

BS EN 62026-7:2013



BSI Standards Publication

Low-voltage switchgear and controlgear — Controller-device interfaces (CDIs)

Part 7: CompoNet

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National foreword

This British Standard is the UK implementation of EN 62026-7:2013. It is derived from IEC 62026-7:2010. It supersedes DD IEC/PAS 62026-7:2009, which is withdrawn.

A CENELEC common modification has been implemented in the text: a NOTE has been inserted in subclause 9.2.8.1.

The UK participation in its preparation was entrusted by Technical Committee PEL/17, Switchgear, controlgear, and HV-LV co-ordination, to Subcommittee PEL/17/2, Low voltage switchgear and controlgear.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

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**Low-voltage switchgear and controlgear -
Controller-device interfaces (CDIs) -
Part 7: CompoNet
(IEC 62026-7:2010, modified)**

Appareillage à basse tension -
Interfaces appareil de commande-appareil
(CDI) -
Partie 7: CompoNet
(CEI 62026-7:2010, modifiée)

Niederspannungsschaltgeräte -
Steuerung-Geräte-Netzwerke (CDIs) -
Teil 7: CompoNet
(IEC 62026-7:2010, modifiziert)

This European Standard was approved by CENELEC on 2012-12-03. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

This document (EN 62026-7:2013) consists of the text of IEC 62026-7:2010 prepared by IEC/SC 17B "Low-voltage switchgear and controlgear" of IEC/TC 17 "Switchgear and controlgear", together with the common modifications prepared by CLC/TC 17B "Low-voltage switchgear and controlgear".

The following dates are fixed:

- latest date by which this document has to be implemented (dop) 2013-12-03
at national level by publication of an identical
national standard or by endorsement
- latest date by which the national standards conflicting (dow) 2015-12-03
with this document have to be withdrawn

Clauses, subclauses, notes, tables, figures and annexes which are additional to those in IEC 62026-7:2010 are prefixed "Z".

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For the relationship with EU Directive 2004/108/EC, see informative Annex ZZ, which is an integral part of this document.

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC).

Endorsement notice

The text of the International Standard IEC 62026-7:2010 was approved by CENELEC as a European Standard with agreed common modifications.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
CISPR 11 (mod)	2009	Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement	EN 55011	2009
IEC 60512-1	-	Connectors for electronic equipment - Tests and measurements - Part 1: General	EN 60512-1	2001
IEC 60529	-	Degrees of protection provided by enclosures (IP Code)	EN 60529 + corr. May + A1	1991 1993 2000
IEC 61000-4-2	-	Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test	EN 61000-4-2	2009
IEC 61000-4-3	-	Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test	EN 61000-4-3 + A1 + A2	2006 2008 2010
IEC 61000-4-4	-	Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test	EN 61000-4-4 + A1	2004 2010
IEC 61000-4-5	-	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test	EN 61000-4-5	2006
IEC 61000-4-6	-	Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields	EN 61000-4-6	2009
IEC 61076-2-101	-	Connectors for electronic equipment - Product requirements - Part 2-101: Circular connectors - Detail specification for M12 connectors with screw-locking	EN 61076-2-101	2008
IEC 61131-2	-	Programmable controllers - Part 2: Equipment requirements and tests	EN 61131-2	2007

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61158-5-2	2007	Industrial communication networks - Fieldbus specifications - Part 5-2: Application layer service definition - Type 2 elements	EN 61158-5-2 ¹⁾	2008
IEC 61158-6-2	2007	Industrial communication networks - Fieldbus specifications - Part 6-2: Application layer protocol specification - Type 2 elements	EN 61158-6-2 ²⁾	2008
IEC 61918	2010	Industrial communication networks - Installation of communication networks in industrial premises	-	-
IEC 62026-1	-	Low-voltage switchgear and controlgear - Controller-device interfaces (CDIs) - Part 1: General rules	EN 62026-1	2007
ISO/IEC 7498-1	-	Information technology - Open Systems Interconnection - Basic Reference Model: The Basic Model	EN ISO/IEC 7498-1	-

1) EN 61158-5-2 is superseded by EN 61158-5-2:2012, which is based on IEC 61158-5-2:2010.

2) EN 61158-6-2 is superseded by EN 61158-6-2:2012, which is based on IEC 61158-6-2:2010.

Annex ZZ (informative)

Coverage of Essential Requirements of EU Directives

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and within its scope the standard covers all relevant essential requirements as given in Article 1 of Annex I of Directive 2004/108/EC.

Compliance with this standard provides one means of conformity with the specified essential requirements of the Directive concerned.

WARNING: Other requirements and other EU Directives may be applicable to the products falling within the scope of this standard.

CONTENTS

INTRODUCTION	15
1 Scope	17
2 Normative references	17
3 Terms, definitions, symbols, abbreviated terms and conventions	18
3.1 Terms and definitions	18
3.2 Symbols and abbreviated terms	21
4 Classification	22
4.1 General	22
4.2 Network specifications	24
4.3 Components	24
4.4 CompoNet communication model	25
4.5 CompoNet and CIP	25
5 Characteristics	26
5.1 Communication cycle	26
5.1.1 General	26
5.1.2 Time domains	26
5.1.3 A typical communication cycle	27
5.2 Messaging protocol	27
5.2.1 Message frame format	27
5.2.2 Message frame types	29
5.2.3 Explicit messaging	52
5.2.4 Explicit messaging client/server timing requirement	62
5.3 CompoNet communication object classes	64
5.3.1 General	64
5.3.2 Identity object class definition (class ID code: 01 _{Hex})	64
5.3.3 Message router object class definition (class ID code: 02 _{Hex})	64
5.3.4 Connection object class definition (class ID code: 05 _{Hex})	64
5.3.5 CompoNet Link object class definition (class ID code: F7 _{Hex})	74
5.3.6 CompoNet Repeater object (class ID code: F8 _{Hex})	80
5.4 Network access state machine	82
5.4.1 General	82
5.4.2 Network access events	82
5.4.3 State transition diagram	84
5.4.4 Data rate auto-detection	85
5.4.5 Duplicate MAC ID detection	86
5.4.6 Repeater behaviour	87
5.5 I/O connection	88
5.6 TDMA	88
5.6.1 General	88
5.6.2 Data link timing features	89
5.6.3 Calculation of Time Domain	92
5.7 Physical layer	98
5.7.1 General	98
5.7.2 Physical signalling	98
5.7.3 Master port requirements	98

5.7.4	Slave port requirements	101
5.7.5	Receiving signal requirements for master and slave ports	104
5.7.6	Requirements for digital processing.	105
5.7.7	Recommended circuits and component parameters	108
5.7.8	Isolation.	113
5.7.9	Transmission medium	114
5.7.10	Topology.	115
5.7.11	Link power	121
5.7.12	Repeater implementation	124
6	Product information	125
7	Normal service, mounting and transport conditions.	125
7.1	Normal service conditions	125
7.1.1	General	125
7.1.2	Ambient air temperature	126
7.1.3	Altitude	126
7.1.4	Climatic conditions	126
7.2	Conditions during transport and storage	126
7.3	Mounting	126
8	Constructional and performance requirements.	126
8.1	Indicators and configuration switches	126
8.1.1	Status indicators	126
8.1.2	Switches	128
8.1.3	CompoNet marking	129
8.2	CompoNet cable	130
8.2.1	Overview	130
8.2.2	Cable profile template	131
8.2.3	Round cable I profile	132
8.2.4	Round cable II profile	134
8.2.5	Flat cable I profile	136
8.2.6	Flat cable II profile	139
8.3	Terminator	141
8.3.1	General	141
8.3.2	Terminating resistor	141
8.3.3	Terminating capacitor	141
8.4	Connectors	141
8.4.1	General	141
8.4.2	Template	141
8.4.3	Engaging specification for connector profiles: open, flat I, flat II	143
8.4.4	Specifications of hooks for connector profiles: open, flat I, flat II	145
8.4.5	Open connector profile	146
8.4.6	Profile of flat connector I	150
8.4.7	Profile of flat connector II	155
8.4.8	Profile of sealed M12 connector	158
8.5	Node power supply implementation	159
8.5.1	General	159
8.5.2	Requirement for node power supply connection	159
8.5.3	The requirements for nodes powered by network power supplies:	160
8.6	Miswiring protection	161
8.7	Electromagnetic compatibility (EMC)	161

8.7.1	General	161
8.7.2	Immunity	161
8.7.3	Emissions	162
9	Tests	162
9.1	General	162
9.2	Electrical testing	163
9.2.1	Slave port operation voltage test	163
9.2.2	Reverse connected power supply line	163
9.2.3	Momentary power interruption	164
9.2.4	Isolation	164
9.2.5	Input impedance	165
9.2.6	Output waveform	166
9.2.7	Minimum input waveform	166
9.2.8	Electromagnetic compatibility testing	167
9.3	Mechanical test	168
9.4	Logical test	168
9.4.1	General	168
9.4.2	Test of slaves and repeaters	168
9.4.3	Test of master	171
Annex A	(normative) CompoNet common services	174
Annex B	(normative) CompoNet error codes	175
Annex C	(normative) Connection path attribute definition	176
Annex D	(normative) Data type specification and encoding	177
Annex E	(normative) Communication objects library	181
Annex F	(normative) Value ranges	182
Annex G	(normative) CN default time domain	183
	Bibliography	187
	Figure 1 – Segment layer	23
	Figure 2 – CompoNet components	25
	Figure 3 – Time domains	26
	Figure 4 – A typical communication cycle	27
	Figure 5 – A general frame	27
	Figure 6 – Preamble of frames	28
	Figure 7 – Transmission direction	28
	Figure 8 – Transmission direction	29
	Figure 9 – OUT frame format	30
	Figure 10 – OUT command code	30
	Figure 11 – TRG frame format	32
	Figure 12 – TRG command code	32
	Figure 13 – CN frame format	32
	Figure 14 – CN command code	33
	Figure 15 – IN frame format	34
	Figure 16 – IN command code	35
	Figure 17 – A_EVENT frame format	35

Figure 18 – A_EVENT command code	36
Figure 19 – B_EVENT frame format	37
Figure 20 – B_EVENT command code meanings	38
Figure 21 – B_EVENT message format	39
Figure 22 – E_CMD block	39
Figure 23 – Group block	40
Figure 24 – Item block	40
Figure 25 – Status Read (STR Response) event data	43
Figure 26 – Configuration event data (STW Request)	45
Figure 27 – Poll data	46
Figure 28 – B_EVENT general decoding phase	47
Figure 29 – Flow chart for processing a matched STW request	49
Figure 30 – BEACON frame format	50
Figure 31 – BEACON command code	50
Figure 32 – Object diagram of A_Event message flow	52
Figure 33 – A_EVENT message format	52
Figure 34 – Compact message type request format (non-fragmented frame/first fragment frame)	53
Figure 35 – Expanded message type request format (non-fragmented frame/first fragment frame)	54
Figure 36 – Compact/Expanded message successful response format (unfragmented frame/ first fragment frame)	54
Figure 37 – Compact/Expanded message unsuccessful response format (unfragmented frame/first fragment frame)	55
Figure 38 – Compact/Expanded message request format for fragments	55
Figure 39 – Compact/Expanded message response format for fragments	55
Figure 40 – Service data format	56
Figure 41 – Predefined master/slave I/O connection state transition diagram	70
Figure 42 – Predefined master/slave I/O connection state transition diagram	72
Figure 43 – Connection flow	73
Figure 44 – Allocate request service data	78
Figure 45 – Allocate response service data	79
Figure 46 – Release request service data	79
Figure 47 – Reset service parameter	82
Figure 48 – State transition diagram	84
Figure 49 – Sub-state of non-participated state	85
Figure 50 – Sub-state of participated state	85
Figure 51 – Data rate detection diagram	86
Figure 52 – BEACON changed by repeaters	88
Figure 53 – Multicast I/O connections	88
Figure 54 – Master MAC and Phy. circuit diagram	89
Figure 55 – Slave MAC and Phy. circuit diagram	90
Figure 56 – Repeater MAC and Phy. circuit diagram	91
Figure 57 – Transmission process	92

Figure 58 – Transmission cycle model	93
Figure 59 – CnDefaultTimeDomain cycle model	95
Figure 60 – Master event communication model	96
Figure 61 – Slave event communication model	97
Figure 62 – Manchester encoding (inverted)	98
Figure 63 – Master port transmit mask	100
Figure 64 – Output waveform test circuit for master or slave port	101
Figure 65 – Slave port transmit mask	103
Figure 66 – Receive mask 1	104
Figure 67 – Receive mask 2	105
Figure 68 – Receive mask 3	105
Figure 69 – PHY/MAC interface diagram	106
Figure 70 – Digital receive mask 1	106
Figure 71 – Digital receive mask 2	107
Figure 72 – Digital receive mask 3	107
Figure 73 – Logical transmit mask	108
Figure 74 – Recommended circuit for a master port	109
Figure 75 – Recommended circuit for a slave port	110
Figure 76 – Transformer symbol	110
Figure 77 – Driver voltage measurement circuit	112
Figure 78 – Propagation delay test circuit	112
Figure 79 – An isolation example of a master port	113
Figure 80 – An isolation example of an I/O module with connectivity to other power sources	114
Figure 81 – An isolation example of a simple slave that requires connection to devices with ungrounded signal wiring	114
Figure 82 – An isolation example of a non-network powered slave	114
Figure 83 – Media topology	116
Figure 84 – Position of a terminator	117
Figure 85 – Number of devices per segment	117
Figure 86 – Cable length limitation Illustration	118
Figure 87 – Branch restriction	118
Figure 88 – Wiring selection	119
Figure 89 – General wiring method	120
Figure 90 – Flexible wiring method	121
Figure 91 – Power dispatching method	123
Figure 92 – Network segment powered by the master	123
Figure 93 – Connection with power supply	123
Figure 94 – Network segments powered by repeaters	124
Figure 95 – A simplified diagram for a repeater	125
Figure 96 – Outline of round cable II	136
Figure 97 – Outline of flat cable I	138
Figure 98 – Dimension of flat cable I	139
Figure 99 – Outline of flat cable II	140

Figure 100 – Dimension of flat cable II	141
Figure 101 – Engaging dimensions of plug connector	143
Figure 102 – Contact space for plug connector.	144
Figure 103 – Engaging dimensions of jack connector.	145
Figure 104 – Connector hook	146
Figure 105 – Open connector plug (informative)	148
Figure 106 – Open connector jack (informative).....	149
Figure 107 – Method to measure contact resistance (open connectors).....	150
Figure 108 – De-rating current for connectors.	150
Figure 109 – Flat connector I plug	153
Figure 110 – Flat connector I jack <u>(informative)</u>	154
Figure 111 – Method to measure contact resistance (flat I, II connectors).	155
Figure 112 – Flat connector II plug <u>(informative)</u>	157
Figure 113 – Flat connector II jack <u>(informative)</u>	157
Figure 114 – Marking connector for trunk lines	158
Figure 115 – M12 connector pinout	159
Figure 116 – Link power circuits	160
Figure 117 – Power-drop along a cable	160
Figure 118 – Power design for a node (informative).....	161
Figure 119 – Operating voltage test circuit	163
Figure 120 – Reverse connected power supply line	164
Figure 121 – Isolation	165
Figure 122 – Input impedance	165
Figure 123 – Output slave test circuit for slave port	166
Figure 124 – Minimum input waveform test circuit.	167
Figure 125 – Minimum input waveform test system	167
Figure 126 – Data link test for slave and repeater DUT.	169
Figure 127 – Test configuration for minimum traffic of master DUT	172
Figure 128 – Test configuration for proxy of master DUT	173
Figure D.1 – An example to generate CRC	180
Table 1 – Network specifications	24
Table 2 – OSI reference model and CompoNet	26
Table 3 – Command codes.	28
Table 4 – Command restrictions for slave MAC	29
Table 5 – Block name description	30
Table 6 – CN target	30
Table 7 – I/O refresh.....	31
Table 8 – Block name description	32
Table 9 – Block name description	33
Table 10 – Duplication checking function status.....	33
Table 11 – A_EVENT sending request.....	33
Table 12 – Status of CN frames	34

Table 13 – Warning bit of CN frames	34
Table 14 – Alarm bit of CN frames	34
Table 15 – Block name description	34
Table 16 – Encoded length	35
Table 17 – Block name description	36
Table 18 – Acknowledgement bit of A_EVENT	36
Table 19 – Command type of A_EVENT	36
Table 20 – Block name description	37
Table 21 – Acknowledgement bit of B_EVENT	38
Table 22 – Command type of B_EVENT	38
Table 23 – E_CMD block meanings	39
Table 24 – Group block meanings	40
Table 25 – Item block meanings	40
Table 26 – Processing rules for a STR request	48
Table 27 – Processing rules for an A_EVENT poll request	48
Table 28 – Processing rules for a STW request	48
Table 29 – STW request commands	50
Table 30 – Block name description	50
Table 31 – Control code of BEACON frames	51
Table 32 – Speed Code of BEACON frames	51
Table 33 – Control code format	56
Table 34 – A Data encoding example	58
Table 35 – Fragment type values	59
Table 36 – Fragmented transmission	60
Table 37 – Fragmented reception	61
Table 38 – Explicit message timeout values	63
Table 39 – Maximum value of expected packet rate	65
Table 40 – CompoNet connection object attribute access rules	65
Table 41 – CompoNet Link object specific additional error codes	68
Table 42 – Connection instance ID for predefined master/slave connections	69
Table 43 – Default multicast poll connection object attribute values	69
Table 44 – Predefined master/slave I/O connection state event matrix	70
Table 45 – CompoNet Link class attributes	74
Table 46 – CompoNet Link class services	74
Table 47 – CompoNet Link instance attributes	74
Table 48 – MAC ID range	75
Table 49 – Data rate	76
Table 50 – Allocation choice	76
Table 51 – Data rate switch value	76
Table 52 – Bit definitions for node state octet	77
Table 53 – Bit definitions for node network state	77
Table 54 – CompoNet Link object common services	77
Table 55 – CompoNet Link Object class specific services	78

Table 56 – Allocation choice octet contents	78
Table 57 – EPR value	79
Table 58 – Explicit message timer	79
Table 59 – Release master/slave connection set request parameters	79
Table 60 – Release choice octet contents	80
Table 61 – Repeater class attribute	80
Table 62 – Repeater class services	80
Table 63 – Instance attributes of repeater class	81
Table 64 – Repeater common service	82
Table 65 – Reset attributes	82
Table 66 – Data rate and network watchdog time periods	83
Table 67 – Description of the state machine	84
Table 68 – Duplicate MAC ID detection mechanism	87
Table 69 – Repeating directions of frames	87
Table 70 – Master timing features	89
Table 71 – Slave timing features	90
Table 72 – Repeater timing features	91
Table 73 – Cable propagation delay	91
Table 74 – Maximum cable length	92
Table 75 – Parameters in TimeDomain calculation	92
Table 76 – Frame marks	93
Table 77 – TimeDomain settings for nodes at first segment layer	94
Table 78 – TimeDomain settings for nodes at 2 nd and 3 rd segment layers	94
Table 79 – Repeater delay for CnDefaultTimeDomain calculation	95
Table 80 – Parameters for CnDefaultTimeDomain calculation	95
Table 81 – First segment layer settings	96
Table 82 – Settings for 2 nd and 3 rd segment layers	96
Table 83 – Parameters for Event Time Domain calculations	97
Table 84 – CompoNet Manchester encoding	98
Table 85 – Allowable connectors for the master port	98
Table 86 – Master port impedance during receive	99
Table 87 – Master port impedance during transmit	99
Table 88 – Master port transmit specifications for data rate of 4 Mbit/s; 3 Mbit/s and 1,5 Mbit/s	100
Table 89 – Master port transmit specifications for data rate of 93,75 kbit/s	100
Table 90 – Allowable connectors for permanently attached cables	101
Table 91 – Allowable connectors for the slave port	101
Table 92 – Slave port impedance during receive	102
Table 93 – Slave port impedance during transmit	102
Table 94 – Slave port transmit specifications for data rate of 4 Mbit/s; 3 Mbit/s and 1,5 Mbit/s	103
Table 95 – Slave port transmit specifications for data rate of 93,75 kbit/s	103
Table 96 – Specifications for digital receive mask 1	106
Table 97 – Specifications for digital receive mask 2	107

Table 98 – Specifications for digital receive mask 3	107
Table 99 – Specifications for logical transmit.	108
Table 100 – Specification for pulse transformer	111
Table 101 – Specifications for transformer core	111
Table 102 – Specifications for transceiver	112
Table 103 – Sending.	113
Table 104 – Receiving	113
Table 105 – Cable types	115
Table 106 – Cable conductor colours	115
Table 107 – CompoNet round cable I: network limitations	117
Table 108 – CompoNet 4-conductor cables: network limitations	118
Table 109 – Resistance characteristics	121
Table 110 – Network power supply specifications	121
Table 111 – Local power supply specifications	122
Table 112 – Node external power supply specifications	122
Table 113 – Module status indicator.	127
Table 114 – CDI status indicator	127
Table 115 – Data rate switch encoding	128
Table 116 – Addresses switches	128
Table 117 – Indicator marking	129
Table 118 – Node address switch and device type marking.	129
Table 119 – Connector marking.	130
Table 120 – Cable profile: data pair specification.	131
Table 121 – Cable profile: d.c. power pair specification	131
Table 122 – Cable profile: general specification	132
Table 123 – Round cable I: data pair specification	133
Table 124 – Round cable I: d.c. power pair specification	133
Table 125 – Round cable I: general specification	134
Table 126 – Round cable II: data pair specification	135
Table 127 – Round cable II: d.c. power pair specification	135
Table 128 – Round cable II: general specification	136
Table 129 – Flat cable I: data pair specification	137
Table 130 – Flat cable I: d.c. power pair specification	137
Table 131 – Flat cable I: general specification	138
Table 132 – Flat cable II: data pair specification	139
Table 133 – Flat cable II: d.c. power pair specification	140
Table 134 – Flat cable II: general specification	140
Table 135 – Connector profile template	142
Table 136 – Specification of open connector	147
Table 137 – Specification of flat connector I	151
Table 138 – Specification of flat connector II	155
Table 139 – Specification of sealed M12 connector	158
Table 140 – Input impedance for master.	166

Table 141 – Input impedance for slave	166
Table B.1 – Newly defined CompoNet error codes	175
Table F.1 – MAC ID and node address ranges.	182
Table G.1 – CN default time domain table for 4 Mbit/s data rate.	183
Table G.2 – CN default time domain table for 3 Mbit/s data rate.	184
Table G.3 – CN default time domain table for 1,5 Mbit/s data rate.	185
Table G.4 – CN default time domain table for 93,75 kbit/s data rate	186

INTRODUCTION

CompoNet™ is intended for use in, but is not limited to, industrial automation applications. These applications may include devices such as limit switches, proximity sensors, electro-pneumatic valves, relays, motor starters, operator interface panels, analogue inputs, analogue outputs and controllers.

Patent declaration

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of the following patents owned by OMRON Corporation:

JP Patent Number 4023342	DUPLICATE MAC. ADDRESS DETECTING METHOD, SLAVE AND MASTER IN FIELD BUS SYSTEM, AND FIELD BUS
JP Patent Number 4107110	FIELD BUS SYSTEM, CONNECTION CONFIRMING METHOD AND MASTER
JP Patent Number 3293089	REMOTE I/O SYSTEM FOR PLC AND EXECUTION METHOD THEREOF
JP Patent Number 3925660 and its counterpart patents in other countries	STARTING CONTROL METHOD OF COMMUNICATION MASTER
JP Patent Number 4006605 and its counterpart patents in other countries	COMMUNICATION SYSTEM REDUCED IN INFLUENCE OF REPEATER DELAY
JP Application Number 2004-059864	COMMUNICATION DEVICE AND NETWORK SYSTEM
JP Application Number 2004-022243	CONNECTOR FOR CONNECTION CABLE
JP Application Number 2007-167281	COMMUNICATION SYSTEM REDUCED IN INFLUENCE OF REPEATER DELAY
JP Application Number 2005-252414	NETWORK REPEATING WITH FILTERING FUNCTION
JP Application Number 2005-252758	A EVENT COMMUNICATION METHOD FOR PROGRAMABLE CONTROLLER SYSTEMS
JP Application Number 2005-203496	GETTING NETWORK CONFIGURATION INFORMATION IN PLC SYSTEMS
JP Application Number 2002-334265	A I/O MAPPING METHOD FOR NETWORK SYSTEMS AND CONTROLLERS
JP Application Number 2005-252682	A SCHEDULING METHOD FOR EVENT COMMUNICATIONS
JP Application Number 2005-105543 and its counterpart patents in other countries	RECEIVED DATA COMPENSATION DEVICE

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LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR – CONTROLLER-DEVICE INTERFACES (CDIs) –

Part 7: CompoNet

1 Scope

This part of IEC 62026 specifies an interface system providing bit-level and word-level communication between a controller and control circuit devices such as sensors, actuators, and switching elements. The interface system uses cabling with round or flat profiles containing a two conductor signalling pair and optionally a two conductor power supply pair. This part establishes requirements for the interchangeability of components with such interfaces.

This part of IEC 62026 specifies the following particular requirements for CompoNet™ 1):

- requirements for interfaces between a controller and control circuit devices;
- normal service conditions for devices;
- constructional and performance requirements;
- tests to verify conformance to requirements.

These particular requirements apply in addition to the general requirements of IEC 62026-1.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60512-1, *Connectors for electronic equipment – Tests and measurements – Part 1: General*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

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IEC 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61076-2-101, *Connectors for electronic equipment – Product requirements – Part 2-101: Circular connectors – Detail specification for M12 connectors with screw-locking*

IEC 61131-2, *Programmable controllers – Part 2: Equipment requirements and tests*

IEC 61158-5-2:2007, *Industrial communication networks – Fieldbus specifications – Part 5-2: Application layer service definition – Type 2 elements*

IEC 61158-6-2:2007, *Industrial communication networks – Fieldbus specifications – Part 6-2: Application layer protocol specification – Type 2 elements*

IEC 61918:2010, *Industrial communication networks – Installation of communication networks in industrial premises*

IEC 62026-1, *Low-voltage switchgear and controlgear – Controller-device interfaces (CDIs) – Part 1: General rules*

CISPR 11:2009, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*

ISO/IEC 7498-1, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1

BEACON

frame generated by the master to notify slaves and repeaters of the present transmission speed and network connection information

3.1.2

bit slave

I/O device working with data lengths not more than 4 bits

3.1.3

branch

a piece of cable making a T connection to a trunk or sub-trunk

3.1.4

CDI status indicator

visual indication reporting the status of the communication link at a CompoNet device

3.1.5

circuit speed

baud rate

communication rate in signalling symbols or marks/s on the transmission medium

NOTE Each CompoNet bit is Manchester encoded using two marks so a circuit speed of 6 Mmarks/s gives a transmission speed or data rate of 3 Mbits/s.

3.1.6

explicit message

command requesting the performance of a particular task and return of the results of the task performance to the requesting entity

[IEC 62026-3, 3.1.22, modified]

3.1.7

IN slave

addressable I/O device with only an input function, able to produce data for input to the master without consuming data

3.1.8

mark

signal symbol used in Manchester encoding technology and transmitted on the bus

NOTE Each data bit is encoded using 2 marks such that data 1 encodes to “01”, and data 0 encodes to “10”.

3.1.9

master

device that controls communication

NOTE There is only one master in a CompoNet network.

3.1.10

master port

port on a master or a repeater with built-in terminators

NOTE There is only one master port in a trunk or sub-trunk.

3.1.11

MIX slave

addressable I/O device with both an input and an output function, able to consume output data from the master and produce data for input to the master

NOTE The produced and consumed data sizes may be different.

3.1.12

MS LED indicator

module status indicator

visual indication reporting the power and operational state of a CompoNet device

3.1.13

node

device with a unique MAC ID

3.1.14

OUT slave

addressable I/O device with only an output function, able to consume output data from the master without producing data for input to the master

3.1.15

repeater

addressable device used for network expansion and communication signal modification

NOTE Repeaters can communicate with a master and execute functions such as message filtering to improve network communication efficiency, they are not passive devices.

3.1.16**segment**

a collection of nodes and connecting physical media on a trunk or sub-trunk bounded by a master port and a terminator

3.1.17**slave**

addressable device with actual I/O data

NOTE The maximum number of slaves in a CompoNet network is 384.

3.1.18**slave port**

ports on a slave device or a repeater with no built-in terminators

3.1.19**STRNP**

STR command targeted at a non-participated node

3.1.20**STRP**

STR command targeted at a participated node

3.1.21**STWNP**

STW command targeted at a non-participated node

3.1.22**STWNP_Reset**

STWNP command with the parameter "ResetRequest = 1"

3.1.23**STWNP_Run**

STWNP command with the parameter "Running=1"

3.1.24**STWP**

STW command targeted at a participated node

3.1.25**STWP_Reset**

STWP command with the parameter "ResetRequest = 1"

3.1.26**STWP_Standby_Lock**

STWP command with the parameter "Running=0, UnRegistrant=1"

3.1.27**STWP_Standby_Offline**

STWP command with the parameter "Running=0, UnRegistrant=0"

3.1.28**sub-branch**

branch off another branch

3.1.29

sub-trunk

shortest communication line from the master port of a repeater to a terminator without going through another master port

NOTE 1 Sub-trunk refers to cabling connected to the master port of a repeater, it is a trunk line that is downstream of a repeater.

NOTE 2 A trunk or sub-trunk may be extended by daisy-chaining of connectors at a device

3.1.30

T-branch

a portion of cable connected to a trunk or sub-trunk by a T-connector

NOTE A T-branch may be extended by daisy-chaining of connectors at a device.

3.1.31

terminating capacitor

capacitor in a terminator

3.1.32

terminating resistor

resistor in a terminator

3.1.33

terminator

entity used to terminate a transmission line in its characteristic impedance to prevent reflections

NOTE 1 In some instances, the terminator may be embedded in an end device or in a connector.

[IEC 61918, 3.1.65]

NOTE 2 For the purpose of this standard, a terminator consists of a terminating resistor and a terminating capacitor.

3.1.34

transmission speed data rate

communication rate in data bits/s on the transmission medium

NOTE Each CompoNet data bit is Manchester encoded using two marks, so the transmission speed in bits/s is half the circuit speed in marks/s.

3.1.35

trunk

shortest communication line from a master to a terminator on the same segment

NOTE A trunk or sub-trunk may be extended by daisy-chaining of connectors at a device.

3.1.36

word slave

I/O device working with data in 16 bit word(s)

3.2 Symbols and abbreviated terms

A_EVENT	Application <u>EVENT</u> communication
B_EVENT	Base memory <u>EVENT</u> communication
BEACON	notification frame generated by the master
CDI	controller device interface
CRC	cyclic redundancy check

CN	<u>C</u> on <u>N</u> ection status
EPR	expected package rate
EUT	equipment under test
IN	input data
LED	light emitting diode
LSB	least significant bit
MAC	media access controller
OUT	<u>O</u> U <u>T</u> put data
PHY	physical layer
PWB	printed wiring board
RMS	root mean square
SID	security identifier
SEM	state event matrix
STR	status read of B_Event frame
STW	status write of B_Event frame
TRG	<u>T</u> R <u>I</u> g <u>g</u> er
UCMM	unconnected message manager

4 Classification

4.1 General

CompoNet is a low-level network that provides high-speed communication between higher-level devices such as controllers and simple industrial devices such as sensors and actuators.

CompoNet connects controllers with sensors and actuators. The controller acts as the master while the sensors and actuators act as the slaves. Two types of slaves are provided. One is a Bit slave with up to 4-point data, and the other is a Word slave with 16-point data. Repeaters extend the communication length.

CompoNet usually consists of several segments each separated by a repeater. Each segment is connected on the network, but is classified from the viewpoint of the physical layer. As shown in Figure 1, the segment that has the master is called the first segment layer. Second and third segment layers can be added using repeaters, but no more than 2 such extra segments can be added. Thus master to slave separation is never more than 2-repeaters or 3-segments. A total of 64 repeaters can be used in one network. All segments shall operate at the same transmission speed.

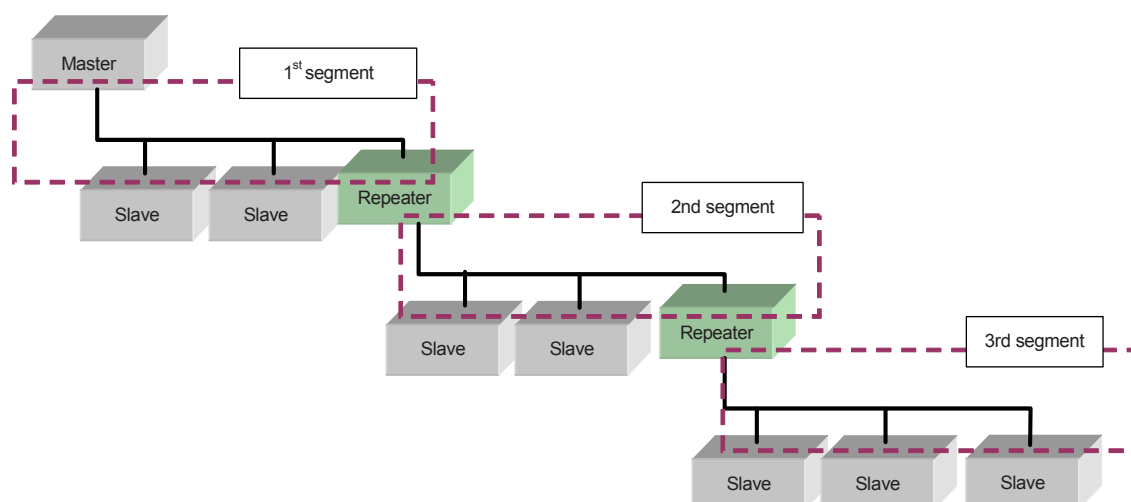


Figure 1 – Segment layer

The master or repeaters shall be connected at the end of segments.

A total of 384 slaves are connectable, i.e. 256 Bit slaves and 128 Word slaves. Within the restrictions set by the physical layer, however, a segment can have up to 32 slave or repeater nodes in total.

Four types of network cables are supported:

- round cable I, a 2-conductor unshielded round cable;
- round cable II, a 4-conductor unshielded round cable;
- flat cable I, a 4 conductor flat cable;
- flat cable II, a 4 conductor flat cable with additional covering.

While 2-conductor cables transmit only communication signals, 4-conductor cables transmit both communication signals and power.

Transmission speed is selectable among 4 Mbit/s; 3 Mbit/s; 1,5 Mbit/s and 93,75 kbit/s. The speed decides the maximum length of a trunk line. It is 30 m at 4 Mbit/s and 3 Mbit/s, 100 m at 1,5 Mbit/s, and 500 m at 93,75 kbit/s. Branching is supported in all speeds except for 4 Mbit/s.

CompoNet uses Manchester encoding technology to achieve higher reliability. For insulation, the physical layer circuits use pulse transformers and differential communication transceivers. The physical layer has master ports and slave ports. A master port has a built-in terminator, and is used by a master and a repeater. Slave ports have no terminators, and are used by slaves and repeaters.

CompoNet supports I/O data communication as well as explicit message communication. The master controls all communication in accordance with configuration settings. The master divides the communication cycle into multiple time domains, and allocates some to I/O communication and others to explicit message communication. Thus efficient communication is realized. For I/O communication, a time domain is allocated in every cycle interval, so that punctuality and time synchronisation is ensured. For explicit message communication, the time domain allocation varies with network load. Therefore, punctuality is not ensured.

4.2 Network specifications

Network specifications are shown in Table 1.

Table 1 – Network specifications

Item	Specification
Topology	Multi-drop and T-branch methods using passive cable components
Transmission speed	4 Mbit/s, 3 Mbit/s, 1,5 Mbit/s, 93,75 kbit/s
Transmission distance	Shall be described separately
Communication cycle	Shall be described separately
Communication media	CompoNet round cables CompoNet flat cables
Connectable master	CompoNet Master. Only one master is allowed in a CompoNet network
Connectable repeater	CompoNet Repeater
Connectable slave	CompoNet Word slaves CompoNet Bit slaves
Maximum number of repeaters in a network	64
Maximum number of nodes in a segment	A maximum of 32 nodes connected to the segment master port
Maximum number of I/O nodes in networks with repeaters	Maximum of 64 IN and 64 OUT word slaves, total 128 Maximum of 128 IN and 128 OUT bit slaves, total 256 Additional rules apply to networks using MIX slaves
Maximum number of I/O nodes in networks without repeaters	32
Available node address	
Word	IN 0 to 63
Word	OUT 0 to 63
Bit	IN 0 to 127
Bit	OUT 0 to 127
Repeater	0 to 63
Number of occupied points per I/O node address	16 points per word-slave address 2 points per bit-slave address
Repeater availability	Maximum 64 repeaters in a network
Maximum segment layers	3
Automatic data rate function	Supported by the MAC

4.3 Components

CompoNet network consists of the following components used to form a network as shown in Figure 2:

- **CompoNet master:** a device that controls communication. There is only one master in a CompoNet network;
- **CompoNet slave:** a device that produces and consumes actual I/O data. There are two types of slaves, Word slaves and Bit slaves. Word slaves deal with 8 bit data words. Bit slaves deal with 2 or 4 bit data units to improve communication efficiency of simple devices;

- **CompoNet repeater:** a device that provides network expansion and communication signal modification. Each repeater has a node address. It can communicate with a master and execute some intelligence functions to improve network communication efficiency. They are not passive devices;
- **CompoNet power supply:** a device providing 24 V d.c.. On 4-conductor segments, power shall be supplied at the master port. On 2-conductor segments, an individual power supply shall be used at each slave;
- **CompoNet terminator:** a passive device to improve communication performance. A terminator shall be mounted on the farthest end of the trunk line from the master port of a master or a repeater. All terminators include a resistance connected between the signal lines and a 4 cable terminator also includes a capacitor connected between the power lines.

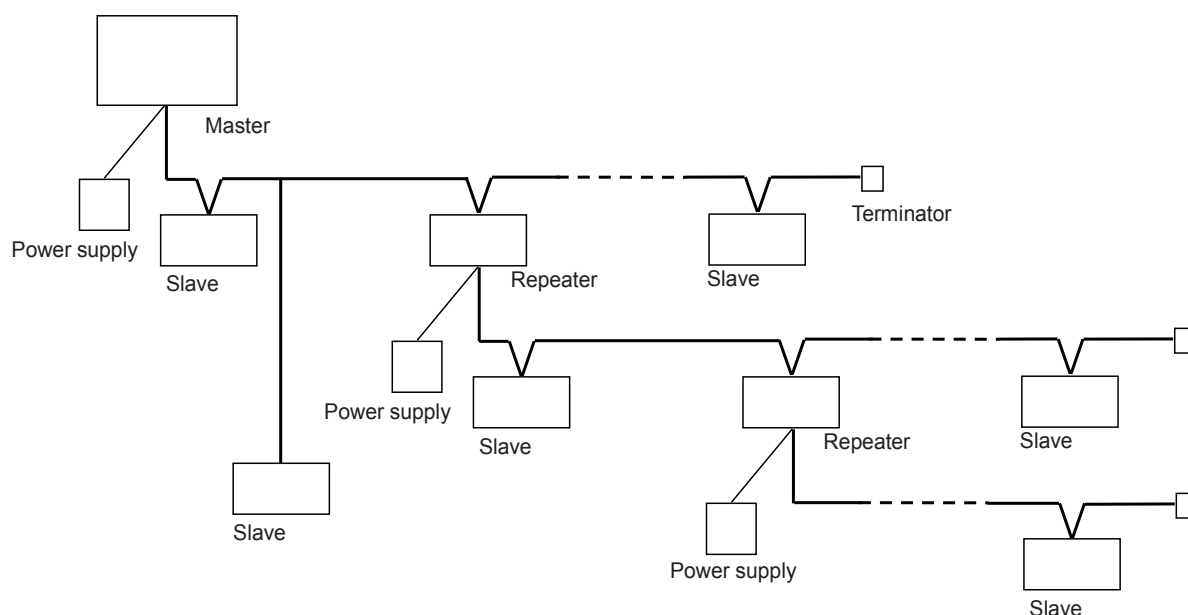


Figure 2 – CompoNet components

4.4 CompoNet communication model

The abstract object-oriented communication model of a node includes the following:

- **Unconnected message manager (UCMM):** processes unconnected explicit messages;
- **Identity object:** identifies and provides general information about the device;
- **Connection class:** allocates and manages internal resources associated with both I/O and explicit messaging connections;
- **Connection object:** manages the communication specific aspects associated with a particular application-to-application relationship;
- **CompoNet link object:** provides the configuration and status of a physical CompoNet CDI;
- **Message router:** forwards explicit request messages to the appropriate object;
- **Application objects:** implement the intended purpose of the product.

4.5 CompoNet and CIP

CompoNet upper layers use a subset of the Common Industrial Protocol (CIP™) and services specified in IEC 61158-5-2 and IEC 61158-6-2.

The relationships between CompoNet, CIP and the OSI reference model (ISO/IEC 7498-1) are shown in Table 2.

Table 2 – OSI reference model and CompoNet

ISO OSI	CompoNet
7	CIP
6	null
5	null
4	null
3	null
2	CompoNet time domain
1	CompoNet physical layer
0	cable and connector

5 Characteristics

5.1 Communication cycle

5.1.1 General

In a CompoNet network, the master controls bus communications according to its configuration. A master divides a communication cycle into several time domains or time slots.

5.1.2 Time domains

CompoNet conducts arbitration under strict time supervision managed by the master. The communication cycle is partitioned into time domains as shown in Figure 3. Each node obtains the right to send data to the network within a specified time period after the completion of the OUT time domain.

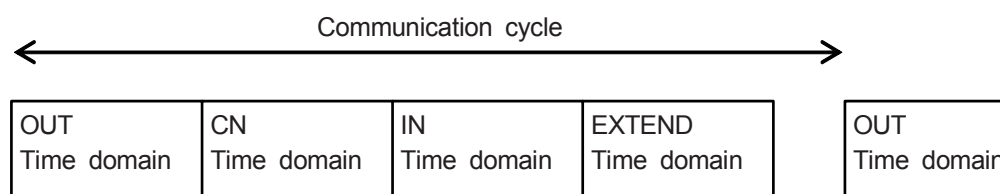


Figure 3 – Time domains

The first domain of each communication cycle is the OUT time domain. Subsequent domains are CN time domain, IN time domain, and EXTEND time domain.

- **OUT Time Domain:** the master sends an OUT frame or a TRG frame in this period.
- **CN Time Domain:** CN frames are sent in this period. The number of CN frames is set by the master.
- **IN Time Domain:** IN frames are sent in this period consecutively by all input type devices.
- **EXTEND Time Domain:** the master executes message communications in this period. Event frames, i.e. A_EVENT frames and B_EVENT frames, can be sent in this period. BEACON frames shall be sent periodically. The master can send a BEACON before every OUT time domain starts, or in an idle EXTEND time domain.

5.1.3 A typical communication cycle

The master sends an OUT frame first. Completion of the OUT frame triggers slaves and repeaters to start their timers. The slaves or repeaters addressed by the "CN Request MAC ID Mask" field in the OUT frame transmit their CN frames consecutively. This is followed by the IN frames from any IN devices in the Participated state, except for EventOnly substate, at a pre-defined time sequence (see Figure 4). Then, an event command frame and a possible immediate acknowledge frame may be transmitted on the bus, depending on the master scheduling. The master, slaves and repeaters can send an event command frame, and the node designated in the event command frame Destination MAC ID field sends an event acknowledge frame, if it is required.

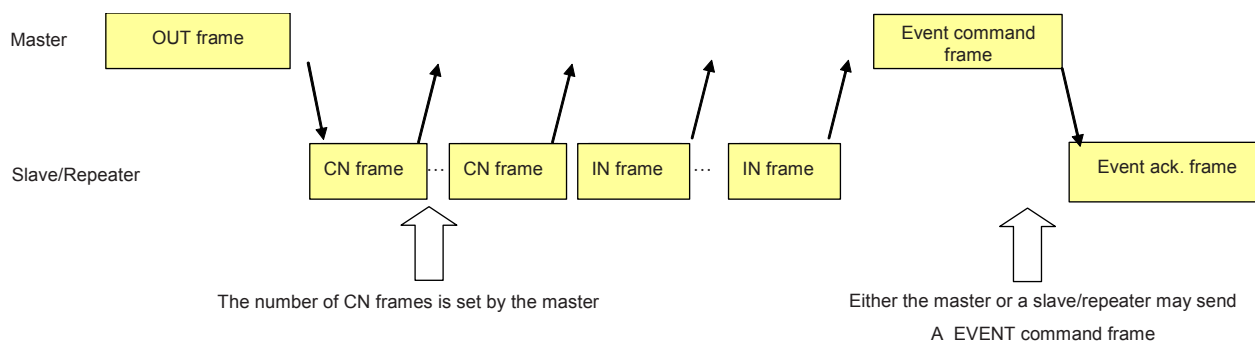


Figure 4 – A typical communication cycle

5.2 Messaging protocol

5.2.1 Message frame format

5.2.1.1 General

A typical message frame is composed of Preamble, Command Code, Command-Code-dependent block(s), and CRC, as shown in Figure 5.

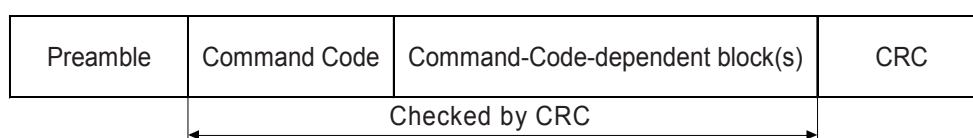


Figure 5 – A general frame

There are seven types of frames:

OUT	stands for <u>OUT</u> put data.
TRG	stands for <u>TRiG</u> ger.
CN	stands for <u>Con</u> Nection status.
IN	stands for Input data.
A_EVENT	stands for <u>A</u> pplication <u>E</u> VENT communication.
B_EVENT	stands for <u>B</u> ase memory <u>E</u> VENT communication.
BEACON	notification frame generated by the master.

Command Code definitions are presented in Table 3.

Table 3 – Command codes

Command code							Meaning
B0	B1	B2	B3	B4	B5	B6	
0	0	0	1	x	x	x	OUT
0	0	1	1	x	x	x	TRG
0	1	x	x				CN
1	0						IN
1	1	1	x	x	x		A_EVENT
1	1	0	x	x	x		B_EVENT
0	0	0	0	1			BEACON

All frames use the same Preamble.

Two types of CRC generator polynomials, CRC8 (8-bit) and CRC16 (16-bit), are used.

5.2.1.2 Preamble

The preamble part of a frame consists of 10 marks: 0011 1001 10. See Figure 6.

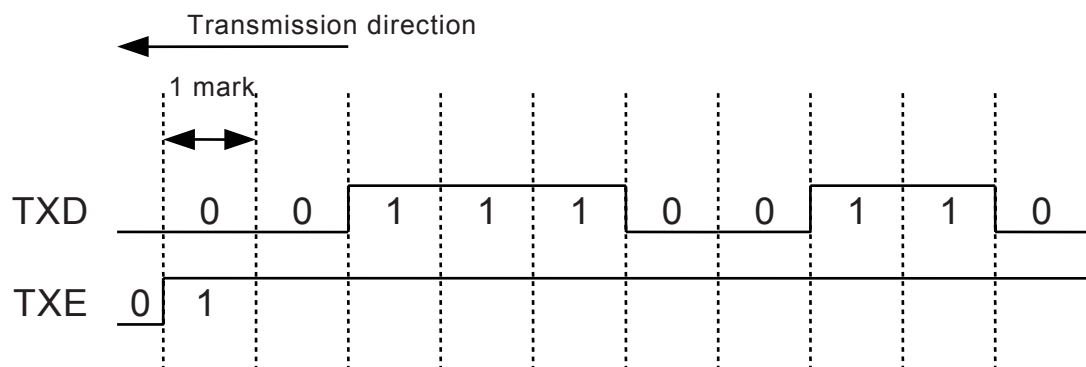


Figure 6 – Preamble of frames

5.2.1.3 CRC generator polynomials

2 types of CRC generator polynomials are used. See Figure 7 and Figure 8.

CRC8 employs the generator polynomial of $X^8 + X^7 + X^4 + X^3 + X + 1$

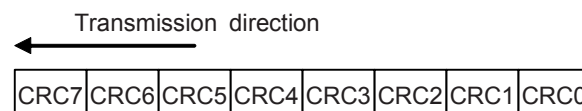


Figure 7 – Transmission direction

CRC16 uses CRC-CCITT, the generator polynomial is $X^{16} + X^{12} + X^5 + 1$.

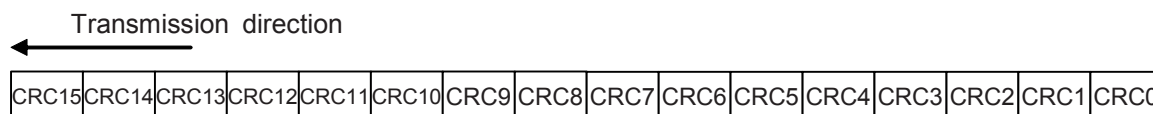


Figure 8 – Transmission direction

5.2.1.4 Transmission directions of command code and command-dependent block

The transmission directions are LSB first as described below:

- the transmission direction for the Command Code is LSB first, i.e. starts from B0;
- the transmission direction for MAC ID is LSB first;
- the transmission direction for the Length is LSB first;
- the transmission direction for the output data is LSB first. In other words, it starts from Word0_bit0 to Word0_bit15 and then the same for the following words;
- the transmission direction for A_EVENT data is LSB first. In other words, it starts from Word0_bit0 to Word0_bit15 and then the same for the following words;
- the transmission direction for B_EVENT data is LSB first. In other words, it starts from Word0_bit0 to Word0_bit15 and then the same for the following words.

5.2.1.5 Command restrictions for slave MAC

The following Table 4 provides a summary of network events and states in which the events are processed.

Table 4 – Command restrictions for slave MAC

MAC Function	Event	State				
		INIT	Offline or locked	Online	CommFault	EventOnly
Receive	OUT/TRG	No	Yes	Yes	Yes	Yes
	CN	No	No	No	No	No
	A_EVENT	No	No	Yes	No	Yes
	B_EVENT	No	Yes	Yes	No	Yes
	Poll (B_EVENT)	No	No	Yes	No	Yes
	IN	No	No	No	No	No
	BEACON	Yes	Yes	Yes	Yes	Yes
	CRC_OK_frame	Yes	Yes	Yes	No	Yes
Send	CN_frame	No	Yes	Yes	Yes	Yes
	IN_frame	No	No	Yes	No	No
	A_EVENT	No	No	Yes	No	Yes

The CRC_OK_frame event indicates that a frame with correct CRC has been received. The event is defined for use during Data Rate detection.

5.2.2 Message frame types

5.2.2.1 OUT frame

5.2.2.1.1 General

An OUT frame is a multicast message generated only by the master and sent to all slaves and repeaters on the network. OUT frames are used for the following purposes:

- OUT data is delivered from the master to all OUT slaves in one broadcast message;
- the addresses of nodes requested to send CN frames in the subsequent CN time domain are designated by this frame;
- after detecting the completion of an OUT frame, IN slaves latch their input data;
- slaves and repeaters start their internal timers when the completion of an OUT frame is detected. These internal timers are used to correctly participate in subsequent time domains in the communication cycle;
- upon detection of an OUT frame, each OUT slave consumes its output data from a preset position within the frame.

Figure 9 and Table 5 present the format and block description of OUT frame.

Preamble	Command code	CN Request MAC ID Mask	Length	OUT data	CRC16
5 bits	7 bits	9 bits	7 bits	0 bits to 1 280 bits	16 bits

Figure 9 – OUT frame format

Table 5 – Block name description

Block name	Bit count (bits)	Feature description
Command Code	7	Identifies this frame as an OUT frame.
CN Request MAC ID Mask	9	Used by slaves or repeaters to determine the MAC ID of the nodes requested to respond with a CN frame during the CN time domain.
Length	7	OUT data length (in words), Indicates 0 words to 80 words.
OUT data (OUT block N°0 to 79)	0 to 1 280	Indicates OUT data from the master to slaves. Indicates 0 points to 1 280 points (in 16 points).

5.2.2.1.2 Command code

Figure 10 presents the command code definition.

B0	B1	B2	B3	B4	B5	B6
0	0	0	1	I/O Refresh	CN Target	

Figure 10 – OUT command code

CN Target: The master uses these parameters as shown in Table 6 to select which nodes are to reply with a CN frame.

Table 6 – CN target

CN Target		
B5	B6	Description
1	0	Nodes in the participated state
0	1	Nodes in the non-participated state
1	1	Nodes in the Communication Fault state
0	0	Prohibits from sending CN_frame

I/O Refresh: If the I/O refresh bit (see Table 7) is clear (0), no IN frames are sent to the master from slaves. The output data in the OUT frame are not to be consumed by slaves.

Table 7 – I/O refresh

I/O Refresh	
B4	Description
0	Disable I/O refreshing
1	Enable I/O refreshing

5.2.2.1.3 CN request MAC ID mask

Nodes with the same upper bits of the CN Request MAC ID Mask send CN frames in ascending order of their lower bits.

For example, if the CnFrameAddressMask value in the STW is 4 (16 CN frames per CN time domain) and this value is 48, nodes whose MAC ID range 48 to 63 respond with CN frames.

5.2.2.1.4 Length

This is the output data length ranged from 0 to 80 in words.

5.2.2.1.5 Output data

Output data is sent for consuming slaves. It is always sent in multiples of words.

For word slaves, the “OutBlockPointer[6:0]” set by STW from the master decides where the output data is located in the frame. For example, value 3 of “OutBlockPointer[6:0]” means the slave output data is from word position 3 of “Output Data” in OUT frames. The number of words of output data that the slave consumes is reported in the “OutIoModeStatus” parameter of the STR.

For bit slaves, a combination of the “OutBlockPointer[6:0]” set by STW from the master and its address determines the location of device’s data in the output data. One word of output data corresponds to a group of eight, bit-slave node addresses (2 bits for each address). The lower 3 bits of the node address correspond to the output data position in the word. For example, if the address of three LSB is “001”, bit 2 in the word pointed by “OutBlockPointer[6:0]” is the starting address of the device’s data.

The application can only apply output data received from OUT frames after the slave has been allocated by the master.

5.2.2.2 TRG frame

5.2.2.2.1 General

A TRG frame functions in a similar manner as an OUT frame except that it does not deliver any output data. It can be generated only by the master. It has following purpose and meaning:

- it designates the addresses of the nodes that are to send CN frames;
- after the completion of a TRG frame is detected, IN slaves latch their input data;
- after the completion of a TRG frame is detected, the indicated slaves and repeaters start their internal timers. The expected CN frames and IN frames are sent successively.

Figure 11 and Table 8 present the format and block description of TRG frame.

Preamble	Command code	CN request MAC ID mask	CRC8
5 bits	7 bits	9 bits	8 bits

Figure 11 – TRG frame format

Table 8 – Block name description

Block name	Bit count (bits)	Feature
Command	7	Identifies this frame as a TRG frame.
CN Request MAC ID Mask	9	Used by slaves or repeaters to determine the MAC ID of the nodes requested to respond with a CN frame during the CN time domain.

5.2.2.2.2 Command code

Figure 12 presents the command code definition.

B0	B1	B2	B3	B4	B5	B6
0	0	1	1	I/O Refresh	CN Target	

Figure 12 – TRG command code

CN Target: See 5.2.2.1.2

I/O Refresh: See 5.2.2.1.2

5.2.2.2.3 CN request MAC ID mask

See 5.2.2.1.3

5.2.2.3 CN frame

5.2.2.3.1 General

A CN frame is used by slaves and repeaters to notify the master of their status. The “CN Request MAC ID Mask” in an OUT frame or TRG frame designates a group of nodes that are to report their status. The number of CN frames sent is specified by the master during configuration.

Additionally, slaves can use a CN frame to notify the master of a request to send an event. CN frames can be transmitted only by slaves and repeaters.

Figure 13 and Table 9 present the format and block description of CN frame.

Preamble	Command code	Source MAC ID	Status	CRC8
5 bits	4 bits	9 bits	4 bits	8 bits

Figure 13 – CN frame format

Table 9 – Block name description

Block name	Bit Count (bits)	Feature
Command Code	4	Identifies this frame as a CN frame
Source MAC ID	9	Indicates CN frame source MAC ID
Status	4	Indicates application status

5.2.2.3.2 Command code

Figure 14 presents the command code definition.

B0	B1	B2	B3
0	1	Duplicate check function status	A_EVENT sending request

Figure 14 – CN command code

Duplicate check function status:

A slave or repeater reports its duplicate MAC ID check function by this bit.

If the bit is reset for a non-participated node, the duplicate MAC ID check is active. In this state, the CN counter in the node increases after each CN frame sent by the node without having received an STW. If the counter reaches 16 without transitioning to the Participated state the node goes to the Communication Fault state.

This bit is ignored when sent from nodes in the Participated state.

The CN counter can be stopped by a “**STW_Standby Locked**” operation (see 5.4.3). A locked node reports this bit with “1”. See Table 10.

Table 10 – Duplication checking function status

B2	Description
0	Duplicate MAC ID check active
1	Duplicate MAC ID check inactive

A_EVENT sending request:

A slave or repeater uses this bit to inform the master if it needs to send an A_EVENT frame. See Table 11.

Table 11 – A_EVENT sending request

B3	Description
1	Need to send an A_EVENT
0	No request for sending A_EVENT

5.2.2.3.3 Source MAC ID

This is the 9-bit MAC ID of the node.

5.2.2.3.4 Status

A slave or repeater uses these bits to report warning and alarm status of applications to the master. As shown in Table 12, reserved 2 bits shall be reset to “0”.

Table 12 – Status of CN frames

B0	B1	B2	B3
Warning	Alarm	Reserved	

Warning: This bit is set to “1” when some error such as maintenance need occurs. This kind of situation can possibly lead to a problem. See Table 13.

Table 13 – Warning bit of CN frames

B0	Description
1	True
0	False

Alarm: This bit is set to “1” when some critical error such as Non-volatile memory malfunction is detected. See Table 14.

Table 14 – Alarm bit of CN frames

B1	Description
1	True
0	False

5.2.2.4 IN frame

5.2.2.4.1 General

An IN frame is generated only by slaves which send input to the master. See Figure 15 and Table 15.

Preamble	Command code	Source MAC ID	Length	IN data	CRC8
5 bits	2 bits	9 bits	5 bits	2 bits to 256 bits	8 bits

Figure 15 – IN frame format

Table 15 – Block name description

Block name	Bit count (bits)	Feature description
Command	2	Identifies this frame as an IN frame.
Source MAC ID	9	Indicates IN data source MAC ID.
Length	5	Coded length in 5 bits indicates 2, 4, 8, 16, 32, 48, ..., 256 bits of input data.
IN data	2 to 256	IN frame for Word slave: 8 points to 256 points of IN data. IN frame for Bit slave: IN data is fixed as 2 bits or 4 bits.

5.2.2.4.2 Command code

Figure 16 presents the command code definition.

B0	B1
1	0

Figure 16 – IN command code

5.2.2.4.3 Source MAC ID

This is the MAC ID of a slave which produces input data.

5.2.2.4.4 Length

Table 16 presents the encoded length definition.

Table 16 – Encoded length

B0	B1	B2	B3	B4	Description
0	0	0	0	0	2 bits
1	0	0	0	0	4 bits
0	1	0	0	0	8 bits
1	1	0	0	0	16 bits
0	0	1	0	0	32 bits
					... (increment of 16 bits)
0	1	0	0	1	256 bits
1	1	0	0	1	Reserved
					...
1	1	1	1	1	Reserved

5.2.2.4.5 Input data

The length of input data shall be the same as indicated by “length” of the frame.

5.2.2.5 A_EVENT frame

5.2.2.5.1 General

The A_EVENT frame is used to execute explicit message communication for the application layer. A_EVENT frames can be transmitted by all devices. They are used for the following purposes:

- event communications between the master and a slave or a repeater.
- event communications between slaves and repeaters. This is realized by the master acting as an intermediary or proxy for the requesting client. The request message is forwarded by the master to the server and the server response is forwarded back to the initiating client.

Figure 17 and Table 17 present the format and block description of A_EVENT frame.

Preamble	Command code	Destination MAC ID	Source MAC ID	Length	Event data	CRC16
5 bits	6 bits	9 bits	9 bits	5 bits	0 bits to 352 bits	16 bits

Figure 17 – A_EVENT frame format

Table 17 – Block name description

Block name	Bit Count (bits)	Feature description
Command	6	Identifies this frame as an A_EVENT frame
Destination MAC ID	9	Indicates event data destination MAC ID
Source MAC ID	9	Indicates event data source MAC ID
Length	5	Indicates 0 words to 22 words of event data length (in word). Use of 23 to 31 is illegal
Event data	0 to 352	Event data of 0 words to 22 words

Event communication is executed during the EXTEND time domain.

5.2.2.5.2 Command code

Figure 18, Table 19 and Table 20 present the command code definition.

B0	B1	B2	B3	B4	B5
1	1	1	Acknowledgement	Command type	

Figure 18 – A_EVENT command code

Acknowledgement: If the bit is set, a receiver shall acknowledge back to an A_EVENT request. In acknowledgement frames to A_EVENT requests, the bit shall be clear. In A_EVENT request frames, the bit shall be set.

Table 18 – Acknowledgement bit of A_EVENT

B3	Description
0	No acknowledgement is required
1	An Acknowledgement is required

Command Type: This part of the code is used to indicate whether the command is a request or an acknowledgement. A positive acknowledgement means a full command has been received and for processing by the receiver. It does not mean that the receiver accepted the command. A negative acknowledgement means the receiver cannot receive the command at the moment. The originator may schedule a retry later.

Table 19 – Command type of A_EVENT

B4	B5	Description
0	0	This command is a request
1	0	Positive Acknowledgement
1	1	Negative Acknowledgement, the receiver is in busy state
0	1	Reserved

5.2.2.5.3 Destination MAC ID and source MAC ID

Either the destination MAC ID or the source MAC ID shall be the master MAC ID for any one of A_EVENT frames.

For an A_EVENT frame sent by a slave or a repeater, the destination MAC ID is the master MAC ID.

For an A_EVENT frame sent by the master, the source MAC ID is the master MAC ID.

5.2.2.5.4 Length

This part indicates the event data length in 0 words to 22 words. Values 23 through 31 are illegal.

For an acknowledgement, this shall be 0.

5.2.2.5.5 A_EVENT data

A_EVENT data has a maximum of 22 words per frame. The data is used for explicit messages. The formats are defined in 5.2.3.2.

When the addresses of explicit message source and destination in the A_EVENT data are not identical with the source and destination MAC ID, the A_EVENT is processed by a master proxy.

For an acknowledgement, there shall be no data.

5.2.2.6 B_EVENT frame

5.2.2.6.1 General

The B_EVENT frame is an event communication frame only for the Data Link Layer. Each node has its own data link settings and parameters. The B_EVENT is used by the master to get or to set these data-link related settings and parameters. Also, the master uses B_EVENT frame to allow a slave or repeater to send A_EVENT. Figure 19 and Table 20 present the format and block description of B_EVENT frame.

Preamble	Command code	Destination MAC ID	Source MAC ID	Length	Event data	CRC16
5 bits	6 bits	9 bits	9 bits	5 bits	16 bits to 352 bits	16 bits

Figure 19 – B_EVENT frame format

Table 20 – Block name description

Block name	Bit Count (bits)	Feature description
Command	6	Identifies this frame as a B_EVENT frame.
Destination MAC ID	9	Indicates destination MAC ID.
Source MAC ID	9	Indicates event data source MAC ID.
Length	5	Indicates 1 words to 22 words of event data length.
Event data	16 to 352	Event data of 1 words to 22 words.

B_EVENT frame is also used in the detection of a duplicate MAC ID and other node operations.

5.2.2.6.2 Command code

Figure 20, Table 21 and Table 22 present the command code definition.

B0	B1	B2	B3	B4	B5
1	1	0	Acknowledgement	Command type	

Figure 20 – B_EVENT command code meanings

Acknowledgement: If the bit is set, a receiver shall acknowledge back to a B_EVENT request. In acknowledgement frames to B_EVENT requests, or “A_EVENT Poll Request” frames, the bit shall be clear. In B_EVENT request frames, the bit shall be set.

Table 21 – Acknowledgement bit of B_EVENT

B3	Description
0	No acknowledgement is required
1	An acknowledgement is required

Command type:

Table 22 – Command type of B_EVENT

B4	B5	Description
0	0	This command is a request for a participated node
1	0	Positive Acknowledgement
1	1	Negative Acknowledgement, the receiver is in busy state
0	1	This command is a request for a non-participated node

5.2.2.6.3 Destination MAC ID and source MAC ID

Either the destination MAC ID or the source MAC ID shall be the master MAC ID for all B_EVENT frames.

For a B_EVENT frame sent by a slave or a repeater, the destination MAC ID is the master MAC ID.

For a B_EVENT frame sent by the master, the source MAC ID is the master MAC ID.

5.2.2.6.4 Length

This part indicates the event data length ranging from 1 word to 22 words. The value 0 as well as values 23 through 31 is illegal.

This length is “1” for STR request, STW response and A_EVENT Poll Request.

5.2.2.6.5 B_EVENT data

5.2.2.6.5.1 General

Figure 21, Figure 22 and Table 23 present the format and block description of B_EVENT frame.

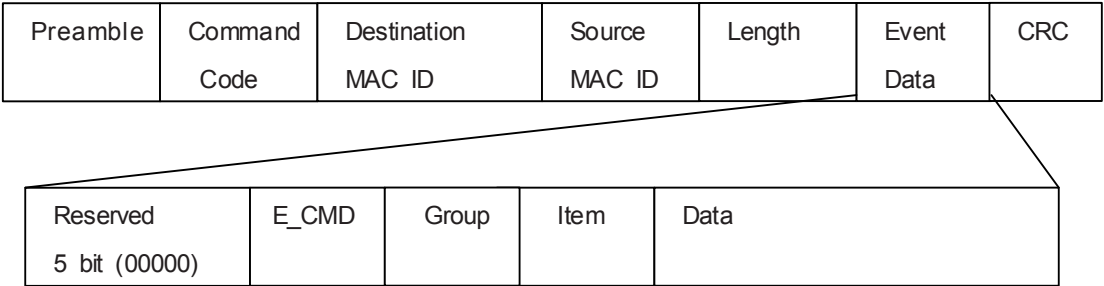


Figure 21 – B_EVENT message format

E_CMD:

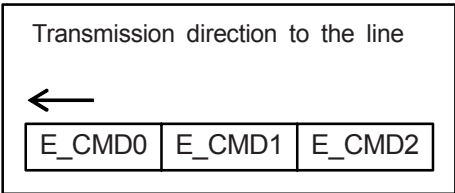


Figure 22 – E_CMD block

Table 23 – E_CMD block meanings

E_CMD0	E_CMD1	E_CMD2	Meaning
0	0	0	Read Request / Response
0	0	1	Write Request / Response
0	1	0	RESERVED
0	1	1	
1	0	0	A_EVENT Poll Request
1	0	1	RESERVED
1	1	0	
1	1	1	
NOTE The content of service is decided in E_CMD block in B_EVENT.			

Group: This part shall be set to “1” for STR, “2” for STW, and “0” for A_EVENT Poll Request as shown in Figure 23 and Table 24:

- Group 1: Network status
- Group 2: Configuration
- Group 3: Obsolete
- Group 4 to Group 7: Reserved, and
- Group 0: A_EVENT Poll Request

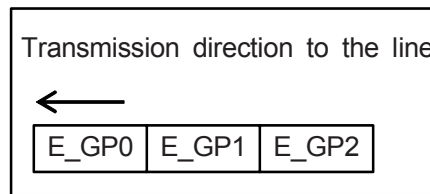


Figure 23 – Group block

Table 24 – Group block meanings

E_GP0	E_GP1	E_GP2	Meaning
0	0	0	A_EVENT Poll Request
1	0	0	Network status
0	1	0	Configuration
1	1	0	Obsolete
0	0	1	RESERVED
1	0	1	
0	1	1	
1	1	1	

Item: This shall be set to “31” for STR and STW, and “0” for A_EVENT Poll Request as shown in Figure 24 and Table 25:

- Item 31: STR or STW operation
- Item 1 to Item 21: Obsolete
- Item 0: A_EVENT Poll Request
- Others: Reserved

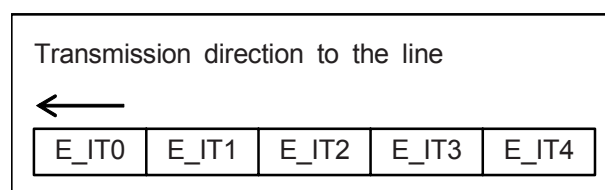


Figure 24 – Item block

Table 25 – Item block meanings

E_IT0	E_IT1	E_IT2	E_IT3	E_IT4	Meaning
0	0	0	0	0	A_EVENT Poll Request
1	0	0	0	0	Obsolete
0	1	0	0	0	
1	1	0	0	0	
0	0	1	0	0	
1	0	1	0	0	
0	1	1	0	0	
1	1	1	0	0	
0	0	0	1	0	
1	0	0	1	0	

E_IT0	E_IT1	E_IT2	E_IT3	E_IT4	Meaning
0	1	0	1	0	
1	1	0	1	0	
0	0	1	1	0	
1	0	1	1	0	
0	1	1	1	0	
1	1	1	1	0	
0	0	0	0	1	
1	0	0	0	1	
0	1	0	0	1	
1	1	0	0	1	
0	0	1	0	1	
1	0	1	0	1	
0	1	1	0	1	
1	1	1	0	1	
0	0	0	1	1	Reserved
1	0	0	1	1	
0	1	0	1	1	
1	1	0	1	1	
0	0	1	1	1	
1	0	1	1	1	
0	1	1	1	1	
1	1	1	1	1	
1	1	1	1	1	STR or STW operation

Data: Group 1, Group 2 and Group 0 data structures are specified.

5.2.2.6.5.2 Network status group

Commands (E_CMD) other than READ are prohibited in this area. Access to this group is called “Status Reading”, abbreviated STR. Figure 25 presents the STR definition.

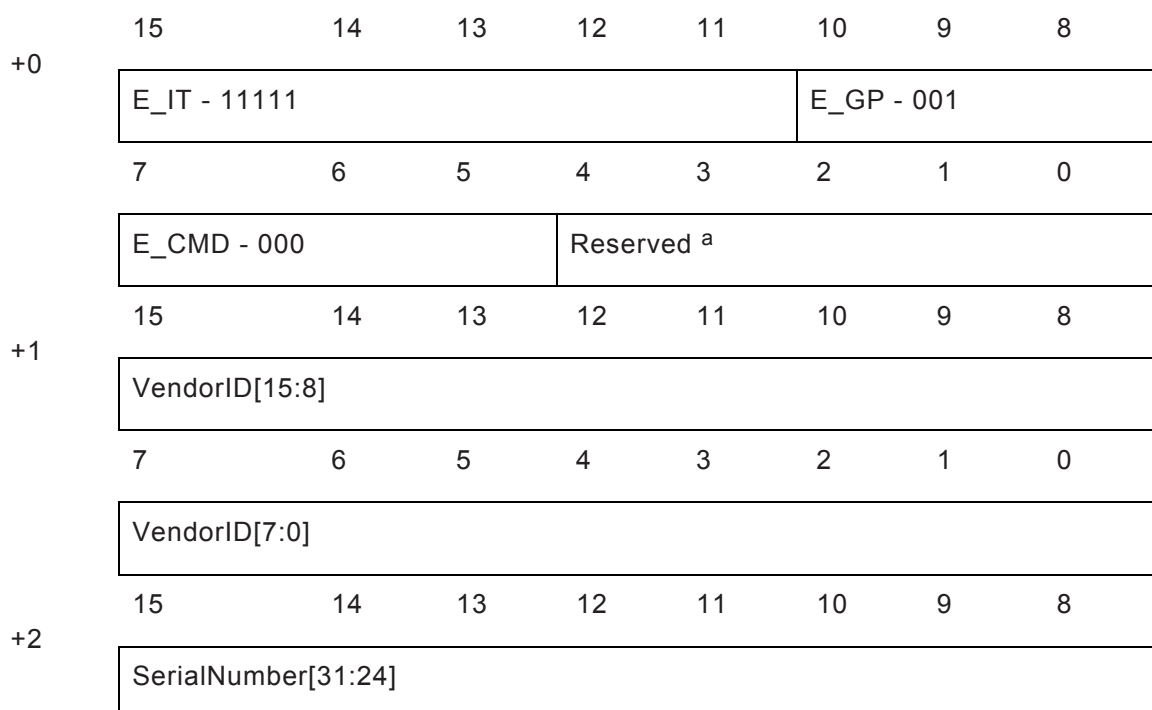


Figure 25 (continued overleaf)

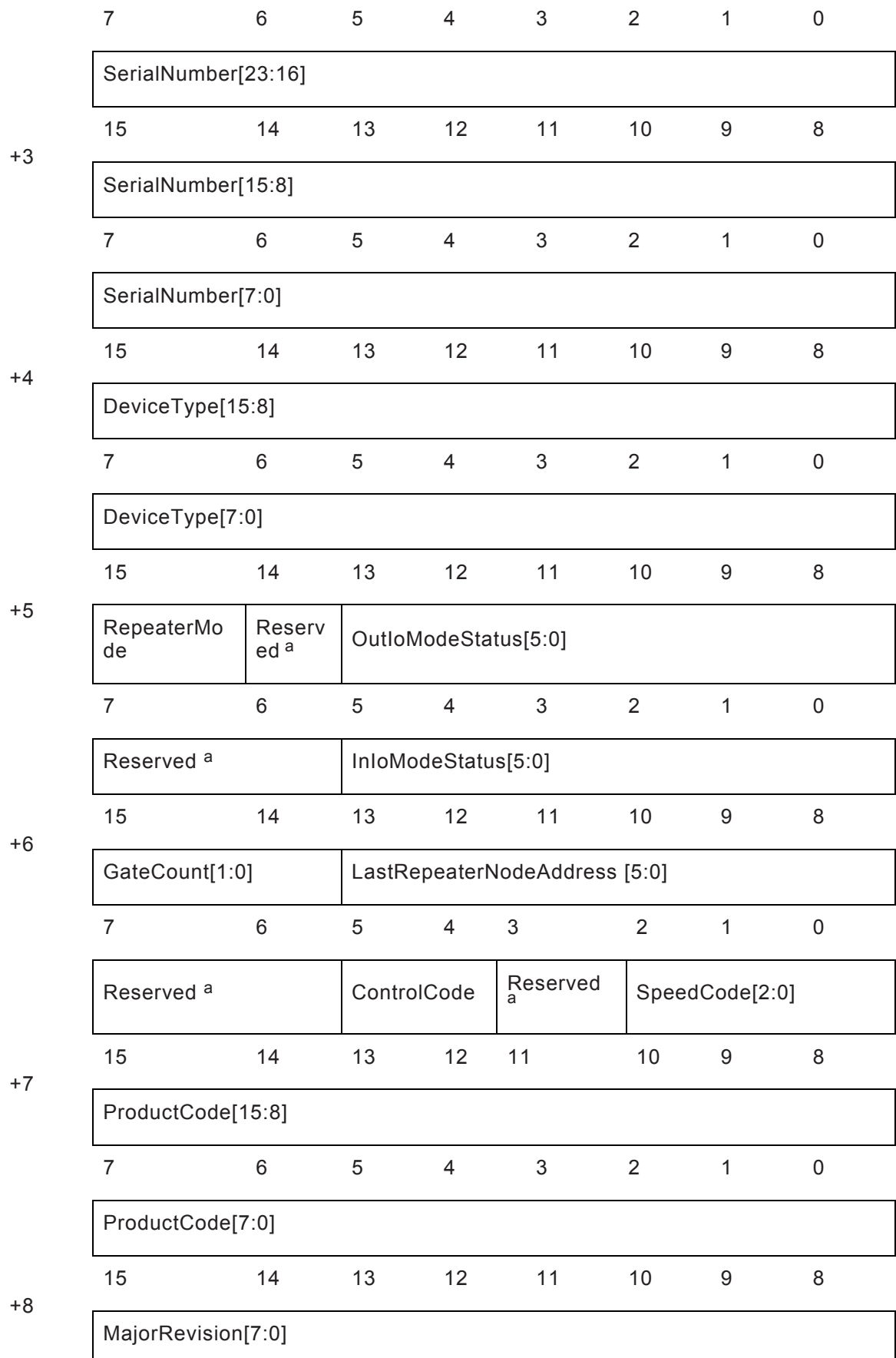


Figure 25 (continued overleaf)

7	6	5	4	3	2	1	0
Reserved ^a [7:4]				Obsolete ^b [3:0]			

^a Reserved part shall be "0".

^b Obsolete part shall be "0".

Figure 25 – Status Read (STR Response) event data

STR field data

- a) VendorID: Vendor ID attribute of the Identity Object as assigned by ODVA
- b) SerialNumber: Serial Number attribute of Identity Object
- c) DeviceType: Device Type attribute in the Identity Object as defined by ODVA
- d) RepeaterMode: True/False
- e) InIoModeStatus: Coded-length of input data and status
 - 1) InIoModeStatus[5]:
 - 1: InIoModeStatus[4:0] indicates size of input data
 - 0: no input data
 - 2) InIoModeStatus[4:0]:
 - 00000: 2 points; 00001: 4 points; 00010: 8 points; 00011: 16 points
 - 00100: 32 points; 00101: 48 points; 00110: 64 points; 00111: 80 points;
 - 01000: 96 points; 01001: 112 points; 01010: 128 points; 01011: 144 points;
 - 01100: 160 points; 01101: 176 points; 01110: 192 points; 01111: 208 points;
 - 10000: 224 points; 10001: 240 points; 10010: 256 points; others: reserved
- f) OutIoModeStatus: Coded-length of output data and status
 - 1) OutIoModeStatus[5]:
 - 1: OutIoModeStatus[4:0] indicates size of output data
 - 0: no output data
 - 2) OutIoModeStatus[4:0]:
 - 00000: 2 points; 00001: 4 points; 00010: 8 points; 00011: 16 points
 - 00100: 32 points; 00101: 48 points; 00110: 64 points; 00111: 80 points;
 - 01000: 96 points; 01001: 112 points; 01010: 128 points; 01011: 144 points;
 - 01100: 160 points; 01101: 176 points; 01110: 192 points; 01111: 208 points;
 - 10000: 224 points; 10001: 240 points; 10010: 256 points; others: reserved
- g) GateCount: 0, 1, 2; the number of repeaters between the master and the node; 2 is not valid for a repeater.
- h) Control Code: Control Code value from the most recent BEACON frame
- i) LastRepeaterNode Address: Repeater address, a copy from BEACON frame
- j) SpeedCode: 0: 93,75 kbit/s; 1: reserved; 2: 1,5 Mbit/s; 3: 3 Mbit/s; 4: 4 Mbit/s.
- k) ProductCode: Product Code attribute in the Identity Object.
- l) MajorRevision: Major Revision attribute in the Identity Object

5.2.2.6.5.3 Configuration group

Access to this group is called “Status Writing”, abbreviated as STW. Read command to this area is not allowed. Figure 26 presents STW definition.

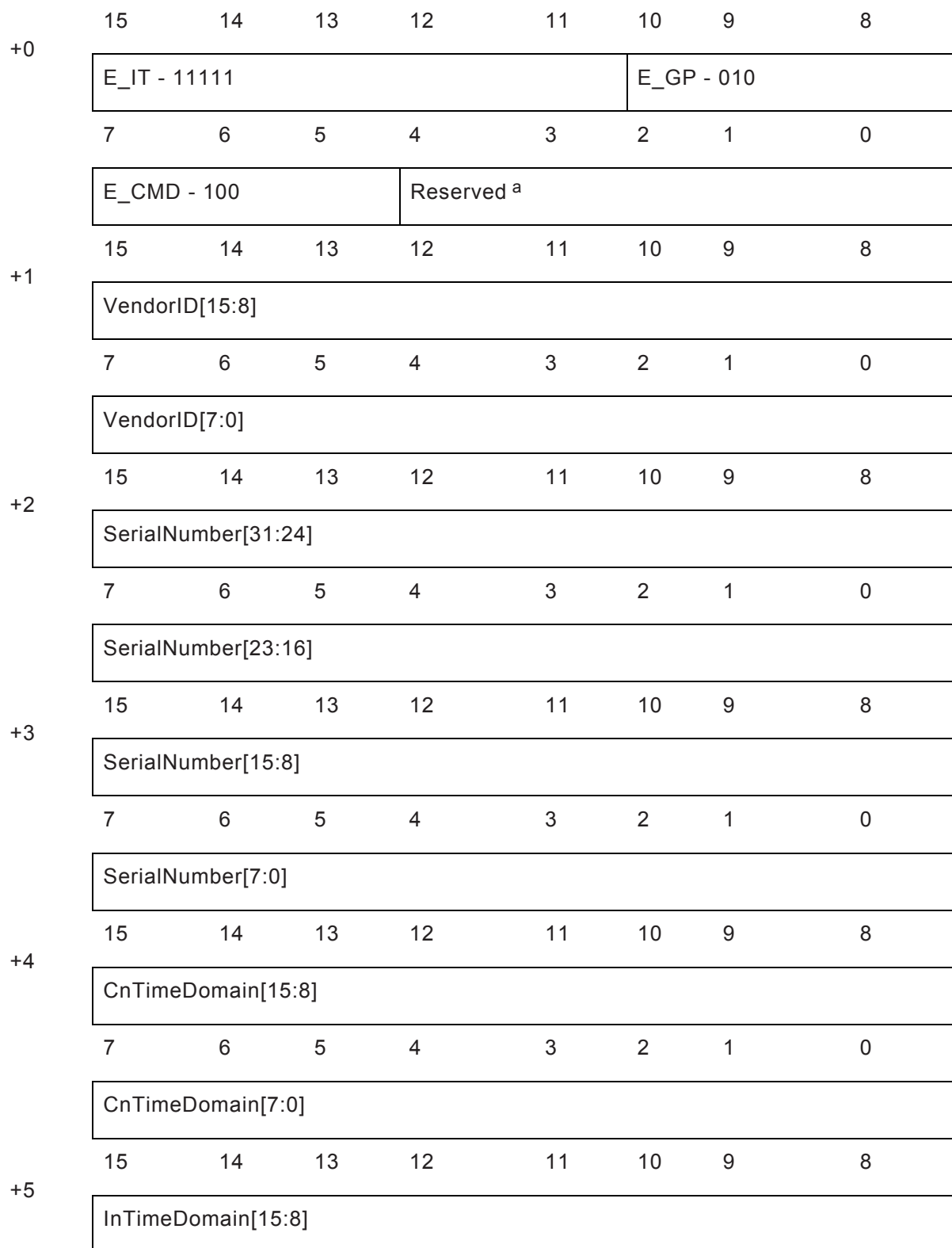
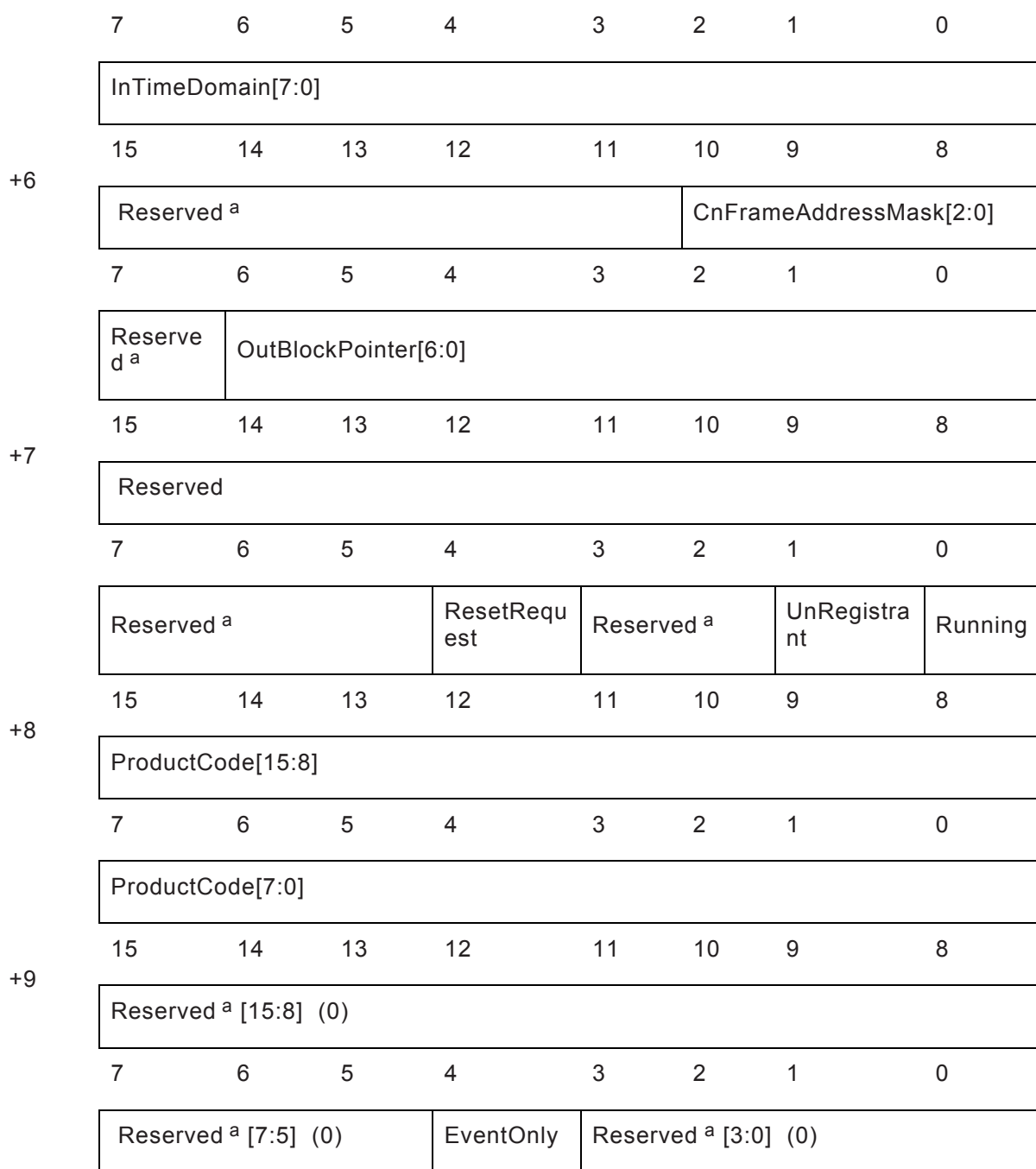


Figure 26 (continued overleaf)



^a Reserved part shall be "0".

Figure 26 – Configuration event data (STW Request)

STW field data

- a) VendorID: Vendor ID attribute of the Identity Object as assigned by ODVA. Normally a copy from STR result is used.
- b) SerialNumber: Serial Number attribute of Identity Object. Normally a copy from STR result is used.
- c) CnTimeDomain: Mark count. This data is set by the master. When a node becomes "Participated", it shall reply a CN frame according to this setting.

- d) InTimeDomain: Mark count. This data is valid for IN and MIX slaves. When a node becomes “Participated” (excluding EventOnly state), it shall transmit an IN frame according to this setting.
- e) CnFrameAddressMask: This data is valid for “Participated” nodes. It indicates the CN frame number after an OUT or TRG frame, which requests “Participated” node CN frames.
- **0:** means 1 CN_Frame after an OUT or TRG frame. The Node with MAC ID identified by the “CN Request MAC ID” sends a CN.
 - **1:** means 2 CN_Frames after an OUT or TRG frame. The Node with the upper 8 bits of it's MAC ID corresponding to the upper 8 bits of the “CN Request MAC ID” in an OUT or TRG sends a CN.
 - **2:** 4 CN_Frame, upper 7 bits of the MAC ID are compared.
 - **3:** 8 CN_Frame, upper 6-bits of the MAC ID are compared.
 - **4:** 16 CN_Frame, upper 5-bits of the MAC ID are compared.
 - **5:** 32 CN_Frame, upper 4-bits of the MAC ID are compared.
 - **6,7:** behave same as value 0
- f) OutBlockPointer: 0 to 79. It indicates output slaves where they pick out output data from OUT frame. 5.2.2.1.5.
- g) ResetRequest: Reset the node similar to power cycle.
- h) UnRegistrant: Enable/Disable duplicate address check function. 0: Enable; 1: Disable. When it is disabled, the node stops the CN counter, so it does not go to duplicate error state when the counter value reaches 15.
- i) Running: 0: to Non-participated; 1: to Participated
- j) ProductCode: Product Code attribute in the Identity Object. Normally a copy from STR result is used. This data is ignored by the receiver.
- k) EventOnly: If this is set to “1”, the node does not send an IN frame after it receives an OUT or TRG frame.

5.2.2.6.5.4 A_EVENT Poll Request Group

The A_EVENT Poll Request format is shown in Figure 27.

Word Offset	15	14	13	12	11	10	9	8
+0	Group=0					Item=0		
	7	6	5	4	3	2	1	0
	E_CMD=1				0			

Figure 27 – Poll data

5.2.2.6.6 B_EVENT frame decoding process

When a B_EVENT frame is received, it is first decoded as shown in Figure 28 This is to see whether the received frame is a STR, STW or A_EVENT Poll request.

If it is an STR request, it is processed according to the rules in Table 26.

If it is an A_EVENT Poll request, it is processed according to the rules in Table 27.

If it is an STW request, it is processed according to the rules in Table 28. If the STW request passes these checks, the B_EVENT Data in the STW request shall overwrite the configuration parameters listed in Figure 26. Processing then follows the flow chart shown in Figure 29. The STW commands used in the flow chart are defined in Table 29.