Electric Power Industry Standard of the People's Republic of China

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DL/T 5392—2007

Specifications of Engineering Design for Digital Synchronization Network of Electric Power System

电力系统数字同步网工程设计规范

（英文版）

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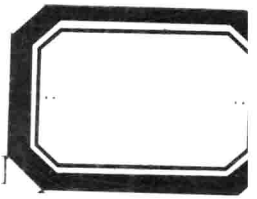

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Reviewed by : Central Southern China Electric Power Design Institute

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Foreword

These specifications are prepared as arranged by the *Notice on Printing and Distributing Industrial Standards Project Plan of the Year 2005* (FGBGY [2005] No.739) issued by the General Office of the National Development and Reform Commission.

With the rapid development of the power communications network, the digital synchronization network has become an important part in it and is the key to ensure the performance and quality of network synchronization. With the introduction of various new services and the rapid development of SDH transport network in electric power communications, a quicker development of digital synchronization network has become an urgent need. Therefore, it is imperative and necessary to develop a specification for engineering design of digital synchronization network, which may suit the electric power communications network and meet the future requirements for some time.

In the development of these specifications, the design experiences in the past decade are summarized. Through extensively referring to the engineering, operation practices and study results, while seeking comments from engineering, operation and management entities concerned, the drafting panel endeavors to work out these specifications that can reflect the relevant requirements in respect of engineering, construction, and operation management.

These specifications are proposed by China Electricity Council.

These specifications are solely managed by the Technical Committee on Electric Power Planning and Engineering of

Standardization Administration of Power Industry.

These specifications are drafted by the Central Southern China Electric Power Design Institute (CSEPD).

The leading authors of these specifications: Xiao Shuiying, Du Mingjun, Cheng Xihai, and Zhou Xianlin.

The opinions and suggestions proposed during the implementation of these specifications are to be referred to the Standardization Center of China Electricity Council (at the following address: No.1, Ertiao, Baiguang Road, Xuanwu District, Beijing, 100761).

These specifications are translated by SUNTHER Translation & Solutions under the authority of China Electric Power Planning & Engineering Association.

Contents

1 Scope

These specifications specify the concept of digital synchronization network, reference distribution network, synchronization distribution, maintenance and management requirements, and synchronization requirements for various communication equipment, equipment and instrument configuration, and design for clock installation.

These specifications apply to the engineering design and the planning design for newly built digital synchronization network, and it may be used as a reference for expansion and renovation projects.

2 Normative References

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of DL/T 5392—2007. For dated references, subsequent amendments to or revision of any of these publications do not apply. However, parties to agreements based on this part of DL/T 5392—2007 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

YD/T 900 *SDH Equipment Technical Requirements—Clock*

YD/T 1011 *Technology Requirement and Test Method of Stand Alone Synchronization Equipment in Digital Synchronization Network*

YD/T 1012 *Node Clock Set of Digital Synchronization Network and Its Timing Feature*

YDN 117 *Planning Methods and Organizational Principles of Digital Synchronization Network*

YDN 121 *Technical Specifications for SDH Synchronization Status Message*

YD/T 5089 *Specifications of Engineering Design for Digital Synchronization Network*

YD/T 1267 *Technical Specification for Synchronization Network Based on SDH Transport Network*

ITU-T Recommendation G.703—2001 *Physical/Electrical Characteristics of Hierarchical Digital Interfaces*

ITU-T Recommendation G.704—1998 *Synchronization Frame*

Structures Used at 1544, 6312, 2048, 8448, and 44 736 kbit/s Hierarchical Levels

ITU-T Recommendation G.707 *Network Node Interface for the Synchronous Digital Hierarchy (SDH)*

ITU-T Recommendation G.781 *SDH Transmission Systems and Media, Digital System and Networks: Synchronization Layer Functions*

ITU-T Recommendation G.783 *Characteristics of Synchronous Digital Hierarchy (SDH) Equipment Functional Blocks*

ITU-T Recommendation G.803 *Architecture of Transport Networks Based on the Synchronous Digital Hierarchy (SDH)*

ITU-T Recommendation G.810 *Definitions and Terminology for Synchronization Network*

ITU-T Recommendation G.811 *Timing Characteristics of Primary Reference Clocks*

ITU-T Recommendation G.812 *Timing Requirements of Slave Clocks Suitable for Use as Node Clocks in Synchronization Networks*

ITU-T Recommendation G.813 *Timing Characteristics of SDH Equipment Slave Clocks (SEC)*

ITU-T Recommendation G. 822 *Controlled Slip Rate Objectives on International Digital Connection*

ITU-T Recommendation G.823 *The Control of Jitter and Wander Within Digital Networks Which Are Based on the 2048 kbit/s Hierarchy*

ITU-T Recommendation G.825 *The Control of Jitter and Wander Within Digital Networks Which Are Based on the Synchronous Digital Hierarchy (SDH)*

ITU-T Recommendation G.957 *Optical Interfaces for Equipments and Systems Relating to the Synchronous Digital Hierarchy*

3 Abbreviations

The following abbreviations apply to these specifications.

ADM	Add and Drop Multiplexer
ADSS	All Dielectric Self-Supporting
AIS	Alarm Indication Signal
ATM	Asynchronous Transfer Mode
BITS	Building Integrated Timing Supply
BPV	Bipolar Polarity Violation
CRC	Cyclic Redundancy Check
DCN	Data Communication Network
DDF	Digital Distribution Frame
DDN	Digital Data Network
DNU	Do Not Use
DXC	Digital cross connect equipment
GLONASS	GLObal Navigation Satellite System
GPS	Global Positioning System
ITU	International Telecommunications Union
LOF	Loss Of Frame
LOS	Loss Of Signal
LPR	Local Primary Reference
MTIE	Maximum Time Interval Error
OOF	Out Of Frame
OPGW	Optical Fiber Composite Overhead Ground Wire
PDH	Plesiochronous Digital Hierarchy
PRC	Primary Reference Clock
SASE	Stand Alone Synchronization Equipment

SDH	Synchronous Digital Hierarchy
SEC	Synchronous digital hierarchy Equipment Clock
SETG	Synchronous Equipment Timing Generator
SNM	Synchronization Network Manager
SRM	Synchronization Regional Manager
SSM	Synchronization Status Message
SSU	Synchronization Supply Unit
SSU-L	Synchronization Supply Unit-Local Node
SSU-T	Synchronization Supply Unit-Transit Node
STM-N	Synchronous Transport Module, level N
TDEV	Time DEViation
TIE	Time Interval Error
TM/ADM	Terminal Multiplexer/Add and Drop Multiplexer
UTC	Universal Time Coordinated
ΔF/F	Frequency Shift

4 General

4.0.1 The engineering design of digital synchronization network shall be scientific and reasonable with the purpose of enhancing the operational stability of power communications networks and improving the operational safety of power networks.

4.0.2 The engineering design must comply with related national and industrial technical standards, and the design must be practical, technically advanced, and economically viable.

4.0.3 The engineering design of digital synchronization network shall meet the communication network's requirements for synchronization performance. The synchronization network's ability to resist natural disasters and emergencies shall be duly considered.

4.0.4 The engineering design shall comply with the communication network development plan and the synchronization network development plan, focusing on the satisfaction of short-term service needs with a consideration of development needs, and creating conditions for expansion and modification.

4.0.5 The synchronous equipment used in the engineering design shall pass performance tests conducted by inspection bodies as appointed by communication industry authorities, and comply with related international and national standards as well as the requirements for the equipment to access network.

5 Concept of Synchronization Network

5.1 Synchronization Modes

ITU-T Recommendation G.810 specifies three synchronization modes of the synchronization network:

1 Fully synchronized

In this mode, the entire network is controlled by one or several primary reference clocks. In the latter case, all the primary reference clocks shall be synchronized, namely, all of them have the same long-term accuracy under normal operating conditions.

2 Fully plesiochronous

In this mode, the clocks in the network operate independently and do not control each other. In this mode, all the clocks are required to have high accuracy and stability, namely, complying with ITU-T Recommendation G.811, so as to ensure the slip caused by relative frequency deviation meets the specified requirements.

3 Mixed synchronization

In this mode, the entire network is divided into several sub-networks. The clocks of digital equipment in various sub-networks are controlled by their respective primary reference clocks and are fully synchronized within one sub-network, while the primary reference clocks of different sub-networks are plesiochronous. The primary reference clocks of sub-networks shall comply with ITU-T Recom-

mendation G.811.

5.2 Synchronization Modes of SDH Transport Network

ITU-T Recommendation G.803 specifies four synchronization modes of SDH transport network:

1 Synchronous

In synchronous mode, all clocks in the network will be traceable to the network PRC. Pointer adjustments will only occur randomly. This is the normal mode of operation within a single network.

2 Pseudo-synchronous

In pseudo-synchronous mode, not all clocks in the network will be traceable to the same PRC. However, each PRC will comply with ITU-T Recommendation G.811 and therefore pointer adjustments will occur at the synchronization boundary network element. This is the normal mode of operation for the international and inter-operator network.

3 Plesiochronous

In plesiochronous mode, all the synchronization links will be disabled. The clock will enter holdover or free-run mode. Various clocks may run at the same nominal frequency and normal traffic can be maintained, but pointer adjustment may occur frequently.

4 Asynchronous

Asynchronous mode corresponds to the situation where large frequency offsets occur. The SDH network is not required to maintain traffic. The equipment is required to send AIS when the clock accuracy is inferior to $\pm 20 \times 10^{-6}$.

5.3 Relationship between Synchronization Network and SDH Transport Network

5.3.1 In the environment of SDH transport network, the timing reference signals of synchronization network need to be transported by SDH transport network, and the synchronization of SDH transport network needs to be supported by the synchronization network.

5.3.2 The synchronization of SDH transport network shall be incorporated into the synchronization network system, but the four synchronization modes of the SDH transport network provided in ITU-T Recommendation do not correspond to the three synchronization modes of the synchronization network.

5.3.3 The synchronization of SDH transport network is a necessary condition to establish a fully synchronized network. Both mixed synchronized network and fully plesiochronous network may cause the SDH transport network to operate in the pseudo-synchronous operation mode, the plesiochronous operation mode and asynchronous operation mode of SDH transport network are separated from the synchronization network system.