High precision time server, grandmaster and PRC

DTS 4160.grandmaster i

The DTS 4160.grandmaster i 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 i:

- 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:
  - 4x E1/2.048MHz*
  - 2x pulse/frequency output
  - 1x IRIG-B
  - 2x serial output
  - 1x DCF
- High degree of system redundancy by connecting two DTS 4160i via fiber-optic link:
  - high availability
  - master-slave operation with automatic switch over in case of an error
- High degree of synchronization redundancy by connecting up to 6 time sources: GPS, Link, PTP, DCF, E1, F-IN

*2.048MHz as E1 unframed

DTS 4160.grandmaster i - Technical details

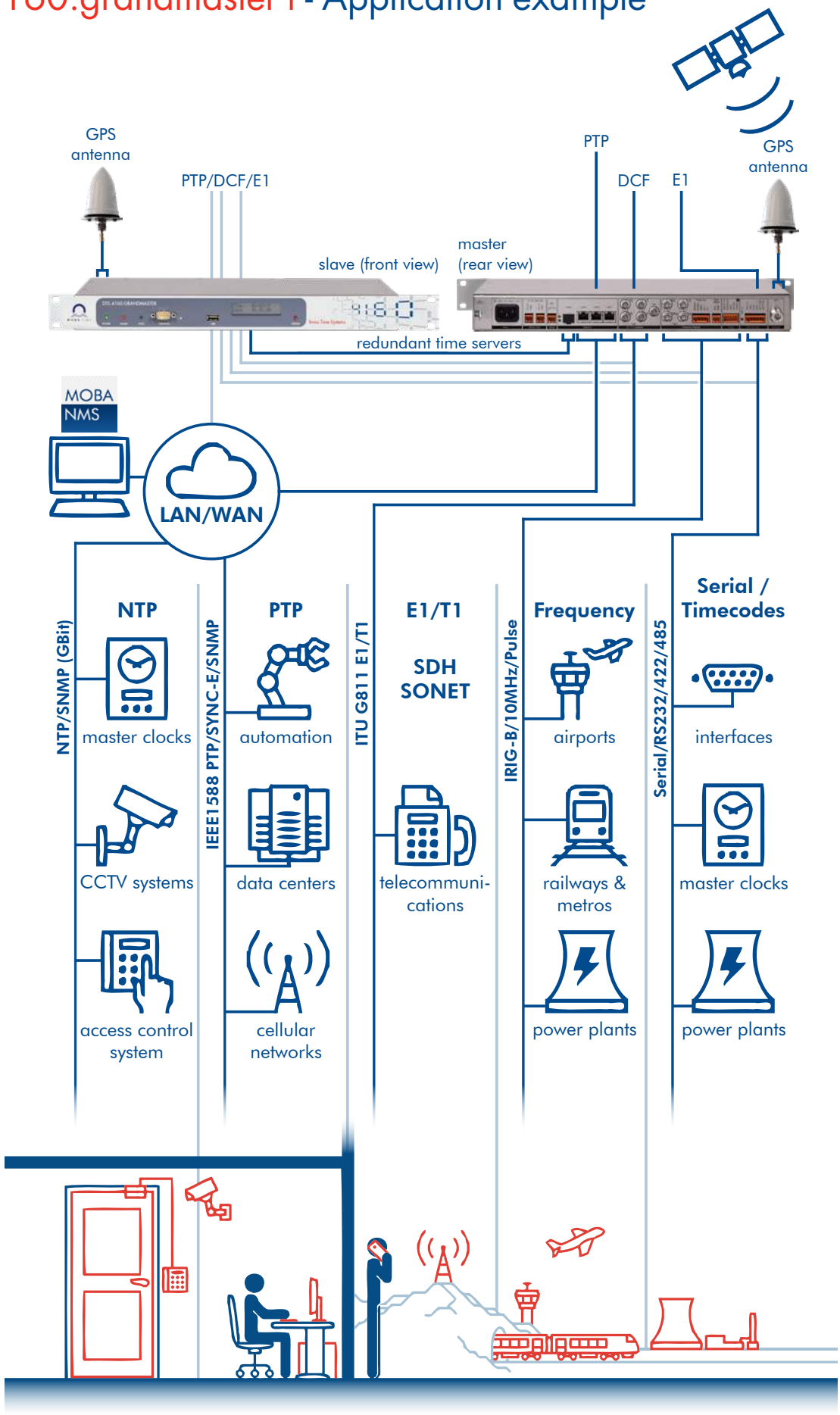
General specifications				
System	CPU	ARM Cortex dual core		
	Oscillator	Rubidium or OCXO	see oscillator option	
Housing	Dimensions (W x H x D)	483 x 44 x 190 mm	19", 1 HU	
	Weight	2.3 kg		
Display	LCD, 2 lines, for status and time info	✓		
LAN interfaces	100/1000 MBit, RJ45	3	3 maintenance ports	
	SFP (miniGBIC interface)	1	May be used for: - redundant operation (see redundant link) - Optical network for NTP/PTP	
Redundant link	For redundant operation of 2 corresponding DTS 4160i with master/slave negotiation	✓	Option to additional network port. See also LAN interfaces miniGBIC/SFP	
RS 232 interface	For operation control, D-Sub 9 connector	1		
USB interface	For firmware update	1		
Power supply	Redundant power supply (supplies 1, 2 and 3)	✓		
	Supply 1 (standard mains connector for 240VAC)	240VAC		
	Supplies 2 & 3	22..29 VDC		
Ambient temperature	at 10-90% relative humidity, without condensation	0 to 50°C		
Reference signal inputs				
	GPS RF input (for GPS Antenna, N female connector) to internal GPS receiver 72 channels, tracking sensitivity -165 dBm	1		
	Optical link from second DTS 4160.grandmaster i (SFP)	1		
	PTP (from other grandmaster)	3 (2 if optical link is used for redundant link)		
	DCF	1		
	E1	1		
	F-IN (1pps, 10MHz, 2,048MHz)	1		
Reference signal outputs				
Network	NTP server	>10'000req/s	on all 4 ports combined	
	PTP Grandmaster (E2E, P2P, 1-step, 2-step, Multicast, Layer 2, IPv4/IPv6)	RJ45 over 2x 1Gbit port SFP over 1Gbit port		
	PTP profiles: default E2E, P2P, utility (IEC 61850-9-3), ITU-T G.8265.1, ITU-T G.8275.1, ITU-T G.8275.2, IEEE 802.1AS			
	SyncE	3 as "hold-over redundancy"		
Others	IRIG-B	1 precision output, 50 Ohms	BNC (AM) spring terminal (DC)	
	Precision pulse/frequency output[1] on BNC, RS422 and CL	1	*future option	
	Serial outputs with configurable time telegrams (10 pin terminal block)	2 RS 232/422/485 RS 422: output only		
	E1/2.048MHz[1], G811, G.812, G813 compatible no protected output (1:1), SSM (only quality level (only option I))	4	BNC (unbalanced)	
	DCF 77 CL (Current loop) passive output (2 pin terminal)	1		
Network interface				
	100/1000BaseT	3		
	SFP for miniGBIC module 100/1000Base-T(X) or FX	1		
Network services				
	PTP master IEEE1588-2008 (V2) 1 or 2-step	✓	2x RJ45 1x SFP	
	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	✓	maintenance ports only	
	SNMP Notifications (Traps)	V2c/V3	maintenance ports only	
	SNMP Get, Put	V1/V2c/V3	maintenance ports only	
	IP V6 support	✓		
	Link Aggregation (IEEE 802.3 ad)	✓	over 2 dedicated LAN interfaces (LAN 2 & 3)	
	VLAN	✓		

[1] 2.048MHz as E1 unframed

IP configuration			
IPv4	DHCP	✓	
	static IP	✓	
IPv6	Autoconfiguration	✓	
	static IP	✓	
	DHCPv6	✓	
Alarm I/O			
Electrical	Output: Relay contact	✓	
Network	Output: SNMP notifications (traps)	V2c/V3	maintenance ports only
	Output: Mail	✓	maintenance ports only
	Supervision possible with MOBA-NMS EXPERT (DSS)	✓	maintenance ports only
Oscillator			
different options: (stability per year)	OCXO +/- $1*10^{-7}$/year	Option a	G.813, G.812 IV
	Rubidium +/- $3*10^{-9}$/year	Option c	G.811
	Hold over (after >24h synchronization) @ constant ambient temperature	according to oscillator	
Accuracy			
Internal accuracy	GPS to internal time	typ. < +/- 30ns[1]	
	Redundant link to internal time	typ. < +/- 50ns	
	PTP to internal time	typ. < +/- 50-100ns	
	DCF to internal time	typ. < +/- 200ns	after compensating fix offset
	E1 to internal time	typ. < +/- 200ns	frequency only
	F-In to internal time	typ. < +/- 200ns	frequency only
Time source input	GPS to NTP	typ. < +/- 100µs	
	GPS to PTP	typ. < +/- 0.25µs	
	GPS to DCF	typ. < +/- 5µs	
	GPS to Pulse	typ. < +/- 5µs	
	GPS to IRIG (analog)	typ. < +/- 200µs	
	GPS to IRIG (digital)	typ. < +/- 1µs	
	Pulse/frequency output, BNC & RS422	typ. < +/- 200ns	
	Pulse/frequency output, current loop	typ. < +/- 10µs	
	GPS to serial output	typ. < +/- 10ms (jitter <10ms)	
Operation control			
	MOBA-NMS	✓	maintenance ports only
	Telnet	✓	maintenance ports only
	SSH	✓	maintenance ports only
	SNMP (V2c/V3 get, put)	✓	maintenance ports only
	RS 232 (terminal)	✓	
	LED Alarm	✓	
	LED Power	✓	
	LED Sync	✓	
Compliancy			
	EMC: EN 50121-4, EN 61000-6-4, EN 61000-6-2	✓	
	Safety: IEC 62368	✓	
	CB	✓	
	G.703	compatible	
	G.811, G.812, G.813	compatible	depending on oscillator option
	IEEE 1588-2008	✓	
	NTP RFC 5905	✓	
	IEC 61850	✓	applicable for SNTP/NTP/ PTP synchronization only

[1] Only with the internal GNSS module and good satellite reception

DTS 4160.grandmaster i - Application example



DTS 4160.grandmaster i - 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

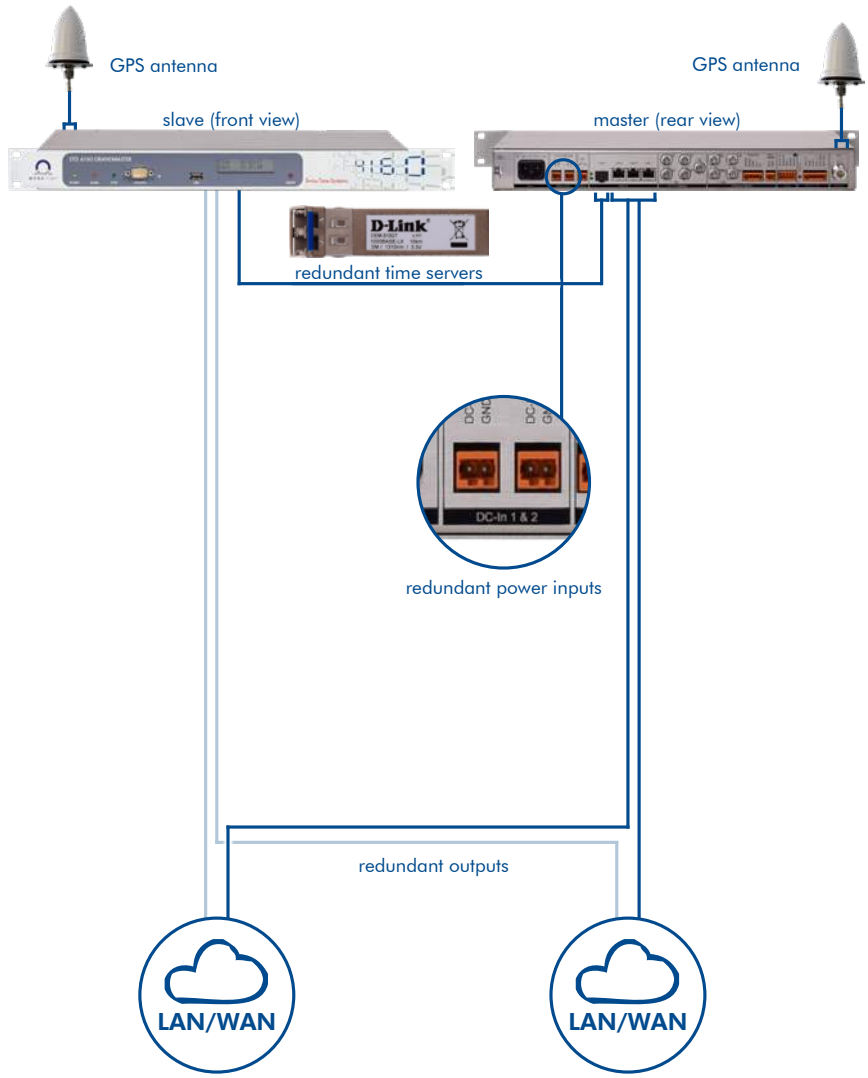
To avoid time deviation between two DTS 4160.grandmaster i, they can be linked via a fiber-optic connection by using two GBIC modules. Ideally, both grandmasters use GPS as primary time reference, but any time reference source can be chosen as primary time reference.

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 i 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 i - 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 i 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, ...

NTP authentication

The DTS 4160i 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.

▲ 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..

▲ Rear view

- Power: 1x mains power connector, 2x DC power supply input
- alarm relay contact
- Synch. inputs
  - GPS
  - Redundant link
  - PTP
  - DCF
  - E1
  - F-in
- Synch. outputs
  - 1x DCF, IRIG-B
  - 2x serial RS 232 / RS 422 / RS 485 interface
  - 4x E1/2.048MHz*
  - 2x pulse/frequency
- LAN connectors
  - 3x RJ45 100/1000MBit
  - 1x SFP
- GPS antenna connector (N female)

*2.048MHz as E1 unframed

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