



# High precision time server, grandmaster and PRC DTS 4160.grandmaster

The DTS 4160.grandmaster is a combined time distribution and synchronization device with up to 4 network ports (IPv4/IPv6). With its high-precision and intelligent concept for redundant operation, it offers a high degree of reliability and availability.

Your benefits using DTS 4160.grandmaster:

- 4 completely separated LAN ports (3x RJ45, 1x SFP):
  - provide PTP on 3 ports
    - 1- and 2-step master
    - different profiles and domains per port
    - multicast/unicast
    - IPv4/IPv6/Layer 2
- provide NTP on 4 ports
   (>10'000 requests/s on all 4 ports combined)

- Multi-purpose device due to the different time code and frequency outputs:
- 1×E1
- 2x pulse/frequency output
- 1x IRIG-B
- 2x serial output
- 1x DCF
- High degree of system redundancy by connecting two DTS 4160 via fiberoptic link:
  - high availability
  - master-slave operation with automatic switch over in case of an error
- High degree of synchronization redundancy by connecting up to 5 time sources: GPS, Link, PTP, DCF, E1



# DTS 4160.grandmaster - Technical details

General specifications				
	CPU	ARM Cortex dual core		
System	Oscillator	Rubidium or OCXO	see oscillator option	
	Dimensions $(M/X H X D)$	483 x 44 x 100 mm		
Housing	Mojaht	2 2 ka	17,1110	
Diaplay	ICD 2 lines for status and time info	2.5 kg		
Dispidy		✓	2	
	100/1000/MBII, Kj43	3	3 mainienance pons	
LAN interfaces	SFP (miniGBIC interface)	1	<ul> <li>redundant operation (see</li> </ul>	
			- Optical network for NTP/PTP	
Redundant link	For redundant operation of 2 corresponding DTS 4160 with master/slave negotiation	1	port. See also LAN interfaces miniGBIC/SFP	
RS 232 interface	For operation control, D-Sub 9 connector	1		
USB interface	For firmware update	1		
	Redundant power supply (supplies 1, 2 and 3)	1		
Power supply	Supply 1 (standard mains connector for 240VAC)	240VAC		
rower copply	Supplies 2 & 3	22 29 VDC		
Ambient temperature	at 10-00% relative humidity, without condensation	$0 to 50^{\circ}C$		
Reference signal inc				
Kelerence signal inp	GPS RE input (for GPS Antonna, NI fomale connector) to internal			
	GPS receiver	1		
	72 channels, tracking sensitivity -165 dBm	'		
	Optical link from second DTS 4160 arandmaster (SEP)	1		
		3 (2 if optical link is used for		
	PIP (from other grandmaster)	redundant link)		
	DCF	1		
	E1	1		
Reference signal out	iputs			
	NTP server	>10'000req/s	on all 4 ports combined	
Natural	PTP Grandmaster (E2E, P2P, 1-step, 2-step, Multicast, Layer 2,	RJ45 over 2x 1Gbit port	·	
	IPv4/IPv6)	SFP over 1 Gbit port		
Network	PTP profiles: default E2E, P2P, utility (61850-9-3), telecom, IEEE 802.1AS			
Network	PTP profiles: default E2E, P2P, utility (61850-9-3), telecom, IEEE 802.1AS SyncE	3 as "hold-over redundancy"		
INETWORK	PTP profiles: default E2E, P2P, utility (61850-9-3), telecom, IEEE 802.1AS SyncE	3 as "hold-over redundancy" 1	BNC (AM)	
Network	PTP profiles: default E2E, P2P, utility (61850-9-3), telecom, IEEE 802.1AS SyncE IRIG-B	3 as "hold-over redundancy" 1 precision output, 50 Ohms	BNC (AM) spring terminal (DC)	
I Network	PTP profiles: default E2E, P2P, utility (61850-9-3), telecom, IEEE 802.1AS SyncE IRIG-B Precision pulse/frequency output* on BNC, RS422 and CL	3 as "hold-over redundancy" 1 precision output, 50 Ohms 1	BNC (AM) spring terminal (DC) *future option	
Others	PTP profiles: default E2E, P2P, utility (61850-9-3), telecom, IEEE 802.1AS SyncE IRIG-B Precision pulse/frequency output* on BNC, RS422 and CL Serial outputs with configurable time telegrams (10 pin terminal block)	3 as "hold-over redundancy" 1 precision output, 50 Ohms 1 2 RS 232/422/485 PS 422 and	BNC (AM) spring terminal (DC) *future option	
Others	PTP profiles: default E2E, P2P, utility (61850-9-3), telecom, IEEE 802.1AS SyncE IRIG-B Precision pulse/frequency output* on BNC, RS422 and CL Serial outputs with configurable time telegrams (10 pin terminal block) E1 ( 2.048MHz, G811, G.812, G813, compatible	3 as "hold-over redundancy" 1 precision output, 50 Ohms 1 2 RS 232/422/485 RS 422: output only	BNC (AM) spring terminal (DC) *future option	
Others	PTP profiles: default E2E, P2P, utility (61850-9-3), telecom, IEEE 802.1AS SyncE IRIG-B Precision pulse/frequency output* on BNC, RS422 and CL Serial outputs with configurable time telegrams (10 pin terminal block) E1 / 2.048MHz, G811, G.812, G813 compatible no prot output (1:1) SSM (only and level (only ont III) 1x BNC 1x RI48	3 as "hold-over redundancy" 1 precision output, 50 Ohms 1 2 RS 232/422/485 RS 422: output only 1	BNC (AM) spring terminal (DC) *future option RJ48 (balanced) BNC (uppalanced)	
Others	PTP profiles: default E2E, P2P, utility (61850-9-3), telecom, IEEE 802.1AS SyncE IRIG-B Precision pulse/frequency output* on BNC, RS422 and CL Serial outputs with configurable time telegrams (10 pin terminal block) E1 / 2.048/MHz, G811, G.812, G813 compatible no prot. output (1:1), SSM (only qual. level (only opt. II), 1x BNC, 1x RJ48 DCF 77 CL (Current loop) passive output (2 pin terminal)	3 as "hold-over redundancy" 1 precision output, 50 Ohms 1 2 RS 232/422/485 RS 422: output only 1 1	BNC (AM) spring terminal (DC) *future option RJ48 (balanced) BNC (unbalanced)	
Others	PTP profiles: default E2E, P2P, utility (61850-9-3), telecom, IEEE 802.1AS SyncE IRIG-B Precision pulse/frequency output* on BNC, RS422 and CL Serial outputs with configurable time telegrams (10 pin terminal block) E1 / 2.048/MHz, G811, G.812, G813 compatible no prot. output (1:1), SSM (only qual. level (only opt. II)), 1x BNC, 1x RJ48 DCF 77 CL (Current loop) passive output (2 pin terminal)	3 as "hold-over redundancy" 1 precision output, 50 Ohms 1 2 RS 232/422/485 RS 422: output only 1 1	BNC (AM) spring terminal (DC) *future option RJ48 (balanced) BNC (unbalanced)	
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Others Network interface	PTP profiles: default E2E, P2P, utility (61850-9-3), telecom, IEEE 802.1AS SyncE IRIG-B Precision pulse/frequency output* on BNC, RS422 and CL Serial outputs with configurable time telegrams (10 pin terminal block) E1 / 2.048MHz, G811, G.812, G813 compatible no prot. output (1:1), SSM (only qual. level (only opt. II), 1x BNC, 1x RJ48 DCF 77 CL (Current loop) passive output (2 pin terminal) 100/1000BaseT SFP for miniGBIC module 100/1000BaseT(X) or FX	3 as "hold-over redundancy" 1 precision output, 50 Ohms 1 2 RS 232/422/485 RS 422: output only 1 1 3 1	BNC (AM) spring terminal (DC) *future option RJ48 (balanced) BNC (unbalanced)	
Network interface	PTP profiles: default E2E, P2P, utility (61850-9-3), telecom, IEEE 802.1AS SyncE IRIG-B Precision pulse/frequency output* on BNC, RS422 and CL Serial outputs with configurable time telegrams (10 pin terminal block) E1 / 2.048/MHz, G811, G.812, G813 compatible no prot. output (1:1), SSM (only qual. level (only opt. II), 1x BNC, 1x RJ48 DCF 77 CL (Current loop) passive output (2 pin terminal) 100/1000BaseT SFP for miniGBIC module 100/1000BaseT(X) or FX	3 as "hold-over redundancy" 1 precision output, 50 Ohms 1 2 RS 232/422/485 RS 422: output only 1 1 3 1	BNC (AM) spring terminal (DC) *future option RJ48 (balanced) BNC (unbalanced)	
Network interface	PTP profiles: default E2E, P2P, utility (61850-9-3), telecom, IEEE 802.1AS SyncE IRIG-B Precision pulse/frequency output* on BNC, RS422 and CL Serial outputs with configurable time telegrams (10 pin terminal block) E1 / 2.048/MHz, G811, G.812, G813 compatible no prot. output (1:1), SSM (only qual. level (only opt. II), 1x BNC, 1x RJ48 DCF 77 CL (Current loop) passive output (2 pin terminal) 100/1000BaseT SFP for miniGBIC module 100/1000BaseT(X) or FX PTP master IEEE1588-2008 (V2) 1 or 2-step	3 as "hold-over redundancy" 1 precision output, 50 Ohms 1 2 RS 232/422/485 RS 422: output only 1 1 3 1 √	BNC (AM) spring terminal (DC) *future option RJ48 (balanced) BNC (unbalanced) 2× RJ45 1× SFP	
Network interface	PTP profiles: default E2E, P2P, utility (61850-9-3), telecom, IEEE 802.1AS SyncE IRIG-B Precision pulse/frequency output* on BNC, RS422 and CL Serial outputs with configurable time telegrams (10 pin terminal block) E1 / 2.048/MHz, G811, G.812, G813 compatible no prot. output (1:1), SSM (only qual. level (only opt. II), 1x BNC, 1x RJ48 DCF 77 CL (Current loop) passive output (2 pin terminal) 100/1000BaseT SFP for miniGBIC module 100/1000BaseT(X) or FX PTP master IEEE1588-2008 (V2) 1 or 2-step SyncE master	3 as "hold-over redundancy" 1 precision output, 50 Ohms 1 2 RS 232/422/485 RS 422: output only 1 1 3 1 4 4 4 4 4 4 4 4 4 4 4 4 4	BNC (AM) spring terminal (DC) *future option RJ48 (balanced) BNC (unbalanced) 2x RJ45 1x SFP	
Network interface	PTP profiles: default E2E, P2P, utility (61850-9-3), telecom, IEEE 802.1AS SyncE IRIG-B Precision pulse/frequency output* on BNC, RS422 and CL Serial outputs with configurable time telegrams (10 pin terminal block) E1 / 2.048/MHz, G811, G.812, G813 compatible no prot. output (1:1), SSM (only qual. level (only opt. II), 1x BNC, 1x RJ48 DCF 77 CL (Current loop) passive output (2 pin terminal) 100/1000BaseT SFP for miniGBIC module 100/1000Base-T(X) or FX PTP master IEEE1588-2008 (V2) 1 or 2-step SyncE master NTP V4 (V3 compatible1 server	3 as "hold-over redundancy" 1 precision output, 50 Ohms 1 2 RS 232/422/485 RS 422: output only 1 1 3 1 4 4 4 4 4 4 4 4 4 4 4 4 4	BNC (AM) spring terminal (DC) *future option RJ48 (balanced) BNC (unbalanced) 2× RJ45 1× SFP	
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Network interface	PTP profiles: default E2E, P2P, utility (61850-9-3), telecom, IEEE 802.1AS SyncE IRIG-B Precision pulse/frequency output* on BNC, RS422 and CL Serial outputs with configurable time telegrams (10 pin terminal block) E1 / 2.048/MHz, G811, G.812, G813 compatible no prot. output (1:1), SSM (only qual. level (only opt. II), 1x BNC, 1x RJ48 DCF 77 CL (Current loop) passive output (2 pin terminal) 100/1000BaseT SFP for miniGBIC module 100/1000Base-T(X) or FX PTP master IEEE1588-2008 (V2) 1 or 2-step SyncE master NTP V4 (V3 compatible) server NTP mode Server, Peer, Broadcast, Multicast SNTP MD5 authentication for NTP TIME, DAYTIME Telnet, SSH, FTP, SCP, SFTP - disengageable SNMP Notifications (Traps)	3 as "hold-over redundancy" 1 precision output, 50 Ohms 1 2 RS 232/422/485 RS 422: output only 1 1 1 3 1 4 4 4 4 4 4 4 4 4 4 4 4 4	BNC (AM) spring terminal (DC) *future option RJ48 (balanced) BNC (unbalanced) 2x RJ45 1x SFP maintenance ports only maintenance ports only	
Network interface Network services	PTP profiles: default E2E, P2P, utility (61850-9-3), telecom, IEEE 802.1AS SyncE IRIG-B Precision pulse/frequency output* on BNC, RS422 and CL Serial outputs with configurable time telegrams (10 pin terminal block) E1 / 2.048/MHz, G811, G.812, G813 compatible no prot. output (1:1), SSM (only qual. level (only opt. II), 1x BNC, 1x RJ48 DCF 77 CL (Current loop) passive output (2 pin terminal) 100/1000BaseT SFP for miniGBIC module 100/1000Base-T(X) or FX PTP master IEEE1588-2008 (V2) 1 or 2-step SyncE master NTP V4 (V3 compatible) server NTP mode Server, Peer, Broadcast, Multicast SNTP MD5 authentication for NTP TIME, DAYTIME Telnet, SSH, FTP, SCP, SFTP - disengageable SNMP Notifications (Traps) SNMP Get, Put	3 as "hold-over redundancy" 1 precision output, 50 Ohms 1 2 RS 232/422/485 RS 422: output only 1 1 1 3 1 3 1 4 4 4 4 4 4 4 4 4 4 4 4 4	BNC (AM) spring terminal (DC) *future option RJ48 (balanced) BNC (unbalanced) 2x RJ45 1x SFP maintenance ports only maintenance ports only maintenance ports only	
Network interface Network services	PTP profiles: default E2E, P2P, utility (61850-9-3), telecom, IEEE 802.1AS SyncE IRIG-B Precision pulse/frequency output* on BNC, RS422 and CL Serial outputs with configurable time telegrams (10 pin terminal block) E1 / 2.048/MHz, G811, G.812, G813 compatible no.prot. output (1:1), SSM (only qual. level (only opt. II), 1x BNC, 1x RJ48 DCF 77 CL (Current loop) passive output (2 pin terminal) 100/1000BaseT SFP for miniGBIC module 100/1000Base-T(X) or FX PTP master IEEE1588-2008 (V2) 1 or 2-step SyncE master NTP V4 (V3 compatible) server NTP mode Server, Peer, Broadcast, Multicast SNTP MD5 authentication for NTP TIME, DAYTIME Telnet, SSH, FTP, SCP, SFTP - disengageable SNMP Notifications (Traps) SNMP Get, Put IP V6 support	3 as "hold-over redundancy" 1 precision output, 50 Ohms 1 2 RS 232/422/485 RS 422: output only 1 1 1 3 1 3 1 4 4 4 4 4 4 4 4 4 4 4 4 4	BNC (AM) spring terminal (DC) *future option RJ48 (balanced) BNC (unbalanced) 2x RJ45 1x SFP maintenance ports only maintenance ports only maintenance ports only	
Network interface	PTP profiles: default E2E, P2P, utility (61850-9-3), telecom, IEEE 802.1AS SyncE IRIG-B Precision pulse/frequency output* on BNC, RS422 and CL Serial outputs with configurable time telegrams (10 pin terminal block) E1 / 2.048MHz, G811, G.812, G813 compatible no prot. output (1:1), SSM (only qual. level (only opt. II), 1x BNC, 1x RJ48 DCF 77 CL (Current loop) passive output (2 pin terminal) 100/1000BaseT SFP for miniGBIC module 100/1000BaseT(X) or FX PTP master IEEE1588-2008 (V2) 1 or 2-step SyncE master NTP V4 (V3 compatible) server NTP mode Server, Peer, Broadcast, Multicast SNTP MD5 authentication for NTP TIME, DAYTIME Telnet, SSH, FTP, SCP, SFTP - disengageable SNMP Notifications (Traps) SNMP Get, Put IP V6 support Link Aggregation (IEEE 802.3 ad)	3 as "hold-over redundancy" 1 precision output, 50 Ohms 1 2 RS 232/422/485 RS 422: output only 1 1 1 3 1 3 1 4 4 4 4 4 4 4 4 4 4 4 4 4	BNC (AM) spring terminal (DC) *future option RJ48 (balanced) BNC (unbalanced) 2x RJ45 1x SFP maintenance ports only maintenance ports only maintenance ports only maintenance ports only maintenance ports only	



IP configuration			
	DHCP	1	
IPv4	static IP	1	
	Autoconfiguration	1	
IPv6	static IP	1	
	DHCPv6	1	
Alarm I/O			
Electrical	Output: Relay contact	1	
	Output: SNMP notifications (traps)	V2c/V3	maintenance ports only
Network	Output: Mail	1	maintenance ports only
	Supervision possible with MOBA-NMS EXPERT (DSS)	1	maintenance ports only
Oscillator			
	OCXO +/- 1 * 10 <sup>.7</sup> /year	Option a	G.813, G.812 IV
different entions:	OCXO +/- 1.5*10 <sup>8</sup> /year	Option b	G.812
(stability per year)	Rubidium +/- 3*10°/year	Option c	G.811
(oldonity por your)	Hold over (after >24h synchronization) @ constant ambient	according to oscillator	
	temperature	according to oscillator	
Accuracy			
Internal accuracy	GPS to internal time	typ. < +/- 50ns	
	GPS to NIP	typ. < +/- 100µs	
	GPS to PIP	typ. < +/- 0.25µs	
	GPS to DCF	typ. < +/- 5µs	
	GPS to Pulse	typ. < +/- 5µs	
	GPS to IRIG (analog)	typ. < +/- 200µs	
lime source input	GPS to IRIG (digital)	typ. < +/- 1 µs	
	Pulse/trequency output, BNC & RS422	typ. < +/- 200ns	
	Pulse/trequency output, current loop	typ. < +/- 10µs	
	SyncE	compatible	G.811, G.812, G.813
		compatible	G.811, G.812, G.813
	GPS to serial output	typ. < +/- 10ms (jitter <10ms)	
Operation control		·	
	MORA-INMS	V	maintenance ports only
	leinet	V	maintenance ports only
	SSH		maintenance ports only
	SIN/VP (V2c/V3 get, put)		maintenance ports only
	KS 232 (terminal)		
	LED Alarm		
	LED Power		
Compliant		V	
Compliancy	EMC. EN 50101 4 61000 6 4 EN 61000 6 0	1	
	ENIC: EN 30121-4, 01000-0-4, EN 01000-0-2		
	CD G 703	✓	
	0.703	companble	depending on oscillator
	G.811, G.812, G.813	compatible	option
	IEEE 1588-2008	1	
	NTP RFC 5905	1	
	IEC 61850	1	applicable for SNTP/NTP/
		v	PTP synchronization only



## DTS 4160.grandmaster - Application example



## DTS 4160.grandmaster - Redundant operation

#### Primary time source

Any of the reference time sources can act as primary time reference to which a grandmaster can synchronize to. Every source the user configures is simultaneously validated by the grandmaster. Two modes are possible: manual (default) and automatic. In manual mode, the grandmaster uses the user-defined priority list for choosing the best source as reference.

In automatic mode, the priority list is generated automatically based on an accuracy rating estimation of all sources.

#### Redundant time

To avoid time deviation between two DTS 4160.grandmasters, they can be linked via a fiber-optic connection by using two GBIC modules. Ideally, both grandmasters use GPS as primary time reference, but any time reference source can be chosen as primary time reference.

The two grandmasters automatically negotiate their state as master or slave. The slave is synchronized by the master as soon as any better rated/prioritized source has a failure. Swap between master and slave state will occur automatic.

#### Redundant outputs

If the slave PTP Grandmaster is in passive mode, it does not provide PTP to the network.

Frequency and time code outputs are generated on both devices all the time.



#### Redundant power

The DTS 4160.grandmaster has three monitored inputs for entirely redundant power supply. The standby power supply input is also monitored.

Possible power variants:

- 24 VDC, non-redundant
- 24 VDC + 24 VDC, redundant
- 230 VAC + 24 VDC, redundant
- 230 VAC, non-redundant



### DTS 4160.grandmaster - Features

#### Time precision

Utmost accuracy is achieved with GPS synchronization. An intelligent time management ensures lasting high accuracy by continuously compensating oscillator drift and aging.

The internal time is adjusted to the active time reference (e.g. GPS) slowly shifted (in adjustable micro steps) to avoid any time leaps (e.g. after a longer loss of the time source).

#### Top performance for large networks

The high performance DTS 4160.grandmaster can reply to more than 10'000 NTP and SNTP requests per second, which allows for the synchronization of several thousand clients.

#### PTP Grandmaster

PTP according to IEEE 1588-2008 for the synchronization of highly accurate clients. Usable for telecom (e.g. LTE), energy (e.g. smart grid), automation, ...



#### Front view

- Serial Terminal for operation (RS232)
- USB connector for software update, file upload and maintenance
- Status LEDs for power, alarm and synchronization
- Display to show time, date, status, alarm, IP address..

#### NTP authentication

The DTS 4160 supports NTP authentication for increased security, which allows the clients to verify the source of the received NTP packets.

#### Safe and convenient operation

Operation over LAN via MOBA-NMS (SNMP), SSH or SNMP protocols is possible. SSH and SNMP (MD5 authentication and DES for encryption) enable a secured connection. Additional connection over RS232 is possible.

#### Alarm indication

Alarms are reported via SNMP messages, e-mail or by alarm relay. Additionally, the alarm is indicated on the display and on the Alarm LED.



#### A Rear view

- Power: 1x mains power connector, 2x DC power supply input
- alarm relay contact
- Synch. inputs
- GPS
- Redundant link
- PTP
- DCF
- E1

- Synch. outputs
- 1 × DCF, IRIG-B
- 2x serial RS 232 / RS 422 / RS 485 interface
- 1×E1
- 2x pulse/frequency

- LAN connectors
  - 3x RJ45 100/1000MBit
- 1× SFP
- GPS antenna connector (N female)