CANopen interface card

SBI-COP

Instruction Manual

Language: English

Thank you for choosing this WEG product.

We will be glad to receive any possible information which could help us improve this manual. The e-mail address is the following: techdoc@weg.net .

Before using the product, read the safety instruction section carefully.

Keep the manual in a safe place and available to engineering and installation personnel during the product functioning period.

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The data can only be used for the product description and they can not be understood as legally stated properties.

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1. INTRODUCTION

This manual describes the SBI-COP optional card aimed at connecting inverters and converters to CANopen networks.

The TPD32-EV drives can be connected in network through the SBI-COP card.

This manual is intended for desing engineeres and technicians responsible for the maintenance, commissioning and operation of CANopen systems.

A basic knowledge of CANopen is therefore required. For further details see the manual:

- CANopen CAL-Base COMMUNICATION PROFILE for Industrial Systems; CiA Draft Standard 301 Version 3.0. Issue October 1996 by CAN in Automation e. V.

1.1 About this manual

Chapter 2	Dimensions, mechanical card mounting, electrical connections and Dip-switch setting.
Chapter 3	CANopen functions: description of the objects controlled by the card
Chapter 4	PDO Receive and Transmit configuration
Chapter 5	Virtual digital I/O configuration
Chapter 6	Alarm signaling and handling
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1.2 Overview of CANopen

CANopen is a CAL-based communication profile for industrial systems. Its reference document is the specification CiA Draft Standard 301 revision 3.0 dated 30.10.1996.

The used CAN protocol (ISO 11898) is CAN2.0A with an 11-bit identificator.

The SBI card is developed as a “Minimum Capabilty Device”.

The data exchange is cyclic; the Master unit reads the data supplied by the Slaves and writes the Slave reference data; the Baud Rates for the SBI card are reported by the CANopen specification.

The physical support is the CAN line; the max. number of Slaves connected to the Bus is 127.

2. HARDWARE DESCRIPTION

2.1 Dimensions, weight, degree of protection

Dimensions	[mm/in.] 157/6.18” (H) x 110/4.33” (L) x 23/1” (P)
Weight	127 g (4.5 oz)
Degree of protection	IP00

2.2 Mounting

The SBI card is supplied with a kit including 6 standoffs (no.2 L=26.5mm and no.2 L=10mm), 4 screws, washers, the WARRANTY label and a 40-pole flat cable provided with connectors.

Tools required (depending on models): 7x2 mm slotted-head screwdriver
Torx ® screwdriver: T10, T20, T25.
Cross-head screwdriver #1, 2, 3.
Socket wrench 6mm

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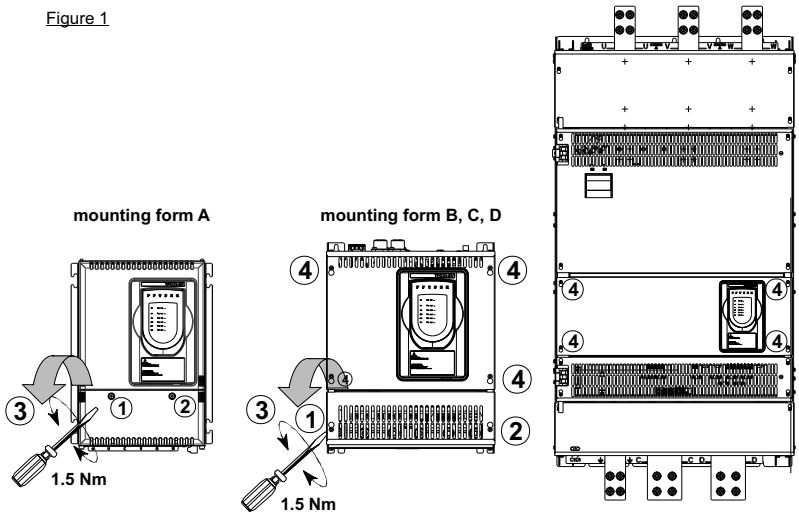
WARNING: Before using the product, read the TPD32-EV safety instruction section (on TPD32-EV manual). Never open the device or covers while the AC Input power supply is switched on. Wait for at least one minute before working on the terminals or inside the device.

Figure 1



1. The front covers of the devices must be removed to mount the option cards. The devices can be opened without the use of force. Only use the tools specified.

   Removing the lower cover:
   To remove the lower cover of devices, use a cross screwdriver. Remove the screws (1) (2), lift cover (3), and open out to the front. See figure 1..

   Removing the upper cover:
   - Frame A: there are 2 seal pins on the top. To remove the cover, align the two slots with the pins and lift the cover as shown in Figure 2:

- Frame B-C-D: loosen the 4 screws (4), align the slots of the cover with the head of the screws and remove the cover. See figure 1.

Disconnect the keypad cable from the control card.

Note: for Frame D, remove only the keypad cover.

Figure 2

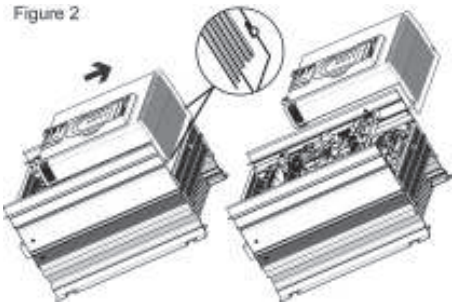


Figure 3A

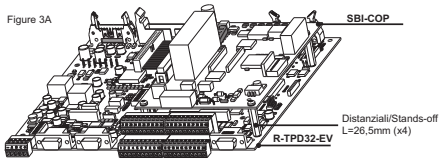
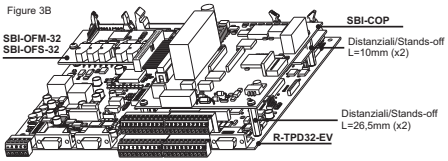


Figure 3B



2. Fasten the SBI card to the drive regulation card by means of screws and 4 standoffs L=26.5mm, see figure 3A. In case there is the SBI-OFM/OFS-32 card, fasten the SBI card to the drive regulation card by means of screws and 2 standoffs L=10 mm + 2 standoffs L=26.5mm, see figure 3B. The BUS connecting terminal is placed in the same direction as the terminals of the regulation card.
3. The flat cable is connected between the XO connector placed on the R-TPD32-EV card and SBI-COP card. In case there is the APC300 card, connect the flat cable from APC300 to XO connector on SBI-COP card.
4. The DIP switch S1 determines the Slave address. The address “0” is reserved to the Broadcast and can not be used. The switch S1-8 is not significant for the address and must always be set to OFF. The address is only detected when the card is switched on. If the address has been modified, the drive has first to be switched off and then on in order to assume the new address.
5. Connect the CANopen network to the BUS connection terminal.
6. Switch the drive on.
7. The PWR and RUN LEDs light up.
8. Power supply the BUS; the H1 LED lights up.
9. The OP LED lights up when the communication enters the “OPERATIONAL” phase.

WARNING: Replace all covers before applying power to the Drive. Failure to do so may result in death or serious injury.

10. Replace the upper and lower cover by performing the procedures described in step 1. in the reverse order.
11. To restore the warranty seal, apply the WARRANTY-R label to the TPD32-.EV converter over the label broken during opening.

Warranty-R label:

2.3 Power supply

The Power supply is provided by the XO connector, which is also used to link data between the SBI card and the drive regulation card.

Current draw 350mA.

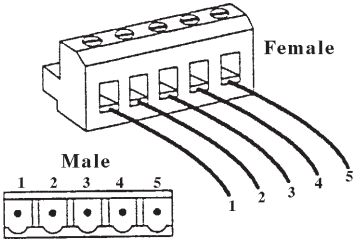
It is necessary to supply externally the CANopen network on pins CAN_V- and CAN_V+ according to next chapter.

2.4 Connectors

Connector ⏚: It allows to connect the ground (GNDE) of the external power supply to the ground (PE).

Connector **XS** It allows to connect the ground (PE) to the shield of the CANopen network cables.

Terminal **BUS** See the figure. It allows to connect the SBI card to the CANopen network. The pins are the following:



Pin	Signal	Description	Signal Level
5	CAN_V+	CAN external positive supply (dedicated for supply of transceiver and optocouplers) (*)	11 … 25 V
4	CAN_H	CAN_H bus line (dominant high)	-
3	CAN_SHLD	CAN shield	-
2	CAN_L	Can_L bus line (dominant low)	-
1	CAN_V-	Ground / 0V /V-	0V

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(*) The supplier size have to be according to the used bus specification (CANopen). Card absorption is 30 mA@24V.

Terminations: the last network connection must have a 120 W resistance between the pins 2 and 4.

2.5 Jumpers

S3 Selection of the interrupt source (INT1 / INT2) from S5 jumper to the 8032 microcontroller or the Dual Port Ram interrupt input (INTR). Default position A (interrupt from the Dual Port Ram).

S4 Synchronization connection of the reset signal of the SBI card to the regulation card which it is connected to. Default position ON.

S5 It is used to connect the INT_OPZ signal to the INT1 (S5.B) or to the INT2 signal (S5.A). The interface card is standard configured as OPTION 1, therefore INT_OPZ is connected to the INT1 signal. (Default position A)

S6 It is used to connect the OUT_OPZ signal to the OUT1 (S6.A) or to the OUT2 (S6.B) signal. Default position B.

S7 It is used to connect the CEM_OPZ signal to the OPZ1 (S7.B) or to the OPZ2 signal

(S7.A). The SBI card is standard configured as OPTION 1, therefore CEM_OPZ is connected to the OPZ1 signal. Default position A.

S8 Connection of the dual port ram BUSY signal to the RDY_EXT signal. Default position ON.

2.6 LEDs

PWR	+5V power supply.
RST	Active reset.
H1	network power supply, provided by the bus.
RUN	It is lighted up when the microcontroller is in the operative phase.
OP	It is lighted up when the communication enters the “OPERATIONAL” phase.
AL0	It is lighted up when the transmission queue is in a “Overflow” condition.
AL1	It is lighted up when the reception queue is in a “Overflow” condition.
AL2	It is lighted up in case of “Can error” condition (Bus loss).

2.7 Technical specification

Storage temperature:	-20°... +70°C (-68...+158°F)
Operating temperature:	0°... +55°C (32...+131°F)

These temperatures are adequate to those of the drive which the cards are connected to.

2.8 Interface

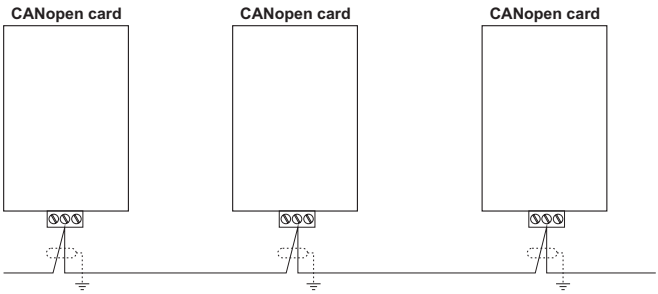
The card must be installed on the regulation card, so that the XO connector of the SBI card is near the XO connector of the regulation card, thus keeping the CANopen network connection terminal in a downward direction.

As for the mechanical connection please use the kit supplied with the card.

As for the electrical connection please use the supplied 40-pin flat cable.

As for the Bus connection please use a shielded twisted pair cable.

The connection among the single cards is carried out with a shielded cable, as shown in the following figure:



3. CANopen functions

This chapter describes the functions of the CANopen communication profile controlled by the SBI card.

The main features of the SBI card are:

1) It supports the “Minimum Boot-up”; the “Extended Boot-up (CAL)” is not supported.
2) It supports the PDO dynamic assignment.
3) The SYNC function is implemented.
4) The Node Guarding is supported.
5) It supports the emergency signal (“EMERGENCY”) in order to signal any Drive alarm.
6) The function Dynamic ID distribution (DBT slave) is not supported.
7) The card ID (address) can be set via the Dip-switch; it can not be configured via the SDO.
8) A “Pre-Defined Master/Slave connection” is implemented in order to simplify the functions performed by the Master during the initialization phase. The “Inhibit-Times” (given as 100 uS units) can not be modified.
9) The high resolution synchronization is not supported.
10) The “TIME STAMP” is not supported.
11) The OFFhex optional subindex (access to the whole object) in the access to the structured parameters is not controlled.
12) Because of efficiency reasons, only the “Expedited” data transfer (max. 4 Byte) of the SDO services is supported.

3.1 Pre-defined Master/Slave connection

The “Pre-defined Master/Slave connection” allows a peer-to-peer communication between a Master and 127 Slaves; the Broadcast address is zero.

3.2 NMT services (Network Management)

The NMT “mandatory” services are:

- Enter_Pre-Operational_State CS = 128.
- Reset_Node CS = 129.
- Reset_Communication CS = 130.

Being that the “Minimum Boot-up” is used, the following NMT services are also supported:

- Start_Remote_Mode. CS = 1.
- Stop_Remote_Mode. CS = 2.

The COB-ID of an NMT initialization service is always 0; CS is the Command Specifier defining the NMT service.

3.2.1 Initialization

The “Minimum Boot-up” is implemented for the communication initialization; the two following optional initialization conditions are also supported:

- Start Transmission of SYNC.

- Start of Node Guarding.

3.3 Communication object

This chapter describes the communication objects of the CANopen protocol supported by the interface card.

The supported communication objects are the following:

1) 1 Reception SDO Server.
2) 1 Transmission SDO Server .
3) 2 cyclical, synchronous reception PDO.
4) 2 cyclical, synchronous transmission PDO.
5) 1 Emergency Object.
6) 1 Node Guarding - Life Guarding.
7) 1 SYNC object.

The following table shows the used communication objects with their priority level and the Message Identifier; in order to obtain the “Resulting COB-ID”, the Note-ID (card address) must be added to the number itself.

OBJECT	PRI0RITY	Message ID
SDO rx	6	1536
SDO tx	6	1408
1° PDO rx	2	512
1° PDO tx	2	384
2° PDO rx	2	768
2° PDO tx	2	640
EMERGENCY	1	220
NODE GUARDING	Not Used	1792
SYNC	0	128

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Table 3.3.1: Communication objects

Node Guarding has no priority as it is an NMT special service but it has the Message-ID because it is not a Broadcast service.

3.3.1 Object dictionary elements

The Object Dictionary (Object Dictionary) of the Drive parameters is not contained in the SBI card but in the Drive regulation card.

The SBI card contains the Object Dictionary of the communication parameters supported by the card itself.

The modification of such parameters can occur only in a “Pre-Operational” condition; a changing attempt in any other condition is not allowed.

The following table shows the communication objects used by the SBI card:

Index (hex)	Name
1000	Device Type
1001	Error Register
1002	Manufacterer Status Register
1003	Predefined Error Field
1004	Number of PDOs supported
1005	COB-ID SYNC Message
1008	Manufacterer Device Name
1009	Manufacterer Hardware Version
100A	Manufacterer Software Version
100B	Node-ID
100C	Guard Time
100D	Life Time Factor
100E	COB-ID Guarding Protocol
1014	COB-ID Emergency Message
1200	Server SDO Parameter
1400	1° Receive PDO CommPar
1401	2° Receive PDO CommPar
1600	1° Receive PDO Mapping
1601	2° Receive PDO Mapping
1800	1° Transm. PDO CommPar
1801	2° Transm. PDO CommPar
1A00	1° Transm. PDO Mapping
1A01	2° Transm. PDO Mapping

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Table. 3.3.2: CANopen communication profile objects.

The object 1003hex “Predefined Error Field” is formed only by two elements.

3.3.1.1 PDO Entries

The structure of the PDO Communication Parameter is the following:

1) Subindex 0 (Number of supported entries) = 4.
2) Subindex 1 (COB-ID used by PDO) is structured as follows:

- Bit 31 (valid/non valid PDO) can be set via SDO.
- Bit 30 (RTR Remote Transmission Request) = 0 as this function is not supported.
- Bit 29 = 0 as the 11-bit ID (CAN 2.0A) is used.
- Bit 11-28 not used.
- Bit 0-10 COB-ID (see table 3.3.1).

3) Subindex 2 (Transmission Type) cyclical-synchronous = 10 (10 SYNC Object between two PDO transmissions).

The elements “Inhibit Time” and “CMS Priority Group” can be reached only in a reading condition.

As for the parameter “PDO Mapping” see chapter 4.0.

3.3.1.2 SDO Entries

The “Expedited” data transfer mode is used (max. 4 Byte).

The structure of the SDO Communication Parameter is the following:

1) Subindex 0 (Number of supported entries) = 3 as the device is a Server of the SDO service.

2) Subindex 1 and 2 (COB-ID used by SDO) are structured as follows:

- Bit 31 (valid/ non valid SDO); being that only the default SDOs are used, it is = 1.
- Bit 30 reserved = 0.
- Bit 29 = 0 as the 11-bit ID (CAN 2.0A) is used.
- Bit 11-28 not used.
- Bit 0-10 COB-ID (see table 3.3.1).

The element “node ID of SDO’s client resp. server” is not supported as only the default SDOs are used.

During a “Domain Download” the data length has always to be entered; if not the service is rejected.

3.3.1.3 COB-ID SYNC Entries

The 32 bits of the communication parameter COB-ID SYNC are structured as follows:

- Bit 31 = 1 because the CANopen interface card is a “consumer” of SYNC messages.
- Bit 30 = 0 because the interface card does not generate any SYNC message.
- Bit 29 = 0 as the 11-bit ID (CAN 2.0A) is used.
- Bit 11-28 not used.
- Bit 0-10 COB-ID (see table 3.3.1).

3.3.1.4 Node Guarding Identifier Entries

The 32 bits of the communication parameter Node Guarding Identifier are structured as follows:

- Bit 30-31 reserved.
- Bit 29 = 0 as the 11-bit ID (CAN 2.0A) is used.
- Bit 11-28 not used.
- Bit 0-10 COB-ID (see table 3.3.1).

3.3.1.5 COB-ID Emergency

The 32 bits of the communication parameter COB-ID Emergency Message are structured as follows:

- Bit 31 = 0 because the CANopen interface card is not a “consumer” of Emergency messages.
- Bit 30 = 0 because the interface card generates Emergency messages.
- Bit 29 = 0 as the 11-bit ID (CAN 2.0A) is used.
- Bit 11-28 not used.
- Bit 0-10 COB-ID (see table 3.3.1).

4. PDO SETTING

This function allows the assignment of the drive parameters to the Process Data Object Words via the SDO.

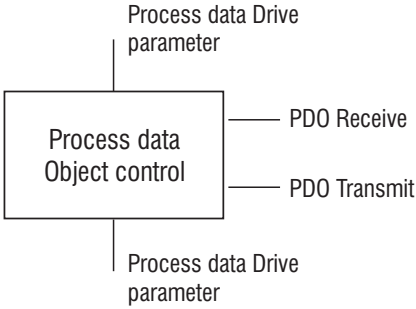
The SBI card uses four words (WORD) for the Process Data Object (abbr. PDO – process data object).

The configuration of the Process Data Object for the SBI card is the following

WORD 0	WORD 1	WORD 2	WORD 3

The Slave can both read and write the Process Data Object data.

The data read by the SBI card are referred to as reception data; the data written by the Slave are referred to as transmission data.

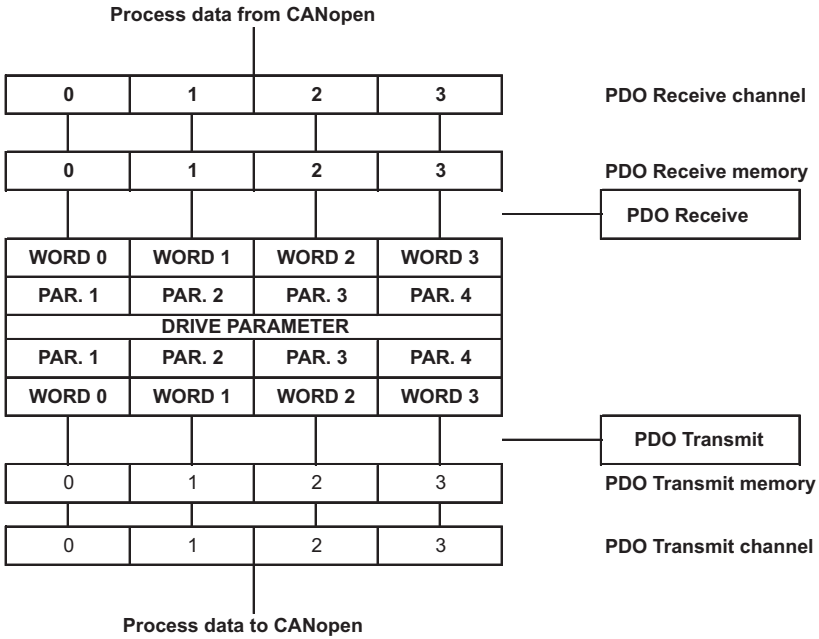


The Slave parameters are cyclically read by the Master by assigning the drive parameters to the “PDO transmit” communication object.

The Master cyclically transmits the drive parameters to the Slave by assigning the drive parameters to the “PDO receive” communication object.

The process data assignment to specific drive parameters can be configured. The “PDO receive” and the “PDO transmit” communication objects are used for this purpose.

Operating modes:



The “PDO Transmit” communication object (input data for the Master) defines the drive parameter assigned to the Process Data Object Words.

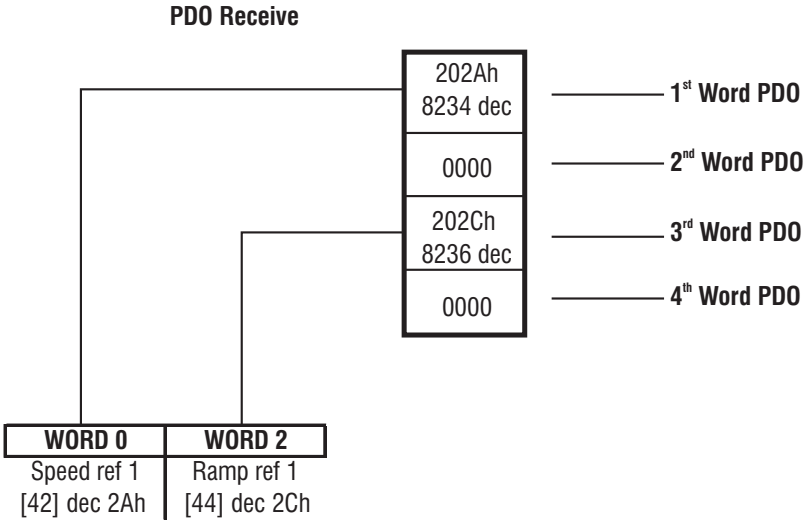
The “PDO Receive” communication object (output data for the Master) defines the Process Data Channel Word assigned to the drive parameters.

The assignment of the drive parameters to the Process Data Object Words is carried out via the index of the parameter itself.

Only parameters with a 16-Bit width (1 Word) may be assigned to the Process Data Object.

NOTE : When using a TPD32-EV drive, the 2000h offset (8192 dec) must be added to the drive parameter index in order to obtain the number of the parameter to be assigned via the field bus.

Reception data descriptor of the Process Data Object:



NOTE: The values 0000 mean that the Word is not assigned to any drive parameter.

Assignment example of 16-Bit drive parameters to the “PDO Receive” object.

4.1 Example of SDO composition for PDO configuration

Example No. 1:

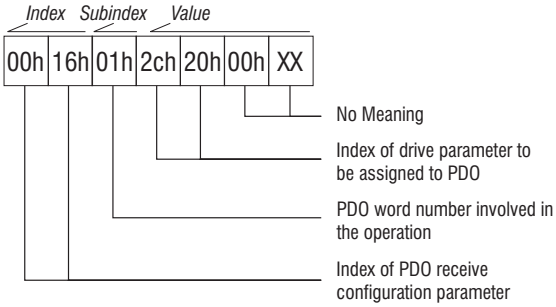
The **Ramp Ref 1** parameter of the TPD32-EV drive must be assigned to the Word No. 1 of the PDO reception data. As this parameter is an Unsigned 16, it has a 16-Bit width and can therefore be assigned to a Process Data Object.

The required information is:

1) Index of the PDO reception data configuration parameter: 1600h.

2) Number of the Word to be configured: 1.

3) Index of the **Ramp ref 1** parameter of the TPD32-EV drive: 202Ch.



Example No. 2:

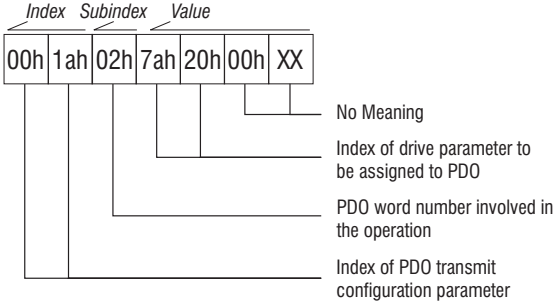
The **Actual speed** parameter of the TPD32-EV drive must be assigned to the Word No. 2 of the PDO transmission data. As this parameter is an Unsigned 16, it has a 16-Bit width and can therefore be assigned to a Process Data Object.

The required information is:

1) Index of the PDO transmission data configuration parameter: 1A00h.

2) Number of the Word to be configured: 2.

3) Index of the **Actual speed** parameter of the TPD32-EV drive: 207Ah.



5. VIRTUAL DIGITAL INPUT/OUTPUT SETTING

The control of the drive virtual digital I/Os is carried out through configuration and control sending parameters.

Please note that in this chapter the virtual digital inputs/outputs are referred to the drive, i.e. in these cases the Master can "write" the virtual digital inputs and "read" the virtual digital outputs.

5.1 Virtual Digital Inputs

As for the virtual digital inputs the involved parameters are:

- Parameter index 5EFCh: virtual digital input configuration.
- Parameter index 5EFEh: writing of the virtual digital input values.
- Parameter 5EFCh: 16-element array Unsigned Int.

This array is used to configure the virtual digital inputs and must therefore be written before using these inputs. It contains the drive parameter index assigned to the input. These inputs are written afterwards through the parameter 5EFEh, type Unsigned Int, where the single Bit status indicates the command to be sent to the virtual digital input.

Example:

The 0 element of the 5EFCh parameter array contains the 2159h parameter index referred to the TPD32-EV drive, which means **Ramp in = 0**.

The functioning method is the following: after configuring the 0 element of the 5EFCh parameter with the 2159h parameter index, the function **Ramp in = 0** of the TPD32-EV drive is controlled by the Bit 0 of the 5EFEh parameter.

5.1.1 Virtual digital input descriptors

The 5EFCh parameter is used to configure the virtual digital inputs and can be written/read by single element only.

Object attribute	Value	Meaning
Index	5EFCh	Virtual digital input configuration
Number of elements	16	16 Virtual digital input channels
Type	--	Unsigned16
Password	00	Non-existing
Access group	00	Non-existing
Access rights	--	Read/Write
Local Address	XXXX	Manufacturer specific

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The 5EFEh parameter is used to control the previously configured virtual digital inputs; the single Bit status controls the virtual digital input assigned to the Bit during the configuration.

Object attribute	Value	Meaning
Index	5EFEh	Value (command) of virtual digital input
Type data index	--	The single Bit status controls the virtual digital input assigned to it
Length	02	2 Bytes
Password	00	Non-existing
Access group	00	Non-existing
Access rights	--	Write only
Local Address	XXXX	Manufacturer specific

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5.2 Virtual Digital Outputs

As for the virtual digital outpus the involved parameters are:

- Parameter index 5EFDh: virtual digital output configuration.
- Parameter index 5EFFh: reading of the virtual digital output values.
- Parameter 5EFDh: 16-element array Unsigned Int

This array is used to configure the virtual digital outputs and must therefore be written before using these outputs. It contains the drive parameter index assigned to the output. These outputs are then read through the 5EFFh parameter, type Unsigned Int, where the single Bit status corresponds to the status of the virtual digital output assigned through the configuration array.

Example:

The 0 element of the 5EFDh parameter array contains the 215Ah parameter index referred to the TPD32-EV drive, which means **Ramp+**. The functioning method is the following: after configuring the 0 element of the 5EFDh parameter with the 215Ah parameter index, the **Ramp+** status of the TPD32-EV drive is read via the Bit 0 of the 5EFFh parameter.

5.2.1 Virtual digital output descriptors

The 5EFDh parameter is used to configure the virtual digital outputs and can be written/read by single element only.

Object attribute	Value	Meaning
Index	5EFDh	Virtual digital output configuration
Number of elements	16	16 virtual digital output channels
Type	--	Unsigned16
Password	00	Non-existing
Access group	00	Non-existing
Access rights	--	Read/Write
Local Address	XXXX	Manufacturer specific

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The 5EFFh parameter is used to read the previously configured virtual digital outputs; the single Bit status corresponds to the status of the virtual digital output assigned to the Bit during the configuration.

Object attribute	Value	Meaning
Index	5EFFh	Value (present status) of the virtual digital output
Type data index	--	The single Bit status corresponds to the virtual digital output status assigned to it
Length	02	2 Bytes
Password	00	Non-existing
Access group	00	Non-existing
Access rights	--	Read only
Local Address	XXXX	Manufacturer specific

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6. ALARMS

6.1 SBI card alarms

The alarms indicated to the drive by the SBI card through the Dpram (Dual-Port-Ram) are the following:

1 - Bus loss: if an accidental interruption of the connection occurs, this alarm is generated.

2 - SBI Hardware Fault: if the SBI card is faulted, this alarm is generated.

3 - SBI Ram Fault: this alarm is generated if there is a fault in the Dual-Port-Ram of the SBI card.

The alarm handling carried out by the drive depends on the drive itself and on the alarm configuration.

If the Master is switched of f before the Slave, the Bus-Loss alarm occurs; the drive handles this event by not storing the alarm in order to avoid having the alarm active when the drive is next switched on. The communication between Master and Slave can only be carried out if the initialization of the drive and of the SBI card is successfully terminated; if not, it is not possible to determine the cause of the erroneous initialization using the Bus.

6.2 Drive alarm handling

The drive reports automatically its status to the SBI card, if an alarm condition occurs.

Every time the Drive changes its status, the SBI card sends the updated drive status to the Master via an "Emergency Object" (see paragraph 5.3).

The information is contained in the field "Manufacturer Specific Error Field' of the diagnostic message.

This field is made up of five bytes. The first and the second byte contain the code of the drive status in a low-byte high-byte format (for the codes please refer to the drive manual).

The three remaining bytes are not important for the drive alarm code.

When a drive alarm occurs, the error code is also stored in the communication object "Error register", index 1001 hex.

7. OPERATION ERROR CODES

The following table shows the different error codes that may occur during the execution of a SDO service.

RESULT	VALUE
OK no error	0000H
Parameter not exist	0001H
Reserved	0002H
Control Access denied	0003H
Reserved	0004H
Attribute Access denied	0005H
Type value error	0006H
Reserved	0007H-000FH
Destination option not exist	0010H
Parameter Access Conflict	0011H
Value out of the maximun range	0012H
Value out of the minimun range	0013H
Value not supported	0014H
Parameter Configuration Conflict	0015H
Command Submitted	0016H
Reserved	0017H
Unknown Command	0018H
Read only Parameter	0019H
Write not allowed	001AH
Value out of constant limits	001BH
State not correct	001CH
Password	001DH
Type Unknown	001EH
Hardware Fail	0030H
Checksum Fail	0031H
Reserved	001FH-007CH
Reserved	0082H-00FCH
NOK generic	00FFH
User defined	0100H-FFFFH

t6000

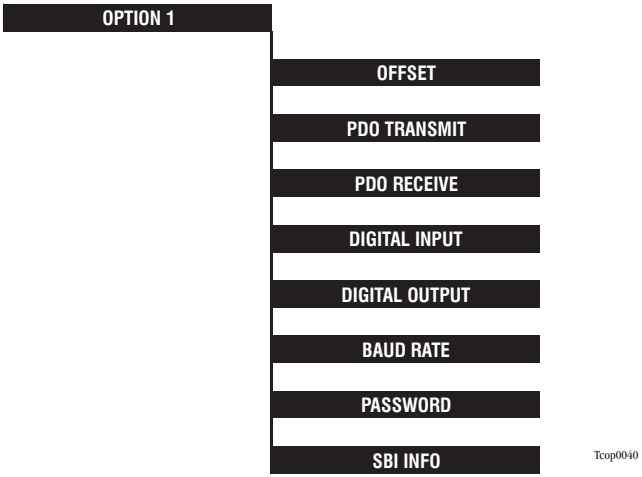
Explanation:

Parameter not exist	The specified parameter does not exist.
Control Access denied	The access is denied because of the drive status.
Attribute Access denied	The parameter attributes do not allow the access.
Type value error	The specified type value is not correct.
Destination option not exist	The destination option does not exist at node
Parameter Access Conflict	The addressed parameter can not be accessed (for example if the command is write and the parameter is connected to an external input).
Value out of the max range	The value is out of the maximum range.
Value out of the min range	The value is out of the minimum range.
Value not supported	The value is in range but not allowed.
Parameter Configuration Conflict	The addressed parameter can not be accessed because of a system configuration conflict.
Command Submitted	The command has been sent but it is not possible to know if it has been executed.
Unknown Command	The command is unknown.
Read only Parameter	The parameter has a read-only attribute.
Write not allowed	The writing operation is not allowed because of the slave conditions.
Value out of constant limits	The value is out of the constant fixed limits.
State not correct	The control state does not allow the command execution.
Password	The command is not executed because the password is active.
Type Unknown	The parameter type is unknown.
Hardware Fail	The access is denied because of an hardware failure.
Checksum Fail	The access is aborted because of a checksum error.
NOK generic	The access is aborted because of a non specified error.

8. KEYBOARD INTERFACE

8.1 Main menu structure

This structure appears when the Enter key is pressed and “OPTION1” is displayed; in this case the keypad control passes to the SBI card.



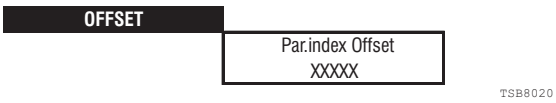
Move among the Menus by pressing the Cursor-Up/ Cursor-Down keys and use the Enter key to enter the currently displayed Menu. By pressing the Cancel key in any displayed menu, the “OPTION1” Menu appears and the keypad control returns to the drive.

8.1.2 Warning and error message handling

The warning and error messages can be shown on the first and second row of the keypad Display and a maximum of 16 characters can be displayed per line. The Cancel key must be pressed in order to clear these messages; at this point the system automatically returns to the immediately upper Menu level.

8.2 Offset menu

The Offset menu is formed as follows:



The displayed Offset will be added to the parameter index specified in the following menus:

- PDO Receive.
- PDO Transmit.
- Digital Input.

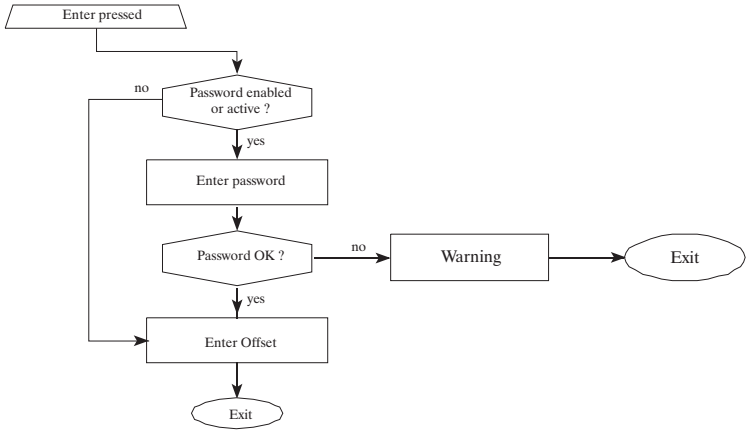
- Digital Output.

The Offset value consists of five digits.

By pressing the “Enter” key, the message “Enter Offset” will be displayed on the first row; the value is entered on the second row.

8.2.1 Offset editing

The Offset editing flowchart is shown below; note that pressing the Cancel key at any time the system returns to the previous Menu or cancels the operation. Refer to paragraph 8.9 for Editing.

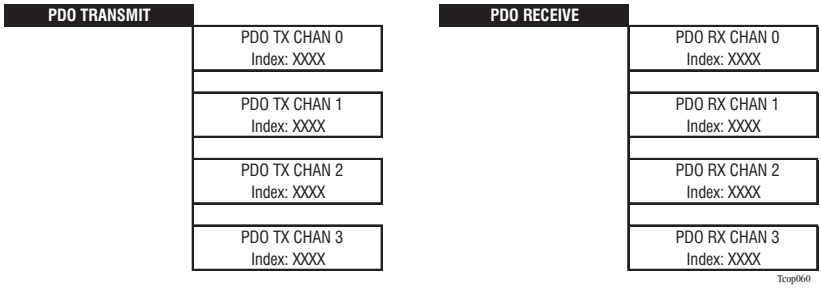


The Offset default value is 0; the entered value is not stored in a non-volatile memory and therefore it remains active only until the power supply is disabled; the Offset is however maintained active even after leaving the SBI main menu.

Refer to paragraph 8.7.1. for messages regarding the Password entry.

8.3 PDC menu

The PDO Menus (both Receive and Transmit) have the following structure:



The index (with or without Offset, see paragraph 8.3) of the drive parameters assigned to the PDO channels is displayed.

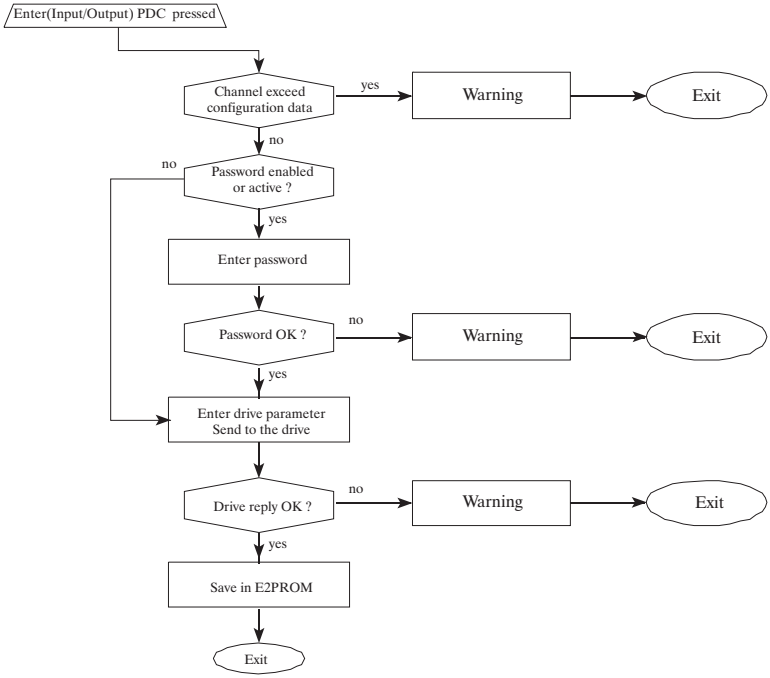
Move among the Menus by pressing the Cursor-Up/Cursor-Down keys; the Cancel key is used to return to the immediately superior Menu level. By pressing the Enter key it is possible to enter the Edit mode of the PDO channels.

The drive parameter indexes are displayed as 5-digit integers.

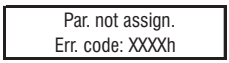
The parameter index is not automatically updated; in other words if a new assignment is performed by a Master while the index displaying is active, the new value is not automatically shown - it is necessary to exit and re-enter the PDO Menu.

8.3.1 Editing of drive parameter assignment to PDO

The flowchart below shows the Editing of the drive parameter assignment to PDOs, both Receive and Transmit; note that pressing the Cancel key at any time the system returns to the previous Menu or cancels the operation. Refer to paragraph 8.9 for Editing.



The validity of the specified Drive parameter is checked by the Drive. If the Drive responses with an error code, the following message is shown on the keypad Display:



TSB8040

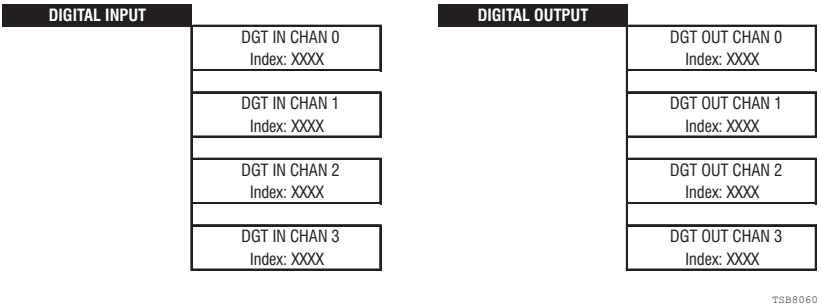
The error code generated by the Drive is displayed in hexadecimal format; all error codes are listed in chapter 6.0. If the setting is correct, the following message is displayed:

TSB8050

This message automatically disappears after two seconds or by pressing the Cancel key. Refer to paragraph 8.7.1. for messages regarding the Password entry.

8.4 Virtual Digital I/O menu

The virtual digital I/O menu has the following structure:



The indexes of the drive parameters (with or without Offset, see paragraph 8.3) assigned to the Virtual digital Input/Output channels are displayed.

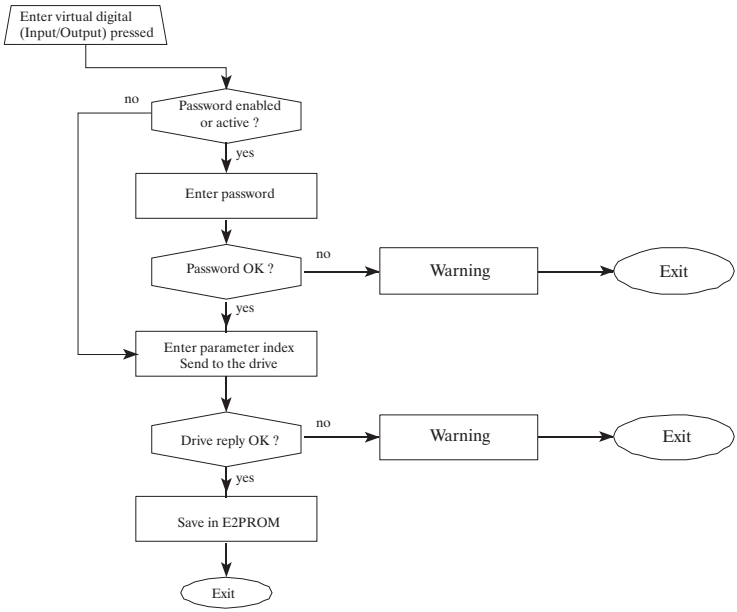
Move among the Channel Menus by pressing the Cursor-Up/Cursor-Down keys; the Cancel key is used to return to the immediately upper Menu level. The Edit mode of the virtual digital I/Os can be entered by pressing the Enter key.

The drive parameters are displayed as 5-digit integers.

The parameter index is not automatically updated; in other words if a new assignment is performed by a Master while the index displaying is active, the new value is not automatically shown - it is necesssary to exit and re-enter the Digital I/O Menu.

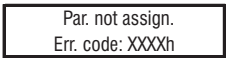
8.5 Editing of drive parameter assignment to virtual Digital I/O

The flowchart below shows the Editing of the drive parameter assignment to the virtual digital I/Os; note that pressing the Cancel key at any time the system returns to the previous Menu or cancels the operation. Refer to paragraph 8.9 for Editing.



The validity of the specified Drive parameter is checked by the Drive.

If the Drive answers with an error code, the following message is shown on the keypad Display:



TSB8040

The error code generated by the Drive is displayed in hexadecimal format; all error codes are listed in chapter 6.0.

If the setting is correct, the following message is displayed:

TSB8050

This message automatically disappears after two seconds or by pressing the Cancel key.

Refer to paragraph 8.7.1. for messages regarding the Password entry.

8.6 Baud Rate menu

The Baud Rate Menu is formed as follows:

A string containing the currently used Baud Rate value is displayed (the same information is contained in the SBI INFO Menu - BaudRate); the supported Baud Rates which can be displayed are:

1000, 500 , 250, 125 , 100 , 50 , 20 and 10 Kbit.

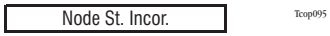
By pressing the “Enter” key, the first line shows the message “Enter Baud Rate”; on the second line the Baud Rate current value starts blinking.

8.6.1 Baud Rate Editing

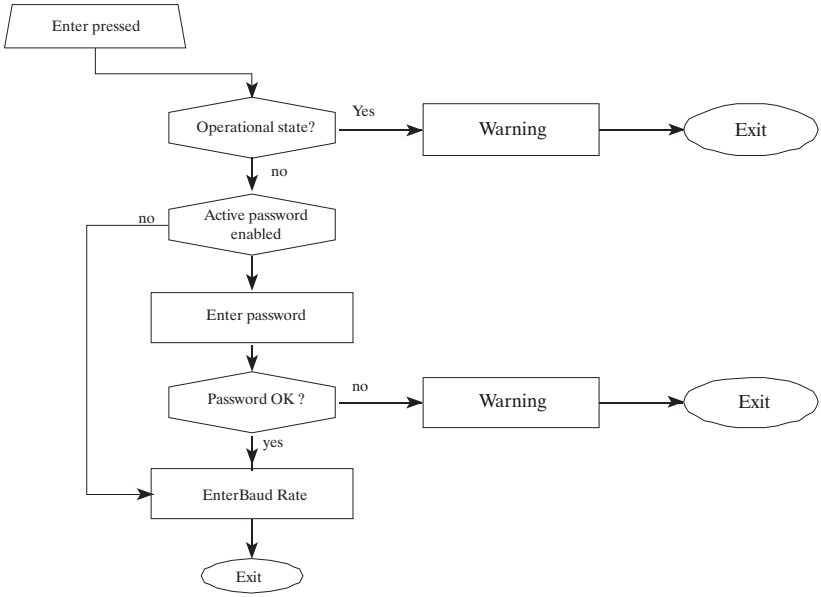
The flowchart of the Baud Rate Editing is shown; note that pressing the Cancel key at any time the system returns to the previous Menu or cancels the operation.

The Editing is carried out as follows: when the current Baud Rate blinks, it is possible, by using the ‘+’ and ‘-’ keys, to read all the previously reported Baud Rate values; when the desired value has been found, it becomes active by pressing the Enter key. It is possible to press the Cancel key in order to exit without modifying the Baud Rate value.

This Menu is protected by a Password; the Baud Rate modification can not be carried out if the card is in the “Operational” condition. In this case the following message appears:



The Baud Rate setting chart is the following:



If the setting is correct, the following message is shown:

This message automatically disappears after 2 seconds or by pressing the Cancel key.

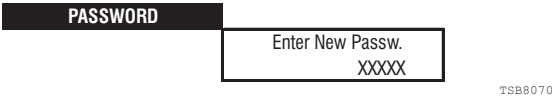
The entered Baud Rate value is stored in a non-volatile memory and therefore it remains active also after the card has been switched off and on again.

For messages regarding the Password entry, see the specific paragraph.

If, for any reason, the new Baud Rate has not been accepted, the following warning message appears:

8.7 Password menu

The Password is handled by a Menu with the following structure:



By pressing the Cancel key you return to the immediately superior Menu level. By pressing the Enter key the Password Edit mode can be entered.

The Password is required when a protected Menu or setting has to be entered. This request depends also on the Password Status; as a consequence, four possible cases can be identified:

a) **Password enabled**: this means that the password has been set up via the suitable Menu; **the zero (0) value (default) disables the Password**.

b) **Password active**: if the Password is enabled, it becomes active as soon as the SBI card main Menu is displayed. It is disabled by entering its value in the right way when first setting a parameter that is protected by it. The Password is automatically enabled after leaving the SBI card main Menu.

c) **Password disabled**: the value is zero (default condition).

d) **Password inactive**: the Password has already been requested and correctly entered.

The Password is an integer number and therefore has a maximum of five digits. If a shorter number is entered, the remaining digits are supposed to be zeroes.

8.7.1 Password request

The Password is requested when it is enabled and active and the access to a protected Menu or setting is attempted; in this case the following message is displayed:

The Password is entered in Edit mode (see chapter 8.9) with the Password digits being shown.

There is also a universal Password with a value equal to 78622.

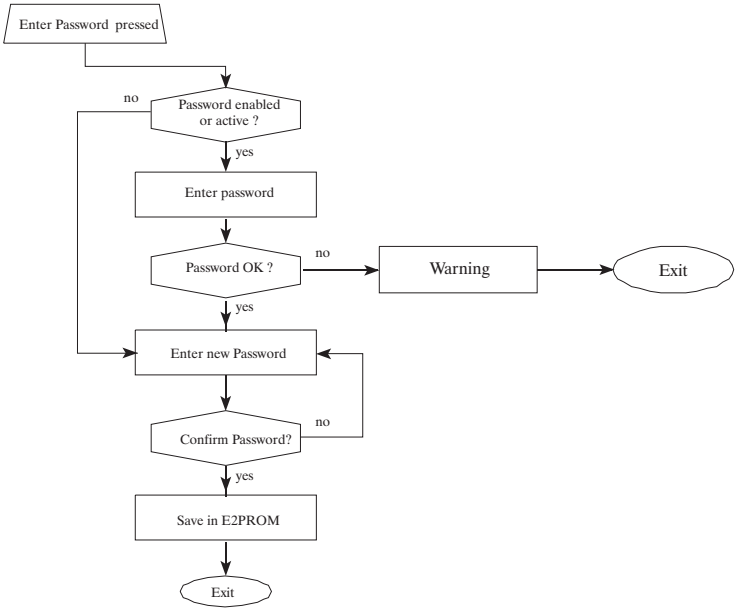
If the Password is correct, the following message is displayed:

This message automatically disappears after two seconds or by pressing the Cancel key.

If the Password is not correct, the following blinking message appears:

This message disappears by pressing the Cancel key.

8.7.2 Password setup Editing

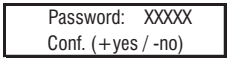


The flowchart of the Password setup Editing is shown; note that pressing the Cancel key at any time the system returns to the previous Menu or cancels the operation. Refer to chapter 8.9 for the Editing.

This Menu allows to set the Password; please note the following:

1) The default value is zero (0) and is equivalent to disabling the Password.
2) By entering a non-zero value via this Menu, the Password is automatically enabled.
3) Enter zero (0) to disable the Password.
4) If the Password is enabled, it also becomes active when the “OPTION1” Menu is accessed. As soon as it is attemped to access a Password protected Menu or setting, the Password is requested. If the Password is correctly entered, it is deactivated from that moment on, i.e. it is possible to access other protected Menus and/or settings without having to specify the Password again.
5) The Password is automatically reactivated when you exit the SBI card main Menu.

The following message is displayed to confirm the Password:

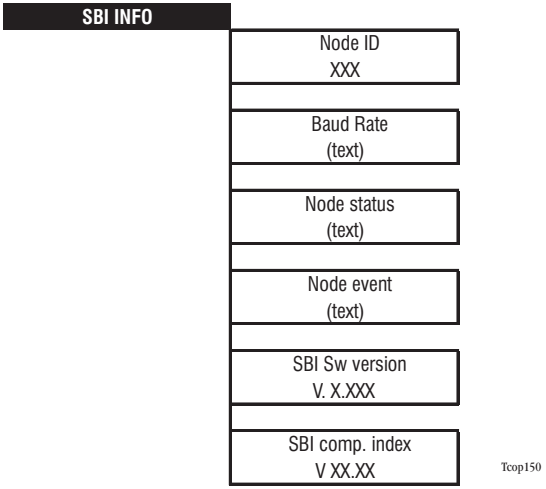


By pressing the “+” key the Password is confirmed and the system goes back to the immediately superior Menu level; at this level the Password is enabled if a non-zero value was entered or disabled if zero was specified.

By pressing the “-” key you go back to the Password Edit mode.

8.8 SBI INFO Menu

This Menu is used to display various information about the SBI card; all data items are strictly read-only.



Move among the Menu items by pressing the Cursor-Up/Cursor-Down keys. Use the Cancel key to return to the immediately superior Menu level.

The “Node status” and “Node event” Menus are automatically updated. As for the texts of the “Node status” and “Node event” Menus, they follow the states and the transactions described in the diagram of the CANopen communication profile state and refer to a “Minimum Capability Device”.

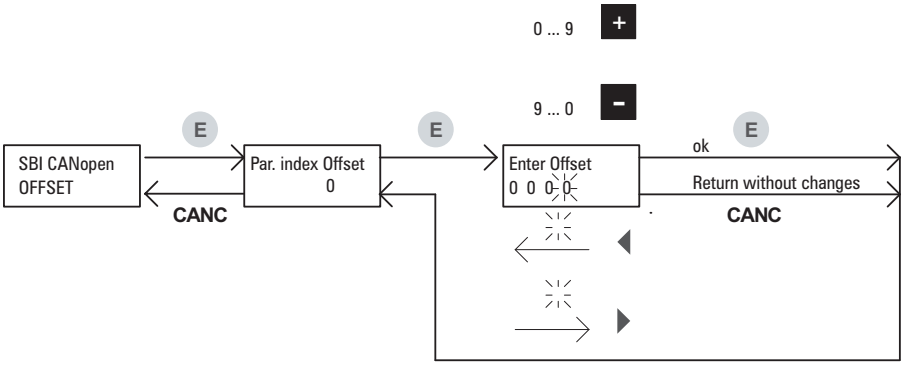
8.9 Edit

The Editing phase is activated by pressing the Enter key when positioned on an Item which can be set; during this phase, the key function is the following:

1) The Right/Left Cursor keys are used to move along the number being specified; the number of permitted digits depends on the type of data being operated on.
2) The “+” and “-” keys are used to increment/decrement the value of the selected digit; the allowed values are in the range of 0 to 9.
3) The Enter key confirms the setting.

4) The Cancel key cancels the setting operation.

During the Editing phase, the digit to be set starts blinking.



The figure above shows an example of editing a value and the key effects during this phase.

9. DEFINITIONS

- CAN: Controller Area Network.
- CiA: CAN in Automation, international user group.
- CMS: CAN Message Specification; it is a service element defined by the CAN Application Layer in the CAN Reference Model.
- COB: Communication Object (CAN Message). It is a transport unit in a CAN network. The data have to be sent in network inside a COB.
- COB-ID COB-Identifier. It identifies a COB inside the network; it also states the COB priority.
- CS: Command Specifier; it defines the NMT service.
- DBT: Distributor. It is a service element of the CAN Application Layer in the CAN Reference Model. The DBT has the task to deliver COB-ID to the COBs used by the CMS.
- LMT: Layer Management. It is a service element of the CAN Application Layer in the CAN Reference Model. It is used to configure the Layer reference parameters in the CAN Reference Model.
- NMT: Network Management. It is a service element of the CAN Application Layer in the CAN Reference Model. It carries out the initialization, configuration and the error control inside a CAN network.
- PDO: Process Data Object, service messages without confirmation used for a data transfer from/to the device in real time.
- RPDO: Receive PDO.
- SDO: Service Data Object, service messages with confirmation used for an acyclic data transfer from/to the device.
- TPDO: Transmit PDO.

10. REFERENCES

1 - CANopen CAL-Base COMMUNICATION PROFILE for Industrial Systems; CiA Draft Standard 301 Version 3.0. Issue October 1996 by CAN in Automation e. V.

2 - Drive instruction manuals.

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