

# Synchronisation MasterClass

## Industry Leading Timing MasterClass

### Industry Leading Sync MasterClass

Building on successful seminars and MasterClasses, Chronos presents a regular Synchronisation MasterClass for people interested in learning more about the specialist topic of synchronisation for communications networks. The course is delivered regularly in the UK.

This version of the MasterClass has been formulated to address some of the challenges operators and networks will face as the communications world moves from TDM to Packet based Ethernet Networks. More than 2000 delegates from UK and overseas manufacturers and operators have attended the MasterClass since 1999. It is delivered on a public basis at Stowfield House or it can be brought to your location anywhere in the world and tailored to meet your specific requirements. The course will always include the essential elements overleaf.

### Duration:

The public course takes place over two days at Stowfield House. Please visit our website for dates of the next public event. The MasterClass is frequently over subscribed so booking early is a good idea to book to avoid disappointment.

### Prior Knowledge:

It is assumed that attendees have a basic understanding of telecoms transmission including an overview of SDH and PDH.

### Course cost includes:

- Refreshments and lunch on both days
- Dinner day one
- Folder with course notes

### Content:

- Introduction to Synchronisation
- Fundamental Concepts: Frequency, Phase, Time, Oscillators & Phase Locked Loops
- Synchronisation Elements: Clock Sources, networks clocks and distribution techniques
- Standards: relevant standards from ITU, ETSI, IETF and IEEE
- Quality Metrics & Testing
- Time Synchronisation
- Core Networks: SyncE, SDH, WDM
- Core Networks: Packet based Synchronisation NTP, PTPv2 and others
- Sync in Power Applications
- Mobile Networks including 5G
- Architecture & Planning

### Essential for:

- Network planners and architects
- Engineers and technicians
- Operations and maintenance staff
- Customer liaison staff
- Network management staff
- Senior line management of staff involved with sync
- Sales and bid preparation staff

Chronos Technology - Proud to be Employee Owned

© Chronos Technology 2026 CTLds159 r1.1 Jan 2026 chronos.uk +44 1594 862200

in x ▶ f



## Detailed Syllabus Day 1:

### Pre-Course Question Session

Day 1 starts with a quiz covering basic telecoms terminology and sync. It is marked before the start of day 2 and feedback given to the delegates. It is used to measure the improvement in delegates' knowledge as the test is repeated on Day 2.

- Written test to assess level of knowledge
- Over 40 questions and acronym definitions

### Introduction to Synchronisation

- History of Telecoms Synchronisation
- Emerging technologies, convergence of voice/data/internet services
- Basic misconceptions about sync
- Typical sync routes through a network
- Impact of poor sync on carriers' services
- Impact of poor Sync on Mobile Networks

### Fundamental Concepts: Frequency, Phase, Time, Oscillators & Phased Locked Loops

- Acronyms and Definitions
- Classical Network Sync Architecture
- Clock Noise and Noise Characterisation
- Jitter and Wander
- Slips and Pointer Adjustments
- Introduction to mixed technology problems

### Synchronisation Elements: clock sources, networks clocks and distribution techniques

- Types of Oscillator
- Atomic clock fundamentals
- Introduction to GPS
- Other PRS Clocks
- PRTC—Time Masters
- Slave Clocks—SSU and SEC
- Comparison of Regional Standards • VCO and PLL Principles
- Examples of SSU and PRC products
- Other off-air references—GLONASS, Galileo, BeiDou, eLORAN • GPS based PRCs & PRTCs—including practical considerations

### Standards: relevant standards from ITU, ETSI, IETF and IEEE

- Evolution to NGN timing protocols- IEEE and IETF standards • Clock standards
- Electrical interface standards
- Jitter and Wander standards
- Comparison of Regional standards

### Quality Metrics and Testing

- Definitions
- Derivation of TIE and sample data
- Derivation of MTIE and sample data
- Derivation of TDEV and sample data
- Real application examples
- Sync test equipment & solutions
- Evolving metrics for PSNs—minTDEV, MAFE and MATIE • Metrics and measurements for 1PPS signals

### Time Synchronisation

- UTC, a global timescale
- NTP
- PTP
- Phase / time distribution for telecom

## Day 2:

### Core Networks: SyncE, SDH & WDM

- Review of SDH technology • Network Elements
- Pointers
- Sync Status Messaging
- Sample SDH network MTIE “signatures”
- Use of Retimers
- Sync over DWDM
- High level review of Sync in Optical Transport Networks • Optical Network Signal Structure
- OTN Sync Transport Mechanisms
- Examination of transport of SDH clients over the OTN • SyncE theory
- Frequency transport mechanism
- Standards limited MTIE/TDEV

### Core Networks: Packet based Sync NTP, PTPv2 and others

- Review of packet network technology
- Network elements
- Transport mechanism
- Network Synchronous, Adaptive Clock Recovery (ACR) and SRTS (Differential) methods
- Sample ATM and ACR network element MTIE ‘signatures’
- Sync over Packet Networks - PTP, NTP and Carrier Class NTP
- The evolution to Next Gen Network standards including G.8260 & G.8270 series
- Synchronous Ethernet introduction
- Emerging technologies—UTI

### Sync in Power Applications

- The power grid
- Electrical substation
- Digital substation IEC 61850
- Fault location
- Standards
- Power profiles for IEEE1588-PTP

### Mobile Networks

- Mobile network requirements
- 5G, GSM, 3G & 4G
- Small cell requirements
- Network and Base Station sync
- Mobile Network Architecture and Connectivity
- Sync for location based services

### Architecture & Planning

Inter-Network Architecture • Intra-Network Architecture • Master Slave PRC

- Flat PRC
- Hybrid PRC
- Intra-Node Architecture
- Sync Element Interworking
- Planning Rules: PRC level; SSU level; SEC level • Interworking of SDH/WDM/SyncE/PTP
- Network Examples

Post Course Questions