Industrial Protocols User's Guide

ETHERLINE ACCESS M05T/M08T

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MODBUS/TCP MAP

Introduction

MODBUS TCP is a protocol commonly used for the integration of a SCADA system. It is also a vendor-neutral communication protocol used to monitor and control industrial automation equipment such as PLCs, sensors, and meters. In order to be fully integrated into industrial systems, LAPP's switches support Modbus TCP/IP protocol for real-time monitoring in a SCADA system.

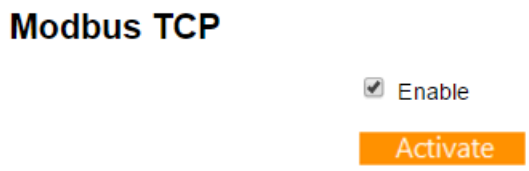
Data Format and Function Code

MODBUS TCP supports different types of data format for reading. The primary four types of them are:

Data Access Type		**Function Code**	**Function Name**	**Note**
Bit access	Physical Discrete Inputs	2	Read Discrete Inputs	
	Internal Bits or Physical Coils	1	Read Coils	
Word access (16-bit access)	Physical Input Registers	4	Read Input Registers	LAPP Support
	Physical Output Registers	3	Read Holding Registers	

LAPP switches support **Function Code 4** with **16-bit (2-word)** data access for **read-only** information.

Configuring MODBUS/TCP on LAPP Switches



Select the checkbox and click **Activate** to enable the Modbus TCP.

MODBUS Data Map and Information Interpretation of LAPP Switches

The data map addresses of LAPP switches shown in the following table start from **MODBUS address 30001** for Function Code 4. For example, the address offset 0x0000 (hex) equals MODBUS address 30001, and the address offset 0x0010 (hex) equals MODBUS address 30017. Note that all the information read from LAPP switches are in hex mode. To interpret the information, refer to the ASCII table for the translation (e.g. 0x4D = 'M', 0x6F = 'o').

Address Offset	Data Type	Interpretation	Description
System Information			
0x0000	1 word	HEX	Vendor ID = 0x1393
0x0001	1 word		Unit ID (Ethernet = 1)
0x0002	1 word	HEX	Product Code = 0x0003
0x0010	20 words	ASCII	Vendor Name = "LAPP Group" Word 0 Hi byte = 'L' Word 0 Lo byte = 'A' Word 1 Hi byte = 'P' Word 1 Lo byte = 'P' Word 2 Hi byte = ' ' Word 2 Lo byte = 'G' Word 3 Hi byte = 'R' Word 3 Lo byte = 'O' Word 4 Hi byte = 'U' Word 4 Lo byte = 'P'
0x0030	20 words	ASCII	Product Name = "ETHERLINE ACCESS MO8T" Word 0 Hi byte = 'E' Word 0 Lo byte = 'T' Word 1 Hi byte = 'H' Word 1 Lo byte = 'E' Word 2 Hi byte = 'R' Word 2 Lo byte = 'L' Word 3 Hi byte = 'I' Word 3 Lo byte = 'N' Word 4 Hi byte = 'E' Word 4 Lo byte = ' ' Word 5 Hi byte = 'A' Word 5 Lo byte = 'C' Word 6 Hi byte = 'C' Word 6 Lo byte = 'E' Word 7 Hi byte = 'S' Word 7 Lo byte = 'S' Word 8 Hi byte = ' ' Word 8 Lo byte = 'M' Word 9 Hi byte = '0' Word 9 Lo byte = '8' Word 10 Hi byte = 'T' Word 10 Lo byte = '\0'
0x0050	1 word		Product Serial Number
0x0051	2 words		Firmware Version Word 0 Hi byte = major (A) Word 0 Lo byte = minor (B) Word 1 Hi byte = release (C) Word 1 Lo byte = build (D)
0x0053	2 words	HEX	Firmware Release Date For example: Word 0 = 0 x 0609 Word 1 = 0 x 0705 Firmware was released on 2007-05-06 at 09 o'clock
0x0055	3 words	HEX	Ethernet MAC Address Ex: MAC = 00-01-02-03-04-05 Word 0 Hi byte = 0 x 00 Word 0 Lo byte = 0 x 01 Word 1 Hi byte = 0 x 02 Word 1 Lo byte = 0 x 03 Word 2 Hi byte = 0 x 04 Word 2 Lo byte = 0 x 05
0x0058	1 word	HEX	Power 1

Address Offset	Data Type	Interpretation	Description
			0x0000: Off 0x0001: On
0x0059	1 word	HEX	Power 2 0x0000: Off 0x0001: On
0x005A	1 word	HEX	Fault LED Status 0x0000: No 0x0001: Yes
0x0080	1 word	HEX	DI1 0x0000:Off 0x0001:On
0x0081	1 word	HEX	DI2 0x0000:Off 0x0001:On
0x0082	1 word	HEX	DO1 0x0000:Off 0x0001:On
0x0083	1 word	HEX	DO2 0x0000:Off 0x0001:On
Port Information			
0x1000 to 0x1011	1 word	HEX	Port 1 to 8 Status 0x0000: Link down 0x0001: Link up 0x0002: Disable 0xFFFF: No port
0x1100 to 0x1111	1 word	HEX	Port 1 to 8 Speed 0x0000: 10M-Half 0x0001: 10M-Full 0x0002: 100M-Half 0x0003: 100M-Full 0xFFFF: No port
0x1200 to 0x1211	1 word	HEX	Port 1 to 8 Flow Ctrl 0x0000:Off 0x0001:On 0xFFFF:No port
0x1300 to 0x1311	1 word	HEX	Port 1 to 8 MDI/MDIX 0x0000: MDI 0x0001: MDIX 0xFFFF: No port
0x1400 to 0x1413 (Port 1) 0x1414 to 0x1427 (Port 2)	20 words	ASCII	Port 1 to 8 Description Port Description = "100TX,RJ45." Word 0 Hi byte = '1' Word 0 Lo byte = '0' Word 1 Hi byte = '0' Word 1 Lo byte = 'T' … Word 4 Hi byte = '4' Word 4 Lo byte = '5' Word 5 Hi byte = '.' Word 5 Lo byte = '\0'
Packets Information			
0x2000 to 0x2023	2 words	HEX	Port 1 to 8 Tx Packets Ex: port 1 Tx Packet Amount = 44332211 Received MODBUS response: 0x44332211 Word 0 = 4433 Word 1 = 2211
0x2100 to 0x2123	2 words	HEX	Port 1 to 8 Rx Packets Ex: port 1 Rx Packet Amount = 44332211 Received MODBUS response: 0x44332211 Word 0 = 4433 Word 1 = 2211
0x2200 to 0x2223	2 words	HEX	port 1 to 8 Tx Error Packets Ex: port 1 Tx Error Packet Amount = 44332211 Received MODBUS response: 0x44332211 Word 0 = 4433 Word 1 = 2211
0x2300 to 0x2323	2 words	HEX	port 1 to 8 Rx Error Packets Ex: port 1 Rx Error Packet Amount = 44332211

Address Offset	Data Type	Interpretation	Description
			Received MODBUS response: 0x44332211 Word 0 = 4433 Word 1 = 2211
Redundancy Information			
0x3000	1 word	HEX	Redundancy Protocol 0x0000:None 0x0001:RSTP 0x0002:Turbo Ring 0x0003:Turbo Ring V2 0x0004:Turbo Chain 0x0005:None
0x3100	1 word	HEX	RSTP Root 0x0000: Not Root 0x0001: Root 0xFFFF: RSTP Not Enable
0x3200 to 0x3211	1 word	HEX	RSTP Port 1 to 8 Status 0x0000: Port Disabled 0x0001: Not RSTP Port 0x0002: Link Down 0x0003: Blocked 0x0004: Learning 0x0005: Forwarding 0xFFFF: RSTP Not Enable
0x3300	1 word	HEX	TurboRing Master/Slave 0x0000: Slave 0x0001: Master 0xFFFF: Turbo Ring Not Enable
0x3301	1 word	HEX	TurboRing 1st Port status 0x0000: Port Disabled 0x0001: Not Redundant Port 0x0002: Link Down 0x0003: Blocked 0x0004: Learning 0x0005: Forwarding
0x3302	1 word	HEX	TurboRing 2nd Port status 0x0000: Port Disabled 0x0001: Not Redundant Port 0x0002: Link Down 0x0003: Blocked 0x0004: Learning 0x0005:Forwarding
0x3303	1 word	HEX	TurboRing Coupling 0x0000: Off 0x0001: On 0xFFFF: Turbo Ring is Not Enabled
0x3304	1 word	HEX	TurboRing Coupling Port Status 0x0000: Port Disabled 0x0001: Not Coupling Port 0x0002: Link Down 0x0003: Blocked 0x0005: Forwarding 0xFFFF: Turbo Ring is Not Enabled
0x3305	1 word	HEX	TurboRing Coupling Control Port Status 0x0000: Port Disabled 0x0001: Not Coupling Port 0x0002: Link Down 0x0003: Blocked 0x0005: Forwarding 0x0006: Inactive 0x0007:Active 0xFFFF:Turbo Ring is Not Enabled
0x3500	1 word	HEX	TurboRing V2 Coupling Mode 0x0000: None 0x0001: Dual Homing 0x0002: Coupling Backup 0x0003: Coupling Primary 0xFFFF:Turbo Ring V2 is Not Enabled
0x3501	1 word	HEX	TurboRing V2 Coupling Port Primary Status (Used in Dual Homing, Coupling Backup, and Coupling Primary) 0x0000:Port Disabled 0x0001: Not Coupling Port

Address Offset	Data Type	Interpretation	Description
			0x0002: Link Down 0x0003: Blocked 0x0004: Learning 0x0005: Forwarding 0xFFFF: Turbo Ring V2 is Not Enabled
0x3502	1 word	HEX	TurboRing V2 Coupling Port Backup Status (Only using in Dual Homing) 0x0000: Port Disabled 0x0001: Not Coupling Port 0x0002: Link Down 0x0003: Blocked 0x0004: Learning 0x0005: Forwarding 0xFFFF: Turbo Ring V2 Not Enable
0x3600	1 word	HEX	TurboRing V2 Ring 1 status 0x0000: Healthy 0x0001: Break 0xFFFF:Turbo Ring V2 Not Enable
0x3601	1 word	HEX	TurboRing V2 Ring 1 Master/Slave 0x0000: Slave 0x0001: Master 0xFFFF: Turbo Ring V2 Ring 1 Not Enable
0x3602	1 word	HEX	TurboRing V2 Ring 1 1st Port Status 0x0000: Port Disabled 0x0001: Not Redundant Port 0x0002: Link Down 0x0003: Blocked 0x0004:Learning 0x0005:Forwarding 0xFFFF:Turbo Ring V2 Ring 1 is Not Enabled
0x3603	1 word	HEX	TurboRing V2 Ring 1's 2nd Port Status 0x0000: Port Disabled 0x0001: Not Redundant Port 0x0002: Link Down 0x0003: Blocked 0x0004: Learning 0x0005: Forwarding 0xFFFF: Turbo Ring V2 Ring 1 is Not Enabled
0x3680	1 word	HEX	TurboRing V2 Ring 2 Status 0x0000: Healthy 0x0001: Break 0xFFFF: Turbo Ring V2 Ring 2 is Not Enabled
0x3681	1 word	HEX	TurboRing V2 Ring 2 Master/Slave 0x0000: Slave 0x0001: Master 0xFFFF: Turbo Ring V2 Ring 2 is Not Enabled
0x3682	1 word	HEX	TurboRing V2 Ring 2's 1st Port Status 0x0000: Port Disabled 0x0001: Not Redundant 0x0002: Link Down 0x0003: Blocked 0x0004: Learning 0x0005: Forwarding 0xFFFF: Turbo Ring V2 Ring 2 is Not Enabled
0x3683	1 word	HEX	TurboRing V2 Ring 2's 2nd Port Status 0x0000: Port Disabled 0x0001: Not Redundant 0x0002: Link Down 0x0003: Blocked 0x0004: Learning 0x0005: Forwarding 0xFFFF: Turbo Ring V2 Ring 2 is Not Enabled
0x3700	1 word	HEX	Turbo Chain Switch Roles 0x0000: Head 0x0001: Member 0x0002: Tail 0xFFFF: Turbo Chain is Not Enabled
0x3701	1 word	HEX	Turbo Chain 1st Port status 0x0000: Link Down 0x0001: Blocking 0x0002: Blocked 0x0003: Forwarding

Address Offset	Data Type	Interpretation	Description
			0xFFFF: Turbo Ring V2 Ring 2 Not Enable
0x3702	1 word	HEX	Turbo Chain 2nd Port status 0x0000: Link Down 0x0001: Blocking 0x0002: Blocked 0x0003: Forwarding 0xFFFF: Turbo Ring V2 Ring 2 Not Enable

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EtherNet/IP

Introduction

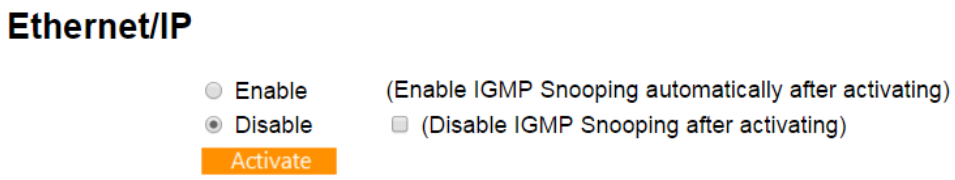
EtherNet/IP is an Industrial Ethernet Protocol defined by the ODVA association. The protocol is open to the public and vendors can implement EtherNet/IP into their industrial devices without incurring a license fee. Many vendors have adopted this protocol as the standard communication protocol between devices. For example, Rockwell Automation uses EtherNet/IP as the standard protocol for their Logix controllers over Ethernet networks.

To allow complete integration with a Rockwell system, LAPP switches not only provide a full-functioning of industrial network infrastructure, but also enable the SCADA system to monitor the status of the switches as well as that of the PLCs, .making the switches part of a Rockwell system.

Messaging Types

EtherNet/IP supports two types of communication methods for EtherNet/IP devices: Explicit Messaging and Implicit Messaging. Explicit Messaging is unscheduled and is used for a request/response communication procedure (or client/server procedure). Explicit Messaging uses TCP/IP over Ethernet. Implicit Messaging is scheduled and is used for a producer/consumer communication with UDP over Ethernet. Implicit Messaging is also called I/O Messaging.

Configuring EtherNet/IP on LAPP Switches



Check the **Enable** checkbox to enable EtherNet/IP. With EtherNet/IP enabled, IGMP Snooping and IGMP Query functions will be enabled automatically to be properly integrated in Rockwell systems for multicast Implicit (I/O) Messaging.

CIP Objects of EtherNet/IP

Several communication objects are defined in CIP (Common Industrial Protocol). LAPP switches support the following objects for PLCs and SCADA systems to monitor:

- Identity Object

- TCP/IP Interface Object
- Ethernet Link Object
- Assembly Object
- Message Router Object
- Connection Manager Object
- Port Object
- LAPP Networking Object (Vendor Specific)

The supported attributes and services of the above objects are introduced in the table below, including the access rules for each attribute. To understand the details of each attribute of the standard objects, refer to the official documents of CIP introduction (Vol. 1) and the EtherNet/IP Adaptation of CIP (Vol. 2).

Identity Object

The Class code of Identity object is **0x01** (Defined in CIP Vol1, 5-2).

There is **one** instance of this object in our product. It stores the information of the production and the device. The following tables summarize the class attributes and the instance attributes.

Class Attribute List

Attr ID	Access Rule	Name	Data Type	Description
1	Get	Revision	UINT (16)	Revision of this object
2	Get	Max Instance	UINT (16)	Maximum instance number of an object currently created in this class level of the device
3	Get	Number of Instances	UINT (16)	Number of object instances currently created in this class level of the device.
6	Get	Maximum ID Number Class Attributes	UINT (16)	The attribute ID number of the last class attribute of the class definition implemented in the device
7	Get	Maximum ID Number Instance Attributes	UINT (16)	The attribute ID number of the last instance attribute of the class definition implemented in the device

Instance Attribute List

Attr ID	Access Rule	Name	(Struct.)	Data Type	Description
1	Get	Vendor ID		UINT (16)	991
2	Get	Device Type		UINT (16)	0 x 307, “Managed Ethernet Switch”.
3	Get	Product Code		UINT (16)	Please refer to Product Code Table.
4	Get	Revision		(Struct.)	The version of the Identity object
			Major	USINT (8)	The structure member, major
			Minor	USINT (8)	The structure member, minor.
5	Get	Status		WORD (16)	Not used
6	Get	Serial Number		UDINT (32)	The serial number of each device
7	Get	Product Name		SHORT_ STRING	The product name in human-readable format
15	Get/Set	Assigned Name		STRINGI	The assigned switch name For example: “Managed Redundant Switch xxxxx”. (xxxxx is series number.)
17	Get/Set	Geographic Location		STRINGI	The assigned switch location The default string is “Switch Location”.

The Identity Object Instance supports the following CIP Common services:

Common Service List

Service Code	Implementation		Service Name	Description
	Class	Instance		
0x01	✓	✓	Get_Attributes_All	Returns the contents of all attributes of the class
0x0E	✓	✓	Get_Attribute_Single	Used to read an object instance attribute.
0x10		✓	Set_Attribute_Single	Used to write an object instance attribute
0x05		✓	Reset	Invokes the reset service for the device

Product Code Table

Product Code	Model Name
0x0006	ETHERLINE ACCESS M05T
0x0007	ETHERLINE ACCESS M08T

TCP/IP Interface Object

The Class code of TCP/IP Interface object is **0xf5** (Defined in CIP Vol2, 5-3).

There is **one** instance of this object.

The following tables summarize the attributes of this object.

Class Attribute List

Attr ID	Access Rule	Name	Data Type	Description
1	Get	Revision	UINT (16)	Revision of this object.
2	Get	Max Instance	UINT (16)	Maximum instance number of an object currently created in this class level of the device
3	Get	Number of Instances	UINT (16)	Number of object instances currently created at this class level of the device
6	Get	Maximum ID Number Class Attributes	UINT (16)	The attribute ID number of the last class attribute of the class definition implemented in the device
7	Get	Maximum ID Number Instance Attributes	UINT (16)	The attribute ID number of the last instance attribute of the class definition implemented in the device

Instance Attribute List

Attr ID	Access Rule	Name	(Struct.)	Data Type	Description
1	Get	Status		DWORD (32)	Interface status 0 = The Interface Configuration attribute has not been configured. 1 = The Interface Configuration attribute contains valid configuration obtained from BOOTP, DHCP or non-volatile storage.
2	Get	Configuration Capability		DWORD (32)	Interface capability flags Bit map of capability flags: Bit 0: BOOTP Client Bit 1: DNS Client Bit 2: DHCP Client Bit 3: DHCP-DNS Update Bit 4: Configuration Settable
3	Get/Set	Configuration Control		DWORD (32)	Interface control flags Bit map of control flags: Bit 0 to 3: Startup Configuration 0 = The device shall use the interface configuration values previously stored (for example, in non-volatile memory or via hardware witches). 1 = The device shall obtain its interface configuration values via BOOTP. 2 = The device shall obtain its interface configuration values via DHCP upon start-up. 3 to15 = Reserved.
4	Get	Physical Link Object		(Struct.)	Path to physical link object
			Path Size	UINT (16)	Size of Path
			Path	Padded	Logical segments identifying the

				EPATH	physical link object
5	Get/Set	Interface Configuration		(Struct.)	TCP/IP network interface configuration
			IP Address	UDINT (32)	The device's IP address
			Network Mask	UDINT (32)	The device's network mask
			Gateway Address	UDINT (32)	Default gateway address
			Name Server	UDINT (32)	Primary name server
			Name Server2	UDINT (32)	Secondary name server
			Domain Name	STRING	Default domain name
6	Get/Set	Host Name		STRING	Host name

The TCP/IP Object Instance supports the following CIP Common services:

Common Service List

Service Code	Implementation		Service Name	Description
	Class	Instance		
0 x 01	✓	✓	Get_Attributes_All	Returns the contents of all attributes of the class
0 x 0E	✓	✓	Get_Attribute_Single	Used to read an object instance attribute
0 x 10		✓	Set_Attribute_Single	Used to modify an object instance attribute

Ethernet Link Object

The Class code of Ethernet Link object is **0xf6** (Defined in CIP Vol2, 5-4). For each switch port, there is an instance of this class. The following table shows the mapping of instance number and the switch port number.

Instance Number	Mapping to
0	Ethernet Link class
1	1st switch port
2	2nd switch port
3	3rd switch port
…	…

The following tables summarize the attributes of the Ethernet Link object.

There are some vendor specific attributes in the table (Starting from attribute Id 100).

Class Attribute List

Attr ID	Access Rule	Name	Data Type	Description
1	Get	Revision	UINT (16)	Revision of this object
2	Get	Max Instance	UINT (16)	Maximum instance number of an object currently created in this class level of the device
3	Get	Number of Instances	UINT (16)	Number of object instances currently created in this class level of the device
6	Get	Maximum ID Number Class Attributes	UINT (16)	The attribute ID number of the last class attribute of the class definition implemented in the device
7	Get	Maximum ID Number Instance Attributes	UINT (16)	The attribute ID number of the last instance attribute of the class definition implemented in the device
100	Get	LAPP-specific Revision	UINT (16)	Revision of LAPP specific attributes and services

Instance attribute list

Attr ID	Access Rule	Name	(Struct.)	Data Type	Description
1	Get	Interface Speed		UDINT (32)	Interface speed currently in use (Speed in Mbps, e.g., 0, 10, 100, 1000, etc.)
2	Get	Interface Flags		DWORD (32)	Refer to the Interface Flags table.
3	Get	Physical Address		ARRAY of 6 USINT(8)	MAC layer address (The System MAC address).
4	Get	Interface Counters		(Struct.)	Counters relevant to the receipt of packets.
			In Octets	UDINT (32)	Octets received on the interface.
			In Ucast Packets	UDINT (32)	Unicast packets received on the interface.
			In NUcast Packets	UDINT (32)	Non-unicast packets received on the interface.
			In Discards	UDINT (32)	Inbound packets received on the interface but are discarded.
			In Errors	UDINT (32)	Inbound packets that contain Errors (does not include In Discards).
			Out Octets	UDINT (32)	Octets sent on the interface.
			Out Ucast Packets	UDINT (32)	Unicast packets sent on the interface.
			Out NUcast Packets	UDINT (32)	Non-unicast packets sent on the interface.
			Out Discards	UDINT (32)	Discarded outbound packets.
			Out Errors	UDINT (32)	Outbound packets that contain errors.
5	Get	Media Counters		(Struct.)	
			Alignment Errors	UDINT (32)	Received frames that are not an integral number of octets in length.
			FCS Errors	UDINT (32)	Received frames that do not pass the FCS check.
			Single Collisions	UDINT (32)	Successfully transmitted frames which experienced exactly one collision.
			Multiple Collisions	UDINT (32)	Successfully transmitted frames which experienced more than one collision.
			SQE Test Errors	UDINT (32)	Number of times the SQE test error message is generated.

			Deferred Transmissions	UDINT (32)	Frames for which first transmission attempt is delayed because the medium is busy.
			Late Collisions	UDINT (32)	Number of times a collision is detected later than 512 bit times into the transmission of a packet.
			Excessive Collisions	UDINT (32)	Frames for which transmission fails due to excessive collisions.
			MAC Transmit Errors	UDINT (32)	Frames for which transmission fails due to an internal MAC sublayer transmit error.
			Carrier Sense Errors	UDINT (32)	Times that the carrier sense condition was lost or never asserted when attempting to transmit a frame.
			Frame Too Long	UDINT (32)	Received frames that exceed the maximum permitted frame size.
			MAC Receive Errors	UDINT (32)	Frames for which reception on an interface fails due to an internal MAC sublayer receive error.
6	Get/Set	Interface Control		(Struct.)	Configuration for physical interface.
			Control Bits	WORD (16)	Bit 0: Auto-Negotiate Value 0: Force Value 1: Auto-Nego Bit 1: Half/Full Duplex Value 0: half duplex Value 1: full duplex Bit 2 to 15: Reserved, all zero
			Forced Interface Speed	UINT (16)	Speed at which the interface shall be forced to operate.
10	Get	Interface Label		SHORT_STRING	Human readable identification
100	Get	Interface Port Index		UDINT (32)	Port index.
101	Get	Interface Port Description		STRING	Port description.
102	Get/Set	Broadcast Storm Protection		USINT (8)	Value 0: Disabled Broadcast Storm Protection. Value 1: Enable Broadcast Storm Protection. (Only selected products support this function)
103	Get	Interface Utilization		USINT (8)	RX interface utilization in percentage
104	Get/Set	Utilization Alarm Upper Threshold		USINT (8)	RX interface utilization upper limit in percentage
105	Get/Set	Utilization Alarm Lower Threshold		USINT (8)	Not supported
106	Get/Set	Port Link Alarm		USINT (8)	Value 0: Ignore Value 1: On (Relay 1) Value 2: On (Relay 2) Value 3: Off (Relay 1) Value 4: Off (Relay 2)
107	Get/Set	Port Traffic-Overload Alarm		USINT (8)	Value 0: Disable Value 1: Enable(Relay 1) Value 2: Enable(Relay 2)
108	Get	Tx Unicast Packet Rate		UDINT(32)	Number of TX unicast packets per second
109	Get	Rx Unicast Packet Rate		UDINT(32)	Number of RX unicast packets per second
110	Get	Tx Multicast Packet Rate		UDINT(32)	Number of TX multicast packets per second
111	Get	Rx Multicast Packet Rate		UDINT(32)	Number of RX multicast packets per second
112	Get	Tx Broadcast Packet Rate		UDINT(32)	Number of TX broadcast packets per second
113	Get	Rx Broadcast Packet Rate		UDINT(32)	Number of RX broadcast packets per second

114	Get	Tx Multicast Packet		UDINT(32)	Total number of TX multicast packets
115	Get	Rx Multicast Packet		UDINT(32)	Total number of RX multicast packets
116	Get	Tx Broadcast Packet		UDINT(32)	Total number of TX broadcast packets
117	Get	Rx Broadcast Packet		UDINT(32)	Total number of RX broadcast packets
118	Get	Redundant Port Status		UDINT(32)	Bit 0 = Disable Bit 1 = Not Redundant port Bit 2 = Link down Bit 3 = Blocking Bit 4 = Learning Bit 5 = Forwarding

Interface Flags

Bit(s)	Called	Definition
0	Link Status	0 indicates an inactive link; 1 indicates an active link.
1	Half/Full Duplex	0 indicates half duplex; 1 indicates full duplex.
2-4	Negotiation Status	Indicates the status of link auto-negotiation 0 = Auto-negotiation in progress. 1 = Auto-negotiation and speed detection failed. Using default values for speed and duplex. Default values are product-dependent; recommended defaults are 10Mbps and half duplex. 2 = Auto negotiation failed but detected speed. Duplex was defaulted. Default value is product-dependent; recommended default is half duplex. 3 = Successfully negotiated speed and duplex. 4 = Auto-negotiation not attempted. Forced speed and duplex.
5	Manual Setting Requires Reset	0 indicates the interface can activate changes to link parameters (auto-negotiate, duplex mode, interface speed) automatically. 1 indicates the device requires a Reset service be issued to its Identity Object in order for the changes to take effect.
6	Local Hardware Fault	0 indicates the interface detects no local hardware fault; 1 indicates a local hardware fault is detected. The meaning of this is product-specific. For example, an AUI/MII interface might detect no transceiver attached, or a radio modem might detect no antenna attached. In contrast to the soft, possibly self-correcting nature of the Link Status being inactive, this is assumed a hard-fault requiring user intervention.
7~31	Reserved.	Shall be set to zero

The Ethernet Link Object Instance supports the following CIP common services:

Common Service List

Service Code	Implementation		Service Name	Description
	Class	Instance		
0x0E	✓	✓	Get_Attribute_Single	Used to read an object instance attribute
0x10		✓	Set_Attribute_Single	Used to modify an object instance attribute

Assembly Object

The LAPP switch support **static** assembly object for CIP I/O messaging.

The Class code is **0x04** (Defined in CIP Vol 1, 5-5).

There are three instances of this object as the following.

	Instance Number	Size (32 bit)
Input	2	5
Output	1	2
Configuration	3	0

The **Input** means the data is produced by switch which includes the information and status report to the originator for monitoring. The **Output** means the data is generated by the originator (remote host) and is consumed by switch.

Class Attribute List

Attr ID	Access Rule	Name	Data Type	Description
1	Get	Revision	UINT (16)	Revision of this object

Instance Attribute List

Attr ID	Access Rule	Name	(Struct.)	Data Type	Description
3	Get/Set	Data		Array of BYTE	The implicit messaging content
4	Get	Size		UINT (16)	Number of bytes in Attr. 3

Common Service List

Service Code	Implementation		Service Name	Description
	Class	Instance		
0x0E	✓	✓	Get_Attribute_Single	Used to read an object instance attribute
0x10		✓	Set_Attribute_Single	Used to modify an object instance attribute

For the definition of the I/O messaging, see the following table for details.

I/O Messaging Content

Direction	I/O data	Size	Value & Description
Input	Switch Fault Status	UDINT (32)	Please refer to LAPP Networking Object Attr ID 2.
	Port Exist	ULINT (64)	Please refer to LAPP Networking Object Attr ID 4.
	Port Link Status	ULINT (64)	Please refer to LAPP Networking Object Attr ID 6.
Output	Port Enable	ULINT (64)	Please refer to LAPP Networking Object Attr ID 5.

Message Router Object

The object within a node that distributes messaging requests to the appropriate application objects.

The supported messaging connections are as the following:

- Explicit Messaging
- Unconnected Messaging
- Implicit messaging

When using the UCMM to establish an explicit messaging connection, the target application object is the Message Router object (Class Code **2**).

Class Attribute List

Attr ID	Access Rule	Name	Data Type	Descriptions
1	Get	Revision	UINT (16)	Revision of this object

Instance Attribute List

Attr ID	Access Rule	Name	(Struct.)	Data Type	Description
1	Get	Object_list		(Struct.)	A list of supported objects
			Number	UINT (16)	Number of supported classes in the classes array
			Classes	Array of UINT (16)	List of supported class codes
2	Get	Number Available		UINT (16)	Maximum number of connections supported
3	Get	Number Active		UINT (16)	Number of connections currently used by system components
4	Get	Active Connections		Array of UINT (16)	A list of the connection IDs of the currently active connections

Common Service List

Service Code	Implementation		Service Name	Description
	Class	Instance		
0x0E		✓	Get_Attribute_Single	Used to read an object instance attribute

Connection Manager Object

The Connection Manager Class allocates and manages the internal resources associated with both I/O and Explicit Messaging connections.

The class code is **0x06**. There is one instance of this object.

The supported connection trigger type is ***cyclic*** and ***change of state***.

The instance attribute list is introduced as the following.

Class Attribute List

Attr ID	Access Rule	Name	Data Type	Description
1	Get	Revision	UINT (16)	Revision of this object

Instance Attribute List

Attr ID	Access Rule	Name	Data Type	Description
1	Get/Set	Open Requests	UINT(16)	Number of Forward Open service requests received

Common Service List

Service Code	Implementation		Service Name	Description
	Class	Instance		
0x0e	✓	✓	Get_Attribute_Single	Returns the contents of the specified attribute
0x10		✓	Set_Attribute_Single	Used to modify an object instance attribute
0x4E		✓	Forward_Close	Closes a connection
0x54		✓	Forward_Open	Opens a connection

Port Object

The port object represents the underlying interface of CIP which is EtherNet/IP.

The class code is **0xf4**. There is one instance of this object.

The instance attribute "**Port Type**" identifies the CIP adaptation.

Class Attribute List

Attr ID	Access Rule	Name	(Struct.)	Data Type	Description
1	Get	Revision		UINT (16)	Revision of this object
2	Get	Max Instance		UINT (16)	Maximum instance number of an object currently created in this class level of the device
3	Get	Number of Instances		UINT (16)	Number of object instances currently created at this class level of the device.
8	Get	Entry Port		UINT (16)	The attribute ID number of the last class attribute of the class definition implemented in the device
9	Get	Port Instance Info		(Array of Struct.)	
			Port Type	UINT (16)	Enumerates the type of port
			Port Number	UINT (16)	CIP port number associated with this port

Instance Attribute List

Attr ID	Access Rule	Name	(Struct.)	Data Type	Description
1	Get	Port Type		UINT (16)	Enumerates the type of port. 4 = EtherNet/IP.
2	Get	Port Number		UINT (16)	CIP port number associated with this port. (Value 1 is reserved for internal product use)
3	Get	Link Object		(Struct.)	
			Path Length	UINT (16)	Number of 16 bit words in the following path.
			Link Path	Padded EPATH	Logical path segments that identify the object for this port.
4	Get	Port Name		SHORT_STRING	String which names the physical network port. The maximum number of characters in

					the string is 64.
5	Get	Port Type Name		SHORT_STRING	String which names the port type. The maximum number of characters in the string is 64.
6	Get/Set	Port Description		SHORT_STRING	String which describes the port. The maximum number of characters in the string is 64.
7	Get	Node Address		Padded EPATH	Node number of this device on port. The range within this data type is restricted to a Port Segment.
9	Get	Port Key		Packed EPATH	Electronic key of network/chassis this port is attached to. This attribute shall be limited to format 4 of the Logical Electronic Key segment.

Common Service List

Service Code	Implementation		Service Name	Description
	Class	Instance		
0x0E	✓	✓	Get_Attribute_Single	Used to read an object instance attribute
0x10		✓	Set_Attribute_Single	Used to modify an object instance attribute

LAPP Networking Object (Vendor Specific)

The LAPP Networking object includes system information and status.

It can also be used to do the device diagnostic & configuration through explicit messaging.

The class code is **0x404**.

Class Attribute List

Attr ID	Access Rule	Name	Data Type	Description
1	Get	Revision	UINT (16)	Revision of this object

Instance Attribute List

Attr ID	Access Rule	Name	Data Type	Description
1	Get	Firmware Version	UDINT (32)	Switch firmware version
2	Get	System Fault Status	UDINT (32)	Switch fault status Bit 0: Reserved Value 0: Ok Value 1: Fail Bit 1: Reserved Value 0: Ok Value 1: Fail Bit 2: Port utilization alarm Value 0: No alarm Value 1: alarm Bit 3: Port link up Value 0: No alarm Value 1: Alarm Bit 4: Port link down Value 0: No alarm Value 1: Alarm Bit 5: Turbo ring break(Ring Master only) Value 0: No alarm Value 1: Alarm Bit 6: Power Input 1 fail Value 0: No alarm Value 1: Alarm Bit 7: Power Input 2 fail Value 0: No alarm Value 1: Alarm Bit 8:DI 1(off) Value 0: No alarm Value 1: Alarm Bit 9: DI 1(on) Value 0: No alarm Value 1: Alarm Bit 10: DI 2(off) Value 0: No alarm Value 1: Alarm

				Bit 11: DI 2(on) Value 0: No alarm Value 1: Alarm Bit 12: Reserved Value 0: Not support Value 1: Detected Bit 13: Power supply 1 Value 0: Off Value 1:On Bit 14: Power supply 2 Value 0: Off Value 1:On Bit 15~31: Reserved.
3	Get	Switch Port Number	USINT (8)	Switch max port number
4	Get	Port Exist	ULINT (64)	switch per port exist Bit mask, the LSB indicates the first port. Value 0: Not exist Value 1: Exist
5	Get/Set	Port Enable	ULINT (64)	Switch per port enable Bit mask, the LSB indicates the first port. Value 0: Enable Value 1: Disable
6	Get	Port Link Status	ULINT (64)	Switch per port link status Bit mask, the LSB indicates the first port. Value 0: Link down Value 1: Link up
7	Get/Set	IGMP Snooping Enable	USINT (8)	IGMP snooping enable: Value 0: Disable Value 1: Enable
8	Get/Set	Query Interval	UDINT (32)	Query interval range from 20 to 600 secs
9	Get/Set	IGMP Enhanced Mode	USINT (8)	IGMP enhanced mode 0: Disable(default) 1: Enable
14	Get/Set	Relay 1	USINT (8)	Override relay warning setting 0: Disable(default) 1: Enable
15	Get/Set	Relay 2	USINT (8)	Override relay warning setting 0: Disable (default) 1: Enable
16	Get/Set	Power 1 Relay Warning	USINT (8)	Power input 1 failure (on->off) 0: Disable (default) 1: Enable (relay 1) 2: Enable (relay 2)
17	Get/Set	Power 2 Relay Warning	USINT (8)	Power input 2 failure (on->off) 0: Disable (default) 1: Enable (relay 1) 2: Enable (relay 2)
18	Get/Set	DI 1 (0ff) Relay Warning	USINT (8)	DI 1 (0ff) 0: Disable (default) 1: Enable (relay 1) 2: Enable (relay 2)
19	Get/Set	DI 1 (on) Relay Warning	USINT (8)	DI 1 (0n) 0: Disable (default) 1: Enable (relay 1) 2: Enable (relay 2)
20	Get/Set	DI 2 (0ff) Relay Warning	USINT (8)	DI 2 (0ff) 0: Disable (default) 1: Enable (relay 1) 2: Enable (relay 2)
21	Get/Set	DI 2 (on) Relay Warning	USINT (8)	DI 2 (0n) 0: Disable (default) 1: Enable (relay 1) 2: Enable (relay 2)
22	Get/Set	Turbo Ring Break Relay Warning	USINT (8)	Turbo ring break (Ring Master only) 0: Disable (default) 1: Enable (relay 1) 2: Enable (relay 2)
23	Get	CPU Usage	USINT (8)	Percent of usage (0 to100)
24	Get	Device Up Time	UDINT (32)	Number of seconds since the device was powered up
25	Get/Set	Reset MIB Counts	USINT (8)	Reset port MIB counters.
26	Get	Redundant Device Mode	UDINT (32)	Bit mask of device roles. Bits 0= RSTP

				Bits 1= Turbo Ring Bits 2= Turbo Ring v2 Bits 3= Turbo Chain Bits 4= None
27	Get/Set	Reset Device	USINT (8)	Reboot and reset to default 1: Reboot the device 2: Reset to default

Common Service List

Service Code	Implementation		Service Name	Description
	Class	Instance		
0x0E	✓	✓	Get_Attribute_Single	Used to read an object instance attribute
0x10		✓	Set_Attribute_Single	Used to modify an object instance attribute

Electronic Data Sheet (EDS) File

The EDS (Electronic Data Sheet) file contains electronic descriptions of all relevant communication parameters and objects of an EtherNet/IP device. It is required for RSLogix 5000 to recognize LAPP switch and its CIP capability.

The list includes the sections which are described in our EDS file.

- [File]
- [Device]
- [Device Classification]
- [Port]

Icon should be 32 * 32 in pixel.

Rockwell RSLogix 5000 Add-On Instructions (AOI)

The Rockwell RSLogix 5000 Add-On Instructions (AOI) encapsulates LAPP switch supported EtherNet/IP functions in a common interface logic component. In RSLogix 5000 programming, users could use the AOI to communicate with LAPP switches and need not know the internal logic.

Our AOI would provide logic of LAPP switch configuration and monitoring by using EtherNet/IP in explicit messaging and implicit messaging. The AOI also provides some tags for RSLogix 5000/SCADA programming.

AOI Installation

To install the AOI, you must use Rockwell RSLogix 5000 version 20 or later and LAPP managed Ethernet switches with firmware version 3.0 or later.

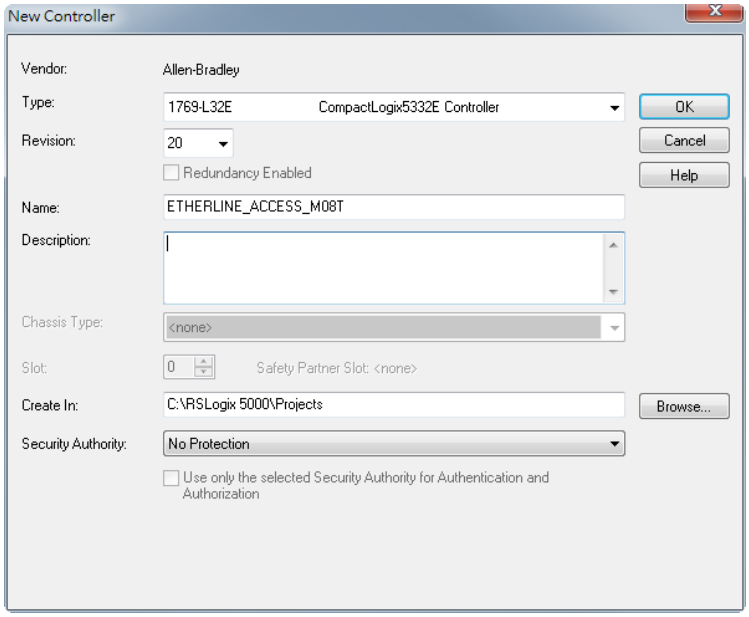
The Five Major Stages of Installing the AOI

1. Add LAPP switch to the I/O configuration tree
2. Import the Add-On Instruction (AOI)
3. Add an instance of the AOI in your application
4. Create and configure tags for the AOI
5. Download the configured AOI to Rockwell PLC

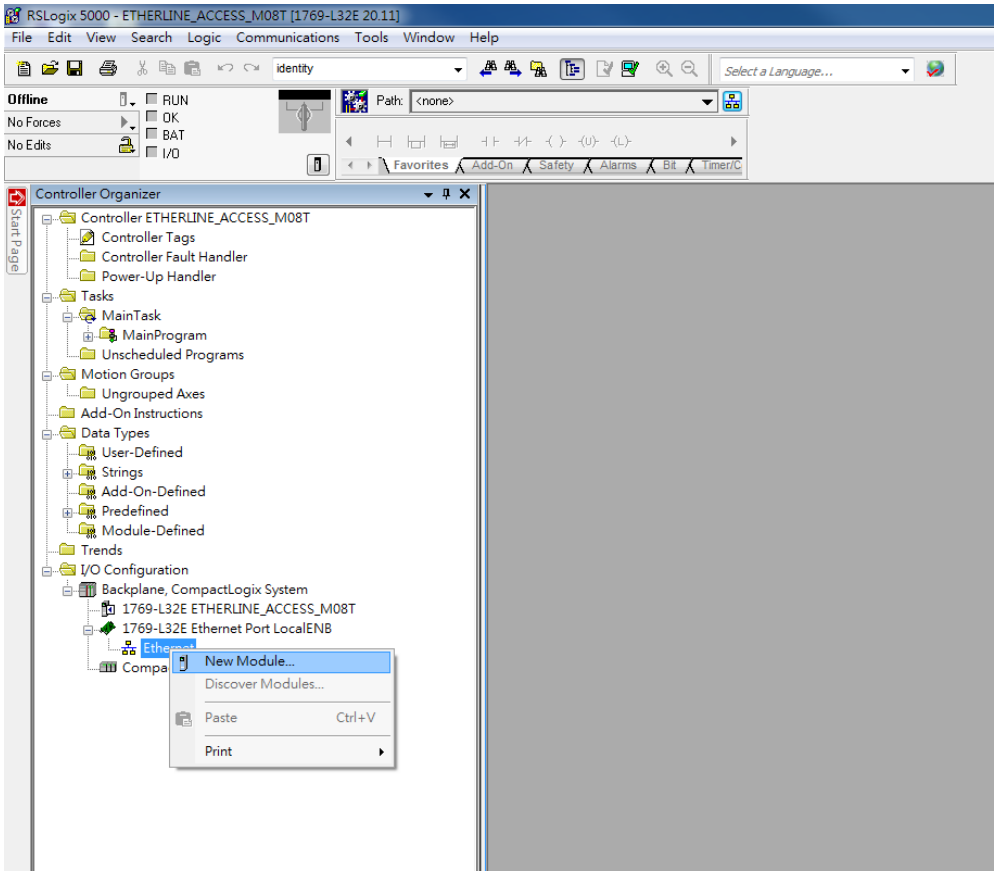
Add LAPP switch to the I/O configuration tree

In order to import the AOI, the first step is to create a new Ethernet Module in RSLogix 5000.

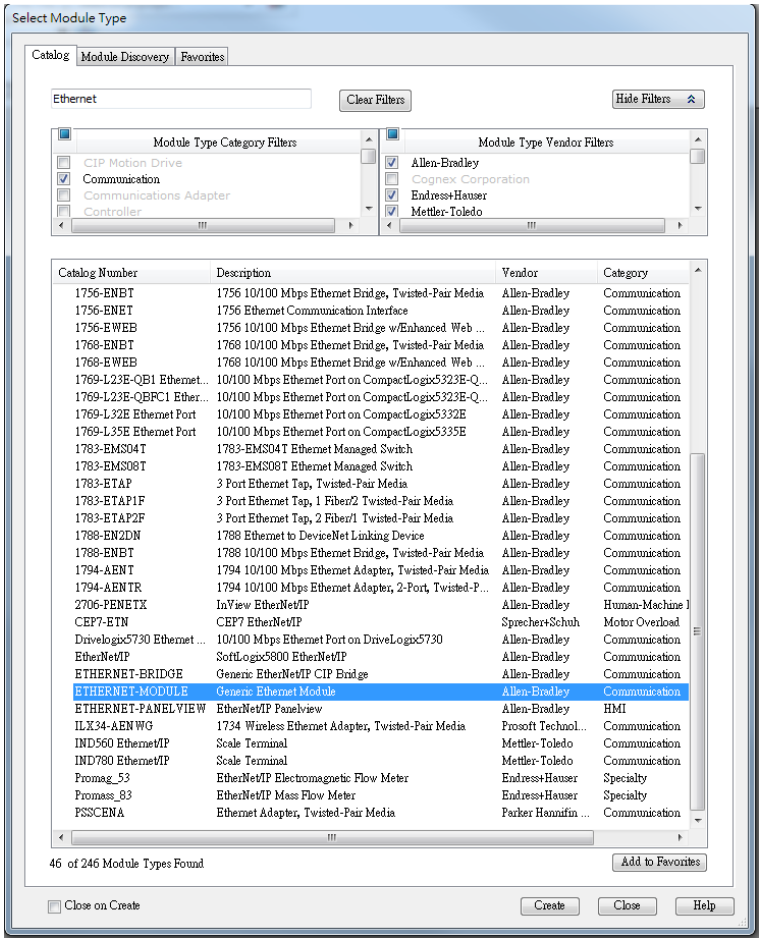
1. Open RSLogix 5000 and create a new controller.
   Click **Type** and select the Rockwell PLC model of the PLC connected to the LAPP switch. Input a **Name** and **Description** for this new controller.



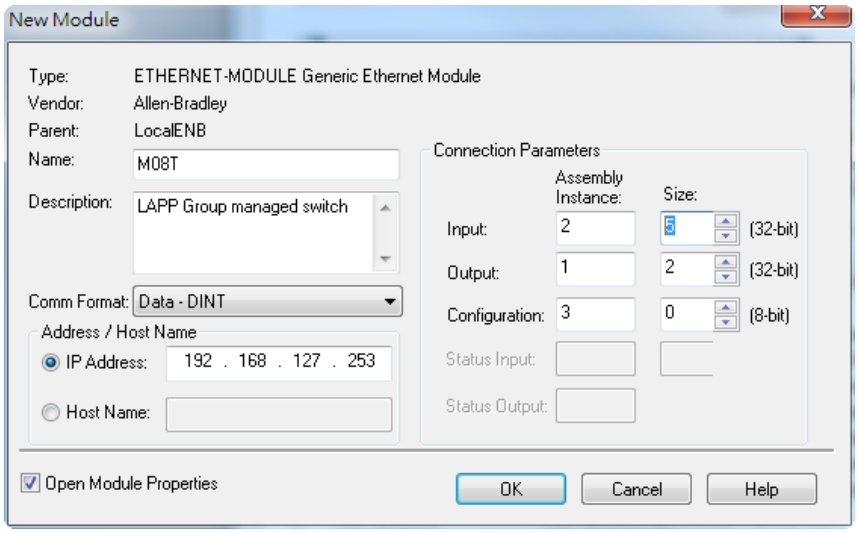
2. Add an Ethernet Module to the I/O Configuration.
   In the controller organizer window, select **I/O Configuration**, right click **Ethernet** under the PLC Ethernet port of the PLC connected to a LAPP switch, and select **New Module**.



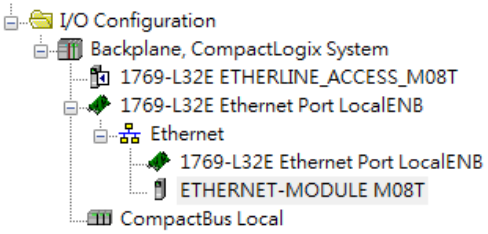
3. Under the **Communications** group, select **Generic Ethernet Module** to represent LAPP Ethernet switches



4. Configure the Ethernet module with the correct name, description, IP address and connection parameters and click OK.



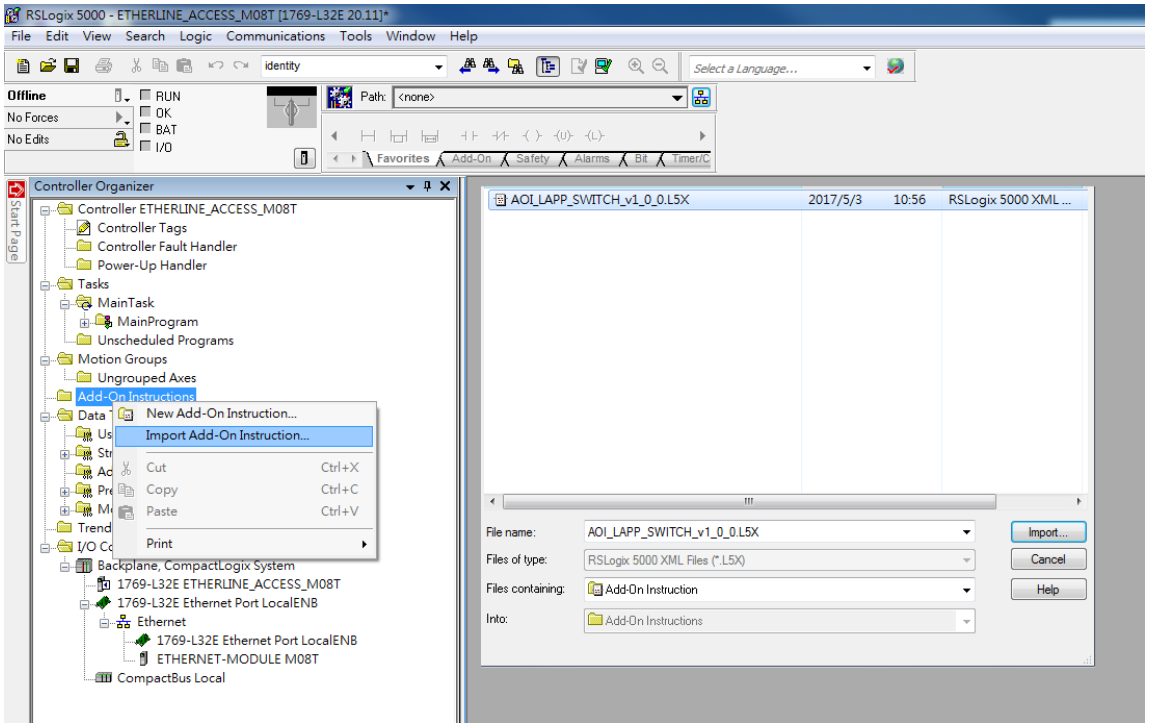
5. After finishing configuration, the new Ethernet module representing the LAPP Ethernet switch will appear under the **I/O Configuration** list in the controller organizer window.



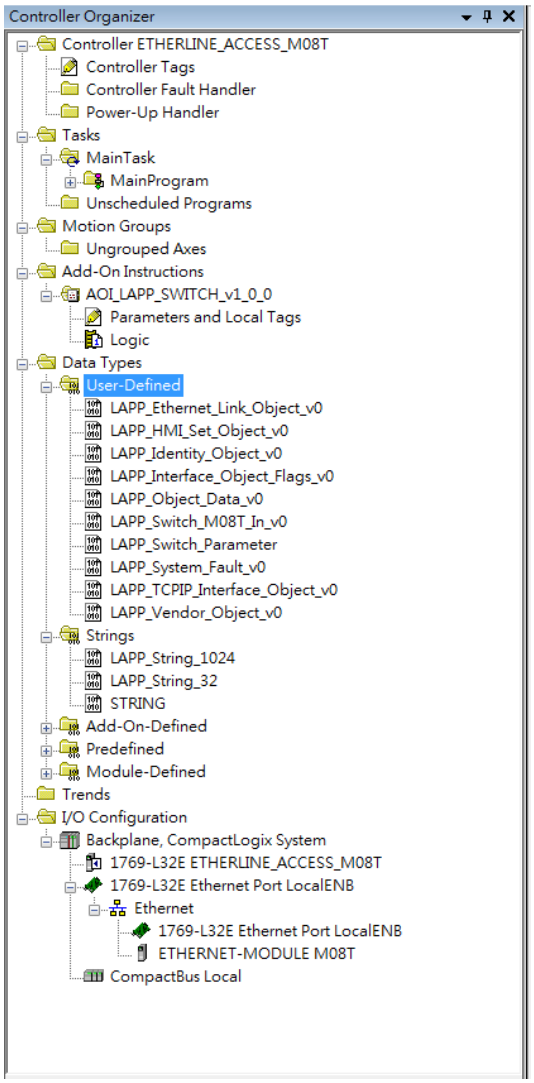
Import the Add-On Instruction (AOI)

1. In the controller organizer window, right click the **Add-On Instructions** folder, select **Import Add-On Instructions** and select the correct AOI file (xxx.L5X) to import.

NOTE The AOI file is available from the LAPP website. Please make sure to use the latest switch firmware and AOI for programming.

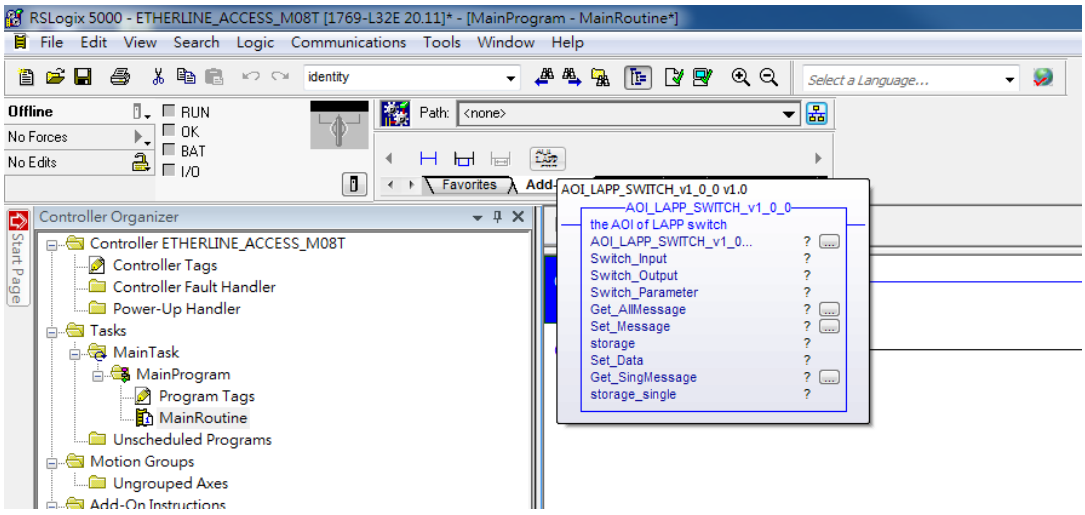


2. After importing, the controller organizer window shows all AOI for LAPP Ethernet switches under the **Add-On Instructions** folder.



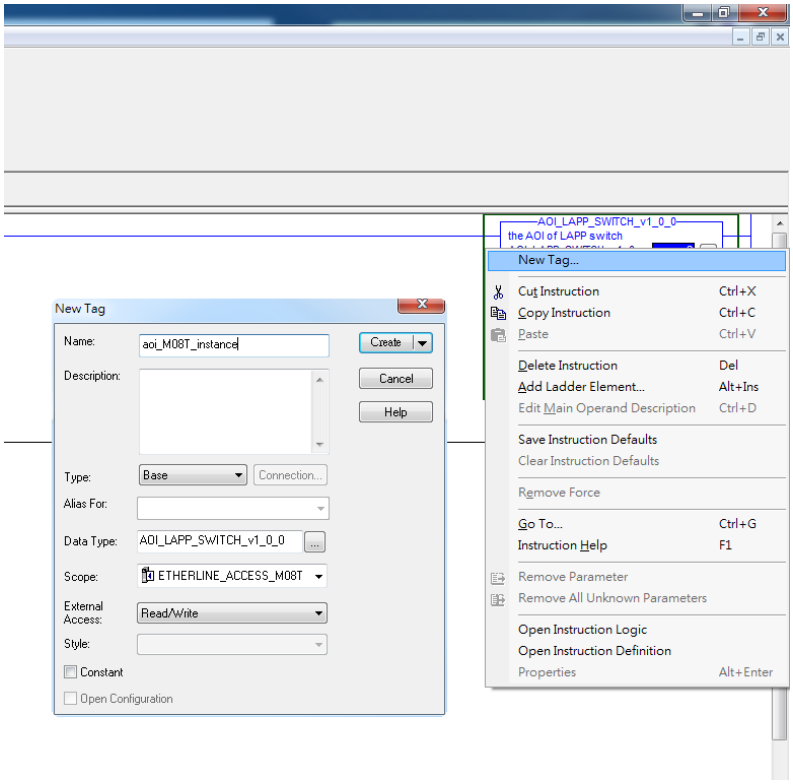
Add an instance of the AOI in your application

1. Double click the **MainRoutine** in the Controller Organizer to start the ladder programming. Add the AOI for the specific LAPP Ethernet switch to create a new rung.

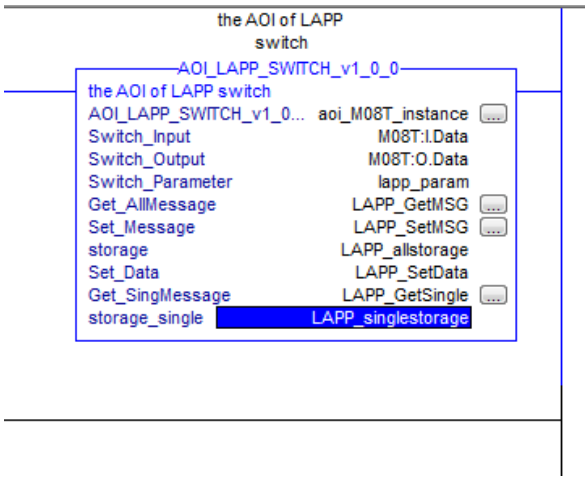


Create and configure tags for the AOI

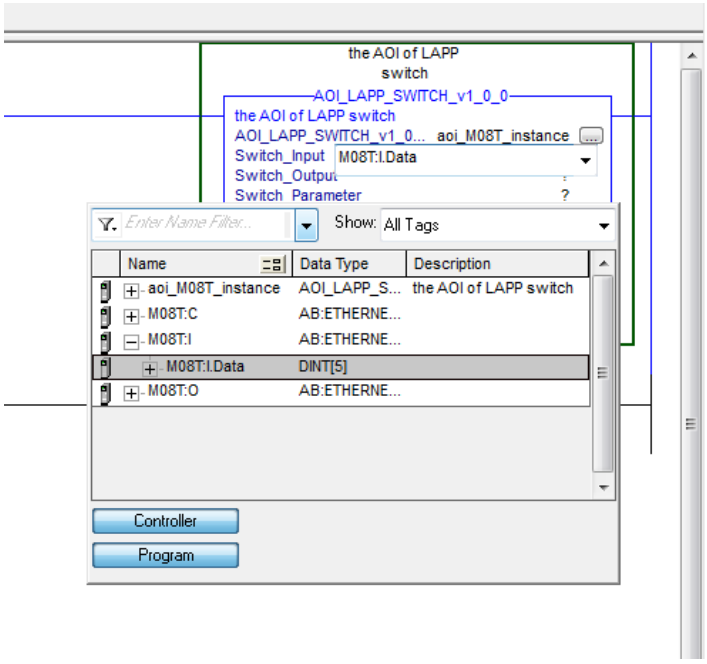
1. Right click on the **?** in the field of each tag, select **New Tag** and input a **Name** for each new tag.



2. Add a **Name** for all AOI tags.



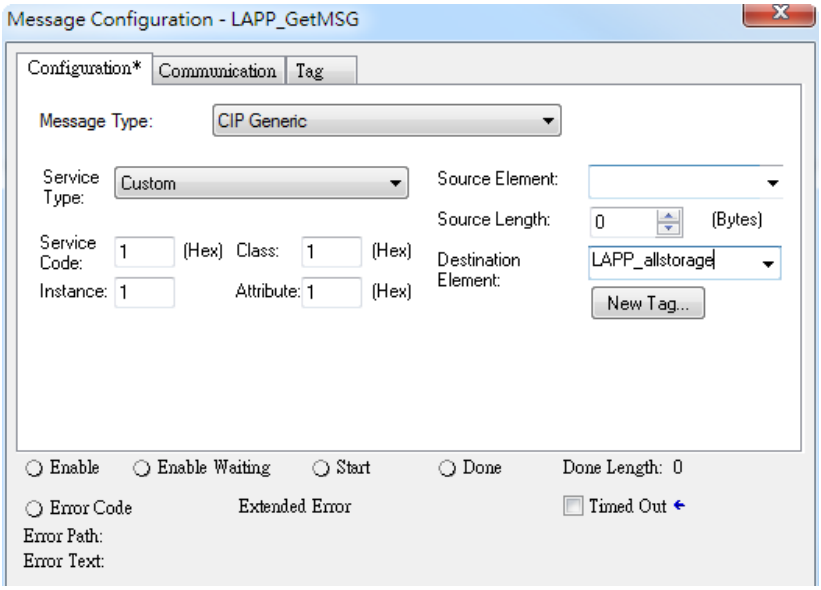
For “Switch_Input” and “Switch_Output”, use the scrollbar to select the tag name



For all other tags, manually type the tag names:

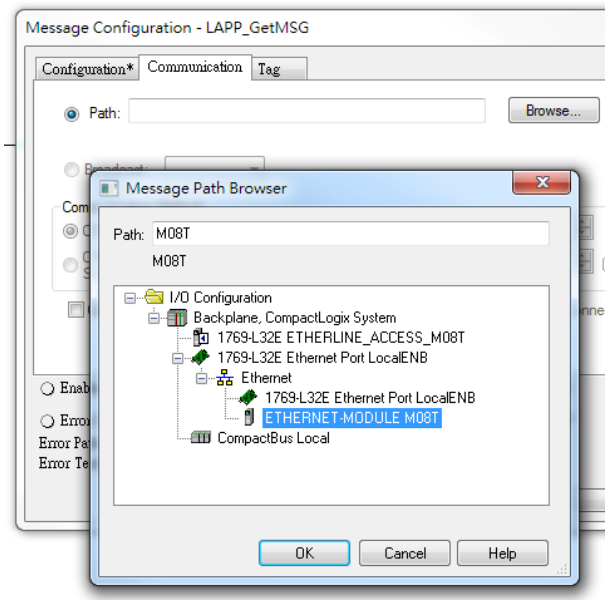
AOI Tag	Reference Tag Name
AOI_LAPP_SWITCH_v1_0	aoi_M08T_instance
Switch_Input	LAPP_ M08T:I.Data
Switch_Output	LAPP_ M08T:O.Data
Switch_Parameter	lapp_param
Get_AllMessage	LAPP_GetMSG
Set_Message	LAPP_SetMSG
storage	LAPP_allstorage
Set_Data	LAPP_SetData
Get_SingMessage	LAPP_GetSingle
storage_single	LAPP_singlestorage

3. Click the square button to the right of the **Get_AllMessage** tag and configure all parameters as follows: (Service Code: 1; Class: 1; Instance: 1; Attribute: 1; Destination: LAPP_allstorage[0])

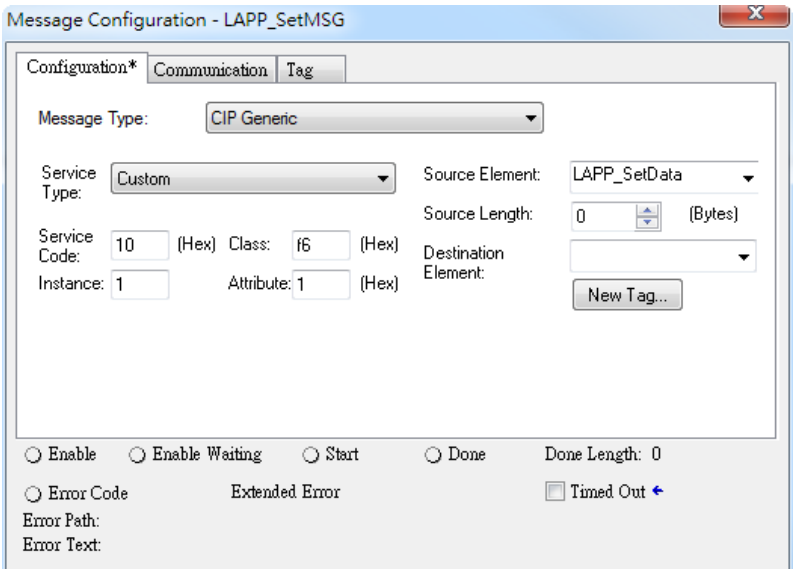


Click the **Communication** tab and set up the communication path to the LAPP Ethernet switch for

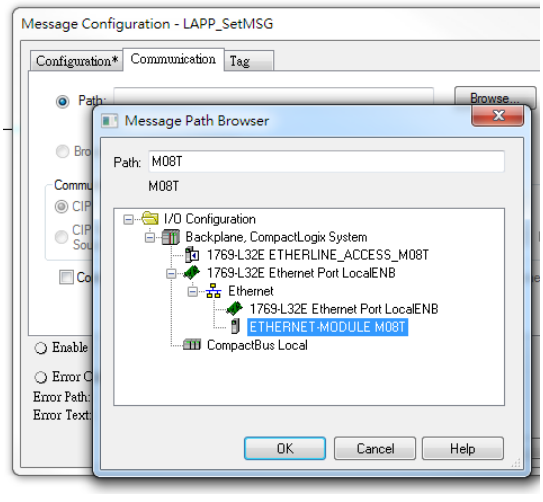
Get_AllMessage



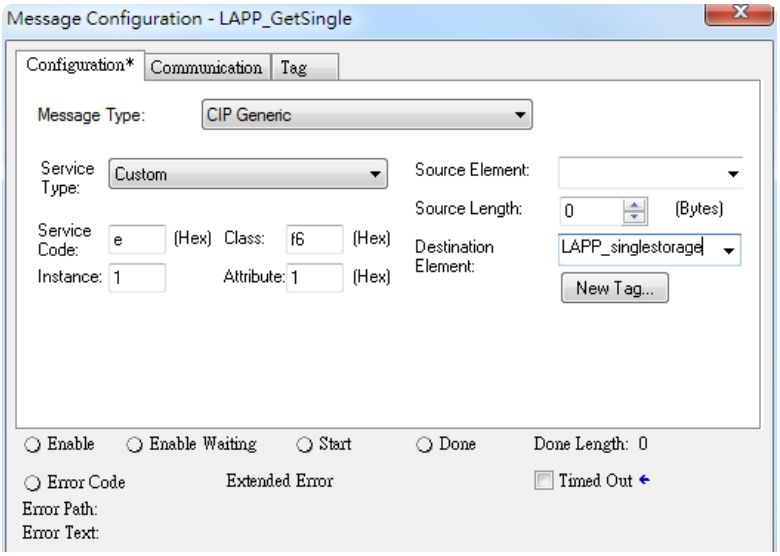
4. Click the square button to the right of the **Set_Message** tag and configure all parameters as follows: (Service Code: 10; Class: f6; Instance: 1; Attribute: 1; Source Ethernet: LAPP_SetData)



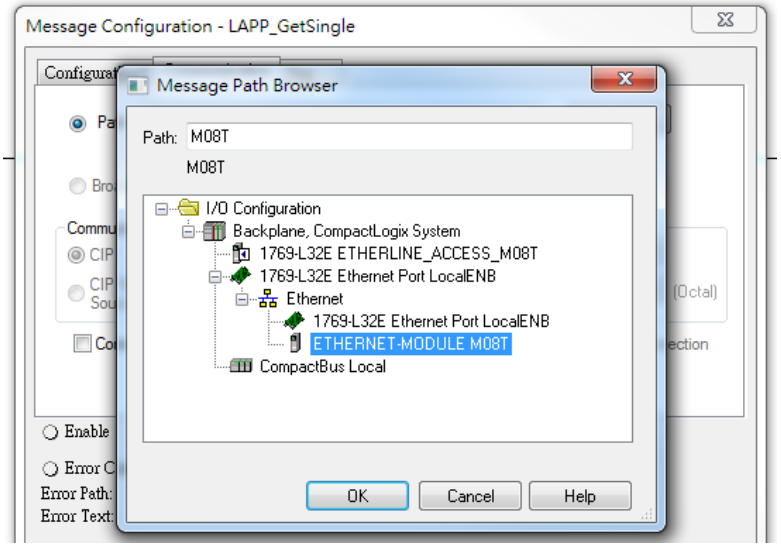
Click the **Communication** tab and set up the communication path to the LAPP Ethernet switch for **Set_Message**



5. Click the square button to the right of the **Get_SingMessage** tag and configure all parameters as follows:
   (Service Code: e; Class: f6; Instance: 1; Attribute: 1; Destination: LAPP_Singlestorage[0])

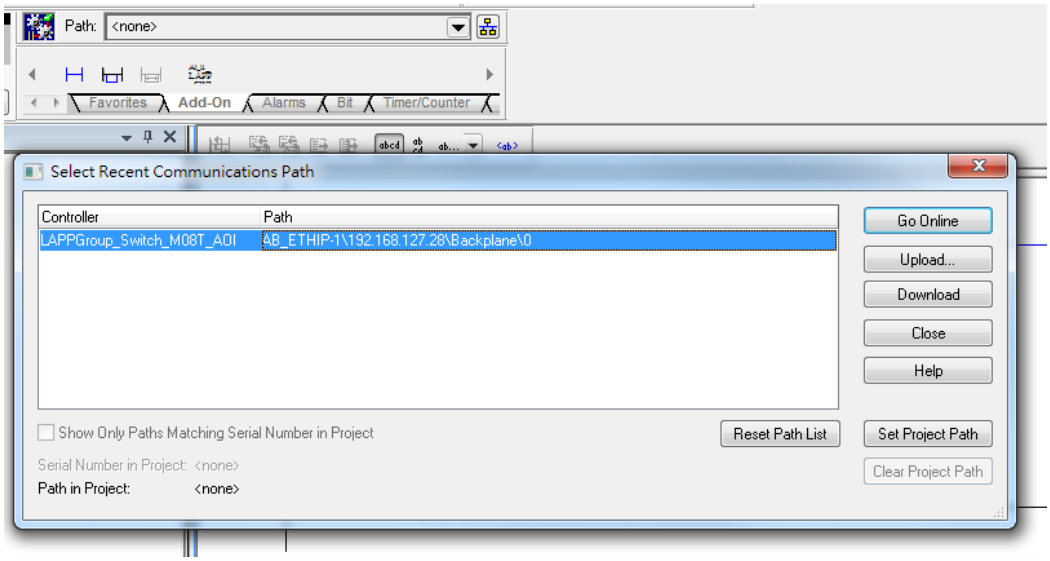


Click the **Communication** tab and set up the communication path to the LAPP Ethernet switch for **Get_SingMessage**

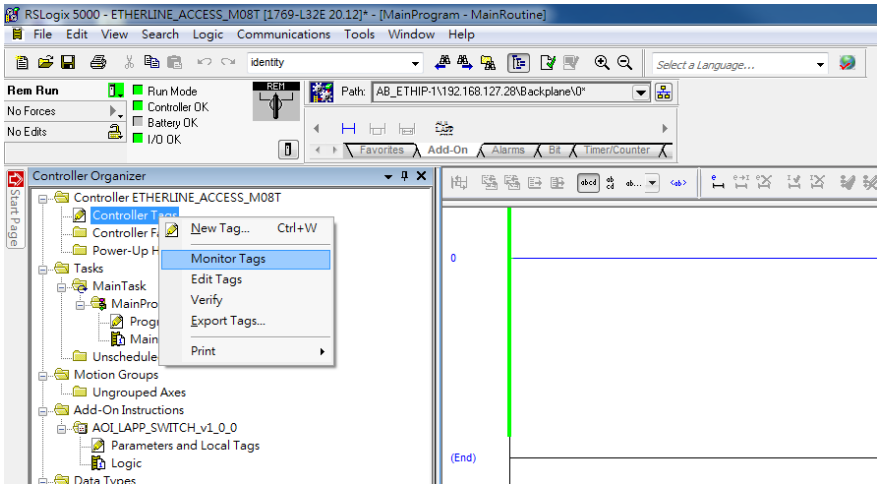


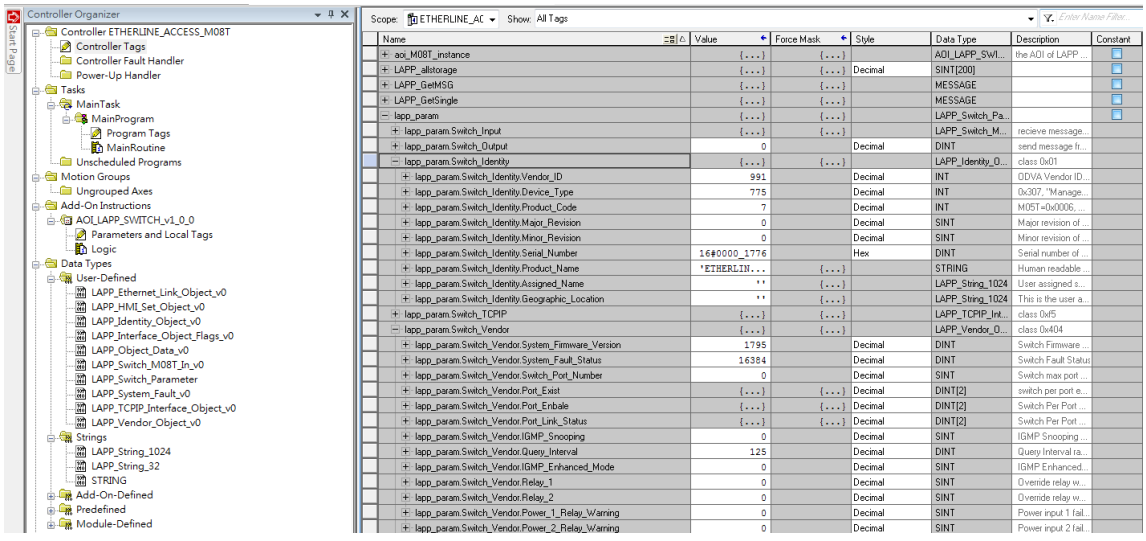
Download the configured AOI to the Rockwell PLC

1. Click the **Network** Icon, select the Rockwell PLC connected to the LAPP switch and click **Download** to install the AOI configuration to the PLC.



2. After finishing configuration, go to the controller organizer window, right click **Controller Tags** and select **Monitor Tags** to check if each tag can display the correct value transferred from the Ethernet device.





NOTE Only LAPP pre-configured tags will display the correct values. Refer to the **CIP Tags** section below for detailed information.

Sample AOI Project

For easier AOI installation, LAPP has also provided a sample AOI project, in which all the parameters are configured with default values. The sample project is a (.ACD) file, which is available for download from the LAPP website. You may import the sample project in RSLogix 5000, and directly download this AOI to the PLC with minimal installation steps. But to use the sample project, you still must change or set up the parameters below.

1. Change the controller type used in the real environment.
2. Change the controller and LAPP switch's IP address.
3. Setup the Project path.

NOTE The sample AOI project supports RSLogix 5000 version 20.

CIP Tags

There are tags for each CIP object. The tags correspond to the object's attributes.

Tags for Identity Object

Data Type: LAPP_Identity_Object_v0

Name	Data Type	Description
Vendor ID	INT	991
Device Type	INT	0x307, "Managed Ethernet Switch"
Product Code	INT	ETHERLINE ACCESS M05T=0x0006, ETHERLINE ACCESS M08T=0x0007
Major Revision	SINT	The structure member, major
Minor Revision	SINT	The structure member, minor
Serial Number	DINT	Switch serial number
Product Name	STRING	Switch model name
Assigned Name	STRING	User assigned switch name
Geographic Location	STRING	User assigned switch location

Tags for TCPIP Object

Data Type: LAPP_TCPIP_Interface_Object_v0

Name	Data Type	Description
Status	DINT	Interface status
Configuration Capability	DINT	Interface capability flags
Configuration Control	DINT	Interface control flags
Path Size	INT	Size of Path
Object Path 1	INT	Logical segments identifying the physical link object
Object Path 2	INT	Logical segments identifying the physical link object
IP Address	DINT	The device's IP address
Network Mask	DINT	The device's network mask
Gateway Address	DINT	Default gateway address
Name Server 1	DINT	Primary name server
Name Server 2	DINT	Secondary name server
Domain Name	STRING	Default domain name
Host Name	STRING	Host name

Tags for Ethernet Link Object

Name	Data Type	Description
Interface Speed	DINT	Interface speed currently in use. Speed in Mbps (e.g., 0, 10, 100, 1000, etc.)
Interface Flags	LAPP_Interface_Object_Flags_v0	Interface status flags
Physical Address	SINT[6]	MAC layer address
InOctets	DINT	Octets received on the interface
InUcastPackets	DINT	Unicast packets received on the interface
InNucastPackets	DINT	Non-unicast packets received on the interface
InDiscards	DINT	Inbound packets received on the interface but discarded
InErrors	DINT	Inbound packets that contain errors (does not include In Discards)
OutOctets	DINT	Octets sent on the interface
OutUcastPackets	DINT	Unicast packets sent on the interface
OutNucastPackets	DINT	Non-unicast packets sent on the interface
OutDiscards	DINT	Outbound packets discarded
OutErrors	DINT	Outbound packets that contain errors
Alignment Errors	DINT	Frames received that are not an integral number of octets in length
FCS Errors	DINT	Frames received that do not pass the FCS check
Single Collisions	DINT	Successfully transmitted frames which experienced exactly one collision
Multiple Collisions	DINT	Successfully transmitted frames which experienced more than one collision
SQE Test Errors	DINT	Number of times SQE test error message is generated
Deferred Transmissions	DINT	Frames for which first transmission attempt is delayed because the medium is busy
Late Collisions	DINT	Number of times a collision is detected later than 512 bit-times into the transmission of a packet
Excessive Collisions	DINT	Frames for which transmission fails due to excessive collisions
MAC Transmit Errors	DINT	Frames for which transmission fails due to an internal MAC sublayer transmit error
Carrier Sense Errors	DINT	Times that the carrier sense condition was lost or never asserted when attempting to transmit a frame
Frame Too Long	DINT	Frames received that exceed the maximum permitted frame size
MAC Receive Errors	DINT	Frames for which reception on an interface fails due to an internal MAC sublayer receive error
Control Bits	INT	0 Auto-negotiate 0 indicates 802.3 link auto-negotiation is disabled. 1 indicates auto-negotiation is enabled
Forced Interface Speed	INT	Speed at which the interface shall be forced to operate. Speed in Mbps (10, 100, 1000, etc.)
Interface Label	STRING	Label like "TX5"
Interface Port Index	DINT	Port index
Interface Port Description	STRING	Port description
Broadcast Storm Protection	SINT	
Interface Utilization	SINT	Percentage of entire interface bandwidth being used (0-100)
Utilization Alarm Upper Threshold	SINT	Upper percentage at which to declare an utilization alarm (0-100)
Utilization Alarm Lower Threshold	SINT	Lower percentage at which to declare an utilization alarm (0-100)
Port Link Alarm	SINT	0: Ignore, 1: On (Relay 1), 2: On (Relay 2), 3: Off (Relay1), 4: Off (Relay2)
Port TrafficOverload Alarm	SINT	0: Disable, 1: Enable(Relay 1), 2: Enable(Relay 2)
Tx Unicast Packet Rate	DINT	Number of TX unicast packets per second
Rx Unicast Packet Rate	DINT	Number of RX unicast packets per second
Tx Multicast Packet Rate	DINT	Number of TX multicast packets per second
Rx Multicast Packet Rate	DINT	Number of RX multicast packets per second
Tx Broadcast Packet Rate	DINT	Number of TX broadcast packets per second
Rx Broadcast Packet	DINT	Number of RX broadcast packets per second

Rate		
Tx Multicast Packet	DINT	Total number of TX multicast packets
Rx Multicast Packet	DINT	Total number of RX multicast packets
Tx Broadcast Packet	DINT	Total number of TX multicast packets
Rx Broadcast Packet	DINT	Total number of RX broadcast packets
Redundant Port Status	DINT	Bit 0 = Disable, Bit 1 = Not Redundant port, Bit 2 = Link down, Bit 3 = Blocking, Bit 4 = Learning, Bit 5 = Forwarding

Tags for LAPP Networking Object

Data Type: LAPP_Vendor_Object_v0

Name	Data Type	Description
System Firmware Version	DINT	Switch firmware version
System Fault Status	DINT	Switch fault status
Switch Port Number	SINT	Switch max port number
Port Exist	DINT[2]	Switch per port exist
Port Enable	DINT[2]	Switch per port exist 0:Enable 1:Disable
Port Link Status	DINT[2]	Switch per port link status
IGMP Snooping	SINT	IGMP snooping enable: 0: Disable 1: Enable
Query Interval	DINT	Query Interval range from 20~600 sec
IGMP Enhanced Mode	SINT	IGMP enhanced mode 0: Disable (default) 1: Enable
Relay 1	SINT	Override relay warning setting 0: Disable (default) 1: Enable
Relay 2	SINT	Override relay warning setting 0: Disable (default) 1: Enable
Power 1 Relay Warning	SINT	Power input 1 failure (on → off) 0: Disable (default) 1: Enable(relay 1) 2: Enable(relay 2)
Power 2 Relay Warning	SINT	Power input 2 failure (on → off) 0: Disable (default) 1: Enable(relay 1) 2: Enable(relay 2)
DI 1 Off Relay Warning	SINT	DI 1 (off) 0: disable (default) 1: Enable(relay 1) 2: Enable(relay 2)
DI 1 On Relay Warning	SINT	DI 1 (on) 0: Disable (default) 1: Enable(relay 1) 2: Enable(relay 2)
DI 2 Off Relay Warning	SINT	DI 2 (off) 0: Disable (default) 1: Enable(relay 1) 2: Enable(relay 2)
DI 2 On Relay Warning	SINT	DI 2 (on) 0: Disable (default) 1: Enable(relay 1) 2: Enable(relay 2)
Turbo Ring Break Relay Warning	SINT	Turbo Ring Break (Ring Master Only) 0: Disable (default) 1: Enable (relay 1) 2: Enable (relay 2)
CPU Usage	SINT	Percent of usage (0-100)
Device Up Time	DINT	Number of seconds since device was powered up
Reset Mib Counter	SINT	Reset port MIB counters
Redundant Device Mode	DINT	Bit 0: RSTP,

		Bit 1: Turbo Ring, Bit 2: Turbo Ring v2, Bit 3: Turbo Chain, Bit 4: None
Reset Device	SINT	1: restart the device 2: reset to default

Pre-configured Tags in the LAPP AOI

The LAPP AOI supports all the CIP tags listed in the tables above. But in the AOI, we only pre-configure logic links between selected tags and LAPP switches. To monitor the non-configured tags, PLC programmers need to create the links manually. Otherwise, in RSLogix 5000, the value column of these tags will display as "0". If you experience problems creating new links, please contact LAPP technical support for assistance.

NOTE For pre-configured tags, LAPP has already created the logic links between the CIP tags and LAPP Ethernet switches so RSLogix 5000 can get/set the switch information correctly.

The table below specifies all the pre-configured tags in LAPP AOI with a ※ mark.

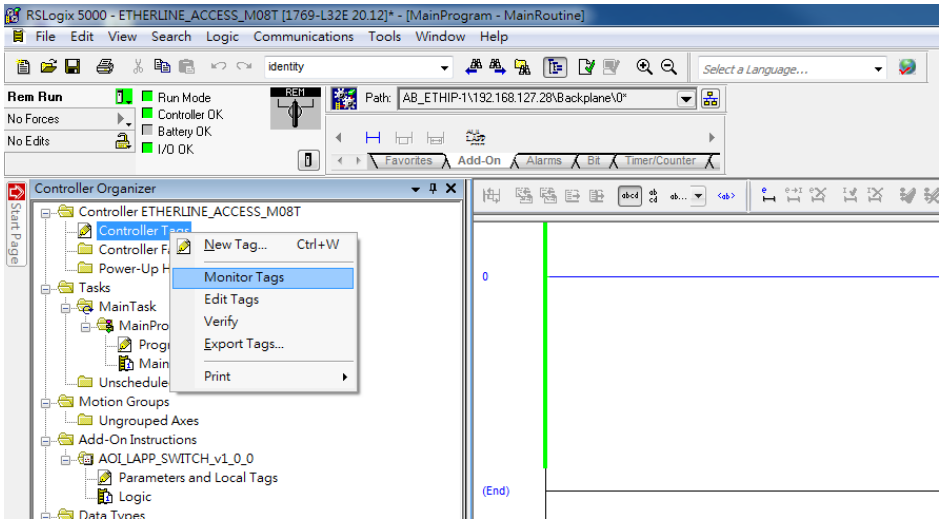
Pre-Configured Tags	**Name**
Identity Object (0x01)	
※	Vendor ID
※	Device Type
※	Product Code
	Revision
	Status
※	Serial Number
※	Product Name
	Assigned Name
	Geographic Location
TCP/IP Interface Object (0xf5)	
	Status
	Configuration Capability
	Configuration Control
	Physical Link Object
	Interface Configuration
※	IP Address
※	Network Mask
	Gateway Address
	Name Server
	Name Server 2
	Domain Name
※	Host Name
Ethernet Link Object (0xf6)- by port	
※	Interface Speed
※	Interface Flags
	Link Status
	Half/Full Duplex
	Negotiation Status
	Manual Setting Requires Reset
	Local Hardware Fault
※	Physical Address
	Interface Counters
	In Octets
	In Ucast Packets
	In Nucast Packets
	In Discards
※	In Errors
	Out Octets
	Out Ucast Packets
	Out Nucast Packets
	Out Discards
※	Out Errors
	Media Counters
	Interface Control
※	Control Bits
※	Forced interface Speed
	Interface Lable

	Interface Description
	Interface Port Description
	Broadcast Storm Protection
※	Interface Utizatiion
	Utilization Alarm Upper Threshold
	Utilization Alarm Lower Threshold
	Port Link Alarm
	Port Traffic-Overload Alarm
※	Tx Unicast Packet Rate
※	Rx Unicast Packet Rate
※	Tx Multicast Packet Rate
※	Rx Multicast Packet Rate
※	Tx Broadcast Packet Rate
※	Rx Broadcast Packet Rate
	Tx Multicast Packet
	Rx Multicast Packet
	Tx Broadcast Packet
	Rx Broadcast Packet
※	Redundant port status
Port Object (0xf4)	
	Port Type
	Port Number
	Link Object
	Port Name
	Port Type Name
	Port Description
	Node Address
	Port Key
LAPP Networking Object (0x404)	
※	Firmware Version
※	System Fault Status
	Switch Port Number
※	Port Exist
※	Port Enable
※	Port Link Status
	IGMP Snooping Enable
※	Query Interval
※	IGMP Enhanced Mode
	Relay1
	Relay2
	Power 1 relay waring
	Power 2 relay waring
	DI 1(off) relay warning
	DI 1(on) relay warning
	DI 2(off) relay warning
	DI 2(on) relay warning
	Turbo Ring Break relay warning
※	CPU usage
	Device Up Time
※	Reset MIB Counts
※	Redundant device mode
	reset device
I/O message Object	
※	Switch Fault Status
※	Port Exist
※	Port Link Status
※	Port Enable

Monitoring AOI Tags

In RSLogix 5000, you can monitor the values of all configured tags by selecting "Monitor Tags" in the controller organizer window. It can also be used to check that the AOI is installed correctly

NOTE Only LAPP pre-configured tags will display the correct values. Refer to the **CIP Tags** section above for detailed information.



Monitor Tags for Identity Object

Click **LAPP_param Switch_Identity** and expand the list to check the values for Identity tags.

Monitor Tags for TCPIP Object

Click **LAPP_param Switch_TCPIP** and expand the list to check the values for TCPIP tags.

Monitor Tags for Ethernet Link Object

Click **LAPP_param Switch_Ethernet_Link** and expand the list to check the values for per port Ethernet Link tags.

Monitor Tags for LAPP Networking Object

Click **LAPP_param Switch_Vendor** and expand the list to check the values for LAPP custom tags.

Rockwell FactoryTalk® View Faceplate

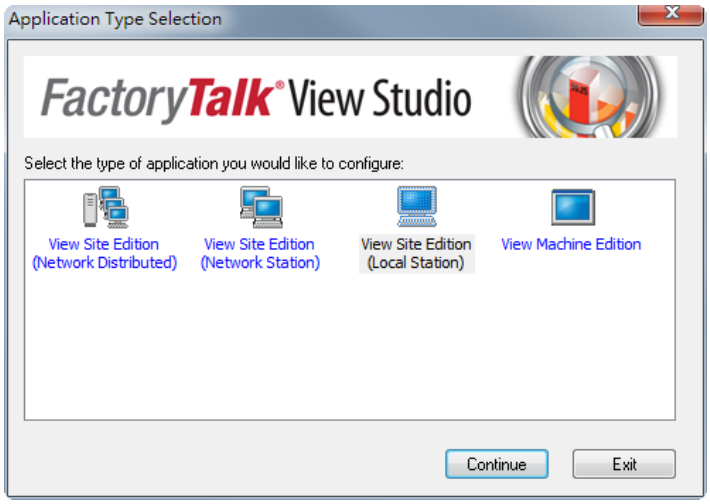
FactoryTalk® View Faceplate Installation

To install the faceplate, you must have Rockwell FactoryTalk® View Studio SE (Site Edition) version 7 or later and a LAPP managed Ethernet switch, which supports EtherNet/IP.

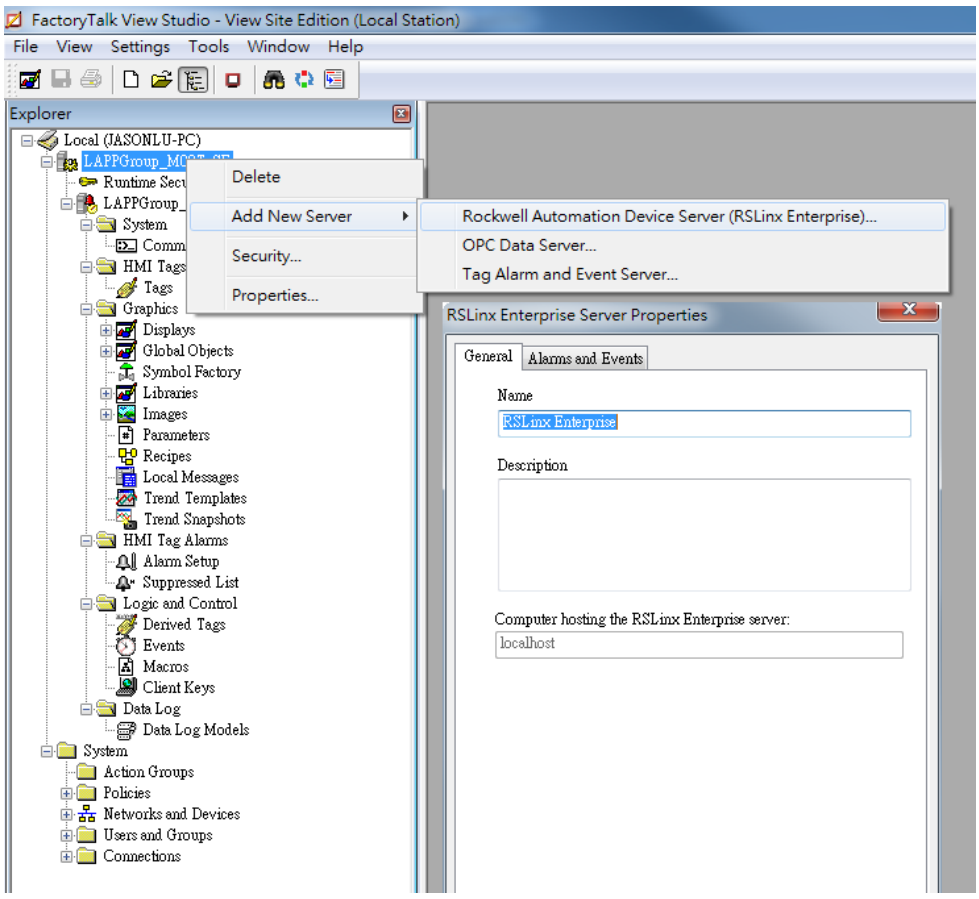
Create a FactoryTalk® View Shortcut to the PLC

1. Start the FactoryTalk® View Studio software and select **Site Edition (Local)**.

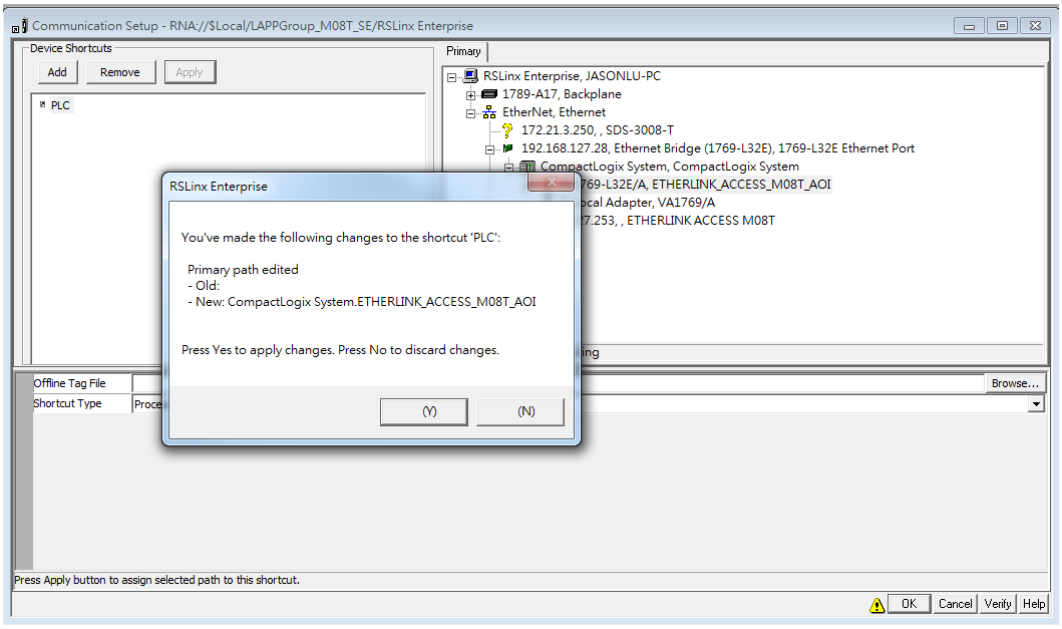
2. Add a new Site Edition (Local) and enter the Application name.



3. Configure a shortcut to the PLC that is running the LAPP AOI.
   In the Explorer window, right click the newly-added application, select **Add New Server** and **Rockwell Automation Device Server (RSLinx Enterprise)**, and click OK.

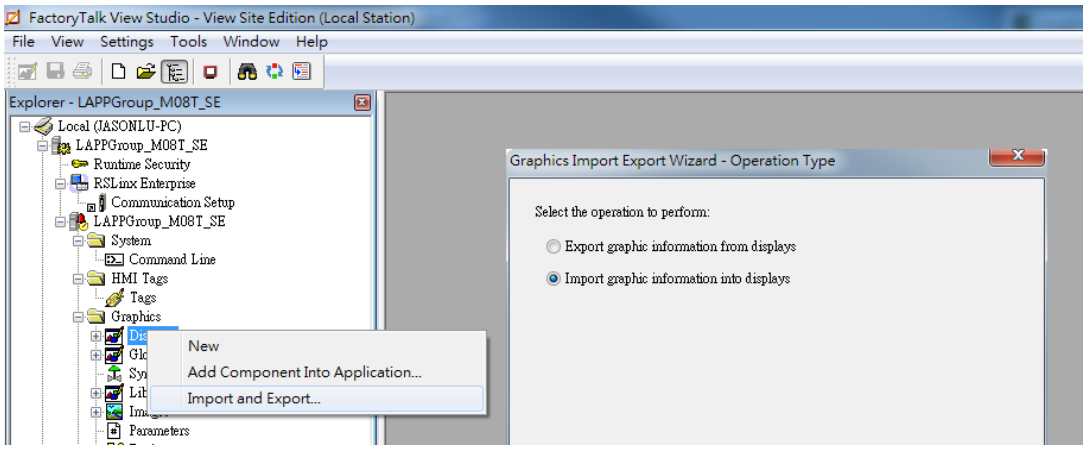


4. The shortcut is named PLC. Click "Yes" to apply the configuration.

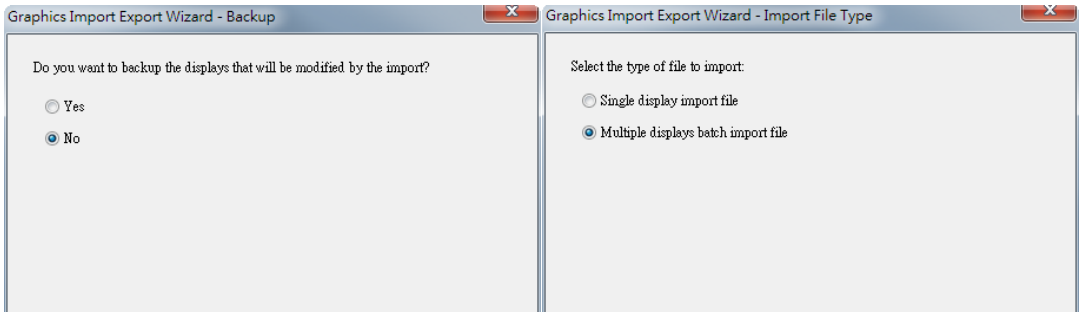


Import FactoryTalk® View Faceplate Graphics

1. Right click **Displays** in the FactoryTalk® View Explorer window, select **Import and Export** and choose **Import graphic information into displays**.

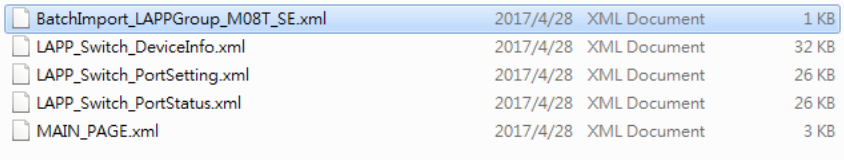


2. Select **No** and **Multiple displays batch import file.**

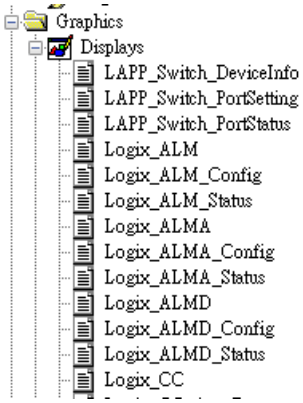


3. Import all graphics files for FactoryTalk® View faceplate display.

NOTE LAPP provides sample graphics files for selected switches, which are available for download at the LAPP website.

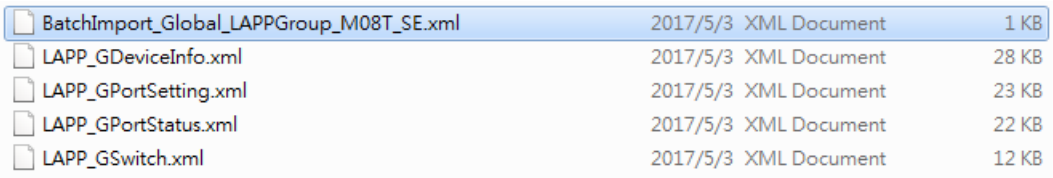


4. After import, these objects will appear under **Displays** in the Explorer window.



Import FactoryTalk® View Faceplate Global Object

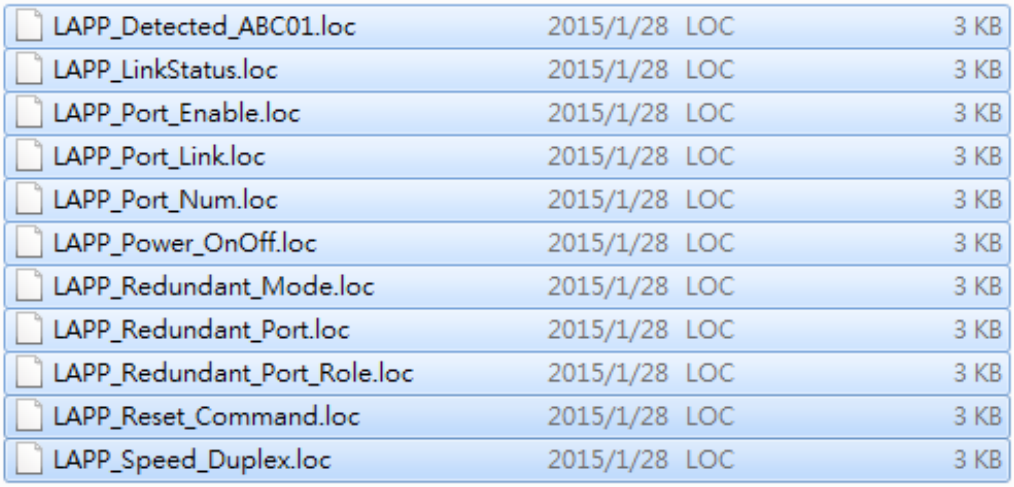
1. Right click **Global Object** in the FactoryTalk® View Explorer window, select **Import and Export** and choose **Import graphic information into displays**.
2. Select **No** and **Multiple displays batch import file.**
3. Import all graphics files (such as below) for FactoryTalk® View faceplate global object.



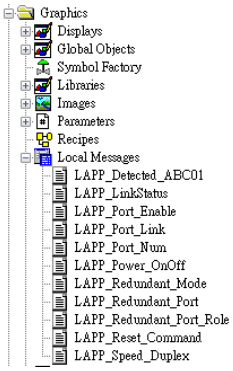
Import FactoryTalk® View Faceplate Local Message

1. Right click **Local Message** in the FactoryTalk® View Explorer window, select **Add Component Into Application** and import all the local message files (.loc)

NOTE LAPP provides sample local message files for selected switches, which are available for download at the LAPP website.



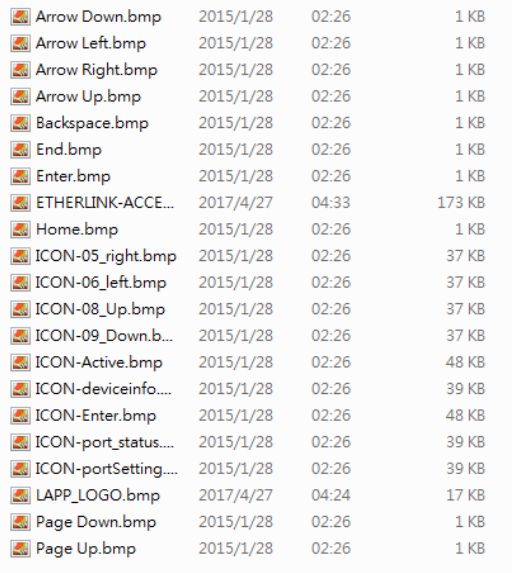
2. After import, these objects will appear under "Local Message" in the Explorer window.



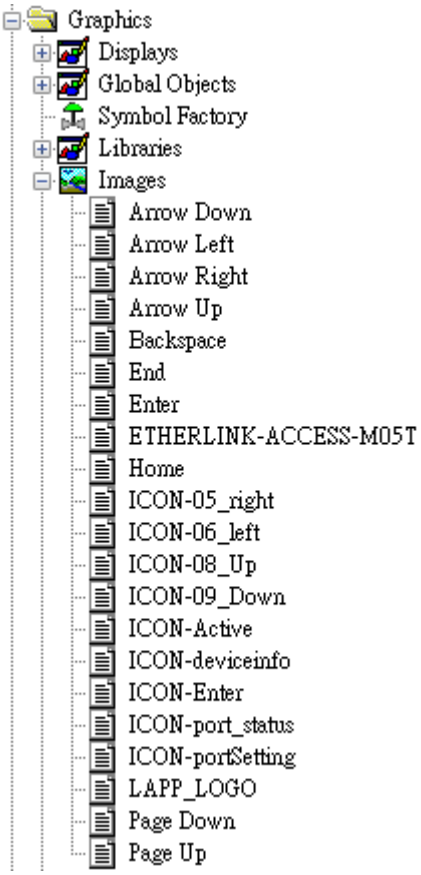
Import FactoryTalk® View Faceplate Images

1. Right click **Images** in the FactoryTalk® View Explorer window, select **Add Component Into Application** and import all the image files (.bmp)

NOTE	LAPP provides sample image files for selected switches, which are available for download at the LAPP website

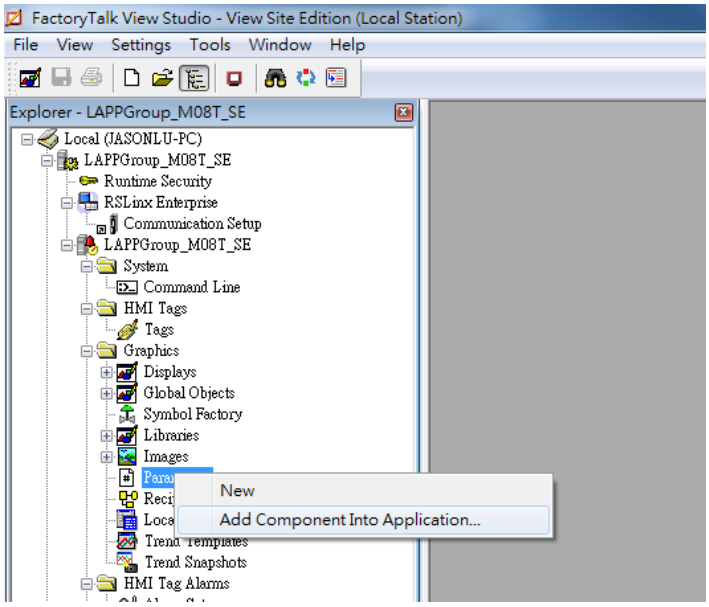


2. After import, these objects will appear under "Local Message" in the Explorer window.

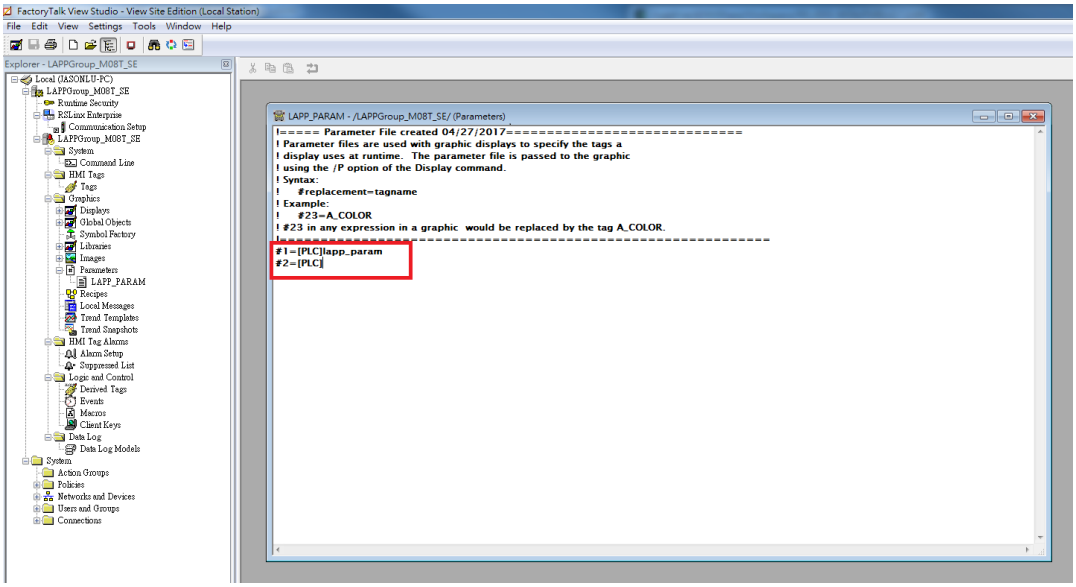


Import FactoryTalk® View Faceplate Parameter

1. Right click **Parameters** in the FactoryTalk® View Explorer window, and select **Add Component Into Application** and import the LAPP PARAM file (.par).

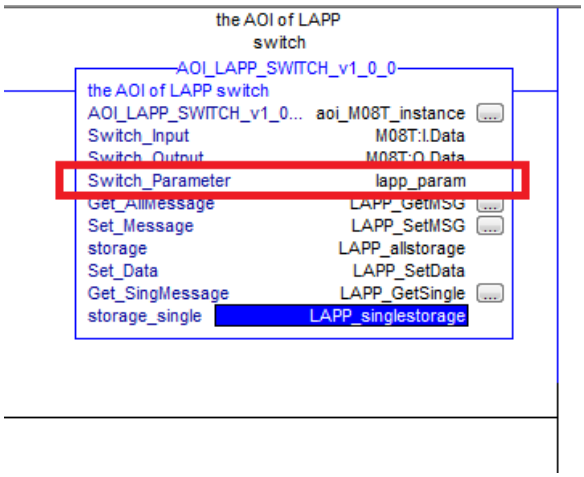


2. A parameter file that will be associated with the display.
   Manually input "#1=[PLC]LAPP_param", and "#2=PLC" in the file.



In the parameter definition, the shortcut **PLC** was created earlier. (Refer to **Create a FactoryTalk® View Shortcut to PLC**)

Another important piece is **lapp_param**, which is the name of the Switch_Parameters tag created for the LAPP_SWITCH_AOI in your RSLogix project. (Refer to **Create and configure tags for the AOI**)

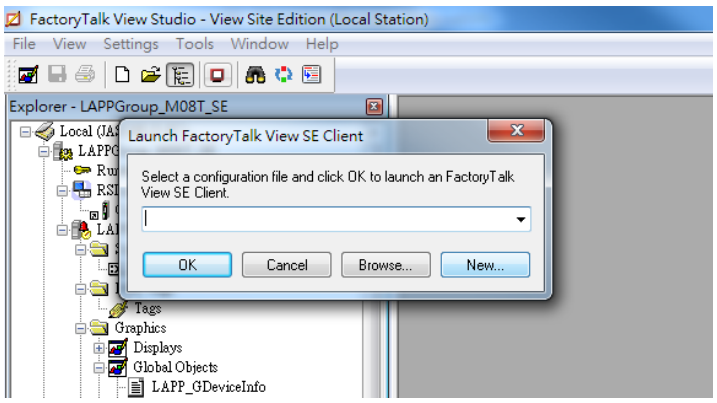


Sample FactoryTalk® View Faceplate Project

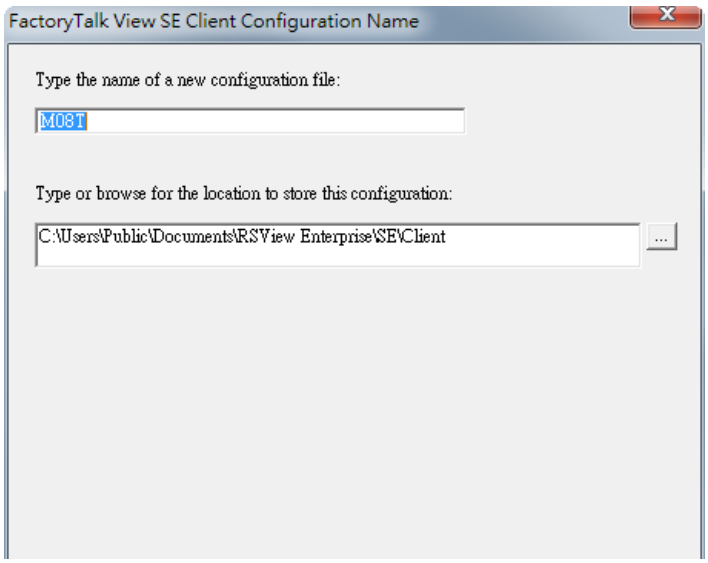
For easier FactoryTalk® View Faceplate installation, LAPP also provides a sample project, in which all the parameters are configured with default values. The sample project is a (.APA) file, which is available for download from the LAPP website. You may import the sample project in FactoryTalk® View Faceplate Site Edition (SE).

Setting Up a FactoryTalk® View SE Client

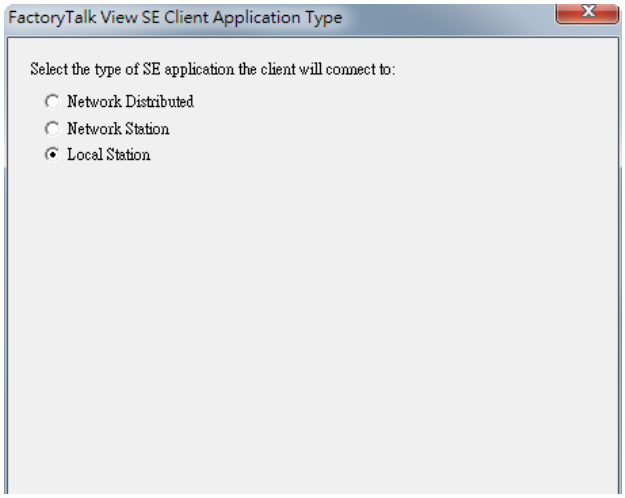
1. Launch FactoryTalk® SE client



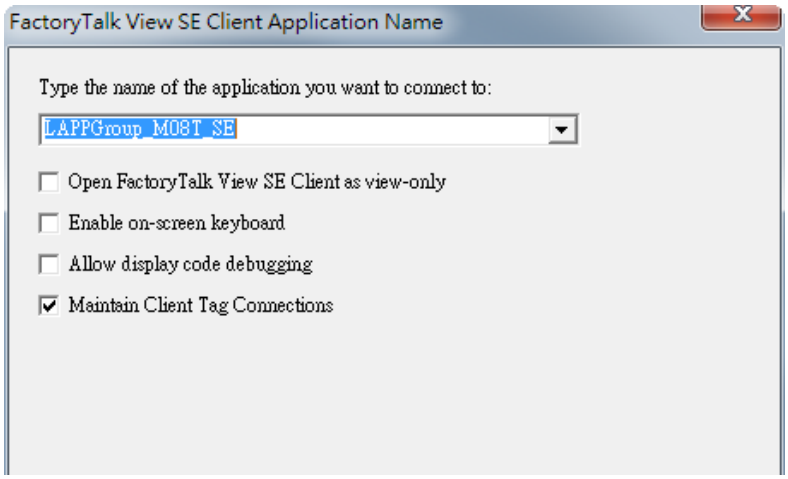
2. Set up the new configuration file name and path.



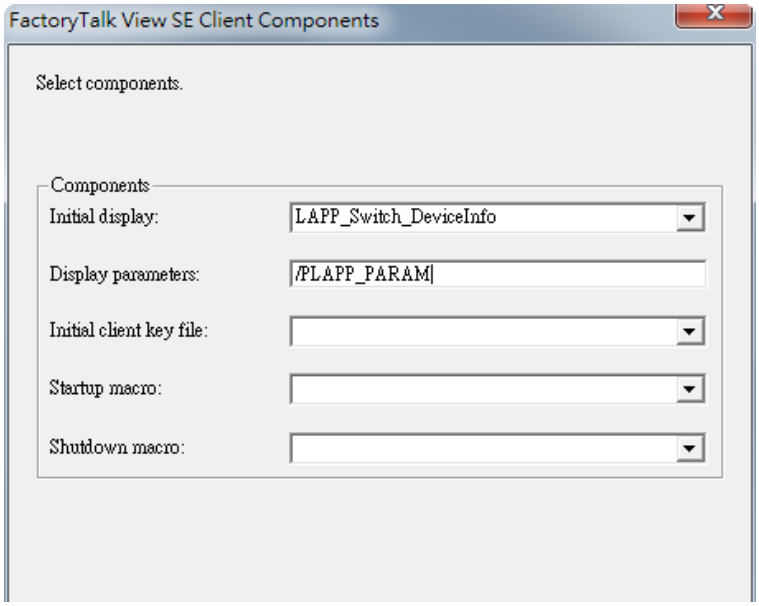
3. Select the application type **Local**



4. Enter the name of the application and select the language



5. Configure the FactoryTalk® View SE Client Components and set **Initial Display** to **LAPP_Device_Info**



6. Configure the FactoryTalk® View SE Window Properties and input **Title bar text** with the text you would like to appear in the title bar.

7. Finish the setup and save the configuration

Introduction to the LAPP Custom Faceplate

The LAPP custom Faceplate consists of three main displays: Device Information, Port Status, and Port Setting. Click the tabs at the top of the screen to change between different displays.

Device Information

The device information display shows general switch information and power and link status.

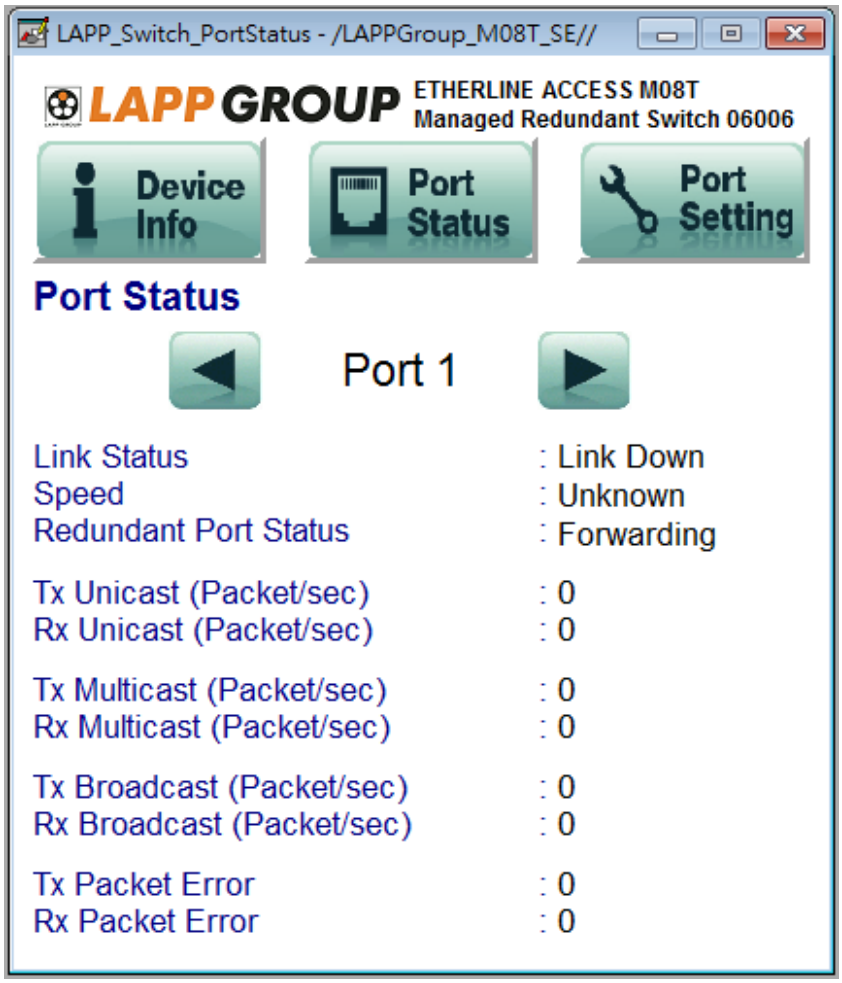
The following table describes fields and values.

Field	Values	Description
IP Address	192.168.192.253 (factory default)	Switch IP address
Netmask	255.255.255.0	Switch subnet mask
MAC Address	xx:xx:xx:xx:xx:xx	MAC address of switch
Serial No.	Max. 5 characters	Switch serial number
Firmware Ver.	Vx.x	Software version of switch
CPU Loading (%)	0-100%	CPU loading percentage
Redundant Protocol	RSTP Turbo Ring Turbo Ring v2 Turbo Chain	Redundant protocol setting
Power Input 1	On Off	Power supply 1 status
Power Input 2	On Off	Power supply 2 status
Model name	ETHERLINE ACCESS XXX	Switch model name
Switch name	Max. 30 characters	User assigned switch name

Field	Color	State	Description
Link Status	Green	Link Up	Current port link state
	Grey	Link Down	
Power Status	Amber	Power On	Current power link state
	Grey	Power Off	

Port Status

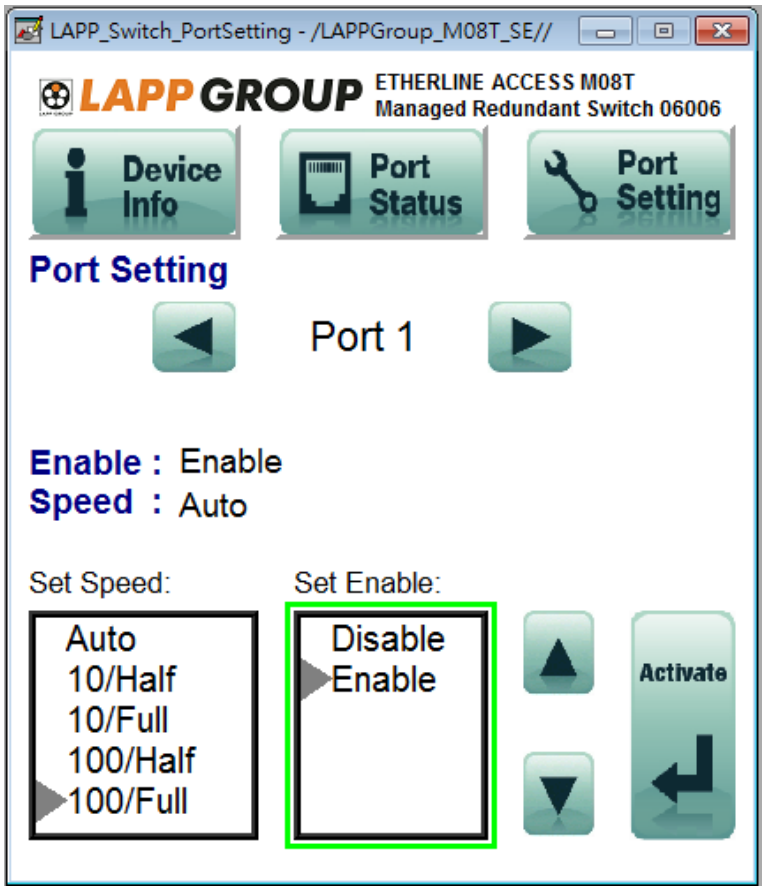
The port status display shows information for a selected switch port. Use the right/left buttons to select a switch port.



Field	Values	Description
Port Index	Port x	Selected port number
Link status	Link up Link down	Selected port link status
Speed	10/Half 10/Full 100/Half 100/Full Unknown	Selected port speed and mode
Redundant Port Status	Disable Not Redundant Port Link Down Blocking Learning Forwarding	Selected port redundancy status
Tx Unicast (Packet/sec)		The Tx unicast packets per second
Rx Unicast (Packet/sec)		The Rx unicast packets per second
Tx Multicast (Packet/sec)		The Tx multicast packets per second
Rx Multicast (Packet/sec)		The Rx multicast packets per second
Tx Broadcast (Packet/sec)		The Tx broadcast packets per second
Rx Broadcast (Packet/sec)		The Rx broadcast packets per second
Tx Packet Error		The number of Tx packet error
Rx Packet Error		The number of Rx packet error

Port Setting

The Port Setting allows some switch port settings to be changed. Use the right/left buttons to select a switch port and click the **Activate** button to save the change.



Field	Values	Description
Port Index	Port x	Selected port number
Speed	Auto 10/Half 10/Full 100/Half 100/Full	Selected port speed and mode
Enable	Enable Disable	Selected port enable or disable