# Meinberg -InfoWare

VIF MEE 2023 - Presentation



The Synchronization Experts.

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- 2. Power distribution Synchronisation needs
- 3. GNSS receiver Intentional/Unintentional perturbations
- 3. Meinberg Solutions actual ... and future coming





- Meinberg Your Partner for professional Time and frequency Synchronisation Solutions
  - Head Quarter in Germany Bad Pyrmont R&D, Manufacturing, Production, Shipment, Support and Administration
     All Meinberg products are developed, manufactured and supported in our plant

MEINB

- End-to-end quality
- Expertise & Products
- All manufactured products undergo 100% burn-in tests before shipment
- Standard Support Service available for all products
  - 3 years warranty covering all hardware and software failures
  - Free product's <u>Lifetime Support</u> (including embedded software upgrade)
- Advanced Customer Support
  - Advanced technical support service available 365 days a year and 24 hours a day
- Rapid Replacement Service
- Warranty Extension





### Standard Support Service

Our standard support services that are included in all Meinberg products.



### Advanced Customer Support

Advanced support services when you need them available 365 days a year, 24 hours a day.

### Rapid Replacement Service

Reserved replacement devices of an identical configuration to the product in use.

### Warranty Extension

The abbility to extend your warranty to up to 10 years.

2. Power distribution – Synchronisation needs





### 2. Power distribution – Synchronisation needs

In the power distribution the synchronization is required for many possible areas:

- 1. All System handling datas and event located within a Power Station Control room needs accurate time information
- 2. SCADA (Supervisory Control and Data Acquisition ) System defined by IEC
- 3. Synchrophasor device used to estimate the magnitude and phase angle of an electrical signal in the GRID using a common time source for synchronization.
- 4. Travelling wave fault detection
- 5. Intelligent electronic device (IED) such as Circuit Breakers, Transformers, Capacitor Banks
- 6. Merging Unit The merging unit measures the current and voltage signals from the instrument transformers, merges and sends them to the protective devices in a standard-based digital output format



## 2. Power distribution – Synchronisation needs

Functionality	Need for Timing	Accuracy Required	Timing Technology
Control Room	Log file coordination	1 sec	(S)NTP
SCADA System	Grid wide monitoring and control	1 ms	NTP, IRIG
Synchrophasor	Monitor of grid stability. Foults predictions	1 us	IRIG IEEE C.37.118.2-2011 PTP
Travelling wave fault detection	Locations of faults to within 100m. Improves maintenance efficency	300 ns	РТР

- 2. Power distribution Meinberg Synchronisation units
- Meinberg single GNSS/GPS receiver Solutions NTP Servers 19" 1U high

LANTIME M250

ORMAL OPERATION ffs. GPS: Ous	Mon, UTC:	19.09.2022 12:00:00	- FI	*	OK	Ref. Time     Time Service     Network
	ORMAL OPERATION ffs. GPS: Øus	ORMAL OPERATION Mon, 1 ffs. GPS: Ous UTC: 1	ORMAL OPERATION Mon, 19.09.2022 ffs. GPS: Ous UTC: 12:00:00	ORMAL OPERATION Mon, 19.09.2022	ORMAL OPERATION Mon, 19.03.2022	ORMAL OPERATION Mon, 19.09.2022





# 2. Power distribution – Meinberg Synchronisation units

Meinberg single GNSS/GPS receiver Solutions – NTP/PTP Servers 19" 1U high

microSync<sup>RX</sup>





microSync<sup>HR</sup>





### 2. Power distribution – Meinberg Synchronisation units



#### LANTIME M4000











- Intentional Perturbations
  - Jamming
  - Spoofing
  - Cyber attacks
- Unintentional Perturbations
  - Solar weather
  - Radiated RF Noise
  - System failure

- Intentional Perturbations Jamming
  - GPS/GNSS jamming is the act of using a frequency transmitting device to block or interfere with satellites radio messages.



- GPS/GNSS jamming is usually taking place for a limited period of time
- GPS/GNSS receiver will easily detect the jamming as no more satellites's signals are accessible
- The Synchronisation Solution enters into holdover operation mo

- Selection of high performance oscillator will maintain the time/phase/frequency error within defined/acceptable limits
- Two (physically) separated GNSS receivers can be configured in Cluster to introduce mitigation/resilience

# MEINBERG

- Monitored by European Global Navigation Satellite Systems Agency
  - Strike3 Project
  - Monitoring stations in 23 countries
- Interference events
  - 450,000 events
  - 73,000 had major impact on GNSS
  - 59,000 of major impact signals from jamming devices
- Jamming devices
  - Used by professional drivers and car thieves to avoid tracking
  - Can be purchased online for as little as \$150





Two or more (physically) separated GNSS receivers Acting as NTP Server Stratum 1 can be configured in Cluster to introduce mitigation/resilience

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All NTP Clients will sent Requests to a defined and fixe IP address, only the active NTP Client is going to answ And porovide accurate time information

- Intentional Perturbations Spoofing
  - GPS/GNSS spoofing is when a counterfeit radio signal is transmitted to a receiver antenna to counteract and override a legitimate GPS satellite signal. It is often a form of cyber-attack perpetrated by bad actors attempting to steer goods
     GPS/GNSS spoofing is very difficult to detect and override a legitimate GPS satellite signal.



 GPS/GNSS spoofing is very difficult to detect as it is not going to affect the normal receiver's operation

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- Various solutions based on the "messages cyber security" strategies between the satellites and the receivers are actually under development
- Monitoring the internal oscillator PLL parameters partially allows to detect a Spoofing situation
- Meinberg decided to collaborate with Fugro and Septentrio to work on a "independent" solution
- Latest deployed Meinberg Synchronisation Solution can be upgraded to AtomiChron<sup>TM</sup> receivers

Intentional Perturbations – Spoofing



MEINBERG

100 locations all around the world – many National Metrology Institutes (UTC(k) sources)





# MEINBERG

- Intentional Perturbations Cyber-attacks
  - Activating all available security features limiting the access to the Meinberg synchronisation Solution unit (SSL, Network Services, Users - authority level and appropriate passwords)
  - Configuring the Loggin/Access parameters (Timeout, Unlock time, Bruteforce Number of tries and Unlock Time)
  - Disabling (if possible and available) front panel interfaces
  - Immediate installation of software upgrades including Cyber-security improvements
  - Storage, on a regular basis, of "Configuration file" for possible restoring
  - Remote Management NMS allows the operator to access/verify all types of configuration modifications
  - SNMP v3 is the only version including security parameters
  - Users management, including password criterias, renewal rules
  - Activate the NTP security features (MD5, SHA1 or AES-128-CMAC)
  - PTP Security is still under discussion within IEEE

- Intentional Perturbations Cyber-attacks
  - Official Security Guideline is available for LTOS 7
  - Meinberg categorized different protocols either "secure" or "unsecure"
  - Default configurations for SSH/SSL are updated automatically by LANTIME Firmware updates to ensure the most secure configuration
    - Revised user privileges in the webinterface
    - Admin users are not allowed to install firmware updates
    - Admin users are not allowed to edit script files through the webinterface
    - Security relevant config changes like password hashes are not shown in the UI anymore





- Admin users are not allowed to edit script files through the webinterface
- Security relevant config changes like password hashes are not shown in the UI anymore





# MEINBERG

- Intentional Perturbations Cyber attacks
  - Over 100 security related improvements in V7 release
  - Major software components updated
    - Linux Kernel
    - Ntpd
    - OpenSSL
    - OpenSSH
    - Bash, ....
  - Hardened Firewall Concept
    - Whitelisting mechanism (vs. Blacklisting in V6)
    - Network traffic that is not explicitly allowed will be dropped by the LANTIME



- Intentional Perturbations Cyber attacks
  - Services can be enabled/disabled for each virtual interface
  - Use different virtual interfaces for management and timing related traffic
    - Prevent management access out of a "timing network"
  - Considered "unsecure" network services like "http" are disabled by default
    - Connection attempts to TCP Port 80 (http) are redirected to TCP Port 443 (https)

Service	NTP	нттр	HTTPS	TELNET	SSH	SNMP	FTP	TIME	DAYTIME	WEBSHELL	
Interface 01 - lan0:0:	~		<b>v</b>		<b>~</b>						+
Interface 02 - lan1:1:											÷
Interface 03 - lan2:2:	✓										+
Interface 04 - lan3:3:											÷
Interface 05 - lan4:4:	✓										+
	-	+	-	+	-	+	+	+	+	+	
Current State:	0	8	0	8	0	•	8	8	•	8	



- Intentional Perturbations Cyber-attacks
  - Support for LDAP and LDAPS (external identification) since LTOS version 7.02
  - Secure communication over LDAP(S) recommended
  - Easy setup via GUI

External Authentication		Radius/TACACS+	LDAP	
Anonymous Bind				
LDAP User	LDAP Password			
admin@test.mbg.de	•••••		8	
Search Scope	Search Base			
sub 🗢	CN=Users,DC=te	st,DC=mbg,DC=de		
base				
one		Filter Mapping		
Add Filter				
Add LDAP Server				

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# MEINBERG

### 3. GNSS receiver Intentional/Unintentional perturbations

Intentional Perturbations – Cyber-attacks

Meinberg's firmware strategy is geared towards the development of innovative solutions that meet the current and future synchronization requirements of modern networks.

As part of our pursuit of this strategy, Meinberg's development team continuously improves the firmware of its products.

Even without a paid support contract, Meinberg customers receive updates for their installed systems, including new features, protocols, and security improvements. This service allows Meinberg products to be kept up to date for a very long time.

### LTOS 7.06.014 Available Now

The latest LANTIME Firmware Version 7.06.014 contains new features, bug fixes and other improvements. All of the changes are listed in our <u>LTOS V7 changelog</u>.

This firmware update is already available for Meinberg customers to download. The latest LTOS firmware update package is compatible with Meinberg's <u>LANTIME M-Series</u> products, modular <u>IMS LANTIME</u> servers, and <u>SyncFire</u> servers.



- Unintentional Perturbations Solar weather
  - There is no way to protect Synchronisation Solution for such type of event The only "solution" to mitigate such type of event is to integrate the adequate oscillator presenting the necessary holdover performance ... Atomic Clock?



- Unintentional Perturbations Radiated RF Noise
  - The Synchronisation Solution can be placed within perturbated environment

It becomes crucial to verify the Synchronisation Solution has been certified to be compliant to the necessary level of radio frequency level interferences (CE, CISPR 16-2-3, etc..)

• The GPS Antenna can also be affected by perturbated environment

The antenna installation must be done taking into consideration its environment. Do not place GPS Antenna nearby radio emitters/receivers, avoid the presence of large metallic objects, sky visibility is an essential parameter, etc..

The possibility to remotely and permanently manage the Synchronisation Solution is a good way to detect perturbated environment, as the perturbation will be reported to the remote NMS.

- Unintentional Perturbations System failures
  - "System Redundancy" is the only way to avoid/mitigate the impact of System failures











### GNSS instead of GPS receivers

- We use to say that GPS receiver can only access the GPS satellites' signals
- We use to say that GNSS receiver can access to a set of satellites' signals issued by more than one System
  - GPS, GLONASS, GALILEO, Beidou
- The GNSS receiver performances can be slightly better compare to GPS receiver
- The GNSS receiver reliability is also improved as the operation interruption of single System is not going to affect the receiver's normal operation





- GNSS is recommended To reduce the impact of a global navigation system shutdown
- GNSS is strongly recommended When sky visiblity is limitied, to increase the number of visible satellites



### Cluster configuration

- Installation of two independent GNSS based NTP Stratum 1 Servers and connfiguring them as Cluster units increases the "Time-source" resilience
- In case of issue within the active NTP Server, the redundant one is going to automatically handle all NTP time requests addressed to the predefined and unique IP Address
- All NTP Clients are not affected by the change of active NTP Server, they are using the same IP address
   during both alternative confgurations





Parallel Redundancy Protocol



- The two frames travel through their respective LAN A and LAN B until they reach a destination node with a certain travel time difference.
- The destination node accepts the first frame of a pair and discards the second.
- Therefore, as long as one LAN (A or B) is operational, the destination application always receives one frame.
- PRP provides zero-time recovery and allows to check the redundancy continuously.





### Parallel Redundancy Protocol – configuration GUI

- Native PRP Support in LTOS7 for redundant network infrastructures
- Easily Configurable through the webinterface
- LANTIME acts as a DAN (Dual Attached Node A device that is connceted to both redundant Networks)

MEINBERG	LANTIME M timeserver	10005			Reference Time     Active Alarm     Time Service     I Critical, 1     Network     Alarm
1ain Network Notificatio	on Security NTP F	TP System Statistics	Clock IO Config SyncMon	Docs & Support Logout	
ANTIME - Netw	<u>vork</u>				
> Main Network Infor	mation				
> Default Gateways					
> Network Services					
Dhysical Natwork C	onfiguration				
	onnguration				
Interface	LANO	LAN1	LAN2	LAN3	LAN4
Net Link Mode	AUTO	¢ AUTO	¢ AUTO ¢	AUTO 🗢	AUTO \$
Monitor Interface					
				_	
Bonding	Assigned to PRP 0	Assigned to PRP 0	♦ Shgle Connection ♦	Single Connection \$	Single Connection 🗢
Bonding Bonding Status	Assigned to PRP 0	Assigned to PRP 0	♦ Single Connection ♦	Single Connection 💠	Single Connection \$
Bonding Bonding Status IPv6 Mode	Assigned to PRP 0	Assigned to PRP 0      Deactivated	<ul> <li>♦ Single Connection</li> <li>♦ Deactivated</li> <li>♦</li> </ul>	Single Connection \$	Single Connection $\Leftrightarrow$ Deactivated $\diamondsuit$
Bonding Bonding Status IPv6 Mode MAC Address	Assigned to PRP 0 Deactivated	<ul> <li>Assigned to PRP 0</li> <li>Deactivated</li> <li>ec:46:70:00:44:eb</li> </ul>	<ul> <li>Sigle Connection</li> <li>Deactivated</li> <li>ec:46:70:00:44:ec</li> </ul>	Single Connection Deactivated ec:46:70:00:44:ed	Single Connection Deactivated ec:46:70:00:44:ee
Bonding Bonding Status IPv6 Mode MAC Address Assigned Virtual Interfaces	Assigned to PRP 0 Deactivated 00:13:95:38:4d:3d	<ul> <li>Assigned to PRP 0</li> <li>Deactivated</li> <li>ec:46:70:00:44:eb</li> <li>02</li> </ul>	<ul> <li>Single Connection</li> <li>Deactivated</li> <li>ec:46:70:00:44:ec</li> </ul>	Single Connection Deactivated ec:46:70:00:44:ed 04	Single Connection Deactivated ec:46:70:00:44:ee OS

■ Meinberg–Fugro–Septentrio -> Atomichron<sup>™</sup>



# End

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The Synchronization Experts.





- 4. Meinberg Product range (partial)
- Meinberg single GNSS/GPS receiver Solutions DIN Rail



### LANTIME M450



### LANTIME M500

Meinberg single GNSS/GPS receiver Solutions – NTP Servers 19" 1U high

LANTIME M250 Ref. Time ок GPS: NORMAL OPERATION Time Service IANTIME M250 NTP: Offs. GPS: Ous Network ESC Alarm LANTIME M320 Ref. Time
 Time Service F1 t ок O Terminal MEINBERG Network LANTIME M320 ESC USB Alarm 100 SYNCFIRE **MEINBERG** SyncFire 1200

Meinberg single GNSS/GPS receiver Solutions – NTP/PTP Servers 19" 1U high

microSync<sup>RX</sup>



#### microSync<sup>HR</sup>





Meinberg single/redundant GNSS/GPS receiver/s Solutions – LANTIME IMS Modular NTP/PTP Servers 19"

LANTIME M1000



LANTIME M2000





Meinberg single/redundant GNSS/GPS receiver/s Solutions – LANTIME IMS Modular NTP/PTP Servers 19"

LANTIME M3000



#### LANTIME M4000



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