

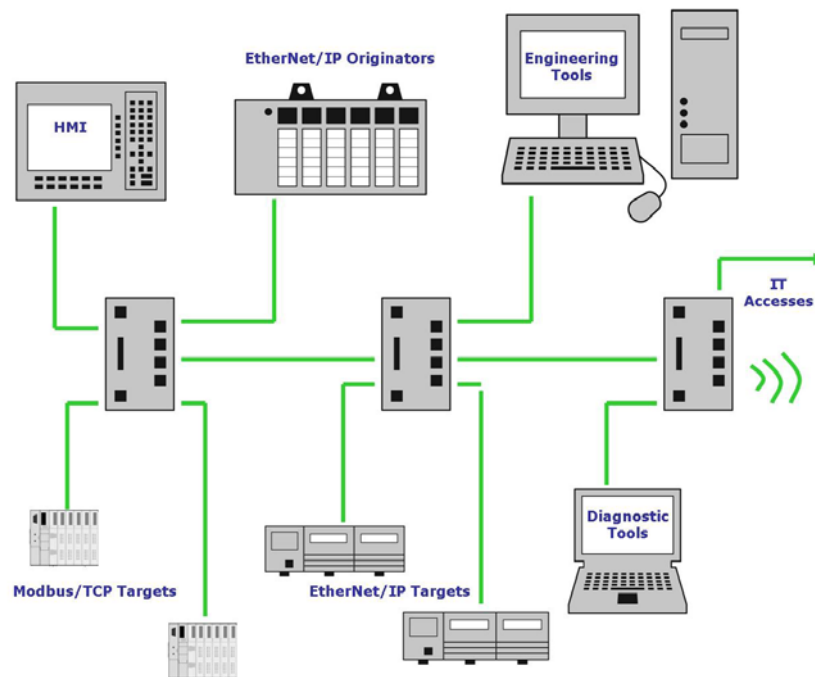


## The CIP Advantage™ Technology Overview Series

# Common Industrial Protocol (CIP™) – Modbus® Integration

### Introduction

In November 2007, ODVA extended the CIP Networks Library of specifications to provide compatibility of Modbus®/TCP devices with networks built on the Common Industrial Protocol (CIP™). This extension provides **seamless access** from CIP originator devices to Modbus target (also known as server) devices consistent with the existing CIP model, providing a standard translation of a subset of CIP functions into the appropriate Modbus functions. It defines how an existing Modbus target has its data items represented by existing standard CIP objects and how those items are described using existing Electronic Data Sheet (EDS) constructs.



**Figure 1**  
**Integrated EtherNet/IP and Modbus/TCP Architecture**

Vendors taking advantage of this requirement will find that there are:

- No required changes to Modbus/TCP target devices
- No required changes to EtherNet/IP target devices
- Minimal changes required for existing EtherNet/IP connection originators (also called scanners or clients) and CIP software tools

CIP-to-Modbus/TCP gateway products are currently in existence, similar to gateway products between any two networks. This extension allows existing vendor-specific CIP-to-Modbus/TCP gateway products to work without change; **however, those vendors and users who take advantage of this extension will see an automatic translation that is not similar to the traditional gateway approach: the enablement of a seamless virtual CIP router, allowing CIP messages to be directly sent to Modbus/TCP target devices.**

In addition, the development allows for seamless CIP-to-Modbus serial line communication in a future revision of the specifications of *The CIP Networks Library*.

The current installed base of equipment is preserved, with full compatibility of existing systems on the same Ethernet network infrastructure:

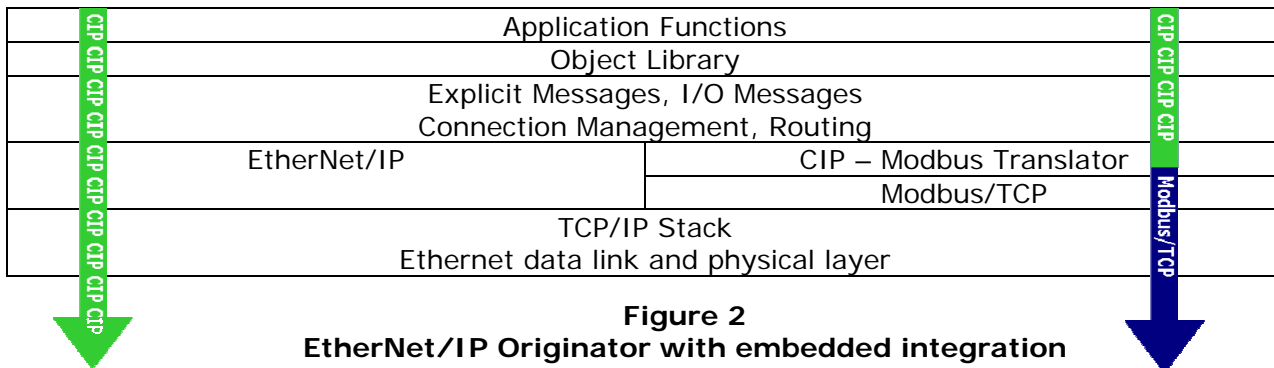
- Existing Modbus/TCP controller-centric systems will continue to support Modbus/TCP target devices
- Existing EtherNet/IP controller-centric systems will continue to support EtherNet/IP target devices
- EtherNet/IP CIP originators that support the new Modbus integration will be able to control and access both EtherNet/IP devices as well as Modbus/TCP target devices from the same application

**Solution Overview**

CIP provides a common set of configuration, control and data collection services for an automation system. The CIP-to-Modbus integration translates between CIP and Modbus/TCP communication protocols and includes both CIP Implicit (I/O) and CIP Explicit Messaging. It brings Modbus/TCP device data into a CIP application in a way that is consistent with the CIP communications model.

This integration may be incorporated into a stand-alone device (e.g., a translator) or incorporated into a CIP connection originator (e.g., controller, scanner, and HMI). All existing Modbus/TCP target devices, from simple devices through complex ones such as programmable controllers, are supported. Further, Modbus/TCP target devices appear as a native CIP target device to a CIP originator.

Defining a CIP to Modbus integration allows all CIP-enabled controllers, originators and clients to use CIP common services for controlling and communicating with all Modbus/TCP target devices, as well as with all EtherNet/IP devices.



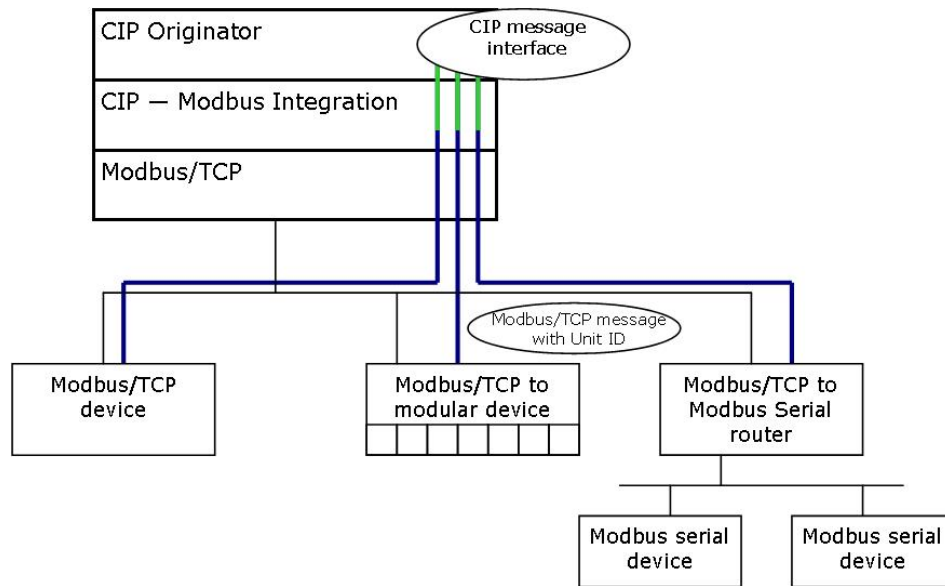
The following outlines how Modbus/TCP functions are represented by existing CIP objects and services:

- Just like other CIP Networks, the Modbus/TCP “port” is identified via the CIP connection path.

- Modbus/TCP data items are accessed with CIP explicit messages using the parameter object. The parameter object instance number is translated to the Modbus data item (e.g., register) number.
- Modbus/TCP I/O data blocks are represented by CIP assembly object instances. The CIP assembly object number are translated to the beginning Modbus register number. When a CIP originator opens an I/O connection, the integration will set up the polling of the appropriate Modbus data blocks using the assembly object instances requested and at the requested cyclic interval.
- Modbus/TCP target device vendors may, if desired, provide an EDS file to simplify the automation system integration by users. An EDS file is used to describe the communication capabilities of a device. An example of this would be to indicate which Modbus/TCP data items are in the device using the ParamN entries (which detail device-specific parameters with such things as min/max/default values, engineering units, scaling, description, etc.) NOTE: It is important to understand that Modbus/TCP target devices do not *require* an EDS file. A generic Modbus/TCP EDS file is defined for use when a vendor-supplied EDS is not provided. This generic file allows software tools that support EDS to set up connection originators for I/O exchanges with Modbus/TCP target devices by prompting the user for basic information available from the vendor's device data sheet. The tool will then provide the conversion to the appropriate assembly object instances and associated sizes.

With this solution, CIP originators can access Modbus/TCP target devices, a specific slot of a Modbus/TCP modular target device, or Modbus serial devices through either a Modbus/TCP-to-Modbus serial Line router or an EtherNet/IP-to-Modbus serial line translator device.

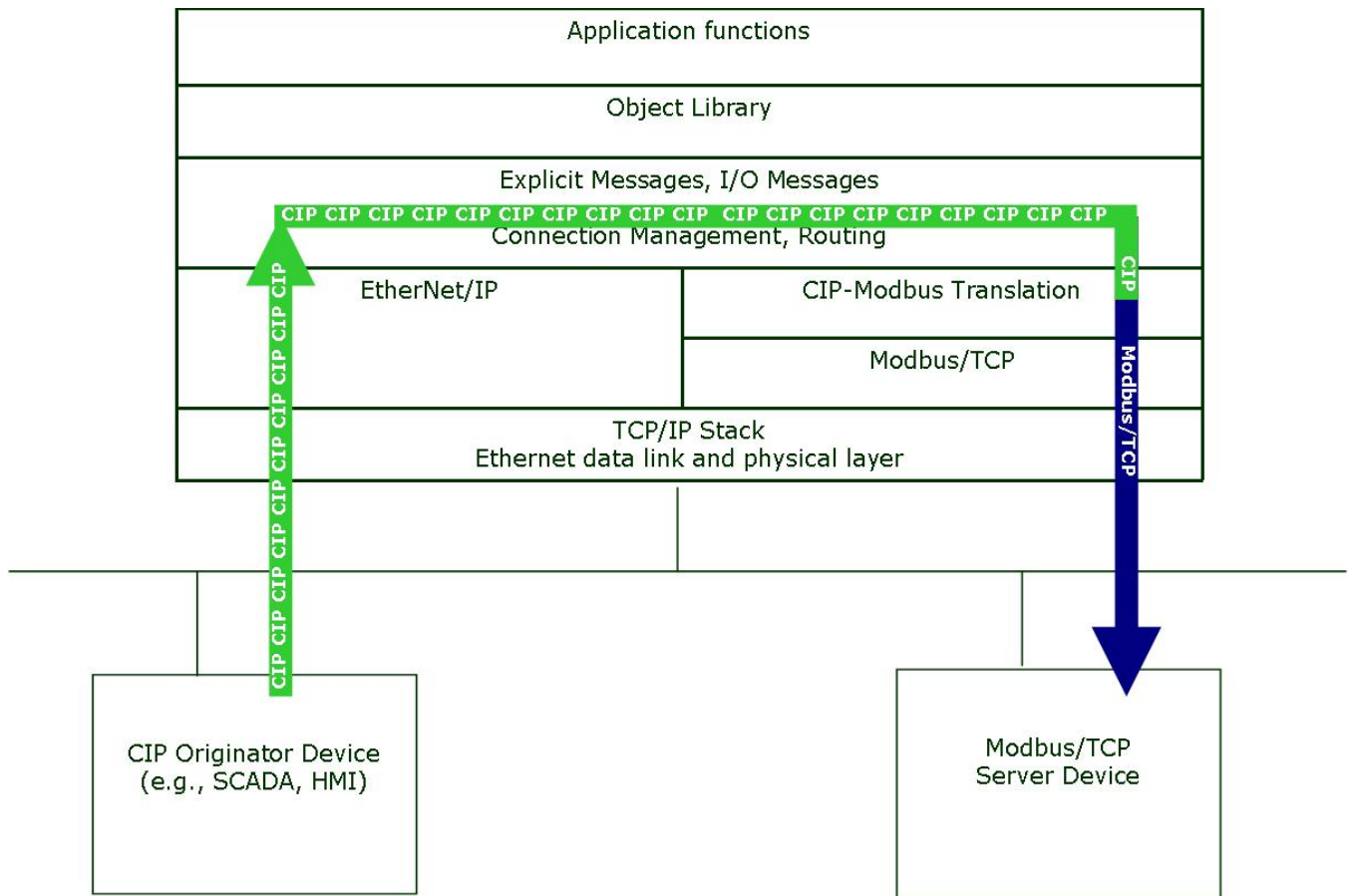
In these applications, the Modbus/TCP Unit-ID protocol field identifies the slot in the Modbus/TCP modular target device or the node number of the Modbus serial device.



**Figure 3**  
**CIP Originator to Modbus/TCP Target Devices**

Due to the flexibility that is inherent with CIP, the routing capability is possible to access Modbus/TCP target devices through a linking device from CIP originator device like an HMI, SCADA, etc.

This standard “routing mechanism” allows EtherNet/IP messages to be translated to Modbus/TCP messages and routed to Modbus server devices.



**Figure 4**  
**CIP Originator to Modbus Device via**  
**External CIP-Modbus Translator**

These same routing services of CIP allow a CIP originator on some other CIP Networks, like ControlNet, DeviceNet or additional EtherNet/IP networks, to be able to access Modbus/TCP or Modbus Serial data items through a CIP router device.

## CIP – Modbus Integration

### Common Questions

- **Will device vendors need to modify existing Modbus/TCP or Modbus Serial target devices to be integrated into an EtherNet/IP system?**  
NO: All existing Modbus/TCP and Modbus Serial target devices will work in an EtherNet/IP system without modification.
- **Will modifications to existing EtherNet/IP devices be required to implement this new feature?**  
NO: All existing EtherNet/IP devices will continue to work in an EtherNet/IP system without modification. They will coexist with Modbus/TCP devices and with EtherNet/IP device that choose to add the translation function.
- **Will end-users benefit from all the CIP services for Modbus/TCP devices?**  
Modbus/TCP devices (and the CIP-to-Modbus integration) are viewed through a subset of CIP objects and services that provide basic Implicit I/O and Explicit messaging functionality. Capabilities like CIP Safety, CIP Sync, and CIP Motion will be not supported through the new integration.
- **Will there be an EDS for each Modbus/TCP device that can be used by CIP software tools supporting device configuration via EDS?**  
Yes, there could be, but an EDS will not be mandatory for a Modbus/TCP device. Software tools that utilize EDS for configuring devices will be able to use a simple Generic Modbus Device EDS file. The tool will prompt the user for the register ranges for input and output data.
- **Will Modbus/TCP devices support CIP Sync?**  
NO: Although Modbus/TCP devices can support IEEE-1588™, they will not support the CIP Sync integration that brings the IEEE-1588 functions into the CIP object model. They will, however, coexist on the same Ethernet system and can be part of the same IEEE-1588 time domain that the CIP Sync devices are using.
- **Will Modbus/TCP devices coexist in a CIP Safety or CIP Motion configuration?**  
YES: Modbus/TCP target devices will be able to coexist in the architecture even if they won't support these functions. The integrated architecture in Figure 1 illustrates this concept.
- **Will Modbus/TCP and EtherNet/IP devices work on the same network wire (in the same Ethernet segment or IP subnet)?**  
YES: Because both protocols utilize standard, unmodified Ethernet and require no special segmentation or separation, there are no limitations.
- **Will a Modbus/TCP client communicate with EtherNet/IP target devices?**  
NO. The CIP - Modbus integration is unidirectional. The purpose of this new capability is to bring Modbus/TCP and Modbus Serial Line target devices into the CIP architecture.
- **What Modbus data item types will be supported by this new integration?**  
All four (4) Modbus data table types will be supported: Discrete Inputs, Coils, Input Registers and Holding Registers.

## Management of the EtherNet/IP Technology

EtherNet/IP is managed by ODVA, an international association of the world's leading automation companies. ODVA's EtherNet/IP management responsibilities include:

- Publishing *The EtherNet/IP Specification*;
- Overseeing the process to incorporate new enhancements to the EtherNet/IP Specification;
- Licensing the EtherNet/IP Technology to companies desiring to make and/or sell EtherNet/IP-compliant products;
- Promoting industry awareness of EtherNet/IP and its benefits; and
- Helping to ensure compliance of EtherNet/IP products with the specification through conformance testing and conformity reporting.

For more information about EtherNet/IP, CIP or ODVA, visit ODVA on the World Wide Web at [www.odva.org](http://www.odva.org).

## About ODVA

ODVA is an international association comprised of members from the world's leading automation companies. Collectively, ODVA and its members support network technologies based on the Common Industrial Protocol (CIP™). These currently include ControlNet™, DeviceNet™, EtherNet/IP™, CompoNet™, CIP Motion™, CIP Safety™ and CIP Sync™. ODVA manages the development of these open technologies, and assists manufacturers and users of CIP Networks through tools, training and marketing activities.

In addition, ODVA offers conformance testing to help ensure that products built to its specifications operate in multi-vendor systems. ODVA also is active in other standards development organizations and industry consortia to drive the growth of open communication standards.

*CIP, CIP Motion, CIP Safety, CIP Sync, CompoNet, ControlNet, DeviceNet, and EtherNet/IP are trademarks of ODVA. Other trademarks are property of their respective owners.*

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