Application Note 012e

# Commissioning CANOpen



l2126-1.0 en

## Content

1	Introduction	3
2	General	4
3	Identification	5
4	Planning the CANOpen network	6
5	Commissioning the network	7
6	Changing the bit rate and the node ID with AED_Panel32	8
7	Commissioning the AED / FIT <sup>®</sup>	10
8	PLC programming	14
9	Transmit PDOs	15
10	Receive PDOs	17
11	References	18
	Index	19
	Application document overview	20

## 1 Introduction

The 3rd generation AED / FIT<sup>®</sup> has a CANopen interface.

This interface opens up new and powerful options for users and their technical weighing applications.

This document describes commissioning an AED / FIT<sup>®</sup> with a programmable controller (PLC). But there are so many different PLCs on the market, that it is only possible to give a general overview.

Thanks are due to Hilscher GmbH (<u>www.hilscher.com</u>), who have generously given us their permission to use screenshots from the SYCON Software.

## 2 General

DeviceNet is a CAN-based network, which has been standardized by CiA (Can in Automation). Specifications can be obtained from CiA (<u>www.cia.org</u>).

CanOpen defines a series of services for data transmission and network management:

#### SDO (Service Data Objects)

This service is provided for transmitting acyclic data and it is normally used to transmit configuration parameters.

#### PDO (Process Data Objects)

Are provided for the transmission of

- cyclic data (measured values and statuses)
- acyclic data (dosing and trigger results)
- PLC output data (control word)

Transmit PDOs are always transmitted whenever a measurement, trigger or dosing result is at hand.

The control word contains individual bits, with which the user can trigger functions such as zeroing and taring. The format of the PDOs can be found in the appendix to this document.

#### **EMCY (Emergency objects)**

EMCY objects are transmitted when error states occur. They comprise a normative and an application-specific part. More detailed information can be found in the AED / FIT<sup>®</sup> online Help.

## 3 Identification

Devices are identified by a vendor ID and a product code:

Device	Vendor ID	Product Code
AD103	11d <sub>Hex</sub>	$501_{\text{Hex}}$
FIT <sup>®</sup> 3	11d <sub>Hex</sub>	502 <sub>Hex</sub>

#### **EDS** file

An EDS file is included among the items supplied with the devices. This is required for commissioning the AED / FIT<sup>®</sup> with a PLC. Import the EDS file associated with your firmware into your controller. Use your controller configuration tool to read out the firmware version of the AED / FIT<sup>®</sup>. EDS files can also be obtained from the HBM Website(<u>www.hbm.com</u>).

File name nomenclature:

#### PRODUCT\_FIRMWAREVERSION\_MAJORREV\_MINORREV\_COS.EDS

#### FIT<sup>®</sup>3\_P73\_1\_01\_COS.EDS

indicates a CANOpen EDS file of Version 1.01 for firmware version P73 of an FIT<sup>®</sup>3.

## Planning the CANOpen network

The structure of a CANOpen network requires careful planning:

 Estimate the expected cables lengths; under no circumstances must you exceed the maximum values applicable to the selected bit rate. Avoid spur lines. This is why the AED / FIT<sup>®</sup> has separate pins or core pairs for CANin and CANout. Use multi-port taps, if necessary.

Maximum cable lengths for CANOpen

Baud rate [kbits/s]	10	20	50	125	250	500	800	1000
Maximum cable length [m]	5000	2500	1000	500	250	100	50	25

- Use only standard-compliant cables with a characteristic impedance of 120  $\Omega$ .
- Estimate the expected bus load. The rule of thumb for estimating the bus load is:

bus load[%] = 12000 \* AED\_FIT<sup>®</sup>\_count \* output rate[number per second] / bit rate.

If the bus load exceeds 75 %, choose the next highest bit rate. If the bit rate cannot be increased any further, the network must be split into several segments, each with separate CANOpen connections.

 Check the dimensioning of the power supply with regard to voltage drops on the power supply lines.

4

5

## Commissioning the network

• Check the bus termination. The bus needs a differential resistance of 120  $\Omega$  at both ends.



The CANBus does not work without termination resistors.

• Check the node ID and the bit rates of the connected nodes.

The factory settings for the AED / FIT® at the time of delivery are:

- Bit rate: 125 kbit/s
- Node ID: 63

Node IDs must not be duplicated, as this would cause the entire network to malfunction. All the nodes used must have identical bit rates. If the bit rates are different, this can result in a "bus off" state for a node and possibly even the entire network. The only way to exit a "bus-off" state is by a reset or a power-on.

- A configuration tool is needed to change the node ID or the bit rate:
  - Sycon manufacturer Hilscher http://www.hilscher.com
  - Larcan manufacturer LARSYS http://www.larsys.com
  - CANOpener from Microcontrol http://www.microcontrol.net
  - AED\_Panel32 from HBM http://www.hbm.com
  - or the configuration tool that came with your controller.

For further details, please see your documentation.

The bit rate or the node ID can only ever be selected for a single AED / FIT<sup>®</sup>. All the other nodes must be disconnected from the bus. The AED9301 has a slide switch for bus disconnection.

6

8

## Changing the bit rate and the node ID with AED\_Panel32

le	Print	Options	Help		? Online_H	lelp			
Communic	ation Mea	sure Grap	hic Para	meters S	ignal cond	itioning [	Display		
Мо	de	CAN_E	Bus						
CAN Bus	active AED	Channel :	AD103C	ADR: 31					
Master	ADR10	ADR20	ADR30	ADR40	ADR50	ADR60	ADR70	ADR80	ADR90
ADR 1	ADR11	ADR21	ADR31	ADR41	ADR51	ADR61	ADR71	ADR81	ADR91
ADR 2	ADR12	ADR22	ADR32	ADR42	ADR52	ADR62	ADR72	ADR82	ADR92
ADR 3	- ADR13	ADR23	ADR33	ADR43	ADR53	ADR63 OK	ADR73	ADR83	ADR93
ADR 4	- ADR14	ADR24	ADR34	ADR44	ADR54	ADR64	ADR74	ADR84	ADR94
ADR 5	- ADR15	ADR25	ADR35	ADR45	ADR55	ADR65	ADR75	ADR85	ADR95
ADR 6	ADR16	ADR26	ADR36	ADR46	ADR56	ADR66	ADR76	ADR86	ADR96
ADR 7	- ADR17	ADR27	ADR37	ADR47	ADR57	ADR67	ADR77	ADR87	ADR97
ADR 8	- ADR18	ADR28	ADR38	ADR48	ADR58	ADR68	ADR78	ADR88	ADR98
ADR 9	- ADR19	ADR29	ADR39	ADR49	ADR59	ADR69	ADR79	ADR89	ADR99
1250	00	Address 63	Write						BusScan

#### Changing the node ID

- Run a bus scan
- Change the node ID in the input field
- Press the Write button
- The panel program now changes the node ID and stores it safe from power failure in the EEPROM of the AED / FIT<sup>®</sup>.

#### Changing the bit rate

• Change the setting in the panel.

The panel program now changes the bit rate and stores it safe from power failure in the EEPROM of the AED /  $\text{FIT}^{\circledast}.$ 



As the *AED\_Panel32* program does not have multi-master capability, the PLC may have to be brought to the stop state.

## Commissioning the AED / FIT®

Use the configuration tool provided with your controller to do this.

The following screenshots show a typical configuration with the Sycon tool from Hilscher.

File Edit View Insert Online Settings V	Vindow Help			_ @ ×
	Turgett Clob			
COM-1	Master Node ID Master	1 CIF100-COM		
	Node2	2 AD103C		
For Help, press F1			CANopen	Config Mode

- First import the EDS file of the AED / FIT<sup>®</sup> into your configuration tool.
- Create a new project
- Enter a master and the requisite slave devices.
- Assign node IDs and meaningful names to the devices.

7

💣 SyCon.I	EXE - [Unname	d1.co]													6	<u> N</u> ×
Eile No	de Configurati	on										×			6	١×
							Node	e receiv	e PDO c	hara	acteristics, master output pr	ocess dal	ta		×	1
	Node         AD103C           Description         Node2           File name         AD103CEDS           If Activate node in actual configuration         Image: Additional configuration           Image: Additional configuration         Image: Additional configuration							Transmission Mode Transmission Mode node shall use a synchronization message to actuate the received PDD, receive PDD transmission Triggering Mode dependent node shall use every 10 receive PDD transmission Triggering Mode dependent receive PDD transmission Triggering Mode dependent receive PDD transmission regering Mode dependent receive PDD transmission receives to defined in the device profile							<u>OK</u>	
	Predefined Proc Obj.Idx. PDO 1400 RPD 1800 TPD 1801 TPD 1802 TPD 1803 TPD 1803 TPD	ess Data Objects ( name 0 1 Communicatior 0 2 Communicatior 0 3 Communicatior 0 4 Communicatior 0 5 Communicatior	PDOs) from Paramete Paramete Paramete Paramete Paramete	m EDS er er er er er er	file			Resulting riggering event cyclic	CANope Mode driven, P transmiss	n spe DO tr ion e	ansmitted when data has change wery 10 node cycle interva	254 ed al (inhibit tin	ne)			
	- Configured PDC	o o communication	i r alaillete	51						_						
	PD0 name RPD0 1 TPD0 1 TPD0 2 TPD0 3 TPD0 4	Symbolic Name PD0_1400 PD0_1800 PD0_1801 PD0_1802 PD0_1803	COB-ID   514 386   642   898   1154	I Type IB IB IB IB	I Addr. 0 6 12 18	I Len. 6 6 8	QB	0 Addr. 0	2 2		PD0 Contents <u>Mapping</u> PD0 C <u>p</u> aracteristics Define new <u>R</u> eceive PD0 Define new <u>I</u> ransmit PD0 <u>D</u> elete configured PD0 <u>Symbolic Names</u>					
For Help, pro	ess F1												CANopen	Config Mode		

- Now edit the node configuration
- Add the required Transmit and Receive PDOs
- The AED / FIT<sup>®</sup> supports the following PDOs:
  - RPDO1 Control word
  - TPDO1 Measured value and status / MSV
  - TPDO2 Trigger value and status / MAV
  - TPDO3 Dosing result and status / FRS
  - TPDO4 Peak values / PVA
  - TPDO5 Alarm status

The format for the PDOs can be found in the AED /  $\text{FIT}^{\circledast}$  / PW20i online Help or in the appendix.



The AED /  $\mathsf{FIT}^{\textcircled{\text{B}}}$  does not support re-mapping of PDO content or COB IDs.

• Edit the PDO parameters.

Set the transmission method for the PDO to "manufacturer-specific".

With this setting, you get a PDO for each newly formed measured value. There is no point in making other settings.

<b>5yCon.</b>	EXE - [Unname	d1.co]															_ 8 ×
	Jue connguraci	ION				PD	0 Conter	ts Ma	nnin	a Ahie	ect 1	Index 1A00				IX	
	Node AD103C																
<u> </u>						_ [	Мараріе	Dects	rrom	EDST	lle -			A		<u>K</u>	
	Description	Node2					1001	joub.i	iux.	error	renis	ter		Bead	-	Cancel	
	File name	AD102C EDS					1002			manu	ifacti	urer status registe	91	Read			
	The name	AD TOSCEDIS					2000	1		MSV	• Me	asuredValue		Read			
	Activate no	de in actual configu	aration				2000	2		MSV	٠Me	asuredValueStat	tus	Read			
	I Automatic C	:0B·ID allocation in	accorda	ance with	n Profile 3	01	2000	3		MAV	• Tri	ggerMeasuremer	nt	Read		Append Object	
	Device Profile	10 0	evice tun	e O			2000	4		MAV	• Tri	ggerMeasuremer	ntStatus	Read			
							2000	5		FRS ·	- Do	singResult		Read	-		
							- Mapped (	) biect o	diction	narv							
	Decide Grand Decid		000.06		c1_		Obildy	Sub	ldv	Parar	nete	r	Sumbolic	name			
		sess Diata Objects (	PDUSJII	OILEDS	nie	_	2000	1	Gr.	MSV	• Me	easuredValue	Object200	)0ldx1	_		
	1400 BPD	name 0.1 Communication	o Parame	tor		- 1	2000	2		MSV			Object200	00ldx2			
	1800 TPD	0.1 Communication 0.1 Communication	n Parame	ter													
	1801 TPD	0 2 Communication	n Parame	ter													
	1802 TPD	0 3 Communication	n Parame	ter													
	1803 TPD	0 4 Communication	n Parame	ter												Delete manned Object	
	1804 TPD	0 5 Communication	n Parame	ter												elece mapped object	
	- Configured PDC	)s															
	- PDO name	Sumbolic Name	Тсовир	I Tupe	Låddr			шаа		en	•	DDO Cardent	. Manning				
	BPD0 1	PDO 1400	514	1.1300	r r raran.	1 2011	OB	0	2		-	T DO CONIENI	s <u>m</u> apping	-			
	TPD0 1	PD0 1800	386	IB	0	6			-			PDO C <u>h</u> ara	cteristics				
	TPD0 2	PD0_1801	642	IB	6	6						Define new Re	ceive PDO				
	TPD0 3	PD0_1802	898	IB	12	6								-			
	TPD0 4	PD0_1803	1154	IB	18	8						Define new Ira	ansmit PDD	·			
												Delete confi	gured PDO				
												Currhalia	klassas				
									_		<u> </u>		Names				
														_			
		1															
For Help, pr	ess F1														CANope	n Config Mode	

	AD103C			OPC 0	Object	Configu	iration				1	-		
Description	Node2			⊢Pr	edefine	d suppor	ted Objec	ts in the E	DS file-					Г <u>ПК</u>
File name	4D103C EDS			0	bj.ldx.	Sub.Idx.	Paramet	er		Default Valu	ie	Access	<u>-</u>	
Activate r	ode in actual confir	uration		10	000	0	device ty	ре		(no default	/alue)	read only		<u>C</u> ancel
Automation	COD ID -II	jaradon		10	001	0	error reg	ster		2		read only		
Automatic	COB-ID allocation I	n accord	iance wit	1 10	002	0	manufac	turer statu	s register	3		read only		
Device Profil	.e 0 [C	)evice ty	pe O	1	005	0	COB-ID :	SYNU mes	sage	0.00		read / write	-	
				10	000	0	manurac	turer devic	e name	ion 0		constant	-1	
					000	0	manurau			ion o		Constant	Ľ	Add to Configured Ubje
- Predefined Pr	ncess Data Objects	(PDOs))	from EDS	⊢Co	onfigure	d Object	s							
Dbildy PD	III name	(1000)	nom Eb c	- 0	- Fildu	Sub Idu	Paramet			Sumbolio Namo	Choor	on) (alua	1.1	
1400 RF	DO 1 Communicatio	on Param	eter	- 2	130	1	IIV1 · Li	⊐ mitValue1€	]n/Ωff	Object2030Ldx1	1		-	
1800 TP	DO 1 Communicatio	n Param	eter	2	030	3	LIV1 · Li	mitValue10 mitValue10	)nlevel	Object2030Idx3	1234			
1801 TF	DO 2 Communicatio	n Param	eter			-								
1802 TP	DO 3 Communicatio	n Param	eter											New User defined SD
1803 TP	DO 4 Communicatio	on Param	eter											
1804 TP	DO 5 Communicatio	on Param	eter	- 1									-	Delete Configured Obj
Configured PI	)Os													
PD0 name	Symbolic Name	e COB-II	)   Type	TAdd	r. I Lei	n. 10 T	ype  U Ac	dr. U Len.		PD0 Contents Mapping	1	-		
RPD0 1	PD0_1400	514				QB	0	2			-			
TPD0 1	PD0_1800	386	IB	0	6					PDU Uharacteristics				
TPD0 2	PD0_1801	642	IB	6	6					Define new <u>R</u> eceive PDO				
TPD0 3	PD0_1802	898	IB	12	6					Define new Transmit PDO				
TPD0 4	PD0_1803	1154	IB	18	8					Deline new Transmit PDO	-1			
									_	Delete configured PDO				
									<b>-</b>	Symbolic Names				

Check the PDO content assignment

Run parameterization. The parameters selected here are written to the AED / FIT<sup>®</sup> each time the network is started up. This process is not suitable for all parameters; see Note. The alternative option is to run parameterization via the *AED\_Panel32*. The parameter set can be stored with index 0 \* 2450 sub-index 2 or the *AED\_Panel* in the EEPROM of the AED / FIT<sup>®</sup>, where it is safe from power failure.



- There is no point in writing all the parameters of the AED / FIT<sup>®</sup>; only modify those parameters that are useful in your application.
- Some of the parameters must only be written in a specific sequence. If the rules are violated, error messages can result.
- Some of the parameters have minimum and maximum values and if these are exceeded, error messages result.
- Some parameters cannot be written in "legal for trade mode" (LFT  $\geq$  1).

Further details can be found in the online Help for the AED / FIT® or the EDS file.

## 8 PLC programming

The network can now be started up. The PLC parameterizes the AED / FIT<sup>®</sup> with the stored values and then starts cyclic operation. If the AED / FIT<sup>®</sup> has to be controlled or parameterized while cyclic operation is ongoing, there must be user programming in the PLC. There are so many different PLCs available on the market, that it is only possible to give a general overview.

CANOpen provides several options for control and parameterization in cyclic operation:

Receive PDO 1

The bits defined in the input data (control word) of Receive PDO 1

are used to control functions such as zeroing, taring, starting the dosing process, etc. The stored functions are triggered when the relevant bit is

set. If the function is to be triggered again, the bit must first be cleared and then reset.

It is preferable to use PDO 1 for control, as this has a higher priority and so you can count on the defined response times.

Accesses via SDOs (Service Data Objects)

With SDOs, a control or re-parameterization can be performed during ongoing operation by writing individual indexes/sub-indexes. As the SDO connection has a low priority, response times can vary considerably. For the indexes and sub-indexes of the individual attributes, please see the EDS file or the AED / FIT<sup>®</sup> online Help.



Some of the functions (such as **LDW/LWT**) have execution times of up to 4.5 seconds. Once these functions start, there is an immediate and positive acknowledgement. The user can query the function end and result with a busy flag (index 0 \* 2000 sub-index 0 \* 0c).

• Reading out variables in cyclic operation.

The data transmitted via the cyclic connections are permanently stored in the firmware of the AED / FIT<sup>®</sup> and cannot be re-mapped.

If required, the user can read out other interesting values, such as the actual dosing time, via the SDO connection. To do this, it is usually necessary to have user-programming in the PLC. PLC manufacturers make function blocks available for this.

9

## **Transmit PDOs**

#### Transmit PDO 1 (measured value and status)

Offset	Byte	Content
0	LSB	MSV value (measured value)
1		MSV value (measured value)
2		MSV value (measured value)
3	MSB	MSV value (measured value)
4	LSB	<b>MSV</b> status (measurement status)
5	MSB	<b>MSV</b> status (measurement status)

### Transmit PDO 2 (trigger value and status)

Offset	Byte	Content
0	LSB	MAV value (trigger value)
1		MAV value (trigger value)
2		MAV value (trigger value)
3	MSB	MAV value (trigger value)
4	LSB	MAV status (trigger status)
5	MSB	MAV status (trigger status)

#### Transmit PDO 3 (dosing result and status)

Offset	Byte	Content
0	LSB	FRS value (dosing result)
1		FRS value (dosing result)
2		FRS value (dosing result)
3	MSB	FRS value (dosing result)
4	LSB	FRS status (dosing status)
5	MSB	FRS status (dosing status)

#### Transmit PDO 4 (peak values)

Offset	Byte	Content
0	LSB	PVA min. value
1		<b>PVA</b> min. value
2		<b>PVA</b> min. value
3	MSB	<b>PVA</b> min. value
4	LSB	PVA max. value
5		PVA max. value
6		PVA max. value
7	MSB	PVA max. value

## 10 Receive PDOs

#### **Receive PDO 1**

Byte	Bit no.	Content
Offset		
0	0	<b>TAR</b> – Tare
	1	TAS – Gross/net selection
	2	CSN – Clear dosing result
	3	RUN – Start dosing process
	4	BRK – End dosing process
	5	CTR – Clear trigger result
	6	CDL – Zeroing
	7	CPV – Clear peak value
1	0	Reserved
	1	Reserved
	2	Output 1 desired state
	3	Output 2 desired state
	4	Output 3 desired state
	5	Output 4 desired state
	6	Output 5 desired state
	7	Output 6 desired state

For further details, please see the AED /  $\mathsf{FIT}^{\circledast}$  online Help.

## 11 References

- CanOpen Specification
  - Can in Automation (CiA)

## Index

## Α

application document
C
Changing the bit rate and the node ID with AED_Panel32
G
General
I
Identification
P
Planning the CANOpen network
PLC programming
R
Receive PDOs
References
т
Transmit PDOs

## Application document overview

Application document	Content
APPN001en	Digital load cells FIT <sup>®</sup> in Checkweigher applications
APPN003en	FIT <sup>®</sup> /= FIT <sup>®</sup> /5 Construction and Application Conditions
APPN004en	Notes on the static adjustment of a scale with $FIT^{^{\otimes}}$ and AED
APPN005en	Measurement query via the serial link (RS232/RS485)
APPN006en	Dosing and filling with AD103 / FIT <sup>®</sup>
APPN007en	Using AED_Panel32 program for time and frequency analysis
APPN010en	Legal for trade applications and parameter checking
APPN011en	Trigger results query
APPN012en	Commissioning CANOpen
APPN013en	Commissioning DeviceNET

Modifications reserved. All details describe our products in general form only. They are not to be understood as express warranty and do not constitute any liability whatsoever.

#### Hottinger Baldwin Messtechnik GmbH

Postfach 100151D-64201 DarmstadtIm Tiefen See 45D-64293 DarmstadtTel.: +49/6151/803-0Fax: +49/6151/8039100E-mail: support@hbm.com · www.hbm.com

