



LinMot[®]



**MC-Link with
Ethernet/IP Interface
User Manual**



This document applies to the following controllers:
B8050-ML-IP

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1 System overview

The LinMot Ethernet/IP controllers have the following functionalities:

Device Property	Value / Remark
Minimal Ethernet/IP cycle time	2 ms
DHCP -Support	Supported
EDS Support	Not yet supported from AB
IEEE1588 (CIP-Synch)	For 3 rd parties not supported from AB
DLR Support (Device Level Ring Protocol)	No

Ethernet/IP is a real time Ethernet protocol based on the standard Ethernet protocols TCP/IP and UDP/IP.

For further information on Ethernet/IP please visit: <http://www.odva.org>

1.1 References

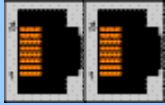
All User Manuals are distributed with the LinMot-Talk configuration software the newest version could be downloaded from the LinMot homepage in the download section.

Ref	Title	Source
1	User Manual Motion Control SW	www.linmot.com
2	LinMot Drive Configuration over Fieldbus Interfaces SG4	www.linmot.com
3	Usermanual_MC_Link_with_Ethernet_IP_SG5.pdf	www.linmot.com

2 Connecting to the Ethernet/IP Network


2.1 Pin Assignment of the Connectors X17-X18

The Ethernet/IP connector is a standard RJ45 female connector with a pin assignment as defined by EIA/TIA T568B:

X17 – X18		RealTime Ethernet Connector	
	Pin	Wire color code	Assignment 100BASE-TX
	1	WHT/ORG	Rx+
	2	ORG	Rx-
	3	WHT/GRN	Tx+
	4	BLU	-
	5	WHT/BLU	-
	6	GRN	Tx-
	7	WHT/BRN	-
	8	BRN	-
case	-	-	
RJ-45	Use standard patch cables (twisted pair, S/UTP, AWG26) for wiring. This type of cable is usually referred to as a "Cat5e-Cable".		

2.2 Default IP Address Settings

The default IP address is 192.168.001.xxx where the last byte xxx is defined via the two Hex-Switches S1 and S2, where S1 sets the high digit and S2 the low digit.

S1, S2:	IP Selectors	
	S1	Bus ID High (0h...Fh)
	S2	Bus ID Low (0h...Fh)



IMPORTANT: The switch position S1 = S2 = 0 (factory default setting) defines acquiring IP address via DHCP.

3 Setup in the PLC

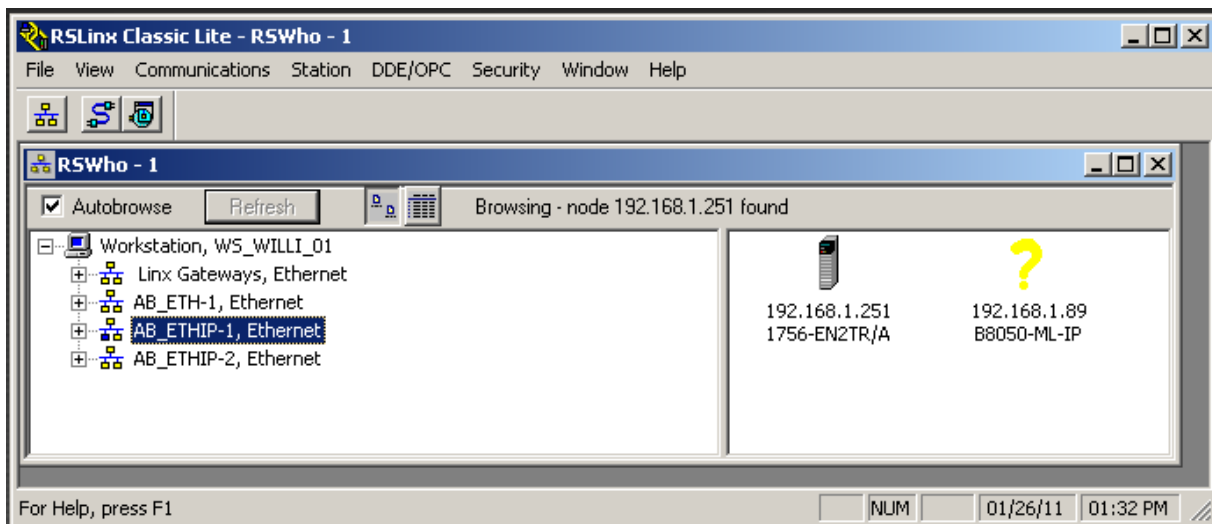


IMPORTANT: Use only AB PLC firmware 18.0 or higher!

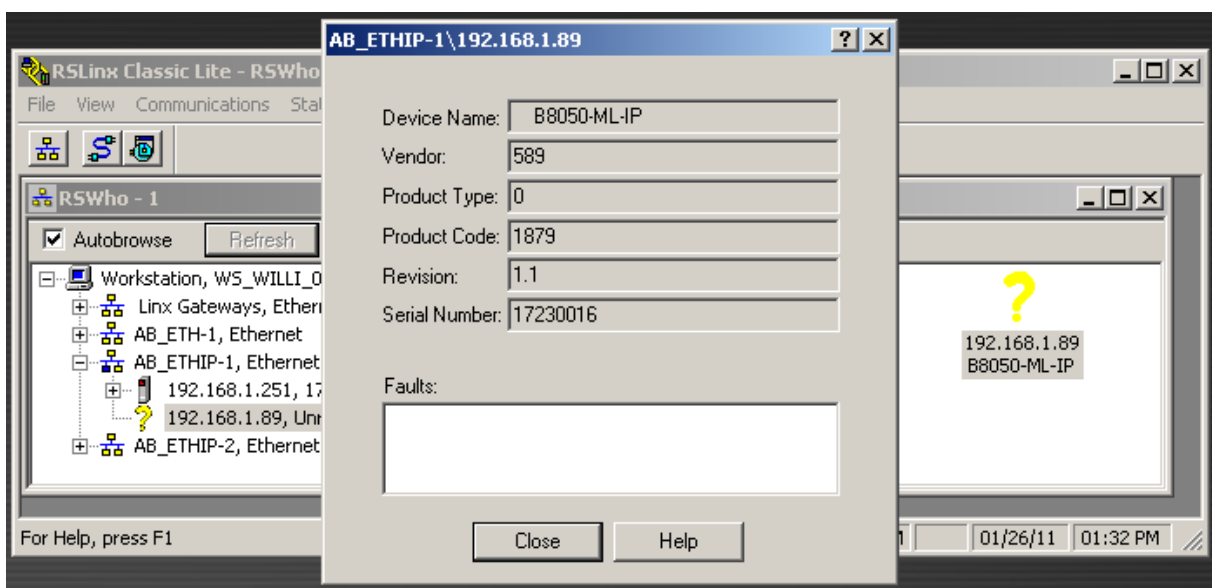
The following steps describe the integration of a LinMot Ethernet/IP controller in the PLC. In the example an Allen Bradley master PLC is used. RSLinx tool can only be used to see if the device is on the network and under which IP-address it can be accessed. The whole configuration is done in the PLC, which is described in Chapter 3.2.

3.1 RSLinx Classic

In the RSLinx the LinMot device should occur under the defined IP address as “Unrecognized Device” B8050-ML-IP



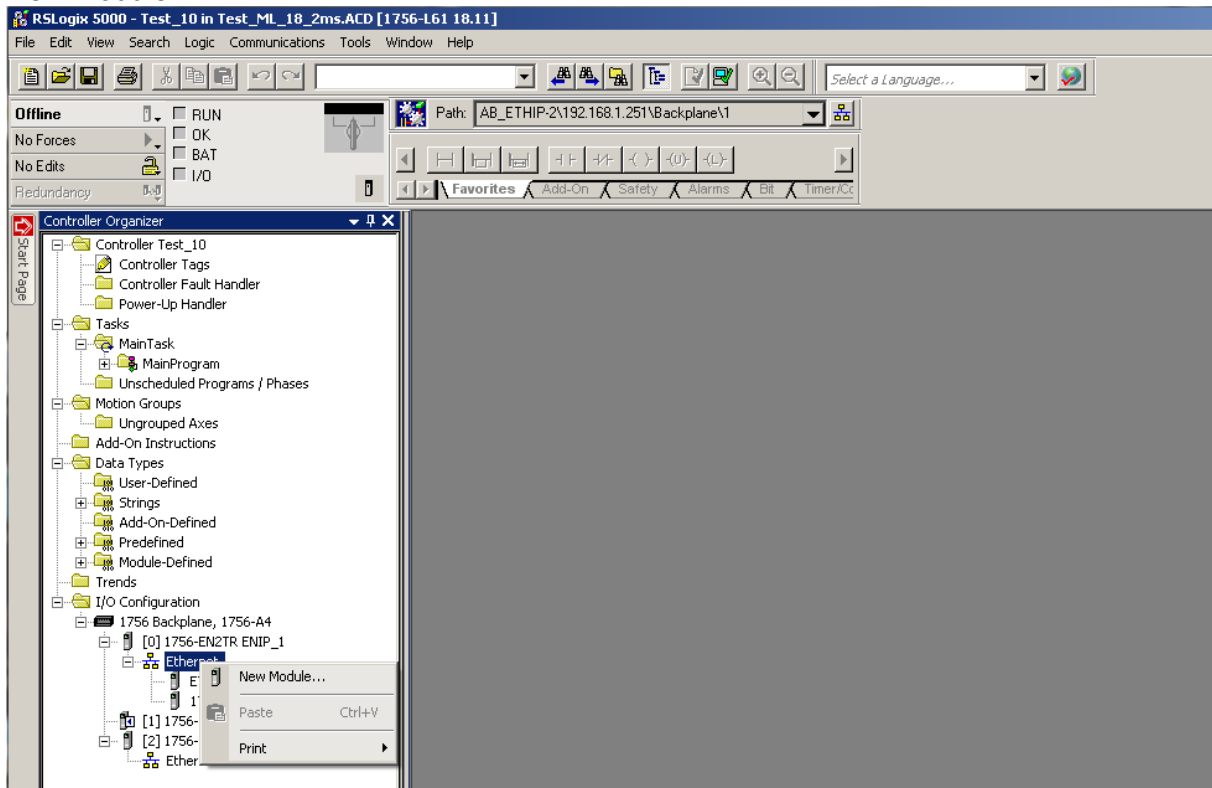
LinMot device with the IP address 192.168.1.89 in the RSLinx tool



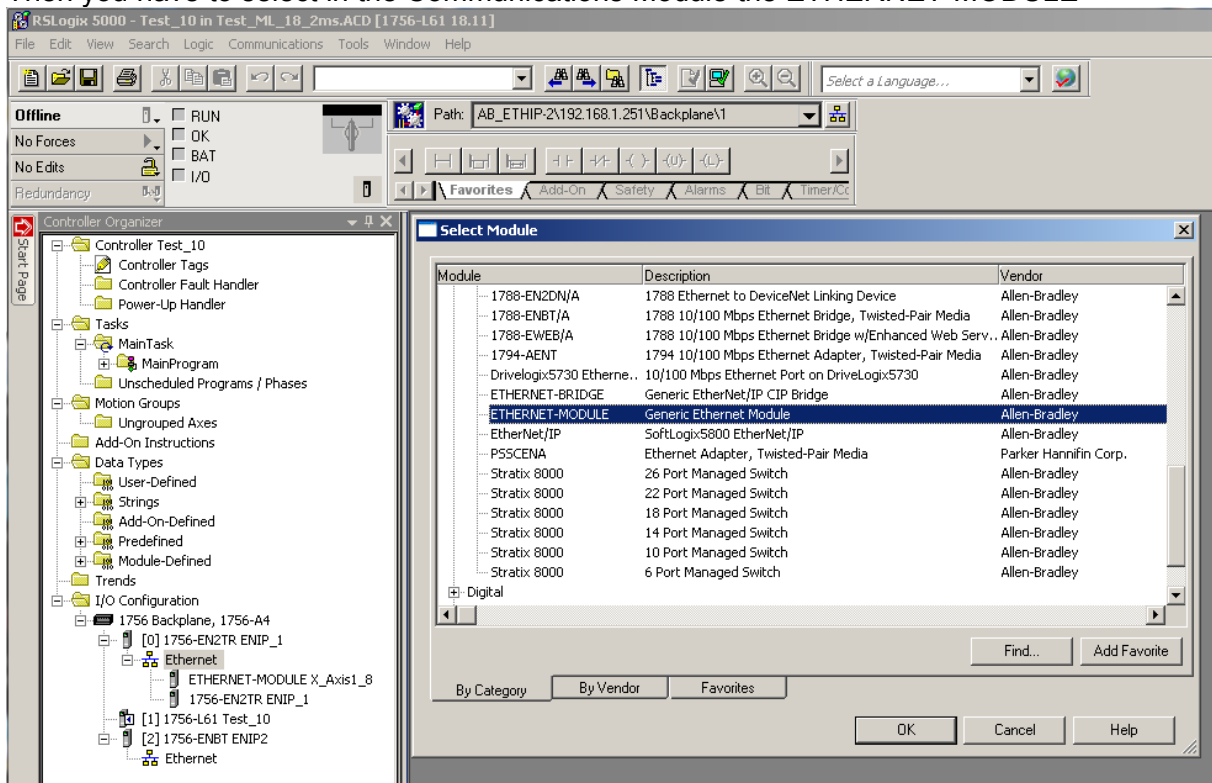
LinMot device properties

3.2 LinMot Configuration in the PLC

The LinMot can be configured in the I/O configuration section, in the Ethernet section as a New Module



Then you have to select in the Communications Module the ETHERNET-MODULE



Under the Module Properties you can define the module specific data:

- Name
- Comm Format in the example a 16 bit Format is chosen!
- IP Address
- Input Assembly instance and size
- Output Assembly Instance and size

Be careful defining these parameters, because only a correct setting will run in the in the Ethernet/IP network. Only the name can be defined freely.

The screenshot shows the 'Module Properties: ENIP_1 (ETHERNET-MODULE 1.1)' dialog box. The 'General' tab is selected. The fields are as follows:

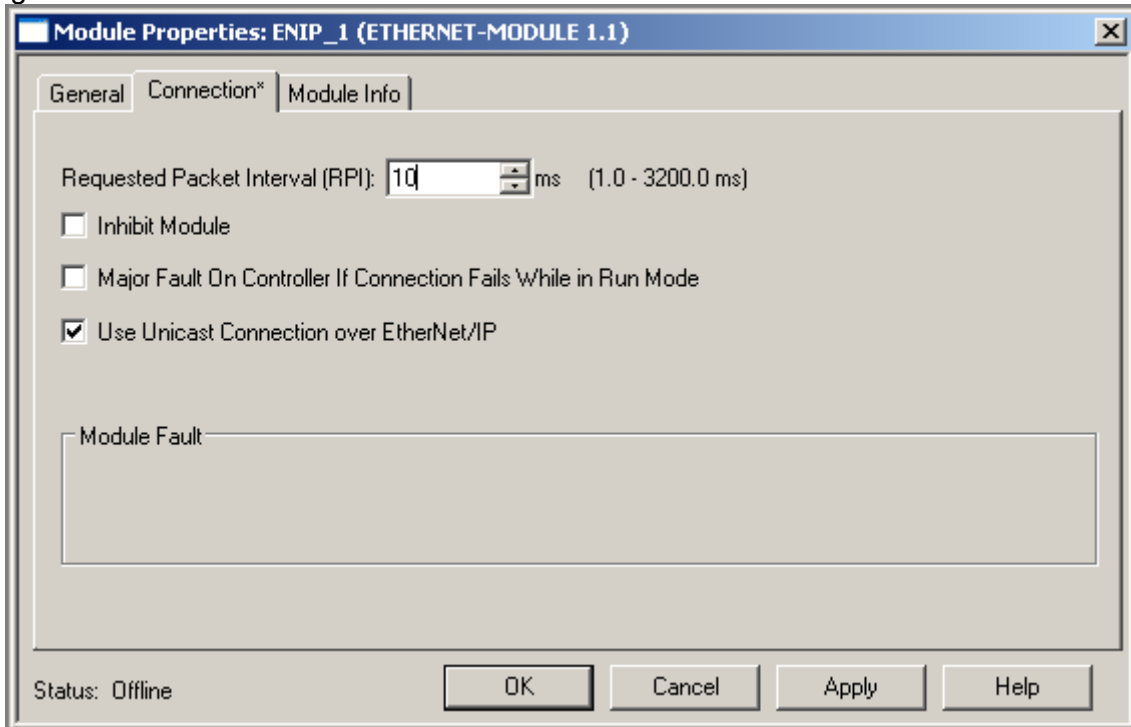
Field	Value
Type	ETHERNET-MODULE Generic Ethernet Module
Vendor	Allen-Bradley
Parent	ENIP_1
Name	X_Axis1_8
Description	
Comm Format	Data - INT
Address / Host Name	IP Address: 192 . 168 . 1 . 89

The 'Connection Parameters' section is also visible, showing the following settings:

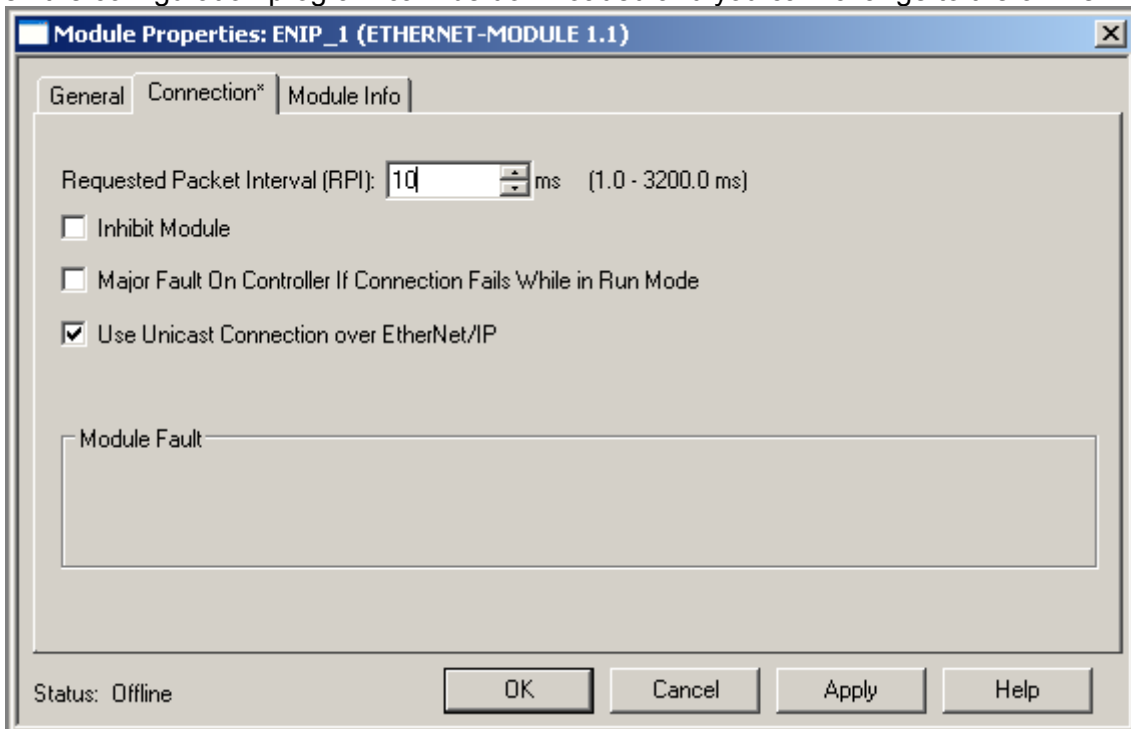
Parameter	Assembly Instance	Size	Bit Size
Input	18	104	(16-bit)
Output	28	128	(16-bit)
Configuration	1	0	(8-bit)
Status Input			
Status Output			

At the bottom, the status is 'Offline' and there are buttons for 'OK', 'Cancel', 'Apply', and 'Help'.

In the Connection Tab of the Module Properties the desired cycle time is specified in the range between 2ms and 3200ms.

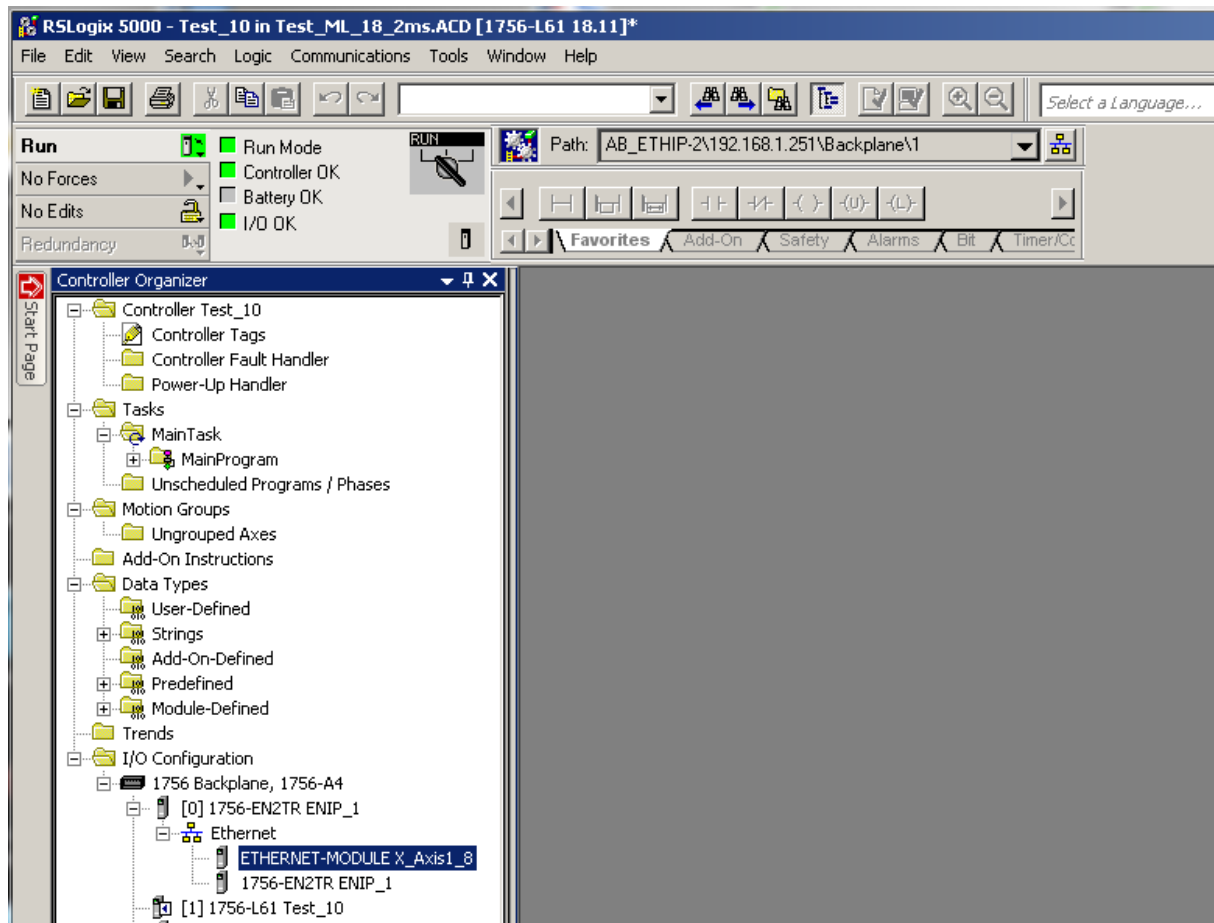


Then the configuration/program can be downloaded and you can change to the online view.



It is recommended to use Unicast Connection type, with this type no problems were known.

If all was set up correctly the LinMot module status should be running



The screenshot shows the LinMot-Talk 4.2 software interface. The left pane displays a project tree for 'Unnamed on CDM3 (DEVELOPER)'. The right pane shows a table of connection state variables.

Name	Value	RawData	UPID
Connection State	Established	3	2360h
Originator IP Address	192.168. 1.251		2361h
O -> T Connection Type	Point to Point	2	2390h
O -> T Assembly Instance	1Ch	28	2374h
O -> T API	10 ms	10000	2370h
O -> T Timeout	160 ms	160000	2373h
O -> T Size	262	262	2371h
O -> T Sequence Number	9375	9375	2372h
T -> O Connection Type	Point to Point	2	23A0h
T -> O Assembly Instance	12h	18	2384h
T -> O API	10 ms	10000	2380h
T -> O Size	210	210	2381h
T -> O Sequence Number	9397	9397	2382h
O -> T Cycle Time	9995.4 us	99954	2398h
Minimal O -> T Cycle Time	9843.2 us	98432	2399h
Maximal O -> T Cycle Time	10203.1 us	102031	239Ah

In The LinMot-Talk configuration software the Ethernet/IP connection state can be watched under variables\Ethernet/IP:O ->T, T-> O config. If everything was set up correctly, the connection state should change to established when powered on after a certain time. In this state both counters O → T and T → O should count up depending on the configured period time.

4 Ethernet/IP Parameters

4.1 Parameters

The Ethernet/IP interface has an additional parameter tree branch (Parameters → Ethernet/IP Intf), which can be configured with the distributed LinMot-Talk software. With these parameters, the Ethernet/IP communication parameters can be configured. The LinMot-Talk software can be downloaded from <http://www.linmot.com> under the section download, software & manuals.

Ethernet/IP Intf\ Dis-/Enable

With the Dis-/Enable parameter the LinMot controller can be run without the Ethernet Ethernet/IP interface going online. So in a first step the system can be configured and run without any bus connection.

Ethernet/IP\ Dis-/Enable	
Disable	The controller runs without Ethernet/IP.
Enable	The controller runs with Ethernet/IP connection.



IMPORTANT: If the Ethernet/IP interface is disabled, the integrated Ethernet/IP switch is not powered! No messages will be sent to other devices connected to the Ethernet-Network via the LinMot controller.

Ethernet/IP Intf\Ethernet Configuration\ IP Configuration Mode

This parameter defines how the IP address is assigned.

Ethernet/IP Intf\Ethernet Configuration\ IP configuration Mode	
DHCP	IP address is acquired via DHCP mechanism.
Static by IP Configuration	IP address is defined with parameters only.
Static with Hex Switches S1 and S2 (DHCP)	IP address is defined with parameters and the last byte is defined with the value of the HEX switches S1 and S2. The default IP address setting is 192.168.001.xxx (xxx stands for the value of the Hex switches S1 and S2)



IMPORTANT: The Switch value **S1 = 0** and **S2 = 0** (factory default setting) acquiring IP address via **DHCP** is activated instead.

Ethernet/IP Int\Ethernet Configuration\ IP Configuration

In this section the parameters for the IP address netmask, default gateway and multicast IP address are located.

Ethernet/IP Int\Ethernet Configuration\ IP Configuration	
IP address 1st Byte	Highest byte of IP address
IP address 2nd Byte	Mid high byte of IP address
IP address 3rd Byte	Mid low byte of IP address
IP address 4th Byte	Lowest byte of IP address
Netmask 1st Byte	Highest byte of Netmask
Netmask 2nd Byte	Mid high byte of Netmask
Netmask 3rd Byte	Mid low byte of Netmask
Netmask 4th Byte	Lowest byte of Netmask
Default Gateway 1st Byte	Highest byte of Default Gateway
Default Gateway 2nd Byte	Mid high byte of Default Gateway
Default Gateway 3rd Byte	Mid low byte of Default Gateway
Default Gateway 4th Byte	Lowest byte of Default Gateway

5 Realtime IO Data Mapping

For each axis a container of data is exchanged which allows to control the axis and even to configure it over the exchanged real time data.

5.1 O ->T and T->O Mapping With Configuration Module

With this real time IO configuration, an additional configuration module is mapped into the IO data communication. The functionality of this module is same for the different fieldbus interfaces. For this reason, the functionality is described in documentation [2] "Drive Configuration over Fieldbus".

5.1.1 O → T Mapping of one axis

In this real time IO Mapping the 16 bit control word the 16 bit motion command header and motion command parameters are exchanged. The size of this mapping is 32 bytes or **16 words** for each configured axis.

O-> T Data Mapping of one axis		
Byte Offset	Description	Size / Type
00h	MC SW ControlWord	Uint16 / Bit coded
02h	MC SW MotionCommandHeader	Uint16 / 12Bit Command 4Bit count nibble
04h	MC SW MotionCommandPar Bytes 00..03	Uint32 / Command specific
08h	MC SW MotionCommandPar Bytes 04..07	Uint32 / Command specific
0Ch	MC SW MotionCommandPar Bytes 08..11	Uint32 / Command specific
10h	MC SW MotionCommandPar Bytes 12..15	Uint32 / Command specific
14h	MC SW MotionCommandPar Bytes 16..19	Uint32 / Command specific
18h	Cfg Module Control Word	Uint16
1Ah	Cfg Module Index/..	Uint16
2Ch	Cfg Module Value/..	Uint32/Sint32

5.1.2 T → O Mapping of one axis

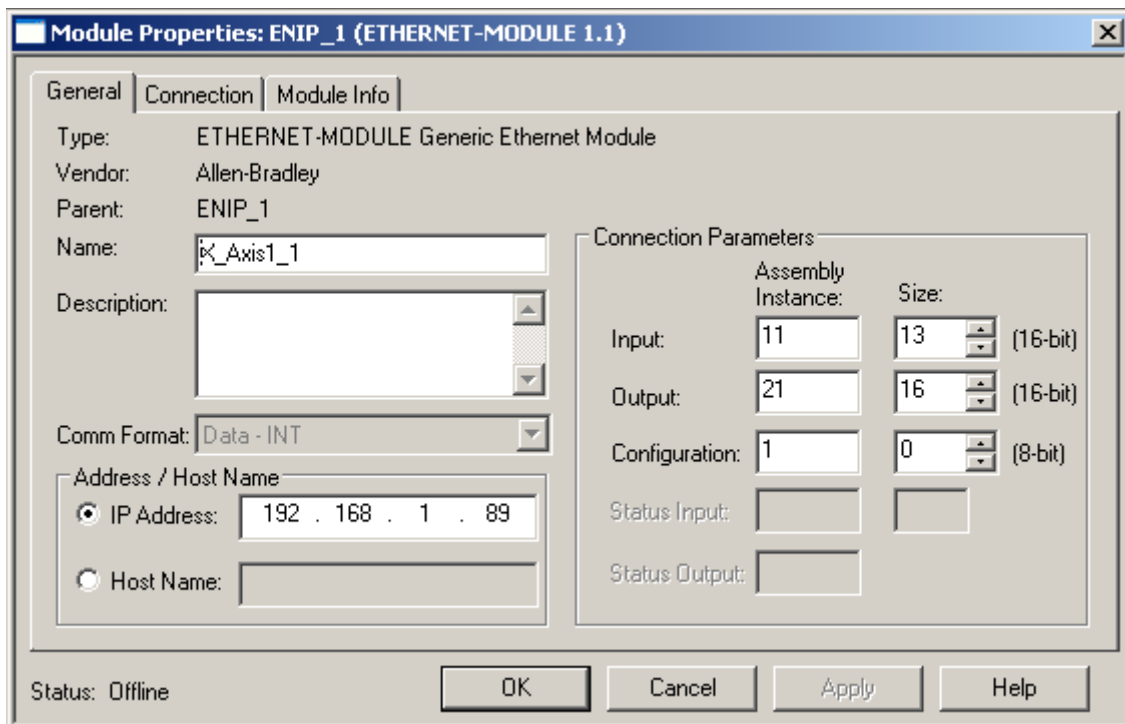
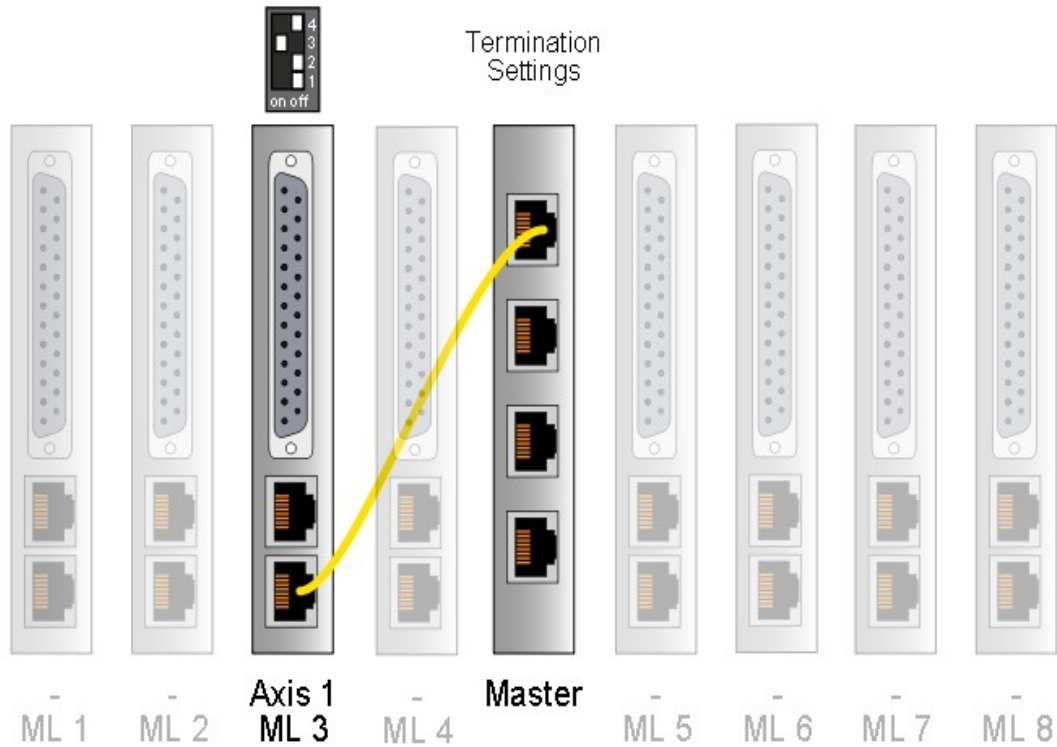
In this real time IO mapping the StateVar for the main state machine and several other helpful data are exchanged. The size of this mapping is 26 bytes or **13 words** for each configured axis.

Assembly Class Instance 24		
Byte Offset	Description	Size / Type
00h	MC SW StateVar	Uint16 / coded state depending
02h	MC SW StatusWord	Uint16 / Bit coded
04h	MC SW WarnWord	Uint16 / Bit coded
06h	MC SW DemandPosition	Int32 / Position [100nm]
0Ah	MC SW ActualPosition	Int32 / Position [100nm]
0Eh	MC SW DemandCurrent	Int32 / Current [1mA]
12h	Cfg Module Status Word	Uint16
14h	Cfg Module Index/..	Uint16
16h	Cfg Module Value/..	Uint32/Sint32

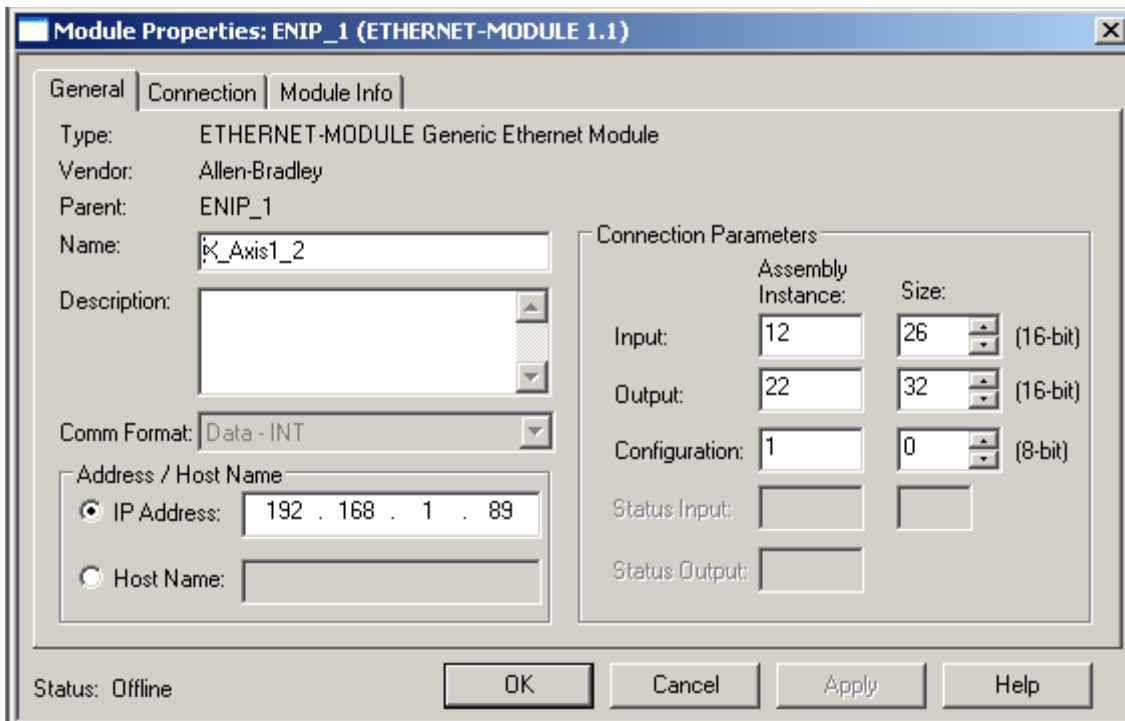
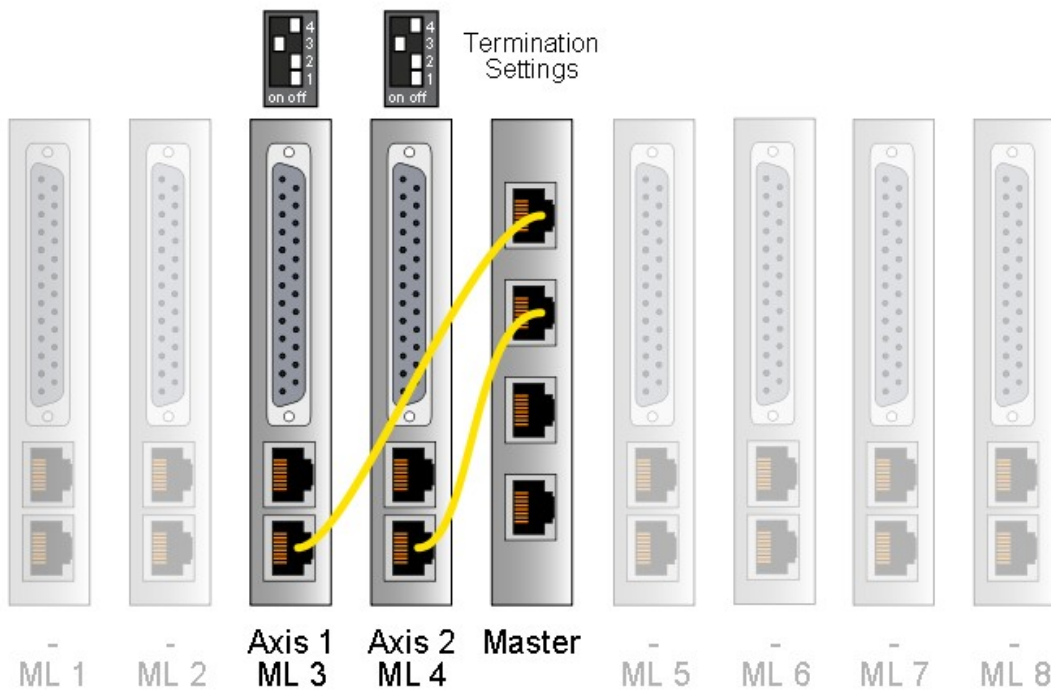
The use of the Control word and Motion Command interface is described in [1]. The real time configuration module is described in [2].

5.2 PLC Setup with different numbers of Axis

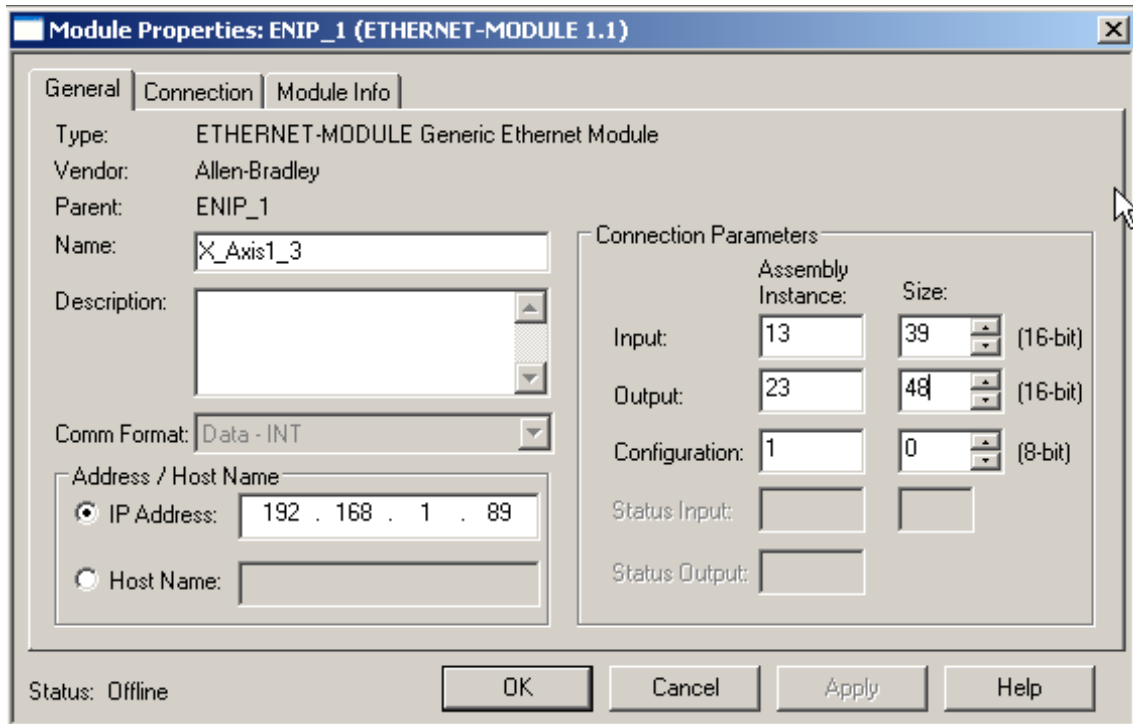
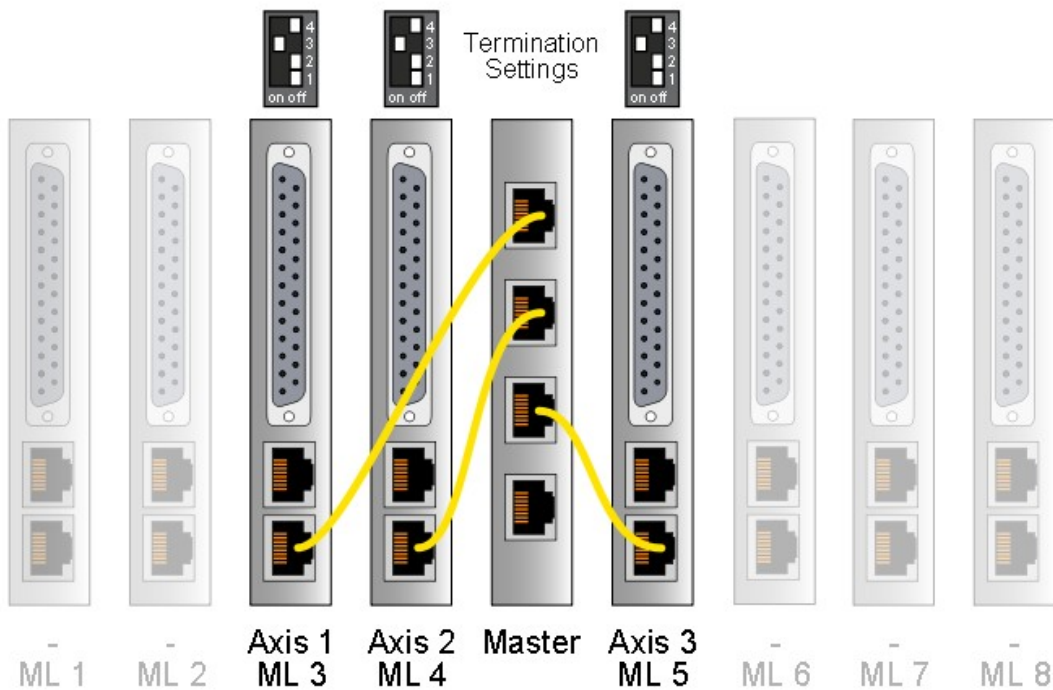
5.2.1 PLC Setup with 1 Axis



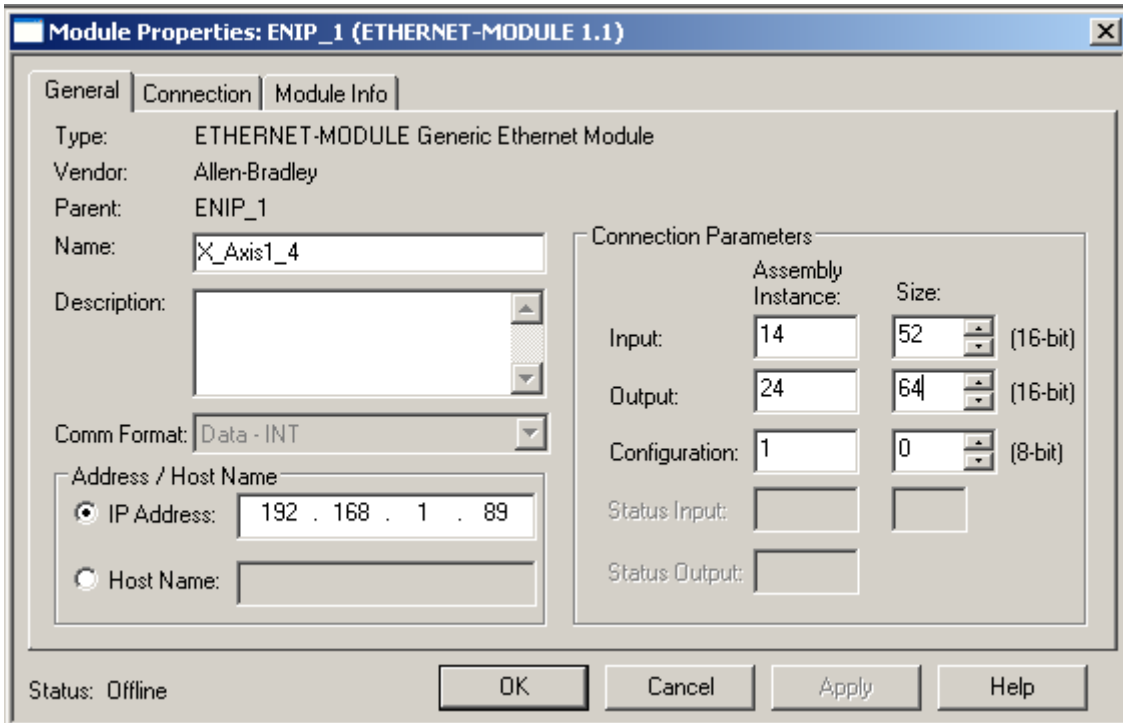
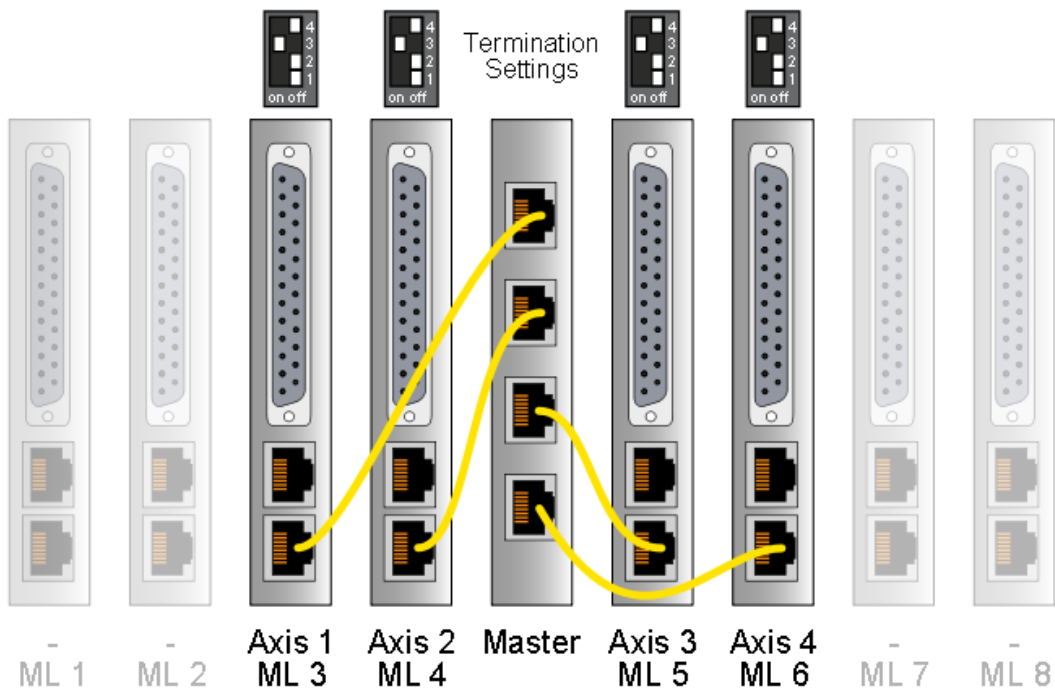
5.2.2 PLC Setup with 2 Axis



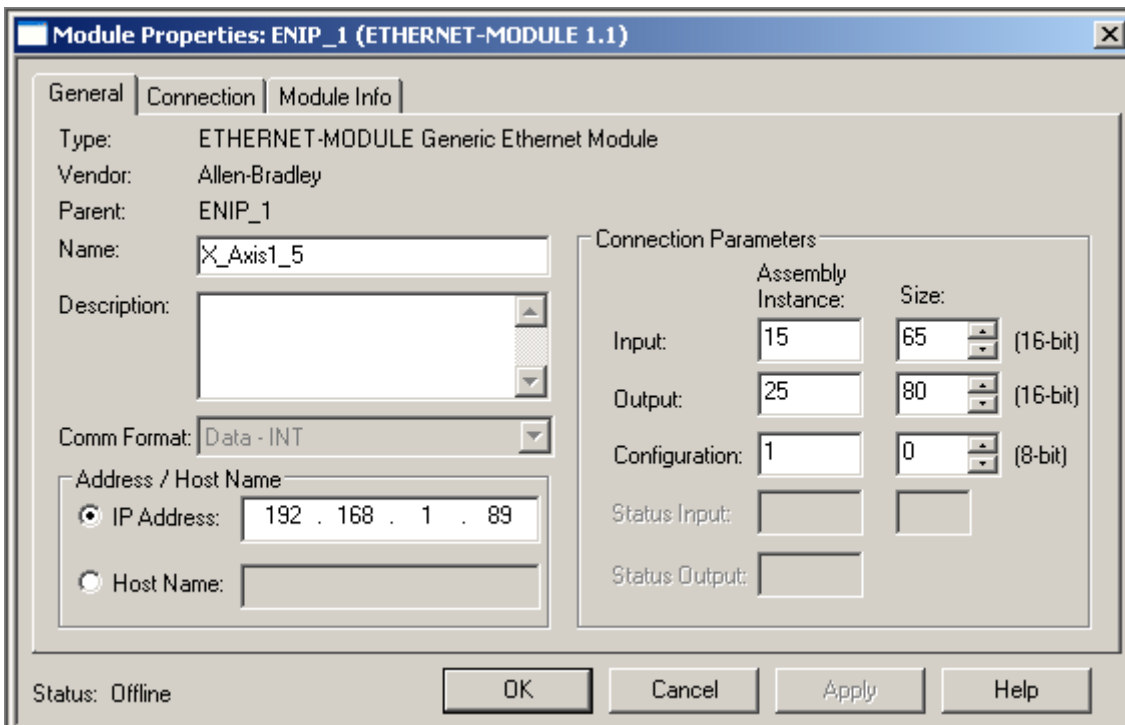
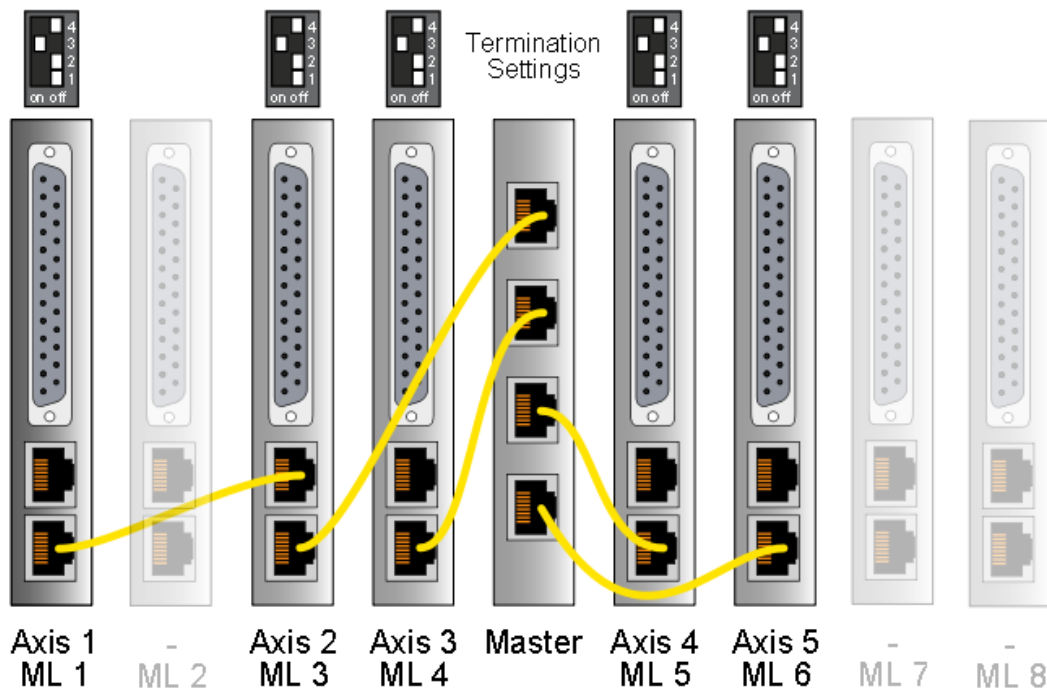
5.2.3 PLC Setup with 3 Axis



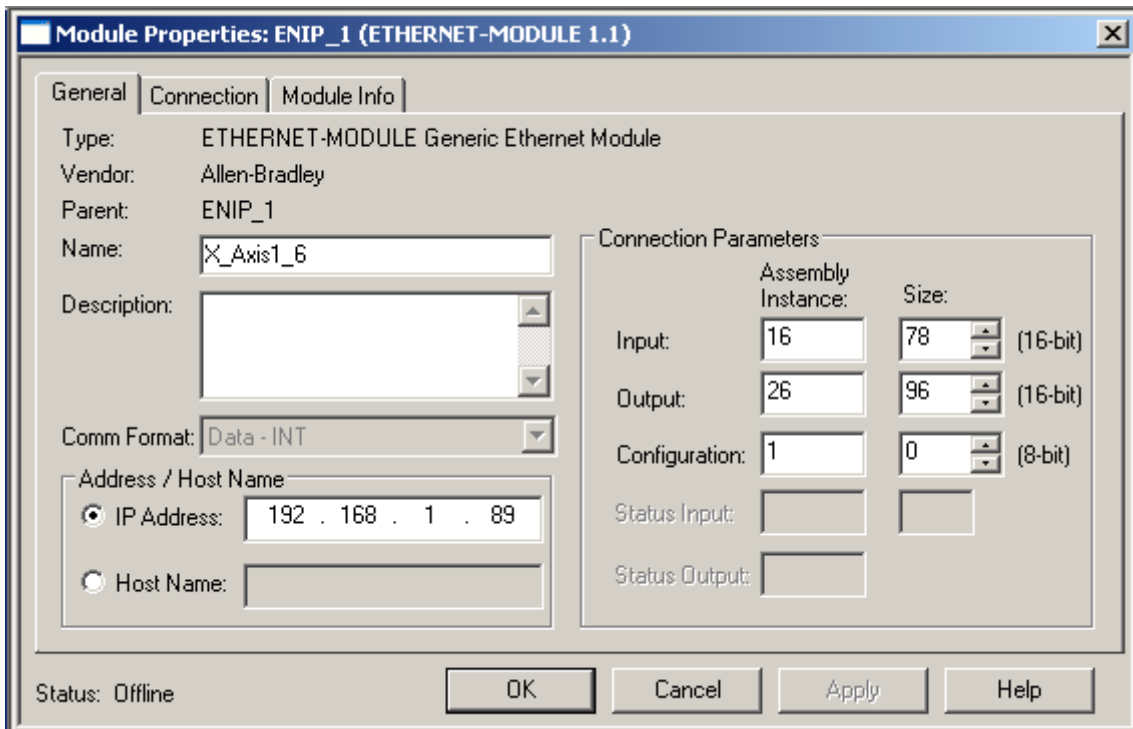
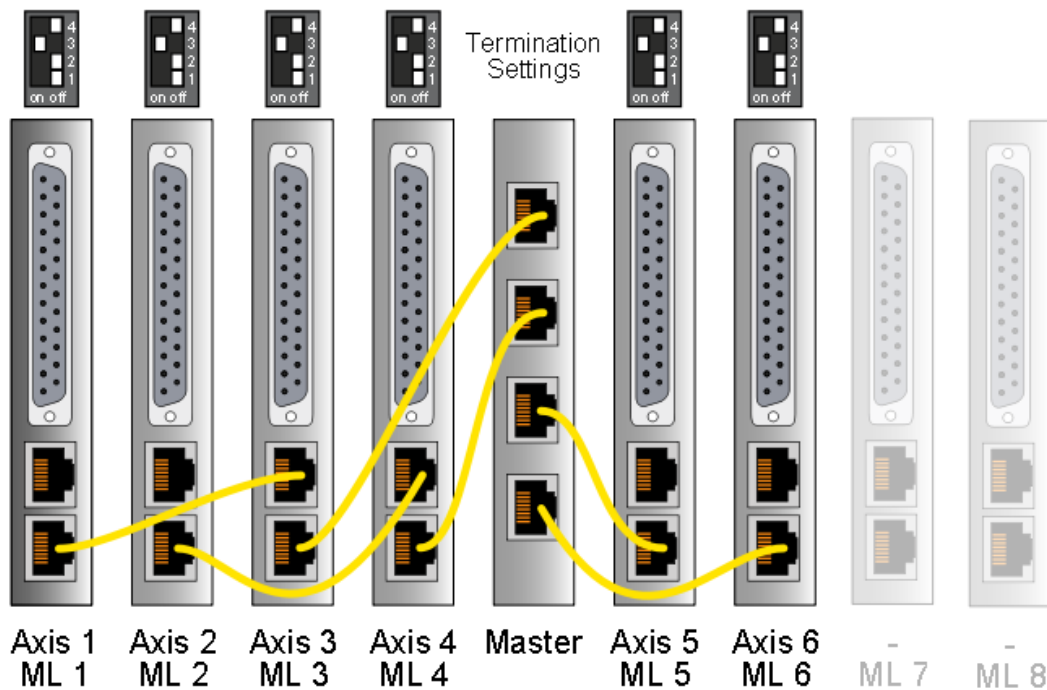
5.2.4 PLC Setup with 4 Axis



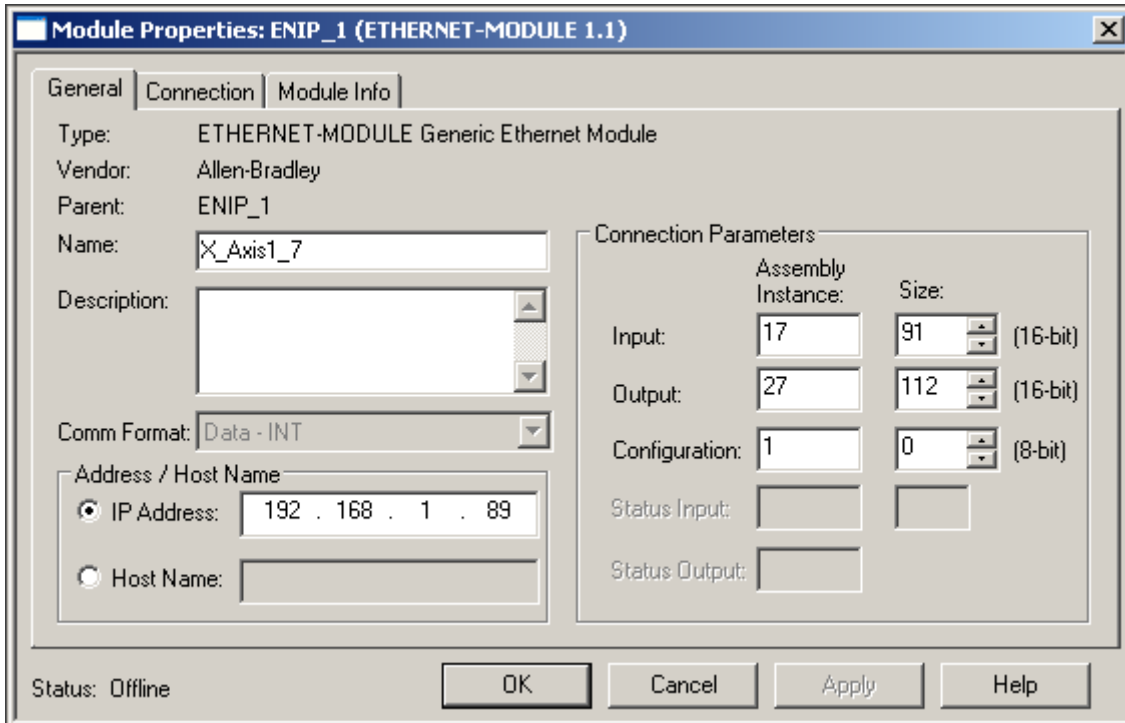
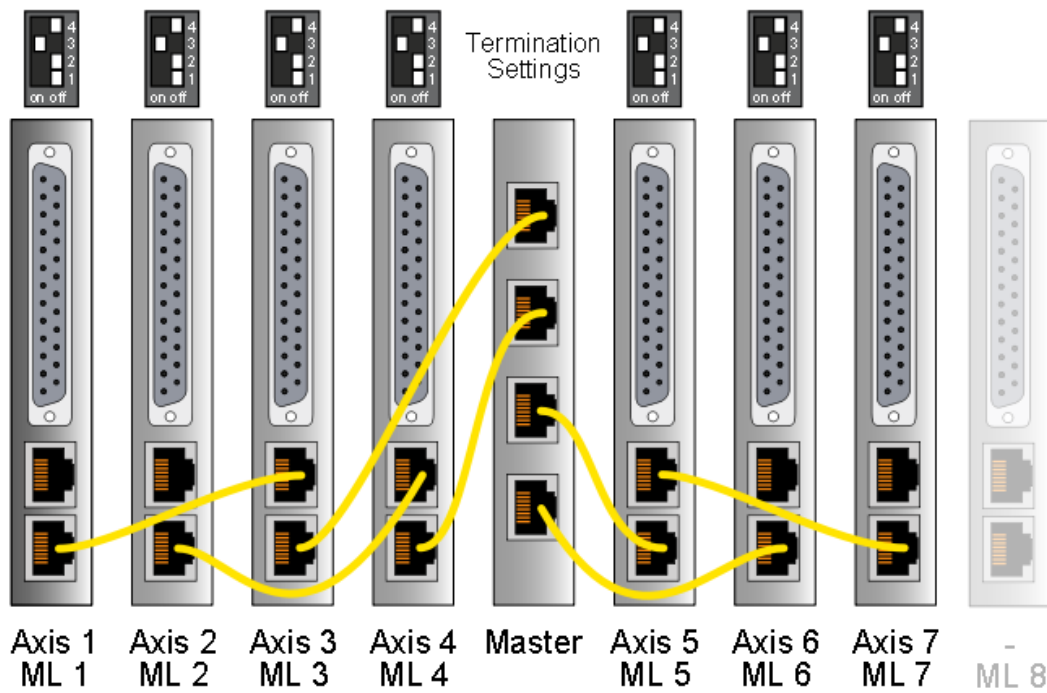
5.2.5 PLC Setup with 5 Axis



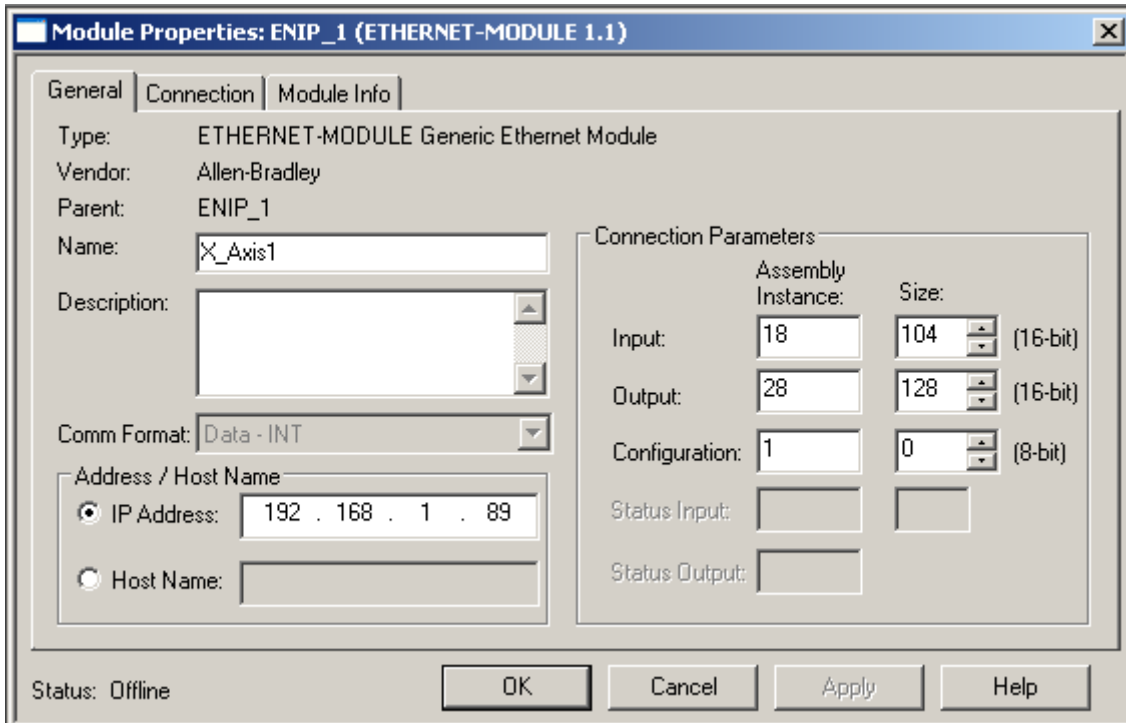
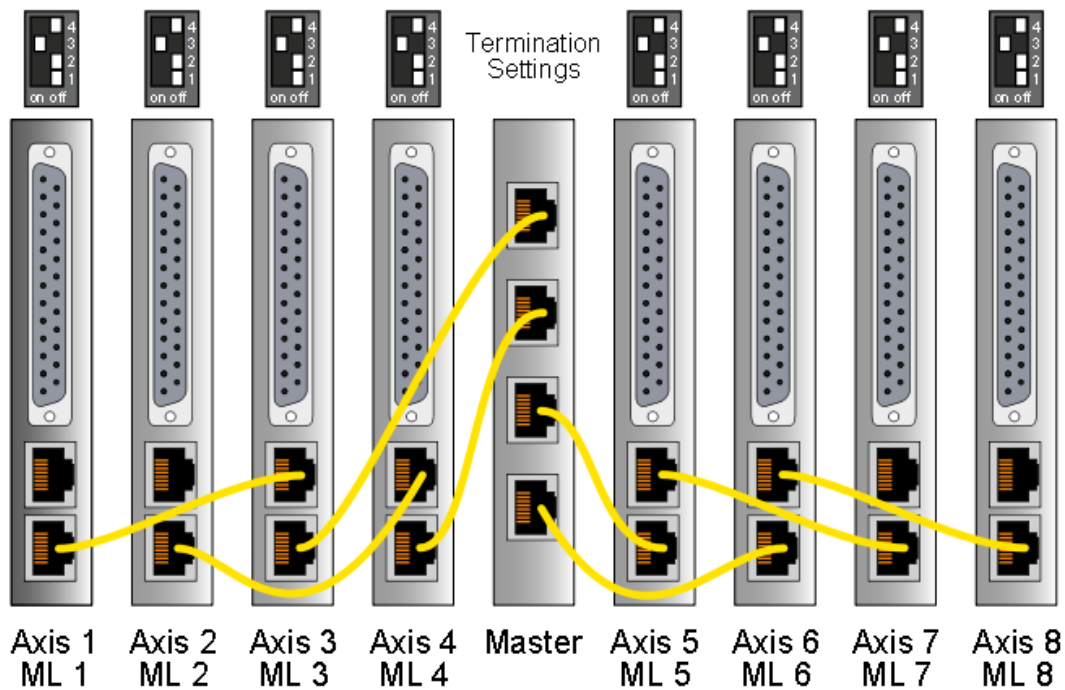
5.2.6 PLC Setup with 6 Axis



5.2.7 PLC Setup with 7 Axis



5.2.8 PLC Setup with 8 Axis



6 Contact Addresses

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