Option 34
Network Time Protocol / Precision Time Protocol Server

Available for Models 1084, 1088, and 1093

The Network Time Protocol / Precision Time Protocol Server option allows an Arbiter Systems®, Inc. GPS Satellite-Controlled Clock to act as a time server over an Ethernet network using the Network Time Protocol (NTP) and the Precision Time Protocol[1] (PTP). Operating as a primary server (NTP stratum 1 or PTP Grandmaster), time is distributed to connected systems, such as workstations, PCs, servers, routers, relays and other IEDs via the two Ethernet interfaces (10/100BT or Fiber). The Network Time Protocol Server understands NTP version 2, version 3 and version 4 frames while optionally supporting authentication via DES and MD5 cryptographic checksums as defined in RFCs 5905. Typical accuracy for NTP is one millisecond on a LAN to a few tens of milliseconds on a WAN as compared to UTC (Coordinated Universal Time); accuracy varies depending upon network traffic. The Precision Time Protocol Server supports the IEEE 1588-2008 protocol and functions as a grandmaster clock[1]. PTP accuracy using software only is better than 100 microseconds and using hardware assist is better than 1 microsecond.

The Option 34 was designed with flexibility and security in mind allowing customized configurations while maintaining NERC CIP compatibility. Dual 10/100 Mb/s, independently configurable Ethernet ports give simultaneously access to both the NTP and PTP servers. Providing both NTP and PTP support allows for future upgrade paths for networks that currently lack PTP hardware support. Configuration is simplified using the web interface or the SSH console. The two 10/100 Ethernet ports can be either the standard electrical RJ-45 connectors, SFF (small form factor) fiber modules or a combination of both.

NTP Principles of Operation

Synchronizing a client to a network server consists of several packet exchanges where each exchange is a pair of request and reply. The client stores its local time into the packet being sent. The server receives the packet and then stores its own estimate of the current time into the packet and returns the updated packet. The client receives the updated packet and will once more log its own receipt time to estimate the travelling time of the packet.

These time differences are used to estimate the time it took for the packet to be transmitted from the server to the client. That round-trip time is taken into account when estimating the current time. The shorter the round-trip time, the more accurate the estimate of the current time.

It takes several packet exchanges before the client accepts the server time is correct. Only when the replies from the server satisfy the conditions defined in the protocol specification, is the server considered valid. Time cannot be synchronized from a server that is considered invalid by the protocol. Multistage filters are used to estimate the quality of the time samples. Usually it takes about five minutes (five good samples) until an NTP client is synchronized to a server.

The quality estimate of a client, obtained using multistage filtering, usually improves over time. If the client has a more accurate estimate than a server, such a server may be considered invalid after some time.

PTP Principles of Operation

PTP was developed to provide very precise time coordination of LAN connected devices using hardware assisted synchronization. Similar to NTP, PTP uses a master clock to provide a time reference for one or more slave clocks or clients. PTP clients use a best master clock algorithm to determine the best clock to synchronize with. The master clock sends out a synch message every 2 seconds (default setting) and then sends out a follow up message with the exact time the original sync message was sent. The slave clock sends a delay request message to the master clock noting the time it was sent in order to measure and eliminate packet delays. The master clock then replies with the time stamp the delay message was received. The slave clock then computes the master clock time compensated for delays and finalizes synchronization.

[1]Hardware support to be added in later firmware revisions.

Option 34 Specifications

Specifications

Performance

Accuracy	NTP: Better than one hundred microseconds, depending on network load and clock accuracy
	PTP: Better than one hundred microseconds (software), Better than one microsecond with hardware assist[1]

Interface

Operator

Status LEDs	Synch (green) Fault (red) Link (green 10 Mb/s, yellow 100 Mb/s)
Front Panel	Server Status Network Status IP Address MAC Address
Management	Web (HTTP or HTTPS) and SSH
Setup	IP Number (DHCP or Static) Net Mask Gateway Reference Identifier UDP Broadcast parameters Authentication

System

Network	Two Ethernet (Ver 2.0/IEEE 802.3) 10/100BT Standard Multi-mode SSF modules (optional)
Protocols	NTP, SNTP, PTP (IEEE 1588™-2008)[1] ICMP, SNMP[1], TCP, SSH, SCP, SSL HTTP, HTTPS, DHCP

Options

Ethernet Modules

The Option 34 comes with two Ethernet ports; please specify both ports (default configuration is Opt34C1C1)

Standard RJ-45 10/100 BT	C1
62.5/125 µm 50/125 µm Multi-mode Fiber (LC connectors)	F1

*More small form factor (SFF) fiber modules available, please contact factory.

[1] Feature to be included in future firmware release.

Specifications subject to change without notice.

Arbiter Systems, Inc. · 1324 Vendels Circle, Suite 121 · Paso Robles, CA 93446 · USA
Tel: +1.805.237.3831 · Fax: +1.805.238.5717 · E-mail: sales@arbiter.com · Internet: http://www.arbiter.com