ALBEDO
it's all about timing

Net.Time τ is a PTP/NTP/SyncE clock with double opt/elec interfaces at 1Gb/s. Once locked to the selected time reference, it delivers highly accurate synchronization signals that maintains in hold-over mode thanks to its OCXO or Rubidium oscillator

Net.Time τ - a rugged PTP/NTP clock

Net.Time τ can be configured as Master, Slave and Boundary clock with redundant in/out clock reference. Multiple options for input (GNSS, PTP, SyncE, ToD, PPS, T1/E1, MHz) and output (PTP, NTP, SyncE, ToD, PPS, T1/E1, MHz) references enable many combinations that facilitates the translation of timing protocols to integrate new and legacy architectures in the telecom industry.

1. Clock Performance
- Default OCXO better than ±0.1 ppm
- Optional Rubidium better than ±5.0 e-11

1.1 Locking time

Table 1. *Locking time*

	OCXO	Rubidium
Locking time	< 5 min	< 4 hours

1.2 Performance (Locked)

Table 2. *Oscillators performance*

Reference	OCXO	Rubidium
GNSS	± 45 ns	± 40 ns
1PPS / ToD	± 10 ns	±10 ns

1.3 Performance (Hold-over)

Table 3. *Oscillators performance*

	OCXO	Rubidium
Phase within ±100 ns	-	10 hours
Phase within ±500 ns	2 hours	24 hours
Phase within ±1.0 µs	4 hours	48 hours
Phase within ±10.0 µs	24 hours	-

2. Ports
Control
- 2 x RJ45: Console and Management
- 1 x USB: Storage

Timing
- 2 x SFP
- 2 x RJ-45
- 1 x SMA: unbalanced 50 Ω
- 3 x SMB: unbalanced 50 Ω
- 3 x RJ-48: balanced (RS-422) 100 Ω

Figure 1. *Mainframe ports*
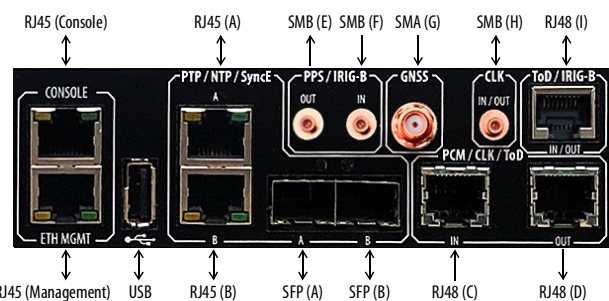
Table 4. *Signals and interfaces*

	GNSS	PTP	NTP	SyncE	ToD	PPS	T1/E1	MHz
RJ45 (A)		out	out	out				
SPF (A)		out	out	out				
RJ45 (B)		in/out	out	in/out				
SPF (B)		in/out	out	in/out				
RJ48 (C)					in		in	in
RJ48 (D)					out		out	out
SMB (E)						out		
SMB (F)						in		
SMA (G)	in							
SMB (H)								in/out
RJ48 (I)					in/out			

3. Ethernet
- 2 x RJ-45: 10BASE-T, 100BASE-TX, 1000BASE-T
- 2 x SFP: 100BASE-FX, 1000BASE-LX, 1000BASE-ZX, 1000BASE-BX
- RJ-45 / SFP work in combo mode, only one of each pair is active

4. Clock functions
- ITU-T G.8272 PRTC-B compliant
- Hierarchical clock reference input configuration
- Automatic Reference switchover on detection of input degradation
- Custom and predefined time zones
- Unmanaged leap second adjustment and reporting

5. GNSS Synchronization Inputs
- Connector: SMA (50 Ω)
- Fixed position mode for GNSS references
- Automatic setting of UTC-to-TAI offset (leap seconds) through GNSS

- 4V - 5V DC output in GNSS port to feed an external antenna
- Cable delay compensation
- Automatic antenna detection

5.1 Single-band Receiver
- 72-channel receiver
- Bands: GPS L1, GLONASS L10F, BeiDou B1, Galileo E1B/C
- Sensitivity: -166 dBm (tracking), -148 dBm (cold start)
- Single or multiple constellation selection
- Anti-jamming technology

5.2 Multi-band Receiver
- 184-channel receiver
- Bands: GPS L1C/A, L2C, L5 / GLONASS L10F / Galileo E1B/C, E5b, E5a / BeiDou B1I, B1C, B2a / NavIC L5
- Sensitivity: -167 dBm (tracking), -148 dBm (cold start)
- Single or multiple constellation selection
- Anti-jamming and anti-spoofing technology

6. Clock Reference Inputs
- PTP over RJ-45 and SFP
- Synchronous Ethernet over RJ.48 and SFP
- 1.5 / 2.0 / 5 / 10 MHz and 1.5 / 2.0 Mb/s over RJ-48
- ToD over RJ-48 (ITU-T G.8271, China Mobile and NMEA)
- 1 PPSS over SMB (ITU-T G.8271)
- Custom delay compensation for phase and time inputs

7. Clock Reference Outputs
- PTP and NTP over RJ-45 and SFP
- Synchronous Ethernet over RJ.48 and SFP
- 1.5 / 2.0 / 5 / 10 MHz, 1.5 / 2.0 Mb/s over RJ-48 (square pulse 2.2 Vpp)
- 2.048 Mb/s (ITU-T G.703), 1.544 Mb/s (ANSI T1.102)
- 1.5 / 2.0 / 5 / 10 over SMB (square pulse, 2.2 Vpp)
- ToD over RJ-48 (ITU-T G.8271 and NMEA)
- PPS with custom period over SMB (ITU-T G.8271)
- Custom delay compensation for phase and time outputs

8. PTP
- Up to 256 unicast users per port
- IEEE 1588-2008 Annex J (Default profiles)
- ITU-T G.8265.1 "Telecom frequency profile"
- ITU-T G.8275.1 "Telecom phase and time profile"
- ITU-T G.8275.2 "PTS / APTS profile"

9. NTP Function
- Up to 500,000 transactions / sec. in two ports in server mode
- NTP protocol versions: NTPv3 (RFC 1305), NTPv4 (RFC 5905)
- SNTP protocol versions: SNTPv3 (RFC 1769)

10. Protocol Translator
- When the Protocol Translator function is enabled the B port becomes a PTP slave while A port remains operating as a PTP master
- PTP messages are forwarded / terminated as specified in IEEE 1588
- Ports A and B have independent PTP profiles

11. SyncE
- Synchronous Ethernet clock input or output from port B.
- Synchronous Ethernet clock output from port A.
- RJ-45: 100BASE-TX, 1000BASE-T
- SFP: 100BASE-FX, 1000BASE-SX / LX / ZX / BX
- Generation, decoding, forwarding of ESMC

12. Protocols and Frames
- Auto-negotiation 10 / 100 / 1000 Mb/s
- Ability to disable auto-negotiation and force line settings
- DIX and IEEE 802.1Q Ethernet frame formats
- Configuration of the VLAN VID
- User Priority if the VLAN encapsulation is enabled (IEEE 802.1Q format)

- Configuration of DSCP CoS labels
- ARP (IETF RFC 826) for automatic resolution of remote MAC address in IP Endpoint mode (IPv4 network protocol)
- DHCP (client side) (IETF RFC 2131)
- Static IPv4 local profile configuration

13. Statistics
- Current, max / min traffic in b/s, frames/s, % channel capacity
- Unicast, multicast, broadcast traffic in b/s, frames/s, % channel capacity
- IPv4 and IPv6 statistics in b/s, frames/s, % channel capacity
- UDP traffic in b/s, frames/s, % channel capacity
- Simultaneous per-port statistics for ports A and B

14. Platform

14.1 Management
- Authentication TACACS and RADIUS
- Web Server
- CLI management interface through Console interface (RJ45)
- Remote management SSH through ETH MGMT interface
- USB soft and firmware updates
- RFC 3164 Syslog event reporting (device role)
- Support of SNMPv2c as defined in RFC 1901
- Support of SNMPv3 as defined in RFC 3410, RFC 3411, RFC 3412
- Support of SNMP traps to report events trough SNMPv2c and SNMPv3.

14.2 Ergonomics
- Fanless operation
- Dimensions: 44 mm x 228 mm x 435 mm (equivalent to 1U in 19" rack)
- Weight: 1.9 kg / 4.2 lb
- MTBF: 150,000 hours (OCXO model), 140,000 hours (Rubidium model).

14.3 Power Supply
- Redundant power supply (Single or Double)
- AC: 100 ~ 240 VAC, 50- 60 Hz (IEC 60320 C13/C14)
- DC: 18 ~ 75 VDC or 43 ~160 VDC (2-pin 5.1 mm)
- AC/DC: 85 - 264 VAC and 100 - 370 VDC (2-pin 5.1 mm)
- Power consumption: 10 W (OCXO model), 14 W (Rubidium model)

14.4 LEDs
- Platform: PSU1, PSU2, System
- Application: Alarm, GNSS, Locked

14.5 USB
- Software and firmware upgrade
- Configuration, results, user files

14.6 Environmental
- Storage: -40 ~ +85ºC
- Operating: -40 ~ +70ºC temp. / 0 ~ 95%RH (non condensing)

15. Certifications

15.1 Summary
- Communications devices installed in electric power substations: IEEE 1613, IEC 61850-3
- Electromagnetic compatibility: CISPR 22 / EN 55022, CISPR 24 / EN 55024, IEC 61000-3-2, IEC 61000-3-3, CFR 47 part 15
- Environmental: IEC 61850-3
- Safety: IEC / EN 61850-3, IEC / EN 62368-1, UL 62368-1, CSA C22.2 No. 62368-1
- Other: EN 63000 (RoHS), EN 303 413 V1.1.1 (RED)

15.2 Electromagnetic Compatibility (Emission)
- Conducted Disturbance: CISPR 22 / EN 55022 (Class B), CFR 47 Part 15
- Radiated Emissions: CISPR 22 / EN 55022 (Class B), CFR 47 Part 15
- Harmonics of Current: IEC 61000-3-2 (Class A)
- Voltage Fluctuation and Flicker: IEC 61000-3-3

15.3 Electromagnetic Compatibility (Immunity)
Radiated RF Susceptibility (RS)
- IEEE C37.90.2: 80 ~ 1000 MHz, 20 V/m, 80% AM (1 kHz)
- IEC 61000-4-3: 80 ~3000 MHz, 10 V/m, 80% AM (1 kHz)

Conducted RF Susceptibility (CS)
- IEC 61000-4-6: 0.15 ~80 MHz, 10 Vrms, 80% AM (1 kHz)

Electrostatic discharge (ESD) immunity
- IEEE C37.90.3: 15 kV air discharge, 8 kV contact discharge
- IEC 61000-4-2: 2008: 8 kV air discharge, 6 kV contact discharge

Electrical fast transient / burst (EFT) immunity
- IEEE C37.90.1: 4 kV in power and telecom ports
- IEC 61000-4-4: 2 kV in power and earth ports, 4 kV in telecom ports

Damped oscillatory wave immunity

IEEE C37.90.1
- 2.5 kV (1 MHz) in power and telecom ports

IEC 61000-4-18
- 0.5 kV diff. / 1 kV comm, (1 MHz) in power port
- 1 kV diff. / 2.5 kV comm, (1 MHz) in telecom ports

Surge immunity

IEC 61000-4-5
- Power port line to line 1 kV, line to ground 2 kV
- Telecom port line to line: 2 kV, line to ground: 4 kV

Power frequency immunity

IEC 61000-4-16
- 30 V (continuous) and 300 V (1 s) in telecom port
- 10 V (continuous) and 100 V (1 s) in power port

Power frequency magnetic field immunity

IEC 61000-4-8
- 100 A/m (continuous) and 1000 A/m (1 s)

Power supply immunity
- IEC 61000-4-11
- IEC 61000-4-17
- IEC 61000-4-29

15.4 Reliability
- Cold storage: IEC 60068-2-1, -40ºC, 16 hours
- Cold operation: IEC 60068-2-1, -40ºC, 16 hours
- Dry heat storage: IEC 60068-2-2, +85ºC, 16 hours
- Dry heat operation: IEC 60068-2-2, +70ºC, 16 hours
- Change of temperature: IEC 60068-2-14, -10 ~ + 65ºC, 5 cycles
- Damp heat cyclic test: IEC 60068-2-30, +25~+40ºC, 55~93%RH, 6 cycles
- Damp heat steady state: IEC 60068-2-78, +40ºC, 55%RH, 10 days
- Vibration response: IEC 60255-21-1 (Class 1)
- Vibration endurance: IEC 60255-21-1 (Class 1)
- Shock response: IEC 60255-21-2 (Class 1)
- Shock Withstand: IEC 60255-21-2 (Class 1)
- Bump: IEC 60255-21-2 (Class 1)
- Seismic test: IEC 60255-21-3 (Class 2)
- Degrees of protection provided by enclosures: IEC 60529 (IP30)

15.5 Safety
- Communications devices installed in electric power substations IEC / EN 61850-3
- Audio / Video, information and communication technology equipment IEC / EN 62368-1, UL 62368-1, CSA C22.2 No. 62368-1

16. Ordering Information

Table 5. Base configuration

Code	Description
NT.TAU.GM.AC	Net.Time Grandmaster Clock. Includes dual 10 / 100 / 1000 Mb/s electrical Ethernet port and dual 100 / 1000 Mb/s optical Ethernet supplying synchronization as specified in IEEE 1588-2008 Annex J "Default Profiles", ITU-T G.8261.1 "Telecom frequency profile", ITU-T G.8275.1 "Telecom phase and time profile" and ITU-T G.8275.2 "PTS / APTS profile" to a maximum of 64 clocks. Network Time Protocol version 3 (RFC 1305), version 4 (RFC 5905) and Simple Network Time Protocol version 3 (RFC 1769) server functionality. Internal OCXO timing source. GPS, GLONASS, BeiDou and Galileo clock reference input. Synchronous Ethernet input / output and ESMC generation and decoding as specified in ITU-T G.8261, G.8262 and G.8264. 1PPS, 1PP2S and time-of-day inputs and outputs. 2048 kHz, 2048 kb/s, 1544 kHz, 1544 kb/s, 10 MHz and 5 MHz clock reference inputs and outputs. Frame and network statistics. Console and Ethernet management ports. Simple Network Management Protocol (SNMP) management. USB firmware upgrade. Single AC 100 -240 V power supply unit (PSU-AC).
NT.TAU.GM.ACDC	Net.Time Grandmaster Clock. Includes dual 10 / 100 / 1000 Mb/s electrical Ethernet port and dual 100 / 1000 Mb/s optical Ethernet supplying synchronization as specified in IEEE 1588-2008 Annex J "Default Profiles", ITU-T G.8261.1 "Telecom frequency profile", ITU-T G.8275.1 "Telecom phase and time profile" and ITU-T G.8275.2 "PTS / APTS profile" to a maximum of 64 clocks. Network Time Protocol version 3 (RFC 1305), version 4 (RFC 5905) and Simple Network Time Protocol version 3 (RFC 1769) server functionality. Internal OCXO timing source. GPS, GLONASS, BeiDou and Galileo clock reference input. Synchronous Ethernet input / output and ESMC generation and decoding as specified in ITU-T G.8261, G.8262 and G.8264. 1PPS, 1PP2S and time-of-day inputs and outputs. 2048 kHz, 2048 kb/s, 1544 kHz, 1544 kb/s, 10 MHz and 5 MHz clock reference inputs and outputs. Frame and network statistics. Console and Ethernet management ports. Simple Network Management Protocol (SNMP) management. USB firmware upgrade. Single AC 85 – 264 V / DC 100 – 370 V power supply unit (PSU-ACDC).
NT.TAU.GM.DCL	Net.Time Grandmaster Clock. Includes dual 10 / 100 / 1000 Mb/s electrical Ethernet port and dual 100 / 1000 Mb/s optical Ethernet supplying synchronization as specified in IEEE 1588-2008 Annex J "Default Profiles", ITU-T G.8261.1 "Telecom frequency profile", ITU-T G.8275.1 "Telecom phase and time profile" and ITU-T G.8275.2 "PTS / APTS profile" to a maximum of 64 clocks. Network Time Protocol version 3 (RFC 1305), version 4 (RFC 5905) and Simple Network Time Protocol version 3 (RFC 1769) server functionality. Internal OCXO timing source. GPS, GLONASS, BeiDou and Galileo clock reference input. Synchronous Ethernet input / output and ESMC generation and decoding as specified in ITU-T G.8261, G.8262 and G.8264. 1PPS, 1PP2S and time-of-day inputs and outputs. 2048 kHz, 2048 kb/s, 1544 kHz, 1544 kb/s, 10 MHz and 5 MHz clock reference inputs and outputs. Frame and network statistics. Console and Ethernet management ports. Simple Network Management Protocol (SNMP) management. USB firmware upgrade.. Single DC 18 – 75 V power supply unit (PSU-DCL).
NT.TAU.GM.DCH	Net.Time Grandmaster Clock. Includes dual 10 / 100 / 1000 Mb/s electrical Ethernet port and dual 100 / 1000 Mb/s optical Ethernet supplying synchronization as specified in IEEE 1588-2008 Annex J "Default Profiles", ITU-T G.8261.1 "Telecom frequency profile", ITU-T G.8275.1 "Telecom phase and time profile" and ITU-T G.8275.2 "PTS / APTS profile" to a maximum of 64 clocks. Network Time Protocol version 3 (RFC 1305), version 4 (RFC 5905) and Simple Network Time Protocol version 3 (RFC 1769) server functionality. Internal OCXO timing source. GPS, GLONASS, BeiDou and Galileo clock reference input. Synchronous Ethernet input / output and ESMC generation and decoding as specified in ITU-T G.8261, G.8262 and G.8264. 1PPS, 1PP2S and time-of-day inputs and outputs. 2048 kHz, 2048 kb/s, 1544 kHz, 1544 kb/s, 10 MHz and 5 MHz clock reference inputs and outputs. Frame and network statistics. Console and Ethernet management ports. Simple Network Management Protocol (SNMP) management. USB firmware upgrade. Single DC 43 – 160 V power supply unit (PSU-DCH).

Table 6. Optional features

Code	Description
NT.TAU.BC	Adds PTP profile translation functionality, PTP to NTP protocol translation and Synchronous Ethernet frequency input.
NT.TAU.GM.USR128	Increases number of client unicast clocks from 64 to 128.

Table 6. *Optional features*

Code	Description
NT.TAU.GM.USR256	Increases number of client unicast clocks from 64 to 256.

Table 7. *Hardware options*

Code	Description
NT.TAU.FHM.RB	Replaces OCXO internal timing source by an atomic (Rubidium) internal timing source.
NT.TAU.FHM.MB	Replaces the standard GNSS receiver by multi-band receiver. Compatible with GPS, GLONASS, Galileo, BeiDou and NavIC. Jamming and spoofing detection and mitigation.
NT.TAU.PSU.AC	Adds an additional AC power supply unit.
NT.TAU.PSU.ACDC	Adds an additional AC / DC power supply unit.
NT.TAU.PSU.DCL	Adds an additional low voltage DC power supply unit.
NT.TAU.PSU.DCH	Adds an additional high voltage DC power supply unit.

Table 8. *Accessories*

Code	Description
NT.ANT	GNSS kit. GNSS antenna kit for fixed installation up to 50 m. Includes antenna, surge arrester and accessories.
NT.ANTC	GNSS kit. GNSS antenna kit for fixed installation up to 200 m. Includes antenna, surge arrester, in-line amplifier 25 dB gain and accessories.
NT.ANT.MB	GNSS kit. Compatible with L1 and L5 frequency bands. GNSS antenna kit for fixed installation up to 50 m. Includes antenna, surge arrester and accessories.
NT.ANTC.MB	GNSS kit. Compatible with L1 and L5 frequency bands. GNSS antenna kit for fixed installation up to 200 m. Includes antenna, surge arrester, in-line amplifier 25 dB gain and accessories.

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