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**EPI 25 Time Reference in ACN Systems  
Using SNTP and NTP**

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### **Published by:**

Entertainment Services and Technology Association  
630 Ninth Avenue, Suite 609  
New York, NY 10036  
USA  
Phone: 1-212-244-1505  
Fax: 1-212-244-1502  
[standards@esta.org](mailto:standards@esta.org)

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 Jason Kyle

LuxBalance Lighting  
 Tyrone Mellon, Jr.  
 Lizz Pittsley  
 Showman Systems  
 Michael Skinner  
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## Contact Information

### Technical Standards Manager

Karl G. Ruling  
ESTA  
630 Ninth Avenue, Suite 609  
New York, NY 10036  
USA  
1-212-244-1505 ext. 703  
[karl.ruling@esta.org](mailto:karl.ruling@esta.org)

### Assistant Technical Standards Manager

Richard J. Nix  
ESTA  
630 Ninth Avenue, Suite 609  
New York, NY 10036  
USA  
1-212-244-1505 ext. 649  
[richard.nix@esta.org](mailto:richard.nix@esta.org)

### Technical Standards Council Chairpersons

Mike Garl  
Mike Garl Consulting LLC  
1-865-389-4371  
[mike@mikegarlconsulting.com](mailto:mike@mikegarlconsulting.com)

Mike Wood  
Mike Wood Consulting LLC  
1-512-288-4916  
[mike@mikewoodconsulting.com](mailto:mike@mikewoodconsulting.com)

### Control Protocols Working Group Co-chairpersons

Milton Davis  
Doug Fleenor Design, Inc.  
1-805-481-9599  
[milton@dfd.com](mailto:milton@dfd.com)

Michael Lay  
Signify  
1-352-433-2479  
[michael.lay@signify.com](mailto:michael.lay@signify.com)

## Acknowledgments

The Control Protocols Working Group members when this document was approved by the working group on 1 July 2019 are shown below.

### Voting members:

Kevin Loewen; Acuity Brands Inc.; MP  
Robert Bell; Acuity Brands Inc.; MP  
Maurits van der Hoorn; Acuity Brands Inc.; MP  
Wayne David Howell; Artistic Licence Holdings; DE  
Christian Krueger; Blizzard Lighting LLC; MP  
Robert Haycock; UC Berkeley; I; U  
Bill Ellis; Candela Controls, Inc.; DE  
Brent Boulnois; Candela Controls, Inc.; DE  
Jim Ohrberg; Candela Controls, Inc.; DE  
Jason Potterf; Cisco; MP  
Paul Kleissler; City Theatrical, Inc.; MP  
Larry Schoeneman; DesignLab Chicago, Inc.; DR  
Milton Davis; Doug Fleenor Design, Inc.; MP  
Ian Campbell; Doug Fleenor Design, Inc.; MP  
Ulrich Kunkel; E3 Engineering & Education for Entertainment GmbH; U  
Steve Terry; Electronic Theatre Controls, Inc.; MP  
Sam Kearney; Electronic Theatre Controls, Inc.; MP  
Eric Rasmussen; Electronic Theatre Controls, Inc.; MP  
Robert Goddard; Goddard Design Co.; MP  
Peter Willis; Howard Eaton Lighting Ltd.; CP  
Edwin S. Kramer; I.A.T.S.E. Local 1; U  
John Huntington; I.A.T.S.E. Local 1; U  
Roger Lattin; I.A.T.S.E. Local 728; U  
Matthew Ardine; I.A.T.S.E. Local 728; U  
David Kane; I.A.T.S.E. Local 728; U

Alan M. Rowe; I.A.T.S.E. Local 728; U  
Mark Primrose; Kino Flo, Inc.; CP  
John Valus Jr.; Lex TM3; CP  
Leroy "Tripp" Oliver, III; Mainstage Theatrical Supply, Inc.; DR  
Scott M. Blair; Megapixel; CP  
Mitch Hefter; USITT; U  
Bill McIntyre; Show Distribution Group, Inc.; CP  
Simon Newton; Open Lighting Project; G  
Daniel Murfin; Royal National Theatre; U  
Michael Lay; Signify; MP  
Maya Nigrosh; Sonos; MP  
Jim Love; Tait Towers Manufacturing LLC; MP  
Julian Hoare; Tait Towers Manufacturing LLC; MP  
Tucker Downs; Tucker Downs; I; G  
Paul Beasley; Walt Disney Company; U  
Eric Bloom; Westview Productions; DR  
Andrew Berry; X-Laser; MP  
Jon Hole; Eaton; MP

**Observer (non-voting) members:**

Cameron Affleck; English National Opera (ENO); U  
Christian Allabauer; Christian Allabauer; G  
Tim Bachman; Altman Stage Lighting; MP  
Nick Ballhorn-Wagner; Electronic Theatre Controls, Inc.; MP  
Robert Barbagallo; Solotech Inc.; U  
Marcus Bengtsson; disguise; MP  
Justin Bennett; University of the Incarnate Word; U  
Andrew Berry; X-Laser; MP  
Javid Butler; Integrated Theatre, Inc.; CP  
Justyn Butler; JBOTS; CP  
Jean-Francois Canuel; A.C. Lighting Ltd.; CP  
Steve Carlson; High Speed Design, Inc.; MP  
Yongzhi Chen; Guangzhou Haoyang Electronic Co., Ltd.; CP  
Anthony Chiappone; Chauvet Lighting; MP  
Martin Chisnall; Martin Chisnall; U  
Jon Chuchla; Audio Visual Systems, Inc.; G  
Edward R. Condit; Edward R. Condit; G  
Gareth Conner; Creative Conners, Inc.; MP  
Fraser Connolly; Obsidian Controls; DE  
Chris Conti; PRG; DR  
Jeremy Day; Lumenpulse Lighting Inc.; MP  
Larry Dew; W.A. Benjamin Electric Co.; DE  
Rich Dionne; Purdue University; DE  
Hamish Dumbreck; James Embedded Systems Engineering; MP  
James Eade; ABTT; G  
Paul K. Ericson; Stantec; DE  
Trevor Forrest; Helvar Lighting Control; MP  
Andrew Frazer; Stellascapes; MP  
David Gooch; Chauvet Lighting; MP  
Sean Goossen; LiteGear, Inc.; MP  
Jerry Gorrell; Theatre Safety Programs; G  
Sean Harding; Port Lighting Systems; G  
Nick Harper; Nick Harper; G  
Bill Hewlett; ImageCue LLC; MP

Jim Holladay; Luxence; G  
Eric Johnson; Eric Johnson; G  
Rob Johnston; Interactive Technologies, Inc.; MP  
Michael Karlsson; LumenRadio AB; MP  
Jonathan Kemble; Electronic Theatre Controls, Inc. ; MP  
Christopher Kennedy; Chauvet Lighting; MP  
Lucas Korytkowski; Insight Lighting; MP  
Jason Kyle; JPK Systems Ltd.; MP  
Hans Leiter; Electronic Theatre Controls, Inc.; MP  
Jon Lenard; Applied Electronics; MP  
Rob Love; Insight Lighting; MP  
David McCulloch; David McCulloch; U  
John Mehlretter; Lehigh Electric Products Co.; MP  
John Musarra; John Musarra; U  
Mit Patel; disguise; MP  
Jaxon Patterson; Insight Lighting; MP  
Soren Sterdorff Peglau; Brother, Brother and Sons; MP  
Gary Pritchard; LSC Lighting Systems PTY Ltd; MP  
Charles Reese; Production Resource Group; DR  
Yngve Sandboe; Sand Network Systems, Inc.; MP  
Nicolai Gubi Schmidt; Nicolai Gubi Schmidt; U  
Ford Sellers; Chauvet Lighting; MP  
Christopher B. Tilton; About the Stage, LLC; DE  
Robert Timmerman; Signify; MP  
Tracy Underhill; Triple C Lighting & Controls; G  
Carlo Venturati; Clay Paky S.P.A.; MP  
Will Wagner; Carallon Ltd.; MP  
Colin Waters; TMB; DR  
Ralph Weber; ENDL Texas; G  
Loren Wilton; Showman Systems; CP  
David Yellin; Sumolight GmbH; MP  
Jeong Sik Yoo; Ghost LX; DE

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## ACN EPIs

ANSI E1.17-2006 is the “ESTA Architecture for Control Networks” standard [ACN]. It specifies an architecture — including a suite of protocols and languages which may be configured and combined with other standard protocols in a number of ways to form flexible networked control systems.

E1.17 Profiles for Interoperability (EPIs) are standards documents which specify how conforming implementations are to operate in a particular environment or situation in order to guarantee interoperability. They may specify a single technique, set of parameters or requirement for the various ACN components. They may also specify how other standards (including other EPIs) either defined within ACN or externally are to be used to ensure interoperability.

## Foreword

This EPI specifies restrictions and guidelines for establishment of a common time reference across components within an ACN system using SNTP (Simple Network Time Protocol) and optionally NTP (Network Time Protocol). This EPI does not define a control synchronization model, but the network wide time reference it establishes can form the basis of a number of different models.

## 1 Introductory Discussion

Within the control of entertainment lighting and effects time synchronization is very important. In a typical system this can require that hundreds or thousands of individual and autonomous components are required to behave in a coordinated manner to achieve a desired effect, and the coordination needs to remain the same night after night.

The variation in synchronization must therefore be imperceptible or at least unobtrusive to an audience.

Historically, connection between a controller and a piece of controlled equipment has taken the form of a direct linkage by wire and in most cases a single controller has been the main or only source of commands. In this model, synchronization is down to the performance of the controller and to the well known characteristics of the wire connection. Delays within the system of tens of milliseconds can easily be compensated if they are nearly constant - and are anyway often imperceptible when the object of control is an incandescent lamp with a filament time constant which ranges into hundreds of milliseconds.

With control of an ever widening array of equipment controlled in entertainment technology and the inclusion of equipment with very short time constants such as LED based or video effects, much smaller time discrepancies become perceptible — especially when sound, lighting and other effects are combined.

Within an ACN system the linking factor for control of all these components is the network - they cannot be relied upon to have any other linkage. However, delays and variation within the network infrastructure can mean that there is much more variability - even where total delays are no greater - than with the historical model described above.

## 2 Definitions

**accuracy:** Refers to how well a clock's frequency and time compare to international standards. See [NTPv3].

**component:** An ACN communications endpoint. Defined in [Arch].

**drift:** The variation in skew over time (the second derivative of offset with time). See [NTPv3].

**host:** A single node on the network. The term is used in the sense commonly used in networking.

**offset:** The difference in time between two clocks. See [NTPv3].

**precision:** A measure of the error (or lack of it). See [NTPv3].

**skew:** The difference in frequency between two clocks (the first derivative of offset with time). See [NTPv3].

**stability:** Refers to how well a clock can maintain a constant frequency. See [NTPv3].

## 3 Synchronization Models

### 3.1 Synchronizing Control vs. Time Reference

There is a difference between synchronization of control and synchronization of time reference. Synchronization of control means that separate controlled devices which are intended to act in a time coordinated way, do so with acceptably small variation from instance to instance. Synchronization of time reference simply means that all components within the system, which operate with a concept of time, use and are synchronized to the same agreed time reference to within acceptable limits.