2500 Series® Ethernet Solutions: What is the Best Solution for Your Needs, and How Does Performance Compare between Solutions?

Ethernet and the PLC

Ethernet has become the standard network for data communications on the plant floor, and most modern PLCs offer some form of Ethernet connectivity. Typical uses for Ethernet in PLC systems include:

- Remote programming of the PLC
- HMI/SCADA access
- Peer-Peer communications between PLCs
- I/O communications

There are several solutions available for adding Ethernet connectivity to CTI 2500 Series® and SIMATIC/TI 505® systems. This article explores the capabilities of each solution to help you in selecting the right product for your needs.
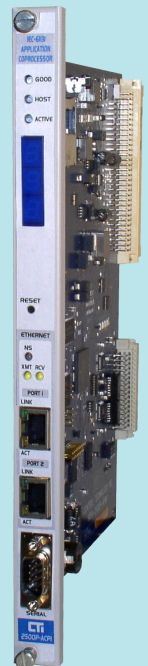
Ethernet Communications Products for 2500 Series® and SIMATIC/TI 505® Systems

There are a number of products that are used for Ethernet communications for CTI 2500 Series® and/or SIMATIC/TI 505® Series systems. Several of the products listed below have been matured and are no longer supported, but they are still in use and included in this article in order to help in comparing the various Ethernet solutions.

Choose the Right Ethernet Communications Solution for Your Needs

CTI offers a variety of products to add Ethernet connectivity to CTI 2500 Series® and SIMATIC/TI 505® PLC systems. Selecting the correct product depends on your needs, including required communication protocols, applications, and performance.

- All CTI 2500 Series® Ethernet products support the 505 Ethernet Protocol also referred to as CAMP or Common ASCII Messaging Protocol

- Speeds vary from 10Mbits to 100Mbits

- Choices range from simple Ethernet interface modules to full-featured co-processing modules to fully compatible 2500 Series® CPUs

- Supported applications include:
  — Peer-to-peer
  — HMI/SCADA access
  — I/O communications
  — Remote programming of the PLC

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Products used for Ethernet communications in CTI 2500 Series® and SIMATIC/TI 505® Series systems include:

- CTI 2572 / SIMATIC® 505-CP2572
- CTI 2572-A
- CTI 2572-B
- CTI 2500 Series® Processors
- CTI 2500P-ECC1
- CTI 2500P-ACP1
- CTI 2500P-JACP
- SIMATIC® 505-CP1434-TF
- SIMATIC® 505-CP1434-TCP

All 2500 Series® Ethernet solutions with the exception of 505-1434-TF use the 505 Ethernet Protocol. You may see this referred to by different names in the literature:

⇒ CAMP (Common ASCII Messaging Protocol)
⇒ NITP over Ethernet
⇒ SIMATIC 505 Ethernet Protocol

This protocol is based on the old serial Non-Intelligent Terminal Protocol (NITP) originally developed by Texas Instruments in the 1980's. Over the years, CTI has enhanced it with new commands to optimize response time and throughput.

Although all the solutions support the 505 Ethernet Protocol (except the 505-CP1434-TF), there are differences between products in the capabilities provided and in other protocols supported. This article summarizes the features of each product in more detail to help you decide on the best solution for your application. The chart at the end of the article provides a one-page high-level comparison of the existing solutions in an easy-to-read

table format.

CTI 2572 / SIMATIC® 505-CP2572

The CTI 2572 / 505-CP2572 enables Ethernet communication between its host CPU (either a CTI 2500 Series® Cxxx or SIMATIC/TI 505® CPU) and other CTI or SIMATIC TI505 controllers (each additional SIMATIC/TI

505 controller requires its own Ethernet solution in order to communicate over Ethernet), SIMATIC S7 controllers (using CP143 modules), PCs and other 3rd-party units supporting the 505 Ethernet protocol. The 2572 can also directly send email messages.

Common applications for the 2572 include peer-peer communications between PLCs, HMI/SCADA access, programming using Workshop / TiSoft / APT, and communication to S7 PLCs using Send/ Receive. The 2572 also supports simultaneous communication to multiple 2572's using a broadcast protocol (Datashare).

The 2572 was introduced in 1995 and matured in 2012. It is still supported but no longer available except as used/refurbished.

Configuration of the module is done offline or from RLL. For peer-peer communications, you must write RLL to initiate communication requests. The module logs in as 2WX/6WY and these words are used to trigger and monitor communications.

The 2572 supports 10Mbit speeds and delivers a performance of 68 packets/sec in our standard SCADA test. This test consists of 3 connections coming from Kepware OPC Servers running on 2 different PCs, with each connection polling 1000 C's and 1000 V's at 10msc speed, and a 30msec PLC scan. The performance measured is the total throughput (packets in + packets out).

CTI 2572-A and 2572-B

Like the 2572, both the CTI 2572-A and the 2572-B enable communications over an Ethernet network between the host PLC and other CTI or SIMATIC TI505® controllers, PCs and other 3rd-party units supporting the 505 Ethernet protocol. Like the 2572, it communicates directly over Ethernet to CTI 2500-Cxxx processors. Unlike the 2572, however, it does not support direct Ethernet communications to S7 PLCs.

Common applications for the 2572-A and 2572-B include peer-peer communications between PLCs, HMI/SCADA access, and programming using Workshop / TiSoft / APT. Both modules also support communications to Modbus-TCP devices (as a Modbus "slave" or "server") and communication to Rockwell PLCs using Ethernet/IP. Simultaneous communication with multiple 2572-A's and 2572-B's is possible using the included IP multicast protocol.

Configuration of the modules is done offline or from RLL. For peer-peer communications, you must write RLL to initiate communication requests. The modules log

in as 2WX/6WY and these words are used to trigger and monitor communications.

The 2572-A was introduced in 2001 and is still supported, but it is no longer manufactured. In June 2016, CTI announced the release of the 2572-B, which is a direct replacement for the 2572-A. The 2572-B includes a more powerful web browser interface and new on-board display of the module IP address.

The 2572-A and 2572-B support 100Mbit speeds and scored a performance of 102 packets/sec in our test, about 50% faster than the 2572.

CTI 2500P-ECC1

The 2500P-ECC1 enables Ethernet communication between its host CPU (which MUST be a CTI 2500 Series® Cxxx CPU) and other CTI ethernet products (CTI CPUs, 2572, 505-CP2572, 2572-A, 2572-B, or 505-CP1434-TCP), PCs and other 3rd-party units supporting the 505 Ethernet protocol.

Common applications include HMI/SCADA access (with extremely fast performance due to the built-in caching of data), and peer-peer communications between PLCs. The module also supports Modbus TCP communications as master or slave, and simultaneous communication to multiple ECC1s using Network Data Exchange protocol.

It was introduced in 2013 and is still manufactured and supported.

Configuration is done offline using a free configuration utility. A big benefit of using the ECC1 over previous Ethernet solutions is that it requires no PLC programming to perform peer-peer communications.

The ECC1 supports 100Mbit speeds and scored a performance of 989 packets/sec in our test, about 10X the performance of 2572-B and 15X the performance of 2572.

CTI 2500P-ACP1 and 2500P-JACP

The CTI 2500P-ACP1 enables Ethernet communication
between its host CPU (CTI 2500 Series® Cxxx CPU or Simatic/TI 505® - with restrictions) and other CTI Ethernet products (CTI CPUs, 2572, 505-CP2572, 2572-A, 2572-B, or 505-CP1434-TCP), PCs and other 3rd-party units supporting the 505 Ethernet protocol.

As a fully programmable module, the APC1 can function as a coprocessor, working in cooperation with the main process PLC but running an independent and complementary logic scan. Up to 4096 PLC registers can be

read/written to the host PLC on each scan. It also features a simple-to-use Ethernet TCP Management interface that allows the user to develop customized Ethernet communications for communicating with a wide variety of third-party devices using a custom protocol.

Common applications include peer-peer communications between PLCs, communication with Rockwell PLCs, and control of Modbus-TCP devices and Ethernet/IP devices like Variable Speed Drives. The module also supports simultaneous communication to multiple ACP1s or ECC1s using Network Data Exchange protocol. The 2500P-ACP1 was introduced in 2014 and is still manufactured and supported. It is configured offline using the CTI Workbench Integrated Development Environment.

The ACP1 supports 100Mbit speeds. As it cannot function as a SCADA interface, it was not tested using our standard SCADA test.

The 2500P-JACP is a new solution offering all the features of 2500P-ACP1 plus:

- New Block Transfer Driver which optimizes the exchange of up to 2048 data points with a Siemens, TI, or CTI PLC using the special function I/O backplane protocol. The application can select to exchange V, X/Y, WX/WY, or Control Relays for continuous Read or Read/Write. Note this feature allows the 2500P-JACP to be used with existing Simatic/TI 545 and 555 PLCs.

- Additional Ethernet/IP capabilities of Tag Server, Explicit Message Client/Server and Flex I/O Client. These new protocols offer additional ways to operate in networks with Rockwell PLCs and other Ethernet/IP devices.

- OPC-UA server provides a standardized interface for data access which is supported by most major HMI/SCADA systems. This allows CTI 2500-Cxxx CPUs and Simatic 545/555 to operate in OPC-UA environments with SCADA systems like Ignition.

The 2500P-JACP should be used on all new designs, instead of 2500P-ACP1. It is backwards compatible with all 2500P-ACP1 programs.

CTI 2500 Series® Processors

CTI 2500 Series® Processors can communicate over an Ethernet network with other CTI or SIMATIC TI505 controllers (both must use a 2572, CP2572, 2572-A, 2572-B, ECC1, ACP1 or 505-CP1434-TCP modules), PCs and other 3rd-party units supporting the 505 Ethernet protocol.

Common applications include HMI/SCADA access and

programming using Workshop / TiSoft / APT. The product was introduced in 2007 and is still manufactured and supported.

2500 Series® Processors can support SCADA communications directly using the on-board Ethernet port at 100mbit speeds. They scored a performance of 199 packets/sec in our test, or about 2X the performance of a 2572-B and 3X the performance of a 2572.

SIMATIC® 505-CP1434-TF (SINEC H1 Module)

The 505-CP1434-TF (SINEC H1 module) enables Ethernet communications over an H1 Ethernet network between its host PLC (SIMATIC/TI 505® or CTI 2500 Series® Cxxx – with restrictions) and other SIMATIC TI505 controllers, SIMATIC TI575 control systems, SIMATIC S5 controllers with CP143 modules, CP1413 Ethernet boards for PCs, and other 3rd-party units supporting H1 protocol.

Common applications include peer-peer communications between PLCs, HMI/SCADA access (PC must have CP1413 card installed and appropriate driver), and programming using TiSoft, APT, or Workshop.

The 1434-TF requires configuration using offline Windows software. The module logs in as 4WX/4WY and these words are used to trigger and monitor communications.

A big drawback to using the 1434-TF is that it requires an H1 card in remote PCs for programming and HMI/SCADA access, and also requires an external AUI media converter to support standard Ethernet cabling. It communicates at 10Mbit speeds, but was not tested in our SCADA test due to the need for the specialized interface card in the PC.

The H1 module was introduced in the early 1990s and matured in 2003. It is no longer supported and is available only as used/refurbished. As the proprietary H1 protocol supported by the product is no longer being used in the industry and has been replaced by other Ethernet protocols, CTI recommends replacement of SINEC H1 modules still in service. We provide technical support and financial incentives to help with Smart Modernization of the these modules. For more details, see our Technical Advisory "505-CP1434TF SINEC H1 Module incompatibilities with CTI 2500 Series® Processors"

SIMATIC® 505-CP1434-TCP

The 505-CP1434-TCP module enables Ethernet communications between its host PLC (either a CTI 2500 Series® or SIMATIC/TI 505® controller) and other CTI or SIMATIC TI505® controllers, SIMATIC S7 controllers (with CP343-1), PCs, and other 3rd-party units supporting the 505 Ethernet protocol. It can also send email messages.

Common applications include peer-peer between SIMATIC 505 PLCs, peer-peer with S7 controllers, and HMI/SCADA access.

It was introduced in the late 1990s and matured in 2003. It is no longer supported and is available only as used/refurbished.

The CP1434-TCP requires configuration using offline Windows software. For peer-peer, you must also write RLL to initiate communication requests. The module logs in as 4WX/4WY and these words are used to trigger and monitor communications. It requires an AUI media converter to support standard twisted-pair Ethernet cabling, and supports 10Mbit communications.

Continuous Evolution

CTI continues to invest in the development of Ethernet communications technology for the 2500 Series® system. With recent enhancements to our 2500P-ACP1 Coprocessor module (to add new protocols) and the introduction of the 2572-B (to continue support for the widely-used 2572-A), we remain committed to offering the latest in capability and performance in Ethernet communications.

Please do not hesitate to contact us if we can be of any assistance. We appreciate your business.

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Comparing 2500 Series® Ethernet Solutions

	2572	2572-A	2572-B	2500 Series® CPU	2500P-ECC1	2500P-ACP1	2500P-JACP	505-CP1434-TF	505-CP1434-TCP
Applications Supported									
PLC programming	✓	✓	✓	✓				✓	✓
HMI/SCADA access	✓	✓	✓	✓	✓		✓[11]	✓	✓
Peer-peer (CAMP)	✓	✓	✓	✓[6]	✓	✓	✓		✓
Peer-peer (other)	✓[1]	✓[2]	✓[2]		✓[2,3]	✓[2,3]	✓[2,3]	✓	
Communication to SIMATIC/TI 505® CPU over the backplane	✓	✓	✓			✓	✓	✓	✓
Communication to Rockwell PLCs		✓[4]	✓[4]			✓[5]	✓[12]		
Communication to S7	✓								✓
Email	✓								✓
Communication to Modbus TCP devices		✓[9]	✓[9]		✓	✓	✓		
Communication to Ethernet/IP devices		✓[4]	✓[4]			✓[5]	✓[12]		
Performance in CTI standard SCADA test									
Packets sent/received per second [10]	68	102	102	199	989	N/A	N/A	N/A	N/A
Protocols Supported									
505 Ethernet (aka CAMP, NITP)	✓	✓	✓	✓[7]	✓	✓[8]	✓		✓
Multicast		✓	✓		✓	✓	✓		
Network Data Exchange					✓	✓	✓		
Data Share	✓								
Modbus-TCP		✓[7]	✓[7]		✓	✓	✓		
Ethernet/IP		✓[4]	✓[4]			✓[5]	✓[12]		
H1								✓	
Communicates Directly With (Over Ethernet)									
2572	✓	✓	✓	✓	✓	✓	✓		✓
2572-A	✓	✓	✓	✓	✓	✓	✓		✓
2572-B	✓	✓	✓	✓	✓	✓	✓		✓
2500 Series® CPUs	✓	✓	✓		✓	✓	✓		✓
2500P-ECC1	✓	✓	✓	✓	✓	✓	✓		✓
2500P-ACP1	✓	✓	✓	✓	✓	✓	✓		✓
505-CP1434-TF								✓	
505-CP1434-TCP	✓	✓	✓	✓	✓	✓	✓		✓
Other									
For Direct Use with SIMATIC TI505®	✓	✓	✓			✓	✓	✓	✓
Webserver for diagostics		✓	✓	✓	✓	✓	✓		
OPC/DDE support	✓	✓	✓	✓	✓		✓	✓	✓
100Mbit speed		✓	✓	✓	✓	✓	✓		
1000Mbit speed							✓		
Availability									
Manufactured and supported			✓	✓	✓	✓	✓		
Support Only	✓	✓							

Notes

[1] Datashare protocol

[2] IP Multicast

[3] Network Data Exchange

[4] Supports accessing V memory using CIP DATA TABLE READ and CIP DATA TABLE WRITE messages

[5] Supports connections to Ethernet/IP devices via I/O Scanner, I/O Adapter, Explicit Message Adapter, and Tag Client interfaces

[6] CPU supports "server only" for peer-peer

[7] Supports "server" operation only

[8] Supports "client" operation only

[9] Supports "slave" operation only

[10] Tested with Kepware OPC Server, 3 connections from 2 different PCs, each connection polling 1000 C's and 1000 V's at 10msc speed, 30msec PLC scan

[11] Using OPC-UA or CAMP Server

[12] Supports connections to Ethernet/IP devices via I/O Scanner, I/O Adapter, Tag Client/Server, Explicit Message Client/Server, and Flex I/O Client

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