



User manual

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APPLICABLE STANDARDS

The AI-08DP module is suited for the CiA DS301 protocol [1] and implements the CiA DS 401 standard Device Profile, as far as the Analogue Input Function Block is concerned [2].

Characteristics

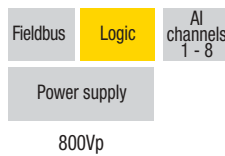
Technical data

Accuracy at 25°C	±0.1% FS
Temperature coefficient	0.01% FS/K
Input impedance	V > 10kΩ
Digital resolution	16 bit
Data format	Binary Integer
Input range	±10 V ±5 V
Total input system transfer time	5 ms
Conversion method	Sigma delta
Overtoltage protection	30 V
CMRR	> 100 dB

General

3 way isolation	800 Vp
Power supply	24 Vdc; -15...+25%
Power consumption	3 W
Dimensions	L: 76; H: 110; W: 65
Weight	220 g
Safety regulations EN61010-1	Isolation class II (50 Vrms) Installation category II Pollution degree 2
CE marking	EN61131-2

3 way isolation diagram



Environment

	Operating	Storage
Temperature	-10...+65°C	-40...+85°C
Relative Humidity	5...95% non condensing Appropriate measures must be taken against humidity >85%	5...95% non condensing For a short period, slight condensation may appear on the housing
Mounting	Vertical, free air	
Protection	IP20	
Vibrations (3 axes)	10...57Hz 0.0375mm 57...150Hz 0.5g	
Shock (3 axes)	15g, 11ms half sine	

CANopen I/O Module

8 Configurable Analogue Inputs

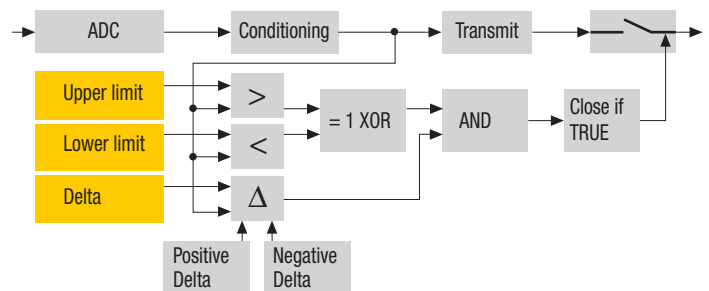
mod. IO-CB/AI-08DP

8 inputs configurable for:
±10 V, ±5 V



- 1) The product described in this manual should only be installed, operated and maintained by qualified application programmers and software engineers who are familiar with automation safety concepts and applicable national standards.
- 2) This product supports the Parameter defaults indicated by CiA standards, in addition, some parameters have a factory set (value present in the module when comes from the factory). The default values can be loaded with the restore command, but after the restore, factory set values are lost.

Functional Block Diagram



The analogue input function block describes, for each input channel, how field values are transmitted.

Every time one of the limit conditions is reached an asynchronous transmission takes place.

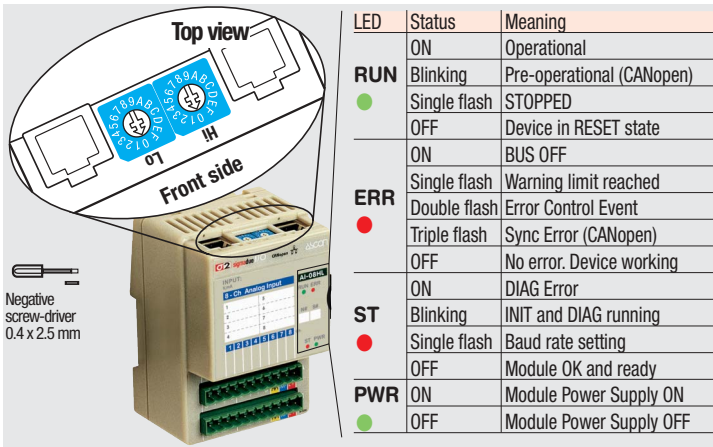
PDOs used by the module

TPDO	Properties	Mapped objects	Index	Sub-index
TPDO 2	COBID: 280h + NodeID Transmission Type: 01h *	Read Analog Input ch 1	6401h	01h
		Read Analog Input ch 2	6401h	02h
		Read Analog Input ch 3	6401h	03h
		Read Analog Input ch 4	6401h	04h
TPDO 3	COBID: 380h + NodeID Transmission Type: 01h *	Read Analog Input ch 5	6401h	05h
		Read Analog Input ch 6	6401h	06h
		Read Analog Input ch 7	6401h	07h
		Read Analog Input ch 8	6401h	08h

Note: * The Transmission Type is configurable; **01h** is the factory set (value present in the modules when come from the factory), the default value is **FFh**.

Hardware Set-up

Hexadecimal rotary switches, service and I/O LEDs



LED	Status	Meaning
	ON	Operational
RUN	Blinking	Pre-operational (CANopen)
●	Single flash	STOPPED
	OFF	Device in RESET state
	ON	BUS OFF
ERR	Single flash	Warning limit reached
●	Double flash	Error Control Event
	Triple flash	Sync Error (CANopen)
	OFF	No error. Device working
	ON	DIAG Error
ST	Blinking	INIT and DIAG running
●	Single flash	Baud rate setting
	OFF	Module OK and ready
PWR	ON	Module Power Supply ON
●	OFF	Module Power Supply OFF

Bit Rate and Node ID configuration

Bit rate

Lo switch	Baud rate kbps	Bus length m
1	20	2500
2	50	1000
3	100	500
4	125	500
5	250	250
6 *	500	100
7	800	50
8	1000	25

Node ID

Hi switch	Lo switch	Valid ID Node
0	1	01h (address 1)
0	2	02h (address 2)
↓	↓	↓
7	F	7Fh (address 127D) *

Notes: * Default value

Procedure for Node ID and Bit Rate configuration

The HI and LO hexadecimal rotary switches set the module's Bit Rate and CAN Node ID. During the configuration, the module must be **off line** and the CAN bus must be physically disconnected.

To configure the module, follow the procedure:

- 1 Turn the Power OFF
- 2 Set the **HI** switch to "F"
- 3 Select the desired Bit Rate value by setting the **LO** switch following the table (e.g. "8" for 1 Mbps)
- 4 Turn the Power ON
- 5 Shift the **HI** switch to "E" (all the module service LEDs should flash)
- 6 Turn the Power OFF. Now configure Node ID
- 7 Set the **HI** and **LO** switches to the desired valid Node ID following the table
- 8 Turn the Power ON.

Alternatively, at step 7 set the value 00h. Then, at the next Power ON, the last valid stored value will be resumed as Node ID.

Default values: Bit Rate = 500 kbps, Node ID = 127D

Parameter configuration

Module specific parameters

Index 2000h – Terminal Block Temperature

Ambient temperature, measured on the module's terminal block.

Not available through TPDO.

Index 3000h – Node Address

Current Module Node ID - Read only access

Index 3001h – Baudrate

Current Module Bit rate - Read only access

Parameters setting

Index 2001h – Analogue Input Type

The n-th subindex (from 1 to 8) contains the configuration parameter of the n-th Analogue Input

Value	Input type	Condition
0x00	-10...+10 V	Default
0x01	-5...+5V	

Standard parameters

Index 6421h - Analog Input Interrupt Trigger Selection

This object determines, which events shall cause an interrupt for a specific channel. Bits set in the list below shall refer to ways in which interrupts may be triggered.

Bit number	Interrupt trigger
0	Upper limit exceeded
1	Input below lower limit
2	Input changed by more than delta
3	Input reduced by more than negative delta
4	Input increased by more than positive delta
5 to 7	reserved for future use

Index 6422h - Analog Input Interrupt Source

This object shall determine which channel has produced an interrupt. Bits set shall relate to the number of any channels that have produced interrupts. The bits shall be reset automatically after read by SDO or transmitted by means of a PDO.

1 = interrupt produced

0 = no interrupt produced.

Index 6423h - Analog Input Global Interrupt Enable

This object shall enable and disable globally the interrupt behaviour without changing the interrupt mask. By default, no analogue input activates an interrupt.

TRUE = global interrupt enabled

FALSE = global interrupt disabled

Index 6424h - Analog Input Interrupt Upper Limit Integer

If enabled (see 6423h object), an interrupt is triggered when the analogue input is equal or rises above the given value. The value shall be always left adjusted. As long as the trigger condition is met, every change of the analogue input data generates a new interrupt, if there is no additional trigger condition, e.g. an input interrupt delta (6426h).

Index 6425h - Analog Input Interrupt Lower Limit Integer

If enabled (see 6423h object), an interrupt is triggered when the analogue input is equal or rises above the given value. The value shall be always left adjusted. As long as the trigger condition is met, every change of the analogue input data generates a new interrupt, if there is no additional trigger condition, e.g. an input interrupt delta (6426h).

Index 6426h - AI Interrupt Delta Unsigned

This object shall set the delta value (rising or falling above or below the last communicated value) for interrupt-enabled analogue inputs (see 6423h object).

Index 6427h - AI Interrupt Negative Delta Unsigned

This object shall set the negative delta value (falling below the last communicated value) for interrupt-enabled analogue inputs (see 6423h object).

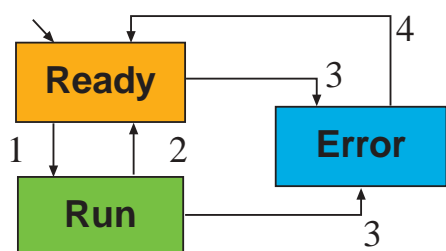
Index 6428h - AI Interrupt Positive Delta Unsigned

This object shall set the positive delta value (rising above the last communicated value) for interrupt-enabled analogue inputs (see 6423h object).

Commands

Index 200Ch – Operating mode

The device has its own internal state machine. It is possible to move through this by sending appropriate values to the Index 200Ch, following the table below.



Transition	Operating mode value	Behaviour
Init	-	At Power-Up, the Device is in the "ready" state. Transition 1 is also executed if Index 200Ch - Operating Mode contains the default value 1
1	01h	Operating mode "RUN" is activated
2	00h	Return to the initialisation "ready" state. The transition is performed: <ul style="list-style-type: none"> • following an operator's command • after assigning the configuration parameter (2001h)
3	FFh	The "error" state is automatically assigned by the device (and the operating mode value is read only) when: <ul style="list-style-type: none"> • an attempt is made to execute an unexpected command
4	00h	This value causes an exit from the "error" state, after the error condition is acknowledged. The only transition is to the "ready" state

Emergency messages

The module automatically sends emergency messages including error codes. The communication errors are described in CiA DS301 [1]. The error codes are expressed as a DEVICE SPECIFIC ERROR type of code, one for each channel: 0xFF0n for channel n. The codes indicating a specific condition are also inserted, following the table below:

Error code	Error
000000000	No error – This code is generated when exiting an error condition, to notify the end of one of the error states
000000001	Error No Valid Calib – An attempt to change the state of an input channel not properly calibrated to "operating"
000000002	Error No Config – An attempt to change the state of an input channel with a non valid Sensor Type to "operating"
000000006	Error No Command – Invalid command received
000000007	Error Wrong Command – An attempt to execute a command from an illegal state
000000008	Error Wrong Assignment – An attempt to assign a parameter from an illegal state

Emergency message	0	1	2	3	4	5	6	7
	0nh	FFh	21h	00h	00h	00h	00h	0yh
	COB – ID = [entry 1014h] + NodeID							
	Error code							

Parameter Store/Restore

This module allows parameters to be saved in a non volatile memory. In order to avoid storing parameters by mistake, storage is only executed when a specific signature is written to the appropriate subindex. The signature is "save".

Similarly, the default values of parameters, according to the communication or device profile, are restored. On receipt of the correct signature in the appropriate subindex, the device restores the default parameters and then confirms the SDO transmission. The signature is "load".

The new configuration becomes active after a reset, i.e. after a "Power Down" or an NMT "Reset Node" message.

Byte	0	1	2	3	4	5	6	7
Store Parameter	22h	10h	10h	01h	73h	61h	76h	65h
	COB – ID = 600h + NodeID							
Restore Parameter	22h	11h	10h	01h	6Ch	6Fh	61h	64h
	COB – ID = 600h + NodeID							

SDO Messages

The entries of a device Object Dictionary are accessed through SDO (Service Data Object) messages. The basic SDO messages are as follows, as based on the Client – Server request and response model:

Byte	0	1	2	3	4	5	6	7
Read request	40h	Index	Sub-Index	Reserved				
	COB – ID = 600h + NodeID							
Read response	4xh *	Index	Sub-Index	Data				
	COB – ID = 580h + NodeID							
Write request	22h	Index	Sub-Index	Data				
	COB – ID = 600h + NodeID							
Write response	60h	Index	Sub-Index	Reserved				
	COB – ID = 580h + NodeID							

* This code is type dependant.

Please refer to the CiA DS301 Profile for more details.

Reference documents

List of CiA documents to which the user should refer:

- [1] CiA DS301 - CANopen Application Layer and Communication Profile
- [2] CiA DS401 - CANopen Device Profile: Generic I/O Modules

Accessories, Spare Parts and Warranty

Power Supply 75W 24Vdc 3A	AP-S2/AL-DR75-24
Power Supply 120W 24Vdc 5A	AP-S2/AL-DR120-24
Additional Terminal Block 2x11	AP-S2/TB-211-1
Female Plug 11 Screw clamp	AP-S2/SPINA-V11
Female Plug 11 Spring clamp	AP-S2/SPINA-M11
RJ45 terminated cable 14cm	AP-S2/LOCAL-BUS76
RJ45 terminated cable 22cm	AP-S2/LOCAL-BUS152
CAN termination Adapter	AP-S2/TERM-CAN

Warranty: 3 years excluding defects due to improper use

