

Allgemein

Das hipecs-CIO160 ist ein leistungsfähiges und dabei kostengünstiges CANopen Modul für Temperaturmessung mit PT100 bzw. PT1000 Sensoren. Je nach Anforderung können die Sensoren in 2-/3- oder 4-Draht-Technik betrieben werden. Dabei sind bis zu 12 Messkanäle in 2-Draht-Technik möglich. Ebenso können PT100 und PT1000 Sensoren gleichzeitig verwendet werden. Hierfür bietet das Modul eine Aufteilung der Messeingänge in 2 Gruppen.

Jeder der 12 Messkanäle besitzt einen Messbereich von -100°C bis $+500^{\circ}\text{C}$. Für jeden Kanal ist ein programmierbarer Eingangsfilter vorgesehen. Die Auflösung entspricht $0,1^{\circ}\text{C}$.

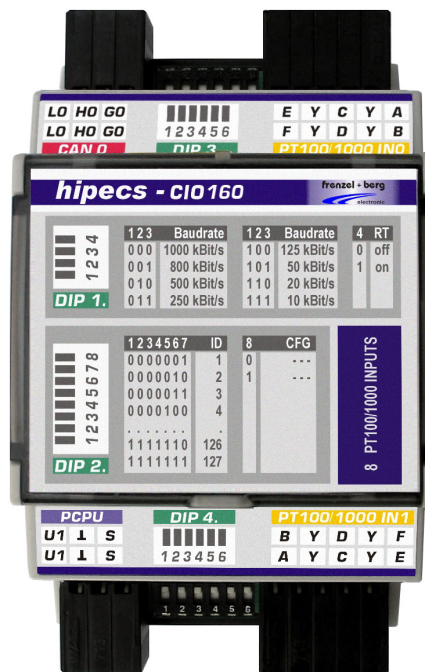
Im CIO160 sind die komplexen CANopen-Standards DS301 und DS401 implementiert. Alle üblichen Baudraten bis zu 1 MBit werden unterstützt.

Das Modul besitzt eine galvanische Trennung zu den analogen Messeingängen. Als Spannungsversorgung werden 24VDC benötigt.



Funktionen

- CANopen remote I/O Module entsprechend den CiA Draft Standards DS301 Version 4.0 und DS401 Version 2.0
- Single-Supply Spannungsversorgung für System/Bus und Messeingänge
- Messkanäle für PT100 und/oder PT1000
- Temperaturmessbereich -100°C bis $+500^{\circ}\text{C}$
- Skalierung in $0,1\text{K}$ Schritten / 16 Bit Auflösung ADC
- Bis zu 12 Messkanäle in 2-Draht-Technik, Bis zu 6 Messkanäle in 3-Draht-Technik, Bis zu 4 Messekanäle in 4-Draht-Technik
- 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 bis $+55^{\circ}\text{C}$ (opt. $-40...+70^{\circ}\text{C}$)



Bestellinformation

Bauteil	Best.-Nr.
hipecs-CIO160-i	EZ 00000.2209.00
12 PT100/PT1000 Eingänge, CAN galvanisch entkoppelt, $0...+55^{\circ}\text{C}$	
hipecs-CIO160-ie	EZ 00000.2210.01
12 PT100/PT1000 Eingänge, CAN galvanisch entkoppelt, $-40...+70^{\circ}\text{C}$	

Technische Daten

Das hipecs-CIO160 Modul hat eine Single-Supply Spannungsversorgung für das System, Bus und Messkanäle.

Spannungsversorgung System	Min.	Norm.	Max.
Nominale Versorgungsspannung	11 V	24 V	32 V
CAN bus Norm	ISO11898		
CiA Draft Standards	DS301 Version 4.0 und DS401 Version 2.0		
Konformitätserklärung	CE		

PT100 / PT1000 Eingänge Gruppe 0 / Gruppe 1	
Anzahl Messkanäle	4 bzw 6 (2-Draht)
	3 (3-Draht)
	2 (4-Draht)
Messstrom	0,5 mA .. 1 mA (PT100)
	0,05 mA .. 0,1 mA (PT1000)
Auflösung (ADC)	16 Bit
Messereich	-100°C .. +500°C
Auflösung (Messbereich)	0,1 Kelvin
Temperatur Drift bei 2- und 4-Drahtmessung	20 ppm/K
Temperatur Drift bei 3-Drahtmessung	30 ppm/K
Genauigkeit bei 25°C Umgebungstemperatur	+/- (0,4 K + 0,4% vom Messwert)

Stecker und Abmessungen	
Stecker	WAGO Steckverbinder Typ 713
Leitungsquerschnitt [mm ²]	0,08 bis 1,5 mm ²
Leitungsquerschnitt [AWG]	14 bis 28 AWG
Leiterlänge	7 mm
Abmessung CIO160 Gehäuse	ca. 125 x 54 x 62 mm (Bild "Abmessungen" beachten!)
Betriebstemperatur	0 .. 55°C (opt. -40...+70°C)

Steckerbelegung

Steckerbelegung CAN0

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

Steckerbelegung PCPU (Versorgung)

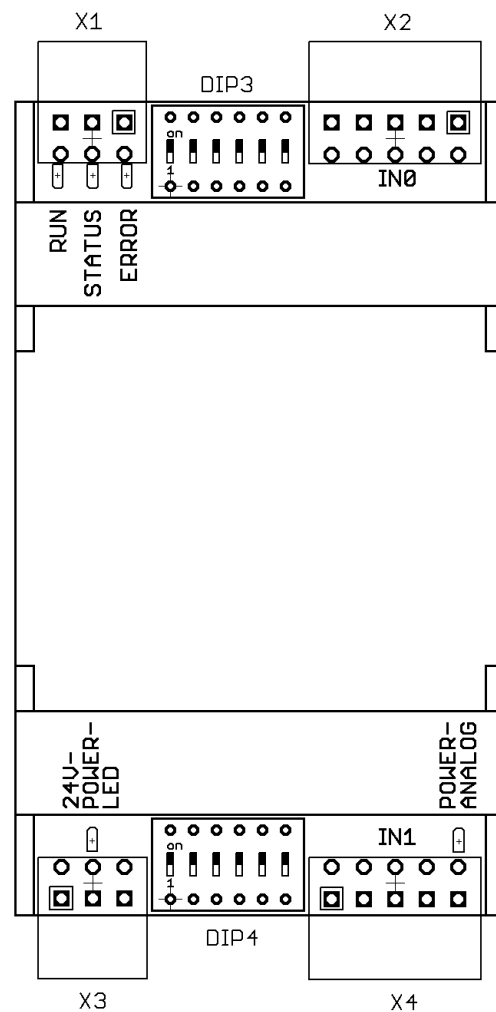
Pin Nr.	Name	Funktion
1, 2	U1	Versorgungsspannung DC 24V für System / Bus
3, 4	GND	Masse für System / Bus
5, 6	S	Schirmung

Steckerbelegung PT100/1000 IN0 (PT-Eingänge Gruppe 0)

Pin Nr.	Name	Funktion
1	PTA0	PT Eingang A Gruppe 0
2	PTB0	PT Eingang B Gruppe 0
3	PTY0	PT Eingang Y Gruppe 0
4	PTY0	PT Eingang Y Gruppe 0
5	PTC0	PT Eingang C Gruppe 0
6	PTD0	PT Eingang D Gruppe 0
7	PTY0	PT Eingang Y Gruppe 0
8	PTY0	PT Eingang Y Gruppe 0
9	PTE0	PT Eingang E Gruppe 0
10	PTF0	PT Eingang F Gruppe 0

Steckerbelegung PT100/1000 IN1 (PT-Eingänge Gruppe 1)

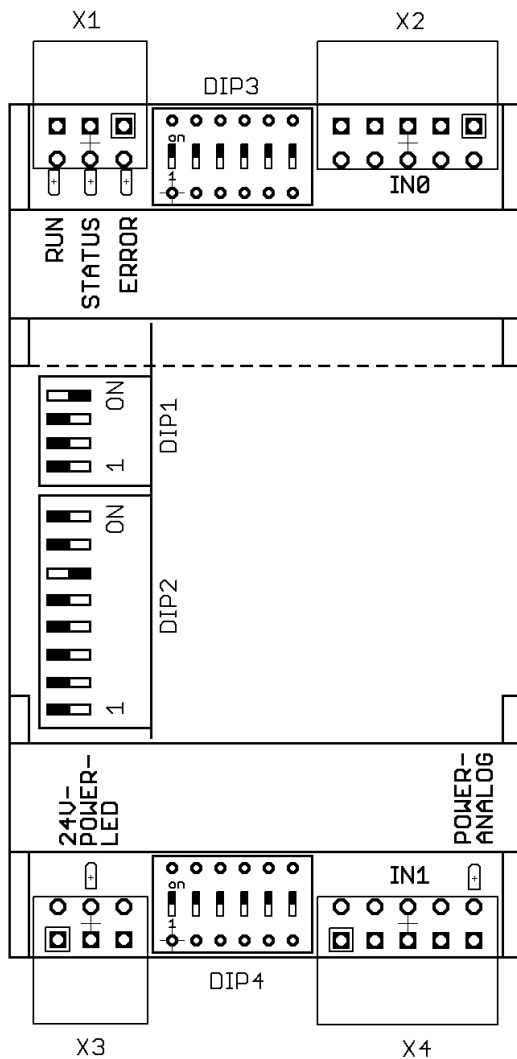
Pin Nr.	Name	Funktion
1	PTA1	PT Eingang A Gruppe 1
2	PTB1	PT Eingang B Gruppe 1
3	PTY1	PT Eingang Y Gruppe 1
4	PTY1	PT Eingang Y Gruppe 1
5	PTC1	PT Eingang C Gruppe 1
6	PTD1	PT Eingang D Gruppe 1
7	PTY1	PT Eingang Y Gruppe 1
8	PTY1	PT Eingang Y Gruppe 1
9	PTE1	PT Eingang E Gruppe 1
10	PTF1	PT Eingang F Gruppe 1



Ansicht von oben

LEDs

LED	Farbe	Funktion
24V-POWER-LED	grün	Versorgungsspannung vorhanden
POWER-ANALOG	grün	Analog-Betriebsspannung vorhanden
RUN	grün	CANopen-RUN-LED zeigt den NMT state bezogen auf das DRP303-3
ERROR	rot	CANopen-ERROR-LED zeigt den Fehlerstatus bezogen auf das DRP303-3
STATUS	gelb	reserviert



Ansicht von oben (Deckel geöffnet)

DIP-Schalter

DIP-Schalter DIP1 (Baudrate/Terminator)

DIP Switch DIP 1 (Einstellung Baudrate)				Funktion
Switch Nummer				
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	10 kbit / sec

DIP-Schalter DIP2 (Knotennummer)

DIP Switch DIP 2 (Einstellung Knotennummer)								Funktion
Switch Nummer								
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	Anzahl der TPDOs je nach Konfiguration *1)
X	X	X	X	X	X	X	OFF	Alle TPDOs definiert

*1) Je nach Grundkonfiguration des Moduls sind 1 bis 3 TPDOs vordefiniert, z.B.:

ON: Gruppe 0 : 4 Draht, 2 Kanäle (TPDO2)
 Gruppe 1 : 4 Draht, 2 Kanäle (TPDO2)
 TPDO3 & 4 ist nicht vordefiniert und frei

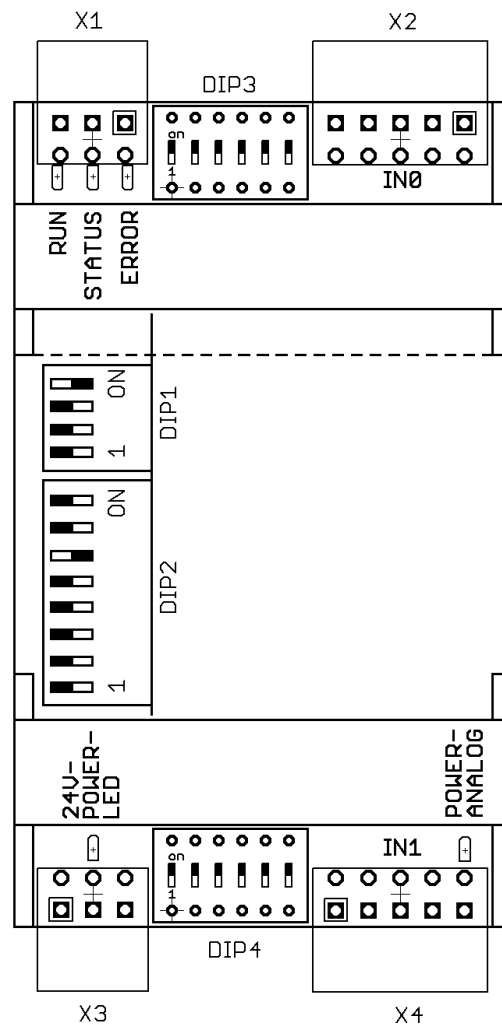
OFF: Alle TPDOs sind vordefiniert

**DIP-Schalter DIP 3 und DIP 4
(PT-Konfiguration)**

DIP Schalter DIP 3 (Gruppe 0) / DIP 4 (Gruppe 1)						
Schalter Nummer					Funktion	
1	2	3	4	5	6	
OFF	x	x	OFF	x	x	PT100
ON	x	x	OFF	x	x	PT1000
x	x	x	ON	x	x	Reserviert

DIP Schalter DIP 3 (Gruppe 0) / DIP 4 (Gruppe 1)						
Schalter Nummer					Funktion	
1	2	3	4	5	6	
x	OFF	OFF	OFF	x	x	2-wire (4 Kanäle)
x	OFF	ON	OFF	x	x	3-wire (3 Kanäle)
x	ON	OFF	OFF	x	x	4-wire (2 Kanäle)
x	ON	ON	OFF	x	x	2-wire (6 Kanäle)
x	x	x	ON	x	x	Reserviert

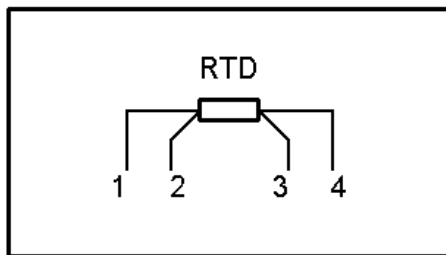
DIP Schalter DIP 3 (Gruppe 0) / DIP 4 (Gruppe 1)						
Schalter Nummer					Funktion	
1	2	3	4	5	6	
						Filterzeit pro Kanal
x	x	x	x	OFF	OFF	100 msec
x	x	x	x	OFF	ON	25 msec
x	x	x	x	ON	OFF	6 msec
x	x	x	x	ON	ON	3 msec



Ansicht von oben (Deckel geöffnet)

**RTD Anschlusskombinationen
(Gruppe 0 und/oder Gruppe 1)**

Die Messverfahren (PT100/PT1000) der Gruppen 0 und 1 sind unabhängig voneinander verwendbar. Alle Y-Anschlüsse einer Gruppe (an einem Stecker) sind identisch.



2-Wire-Messtechnik (4 bzw 6 Kanäle je Gruppe)

Kanal (RTD)	PT-Eingang						
	A	B	C	D	E	F	Y
1	1						4
2		1					4
3			1				4
4				1			4
5					1		4
6						1	4

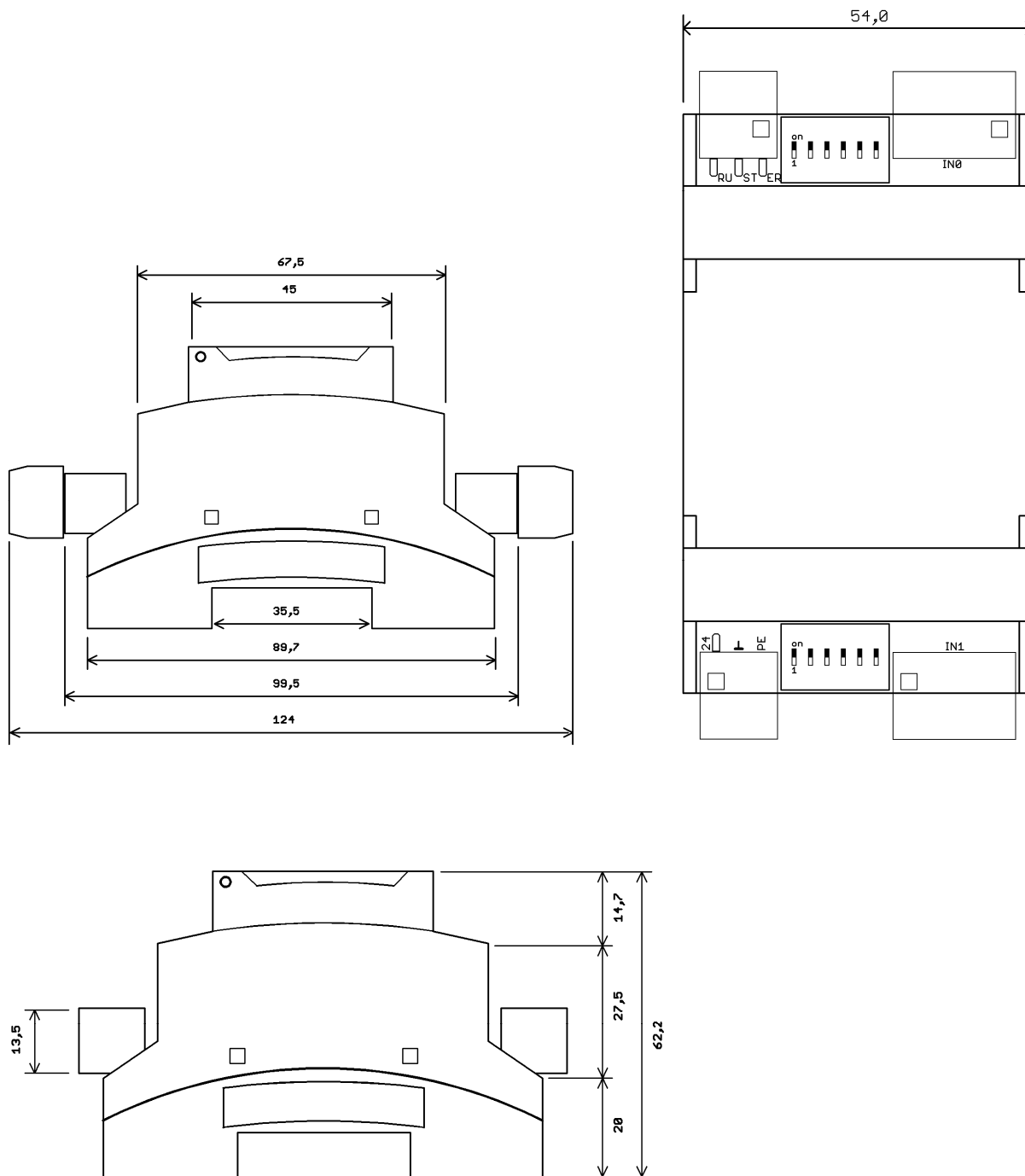
3-Wire-Messtechnik (3 Kanäle je Gruppe)

Kanal (RTD)	PT-Eingang						
	A	B	C	D	E	F	Y
1	1	3					4
2			1	3			4
3					1	3	4

4-Wire-Messtechnik (2 Kanäle je Gruppe)

Kanal (RTD)	PT-Eingang						
	A	B	C	D	E	F	Y
1	1	2	3				4
2				1	2	3	4

Abmessungen Kunststoffgehäuse



Alle Maße in mm

CANopen Temperaturwerte

Die gemessenen Temperaturwerte sind unter CANopen nach DS401 in den Analog-Input-Objekten 6401.1 und folgende verfügbar. Die eingetragenen Werte sind als signed integer Werte formatiert und entsprechend der Skalierungseinstellung des Objekt 5302 dargestellt. Im Default-Zustand wird auf auf 0,1°C formatiert. (Bsp. 325 → +32,5°C)

Die maximale Anzahl von Messkanälen einer Gruppe ist abhängig von der gewählten Messtechnik. So sind bei 2-Draht Topologie max. 6 Kanäle vorhanden, bei 3-Draht 3 und bei 4-Draht nur 2. Generell werden nur die Anzahl von Messkanälen in die Analog-Input-Objekte eingetragen, die der eingestellten Topologie entsprechen. In den Objekten befinden sich dann zuerst die Messwerte der Gruppe 0 gefolgt von denen der Gruppe 1.

Ob die Messung mit PT100 oder PT1000 erfolgt hat keinen Einfluss auf die Reihenfolge. Diese werden der Reihe nach eingetragen. Es kann nur gruppenweise zwischen PT100 Messung und PT1000 Messung umgeschaltet werden.

Beispiele:

Gruppe 0 → 3-Draht Topologie Gruppe 1 → 4-Draht Topologie				
Gruppe	Messkanal	Objekt	Wertebereich (x 0,1°C)	Temperatur
0	1	6401.01	-1000 ... +5000	-100°C ... +500°C
	2	6401.02		
	3	6401.03		
1	1	6401.04		
	2	6401.05		

Gruppe 0 → 2-Draht Topologie (mit 4 Kanälen) Gruppe 1 → 3-Draht Topologie				
Gruppe	Messkanal	Objekt	Wertebereich (x 0,1°C)	Temperatur
0	1	6401.01	-1000 ... +5000	-100°C ... +500°C
	2	6401.02		
	3	6401.03		
	4	6401.04		
1	1	6401.05		
	2	6401.06		
	3	6401.07		

Gruppe 0 → 2-Draht Topologie (mit 4 Kanälen) Gruppe 1 → 2-Draht Topologie (mit 6 Kanälen)				
Gruppe	Messkanal	Objekt	Wertebereich (x 0,1°C)	Temperatur
0	1	6401.01	-1000 ... +5000	-100°C ... +500°C
	2	6401.02		
	3	6401.03		
	4	6401.04		
1	1	6401.05		
	2	6401.06		
	3	6401.07		
	4	6401.08		
	5	6401.09		
	6	6401.0A		

CANopen Objektverzeichnis

Im hipecs-CIO160 Controller ist das komplexe Objektverzeichnis für CANopen E/A-Geräte implementiert.

hipecs-CIO160 Objekte

Alle Werte dieser Tabelle sind in hexadezimaler Schreibweise notiert.

Als Zugriffsberechtigungen sind folgend Typen definiert:

ro read only / nur lesen

wo write only / nur schreiben

rw read and write access enabled / lesen 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	0003 0191 h	Global
1001	-	Error Register	Unsigned 8	ro	yes	0	Global
1002	-	Manufacturer Status Register	Unsigned 32	ro	yes	0	Global
1005	-	COB-ID Sync Identifier Sync Object	Unsigned 32	rw	no	80 h	Global
1008	-	Device Name	Visible String	ro	no	"hipecs-CIO160"	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
100E	-	COB-ID Guard	Unsigned 32	-	no	700 h + Node-ID	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 6000 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 PDO0 - 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 PDO1 - Communication Parameters	Record	-	-	-	PDO
	0	Nr of Subobjects	Unsigned 8	ro	no	2 h	PDO
	1	COB-ID	Unsigned 32	rw	no	0x80000300 + Node-ID	PDO
	2	Transmission Type	Unsigned 8	rw	no	FF h	PDO
1402		Receive PDO2 - Communication Parameters	Record	-	-	-	PDO
	0	Nr of Subobjects	Unsigned 8	ro	no	2 h	PDO
	1	COB-ID	Unsigned 32	rw	no	0x80000400 + Node-ID	PDO
	2	Transmission Type	Unsigned 8	rw	no	FF h	PDO
1403		Receive PDO3 - 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 PDO0 - Mapping Parameters	Record	-	-	-	PDO
	0	Nr of Subobjects	Unsigned 8	rw	no	0 h	PDO
1601		Receive PDO1 - Mapping Parameters	Record	-	-	-	PDO
	0	Nr of Subobjects	Unsigned 8	rw	no	0 h	PDO
1602		Receive PDO2 - Mapping Parameters	Record	-	-	-	PDO
	0	Nr of Subobjects	Unsigned 8	rw	no	0 h	PDO
1603		Receive PDO3 - Mapping Parameters	Record	-	-	-	PDO
	0	Nr of Subobjects	Unsigned 8	rw	no	0 h	PDO
1800		Transmit PDO0 - Communication Parameters	Record	-	-	-	PDO
	0	Nr of Subobjects	Unsigned 8	ro	no	5 h	PDO
	1	COB-ID	Unsigned 32	rw	no	0x80000180 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
1801		Transmit PDO1 - 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

Index	Sub-Index	Name	Data type	Acc.	Map- pable	Default Value / Note	Object Category	
1802		Transmit PDO2 - 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	
1803	5	Event Time	Unsigned 16	rw	no	0 h	PDO	
		Transmit PDO2 - Communication Parameters	Record	-	-	-	PDO	
	0	Nr of Subobjects	Unsigned 8	ro	no	5 h	PDO	
	1	COB-ID	Unsigned 32	rw	no	480 h + Node-ID	PDO	
	2	Transmission Type	Unsigned 8	rw	no	FF h	PDO	
	3	Inhibit Time	Unsigned 16	rw	no	0 h	PDO	
1A00	4	Compatibility Entry	Unsigned 8	rw	no	-	PDO	
	5	Event Time	Unsigned 16	rw	no	0 h	PDO	
		Transmit PDO0 – Mapping Parameters	Record	-	-	-	PDO	
	0	Nr of Subobjects	Unsigned 8	rw	no	0 h	PDO	
	1A01		Transmit PDO1 – 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	
1A02	4	Mapped Object	Unsigned 32	rw	no	6401 04 10 h analog AIN3	PDO	
		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 05 10 h analog AIN4	PDO	
	2	Mapped Object	Unsigned 32	rw	no	6401 06 10 h analog AIN5	PDO	
1A03	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	
		Transmit PDO3 – Mapping Parameters	Record	-	-	-	PDO	
	0	Nr of Subobjects	Unsigned 8	rw	no	0 h	PDO	
	1	Mapped Object	Unsigned 32	rw	no	6401 09 10 h analog AIN8	PDO	
	2	Mapped Object	Unsigned 32	rw	no	6401 0A 10 h analog AIN9	PDO	
	3	Mapped Object	Unsigned 32	rw	no	6401 0B 10 h analog AIN10	PDO	
	4	Mapped Object	Unsigned 32	rw	no	6401 0C 10 h analog AIN11	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
5302	-	Analog Input Temperature Resolution Einstellung der Auflösung, mit der die Temperatur-Werte übertragen werden.	Array	-	-	Zulässige Werte: 0 : Temperaturen in Grad Celsius 1 : Temperaturen in 1/10 Grad 2 : Temperaturen in 1/100 Grad	Global
	0	Nr of Subobjects	Unsigned 8	ro	no	2 h	Global
	1	Analog Input Temperature Resolution Group 0	Unsigned 16	rw	no	1 h	Global
	2	Analog Input Temperature Resolution Group 1	Unsigned 16	rw	no	1 h	Global
5303	-	Analog Input Nr of Active Channel	Unsigned 16	ro	no		Global
5304	-	Auto Disable Inactive Channels Mit dieser Option können Eingänge, an denen kein Sensor angeschlossen ist, automatisch deaktiviert werden.				Zulässige Werte : 0 : Automatische Deaktivierung aus 1 : Automatische Deaktivierung ein	
	0	Nr of Subobjects	Unsigned 8	ro	no	2 h	Global
	1	Auto Disable Inactive Channels Group 0	Unsigned 8	rw	no	1	
	2	Auto Disable Inactive Channels Group 1	Unsigned 8	rw	no	1	
5305	-	Force Disable Channels Mit dieser Option können Eingänge deaktiviert werden, um Störungen zu vermeiden.				Die Kanäle, die deaktiviert werden sollen, können bitweise selektiert werden.	
	0	Nr of Subobjects	Unsigned 8	ro	no	2 h	Global
	1	Force Disable Channels Group 0	Unsigned 8	rw	no	0	
	2	Force Disable Channels Group 1	Unsigned 8	rw	no	0	

Index	Sub-Index	Name	Data type	Acc.	Map-pable	Default Value / Note	Object Category
5306	-	Active Channel Info Dieses Objekt zeigt die aktiven Kanäle bitweise an.					
	0	Nr of Subobjects	Unsigned 8	ro	no	2 h	Global
	1	Active Channel Info Group 0	Unsigned 8	ro	yes		
	2	Active Channel Info Group 1	Unsigned 8	ro	yes		
5307		Identify Invalid Channels and Errors Wenn diese Funktion aktiviert wird, dann werden für Fehlerzustände unzulässige Temperaturwerte ausgegeben: -30000 : Sensor nicht erkannt oder Sensor Kurzschluss -30001 : Auslesefehler des AD-Wandlers z.B. auf Grund von Störungen	Unsigned 8	rw	no	0 Mögliche Werte: 0 : Funktion aus 1 : Funktion ein	Global
5308	-	Filter Time Setzt das Eingangsfiler. Ein Schreibzugriff überschreibt damit die Einstellungen der DIP-Schalter. Die Filterzeit sollte grundsätzlich auf eine möglichst lange Zeit gesetzt werden.				Mögliche Werte 0 : 200 ms 1 : 100 ms 2 : 50 ms 3 : 25 ms 4 : 12 ms 5 : 6 ms 6 : 3 ms	
	0	Nr of Subobjects	Unsigned 8	ro	no	2 h	Global
	1	Filter Time Group 0	Unsigned 8	rw	yes	Dip-Schalter	
	2	Filter Time Group 1	Unsigned 8	rw	yes	Dip-Schalter	
6401	-	Analog Input 16bit	Array	-	-		Global
	0	Nr of Subobjects	Unsigned 8	ro	no	12	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
	...	...	...	...	...		Global
	9	Analog Input 16bit9	Integer 16	ro	yes		Global
	A	Analog Input 16bit10	Integer 16	ro	yes		Global
	B	Analog Input 16bit11	Integer 16	ro	yes		Global
C	Analog Input 16bit12	Integer 16	ro	yes		Global	
6421		Ana. Input Trigger Selection	Array	-	-		Global
	0	Nr of Subobjects	Unsigned 8	ro	no	12	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
	...	...	...	...	...	...	Global
	B	An. Input Trigger Selection11	Unsigned 8	rw	no	7 h	Global
C	An. Input Trigger Selection12	Unsigned 8	rw	no	7 h	Global	
6423		Analog Input Interrupt Enable	Unsigned 8	rw	no		Global

Index	Sub-Index	Name	Data type	Acc.	Map-pable	Default Value / Note	Object Category
6424		Ana Input Interrupt Upper L.	Array	-	-		Global
	0	Nr of Subobjects	Unsigned 8	ro	no	12	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
	...	...	...	...	...	...	Global
	B	Ana. Input Irq Upper Limit11	Integer 32	rw	no	0 h	Global
C	Ana. Input Irq Upper Limit12	Integer 32	rw	no	0 h	Global	
6425		Ana Input interrupt Lower L.	Array	-	-		Global
	0	Nr of Subobjects	Unsigned 8	ro	no	12	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
	...	...	...	...	...	...	Global
	B	Ana. Input Irq Lower Limit11	Integer 32	rw	no	0 h	Global
C	Ana. Input Irq Lower Limit12	Integer 32	rw	no	0 h	Global	
6426		Ana Input interrupt Delta	Array	-	-		Global
	0	Nr of Subobjects	Unsigned 8	ro	no	12	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
	...	...	...	...	...	...	Global
	B	Ana. Input Interrupt Delta 11	Integer 32	rw	no	0 h	Global
C	Ana. Input Interrupt Delta 12	Integer 32	rw	no	0 h	Global	
6427		Ana Input interrupt Neg. Delta	Array	-	-		Global
	0	Nr of Subobjects	Unsigned 8	ro	no	12	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
	...	...	...	...	...	...	Global
	B	Ana. Input Irq Neg. Delta 11	Integer 32	rw	no	0 h	Global
C	Ana. Input Irq Neg. Delta 12	Integer 32	rw	no	0 h	Global	
6428		Ana Input interrupt Pos. Delta	Array	-	-		Global
	0	Nr of Subobjects	Unsigned 8	ro	no	12	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
	...	...	...	...	...	...	Global
	B	Ana. Input Irq Pos. Delta 11	Integer 32	rw	no	0 h	Global
C	Ana. Input Irq Pos. Delta 12	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 CIO160 Parameter können alle im CANopen-Zustand „operational“, als auch im Zustand „pre-operational“ erfolgen.

Beschreibung des Object Verzeichnis

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

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

DS301: Global Objects

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	0003 0191 h

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-CIO160"

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 milliseconds) and 100Dh (Life Time Factor) are used to implement the life guarding protocol. The Guard Time multiplied with the 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. The Guard Time multiplied with the 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 (disabled)

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	0

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 of the device and the CANopen chip manufacturer frenzel + berg electronic GmbH & Co.KG. 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-CIO160 at frenzel + berg electronic
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	0301 6000 h

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 CANopen chip 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	<table border="1"> <tr> <td>1400.01</td> <td>Node-Id + 80000200h</td> </tr> <tr> <td>1401.01</td> <td>Node-Id + 80000300h</td> </tr> <tr> <td>1402.01</td> <td>Node-Id + 80000400h</td> </tr> <tr> <td>1403.01</td> <td>Node-Id + 80000500h</td> </tr> <tr> <td>1800.01</td> <td>Node-Id + 80000180h</td> </tr> <tr> <td>1801.01</td> <td>Node-Id + 280h</td> </tr> <tr> <td>1802.01</td> <td>Node-Id + 380h</td> </tr> <tr> <td>1803.01</td> <td>Node-Id + 480h</td> </tr> </table>	1400.01	Node-Id + 80000200h	1401.01	Node-Id + 80000300h	1402.01	Node-Id + 80000400h	1403.01	Node-Id + 80000500h	1800.01	Node-Id + 80000180h	1801.01	Node-Id + 280h	1802.01	Node-Id + 380h	1803.01	Node-Id + 480h
1400.01	Node-Id + 80000200h																
1401.01	Node-Id + 80000300h																
1402.01	Node-Id + 80000400h																
1403.01	Node-Id + 80000500h																
1800.01	Node-Id + 80000180h																
1801.01	Node-Id + 280h																
1802.01	Node-Id + 380h																
1803.01	Node-Id + 480h																

An Identifier of 8xxxxxxh 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 / 01h

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 an digital output byte) and the data field inside an 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-CIO160 CANopen IO uses the following default mapping entries for receive PDO mapping:

Index	Entry	Explanation
Receive-PDO1		
1600.00	0	RPDO1: no mapped object
Receive-PDO2		
1601.00	0	RPDO2: no mapped object
Receive-PDO3		
1602.00	0	RPDO3: no mapped objects
Receive-PDO4		
1603.00	0	RPDO4: no mapped objects

Transmit PDOs

The hipecs-CIO160 CANopen IO uses the following default mapping entries for transmit PDO mapping:

Index	Entry	Explanation
Transmit - PDO1		
1A00.00	0	TPDO1: no mapped object
Transmit - PDO2		
1A01.00	4	TPDO2: 4 mapped object
1A01.01	64010110h	analog AIN0
1A01.02	64010210h	analog AIN1
1A01.03	64010310h	analog AIN2
1A01.04	64010410h	analog AIN3
Transmit - PDO3		
1A02.00	4	TPDO3: 4 mapped object
1A02.01	64010510h	analog AIN4
1A02.02	64010610h	analog AIN5
1A02.03	64010710h	analog AIN6
1A02.04	64010810h	analog AIN7
Transmit - PDO4		
1A03.00	4	TPDO4: 4 mapped objects
1A03.01	64010910h	analog AIN8
1A03.02	64010A10h	analog AIN9
1A03.03	64010B10h	analog AIN10
1A03.04	64010C10h	analog AIN11

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-CIO160.

Index	2101h
Name	System Configuration
Description	-
Data Type	Unsigned 32
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	0

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 disabled, 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 increases 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 Api State

This Object holds error information of the CANopen controller.

Index	2105h
Name	Internal Api State
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	1

Index	2110h Subindex 1
Name	Range Check Object
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)

Special Function Related Objects

These objects are related to the CIO160s special functions. Use these objects to handle the PT100 / PT1000 channels measurement functions.

Index 5302 : Temperature Resolution

Use this Object in order to select the resolution of the temperature values which are transmitted.

Index	5302h
Name	Analog Input Temperature Resolution
Description	-
Data Type	Array

Index	5302h Subindex 0
Name	Largest Subindex supported
Description	-
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	2h

Index	5302h Subindex 1/2
Name	Temperature Resolution Group 0 / 1
Description	-
Data Type	Unsigned 16
Access modes	rw
PDO Mapping	NO
Value Range	0: Temperature in degree Celsius 1: Temperature in 1/10 degree 2: Temperature in 1/100 degree
Default Value	1h

Index 5303 : Active Channels

This object holds the complete number of analog input channels (Group0 + Group1) which are selected by measurement mode.

Index	5303h
Name	Analog Input Nr of Channels
Description	-
Data Type	Unsigned 16
Access modes	ro
PDO Mapping	No
Value Range	-
Default Value	

Index 5304 : Auto Disable Inactive Channels

Use this Object in order to enable or disable the automatic disable function of inactive channels.

Index	5304h
Name	Auto Disable Inactive Channels
Description	-
Data Type	Array

Index	5304h Subindex 0
Name	Largest Subindex supported
Description	-
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	2h

Index	5304h Subindex 1/2
Name	Auto Disable Inactive Channels Group 0 / 1
Description	-
Data Type	Unsigned 16
Access modes	rw
PDO Mapping	NO
Value Range	0: auto disable off 1: auto disable on
Default Value	1h

Index 5305: Force Disable Channels

Use this Object in order to reduce interference by deactivation not used inputs.

Index	5305h
Name	Force Disable Channels
Description	-
Data Type	Array

Index	5305h Subindex 0
Name	Largest Subindex supported
Description	-
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	2h

Index	5305h Subindex 1/2
Name	Force Disable Channels Group 0 / 1
Description	-
Data Type	Unsigned 8
Access modes	rw
PDO Mapping	NO
Value Range	bitwise deactivation of input channels
Default Value	0

Index 5306: Active Channel Info

All active channels are shown with their corresponding bit active.

Index	5306h
Name	Active Channel Info
Description	-
Data Type	Array

Index	5306h Subindex 0
Name	Largest Subindex supported
Description	-
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	2h

Index	5306h Subindex 1/2
Name	Active Channel Info Group 0/1
Description	-
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	NO
Value Range	shows bitwise which input channels are active
Default Value	

Index 5307 : Identify Invalid Channels and Errors

Use this Object in order to get irregular values to indicate errors of a channel.

Index	5307h
Name	Identify Invalid Channels and Errors
Description	
Data Type	Unsigned 8
Access modes	rw
PDO Mapping	NO
Value Range	0 : function off 1 : function on
Default Value	0

irregular values are:

- 30000: no sensor detected or hot wired
- 30001: read error of AD converter due to interferences

Index 5308 : Set Filter Time

Use this Object in order to set input filter time. The filter time should be as long as possible.

Index	5308h
Name	Set Filter Time
Description	-
Data Type	Array

Index	5308h Subindex 0
Name	Largest Subindex supported
Description	-
Data Type	Unsigned 8
Access modes	RO
PDO Mapping	No
Value Range	-
Default Value	2h

Index	5308h Subindex 1/2 Group 0/1
Name	
Description	-
Data Type	Unsigned 8
Access modes	rw
PDO Mapping	NO
Value Range	0 : 200 ms 1 : 100 ms 2 : 60 ms 3 : 25 ms 4 : 12 ms 5 : 6 ms 6 : 3 ms
Default Value	external DIP3 / 4 Pin 5 and 6

Attention:

A write access to this object overwrites the DIP switch adjustments!

DS401: Analog Input Objects

The following objects are describing the functionality of the analog input lines of the CIO160.

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 is a signed value.

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	12

Index	Subindex 1 to 12
Name	Read Analog Input
Description	
Data Type	Signed 16
Access modes	RO
PDO Mapping	YES
Value Range	-
Default Value	-

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 Subindex for each channel to enable individual setting according to application requirements.

Table of possible Trigger Conditions:

Bit Nr	Interrupt Trigger Selection
0	temperature greater than Upper Limit
1	temperature less than Lower Limit
2	temperature changed by more than Delta
3	temperature reduced more than Negative Delta
4	temperature 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	12

Index	Subindex 1 to 12
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 (6400.xx, 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
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
Name	See table above
Description	
Data Type	Integer 32
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0

Index 6431 : Analog Input Offset

Object 6431 adds an offset value to the analog input data object (6400 / 6401).

The normal input scaling for analog data objects 6400 and 6401 considers conversion of negative input voltages (input amplifier must shift to positive voltages because input port pin is 0 to 5V only) by placing the zero point (of data) to 2.5V. (middle of input voltage range)

If application requires only positive input values an offset may be add with object 6431, in order to adjust the zero point for data to an input voltage of 0V. For 8 Bit analog conversion (object 6400) the offset value (object 6431) must be 8000h. For 16 Bit analog conversion (object 6401) the offset value must be set to 8000h.

For calculating a transmission request for the PDOs the objects 640x.xx are always interpreted as signed integer values.

Index	6431h
Name	Analog Input Offset
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 Offset
Description	
Data Type	Signed 32
Access modes	RW
PDO Mapping	No
Value Range	-
Default Value	0

Emergency Messages

Das hipecs-CIO160 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	CIOXXX-Code					

EMY-Code: Emergency-Error-Code nach DS301

1001: Inhalt von Object 1001

CIO160-Code: Emergency-Error-Code CIO160 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
1000 0000	X	X	Heartbeat Fehler
2000 0000			Node guarding Warnung
3000 0000	X	X	Life guarding Fehler
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 CIO160-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 setzen. Das jeweilige Verhalten hängt von den Einstellungen im Objekt 1029 ab.

Der Identifier für die Emergency-Nachrichten ist festgelegt auf: **0x80 + Knotennummer**

Liste der Emergency-Nachrichten:

Heartbeat-Fehler							
30	81	11	00	00	00	00	10

Mit dieser Nachricht zeigt der Knoten einen Heartbeat-Fehler an.

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“ sendet.

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)

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								
12 analoge Temperatureingänge (PT100/1000)								
EDS-file: hipecs_CIO160.EDS								
Mapping im Objektverzeichnis								
Index.	gemapptes I/O Signal Bit/Wert							
SubIndex	7	6	5	4	3	2	1	0
6401.01	AIN0 (Temperaturwert 1)							
6401.02	AIN1 (Temperaturwert 2)							
6401.03	AIN2 (Temperaturwert 3)							
6401.04	AIN3 (Temperaturwert 4)							
6401.05	AIN4 (Temperaturwert 5)							
6401.06	AIN5 (Temperaturwert 6)							
6401.07	AIN6 (Temperaturwert 7)							
6401.08	AIN7 (Temperaturwert 8)							
6401.09	AIN8 (Temperaturwert 9)							
6401.0A	AIN9 (Temperaturwert 10)							
6401.0B	AIN10 (Temperaturwert 11)							
6401.0C	AIN11 (Temperaturwert 12)							
Default PDO Mapping								
PDO	gemappte Daten							
TPDO1	6401.01 analog Eing. AIN0 6401.02 analog Eing. AIN1 6401.03 analog Eing. AIN2 6401.04 analog Eing. AIN3							
TPDO2	6401.05 analog Eing. AIN4 6401.06 analog Eing. AIN5 6401.07 analog Eing. AIN6 6401.08 analog Eing. AIN7							
TPDO3	6401.09 analog Eing. AIN8 6401.0A analog Eing. AIN9 6401.0B analog Eing. AIN10 6401.0C analog Eing. AIN11							

Version History

Version	Datum	Änderung
1.00 Rev. 0	25.11.2011	erste Version
1.41 Rev. 02	16.09.2013	Beschreibung der CANopen-Objekte eingefügt
1.41 Rev. 03	18.09.2013	Änderung Temperaturbereich von 0 .. 70°C auf 0 .. 55°C
1.41 Rev. 04	22.08.2014	Abbildungen und Zeichnungen aktualisiert
1.47 Rev. 05	21.10.2014	Aktualisierung Temperaturbereiche
1.47 Rev. 06	19.02.2015	Bestellinformationen ergänzt
1.47 Rev. 07	05.08.2015	Aktualisierung gesamtes Datenblatt

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