

Net.Time  $\phi$  is a versatile PTP / NTP over PRP clock capable to synchronize both IEEE 61850 and legacy devices making it ideal for the transition to new synchronization standards while protection existing investments.

Datasheet

Updated on 17/6/21

# Net.Time $\phi$ a power utility clock

Net.Time P has all the functionality required to provide synchronization to power substations. This clock has the ability to generate PTP and NTP to generate timing for IEC 61850 IEDs and at the same time it provides the IRIG-B and 1PPS clock sources for legacy devices. Net.Time P accepts GNSS inputs but it is also compatible with a large number of backup or complementary inputs.

## 1. Clock Performance

- Default OCXO better than  $\pm 0.1$  ppm
- Optional Rubidium better than  $\pm 5.0$  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	$\pm 45$ ns	$\pm 40$ ns
1PPS / ToD	$\pm 10$ ns	$\pm 10$ ns

### 1.3 Performance (Hold-over)

Table 3. Oscillators performance

	OCXO	Rubidium
Phase within $\pm 100$ ns	-	2 hours
Phase within $\pm 1.0$ $\mu$ s	1 hours	24 hours
Phase within $\pm 10.0$ $\mu$ s	12 hours	120 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  $\Omega$
- 3 x SMB: unbalanced 50  $\Omega$
- 3 x RJ-48: balanced (RS-422) 100  $\Omega$

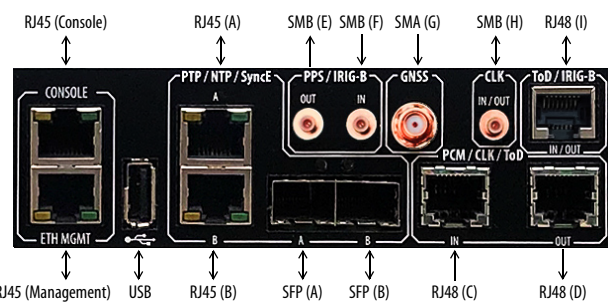


Figure 1. Mainframe ports

Table 4. Signals and interfaces

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

- GPS/GLONASS/Beidou/Galileo over SMA
- Single or multiple constellation selection
- Fixed position mode for GNSS references
- Automatic setting of UTC-to-TAI offset (leap sec. count) through GNSS
- 4V - 5V DC output in GNSS port to feed an external antenna
- Cable delay compensation
- Automatic antenna detection

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### 5. Clock Reference Inputs

- PTP and NTP over RJ-45 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 PPS, 1 PP2S over SMB (ITU-T G.8271)
- IRIG-B00X, B15X, B22X over SMB (up to 25 Vpp with AC / DC coupling)
- IRIG-B00X, B22X over RJ-48 (ITU-T V.11)
- Custom delay compensation for phase and time inputs

### 6. Clock Reference Outputs

- PTP and NTP over RJ-45 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)
- 1 PPS / 1 PP2S over SMB (ITU-T G.8271)
- IRIG-B00X / B1XX / B22X over SMB (5 Vpp with AC / DC coupling)
- IRIG-B00X / B22X over RJ-48 (ITU-T V.11)
- Custom delay compensation for phase and time outputs

### 7. Auxiliary Clock Reference Outputs

Implemented through factory configurable and replaceable modules.

#### 7.1 RIC-50 Module

Provides a combination of 5 x BNC / ST ports (up) and 5 x BNC ports (down):

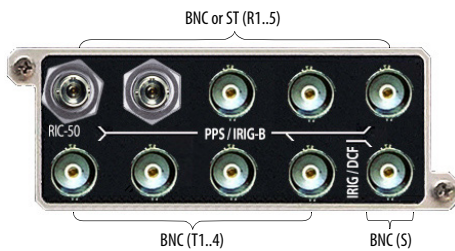


Figure 2. RIC-50 connector layout

- ST (R1..5): IRIG-B00X, PPS
- BNC (R1..5): IRIG-B00X, PPS
- BNC (T1..4): IRIG-B00X, PPS, 1.5 / 2.0 / 5 / 10 MHz
- BNC (S): IRIG-B1XX, DCF77

Table 5. RIC-50 ports and interfaces

	ToD	IRIGB	PPS	ASCII	DCF77	Alarm	MHz
ST (R1..5)		out	out				
BNC (R1..5)		out	out				
BNC (S)			out		out		
BNC (T1..4)		out	out				out

#### 7.2 RIC-52 Module

Provides 4 x RJ48 (up) and 5 x BNC (down) ports:

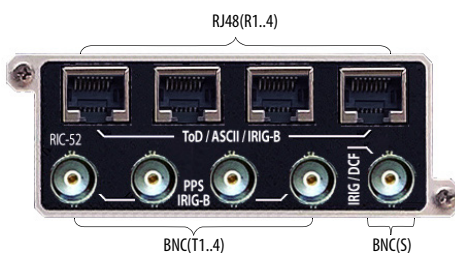


Figure 3. RIC-52 connector layout

- RJ48(R1..4): IRIG-B00X, ToD (NMEA, G.8271), ASCII (NMEA, Meinberg)
- BNC (T1..4): IRIG-B00X, PPS, 1.5 / 2.0 / 5 / 10 MHz
- BNC (S): IRIG-B1XX, DCF77

Table 6. RIC-52 ports and interfaces

	ToD	IRIGB	PPS	ASCII	DCF77	Alarm	MHz
RJ48 (R1..4)	out	out		out			
BNC (S)		out			out		
BNC (T1..5)		out	out				out

#### 7.3 RIC-54 Module

Provides 5 x BNC (up) and a 16-pin terminal block (down) ports:

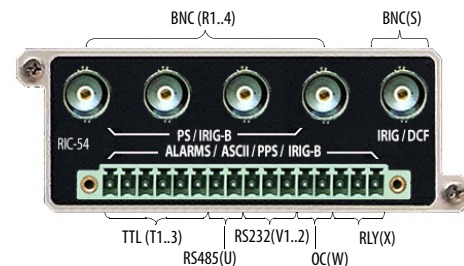


Figure 4. RIC-54 connector layout

- BNC (R1..4): IRIG-B00X, PPS, 1.5 / 2.0 / 5 / 10 MHz
- BNC (S): IRIG-B1XX, DCF77
- TTL (T1..3): IRIG-B00X, PPS
- RS232 (V1..2): ASCII (NMEA, Meinberg)
- RS485 (U): ASCII (NMEA, Meinberg)
- OC (W): PPS, Alarm (Electronic -MOSFET driver- relay)
- RLY (X): Alarm (Electro-mechanic relay)

Table 7. SRIC-54 ports and interfaces

	ToD	IRIGB	PPS	ASCII	DCF77	Alarm	MHz
BNC (R1..4)		out	out				out
BNC (S)		out			out		
TTL (T1..3)		out	out				
RS485 (U)		out	out	out			
RS232 (V1..2)				out			
OC (W)			out			out	
RLY (X)						out	

#### 7.4 RIC-82 Module

Provides a combination of 5 x BNC / ST ports (up) and 16-pin terminal block:

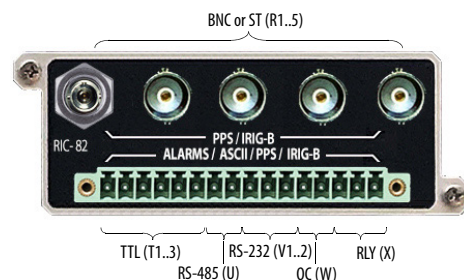


Figure 5. RIC-82 connector layout

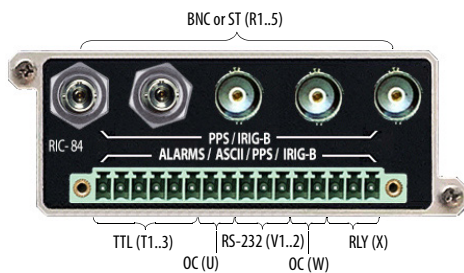
- ST (R1..5): IRIG-B00X, PPS
- BNC (R1..5): IRIG-B00X, PPS
- TTL (T1..3): IRIG-B00X, PPS
- RS232 (V1..2): ASCII (NMEA, Meinberg)
- RS485 (U): ASCII (NMEA, Meinberg)
- OC (W): PPS, Alarm (Electronic -MOSFET driver- relay)
- RLY (X): Alarm (Electro-mechanic relay)

**Table 8. RIC-82 ports and interfaces**

	ToD	IRIGB	PPS	ASCII	DCF77	Alarm	MHz
ST (R1..5)		out	out				
BNC (R1..5)		out	out				
TTL (T1..3)		out	out				
RS485 (U)		out	out	out			
RS232 (V1..2)				out			
OC (W)			out			out	
RLY (X)						out	

**7.5 RIC-84 Module**

Provides a combination of 5 x BNC / ST ports (up) and 16-pin terminal block:



**Figure 6. RIC-84 connector layout**

- ST (R1..5): IRIG-B00X), PPS
- BNC (R1..5): IRIG-B00X), PPS
- TTL(T1..3): IRIG-B00X), PPS
- OC (U): PPS (NMEA, Meinberg)
- RS232(V1..2): ASCII (NMEA, Meinberg)
- OC (W): PPS, Alarm (Electronic -MOSFET driver- relay)
- RLY (X): Alarm (Electro-mechanic relay).

**Table 9. RIC-84 ports and interfaces**

	ToD	IRIGB	PPS	ASCII	DCF77	Alarm	MHz
ST (R1..5)		out	out				
BNC (R1..5)		out	out				
TTL (T1..3)		out	out				
OC (U)			out			out	
RS232 (V1..2)				out			
OC (W)			out			out	
RLY (X)						out	

**8. PTP Function**

- 256 unicast / multicast users in two ports in master mode
- IEEE 1588-2008 Annex J (Default profiles)
- IEC 61850-9-3 (Utility Profile)
- IEEE C37.238-2011 (Power Profile 2011)
- IEEE C37.238-2017 (Power Profile 2017)
- Operation as 1-step clock or 2-step clock
- Configuration of Domain, Priority 1 and Priority 2
- Rate Setting for Sync, Delay Request, Peer Delay Request, Announce
- Configuration of Announce message timeout

**9. NTP Function**

- Up to 1000 transactions / sec. in two ports in server mode
- NTP protocol versions: NTPv3 (RFC 1305), NTPv4 (RFC 5905)
- SNTP protocol versions: SNTPv3 (RFC 1769)
- Configuration of Unsynchronized stratum, Maximum polling interval and Minimum polling interval

**10. Protocol Translator Function**

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

**11. 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

**11.1 Parallel Redundancy Protocol**

- Parallel Redundancy Protocol (PRP) Link Redundancy Entity (LRE) as IEC 62439-3, generation of RCT trailers on Ethernet frames
- Duplicate discard mode and PRP supervision generation / decoding
- PRP extensions for IEEE 1588-2088 / IEC 61588:2009 defined in IEC 62439-3 Annex A connected with grandmaster clock operation

**12. 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

**12.1 PRP LRE Statistics**

- Port A, Port B and aggregated inbound and outbound frames
- Port A, Port B and aggregated inbound and outbound RCT frames
- Port A / LAN A and Port B / LAN B mismatches
- Port A, Port B and aggregated errors
- PRP node count, Port A and Port B unique entries, Port A and Port B single duplicated entries, Port A and Port B multiple duplicated entries
- Source MAC address, time to live and node time for each entry

**13. Platform**

**13.1 Management**

- 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)

**13.2 Ergonomics**

- Fanless operation
- 19" / ETSI/1U/201 mm rack mount
- Weight: 2.8 kg / 6.2 lb

**13.3 Power Supply**

- Redundant power supply (Single or Double)
- AC: 85 ~ 264 Vac, 47 - 63 Hz (IEC 60320 C13/C14)
- DC: 18 ~ 75 Vdc (2-pin 5.1 mm)

**13.4 LEDs**

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

**13.5 USB**

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

**13.6 Environmental**

- Storage: -20 ~ +85°C
- Operating: -10 ~ +65°C temp. / 10 ~ 90% humidity

13.7 Type Test

- Safety: IEC / EN 62368-1, UL 62368-1, CSA C22.2 No. 62368-1
- EMC: EN 55022, EN 55024, EN 61000, CISPR 22:2008, CISPR 24:2010, FCC Part 15
- Other: EN 63000 (RoHS), EN 303 413 V1.1.1 (RED)

14. Ordering Information

Table 10. Base configuration

Code	Description
NT.PHI.GM.AC	Net.Time Grandmaster Clock. Includes dual 10 / 100 Mb/s electrical Ethernet port and dual 100 Mb/s optical Ethernet supplying synchronization as specified in IEEE 1588-2008 Annex J "Default Profiles", IEC 61850-9-3 "Utility Profile", IEEE C37.238-2011 "Power Profile 2011", IEEE C37.238-2017 "Power Profile 2017" 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. 1PPS, 1PP2S and time-of-day inputs and outputs. Inter Range Instrumentation Group type B (IRIG-B) time codes input and output over balanced or unbalanced interfaces. Frame and network statistics. Console and Ethernet management ports. USB firmware upgrade. Single AC power supply unit (PSU-AC).
NT.PHI.GM.DCL	Net.Time Grandmaster Clock. Includes dual 10 / 100 Mb/s electrical Ethernet port and dual 100 Mb/s optical Ethernet supplying synchronization as specified in IEEE 1588-2008 Annex J "Default Profiles", IEC 61850-9-3 "Utility Profile", IEEE C37.238-2011 "Power Profile 2011", IEEE C37.238-2017 "Power Profile 2017" 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. 1PPS, 1PP2S and time-of-day inputs and outputs. Inter Range Instrumentation Group type B (IRIG-B) time codes input and output over balanced or unbalanced interfaces. Frame and network statistics. Console and Ethernet management ports. USB firmware upgrade. Single DC 18 – 75 V power supply unit (PSU-DCL).

Table 11. Optional features

Code	Description
NT.PHI.1GE	1 Gb/s Ethernet interfaces over electrical and optical interfaces
NT.PHI.BC	PTP profile translation functionality PTP to NTP protocol translation
NT.PHI.PRP	Parallel Redundancy Protocol following IEC 62439-3 for simultaneous transmission of information over two redundant Ethernet ports with zero seconds failover recovery time
NT.PHI.FREQ	2048 kHz, 2048 kb/s, 1544 kHz, 10 MHz and 5 MHz clock reference inputs and outputs
NT.PHI.GM.USR256	Increases number of client unicast clocks from 64 to 128 in AT.NT.PHI.GM.AC or AT.NT.PHI.GM.DCL
NT.PHI.GM.USR256	Increases number of client unicast clocks from 64 to 256 in AT.NT.PHI.GM.AC or AT.NT.PHI.GM.DCL

Table 12. Hardware options

Code	Description
NT.PHI.FHM.RB	Replaces OCXO internal timing source by an atomic (Rubidium) internal timing source in AT.NT.PHI.GM.AC or AT.NT.PHI.GM.DCL
NT.PHI.PSU.AC	Additional AC power supply unit to AT.NTIMEP.GM.AC (PSU-AC2) or AT.NTIMEP.GM.DCL (PSU-AC-DCL).
NT.PHI.PSU.DCL	Additional DC power supply unit to AT.NTIMEP.GM.AC (PSU-AC-DCL) or AT.NTIMEP.GM.DCL (PSU-DCL2).
NT.PHI.RIC.50.X	Provides additional clock reference outputs. Includes ToD, ASCII and IRIG-B00X references in 4 x RS-232 ports (RJ48 connector). Includes PPS, IRIG-B00X and frequency references in 4 x BNC ports. Includes IRIG-B1XX and DCF77 in a single BNC port.
NT.PHI.RIC.52	Provides additional clock reference outputs. Includes ToD, ASCII and IRIG-B00X references in 4 x RS-232 ports (RJ48 connector). Includes PPS, IRIG-B00X and frequency references in 4 x BNC ports. Includes IRIG-B1XX and DCF77 in a single BNC port.

Table 12. Hardware options

Code	Description
NT.PHI.RIC.54	Provides additional clock reference outputs. Includes PPS, IRIG-B00X and frequency references in 4 x BNC ports. Includes IRIG-B1XX and DCF77 in a single BNC port. Includes miscellaneous references, time codes and alarm relay functions in 3 x TTL, 1 x RS-485, 2 x RS-232, 1 x open collector and 1 x electro-mechanic relay outputs.
NT.PHI.RIC.82.X	Provides additional clock reference outputs. Includes PPS, IRIG-B00X and frequency references in 5 x BNC / ST factory configurable ports. Includes miscellaneous references, time codes and alarm relay functions in 3 x TTL, 1 x RS-485, 2 x RS-232, 1 x open collector and 1 x electro-mechanic relay outputs.
NT.PHI.RIC.84.X	Provides additional clock reference outputs. Includes PPS, IRIG-B00X and frequency references in 5 x BNC / ST factory configurable ports. Includes miscellaneous references, time codes and alarm relay functions in 3 x TTL, 2 x RS-232, 2 x open collector and 1 x electro-mechanic relay outputs.

Table 13. Accessories

Code	Description
NT.ANT	GNSS kit. GNSS antenna kit for fixed installation up to 50 m. Includes antenna, surge arrestor and accessories.
NT.ANTC	GNSS kit. GNSS antenna kit for fixed installation up to 200 m. Includes antenna, surge arrestor, in-line amplifier 35 dB gain and accessories.