

EtherNet/IP® - Network Adapter

PLC500, PLC500ED, PLC500MC
PLC410

Application Note



Application Note

PLC410, PLC500, PLC500ED, PLC500MC

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SUMMARY OF REVISIONS

The information below describes the reviews made in this manual.

Version	Revision	Description
1.4.0	R01	Update of information and inclusion of PLC models PLC410, PLC500ED, and PLC500MC.
1.0.0	R00	First edition.

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1 INTRODUCTION

This Application Note is intended to assist with the use of the **EtherNet/IP®** protocol in WEG PLCs, models PLC410, PLC500, PLC500ED, and PLC500MC. Throughout this document, the PLC500 is used as an example. However, the information presented applies to the other PLC models described earlier.

This document provides information about the EtherNet/IP protocol, Ethernet interface description, installation recommendations, protocol network topologies, and a guide to establishing EtherNet/IP communication using a PLC500 as an adapter in **CODESYS®**.

For more information about hardware, interfaces, and communication protocols, consult the User Manual for the respective product, available on the [WEG](#) website. For a more in-depth and detailed description of the EtherNet/IP network operation, access the online help at [CODESYS Online Help](#).

**ATTENTION!**

This application note is directed to professionals trained in industrial networks. The installation and configuration of devices must be performed according to the manufacturer's manual.

**NOTE!**

This application note is directed to the CODESYS programming tool, and it is recommended to use version **CODESYS V3.5 SP19** or higher. It is also recommended to use the latest available version of the configuration libraries for the EtherNet/IP network.

1.1 TERMS AND DEFINITIONS USED

Adapter: a device that responds to communication requests made by an EtherNet/IP scanner.

CODESYS: PLC500 programming software. A programming platform that allows the development, configuration, and monitoring of solutions for industrial automation and system integration.

DHCP: from English “*Dynamic Host Configuration Protocol*”, a network management protocol that automatically assigns IP addresses and other configuration information to devices connected to a network.

Mbps: Megabits per second.

ODVA: from English “*Open Device Vendors Association*”, a global organization responsible for the development, promotion, and management of industrial communication protocols, such as EtherNet/IP.

Scanner: a device responsible for managing and controlling the communication of other devices within an EtherNet/IP network.

s: second.

1.2 NUMERICAL REPRESENTATION

Decimal numbers are represented using digits without a prefix. Hexadecimal numbers are represented with the prefix '0x'.

1.3 ETHERNET/IP DOCUMENTS

It is recommended to consult the documents related to the EtherNet/IP network presented in [Table 1.1](#) on [page 1-2](#).

Table 1.1: Reference documents.

Document	Version	Source
Volume One - Common Industrial Protocol (CIP) Specification	3.32	ODVA
Volume Two - EtherNet/IP Adaptation of CIP	1.30	ODVA
Media Planning and Installation Manual - EtherNet/IP	PUB00148R0	ODVA
Network Infrastructure for EtherNet/IP: Introduction and Considerations	PUB00035R0	ODVA

1.4 IMPORTANT NOTICE ABOUT CYBERSECURITY AND COMMUNICATIONS

WEG PLCs, models PLC410, PLC500, PLC500ED, and PLC500MC, have the capability to connect and exchange information through networks and communication protocols. Although they have been designed and tested to ensure proper operation with other automation systems using the protocols mentioned in this manual, it is essential that the customer understands the responsibilities associated with information and cybersecurity when using this equipment.

Therefore, it is the sole responsibility of the customer to adopt defense-in-depth strategies and implement policies and measures to ensure the overall security of the system, including the communications sent and received by the equipment. These measures include, but are not limited to, the installation of firewalls, antivirus and antimalware programs, data encryption, authentication control, and physical access control of users.

WEG and its affiliates are not responsible for any damages or losses resulting from cybersecurity breaches, including but not limited to unauthorized access, intrusion, leakage and/or theft of data or information, denial of service, or any other form of security violation. Using this product in conditions for which it was not specifically designed is not recommended and may result in damage to the product, network, and automation system.

In this regard, it is essential that the customer understands that external interventions through third-party programs, such as sniffers or similar programs, have the potential to cause disruptions or restrictions in the functionality of the equipment.

1.5 TRADEMARKS

EtherNet/IP® is a registered trademark of ODVA, Inc.

All other trademarks are the property of their respective owners.

2 ETHERNET INTERFACE

EtherNet/IP communication is performed through Ethernet connections, as shown in [Figure 2.1 on page 2-1](#) for the PLC500 and PLC410. Initially, each Ethernet port has the IP address indicated in [Table 2.1 on page 2-1](#), which can be changed at any time through the CODESYS software.

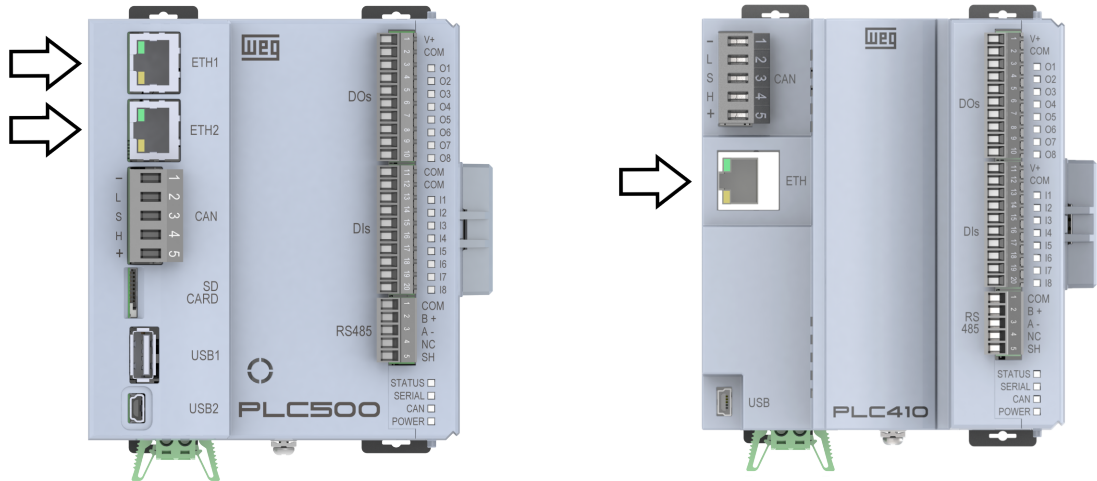


Figure 2.1: Indication of Ethernet connections on the PLC500 and PLC410.

Table 2.1: Default IP addresses for Ethernet ports.

Ethernet (PLC410)	Ethernet (PLC500)	Default IP address
ETH	ETH1	192.168.1.10
-	ETH2	192.168.2.10

The pin distribution of the connector follows the Ethernet 1000BASE-TX standard. The Ethernet interface of the PLC410 supports speeds of up to 100 Mbps, while the Ethernet interfaces of the PLC500 reach up to 1000 Mbps.

The PLC500, PLC500ED, and PLC500MC have two Ethernet interfaces, which can be configured in **Independent** mode, where the interfaces operate with distinct IPs, or in **Switch** mode, where the interfaces share the same IP address.

The interface is compatible with several communication protocols, including EtherNet/IP, and can be used simultaneously for multiple Ethernet-based protocols. For instructions on how to configure these additional networks, refer to the Product Application Notes available on the [WEG](#) website.

2.1 LED INDICATIONS

The Ethernet ports have LEDs to indicate speed and link/activity status, as shown in [Figure 2.2 on page 2-2](#). These LEDs have the behavior described in [Table 2.2 on page 2-2](#) and [Table 2.3 on page 2-2](#).

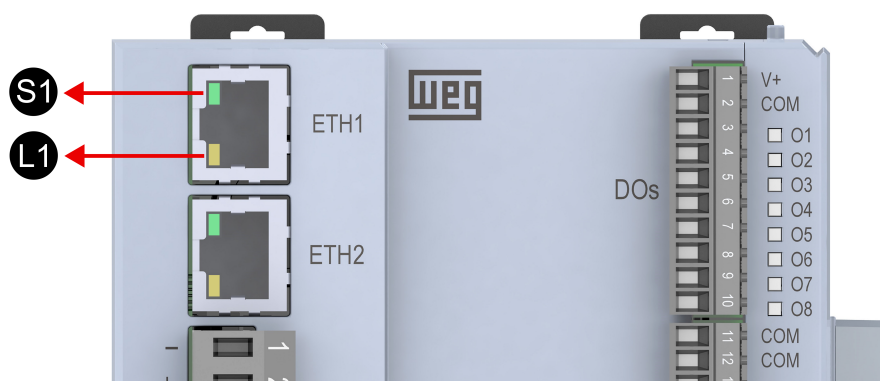


Figure 2.2: Speed and link/activity LEDs of the PLC500 Ethernet interface.

Table 2.2: LED S1 - Speed.

State	Description
Off	Equipment off or 10 Mbps link
Green, solid	100 Mbps link

Table 2.3: LED L1 - Link/Activity.

State	Description
Off	Equipment off or no link
Amber, solid	With link, no network activity
Amber, blinking	With link, network activity present

2.2 ETHERNET/IP NETWORK INSTALLATION

EtherNet/IP network, like many industrial communication networks, due to being applied frequently in aggressive environments with high exposure to electromagnetic interference, requires certain precautions to ensure a low communication error rate during its operation.



ATTENTION!

It is recommended to use passive components (cables, connectors, switches, hubs) certified for industrial applications.

The recommended characteristics for the cable used in the installation are:

- Ethernet standard cable, 1000Base-TX, CAT 5e or higher.
- Shielded cable.
- Maximum length of 100 m for connection between devices.

An adequate connection to the grounding system is essential to reduce electromagnetic interference problems in industrial environments. It is important to avoid connecting the cable to multiple grounding points, especially where there are grounds with different voltage potentials. In addition, it is recommended that signal and communication cables be installed on dedicated routes, keeping them away from power cables.

For detailed information on the correct installation of an EtherNet/IP network, it is recommended to consult the ODVA documents listed in [Table 1.1 on page 1-2](#).



DANGER!

Defective grounding installations can lead to death and malfunctioning of the EtherNet/IP network.

2.3 ETHERNET/IP NETWORK TOPOLOGIES

Network topologies in an EtherNet/IP system can vary depending on the project requirements and installation architecture. The star topology stands out, where a central switch connects all devices, as shown in [Figure 2.3 on page 2-3](#); the daisy-chain topology, which allows devices to be connected in sequence, as shown in [Figure 2.4 on page 2-3](#); and the combination of both topologies, as illustrated in [Figure 2.5 on page 2-3](#).

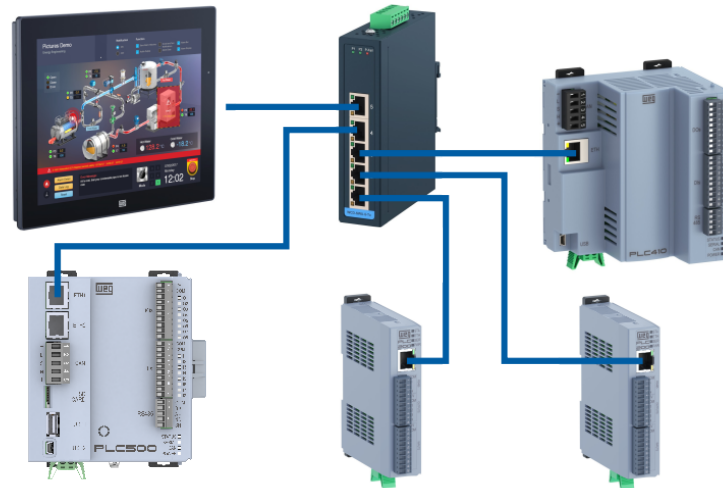


Figure 2.3: EtherNet/IP Star Topology.



Figure 2.4: EtherNet/IP Daisy-Chain Topology.



Figure 2.5: EtherNet/IP Star and Daisy-Chain Topology.

3 PROJECT IN CODESYS

This chapter presents the steps to create a project and add the EtherNet/IP network adapter device in CODESYS.

3.1 CREATING THE PROJECT

In the CODESYS software, create a new project using the **Standard project** template, choose the directory and the application name. Then, select the PLC500 device and the desired programming language, as shown in [Figure 3.1 on page 3-1](#).

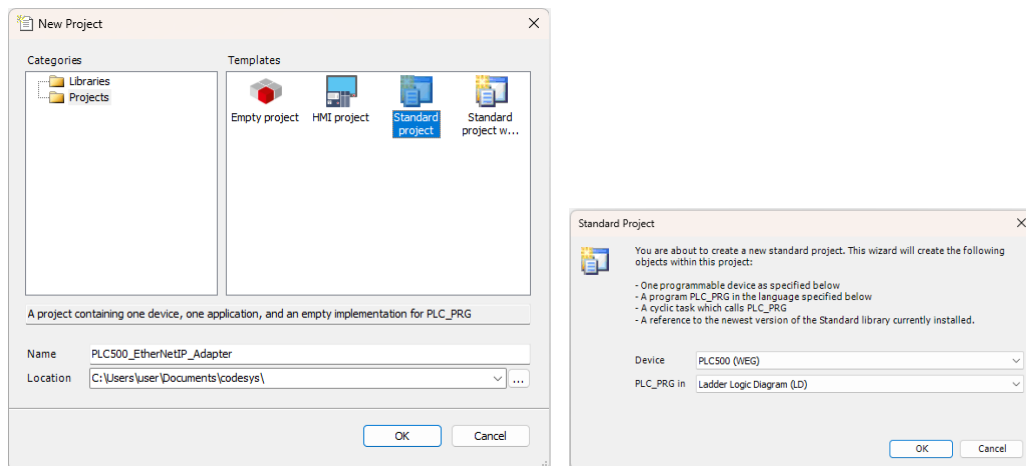


Figure 3.1: Project configuration in Codesys.



NOTE!

If the PLC410, PLC500, PLC500ED, or PLC500MC device is not yet available in CODESYS options, the configuration file must be downloaded and installed. Refer to the **Product Manual** available on the [WEG](#) website to find the necessary steps and configurations.

With the PLC500 device selected, the project tree will appear as shown in [Figure 3.2 on page 3-1](#).

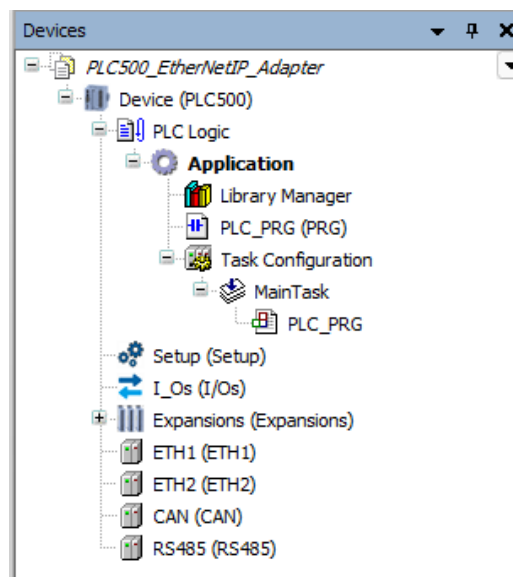


Figure 3.2: Initial project tree of PLC500.

3.2 ADDING THE ADAPTER DEVICE

In the chosen Ethernet interface, right-click and select **Add Device**. A new window will open. Expand the **EtherNet/IP** and **EtherNet/IP Local Adapter** icons using the **+** symbol until the **EtherNet/IP Adapter** device appears as shown in [Figure 3.3 on page 3-2](#). With the device selected, click **Add Device**.

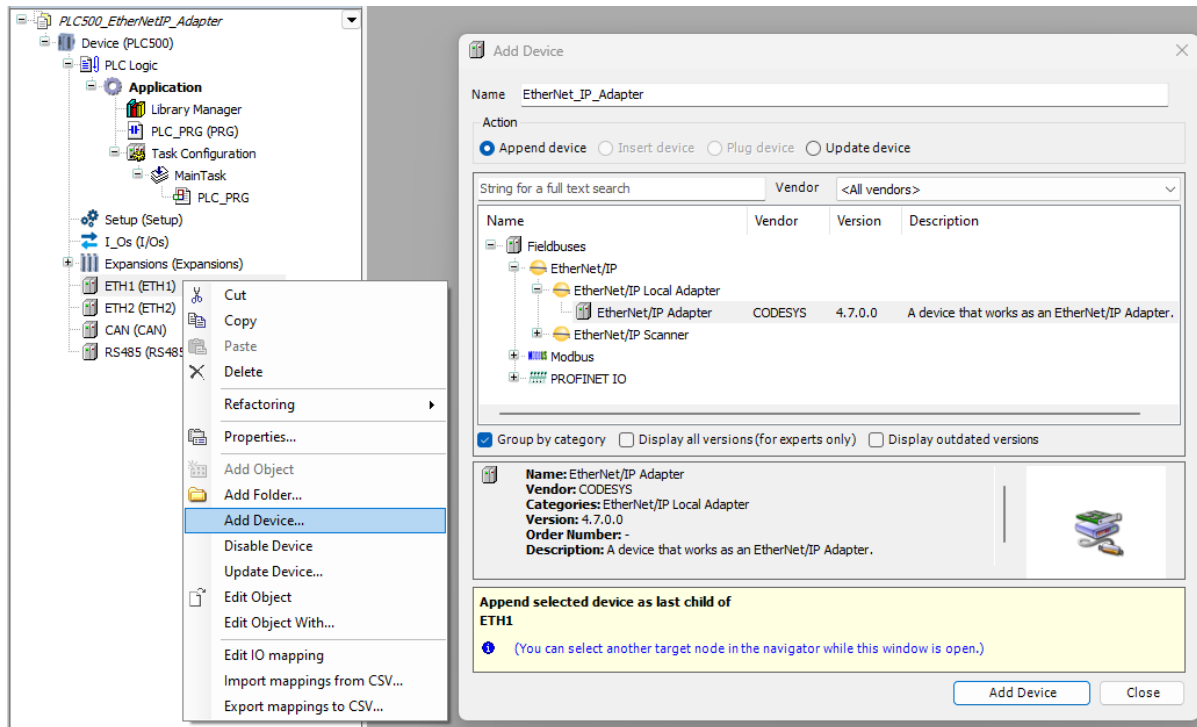


Figure 3.3: Adding the EtherNet/IP Adapter device.

The device will be incorporated into the project tree directly below the selected Ethernet interface, and the **ENIPAdapterIOTask** and **ENIPAdapterServiceTask** tasks will be automatically added, as shown in [Figure 3.4 on page 3-2](#).

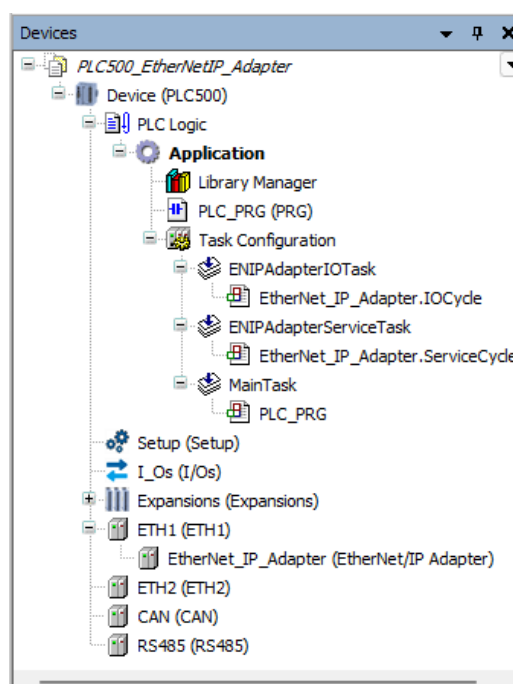


Figure 3.4: EtherNet/IP Adapter device added to the project tree.

3.3 ADDING ETHERNET/IP MODULE

Right-clicking on the **EtherNet_IP_Adapter** icon, the **EtherNet/IP Module** can be added following the same steps as before. [Figure 3.5 on page 3-3](#) shows the steps for this configuration.

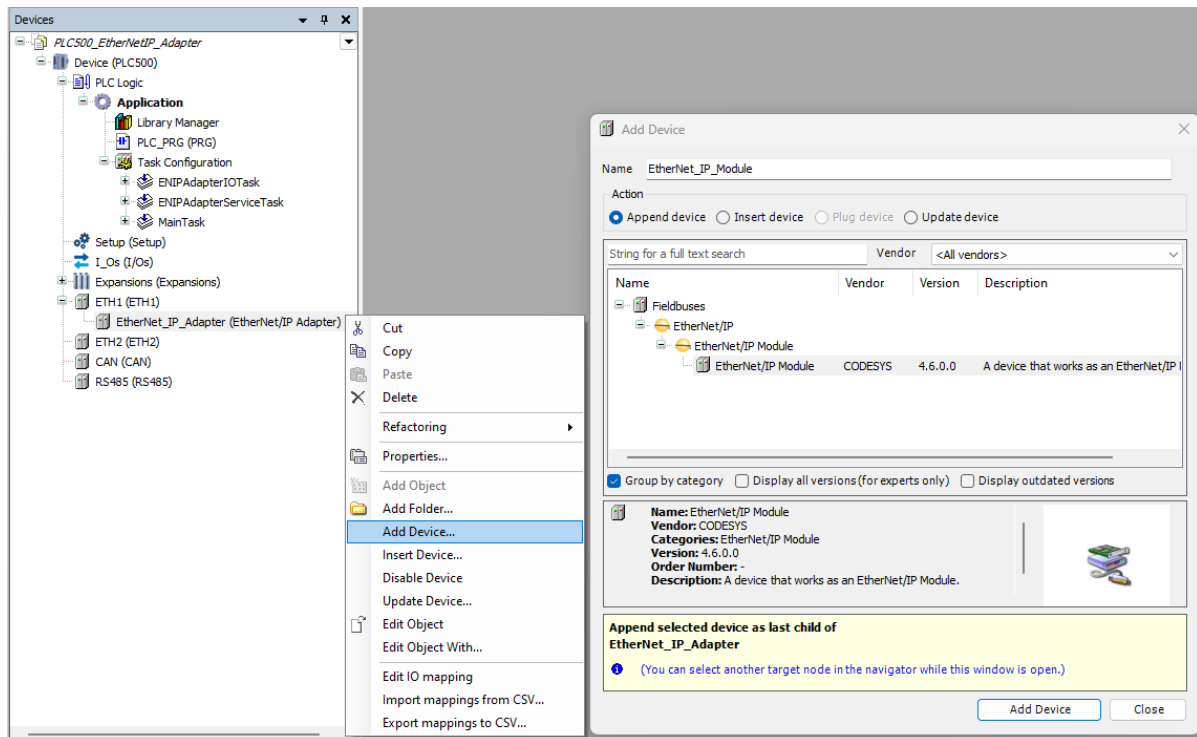


Figure 3.5: Adding the EtherNet/IP module.

At this point, the selected Ethernet interface should have the items shown in [Figure 3.6 on page 3-3](#). More EtherNet/IP modules can be added following the same procedures.

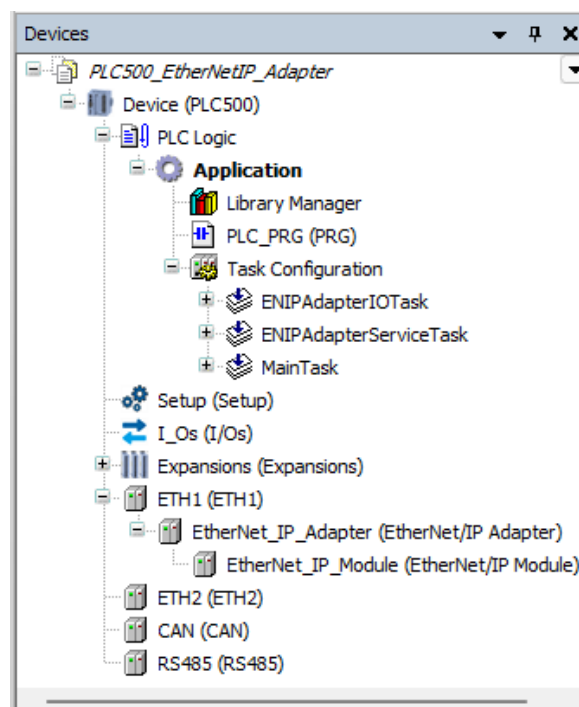


Figure 3.6: Items added for EtherNet/IP communication.

4 CONFIGURING ETHERNET/IP ADAPTER

In this chapter, the steps to configure the PLC500 as an EtherNet/IP adapter in CODESYS are presented.

4.1 CONFIGURING ETHERNET INTERFACE

The configuration of the PLC500 Ethernet interfaces can be done through the **Setup** tab in CODESYS, as shown in [Figure 4.1 on page 4-1](#).

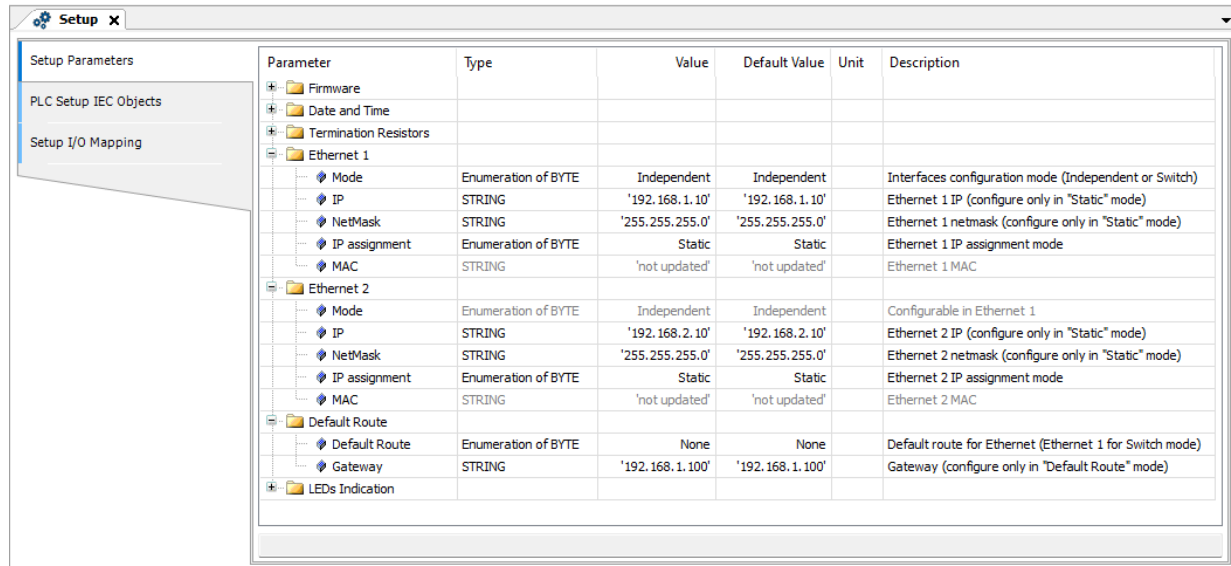


Figure 4.1: Configuring network interfaces for the PLC500.

To obtain the IP address of an interface automatically on the network, change the **IP assignment** field to **DHCP**. By selecting this option, the interface will request an IP address from a DHCP server available on the network, which will assign a valid IP and other configurations such as subnet mask and default gateway.



ATTENTION!

The Ethernet ports, when configured in **Independent** mode, must operate in **distinct networks**. Do not use the address range **192.168.234.xxx**, as it is reserved for accessing the PLC500 through the USB2 interface. **Incorrectly configuring these ports may result in loss of access to the PLC**, making it inaccessible via Ethernet until the configurations are corrected.

4.2 SWITCH MODE

The PLC500 can operate in **Switch** mode, where a new network interface, called **br1**, is created to virtually link Ethernet 1 and Ethernet 2 interfaces, allowing both to share the same IP address configured on Ethernet 1. The user can change the interface operation mode from **Independent** to **Switch** in the **Mode** parameter of the Ethernet 1 interface, as shown in [Figure 4.2 on page 4-2](#).

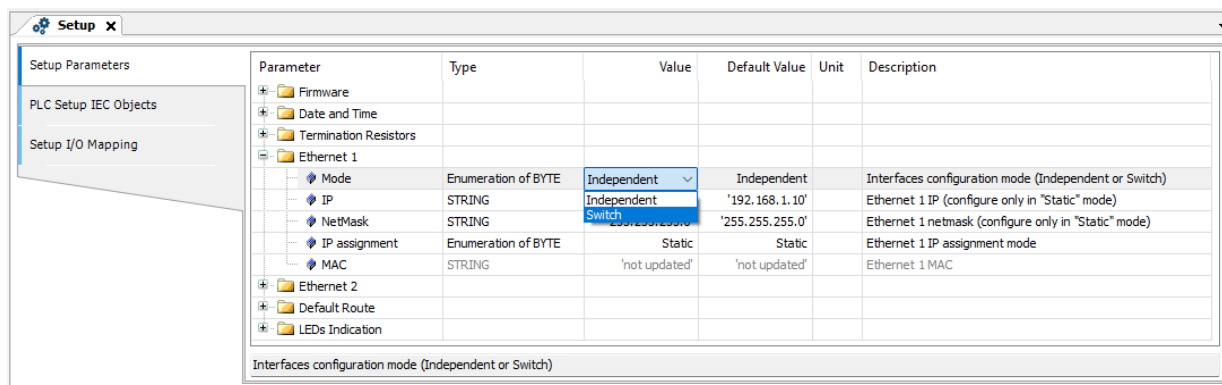


Figure 4.2: Configuring switch mode for Ethernet interfaces.



NOTE!

When changing to **Switch** mode, it is recommended to restart the product, as this action is required to ensure the proper functioning of some communication protocols.

4.3 NETWORK CONFIGURATION

Each device on an Ethernet network requires an IP address and a subnet mask. The network must be configured with valid addresses for each scanner and adapter device, ensuring that the addresses are unique and within the allowed range of IPv4 addresses. Otherwise, connectivity issues may occur.

By double-clicking on the Ethernet interface that has the EtherNet/IP adapter, a window opens as shown in Figure 4.3 on page 4-2. The **Browse** box is used to select the Ethernet port. Below this box, the IP, subnet mask, and gateway of the device can be changed.



NOTE!

To use the **Browse** box, the PLC500 must be correctly connected and identified on the computer. Otherwise, a network communication error will be generated.

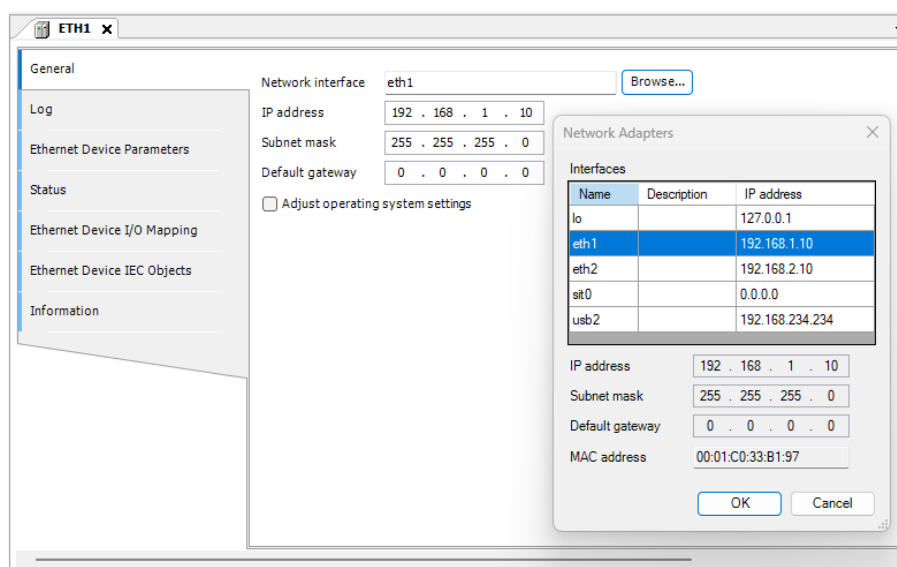


Figure 4.3: Network configuration for the PLC500 using ETH1 in independent mode.

If the PLC500 is configured in **Switch** mode, the **br1** interface must be used for EtherNet/IP communication, as shown in [Figure 4.4 on page 4-3](#). If the interface is not yet configured in this mode, it will not appear in the **Browse** option and must be entered manually. Make sure the IP address matches the one configured on Ethernet port 1 in the **Setup** of the PLC500.



NOTE!

The **br1** interface appears after the program is downloaded to the PLC500 configured in **Switch** mode. Again, it is important to ensure the product is restarted when this is the first time the Ethernet interface is being configured in this mode.

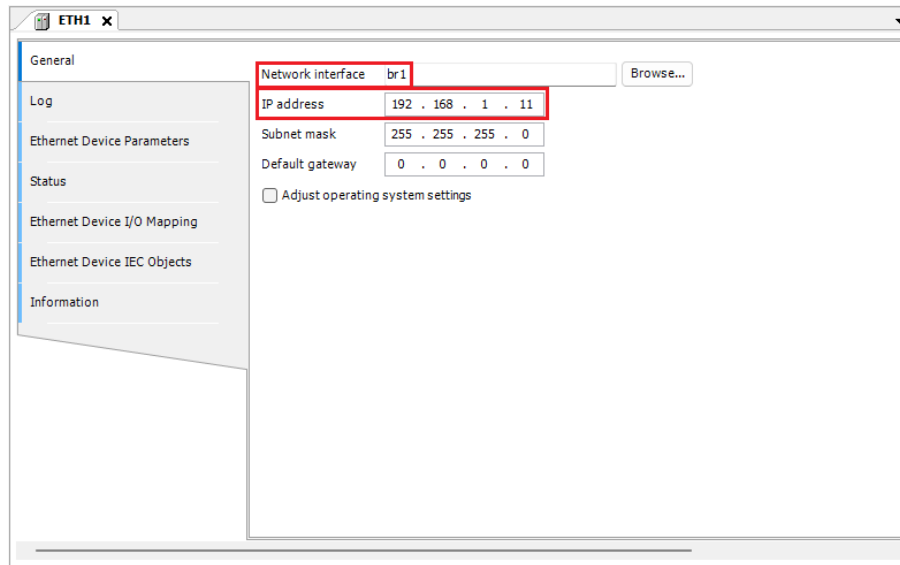


Figure 4.4: Network configuration for the PLC500 in switch mode.

4.4 CONFIGURING IMPLICIT ETHERNET/IP COMMUNICATION

The variables and data for implicit communication on an adapter device must be declared in the created modules (EtherNet/IP Modules). By double-clicking on **EtherNet_IP_Module**, the window shown in [Figure 4.5 on page 4-3](#) will open.

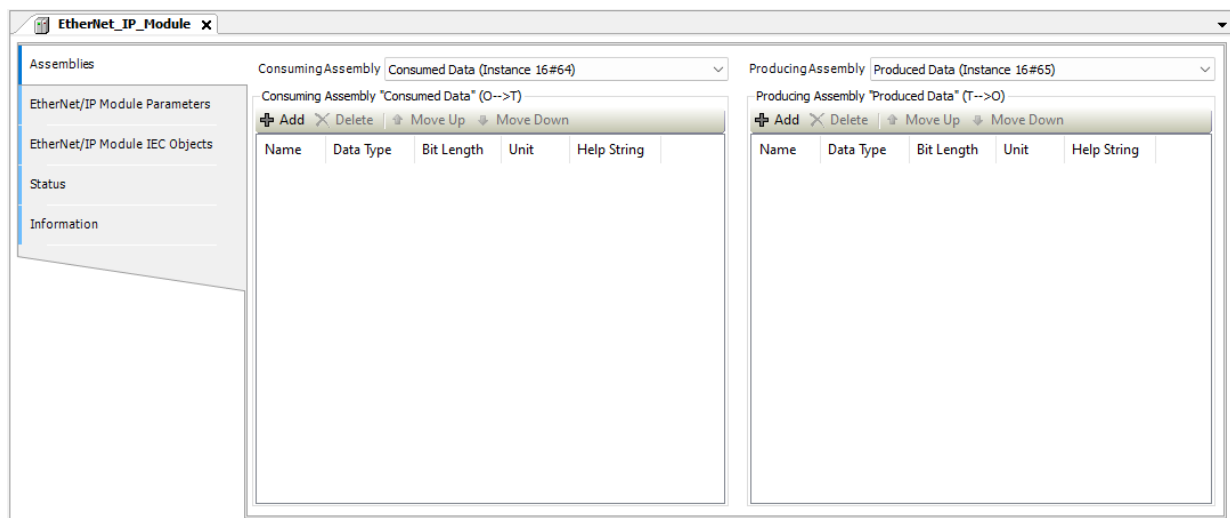


Figure 4.5: Window to add EtherNet/IP network data set.

For each application, it is possible to define which data sets (**Assemblies**) are relevant for implicit or cyclic communication between devices in an EtherNet/IP network. For example, a PLC500 can be configured as an adapter, making variables available for use in its I/Os, as well as other variables of type REAL and FLOAT. An

CONFIGURING ETHERNET/IP ADAPTER

example is presented here that reads and writes values on the PLC500; the transmission data is summarized in [Table 4.1 on page 4-4](#). In [Figure 4.6 on page 4-4](#), there is a schematic representation of this data exchange example between a scanner device and an EtherNet/IP PLC500 adapter.

Table 4.1: Summary of Assemblies for implicit communication in the EtherNet/IP network.

Name	Data type	Bit size	Quantity
Digital Outputs PLC500	USINT	8	1
Digital Inputs PLC500	USINT	8	1
Output WORD	WORD	16	3
Input REAL	REAL	32	3

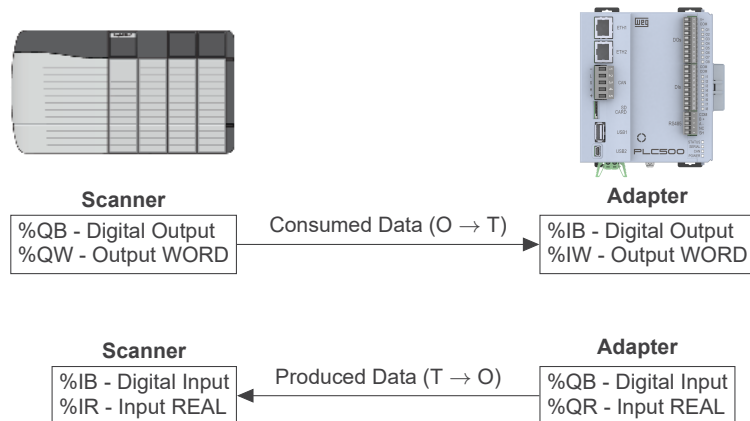


Figure 4.6: Schematic representation of the EtherNet/IP implicit communication configuration.

To add a transmission data from the scanner to the adapter, click **Add** below **Consuming Assembly**. In [Figure 4.7 on page 4-4](#), the addition of the variable used to trigger the PLC500's digital outputs is shown.

Figure 4.7: Adding transmission data from scanner to adapter.

The same procedure is applied for the other variables summarized in [Table 4.1 on page 4-4](#). Transmission data from the adapter to the scanner is added in **Consuming Assembly**. Thus, all data will be configured as shown in [Figure 4.8 on page 4-5](#).

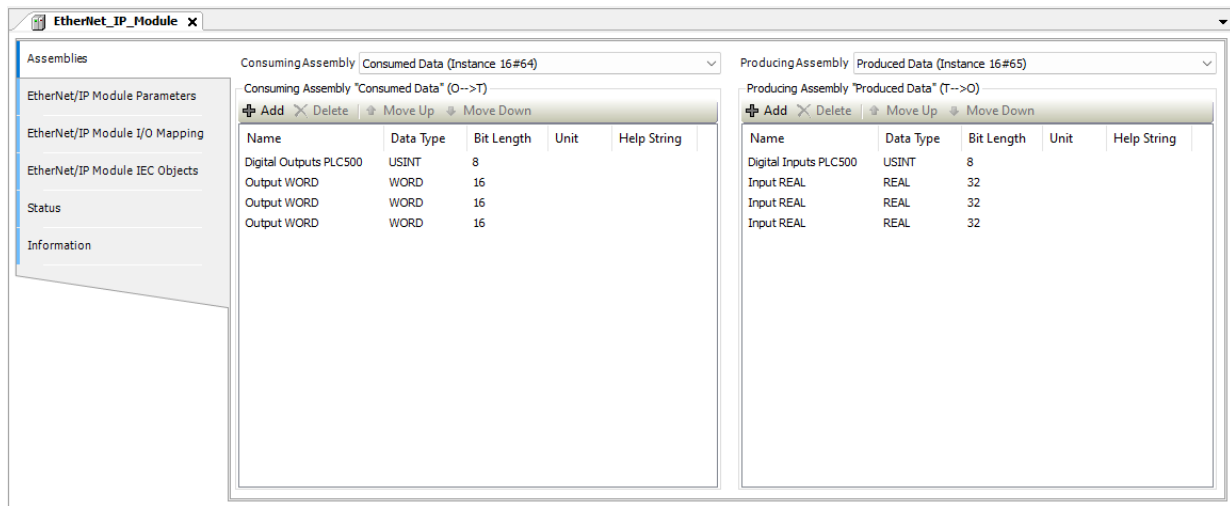


Figure 4.8: Data set added in the EtherNet/IP network example.

The configured data set can be viewed in the **EtherNet/IP Module I/O Mapping** tab. In the case of the PLC500, the I/Os do not have fixed EtherNet/IP addresses. Therefore, to access the digital inputs and outputs of the device, it is necessary to map the variables using auxiliary variables in the application. In [Figure 4.9 on page 4-5](#), the mapping of the USINT type variables using these auxiliary variables is shown.

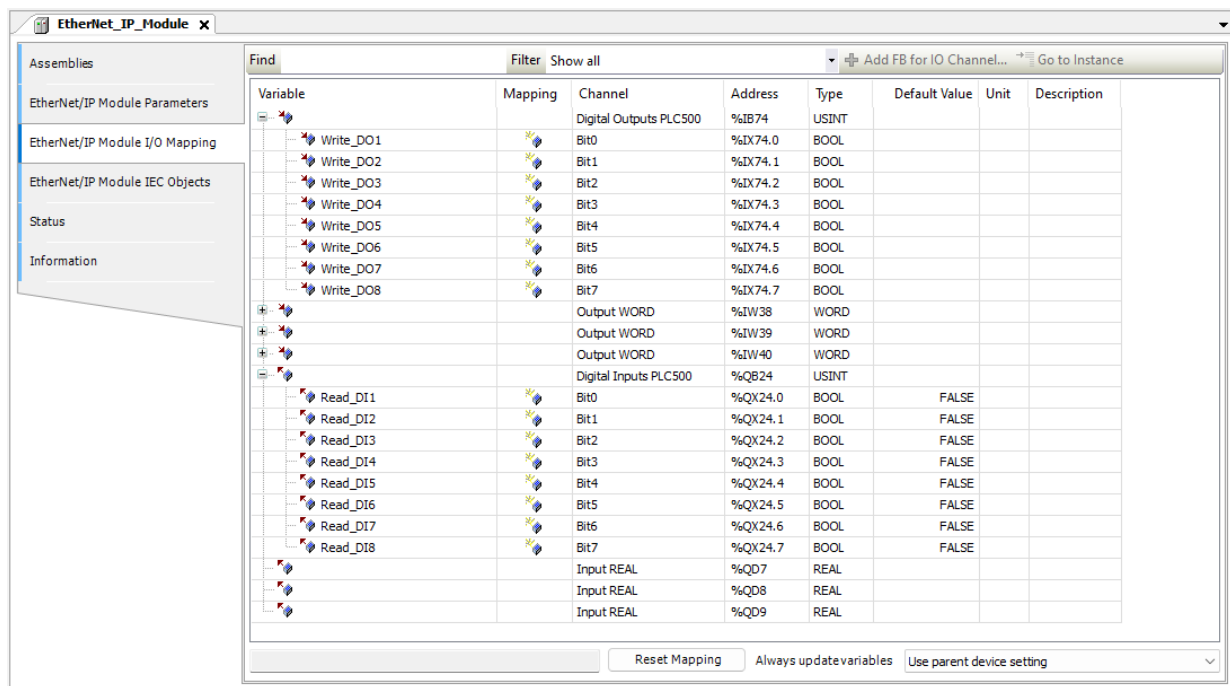


Figure 4.9: Declared and mapped variables for the EtherNet/IP adapter device.



NOTE!

The availability and access to data types through the EtherNet/IP network may vary from one device to another. Therefore, during configuration, it is recommended to consult the **User Manual** for information on the available data.

To link the EtherNet/IP network variables with the I/Os mapped to their default names in the PLC500 (DO1, DO2 ... DI1, DI2 ...), a simple Structured Text code is shown in [Figure 4.10 on page 4-6](#).



ATTENTION!

Do not alter the default names of the I/O variables that have been previously declared. When updating the device to a different model and/or version, **the variables will revert to their original declaration.**

IO_mapping - Structured Text (ST)

```
Read_DI1 := DI1;  
Read_DI2 := DI2;  
Read_DI3 := DI3;  
Read_DI4 := DI4;  
Read_DI5 := DI5;  
Read_DI6 := DI6;  
Read_DI7 := DI7;  
Read_DI8 := DI8;  
  
DO1 := Write_DO1;  
DO2 := Write_DO2;  
DO3 := Write_DO3;  
DO4 := Write_DO4;  
DO5 := Write_DO5;  
DO6 := Write_DO6;  
DO7 := Write_DO7;  
DO8 := Write_DO8;
```

Figure 4.10: IO_mapping program in structured text.



NOTE!

For larger applications, where the state of the PLC500 digital inputs and outputs is critical, it is recommended that input variables be read at the beginning of the main program, while output variables be written at the end. For more information, refer to **Bus Cycle Task** in the online help at [CODESYS Online Help](#).

4.5 EDS FOR ETHERNET/IP IN CODESYS

The PLC410, PLC500, PLC500MC, and PLC500ED models do not have predefined EtherNet/IP EDS files, so it is necessary to **generate the file after configuring the adapter communication data**. To do this, double-click on **EtherNet_IP_Adapter** to open the general configuration window of the adapter device, as shown in [Figure 4.11 on page 4-7](#). The fields **Vendor name**, **Vendor ID**, **Product name**, **Product code**, **Major revision**, and **Minor revision** can be configured by the user.

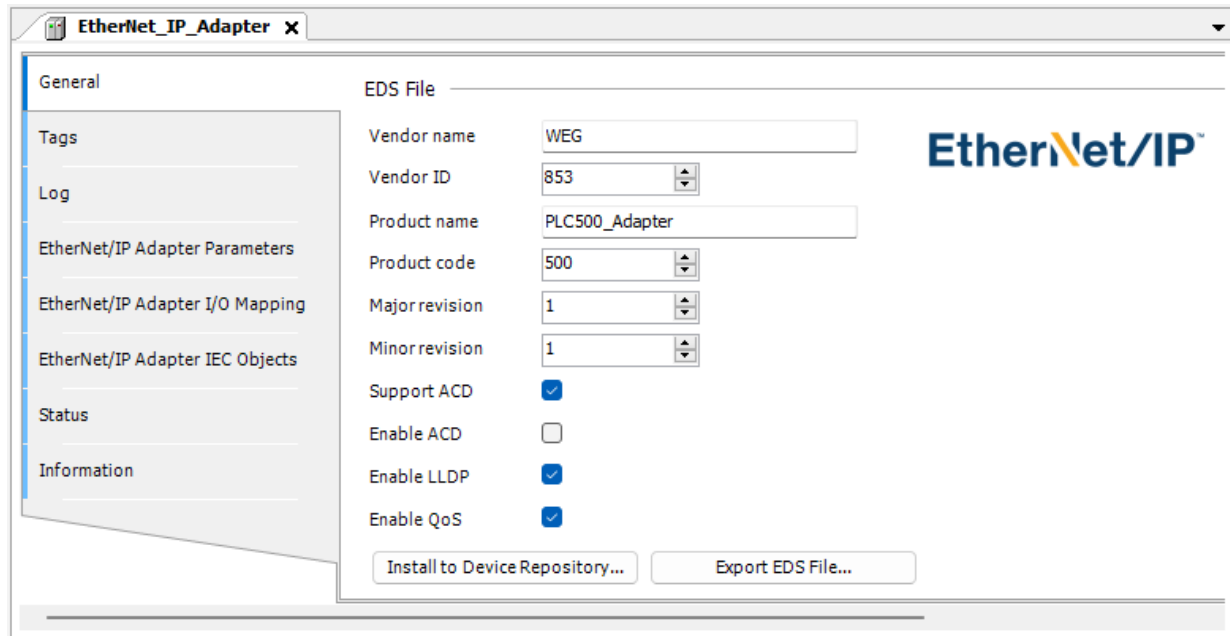


Figure 4.11: EDS configuration for the PLC500 as EtherNet/IP Adapter.

To export the EDS file, select **Export EDS File...** and choose the name and target directory for the file. If the scanner device uses CODESYS, select **Install to Device Repository...** so the adapter device is automatically added to the repository.



ATTENTION!

When generating a new EDS with the same **Vendor ID**, **Product Code**, **Major Revision**, and **Minor Revision**, it is essential to be careful not to accidentally overwrite an already used EDS in the repository. Ensure that all values are correct before creating the new EDS and that it will not overwrite an existing EDS file.



NOTE!

For more information on configuring the PLC500 as an EtherNet/IP scanner in CODESYS, refer to the Application Note available on the product page on [WEG's website](#).

5 MONITORING

This chapter presents some methods for monitoring EtherNet/IP network variables and diagnosing communication errors in CODESYS.

5.1 MONITORING VARIABLES

The declared variables in the network can be monitored through two methods. The first possibility is to add them in the CODESYS program and monitor the variable values online. The second method only requires enabling **Always Update Variables** in the footer of the **EtherNet/IP Module I/O Mapping** tab, as indicated by the red arrow in [Figure 5.1 on page 5-1](#).

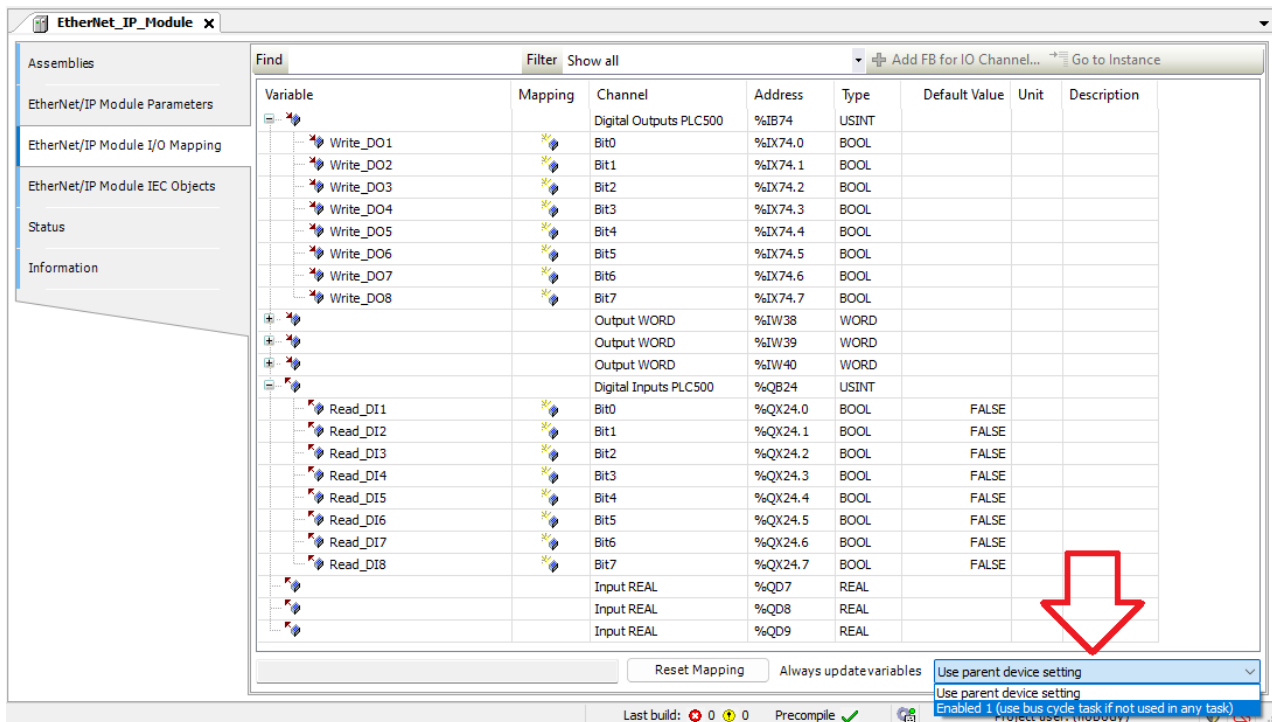


Figure 5.1: Option to always update the EtherNet/IP variable values with the bus cycle task.

[Figure 5.2 on page 5-1](#) shows the CODESYS variable visualization screen for the EtherNet/IP adapter through online monitoring.

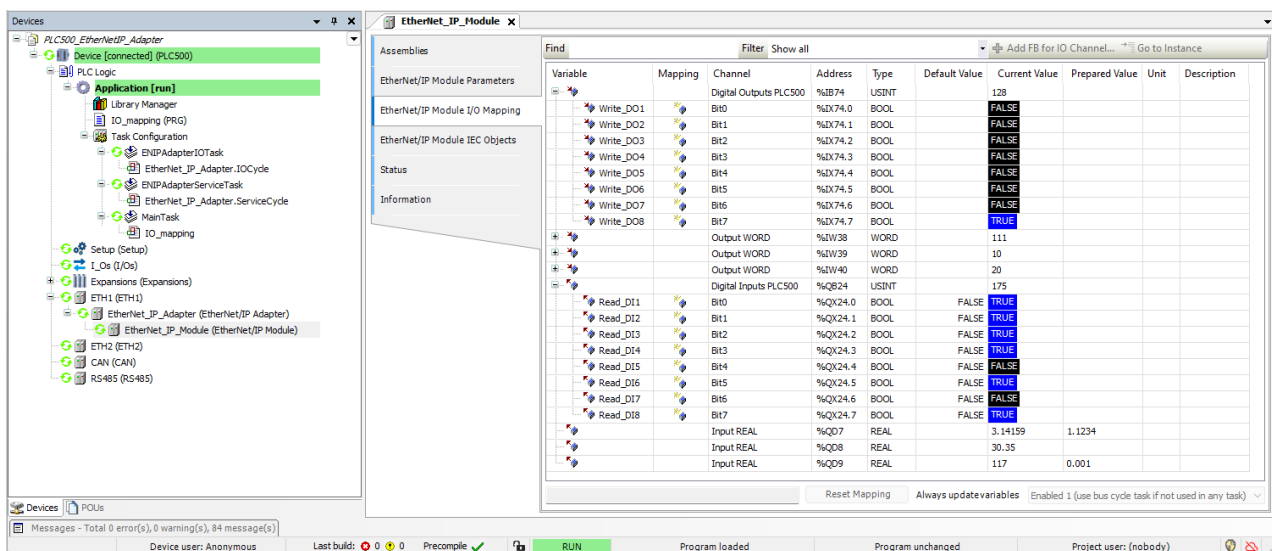


Figure 5.2: Monitoring EtherNet/IP variables online in CODESYS.

5.2 COMMUNICATION ERRORS

Network state monitoring can be done in **Devices**, showing the state of each communication step and reporting the status (**Status**). If connection issues are found, as shown in [Figure 5.3 on page 5-2](#), check if the cables are properly connected, the Ethernet port LED status on the PLC, and then review the configuration settings.

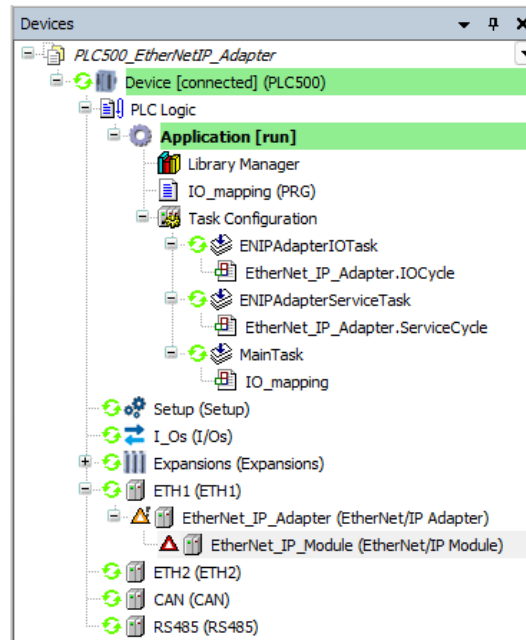


Figure 5.3: Communication error indication.

In online mode, access the **Status** tab of the **EtherNet_IP_Adapter** as shown in [Figure 5.4 on page 5-2](#). Here, CODESYS will indicate the issue preventing communication. In this case, the cable was not properly connected to the adapter device.

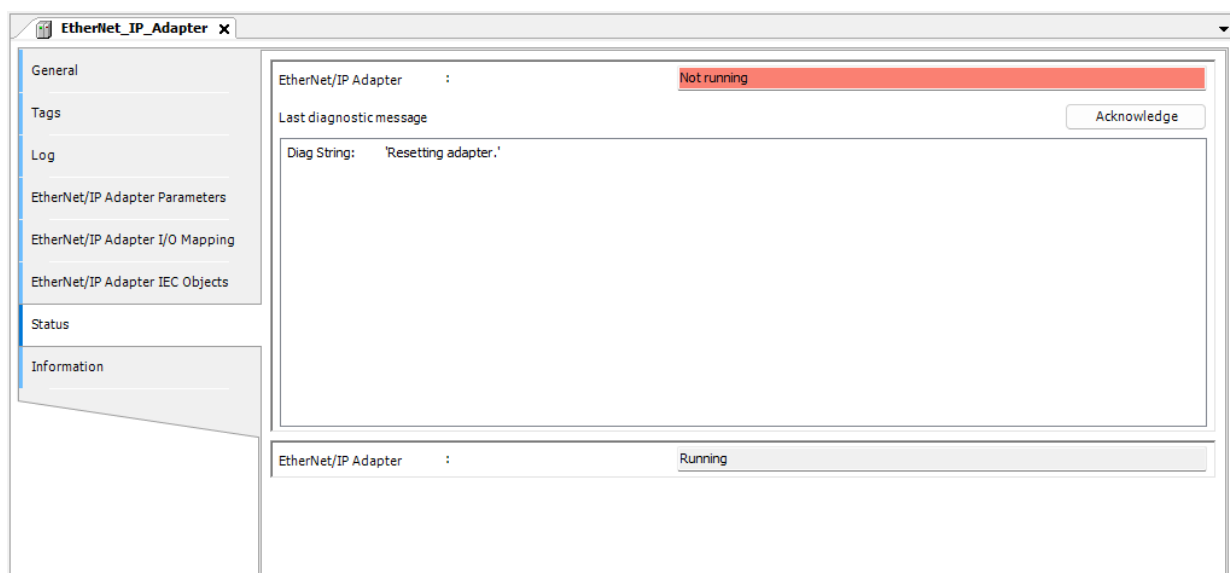


Figure 5.4: EtherNet/IP adapter device status tab.

After reconnecting the cable and waiting a few moments, the network communication is restored, and the device icons turn green. An exclamation mark icon is displayed on the device indicating that an error has been declared, as shown in [Figure 5.5 on page 5-3](#).

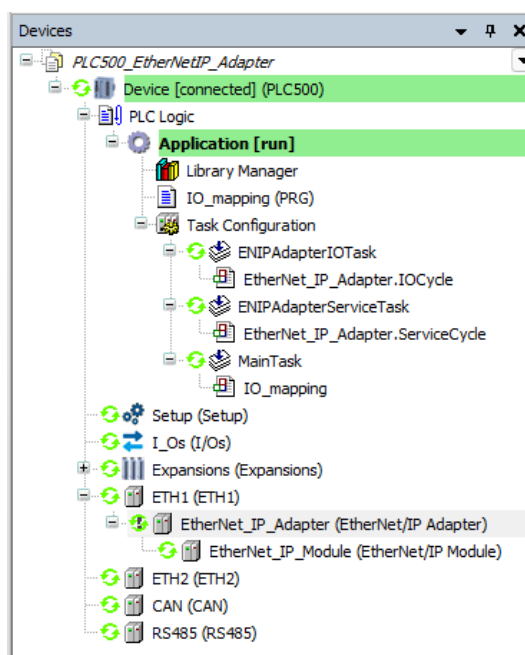


Figure 5.5: Indication of an error declared in the EtherNet/IP network.

To remove the alert, simply click on **Acknowledge**, as shown in Figure 5.6 on page 5-3.

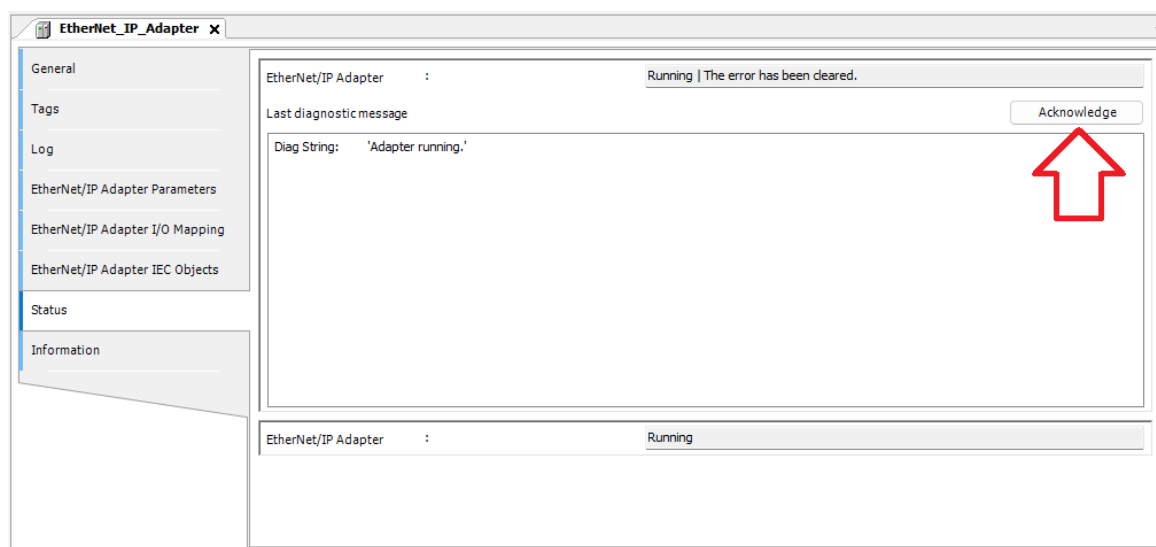


Figure 5.6: Acknowledging the declared EtherNet/IP network error.

After acknowledging the alert and verifying the proper functioning of the network, the device icons will appear as shown in Figure 5.7 on page 5-4.

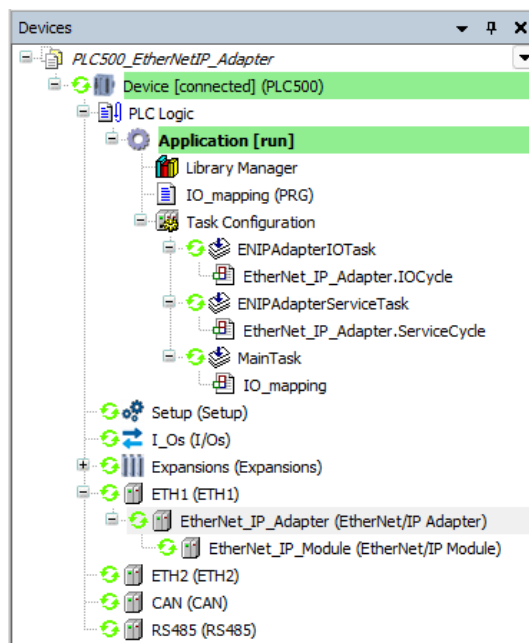


Figure 5.7: Correctly configured communication and devices communicating.



NOTE!

It is recommended to consult the documentation available in the **Library Manager**, or access the online help at [CODESYS Online Help](#), for more information on EtherNet/IP network configuration and available methods and functions.



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