

NTS-5000 Rb ocxo

NTP/PTP IEEE1588 Modular Time Server

- PTP IEEE1588 Grandmaster
- NTP TimeServer STRATUM1
- ePRTC* PRTC PRC Clock

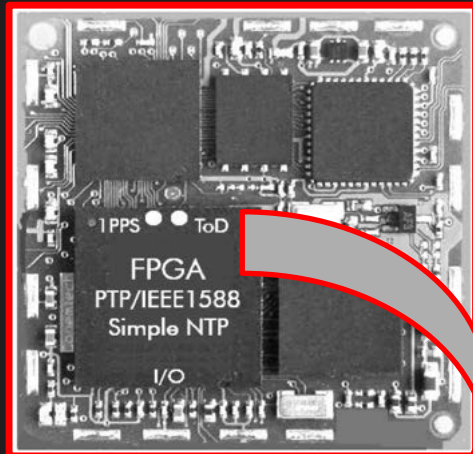


- GNSS Jamming* Detection
- GNSS Spoofing* Detection
- ATTACK Auto-ON Holdover
- HOLDOVER Rubidium OCXO
- PTP IEEE1588 White Rabbit*
- SyncE Support Expander*1-4
- NTP v4 (RFC5905-09) v3 (RFC1305)
- SNTP v4 (RFC4330) v3 (RFC2030)
- LAN 2x 100Mbps sw-stamps
- LAN 1GbE* PHY hw-stamps
- LAN 10GbE* with sw-stamps
- PRIVATE PTP-stack/NIC(LAN)
- IRIG-B AM DCLS
- REMOTE HTTP(S) SSH TELNET
- SNMPv3 MIB2 RADIUS
- OUTPUT PPS PPM PPH 10MHz
- CRYPTO MD5 RSA DSA SSL
- REDUNDANT Power Supply
- REDUNDANT GNSS receivers*

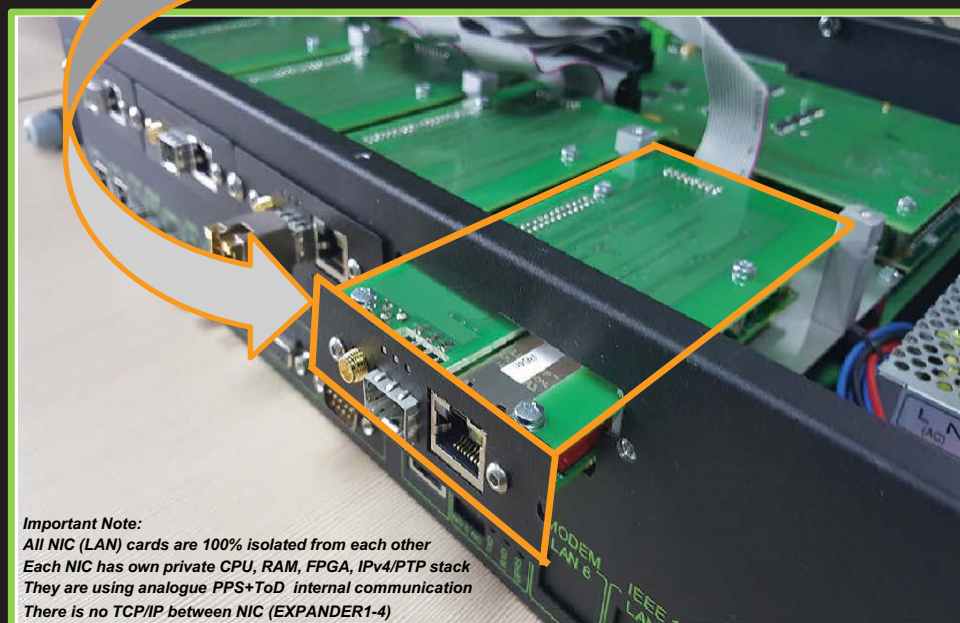
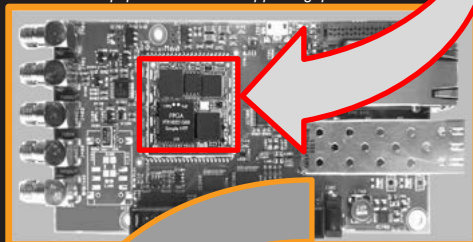
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safetime
ADVANCED CYBER-SECURITY SYNC

ELPROMA



FPGA supports nanosecond hardware PHY timestamping
Each NIC is equipped with FPGA supporting private PTP-stack



Important Note:
All NIC (LAN) cards are 100% isolated from each other
Each NIC has own private CPU, RAM, FPGA, IPv4/PTP stack
They are using analogue PPS+ToD internal communication
There is no TCP/IP between NIC (EXPANDER1-4)

The 4x NIC (EXPANDER 1-4) are autonomous timeservers. There is analog communication PPS+ToD (no TCP/IP) to MAIN boards

The **NTS-5000** is Rubidium and **NTS-5000LITE** is OCXO holdover class network appliance. It delivers *Time (time of a day ToD)* and *Frequency* reference using **NTP**, **IEEE1588** protocols. It stabilizes the frequency of a clock at end network devices using **SyncE**, PTP, 10MHz. The std. configuration includes **LAN1-2 100/10Mbps** upgradable to **1GbE** or **10GbE** each. Another **8x 1GbE** (grouped pairs of LAN: 3-4, 5-6, 7-8, 9-10) are available optionally. The 8x 1GbE (LAN3-10) are special network interface cards (NIC). They are located in **EXPANDERS 1-4***. They support PHY **hardware timestamping** for IEEE1588. The EXPANDER 1-4 NIC also supports PTP profiles: *default, telecom, power, broadcasting*. The built-in **Rubidium & OCXO** oscillators ensure holdover GNSS less operation.

NTS-5000 appoints the 21st century paradigm of cybersecurity

Comparing to other products available today, the NTS-5000 is the only device on market supporting **GNSS jamming and spoofing** detection. When GNSS jamming or spoofing attack, the smart NTS-antenna sends special alarm message directly down to time server ANT1 and ANT(2) inputs. It lets NTS-5000 switch early enough to internal holdover oscillator (Rubidium/OCXO) refusing false data and GNSS noise. Once the attack is ended the NTS-5000 switches back to normal mode of GNSS synchronization. Optionally the NTS-5000 can be equipped with special **LEVEL-2 anti-jamming/anti-spoofing active RF filter**. Finally the **LEVEL-3 Time Fire Wall** device with **GNSS NMEA183 simulation** is available too. The true novelty of NTS-5000 is physical cyber-isolation of EXPANDER 1-4 cards. Each NIC has own **private PTP-stack** and **exclusive FPGA**. In fact, this makes each of NIC 1-4 acting the autonomous time-server, a 100% information isolated from each other. The synchronization of 1-4 NIC is supported internally by **analog signal PPS/ToD**. There is no TCP/IP communication between EXPANDERS 1-4. Such seemingly ordinary feature is not obvious, but it is the critical factor for ensuring cyber security for Industry40 and TSN.

Why hackers cannot succeed ?

The typical IEEE1588 appliance shares single FPGA chip. It also shares the PTP-stack to all its network LAN interfaces. The NTS-5000 uses private FPGA per NIC. The autonomous NIC concept and isolation ensures hackers cannot break into NTS-5000 device taking any control over it. Hackers also cannot move between networks.

Best synchronization performance

The private FPGA support PTP-stack/NIC lets a single NTS-5000 synchronize several different networks simultaneously. This enables to set a different **PTP profile** for each EXPANDER 1-4:

- **DATACOM** (Default profile, HA*)
- **TELECOM** ITU-T G.8275.1 / G.8275.2
- **POWER** IEEE C37.238 / IEC 61850-9-3
- **BROADCASTING** SMPTE 2059.2

Standard holdover	Rb	SI	OCXO	SI
1s	0,1	ns	5	ns
1minute	10	ns	300	ns
1hour	30	ns	500	ns
1day	1	µs	50	µs
1week	10	µs	2	ms
1month	0,2	ms	50	ms
1 year	16	ms	1,5	s

Boosted holdover	TCXO & Rb	SI	TCXO & OCXO	SI
1s	0,1	ns	3	ns
1minute	9	ns	150	ns
1hour	25	ns	250	ns
1day	0,7	µs	25	µs
1week	9	µs	1,2	ms
1month	0,2	ms	25	ms
1 year	12	ms	0,9	s

Performance confirmed by professional metrology (NMI)

The autonomous EXPANDER grandmaster technology improves sync performance. The NPL MiFID II tests report for London Stock Exchange (LSE) has confirmed accuracy of 50ns at 50km dark fiber. This test results were released by NPL public and presented during ION/PTTI 2017 conference in Monterey CA (USA).

OSC Holdover vs. Low-Noise TCXO CHIP clocking

The std. holdover is Rubidium and OCXO oscillator. It is ensuring UTC stability when missing GNSS signals. Extra ordinary low-noise TCXO clocking is available as option. The low-noise TCXO replaces std. quartz that clocks CPU, RAM inside NTS-5000. The TCXO makes deep impact to NTP/PTP stability and precision factor. The TCXO should be considered as extra-ordinary holdover boosting factor.



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std.
QUARTZ
clocking

Quartz is replaced by TCXO

Low-Noise
TCXO
clocking

Standard GNSS Receiver and Antenna

Std. product includes smart NTS-antenna (pcs. 1). Optionally 2x smart NTS-antennas are supported. Server antenna PPS-in accuracy is better than 5ns. Final accuracy depends on selected GNSS receiver. The multi-path mitigation* GNSS-rcv is available. The anti-jamming/spoofing is available as option* Supported single band L1 GNSS systems are:

GPS	L1 (1575,42MHz)
GLONASS	L1 (1598,06-1605,38MHz)
GALILEO*	E1 (1575,42MHz)
BEIDOU*	L1 (1561,09-1575,42MHz)

Dual band frequency options: L1+L2, L1+L5

Triple band frequency option: L1+L2+L5

Network Time Protocol

NTP v2, v3, v4 LAN1-2:

RFC1305
RFC1119
RFC5905
RFC5906
RFC5907
RFC4330
RFC2030

Performance

GNSS synchronization precision /1PPS-in stability @ 2-sigma/ < 5ns
ELPROMA PTP master-2-slave synchronization accuracy @ LAN < 25ns
Network performance at full load (all std. LAN interfaces) 9000 req/s
Max. concurrent NTP clients served at 1024 polling rate 9,200,000

Precision Time Protocol

PTP IEEE1588 LAN3-10:

Profiles:

Default	
Telecom	ITU-I G.8265.1 ITU-I G.8275.1 ITU-I G.8275.2
Power	IEEE C37.238 IEC 61850-9-3*
Broadcast	ASMPTE 2059.2
Finance**	HA/White Rabbit**

Standard I/O

Factory defaults
Sync INPUT
OUTPUT

ANT

2x RJ45
2
(NMEA183)
(RJ45)

LAN

2x RJ45
2
(see above)
(RJ45 & SFP)

PPS

2x BNC
1
1
(BNC 50 Ohm)

10Mhz

1x BNC
0
1
(BNC 50 Ohm)

IRIG-B AM

2x BNC
1
1
(BNS 50 Ohm)

IRIG-B DCLS

2x DSUB-9 (TTL)
1
1
(DSUB-9 pin)

Special I/O

2x USB 2.0 (for firmware upload) 3x RS232 (DSUB-9) 2x ANT1-2 OUTPUT (NMEA183 EMULATION)

IEEE802.3 Network Interfaces

Network Interface Expander #No
Network Cards Speed
Update to 1Gb (RJ45)
Update to 1Gb (SFP)
Update to 10Gb (SFP)
Connector Ended

LAN1-2

#0 (MAIN)
10/100Mbps
10/100/1000Mbps
10/100/1000Mbps
YES*
LAN1: RJ45
LAN2: RJ45
SOFTWARE

LAN3*-4*

#1 (EXPANDER)
1GbE
NO
LAN3: SFP
LAN4: RJ45
HARDWARE
ITU-T G.8261
PTP v2

LAN5*-6*

#2 (EXPANDER)
1GbE
NO
LAN5: SFP
LAN6: RJ45
HARDWARE
ITU-T G.8261
PTP v2

LAN7*-8*

#3 (EXPANDER)
1GbE
NO
LAN7: SFP
LAN8: RJ45
HARDWARE
ITU-T G.8261
PTP v2

LAN9*-10*

#4 (EXPANDER)
1GbE
NO
LAN9: SFP
LAN10: RJ45
HARDWARE
ITU-T G.8261
PTP v2

Timestamping

SyncE

IEEE1588:2008 Precision Time Protocol

MASTER & SLAVE

PTP Clock mode

IEEE1588 PTP Profiles

DEFAULT YES

TELECOM NO

NO

NO

POWER NO

(Supported via IEEE C37.238) => POWER UTILITY NO

BROADCAST NO

BROADCAST NO

TSN NO

PTP #SLAVE UNLIMITED

Concurrent clients at 1024 NTP pool

9mln clients

NTP Network Time Protocol support

NTP/SNTP

NTP server compatybility to CLIENTS

NTP/SNTP

CHRONY

MASTER & SLAVE

YES

ITU-T G.8265.1

ITU-T G.8275.1

ITU-T G.8275.2

IEEE C37.238

IEC61850-9-3

SMPTE 2059.2

AES67**

IEEE 802.1AS**

32std./128**

256**/450**

MASTER & SLAVE

YES

ITU-T G.8265.1

ITU-T G.8275.1

ITU-T G.8275.2

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SMPTE 2059.2

AES67**

IEEE 802.1AS**

32std./128**

256**/450**

EXPANDER

10GbE SW-stamping
1GbE HW-stamping
IRIG-B DCLS

MAIN #0

NO
NO
D-SUB9

EXPANDER #1

SFP
SFP+RJ45
NO

EXPANDER #2

SFP
SFP+RJ45
NO

EXPANDER #3

NO
SFP+RJ45
NO

EXPANDER #4

NO
SFP+RJ45
4xTB RS422
1xTB PPS HV

EXPANDER #5

NO
NO
2x BNC TTL5V 50Ohm
2x ST FIBER OPTIC
2x BNC TTL 5V 50Ohm
NO

IRIG-B AM
RELAYS

2x BNC TTL5V
NO

NO
NO

NO
NO

NO
4xTB ALARM

NO
NO

Accuracy of oscillator

10E-11[s] (24h)

Oscillator aging

10E-11[s] (1 month)

Remote Configuration

• SNMPv3 • MIB-2

• RADIUS • HTTP • HTTPS • SSH • TELNET • NTPQ/NTPDC • DHCP • MODBUS**

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- Size: 484x 300x 88,8 mm (rack'19 2U)
- Operating temp: -55 °C to +80 °C (receiver)
- Operating temp: 0 °C to +60 °C (server)
- Storage temp: -55 °C to +80 °C
- Humidity: up to 95%
- MTBF 391000 hours

Power supply

- Power: 110-230 VAC, 120-370 VDC (1A)
- Telecom (48VDC) option: 20-70 VDC (2A)
- Max. power NTS-5000 Rb & OCXO: 80W
- NTS-500 LITE OCXO (no Rubidium) 60W



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DATACOM & FINANCIAL - Popular Configurations

DATACOM1: 2x100/10Mbps (Software Time-Stamping) LAN1&LAN2



DATACOM2: 1x10GbE(LAN1) + 1x100/10Mbps LAN2 (Software Time-Stamping)



DATACOM4: 2x1GbE LAN3-4 (Hardware Time-Stamping) + DATACOM1 config



DATACOM5: 4x1GbE LAN3-6 (Hardware Time-Stamping) + DATACOM1 config



DATACOM7: 8x1GbE LAN3-LAN10 (Hardware Time-Stamping) + DATACOM1



DATACOM9: 6x1GbE LAN3-8 (Hardware Time-Stamping) + DATACOM2"(LAN2)



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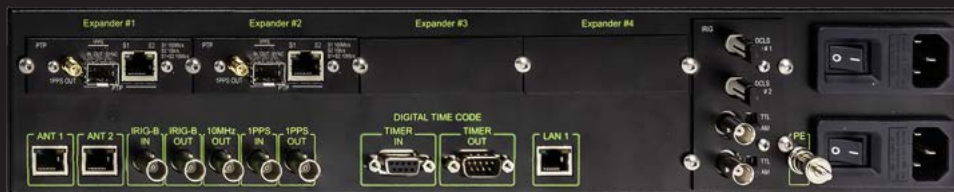
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SMART GRIDS & INDUSTRY 4.0 - Selected Configurations

SMART-GRIDS1 4xIRIG-B DCLS rs422 (Expander #4) basis on DATACOM-5 conf.



SMART-GRIDS2 2xDCLS Fiber 2xDCLS TTL (Exp. #5) basis on DATACOM-5 conf.



SMART-GRIDS3 is a summary of 2x& 3 item above



SMART-GRIDS4 is like SMART-GRIDS3 with extra 4x ALARM RELAY



SMART-GRIDS CUSTOM1 – This is PTP SLAVE generating IRIG like SMARTGRIDS4



SMART-GRIDS CUSTOM2 – This is PTP SLAVE + CUSTOMS1 (above) + 10GbE out



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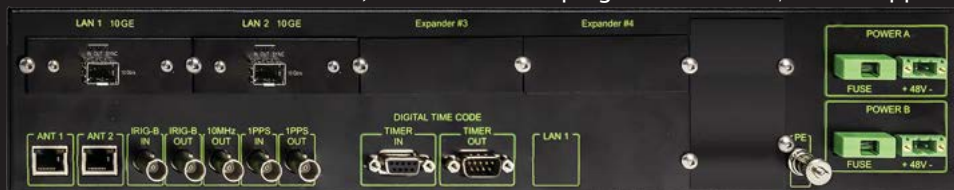
TELECOM Lte/5G - Selected Popular Configurations

TELECOM-1 PRTC-A 2x100/10Mbps, 48VDC

NTP-Server w/ PTPd support



TELECOM-3 PRTC-A 2x10GbE, 48VDC SW-stamping NTP-Server w/ PTPd support



TELECOM-5 PRTC-A 4x1GbE HW-stamping Autonomous NTP/PTP GrandMasters



TELECOM-7 PRTC-A 8xGbE HW-stamping Autonomous NTP/PTP GrandMasters



TELECOM-8 PRTC-A 2x10GbE, 4xGbE HW-stamping Autonomous GrandMasters



TELECOM-9 ePRTC 1x10GbE, 4xGbE HW-stamping Autonomous GrandMasters



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