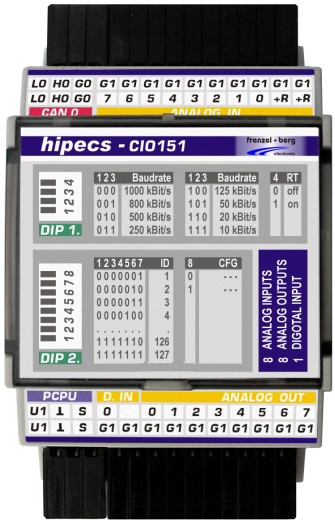
Allgemein

Das Modul hipecs-CIO151 ist ein kostengünstiges CANopen-I/O-System mit 8 analogen Eingängen, 8 analogen Ausgängen und zwei digitalen Eingängen. Die E/A's sind galvanisch vom Bussystem und der Versorgung getrennt. Die Ausgänge sind kurzschlussfest. Mit dem ersten digitalen Eingang kann ein Sondermodus aktiviert werden, bei dem die Werte der analogen Eingänge direkt an den analogen Ausgängen ausgegeben werden.

In diesem I/O-Modul sind die komplexen CANopen-Standards DS301 und DS401 implementiert. Alle üblichen Baudraten bis zu 1 Mbit werden unterstützt.



Funktionen

- **CANopen remote I/O Modul entsprechend den CiA Draft Standards DS301 Version 4.2 DS401 Version 3.0**
- **Spannungsversorgung 24V DC**
- **8 analoge Eingänge galvanisch isoliert von Bus und Spannungsversorgung, 16 Bit Auflösung**
- **Eingangsspannungsbereich: 0 .. +10V**
- **8 analoge Ausgänge galvanisch vom Bus und Spannungsversorgung getrennt, Kurzschlussstrom 40mA, 12 Bit Auflösung**
- **Ausgangsspannungsbereiche: 0 .. +10 V oder –10V .. +10V**
- **2 dig. Eingang für 24V DC, high aktiv**
- **CAN-Baudraten bis 1Mbit**
- **CAN-Bus ISO11898 mit Transceiver TJA1050**
- **4 Transmit und 4 Receive PDOs**
- **Dynamisches PDO Mapping**
- **Variable PDO Identifier**
- **CANopen PDO Übertragungsmodi: synchron, asynchron, ereignisgesteuert, zyklisch, azyklisch und Remote Frame bezogen.**
- **Event Timer und Inhibit Timer für alle Transmit PDOs.**
- **Nodeguarding, Lifeguarding und Heartbeat**
- **Emergency Nachrichten**
- **Minimum boot up**
- **Kunststoffgehäuse zum Aufrasten auf DIN-Trageschienen**
- **Betriebstemperatur: 0°C bis +55 °C optional –40°C…+70 °C**

Bestellinformation

Bauteil	Best.-Nr.
hipecs-CIO151-i	EZ.00000.2206.01
CANopen I/O mit 8/8 analogen Ein-/Ausgängen galvanisch entkoppelte CAN-Schnittstelle Betriebstemperaturbereich 0…+55 °C	
hipecs-CIO151-ie	
CANopen I/O mit 8/8 analogen Ein-/Ausgängen galvanisch entkoppelte CAN-Schnittstelle Betriebstemperaturbereich -40…+70 °C	

Technische Daten

Spannungsversorgung System	Min.	Norm.	Max.
Nominale System/Bus Versorgungsspannung	11 Volt	24 Volt	32 Volt
CAN bus Norm	ISO11898		
CiA Draft Standards	DS301 Version 4.0 und DS401 Version 2.0		
Isolation zwischen Bus und System / Vcc	60 Volt		
Konformitätserklärung	CE		

Analoge Eingänge	
Anzahl Eingänge	8
minimale Messeingangsspannung	0 Volt
maximale Messeingangsspannung	+10 Volt
max. zulässige Spannung an den Eingängen	+/- 24 Volt
Verzögerungszeit (CAN reaction time)	2 ms (typisch < 1ms)
Auflösung	16 bit
Isolation zum Bus/System	60 Volt

Analoge Ausgänge	
Anzahl Ausgänge	8
Kurzschlussfest	ja
Auflösung	12 Bit
Verzögerungszeit (CAN reaction time)	2 ms (typisch < 1ms)
max. Ausgangsstrom bei Kurzschluss für alle Kanäle	40 mA
max. Ausgangsstrom pro Kanal	5 mA (minimale Ausgangslast größer 2 kOhm bei Spannungsbereich –10..+10V / 0..+10V)
max Kapazität am Ausgang	4 nF

Referenzausgänge	
Anzahl Referenzausgänge	2x +10Volt
max. Ausgangsstrom Referenzausgänge	10 mA

Digitaler Eingang	
Signalpegel Low	0..3 Volt
Signalpegel High	9..32 Volt
Verzögerungszeit (CAN reaction time)	2 ms (typisch < 1ms)
Eingangsstrom bei DC24 V	3,5 mA
Isolation zum Bus/System	60 Volt

Stecker und Abmessungen	
Stecker	WAGO Steckverbinder Typ 713 (Im Lieferumfang enthalten)
Leitungsquerschnitt [mm²]	0,08 bis 1,5 mm²
Leitungsquerschnitt [AWG]	14 bis 28 AWG
Leiterlänge	7 mm
Abmessung CIO151 Gehäuse	ca. 125 x 54 x 62 mm (Bild “Abmessungen” beachten!)
Betriebstemperatur	0 .. 55°C

Steckerbelegung X1 (CAN)

Pin Nr.	Name	Funktion
1	G0	CAN Ground
2	G0	CAN Ground
3	H0	CAN High Signal
4	H0	CAN High Signal
5	L0	CAN Low Signal
6	L0	CAN Low Signal

Steckerbelegung X2 (analoge Eingänge und Referenzspannung +10V)

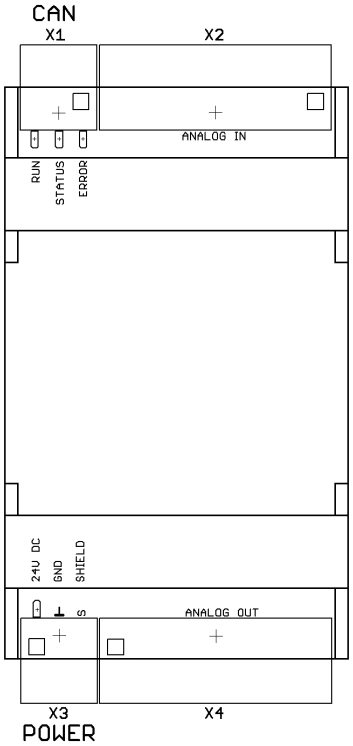
Pin Nr.	Name	Funktion
1	G1	Masse für Analogeingänge
2	R+	Referenzspannung +10 Volt
3	G1	Masse für Analogeingänge
4	R+	Referenzspannung +10 Volt
5	G1	Masse für Analogeingänge
6	AIN 0	Analogeingang 0
7	G1	Masse für Analogeingänge
8	AIN 1	Analogeingang 1
9	G1	Masse für Analogeingänge
10	AIN 2	Analogeingang 2
11	G1	Masse für Analogeingänge
12	AIN 3	Analogeingang 3
13	G1	Masse für Analogeingänge
14	AIN 4	Analogeingang 4
15	G1	Masse für Analogeingänge
16	AIN 5	Analogeingang 5
17	G1	Masse für Analogeingänge
18	AIN 6	Analogeingang 6
19	G1	Masse für Analogeingänge
20	AIN 7	Analogeingang 7

Steckerbelegung X3 (PCPU Versorgung)

Pin Nr.	Name	Funktion
1	U1	Versorgungsspannung DC 24V für System / Bus
2	U1	Versorgungsspannung DC 24V für System / Bus
3	GND	Masse für System / Bus
4	GND	Masse für System / Bus
5	S	Schutzleiter
6	S	Schutzleiter

Steckerbelegung X4 (analoge Ausgänge und digitaler Eingang)

Pin Nr.	Name	Funktion
1	G2	Masse für Digitaleingänge
2	DIN0	Digital Eingang 24 Volt DC
3	G2	Masse für Digitaleingänge
4	DIN1	Digital Eingang 24 Volt DC
5	G1	Masse für Analogausgänge
6	AOUT 0	Analogausgang 0
7	G1	Masse für Analogausgänge
8	AOUT 1	Analogausgang 1
9	G1	Masse für Analogausgänge
10	AOUT 2	Analogausgang 2
11	G1	Masse für Analogausgänge
12	AOUT 3	Analogausgang 3
13	G1	Masse für Analogausgänge
14	AOUT 4	Analogausgang 4
15	G1	Masse für Analogausgänge
16	AOUT 5	Analogausgang 5
17	G1	Masse für Analogausgänge
18	AOUT 6	Analogausgang 6
19	G1	Masse für Analogausgänge
20	AOUT 7	Analogausgang 7



Ansicht von oben

Konfiguration Dip-Schalter

DIP1 und DIP2 am Einstellmodul

DIP Switch DIP1 (Einstellung **Baudrate**)				
Switch Nummer				Funktion
1	**2**	**3**	**4**	
BD2	**BD1**	**BD0**	**RT**	
X	X	X	ON	CAN-Terminierung ein (120 Ohm)
X	X	X	OFF	CAN-Terminierung aus
OFF	OFF	OFF	X	1 Mbit / sec
OFF	OFF	ON	X	800 kbit / sec
OFF	ON	OFF	X	500 kbit / sec
OFF	ON	ON	X	250 kbit / sec
ON	OFF	OFF	X	125 kbit / sec
ON	OFF	ON	X	50 kbit / sec
ON	ON	OFF	X	20 kbit / sec
ON	ON	ON	X	reserviert

DIP Switch DIP2 (Einstellung **Knotennummer und Mode**)								
Switch Nummer								Funktion
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
0	0	0	0	0	0	1	X	Node ID = 1
0	0	0	0	0	1	0	X	Node ID = 2
0	0	0	0	0	1	1	X	Node ID = 3
0	0	0	0	1	0	0	X	Node ID = 4
.	.	.	.	.	.	.	X	….
1	1	1	1	1	1	0	X	Node ID = 126
1	1	1	1	1	1	1	X	Node ID = 127
X	X	X	X	X	X	X	ON	Invertierung für digitalen Eingang aktiv
X	X	X	X	X	X	X	OFF	Invertierung für digitalen Eingang inaktiv

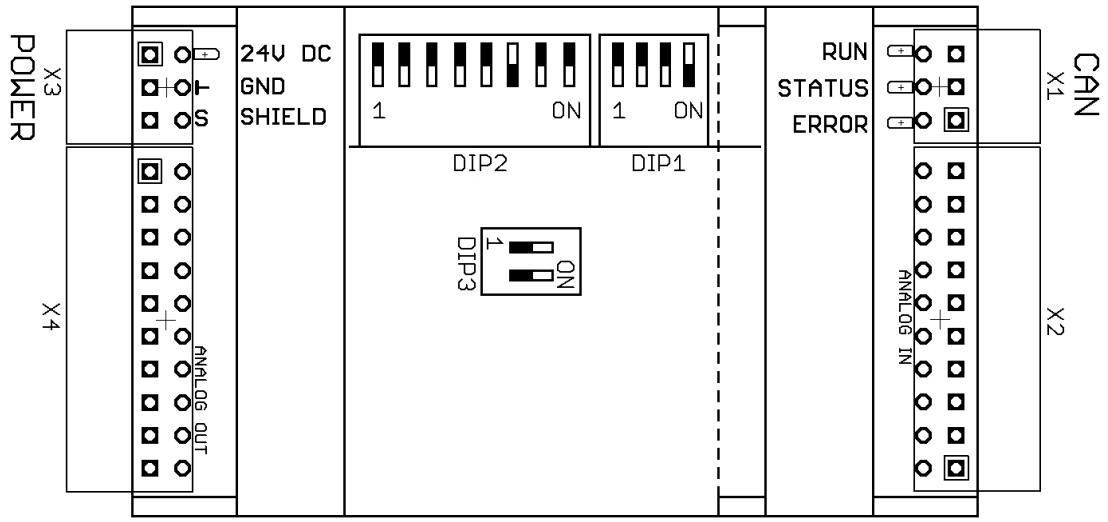
Schalter DIP3 im Modul

Schalter 1 ON: Durch Anlegen eines positiven Pegels am digitalen Eingang DIN0 wird ein „Durchschleifbetrieb“ aktiviert. Die Werte der analogen Eingänge werden direkt an die analogen Ausgänge weitergereicht. Die Werte, die über den CAN als Ausgangswerte vorgegeben sind, werden in diesem Fall ignoriert. DIN1 steht weiterhin als normaler, digitaler Eingang zur Verfügung.

Schalter 1 OFF: Normalbetrieb. Kein „durchschleifen“ möglich. Analoge Ausgänge werden über den CAN bedient. Beide digitale Eingänge sind als normale Eingänge verfügbar.

Schalter 2: Reserviert. Muss dauerhaft OFF sein.

Lageplan DIP-Schalter

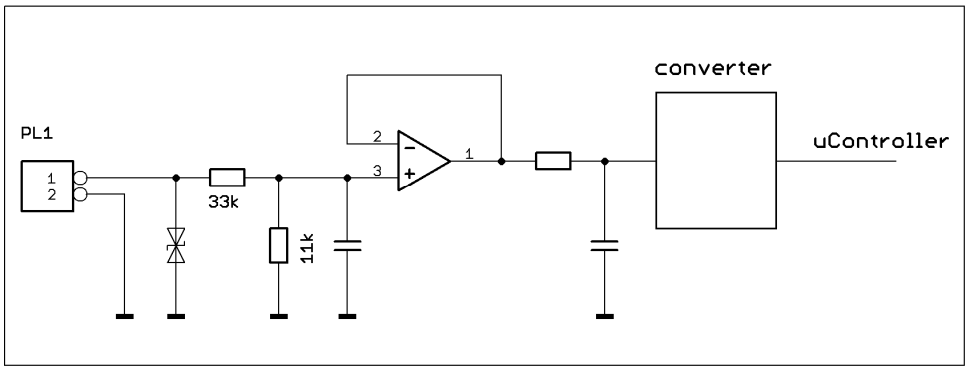


Ansicht von rechts (Deckel geöffnet)

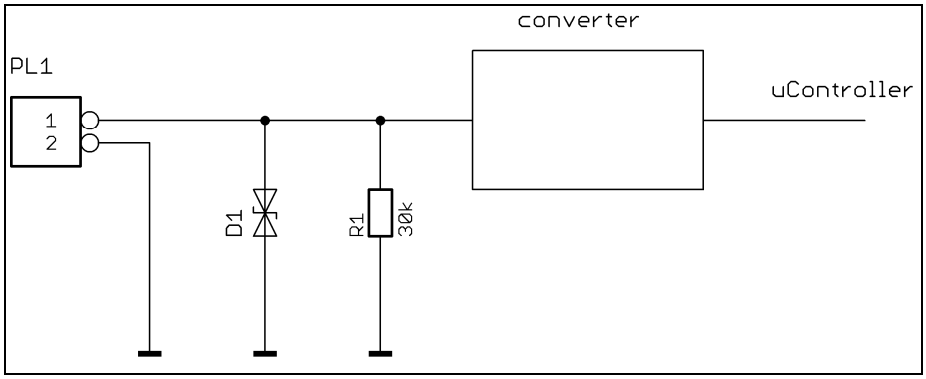
CAN Signal LED's

LED	Farbe	Funktion
RUN-LED	grün	Die RUN-LED zeigt den NMT-Zustand entsprechend DRP303-3 an Aus — Betriebsspannung fehlt oder Defekt flackern — CAN noch nicht gestartet 1 x flashen (kurzes Aufblitzen) — Stopped blinken — Preoperational ein — Operational
ERROR-LED	rot	Die Error-LED zeigt den Fehlerzustand entsprechend DRP303-3 an aus — Kein Fehler 1 x flashen — CAN-Modul ist im Error-Warning-Zustand 2 x flashen — Node-Guarding-Fehler ein — Bus-Off-Zustand des Knoten
STATUS-LED	gelb	Die gelbe Status LED zeigt weitere Fehler an 3x flashen — noch keine boot-up Nachricht gesendet Blinken — unkritischer Fehler / kein NMT-Wechsel an — kritischer Fehler / NMT state gewechselt

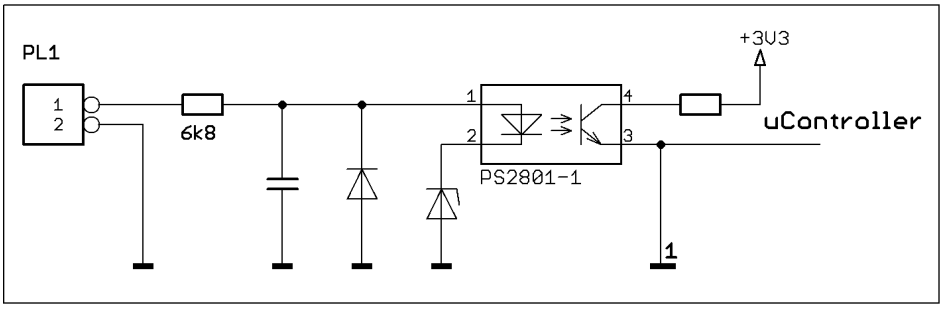
Prinzipschaltbild analoge Eingänge



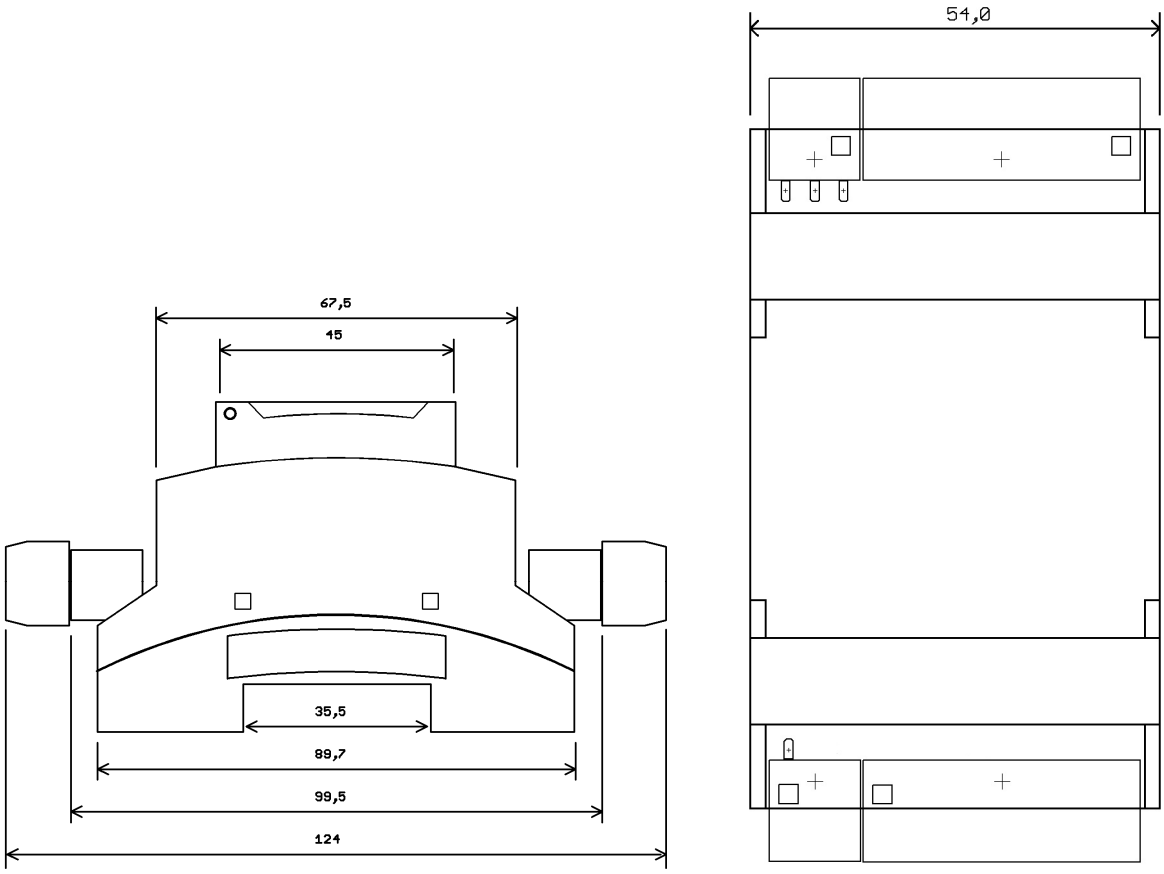
Prinzipschaltbild analoge Ausgänge

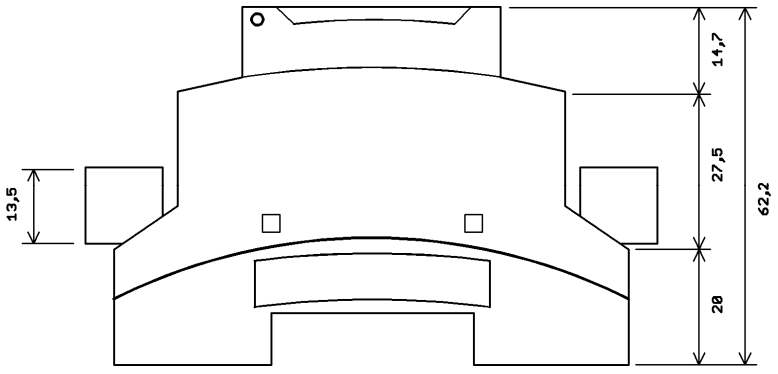


Prinzipschaltbild digitaler Eingang



Abmessungen Kunststoffgehäuse





Alle Maße in mm

CANopen Objektverzeichnis

Im hipecs-CIO151 Controller ist das komplexe Objektverzeichnis für CANopen E/A-Geräte implementiert.

hipecs-CIO151 Objekte

Alle Werte dieser Tabelle sind in hexadezimaler Schreibweise notiert.
Als Zugriffsberechtigungen sind folgende Typen definiert:
ro read only / nur lesen
wo write only / nur schreiben
rw read and write access enabled / lessen und schreiben
rww read and write access enabled by SDO, write only by PDO / lesen, schreiben per SDO,PDO nur schreiben

Index	Sub-Index	Name	Data type	Acc.	Map-pable	Default Value / Note	Object Category
1000	-	Device Type	Unsigned 32	ro	no	000D 0191 h	Global
1001	-	Error Register	Unsigned 8	ro	yes	-	Global
1002	-	Manufacturer Status Register	Unsigned 32	ro	yes	-	Global
1005	-	COB-ID Sync Identifier Sync Object	Unsigned 32	ro	no	80 h	Global
1008	-	Device Name	Visible String	ro	no	"hipecs-CIO151"	Global
1009	-	Hardware Version	Visible String	ro	no	-	Global
100A	-	Software Version	Visible String	ro	no	active Version	Global
100C	-	Guard Time	Unsigned 16	rw	no	0 h	Global
100D	-	Life Time Factor	Unsigned 8	rw	no	0 h	Global
1014	-	COB ID Emergency	Unsigned 32	rw	no	80 h + Node-ID	Global
1015	-	Inhibit Time Emergency	Unsigned 16	rw	no	0 h (disabled)	Global
1016		Consumer Heartbeat Time	Array	-	no	-	Global
	0	Nr of Subobjects	Unsigned 8	ro	no	04 h	Global
	1	Consumer Heartbeat Time 1	Unsigned 32	rw	no	0 h	Global
	2	Consumer Heartbeat Time 2	Unsigned 32	rw	no	0 h	Global
	3	Consumer Heartbeat Time 3	Unsigned 32	rw	no	0 h	Global
	4	Consumer Heartbeat Time 4	Unsigned 32	rw	no	0 h	Global
1017	-	Producer Heartbeat Time	Unsigned 16	rw	no	0 h	Global
1018		Identity Object	Record	-	-	-	Global
	0	Nr of Subobjects	Unsigned 8	ro	no	04 h	Global
	1	Vendor ID	Unsigned 32	ro	no	0000 0058 h	Global
	2	Product Code	Unsigned 32	ro	no	0301 5100 h	Global
	3	Revision Number	Unsigned 32	ro	no	active Rev. Code	Global
	4	Serial Number	Unsigned 32	ro	no	-	Global
1029		Error Behavior Object	Array	-	-	-	Global
	0	Nr of Subobjects	Unsigned 8	ro	no	2 h	Global
	1	Communication error	Unsigned 8	rw	no	0 h	Global
	2	Application error	Unsigned 8	rw	no	0 h	Global
1400		Receive PDO1 - Communication Parameters	Record	-	-	-	PDO
	0	Nr of Subobjects	Unsigned 8	ro	no	2 h	PDO
	1	COB-ID	Unsigned 32	rw	no	0x80000200 + Node-ID	PDO
	2	Transmission Type	Unsigned 8	rw	no	FF h	PDO

Index	Sub-Index	Name	Data type	Acc.	Map-pable	Default Value / Note	Object Category
1401		Receive PDO2 - Communication Parameters	Record	-	-	-	PDO
	0	Nr of Subobjects	Unsigned 8	ro	no	2 h	PDO
	1	COB-ID	Unsigned 32	rw	no	300 h + Node-ID	PDO
	2	Transmission Type	Unsigned 8	rw	no	FF h	PDO
1402		Receive PDO3 - Communication Parameters	Record	-	-	-	PDO
	0	Nr of Subobjects	Unsigned 8	ro	no	2 h	PDO
	1	COB-ID	Unsigned 32	rw	no	400 h + Node-ID	PDO
	2	Transmission Type	Unsigned 8	rw	no	FF h	PDO
1403		Receive PDO4 - Communication Parameters	Record	-	-	-	PDO
	0	Nr of Subobjects	Unsigned 8	ro	no	2 h	PDO
	1	COB-ID	Unsigned 32	rw	no	0x80000500 h + Node-ID	PDO
	2	Transmission Type	Unsigned 8	rw	no	FF h	PDO
1600		Receive PDO1 - Mapping Parameters	Record	-	-	-	PDO
	0	Nr of Subobjects	Unsigned 8	rw	no	0 h	PDO
1601		Receive PDO2 - Mapping Parameters	Record	-	-	-	PDO
	0	Nr of Subobjects	Unsigned 8	rw	no	4 h	PDO
	1	Mapped Object	Unsigned 32	rw	no	6411 01 10 h analog AOUT0	PDO
	2	Mapped Object	Unsigned 32	rw	no	6411 02 10 h analog AOUT1	PDO
	3	Mapped Object	Unsigned 32	rw	no	6411 03 10 h analog AOUT2	PDO
	4	Mapped Object	Unsigned 32	rw	no	6411 04 10 h analog AOUT3	PDO
1602		Receive PDO3 - Mapping Parameters	Record	-	-	-	PDO
	0	Nr of Subobjects	Unsigned 8	rw	no	4 h	PDO
	1	Mapped Object	Unsigned 32	rw	no	6411 01 10 h analog AOUT4	PDO
	2	Mapped Object	Unsigned 32	rw	no	6411 02 10 h analog AOUT5	PDO
	3	Mapped Object	Unsigned 32	rw	no	6411 03 10 h analog AOUT6	PDO
	4	Mapped Object	Unsigned 32	rw	no	6411 04 10 h analog AOUT7	PDO
1603		Receive PDO4 - Mapping Parameters	Record	-	-	-	PDO
	0	Nr of Subobjects	Unsigned 8	rw	no	0 h	PDO
1800		Transmit PDO1 - Communication Parameters	Record	-	-	-	PDO
	0	Nr of Subobjects	Unsigned 8	ro	no	5 h	PDO
	1	COB-ID	Unsigned 32	rw	no	180 h + Node-ID	PDO
	2	Transmission Type	Unsigned 8	rw	no	FF h	PDO
	3	Inhibit Time	Unsigned 16	rw	no	0 h	PDO
	4	Compatibility Entry	Unsigned 8	rw	no	-	PDO
	5	Event Time	Unsigned 16	rw	no	0 h	PDO

Index	Sub-Index	Name	Data type	Acc.	Map-pable	Default Value / Note	Object Category
1801		Transmit PDO2 - Communication Parameters	Record	-	-	-	PDO
	0	Nr of Subobjects	Unsigned 8	ro	no	5 h	PDO
	1	COB-ID	Unsigned 32	rw	no	280 h + Node-ID	PDO
	2	Transmission Type	Unsigned 8	rw	no	FF h	PDO
	3	Inhibit Time	Unsigned 16	rw	no	0 h	PDO
	4	Compatibility Entry	Unsigned 8	rw	no	-	PDO
	5	Event Time	Unsigned 16	rw	no	0 h	PDO
1802		Transmit PDO3 - Communication Parameters	Record	-	-	-	PDO
	0	Nr of Subobjects	Unsigned 8	ro	no	5 h	PDO
	1	COB-ID	Unsigned 32	rw	no	380 h + Node-ID	PDO
	2	Transmission Type	Unsigned 8	rw	no	FF h	PDO
	3	Inhibit Time	Unsigned 16	rw	no	0 h	PDO
	4	Compatibility Entry	Unsigned 8	rw	no	-	PDO
	5	Event Time	Unsigned 16	rw	no	0 h	PDO
1803		Transmit PDO4 - Communication Parameters	Record	-	-	-	PDO
	0	Nr of Subobjects	Unsigned 8	ro	no	5 h	PDO
	1	COB-ID	Unsigned 32	rw	no	80000480 h + Node-ID	PDO
	2	Transmission Type	Unsigned 8	rw	no	FF h	PDO
	3	Inhibit Time	Unsigned 16	rw	no	0 h	PDO
	4	Compatibility Entry	Unsigned 8	rw	no	-	PDO
	5	Event Time	Unsigned 16	rw	no	0 h	PDO
1A00		Transmit PDO1 – Mapping Parameters	Record	-	-	-	PDO
	0	Nr of Subobjects	Unsigned 8	rw	no	0 h	PDO
	1	Mapped Object	Unsigned 32	rw	no	6000 01 08 h digital DIN-Byte0	PDO
1A01		Transmit PDO2 – Mapping Parameters	Record	-	-	-	PDO
	0	Nr of Subobjects	Unsigned 8	rw	no	4 h	PDO
	1	Mapped Object	Unsigned 32	rw	no	6401 01 10 h analog AIN0	PDO
	2	Mapped Object	Unsigned 32	rw	no	6401 02 10 h analog AIN1	PDO
	3	Mapped Object	Unsigned 32	rw	no	6401 03 10 h analog AIN2	PDO
	4	Mapped Object	Unsigned 32	rw	no	6401 04 10 h analog AIN3	PDO
1A02		Transmit PDO3 – Mapping Parameters	Record	-	-	-	PDO
	0	Nr of Subobjects	Unsigned 8	rw	no	4 h	PDO
	1	Mapped Object	Unsigned 32	rw	no	6401 05 10 h analog AIN4	PDO
	2	Mapped Object	Unsigned 32	rw	no	6401 06 10 h analog AIN5	PDO
	3	Mapped Object	Unsigned 32	rw	no	6401 07 10 h analog AIN6	PDO
	4	Mapped Object	Unsigned 32	rw	no	6401 08 10 h analog AIN7	PDO
1A03		Transmit PDO4 – Mapping Parameters	Record	-	-	-	PDO
	0	Nr of Subobjects	Unsigned 8	rw	no	0 h	PDO

Index	Sub-Index	Name	Data type	Acc.	Map-pable	Default Value / Note	Object Category
2000	-	Device Manufacturer	Visible String	ro	no	"FRENZEL+BERG"	Global
2009		Serial Number 64 Bit	Array	-	-	-	Global
	0	Nr of Subobjects	Unsigned 8	ro	no	2 h	Global
	1	Serial Number 64 Bit LSDW	Unsigned 32	ro	no	-	Global
	2	Serial Number 64 Bit MSDW	Unsigned 32	ro	no	-	Global
2101	-	System Configuration	Unsigned 32	ro	no	Setting of Config. Input Pins	Global
2102	-	Remapping Enabled Info	Unsigned 8	ro	no	1 h (enabled)	Global
2103	-	Enable Guarding Warning	Unsigned 8	rw	no	0 h (disabled)	Global
2105	-	Internal API State	Unsigned 32	ro	yes	-	Global
2110	-	Conformance Test Object	Record	-	-		Global
	0	Nr of Subobjects	Unsigned 8	ro	no	1 h	Global
	1	Range Check Object	Unsigned 16	rw	no	500	Global
2180	-	CAN Restart Time	Unsigned 16	rw	no	1000 h (restart after one second)	Global
5100		Analog Operation Mode	Unsigned 16	rw	no	0	Global
5301		Analog Input Filter Level	Unsigned 16	rw	no	10	Global
5310		Input Scaling	Record	-	-		Global
	0	Nr of Subobjects	Unsigned 8	ro	no	4 h	Global
	1	Input Scaling Key	Unsigned 32	rw	no	0 h	Global
	2	Input Scaling Command	Unsigned 32	wo	no	0 h	Global
	3	Input Scaling Result	Unsigned 16	ro	no		Global
	4	Input Scaling Step	Unsigned 16	ro	no		Global
6000		Digital Input 8 Bit	Array	-	-	-	Dig. Input
	0	Nr of Subobjects	Unsigned 8	ro	no	2 h	Dig. Input
	1	Digital Input Byte 0	Unsigned 8	ro	yes	-	Dig. Input
	2	Digital Input Byte 1	Unsigned 8	ro	yes	-	Dig. Input
6002		Polarity Input 8 Bit	Array	-	-	-	Dig. Input
	0	Nr of Subobjects	Unsigned 8	ro	no	2 h	Dig. Input
	1	Polarity Input Byte 0	Unsigned 8	rw	no	0 h	Dig. Input
	2	Polarity Input Byte 1	Unsigned 8	rw	no	0 h	Dig. Input
6005		Global Interrupt Enable	Unsigned 8	rw	no	1 h	Dig. Input
6006		Interrupt Mask any Change	Array	-	-	-	Dig. Input
	0	Nr of Subobjects	Unsigned 8	ro	no	2 h	Dig. Input
	1	Interrupt Mask Any Change Byte 0	Unsigned 8	rw	no	FF h (interrupt enabled)	Dig. Input
	2	Interrupt Mask Any Change Byte1	Unsigned 8	rw	no	FF h (interrupt enabled)	Dig. Input
6007		Interrupt Mask Rising Edge	Array	-	-	-	Dig. Input
	0	Nr of Subobjects	Unsigned 8	ro	no	2 h	Dig. Input
	1	Interrupt Mask Rising Edge Byte 0	Unsigned 8	rw	no	0 h (interrupt disabled)	Dig. Input
	2	Interrupt Mask Rising Edge Byte 1	Unsigned 8	rw	no	0 h (interrupt disabled)	Dig. Input
6008		Interrupt Mask Falling Edge	Array	-	-	-	Dig. Input
	0	Nr of Subobjects	Unsigned 8	ro	no	2 h	Dig. Input
	1	Interrupt Mask Falling Edge Byte 0	Unsigned 8	rw	no	0 h (interrupt disabled)	Dig. Input
	2	Interrupt Mask Falling Edge Byte 1	Unsigned 8	rw	no	0 h (interrupt disabled)	Dig. Input
6100		Read Digital Input 16 Bit	Array	-	-	-	Dig. Input
	0	Nr of Subobjects	Unsigned 8	ro	no	1 h	Dig. Input
	1	Read Digital Input 16 Bit	Unsigned 16	ro	no	-	Dig. Input

Index	Sub-Index	Name	Data type	Acc.	Map-pable	Default Value / Note	Object Category
6120		Read Digital Input 32 Bit	Array	-	-	-	Dig. Input
	0	Nr of Subobjects	Unsigned 8	ro	no	1 h	Dig. Input
	1	Read Digital Input 32 Bit Long 0	Unsigned 16	ro	no	-	Dig. Input
6401	-	Analog Input 16bit	Array	-	-		Global
	0	Nr of Subobjects	Unsigned 8	ro	no	8 h	Global
	1	Analog Input 16bit1	Integer 16	ro	yes		Global
	2	Analog Input 16bit2	Integer 16	ro	yes		Global
	3	Analog Input 16bit3	Integer 16	ro	yes		Global
	4	Analog Input 16bit4	Integer 16	ro	yes		Global
	5	Analog Input 16bit5	Integer 16	ro	yes		Global
	6	Analog Input 16bit6	Integer 16	ro	yes		Global
	7	Analog Input 16bit7	Integer 16	ro	yes		Global
	8	Analog Input 16bit8	Integer 16	ro	yes		Global
6411		Analog Output 16bit	Array	-	-		Global
	0	Nr of Subobjects	Unsigned 8	ro	no	8 h	Global
	1	Analog Output 16bit1	Integer 16	rww	yes		Global
	2	Analog Output 16bit2	Integer 16	rww	yes		Global
	3	Analog Output 16bit3	Integer 16	rww	yes		Global
	4	Analog Output 16bit4	Integer 16	rww	yes		Global
	5	Analog Output 16bit5	Integer 16	rww	yes		Global
	6	Analog Output 16bit6	Integer 16	rww	yes		Global
	7	Analog Output 16bit7	Integer 16	rww	yes		Global
	8	Analog Output 16bit8	Integer 16	rww	yes		Global
6421		Ana. Input Trigger Selection	Array	-	-		Global
	0	Nr of Subobjects	Unsigned 8	ro	no		Global
	1	Ana. Input Trigger Selection1	Unsigned 8	rw	no	7 h	Global
	2	Ana. Input Trigger Selection2	Unsigned 8	rw	no	7 h	Global
	3	Ana. Input Trigger Selection3	Unsigned 8	rw	no	7 h	Global
	4	Ana. Input Trigger Selection4	Unsigned 8	rw	no	7 h	Global
	5	Ana. Input Trigger Selection5	Unsigned 8	rw	no	7 h	Global
	6	Ana. Input Trigger Selection6	Unsigned 8	rw	no	7 h	Global
	7	Ana. Input Trigger Selection7	Unsigned 8	rw	no	7 h	Global
	8	Ana. Input Trigger Selection8	Unsigned 8	rw	no	7 h	Global
6423		Analog Input Interrrupt Enable	Unsigned 8	rw	no		Global
6424		Ana Input Interrupt Upper L.	Array	-	-		Global
	0	Nr of Subobjects	Unsigned 8	ro	no	8 h	Global
	1	Ana. Input Irq Upper Limit1	Integer 32	rw	no	0 h	Global
	2	Ana. Input Irq Upper Limit2	Integer 32	rw	no	0 h	Global
	3	Ana. Input Irq Upper Limit3	Integer 32	rw	no	0 h	Global
	4	Ana. Input Irq Upper Limit4	Integer 32	rw	no	0 h	Global
	5	Ana. Input Irq Upper Limit5	Integer 32	rw	no	0 h	Global
	6	Ana. Input Irq Upper Limit6	Integer 32	rw	no	0 h	Global
	7	Ana. Input Irq Upper Limit7	Integer 32	rw	no	0 h	Global
	8	Ana. Input Irq Upper Limit8	Integer 32	rw	no	0 h	Global
6425		Ana Input interrupt Lower L.	Array	-	-		Global
	0	Nr of Subobjects	Unsigned 8	ro	no	8 h	Global
	1	Ana. Input Irq Lower Limit1	Integer 32	rw	no	0 h	Global
	2	Ana. Input Irq Lower Limit2	Integer 32	rw	no	0 h	Global
	3	Ana. Input Irq Lower Limit3	Integer 32	rw	no	0 h	Global
	4	Ana. Input Irq Lower Limit4	Integer 32	rw	no	0 h	Global
	5	Ana. Input Irq Lower Limit5	Integer 32	rw	no	0 h	Global
	6	Ana. Input Irq Lower Limit6	Integer 32	rw	no	0 h	Global
	7	Ana. Input Irq Lower Limit7	Integer 32	rw	no	0 h	Global
	8	Ana. Input Irq Lower Limit8	Integer 32	rw	no	0 h	Global

Index	Sub-Index	Name	Data type	Acc.	Map-pable	Default Value / Note	Object Category
6426		Ana Input interrupt Delta	Array	-	-		Global
	0	Nr of Subobjects	Unsigned 8	ro	no	8 h	Global
	1	Ana. Input Interrupt Delta 1	Integer 32	rw	no	0 h	Global
	2	Ana. Input Interrupt Delta 2	Integer 32	rw	no	0 h	Global
	3	Ana. Input Interrupt Delta 3	Integer 32	rw	no	0 h	Global
	4	Ana. Input Interrupt Delta 4	Integer 32	rw	no	0 h	Global
	5	Ana. Input Interrupt Delta 5	Integer 32	rw	no	0 h	Global
	6	Ana. Input Interrupt Delta 6	Integer 32	rw	no	0 h	Global
	7	Ana. Input Interrupt Delta 7	Integer 32	rw	no	0 h	Global
	8	Ana. Input Interrupt Delta 8	Integer 32	rw	no	0 h	Global
6427		Ana Input interrupt Neg. Delta	Array	-	-		Global
	0	Nr of Subobjects	Unsigned 8	ro	no	8 h	Global
	1	Ana. Input Irq Neg. Delta 1	Integer 32	rw	no	0 h	Global
	2	Ana. Input Irq Neg. Delta 2	Integer 32	rw	no	0 h	Global
	3	Ana. Input Irq Neg. Delta 3	Integer 32	rw	no	0 h	Global
	4	Ana. Input Irq Neg. Delta 4	Integer 32	rw	no	0 h	Global
	5	Ana. Input Irq Neg. Delta 5	Integer 32	rw	no	0 h	Global
	6	Ana. Input Irq Neg. Delta 6	Integer 32	rw	no	0 h	Global
	7	Ana. Input Irq Neg. Delta 7	Integer 32	rw	no	0 h	Global
	8	Ana. Input Irq Neg. Delta 8	Integer 32	rw	no	0 h	Global
6428		Ana Input interrupt Pos. Delta	Array	-	-		Global
	0	Nr of Subobjects	Unsigned 8	ro	no	8 h	Global
	1	Ana. Input Irq Pos. Delta 1	Integer 32	rw	no	0 h	Global
	2	Ana. Input Irq Pos. Delta 2	Integer 32	rw	no	0 h	Global
	3	Ana. Input Irq Pos. Delta 3	Integer 32	rw	no	0 h	Global
	4	Ana. Input Irq Pos. Delta 4	Integer 32	rw	no	0 h	Global
	5	Ana. Input Irq Pos. Delta 5	Integer 32	rw	no	0 h	Global
	6	Ana. Input Irq Pos. Delta 6	Integer 32	rw	no	0 h	Global
	7	Ana. Input Irq Pos. Delta 7	Integer 32	rw	no	0 h	Global
	8	Ana. Input Irq Pos. Delta 8	Integer 32	rw	no	0 h	Global
6443		Analog Output Error Mode	Array	-	-		Global
	0	Nr of Subobjects	Unsigned 8	ro	no	8 h	Global
	1	Analog Output Error Mode1	Unsigned 8	rw	no	1 h	Global
	2	Analog Output Error Mode2	Unsigned 8	rw	no	1 h	Global
	3	Analog Output Error Mode3	Unsigned 8	rw	no	1 h	Global
	4	Analog Output Error Mode4	Unsigned 8	rw	no	1 h	Global
	5	Analog Output Error Mode5	Unsigned 8	rw	no	1 h	Global
	6	Analog Output Error Mode6	Unsigned 8	rw	no	1 h	Global
	7	Analog Output Error Mode7	Unsigned 8	rw	no	1 h	Global
	8	Analog Output Error Mode8	Unsigned 8	rw	no	1 h	Global

Index	Sub-Index	Name	Data type	Acc.	Map-pable	Default Value / Note	Object Category
6444		Analog Output Error Value	Array	-	-		Global
	0	Nr of Subobjects	Integer 32	ro	no	8 h	Global
	1	Analog Output Error Value1	Integer 32	rw	no	0 h	Global
	2	Analog Output Error Value2	Integer 32	rw	no	0 h	Global
	3	Analog Output Error Value3	Integer 32	rw	no	0 h	Global
	4	Analog Output Error Value4	Integer 32	rw	no	0 h	Global
	5	Analog Output Error Value5	Integer 32	rw	no	0 h	Global
	6	Analog Output Error Value6	Integer 32	rw	no	0 h	Global
	7	Analog Output Error Value7	Integer 32	rw	no	0 h	Global
	8	Analog Output Error Value8	Integer 32	rw	no	0 h	Global

Bemerkung: DS301 PDO Parameter Objekte

Beschreibung der PDO-Parameter-Objekte
Diese Objekte ermöglichen ein dynamisches PDO-Mapping, variable PDO-Identifier Einstellungen, das Einstellen der Übertragungsmodi, sowie inhibit und event time Konfiguration.
Die Einstellungen für diese CIO151 Parameter können alle im CANopen-Zustand „operational“, als auch im Zustand „pre-operational“ erfolgen.

Description of Object Dictionary

The following list gives a short description of all dictionary entries, available for the hipecs-CIO series of CANopen I/O modules.

DS301: Global Objects

Index 0005

This object is implemented to enable reservation of data space in PDOs by mapping dummy entries.

Index	0005
Name	Dummy 8
Description	
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	Yes
Value Range	-
Default Value	0

Index 0006

This object is implemented to enable reservation of data space in PDOs by mapping dummy entries.

Index	0006
Name	Dummy 16
Description	-
Data Type	Unsigned 16
Access modes	RO
PDO Mapping	Yes
Value Range	-
Default Value	0

Index 0007

This object is implemented to enable reservation of data space in PDOs by mapping dummy entries.

Index	0007
Name	Dummy 32
Description	-
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	Yes
Value Range	-
Default Value	0

Index 1000 : Device Type

Description of the device type. The Object gives the CiA device profile number and additionally the functionality of the device.

Index	1000h
Name	Device Type
Description	-
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	see device datasheet

Index 1001 : Error Register

This object holds an error of the device.

Index	1001h
Name	Error Register
Description	-
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	Yes
Value Range	-
Default Value	-

The error register has the following structure

Bit	Meaning
0	Generic error. This bit is set, if any error is active
1	0
2	0
3	0
4	CAN bus or communication error
5	0
6	0
7	Device Error

Index 1002 : Status Register

This object gives additional information for the device

Index	1002h
Name	Status Register
Description	-
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	Yes
Value Range	-
Default Value	-

Index 1005 : COB-ID Sync

Identifier of CAN object for the synchronisation message. The hipecs-CIO may only operate in Sync consumer mode. Generating of Sync messages is not possible. Therefore the Identifier for the Sync message can only be set to the value range 1 . 7FFh.

Index	1005h
Name	COB-ID Sync
Description	-
Data Type	Unsigned 32
Access modes	RW
PDO Mapping	No
Value Range	1 .. 7FFh
Default Value	80h

Index 1008 : Device Name

This object shows the name of the device as visible string.

Index	1008h
Name	Device Name
Description	-
Data Type	Visible String
Access modes	RO
PDO Mapping	No
Value Range	The maximum string length is 20 characters
Default Value	“hipecs-CIO151”

Index 1009 : Hardware Version

This object shows the hardware version and firmware version as visible string.

Index	1009h
Name	Hardware Version
Description	-
Data Type	Visible String
Access modes	RO
PDO Mapping	No
Value Range	The maximum string length is 20 characters
Default Value	-

Index 100A : Software Version

This object shows the software version as visible string.

Index	100Ah
Name	Software Version
Description	-
Data Type	Visible String
Access modes	RO
PDO Mapping	No
Value Range	The maximum string length is 20 characters
Default Value	-

Index 100C : Guard Time

The objects at index 100Ch (Guard Time in milli-seconds) and 100Dh (Life Time Factor) are used to implement the life guarding protocol. Guard Time multiplied by Life Time Factor gives the Life Time in milliseconds.
It is 0 (zero) if not used.

Index	100Ch
Name	Guard Time
Description	-
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	
Default Value	0

Index 100D : Life Time Factor

The objects at index 100Ch (Guard Time in milliseconds) and 100Dh (Life Time Factor) are used to implement the life guarding protocol. Guard Time multiplied by Life Time Factor gives the Life Time in milliseconds.
It is 0 (zero) if not used.

Index	100Dh
Name	Life Time Factor
Description	-
Data Type	Unsigned 8
Access modes	RW
PDO Mapping	No
Value Range	
Default Value	0

Index 100E : COB-ID Guard

Identifier of CAN object for the Node Guarding protocol. The Object is not represented in the object dictionary because of standard conforming reasons.

Index	100Eh
Name	COB-ID Guard
Description	-
Data Type	Unsigned 32
Access modes	-
PDO Mapping	No
Value Range	-
Default Value	700h + Node-ID

Index 1014 : COB-ID Emergency

Identifier of CAN object for the emergency messages.

Index	1014h
Name	COB-ID Emergency
Description	-
Data Type	Unsigned 32
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	80h + Node-ID

Index 1015 : Inhibit Time Emergency

Inhibit Time for emergency messages. If the Inhibit Time is set to 0, inhibit delay is disabled. The Inhibit Time is a multiple of 100usec, but the hipecs-CIO offers a maximum resolution of 1 millisecond.

Index	1015h
Name	Inhibit Time Emergency
Description	-
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0

Index 1016 : Consumer Heartbeat Time

The objects of Index 1016 are used to define the consumer heartbeat times for up to 4 nodes. With each sub index, the configuration for one monitored node can be set.

Index	1018h
Name	Consumer Heartbeat Time
Description	-
Data Type	Structure

Index	1016h Subindex 0
Name	Largest SubIndex supported
Description	-
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	4

Index	1016h Subindex 1
Name	Consumer Heartbeat Time 1
Description	-
Data Type	Unsigned 32
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0

Index	1016h Subindex 2
Name	Consumer Heartbeat Time 2
Description	-
Data Type	Unsigned 32
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0

Index	1016h Subindex 3
Name	Consumer Heartbeat Time 3
Description	-
Data Type	Unsigned 32
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	Revision of the device

Index	1016h Subindex 4
Name	Consumer Heartbeat Time 4
Description	-
Data Type	Unsigned 32
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0

Structure of consumer heartbeat time:

MSB			LSB
Byte3	Byte2	Byte1	Byte0
reserved	Node-ID	Heartbeat time	

Note:
Monitoring of the heartbeat producer starts after the reception of the first heartbeat.
The consumer heartbeat time should be higher than the corresponding producer heartbeat time.
Before the reception of the first heartbeat the status of the heartbeat producer is unknown.

Index 1017 : Producer Heartbeat Time

The producer heartbeat time defines the cycle time of the heartbeat. The producer heartbeat time is 0 if it is not used. The time has to be a multiple of 1ms.

Index	1017h
Name	Producer Heartbeat Time
Description	-
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0

Note:
Either Heartbeat or node guarding may be allowed at the same time. Do not use both protocols at the same time.

Index 1018 : Identity Object

The object at index 1018h keeps general information about the device and the manufacturer frenzel + berg electronic. It cannot be modified.

Index	1018h
Name	Identity Object
Description	-
Data Type	Structure

Index	1018h Subindex 0
Name	Largest SubIndex supported
Description	-
Data Type	Unsigned char
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	4

Index	1018h Subindex 1
Name	Vendor ID
Description	Registration Code of frenzel + berg electronic at the CiA
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	58h

Index	1018h Subindex 2
Name	Product Code
Description	Internal Product Code hipecs-CIO at frenzel + berg elektronic
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	see device datasheet

Index	1018h Subindex 3
Name	Revision Code
Description	
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	Revision of the device

Index	1018h Subindex 4
Name	Serial Number
Description	
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	0

Index 1029 : Error Behaviour

With object 1029 the hipecs-CIO can be configured to enter alternatively the preoperational or the stopped state or remain in the current state in case of a device failure. Device failures shall include the following communication errors:
Bus-off conditions of the CAN interface, Life guarding error, serious device errors also can be caused by device internal failures.
The value of the Error Classes is as follows:
0 = pre-operational
(only if current state is operational)
1 = no state change
2 = stopped
3 .. 127 = reserved

Index	1029h
Name	Error Behaviour Object
Description	-
Data Type	Structure

Index	1029h Subindex 0
Name	Largest Subindex supported
Description	-
Data Type	Unsigned char
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	2

Index	1029h Subindex 1
Name	Communication Error
Description	NMT state change in case of communication error
Data Type	Unsigned 8
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	00h

Index	1029h Subindex 2
Name	Application Error
Description	NMT state change in case of internal error due to hardware malfunction
Data Type	Unsigned 8
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	00h

DS301: PDO Parameter Objects

Communication Parameter Objects

The following table shows the communication parameter objects for Index 140x (Receive PDOs) and Index 180x (Transmit PDOs). The tables show Index 1400 as an example for all PDOs
The transmission type (sub-index 2) defines the mode for transmission / reception of the PDO. See table for detailed description of this entry.
Description of transmission type:

Type	PDO transmission				
	cyclic	acyclic	Sync related	Async.	Only on remote
0		X	X		
1-240	X		X		
241-251	Reserved				
252			X		X
253				X	X
254				X	
255				X	

Synchronous transmission types 0-240 and 252 mean that the transmission of the PDO shall be related to the SYNC object. Asynchronous means that the transmission of the PDO is not related to the SYNC object.
A transmission type of zero means that the message shall be transmitted synchronously with the SYNC object but not periodically but only in case of data change.
A value between 1 and 240 means that the PDO is transferred synchronously and cyclically, the transmission type indicating the number of SYNC signals, which are necessary to trigger PDO transmissions or receptions.
The transmission types 252 and 253 mean that the PDO is only transmitted on reception of a remote frame. At transmission type 252, the data is updated (but not sent) immediately after reception of the SYNC object. At transmission type 253 the data is updated at the reception of the remote frame. These values are only possible for transmit PDOs.

Transmission type 255 means, the application event is defined in the device profile. For receive PDOs the reception of a PDO will update the mapped data (normally the analog or digital outputs).
Sub-index 3h contains the inhibit time. This time is a minimum interval for PDO transmission. The value is defined as multiple of 100ms.

In mode 254/255 additionally an event time can be used for TPDO. If an event timer exists for a TPDO (value not equal to 0) the elapsed timer is considered to be an event. The event time is a multiple of 1 ms. This event will cause the transmission of this TPDO in addition to otherwise defined events.
The PDO communication parameter objects have the same structure for all PDOs. The following Objects are used.
Sub-index 4h is reserved.

Index	PDO
1400h	Receive PDO1
1401h	Receive PDO2
1402h	Receive PDO3
1403h	Receive PDO4
1800h	Transmit PDO1
1801h	Transmit PDO2
1802h	Transmit PDO3
1803h	Transmit PDO4

Index	14xxh / 18xxh
Name	Receive / Transmit PDOx Communication Parameters
Description	-
Data Type	Structure

Index	14xxh / 18xxh Subindex 0
Name	Largest SubIndex supported
Description	-
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	2 / 5

Index	14xxh / 18xxh Subindex 1	
Name	COB-ID	
Description	Identifier for CAN-Object for PDO	
Data Type	Unsigned 32	
Access modes	RW	
PDO Mapping	No	
Value Range	-	
Default Value	1400.01	Node-Id + 8000 0200h
	1401.01	Node-Id + 300h
	1402.01	Node-Id + 400h
	1403.01	Node-Id + 8000 0500h
	1800.01	Node-Id + 180h
	1801.01	Node-Id + 280h
	1802.01	Node-Id + 380h
	1803.01	Node-Id + 8000 0480h

An Identifier of 80000x00h means, that this PDO is disabled by default and must be enabled from the CANopen master by assigning a valid PDO ID.

Index	14xxh / 18xxh Subindex 2
Name	Transmission Type
Description	-
Data Type	Unsigned 8
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0FFh

Index	14xxh / 18xxh Subindex 3
Name	Inhibit Time
Description	-
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0

Index	14xxh / 18xxh Subindex 4
Name	Reserved
Description	-
Data Type	-
Access modes	-
PDO Mapping	No
Value Range	-
Default Value	-

Index	14xxh / 18xxh Subindex 5
Name	Event Time
Description	-
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0

PDO Mapping Objects

The following table shows the PDO Mapping Objects. The principle of PDO mapping is the same for all PDOs. The PDO Mapping table is the cross reference between the Object dictionary entries (for example the data of a digital output byte) and the data field inside a PDO data field (position in the data field of a CAN message for PDO transfer).

Subindex 0 determines the valid number of objects that have been mapped. The hipecs-CIO allows a maximum of 8 mapped objects for each PDO. For changing the PDO mapping first subindex 0 must be set to 0 (mapping is deactivated). Then the objects can be remapped. When a new object is mapped by writing a subindex between 1 and 8, the device may check whether the object specified by index /subindex exists. If the object does not exist or the object cannot be mapped, the SDO transfer will be aborted.

Subindexes 1 to 8 keep the pointers of the mapped objects as unsigned 32 values. The value is 0 if there is no mapped object. The structure for these pointers is as follows.

MSB			LSB
Byte3	Byte2	Byte1	Byte0
Mapped index		Subindex	Length

Mapped Index and Subindex together are the Pointer to the Object dictionary data to be mapped at this location.
Length gives the length of the mapped object in bits.

Index	160xh / 1A0xh
Name	Receive / Transmit PDO Mapping Parameters
Description	-
Data Type	Array

Index	160xh / 1A0xh Subindex 0
Name	Largest SubIndex supported
Description	Number of mapped objects
Data Type	Unsigned 8
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	See table below

Index	160xh / 1A0xh Subindex 1 to 8
Name	Mapped object
Description	
Data Type	Unsigned 32
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	See table below

Receive PDOs
The hipecs-CIO151 CANopen IO uses the following default mapping entries for receive PDO mapping:

Index	Entry	Explanation
Receive-PDO1		
1600.00	0	RPDO1: no mapped objects
Receive-PDO2		
1601.00	4	RPDO2: 4 mapped objects
1601.01	64110110h	Analog Output Integer 1
1601.02	64110210h	Analog Output Integer 2
1601.03	64110310h	Analog Output Integer 3
1601.04	64110410h	Analog Output Integer 4
Receive-PDO3		
1602.00	4	RPDO3: 4 mapped objects
1602.01	64110510h	Analog Output Integer 5
1602.02	64110610h	Analog Output Integer 6
1602.03	64110710h	Analog Output Integer 7
1602.04	64110810h	Analog Output Integer 8
Receive-PDO4		
1603.00	0	RPDO4: no mapped objects

Transmit PDOs
The hipecs-CIO151 CANopen IO uses the following default mapping entries for transmit PDO mapping:

Index	Entry	Explanation
Transmit - PDO1		
1A00.00	1	TPDO1: 1 mapped object
1A00.01	60000108	Digital Input byte 1
Transmit – PDO2		
1A01.00	4	TPDO2: 4 mapped objects
1A01.01	64010110h	Analog Input Integer 0
1A01.02	64010210h	Analog Input Integer 1
1A01.03	64010310h	Analog Input Integer 2
1A01.04	64010410h	Analog Input Integer 3
Transmit – PDO3		
1A02.00	4	TPDO3: 4 mapped objects
1A02.01	64010510h	Analog Input Integer 4
1A02.02	64010610h	Analog Input Integer 5
1A02.03	64010710h	Analog Input Integer 6
1A02.04	64010810h	Analog Input Integer 7
Transmit – PDO4		
1A03.00	0	TPDO4: no mapped objects

Manufacturer Specific Profile Area

The Objects in this area offer special device specific functions in order to configure additional functions implemented in the devices firmware. These additional functions can not be edited within the standardized profile areas.

Index 2000 : Device Manufacturer

This Object shows "Frenzel + Berg" as visible string. If OEMs do not want to give access to this entry, it may be removed from the EDS (electronic data sheet).

Index	2000h
Name	Device Manufacturer
Description	-
Data Type	Visible String
Access modes	RO
PDO Mapping	No
Value Range	The maximum string length is 20 characters
Default Value	"Frenzel + Berg"

Index 2009 : Serial Number 64 Bit

This object shows the serial number of the device. The serial number is given as an unsigned 64 bit number and is divided into two sub objects.

Index	2009h
Name	Serial Number 64 Bit
Description	-
Data Type	Array

Index	2009h Subindex 0
Name	Largest SubIndex supported
Description	-
Data Type	Unsigned char
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	2

Index	2009h Subindex 1
Name	Serial Number 64 Bit Low Double Word
Description	Holds bits 0 .. 31 of the serial number
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	-

Index	2009h Subindex 1
Name	Serial Number 64 Bit High Double Word
Description	Holds bits 32 .. 63 of the serial number
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	-

Index 2101 : System Configuration

This object returns the operation mode of the hipecs-CIO.

Index	2101h
Name	System Configuration
Description	-
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	-

System Configuration	
Bit 0	Status of DIP switch SW2.8
Bit 1..6	0
Bit 7	1
Bit 8	Analog Mode 5100 Bit 0 Input Range
Bit 9	Analog Mode 5100 Bit 1 Output Range
Bit 10	Analog Mode 5100 Bit 2 Output Range
Bit 11	Analog Mode 5100 Bit 3 Data Scaling

Index 2102 : Remapping Enabled Info

This object informs the user whether the system configuration enables remapping of the PDOs.
A value of 0 means that remapping is dsabled, all other values indicate that remapping of the PDOs is enabled.

Index	2102h
Name	Remapping Enabled Info
Description	-
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	1

Index 2103 : Enabled Guarding Warning

This object enables/disables transmission of emergency messages in case of a node guarding warning.
The condition of a guarding warning is met, if the time between two node guarding frames exceeds the guarding time given in object 100C independent of the setting of the life time (object 100D). The node guarding warning does not cause any NMT state change or switching the output pins to the error state. It is implemented to give the CANopen master an early information that the guarding interval has already exceeded the predefined value.
0 : Guarding Warning is disabled
1 : Guarding Warning is enabled

Index	2103h
Name	Enable Guarding Warning
Description	-
Data Type	Unsigned 8
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0

Index 2105 : Internal Error Code

This object holds error information of the CANopen controller.

Index	2105h
Name	Internal Error Code
Description	-
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	YES
Value Range	-
Default Value	0 (no error condition)

Index 2110 : Test Object

This object is implemented for testing purposes and should not be used.
The test entry does not have any functional behaviour.

Index	2110h
Name	Test Object 01
Description	-
Data Type	Structure

Index	2110h Subindex 0
Name	Largest SubIndex supported
Description	-
Data Type	Unsigned char
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	0x01

Index	2110h Subindex 1
Name	Test Object 01
Description	-
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	100 .. 1000
Default Value	500

Index 2180 : CAN Restart Time

This object gives the restart time out for the CAN communication layer in case of bus off errors in milliseconds.
If the restart time is set to 0 automatic restart of the device in case of bus off is prohibited.

Index	2180h
Name	CAN Restart Time
Description	-
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	0 .. 50000
Default Value	1000 (restart after one second)

DS401: Digital Input Objects

The following objects are describing the functionality of the digital input lines of the hipecs-CIO. The CIO151 module supports 8, 16 and 32 bit access to the digital inputs.

The mapping of the I/O lines to object 6000 is explained in chapter "Mapping I/O to Object Dictionary"

Index 6000 : Read Digital Input 8 Bit

This object represents the digital input bytes. The value of the input lines is written to this object.

Index	6000h
Name	Digital Input 8 Bit
Description	-
Data Type	Array

Index	Subindex 0
Name	Nr of Subobjects
Description	
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	Number of digital input bytes

Index	Subindex 1 to Nr of input bytes
Name	Digital Input 8 Bit Byte n
Description	
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	Yes
Value Range	-
Default Value	-

Object 0x6000 sub index 1 bit 0 controls the operation mode of the module.

Object 0x6000 sub index 1 bit 0	
0	CANopen Mode All analog output channels are written with the values set in object 6411.x
1	Direct Mode All analog output channels are directly written with the analog input data, regardless the actual value set in object 6411.x

Please note, that object 6000.01 may also be inverted by using object 6002.01 and by the setting of DIP switch 2.8

Index 6002 : Polarity Input 8 Bit

With this object, the digital inputs may be inverted. See also Index 6000 for additional information.

Index	6002h
Name	Polarity Input 8 Bit
Description	-
Data Type	Array

Index	Subindex 0
Name	Nr of Subobjects
Description	
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	Number of digital input bytes

Index	Subindex 1 to Nr of input bytes
Name	Polarity Input 8 Bit Byte n
Description	
Data Type	Unsigned 8
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0

Index 6005 : Global Interrupt Enable

This object enables or disables globally the interrupt behaviour without changing the interrupt masks.
In event-driven mode the device transmits the input values depending on the interrupt masks in objects 6006h, 6007h, and 6008h and the PDO transmission type.
TRUE (1)= global interrupt enabled
FALSE (0)= global interrupt disabled

Index	6005h
Name	Global Interrupt Enable
Description	-
Data Type	Boolean
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	TRUE

Index 6006 : Interrupt Mask Any Change

This object determines which input lines shall activate an interrupt by any change of the input line. Both negative and positive edge will cause an interrupt, if enabled.
An interrupt will cause a PDO transmission in case of event driven transmission mode.
1 = interrupt enabled
0 = interrupt disabled

Index	6006h
Name	Interrupt Mask any change
Description	-
Data Type	Array

Index	Subindex 0
Name	Nr of Subobjects
Description	
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	Number of digital input bytes

Index	Subindex 1 to Nr of input bytes
Name	Interrupt Mask any change
Description	
Data Type	Unsigned 8
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0FFh (interrupt enabled)

Index 6007 : Interrupt Mask Low to High

This object has the same structure and behaviour as object 6006h but will cause interrupts only on rising edge of object index 6000. Note that input lines are active low, so rising edge of input data (object 6000) means falling edge of input port line.
Default value is 0.

Index 6008 : Interrupt Mask High to Low

This object has the same structure and behaviour as object 6006h but will cause interrupts only on falling edge of object index 6000. Note that input lines are active low, so falling edge of input data (object 6000) means rising edge of input port line.
Default value is 0.

Index 6100 : Read Digital Input 16 Bit

This object enables 16-Bit access to the digital input bytes. The Object addresses the same data area as object 6000 but using unsigned integer data type. See Index 6000 for further details.

Index 6120 : Read Digital Input 32 Bit

This object enables 32-Bit access to the digital input bytes. The Object addresses the same data area as object 6000 but using unsigned long data type. See Index 6000 for further details.

DS401: Analog Input Objects

The following objects are describing the functionality of the analog input lines of the hipecs-CIO151.

The analog input channels are scanned only for positive voltages. The data range can be set to binary or millivolt output data range using object 5100

Index 5301 : Analog Input Filter Level

The hipecs-CIO151 provides internal digital filter for all analog input channels.
This object sets the depth of the internal digital filter.

The filter setting is common for all input channels.

Higher values will result in better noise suppression.

Index	5301h
Name	Analog Input Filter Level
Description	-
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	0 .. 20
Default Value	10

Index 6401 : Read Analog Input 16 Bit

Object 6401, represents the value of the analog channels. The 16 bit conversion result of the analog input voltage is a signed value.

The mapping of the I/O lines to object 6401 is explained in chapter "Mapping I/O to Object Dictionary"

Index	6401h
Name	Read Analog Input
Description	-
Data Type	Array

Index	Subindex 0
Name	
Description	Number of mapped objects
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	Number of analog input bytes

Index	Subindex 1 to Nr of input lines
Name	Read Analog Input
Description	
Data Type	Signed 16
Access modes	RO
PDO Mapping	YES
Value Range	-
Default Value	-

The data output format depends on the setting of object 5100 and can be programmed to either binary output or millivolt output format.

Data output format	
mode	Data range for 0 .. 10 V
binary	0 .. 32767 / 0 .. 0x7FFF
millivolt	0 .. 10000 / 0 .. 0x2710

Index 6421 : Analog Input Interrupt Trigger

Object 6421 selects the event that shall cause a transmission interrupt for the selected analog channel.

There is one sub-index for each channel to enable individual setting according to application requirements.

Table of possible Trigger Conditions:

Bit Nr	Interrupt Trigger Selection
0	Input voltage greater than Upper Limit
1	Input voltage less than Lower Limit
2	Input changed by more than Delta
3	Input reduced more than Negative Delta
4	Input increased more than Positive Delta
5 to 7	Reserved (must be forced to zero)

Index	6421h
Name	Analog Input Interrupt Trigger
Description	-
Data Type	Array

Index	Subindex 0
Name	
Description	Number of mapped objects
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	Number of analog input lines

Index	Subindex 1 to Nr of input lines
Name	Analog Input Interrupt Trigger
Description	Selects trigger condition
Data Type	Unsigned 8 (See Table of Trigger Conditions)
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	7

Index 6423 : Analog Input Interrupt Enable

This object enables or disables globally the interrupt behaviour without changing the interrupt masks.
The interrupt is disabled by default, in order to avoid transmission of analog input values.

TRUE (1)= global interrupt enabled
FALSE (0)= global interrupt disabled

Index	6423h
Name	Analog Input Interrupt Enable
Description	-
Data Type	Boolean
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	FALSE

Index 6424/5/6/7/8 : Analog Input Interrupt Limits

These objects give the limit for generation of interrupts. All objects have the same structure.
The function of the interrupt limit is only enabled, if the corresponding bit of object 6421 is set.
All values of limit parameters are signed 32. So the user must take care not to exceed the range of the input data objects.

Note especially for limit calculations
For calculation whether an interrupt (PDO transmission) must be generated or not, the analog input data object (6401.xx) is always evaluated as signed value, even if an offset is set to simulate an unsigned value.

Table of Limit Function

Object	Object Name and Function
6424	Analog Input Upper Limit Generate interrupt if input voltage is greater than or equal to Upper Limit (6424)
6425	Analog Input Lower Limit Generate interrupt if input voltage is less than Lower Limit (6425)
6426	Analog Input Interrupt Delta Generate interrupt if input voltage changed by more than Interrupt Delta
6427	Analog Input Negative Delta Generate interrupt if input voltage reduced by more than Negative Delta
6428	Analog Input Positive Delta Generate interrupt if input voltage increased by more than Positive Delta

Index	6424/5/6/7/8/9
Name	See table above
Description	-
Data Type	Array

Index	Subindex 0
Name	
Description	Number of mapped objects
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	Number of analog input lines

Index	Subindex 1 to Nr of input lines (8)
Name	See table above
Description	
Data Type	Integer 32
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0

DS401: Analog Output Objects

The following objects are describing the functionality of the analog output channels of the hipecs-CIO151. The CIO151 module supports 16 bit access to the analog outputs.

The analog output channels can be programmed to one of the following output voltage ranges:
0 .. +10V / -10V .. +10V

The output data format can be programmed to either binary or millivolt format.

The mapping of the outputs to object 6411 is explained in chapter "Mapping I/O to Object Dictionary"

Index 6411 : Write Analog Output

With object 6411, the analog outputs of the CIO151 can be written. The output resolution is 12 bit.

Index	6411h
Name	Write to digital output
Description	-
Data Type	Array

Index	Subindex 0
Name	
Description	Number of mapped objects
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	-
Default Value	Number of digital output bytes

Index	Subindex 1 to Nr of outputs
Name	Write to analog output
Description	
Data Type	Integer 16
Access modes	RW
PDO Mapping	YES
Value Range	
Default Value	0

The data output format depends on the setting of object 5100 and can be programmed to either binary output or millivolt output format.

Please note:
If not the CANopen but the direct output mode is selected using the digital input, the values of object 6411.xx are discarded and the analog output pins are directly written with the values of the digital input channels.

Index 6443 : Error Mode Output 16 Bit

This object indicates, whether an output is forced to a predefined value (given in object 6444) in case of a device error.
1 = Output will be forced to the value selected in object 6444
0 = Output will be unchanged even in case of an error condition.

Index	6443h
Name	Error Mode Output 16 Bit
Description	-
Data Type	Array

Index	Subindex 0
Name	Nr of Subobjects
Description	
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	8 h

Index	Subindex 1 to Nr of output
Name	Error Mode Output 8 Bit n
Description	
Data Type	Unsigned 8
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0001h (Take error condition from object 6444)

Index 6444 : Error Value Output 32 Bit

This object selects the level the outputs are forced to in case of device error mode if the error mode (object 6443 is enabled)
1 = Output will be forced to active state
0 = Output will be forced to inactive state.

Index	6443h
Name	Error Value Output 32 Bit
Description	-
Data Type	Array

Index	Subindex 0
Name	Nr of Subobjects
Description	
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	8 h

Index	Subindex 1 to Nr of output
Name	Error Value Output 32 Bit n
Description	
Data Type	Integer 32
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0 (Inactive, high level)

Analog Mode Objects

The hipecs-CIO151 may be set to various operation modes.

The input channels are fixed to 0 .. +10V

The analog output channels can be programmed to one of the following output voltage ranges:
0 .. +5V / 0 .. +10V / -5V .. +5V / -10V .. +10V

The input and output data format can be programmed to either binary or millivolt format.

Index 5100 : Analog Mode

This object sets the analog operation mode and data format.

Index	5100h
Name	Analog Mode
Description	-
Data Type	Unsigned 16
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0

Analog Mode and Data Format					
Bit					Setting
15..4	3	2	1	0	
R	S	O		I	Input Range
				0	0 .. 10V
				1	Reserved, force this bit to 0 in order to keep compatibility to future versions
		O			Output Range
		0	0		0 .. 10V
		0	1		0 .. 5V
		1	0		-10V .. +10V
		1	1		-5V .. +5V
	S				Data Scaling For input and output data
	0				Binary scaling mode
	1				Mili Volt (mV) scaling mode
R					Reserved, force these bits to 0 in order to keep compatibility to future versions

Emergency Messages

Das hipecs-CIO151 Modul unterstützt diverse Emergency Messages. Für alle Emergencys wird die selbe Struktur angewendet.

Byte							
0	1	2	3	4	5	6	7
EMY-Code		1001	0	CIO151-Code			

EMY-Code: Emergency-Error-Code nach DS301

1001: Inhalt von Object 1001

CIO151-Code: Emergency-Error-Code CIO151 als unsigned 32 Wert

CIO-XXX-Code (hex)	ändert:		Beschreibung
	NMT	I/O	
8000 0000	X	X	CAN bus ist bus off
4000 0000			CAN bus in error warning state
2000 0000			Node guarding Warnung
3000 0000	X	X	Life guarding error
1000 0000	X	X	Heartbeat error
0000 0001	X	X	Überlast am Ausgang
0000 0100			Wake up vom Power down Modus

Die Emergency 2000 0000 (Node guarding Warnung) muss über das Objekt 2103 freigeschalten werden.
Wenn mehr als eine Fehlermeldung zur selben Zeit aktiv sind, wird das CIO151-Code Bitmuster durch eine logische Verknüpfung der einzelnen Codes gebildet.
Manche der Emergencys können einen NMT-State-Wechsel bewirken oder die Ausgänge in den Fehlerzustand setzten. Das jeweiligen Verhalten hängt von den Einstellungen im Objekt 1029 ab.
Der Identifier für die Emergency-Nachrichten ist festgelegt auf: **0x80 + Knotennummer**

Liste der Emergency-Nachrichten:

Node-Guarding Warnung							
30	81	01	00	00	00	00	20

Diese Nachricht wird vom Knoten gesendet, wenn der Master nicht innerhalb der spezifizierten „guard time“ (Objekt 100C) einen “guarding remote frame” endet. Diese Funktion wird im Objekt 2103 eingestellt.

Life-Guarding Fehler							
30	81	11	00	00	00	00	30

Dieser Fehler tritt auf, wenn der Master nicht innerhalb der eingestellten “Life Time” einen “guarding remote frame”. (Guard Time im Objekt 100C multipliziert mit dem Lifetime-Faktor Objekt 100D)

Heartbeat Fehler							
30	81	11	00	00	00	00	10

Fehlermeldung wenn die Regeln des eingestellten Heartbeat verletzt werden.

CAN Bus im Error Warning state							
00	81	01	00	00	00	00	40

Fehlermeldung wenn sich das chipinterne CAN-Modul im „error warning state“ befindet.

Rückkehr aus CAN-Bus-Off							
40	81	01	00	00	00	00	C0

Mit dieser Nachricht zeigt der Knoten seine Rückkehr vom Bus-Off-Zustand an.

Daten-Mapping im Objektverzeichnis

Betriebsmodus 0: 8 analoge Eingänge / 8 analoge. Ausgänge 1 digitaler Eingang EDS-file: hipecs_CIO151.EDS	
Mapping im Objektverzeichnis	
Index. SubIndex	gemapptes I/O Signal Bit/Wert
6000.01	DIN0 (Mode-Input)
6401.01	AIN0
6401.02	AIN1
6401.03	AIN2
6401.04	AIN3
6401.05	AIN4
6401.06	AIN5
6401.07	AIN6
6401.08	AIN7
6411.01	AOUT0
6411.02	AOUT1
6411.03	AOUT2
6411.04	AOUT3
6411.05	AOUT4
6411.06	AOUT5
6411.07	AOUT6
6411.08	AOUT7
Default PDO Mapping	
PDO	gemappte Daten
RPDO1	-
RPDO2	6411.01 analog Ausg. AOUT0 6411.02 analog Ausg. AOUT1 6411.03 analog Ausg. AOUT2 6411.04 analog Ausg. AOUT3
RPDO3	6411.05 analog Ausg. AOUT4 6411.06 analog Ausg. AOUT5 6411.07 analog Ausg. AOUT6 6411.08 analog Ausg. AOUT7
RPDO4	-
TPDO1	6000.01 digitaler Eing. Byte 0
TPDO2	6401.08 analog Eing. AIN0 6401.08 analog Eing. AIN1 6401.03 analog Eing. AIN2 6401.04 analog Eing. AIN3
TPDO3	6401.08 analog Eing. AIN4 6401.08 analog Eing. AIN5 6401.07 analog Eing. AIN6 6401.08 analog Eing. AIN7
TPDO4	-

Version History

Version	Datum	Änderung
1.000 Rev. 1	15.08.2014	Erste Version
1.560 Rev. 0	27.08.2014	Prototyp X4.1, X4.3 eigener Ground (Masse) für digitale Eingänge
1.560 Rev. 1	29.08.2014	Fehler im CAN-Objektverzeichnis behoben
1.660 Rev. 0	24.03.2015	Änderungen in der Hardware (digitale E/A, Durchschleifbetrieb)
1.660 Rev. 1	25.11.2015	CAN-Baudrate 10kBit entfernt (nicht unterstützt)

Inhaltsverzeichnis