

Industry4.0 Telecom-5G IEC-61850 SmartGrids MiFID II

NTS-5000 Rb ocxo

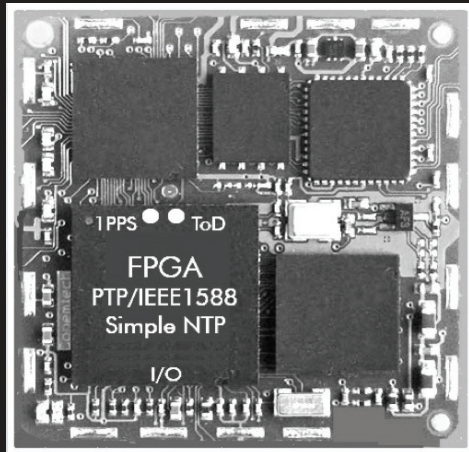
NTP/PTP IEEE1588 Modular Time Server

● PTP IEEE1588 Grand Master

● NTP STRATUM-1 Time Server

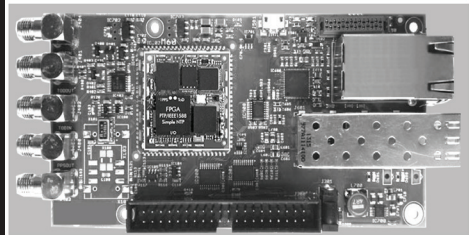


- GNSS anti-jamming/spoofing
- TSN CLOCK ePRTC* cnPRTC*
- LAN 10GbE* 1GbE* 100Mbps
- PRIVATE PTPstacks/LANcard
- TIME STAMPING Hardware
- HOLDOVER Rubidium/OCXO
- IRIG-B DCLS Fiber/TTL/rs422
- IRIG-B AM High Accuracy 1us
- IEC 61850 Smart Grids
- IEC IEEE C37.238 v2 v1
- ITU-T G.8275.1 G.8275.2
- MiFID II Financial Market
- INDUSTRY 4.0 TSN cnPRTC*
- SNMP v3 v2 MIB2 RADIUS
- OUTPUT PPS PPM PPH 10MHz
- CRYPTO MD5 RSA DSA SSL
- 2xREDUNDANT Power Supply



FPGA supports hardware timestamping

Each NIC card is quipped with local FPGA & private PTP-stack



All NIC cards are 100% isolated from each other using analog PPS (no TCP/IP).



4x NIC (EXPANDER 1-4) are 100% isolated from each other. There is analog communication between NIC and NTS-5000 (no TCP/IP)

NTS-5000 is Rubidium and **NTS-5000LITE** is OCXO holdover class network appliance. It delivers **Time of a Day (ToD)** and **Frequency ref.** using NTP, PTP, IRIG-B protocols. It stabilizes the frequency of end-device clock using **SyncE***, PTP, 10 MHz signals. The std configuration incl. **LAN1-2 100/10Mbps** upgradable to **1GbE** or **10GbE** each. Another **8x 1GbE** grouped in paris of LAN3-4/5-6/7-8/9-10 are available optional. The 8x 1GbE are special interfaces. They are located in isolated **EXPANDERS 1-4*** Network Interface Cards (NIC) supporting PHY **hardware timestamping** with profiles. Built-in oscillators **Rubidium** or **OCXO** ensures holdover when missing GNSS signals.

NTS-5000 appoints the 21st century paradigm of cybersecurity

Comparing to other products available today, the NTS-5000 is the only device on a market today supporting in standard configuration **GNSS anti-jamming/anti-spoofing**. When GNSS JAMMING/SPOOFING attacks are pending, the smart NTS-antenna sends special alarm message directly down to time server ANT1(2) input. It lets time server NTS-5000 switch early enough to internal holdover clocks (Rubidium/OCXO) and re-fusing false data from GNSS. Once JAMMING/SPOOFING attack is ended the NTS-5000 switches back to normal GNSS synchronization. There are more advanced functional devices available supporting NTS-5000 including: (1) **anti-jamming/spoofing FILTER**; (2) **TIME Fire Wall device** with ANT output **GNSS simulation** NMEA183 satellite signal. The NTS-5000 advantage is that it supports **private PTP-stack** and **exclusive FPGA** for each EXPANDER1-4 Network Interface Card (NIC) individually. It makes each 1-4 EXPANDERS acting autonomous GRANDMASTER 100% information isolated from each other. The internal synchronization is supported by **analog signal PPS/ToD** and there is no TCP/IP communication between EXPANDERS. Such seemingly ordinary feature is not obvious, but it is the critical factor for ensuring cyber security to Industry4.0 TSN

Why hackers cannot succeed ?

The typical PTP/NTP network appliance has single FPGA/ASIC chip sharing PTP-stack to all network LAN interfaces. The NTS-5000 uses private FPGA per NIC. The autonomous NIC concept ensures hackers cannot break into NTS-5000 taking any control over it. Hackers also cannot move between network cards supported by different EXPANDERS.

Best NTP/PTP performance

Private FPGA and PTP-stack let a single NTS server synchronize several different IT/IoT infrastructures simultaneously. This is the only device on a market that let set different PTP profiles for each EXPANDER 1-4:

- DATACOM (Default profile, HA*)
- TELECOM ITU-T G.8275.1 Frequency only
- TELECOM ITU-T G.8275.2 Time & Freq
- POWER IEEE C37.238 / IEC 61850-9-3

Performance Confirmed by Professional Metrology Market (NMI)

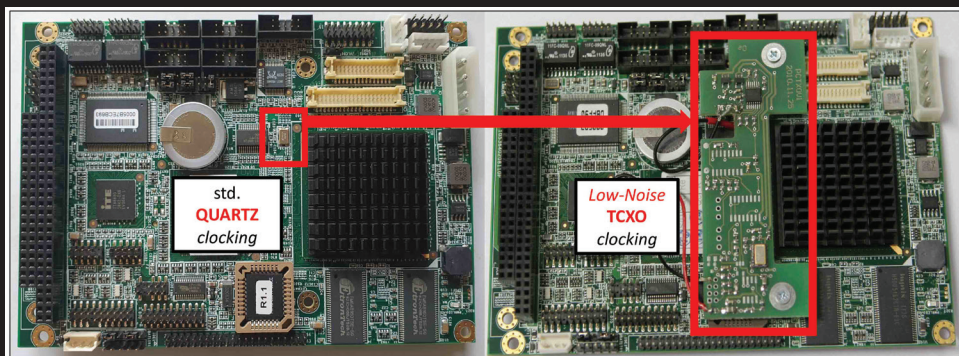
The autonomous EXPANDER grandmaster technology improves sync performance too. The 2017 NPL MiFID II tests for London Stock Exchange confirmed TDEV on level of 50ns for 50km dark fiber. This test results were released public during ION/PTTI US conference in Monterey CA. Using White Rabbit IEEE1588:2019 accuracy is below 1ns.

OSC Holdover vs. Low-Noise TCXO CHIP clocking

The std. NTS-5000 is equipped with Rubidium or OCXO holdover oscillator ensuring UTC stability when missing GNSS signals. Extra ordinary LOW-NOISE TCXO clocking for all CHIPS is available from ELPROMA too. It replaces std. QUARTZ clock by TCXO. The LOW-NOISE has deep impact on NTP/PTP accuracy, precision and stability too.

STD. HOLDOVER TIME

	Rubidium	OXCO
1s	0,1ns	5ns
1minute	10ns	300ns
1hour	30ns	560ns
1day	0,8us	47us
1week	11us	2,2ms
1month	0,2ms	40ms
1year	16ms	1,6s



The extra Low-Noise TCXO CHIP clocking (a HOLDOVER time improvement)

	Rubidium	OXCO
1s	0.1ns	3ns
1minute	9 ns	140ns
1hour	25 ns	250ns
1day	0.7us	22us
1week	9 us	1.2ms
1month	0.2ms	22ms
1year	12ms	0.9s

Standard GNSS Receiver and Antenna

Std. product includes smart NTS-antenna (pcs. 1). Optionally 2x smart NTS-antennas are supported. Server antenna input PPS accuracy 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 or L1+L5
The replaceable GNSS modules is extra pay service.

Network Time Protocol NTP v2, v3, v4 LAN1-2:

RFC1305
RFC1119
RFC5905
RFC5906
RFC5907
RFC4330
RFC2030

Performance

GNSS synchronization precision /1PPS-in stability @ 1-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 9.2 mln

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*
Audio**	AES67**
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)
2x
1
(DSUB-9 pin)

Special I/O

2x USB 2.0 (for firmware upload)

1x DSUB-9 TTY (RS232)

2x ANT1-2 OUTPUT (NMEA183 EMULATION)

IEEE802.3 Network Interfaces

Network Interface Expadner #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
PTPd

LAN3*-4*

#1
1GbE
NO
LAN3: SFP
LAN4: RJ45
HARDWARE
PTP v2

LAN5*-6*

#2
1GbE
NO
LAN5: SFP
LAN6: RJ45
HARDWARE
PTP v2

LAN7*-8*

#3
1GbE
NO
LAN7: SFP
LAN8: RJ45
HARDWARE
PTP v2

LAN9*-10*

#4
1GbE
NO
LAN9: SFP
LAN10: RJ45
HARDWARE
PTP v2

Timestamping

IEEE1588:2008 Precision Time Protocol

PTP mode (clock)

MASTER
& SLAVE

MASTER
& SLAVE

MASTER
& SLAVE

MASTER only

MASTER only

IEEE1588 Profiles

TELECOM

NO

Default

Default

Default

Default

POWER IEEE C37

NO

ITU-T G.8265.1

ITU-T G.8265.1

ITU-T G.8265.1

ITU-T G.8265.1

IEC61850-9-3

NO

ITU-T G.8275.1

ITU-T G.8275.1

ITU-T G.8275.1

ITU-T G.8275.1

MAX PTP #SLAVE

NO

ITU-T G.8275.2

ITU-T G.8275.2

ITU-T G.8275.2

ITU-T G.8275.2

UNLIMITED

NO

IEEE C37.238

IEEE C37.238

IEEE C37.238

IEEE C37.238

via C37.238

NO

via C37.238

via C37.238

via C37.238

via C37.238

32std./128**

UNLIMITED

32std./128**

32std./128**

32std./128**

32std./128**

256**/450**

UNLIMITED

256**/450**

256**/450**

256**/450**

256**/450**

LAN performance REQ/s

100,000/s

Max. concurrent NTP CLIENTS 1024 pool

9 mln clients

NTP Network Time Protocol support

NTP/SNTP

(S)NTP

(S)NTP

(S)NTP

(S)NTP

NTP server compatybility to CLIENTS

NTP/SNTP

NTP/SNTP

NTP/SNTP

NTP/SNTP

NTP/SNTP

CHRONY

CHRONY

CHRONY

CHRONY

CHRONY

Synchronous Ethernet ITU-T G.8261.1

NO

SyncE

SyncE

SyncE

SyncE

Master & Slave

Master & Slave

Master only

Master only

EXPANDER

MAIN #0

EXP #1

EXP #2

EXP #3

EXP #4

EXP #5

10GbE SW-stamping

NO

SFP

SFP

NO

NO

NO

1GbE HW-stamping

NO

SFP+RJ45

SFP+RJ45

SFP+RJ45

SFP+RJ45

NO

IRIG-B DCLS

D-SUB9

NO

NO

NO

4xTB RS422

2x BNC TTL5V 50Ohm

IRIG-B AM

2x BNC TTL5V

NO

NO

NO

1xTB PPS HV

2x ST FIBER OPTIC

RELAYS

NO

NO

NO

4xTB ALARM

NO

2x BNC TTL 5V 50Ohm

NO

Remote Configuration •SNMP v2, v3 •MIB 2 •RADIUS •HTTP •HTTPS •SSH •TELNET •NTPQ/NTPDC •MODBUS**

Mechanical/environmental

- Size: 484 x 300 x 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: 80W
- NTS-5000 LITE OCXO: 60W (no Rubidium)

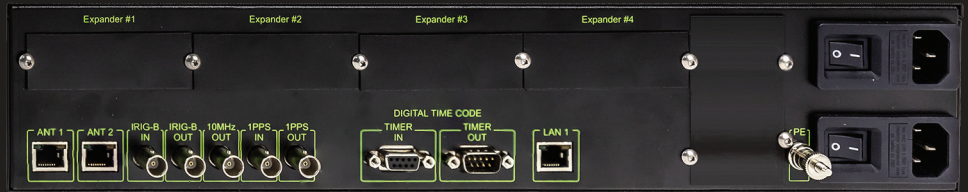


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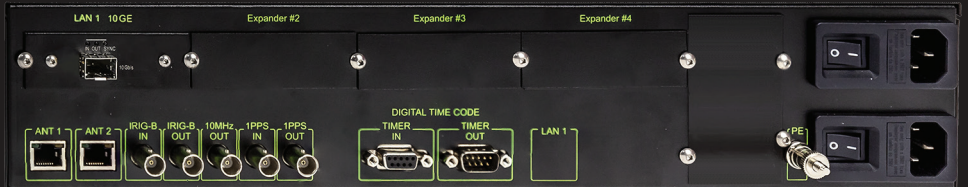
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DATAKOM & FINANCIAL - Popular Configurations

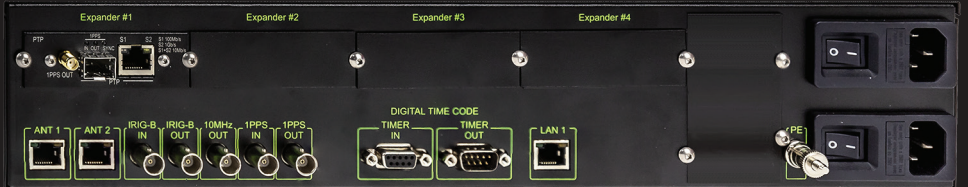
DATAKOM1: 2x100/10Mbps (Software Time-Stamping) LAN1&LAN2



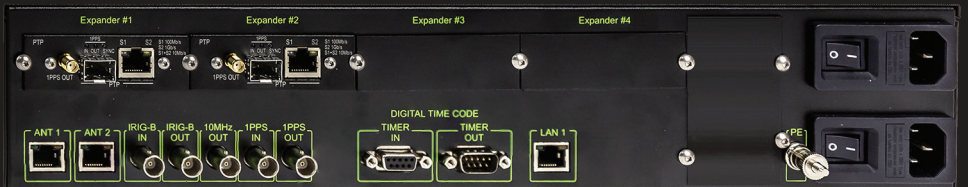
DATAKOM2: 1x10GbE(LAN1) + 1x100/10Mbps LAN2 (Software Time-Stamping)



DATAKOM4: 2x1GbE LAN3-4 (Hardware Time-Stamping) + DATAKOM1 config



DATAKOM5: 4x1GbE LAN3-6 (Hardware Time-Stamping) + DATAKOM1 config



DATAKOM7: 8x1GbE LAN3-LAN10 (Hardware Time-Stamping) + DATAKOM1



DATAKOM9: 6x1GbE LAN3-8 (Hardware Time-Stamping) + DATAKOM2”(LAN2)

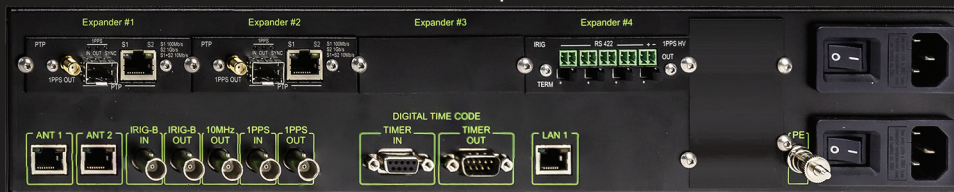


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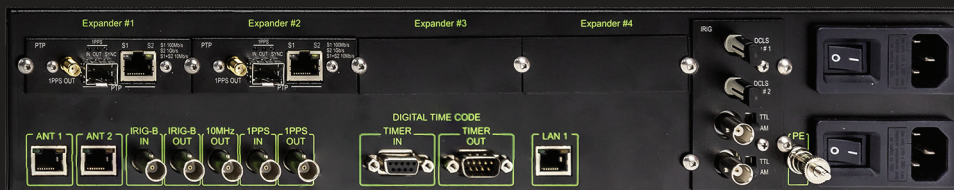
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SMART GRIDS & INDUSTRY 4.0 - Selected Configurations

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



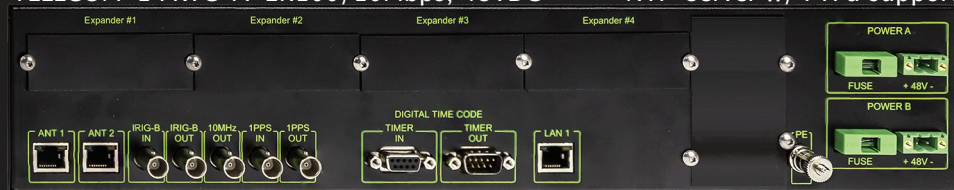
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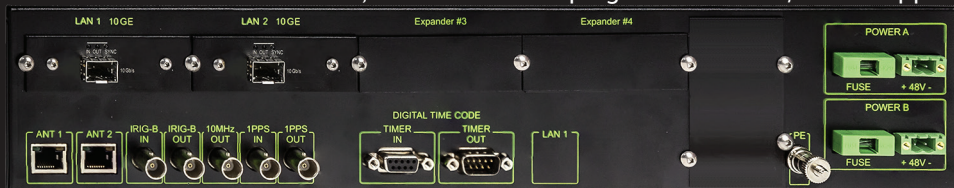
TELECOM Lte/5G - Selected Popular Configurations

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

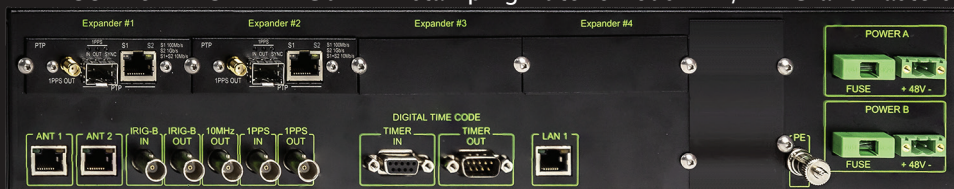
NTP-Server w/ PTPd support



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



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



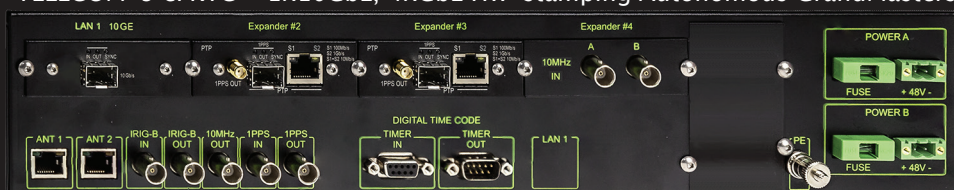
TELECOM-7 PRTC-A 8xGbE HW-stamping Autonomous NTP/PTP GrandMasters



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



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



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