## *Allgemein*

Das CIO59 ist ein kostengünstiges CANopen Modul mit 2 digitalen Ein- und 2 digitalen Ausgängen für 24V Anwendungen. Die E/A sind spannungsschaltend, galvanisch vom Bussystem und der Versorgung getrennt und kurzschlussfest.

Einer der Eingänge bietet zusätzlich die Funktion eines abwärts zählenden Positionszählers. Bei Erreichen des Endwertes ist es möglich die Ausgänge setzen zu lassen, z.B. um weiterfolgenden Geräten Freigaben für weitere Aktionen zu erteilen.

In diesem E/A-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 4.0 und DS401 Version 2.0**
- **Getrennte Spannungsversorgung für System/Bus und Ein-/Ausgänge (DC 24V)**
- **2 digitale Eingänge galvanisch getrennt von Bus und Spannungsversorgung**
  **Sonderfunktion:**
  **IN0: - Zähler (24 Bit) abwärts (0…100 kHz) mit ereignisgesteuertem Setzen der Ausgänge**
  **- Voreinstellen kompletter Zählreihen möglich (FIFO Preload)**
  **- Ausgängsinmpulslänge frei wählbar**
- **2 dig. Ausgänge galvan. getrennt (DC 24 V) spannungsschaltend, kurzschlussfest**
- **CAN-Baudraten bis 1 MBit**
- **CAN-Bus ISO11898 mit Transceiver TJA1050**
- **4 Transmit und 4 Receive PDO**
- **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 PDO**
- **Nodeguarding, Lifeguarding und Heartbeat**
- **Emergency Nachrichten**
- **Minimum boot up**
- **Kunststoffgehäuse zum Aufrasten auf DIN-Trageschienen**
- **Betriebstemperatur 0…+55 °C**
  **(opt. -40…+70 °C)**

## *Bestellinformation*

| Bauteil | Best.-Nr. |
|---|---|
| hipecs-CIO59-i | EZ00000.2159.00 |
| 2/2 digitale Ein-/Ausgänge, CAN galvanisch entkoppelt, Abwärtszählerfunktion 0…+55 °C | |
| hipecs-CIO59-ie | EZ00000.3059.00 |
| 2/2 digitale Ein-/Ausgänge, CAN galvanisch entkoppelt, Abwärtszählerfunktion -40…+70 °C | |

## *Technische Daten*

Das hipecs-CIO59 Modul hat getrennte Spannungsversorgungen für das System und die digitalen E/As.

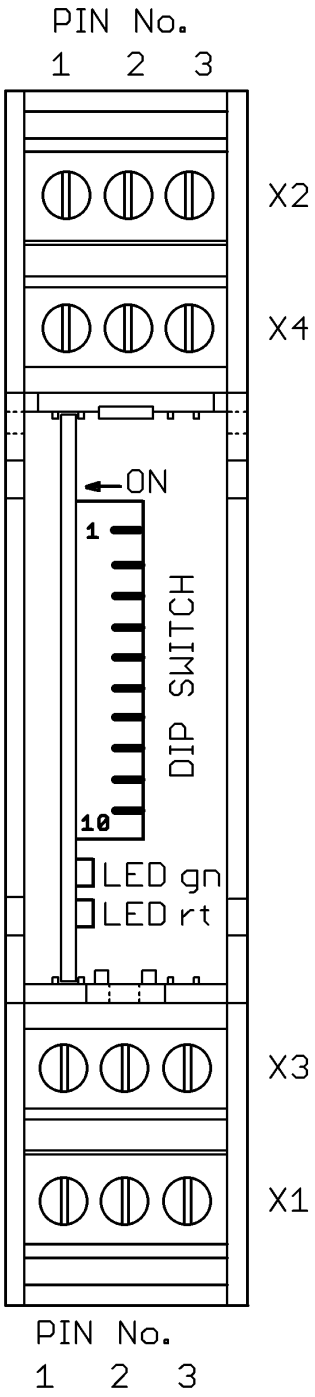
| Spannungsversorgung System | Min. | Norm. | Max. |
|---|---|---|---|
| Nominale System/Bus Versorgungsspannung | 11 V | 24 V | 32 V |
| Stromaufnahme System / Bus | 20 mA (bei Vcc=32V) | 30 mA | 60 mA (bei Vcc=11V) |
| Nominale E/A Versorgungsspannung DC | 11 V | 24 V | 32 V |
| CAN bus Norm | ISO11898 | | |
| CiA Draft Standards | DS301 Version 4.0 und DS401 Version 2.0 | | |
| Konformitätserklärung | CE | | |

| Digitale Eingänge | |
|---|---|
| Anzahl Eingänge | 2 |
| Signalpegel LOW | < 8,1 V |
| Signalpegel HIGH | > 8,2 V |
| Verzögerungszeit ( CAN reaction time ) | typ. 1 ms |
| Eingangsstrom bei DC 24V | 5,5 mA |
| Isolation zum Bus/System | 100 V |

| Digital Ausgänge | |
|---|---|
| Anzahl Ausgänge | 2 |
| Schaltverhalten | plusschaltend |
| Kurzschlussfest | Ja |
| Isolation zum Bus/System | 100 V |
| Versorgungsspannung für Ausgänge | DC 24V (11-32V) |
| Verzögerungszeit ( CAN reaction time ) | typ. 1 ms |
| Signal-Rise-Time (0...70%) | typ. 1 µs [Last 100 Ohm] |
| Signal-Fall-Time (100...30%) | typ. 3 µs [Last 100 Ohm] |
| Ausgangslasten | Resistiv, induktiv, Lampen |
| max. Ausgangsstrom dauerhaft | 0,5 A |
| Spitzenausgangsstrom | 1,0 A (max. 1 s) |
| Ausgangslastüberwachung | - |

| Stecker und Abmessungen | |
|---|---|
| Stecker | Schraubklemme |
| Leitungsquerschnitt [mm²] | 0,08 bis 1,5 mm² |
| Leitungsquerschnitt [AWG] | 14 bis 28 AWG |
| Leiterlänge | 7 mm |
| Abmessung CIO59 Gehäuse | ca. 17,8 x 90 x 62 mm (Bild “Abmessungen” beachten!) |
| Betriebstemperatur | 0…+55 °C (opt. -40…+70 °C) |

## Anschluss-Klemmen




## Klemmenbelegung X1 (Versorgung)

| Pin Nr. | Name | Funktion |
|---|---|---|
| 1 | U | Versorgungsspannung DC +24V für System / Bus |
| 2 | GND | Masse für System / Bus |
| 3 | G1 | Masse für Ausgänge |

## Klemmenbelegung X2 (CAN)

| Pin Nr. | Name | Funktion |
|---|---|---|
| 1 | L0 | CAN Low Signal |
| 2 | H0 | CAN High Signal |
| 3 | G0 | CAN GND Masse für CAN-Bus |

## Klemmenbelegung X3 (Ausgänge)

| Pin Nr. | Name | Funktion |
|---|---|---|
| 1 | O0 | Ausgang 0.0 DC 24 V |
| 2 | O1 | Ausgang 0.1 DC 24 V |
| 3 | P1 | Versorgungsspannung DC 24V für Ausgänge |

## Klemmenbelegung X4 (Eingänge)

| Pin Nr. | Name | Funktion |
|---|---|---|
| 1 | I0 | Eingang 0.0 DC 24 V |
| 2 | I1 | Eingang 0.1 DC 24 V |
| 3 | G2 | GND (Masse für Eingänge) |

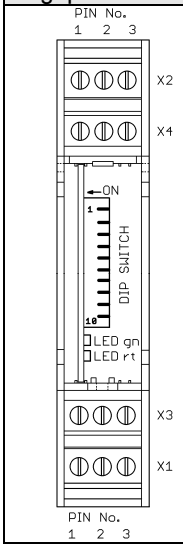
## *Konfiguration Dip-Schalter*

Der DIP-Schalter zur Einstellung von Knotennummer und Baudrate liegen hinter der Frontklappe, die nach oben geöffnet werden kann.

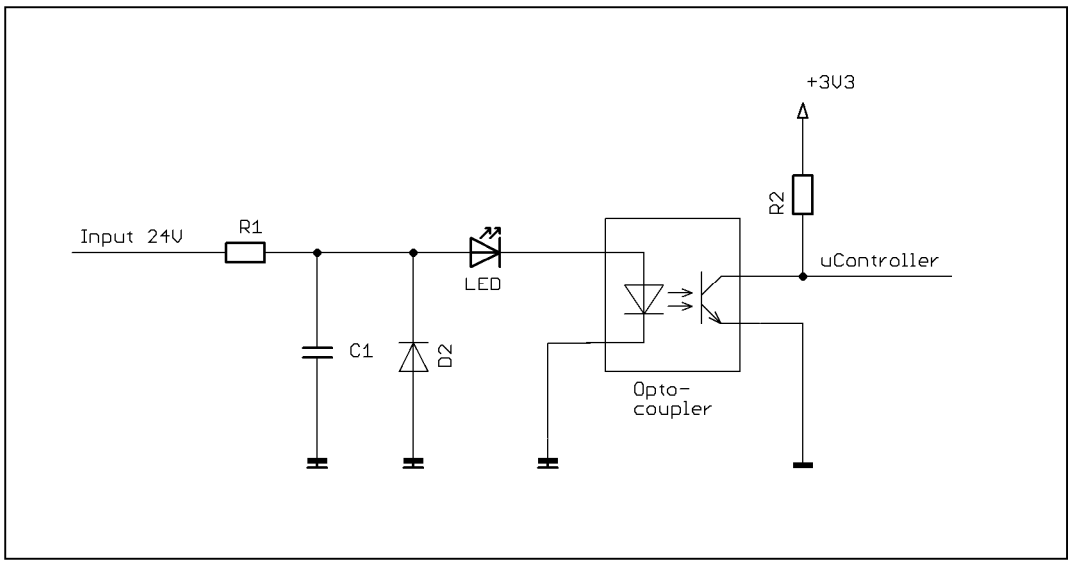
| Switch Nummer | | | | | | | | | | Funktion |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| RT | | | | | | | | | | RT Abschluss-Widerstand CAN-Bus |
| | BD2 | BD1 | BD0 | | | | | | | BDx Baudrate CAN-Bus |
| | | | | ID5 | ID4 | ID3 | ID2 | ID1 | ID0 | IDx Einstellung Node-ID |
| ON | | | | | | | | | | CAN-Terminierung ein (120 Ohm) |
| OFF | | | | | | | | | | CAN-Terminierung aus |
| | OFF | OFF | OFF | | | | | | | 1 MBit/s |
| | OFF | OFF | ON | | | | | | | 800 kBit/s |
| | OFF | ON | OFF | | | | | | | 500 kBit/s |
| | OFF | ON | ON | | | | | | | 250 kBit/s |
| | ON | OFF | OFF | | | | | | | 125 kBit/s |
| | ON | OFF | ON | | | | | | | 50 kBit/s |
| | ON | ON | OFF | | | | | | | 20 kBit/s |
| | ON | ON | ON | | | | | | | Reserviert |
| | | | | OFF | OFF | OFF | OFF | OFF | OFF | Reserviert |
| | | | | OFF | OFF | OFF | OFF | OFF | ON | Node ID = 1 |
| | | | | OFF | OFF | OFF | OFF | ON | OFF | Node ID = 2 |
| | | | | OFF | OFF | OFF | OFF | ON | ON | Node ID = 3 |
| | | | | … | … | … | … | … | … | … |
| | | | | ON | ON | ON | ON | OFF | OFF | Node ID = 60 |
| | | | | ON | ON | ON | ON | OFF | ON | Node ID = 61 |
| | | | | ON | ON | ON | ON | ON | OFF | Node ID = 62 |
| | | | | ON | ON | ON | ON | ON | ON | Node ID = 63 |

## *CAN Signal LED's*

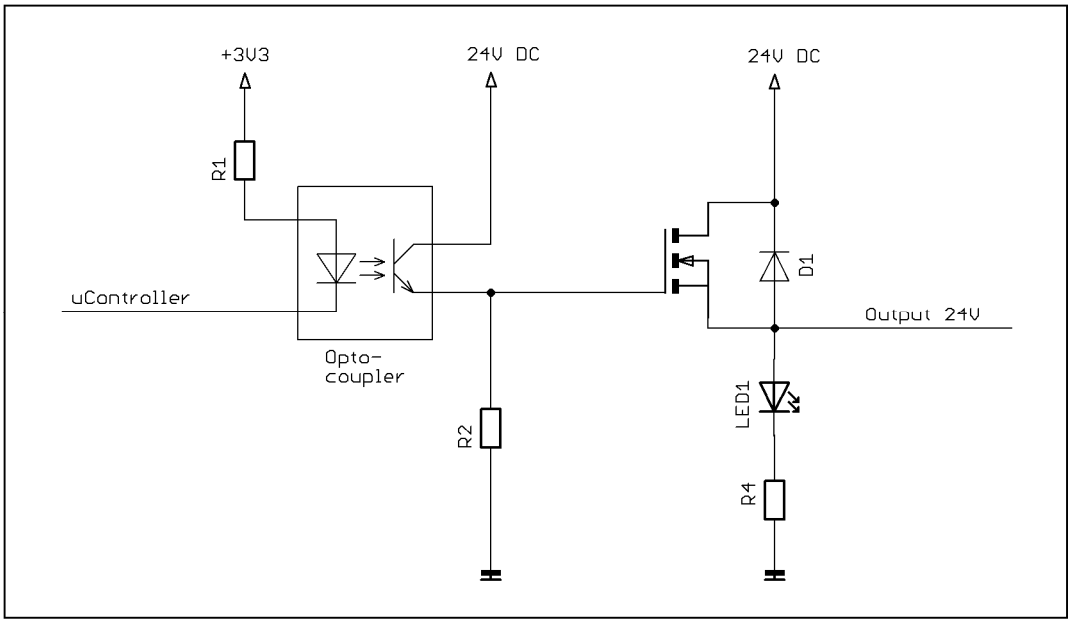
Die LEDs befinden sich ebenfalls hinter der Frontklappe.

| Lageplan | LED | Farbe | Funktion |
|---|---|---|---|
|  | RUN-LED | grün | Die RUN-LED zeigt den NMT-Zustand entsprechend DRP303-3 an<br><br>Aus — Betriebsspannung fehlt oder Defekt<br>Flackern — CAN noch nicht gestartet<br>1 x Flashen (kurzes Aufblitzen) — Stopped<br>Blinken — Preoperational<br>Ein — Operational |
| | ERR-LED | rot | Die Error-LED zeigt den Fehlerzustand entsprechend DRP303-3 an<br><br>Aus — Kein Fehler<br>1 x Flashen — CAN-Modul ist im Error-Warning-Zustand<br>2 x Flashen — Node-Guarding-Fehler<br>Ein — Bus-Off-Zustand des Knoten |

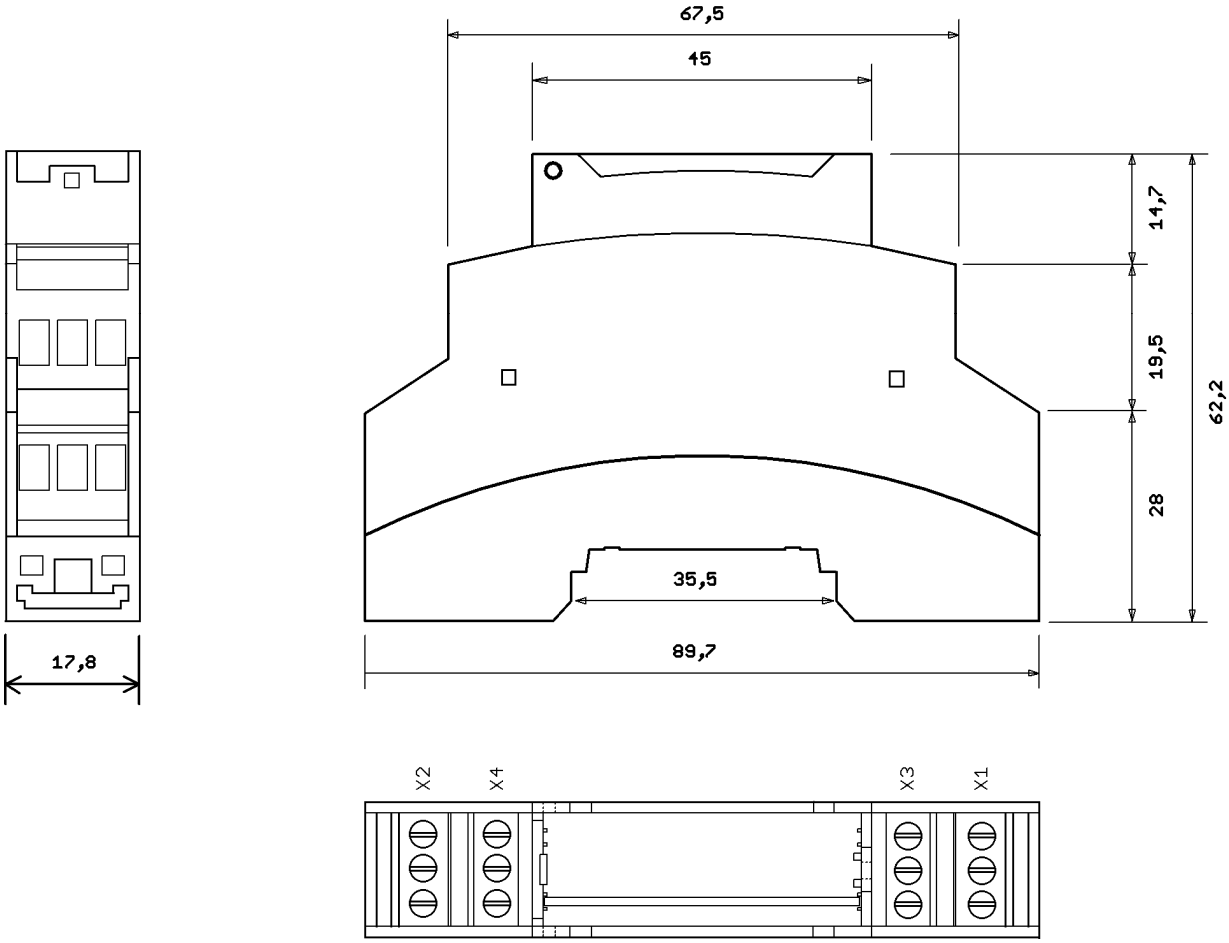
## Prinzipschaltbild digitale Eingänge




## Prinzipschaltbild digitale Ausgänge



## *Abmessungen Kunststoffgehäuse*




Alle Maße in Millimeter (mm)

## *CANopen Objektverzeichnis*

Im hipecs-CIO59 Controller ist das komplexe Objektverzeichnis für CANopen E/A-Geräte implementiert.

***hipecs-CIO59 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 / 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 | 0083 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 | "hipecsCIO59" | 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 | - | - | | 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 | 0300 5900 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 | 200 h + Node-ID | PDO |
| | 2 | Transmission Type | Unsigned 8 | rw | no | FF h | PDO |
| 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 | 0x80000300 + 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 |
|---|---|---|---|---|---|---|---|
| 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 | 0x80000400 + 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 + 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 | 1 h | PDO |
| | 1 | Mapped Object | Unsigned 32 | rw | no | 6200 0108 h Dig. Output OUT00-OUT01 | PDO |
| 1601 | | Receive PDO2 - Mapping Parameters | Record | - | - | - | PDO |
| | 0 | Nr of Subobjects | Unsigned 8 | rw | no | 2 h | PDO |
| | 1 | Mapped Object | Unsigned 32 | rw | no | 4001 0010 h Counter Control | PDO |
| | 2 | Mapped Object | Unsigned 32 | rw | no | 4002 0020 Counter Next Offset | |
| 1602 | | Receive PDO3 - Mapping Parameters | Record | - | - | - | PDO |
| | 0 | Nr of Subobjects | Unsigned 8 | rw | no | 0 h | 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 |
| 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 | 0x80000280 + Node-ID | PDO |
| | 2 | Transmission Type | Unsigned 8 | rw | no | 01 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 PDO3 - Communication Parameters | Record | - | - | - | PDO |
| | 0 | Nr of Subobjects | Unsigned 8 | ro | no | 5 h | PDO |
| | 1 | COB-ID | Unsigned 32 | rw | no | 0x80000380 + Node-ID | PDO |
| | 2 | Transmission Type | Unsigned 8 | rw | no | 01 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 | 0x80000480 + Node-ID | PDO |
| | 2 | Transmission Type | Unsigned 8 | rw | no | 01 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 | 1 h | PDO |
| | 1 | Mapped Object | Unsigned 32 | rw | no | 60000108 h Digital Input IN0 – IN1 | PDO |
| 1A01 | | Transmit PDO2 – Mapping Parameters | Record | - | - | - | PDO |
| | 0 | Nr of Subobjects | Unsigned 8 | rw | no | 2 h | PDO |
| | 1 | Mapped Object | Unsigned 32 | rw | no | 40070010 h Counter Status | PDO |
| | 2 | Mapped Object | Unsigned 32 | rw | no | 40000020 h Counter Value | |
| 1A02 | | Transmit PDO3 – Mapping Parameters | Record | - | - | - | PDO |
| | 0 | Nr of Subobjects | Unsigned 8 | rw | no | 0 h | PDO |
| 1A03 | | Transmit PDO4 – Mapping Parameters | Record | - | - | - | PDO |
| | 0 | Nr of Subobjects | Unsigned 8 | rw | no | 0 h | PDO |
| 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 |

| Index | Sub-Index | Name | Data type | Acc. | Map-pable | Default Value / Note | Object Category |
|---|---|---|---|---|---|---|---|
| 2180 | - | CAN Restart Time | Unsigned 16 | rw | no | 1000 h (restart after one second) | Global |
| 4000 | - | Counter Value for IN0 | Unsigned 32 | ro | yes | - | Counter |
| 4001 | - | Counter Control for IN0 | Unsigned 16 | rww | yes | 0 | Counter |
| 4002 | - | Counter Next Offset | Unsigned 32 | wo | yes | - | Counter |
| 4007 | - | Counter Status | Unsigned 16 | ro | yes | - | Counter |
| 4008 | - | Counter Mode for IN0 | Unsigned 8 | rw | no | 0 | Counter |
| 4009 | | Counter Output Time | Array | - | - | - | Counter |
| | 0 | Nr of Subobjects | Unsigned 8 | ro | | 2 h | Counter |
| | 1 | Counter Output Time1 | Unsigned 16 | rw | no | 50 | Counter |
| | 2 | Counter Output Time2 | Unsigned 16 | rw | no | 50 | Counter |
| 5200 | - | Reset Output Object on Error | Unsigned 8 | rw | no | 1 h | Dig. Output |
| 6000 | | Digital Input 8 Bit | Array | - | - | - | Dig. Input |
| | 0 | Nr of Subobjects | Unsigned 8 | ro | no | 1 h | Dig. Input |
| | 1 | Digital Input Byte 0 | Unsigned 8 | ro | yes | - | Dig. Input |
| 6002 | | Polarity Input 8 Bit | Array | - | - | - | Dig. Input |
| | 0 | Nr of Subobjects | Unsigned 8 | ro | no | 1 h | Dig. Input |
| | 1 | Polarity Input Byte 0 | 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 | 1 h | Dig. Input |
| | 1 | Interrupt Mask Any Change Byte 0 | 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 | 1 h | Dig. Input |
| | 1 | Interrupt Mask Rising Edge Byte 0 | 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 | 1 h | Dig. Input |
| | 1 | Interrupt Mask Falling Edge Byte 0 | 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 |
| 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 |
| 6200 | | Write Digital Output 8 Bit | Array | - | - | - | Dig. Output |
| | 0 | Nr of Subobjects | Unsigned 8 | ro | no | 1 h | Dig. Output |
| | 1 | Dig. Output Byte 0 | Unsigned 8 | rww | yes | - | Dig. Output |
| 6206 | | Error Mode Output 8 bit | Array | - | - | - | Dig. Output |
| | 0 | Nr of Subobjects | Unsigned 8 | ro | no | 1 h | Dig. Output |
| | 1 | Error Mode Output 8 Bit Byte 0 | Unsigned 8 | rw | no | FF h | Dig. Output |
| 6207 | | Error State Output | Array | - | - | - | Dig. Output |
| | 0 | Nr of Subobjects | Unsigned 8 | ro | no | 1 h | Dig. Output |
| | 1 | Error Value Output 8 Bit Byte 0 | Unsigned 8 | rw | no | 0 h (inactive, high level) | Dig. Output |
| 6300 | | Write Digital Output 16 bit | Array | - | - | - | Dig. Output |
| | 0 | Nr of Subobjects | Unsigned 8 | ro | no | 1 h | Dig. Output |
| | 1 | Dig. Output Word 1 | Unsigned 16 | rww | yes | - | Dig. Output |
| 6320 | | Write Digital Output 32 bit | Array | -- | - | - | Dig. Output |
| | 0 | Nr of Subobjects | Unsigned 8 | ro | no | 1 h | Dig. Output |
| | 1 | Dig. Output Long 1 | Unsigned 32 | rww | yes | - | Dig. Output |

## 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.

### 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 | 0083 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-CIO59” |

### 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. 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 | 1016h |
| 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-CIO59 at frenzel + berg electronic |
| Data Type | Unsigned 32 |
| Access modes | RO |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 0300 5900 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 | 1400.01 | Node-Id + 200h |
| | 1401.01 | Node-Id + 80000300h |
| | 1402.01 | Node-Id + 80000400h |
| | 1403.01 | Node-Id + 80000500h |
| | 1800.01 | Node-Id + 180h |
| | 1801.01 | Node-Id + 80000280h |
| | 1802.01 | Node-Id + 80000380h |
| | 1803.01 | Node-Id + 80000480h |

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 |

**Attention**: By default, only the transmit and receive PDO 1 is enabled. Transmit and receive PDO2...4 are disabled by default and must be activated by your CANopen Master.

## *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-CIO59** CANopen IO uses the following default mapping entries for receive PDO mapping:

| Index | Entry | Explanation |
|---|---|---|
| Receive-PDO1 | | |
| 1600.00 | 1 | RPDO1: 1 mapped object |
| 1600.01 | 62000108h | Digital Output Byte0 |
| Receive-PDO2 | | |
| 1601.00 | 2 | RPDO2: 2 mapped object |
| 1601.01 | 40010010h | Counter Control for IN0 |
| 1601.02 | 40020020h | Counter Next Offset |
| Receive-PDO3 | | |
| 1602.00 | 0 | RPDO3: no mapped objects |
| Receive-PDO4 | | |
| 1603.00 | 0 | RPDO4: no mapped objects |

**Attention**: Receive PDO1 is active by default. RPDO2...4 have to be activated by CANopen Master.

**Transmit PDOs**
The **hipecs-CIO59** 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 | 60000108h | Digital Input Byte0 |
| Transmit – PDO2 | | |
| 1A01.00 | 2 | TPDO2: 2 mapped object |
| 1A01.01 | 40070010h | Counter Status |
| 1A01.02 | 40000020h | Counter Value |
| Transmit – PDO3 | | |
| 1A02.00 | 0 | TPDO3: no mapped object |
| Transmit – PDO4 | | |
| 1A03.00 | 0 | TPDO4: no mapped objects |

**Attention**: Transmit PDO1 is active by default. TPDO2...4 have to be activated by CANopen Master.

## *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 2101: System Configuration*

This Object returns the operation mode of the hipecs-CIO59.

| 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 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 | 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 CIO59's special functions. Use these objects to handle the counter.

### Index 4000: Counter Value

This Object holds the counter value from the IN0.0 event counter.

| | |
|---|---|
| Index | 4000h |
| Name | Counter Value |
| Description | Counter Value for IN0 |
| Data Type | Unsigned 32 |
| Access modes | RO |
| PDO Mapping | YES |
| Value Range | - |
| Default Value | 0 |

### Index 4001: Counter Control

Use this object in order to start/stop or reset the IN0 counter.

| | |
|---|---|
| Index | 4001h |
| Name | Counter Control |
| Description | Counter Control for IN0 Counter |
| Data Type | Unsigned 16 |
| Access modes | rww |
| PDO Mapping | YES |
| Value Range | - |
| Default Value | 0 (disabled) |

Bit 0, 1 and 4 are available:

| Bit | Value | Function |
|---|---|---|
| 0 | Enable Counter | |
| | 0 | Counter disabled |
| | 1 | Counter enabled |
| 1 | Run Counter | |
| | 0 | Counter stopped |
| | 1 | Counter started |
| 4 | Reset Counter | |
| | 0 | - |
| | 1 | Counter reset |

### Index 4002: Counter Next Offset

This object holds the next available counter offset. Whether one of the outputs is activated or not, when reaching 0, is also set in this object. Multiple offset values can be written to this object, because it works as a FIFO buffer.

| | |
|---|---|
| Index | 4002h |
| Name | Counter Next Offset |
| Description | Counter Offset for IN0 |
| Data Type | Unsigned 32 |
| Access modes | wo |
| PDO Mapping | YES |
| Value Range | - |
| Default Value | - |

The value written to this object, is set up as followed:

| | |
|---|---|
| Bit 31, 30 | Toggle bits to accept new data |
| Bit 29 | Valid flag, set to use this value as new offset |
| Bit 28 | Repeat until counter is cleared |
| Bit 26, 27 | unused, set to 0 |
| Bit 25 | Set output O1 when counter is 0 |
| Bit 24 | Set output O0 when counter is 0 |
| Bit 23…0 | New offset |

### Index 4007: Counter Status

This object holds the current status of the counter.

| | |
|---|---|
| Index | 4007h |
| Name | Counter Status |
| Description | |
| Data Type | Unsigned 16 |
| Access modes | ro |
| PDO Mapping | YES |
| Value Range | - |
| Default Value | - |

This object is set up as followed:

| | |
|---|---|
| Bit 11-16 | not used, always 0 |
| Bit 10 | FIFO toggle bit, toggle with each new offset |
| Bit 9 | Counter offset value FIFO full |
| Bit 8 | Counter offset value FIFO empty |
| Bit 7 | Counter processes repeat value |
| Bit 6 | not used, always 0 |
| Bit 5 | Counter value preloaded |
| Bit 4 | Counter value loaded |
| Bit 3 | Counter ready to enable |
| Bit 2 | not used, always 0 |
| Bit 1 | Counter running |
| Bit 0 | Counter Enabled |

### Index 4008: Counter Mode

This object is reserved at this time. Leave value at 0!

| | |
|---|---|
| Index | 4008h |
| Name | Counter Mode |
| Description | RESERVED |
| Data Type | Unsigned 16 |
| Access modes | rw |
| PDO Mapping | NO |
| Value Range | - |
| Default Value | 0 (do not change) |

### Index 4009: Counter Output Time

This objects defines the time, how long a selected output is activated after counter is 0. Time is set in milliseconds for each output separately.

| | |
|---|---|
| Index | 4009h |
| Name | Counter Output Time |
| 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 | 2h |

| | |
|---|---|
| Index | 1/2 |
| Name | Counter Output Time1/2 |
| Description | |
| Data Type | Unsigned 16 |
| Access modes | rw |
| PDO Mapping | NO |
| Value Range | 0…10000 |
| Default Value | 50 |

### Index 5200: Output Reset on Error Option

This Object selects the function for error handling if a critical error is detected.
If the value is 0, the Outputs objects 6200.xx will keep unchanged. The ports will be set to their error state given in object 6207 as long as the error is active. If error condition ends, the outputs will return to the state according to the output object 6200h.
If the value is 1, the Outputs error handling depends on the objects 6206h and 6207h and the output object 6200 will be overwritten with the error output state according to objects 6206 and 6207.

| | |
|---|---|
| Index | 5200h |
| Name | Output Reset on Error Option |
| Description | - |
| Data Type | Unsigned 8 |
| Access modes | RW |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 1 |

## DS401: I/O Configuration Objects

The following objects are describing the objects for configuration of the input and output channels.

## DS401: Digital Input Objects

The following objects are describing the functionality of the digital input lines of the CIO59. The CIO59 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 | 1h |

| | |
|---|---|
| Index | Subindex 1 |
| Name | Digital Input 8 Bit Byte 0 |
| Description | |
| Data Type | Unsigned 8 |
| Access modes | RO |
| PDO Mapping | Yes |
| Value Range | - |
| Default Value | - |

### 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 | 1h |

| | |
|---|---|
| Index | Subindex 1 to Nr of input bytes |
| Name | Polarity Input 8 Bit Byte 1 |
| 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: Digital Output Objects

The following objects are describing the functionality of the digital output lines of the CIO59.
The CIO59 supports 8, 16 and 32 bit access to the digital outputs.

The mapping of the I/O lines to object 6200 is explained in chapter "Mapping I/O to Object Dictionary"

### Index 6200: Write to Digital Output

With object 6200, the digital outputs of the CIO59 can be written.

| | |
|---|---|
| Index | 6200h |
| 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 | 1h |

| | |
|---|---|
| Index | Subindex 1 |
| Name | Write to digital output |
| Description | |
| Data Type | Unsigned 8 |
| Access modes | RW |
| PDO Mapping | YES |
| Value Range | - |
| Default Value | 0 |

### Index 6202: Polarity Output 8 Bit

With this object, the digital outputs may be inverted. See also Index 6200 for additional information.

| | |
|---|---|
| Index | 6202h |
| Name | Polarity Output 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 | 1h |

| | |
|---|---|
| Index | Subindex 1 |
| Name | Polarity Output 8 Bit Byte 0 |
| Description | |
| Data Type | Unsigned 8 |
| Access modes | RW |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 0 |

### Index 6206: Error Mode Output 8 Bit

This object indicates, whether an output is forced to a predefined value (given in object 6207) in case of a device error.
1 = Output will be forced to the value selected in object 6207
0 = Output will be unchanged even in case of an error condition.

| Index | 6206h |
|---|---|
| Name | Error Mode Output 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 | 1h |

| Index | Subindex 1 |
|---|---|
| Name | Error Mode Output 8 Bit Byte 0 |
| Description | |
| Data Type | Unsigned 8 |
| Access modes | RW |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 0FFh<br>(Take error condition from object 6207) |

### Index 6207: Error Value Output 8 Bit

This object selects the level the outputs are forced to in case of device error mode if the error mode (object 6206 is enabled)
1 = Output will be forced to active state
0 = Output will be forced to inactive state.

| Index | 6207h |
|---|---|
| Name | Error Value Output 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 | 1h |

| Index | Subindex 1 |
|---|---|
| Name | Error Value Output 8 Bit Byte n |
| Description | |
| Data Type | Unsigned 8 |
| Access modes | RW |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 0 (Inactive, high level) |

### Index 6300: Write Digital Output 16 Bit

This object enables 16-Bit access to the digital output bytes. The Object addresses the same data area as object 6200 but using unsigned integer data type. See Index 6200 for further details.

### Index 6320: Write Digital Output 32 Bit

This object enables 32-Bit access to the digital output bytes. The Object addresses the same data area as object 6200 but using unsigned long data type. See Index 6200 for further details.

## *Emergency Messages*

The hipecs-CIO59 module supports several emergency messages. All of them have the same structure.

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

EMY-Code: emergency-Error-Code according to DS301
1001: content of object 1001

CIO-Code: Emergency-Error-Code as unsigned 32 value

| CIO-XX-Code (hex) | changes: | | description |
|---|---|---|---|
| | NMT | I/O | |
| 8000 0000 | X | X | CAN bus is bus off |
| 4000 0000 | | | CAN bus in error warning state |
| 2000 0000 | | | Node guarding warning |
| 3000 0000 | X | X | Life guarding error |
| 4000 0000 | X | X | Heartbeat error |
| 0000 0100 | | | Wake up from power down mode |

Emergency 2000 0000 ( Node guarding warning ) must be enabled with object 2103.
If more than one error is active at the same time, the bitmap of the CIO-Codes for all active errors are combined with a logical or conjunction.
Some of the emergencies may cause a NMT state change and/or may force the output pins to the error state. This behaviour depends on the setting of object 1029.
The ID for emergency transmission is fixed to:
**0x80 + $NodeID**.

List of emergency messages:

| Node-Guarding warning | | | | | | | |
|---|---|---|---|---|---|---|---|
| 30 | 81 | 01 | 00 | 00 | 00 | 00 | 20 |

This warning occurs, if the master fails to transmit the guarding remote frame within the specified Guard Time object 100C and if transmission is enabled in object 2103

| Life-Guarding error | | | | | | | |
|---|---|---|---|---|---|---|---|
| 30 | 81 | 11 | 00 | 00 | 00 | 00 | 30 |

This error occurs, if the masters fails to transmit the guarding remote frame within the specified Life Time (Guard Time object 100C multiplied with Life Time Factor object 100D)

| Heartbeat Error | | | | | | | |
|---|---|---|---|---|---|---|---|
| 30 | 81 | 11 | 00 | 00 | 00 | 00 | 10 |

This message indicates Heartbeat failure.

| CAN Bus in error warning state | | | | | | | |
|---|---|---|---|---|---|---|---|
| 00 | 81 | 01 | 00 | 00 | 00 | 00 | 40 |

This error occurs, if the chips internal CAN module is in error warning state.

| return from CAN bus off | | | | | | | |
|---|---|---|---|---|---|---|---|
| 40 | 81 | 01 | 00 | 00 | 00 | 00 | C0 |

This message indicates a return from Bus OFF state.

## *Data Mapping to Dictionary*

| operation mode 0<br>2 dig. inputs / 2 dig. outputs<br>EDS-file: hipecs_CIO-059.EDS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **mapping to dictionary** | | | | | | | | |
| Index. | mapped I/O signal bit/value | | | | | | | |
| SubIndex | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 4000 | Counter Value IN0 | | | | | | | |
| 4001 | Counter Control | | | | | | | |
| 4002 | Counter Next Offset | | | | | | | |
| 4007 | Counter Status | | | | | | | |
| 6000.01 | IN0.0 to IN0.1 | | | | | | | |
| 6200.01 | OUT0.0 to OUT0.1 | | | | | | | |
| **Default PDO Mapping** | | | | | | | | |
| PDO | mapped data | | | | | | | |
| RPDO1 | 6200.01 dig. outputs<br>OUT00 to OUT01 | | | | | | | |
| RPDO2 | 4001.00 Counter Control<br>4002.00 Counter Next Offset | | | | | | | |
| RPDO3 | - | | | | | | | |
| RPDO4 | - | | | | | | | |
| TPDO1 | 6000.01 dig. Inputs<br>IN00 to IN01 | | | | | | | |
| TPDO2 | 4007.00 Counter Status<br>4000.00 Counter Value | | | | | | | |
| TPDO3 | - | | | | | | | |
| TPDO4 | - | | | | | | | |

## *Version History*

| Version | Datum | Änderung |
|---|---|---|
| 1.44 Rev. 0 | 22.03.2013 | Erste Version |
| 1.57 Rev. 1 | 20.10.2014 | Produktspezifikationen aktualisiert (Temperaturbereich) |
| 1.57 Rev. 2 | 18.02.2015 | Bestellinformationen ergänzt |
| 1.63 Rev. 1 | 19.05.2015 | Release version |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

## *Table of Content*