GE
Digital Energy

MultiSync™ 100 1588 GPS Clock

Modernize time synchronization for power systems

Accurate time synchronization is required to coordinate the actions of protective relays, generator controllers, distributed resources, power system controllers, energy storage, and microgrids. Every device must be synchronized to the same time source to ensure coordinated action. Traditional time synchronization methods have shortcomings, such as the separate analog copper wiring required for IRIG-B or the lower accuracy of SNTP/NTP over Ethernet networks.

The MultiSync 100 uses the IEEE® Standard 1588-2008 for Precision Clock Synchronization Protocols used in Networked Measurement and Control Systems, as well as the C37.238-2011 IEEE Standard Profile used in Precision Time Protocols within Power System Applications. As a result, the MultiSync 100 provides highly accurate time synchronization, and allows for the gradual retirement of less accurate or more costly methods.

Key Benefits

- Supports latest 1588-2008 and C37.238-2011 standards for Ethernet-based time synchronization
- Upgrade existing substations to 1588 support without replacing existing time synchronization infrastructure
- Provides accurate time synchronization for protection and control applications through MultiLink™ Ethernet switches, Multilin™ Universal Relays and Multilin 8 Series Relays
- Designed and tested specifically for rugged environments such as utility substations

Application

- Power substations for synchrophasor and grid modernization applications
- IEC® 61850 process bus sampled value applications
- Industrial Ethernet for time-based control
- Upgrading legacy installations to IEEE 1588

Precise Time Synchronization

- Supports IEEE 1588-2008 and C37.238-2011 for power system applications
- Operates as a master clock or ordinary clock
- Part of complete GE end-to-end timing solution for protection and control
- Integrates into existing time synchronization networks by supporting traditional time synchronizing methods

Supports Common Methods

- IEEE 1588-2008
- IEEE 1588-2008 / C37.238-2011
- NTP/SNTP
- IRIG-B
- DCF77
- TTL
- XYZ

Flexible Design

- Compact size and DIN rail mountable case for easy mounting
- Tested to substation environmental standards
- Wide range, Isolated power supply

imagination at work

The need for cost-effective, accurate time synchronization

Accurate time synchronization is becoming a critical requirement in today's power system substations. For example:

- Synchrophasor measurements to support wide area monitoring systems and remedial action schemes require time synchronization accurate down to 1 microsecond
- Merging units, that publish sampled values for use by protective relays, meters, and control devices require time synchronization accuracy of 25 microseconds
- Coordinating fault records and event logs across multiple devices requires time synchronization of 500 microseconds

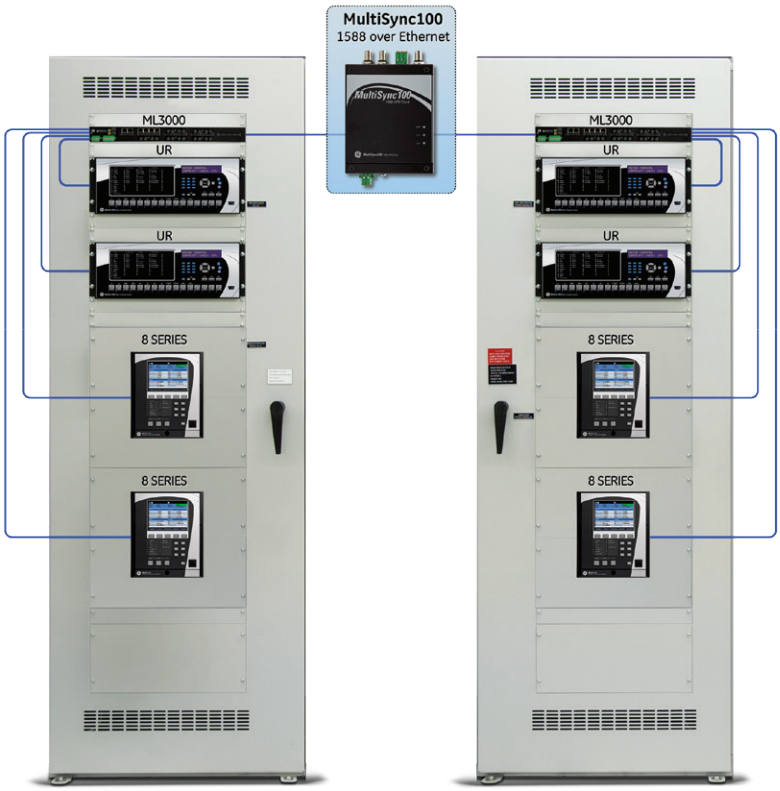
There are two different challenges to the traditional method for time synchronization. The first is that time synchronization has been implemented by connecting end devices to a local satellite clock. This synchronizes all elements in a specific substation together, but this may not be adequate for system wide synchrophasor applications. The second challenge is that accurate time synchronization has required a dedicated time network. The most common method employed which provides the accuracy required is IRIB-G. IRIG-B sends out analog pulses, which requires a dedicated analog network built on copper wiring. This network must be installed separately, and is challenged by voltage drop due to distance and the number of connected devices, as well as electrical interference. SNTP/NTP can send time synchronization signals via an Ethernet network, but does not account for switching time delays, and therefore doesn't meet the accuracy requirements of time sensitive applications.

Upgrade to IEEE 1588 at low cost

IEEE 1588-2008 is the technical solution designed to provide cost effective time synchronization from devices in a substation up to the whole utility grid. The challenge to implementing 1588 in a substation is interfacing with devices that only support legacy time synchronization methods. The MultiSync 100 1588 GPS Clock is a cost-effective solution to this challenge. Compact size, with DIN rail mounting, provides great flexibility in installation. Network and analog output ports allow interfacing into legacy time synchronization networks while simultaneously providing IEEE 1588 signals.

The MultiSync 100 supports common network time synchronization methods, including IEEE 1588, C37.238 and SNTP/NTP. The MultiSync 100 also supports common analog methods of time synchronization, including IRIG-B, TTL, and user defined pulse methods. The network and analog methods can be supported simultaneously by MultiSync 100. One compact, affordable MultiSync 100 GPS Clock can provide timing synchronization for 1588 compliant devices and legacy devices in the substation, providing a simple, low cost upgrade path.

A complete end-to-end solution for IEEE 1588



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IEEE 1588-2008 support

The MultiSync 100 clock is a 1588 GrandMaster clock that can be synchronized to a GPS satellite, and also an ordinary clock synchronized to a local or system wide 1588 GrandMaster clock. The operating mode is determined by the Best Master Clock algorithm. The MultiSync 100 supports both IEEE 1588-2008 and the C37.238-2011 Power Profile. Specifics of the 1588-2008 implementation are as follows:

- Timing accuracy is <100ns to UTC for 1588 and SNTP/NTP
- Best Master Clock algorithm to determine GrandMaster or ordinary clock operation
- Profile selection: 1588-2008 or C37.238-2011
- Layer 2 or Layer 3 mapping
- Peer-to-Peer and End-to-End delay support
- Multicast operation
- Typical ordinary clock PPS accuracy (single subnet) <250ns

A complete end-to-end solution for IEEE 1588

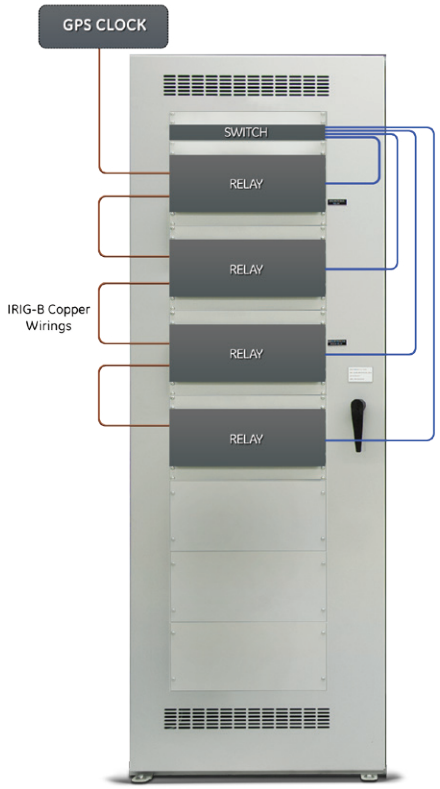
The MultiSync 100 is part of a complete end-to-end 1588 time synchronization solution for power system substations and industrial applications. This solution includes:

- MultiSync 100 operating as a GrandMaster clock
- MultiLink ML3001/ML3100 Ethernet switches with 1588 modules
- The MultiLink switches can operate as a 1588 Transparent Clock or 1588 Boundary Clock

Retrofit application

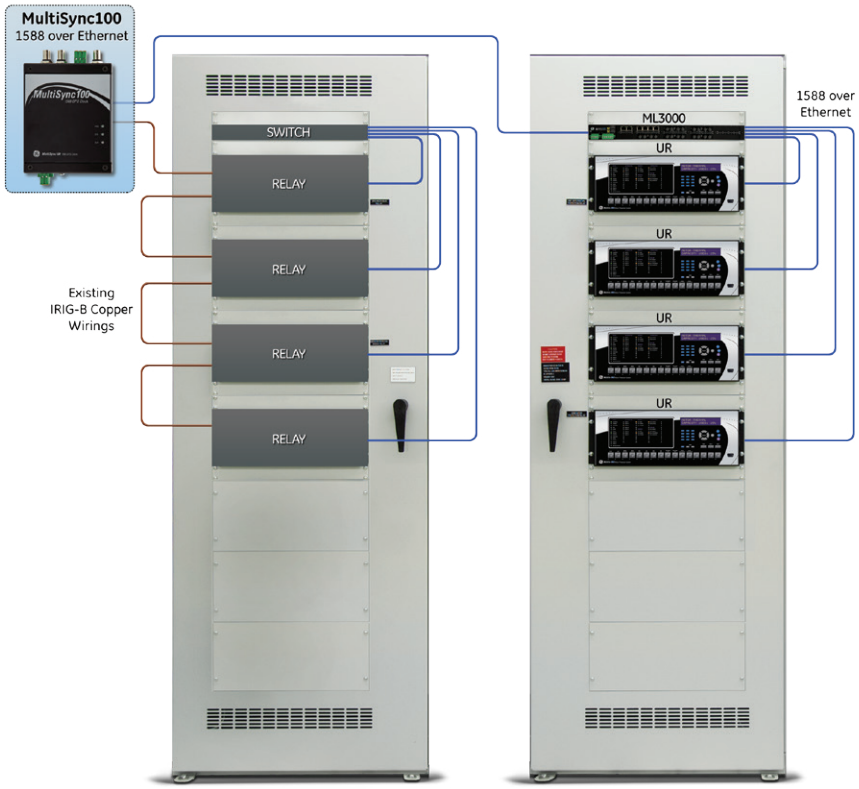
A utility desires to add 1588/C37.238 time synchronization to an existing substation. Installed devices only support IRIG-B or other traditional time synchronization methods. The MultiSync 100 integrates into the existing infrastructure through the included TTL (IRIG-B) analog output ports, while simultaneously publishing 1588/C37.238 time synchronization signals over the Ethernet network. Adding 1588 simply requires installing the MultiSync 100, and an Ethernet switch that supports 1588 such as the MultiLink ML3000 Series.

Before



IRIG-B is a separate analog communication network just for timing.

After upgrade to IEEE 1588

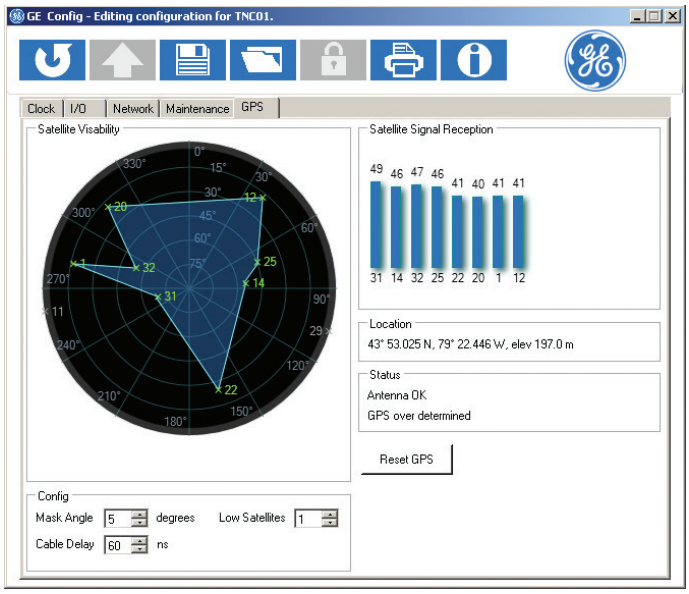


Upgrade to 1588 over Ethernet while maintaining existing timing network for installed relays.

Ease of configuration

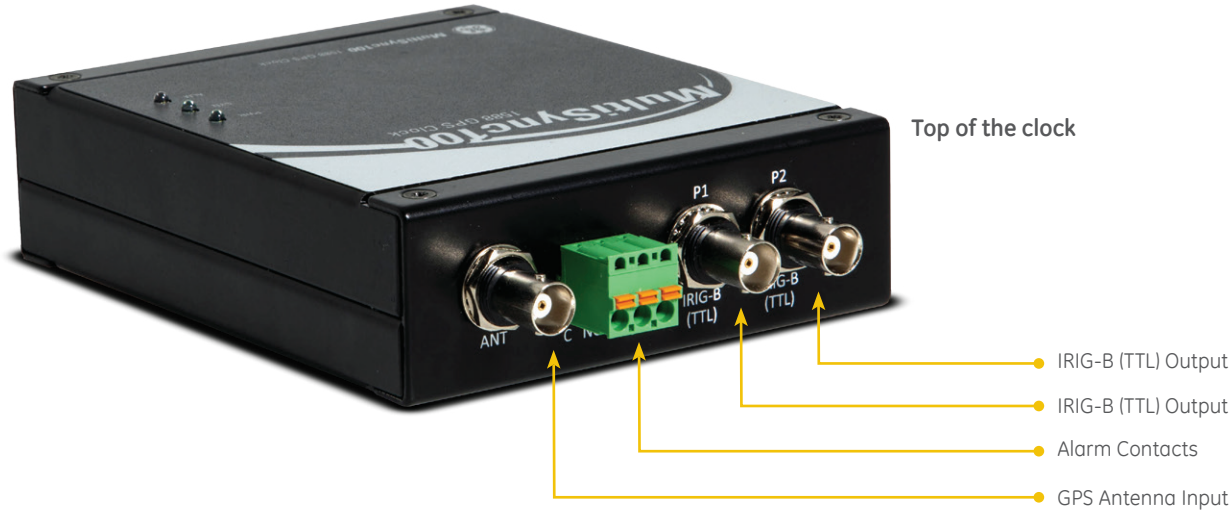
The MultiSync 100 provides intuitive software to completely configure all aspects of the clock, as well as to display time synchronization data. Timing and synchronization options include:

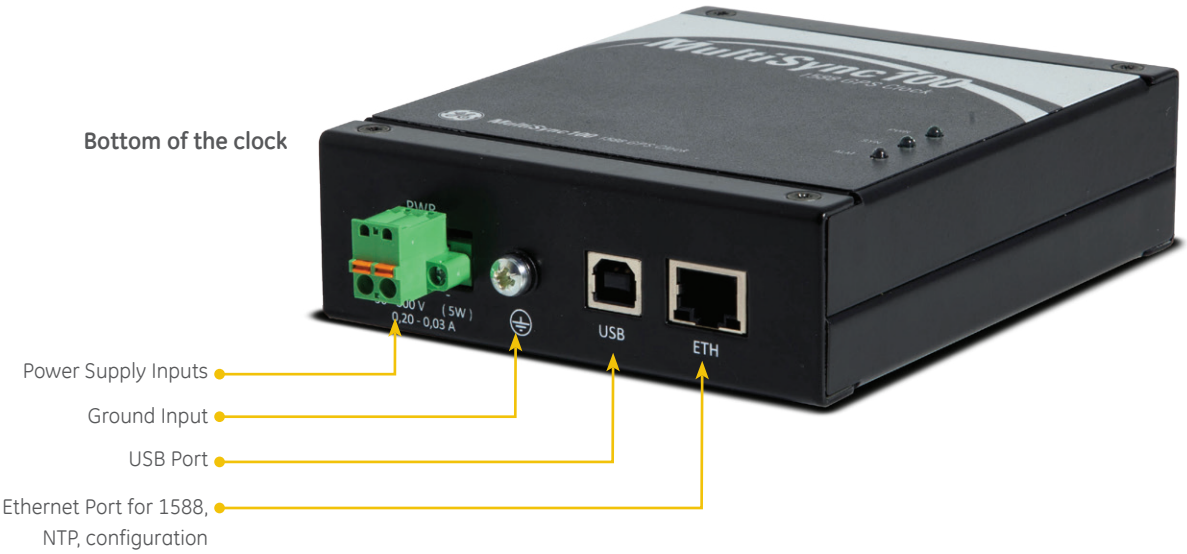
- Worldwide daylight savings and local time configuration using rule based or fixed date methods
- Adjustable holdover times for reliability for poor GPS coverage
- Compensation for installation parameters such as GPS signal delay through antenna cable
- Programmable outputs include:
- IRIG-B (B00x/B22x) time code with selectable IEEE 1344 and AFNOR S87-500 extensions
- DCF77 time code
- ¬1000Hz (500¬s) pulse
- User defined pulse sequences with repetition rates from 20ms to 24 hours, and 100ns accuracy



Configuration screen for MultiSync 100.

Connection drawings





Technical specifications

ELECTRICAL	
POWER SUPPLY	
Voltage	36 to 300 VDC
Power drain	5 W max
ISOLATION	
Power to antenna	3.75kV
Power to I/O	3.75kV
INPUTS	
RJ45 UTP connector	10/100 Mbps
USB2.0	Type B
OUTPUTS	
Sync indication output	200 V, 150 mA (max)
2 x TTL outputs	• Time codes or pulses or user defined • Electrical specifications: TTL/ CMOS compatible • 0-5 V, 150 mA sink/source • Timing accuracy ≤ 100 ns to UTC

ENVIRONMENT SPECIFICATIONS	
AMBIENT TEMPERATURES	
Operating temperature	-40 to +85° C
OTHER ENVIRONMENTAL	
Humidity (non-condensing)	to 95%
MECHANICAL PROPERTIES	
Dimensions (H x W x D)	45 x 110 x 155 mm
Weight	0.42 kg
Insulation	Metal DIN rail-mountable case with IP30 (Ingress Protection rating)

OUTPUT OPTIONS	
TTL	
Programmable pulses	From 1000 per second to 1 per day with programmable offset & duration
DCF-77	• DC level shift • Local or universal time
IRIG-B	• DC level shift or Modified Manchester • IEEE 1344 extensions (C37.118) • AFNOR NF S87-500 extensions • Local or universal time

NETWORKING	
GENERAL	
DHCP	Auto-configuration with fallback to ARP tested link-local Address
VLAN	Packet tagging
PTP (IEEE 1588 V2)	
General	• One-step or two-step operation • End-to-end or peer-to-peer delay calculations • Layer 2 (Ethernet) or Layer 3 (UDP) transport • Slave only mode • Default profile support
Power Profile support	C37.238
TLV support	C37.238
Alternate Time Offset TLV support	with automatic or manual offset
SNMP MIB support	C37.238

NTP	
General	• Stratum-1 NTP & SNTP time server • Multicast & Broadcast server capability • Optional MDS authentication
SNMP	
General	• V1, V2C, and V3 support, independently enabled • Configurable V1 and V2C community names and security groups • Fully configurable via SNMP • V3 User-based Security Module (USM) support • USM MIB support
USM authentication methods	MDS, SHA
USM privacy methods	• DES, AES (Ingress Protection rating)
NOTIFICATIONS	
General	• SNMP trap generation V1, V2C, and V3 • SNMPv3 traps authenticated and privatized via USM • Syslog (RFC-3164 and 5424 verified)

Approvals and certification

COMPLIANCE	APPLICABLE COUNCIL DIRECTIVE	ACCORDING TO
CE compliance	Low voltage directive	EN60950-1
	EMC directive	EN61000-6-2, EN61000-6-4
North America	cULus	UL60950-1, C22.2 No. 60950-1, CB Report including all country deviations
ISO	Manufactured under a registered quality program	ISO 9001:2008

IEEE 1613 (37.90.X) EMI immunity type tests

TEST	DESCRIPTION		LEVELS
IEEE 37.90.3	ESD	Enclosure Contact	+/-2 kV, +/-4 kV, +/- 8 kV
		Enclosure Air	+/-4 kV, +/-8 kV, +/- 15 kV
IEEE 37.90.2	Radiated RFI	Enclosure Ports	35 V/m
IEEE 37.90.1	Fast Transient	Signal Ports	+/-4 kV @2.5kHz
		D.C. Power Ports	+/-4 kV
IEEE 37.90.1	Oscillatory	Signal Ports	2.5kV common mode @1MHz
		D.C Power ports	2.5 kV common, 1 kV diff. Mode @1MHz
IEEE 37.90	H.V. Impulse	Signal Ports	5 kV (fail-safe relay output)
		D.C. Power ports	5 kV
IEEE 37.90	Dielectric Strength	Signal Ports	2 kVAC
		D.C. Power ports	2 kVAC

Type tests

TEST	REFERENCE STANDARD	LEVELS
Electrostatic Discharge	EN61000-4-2	Level 4
RF immunity	EN61000-4-3	Level 3 20V/m 80-1GHz, 1.4 GHz to 3 GHz
Fast Transient Disturbance	EN61000-4-4	Level 3 & 4
Surge Immunity	EN61000-4-5	Level 4
Conducted RF Immunity	EN61000-4-6	Level 3
Power magnetic Immunity	IEC61000-4-8	Level 3
Voltage Dip & interruption	IEC61000-4-29, IEC61000-4-11	
Ripple on DC power supply	IEC61000-4-17	
Damped Oscillatory	IEC61000-4-12	
Radiated & Conducted Emissions	CISPR22	Class A
Sinusoidal Vibration	60255-21-1	Class 1
Shock & Bump	60255-21-2	Class 1
Seismic	60255-21-3	Class 2
Safety	EN60950-1	standard
RF Immunity	IEEE C37.90.2	20 V/m, 80-1 GHz
Oscillatory Surge	IEC61850-3	Level 4 (4 kV)
Dielectric	IEEE 1613	2 kV, 500 V
Impulse	IEEE 1613	5 kV

Environmental type tests

TEST	DESCRIPTION		LEVELS
IEC 60068-2-1	Cold Temperature	Test Ad	-40°C, 16 hours
IEC 60068-2-2	Dry Heat	Test Bd	+85°C, 16 hours
IEC 60068-2-30	Humidity (Damp Heat, Cyclic)	Test Db	95% (non-condensing), 55°C, 6 cycles
IEC 60255-21-1	Vibration		2 g at 10-150 Hz
IEC 60255-2	Shock		30 g @ 11 mS

Product ordering

PART NUMBER	DESCRIPTION
MultiSync 100-P	MultiSync 100 1588/C37.238 GPS Clock

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