not cause the device to go into one of the faulted states.
10	Major Recoverable Fault	TRUE indicates the device detected a problem with itself, which caused the device to go into the “Major Recoverable Fault” state.
11	Major Unrecoverable Fault	TRUE indicates the device detected a problem with itself, which caused the device to go into the “Major Unrecoverable Fault” state.
12 – 15		Reserved, always 0

Assembly Object (04_h – 4 Instances)

NOTE: Instance attributes show the default mapping of parameters to an attribute. This mapping may be changed to any MCode mnemonic of the same data type using the TCP/IP Configuration Utility. See Section 5: Commissioning.

Assembly Object (04h – 4 instances)					
Instance	**Attribute ID**	**Name**	**Data Type**	**Data Value**	**Access Rule**
Class (Instance 0)	1	Revision	UINT	2	Get
	2	Max instance	UINT	0xFF	Get
Input (T→O) Instance 100	3	**Bytes**	**MCode Mnemonic**	**Description**	Get
		BOOL	EF	Error flag / Same byte	
		BOOL	MV	Moving flag	
		USINT	IN	Read inputs as a group	
		USINT	Pad	Pad byte	
		USINT	Pad	Pad byte	
		DINT	C1	Position counter	
		DINT	C2	Encoder counter	
		DINT	LL	Lead/Lag	
Output (O→T) Instance 112	3	**Bytes**	**MCode mnemonic**	**Description**	Get/set
		UDINT	A	Acceleration	
		UDINT	D	Deceleration	
		DINT	MA	Move to absolute position	
		DINT	MR	Move to relative position	
		USINT	RC	Run current percent	
		USINT	HC	Hold current percent	
		BYTE	OT	Write digital outputs	
		USINT	Pad	Pad byte	
		DINT	SL	Slew	
		UDINT	VI	Initial (starting) velocity	
		UDINT	VM	Maximum (final) velocity	
		USINT	TQ	Torque percent	
		USINT	EF	Error Flag	

1 This instance allows clients to monitor input data without providing output data.
2 This instance allows clients (PLCs) to monitor input data without providing output data. To use this connection type, an owning connection must exist from a second client and the configuration of the connection must match exactly.
3 Configuration data is not required, but it must match if supplied. Contents of the configuration instance are yet to be determined.

Assembly Object's Common Services			
Service Code	**Implemented for:**		**Service Name**
	Class Level	**Instance Levels**	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	Yes	Yes	Set_Attribute_Single

TCP Object ($F5_h$ – 1 Instance)

The following tables contain the attribute and common services information for the TCP Object.

TCP Object (05h – 1 instance)					
Instance	**Attribute ID**	**Name**	**Data type**	**Data value**	**Access rule**
Class (Instance 0)	1	Revision	UINT	1	Get
Instance 1	1	Status[2]	DWORD	See Table 5-3.2*	Get
	2	Configuration capability[2]	DWORD	See Table 5-3.4*	Get
	3	Configuration control[2]	DWORD	0x0	Get/set
	4	Physical Link Object [2] Structure of		Below are defaults	Get
		Path Size	UINT	0x2	
		Path	Array of Word	0x20 0xF6 0x24 0x01	
	5	Interface configuration[2] Structure of		Below are defaults	Get/set
		Important: The interface configuration takes effect under the following conditions: Power cycle or Reset. I reset may be initiated by sending the character R (0x52) to the Name Server attribute.			
		IP Address	UDINT	192.168.33.1	
		Network Mask	UDINT	255.255.0.0	
		Gateway Address	UDINT	192.168.1.200	
		Name Server[1]	UDINT	0x0	
		Name Server 2[1]	UDINT	0x0	
		Domain Name Size[1]	UINT	0x0	
		Domain Name[1]	STRING	0x0	
	6	Host name[2] Structure of:		Below are defaults	Get
		Host Name Size	UINT	0x0	
		Host Name	STRING	0x0	

1 Always send NULL
2 For additional details on these attributes, refer to *Volume 2: Ethernet/IP Adaptation of CIP,* available from ODVA.

Assembly Object's Common Services			
Service Code	**Implemented for:**		**Service Name**
	Class Level	**Instance Levels**	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

Ethernet Link Object ($F6_h$ – 1 Instance)

The following tables contain the attribute and common services information for the Ethernet Link Object.

Ethernet Object (0xF6 – 1 Instance)					
Instance	**Attribute ID**	**Name**	**Data type**	**Data value**	**Access rule**
Class (Instance 0)	1	Revision	UINT	1	Get
Instance 1	1	Interface speed[1]	DWORD	0	Get
	2	Interface flag[1]	DWORD	See note[1]	Get
	3	Physical address	ARRAY	MAC Address	Get

1 For additional details on these attributes, refer to *Volume 2: Ethernet/IP Adaptation of CIP* available from ODVA.

Assembly Object's Common Services			
Service Code	**Implemented for:**		**Service Name**
	Class Level	**Instance Levels**	
0x0E	Yes	Yes	Get_Attribute_Single

Chapter 3
Manufacturer Specific Objects

What's in this Chapter?

This chapter includes the following topics:

Preliminary

This section contains the objects specific to the LMD Motion Control devices.

The LMD Motion Control device is divided into Object classes by functional grouping.

Object Class Groupings	
Object	**Description**
0x64	Setup instructions
0x65	Miscellaneous instructions and flags
0x66	Motion instructions and flags
0x67	I/O instruction variables and flags
0x68	Position related instructions and flags
0x69	Encoder related instructions and flags
0x6A	Hybrid specific instructions and flags

Access Types Identification	
Access	**Description**
RO	Readable only
WO	Writable only
WONE	Writable only , no equal sign
RW	Readable and writable, unconditional
RW_IO	Readable always, Writable only if I/O connection present

NOTE: References in the section to “I/O” refer to the control of the hardware input/output points on the device.

MCode Compatibility

Each attribute on the object class grouping references a 1 or 2 character MCode mnemonic.

For detailed usage instructions, value ranges and restrictions, reference the *LMD Programming and Reference Manual*, available for download from:

NOTE: https://novantaims.com/dloads/product-literature/manuals-3/

Product Support

Each attribute table has a column indicating the LMD product supported by the object.

- O: Open loop
- C: Closed loop with hMT
- A: Absolute encoder

Setup Object (64_h – 1 instance)

The Setup object contains attributes configuring basic setup parameters.

Setup Object (64_h – 1 Instance)						
Instance	**Attribute ID**	**Description**	**Support**	**Data Type**	**MCode**	**Access**
Class (Instance 0)	0x01	Revision	—	UINT	—	RO
Instance 1	0x01	Escape	O C A	BOOL	<esc>	CMD
	0x02	Output clock width	O C A	USINT	CW	RW
	0x03	Drive enable	O C A	BOOL	DE	RW
	0x04	Trip on relative position	O C A	USINT	TR	RW
	0x05	Warning temperature	O C A	USINT	WT	RW
	0x06	Execute resident MCode script	O C A	STRING	EX	WO
	0x07	Busy (resident MCode script running)	O C A	BOOL	BY	RO
	0x08	User registers for data exchange with resident MCode script. **NOTE**: The variables V1 - V8 are not part of the MCode instruction set and must be declared (either global or local in scope) in the MCode script using the VA (Declare User Variable) command: i.e., VA V1=<integer>. These variable names, along with the registers R1-R4, are the only allowed method to data exchange between the resident program and the PLC.	O C A	DINT	V1	RW
	0x09		O C A	DINT	V2	RW
	0x0A		O C A	DINT	V3	RW
	0x0B		O C A	DINT	V4	RW
	0x0C		O C A	DINT	V5	RW
	0x0D		O C A	DINT	V6	RW
	0x0E		O C A	DINT	V7	RW
	0x0F		O C A	DINT	V8	RW
	0x10	Following mode enable	O C A	BOOL	FL	RW

Miscellaneous Object (65_h – 1 Instance)

The Miscellaneous object contains attributes for reading and/or setting miscellaneous variables and flags.

Miscellaneous Object (65_h – 1 Instance)						
Instance	**Attribute ID**	**Description**	**Support**	**Data Type**	**MCode**	**Access**
Class (Instance 0)	0x01	Revision	—	UINT	—	RO
Instance 1	0x01	Output clock width	O C A	USINT	CW	RW
	0x02	Error flag	O C A	BOOL	EF	RO
	0x03	Read/clear error condition	O C A	UNIT	ER	RW
	0x04	Read internal temperature	O C A	STRING	IT	RO
	0x05	Part Number	O C A	STRING	PN	RO
	0x06	Read/set user register 1 value	O C A	DINT	R1	RW
	0x07	Read/set user register 2 value	O C A	DINT	R2	RW
	0x08	Read/set user register 3 value	O C A	DINT	R3	RW
	0x09	Read/set user register 4 value	O C A	DINT	R4	RW
	0x0A	Read device serial number	O C A	STRING	SN	RO
	0x0B	Read hardware/firmware version number	O C A	STRING	VR	RO
	0x0C	Read device voltage	O C A	STRING	VT	RO

Motion Object (66_h – 1 Instance)

The Motion object contains attributes for issuing motion commands and reading and/or writing motion related variables or flags.

Motion Object (66_h – 1 Instance)						
Instance	**Attribute ID**	**Description**	**Support**	**Data Type**	**MCode**	**Access**
Class (Instance 0)	0x01	Revision	—	UINT	—	RO
Instance 1	0x01	Read/set acceleration	O C A	UDINT	A	RW_IO
	0x02	Read/set deceleration	O C A	UDINT	D	RW_IO
	0x03	Read/set motor holding current percent	O C A	USINT	HC	RW_IO
	0x04	Read/set holding current time delay	O C A	UINT	HT	RW
	0x05	Read/set jog mode enable/disable	O C A	BOOL	JE	RW
	0x06	Read/set limit switch response mode	O C A	USINT	LM	RW
	0x07	Command absolute move	O C A	DINT	MA	WO
	0x08	Moving to position flag	O C A	BOOL	MP	RO
	0x09	Command relative move	O C A	DINT	MR	WO
	0x0A	Read/set microstep resolution	O C A	UINT	MS	RW
	0x0B	Read/set motor settling delay time	O C A	UINT	MT	RW
	0x0C	Read axis in motion flag	O C A	BOOL	MV	RO
	0x0D	Read/set motor run current percent	O C A	USINT	RC	RW_IO
	0x0E	Command slew at constant velocity	O C A	DINT	SL	WO
	0x0F	Read current velocity	O C A	DINT	V	RO
	0x10	Read velocity changing flag	O C A	BOOL	VC	RO
	0x11	Read/set initial (starting) velocity	O C A	UDINT	VI	RW_IO
	0x12	Read/set maximum (terminal) velocity	O C A	UDINT	VM	RW_IO
	0x13	Read/set the reverse direction bit	O C A	BOOL	RD	RW
	0x14[1]	Read/set the Acceleration Jerk	O C A	USINT	AJ	RW
	0x15[1]	Read/set Acceleration Type	O C A	USINT	AT	RW
	0x16[1]	Read/set Backlash Enable	O C A	BOOL	BE	RW
	0x17[1]	Read/set Backlash Amount	O C A	DINT	BL	RW
	0x18[1]	Read/set Backlash Mode	O C A	BOOL	BM	RW
	0x19[1]	Read/set the Deceleration Jerk	O C A	USINT	DJ	RW
	0x1A[1]	Read/set Deceleration Type	O C A	USINT	DT	RW
	0x1B[1]	Read/set Soft Limits	O C A	STRING	LS	RW

1 These attributes require that MCode Operating System 6.004 or greater be installed in the LMD Motion product.

I/O Object (67_h – 1 Instance)

The I/O object contains attributes for issuing I/O commands and reading and/or writing I/O related variables or flags.

NOTE: Attributes in this object relate solely to the configuration and control of the hardware Input–Output points and have no bearing on Ethernet/IP communications protocol I/O messaging.

I/O Object (67_h – 1 Instance)						
Instance	**Attribute ID**	**Description**	**Support**	**Data Type**	**MCode**	**Access**
Class (Instance 0)	0x01	Revision		UINT	—	RO
Instance 1	0x01	Read/set attention output mask	O C A	UINT	AO	RW
	0x02	Read/set digital filtering for input 1	O C A	USINT	D1	RW
	0x03	Read/set digital filtering for input 2	O C A	USINT	D2	RW
	0x04	Read/set digital filtering for input 3	O C A	USINT	D3	RW
	0x05	Read/set digital filtering for input 4	O C A	USINT	D4	RW
	0x06	Read/set digital filtering for analog input	O C	UINT	D5	RW
	0x07	Read/set filtering for the capture input	O C A	USINT	FC	RW
	0x08	Read/set filtering for the motion inputs	O C A	USINT	FM	RW
	0x09	Read the state of input 1	O C A	BOOL	I1	RO
	0x0A	Read the state of input 2	O C A	BOOL	I2	RO
	0x0B	Read the state of input 3	O C A	BOOL	I3	RO
	0x0C	Read the state of input 4	O C A	BOOL	I4	RO
	0x0D	Read the value of the analog input	O C A	UINT	I5	RO
	0x0E	Read inputs as a group	O C A	USINT	IN	RO
	0x0F	Setup input function	O C A	STRING	IS	RW
	0x10	Set the state of output 1	O C A	BOOL	O1	WO
	0x11	Set the state of output 2	O C	BOOL	O2	WO
	0x12	Set the state of output 3	O C A	BOOL	O3	WO
	0x13	Read the output fault flag	O C A	BOOL	OF	RO
	0x14	Setup output function	O C A	STRING	OS	RW
	0x15	Write the binary state of the outputs as a group (NEMA 23 and 34 only)	O C A	UINT	OT	WO

Position Object (68_h – 1 Instance)

CAUTION

DAMAGE TO COMPONENTS

Modifying the data in Motor Counter C1 or Encoder Counter C2 on LMD models with a multi-turn absolute encoder during operation will desynchronize the relationship between C1/C2 and the internal absolute counter, causing a discrepancy between reported and actual shaft position.

- Do not modify, manually or by program, counters C1 or C2 during operation.

Failure to follow these instructions can result in equipment damage.

The position object contains attributes for reading and/or writing position related variables or flags.

Position Object (68_h – 1 Instance)

Instance	Attribute ID	Description	Support	Data Type	MCode	Access
Class (Instance 0)	0x01	Revision		UINT	—	RO
Instance 1	0x01	Read/set counter 1 (position)	O C A	DINT	C1	RW
	0x02	Read/set homing mode	O C A	USINT	HM	RW
	0x03	Read/set position	O C A	DINT	P	RW
	0x04	Read position capture at trip	O C A	DINT	PC	RO
	0x05	Read/set trip enable	O C A	USINT	TE	RW
	0x06	Read/set Trip Capture	O C A	STRING	TC	RW
	0x07[1]	Read/set Index Offset	C A	DINT	FS	RW
	0x08[1]	Home to Index Offset	C A	USINT	HF	WO
	0x09[1]	Referenced Position	C A	DINT	RP	RO

1 These attributes require MCode Operating System 6.004 or greater be installed in the LMD Motion product.

Encoder Object (69_h – 1 Instance)

CAUTION

DAMAGE TO COMPONENTS

Modifying the data in Motor Counter C1 or Encoder Counter C2 on LMD models with a multi-turn absolute encoder during operation will desynchronize the relationship between C1/C2 and the internal absolute counter, causing a discrepancy between reported and actual shaft position.

- Do not modify, manually or by program, counters C1 or C2 during operation.

Failure to follow these instructions can result in equipment damage.

The encoder object contains attributes for reading and/or writing encoder related variables or flags.

Encoder Object (69_h – 1 Instance)

Instance	Attribute ID	Description	Support	Data Type	MCode	Access
Class (Instance 0)	0x01	Revision		UINT	—	RO
Instance 1	0x01	Read/set counter 2 (encoder)	C A	DINT	C2	RW
	0x02	Read/set encoder deadband	C A	UINT	DB	RW
	0x03	Enable/disable encoder functions	C A	BOOL	EE	RW
	0x04	Read/set home to index mode	C A	USINT	HI	RW
	0x05	Read encoder index mark	C A	BOOL	I6	RO
	0x06	Enable/disable position maintenance (non-hybrid only)	C A	BOOL	PM	RW
	0x07	Read/set stall factor (non-hybrid only)	C A	UINT	SF	RW
	0x08	Read/set stall detect mode (non-hybrid only)	C A	BOOL	SM	RW
	0x09	Read stall flag (non-hybrid only)	C A	BOOL	ST	RW
	0x0A	Backup voltage level for Absolute Encoder	A	STRING	VB	RO

Hybrid Specific Object ($6A_h$ – 1 Instance)

The hybrid specific object contains attributes for issuing hybrid commands and reading and/or writing hybrid related variables or flags.

Hybrid Specific Object ($6A_h$ – 1 Instance)						
Instance	**Attribute ID**	**Description**	**Support**	**Data type**	**MCode**	**Access**
Class (Instance 0)	0x01	Revision		UINT	—	RO
Instance 1	0x01	Read hybrid status	C A	UINT	AF	RO
	0x02	Read/set hybrid operating mode	C A	USINT	AS	RW
	0x03	Read/set control bounds	C A	USINT	CB	RW
	0x04	Clear locked rotor flag	C A	BOOL	CF	CMD
	0x05	Read/set remote encoder line count	C A	UINT	EL	RW
	0x06	Read/set lead limit	C A	UDINT	LD	RW
	0x07	Read lead/lag position error	C A	DINT	LL	RO
	0x08	Read/set lag limit	C A	UDINT	LG	RW
	0x09	Read state of rotor locked/unlocked	C A	BOOL	LR	RO
	0x0A	Read/set locked rotor timeout time	C A	UINT	LT	RW
	0x0B	Read/set make-up speed	C A	UDINT	MF	RW
	0x0C	Read/set make-up mode	C A	STRING	MU	RW
	0x0D	Command calibration start	C A	USINT	SC	WO
	0x0E	Read/set torque direction	C A	BOOL	TD	RW
	0x0F	Read/set torque current percent	C A	USINT	TQ	RW
	0x10	Read/set torque speed	C A	UDINT	TS	RW
	0x11[1]	Read/set torque velocity filter	C A	UINT	VF	RW
	0x12[1]	Read hMT Velocity	C A	DINT	AV	RO

1 These attributes require that MCode Operating System 6.004 or greater be installed in the LMD Motion product.

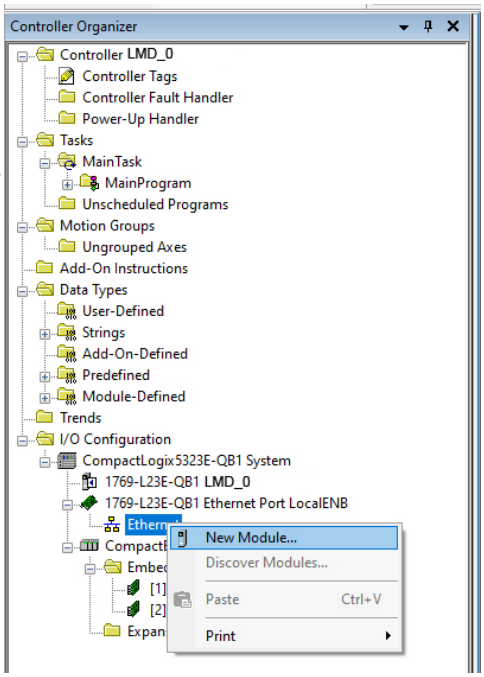
Appendix A
LMD Setup using RS Logix 5000

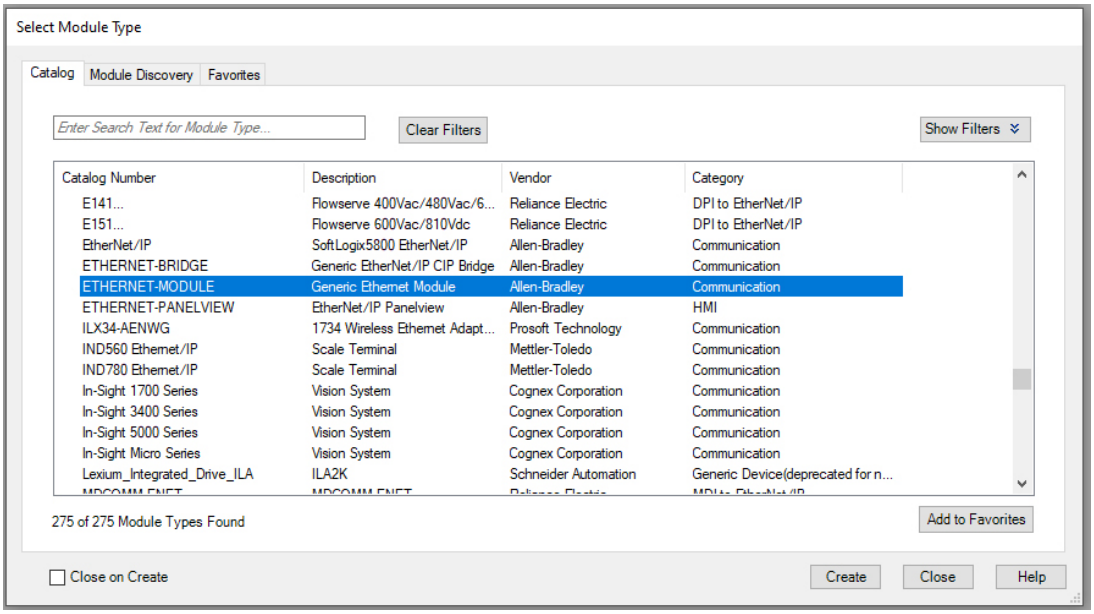
This appendix shows an example of adding an LMD Ethernet/IP unit to an RS Logix 5000 project. The PLC used in this example was a Rockwell Automation Compact Logix L23E.

Adding the LMD to the Project

Perform the following steps to add the LMD to the project:

1. Create a new project.
2. In the Controller Organizer, click the [+] next to “I/O Configuration” to expand the selection.
3. Locate the PLC name and click the [+] to expand the selection.
4. Right-click on “Ethernet”.
5. Select “New Module”. The “Select Module” dialog box will be displayed. (See below)
6. Select “ETHERNET-MODULE” in the “Module” column. (Generic Ethernet Module).



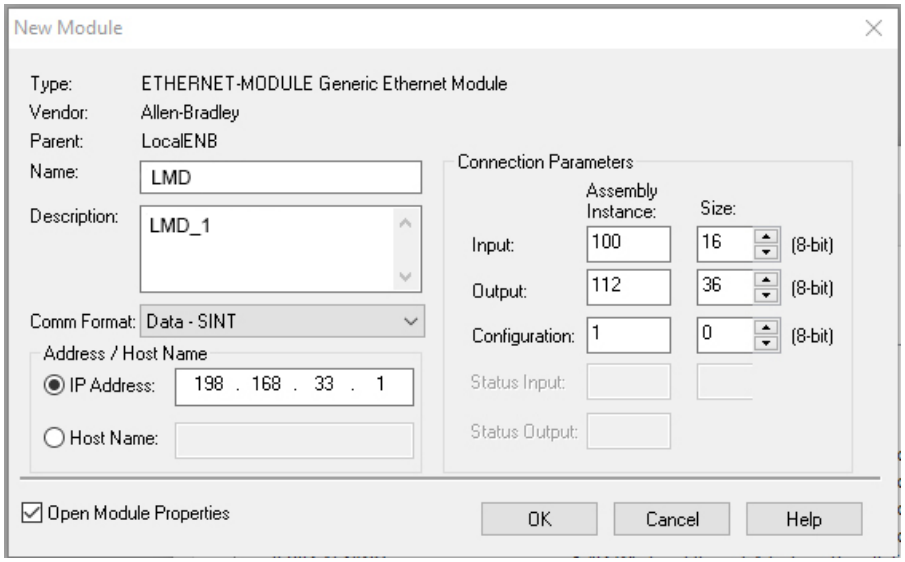


7. Click Create. The “New Module” dialog box will be displayed.

8. In the “New Module” dialog box, fill in the following information:

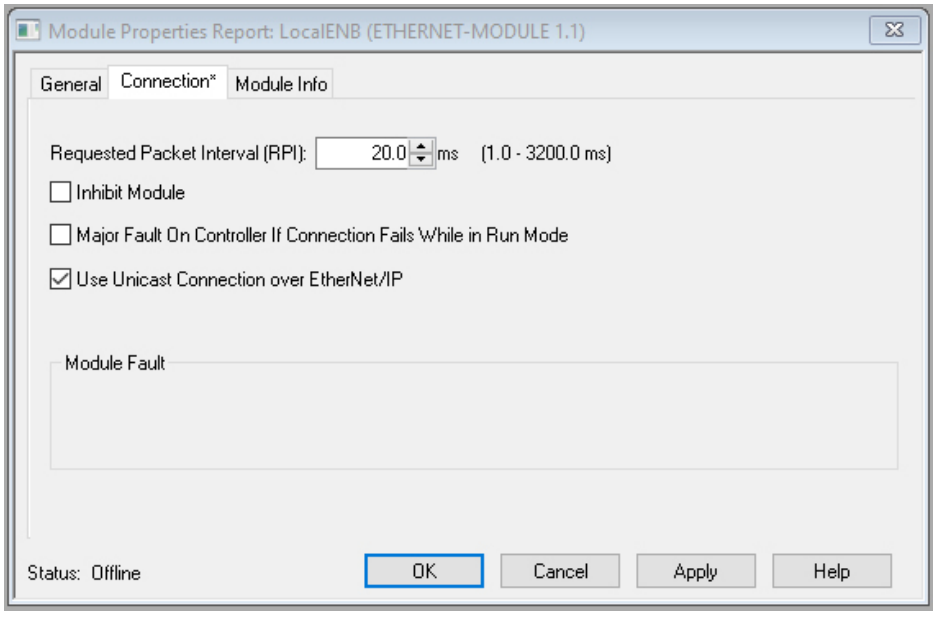
Name: LMD (Name is at user’s discretion)
Description: LMD_1 (Desc. is at user discretion)
Comm Format: Data - SINT
IP Address: 192.168.33.1 (IP Address should match the IP Address assigned to the LMD)
Connection Parameters:

	Assembly Instance	Size
Input	100	16
Output	112	36
Configuration	1	0



9. Select the “Open Module Properties” option and click OK. The Module Properties dialog box for the new module will be displayed.

10. Under the Connection tab, set “Request Packet Interval (RPI)” to 20ms and click OK.

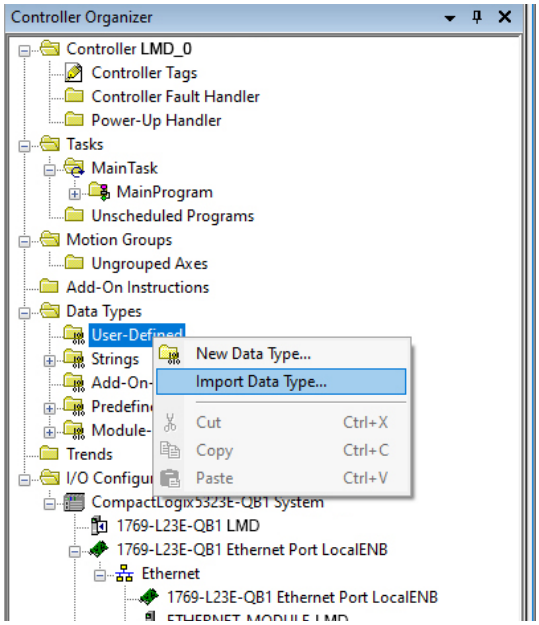


The new module has been created.

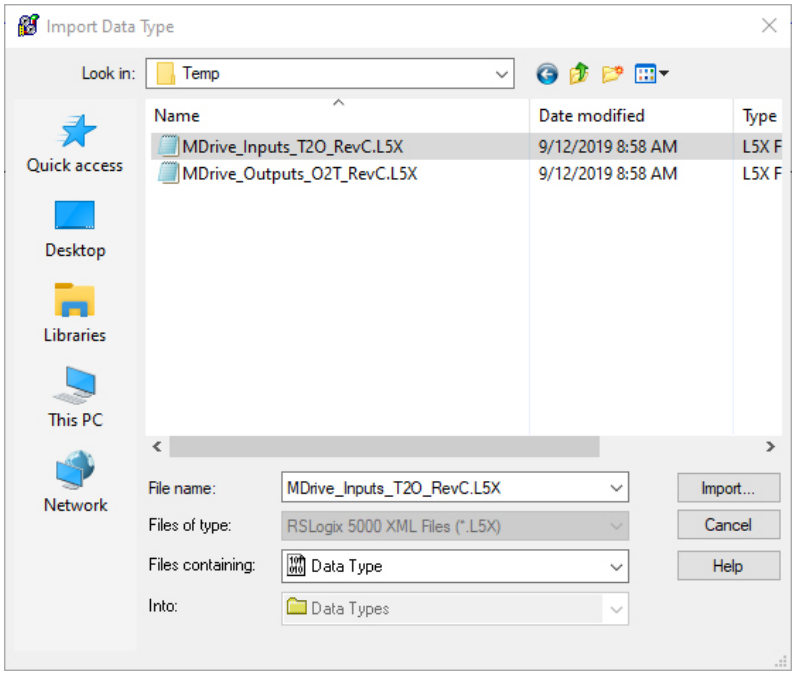
Importing Data

Perform the following steps to import data for the project.

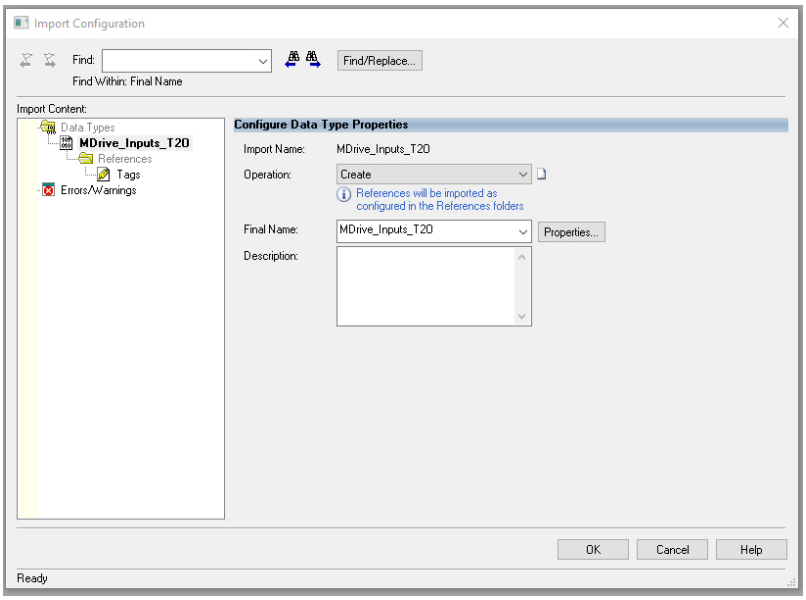
1. From the Controller Organizer, click the [+] next to “Data Types” to expand the menu selection.
2. Right-click on “User-Defined” and select “Import Data Type”. The “Import Data Type” screen will be displayed.



3. Select the LMD_Inputs_T2O.L5X file that was created using the TCP/IP Configuration Utility. Click Import.



4. The “Import Configuration Screen” will be displayed. Click OK.



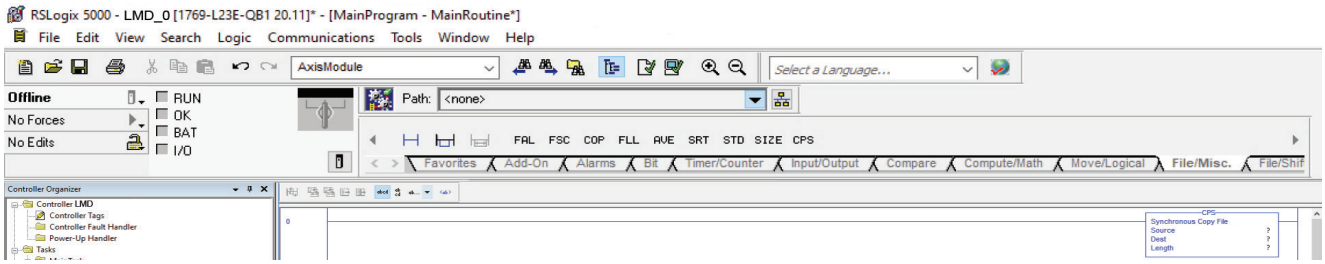
5. Repeat Steps 1 through 4 to import the LMD_Outputs_O2T.L5X file.

The input and output files are now loaded into the project.

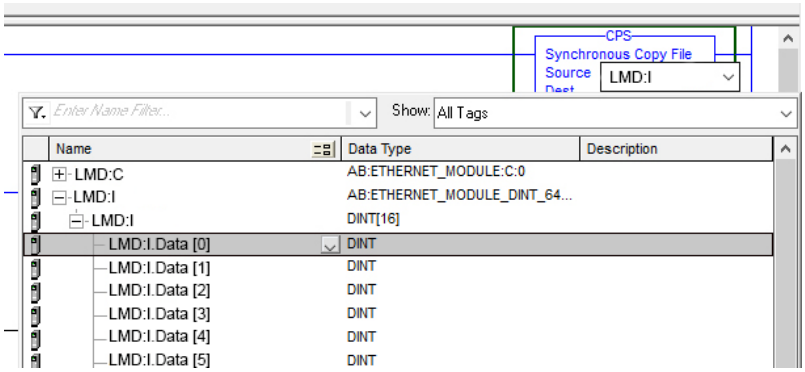
Synchronous Copy File Function (CPS)

Perform the following steps to add a CPS function to the routine.

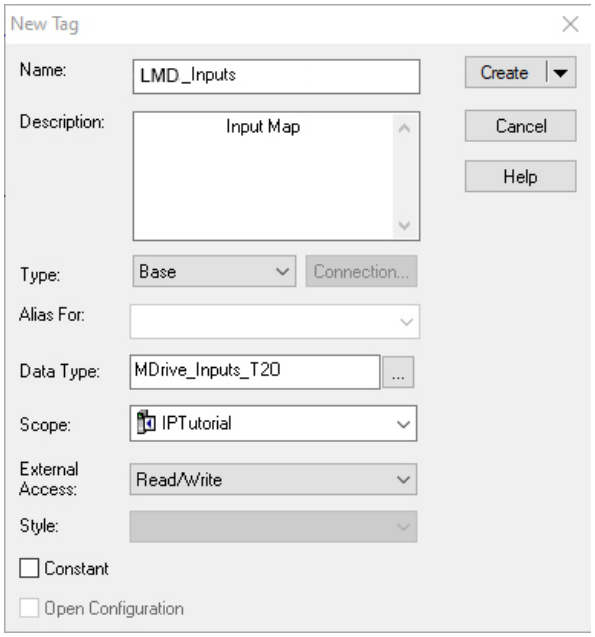
1. On the Controller Organizer, click the Main Routine option (Tasks > Main Task > Main Routine). This will open the Main Routine window. The routine will show one rung of the ladder program (Rung 0) and the End rung.
2. With the rung selected, select CPS from the File/Misc tab on the Instructions toolbar . A CPS function will be added to rung 0.



3. On the CPS function just created, click in the Source field (currently displaying “?”). Click the down arrow to display available sources. Select the LMD Input Data file (LMD:I), bit 0, as shown below.

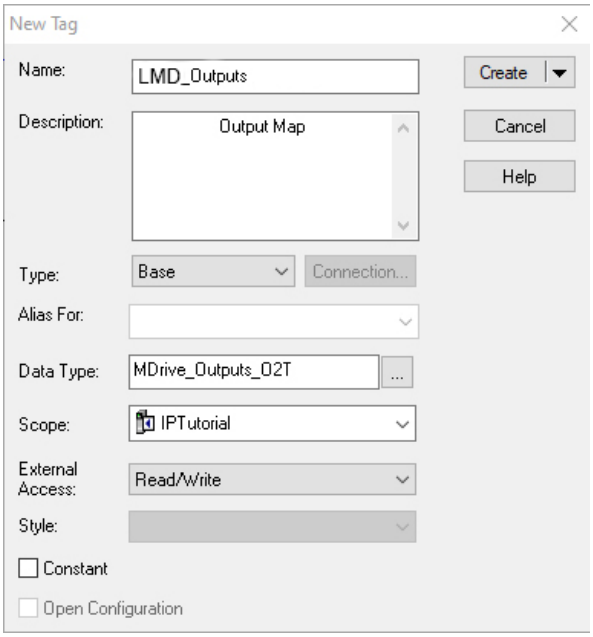


4. For the CPS Destination, right click on the field, currently displaying a “?”, and create a new tag. The “New Tag” dialog box is displayed.
5. Enter a name for the tag and select MDrive_Inputs_T2O as the Data Type. Click Create.



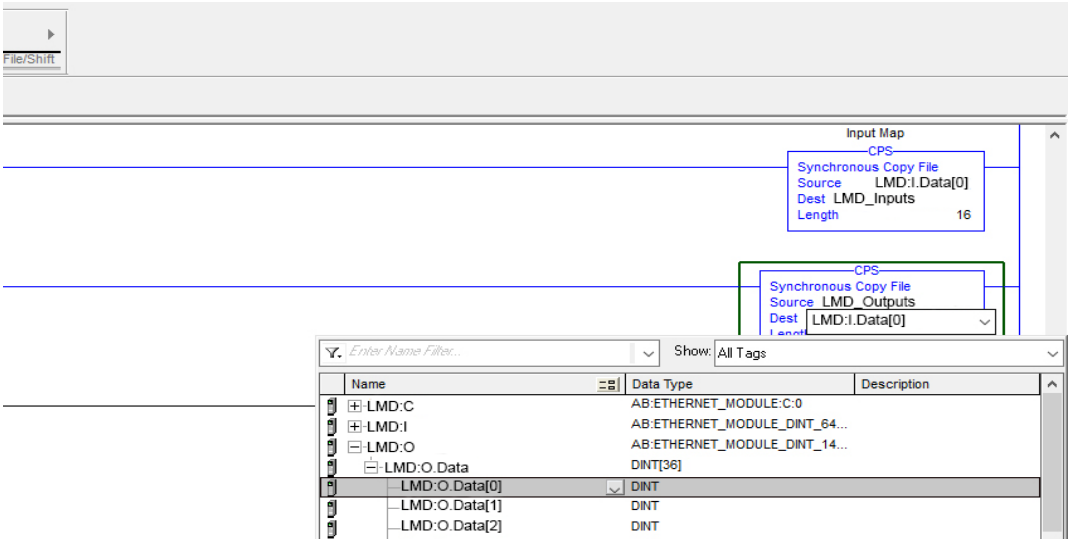
6. For the Length field, left click on the field, currently displaying a “?” and enter “16”.
7. Add another rung to the ladder program. This will add rung 1 to the ladder program.
8. With the rung selected, select CPS from the File/Misc tab on the Instructions toolbar. A CPS function will be added to rung 1.

9. For the CPS Source, right click on the field, currently displaying a “?”, and create a new tag. The “New Tag” dialog box is displayed.



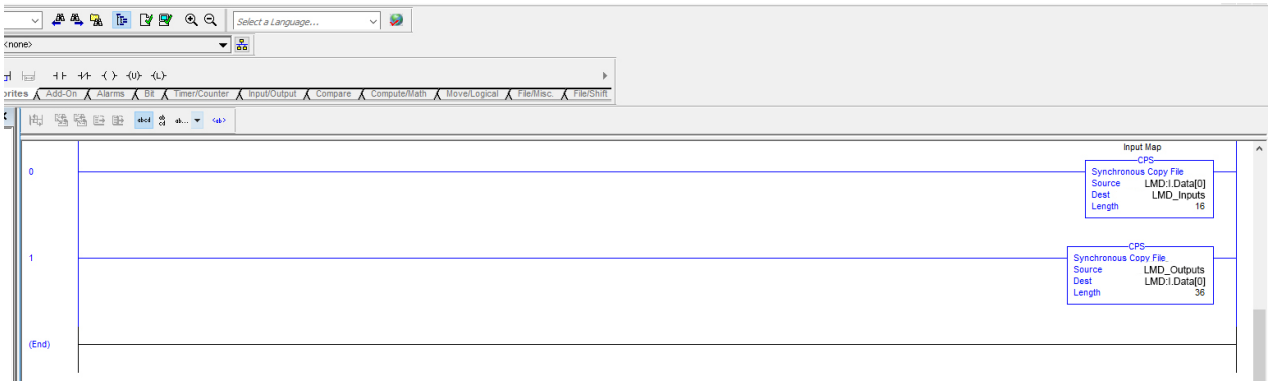
10. Enter a name for the tag and select MDrive_Outputs_O2T as the Data Type. Click Create.

11. Select the Dest field and click the down arrow to display available destinations. Select the LMD Output Data file (LMD:O.Data), bit 0, as shown below.



12. For the Length field, left click on the field, currently displaying a “?” and enter “36”.

The Main Program/Main Routine window will appear as shown below.

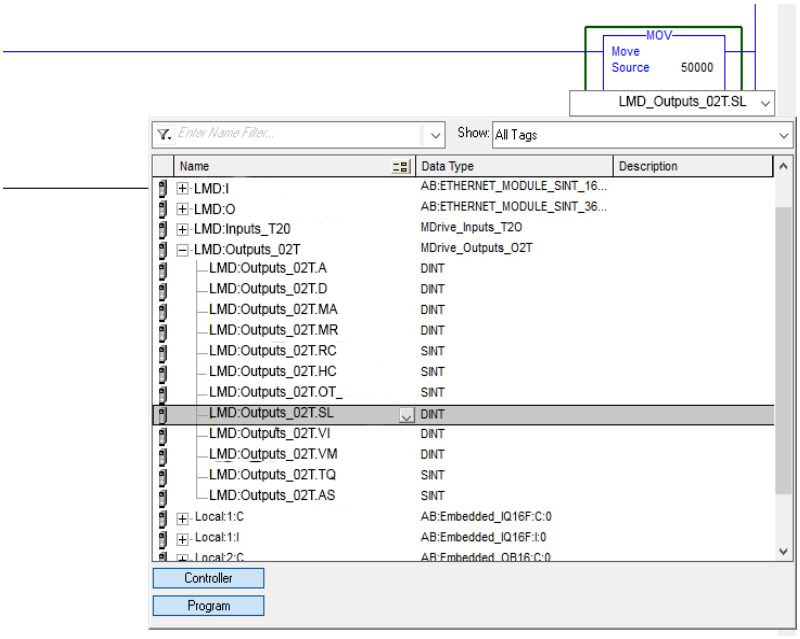


This associates the Tags created during the import of the user defined data types with the data in the implicit data object in the LMD.

Adding a MOV Command

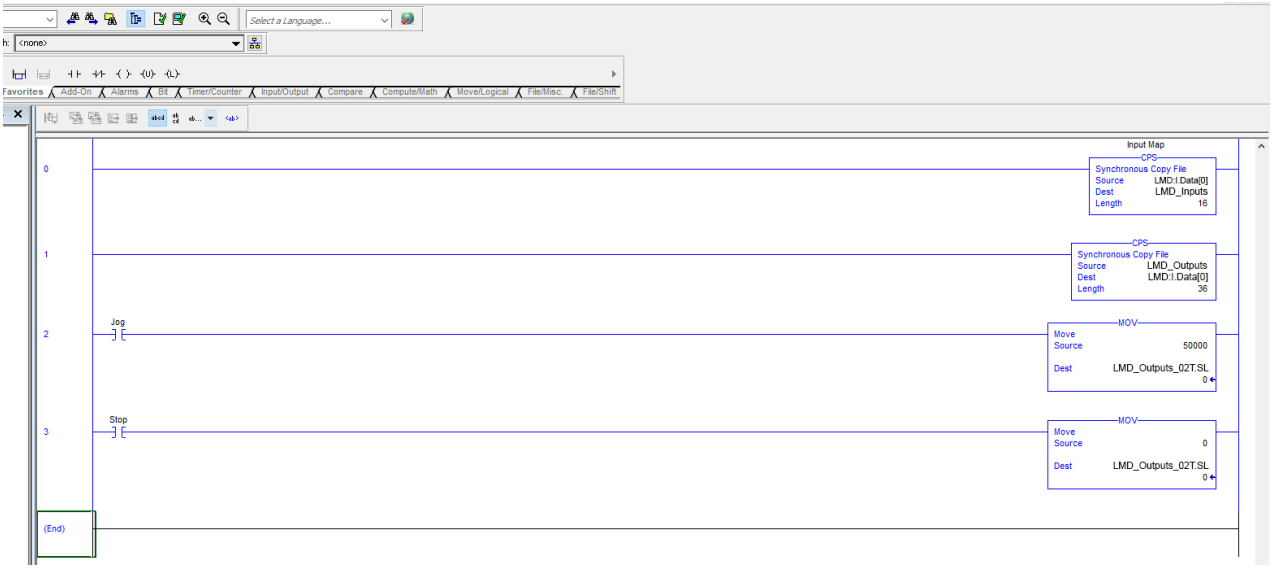
Perform the following steps to add move commands to the Main Routine.

1. Add another rung to the routine created in the previous section.
2. Place an XIC (Examine On) function to the rung by clicking on the XIC symbol -[ ]- in the Favorites tab on the Instructions toolbar.
3. For the XIC function, create a Tag called “Jog” by right clicking on the “?” in the XIC function and selecting “New tag..”. All fields remain at default values.
4. Place a Move (MOV) command on the same rung by selecting the MOV function from the MOVE/LOGICAL tab of the Instructions toolbar.
5. In the Move function, enter the Source to be a jog speed in micosteps/sec. For this example, 50000.
6. To set the Destination, click on the down arrow of the Dest field. Select the “SL” file within the LMD Output Tag imported previously.



7. Repeat steps 1 through 6, creating a Stop routine for the movement. Change the XIC tag to “Stop” and set the MOV source to 0.

The Main Program/Main Routine window will appear as shown below.



8. Download the application and go online with the project.

Engaging the contact associated with the “Jog” function will cause the connected LMD to Slew at the requested speed (50000 microsteps/sec).

Engaging the contact associated with the “Stop” function will bring the LMD to a stop.

Explicit Messaging

Explicit messaging is used to transfer data that does not require continual updates. Many LMD parameters may be accessed via explicit messaging.

Explicit Message Example: Displaying the LMD Serial Number

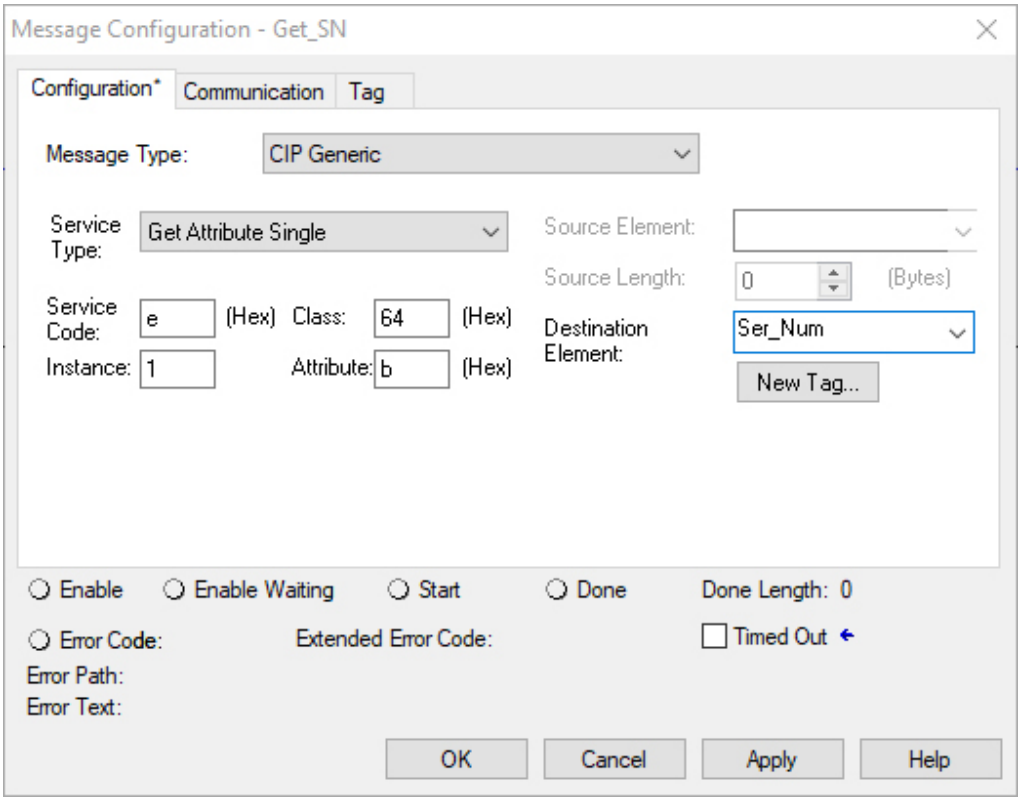
The message instruction must be configured to read or write to a specific Attribute (parameter) in the LMD.

For this example, the Message is set to read the Serial Number from the LMD and move it into a Tag labeled “Ser_Num”.

Perform the following steps to add the message to the routine created in the previous sections.

1. Add a new rung to the routine (rung 4).
2. Place an XIC (Examine On) function to the rung by clicking on the XIC symbol -[ ]- in the Favorites tab on the Instructions toolbar.
3. For the XIC function, create a Tag called “Query_SN” by right clicking on the “?” in the XIC function and selecting “New tag..”. All fields remain at default values.
4. Add the message function to the rung by clicking MSG from the Input/Output tab of Instruction toolbar.

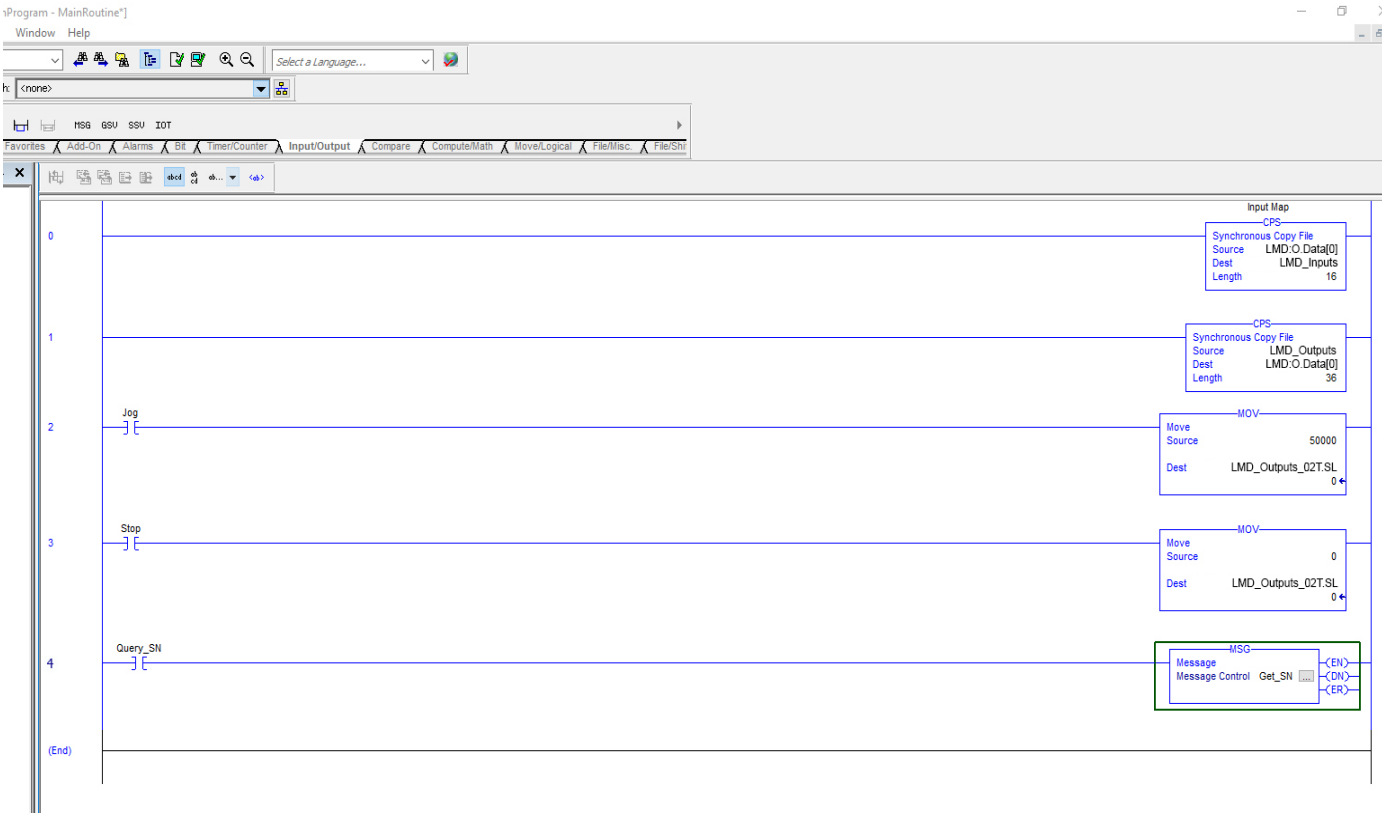
5. On the MSG function, enter “Get_SN” in the Message Control field and click the configuration button (shown as “...”). The Message Configuration screen will be displayed.



6. Set the message parameters as shown in the screen capture above in accordance with the following table:

Field	Description
Message Type	The message type for LMD parameters will be **`CIP Generic`**
Service Type	The service type for LMD, in this case will be **`Get Attribute Single`**. If setting a parameter the service type would be **`Set Attribute Single`**. Available services depend on the class and instance being read or written.
Service code	This field will be read only when **`Set Attribute Single`** or **`Get Attribute Single`** is the service type.
Class	This is the Ethernet/IP class. For this exercise it is **64_h** Miscellaneous. Refer to “Chapter 3 Manufacturer Specific Objects” on page 23, for a listing of supported classes, instances and attributes.
Instance	This is the Ethernet/IP instance or object. Refer to “Chapter 3 Manufacturer Specific Objects” on page 23, for a listing of supported classes, instances and attributes.
Attribute	The attribute represents, in this exercise, the hex number (0x0B), of the instance assigned to the **`Read_Serial_Number`** command. Refer to “Chapter 3 Manufacturer Specific Objects” on page 23 for a listing of supported classes, instances and attributes.

The Main Program/Main Routine window will appear as shown below.



Appendix B
Diagnostics and Troubleshooting

Fieldbus Communication Error Diagnostics

A properly operating fieldbus is essential for evaluating operating and error messages.

Connections for Fieldbus Mode

If the product cannot be addressed via the fieldbus, first check the connections. The product manual contains technical data and information on network and device installation.

Check the following:

- Power connections to the device.
- Fieldbus cable and fieldbus wiring.
- Network connection to the device.

You can also use the LMD Software Suite (LSS) for troubleshooting.

Fieldbus Function Test

If the connections are correct, check the settings for the fieldbus addresses. After correct configuration of the transmission data, test fieldbus mode.

1. In addition to the master that knows the product via the EDS file and addressing, activate a bus monitor that, as a passive device, displays messages.
2. Switch the supply voltage off and on.
3. Observe the network messages that are generated briefly after the supply voltage is switched on. A bus monitor can be used to record the elapsed time between.

Addressing, Parameterization

If the device is still unable to connect, check the following:

1. Addressing: Each network device must have a unique IP address and correct subnet mask.
2. Parameterization: “Vendor ID” and “Product Code” must match the values stored in the EDS file.

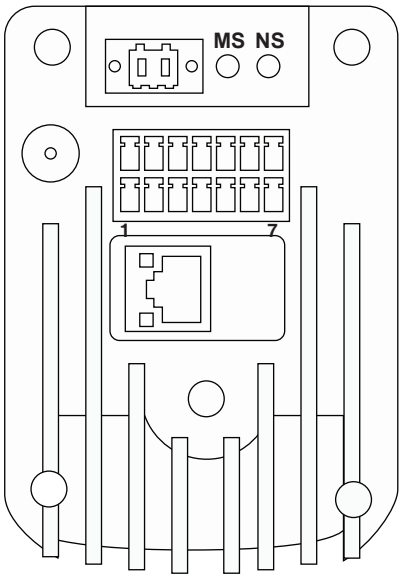
Status LEDs

The LMD with Ethernet has two dual-color (red/green) LEDs visible from the back of the drive to give status and error indication of the Ethernet/IP connection.

When power is first applied to the motor, both the Module Status (MS) and Network Status (NS) LEDs will flash orange for approximately one (1) second and then remain dark until the motor receives a valid connection.

Refer to the product’s hardware manual for LED location information.

NOTE: If power is applied to the motor and the LED’s are blank and the motor has proper Ethernet and power connections, observe activity on the RJ45 port/connector.



MS = Module Status
NS = Network Status

Color	State	Description
LED 1 – Network Status (NS)		
None	Off	No power
Red	Flashing	Recoverable fault or I/O connection timed out
Green	Solid	Normal runtime operation (I/O connection allocated)
	Flashing	Device is idle or not allocated to a client (PLC)
Red/green	Alternating	Power-up self test in progress
LED 2 – Module Status (MS)		
None	Off	No power
Red	Solid	Unrecoverable fault
	Flashing	Minor, recoverable fault
Green	Solid	Device operational
	Flashing	Standby, device has not been configured
Red/green	Alternating	Power-up self test in progress

NOTE: The term I/O refers to Ethernet/IP communications protocol and is unrelated to the hardware Input - output points.

Warranty

For the latest warranty and product information, visit: https://novantaims.com/warranty-and-disclaimer/

Document Revision History

LMD Ethernet TCP/IP: LMD-EIP-REV-F		
Date	**Revision**	**Changes**
02/21/2013	V1.00, 03.2013	Initial release
08/15/2014	V1.00, 08.2014	Changed Max Velocity (VM) from 5000000 to 2560000 steps/sec
08/02/2016	REV-B	Added support for Firmware Release 2.4.0.X. Added attributes supporting MCode Operating System 6.004: S-Curve Acceleration/Deceleration profiles, Home to Index Offset, Backlash compensation
03/01/2018	REV-C	Added support for LMD Absolute Encoder
06/11/2020	REV-D	Updated format, updated RS Logix screenshots and steps. Added Cyber-Security statement to Safety
01/06/2021	REV-E	Updated the Web Directory, added note regarding Echo Mode to the configuration section, updated hyperlinks throughout, updated Safety messages.
02/22/2022	REV-F	Update brand to Novanta

Novanta IMS is a part of the Precision Motion Group within Novanta, a leading technology company that delivers innovation to medical and advanced industrial OEMS.

As standards, specifications, and designs may change, confirmation of the information given in this publication can be found in the product disclaimer and most recent product information, available online.
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documentation@imshome.com

Novanta IMS
370 North Main Street
Marlborough, CT 06447
Phone: (860) 295-6102
www.novantaims.com