

User Manual

Human Machine Interface EtherNet/IP - Slave

GRAPHIC SYMBOLS



INFORMATION, it helps users with more details about the topic and failure to follow may lead to unpredictable results.



WARNING, Failure to follow may lead to minor injury or damage / malfunctioning of equipment



DANGER, Failure to follow may lead to injury or fatal accident to operating personal or damage/malfunctioning of equipment



CAUTION, Failure to follow may lead to malfunctioning of equipment, damage or repair



Protective Earth



DC Supply

PREFACE

Original equipment manufacturer reserves the right to change information available in this document without notice. Original Equipment manufacturer is not liable for any damages incurred to equipment/personal during installation or use of equipment as explained in this document. User must acquire sufficient knowledge & skills prior to use the equipment in the application and follow all the local standards & regulations to meet safety requirements

EtherNet/IP[®], is registered trade mark of ODVA

Rslogix5000, Control logix, Compact logix[®], is registered trade mark of Allen Bradley

Anybus CC[®] is registered trade mark of HMS

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1. OVERVIEW

1.1 Introduction

EtherNet/IP (Ethernet Industrial Protocol) is a communications protocol developed by Rockwell Automation, managed by ODVA and designed for use in process control and other industrial automation applications. EtherNet/IP is an application layer protocol and it considers all the devices on the network as a series of "objects". **EtherNet/IP** makes use of existing network infrastructure (Ethernet) and the entire EtherNet/IP stack can be implemented in software on a microprocessor. **EtherNet/IP** is built on the standard TCP/IP stack, and makes use of all 7 layers of OSI reference model

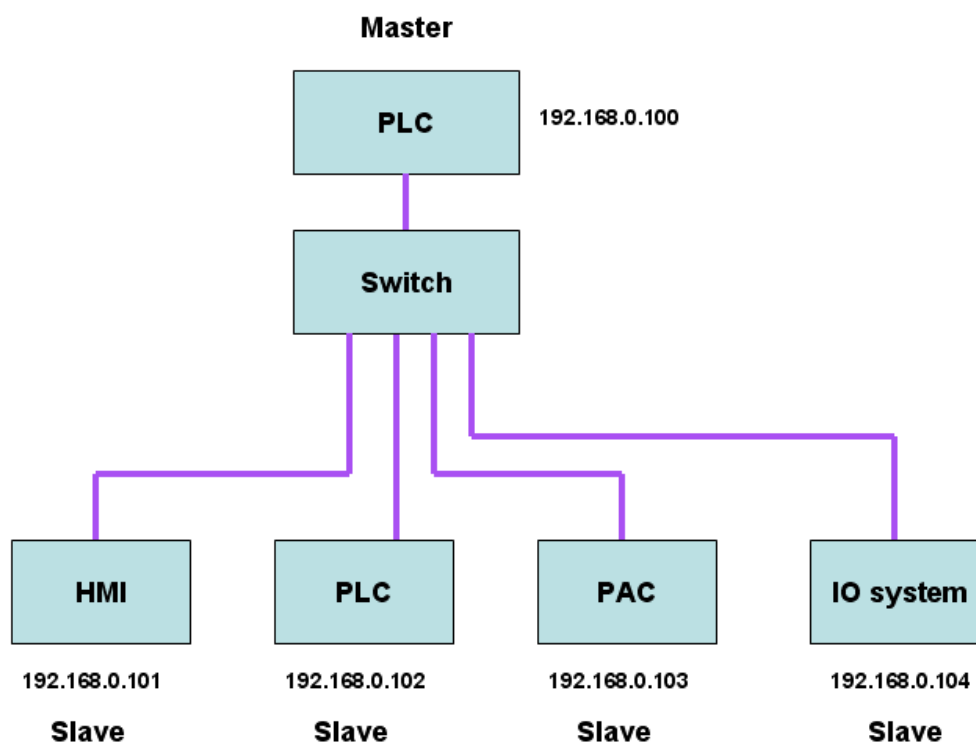


Fig: Typical configuration

HMI supports EtherNet/IP slave functionality using plug in optional extension card. Check HMI ordering code for Network extension card availability

EDS file will be supplied for EtherNet/IP slave

EtherNet/IP supports several networking topologies but not limited to Star, Ring & Linear etc..

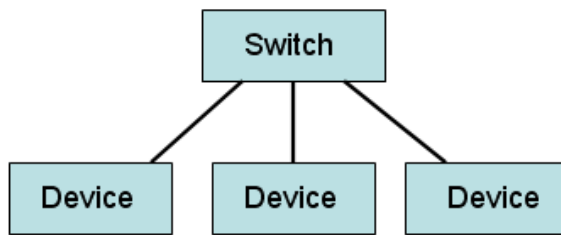


Fig: EtherNet/IP- Star Topology

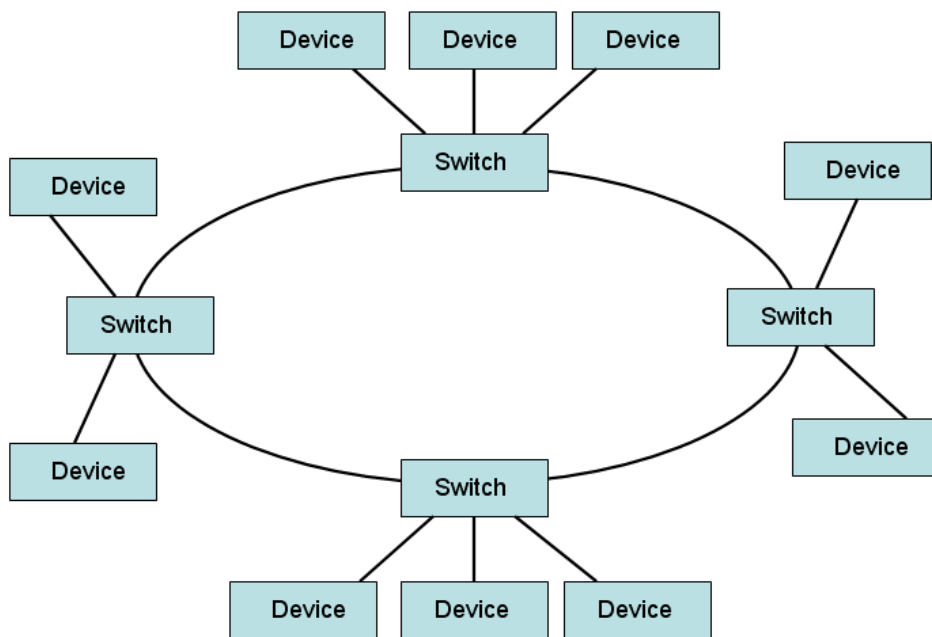


Fig: EtherNet/IP- Switch ring Topology

1.2 Communication

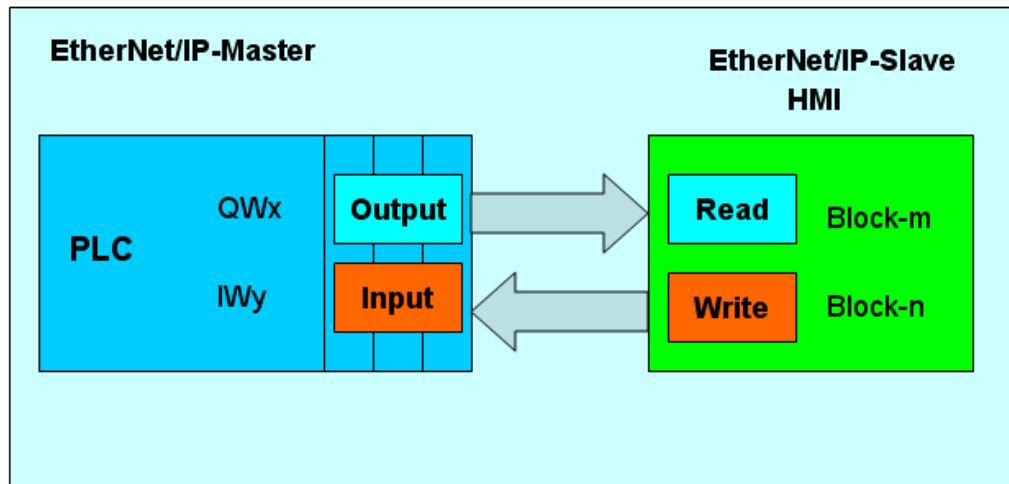


Fig: Data exchange between master and slave

2. SPECIFICATIONS

Item	Description
Port number in HMI	COM3 (for network option, extension card)
Master to Slave, maximum bytes	256
Slave to Master, maximum bytes	256
Total bytes	512
Supported baud rates	10/100 Mbit full/half duplex operation
Data types supported	Byte, Int16, Int32, Ubyte, Uint16, Uint32, Float
Network identity	
Vendor ID	005Ah
DeviceType	0000h (Generic device)
Product code	0063h
Product name	Anybus CC EtherNet/IP
EDS file name	EDS_ABCC_EIP_V_2_2

3. EXTENSION CARD INSTALLTION

COM3 is dedicated for extension card. It is clearly marked on rear side of HMI.

Check HMI ordering code for Network extension card availability

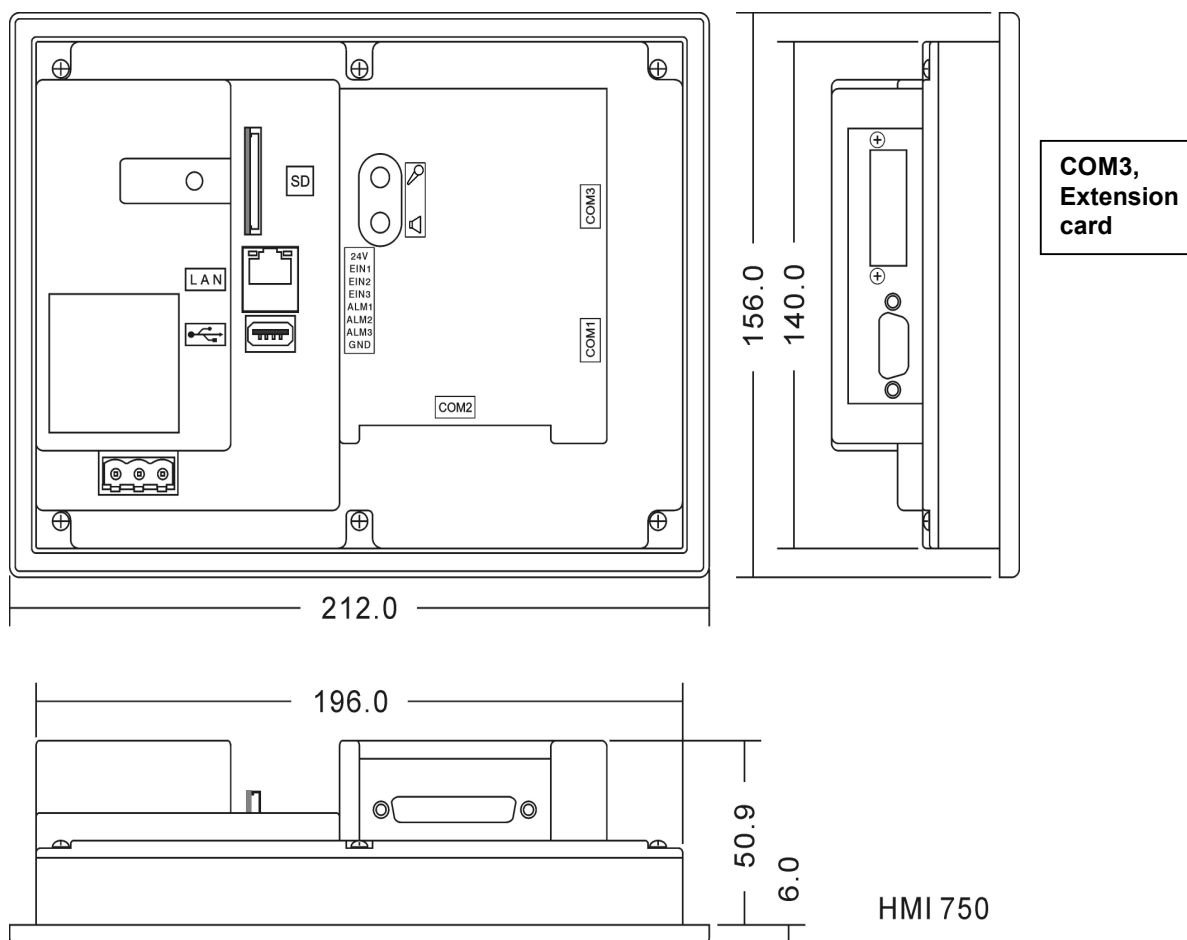


Fig: Typical dimensional drawing of HMI 7"

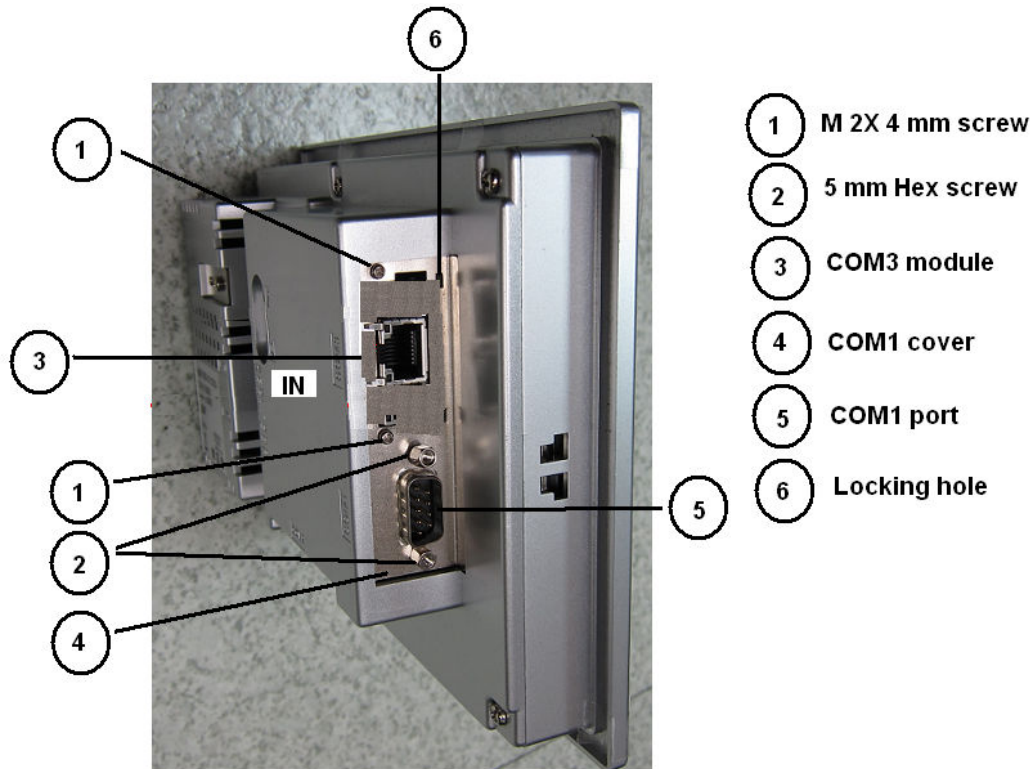


Fig: Typical HMI 7" with EtherNet/IP module



1. Open HMI rear cover by removing all the screws
2. Remove M2 X 4 mm screws (2 nos.) and open network module blank cover
3. Remove 5 mm hex screws (2 nos.) for COM1 port using tool 5mm Hex nut screwdriver
4. Remove COM1 cover. At this time, COM1 enclosure will be opened. Note down the direction of enclosure carefully as it need to fit in same direction later
5. Remove 5 mm hex screws for network extension card
6. Now, insert network extension card into main board and make sure it is properly inserted with in guider pins

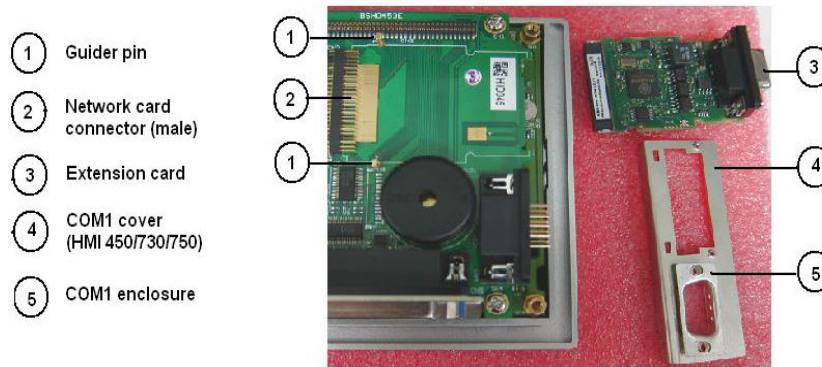
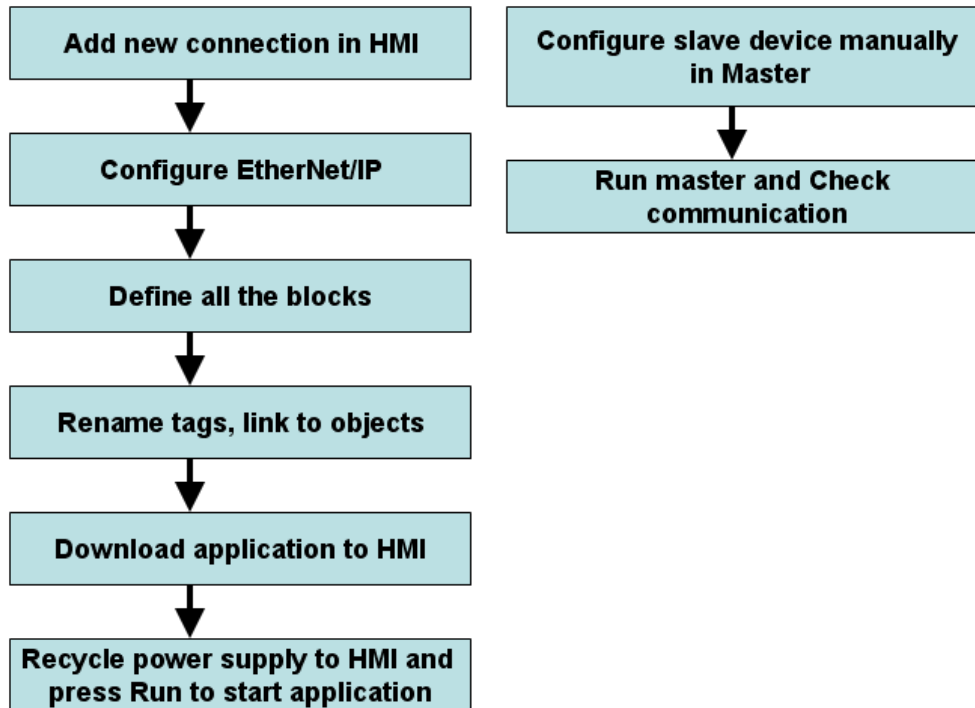


Fig: Extension card connector and guider

7. Fix COM1 cover properly and make sure that PCB is locked with in locking holes
8. Fix 5 mm hex screws (2 nos.) for COM1 port
9. Fix network module cover. Remember, these covers are different for different network extension modules. You will receive specific network module cover along with network extension card
10. Fix 5 mm hex screws (2 nos.) for network extension card. If required gently push network extension card downside to allow screws go inside properly
11. Fix M2 X 4 mm screws (2 nos.) on network module cover. If required gently push network extension card downside to allow screws go inside properly
12. Close the HMI rear cover

4. QUICK SETUP

Configuration sequence



Tips



Steps

1. First decide how much data to be exchanged between Master and Slave.
2. In HMI configuration, create required Read blocks (Master to Slave) first, then, write blocks (Slave to Master).
3. Open Tag data base from Project explorer. It is possible to modify blocks to Tag names at Tag database here. Once block name is changed to Tag name, never attempt to delete the EtherNet/IP setup from connection as you will lose all the Tag names.
4. Link tags with Objects like Label, Text box etc... Once Tag is linked with objects, never attempt to delete EtherNet/IP configuration from Connections.

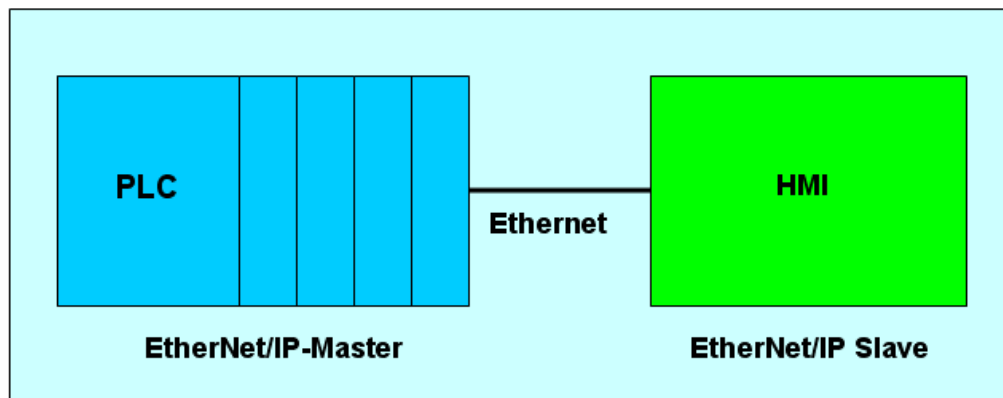
5. Make sure HMI (COM3) is connected to PLC on EtherNet/IP. Download application from PC to HMI
6. Switch OFF power supply to HMI. Press your finger on HMI active screen area and then switch ON the power. On Control center, press "Run".
7. Put PLC in RUN mode and check communication between PLC and HMI

5. PLC CONFIGURATION

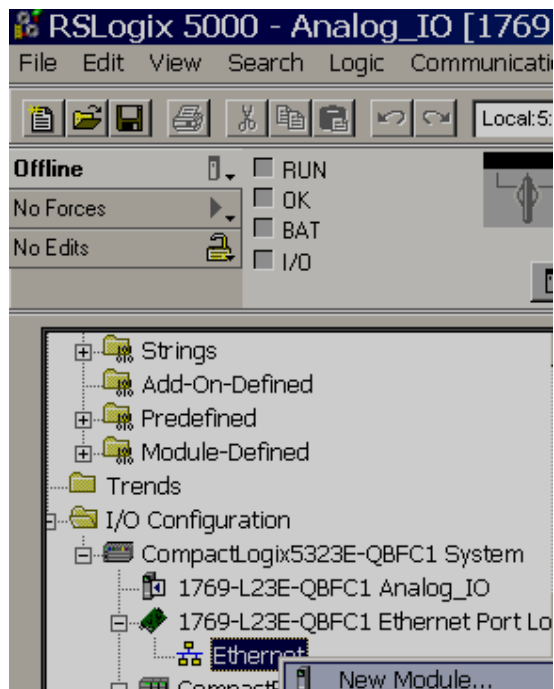
In this case the Control Logix PLC from Allen Bradley used as a Master on the EtherNet/IP network. To configure the PLC, RSLogix5000 software is used.

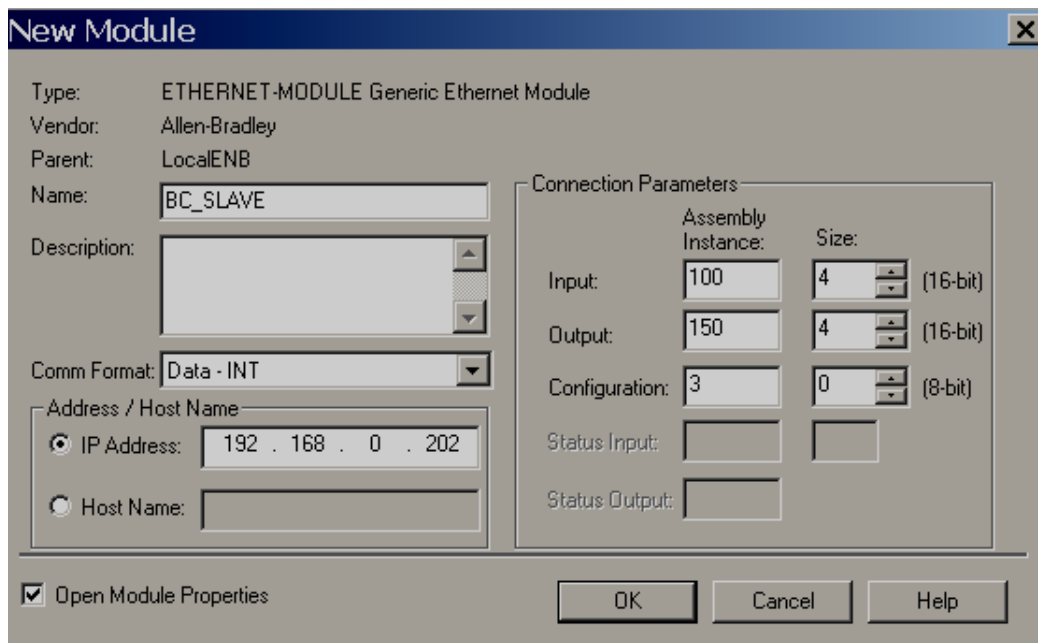
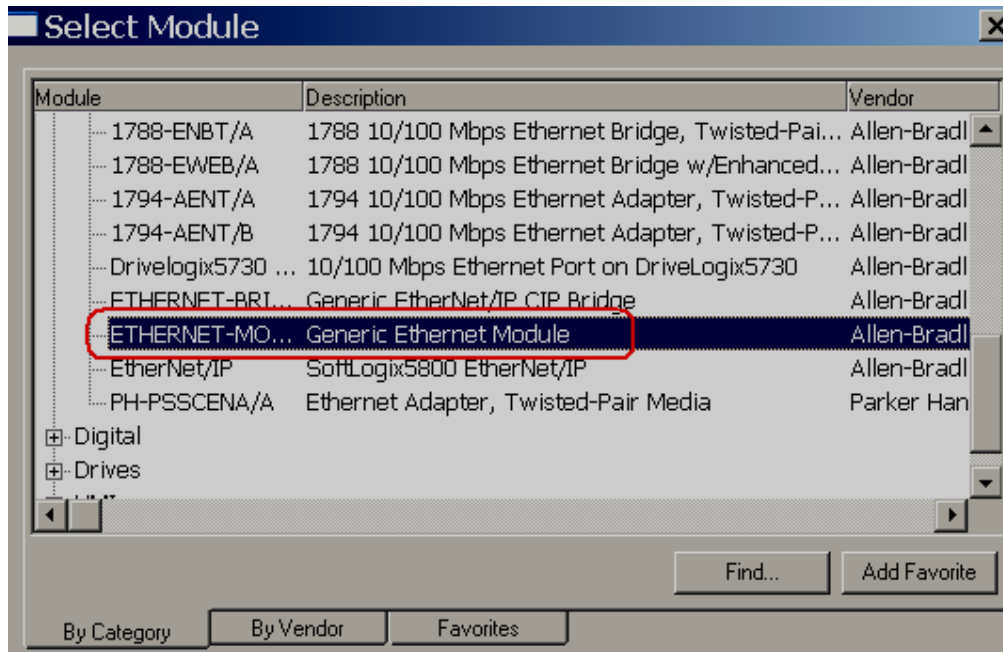


It is expected user is fully aware of Rslogix 5000 ® software. If any questions on Rslogix 5000 software, please check Rslogix documentation



In this example, Compact logix L23E PLC used. It is having Ethernet port supporting EtherNet/IP protocol





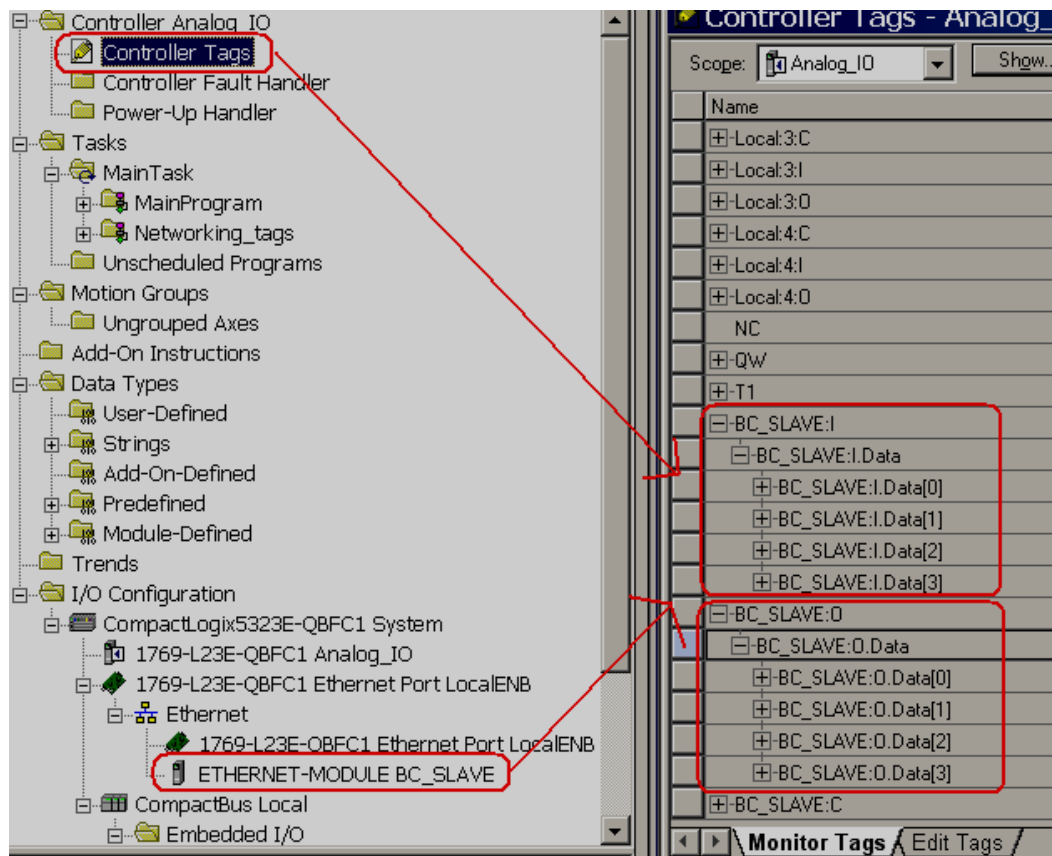
IP address: This must be same as defined in HMI configuration

Input instance: 100, Size: This must be same as block length defined at HMI configuration for Read block



Output assembly instance: 150, size: this must be same as block length defined at HMI configuration for Write block

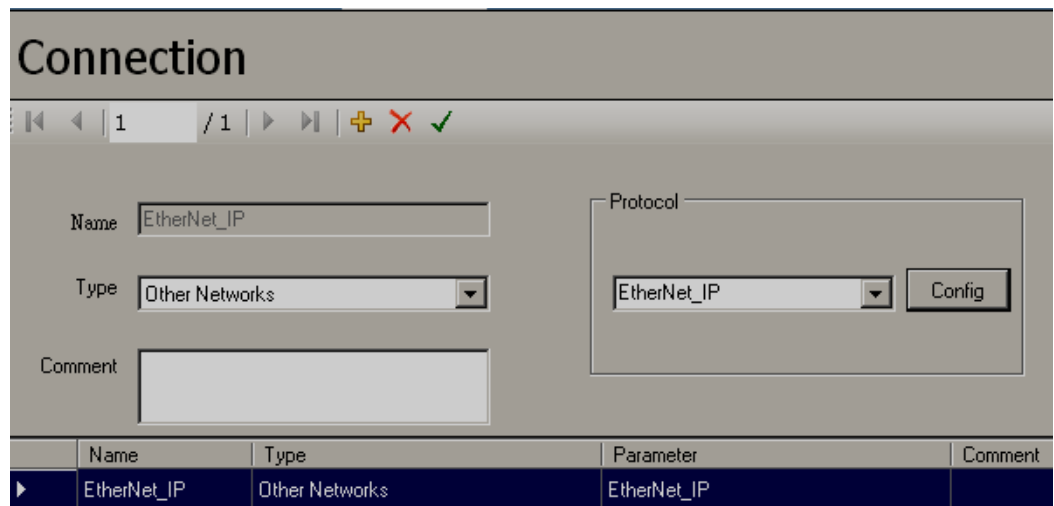


If block size defined in HMI and PLC, then, no communication takes place.




6. HMI CONFIGURATION

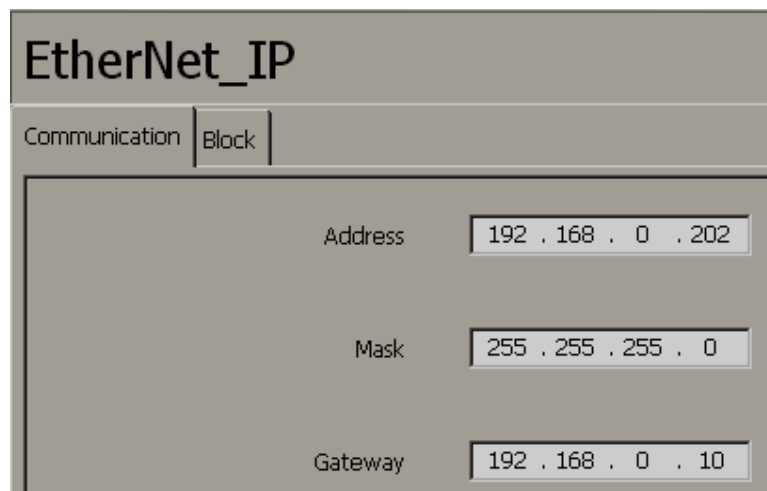
1. In project explorer, double click at “Connections”
2. Click  to add a new connection.
3. Select Type= Other Networks. Select Protocol = EtherNet_IP, then click apply icon  to save this setup



The screenshot shows the 'Connection' dialog box. It has a title bar 'Connection' and a toolbar with navigation and action icons. The main area contains fields for 'Name' (EtherNet_IP), 'Type' (Other Networks), and 'Comment'. To the right, there is a 'Protocol' section with a dropdown menu set to 'EtherNet_IP' and a 'Config' button. At the bottom, there is a table listing the connection details.

	Name	Type	Parameter	Comment
▶	EtherNet_IP	Other Networks	EtherNet_IP	

4. Click “Config”  to open EtherNet/IP slave configuration
5. Select Communication and enter settings



The screenshot shows the 'EtherNet_IP' configuration dialog box. It has a title bar 'EtherNet_IP' and two tabs: 'Communication' and 'Block'. The 'Communication' tab is active, showing fields for 'Address' (192 . 168 . 0 . 202), 'Mask' (255 . 255 . 255 . 0), and 'Gateway' (192 . 168 . 0 . 10).

Address: Enter unique IP address of HMI device being configured as Slave in EtherNet/IP network

Mask: Enter subnet mask address

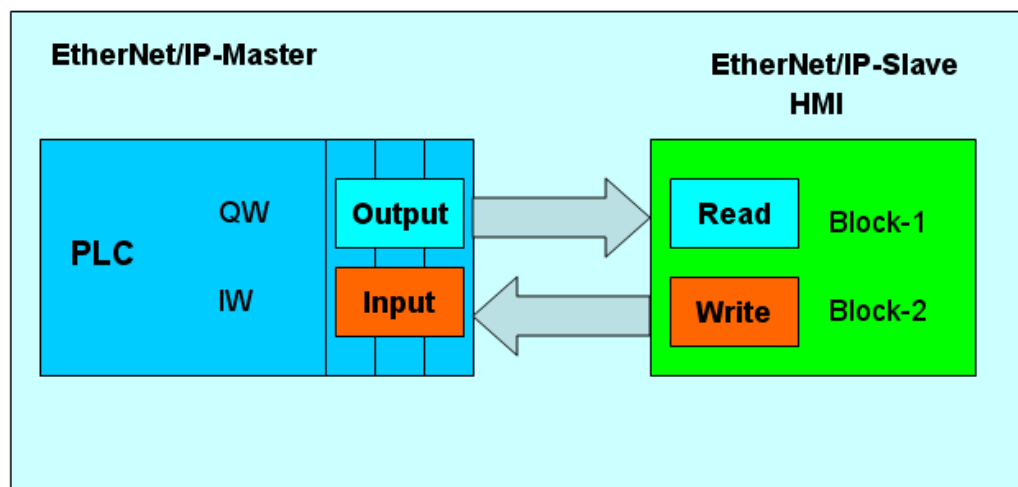
Gateway: Enter gateway address

6. Select “Block” and add required blocks as per requirement.

EtherNet_IP				
Communication		Block		
Name	I/O Type	Data Type	Length	Comment
Block1	Read	UInt16	1	Master to Slave
Block2	Write	UInt16	1	Slave to Master

Fig: HMI configuration screen

Each Block is linked with one CIP object. Length indicates elements in specific CIP object. By default, length = 1, Type = Unit16.



Please do use same data type for all the blocks in HMI configuration as it has to match with “Communication format” to be defined for the Slave module at the PLC. Never try with different blocks with different data types

New Module

Type: ETHERNET-MODULE Generic Ethernet Module
Vendor: Allen-Bradley
Parent: LocalENB
Name: BC_SLAVE
Description:

Comm Format: Data - INT

Address / Host Name
☒ IP Address: 192 . 168 . 0 . 202
☐ Host Name:

Connection Parameters

	Assembly Instance:	Size:	
Input:	100	4	(16-bit)
Output:	150	4	(16-bit)
Configuration:	3	0	(8-bit)
Status Input:			
Status Output:			

☒ Open Module Properties

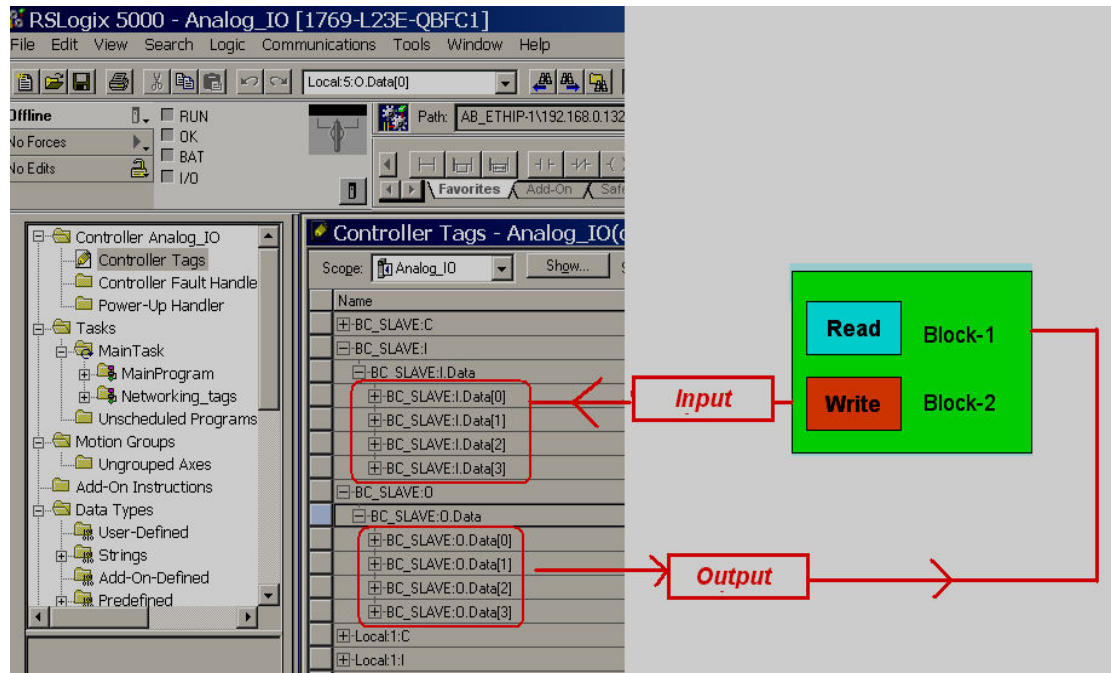
OK Cancel Help

Fig: Communication data format for data exchange

	HMI data type	Range	PLC data type	Range
1	Byte	-128 to 127	SINT	-128 to 127
2	Int16	-32768 to 32767	INT	-32,768 to 32,767
3	Int32	-2,147,483,648 to 2,147,483,647	DINT	-2,147,483,648 to 2,147,483,647
4	Ubyte	0 to 255		XXX
5	UInt16	0 to 65535		XXX
6	UInt32	4294967295		XXX
7	Float	-3.402823E38 to -1.1754944E-38 (negative values) and 0 and 1.1754944E-38 to 3.402823E38 (positive values)	Real	-3.402823E38 to -1.1754944E-38 (negative values) and 0 and 1.1754944E-38 to 3.402823E38 (positive values)



XXX : Control Logix PLC don't support this data type



7. Make sure that all the required blocks are entered in HMI slave configuration screen in HMI editing software. Then, click “OK” to finish block configuration
8. In project explorer, double click “Tags” and check all the network tags. If required, it is possible to modify Tag names here. Once tag names are modified and linked with objects, do not attempt to modify configuration of blocks again at connections in Project explorer. Before modification of tag names in tag data base, make sure block settings are completely finished at Connections

EtherNet_IP				
Communication		Block		
Name	I/O Type	Data Type	Length	Comment
Block1	Read	Int16	4	Master to Slave
Block2	Write	Int16	4	Slave to Master

Tag

User Define
System
Conversion

1
/8
▶
◀
▶
◀
+
×
✓
📄
📄
↑
↓

Connection EtherNet_IP

Name EtherNet_IP_Block1_0

Read/Wri Read & Write Type Analog

Scan mode Automatic Scan rate 100 ms

Conversion Disable

Comment Master to Slave

Register EtherNet_IP.Block1.0

Gain 1

Offset 0

	Connection	Name	Type	Scan mode	Scan rate	Register	Comment
▶	EtherNet_IP	EtherNet_IP_Block1_0	Analog	Automatic	100	EtherNet_IP.Block1.0	Master to Slave
	EtherNet_IP	EtherNet_IP_Block1_1	Analog	Automatic	100	EtherNet_IP.Block1.1	Master to Slave
	EtherNet_IP	EtherNet_IP_Block1_2	Analog	Automatic	100	EtherNet_IP.Block1.2	Master to Slave
	EtherNet_IP	EtherNet_IP_Block1_3	Analog	Automatic	100	EtherNet_IP.Block1.3	Master to Slave
	EtherNet_IP	EtherNet_IP_Block2_0	Analog	Automatic	100	EtherNet_IP.Block2.0	Slave to Master
	EtherNet_IP	EtherNet_IP_Block2_1	Analog	Automatic	100	EtherNet_IP.Block2.1	Slave to Master
	EtherNet_IP	EtherNet_IP_Block2_2	Analog	Automatic	100	EtherNet_IP.Block2.2	Slave to Master
	EtherNet_IP	EtherNet_IP_Block2_3	Analog	Automatic	100	EtherNet_IP.Block2.3	Slave to Master



After application download to HMI, it is a must to recycle power to HMI.

Switch OFF power supply to HMI and switch ON power supply to HMI. Then only networking application works properly. At power on, it might show message “Extension card fail” in HMI. Press “OK”. If tags are linked with text boxes, it may show “Error” while reading data from Master to Slave. Once Master is started, communication will be established with slave and “Error” message disappears in objects and show real time data

7. CONVERTER

It is possible to do scaling in HMI application for Read/Write blocks

Task1: Read (Master to Slave)

PLC Value range=-32768 to 32767.

Convert this to 0 to 100 and display in HMI

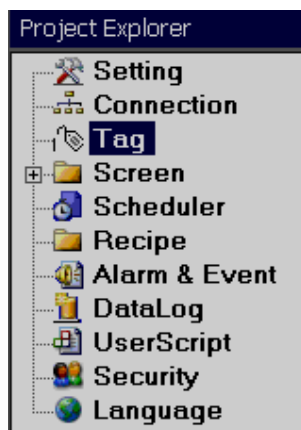
Use Block1, Signed integer 16 type in HMI configuration

Task2: Write (Slave to Master)

Write 0 to 100 in HMI. Convert this to -32768 to 32767 and send to PLC

Use Block2, Signed integer 16 type in HMI configuration

Read, Block1_0		Write, Block2_0	
Value at PLC	Value Read in HMI	Value write in HMI	Value at PLC
-32768	0	0	-32768
0	50	50	0
32767	100	100	32767



Tag

User Define
System
Conversion

1
/1
+
-
✓
📄
📁
↑
↓

Type
Linear
Name
Conversion1

Linear

Engineering Low
0
Engineering High
100
Range Low
-32768
Range High
32767

Enter Scaling equation at “Conversion” tab

Tag

User Define
System
Conversion

1
/8
▶
▶
+
-
✓
📄
📁
↑
↓

Connection
EtherNet_IP
Name
EtherNet_IP_Block1_0
Read/Wri
Read & Write
Type
Analog
Scan mode
Automatic
Scan rate
100 ms
Register
EtherNet_IP.Block1.0
Gain
1
Offset
0

Conversion
Conversion1
Comment
Master to Slave

	Connection	Name	Type	Scan mode	Scan rate	Register
▶	EtherNet_IP	EtherNet_IP_Block1_0	Analog	Automatic	100	EtherNet_IP.Block1.0
	EtherNet_IP	EtherNet_IP_Block1_1	Analog	Automatic	100	EtherNet_IP.Block1.1

Select required Conversion equation for the networking tags as shown above

8. EXAMPLES

8.1.1 4 UInt Read, 4 UInt Write

Connection

1 / 1

Name: EtherNet_IP

Type: Other Networks

Comment:

Protocol: EtherNet_IP

	Name	Type	Parameter	Comment
▶	EtherNet_IP	Other Networks	EtherNet_IP	

EtherNet_IP

Communication | Block

Address: 192 . 168 . 0 . 202

Mask: 255 . 255 . 255 . 0

Gateway: 192 . 168 . 0 . 10

EtherNet_IP

Communication | Block

Name	I/O Type	Data Type	Length	Comment
Block1	Read	UInt16	4	Master to Slave
Block2	Write	UInt16	4	Slave to Master

Screen1

Inputs (Block1), Read Master to Slave

1_0	Label19
1_1	Label19
1_2	Label19
1_3	Label19

Label19's Properties

General | Common | Events

Appearance

BackColor

Text

Label19

TextFont

Name

Tahoma

Style

Bold

Decimal

0

TagBinding

TagBinding

EtherNet_IP_Block1_0

Screen2

Outputs (Block2), Write Slave to Maste

2_0	0 ▲ ▼
2_1	0 ▲ ▼
2_2	0 ▲ ▼
2_3	0 ▲ ▼

Values

Value

0

Increment

1

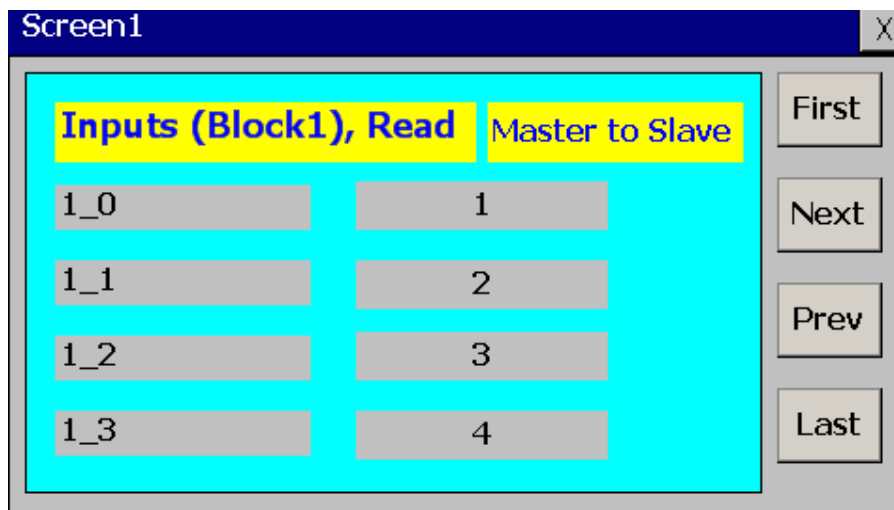
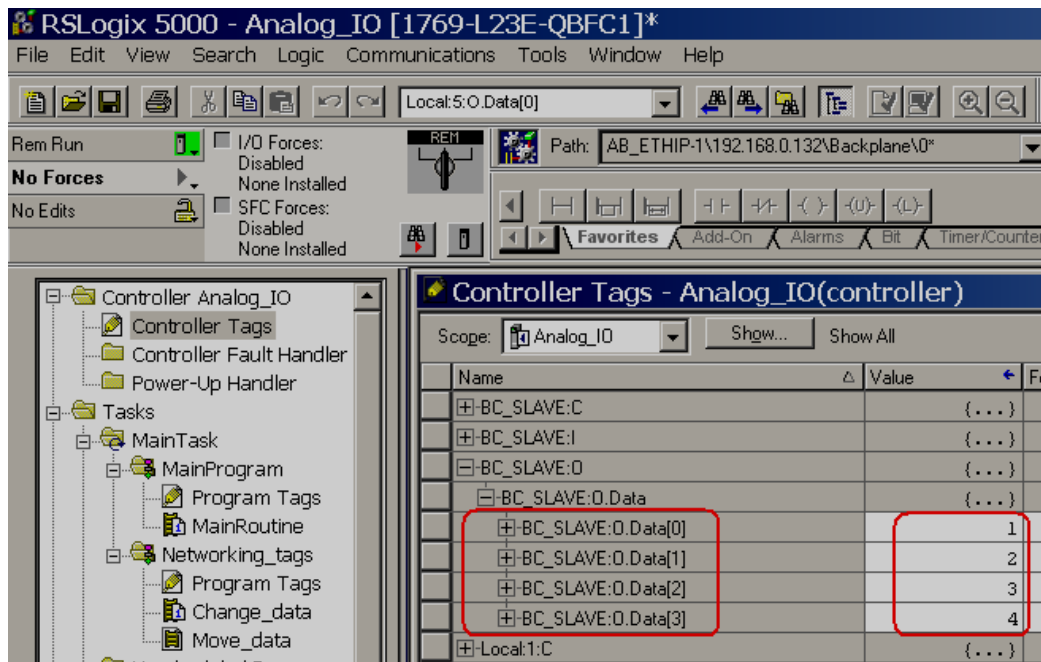
Soft Keyboard

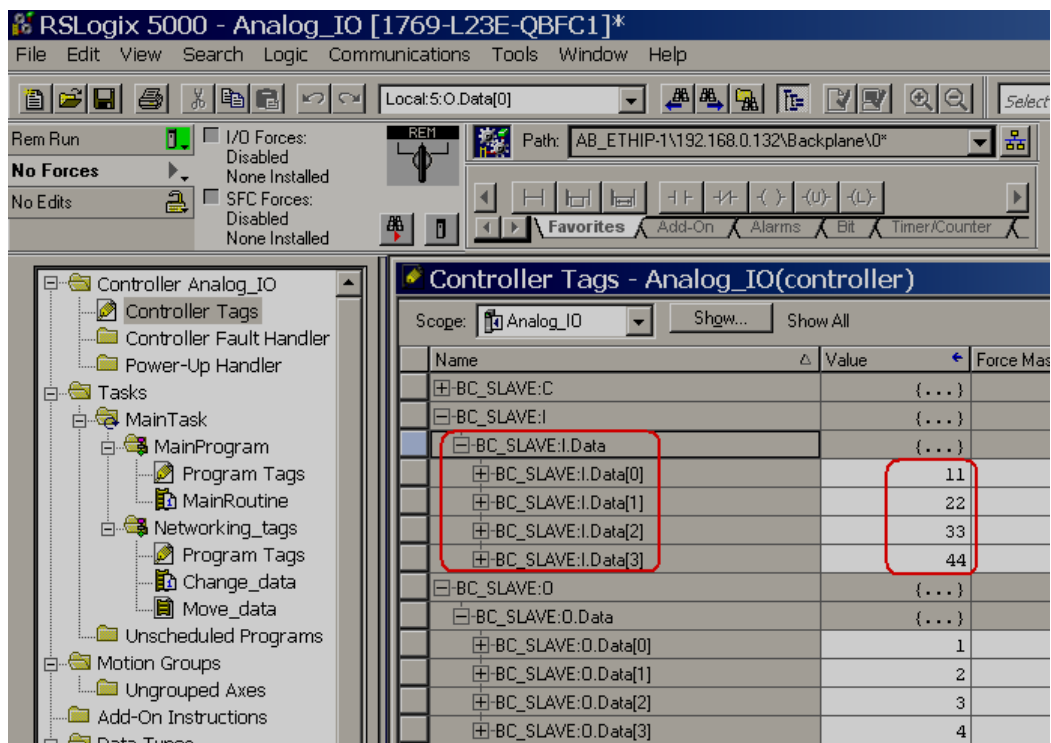
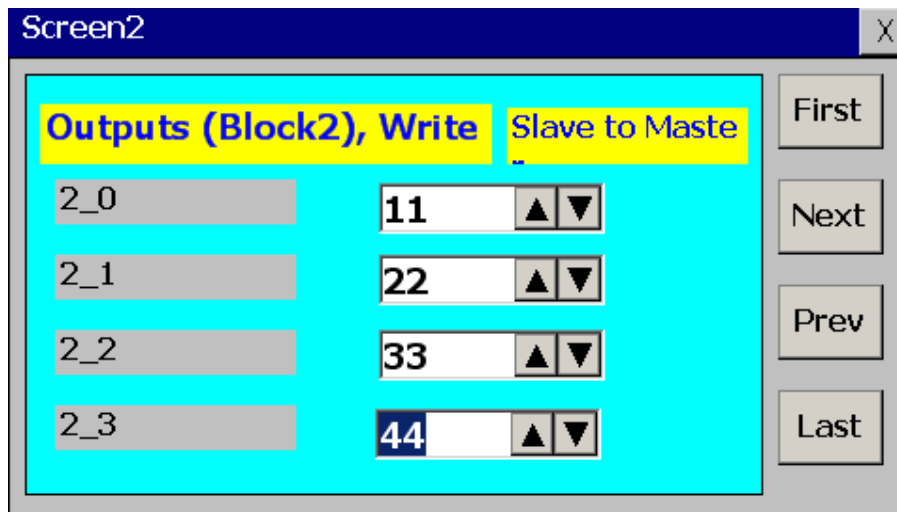
☒ Enable

TagBinding

TagBinding

EtherNet_IP_Block2_0

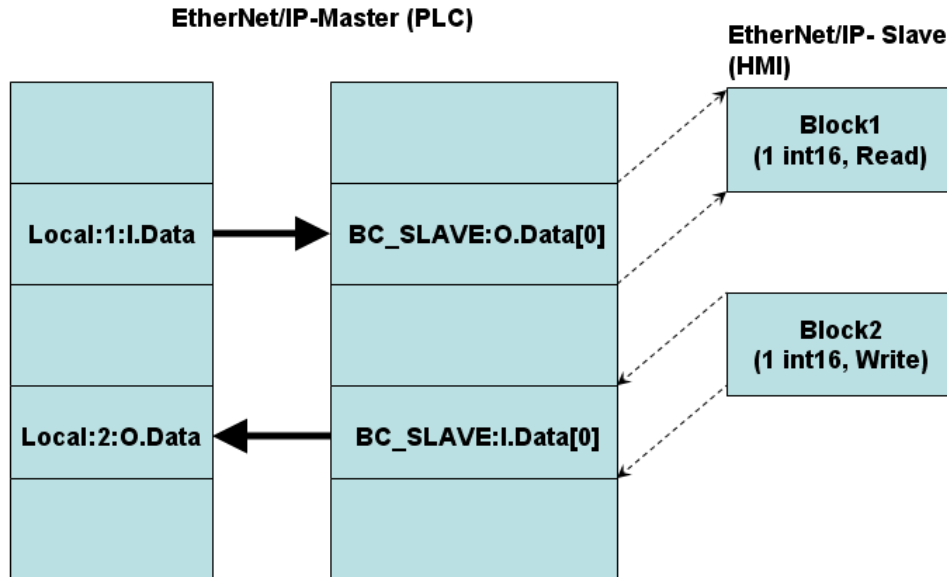




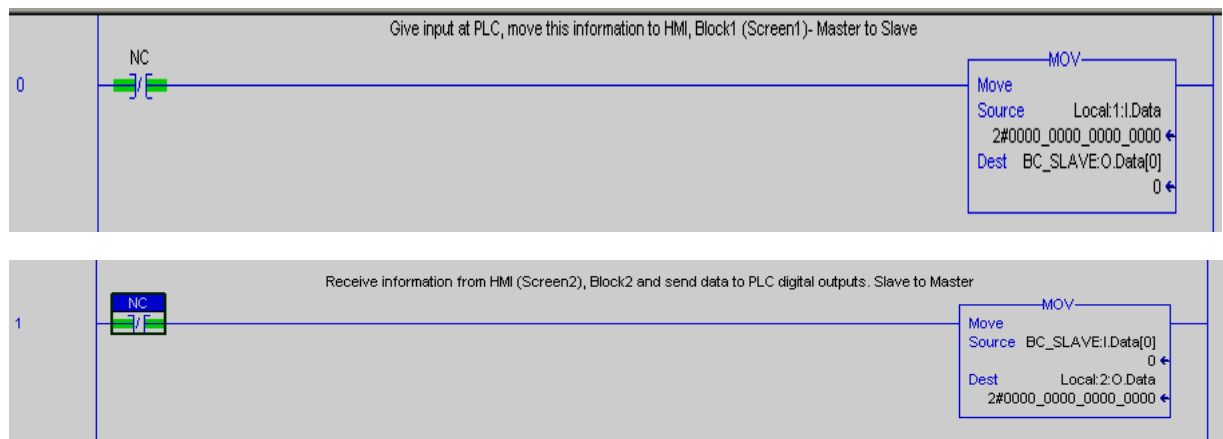
8.1.2 16 bits Read, 16 bits write

Task1: Give digital input at PLC, this information should be displayed in HMI at Screen1 (Master to Slave)

Task2: Give digital output at HMI (Screen2), it should switch On digital outputs at PLC



Data type	PLC address	HMI block address	HMI tag name	HMI IO type	Details
UInt16	BC_SLAVE:O.Data	Block1	EtherNet_IP_Block1	Read	Master to Slave
UInt16	BC_SLAVE:I.Data	Block2	EtherNet_IP_Block2	Write	Slave to Master



EtherNet_IP				
Communication		Block		
Name	I/O Type	Data Type	Length	Comment
Block1	Read	UInt16	1	Master to Slave
Block2	Write	UInt16	1	Slave to Master

Fig: EtherNet/IP slave block configuration in HMI

Tag							
User Define		System		Conversion			
<div> <div>1 / 2</div> <div> </div> </div>							
Connection: EtherNet_IP		Name: EtherNet_IP_Block1_0		Register: EtherNet_IP.Block1.0		Gain: 1	
Read/Wri: Read & Write		Type: Analog		Scan mode: Automatic		Scan rate: 100 ms	
Conversion: Disable		Comment: Master to Slave		Offset: 0			
	Connection	Name	Type	Scan mode	Scan rate	Register	Comment
▶	EtherNet_IP	EtherNet_IP_Block1_0	Analog	Automatic	100	EtherNet_IP.Block1.0	Master to Slave
	EtherNet_IP	EtherNet_IP_Block2_0	Analog	Automatic	100	EtherNet_IP.Block2.0	Slave to Master

Fig: EtherNet/IP slave tags in HMI database

Read (Master to Slave)

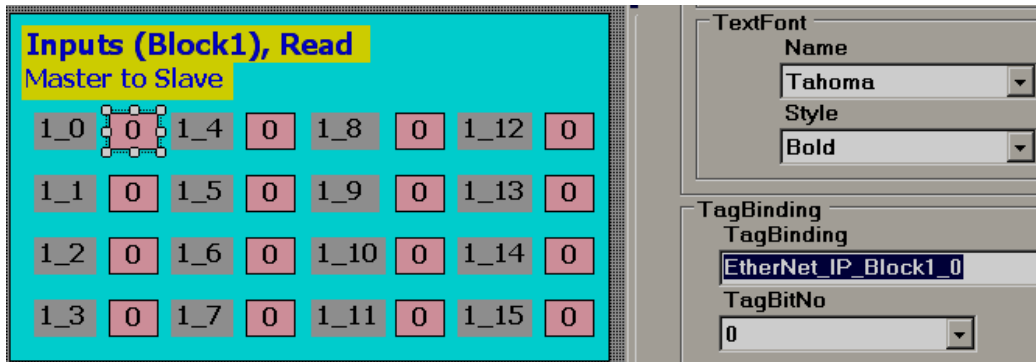


Fig: 16 bits read from Master to Slave, Bit lamp Tag binding with Block, design time

[-] Local:1:I	{...}
[+] Local:1:I.Fault	2#0000_000...
[-] Local:1:I.Data	2#0000_000...
[-] Local:1:I.Data.0	1
[-] Local:1:I.Data.1	0
[-] Local:1:I.Data.2	0
[-] Local:1:I.Data.3	0
[-] Local:1:I.Data.4	0
[-] Local:1:I.Data.5	0
[-] Local:1:I.Data.6	0
[-] Local:1:I.Data.7	0
[-] Local:1:I.Data.8	0
[-] Local:1:I.Data.9	0
[-] Local:1:I.Data.10	0
[-] Local:1:I.Data.11	0
[-] Local:1:I.Data.12	0
[-] Local:1:I.Data.13	0
[-] Local:1:I.Data.14	0
[-] Local:1:I.Data.15	0

Fig: Digital input status at PLC (Online status)

[-BC_SLAVE:0	{...}
[-BC_SLAVE:0.Data	{...}
[-BC_SLAVE:0.Data[0]	1
BC_SLAVE:0.Data[0].0	1
BC_SLAVE:0.Data[0].1	0
BC_SLAVE:0.Data[0].2	0
BC_SLAVE:0.Data[0].3	0
BC_SLAVE:0.Data[0].4	0
BC_SLAVE:0.Data[0].5	0
BC_SLAVE:0.Data[0].6	0
BC_SLAVE:0.Data[0].7	0
BC_SLAVE:0.Data[0].8	0
BC_SLAVE:0.Data[0].9	0
BC_SLAVE:0.Data[0].10	0
BC_SLAVE:0.Data[0].11	0
BC_SLAVE:0.Data[0].12	0
BC_SLAVE:0.Data[0].13	0
BC_SLAVE:0.Data[0].14	0
BC_SLAVE:0.Data[0].15	0

Fig: Digital input status at slave device (After moving by ladder)

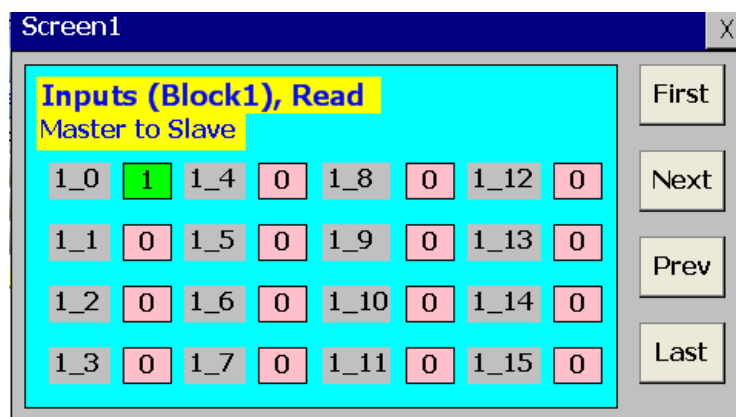


Fig: HMI in Run time

Write (Slave to Master)

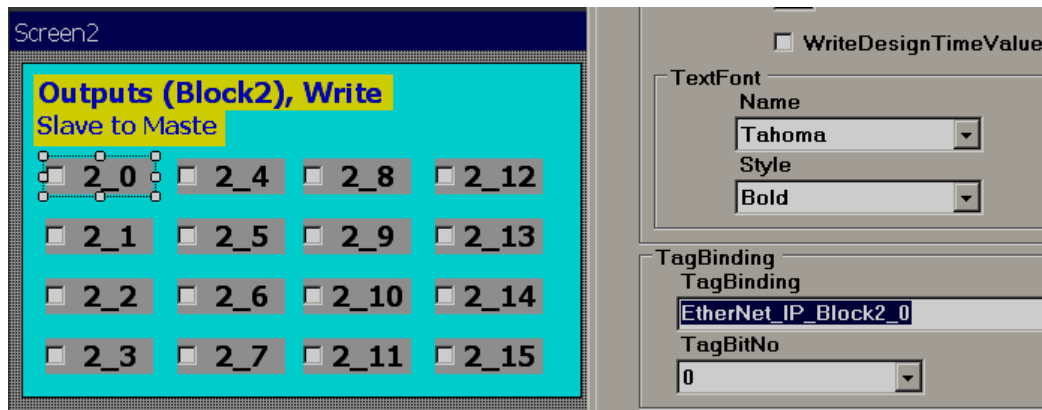


Fig: 16 bits Write from Slave to Master, Check box Tag binding with Block, design time



Fig: HMI in Run time

⊕-BC_SLAVE:C	{...}
⊖-BC_SLAVE:I	{...}
⊖-BC_SLAVE:I.Data	{...}
⊖-BC_SLAVE:I.Data[0]	1
BC_SLAVE:I.Data[0].0	1
BC_SLAVE:I.Data[0].1	0
BC_SLAVE:I.Data[0].2	0
BC_SLAVE:I.Data[0].3	0
BC_SLAVE:I.Data[0].4	0
BC_SLAVE:I.Data[0].5	0
BC_SLAVE:I.Data[0].6	0
BC_SLAVE:I.Data[0].7	0
BC_SLAVE:I.Data[0].8	0
BC_SLAVE:I.Data[0].9	0
BC_SLAVE:I.Data[0].10	0
BC_SLAVE:I.Data[0].11	0
BC_SLAVE:I.Data[0].12	0
BC_SLAVE:I.Data[0].13	0
BC_SLAVE:I.Data[0].14	0
BC_SLAVE:I.Data[0].15	0

Fig: Read values at PLC in Run time

⊖-Local:2:0	{...}
⊖-Local:2:0.Data	2#0000_000...
Local:2:0.Data.0	1
Local:2:0.Data.1	0
Local:2:0.Data.2	0
Local:2:0.Data.3	0
Local:2:0.Data.4	0
Local:2:0.Data.5	0
Local:2:0.Data.6	0
Local:2:0.Data.7	0
Local:2:0.Data.8	0
Local:2:0.Data.9	0
Local:2:0.Data.10	0
Local:2:0.Data.11	0
Local:2:0.Data.12	0
Local:2:0.Data.13	0
Local:2:0.Data.14	0
Local:2:0.Data.15	0

Fig: Digital Output status at PLC (After moving by ladder)

Button application (On/OFF from HMI) linked with ladder program in PLC

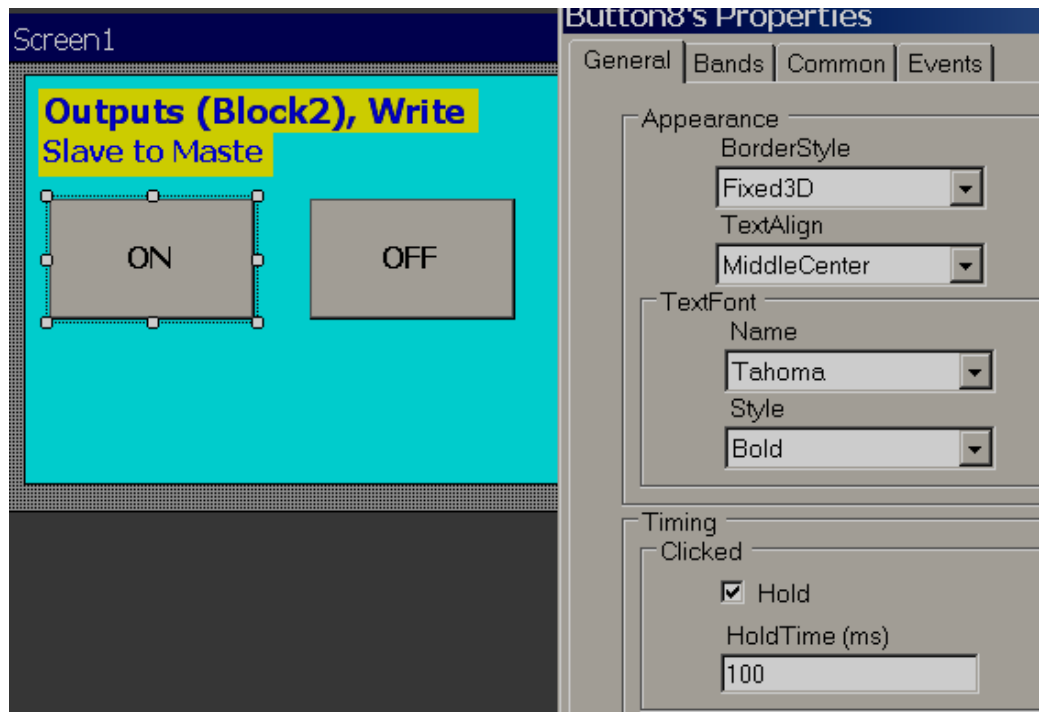


Fig: ON button configuration, design time

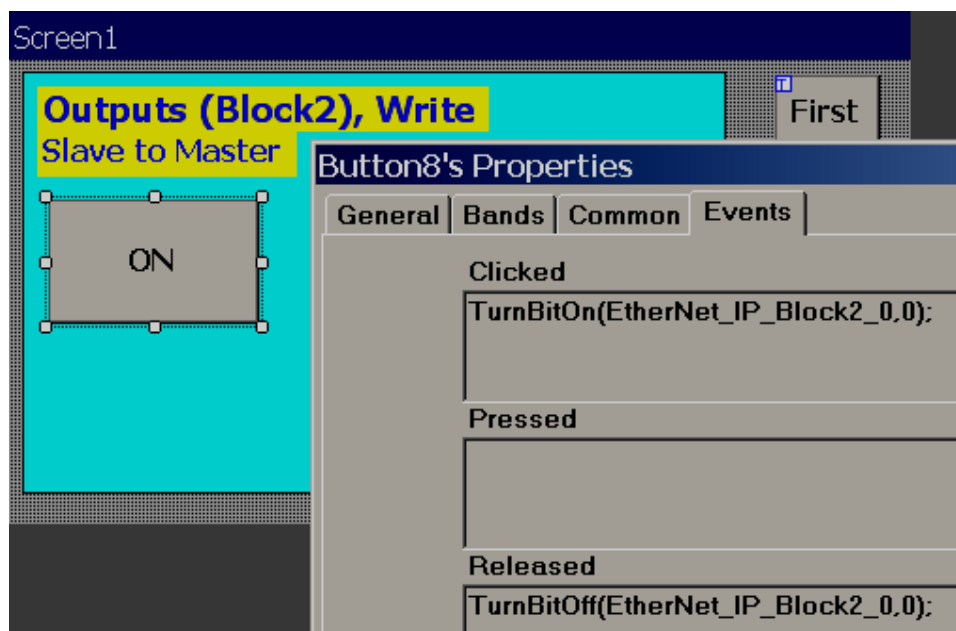


Fig: ON button events configuration, design time

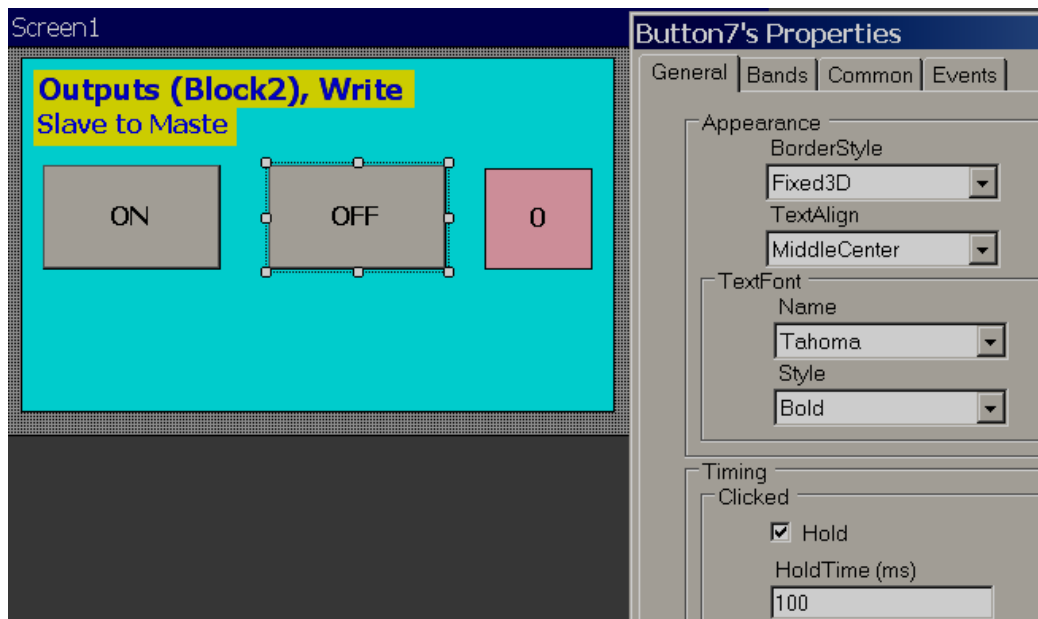


Fig: OFF button configuration, design time

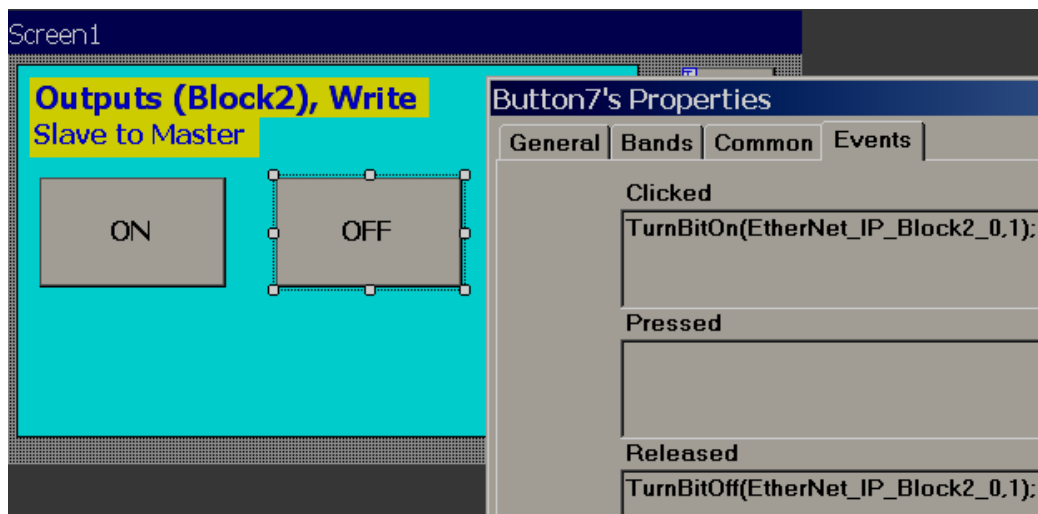


Fig: OFF button events configuration, design time

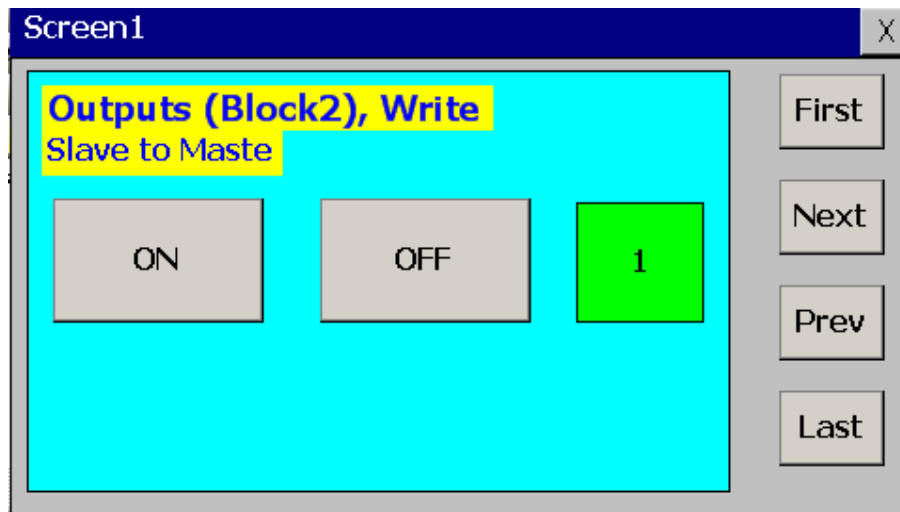


Fig: HMI run time

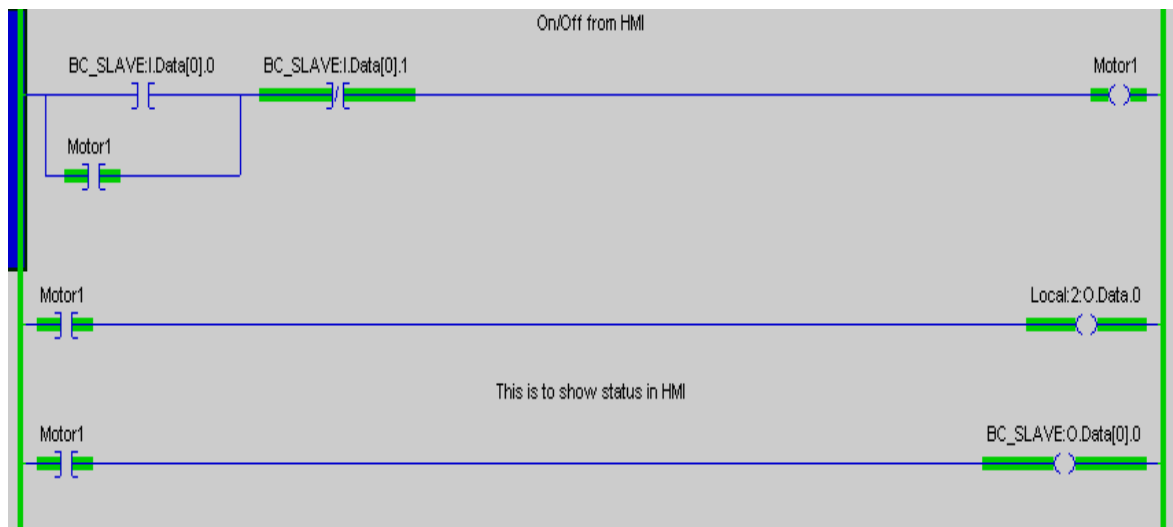


Fig: PLC ladder in run time

9. FAQ

1. Can we order HMI first and then network extension card later? Can I fix network extension card my self?
Yes, it is possible.
2. All HMI support network extension card
Check HMI ordering code for Network extension card availability
3. After inserting network extension card, HMI is Master or Slave on specific network?
Slave
4. Is it possible to have more than 1 HMI in EtherNet/IP network
Yes, it is possible.
5. Is it possible to connect 1 HMI to 2 Masters on EtherNet/IP?
No, it is not possible.
6. Can I access PLC addressing areas directly in HMI software
No, it is not possible
7. What is the maximum data I can exchange between Master and Slave
Master to Slave: 256 bytes
Slave to Master: 256 bytes
Total: 512 bytes
8. Is EDS file is required to configure EtherNet/IP slave
It depends on Master. If you are using ControlLogix / Compact logix PLC from Allen Bradley, generally it is not required
9. What are the settings required in EtherNet/IP slave
Ethernet, Mask, Gateway address and block configuration is required.
10. How many blocks I can add in HMI configuration.
It depends on block length. By default, block length=1. We suggest defining only two blocks, one for Read and one for Read. Then, define length as per your project requirements to avoid complexity
11. I am getting message "Extension card fail" in HMI after power on.
Make sure network card inserted in slot. Please switch OFF power supply to HMI and Power ON again after downloading application from PC to HMI.
12. I have 2 HMI configured as EtherNet/IP slave. Can I connect both these HMI's to Ethernet switch and exchange data with Master?

Yes, it is possible. Make sure you follow one of right topology to be used for EtherNet/IP
13. Can I exchange data between two slaves directly with out Master?
No, it is not possible. You must do this via Master only