safety remote control

DYNAMIC SERIES

CAN manual

LIDCOEC0-00

INDEX

Index

Back

1 Manual for the Dynamic series's CANopen

1.1 General instructions

This manual aims at providing information about CANopen to manufacturers of machines that they want to equip with an Autec's Dynamic series radio remote control.

Instructions to install the radio remote control are contained in the “installer user manual” (provided in soft copy).
Instructions regarding the use of the radio remote control are contained in the “user manual” (provided together with the radio remote control).
This manual, the “installer manual” and the “user manual” must be read and understood in all their parts by those who decide and/or carry out the radio remote control installation.

Always remember that:
- photos and drawings contained in this manual are useful examples that help understand its instructions and warnings
- if necessary, contact Autec if any of the instructions and/or warnings given in this manual are not clear.

No part of this manual may be reproduced, in any form or by any means, without written permission of Autec (including recording and photocopying).
If this manual is lost or damaged, ask Autec for a copy. Please specify the serial number of the related radio remote control.

All installation operations can only be carried out by qualified technicians who are suitably trained with respect to the relevant norms and laws.

This manual integrates instructions provided by the manufacturer of the machine where the radio remote control is to be installed.
As for instructions and warnings regarding the machine where the radio remote control is to be installed, follow the instructions given in the machine's manual.

1.2 Definitions

CiA[1]	CAN in Automation.
CAN	Controller Area Network
CANopen	CANopen is a CAN-based higher layer protocol.
COB	Communication Object. CAN message. Data is transferred within the network using COBs.
COB-ID	COB-Identifier. Unique identifier of CAN message. The identifier also determines with what priority that message is put on the network.
DS	Draft Standard
DSP	Draft Standard Proposal;
ID	Identifier (see COB-ID)
LSB	Least significant bit/byte
LSS	Layer Setting Services
MSB	Most significant bit/byte
NMT	Network Management. Service responsible for network initialisation, configuration and management.
OSI	Open Systems Interconnection.
PDO	Process Data Object. Object used to exchange process data.
RTR	Remote Transmission Request.
SDO	Service Data Object. COB that enables a node to access the information contained in the OD.
SYNC	Synchronisation message.
OD	Object Dictionary
RRC	Radio Remote Control
TU	Transmitting Unit
RU	Receiving Unit

1. CiA® and CANopen® are registered Community Trademarks of CAN in Automation e.V.

1.3 References

[1] CiA 301 DS V4.0.2
CANopen application layer and communication profile Date: 13 February 2002
[2] CiA 303-1 DR V1.6
CANopen additional specification - Part 1: Cabling and connector pin assignment Date: 03 June 2008
[3] CiA 303-2 DR V1.4
CANopen additional specification - Part 2: Representation of SI units and prefixes Date: 14.08.2006
[4] CiA 303-3 DR V1.3
CANopen additional specification - Part 3: Indicator specification Date: 14.08.2006
[5] CiA 306 DS V1.3
Electronic data sheet specification for CANopen Date: 01 January 2005
[6] CiA 401 DS V3.0
CANopen device profile for generic I/O modules Date: 03 June 2008

2 Introducing CANopen

CANopen is one of the high-level protocols based on CAN serial bus; it provides standard communication objects for real-time network configuration and maintenance data.
Thanks to their high standardisation, CANopen devices are easily integrated into pre-existing CAN networks.
For further information, please visit this website: http://www.can-cia.org/.

2.1 General features

The RU is configured in the network as a slave node with **CAN 2.0A** protocol (**COB-ID** at 11 bit).
Node ID is configurable between 1 and 127.
The following services are supported:

- **SDO** in server mode (expedited and segmented data transfer). The SDO service gives access to the “Object dictionary” to change some system operating parameters.
- **NMT**: the node may automatically enter the “operational” state after power on
- **PDO**: up to 3 transmit PDOs and 2 receive PDOs are supported. PDO content is statically mapped.
- **Emergency message**: error or warning indications are given; differentiation of causes for malfunctions is possible
- **Error control**: these messages enable monitoring of RU working

User indications are supported according to standard [4].

2.2 Main constraints

Communication through COB-IDs with 29-bit IDs is currently not supported.
The “Node-ID claiming” procedure is not supported.
A single communication channel is used for the SDO service.
Node guarding is not supported.

3 Objects and identifiers

Each message exchanged within a CAN network consists of an identifier and a data section (max. 8 bytes).
To achieve standardized management, CANopen uses the “Predefined connection set” (see Communication profile DS301), in which all identifiers of exchanged objects have a standard value [1].
Identifiers consist of 11 bits composed as follows:

COB Identifier										
10	9	8	7	6	5	4	3	2	1	0
Function Code				Node-ID [1 - 127]						

tab.1 Communication Object identifier

Node ID is the address of the RU within a CANopen network and supports a value range between 1 and 127. COB-ID depends on the value of selected Node ID and on Function Code.
The set of standard identifiers denotes network-wide objects (independent of Node ID) and objects exchanged between two specific nodes (peer-to-peer, dependent on Node ID).
Messages have a given priority, so that the higher-prior message is sent over the network in the event of a conflict.
Not all COB-IDs associated with the various services can be changed; mandatory services (NMT, SDO, NMT Error Control) and the LSS service have pre-defined COB-IDs that cannot be changed.

PRIORITY

Object	Function Code				COB-ID	Editable in OD (Index)	Mandatory
NMT	0	0	0	0	0h	-	*
SYNC	0	0	0	1	80h	1005h 1006h 1007h	
EMERGENCY	0	0	0	1	80h + Node ID	1014h 1015h	
TIME STAMP	0	0	1	0	100h	1012h 1013h	
PDO1 (tx)	0	0	1	1	180h + Node ID	1800h	
PDO1 (rx)	0	1	0	0	200h + Node ID	1400h	
PDO2 (tx)	0	1	0	1	280h + Node ID	1801h	
PDO2 (rx)	0	1	1	0	300h + Node ID	1401h	
PDO3 (tx)	0	1	1	1	380h + Node ID	1802h	
PDO3 (rx)	1	0	0	0	400h + Node ID	1402h	
PDO4 (tx)	1	0	0	1	480h + Node ID	1803h	
PDO4 (rx)	1	0	1	0	500h + Node ID	1403h	
SDO (tx)	1	0	1	1	580h + Node ID	1200h	*
SDO (rx)	1	1	0	0	600h + Node ID	1200h	*
NMT Error Control	1	1	1	0	700h + Node ID	1016h, 1017h	*
LSS (rx-tx)	1	1	1	1	7E4h-7E5h		

tab.2 List of COB identifiers

Index
Back

Within the set of pre-defined identifiers, the following COB-IDs are not used:

COB-ID
001h - 07Fh
101h - 180h
200h / 280h / 300h / 380h / 400h / 480h / 500h / 580h
600h / 680h
780h - 7E3h
7E6h - 7FFh

tab.3 Non-permitted COBs

The slave node can be incorporated in a network that does not support the CANopen protocol (such as a CAN rather than CANopen network), provided that “non-CANopen” devices do not use:
- Identifiers with a 0h value (to avoid collision with NMT service messages)
- Identifiers associated with the SDO and NMT Error Control services (when this is the case, a different Node ID can be assigned to the CANopen node to avoid overlap)

4 Object dictionary

All application data and configuration parameters (i.e., “Communication Objects”) are held in the Appendix A: Object Dictionary (OD).Each and every function, variable and data type visible over the network must be described in the OD. The OD provides the interface between application processes and a communication interface with every node in the network.
Access to such data is standard and occurs through entries consisting of an index (16 bits) and a sub-index (8 bits).

5 Data transmission

Data can be transferred using two services having different characteristics:

1. Service Data Object (SDO):
   - they enable access to OD information
   - communication occurs towards a specific node (peer to peer)
   - service requires that exchange messages be confirmed
   - messages have low priority

   The SDO service is mainly used to read/write configuration parameters from/in the OD and for diagnostic purposes. Normally it is not used to transfer data, as this service requires significant overhead. While poorly efficient, the SDO service can transfer more data than the 8 bytes allowed by PDOs and sent data is confirmed.

2. Process Data Object (PDO)
   - messages are visible to all network nodes (broadcast)
   - they do not require any confirmation messages
   - they cannot transfer more than 8 data bytes
   - supported transmission modes are synchronous / asynchronous, cyclic / acyclic, event-driven (Change Of State)
   - they have high priority

   They are used for the real-time exchange of information. They are the priority data exchange mechanism between network node processes.

6 Service Data Object (SDO)

The RU supports the SDO service in expedited mode (transfer of up to 4 bytes) or segmented mode (transfer of up to n-bytes). Maximum number of transferred bytes is set to 12.
The SDO service enables OD entry read/write.
The RU acts as a server to network nodes, that is to say, it can provide information to requesting nodes.
There is a single SDO channel; a request sent to the RU before it has finished sending the information requested by a previous query will be rejected with an “SDO abort” error message.

6.1 SDO - Timeout

When several SDO messages are required to complete a single transaction (segmented mode), the maximum time allowed between 2 consecutive messages is 100 ms.

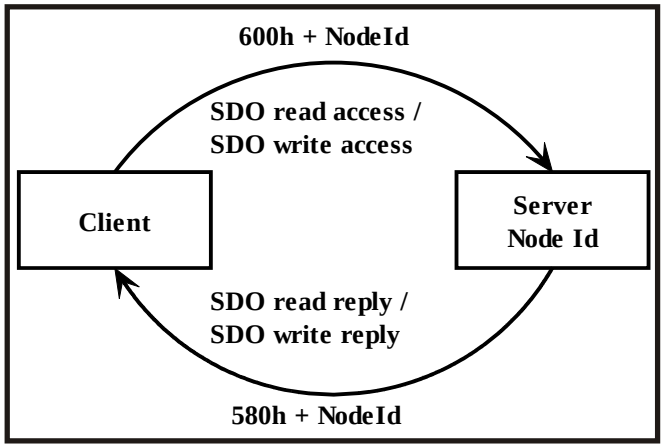


fig.1 Default ID for SDO service

Affected dictionary objects are as follows:

Name	Server SDO Parameters				
Index	Subindex	Name	Type	Default	Editable
1200h	00h	Server SDO Parameter	UNSIGNED8	02h	No
	01h	COB-ID Client → Server	UNSIGNED32	00000600h + Node ID	No
	02h	COB-ID Server → Client	UNSIGNED32	00000580h + Node ID	No

tab.4 SDO communication parameters

The parameters described in the OD report the COB-IDs associated with the SDO service; note how these COB-IDs cannot be changed.

When an error occurs during message exchange, it is indicated over the CANopen network with an “Error message” (COB-ID: 80h). An error may be due to faulty communication or incorrect access to dictionary (non-existent entries, incorrect data length, attempt to edit a read-only field,…).
Error codes are described in [1].

7 Process Data Object (PDO)

PDOs enable the transmission of digital and analogue command information from the TU, and receipt of information to be sent to the TU.

Transmitted PDOs are:
- TPDO1: System commands
- TPDO2: Analogue commands
- TPDO3: Auxiliary commands.

Received PDOs are:
- RPDO1: Strings
- RPDO2: Signals.

Machine's information may be displayed on a display unit (alphanumeric information) or through LEDs on TUs that are equipped with such interfaces.

Arrangement of information in the messages is fixed an cannot be modified.

7.1 Transmission Process Data Object (TPDO)

Transmit PDOs can be activated by a number of events described in the OD section dedicated to the communication parameters (Index:1800h + i, with i = 0,1,2). Message transmission after a remote request executed through RTR (remote frame) is not supported.

Name	**Transmit PDO Communication Parameter**				
Index	Subindex	Name	Type	Default	Editable
1800h 1801h 1802h	00h	Number of subindex	UNSIGNED8	05h	No
	01h	COB ID	UNSIGNED32	See Appendix A: Object Dictionary (OD)	Yes
	02h	Transmission Type	UNSIGNED8	255	Yes
	03h	Inhibit Time	UNSIGNED16	300	Yes
	04h	Compatibility Entry	UNSIGNED8	-	No
	05h	Event Timer	UNSIGNED16	50	Yes

tab.5 Communication parameters for PDO i-th (i=0,1,2) sent

NOTE: Default communication parameters for the 3 TPDOs sent by the RU require that PDOs be sent over the network with a frequency of at least 50 ms (Event Timer), however not less than 30 ms (Inhibit Time) when changes in transmitted data occur (COS: Change Of State), in asynchronous transmission mode (Transmission type 255).

7.1.1 COB-ID

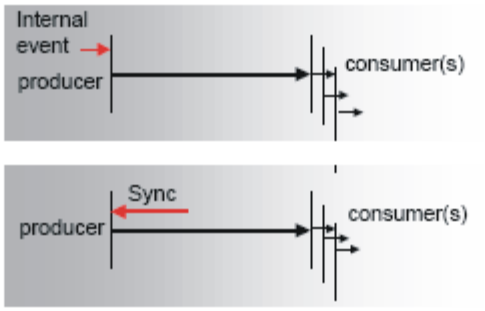
Related examples:
- Changing COB-ID
- Disabling TPDO transmission

The default value of the COB-ID field (00000000h) indicates that the COB-IDs to be used are those specified by the CANopen standard.

The COB-IDs used for the exchange of information can be modified through SDO messages.

Index
Back

7.1.2 Transmission Type



Transmission Type	PDO Transmission Sync Character				
	Cyclic	Acyclic	Synchronous	Asynchronous	Remote Request
0		X	X		
1 through 240	X		X		
241 through 251	Reserved				
252			X		X
253				X	X
254				X	
255				X	

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fig.2 Transmission Type

Transmission may be event-driven (information is transmitted when a change occurs in the data to be transmitted, or when a timer elapses) or synchronous with requests received over the network with one or more SYNC messages.

7.1.3 Inhibit Time

Related examples:
- Disabling “Inhibit Time”

This parameter specifies the minimum time interval between two transmissions of the same PDO. This parameter is a multiple of 100 us. When set to 0, the “Inhibit Time” function is disabled.

7.1.4 Event Timer

Related examples:
- Setting “Event Timer”

This parameter specifies that the PDO must be sent when a timer elapses. This parameter is a multiple of ms. If value is 0, the function is disabled. With any parameter values other than 0, the PDO is transmitted periodically.

7.1.5 TPDO1: System commands

This PDO enables the transfer of information concerning:
- direction of the main analogue commands (H1-8…H8: high, L1-8…L8: low)
- main on/off commands (D1…D16),
- a sub-set of auxiliary on/off commands (D17…D32).
- System (reserved information, STOP, SAF,…)

The mapping of commands included in the PDO is described in tab.6.

	MSB				Content (bit)			LSB	
Byte	7	6	5	4	3	2	1	0	Description
0	**H8**	**H7**	**H6**	**H5**	**H4**	**H3**	**H2**	**H1**	Directions High
1	**L8**	**L7**	**L6**	**L5**	**L4**	**L3**	**L2**	**L1**	Directions Low
2	**D8**	**D7**	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	Main ON/OFF commands
3	**D16**	**D15**	**D14**	**D13**	**D12**	**D11**	**D10**	**D9**	Main ON/OFF commands
4	**D24**	**D23**	**D22**	**D21**	**D20**	**D19**	**D18**	**D17**	Auxiliary on/off commands
5	**D32**	**D31**	**D30**	**D29**	**D28**	**D27**	**D26**	**D25**	Auxiliary on/off commands
6	**RES**	**RES**	**RES**	**RES**	**RES**	**RES**	**RES**	**RES**	System information
7	**STOP**	**SAF**	**RES**	**RES**	**EMGY**	**TMS**	**BAT**	**RES**	System information

tab.6 Map of commands related to TPDO1

Commands are considered active when value is '1', otherwise they are considered inactive.
The first/second bytes contain the "High"/"Low" directions associated with analogue commands.
The third and fourth bytes contain the "main" on/off commands (D1 is normally associated with the TU START push-button).
The fifth and sixth bytes contain part of the "auxiliary" on/off commands.
The sixth and seventh bytes report certain system information.

Command	Information source				Description
	TU		RU		
	Hw	Sw	Hw	Sw	
H1-8	*				Directions "High" of related analogue commands A1-8
L1-8	*				Directions "Low" of related analogue commands A1-8
D1-16	*				Main digital commands
D17-32	*				Auxiliary digital commands
STOP	*				If the RU is connected, it reflects STOP pushbutton state Under normal conditions (radio link and Run present), the command is active.
SAF	*				When at least one direction (High/Low) of the main analogue commands or any on/off command (appropriately wired on the TU) is active, field value is active.
EMGY			*		EmerGencY: If active, it indicates that radio connection between TU and RU has been established and the run command has been executed. It is active during normal working
TMS				*	TiMed Stop: When the STOP pushbutton on the TU connected with an RU is pressed, this field takes on the active value for approximately 10". After this time, or after the radio link is restored, this bit is deactivated. It is inactive during normal working.
BAT	*				Battery: If active, it indicates that the TU battery is running flat. Normally inactive
RES	-	-	-	-	Reserved information. No assumptions may be made for the values of these bits

OD entries involved in the conditioning of digital signals transferred with TPDO 1 are shown in fig.3.
Mapping of the data contained in TPDO1 is static and is described by the 1A00h dictionary entries.
When an error condition (such as radio link failure due to user intervention "active emergency" or to a recovery time-out "passive emergency") is detected during signal processing, the value taken on by the digital outputs may:
- assume a pre-defined default value (normally "0")
- retain the value taken on at the time the error occurred ("0" or "1")
- evolve normally.

Index
Back

This behaviour is determined by dictionary entries 6206h, 6207h, and 2006h

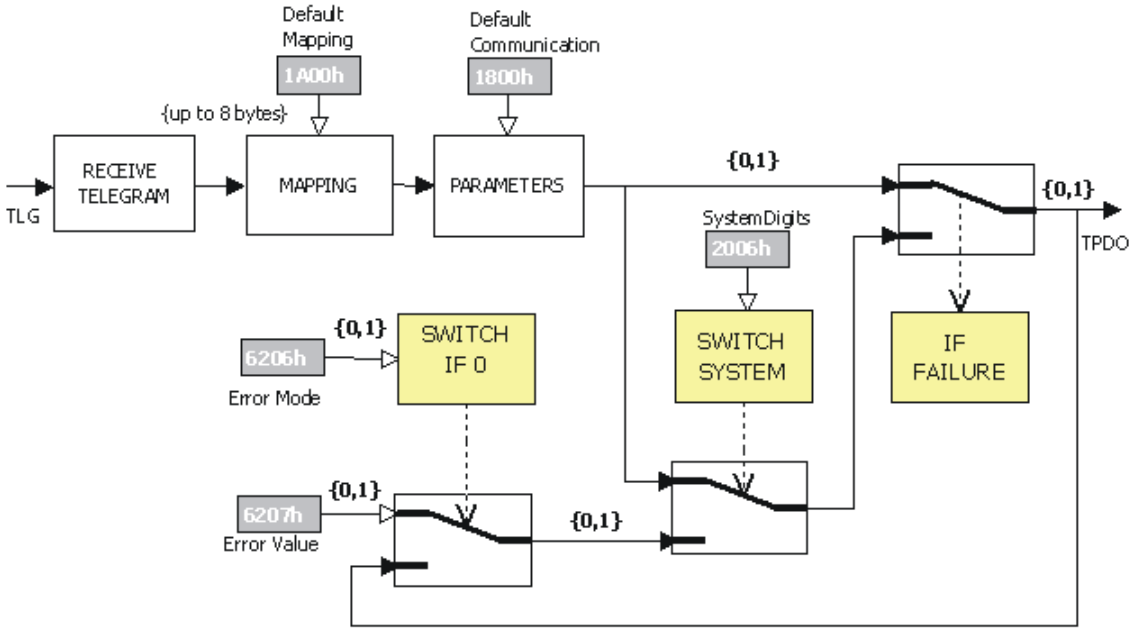


fig.3 Conditioning of values contained in TPDO1

The configuration of the sub-indexes of entry 6206h determines whether the value defined in 6207h must be taken on in the event of an error, or the value present before the error occurred should be retained
Sub-indexes of entry 6206h from 01h to 10h must be interpreted as bit-field and associated to the advised commands: if bit is set to 1, the value present in entry 6207h will be taken on in the event of an error; if set to 0, the value present when the error occurred is retained until error cause is removed.

Name	**Digital Error Mode**												
Index	Subindex	Name	Type	Default	Editable	Associated on/off command (bit field)							
6206h	00h	Number of subindex	UNSIGNED8	10h	No	7	6	5	4	3	2	1	0
	01h	EM_H1H8	UNSIGNED8	FFh	Yes	H8	H7	H6	H5	H4	H3	H2	H1
	02h	EM_L1L8	UNSIGNED8	FFh	Yes	L8	L7	L6	L5	L4	L3	L2	L1
	03h	EM_D1D8	UNSIGNED8	FFh	Yes	D8	D7	D6	D5	D4	D3	D2	D1
	04h	EM_D9D16	UNSIGNED8	FFh	Yes	D16	D15	D14	D13	D12	D11	D10	D9
	05h	EM_D17D24	UNSIGNED8	00h	Yes	D24	D23	D22	D21	D20	D19	D18	D17
	06h	EM_D25D32	UNSIGNED8	00h	Yes	D32	D31	D30	D29	D28	D27	D26	D25
	07h	EM_Info_0	UNSIGNED8	FFh	Yes	RES	RES	RES	RES	RES	RES	RES	RES
	08h	EM_Info_1	UNSIGNED8	C3h	Yes	STOP	SAF	RES	RES	EMGY	TMS	BAT	RES
	09h	EM_RES_0	UNSIGNED8	FFh	Yes	RES	RES	RES	RES	RES	RES	RES	RES
	0Ah	EM_RES_1	UNSIGNED8	FFh	Yes	RES	RES	RES	RES	RES	RES	RES	RES
	0Bh	EM_RES_2	UNSIGNED8	FFh	Yes	RES	RES	RES	RES	RES	RES	RES	RES
	0Ch	EM_RES_3	UNSIGNED8	FFh	Yes	RES	RES	RES	RES	RES	RES	RES	RES
	0Dh	EM_RES_4	UNSIGNED8	FFh	Yes	RES	RES	RES	RES	RES	RES	RES	RES
	0Eh	EM_RES_5	UNSIGNED8	FFh	Yes	RES	RES	RES	RES	RES	RES	RES	RES
	0Fh	EM_D33D40	UNSIGNED8	00h	Yes	D40	D39	D38	D37	D36	D35	D34	D33
	10h	EM_D41D48	UNSIGNED8	00h	Yes	D48	D47	D46	D45	D44	D43	D42	D41

tab.7 Error mode digital entry

Index
Back

Default values to be taken on in the event of an error are defined by entry 6207h.

Name	Digital Error Value												
Index	Subindex	Name	Type	Default	Editable	Associated on/off command (bit field)							
6207h	00h	Number of subindex	UNSIGNED8	10h	No	7	6	5	4	3	2	1	0
	01h	EV_H1H8	UNSIGNED8	00h	Yes	H8	H7	H6	H5	H4	H3	H2	H1
	02h	EV_L1L8	UNSIGNED8	00h	Yes	L8	L7	L6	L5	L4	L3	L2	L1
	03h	EV_D1D8	UNSIGNED8	00h	Yes	D8	D7	D6	D5	D4	D3	D2	D1
	04h	EV_D9D16	UNSIGNED8	00h	Yes	D16	D15	D14	D13	D12	D11	D10	D9
	05h	EV_D17D24	UNSIGNED8	00h	Yes	D24	D23	D22	D21	D20	D19	D18	D17
	06h	EV_D25D32	UNSIGNED8	00h	Yes	D32	D31	D30	D29	D28	D27	D26	D25
	07h	EV_Info_0	UNSIGNED8	00h	Yes	RES	RES	RES	RES	RES	RES	RES	RES
	08h	EV_Info_1	UNSIGNED8	00h	Yes	STOP	SAF	RES	RES	EMGY	TMS	BAT	RES
	09h	EV_RES_0	UNSIGNED8	00h	Yes	RES	RES	RES	RES	RES	RES	RES	RES
	0Ah	EV_RES_1	UNSIGNED8	00h	Yes	RES	RES	RES	RES	RES	RES	RES	RES
	0Bh	EV_RES_2	UNSIGNED8	00h	Yes	RES	RES	RES	RES	RES	RES	RES	RES
	0Ch	EV_RES_3	UNSIGNED8	00h	Yes	RES	RES	RES	RES	RES	RES	RES	RES
	0Dh	EV_RES_4	UNSIGNED8	00h	Yes	RES	RES	RES	RES	RES	RES	RES	RES
	0Eh	EV_RES_5	UNSIGNED8	00h	Yes	RES	RES	RES	RES	RES	RES	RES	RES
	0Fh	EV_D33D40	UNSIGNED8	00h	Yes	D40	D39	D38	D37	D36	D35	D34	D33
	10h	EV_D41D48	UNSIGNED8	00h	Yes	D48	D47	D46	D45	D44	D43	D42	D41

tab.8 Error value digital entry

If you want commands to change their values in accordance with their operating specifications even when any errors are present, this behaviour can be forced using entry 2006h.

Name	Sys_Digital_Output_Mode												
Index	Subindex	Name	Type	Default	Editable	Associated on/off command (bit field)							
2006h	00h	Number of subindex	UNSIGNED8	10h	No	7	6	5	4	3	2	1	0
	01h	SD_H1H8	UNSIGNED8	00h	Yes	H8	H7	H6	H5	H4	H3	H2	H1
	02h	SD_L1L8	UNSIGNED8	00h	Yes	L8	L7	L6	L5	L4	L3	L2	L1
	03h	SD_D1D8	UNSIGNED8	00h	Yes	D8	D7	D6	D5	D4	D3	D2	D1
	04h	SD_D9D16	UNSIGNED8	00h	Yes	D16	D15	D14	D13	D12	D11	D10	D9
	05h	SD_D17D24	UNSIGNED8	00h	Yes	D24	D23	D22	D21	D20	D19	D18	D17
	06h	SD_D25D32	UNSIGNED8	00h	Yes	D32	D31	D30	D29	D28	D27	D26	D25
	07h	SD_Info_0	UNSIGNED8	00h	Yes	RES	RES	RES	RES	RES	RES	RES	RES
	08h	SD_Info_1	UNSIGNED8	3Ch	Yes	STOP	SAF	RES	RES	EMGY	TMS	BAT	RES
	09h	SD_RES_0	UNSIGNED8	00h	Yes	RES	RES	RES	RES	RES	RES	RES	RES
	0Ah	SD_RES_1	UNSIGNED8	00h	Yes	RES	RES	RES	RES	RES	RES	RES	RES
	0Bh	SD_RES_2	UNSIGNED8	00h	Yes	RES	RES	RES	RES	RES	RES	RES	RES
	0Ch	SD_RES_3	UNSIGNED8	00h	Yes	RES	RES	RES	RES	RES	RES	RES	RES
	0Dh	SD_RES_4	UNSIGNED8	00h	Yes	RES	RES	RES	RES	RES	RES	RES	RES
	0Eh	SD_RES_5	UNSIGNED8	00h	Yes	RES	RES	RES	RES	RES	RES	RES	RES
	0Fh	SD_D33D40	UNSIGNED8	00h	Yes	D40	D39	D38	D37	D36	D35	D34	D33
	10h	SD_D41D48	UNSIGNED8	00h	Yes	D48	D47	D46	D45	D44	D43	D42	D41

tab.9 System digits error mode entry

Index
Back

7.1.6 TPDO2: Analogue commands

This PDO enables the transfer of information concerning:
- main analogue commands (A1…A8)

The mapping of commands included in the PDO is described in tab.10.
Analogue commands may take on values between 00h and FFh with 1-bit resolution.

	MSB			Content (bit)				LSB	
Byte	7	6	5	4	3	2	1	0	Description
0	A1								Analogue command
1	A2								Analogue command
2	A3								Analogue command
3	A4								Analogue command
4	A5								Analogue command
5	A6								Analogue command
6	A7								Analogue command
7	A8								Analogue command

tab.10 Map of commands related to TPDO2

OD entries involved in the conditioning of analogue signals transferred with TPDO 2 are shown in fig.4.
Mapping of the data contained in TPDO2 is static and is described by the 1A01h dictionary entries.
When an error condition (such as radio link failure due to user intervention ”active emergency” or to a recovery time-out “passive emergency”) is detected during signal processing, the value taken on by the analogue outputs may:
- assume a pre-defined default value
- retain the value taken on at the time the error occurred

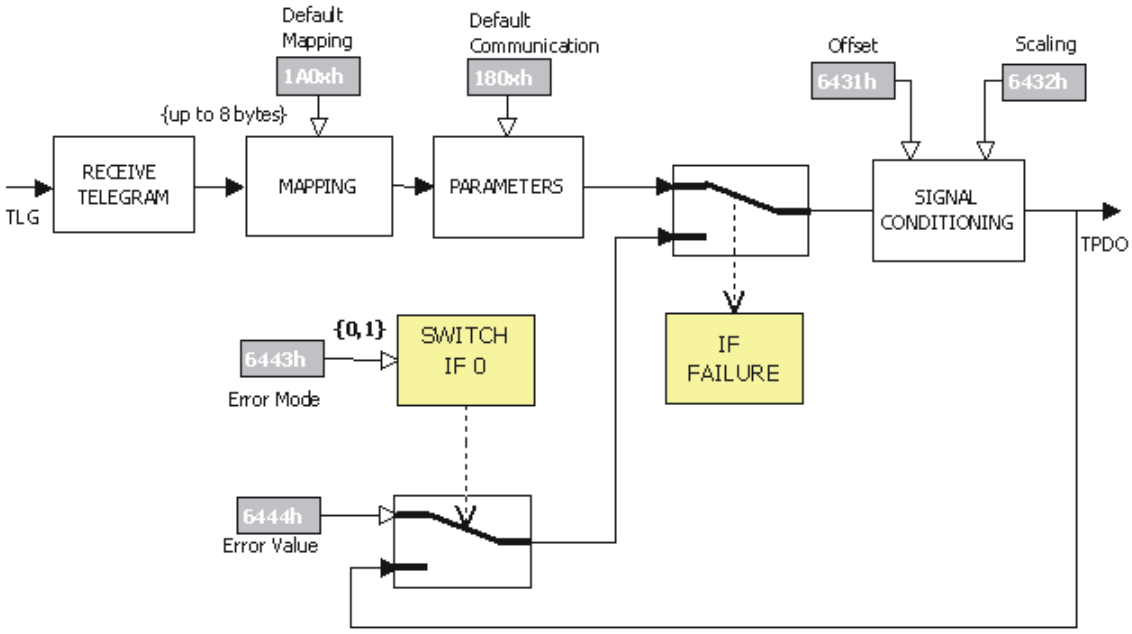


fig.4 Conditioning of values contained in TPDO2

This behaviour is determined by dictionary entries 6443h, 6444h.
Entries 6431h and 6432h may be used to condition the value of the signal sent over the CAN network changing its width and offset.
Entry 2020h may be used to condition analogue outputs so that they will only be active when the corresponding directions are also active.

The configuration of the sub-indexes of OD entry 6443h determines whether the value defined in 6444h must be taken on in the event of an error (bit set to “1”), or the value present before the error occurred should be retained (bit set to “0”).

Name	**Analog Error Mode**					
Index	Subindex	Name	Type	Default	Editable	Analogue command
6443h	00h	Number of subindex	UNSIGNED8	10h	No	
	01h	EM_A1	UNSIGNED8	01h	Yes	A1 (TPDO2)
	02h	EM_A2	UNSIGNED8	01h	Yes	A2 (TPDO2)
	03h	EM_A3	UNSIGNED8	01h	Yes	A3 (TPDO2)
	04h	EM_A4	UNSIGNED8	01h	Yes	A4 (TPDO2)
	05h	EM_A5	UNSIGNED8	01h	Yes	A5 (TPDO2)
	06h	EM_A6	UNSIGNED8	01h	Yes	A6 (TPDO2)
	07h	EM_A7	UNSIGNED8	01h	Yes	A7 (TPDO2)
	08h	EM_A8	UNSIGNED8	01h	Yes	A8 (TPDO2)
	09h	EM_A9	UNSIGNED8	00h	Yes	A9 (TPDO3)
	0Ah	EM_A10	UNSIGNED8	00h	Yes	A10 (TPDO3)
	0Bh	EM_A11	UNSIGNED8	00h	Yes	A11 (TPDO3)
	0Ch	EM_A12	UNSIGNED8	00h	Yes	A12 (TPDO3)
	0Dh	EM_RES13	UNSIGNED8	00h	Yes	RESERVED (TPDO3)
	0Eh	EM_RES14	UNSIGNED8	00h	Yes	RESERVED (TPDO3)
	0Fh	EM_RES15	UNSIGNED8	00h	Yes	RESERVED (TPDO3)
	10h	EM_RES16	UNSIGNED8	00h	Yes	RESERVED (TPDO3)

tab.11 Error mode analogic entry

Default values to be taken on in the event of an error (6443h with value 01h) are defined by entry 6444h.

Name	**Analog Error Value**					
Index	Subindex	Name	Type	Default	Editable	Analogue command
6444h	00h	Number of subindex	UNSIGNED8	00000080h	No	
	01h	EV_A1	INTEGER32	00000080h	Yes	A1 (TPDO2)
	02h	EV_A2	INTEGER32	00000080h	Yes	A2 (TPDO2)
	03h	EV_A3	INTEGER32	00000080h	Yes	A3 (TPDO2)
	04h	EV_A4	INTEGER32	00000080h	Yes	A4 (TPDO2)
	05h	EV_A5	INTEGER32	00000080h	Yes	A5 (TPDO2)
	06h	EV_A6	INTEGER32	00000080h	Yes	A6 (TPDO2)
	07h	EV_A7	INTEGER32	00000080h	Yes	A7 (TPDO2)
	08h	EV_A8	INTEGER32	00000080h	Yes	A8 (TPDO2)
	09h	EV_A9	INTEGER32	00000000h	Yes	A9 (TPDO3)
	0Ah	EV_A10	INTEGER32	00000000h	Yes	A10 (TPDO3)
	0Bh	EV_A11	INTEGER32	00000000h	Yes	A11 (TPDO3)
	0Ch	EV_A12	INTEGER32	00000000h	Yes	A12 (TPDO3)
	0Dh	EV_RES13	INTEGER32	00000000h	Yes	RESERVED (TPDO3)
	0Eh	EV_RES14	INTEGER32	00000000h	Yes	RESERVED (TPDO3)
	0Fh	EV_RES15	INTEGER32	00000000h	Yes	RESERVED (TPDO3)
	10h	EV_RES16	INTEGER32	00000000h	Yes	RESERVED (TPDO3)

tab.12 Error value analogic entry

Index
Back

Entries 6431h (Offset) and 6432h (Scale) may be used to condition the values of fields A1…A12 in terms of offset of analogue values and scale to be applied.

Name	**Analog Offset**					
Index	Subindex	Name	Type	Default	Editable	Analogue command
6431h	00h	Number of subindex	UNSIGNED8	10h	No	
	01h	OFS_A1	INTEGER32	0000000h	Yes	A1 (TPDO2)
	02h	OFS _A2	INTEGER32	0000000h	Yes	A2 (TPDO2)
	03h	OFS _A3	INTEGER32	0000000h	Yes	A3 (TPDO2)
	04h	OFS _A4	INTEGER32	0000000h	Yes	A4 (TPDO2)
	05h	OFS _A5	INTEGER32	0000000h	Yes	A5 (TPDO2)
	06h	OFS _A6	INTEGER32	0000000h	Yes	A6 (TPDO2)
	07h	OFS _A7	INTEGER32	0000000h	Yes	A7 (TPDO2)
	08h	OFS _A8	INTEGER32	0000000h	Yes	A8 (TPDO2)
	09h	OFS _A9	INTEGER32	0000000h	Yes	A9 (TPDO3)
	0Ah	OFS _A10	INTEGER32	0000000h	Yes	A10 (TPDO3)
	0Bh	OFS _A11	INTEGER32	0000000h	Yes	A11 (TPDO3)
	0Ch	OFS _A12	INTEGER32	0000000h	Yes	A12 (TPDO3)
	0Dh	OFS _RES13	INTEGER32	0000000h	Yes	RESERVED (TPDO3)
	0Eh	OFS _RES14	INTEGER32	0000000h	Yes	RESERVED (TPDO3)
	0Fh	OFS _RES15	INTEGER32	0000000h	Yes	RESERVED (TPDO3)
	10h	OFS _RES16	INTEGER32	0000000h	Yes	RESERVED (TPDO3)

tab.13 Analog offset entry

Name	**Analog Scale**					
Index	Subindex	Name	Type	Default	Editable	Analogue command
6432h	00h	Number of subindex	UNSIGNED8	10h	No	
	01h	SCA_A1	INTEGER32	0000400h	Yes	A1 (TPDO2)
	02h	SCA_A2	INTEGER32	0000400h	Yes	A2 (TPDO2)
	03h	SCA_A3	INTEGER32	0000400h	Yes	A3 (TPDO2)
	04h	SCA_A4	INTEGER32	0000400h	Yes	A4 (TPDO2)
	05h	SCA_A5	INTEGER32	0000400h	Yes	A5 (TPDO2)
	06h	SCA_A6	INTEGER32	0000400h	Yes	A6 (TPDO2)
	07h	SCA_A7	INTEGER32	0000400h	Yes	A7 (TPDO2)
	08h	SCA_A8	INTEGER32	0000400h	Yes	A8 (TPDO2)
	09h	SCA_A9	INTEGER32	0000400h	Yes	A9 (TPDO3)
	0Ah	SCA_A10	INTEGER32	0000400h	Yes	A10 (TPDO3)
	0Bh	SCA_A11	INTEGER32	0000400h	Yes	A11 (TPDO3)
	0Ch	SCA_A12	INTEGER32	0000400h	Yes	A12 (TPDO3)
	0Dh	SCA_RES13	INTEGER32	0000400h	Yes	RESERVED (TPDO3)
	0Eh	SCA_RES14	INTEGER32	0000400h	Yes	RESERVED (TPDO3)
	0Fh	SCA_RES15	INTEGER32	0000400h	Yes	RESERVED (TPDO3)
	10h	SCA _RES16	INTEGER32	0000400h	Yes	RESERVED (TPDO3)

tab.14 Analog scale entry

Entry 2020h may be used to condition the values of analogue commands if the corresponding directions are present (i.e. H1 or L1 for A1); if the direction associated to the analogue command is not active, the default value is taken on.

Name	**UMWD Mode**					
Index	Subindex	Name	Type	Default	Editable	Analogue command
2020h	00h	Number of subindex	UNSIGNED8	10h	No	
	01h	UM_A1	UNSIGNED8	00h	Yes	A1 (TPDO2)
	02h	UM_A2	UNSIGNED8	00h	Yes	A2 (TPDO2)
	03h	UM_A3	UNSIGNED8	00h	Yes	A3 (TPDO2)
	04h	UM_A4	UNSIGNED8	00h	Yes	A4 (TPDO2)
	05h	UM_A5	UNSIGNED8	00h	Yes	A5 (TPDO2)
	06h	UM_A6	UNSIGNED8	00h	Yes	A6 (TPDO2)
	07h	UM_A7	UNSIGNED8	00h	Yes	A7 (TPDO2)
	08h	UM_A8	UNSIGNED8	00h	Yes	A8 (TPDO2)
	09h	UM_A9	UNSIGNED8	00h	Yes	A9 (TPDO3)
	0Ah	UM_A10	UNSIGNED8	00h	Yes	A10 (TPDO3)
	0Bh	UM_A11	UNSIGNED8	00h	Yes	A11 (TPDO3)
	0Ch	UM_A12	UNSIGNED8	00h	Yes	A12 (TPDO3)
	0Dh	UM_RES13	UNSIGNED8	00h	Yes	RESERVED (TPDO3)
	0Eh	UM_RES14	UNSIGNED8	00h	Yes	RESERVED (TPDO3)
	0Fh	UM_RES15	UNSIGNED8	00h	Yes	RESERVED (TPDO3)
	10h	UM_RES16	UNSIGNED8	00h	Yes	RESERVED (TPDO3)

tab.15 Unintentional movement entry

7.1.7 TPDO3: Auxiliary commands

This PDO enables the transfer of information concerning:
- Values of auxiliary analogue commands (A9…A12)
- Reserved information
- A sub-set of auxiliary on/off commands (D33…D48).

The mapping of commands included in the PDO is described in tab.16.

	MSB			**Content (bit)**				**LSB**	
Byte	7	6	5	4	3	2	1	0	Description
1	**A9**								Auxiliary analogue command
2	**A10**								Auxiliary analogue command
3	**A11**								Auxiliary analogue command
4	**A12**								Auxiliary analogue command
5	**Reserved**								Reserved
6	**Reserved**								Reserved
7	**D40**	**D39**	**D38**	**D37**	**D36**	**D35**	**D34**	**D33**	Auxiliary digital commands
8	**D48**	**D47**	**D46**	**D45**	**D44**	**D43**	**D42**	**D41**	Auxiliary digital commands

tab.16 Map of commands related to TPDO3

Analogue commands are conditioned as shown in fig.4 (see 6432h, 6443h, 6444h).
Analogue commands A9-12 may be conditioned by entry 2020h (see tab.15).
Auxiliary digital commands are conditioned as shown in fig.3 (see 6206h, 6207h).

Index
Back

7.2 Receiving Process Data Object (RPDO)

The PDOs that may be received have the communication parameters (Index: 1400h + i, with i = 0,1) specified in the OD.

Name	Receive PDO Communication parameter				
Index	Subindex	Name	Type	Default	Editable
1400h 1401h	00h	Number of subindex	UNSIGNED8	05h	No
	01h	COB ID	UNSIGNED32	see tab.18	Yes
	02h	Transmission Type	UNSIGNED8	255	Yes

tab.17 Communication parameters for PDO i-th (i=0,1) received

Index	Sub-index	Name	Default value
1400h	1	COB-ID	00000200h + Node ID
1401h	1	COB-ID	00000300h + Node ID

tab.18 Default COB-IDs used by received PDOs

7.2.1 RPDO1: Strings

Related examples:
- String acquisition

RPDO1 enables the transfer of alphanumeric information to the TU.
The configuration of the display unit on the TU supports up to eight strings; strings are arranged on the display according to the pattern shown in fig.5.
Each string holds up to 8 alphanumeric characters with ASCII codes from 20h to 7Fh. Strings longer than 8 characters (e.g. 16 characters) may be displayed by joining two 8-character strings.

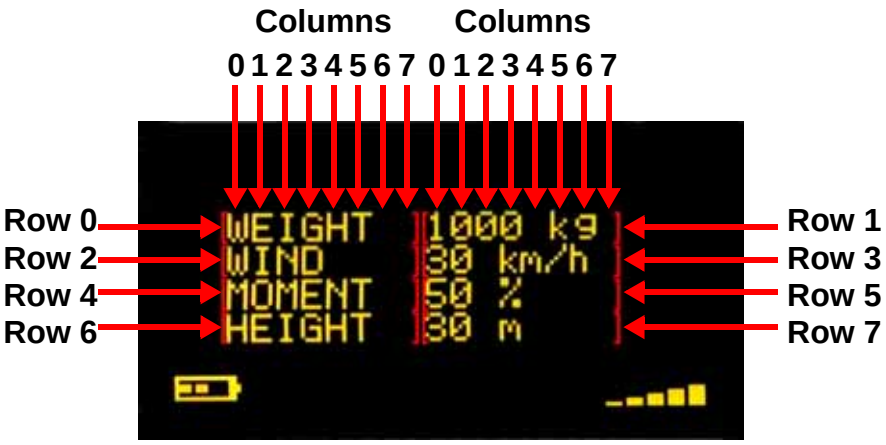


fig.5 Regions of alphanumeric display available on TU

The information to be shown on the display may be transmitted over the CAN interface by sending RPDO1.
Strings are addressed using row coordinates (first character, high nibble) and column coordinates (first character, low nibble). This means valid values for field “Row” range from 0 to 7. Valid values for the column field range from 0 to 7.
The number of characters to be transferred is specified in field “Number of characters” and may take on valid values if it is between 0 and 6.

Strings with 8 characters are therefore obtained when at least 2 RPDO1s are sent.

	MSB			Content (bit)				LSB	
Byte	7	6	5	4	3	2	1	0	Description
1	Row				Column				Write coordinates
2	Number of characters								Number of characters transferred
3	Character								Data
4	Character								Data
5	Character								Data
6	Character								Data
7	Character								Data
8	Character								Data

tab.19 Map of data transferred by RPDO1

7.2.2 RPDO2: Signals

Related examples:
- Acquisition of primary and secondary indications
- Acquisition of extensive indications

RPDO2 enables the transfer of indication information to the TU.
If the TU has a display, information is displayed by appropriate icons turning on; otherwise, the TU may be equipped with LED indicators.
The configuration of the display unit available on the TU supports up to 16 different indications, 8 of which can be displayed at the same time. These are called “basic indications”.
The “basic indications” may be grouped in two classes according to display priority:
- primary or main indications (P1-8)
- secondary indications (S1-8)

Arrangement of the “basic indications” on the display is shown in fig.6.
(The icons shown are just an example).

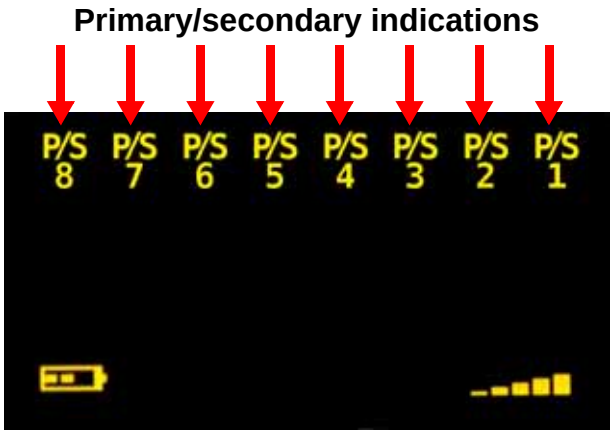


fig.6 Display regions dedicated to indications available on TU

Other 16 generic indications, displayed through LEDs, may be transferred; these are called “extensive indications”: E1-16.

It is possible to manage up to 32 indications in total.
An indication is regarded as present and active when the bit that represents it takes on value ‘1’; conversely, the indication is considered as missing when the value of its bit is '0'.

	MSB			Content (bit)				LSB	
Byte	7	6	5	4	3	2	1	0	Description
0	P1	P2	P3	P4	P5	P6	P7	P8	Primary indications
1	S1	S2	S3	S4	S5	S6	S7	S8	Secondary indications
2	E1	E2	E3	E4	E5	E6	E7	E8	Extensive indications
3	E9	E10	E11	E12	E13	E14	E15	E16	Extensive indications
4	Reserved								Reserved
5	Reserved								Reserved
6	Reserved								Reserved
7	Reserved								Reserved

tab.20 Map of data transferred by RPDO2

8 Network Management (NMT) service

Related examples:
- Reception of NMT commands

Distributed systems require a service for node configuration, initialisation and control. In CANopen, such service is offered by the NMT master; all NMT slave nodes must implement a pre-defined state machine that can be controlled by the Master node.
The NMT master controls the state of all NMT slaves in the network.
The RU implements the state machine shown in figure fig.7.

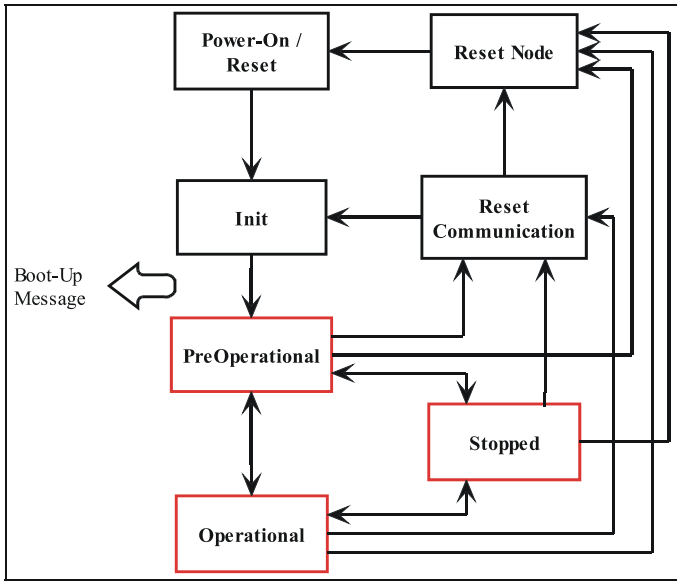


fig.7 Node states

Affected dictionary objects are as follows:

Name	NMT startup			
Index	Subindex	Type	Default	Editable
1F80h	00h	UNSIGNED8	00000000h	Yes

The node can be automatically brought into Operational state (Bit2: 0) or into Pre-Operational state (Bit2:1) after a boot-up procedure. Only bit 2 of entry 1F80h is considered and can be changed.

Bit	Description
0	**0**: The RU is not a Master node 1: The RU is a Master node
1	**0**: Starts only indicated nodes 1: Starts all nodes. (If bit 3 equals 1, then this bit is ignored)
2	**0**: Node automatically enters Operational state after a reset 1: After “Power-On/Reset”, node remains in Pre-Operational state
3	**0**: NMT master node can start all nodes automatically 1: NMT master node does not start all nodes automatically (see Bit 0)
4	**0**: If any errors are present at a node (heartbeat/node guarding), only the faulty node is managed 1: If any errors are present at a node (heartbeat/node guarding), all nodes are reset (if bit 6 is ignored)
5	**0**: NMT master node does not take part in Flying Master procedure 1: NMT master node takes part in Flying Master procedure
6	**0**: see bit 4 1: Bit 4 must be ignored and if an error is present at a node, all nodes in the network are reset.
7-31	Reserved; always at **0**

tab.21 Bit meaning of entry “NMT startup”

Index
Back

After Power-On and an internal initialisation stage, the NMT master node automatically brings every slave node into Pre-Operational state. In this state, each slave node can be configured by the SDO service, but cannot transmit any PDOs. NMT master can either bring all nodes (Byte 2 at 00h) into Operational state at the same time, or do so individually (Byte 2 equals node ID to which command is addressed). In the Operational state, all Communication Objects are active.
Nodes can be brought into Stopped state, so that transmission of PDO and SDO messages is terminated.
Listed in the following table are the messages allowed in the different NMT states:

Message	Init	PreOperational	Operational	Stopped
Boot-up	x			
PDO			x	
NMT		x	x	x
SRDO			x	
SDO		x	x	
SYNC		x	x	
EMERGENCY		x	x	

tab.22 Messages permitted in the different states

9 Emergency Objects

Related examples:
- Indication “Overcurrent”

Emergency Objects are sent over the CAN network with a standardised 8-byte high-prior message when any error conditions occur.

	MSB			Content (bit)				LSB	
Byte	7	6	5	4	3	2	1	0	Description
0	**EEC (LSB)**								see tab.23.
1	**EEC (MSB)**								
2	**Error Register**								Object 1001h in the OD
3	**Manufacturer Specific Error Field**								
4									
5									
6									
7									

Important: when the event occurs, a single-shot transmission of the Emergency Object takes place; there are no repeat messages if the event that triggered message transmission persists.
If the cause for the event is removed, an emergency-over message is sent (EEC=0000h).
The list of possible EECs that can be returned is provided below:

Emergency Error Code	Description
8110h	CAN overrun (Objects lost)
8120h	CAN in Error Passive Mode
8130h	Life Guard Error or Heartbeat Error
8140h	Recovered from bus off
8150h	Transmit COB-ID collision
8210h	PDO not processed due to length error
8220h	PDO length exceeded
0000h	Error Reset or No Error
1000h	Generic Error
2000h	Current
2100h	Current, device input side
2200h	Current inside the device
2300h	Current, device output side
2310h	DS-401:Current at outputs too high (overload)
2320h	DS-401:Short circuit at outputs
2330h	DS-401:Load dump at outputs
3000h	Voltage
3100h	Mains Voltage
3110h	DS-401:Input voltage too high
3120h	DS-401:Input voltage too low
3200h	Voltage inside the device
3210h	DS-401:Internal voltage too high
3220h	DS-401:Internal voltage too low
3300h	Output Voltage
3310h	DS-401:Output voltage too high
3320h	DS-401:Output voltage too low
4000h	Temperature
4100h	Ambient Temperature

Index
Back

Emergency Error Code	Description
4200h	Device Temperature
5000h	Device Hardware
6000h	Device Software
6100h	Internal Software
6200h	User Software
6300h	Data Set
7000h	Additional Modules
8000h	Monitoring
8100h	Communication
8200h	Protocol Error
9000h	External Error
F000h	Additional Functions
FF00h	Device specific

Field “Error Register” ER reports the class of the errors occurred in the RU. The values of bits belonging to field ER are listed below (value “1” at a specific bit indicates that an error belonging to that class has occurred):

Bit of Error Register field	Description
0	Generic Error
1	Current
2	Voltage
3	Temperature
4	Communication error
5	Device profile Defined Error
6	Reserved (always at 0)
7	Manufacturer Specific Error

The content of this byte is repeated in the OD at entry 1001h.

Field “Manufacturer Specific Error Field” (MSEF) contains information specific to that problem. A list with some values taken on by field MSEF is provided by way of example.

EEC	ER	MSEF
2310h	32h	Current overload at output I1
	33h	Current overload at output I2
	34h	Current overload at output I3
4200h	36h	RU temperature exceeded an alarm threshold
3210h	30h	Supply voltage over specified maximum threshold
3220h	31h	Supply voltage below specified minimum threshold
5000h	35h	RU was not configured correctly

10 Bit rate

Related examples:
- Changing the bit rate

All CAN network nodes must have the same bit rate. Values that can be configured in the RU are listed below:

	Bit rate [kbit/s]	Index OD 2000h	Maximum network length (approximately) [m]
	1000	0	30
	800	1	50
	500	2	100
Default value	250	3	250
	125	4	500
	100	5	600
	50	6	1000
	20	7	2500
	10	8	5000

tab.23 Configurable bit rates

Affected dictionary objects are as follows:

Name	Bit rate			
Index	Subindex	Type	Default	Editable
2000h	00h	UNSIGNED8	03h	Yes

Please consider that bit rate selection is strictly dependent on overall network length.
Network bit rate may be changed using the SDO service.

Important: Timeout configuration (“cycle timer”), such as the “Event Timer” of communication parameters 1800h,1801h,1802h, must take into account the time delays introduced by data transmission through serial protocol. Specifically, time settings must be such that:

Bit rate [Kbit/s]	1000	800	500	250	125	100	50	20	10
“Event Timer” (1800h,1801h,1802h) [ms]	-	-	-	> 1	> 2	> 3	> 4	> 8	> 14

tab.24 Minimum “Event Timer” settings according to bit rate

Index
Back

11 Node ID

Related examples:
- Changing Node ID

All CAN network nodes must be identified by a unique node identifier.
The range of values that can be configured in the RU is 1-127.

	Node ID
	1
	2
	....
	9
Default value	10
	11
	....
	126
	127

tab.25 Configurable bit rates

Affected dictionary objects are as follows:

Name	**Node ID**			
Index	Sub-index	Type	Default	Editable
2001h	00h	UNSIGNED8	0Ah	Yes

Please consider that Node ID selection is strictly dependent on the network the RU is incorporated into.
Node ID may be changed using the SDO service.

Important: changing Node ID value entails changing all node identifiers that depend on it.

12 Light signals

LED indications associated with communication with the CANopen standard use two distinct LEDs; nomenclature - according to [1] - is as follows:
- **ERROR LED**: red LED
- **RUN LED** green LED.

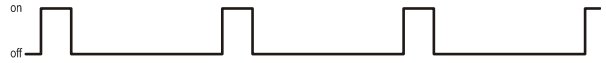
Possible states of LED indicators are as follows:

LED state	Description
On	LED constantly on
Switched off	LED constantly off
Flickering[a]	Sequence: one flash (approximately 50 ms) and an off phase (approximately 50 ms) (10 Hz).
Blinking	Sequence: one flash (approximately 200 ms) and an off phase (approximately 200 ms) (2.5 Hz).
Single flash	Sequence: one flash (approximately 200 ms) and an off phase (approximately 1 s).
Double flash	Sequence: two flashes (approximately 200 ms) separated by an off phase (approximately 200 ms). The sequence ends with an off phase (approximately 1 s).
Triple flash	Sequence: three flashes (approximately 200 ms) separated by an off phase (approximately 200 ms). The sequence ends with an off phase (approximately 1 s).
Quadruple flash[a]	Sequence: four flashes (approximately 200 ms) separated by an off phase (approximately 200 ms). The sequence ends with an off phase (approximately 1 s).

a. These indications are allowed by the standard, but the device does not provide them currently.

12.1 ERR LED

The red LED shall indicate the status of the CAN bus physical layer and errors due to incorrect configurations.

State	Description	Corrective action
Switched off	No operating problems	None, this is the correct working condition.
Flickering	CAN communication is not available: configuration through the LSS  services is in progress (ERR and RUN LEDs blink alternatively)	
Blinking	RU configuration errors 	RU reset
Single flash	At least one of the frame error counters has reached the warning level 	This condition is not harmful, it may be resolved with an RU reset.
Double flash	A “guard event” or a “heartbeat event” has occurred 	RU reset and network configuration check
Triple flash	A SYNC message was not received within the set time 	RU reset and network configuration check
On	The CAN controller is bus off	Indicates a severe malfunction; RU reset and network configuration check

12.2 RUN LED

The green LED shall indicate the status of the application layer (CANopen node).

Index
Back

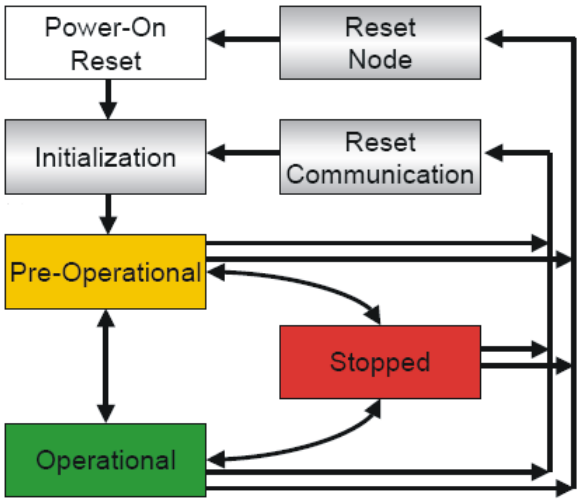


fig.8 Node state

State	Description	Associated CANopen stack state
Switched off	RU is off or resetting	Power-On Reset, Reset Node Reset Communication Initialization
Flickering	The RU does not send commands in the CAN network: configuration through LSS services is in progress 	
Blinking	The RU is in PREOPERATIONAL state 	Pre-Operational
Single flash	The RU is in STOPPED state 	Stopped
On	The RU is in OPERATIONAL state	Operational

13 Examples

13.1 Changing COB-ID

Let us consider an example configuration where RU is Node ID 10 and the COB-ID of TPDO 1 is 180h + Node ID = 18Ah. Let us assume that COB-ID needs to be changed to 18Ch.
The SDO message to be sent is:

Direction	**COB-ID**	**Byte**							
To device	**600h + Node ID**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Client → Server	60Ah	23	00	18	01	8C	01	00	40

The RU obtains the following confirmation message:

Direction	**COB-ID**	**Byte**							
From device	**580h + Node ID**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Server → Client	58Ah	60	00	18	01	00	00	00	00

Once the OD entry has been changed, the node must perform a reset (Reset/Cycle Power or “Communication Reset”) before the change takes effect.

13.2 Disabling TPDO transmission

Let us assume that TPDO3 transmission from RU to CAN network needs to be disabled. This is done as follows: simply obtain write access to the COB-ID field of TPDO3 and write value C0000000h in the related location.
The SDO message to be sent is:

Direction	**COB-ID**	**Byte**							
To device	**600h + Node ID**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Client → Server	60Ah	23	02	18	01	00	00	00	C0

The RU obtains the following confirmation message:

Direction	**COB-ID**	**Byte**							
From device	**580h + Node ID**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Server → Client	58Ah	60	02	18	01	00	00	00	00

Once the OD entry has been changed, the node must perform a reset (Reset/Cycle Power or “Communication Reset”) before the change takes effect.

13.3 Disabling “Inhibit Time”

Let us assume that the Inhibit Time function needs to be disabled for TPDO3; If communication parameters specify a 50-ms Event Timer, what happens is the TPDO is sent over the CANopen network no less than every 50 ms. This is done as follows: simply obtain write access to the Inhibit Time field of TPDO3 and write value 0000h in the related location.
The SDO message to be sent is:

Direction	**COB-ID**	**Byte**							
To device	**600h + Node ID**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Client → Server	60Ah	2B	02	18	03	00	00	00	00

Index
Back

The RU obtains the following confirmation message:

Direction	COB-ID	Byte							
From device	**580h + Node ID**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Server → Client	58Ah	60	02	18	03	00	00	00	00

13.4 Setting “Event Timer”

Let us assume that TPDO3 needs to be sent over the network with a frequency of 100 ms.
This is done as follows: simply obtain write access to the Event Timer field of TPDO3 and write value 0064h in the related location.
The SDO message to be sent is:

Direction	COB-ID	Byte							
To device	**600h + Node ID**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Client → Server	60Ah	2B	02	18	05	64	00	00	00

The RU obtains the following confirmation message:

Direction	COB-ID	Byte							
From device	**580h + Node ID**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Server → Client	58Ah	60	02	18	05	00	00	00	00

13.5 String acquisition

Let us assume that a string “Weight 1000 kg ” needs to be displayed in row 0 and row 1, as shown in fig.9.

fig.9 Example of two 8-character rows display

It is obtained from 4 RPDO1 messages listed below:
- the first two RPDO1s complete row 0:

ROW 0		Byte							
Direction	**COB-ID**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
To device	200h + Node ID	00	06	57	65	69	67	68	74
“	“	06	02	20	20	00	00	00	00

- the following two RPDO1s complete row 1:

ROW 1		Byte							
Direction	**COB-ID**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
To device	200h + Node ID	10	06	31	30	30	30	20	6B
“	“	16	02	67	20	00	00	00	00

TU only updates the displayed string after a single string (row 0 or row 1) is completed.

Index
Back

Final result is shown in fig.9.

13.6 Acquisition of primary and secondary indications

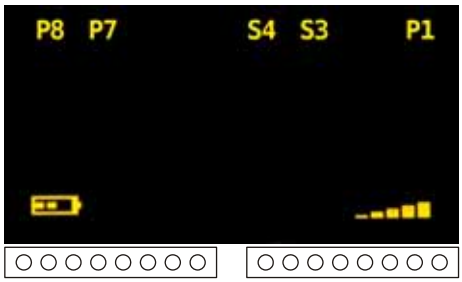
The following examples refer to a condition in which a pre-existing primary indication is followed by a secondary indication; the latter will be displayed after the primary indication disappears.

		Byte							
Direction	**COB ID**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
To device	300h + Node ID	83	30	00	00	00	00	00	00

Exchanged data causes three primary indications (P1, P7 and P8) and two secondary indications (S3 and S4) to be displayed.

Note how the display of primary alarms may co-exist with the display of secondary indications.

Byte	MSB			bit				LSB
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	1	0	0	0	0	0	1	1
1	0	0	1	1	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0

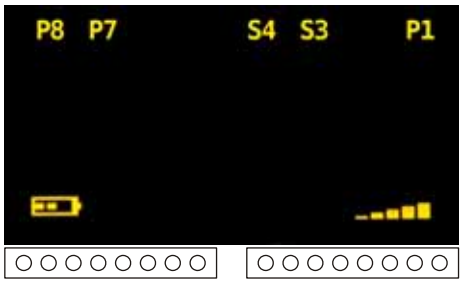


The following message adds a secondary indication (overlapped with indication 1) to the preceding indications

		Byte							
Direction	**COB ID**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
To device	300h + Node ID	83	B0	00	00	00	00	00	00

The co-existence of primary and secondary indications on the same bit (see Bit 7 – Byte 0 and Byte 1) is resolved at the display stage according to the higher priority assigned to primary indications.

Byte	MSB			bit				LSB
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	1	0	0	0	0	0	1	1
1	1	0	1	1	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0



Overlap of primary and secondary indications

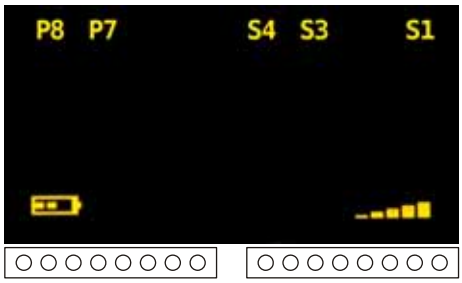
The following message removes a primary indication (with pre-existing secondary indication in 1)

		Byte							
Direction	**COB ID**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
To device	300h + Node ID	03	B0	00	00	00	00	00	00

Index
Back

If the primary indication is deactivated (Bit 7 – Byte 0), the secondary indication (Bit 7 – Byte 1), if still present, will be displayed.

Byte	MSB			bit				LSB
	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	1	1
1	1	0	1	1	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0

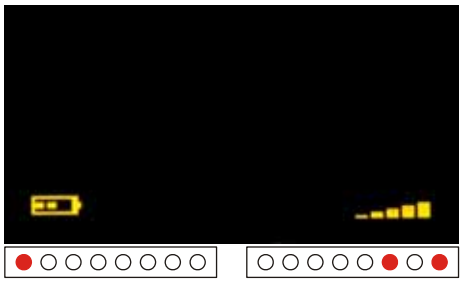


Display of a pre-existing secondary indication after the primary indication disappears.

13.7 Acquisition of extensive indications

In the following example, indications E1 (Bit 7 – Byte 2), E3 (Bit 5 – Byte 2) and E16 (Bit 0 – Byte 3) are displayed.

Byte	MSB			bit				LSB
	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
2	1	0	1	0	0	0	0	0
3	0	0	0	0	0	0	0	1
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0



13.8 Reception of NMT commands

Let us assume that the following NMT commands need to be sent to Node ID 10 of the network:

Direction	COB-ID	Byte	
To device		1	2
	000h	01	0A

On receipt of this command, node 0Ah enters Operational state

Direction	COB-ID	Byte	
To device		1	2
	000h	80	0A

On receipt of this command, node 0Ah enters Pre-Operational state

Direction	COB-ID	Byte	
To device		1	2
	000h	02	0A

On receipt of this command, node 0Ah enters Stopped state

Direction	COB-ID	Byte	
To device		1	2
	000h	81	0A

On receipt of this command, node 0Ah performs a Node Reset

Direction	COB-ID	Byte	
To device		1	2
	000h	82	0A

On receipt of this command, node 0Ah performs a Communication Reset

Index
Back

13.9 Indication “Overcurrent”

Let us assume that a voltage exceeding the specified maximum limit is fed to the receiver.
The following error message is generated:

Direction	COB-ID	Byte							
From device	**80h + Node ID**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Server → Client	8Ah	10	32	00	30	01	00	00	00

Let us assume that voltage falls back within the specified limits; the following message is sent:

Direction	COB-ID	Byte							
From device	**80h + Node ID**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Server → Client	8Ah	00	00	00	30	00	00	00	00

13.10 Changing the bit rate

Let us assume that the bit rate of a node with Node ID 10 needs to be changed from 250 kbit/s to 125 kbit/s (value of OD index 2000h = 4).
The SDO message to be sent is:

Direction	COB-ID	Byte							
To device	**600h + Node ID**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Client → Server	60Ah	2F	00	20	00	04	00	00	00

The RU obtains the following confirmation message:

Direction	COB-ID	Byte							
From device	**580h + Node ID**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Server → Client	58Ah	60	00	20	00	00	00	00	00

The change is stored in the non-volatile memory and will only take effect after a node or communication reset.

13.11 Changing Node ID

Let us assume that Node ID needs to be changed from 10 to 80 (from 0Ah to 50h in hexadecimal).
The SDO message to be sent is:

Direction	COB-ID	Byte							
To device	**600h + Node ID**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Client → Server	60Ah	2F	01	20	00	50	00	00	00

The RU obtains the following confirmation message:

Direction	COB-ID	Byte							
From device	**580h + Node ID**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Server → Client	58Ah	60	01	20	00	00	00	00	00

The change is stored in the non-volatile memory and will only take effect after a node or communication reset.

Index
Back

14 Appendix A: Object Dictionary (OD)

Index	Sub index	Object	Name	Type	Access	Default	Notes
1000h		VAR	Device Type	UNSIGNED32	RO	00870191h	
1001h		VAR	Error Register	UNSIGNED8	RO	00h	
1002h		VAR	Manufacturer Status Register	UNSIGNED32	RO	00000000h	
1003h		RECORD	Predefined error field				
	1		Standard Error Field	UNSIGNED32	RO	0	
	2		Standard Error Field	UNSIGNED32	RO	0	
	3		Standard Error Field	UNSIGNED32	RO	0	
	4		Standard Error Field	UNSIGNED32	RO	0	
	5		Standard Error Field	UNSIGNED32	RO	0	
	6		Standard Error Field	UNSIGNED32	RO	0	
	7		Standard Error Field	UNSIGNED32	RO	0	
	8		Standard Error Field (first error)	UNSIGNED32	RO	0	
1005h		VAR	SYNC COB ID	UNSIGNED32	RW	00000080h	
1006h		VAR	Communication Cycle Period	UNSIGNED32	RW	00000000h	hundreds of us
1007h		VAR	Synchronous Window Length	UNSIGNED32	RW	00000000h	hundreds of us
1008h			Manufacturer Device Name	VISIBLE STRING	CONST	“C.O. stack”	
1009h			Manufacturer Hardware Version	VISIBLE STRING	CONST	-	
100Ah			Manufacturer Software Version	VISIBLE STRING	CONST	-	
1010h		ARRAY	Store parameters	UNSIGNED8		01h	
	1		Save all parameters	UNSIGNED32	RO	00000002h	
1011h		ARRAY	Restore default parameters	UNSIGNED8		01h	
	1		Restore all default parameters	UNSIGNED32	RW	00000001h	
1014h		VAR	COB-ID EMGY message	UNSIGNED32	RO	00000080h + Node ID	
1015h		VAR	Inhibit Time Emergency	UNSIGNED16	RW	50	hundreds of us
1017h		VAR	Producer heartbeat time	UNSIGNED16	RW	0	Milliseconds
1018h		RECORD	Identity Object		RO	04h	
	1		Vendor ID	UNSIGNED32	RO	000002DFh	
	2		Product Code	UNSIGNED32	RO	00000000h	
	3		Revision number	UNSIGNED32	RO	00010000h	
	4		Serial number	UNSIGNED32	RO	00000000h	
1029h		ARRAY	Error Behaviour	UNSIGNED8		1	
	1		Communication Error	UNSIGNED8	RW	01h	
1200h		RECORD	Server SDO Parameter			02h	
	1		COB-ID Client → Server	UNSIGNED32	RO	00000600h + Node ID	
	2		COB-ID Server → Client	UNSIGNED32	RO	00000580h + Node ID	
1400h		RECORD	Receive PDO communication Parameter		RO	02h	
	1		COB-ID	UNSIGNED32	RO	00000200h + Node ID	
	2		Transmission Type	UNSIGNED8	RO	255	
1401h		RECORD	Receive PDO communication Parameter		RO	02h	
	1		COB-ID	UNSIGNED32	RO	00000300h + Node ID	
	2		Transmission Type	UNSIGNED8	RO	255	
1600h		RECORD	Receive PDO Mapping Parameter			08h	
	1		PDO Mapping Entry	UNSIGNED32	CONST	62000108h	
	2		PDO Mapping Entry	UNSIGNED32	CONST	62000208h	
	3		PDO Mapping Entry	UNSIGNED32	CONST	62000308h	
	4		PDO Mapping Entry	UNSIGNED32	CONST	62000408h	
	5		PDO Mapping Entry	UNSIGNED32	CONST	62000508h	
	6		PDO Mapping Entry	UNSIGNED32	CONST	62000608h	
	7		PDO Mapping Entry	UNSIGNED32	CONST	62000708h	
	8		PDO Mapping Entry	UNSIGNED32	CONST	62000808h	

Index
Back

Index	Sub index	Object	Name	Type	Access	Default	Notes
1601h		RECORD	Receive PDO Mapping Parameter			08h	
	1		PDO Mapping Entry	UNSIGNED32	CONST	62000908h	
	2		PDO Mapping Entry	UNSIGNED32	CONST	62000A08h	
	3		PDO Mapping Entry	UNSIGNED32	CONST	62000B08h	
	4		PDO Mapping Entry	UNSIGNED32	CONST	62000C08h	
	5		PDO Mapping Entry	UNSIGNED32	CONST	00000000h	
	6		PDO Mapping Entry	UNSIGNED32	CONST	00000000h	
	7		PDO Mapping Entry	UNSIGNED32	CONST	00000000h	
	8		PDO Mapping Entry	UNSIGNED32	CONST	00000000h	
1800h		RECORD	Transmit PDO Communication Parameter			05h	
	1		COB-ID	UNSIGNED32	RW	00000180h + Node ID	
	2		Transmission Type	UNSIGNED8	RW	255	
	3		Inhibit Time	UNSIGNED16	RW	300	hundreds of us
	4		Compatibility Entry	UNSIGNED8	-	-	
	5		Event Timer	UNSIGNED16	RW	50	Milliseconds
1801h		RECORD	Transmit PDO Communication Parameter			05h	
	1		COB-ID	UNSIGNED32	RW	00000280h + Node ID	
	2		Transmission Type	UNSIGNED8	RW	255	
	3		Inhibit Time	UNSIGNED16	RW	300	hundreds of us
	4		Compatibility Entry	UNSIGNED8	-	-	
	5		Event Timer	UNSIGNED16	RW	50	Milliseconds
1802h		RECORD	Transmit PDO Communication Parameter			05h	
	1		COB-ID	UNSIGNED32	RW	00000380h + Node ID	
	2		Transmission Type	UNSIGNED8	RW	255	
	3		Inhibit Time	UNSIGNED16	RW	300	hundreds of us
	4		Compatibility Entry	UNSIGNED8	-	-	
	5		Event Timer	UNSIGNED16	RW	50	Milliseconds
1A00h		RECORD	Transmit PDO Mapping Parameter			08h	
	1		PDO Mapping Entry	UNSIGNED32	CONST	60000108h	
	2		PDO Mapping Entry	UNSIGNED32	CONST	60000208h	
	3		PDO Mapping Entry	UNSIGNED32	CONST	60000308h	
	4		PDO Mapping Entry	UNSIGNED32	CONST	60000408h	
	5		PDO Mapping Entry	UNSIGNED32	CONST	60000508h	
	6		PDO Mapping Entry	UNSIGNED32	CONST	60000608h	
	7		PDO Mapping Entry	UNSIGNED32	CONST	60000708h	
	8		PDO Mapping Entry	UNSIGNED32	CONST	60000808h	
1A01h		RECORD	Transmit PDO Mapping Parameter			08h	
	1		PDO Mapping Entry	UNSIGNED32	CONST	64000108h	
	2		PDO Mapping Entry	UNSIGNED32	CONST	64000208h	
	3		PDO Mapping Entry	UNSIGNED32	CONST	64000308h	
	4		PDO Mapping Entry	UNSIGNED32	CONST	64000408h	
	5		PDO Mapping Entry	UNSIGNED32	CONST	64000508h	
	6		PDO Mapping Entry	UNSIGNED32	CONST	64000608h	
	7		PDO Mapping Entry	UNSIGNED32	CONST	64000708h	
	8		PDO Mapping Entry	UNSIGNED32	CONST	64000808h	

Index
Back

Index	Sub index	Object	Name	Type	Access	Default	Notes
1A02h		RECORD	Transmit PDO Mapping Parameter			08h	
	1		PDO Mapping Entry	UNSIGNED32	CONST	64000908h	
	2		PDO Mapping Entry	UNSIGNED32	CONST	64000A08h	
	3		PDO Mapping Entry	UNSIGNED32	CONST	64000B08h	
	4		PDO Mapping Entry	UNSIGNED32	CONST	64000C08h	
	5		PDO Mapping Entry	UNSIGNED32	CONST	64000D08h	
	6		PDO Mapping Entry	UNSIGNED32	CONST	64000E08h	
	7		PDO Mapping Entry	UNSIGNED32	CONST	60000908h	
	8		PDO Mapping Entry	UNSIGNED32	CONST	60000A08h	
1F80h		VAR	NMT startup	UNSIGNED32	RW	00000000h	Bit 2: 0 = operational 1 = pre-operational
2000h		VAR	Bit rate	UNSIGNED8	RW	03h	0 = 1000 kbit / s 1 = 800 kbit / s 2 = 500 kbit/s 3 = 250 kbit / s 4 = 125 kbit/s 5 = 100 kbit/s 6 = 50 kbit/s 7 = 20 kbit/s 8 = 10 kbit/s
2001h		VAR	Node ID	UNSIGNED8	RW	0Ah	
2002h		VAR	Sanity Guard	UNSIGNED8	WO	55h	Allowed values: 55h / AAh
2003h		RECORD	Application Data			08h	
	1		Application Data Field	UNSIGNED16	RO	0000h	
	2		Application Data Field	UNSIGNED16	RO	0000h	
	3		Application Data Field	UNSIGNED16	RO	0000h	
	4		Application Data Field	UNSIGNED16	RO	0000h	
	5		Application Data Field	UNSIGNED16	RO	0000h	
	6		Application Data Field	UNSIGNED16	RO	0000h	
	7		Application Data Field	UNSIGNED16	RO	0000h	
	8		Application Data Field	UNSIGNED16	RO	0000h	
2006h		RECORD	Sys_Digital_Output_Mode			08h	
	1		SD_H1H8	UNSIGNED8	RO	00h	
	2		SD_L1L8	UNSIGNED8	RO	00h	
	3		SD_D1D8	UNSIGNED8	RO	00h	
	4		SD_D9D16	UNSIGNED8	RO	00h	
	5		SD_D17D24	UNSIGNED8	RO	00h	
	6		SD_D25D32	UNSIGNED8	RO	00h	
	7		SD_Info_0	UNSIGNED8	RO	00h	
	8		SD_Info_1	UNSIGNED8	RO	3Ch	
	9		SD_RES_0	UNSIGNED8	RO	00h	
	10		SD_RES_1	UNSIGNED8	RO	00h	
	11		SD_RES_2	UNSIGNED8	RO	00h	
	12		SD_RES_3	UNSIGNED8	RO	00h	
	13		SD_RES_4	UNSIGNED8	RO	00h	
	14		SD_RES_5	UNSIGNED8	RO	00h	
	15		SD_D33D40	UNSIGNED8	RO	00h	
	16		SD_D41D48	UNSIGNED8	RO	00h	
2010h		VAR	Frame Type	UNSIGNED8	RO	00h	

Index
Back

Index	Sub index	Object	Name	Type	Access	Default	Notes	
2020h		RECORD	UMWD Mode			16	Low[a]	High[a]
	1		UMWD_A1	UNSIGNED8	RW	00h	L1	H1
	2		UMWD_A2	UNSIGNED8	RW	00h	L2	H2
	3		UMWD_A3	UNSIGNED8	RW	00h	L3	H3
	4		UMWD _A4	UNSIGNED8	RW	00h	L4	H4
	5		UMWD_A5	UNSIGNED8	RW	00h	L5	H5
	6		UMWD_A6	UNSIGNED8	RW	00h	L6	H6
	7		UMWD_A7	UNSIGNED8	RW	00h	L7	H7
	8		UMWD_A8	UNSIGNED8	RW	00h	L8	H8
	9		UMWD_A9	UNSIGNED8	RW	00h	D26	D25
	10		UMWD_A10	UNSIGNED8	RW	00h	D28	D27
	11		UMWD_A11	UNSIGNED8	RW	00h	D30	D29
	12		UMWD_A12	UNSIGNED8	RW	00h	D32	D31
	13		UMWD_RES13	UNSIGNED8	RW	00h	--	--
	14		UMWD_RES14	UNSIGNED8	RW	00h	--	--
	15		UMWD_RES15	UNSIGNED8	RW	00h	--	--
	16		UMWD_RES16	UNSIGNED8	RW	00h	--	--
2100h		RECORD	Error Status Bits			08h		
	1		Error Status	UNSIGNED8	RO	00h		
	2		Error Status	UNSIGNED8	RO	00h		
	3		Error Status	UNSIGNED8	RO	00h		
	4		Error Status	UNSIGNED8	RO	00h		
	5		Error Status	UNSIGNED8	RO	00h		
	6		Error Status	UNSIGNED8	RO	00h		
	7		Error Status	UNSIGNED8	RO	00h		
	8		Error Status	UNSIGNED8	RO	00h		
2103h		VAR	CO_SYNCounter	UNSIGNED16	RW	00h		
2104h		VAR	CO_SYNCTime	UNSIGNED16	RO	00h		
6000h		RECORD	RRC ON/OFF commands			10		
	1		ON/OFF commands	UNSIGNED8	RO	00h		
	2		ON/OFF commands	UNSIGNED8	RO	00h		
	3		ON/OFF commands	UNSIGNED8	RO	00h		
	4		ON/OFF commands	UNSIGNED8	RO	00h		
	5		ON/OFF commands	UNSIGNED8	RO	00h		
	6		ON/OFF commands	UNSIGNED8	RO	00h		
	7		ON/OFF commands	UNSIGNED8	RO	00h		
	8		ON/OFF commands	UNSIGNED8	RO	00h		
	9		ON/OFF commands	UNSIGNED8	RO	00h		
	10		ON/OFF commands	UNSIGNED8	RO	00h		
6200h		RECORD	RRC Data Feedback			12		
	1		Data Feedback	UNSIGNED8	RWW	00h		
	2		Data Feedback	UNSIGNED8	RWW	00h		
	3		Data Feedback	UNSIGNED8	RWW	00h		
	4		Data Feedback	UNSIGNED8	RWW	00h		
	5		Data Feedback	UNSIGNED8	RWW	00h		
	6		Data Feedback	UNSIGNED8	RWW	00h		
	7		Data Feedback	UNSIGNED8	RWW	00h		
	8		Data Feedback	UNSIGNED8	RWW	00h		
	9		Data Feedback	UNSIGNED8	RWW	00h		
	10		Data Feedback	UNSIGNED8	RWW	00h		
	11		Data Feedback	UNSIGNED8	RWW	00h		
	12		Data Feedback	UNSIGNED8	RWW	00h		

Index
Back

Index	Sub index	Object	Name	Type	Access	Default	Notes
6206h		RECORD	Digital Error Mode			16	
	1		EM_H1H8	UNSIGNED8	RW	FFh	
	2		EM_L1L8	UNSIGNED8	RW	FFh	
	3		EM_D1D8	UNSIGNED8	RW	FFh	
	4		EM_D9D16	UNSIGNED8	RW	FFh	
	5		EM_D17D24	UNSIGNED8	RW	00h	
	6		EM_D25D32	UNSIGNED8	RW	00h	
	7		EM_Info_0	UNSIGNED8	RW	FFh	
	8		EM_Info_1	UNSIGNED8	RW	C3h	
	9		EM_RES_0	UNSIGNED8	RW	FFh	
	10		EM_RES_1	UNSIGNED8	RW	FFh	
	11		EM_RES_2	UNSIGNED8	RW	FFh	
	12		EM_RES_3	UNSIGNED8	RW	FFh	
	13		EM_RES_4	UNSIGNED8	RW	FFh	
	14		EM_RES_5	UNSIGNED8	RW	FFh	
	15		EM_D33D40	UNSIGNED8	RW	00h	
	16		EM_D41D48	UNSIGNED8	RW	00h	
6207h		RECORD	Digital Error Value			16	
	1		EV_H1H8	UNSIGNED8	RW	00h	
	2		EV_L1L8	UNSIGNED8	RW	00h	
	3		EV_D1D8	UNSIGNED8	RW	00h	
	4		EV_D9D16	UNSIGNED8	RW	00h	
	5		EV_D17D24	UNSIGNED8	RW	00h	
	6		EV_D25D32	UNSIGNED8	RW	00h	
	7		EV_Info_0	UNSIGNED8	RW	00h	
	8		EV_Info_1	UNSIGNED8	RW	00h	
	9		EV_RES_0	UNSIGNED8	RW	00h	
	10		EV_RES_1	UNSIGNED8	RW	00h	
	11		EV_RES_2	UNSIGNED8	RW	00h	
	12		EV_RES_3	UNSIGNED8	RW	00h	
	13		EV_RES_4	UNSIGNED8	RW	00h	
	14		EV_RES_5	UNSIGNED8	RW	00h	
	15		EV_D33D40	UNSIGNED8	RW	00h	
	16		EV_D41D48	UNSIGNED8	RW	00h	
6400h		RECORD	RRC Analog commands			16	
	1		Analog commands	UNSIGNED8	RO	00h	
	2		Analog commands	UNSIGNED8	RO	00h	
	3		Analog commands	UNSIGNED8	RO	00h	
	4		Analog commands	UNSIGNED8	RO	00h	
	5		Analog commands	UNSIGNED8	RO	00h	
	6		Analog commands	UNSIGNED8	RO	00h	
	7		Analog commands	UNSIGNED8	RO	00h	
	8		Analog commands	UNSIGNED8	RO	00h	
	9		Analog commands	UNSIGNED8	RO	00h	
	10		Analog commands	UNSIGNED8	RO	00h	
	11		Analog commands	UNSIGNED8	RO	00h	
	12		Analog commands	UNSIGNED8	RO	00h	
	13		Analog commands	UNSIGNED8	RO	00h	
	14		Analog commands	UNSIGNED8	RO	00h	
	15		Analog commands	UNSIGNED8	RO	00h	
	16		Analog commands	UNSIGNED8	RO	00h	

Index
Back

Index	Sub index	Object	Name	Type	Access	Default	Notes
6431h		RECORD	Analog Offset			16	
	1		OFS_A1	INTEGER32	RW	00000000h	
	2		OFS _A2	INTEGER32	RW	00000000h	
	3		OFS _A3	INTEGER32	RW	00000000h	
	4		OFS _A4	INTEGER32	RW	00000000h	
	5		OFS _A5	INTEGER32	RW	00000000h	
	6		OFS _A6	INTEGER32	RW	00000000h	
	7		OFS _A7	INTEGER32	RW	00000000h	
	8		OFS _A8	INTEGER32	RW	00000000h	
	9		OFS _A9	INTEGER32	RW	00000000h	
	10		OFS _A10	INTEGER32	RW	00000000h	
	11		OFS _A11	INTEGER32	RW	00000000h	
	12		OFS _A12	INTEGER32	RW	00000000h	
	13		OFS _RES13	INTEGER32	RW	00000000h	
	14		OFS _RES14	INTEGER32	RW	00000000h	
	15		OFS _RES15	INTEGER32	RW	00000000h	
	16		OFS _RES16	INTEGER32	RW	00000000h	
6432h		RECORD	Analog Scale			16	
	1		SCA_A1	INTEGER32	RW	00000400h	
	2		SCA_A2	INTEGER32	RW	00000400h	
	3		SCA_A3	INTEGER32	RW	00000400h	
	4		SCA_A4	INTEGER32	RW	00000400h	
	5		SCA_A5	INTEGER32	RW	00000400h	
	6		SCA_A6	INTEGER32	RW	00000400h	
	7		SCA_A7	INTEGER32	RW	00000400h	
	8		SCA_A8	INTEGER32	RW	00000400h	
	9		SCA_A9	INTEGER32	RW	00000400h	
	10		SCA_A10	INTEGER32	RW	00000400h	
	11		SCA_A11	INTEGER32	RW	00000400h	
	12		SCA_A12	INTEGER32	RW	00000400h	
	13		SCA_RES13	INTEGER32	RW	00000400h	
	14		SCA_RES14	INTEGER32	RW	00000400h	
	15		SCA_RES15	INTEGER32	RW	00000400h	
	16		SCA _RES16	INTEGER32	RW	00000400h	
6443h		RECORD	Analog Error Mode			16	
	1		EM_A1	UNSIGNED8	RW	01h	
	2		EM_A2	UNSIGNED8	RW	01h	
	3		EM_A3	UNSIGNED8	RW	01h	
	4		EM_A4	UNSIGNED8	RW	01h	
	5		EM_A5	UNSIGNED8	RW	01h	
	6		EM_A6	UNSIGNED8	RW	01h	
	7		EM_A7	UNSIGNED8	RW	01h	
	8		EM_A8	UNSIGNED8	RW	01h	
	9		EM_A9	UNSIGNED8	RW	00h	
	10		EM_A10	UNSIGNED8	RW	00h	
	11		EM_A11	UNSIGNED8	RW	00h	
	12		EM_A12	UNSIGNED8	RW	00h	
	13		EM_RES13	UNSIGNED8	RW	00h	
	14		EM_RES14	UNSIGNED8	RW	00h	
	15		EM_RES15	UNSIGNED8	RW	00h	
	16		EM_RES16	UNSIGNED8	RW	00h	

Index
Back

Index	Sub index	Object	Name	Type	Access	Default	Notes
6444h		RECORD	Analog Error Value			16	
	1		EV_A1	INTEGER32	RW	80h	
	2		EV_A2	INTEGER32	RW	80h	
	3		EV_A3	INTEGER32	RW	80h	
	4		EV_A4	INTEGER32	RW	80h	
	5		EV_A5	INTEGER32	RW	80h	
	6		EV_A6	INTEGER32	RW	80h	
	7		EV_A7	INTEGER32	RW	80h	
	8		EV_A8	INTEGER32	RW	80h	
	9		EV_A9	INTEGER32	RW	00h	
	10		EV_A10	INTEGER32	RW	00h	
	11		EV_A11	INTEGER32	RW	00h	
	12		EV_A12	INTEGER32	RW	00h	
	13		EV_RES13	INTEGER32	RW	00h	
	14		EV_RES14	INTEGER32	RW	00h	
	15		EV_RES15	INTEGER32	RW	00h	
	16		EV_RES16	INTEGER32	RW	00h	

a. Map of the matched directions is only valid if the “Frame Type” field (2010h) is 0 or 1.

Autec srl - via pomaroli, 65 - 36030 Caldogno - Italy - phone +39.0444.901000 - fax +39.0444.901011 - info@autecsafety.com - www.autecsafety.com