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**Real-time Ethernet TCnet
(Time-Critical Control Network)**

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CONTENTS

FOREWORD.....	9
1 Introduction	11
1.1 General	11
1.2 Nomenclature for references within this PAS	12
2 Scope	12
2.1 Field of applications.....	12
2.2 Scope and objectives.....	13
3 Normative references	14
4 Terms and definitions	14
5 Symbols and abbreviations	14
6 Data Link Layer Service definitions	15
6.1 Introduction	15
6.2 Scope.....	15
6.2.1 Overview	15
6.2.2 Specifications	16
6.2.3 Conformance	16
6.3 Void	17
6.4 Terms and definitions	17
6.5 Symbols and abbreviations	18
6.5.1 Common symbols and abbreviations.....	18
6.5.2 DLC DL-connection.....	18
6.5.3 RTE-TCnet: Additional symbols and abbreviations	18
6.6 Conventions.....	19
6.6.1 General conventions	19
6.6.2 Additional convention	20
6.7 Data link service and concept	20
6.7.1 General description of services	20
6.7.2 Time critical cyclic data service	26
6.7.3 Detail description of Sporadic Message Data service	29
6.8 DL-management services	31
6.8.1 General	31
6.8.2 Facilities of the DL-Management service	31
6.8.3 Service of the DL-management	31
Overview of interactions	33
6.8.4 Detail specification of service and interactions.....	34
7 Data Link Layer Protocol specification.....	44
7.1 Introduction	44
7.2 Scope.....	45
7.2.1 Overview	45
7.2.2 Specifications	45
7.2.3 Procedures	45
7.2.4 Applicability	46
7.2.5 Conformance	46
7.3 Void	46
7.4 Terms and definitions	46

7.5	Symbols and abbreviations	47
7.5.1	Common symbols and abbreviations.....	47
7.5.2	RTE-TCnet: Additional symbols and abbreviations	48
7.6	Overview of the DL-protocol.....	49
7.6.1	Overview of the media access control.....	49
7.6.2	Service assumed from the PhL	50
7.6.3	DLL architecture	51
7.6.4	Access Control Machine and schedule support functions	52
7.6.5	Local parameters, variable, counters, timers.....	53
7.7	General structure and encoding of PhIDUs and DLPDU and related elements of procedure.....	61
7.7.1	Overview	61
7.7.2	PhIDU structure and encoding.....	61
7.7.3	Common MAC frame structure, encoding and elements of procedure	61
7.7.4	Elements of the MAC frame.....	62
7.7.5	Order of bit transmission	65
7.7.6	Invalid DLPDU	65
7.8	DLPDU-specific structure, encoding and elements of procedure	65
7.8.1	General	65
7.8.2	Synchronization DLPDU (SYN).....	66
7.8.3	Transmission Complete DLPDU (CMP).....	71
7.8.4	In-Ring Request DLPDU (REQ).....	72
7.8.5	Claim DLPDU (CLM).....	73
7.8.6	Command (COM) DLPDU.....	74
7.8.7	Cyclic data and Cyclic data with transmission complete DLPDU (DT) and (DT-CMP).....	75
7.8.8	RAS DLPDU (RAS).....	76
7.9	DLE elements of procedure.....	77
7.9.1	Overall structure	77
7.9.2	Initialization	78
7.9.3	Cyclic transmission TX/RX Control (CTRC).....	79
7.9.4	Sporadic TX/RX Control (STRC)	83
7.9.5	Access Control Machine (ACM)	86
7.9.6	Redundancy medium control (RMC)	95
7.9.7	Serializer and Deserializer	103
7.9.8	DLL Management protocol.....	103
8	Application Layer Service definitions	108
8.1	Introduction	108
8.2	Scope.....	108
8.3	Void	109
8.4	Term and definitions	109
8.4.1	ISO/IEC 7498-1 terms	109
8.4.2	ISO/IEC 8822 terms	109
8.4.3	ISO/IEC 9545 terms	110
8.4.4	ISO/IEC 8824-1 terms	110
8.4.5	Fieldbus Data Link Layer terms	110
8.4.6	Fieldbus Application Layer terms	110
8.4.7	RTE-TCnet specific terms	111

8.4.8	Symbols and abbreviations.....	111
8.4.9	Conventions.....	112
8.5	Concept	112
8.5.1	Overview	112
8.5.2	Common memory concept.....	113
8.5.3	Relationship of common memory and AREP	114
8.5.4	Common memory data type.....	115
8.5.5	RTE-TCnet ASE and services.....	115
8.6	Common memory ASE.....	116
8.6.1	Overview	116
8.6.2	Common memory model class specification	116
8.6.3	Service specification of Common memory (CM) ASE	117
8.7	Application Relationship ASE.....	119
8.7.1	Overview	119
8.7.2	Application relationship endpoint class specification	121
8.7.3	Application relationship ASE service specifications.....	122
9	Application Layer Protocol specification	125
9.1	Introduction	125
9.2	Scope.....	125
9.3	Void	126
9.4	Term and definitions	126
9.4.1	Summary	126
9.4.2	Terms and definitions from other ISO/IEC standards.....	126
9.4.3	Symbols and abbreviations.....	127
9.4.4	Conventions.....	127
9.5	FAL Syntax description	128
9.5.1	General	128
9.5.2	FAL-AR PDU abstract syntax	128
9.5.3	Abstract syntax of PDU Body.....	128
9.5.4	Data Type.....	129
9.6	Transfer Syntax.....	129
9.6.1	Overview and FAL header	129
9.6.2	Encoding Rule	129
9.6.3	Encoding of structured types	131
9.7	FAL protocol state machines structures.....	131
9.7.1	Overview	131
9.8	FAL service protocol machine (FSPM).....	133
9.8.1	General	133
9.8.2	Primitives definitions	133
9.8.3	FSPM state tables.....	133
9.9	Application relationship protocol machine (ARPM).....	135
9.9.1	General	135
9.9.2	Primitive definitions.....	135
9.9.3	DLL mapping of BNU-PEC AREP class.....	136
9.9.4	BNU-PEC ARPM states machine	137
9.10	DLL Mapping Protocol Machine (DMPM)	139
9.10.1	Overview	139
9.10.2	Primitive definitions.....	140

9.10.3 DLL Mapping Protocol Machine (DMPM).....	141
9.10.4 Data Link Layer service selection	144

FIGURES

Figure 1 – RTE-TCnet communication profile.....	11
Figure 2 – Scope of this specification	13
Figure 3 – Relationship of the RTE-TCnet Data link layer to other RTE layers and to users of RTE Data link service	15
Figure 4 – Overall flow of Data frames during 1 Minimum Cycle period (High-speed Transmission-period)	22
Figure 5 – Overall flow of Cyclic Data frames over 1 Maximum cycle period (Low-speed-Transmission-period).....	22
Figure 6 – Sequence Diagram of Time-critical Cyclic Data service	23
Figure 7 – Sequence diagram of Sporadic Message service.....	24
Figure 8 – Relationship of DLSAP, DLCEP and DLCEP-address	25
Figure 9 – Sequence diagram of Reset, Set value, Get value, Set CM configuration, Get CM configuration, Activate Time-critical cyclic data and Deactivate Time-critical Cyclic data service primitives	33
Figure 10 – Sequence diagram of Sporadic Message service.....	33
Figure 11 – Relationship of RTE-TCnet Data Link Protocol to other RTE layers and to users of RTE Data link service	44
Figure 12 – Basic principle of Media Access Control.....	49
Figure 13 – Interaction of PhS primitives to DLE.....	50
Figure 14 – Data Link layer internal architecture.....	52
Figure 15 – Common MAC frame format for RTE-TCnet DLPDU	62
Figure 16 – Sporadic DLPDU format.....	62
Figure 17 – Structure of FC field	63
Figure 18 – Structure of SYN DLPDU	66
Figure 19 – Structure of CMP DLPDU.....	71
Figure 20 – Structure of the REQ DLPDU	72
Figure 21 – Structure of CLM DLPDU.....	73
Figure 22 – Structure of COM DLPDU	74
Figure 23 – Structure of DT DLPDU	75
Figure 24 – Structure of RAS DLPDU.....	76
Figure 25 – Overall structure of DLL.....	78
Figure 26 – DLE state transition	79
Figure 27 – State transition diagram of CTRC.....	81
Figure 28 – State transition diagram of STRC.....	85
Figure 29 – State transition diagram of ACM	89
Figure 30 – State transition diagram of RMC Sending and Send arbitration	97
Figure 31 – State transition diagram of RMC Receiving	100
Figure 32 – State transition diagram of DLM.....	104

Figure 33 – Relationship of the RTE-TCnet Application layer to other RTE layers and to users of RTE Application Layer service 108

Figure 34 – RTE-TCnet Application (Example)..... 113

Figure 35 – Global Common Memory concept over RTE-TCnet..... 113

Figure 36 – Relationship of Common Memory and AREP 114

Figure 37 – Structure of RTE-TCnet AL ASE. 116

Figure 38 – Common Memory Publisher/Subscriber model..... 119

Figure 39 – Relationship of RTE-TCnet Application layer to other RTE layers and to users of RTE Application service..... 125

Figure 40 – APDU overview 129

Figure 41 – Relationship between FSPM, ARPM, DMPM and External Physical CM 132

Figure 42 – State transition diagram of FSPM..... 134

Figure 43 – State transition diagram of the BNU-PEC 137

Figure 44 – State transition diagram of DMPM..... 141

TABLES

Table 1 – Primitives and parameters used on time critical cyclic data service 26

Table 2 – Data request primitives and the parameters 26

Table 3 – Put buffer primitives and parameters..... 27

Table 4 – Get buffer primitives and parameters 28

Table 5 – Notify buffer received primitives and parameters 29

Table 6 – Primitives and parameters used on Sporadic message data service..... 29

Table 7 – Submit sporadic message primitives and parameters..... 30

Table 8 – Summary of DL-management primitives and parameters 33

Table 9 – DLM-Reset primitives and parameters..... 34

Table 10 – DLM-Set-value primitives and parameters 34

Table 11 – Mandatory DLE-variables and the permissible values 35

Table 12 – DLM-Get-value primitives and parameters..... 37

Table 13 – Observational variables and the range of values..... 37

Table 14 – Event primitives and parameters 39

Table 15 – Event related state change variables..... 39

Table 16 –Set Publisher Configuration primitives and parameters 40

Table 17 – DLM-Get-Publisher-Configuration primitives and parameters 41

Table 18 – DLM-Activate-TCC primitives and the parameters..... 42

Table 19 – DLM-Deactivate-TCC primitives and the parameters..... 43

Table 20 – Data Link Layer components..... 51

Table 21 – F-Type and TCnet DLPDU 64

Table 22– PN -parameter: 3rd Octet..... 67

Table 23– CW -parameters: 4th Octet 67

Table 24 – PM parameter..... 67

Table 25 – RMSEL parameter 68

Table 26 – ST-parameter: 5th Octet 68

Table 27 – Th-parameter: 6th, 7th and 8th Octets	68
Table 28 – Tm-parameter: 9th and 10th Octets	69
Table 29 – Ts-parameter: 11th and 12th Octets	69
Table 30 – TI-parameter: 13th and 14th Octets	69
Table 31 – LL parameters: 15th to 46th Octets	70
Table 32 – CLM-parameter: 4th Octet.....	73
Table 33 – DT parameter: 3rd and 4th Octet.....	75
Table 34 – RAS parameter: 3rd and 4th byte.....	76
Table 35 – Primitives exchanged between DLS-user and CTRC.....	80
Table 36 – Primitives exchanged between CTRC and ACM.....	80
Table 37 – Parameters used with primitives exchanged between DLS-user and CTRC	81
Table 38 – CTRC state table	82
Table 39 – CTRC Functions table.....	83
Table 40 – Primitives exchanged between DLS-user and STRC.....	84
Table 41 – Primitives exchanged between STRC and ACM.....	84
Table 42 – Parameters used with primitives exchanged between DLS-user and STRC	84
Table 43 – STRC state table	85
Table 44 – STRC Functions table.....	86
Table 45 – Primitives exchanged between ACM and RMC	87
Table 46 – Parameters used with primitives exchanged between ACM and RMC.....	87
Table 47 – Primitives exchanged between ACM and CTRC.....	87
Table 48 – Parameters used with primitives exchanged between ACM and CTRC	88
Table 49 – Primitives exchanged between ACM and STRC.....	88
Table 50 – Parameters used with primitives exchanged between ACM and STRC	88
Table 51 – ACM state table.....	90
Table 52 – ACM Function table.....	95
Table 53 – Primitives exchanged between ACM and RMC	96
Table 54 – Primitives exchanged between RMC and Serializer / Deserializer	96
Table 55 – Primitives exchanged between RMC and Ph-layer	96
Table 56 – Parameters between RMC and ACM	97
Table 57 – Parameters between RMC and Ph-layer.....	97
Table 58 – State table of RMC Sending.....	98
Table 59 – State table of RMC Send arbitration	99
Table 60 – State table for RMC Receiving	100
Table 61 – RMC function table	102
Table 62– Primitives exchanged between DLMS-User and DLM.....	103
Table 63 – Parameters used with primitives exchanged between DL-user and DLM.....	104
Table 64 – DLM state table	105
Table 65 – DLM function table.....	107
Table 66 – Update Memory service parameters	118
Table 67 – Memory-Status service parameters	118
Table 68 – AR-Unconfirmed Send	122

Table 69 – AR-Gut Buffered message service	123
Table 70 – AR-Status service	124
Table 71 – FAL header	129
Table 72 – Primitives issued by FAL user to FSPM	133
Table 73 – Primitives issued by FSPM to FAL user	133
Table 74 – FSPM state table – sender transactions	134
Table 75 – FSPM state table – receiver transactions	134
Table 76 – Function SelectArep	135
Table 77 – Primitives issued by FSPM to ARPM	135
Table 78 – Primitives issued by ARPM to FSPM	135
Table 79 – Parameters used with primitives exchanged between FSPM and ARPM	136
Table 80 – BNU-PEC state descriptions	137
Table 81 – BNU-PEC ARPM state table – sender transactions	137
Table 82 – BNU-PEC ARPM state table – receiver transactions	138
Table 83 – Function GetArepId ()	138
Table 84 – Function BuildFAL-PDU	139
Table 85 – Function FAL_Pdu_Type	139
Table 86 – Primitives issued by ARPM to DMPM	140
Table 87 – Primitives issued by DMPM to ARPM	140
Table 88 – Parameters used with primitives exchanged between ARPM and DMPM	140
Table 89 – Primitives exchanged between Data Link Layer and DMPM	141
Table 90 – DMPM state descriptions	141
Table 91 – DMPM state table – sender transactions	142
Table 92 – DMPM state table – receiver transactions	143
Table 93 – Function PickArep	143
Table 94 – Function FindAREP	144

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Real-time Ethernet TCnet (Time-Critical Control Network)

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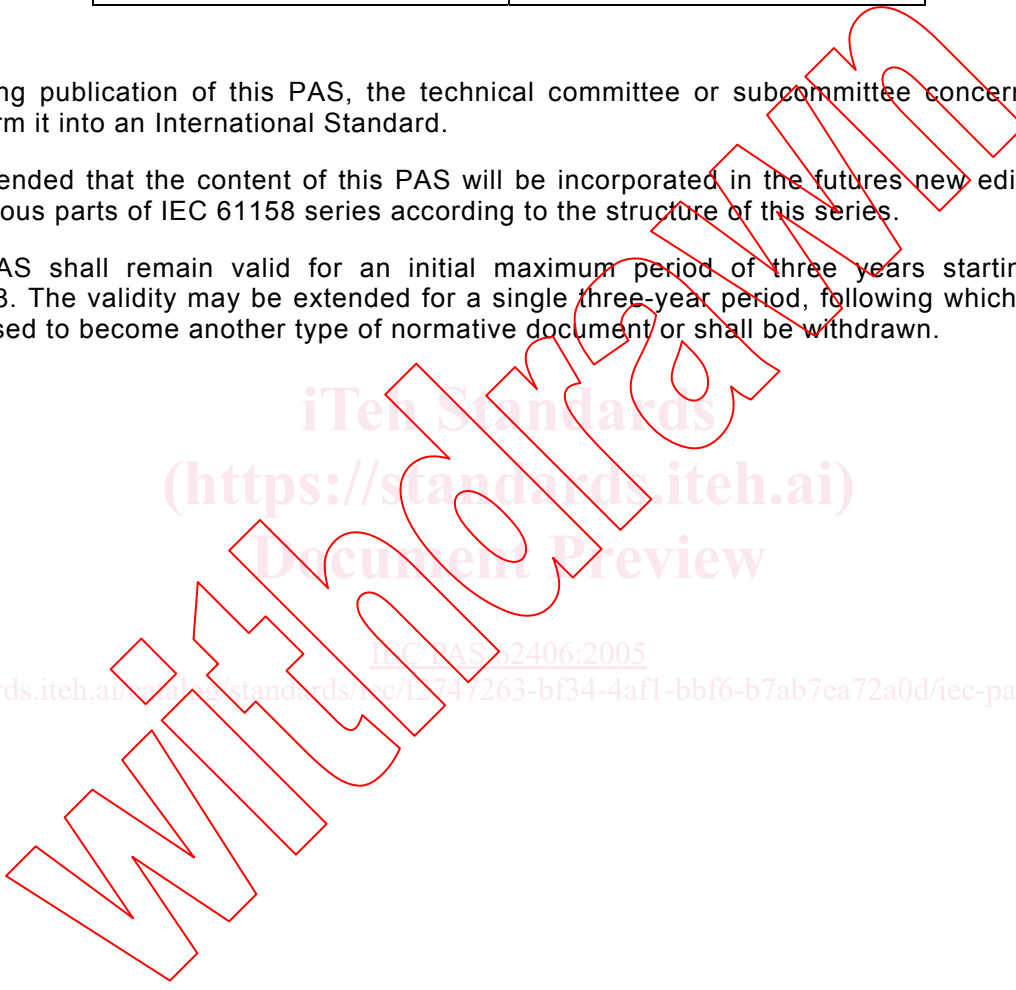
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Real-time Ethernet TCnet (Time-Critical Control Network)

1 Introduction

1.1 General

This PAS describes a set of the specifications essential for the ISO/IEC 8802-3 based “Time-critical Control Network (TCnet)”, which is one of the communication networks for Real- Time Ethernet (RTE) defined in IEC 61784-2 and is referred to as “RTE-TCnet” hereafter, and each specification in this PAS is to be classified into a separate part of IEC 61158 series.

This PAS meets the industrial automation market objective of providing predictable time deterministic and reliable time-critical data transfer and means, which allow co-existing with non time-critical data transfer over the ISO/IEC 8802-3 series communications medium, for support of cooperation and synchronization between automation processes on field devices in real time application system. The term “time-critical” is used to represent the presence of a time-window, within which one or more specified actions are required to be completed with some defined level of certainty.

This PAS specifies the part of the protocol set of the RTE-TCnet communication profile and/or of one or more communication profiles related to a common family of RTE-TCnet. The RTE-TCnet communication profile, shown in Figure 1 as one of the profile set, is based on the 7 layer OSI Basic Reference model. For regular ISO/IEC 8802-3 based applications the upper layers mapped over the Data Link layer is in the ordinary way, on the other hand for time-critical applications with Common Memory running in parallel the specific application layer for RTE-TCnet is specified. The Data Link layer for RTE-TCnet has the extension, but compliant to the ISO/IEC 8802-3 MAC protocol in order to provide both services for time-critical communications and common memory applications respectively.

	Regular ISO/IEC 8802-3 based applications	Time-critical applications with Common memory
Application layer	TELNET, FTP, HTTP OPC XML-DA etc	Common memory
Transport layer	RFC 768(UDP) RFC 793 (TCP)	null
Network layer	RFC 791 (IP)	
Data Link layer	ISO/IEC 8802-3 Specific scheduling extension	
Physical layer	ISO/IEC 8802-3 (Redundant)	

Figure 1 – RTE-TCnet communication profile

This PAS addresses the essential part of the RTE-TCnet profile, which are the extension part of ISO/IEC 8802-3 based Data Link layer and the Application layer exploiting the services of the Data Link layer immediately below.

This PAS describes the specifications essential for RTE-TCnet profile, specifically on the Data Link layer and the Application layer, in terms of the "three-layer" Fieldbus Reference Model which is based in part on the OSI Basic Reference Model. Other part of RTE-TCnet profile is not in the scope of this PAS.

1.2 Nomenclature for references within this PAS

Clauses, including annexes, can be referenced in their entirety, including any subordinate subclauses, as "Clause N" or "Annex N", where N is the number of the clause or letter of the annex.

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2 Scope

2.1 Field of applications

In industrial control systems, several kinds of field devices such as Drives, Sensors and Actuators, Programmable controllers, Distributed Control Systems and Human Machine Interface devices are required to be connected with control networks. The process control data and the state data is transferred among these field devices in the system and the communications between these field devices requires simplicity in application programming and to be executed with adequate response time. In most industrial automation systems such as food, water, sewage, paper and steel, including a rolling mill, the control network is required to provide time-critical response capability for their application, as required in ISO/TR 13283 for time critical communications architectures.

Plant production may be compromised due to errors, which could be introduced to the control system if the network does not provide a time-critical response. Therefore the following characteristics are required for a time-critical control network.

- A deterministic response time between the control device nodes

- Ability to share process data seamlessly across the control system

RTE-TCnet is applicable to such industrial automation environment, in which time-critical communications is primarily required. The term "time-critical" is used to represent the presence of a time-window, within which one or more specified actions are required to be completed with some defined level of certainty. Failure to complete specified actions within the time window risks failure of the applications requesting the actions, with attendant risk to equipment, plant and possibly human life.