TBEN EtherNet/IP™ LX Series

Configuration Guide

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About this Guide

This guide will show the user how to set-up TURCK's TBEN-LX stations, explain LED diagnostics, explain IP addressing, configure the device using an EDS file, configure the device as a "Generic Device", and will also address DLR and QC start-up.

TBEN-LX indicates a generic name where:

TBEN-L1 – Stands for devices with 5 pin power connector

TBEN-L4 – Stands for devices with 4 pin power connector

TBEN-LG – Is a 4 pin power connector with a 0-15 number scheme on the I/O

TBEN-Lx Modules

Introduction

The TBEN-Lx series are multiprotocol communication adapters which support multiple Ethernet standards: Modbus TCP/IP, EtherNet/IP and PROFINET. The factory default, “out of the box” setting, is that all Ethernet protocols are enabled. After power up, a multiprotocol station is listening on all necessary ports to detect on which kind of network it is used. The “Active Fieldbus Protocol” is defined as the first protocol to do one of the following actions:

- Modbus TCP - Write to output register range.
- EtherNet/IP - Establish Class 1 Exclusive Owner connection to device.
- PROFINET RT - Connect request.

This “Configuration Guide” describes features and configuration procedure of the TBEN-LX series blocks. This guide uses the TBEN-LX-8DIP-8DOP in an EtherNet/IP environment to display all the features.

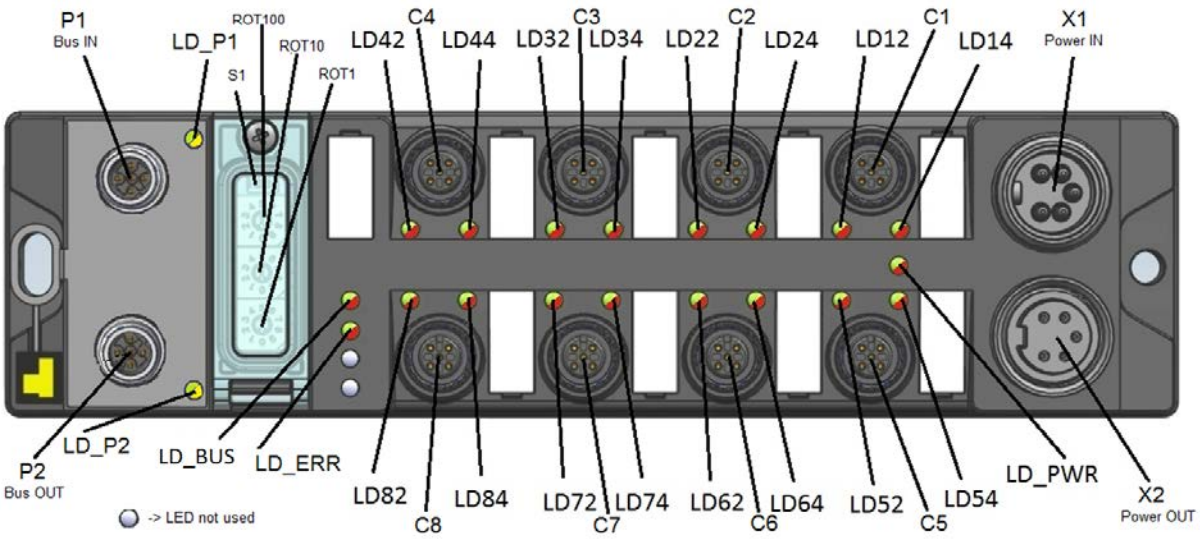
TBEN-LX Modules

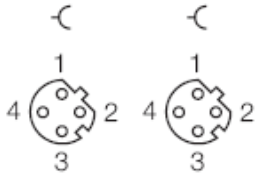
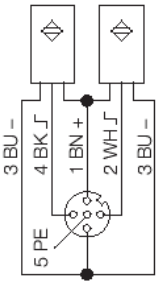
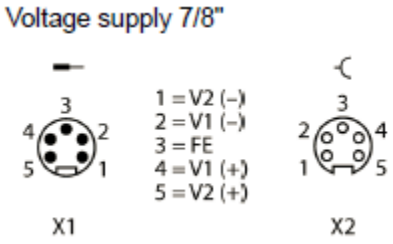
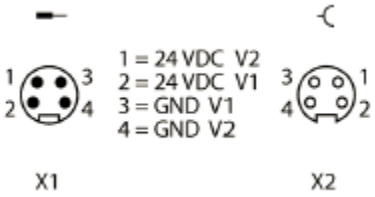
Part Number	Input description				Output description					Ethernet				
	Number of inputs	Input type	Inputs per connector	PNP / NPN type	Number of outputs	Output type	outputs per connector	Maximum output load	Short circuit protection	Ethernet ports	Configuration Assembly	DLR	QC	ACD
TBEN-LX-16DIP	16	2S	2	PNP					✔[#2]	2	✔	✔	✔	✔
TBEN-LX-16DOP					16	2G	2	1A[#1]	✔	2	✔	✔	✔	✔
TBEN-LX-16DXP	16	2X	2	PNP	16	2X	2	1A	✔	2	✔	✔	✔	✔
TBEN-LX-8DIP-8DOP	8	2S	2	PNP	8	2G	2	1A	✔	2	✔	✔	✔	✔

Abbreviations:

LX : L1 (5 pin power connector), L4 (4 pin power connector), LG (4 pin power connector with 0-15 numbering scheme)
2S: Two PnP inputs per connector
2X: Dual combined input/output per connector, PNP / 1A
2G: Two outputs per connector, 1A each
#1: 2A output when single output per connector is used
#2: Inputs protected per connector; outputs individually
DLR Device Level Ring
QC Quick Connect; QC time 100msec
ACD Address Conflict Detection and resolution

Connection Diagrams



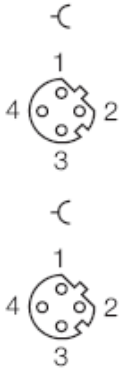
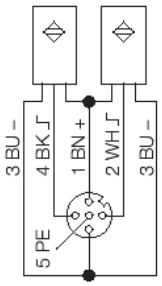
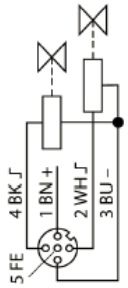
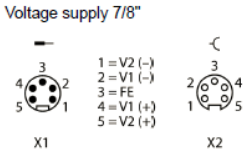
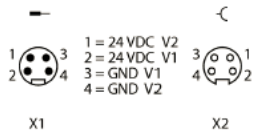
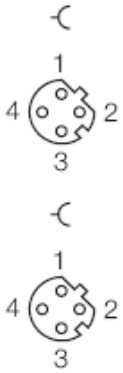
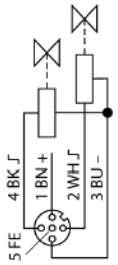
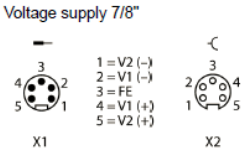
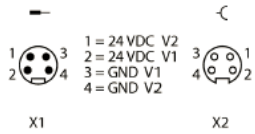
Device Type	Ethernet M12, d-coded	IN M12, a-coded	Power (7/8“)
TBEN-L1-16DIP	 **P1** **P2** **1 = TD+** **1 = RD+** **2 = RD+** **2 = TD+** **3 = TD-** **3 = RD-** **4 = RD-** **4 = TD-** **(see „Note 1“)**	 **C1 … C8** **1 = VAUX1 (+)** **2 = Second input** **3 = V1 (-)** **4 = First input** **5 = FE**	 Voltage supply 7/8" 1 = V2 (–) 2 = V1 (–) 3 = FE 4 = V1 (+) 5 = V2 (+) X1 X2
TBEN-L4-16DIP / **TBEN-LG-16DIP**			 1 = 24 VDC V2 2 = 24 VDC V1 3 = GND V1 4 = GND V2 X1 X2

The LEDs notation:
The notation of the channel LEDs (LD12 … LD84) are linked to the appropriate channel (CH) and are coded as LDxy, where:

“x” represents the connector number (x=1 means Connector C1)

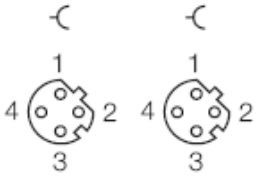
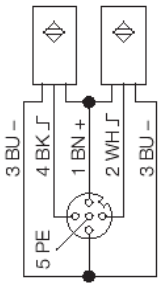
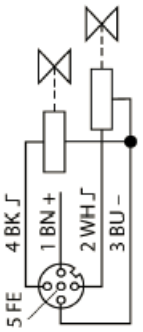
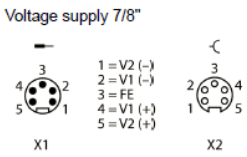
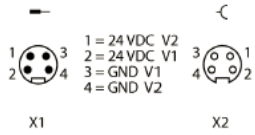
“y” represents the signal pin number (y=4 means signal pin number 4)

Example:
LD34 = Connector C3, signal pin number 4; Channel CH3/4

Device Type	Ethernet M12, d-coded	IN M12, a-coded	Out M12, a-coded	Power (7/8“)
TBEN-L1-8DIP-8DOP				
TBEN-L4-8DIP-8DOP / TBEN-LG-8DIP-8DOP	**P1** **P2** **1 = TD+ 1 = RD+** **2 = RD+ 2 = TD+** **3 = TD- 3 = RD-** **4 = RD- 4 = TD-** **(see „Note 1“)**	**C1 … C4** **1 = VAUX1 (+)** **2 = Second input** **3 = V1 (-)** **4 = First input** **5 = FE**	**C5 … C8** **1 = VAUX2 (+)** **2 = Second output** **3 = V2 (-)** **4 = First output** **5 = FE**	
TBEN-L1-16DOP				
TBEN-L4-16DOP / TBEN-LG-16DOP	**P1** **P2** **1 = TD+ 1 = RD+** **2 = RD+ 2 = TD+** **3 = TD- 3 = RD-** **4 = RD- 4 = TD-** **(see „Note 1“)**		**C1 … C8** **1 = VAUX2 (+)** **2 = Second output** **3 = V2 (-)** **4 = First output** **5 = FE**	

Note:

VAUX1 = V1 – 0.2 VDC (voltage drop over protective circuit)
VAUX2 = V2 – 0.2 VDC (voltage drop over protective circuit)

Device Type	Ethernet M12, d-coded	IN M12, a-coded	Out M12, a-coded	Power (7/8“)
TBEN-L1-16DXP				
TBEN-L4-16DXP / TBEN-LG-16DXP	**P1** **P2** **1 = TD+** **1 = RD+** **2 = RD+** **2 = TD+** **3 = TD-** **3 = RD-** **4 = RD-** **4 = TD-** **(see „Note 1“)**	**C1 … C8** **1 = VAUX1 (+)** **2 = Second input** **3 = V1 (-)** **4 = First input** **5 = FE** DXP allows for any combination of IO per single connector	**C1 … C8** **1 = VAUX2 (+)** **2 = Second output** **3 = V2 (-)** **4 = First output** **5 = FE**	

Note 1:

The pin-out of P1 and P2 are “crossed over”. P1 has a “NIC-Type” connection and P2 has a “Switch-Type” connection. The TBEN devices without fast start-up are configured with Auto-MDIX enabled. In that case the switch detects the cabling type itself.

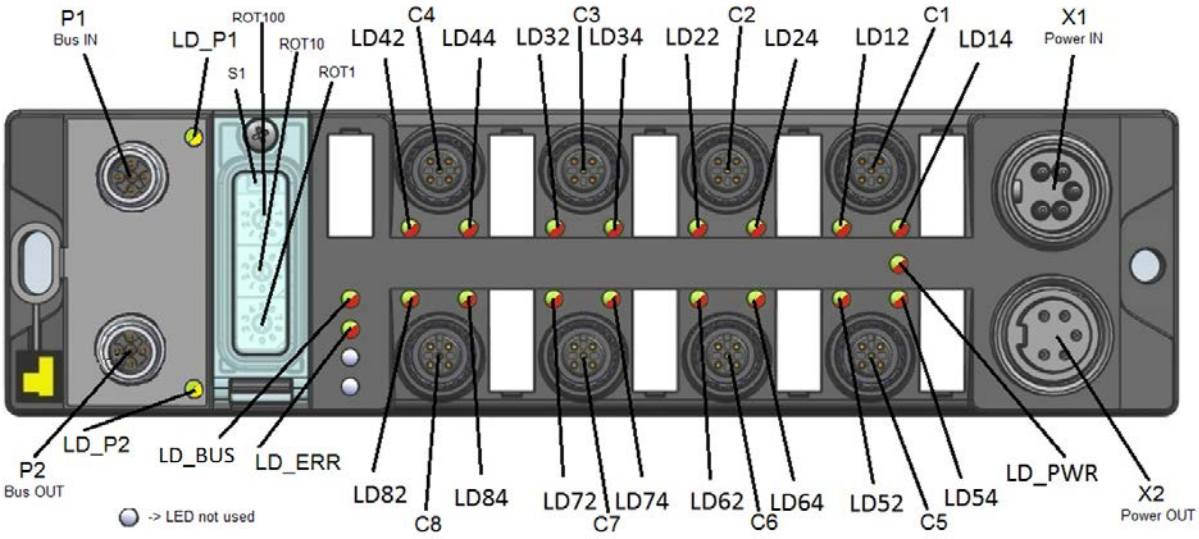
With the crossed connection of P2 it is possible to connect multiple devices in a row without Auto-MDIX with 1:1 EtherNet cables. This ensures that the switch could establish a link quickly for fast start-up devices.

LED Diagnostics

The notation of the channel LEDs (LD12 … LD84) are linked to the appropriate channel (CH) and are coded in the following way:

LDxy: “x” represents the connector number
(x=1 means Connector C1)
“y” represents the signal pin number of the appropriate connector
(y=4 means signal pin number 4)

Example:
LD34 Connector C3, signal pin number 4; Channel CH3/4


P1
Bus IN
LD_P1
ROT100
ROT10
ROT1
S1
C4
LD42
LD44
C3
LD32
LD34
C2
LD22
LD24
C1
LD12
LD14
X1
Power IN
P2
Bus OUT
LD_P2
LD_BUS
LD_ERR
-> LED not used
LD82
C8
LD84
LD72
C7
LD74
LD62
C6
LD64
LD52
C5
LD54
LD_PWR
X2
Power OUT

Ethernet Ports and Device Fault LEDs

LED	Status	Description
LD_P1 and LD_P2 (same functionality for all device types)		
LD_P1 , LD_P2 (yellow / green)	off	No connection.
	green on	Link 100MBit. The LED flashes during data transfer.
	yellow on	Link 10MBit. The LED flashes during data transfer.
	yellow on / green on	no valid state
LD_BUS (same functionality for all device types)		
LD_BUS (red / green)	off	No supply voltage
	green on	Logic connection to master established
	green blinking	Ready for operation
	red on	IP address conflict or restore mode (0 / 900 switch position),
	red flashing	Blink / Wink command (e.g. from the IO assistant, supervisor tools, etc.)
	alternating red on / green on	Auto-Negotiation and/or DHCP/BOOTP waiting for IP address assignment
LD_ERR (same functionality for all device types)		
LD_ERR (red / green)	off	not powered
	green on	no diagnosis
	red on	diagnosis
	red on / green on	no valid state

Power LED

LED	Status	Description
LD-PWR (device types only supplied by power supply V1) TBEN-LX-16DIP		
LD_PWR (green)	off	V1 : undervoltage or missing power
	on	V1 :power present
LD_PWR (device types powered by V1 and V2) TBEN-LX-8DIP-8DOP TBEN-LX-16DOP TBEN-LX-16DXP		
LD_PWR (red / green)	off	V1: undervoltage mode or missing power
	green on	V1 and V2: power present
	red on	V2: undervoltage mode or missing power
	red on / green on	no valid state

IO LEDs TBEN-LX-16DIP

LED	Status	Description
Channel LEDs: LD12 … LD84 (Channel CH12 … Channel CH84) TBEN-LX-16DIP		
LD12...LD82 LD14…LD84 (red / green)	off	Status = 0: Input signal inactive
	green on	Status = 1: Input signal active and auxiliary supply of the appropriate channel is normal
	red flashing	Overload of the auxiliary supply of a channel of the appropriate connector and input signal not active. LDx2 and LDx4 flashing if an overload condition happens at connector x.
	green on / red flashing	Input signal active (voltage from outside, not from aux supply) and auxiliary supply of the appropriate channel not ok. (This is the case with the standard input circuit. This functionality can vary with the input circuit.)

IO LEDs TBEN-LX-8DIP-8DOP

LED	Status	Description
Channel LEDs: LD12 … LD84 (Channel CH12 … Channel CH84) TBEN-LX-8DIP-8DOP INPUTS		
LD12, LD14, LD22, LD24, LD32, LD34, LD42, LD44, (red / green)	off	Status = 0: Input signal inactive
	green on	Status = 1: Input signal active and auxiliary supply of the appropriate channel o.k.
	red flashing	Overload of the auxiliary supply of a channel of the appropriate connector and input signal not active. LDx2 and LDx4 flashing if an overload condition happens at connector x.
	green on / red flashing	Input signal active (voltage from outside, not from aux supply) and auxiliary supply of the appropriate channel not ok. (This is the case with the standard input circuit. This functionality can vary with the input circuit.)
TBEN-LX-8DIP-8DOP OUTPUTS		
LD52, LD54, LD62, LD64, LD72, LD74, LD82, LD84, (red / green)	off	Status = 0: Output signal inactive, no actuator overload and aux supply ok.
	green on	Status = 1: Output signal active, no actuator overload condition and aux supply ok.
	red flashing	Overload of the auxiliary supply of the appropriate connector and output not active. LDx2 and LDx4 are flashing if an aux supply overload condition happens at connector x.
	red on	Actuator-overload condition of the appropriate channel.
	green on / red on	The output is not active and the output is supplied from outside. This mode is used for testing purposes only. A diagnosis is not generated.
	green on / red flashing	Output signal active and no actuator overload condition happened. **VAUX2** of the corresponding connector is in overload condition. LDx2 and LDx4 are flashing if an overload condition happens at connector x.

IO LEDs TBEN-LX-16DOP

LED	Status	Description
Channel LEDs: LD12 ... LD84 (Channel CH12 ... Channel CH84) TBEN-L1-16DOP		
	off	Status = 0: Output signal inactive, no actuator overload condition and aux supply ok.
	green on	Status = 1: Output signal active, no actuator overload condition and aux supply ok.
LD12 ... LD82, LD14 ... LD84,	red flashing	Overload of the auxiliary supply of the appropriate connector and output not active. LDx2 and LDx4 are flashing if an aux supply overload condition happens at connector x.
(red / green)	red on	Actuator over load condition of the appropriate channel.
	green on / red on	The output is not active and the output is supplied from outside. This mode is used for testing purposes only. A diagnosis is not generated.
	green on / red flashing	Output signal active and no actuator overload condition happened. V_{Aux2} of the corresponding connector is in overload condition.
		LDx2 and LDx4 are flashing if an overload condition happens at connector x.

IO LEDs TBEN-LX-16DXP

LED	Status	Description
Channel LEDs: LD12 … LD84 (Channel CH12 … Channel CH84) TBEN-L1-16DXP		
	off	Status = 0: Input signal inactive AND Output signal inactive AND No actuator overload condition and aux supply ok.
LD12 … LD82, LD14 … LD84 (red / green)	green on	Status = 1: Input signal active and auxiliary supply of the appropriate channel o.k. OR Output signal active, no actuator Over load condition and aux supply ok.
	red flashing	Overload of the auxiliary supply of a channel of the appropriate connector. LDx2 and LDx4 are blinking if an overload condition happens at connector x.
	red on	Actuator overload condition of the appropriate channel.
	green on / red flashing	Input signal active or output active and auxiliary supply of the appropriate channel not ok. (This is the case with the standard input circuit. This functionality can vary with the input circuit.). This behaviour differs from the DOP functionality because the input functionality cannot be deactivated on a DXP device.

IO and Diagnostic Data Format

Abbreviations:

I1…I16:	Inputs
O1…O16:	Outputs
FCE:	Force mode active
CFG:	I/O configuration error
COM:	Communication lost on the internal bus
V1:	V1 too low
V2:	V2 too low
DiagWarn:	Summarized diagnostic of the device
EM0:	Summarized diagnostic of the I/Os
ECx :	Error Code bit x in error-code bit area
SRO1…16:	Short circuit recovery mode of outputs 1…16
Err VAUX1…8:	Auxiliary supply error on connector 1…8
Err Out1…16:	Short circuit output 1…16
Inv.I1…I16:	Inverted inputs 1…16

TBEN-LX-16DIP

TBEN-L1-16DIP																	
Type	**Word Nr**	**Bit 15**	**Bit 14**	**Bit 13**	**Bit 12**	**Bit 11**	**Bit 10**	**Bit 9**	**Bit 8**	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Output (scanner -> station)																	
GW Command Word	1																
Input (station -> scanner)																	
GW Status Word(*)	1		FCE			CFG	COM	V1									Diag Warn
Input	2	I16	I15	I14	I13	I12	I12	I10	I9	I8	I7	I6	I5	I4	I3	I2	I1
Diagnostic Word 1 (*)	3			EC 5													EM 0
Diagnostic Word 2 (*)	4									Err VAUX 8	Err VAUX 7	Err VAUX 6	Err VAUX 5	Err VAUX 4	Err VAUX 3	Err VAUX 2	Err VAUX 1

TBEN-LX-8DIP-8DOP

TBEN-L1-8DIP-8DOP																	
Type	**Word Nr**	**Bit 15**	**Bit 14**	**Bit 13**	**Bit 12**	**Bit 11**	**Bit 10**	**Bit 9**	**Bit 8**	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Output (scanner -> station)																	
GW Command Word	1																
Output	2									O8	O7	O6	O5	O4	O3	O2	O1
Input (station -> scanner)																	
GW Status Word(*)	1		FCE			CFG	COM	V1		V2							Diag Warn
Input	2									I8	I7	I6	I5	I4	I3	I2	I1
Diagnostic Word 1 (*)	3			EC 5													EM 0
Diagnostic Word 2 (*)	4	Err Out8	Err Out7	Err Out6	Err Out5	Err Out4	Err Out3	Err Out2	Err Out1	Err VAUX8	Err VAUX7	Err VAUX6	Err VAUX5	Err VAUX4	Err VAUX3	Err VAUX2	Err VAUX1

TBEN-LX-16DOP

TBEN-L1-16DOP																	
Type	**Word Nr**	**Bit 15**	**Bit 14**	**Bit 13**	**Bit 12**	**Bit 11**	**Bit 10**	**Bit 9**	**Bit 8**	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Output (scanner -> station)																	
GW Command Word	1																
Output	2	O16	O15	O14	O13	O12	O11	O10	O9	O8	O7	O6	O5	O4	O3	O2	O1
Input (station -> scanner)																	
GW Status Word(*)	1		FCE			CFG	COM	V1		V2							Diag Warn
Diagnostic Word 1 (*)	2			EC 5													EM 0
Diagnostic Word 2 (*)	3	Err Out8	Err Out7	Err Out6	Err Out5	Err Out4	Err Out3	Err Out2	Err Out1	Err VAUX8	Err VAUX7	Err VAUX6	Err VAUX5	Err VAUX4	Err VAUX3	Err VAUX2	Err VAUX1
Diagnostic Word 3 (*)	4									Err Out16	Err Out15	Err Out14	Err Out13	Err Out12	Err Out11	Err Out10	Err Out9

TBEN-LX-16DXP

TBEN-L1-16DXP																	
Type	Word Nr	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Output (scanner -> station)																	
GW Command Word	1																
Output	2	O16	O15	O14	O13	O12	O11	O10	O9	O8	O7	O6	O5	O4	O3	O2	O1
Input (station -> scanner)																	
GW Status Word(*)	1		FCE			CFG	COM	V1		V2							Diag Warn
Input	2	I16	I15	I14	I13	I12	I11	I10	I9	I8	I7	I6	I5	I4	I3	I2	I1
Diagnostic Word 1 (*)	3			EC 5													EM 0
Diagnostic Word 2 (*)	4	Err Out8	Err Out7	Err Out6	Err Out5	Err Out4	Err Out3	Err Out2	Err Out1	Err VAUX8	Err VAUX7	Err VAUX6	Err VAUX5	Err VAUX4	Err VAUX3	Err VAUX2	Err VAUX1
Diagnostic Word 3 (*)	5									Err Out16	Err Out15	Err Out14	Err Out13	Err Out12	Err Out11	Err Out10	Err Out9

IP Address Setup

The general procedure for IP address setup is:

- Set rotary switches to desired position
- Cycle (reset) power to the station
- Run IP address utility to assign IP address
- Set address switches to rotary mode or PGM mode
- Cycle power to the station

When address switches are in rotary mode, the last octet may be dialed in 1-254 range.

Default IP Address

When rotary switches are set to 0, the default IP address is:

- IP-address 192.168.1.254
- Subnet mask 255.255.255.0
- Default gateway 192.168.1.1

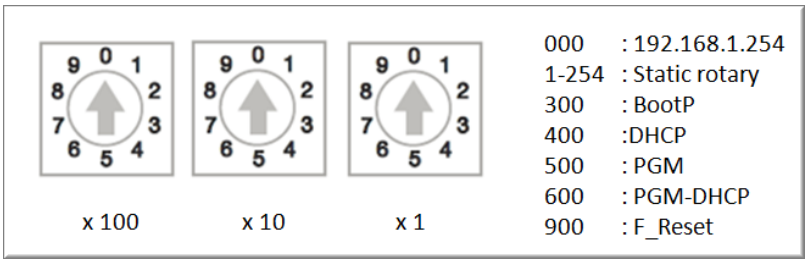
To reset IP address to the default, set address switches to 0 and cycle device power. Upon re-set, set rotary switches to one of the modes as described hereafter.

Address Switches

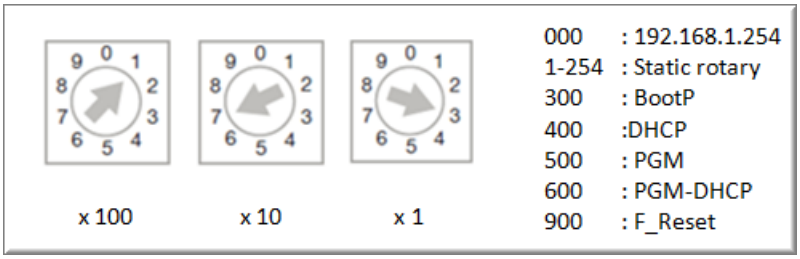
TBEN devices have three rotary switches marked as follows:

x100	sets the last digit of IP address to a 100's value
x10	sets the last digit of IP address to a 10's value
x1	sets the last digit of IP address to a 1's value

Switch position determines either address or device mode of operation as follows:

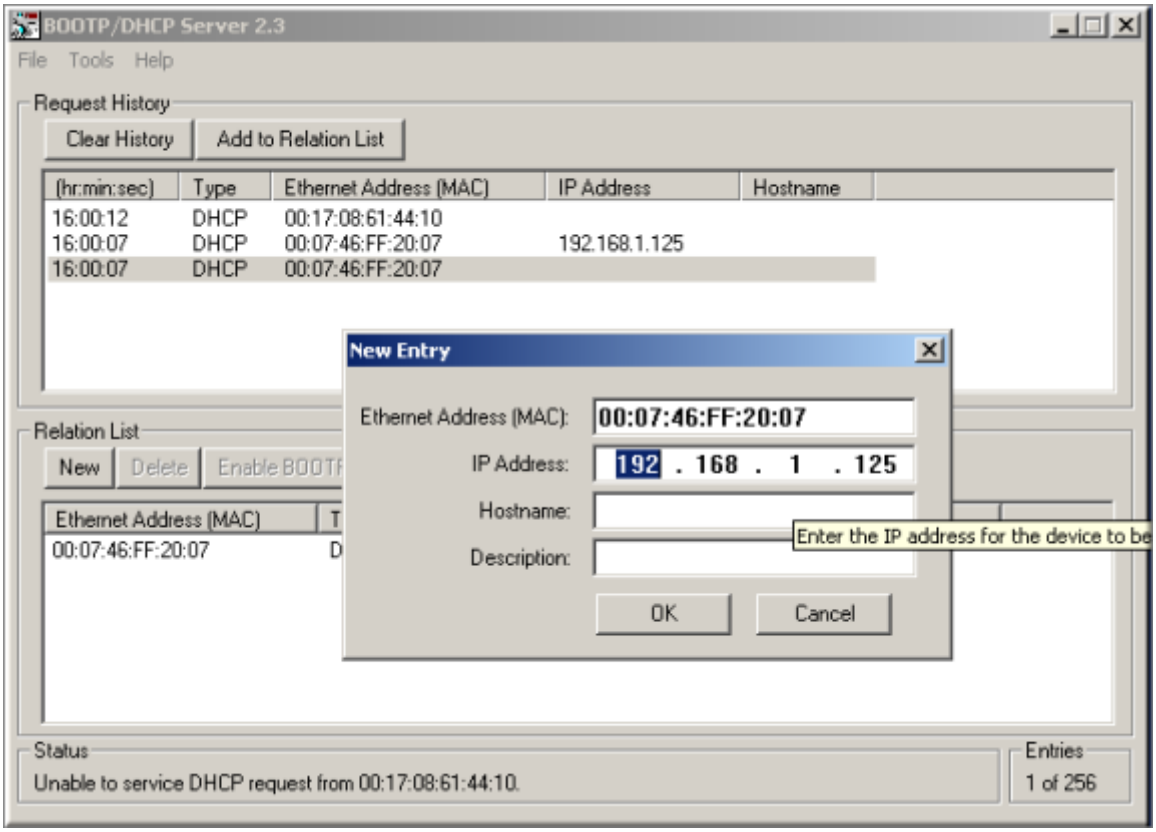


When using the static rotary mode, the last octet of the module's IP address can be set via the rotary coding-switches on the module.
Address range is 1 to 254. Addresses 0 and 255 are reserved and cannot be used.
Following example shows the last octet set to of address xx.xxx.xxx.**173**



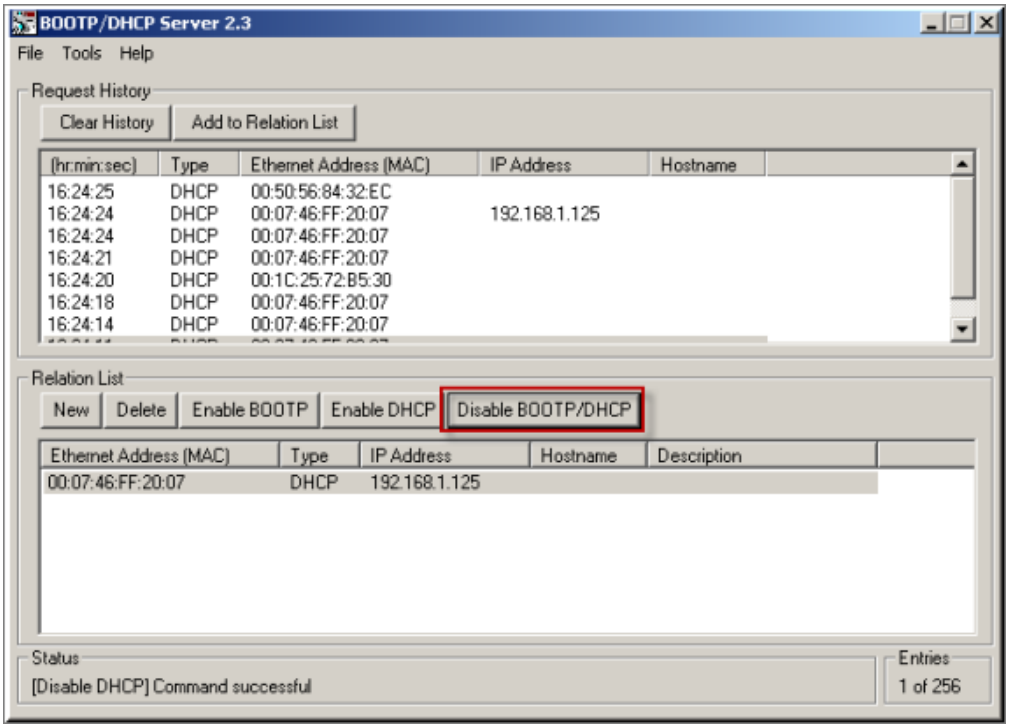
BOOTP/DHCP Mode (300/400)

The device obtains IP address from the BOOTP or DHCP servers when address switches are set to 300 (BOOTP) or 400 (DHCP) position. The IP address, as well as the subnet mask assigned to the station, is stored in the device's EEPROM. When the station is subsequently switched to rotary or PGM mode and its power reset, the IP address is read from the EEPROM.



PGM-DHCP Mode (600)

When the rotary switches are set to 600 it enables PGM–DHCP mode of operation. This mode is the out-of-the-box mode and provides the customer with powerful and convenient IP address setup. Procedure is the identical to DHCP mode. When finished, **click on "*Disable BOOTP/DHCP" button.*** Leave address switches in 96 position and cycle power. The IP address is read from the EEPROM memory.



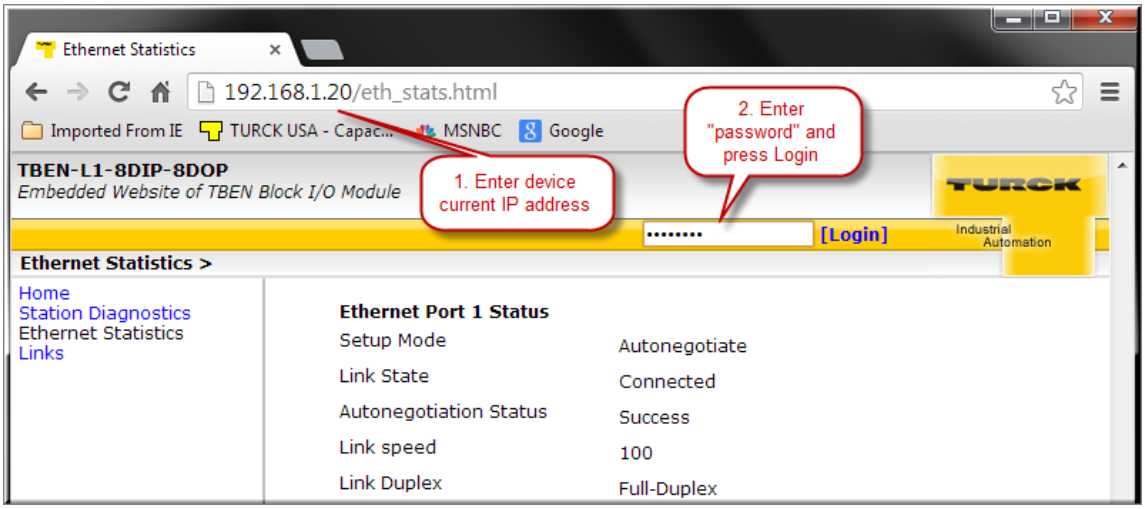
PGM Mode (500)

When the rotary switches are set to 500 (PGM mode), the device will use either the factory default IP address on the first power-up or maintain current IP address whatever it is. Device IP address may be also changed, when in PGM mode, with software tools like:

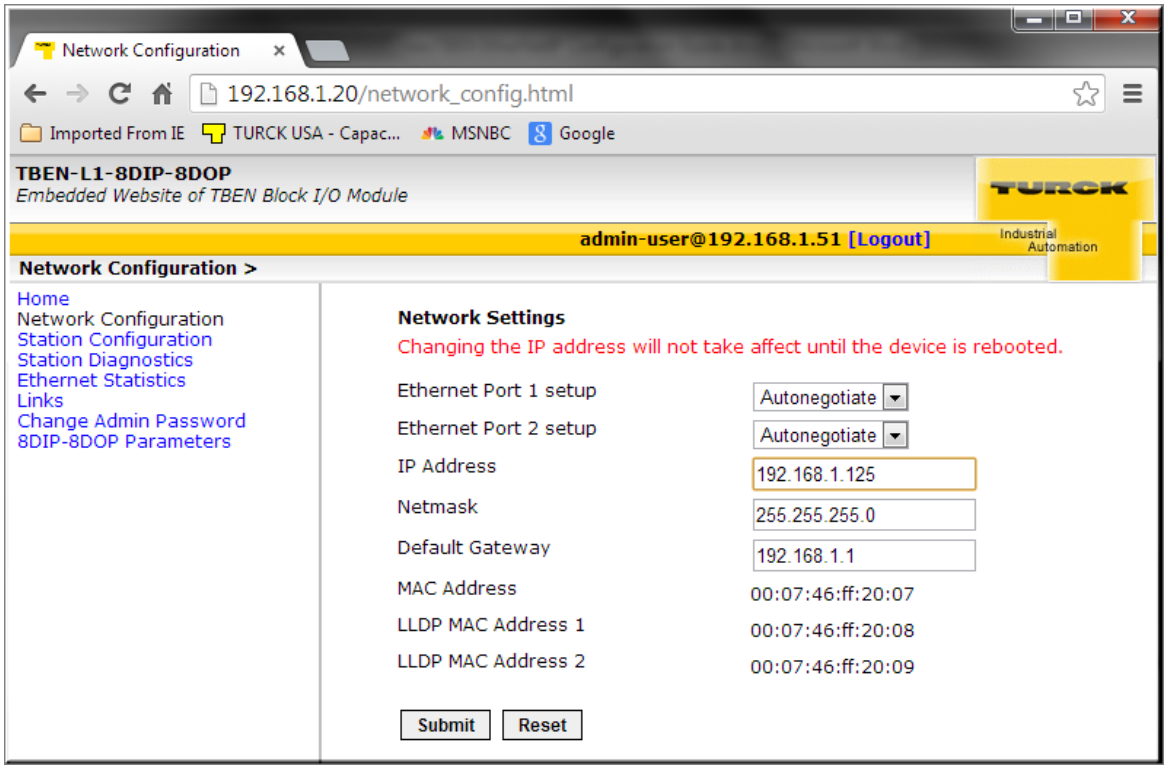
- Device WEB server
- TURCK IP address tool
- IOAssistant configuration tool

PGM (500) and Web Server

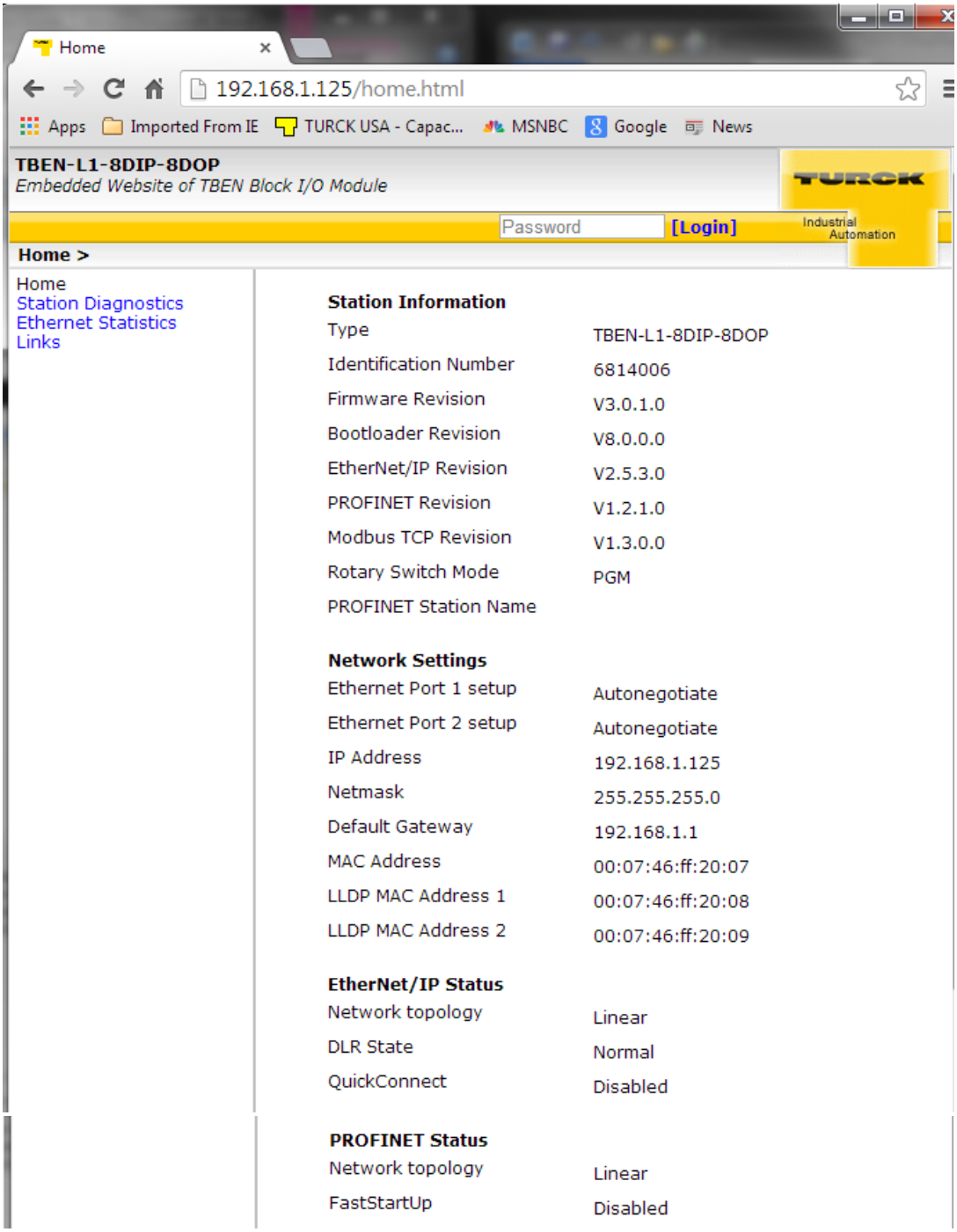
- Read current IP address of the device (e.g. 192.168.1.20)
- Set rotary switches to 500 and cycle device power
- Enter device current IP address into web browser
- When device web server starts, enter “password” into “Login” field and press Login



- Select “Network Configuration” at the left column
- Enter new IP address e.g. 192.168.1.125 and press ***“Submit”***

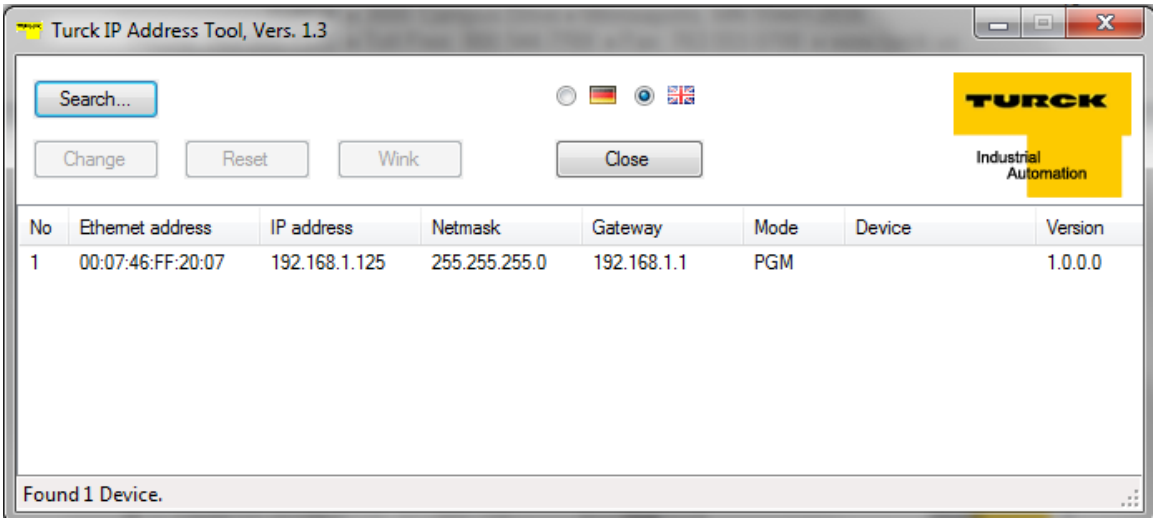


- Leave rotary switches in 500,
- Cycle device power and restart Web page at IP 192.168.1.125

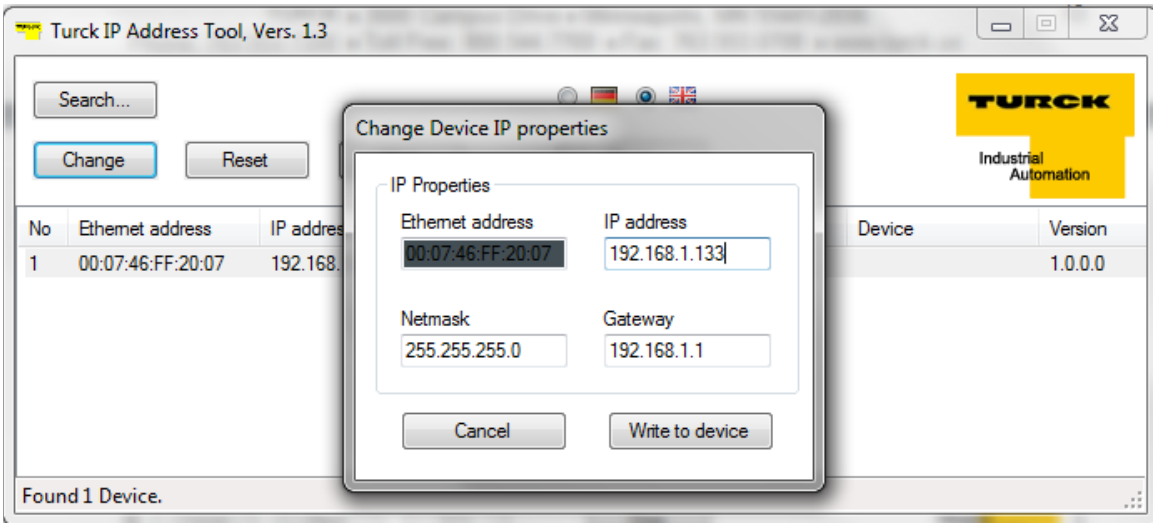


PGM (500) and TURCK IP address tool

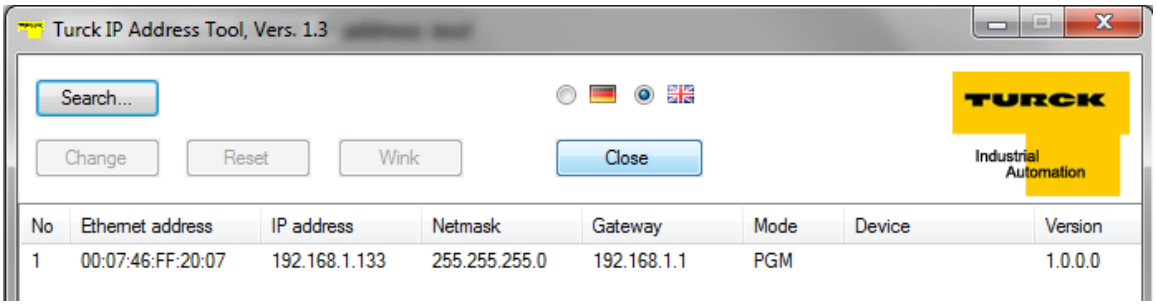
Start the IP address tool and press search:



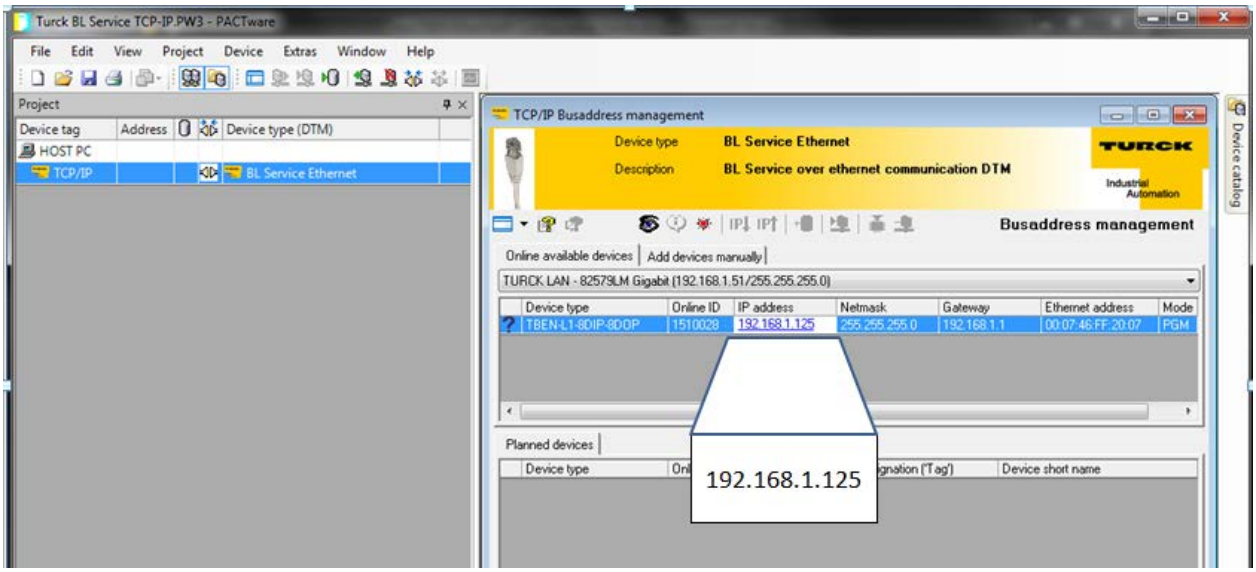
Highlight device, press ***"Change"*** button and enter new IP address; press ***"Write to device".***



Press search and verify address:



PGM (500) and IOAssistant

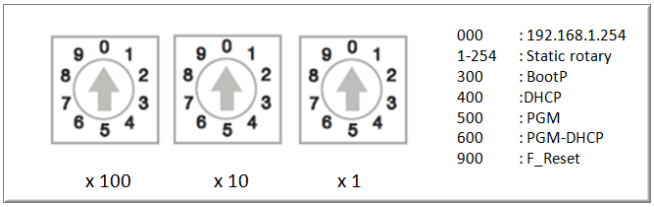


RESTORE Mode (0)

The RESTORE mode is a special mode which restores the IP address to the factory default values. Station responds to PING command, but it does not operate when switches are set to 0. Set all three rotary switches to 0 and cycle the power to the station. It instantaneously restores IP address, Mask and Gateway as follows:

- IP address: 192.168.1.254
- Mask: 255.255.255.0
- Gateway: 192.168.1.1

Set rotary switches to any position as following shown and cycle device power:



F_Reset (900)

The factory reset (900) is a special mode which restores the IP address to 192.168.1.254 and clears all previously assigned values to the parameter of the gateway and IO modules. Set rotary switches to 900 and cycle the power to the station. Wait for a moment, set rotary switches as previously described and cycle device power again.

TBEN EtherNet/IP Configuration

Following section provides information how to configure the TBEN product line with Rockwell Automation Logix controllers (mainly ControlLogix, GuardLogix, CompactLogix controllers). Third party devices may be configured using two different configuration methods which depend on a controller revision:

- Device configuration using EDS file (Electronic Data Sheet):
  It is only supported by the Logix controllers, firmware revision 20.00.00 and above. It requires that device EDS file (EDS profile) include configuration assembly data

- Device configuration using Ethernet Generic profile:
  It is supported by all Logix controllers and all devices.

TBEN Configuration Using EDS Files

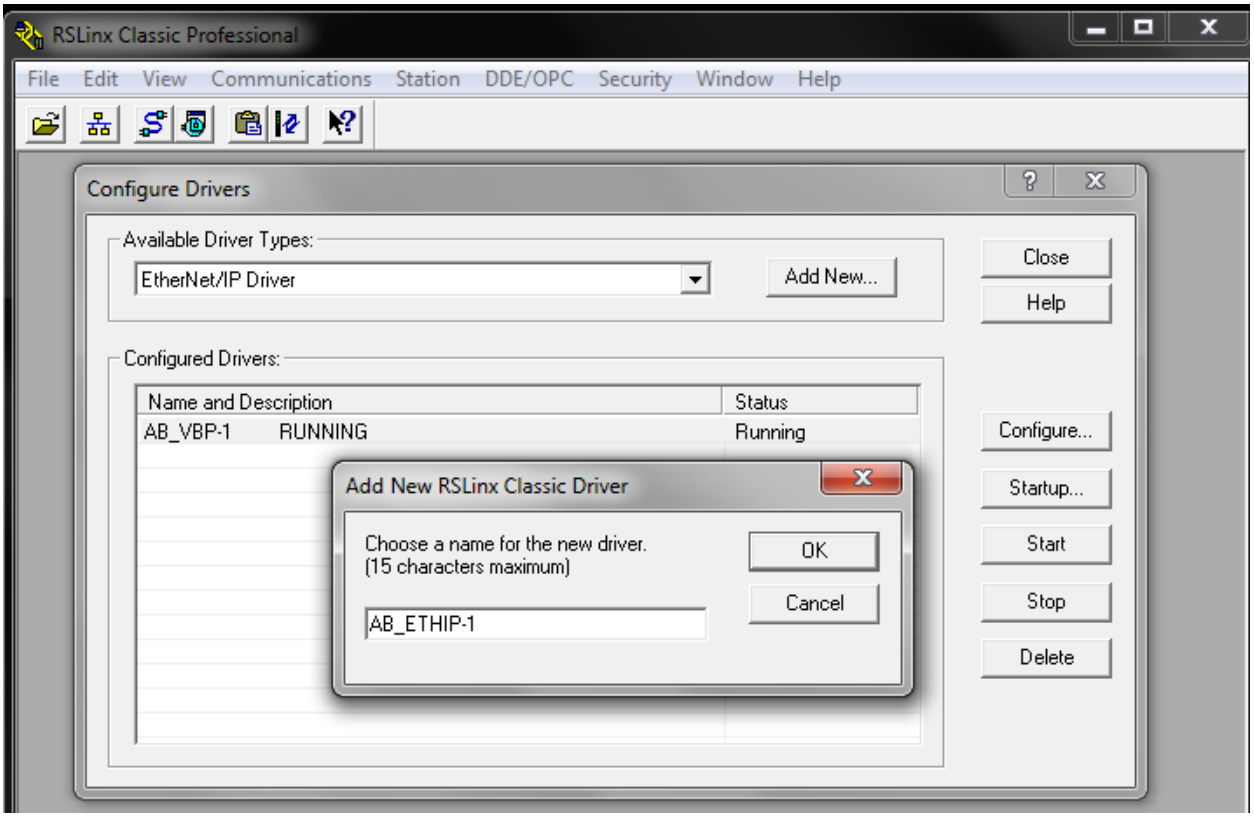
The EDS file which supports configuration assembly may be imported into RSLogix5000 project. The Logix Designer creates device profile based on EDS and saves device configuration in the project. The controller pushes configuration data to the device whenever connection between them is established.

The TBEN-LX device configuration procedure includes following steps:

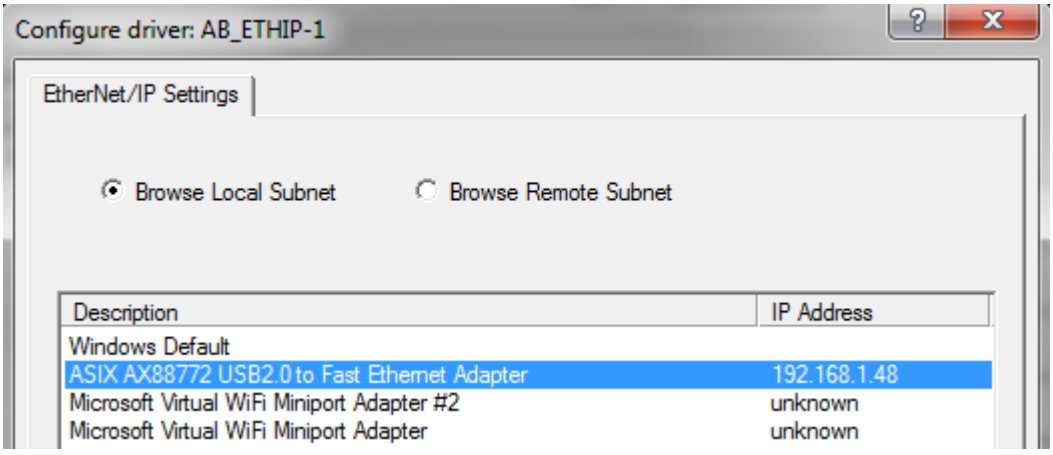
- Configure EtherNet/IP User Interface
- Create RSLogix5000 project
- Install Device EDS File(s)
- TBEN General Configuration
- TBEN Connection Configuration
- Module Definition Data Format
- Communication RPI, Multicast / Unicast
- TBEN Input, Output and Configuration Data Tags

Configure EtherNet/IP User Interface

Configure user interface to the ControlLogix platform using RSLinx communication software. Add new EtherNet/IP driver that is used to establish connection between programing PC and the Logix controller:

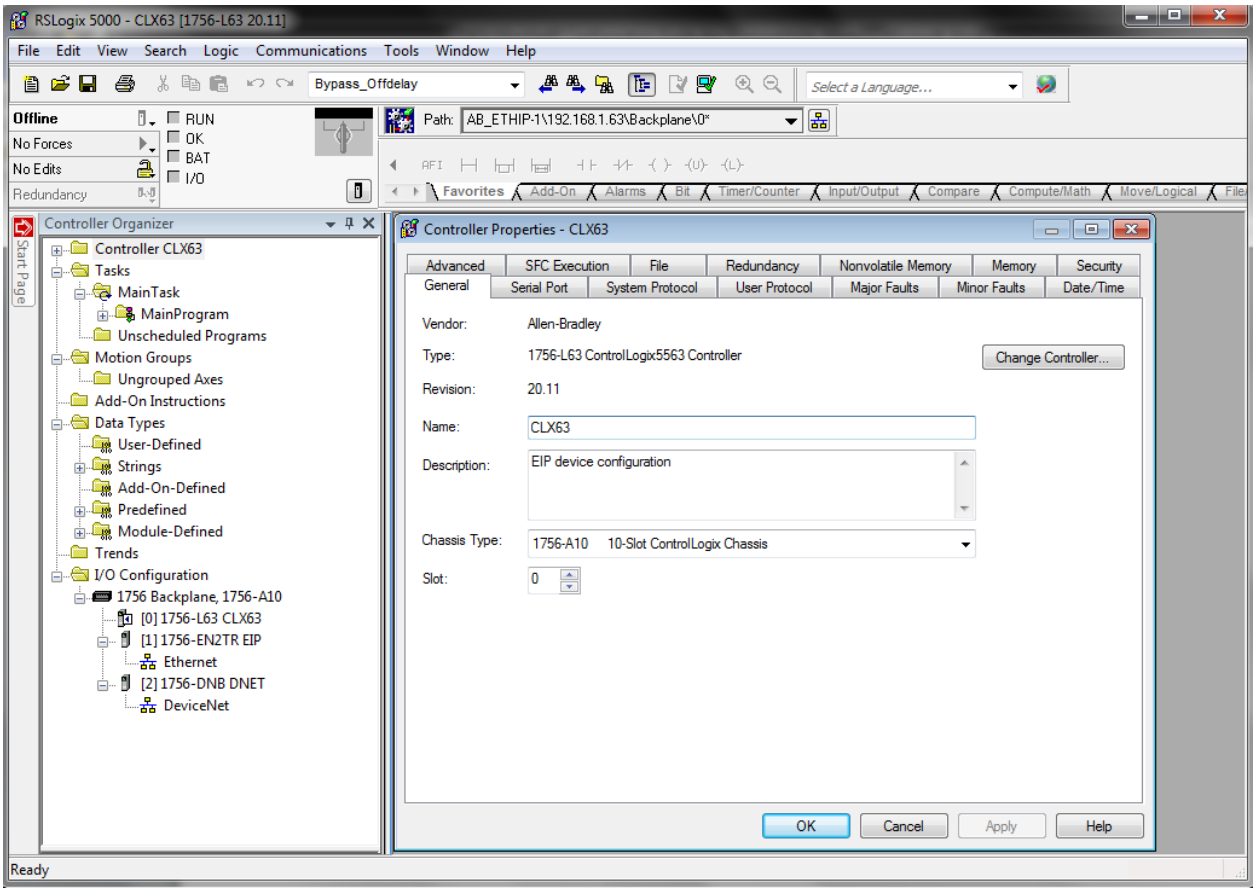


Select designated driver and click apply:



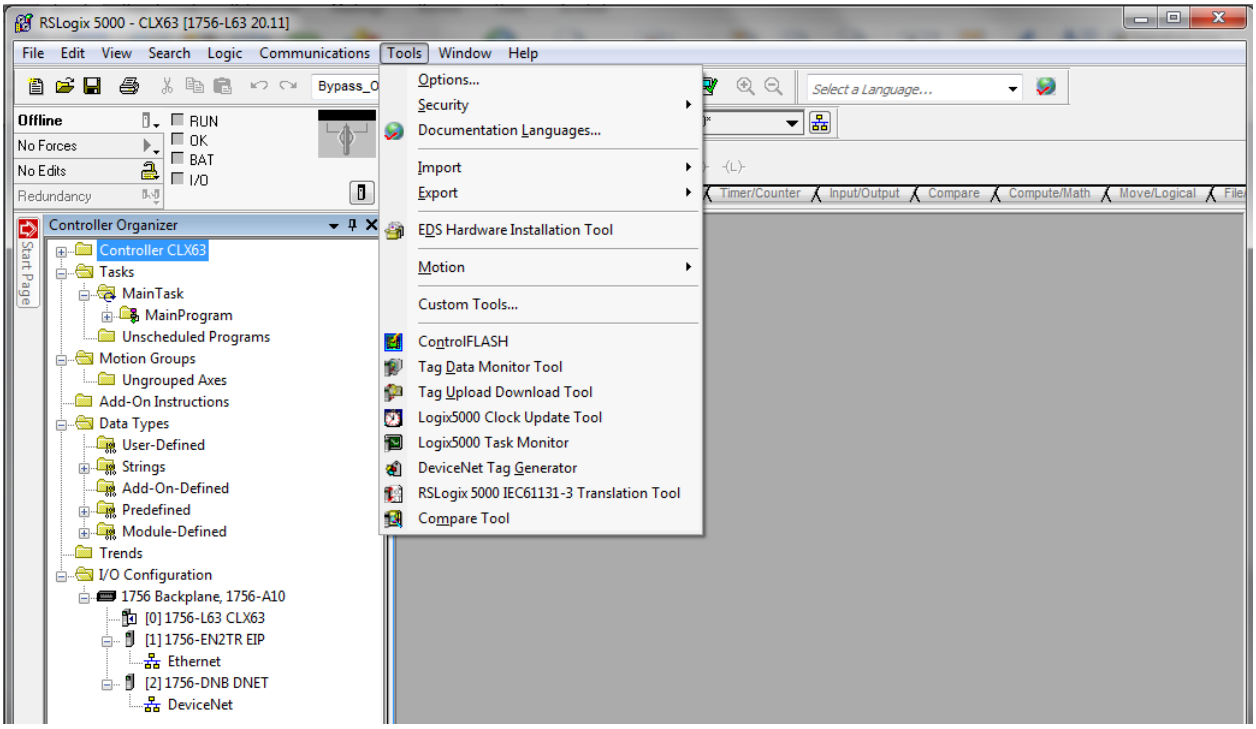
Create RSLogix5000 Project

Following example is valid if the revision of the controller is 20 or above. Open new RSlogix5000 project and configure your PLC or use an existing project.



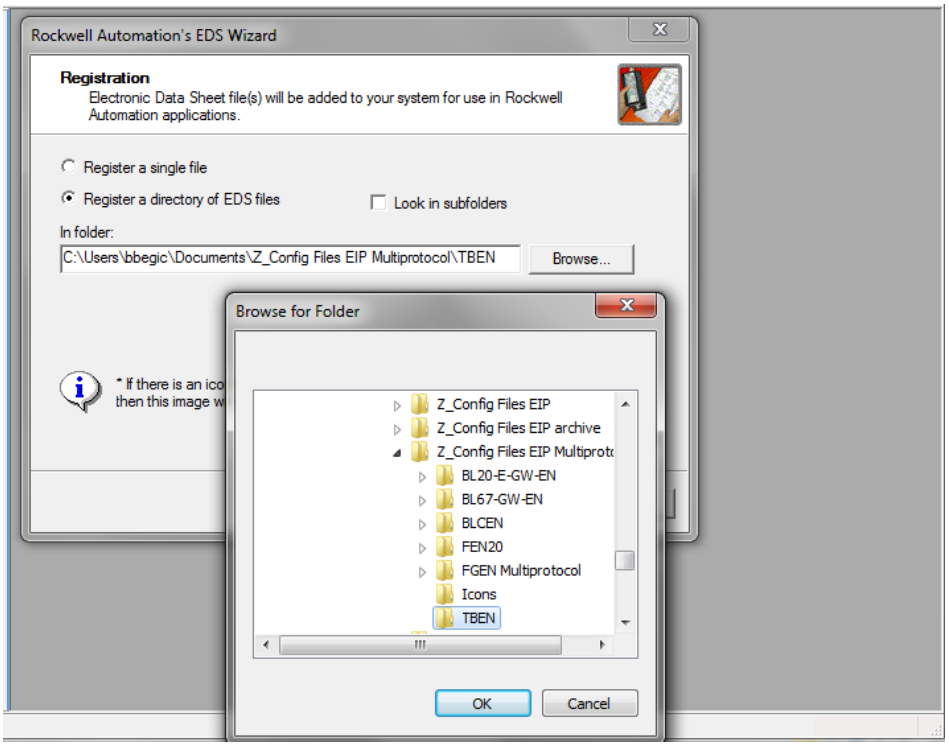
Install EDS File(s)

Tools > EDS Hardware Installation Tool

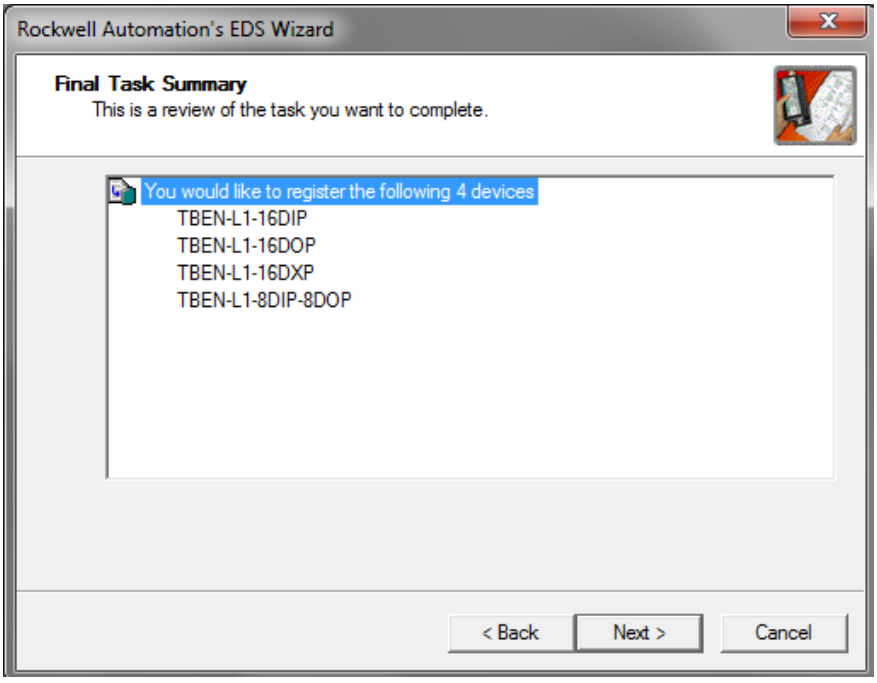


Follow the wizard instructions

Register single file or directory of EDS files and follow registration dialog:



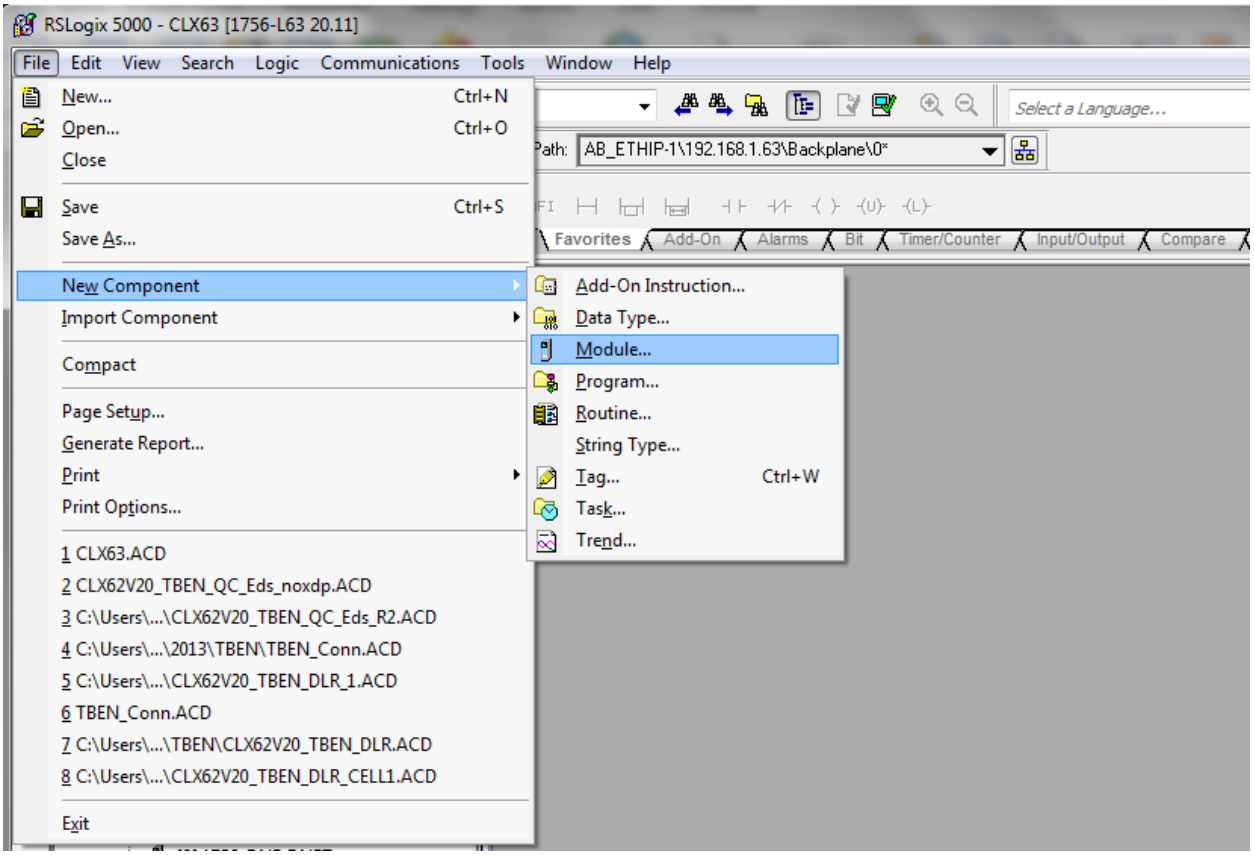
Following files are registered



Create new TBEN Module

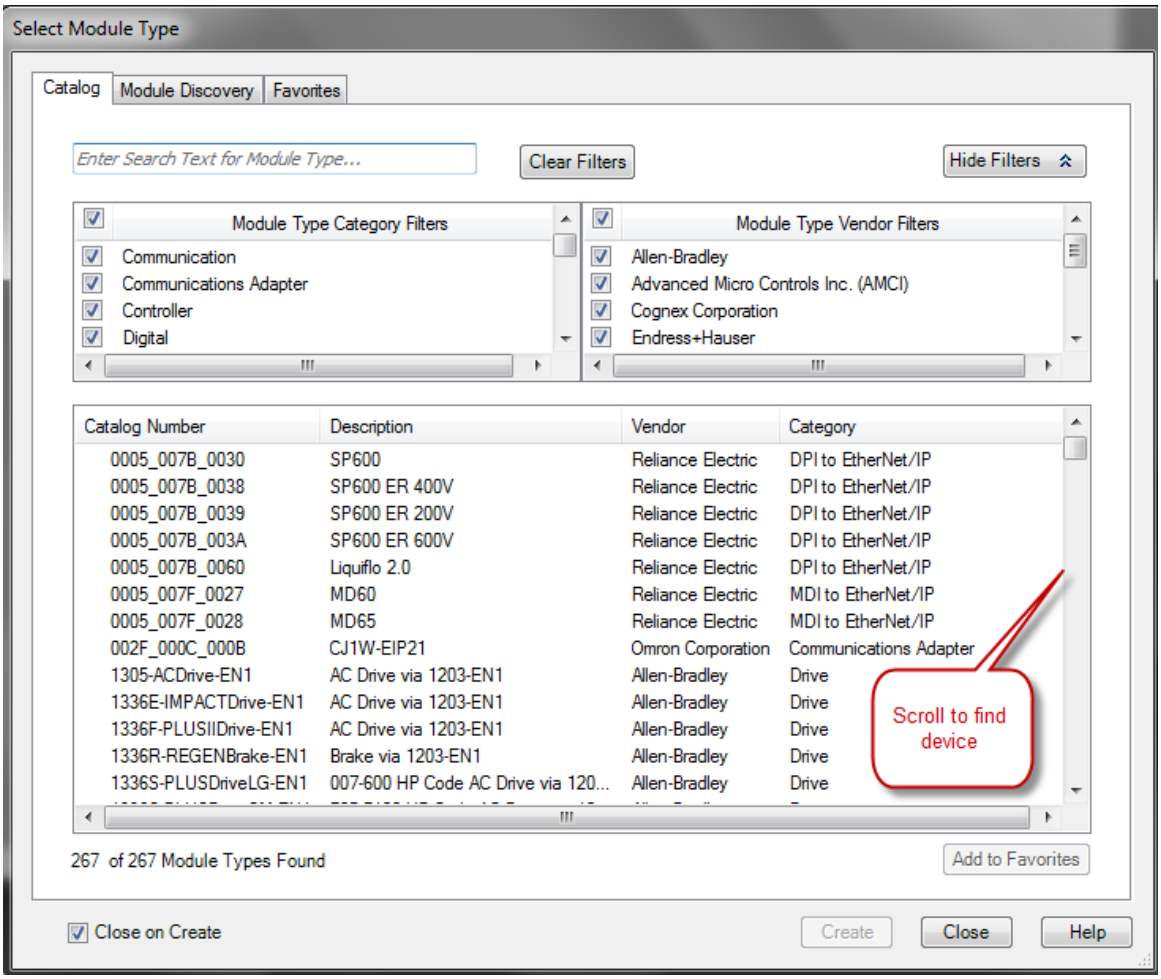
To configure new TBEN device in RSLogix5000, use File menu:

- ***File > New Component > Module***

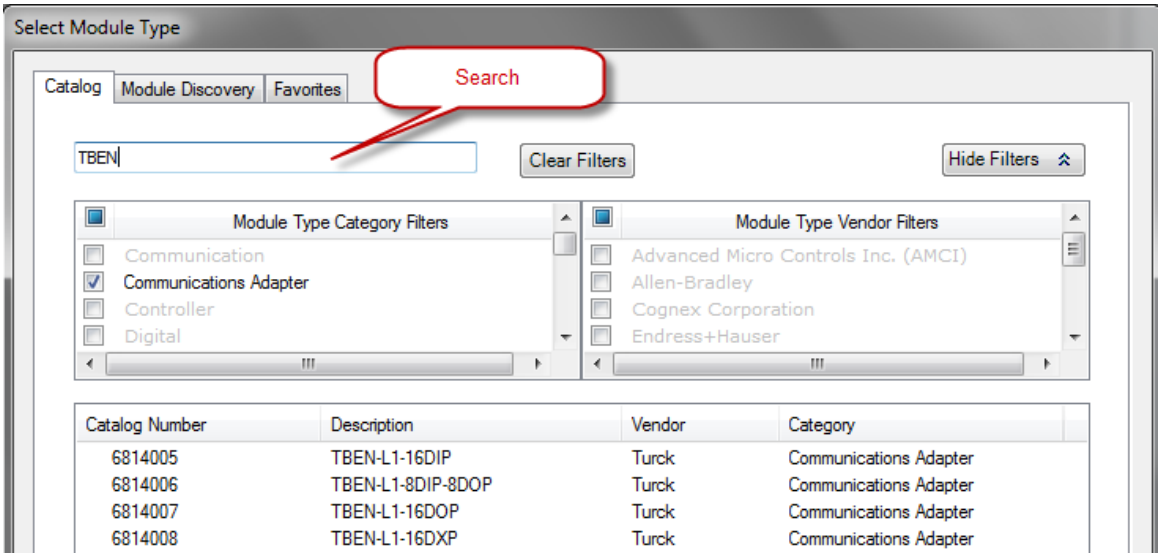


Or right-click at ***"Ethernet"*** and select ***"New module"***

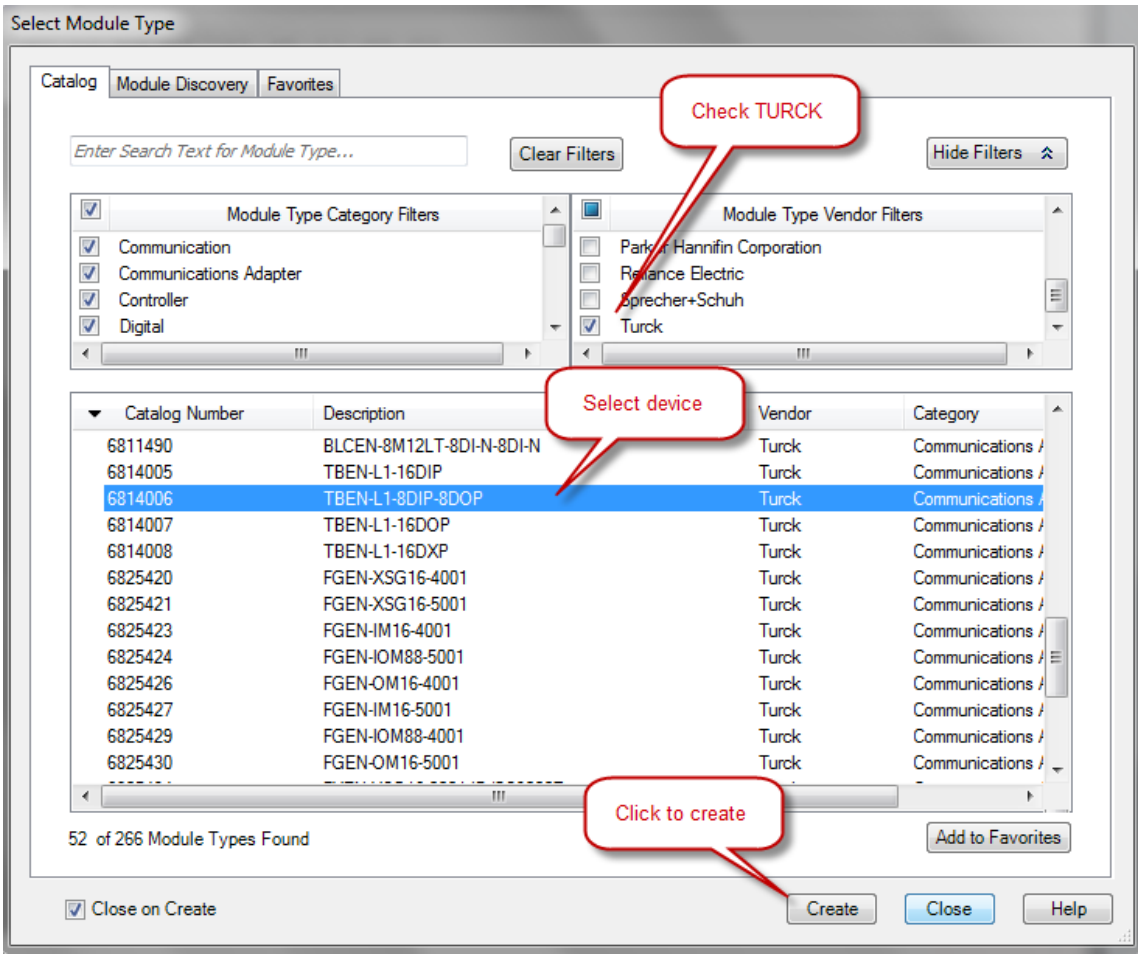
New device may be located in the **"Select Module Type"** by scrolling:



By searching specific name:



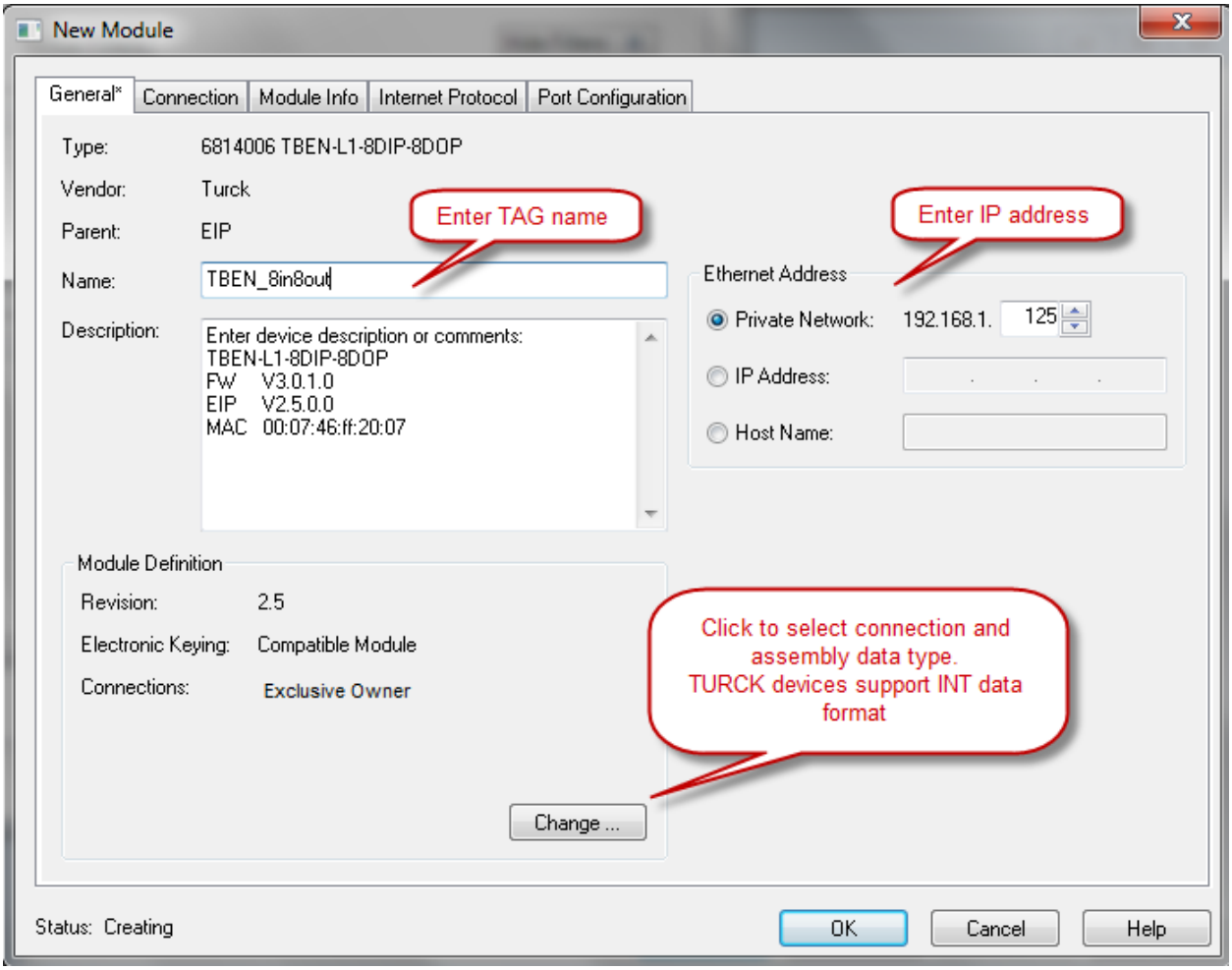
Or by filtering the **"Module Type Vendor Filters"** to search specific products, as follows:



If device name does not appear in the list of registered device, either device EDS file is not installed or installation failed.

Enter required data into the **"New Module"** general page:

- Name (tag name) and description
- IP address
- Click ***"Change"*** to open Module Definition page



Configure Connection Parameters

The connection parameters may be selected when a Module Definition page is opened. It is used to select connection type and IO data format.

Module Definition Data Format

TBEN supports INTEGER data format only. It is important to edit and change data format used by RSLogix5000 to match INTEGER. A failure to do so may case erroneous IO data or in-operable IO data update. Use "Change" button to:

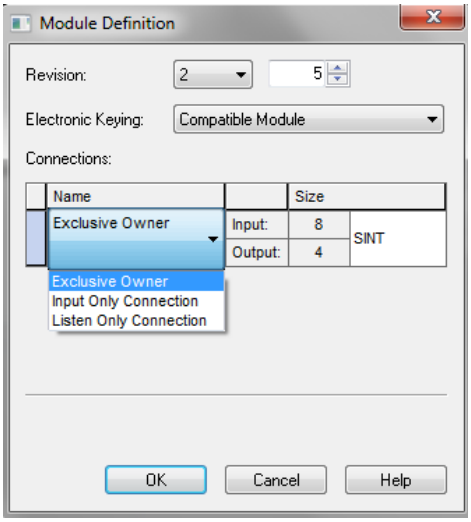
- Change data format to INTEGER
- Review connection type

TBEN supports following connections:

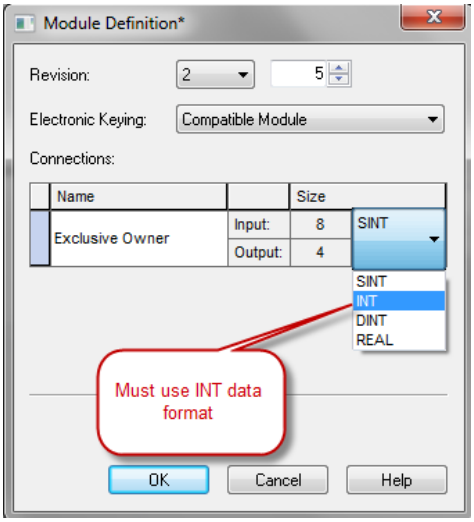
- Exclusive Owner
- Input-Only connection
- Listen-Only connection

Note:
Exclusive Owner connection is the preferred, default, connection type use by the device. Input-Only and Listen-Only connections are used to configure the device with multiple PLC's and they do not support configuration assemblies.

The **"Module Definition"** page provides following setup options:



and



Follow dialog to complete setup.

Communication RPI, Multicast / Unicast

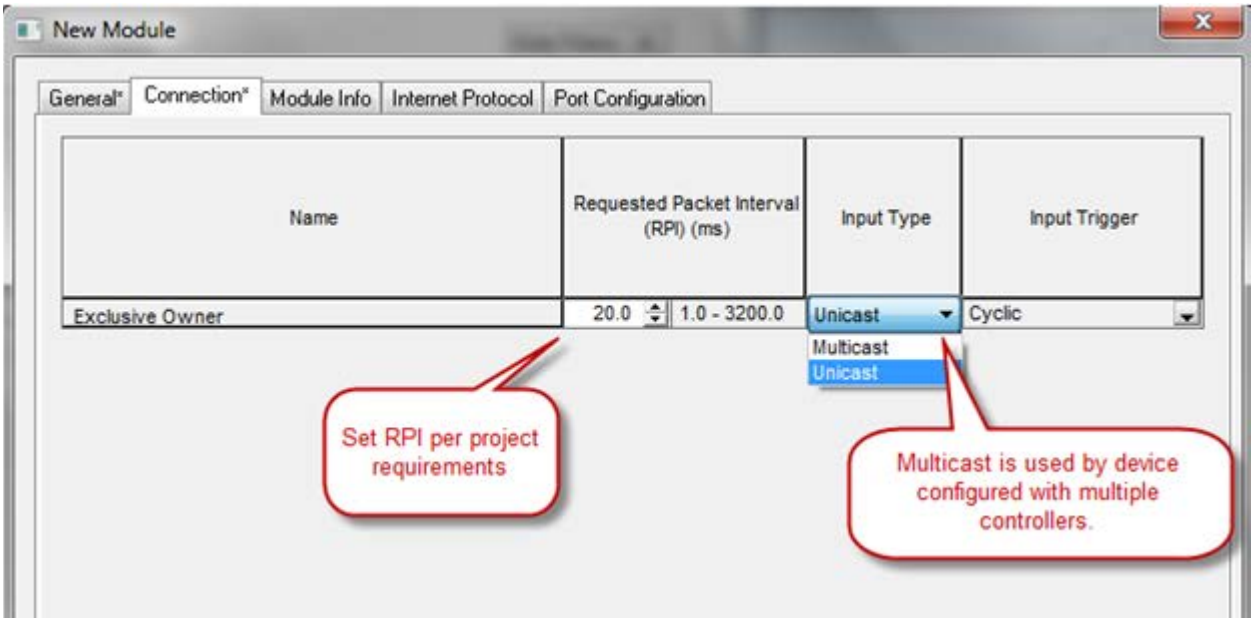
The **"Connection"** tab is used for selecting:

- RPI (Requested Packet Rate) is a scheduled interval when a Target (TBEN) and Origin (controller) transmit data. The connection timeout may occur after 4xRPI time, when either Target or Origin stops sending data.

- Unicast:
  - Used for point-to-point communication (TCP, UDP)
  - Both Producer /Consumer use IP address classes A, B, or C for data exchange
  - No need to process and reject multicast packets
  - Reduces burden on all EIP participants

- Multicast :
  - Used for one-to-many communications (UDP)
  - Multicast allows for multiple consumers. However, a single consumer is also supported
  - With multiple consumers, Multicast is more timely efficient than Unicast
  - Uses IP address class D (Multicast addresses, e.g. 239.192.1.2)

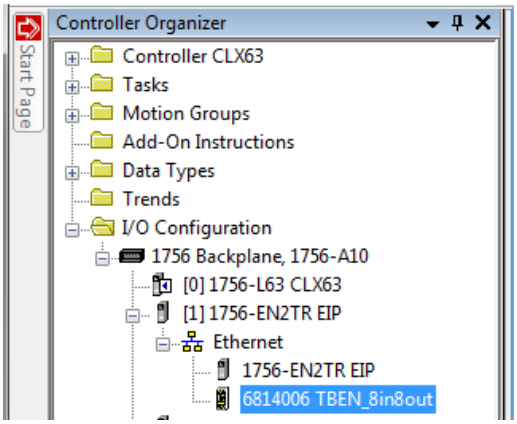
Multicast is used by device



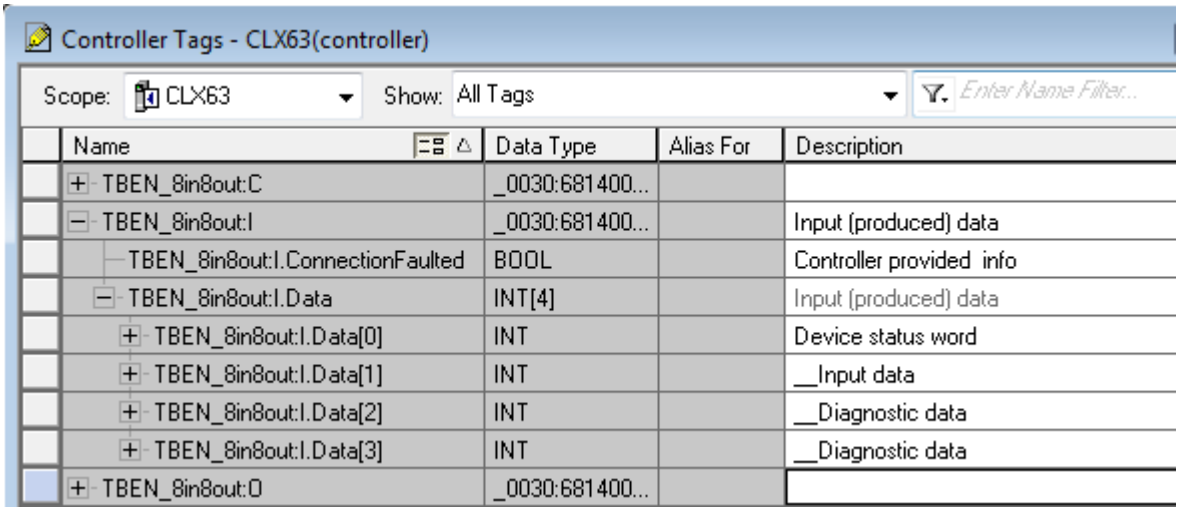
Follow the dialog to complete device configuration.

TBEN Input, Output and Configuration Data Tags

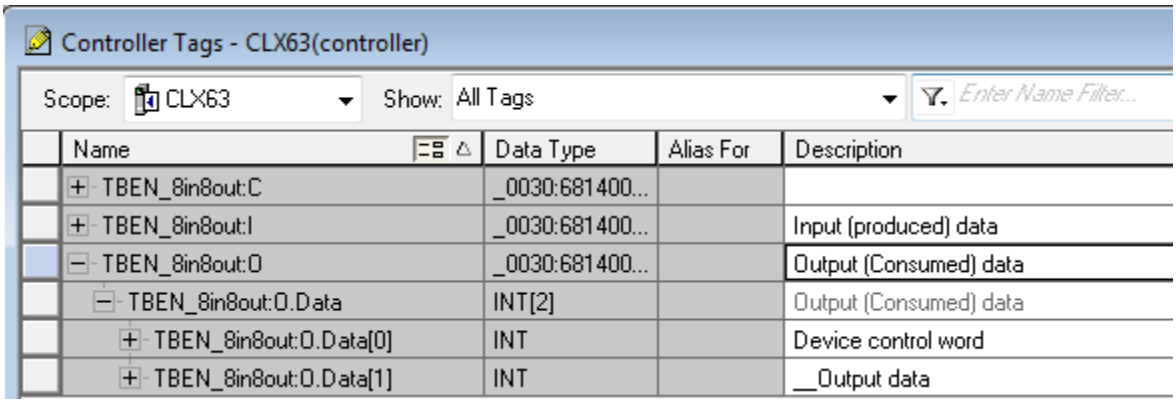
The new device, after being configured, is added to the Controller Organizer and associated input, output and configuration tags are created at the Controller Tags level.



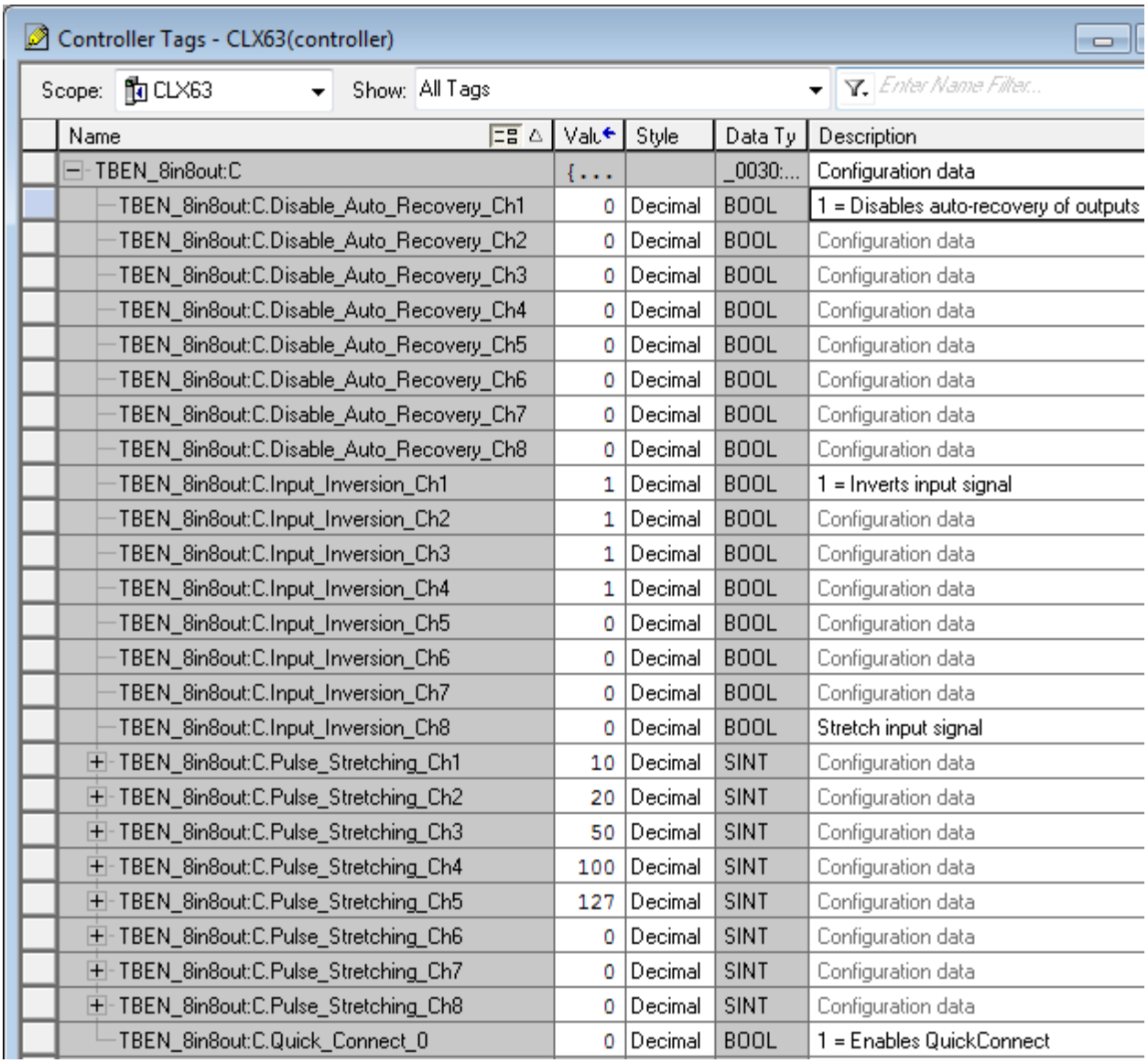
Input data tag content:
Device “Connection Faulted” flag is attached to the input data by the controller.



Output data tag content:



Configuration data tag content:



Name	Value	Style	Data Type	Description
TBEN_8in8out:C	{...}		_0030:...	Configuration data
TBEN_8in8out:C.Disable_Auto_Recovery_Ch1	0	Decimal	BOOL	1 = Disables auto-recovery of outputs
TBEN_8in8out:C.Disable_Auto_Recovery_Ch2	0	Decimal	BOOL	Configuration data
TBEN_8in8out:C.Disable_Auto_Recovery_Ch3	0	Decimal	BOOL	Configuration data
TBEN_8in8out:C.Disable_Auto_Recovery_Ch4	0	Decimal	BOOL	Configuration data
TBEN_8in8out:C.Disable_Auto_Recovery_Ch5	0	Decimal	BOOL	Configuration data
TBEN_8in8out:C.Disable_Auto_Recovery_Ch6	0	Decimal	BOOL	Configuration data
TBEN_8in8out:C.Disable_Auto_Recovery_Ch7	0	Decimal	BOOL	Configuration data
TBEN_8in8out:C.Disable_Auto_Recovery_Ch8	0	Decimal	BOOL	Configuration data
TBEN_8in8out:C.Input_Inversion_Ch1	1	Decimal	BOOL	1 = Inverts input signal
TBEN_8in8out:C.Input_Inversion_Ch2	1	Decimal	BOOL	Configuration data
TBEN_8in8out:C.Input_Inversion_Ch3	1	Decimal	BOOL	Configuration data
TBEN_8in8out:C.Input_Inversion_Ch4	1	Decimal	BOOL	Configuration data
TBEN_8in8out:C.Input_Inversion_Ch5	0	Decimal	BOOL	Configuration data
TBEN_8in8out:C.Input_Inversion_Ch6	0	Decimal	BOOL	Configuration data
TBEN_8in8out:C.Input_Inversion_Ch7	0	Decimal	BOOL	Configuration data
TBEN_8in8out:C.Input_Inversion_Ch8	0	Decimal	BOOL	Stretch input signal
TBEN_8in8out:C.Pulse_Stretching_Ch1	10	Decimal	SINT	Configuration data
TBEN_8in8out:C.Pulse_Stretching_Ch2	20	Decimal	SINT	Configuration data
TBEN_8in8out:C.Pulse_Stretching_Ch3	50	Decimal	SINT	Configuration data
TBEN_8in8out:C.Pulse_Stretching_Ch4	100	Decimal	SINT	Configuration data
TBEN_8in8out:C.Pulse_Stretching_Ch5	127	Decimal	SINT	Configuration data
TBEN_8in8out:C.Pulse_Stretching_Ch6	0	Decimal	SINT	Configuration data
TBEN_8in8out:C.Pulse_Stretching_Ch7	0	Decimal	SINT	Configuration data
TBEN_8in8out:C.Pulse_Stretching_Ch8	0	Decimal	SINT	Configuration data
TBEN_8in8out:C.Quick_Connect_0	0	Decimal	BOOL	1 = Enables QuickConnect

The device configuration data comes from the EDS file and consist of parameters that are read / write enabled. The controller must be in the program mode (off-line) to accept configuration modifications. The configuration changes must be downloaded to the controller and take effect on the next startup. Make sure to save any program changes.

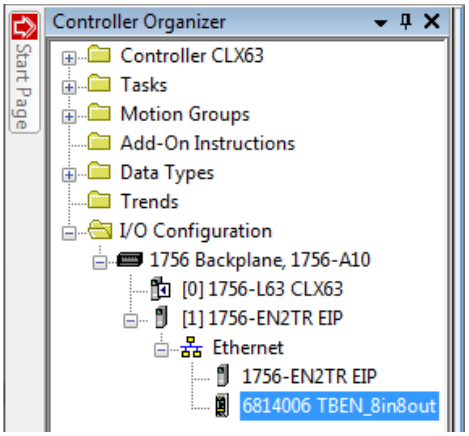
TBEN-LX Configuration Parameters

Item	Parameter name	Description
TBEN-LX-series: Digital Inputs		
Pulse_stretching Trigger to an internal TOF timer, (available for input channels only)	IStx	It is an input signal OFF timer. The time base is 10ms. For example a value of 10 means 100ms. Pulse stretching range [0-127]. The default value is 0 [Pulse stretching is disabled].
Input_Inversion	Inv.Ix	Inversion of input signal. A 0 means that an activated input (green LED on) is transmitted as a logical 1 in the process data. A 1 means that an activated input (green LED on) is transmitted as a logical 0 in the process data. The default value of the bit is 0.

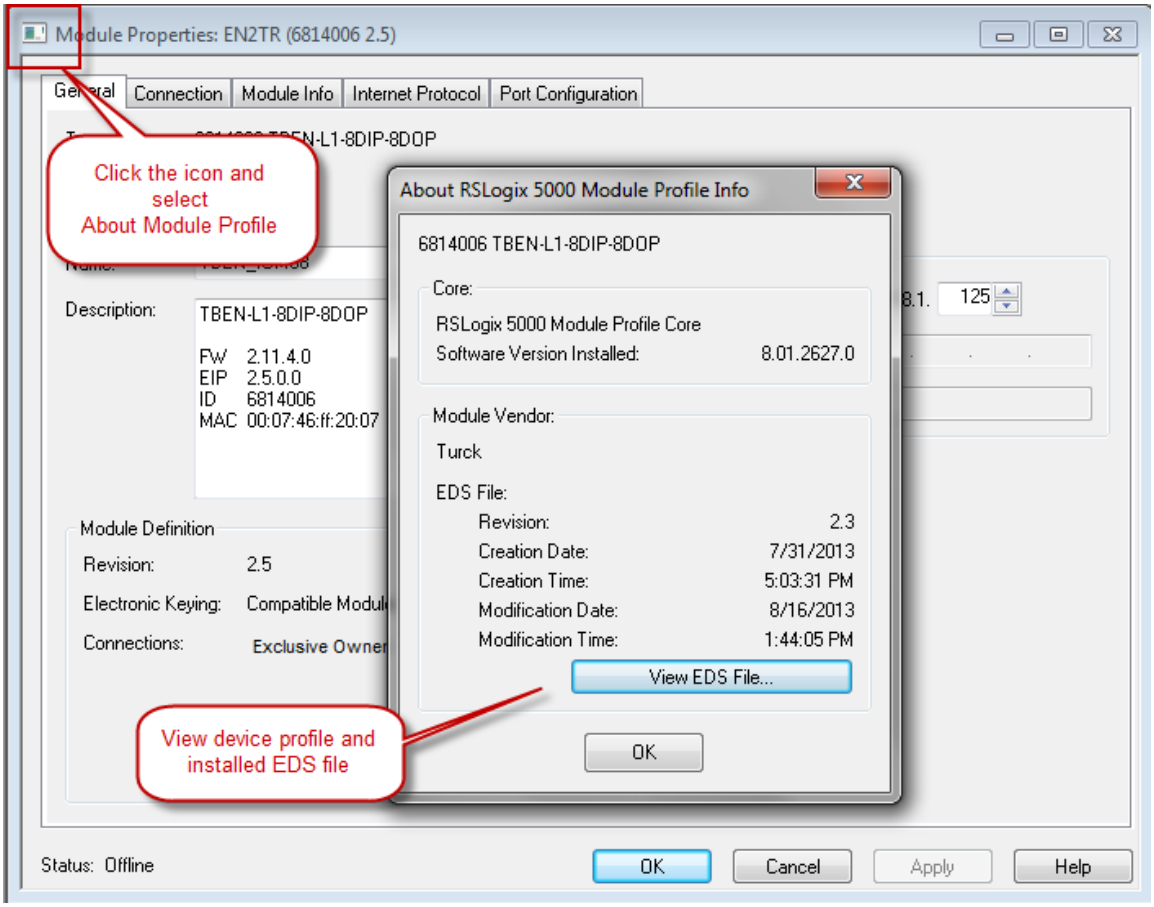
TBEN-LX-series: Digital Outputs		
Disable_Auto_Recovery Recovery mode of the outputs in case of short circuit	SROx	The corresponding parameter bits are named “SROx”. If the bit is zero the output is in “Automatic recovery mode” and the Output is directly set again after the overload condition is gone. If the SROx Bit is set to one the Output is in “Controlled recovery mode”. In this mode the PLC must switch the output off and on again to set the output. The default value of the bit is 0.
Output_Enable	Out Enable x	Only available on DXP devices. 0 = output driver is not be enabled. 1 = output driver is enabled The default value of the bit is 1.

TBEN-LX Profile Info

The device property is a subject to change. It also provides path to check installed EDS file: right-click on the device and select ***"Properties"***:



Click on marked icon and follow instructions:



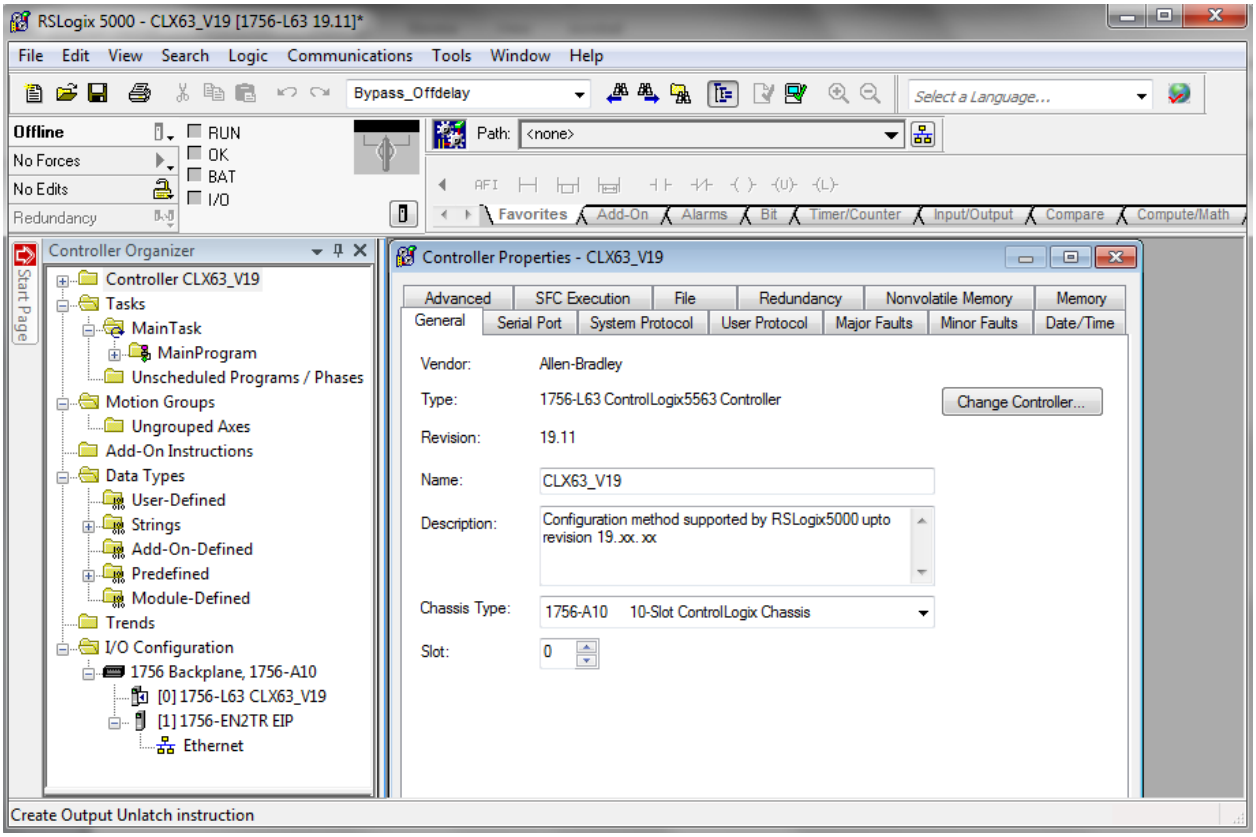
TBEN Configured as Ethernet Generic Device

Earlier versions of RSlogix5000 Programming Software and Logix controllers, revision 19 or less do not support EDS files. In such case, TBEN may be configured using Ethernet Generic profile. It generally creates input, output and configuration tags, once the device is configured. Configuration data support a single parameter. The device is implicitly configured using one of the following connections: Exclusive Owner, Input-Only or Listen-Only connection.

The TBEN device configuration procedure includes following steps:

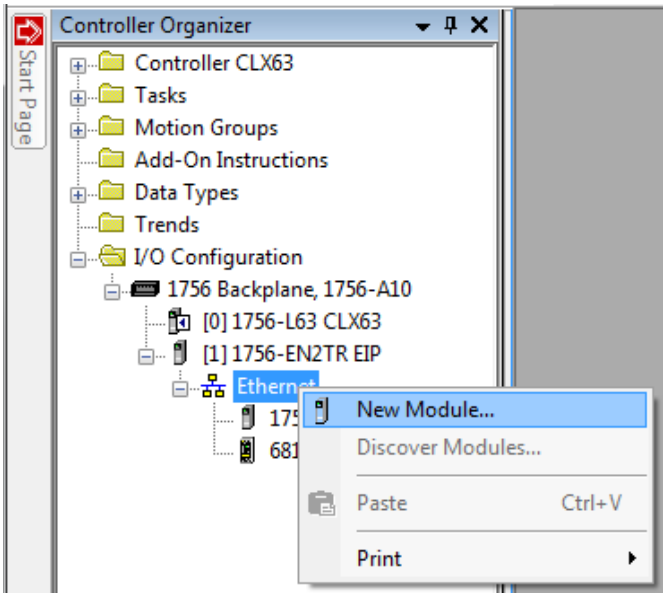
- Create RSLogix5000 project
- Add new device using Ethernet Generic device profile
- Configure connection data
- Review Input, Output and Configuration Data Tags

Create a New RSLogix5000 Project

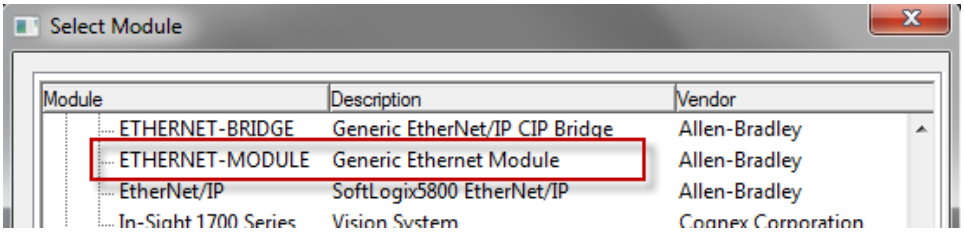


Add New Device

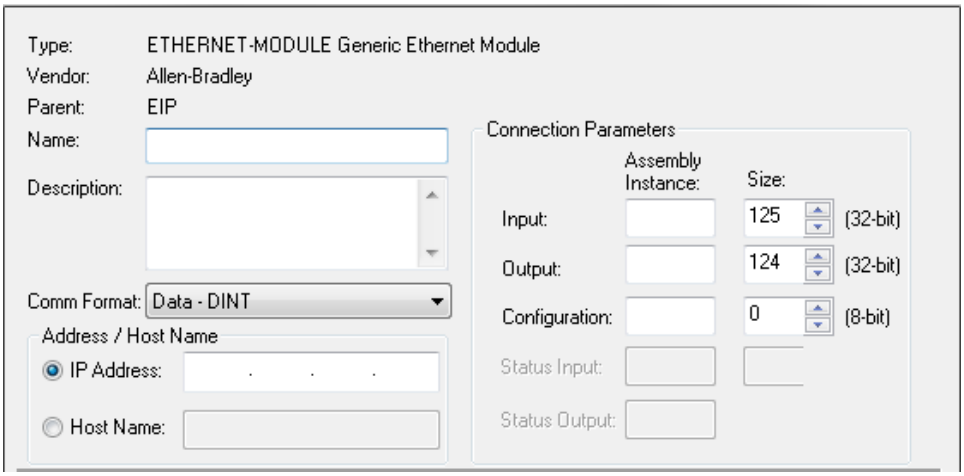
Right-click on the Ethernet to add new module:



Select “ETHERNET-MODULE” and click “OK”:



New device configuration page looks as follows:

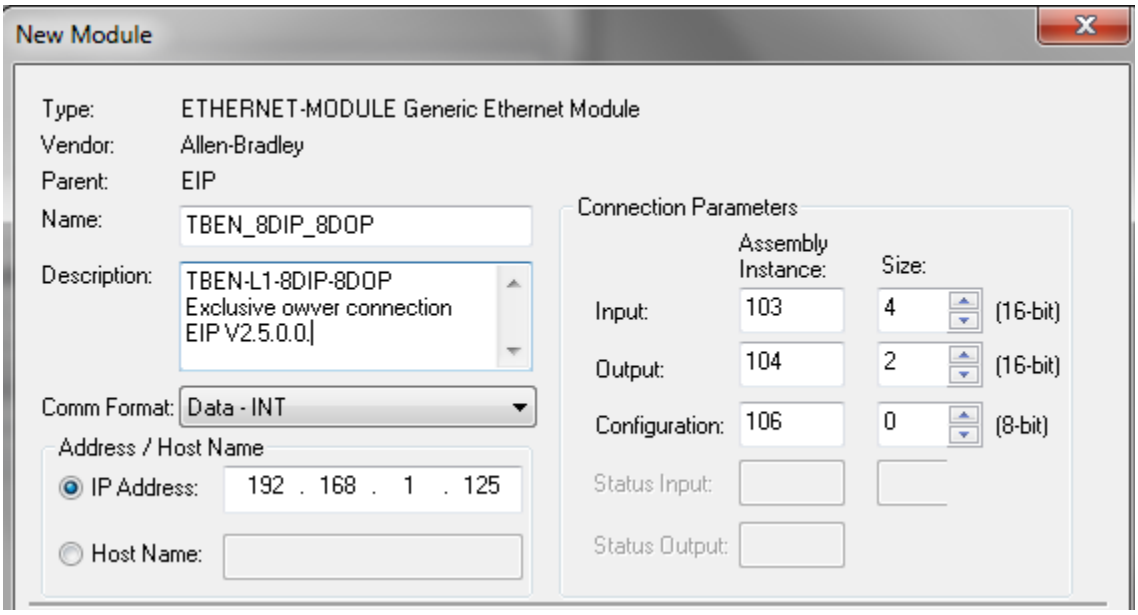


Configure New Device

TURCK devices are configured using Explicit Owner, Input-Only and Listen-Only connections.

Exclusive Owner Connection

The controller, who is “Exclusive Owner” of the device, is the only PLC able to control device outputs. The device may communicate with multiple PLC’s and provide input or explicit data. The “Exclusive Owner” connection is implicitly used when following parameters are entered:



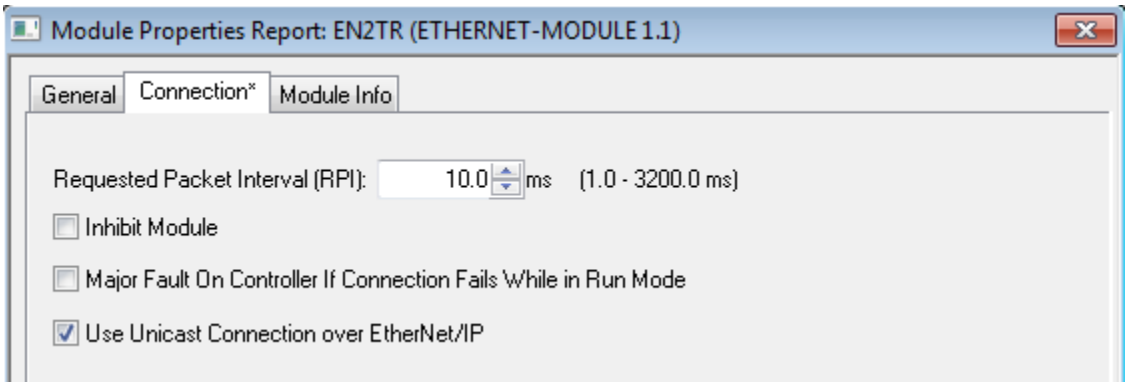
The device is implicitly configured with the controller using “Exclusive Owner” connection. It is default connection and only one that supports configuration assembly data.

Table 2.1 contains assembly instance and data size information for the TBEN-LX product family. The configuration assembly data is pushed to the device during the communication startup (a Forward Open request).

Exclusive Owner connection	Input assembly instance	Input size	Output assembly instance	Output size	Configuration assembly instance	Configuration size
TBEN-LX-16DIP	103	4	104	1	106	0
TBEN-LX-16DOP	103	4	104	2	106	0
TBEN-LX-16DXP	103	5	104	2	106	0
TBEN-LX-8DIP-DOP	103	4	104	2	106	0

Table 2.1 – Exclusive Owner configuration data

Configure connection data according to the project requirements:



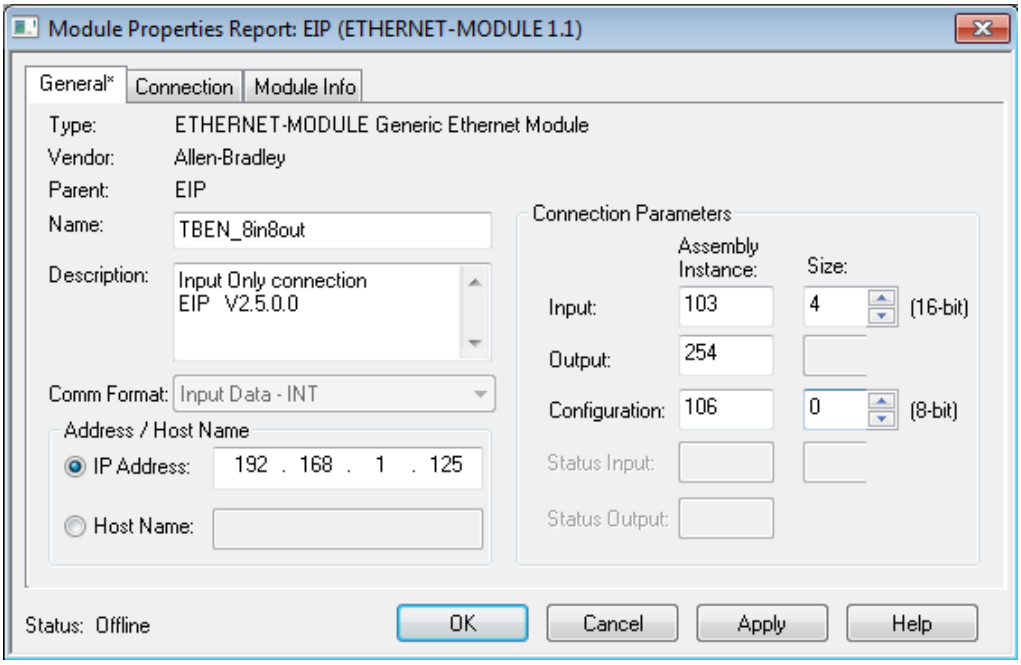
Input-Only Connection

Input-Only connection is used to configure TBEN when:

- It is already configured with another PLC as Exclusive Owner, and you are configuring device with the second PLC to receive input data only. In such case, the device is configured with the same RPI and Multicast transmission with both PLCs.
- PLCs may reside on different subnets, VLANs, when infrastructure is available.

Enter following data and click OK:

- Name
- CommFormat field : **Input Data – INT**
- IP address

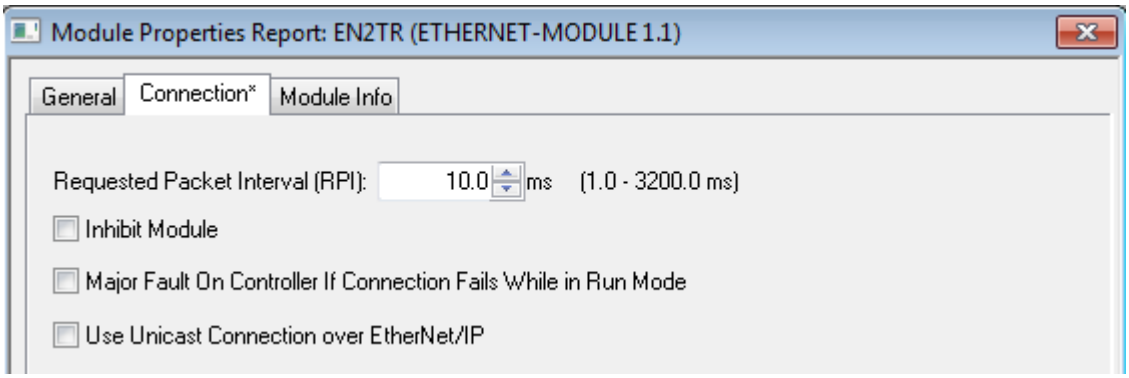


The device is implicitly configured with the controller using “Input-Only” connection. Table 2.2 contains assembly instance and data size information for the TBEN-LX product family.

Exclusive Owner connection	Input assembly instance	Input size	Output assembly instance	Output size	Configuration assembly instance	Configuration size
TBEN-LX-16DIP	103	4	254	n/a	106	0
TBEN-LX-16DOP	103	4	254	n/a	106	0
TBEN-LX-16DXP	103	5	254	n/a	106	0
TBEN-LX-8DIP-DOP	103	4	254	n/a	106	0

Table 2.2 – Input-Only configuration data

Note: If multiple connections to the device are used, then use the same RPI and Multicast



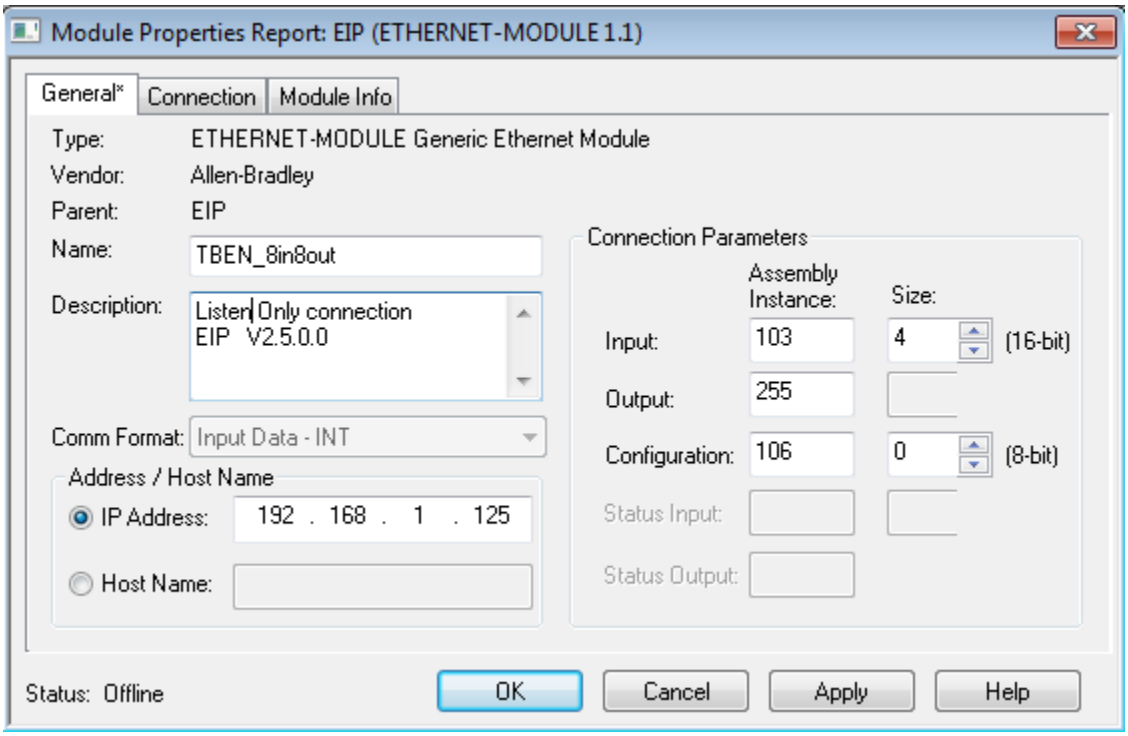
Listen-Only Connection Configuration

Listen-Only connection is used to configure a device when:

- It is configured with multiple PLCs (max three) where only one is Exclusive Owner
- Other PLCs get input data only. They drop connection if exclusive owner is closed
- PLCs have to be set to the same RPI and must use MULTICAST messaging. PLCs may reside on different subnets, VLANs, when infrastructure is available.

Enter following data and click OK:

- Name
- CommFormat field : **Input Data – INT**
- IP address

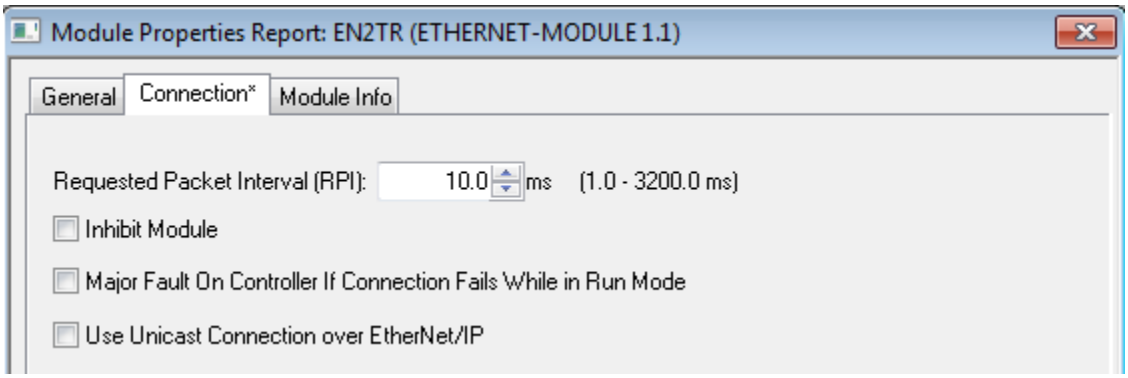


The device is implicitly configured with the controller using “Input-Only” connection. Table 2.3 contains assembly instance and data size information for the TBEN-LX product family

Exclusive Owner connection	Input assembly instance	Input size	Output assembly instance	Output size	Configuration assembly instance	Configuration size
TBEN-LX-16DIP	103	4	255	n/a	106	0
TBEN-LX-16DOP	103	4	255	n/a	106	0
TBEN-LX-16DXP	103	5	255	n/a	106	0
TBEN-LX-8DIP-DOP	103	4	255	n/a	106	0

Table 2.3 – Listen-Only configuration data

Note: If multiple connections to the device are used, then use the same RPI and Multicast.


Module Properties Report: EN2TR (ETHERNET-MODULE 1.1)
General
Connection*
Module Info
Requested Packet Interval (RPI):
10.0
ms
(1.0 - 3200.0 ms)
Inhibit Module
Major Fault On Controller If Connection Fails While in Run Mode
Use Unicast Connection over EtherNet/IP

Configuration Assembly Data Structure

The device Configuration data resides in a PLC. PLC pushes configuration to the device during the Forward Open request. That occurs every time when the device is connected, or power re-set or replaced with the same model. The Configuration assembly maintains consistency of the device configuration for as long as a control system stays the same.

The structure of the configuration data is different for each TBEN-LX device, as follows:

TBEN-LX-8DIP-8DOP								
	Bit7	BIt6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0	Reserved							
Byte1								
Byte2								
Byte3								
Byte4								
Byte5								
Byte6								
Byte7								
Byte8								
Byte9	Reserved							QC
Byte10	INV 8	INV 7	INV 6	INV 5	INV 4	INV 3	INV 2	INV 1
Byte11	SRO 8	SRO 7	SRO 6	SRO 5	SRO 4	SRO 3	SRO 2	SRO 1
Byte12	Reserved							
Byte13								
Byte14								
Byte15	ISt1							
Byte16	ISt2							
Byte17	ISt3							
Byte18	ISt4							
Byte19	ISt5							
Byte20	ISt6							
Byte21	ISt7							
Byte22	ISt8							
Byte23-45	Reserved							

Table 2.4 – TBEN-LX-8DIP-8DOP configuration data

Abbreviations:

- QC Quick Connect
- INVx Input Inversion
- SROx Output Short Recovery
- IStx Input pulse stretching
- OE Output enable

TBEN-LX-16DIP								
	Bit7	BIt6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0	Reserved							
Byte1								
Byte2								
Byte3								
Byte4								
Byte5								
Byte6								
Byte7								
Byte8								
Byte9	Reserved							QC
Byte10	Reserved							
Byte11								
Byte12	INV 8	INV 7	INV 6	INV 5	INV 4	INV 3	INV 2	INV 1
Byte13	INV 16	INV 15	INV 14	INV 13	INV 12	INV 11	INV 10	INV 9
Byte14	Reserved							
Byte15	ISt1							
Byte16	ISt2							
Byte17	ISt3							
Byte18	ISt4							
Byte19	ISt5							
Byte20	ISt6							
Byte21	ISt7							
Byte22	ISt8							
Byte23	ISt9							
Byte24	ISt10							
Byte25	ISt11							
Byte26	ISt12							
Byte27	ISt13							
Byte28	ISt14							
Byte29	ISt15							
Byte30	ISt16							
Byte31-45	Reserved							

Table 2.5 – TBEN-LX-16DIP configuration data

TBEN-LX-16DXP								
	Bit7	BIt6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0	Reserved							
Byte1								
Byte2								
Byte3								
Byte4								
Byte5								
Byte6								
Byte7								
Byte8								
Byte9	Reserved							QC
Byte10	Reserved							
Byte11								
Byte12	INV 8	INV 7	INV 6	INV 5	INV 4	INV 3	INV 2	INV 1
Byte13	INV 16	INV 15	INV 14	INV 13	INV 12	INV 11	INV 10	INV 9
Byte14	SRO 8	SRO 7	SRO 6	SRO 5	SRO 4	SRO 3	SRO 2	SRO 1
Byte15	SRO 16	SRO 15	SRO 14	SRO 13	SRO 12	SRO 11	SRO10	SRO 9
Byte16	OE 8	OE 7	OE 6	OE 5	OE 4	OE 3	OE 2	OE 1
Byte17	OE 16	OE 15	OE 14	OE 13	OE 12	OE 11	OE 10	OE 9
Byte18	Reserved							
Byte19	ISt1							
Byte20	ISt2							
Byte21	ISt3							
Byte22	ISt4							
Byte23	ISt5							
Byte24	ISt6							
Byte25	ISt7							
Byte26	ISt8							
Byte27	ISt9							
Byte28	ISt10							
Byte29	ISt11							
Byte30	ISt12							
Byte31	ISt13							
Byte32	ISt14							
Byte33	ISt15							
Byte34	ISt16							
Byte35-45	Reserved							

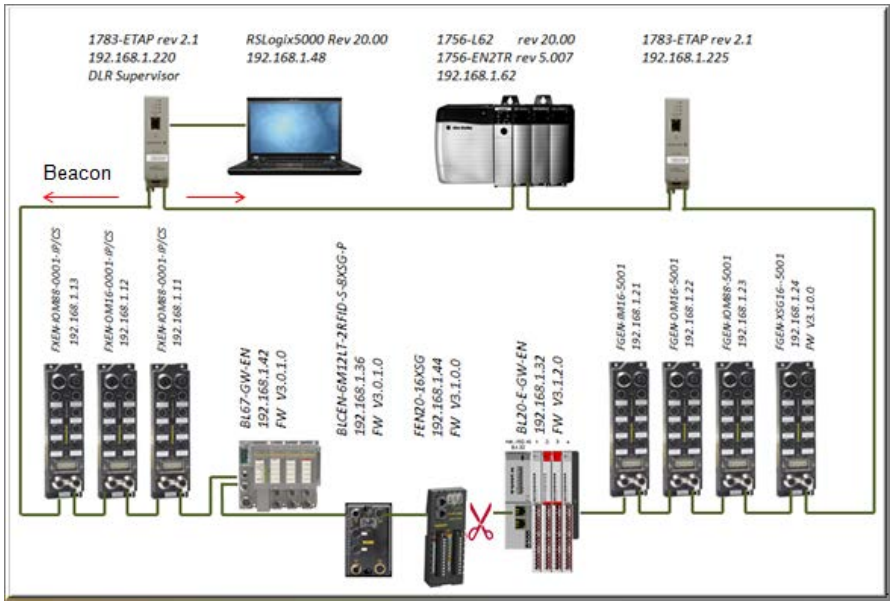
Table 2.6 – TBEN-LX-16DXP configuration data

TBEN-LX-16DOP								
	Bit7	BIt6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0	Reserved							
Byte1								
Byte2								
Byte3								
Byte4								
Byte5								
Byte6								
Byte7								
Byte8								
Byte9	Reserved							QC
Byte10	SRO 8	SRO 7	SRO 6	SRO 5	SRO 4	SRO 3	SRO 2	SRO 1
Byte11	SRO 16	SRO 15	SRO 14	SRO 13	SRO 12	SRO 11	SRO10	SRO 9
Byte12	Reserved							
Byte13								
Byte14-45	Reserved							

Table 2.7 – TBEN-LX-16DOP configuration data

TBEN and DLR Network

A Device Level Ring (DLR) network is the EtherNet/IP network capable of fast recovery and uninterrupted service in case of a single break point in network topology. It consists of a ring supervisor and ring nodes connected in closed loop, i.e. ring topology. The ring supervisor maintains DLR protocol, performs fast fault detection and reconfiguration of the network architecture into a linear in less than 3msec for 50 node network.
A DLR device must have embedded switching technology and support for DLR protocol. The device is configured as previously described: using EDS file or as Ethernet Generic device. External switches are not required. Following image illustrates a simple ring network:



TBEN-LX DLR Features

TBEN-LX series is designed to meet DLR network requirements including:

- Compliance with the DLR and QoS Object Specification, *Volume 2: EtherNet/IP Adaptation of CIP, Chapter 5: Object library, Edition 1.10*
- Integrated embedded switching technology that supports two external and an internal Ethernet ports with following features:
  - Auto-negotiation, with 10/100Mbps, full/half duplex
  - Forced setting of speed/duplex
  - Turn off flow control on ring ports;
  - Auto MDIX (medium dependent interface crossover), in both auto-negotiate and forced speed/duplex modes.
- Fault detection in the ring topology on either Ethernet ports to the left or right of the breaking point and error reporting to the supervisor

TBEN and QC Startup

The Quick Connect (QC) provides high device availability during startup of EtherNet/IP network. Typical application where it is implemented is a frequent robot tool exchange along assembly lines in the automotive industry, Figure 1.

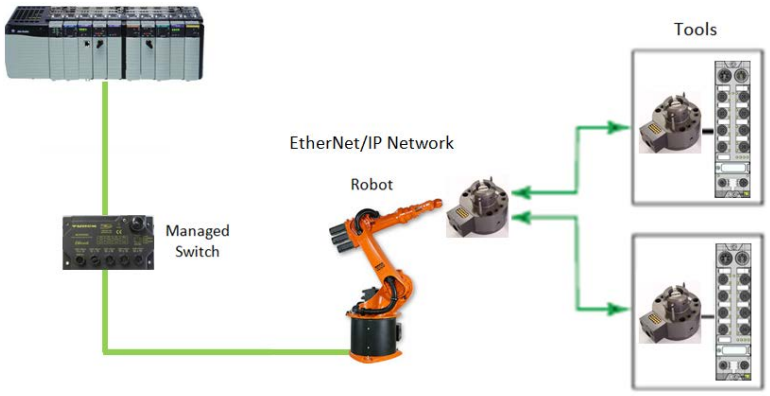


Figure 1: Tool exchange

When new tool is engaged and locked into the robot arm, it generates a high lock signal to the Logix controller which starts the QC allocation sequence. The QC sequence has to be complete in less than 350msec. The QC is supported by Logix controllers revision 20.00.00 and above.

The Quick Connect Sequence

Following sequence of events describe Quick Connect application:

- The Logix controller inhibits current QC modules and turns power OFF
- The robot arm physically disengages a tool
- The robot arm physically attaches a new tool that has one or more QC modules mounted on the tool
- The robot acknowledges successful attachment of a tool with appropriate lock signal
- The Logix controller turns power ON to the QC modules when lock signal is received
- The Logix controller waits for QC devices to complete self powerup initialization before it uninhibits device
- The robot is ready for operation when connections with device are established

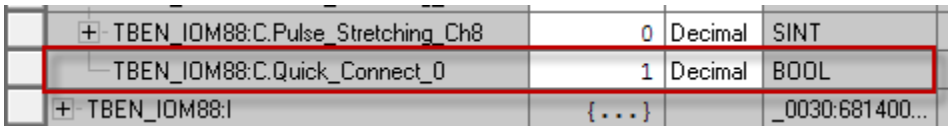
Ethernet Port Setup

When QC is enabled, Ethernet ports are set as follows:

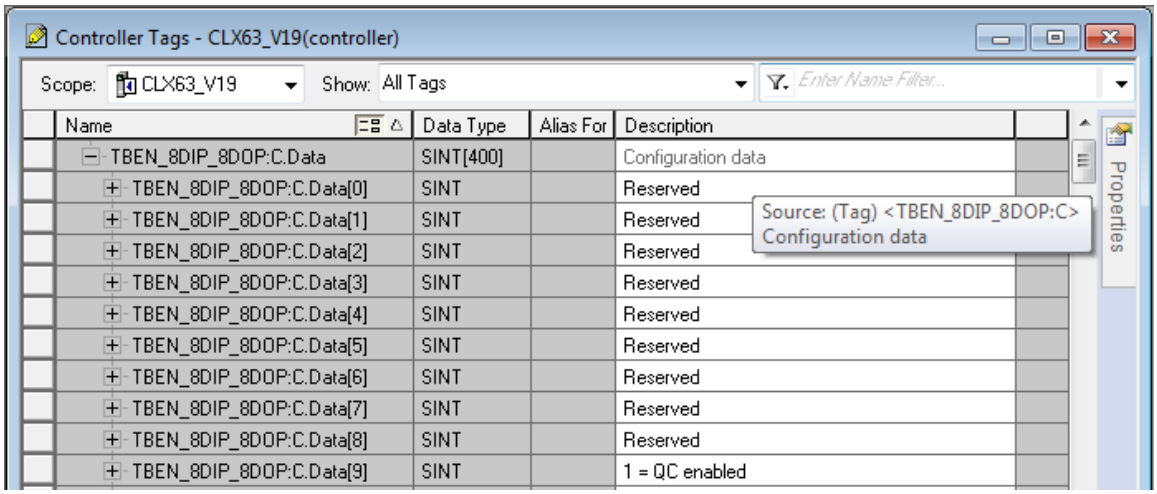
Ports	Autonegotiate	Mode	Force speed/duplex	Speed	Duplex
Eth1	Disabled	MDI	Enabled	100	Full
Eth2	Disabled	MDIX	Enabled	100	Full

Enable QC

- If TBEN is configured using EDS file, set QC parameter to 1



- If TBEN is configured as Ethernet Generic module, set "… C:Data[9]:= 1"



- Download configuration to the PLC and connect the gateway
- QC mode will be executed during the next gateway power-up and subsequent power cycles

Disable QC

- If TBEN is configured using EDS file, reset QC parameter to 0, or
- Clear QC flag of the configuration assembly "… C:Data[9]:= 0"
- Download configuration to the PLC and connect the gateway
- Standard mode is executed on the next and subsequent power cycles of the gateway

Reset to Factory Default

An alternative way to reset QC port setup is to reset device to factory default:

- Set the rotary switches to 900 and cycle power to the module
- Set the rotary switches to 100 and cycle power to the module
- The module is reset to factory default settings and
  - IP address 192.168.1.100
  - Mask 255.255.255.0
  - Gateway 192.168.1.1

QC Startup Time

The startup time is 100msec.