

General

The hipecs-CIO52 is a low-cost CANopen module with 4 analog output lines. The I/O are isolated from power supply and the CAN bus sub system. Furthermore, the module has an output resolution of 12 bit and a voltage range of -10...+10 volt.

Direct links with other I/O modules of the hipecs-CIO series are possible without a master PLC.

CANopen is available according to DS301 and DS401. All usual baud rates up to 1 Mbit/s supported.



Features

- 4 analog outputs isolated from CAN and supply
- Short-circuit proof
- Voltage range: -10...+10 V
- Sending of values without PLC/CAN-Master to suitable counterpart module possible
- Plastic housing for mounting onto DIN carrier rails
- Operating temperature 0...+55 °C (opt. -40...+70 °C)

CANopen Features

- CAN baud rates up to 1 Mbit/s
- CAN bus ISO11898 with Transceiver TJA1050
- 4 Transmit- and 4 Receive-PDO
- Dynamic PDO Mapping
- Variable PDO Identifier
- CANopen PDO transfer modes: synchronous, asynchronous, event triggered, cyclic, acyclic and RTR
- Event Timer and Inhibit Timer for all Transmit-PDO
- Node-Guarding, Lifeguarding und Heartbeat
- Emergency messages
- Minimum Boot-Up

Ordering information

| Part | Order number |
|---|-----------------|
| hipecs-CIO52-i | EZ00000.2152.01 |
| 4 analog outputs, CAN isolated, 0...+55 °C | |
| hipecs-CIO52-ie | EZ00000.3052.00 |
| 4 analog outputs, CAN isolated, -40...+70 °C | |

Technical data

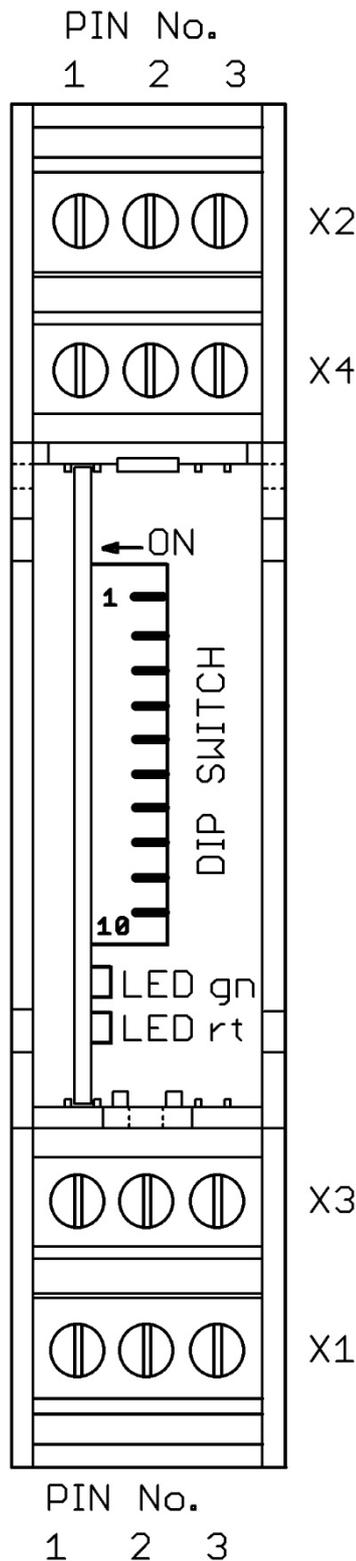
Separated potentials for system/bus and outputs

| Power supply System | Min. | Norm. | Max. |
|--------------------------------|---|--------------|-------------------------------------|
| Supply voltage System/Bus | +11 V DC | +24 V DC | +32 V DC |
| Current consumption System/Bus | +43 mA (at $V_{CC} = +32$ V DC) | +55 mA | +112 mA (at $V_{CC} = +11$ V DC) |
| CAN bus Norm | ISO11898 | | |
| CiA Draft Standards | DS301 Version 4.0 and DS401 Version 2.0 | | |
| Conformance declaration | CE | | |
| MTBF | 4,571,604 hrs | | |

| Analog outputs | |
|--------------------------------------|---------------------------|
| Number of outputs | 4 |
| Resolution | 12 Bit (11 bit plus sign) |
| Control | DAC |
| Max. output current each line | +10 mA ($R_L > 1$ kOhm) |
| Short-circuit proof | Yes |
| Max. short-circuit current each line | +20 mA ($R_L > 500$ Ohm) |
| Isolation between System/Bus | 60 V DC |
| Voltage range output lines | -10...+10 V |
| Max. capacity each line | 4 μ F |
| Delay (CAN reaction time) | typ. 1 ms |

| Connectors and dimensions | |
|--|--|
| Connectors | Screw clamps |
| Cable cross-section [mm ²] | 0.08...1.5 mm ² (massive/flexible) |
| Cable cross-section [AWG] | 26...14 AWG (massive/flexible) |
| Stripping length | 8 mm |
| Dimensions housing | approx. 17.8 x 90 x 62 mm (see picture "dimensions") |
| Operating temperature | 0...+55 °C (optional -40...+70 °C) |
| Weight module | approx. 64 g |

Connectors assignment



Connector X1 (power)

| Pin-No. | Name | Description |
|---------|------|-------------|
| 1 | U | +24 V DC |
| 2 | GND | Ground |
| 3 | - | n.c. |

Connector X2 (CAN)

| Pin-No. | Name | Description |
|---------|------|-------------|
| 1 | L0 | CAN Low |
| 2 | H0 | CAN High |
| 3 | G0 | ground |

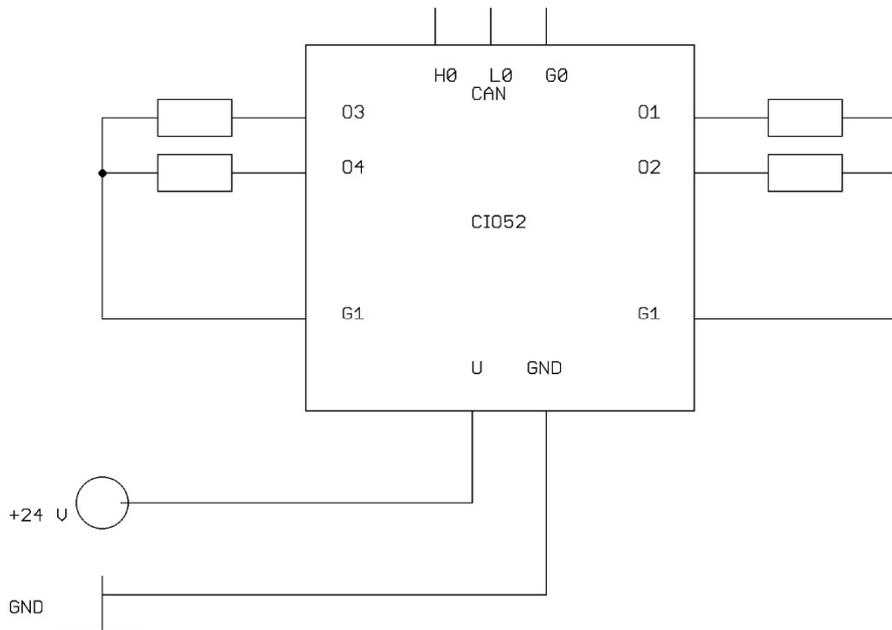
Connector X3 (outputs)

| Pin-No. | Name | Description |
|---------|------|-------------|
| 1 | O1 | Output 1 |
| 2 | G1 | Ground |
| 3 | O2 | Output 2 |

Connector X4 (outputs)

| Pin-No. | Name | Description |
|---------|------|-------------|
| 1 | O3 | Output 3 |
| 2 | G1 | Ground |
| 3 | O4 | Output 4 |

Wiring diagram



Information to direct links

It is possible to create direct links to other devices of the hipecs-CIO series with this device. Matching modules are needed for this feature.

With a direct link a fail-safe transmission of analog values is provided within the reach of strong electric machines, e.g. electric motors, or over great distances.

It is even possible to add such a direct link into already existing CAN sub-systems.

The modules are wired and the CAN connections linked.

Further information about settings and start-up of the direct link is available in document (application note) "AN_CIO_english.pdf".

Configuration Dip-Switch

Configuration of node-ID, baud rate and termination via DIP-Switch.
The switches are inside the housing (open lid).

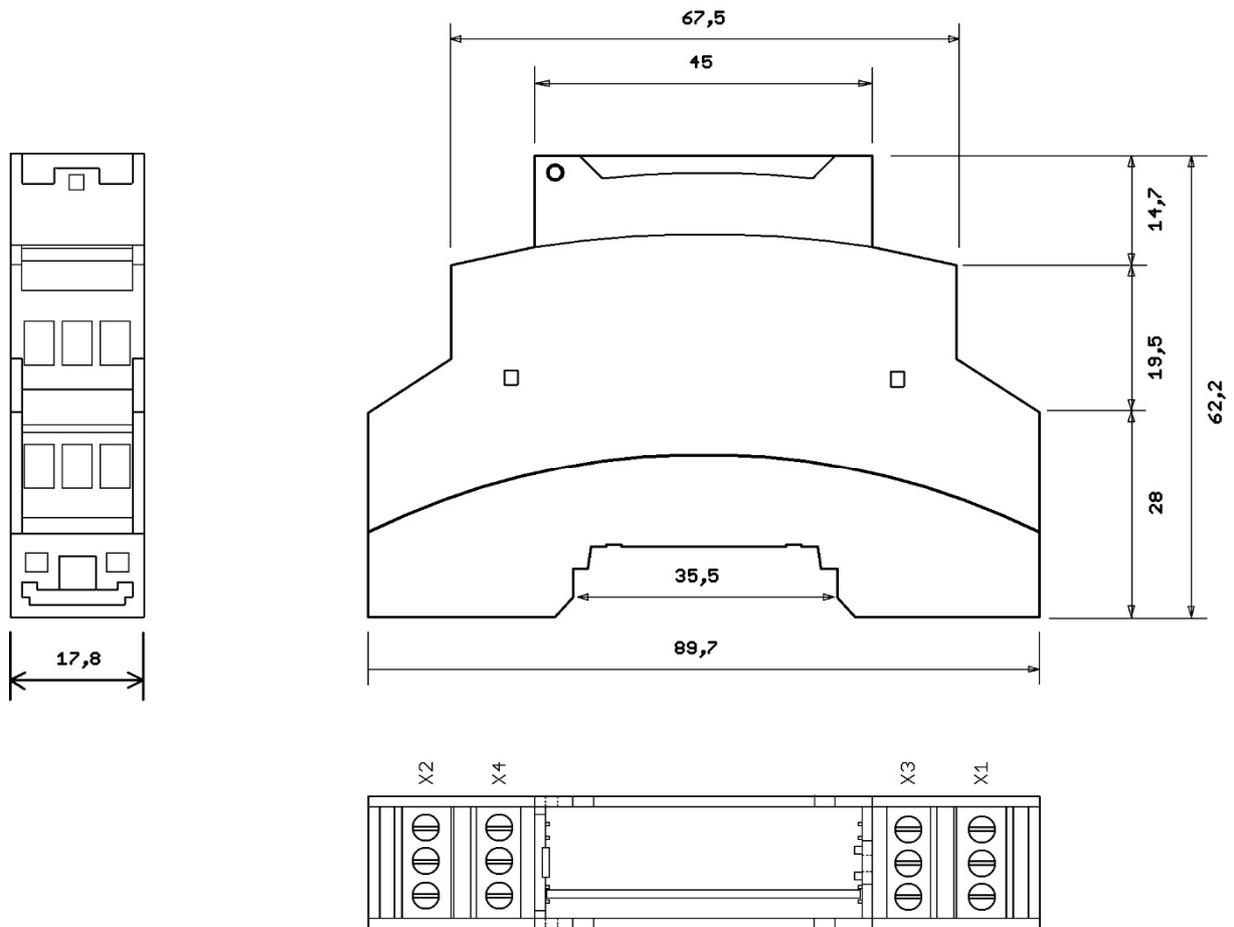
| Switch Number | | | | | | | | | | Description |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------------------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| RT | | | | | | | | | | RT Termination CAN-Bus |
| | BD2 | BD1 | BD0 | | | | | | | BDx Baud rate CAN-Bus |
| | | | | ID5 | ID4 | ID3 | ID2 | ID1 | ID0 | IDx Select Node-ID |
| ON | | | | | | | | | | CAN-Termination on (120 Ohm) |
| OFF | | | | | | | | | | CAN-Termination off |
| | 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 | | | | | | | Reserved |
| | | | | OFF | OFF | OFF | OFF | OFF | OFF | Reserved |
| | | | | 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

The LED are located behind the lid. States are coded according to DRP303-3.

| LED | Color | Function |
|---------|-------|--|
| RUN-LED | green | off no supply or faulty flickering CAN not started flashing Stopped blinking Preoperational on Operational |
| ERR-LED | red | off no error 1x flashing CAN module in Error Warning State 2x flashing Node-Guarding error on Bus-Off |

Dimensions



All measurements in millimeter (mm)

CANopen Object Dictionary

DS301: global objects

| Index | Sub-Index | Name | Access |
|-------|-----------|------------------------------|--------|
| 0005 | - | Dummy 8 | r/o |
| 0006 | - | Dummy 16 | r/o |
| 0007 | - | Dummy 32 | r/o |
| 1000 | - | Device Type | r/o |
| 1001 | - | Error Register | r/o |
| 1002 | - | Manufacturer Status Register | r/o |
| 1005 | - | COB-ID SYNC | r/o |
| 1008 | - | Device Name | r/o |
| 1009 | - | Hardware Version | r/o |
| 100A | - | Software Version | r/o |
| 100C | - | Guard Time | r/w |
| 100D | - | Life Time Factor | r/w |
| 100E | - | COB-ID Guard | - |
| 1014 | - | COB ID Emergency | r/w |
| 1015 | - | Inhibit Time Emergency | r/w |
| 1016 | 0 | Consumer Heartbeat Time | r/o |
| | 1 | Consumer Heartbeat Time 1 | r/w |
| | 2 | Consumer Heartbeat Time 2 | r/w |
| | 3 | Consumer Heartbeat Time 3 | r/w |
| | 4 | Consumer Heartbeat Time 4 | r/w |
| 1017 | - | Producer Heartbeat Time | r/w |
| 1018 | 0 | Identity Object | r/o |
| | 1 | Vendor ID | r/o |
| | 2 | Product Code | r/o |
| | 3 | Revision Number | r/o |
| | 4 | Serial Number | r/o |
| 1029 | | Error Behavior Object | r/o |
| | 1 | Communication error | r/w |
| | 2 | Application error | r/w |

All index values are hexadecimal. Values in tables are hexadecimal (0x...) or decimal.

r/o read only
w/o write only
r/w read and write

All visible string data types are 20 characters at max.

DS301: PDO Parameter objects

Description of PDO Parameter. With these indexes, dynamic PDO-Mapping, free selection of IDs, transmission type, inhibit and event time is possible. These settings are selectable in "operational" as well as "preoperational" mode.

| Index | Sub-Index | Name | Access |
|-------------|-----------|---|--------|
| 1400 | 0 | Receive-PDO1 Communication Parameter | r/o |
| | 1 | COB-ID | r/w |
| | 2 | Transmission Type | r/w |
| 1401...1403 | | Receive-PDO2 to RPDO4 Communication Parameter same as 1400 | r/w |
| 1600 | 0 | Receive-PDO1 Parameter mapping | r/w |
| | 1 to n | Mapped objects (max. 8 objects mappable) | r/w |
| 1601...1603 | | Receive-PDO2 to RPDO4 Parameter mapping same as 1600 | r/w |
| 1800 | 0 | Transmit-PDO1 Communication Parameter | r/o |
| | 1 | COB-ID | r/w |
| | 2 | Transmission Type | r/w |
| | 3 | Inhibit Time | r/w |
| | 4 | Reserved | r/w |
| | 5 | Event Time | r/w |
| 1801...1803 | | Transmit-PDO2 to TPDO4 Communication Parameter same as 1800 | r/w |
| 1A00 | 0 | Transmit-PDO1 Parameter mapping | r/w |
| | 1 to n | Mapped objects (max. 8 objects mappable) | r/w |
| 1A01...1A03 | | Transmit-PDO2 to TPDO4 Parameter mapping same as 1A00 | r/w |

Specific objects

| Index | Sub-Index | Name | Access |
|-------|-----------|---------------------------|--------|
| 2000 | - | Device Manufacturer | r/o |
| 2009 | 0 | Serial Number 64 Bit | r/o |
| | 1 | Serial Number 64 Bit LSDW | r/o |
| | 2 | Serial Number 64 Bit MSDW | r/o |
| 2101 | - | System Configuration | r/o |
| 2102 | - | Remapping Enabled Info | r/o |
| 2103 | - | Enable Guarding Warning | r/w |
| 2105 | - | Internal API State | r/o |
| 2110 | 0 | Conformance Test Object | r/o |
| | 1 | Range Check Object | r/w |
| 2180 | - | CAN Restart Time | r/w |

DS401: analog outputs

| Index | Sub-Index | Name | Access |
|-------|-----------|------------------------------|--------|
| 5400 | - | Analog Output Reset on Error | r/w |
| 5410 | - | Analog Output Mode | r/w |
| 6411 | 0 to n | Analog Output 16 Bit | r/w |
| 6443 | 0 to n | Analog Output Error Mode | r/w |
| 6444 | 0 to n | Analog Output Error Value | r/w |

Product related specific objects sorted by function

| Index | Sub-Index | Name | Access |
|-------|-----------|-------------|--------|
| 2EFF | - | Direct Link | r/w |

Direct link

| Index | Sub-Index | Name | Access |
|-------|-----------|---------------------------|--------|
| 2FF0 | - | Compatibility Test Object | r/w |

Internal test object

Object dictionary (description)

Following comes a short description of every dictionary entry.

DS301: Global objects

Index 0005

Dummy for spaces in PDO mapping (8-bit length).
Can be used, more than once.

| | |
|---------------|------------|
| Index | 0005 |
| Name | Dummy 8 |
| Description | |
| Data Type | Unsigned 8 |
| Access | r/o |
| PDO Mapping | Yes |
| Value Range | - |
| Default Value | 0 |

Index 0006

Dummy for spaces in PDO mapping (16-bit length).
Can be used, more than once.

| | |
|---------------|-------------|
| Index | 0006 |
| Name | Dummy 16 |
| Description | |
| Data Type | Unsigned 16 |
| Access | r/o |
| PDO Mapping | Yes |
| Value Range | - |
| Default Value | 0 |

Index 0007

Dummy for spaces in PDO mapping (32-bit length).
Can be used, more than once.

| | |
|---------------|-------------|
| Index | 0007 |
| Name | Dummy 32 |
| Description | |
| Data Type | Unsigned 32 |
| Access | r/o |
| PDO Mapping | Yes |
| Value Range | - |
| Default Value | 0 |

Index 1000: Device Type

This index contains a description of the device type. Within are encoded the CiA profile code and additional specifications of the device.

| | |
|---------------|-------------|
| Index | 1000 |
| Name | Device Type |
| Description | - |
| Data Type | Unsigned 32 |
| Access | r/o |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 0x0083 0191 |

Index 1001: Error Register

This index contains the internal error code in case of emergency.

| | |
|---------------|----------------|
| Index | 1001 |
| Name | Error Register |
| Description | - |
| Data Type | Unsigned 8 |
| Access | r/o |
| PDO Mapping | Yes |
| Value Range | - |
| Default Value | - |

The error register is built as shown. If more than one error occur, the values are combined via logical OR.

| Bit | Description |
|-----|---|
| 0 | Common error. This bit is set with every error. |
| 1 | 0 |
| 2 | 0 |
| 3 | 0 |
| 4 | CAN bus or communication error |
| 5 | 0 |
| 6 | 0 |
| 7 | Device error |

Index 1002: Status Register

This index contains additional status information of the device.

| | |
|---------------|-----------------|
| Index | 1002 |
| Name | Status Register |
| Description | - |
| Data Type | Unsigned 32 |
| Access | r/o |
| PDO Mapping | Yes |
| Value Range | - |
| Default Value | - |

Index 1005: COB-ID SYNC

This index sets the COB-ID for SYNC messages.

This device is a receiving device. SYNC production is not supported.

| | |
|---------------|-------------|
| Index | 1005 |
| Name | COB-ID Sync |
| Description | - |
| Data Type | Unsigned 32 |
| Access | r/w |
| PDO Mapping | No |
| Value Range | 1..0x7FF |
| Default Value | 0x80 |

Index 1008: Device Name

This index contains the device name as a visible string.

¹⁾ xxx: Number of the product

| | |
|---------------|--|
| Index | 1008 |
| Name | Device Name |
| Description | - |
| Data Type | Visible String |
| Access | r/o |
| PDO Mapping | No |
| Value Range | The maximum string length is 20 characters |
| Default Value | "hipecs-CIOxxx ¹⁾ " |

Index 1009: Hardware Version

This index contains the revision code of the hardware as visible string.

| | |
|---------------|--|
| Index | 1009 |
| Name | Hardware Version |
| Description | - |
| Data Type | Visible String |
| Access | r/o |
| PDO Mapping | No |
| Value Range | The maximum string length is 20 characters |
| Default Value | - |

Index 100A: Software Version

This index contains the firmware version as visible string.

| | |
|---------------|--|
| Index | 100A |
| Name | Software Version |
| Description | - |
| Data Type | Visible String |
| Access | r/o |
| PDO Mapping | No |
| Value Range | The maximum string length is 20 characters |
| Default Value | - |

Index 100C: Guard Time

Together with index 100D, this index represents the lifeguarding protocol. Values are in milliseconds.

Guard Time multiplied by Life Time Factor results in Life Time.

Set up 0 (zero), if not used.

| | |
|---------------|-------------|
| Index | 100C |
| Name | Guard Time |
| Description | - |
| Data Type | Unsigned 16 |
| Access | r/w |
| PDO Mapping | No |
| Value Range | |
| Default Value | 0 |

Index 100D: Life Time Factor

Together with index 100C, this index represents the lifeguarding protocol. Values are factors.

Guard Time multiplied by Life Time Factor results in Life Time.

Set up with 0 (zero), if not used.

| | |
|---------------|------------------|
| Index | 100D |
| Name | Life Time Factor |
| Description | - |
| Data Type | Unsigned 8 |
| Access | r/w |
| PDO Mapping | No |
| Value Range | |
| Default Value | 0 |

Index 100E: COB-ID Guard

This index contains the ID for guarding protocol.

| | |
|---------------|-----------------|
| Index | 100E |
| Name | COB-ID Guard |
| Description | - |
| Data Type | Unsigned 32 |
| Access | - |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 0x700 + Node-ID |

Index 1014: COB-ID Emergency

This index sets the ID for emergency messages.

| | |
|---------------|------------------|
| Index | 1014 |
| Name | COB-ID Emergency |
| Description | - |
| Data Type | Unsigned 32 |
| Access | r/w |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 0x80 + Node-ID |

Index 1015: Inhibit Time Emergency

This index sets up a delay for transmitting any emergency. This device supports a delay with an interval of one millisecond.

| | |
|---------------|------------------------|
| Index | 1015 |
| Name | Inhibit Time Emergency |
| Description | - |
| Data Type | Unsigned 16 |
| Access | r/w |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 0 (disabled) |

Index 1016: Consumer Heartbeat Time

Index 1016 is used to monitor the Heartbeat Consuming of up to four nodes.

| | |
|-------------|-------------------------|
| Index | 1016 |
| Name | Consumer Heartbeat Time |
| Description | - |
| Data Type | Structure |

Attention:

Heartbeat monitoring starts with the reception of the first heartbeat.

The Producer Time should be greater than the Consumer Time.

Ahead of the first heartbeat, the Producers status is unknown.

| | |
|---------------|-----------------------------|
| Index | 1016.00 |
| Name | Number of indexes supported |
| Description | - |
| Data Type | Unsigned 8 |
| Access | r/o |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 4 |

Structure of the Consumer Heartbeat Time

| MSB | | LSB | |
|----------|---------|----------------|-------|
| Byte3 | Byte2 | Byte1 | Byte0 |
| Reserved | Node-ID | Heartbeat time | |

| | |
|---------------|-------------------------------|
| Index | 1016.01...1016.04 |
| Name | Consumer Heartbeat Time 1...4 |
| Description | - |
| Data Type | Unsigned 32 |
| Access | r/w |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 0 |

Index 1017: Producer Heartbeat Time

This index sets up the heartbeat cycle in an interval of one millisecond.

If it is not used, set up 0 (zero).

Attention:

Use either Heartbeat or Node-Guarding. Both at once is not allowed.

| | |
|---------------|-------------------------|
| Index | 1017 |
| Name | Producer Heartbeat Time |
| Description | - |
| Data Type | Unsigned 16 |
| Access | r/w |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 0 |

Index 1018: Identity Object

This index contains common information about the device and the manufacturer, frenzel + berg electronic GmbH & Co.KG. It cannot be modified.

| | |
|-------------|-----------------|
| Index | 1018 |
| Name | Identity Object |
| Description | - |
| Data Type | Structure |

| | |
|---------------|-----------------------------|
| Index | 1018.00 |
| Name | Number of indexes supported |
| Description | - |
| Data Type | Unsigned char |
| Access | r/o |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 4 |

Registration code of frenzel + berg electronic GmbH & Co.KG at the CiA

| | |
|---------------|-------------|
| Index | 1018.01 |
| Name | Vendor ID |
| Description | |
| Data Type | Unsigned 32 |
| Access | r/o |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 0x58 |

Internal product code of the product at frenzel + berg electronic GmbH & Co.KG

| | |
|---------------|--------------|
| Index | 1018.02 |
| Name | Product Code |
| Description | |
| Data Type | Unsigned 32 |
| Access | r/o |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 0x0300 5200 |

| | |
|---------------|------------------------|
| Index | 1018.03 |
| Name | Revision Code |
| Description | |
| Data Type | Unsigned 32 |
| Access | r/o |
| PDO Mapping | No |
| Value Range | - |
| Default Value | Revision of the device |

| | |
|---------------|---------------|
| Index | 1018.04 |
| Name | Serial Number |
| Description | |
| Data Type | Unsigned 32 |
| Access | r/o |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 0 |

Index 1029: Error Behavior

This index sets up whether the device switches its operating state in case of emergency, or not. Possible changes are Pre-Operational or Stopped. No change at all and keeping the current state is possible, too.

| | |
|-------------|-----------------------|
| Index | 1029 |
| Name | Error Behavior Object |
| Description | - |
| Data Type | Structure |

As communication error counts, e.g., Bus-Off, Heartbeat, Guarding or internal errors of the device.

| | |
|---------------|-----------------------------|
| Index | 1029.00 |
| Name | Number of indexes supported |
| Description | - |
| Data Type | Unsigned char |
| Access | r/o |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 2 |

The values of the states are as follows:

- 0 Pre-Operational (only if Operational)
- 1 no change
- 2 Stopped
- 3...255 reserved

| | |
|---------------|---|
| Index | 1029.01 |
| Name | Communication Error |
| Description | NMT state change in case of communication error |
| Data Type | Unsigned 8 |
| Access | r/w |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 0 |

| | |
|---------------|--|
| Index | 1029.02 |
| Name | Application Error |
| Description | NMT state change in case of internal error due to hardware malfunction |
| Data Type | Unsigned 8 |
| Access | r/w |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 0 |

DS301: PDO Parameter Objects

Communication Parameter Objects

The transmission type for Transmit- and Receive-PDO are set up with sub-index 2.

| Type | PDO transmission | | | | |
|---------|------------------|---------|-------------|--------------|-----|
| | cyclic | acyclic | synchronous | asynchronous | RTR |
| 0 | | X | X | | |
| 1-240 | X | | X | | |
| 241-251 | Reserved | | | | |
| 252 | | | X | | X |
| 253 | | | | X | X |
| 254 | | | | X | |
| 255 | | | | X | |

The synchronous transmission types 0...240 and 252 are dependent on the SYNC signal. Asynchronous transmission is independent from the SYNC.

Type 0 is triggered by the SYNC, however, a transmission is only made, if the PDO data changes.

A value between 1 and 240 says the transmission is synchronous and cyclic. The transmission type represents the needed number of SYNCs for triggering the PDO.

Type 252 triggers a transmission with the next available SYNC, but only if a RTR releases the PDO.

Type 253 transmits the PDO immediately, however, only on RTR.

With type 254 and 255, the manufacturer or the device profile set the conditions.

An inhibit time can be set in sub-index 3. The PDO are triggered by their conditions, but only transmitted if the inhibit time is up. This time is set as a multiple of 100 µs, a value of 0 (zero) renders the function useless.

In mode 254/255, an additional Event Time is set. This timer running out is considered an event. The time is set as a multiple of 1 ms. This event triggers a PDO transmission in addition to other possible events.

Index 1400 is an example for Receive-PDO and index 1800 is an example for Transmit-PDO.

| Index | PDO |
|-------------|--------------------------------|
| 1400...14xx | Receive-PDO1...Receive-PDOxx |
| 1800...18xx | Transmit-PDO1...Transmit-PDOxx |

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

| | |
|---------------|-----------------------------|
| Index | 14xx.00/18xx.00 |
| Name | Number of indexes supported |
| Description | - |
| Data Type | Unsigned 8 |
| Access | r/o |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 2/5 |

| | | | |
|---------|------------------|---------|------------------|
| 1400.01 | ID + 80000200 | 1800.01 | ID + 80000180 |
| 1401.01 | ID + 300 | 1801.01 | ID + 80000280 |
| 1402.01 | ID + 80000400 | 1802.01 | ID + 80000380 |
| 1403.01 | ID + 80000500 | 1803.01 | ID + 80000480 |

The table shows the default PDO-ID values.
An Identifier von 8xxxxxxx means the PDO is rendered inactive. The CAN master has to assign a valid PDO-ID.

See table on top of the chapter.

Multiple of 1 μ s.

Multiple of 1 ms.

| | |
|---------------|-----------------------------------|
| Index | 14xx.01/18xx.01 |
| Name | COB-ID |
| Description | Identifier for CAN-Object for PDO |
| Data Type | Unsigned 32 |
| Access | r/w |
| PDO Mapping | No |
| Value Range | - |
| Default Value | |

| | |
|---------------|-------------------|
| Index | 14xx.02/18xx.02 |
| Name | Transmission Type |
| Description | - |
| Data Type | Unsigned 8 |
| Access | r/w |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 0xFF |

| | |
|---------------|--------------|
| Index | 18xx.03 |
| Name | Inhibit Time |
| Description | - |
| Data Type | Unsigned 16 |
| Access | r/w |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 0 |

| | |
|---------------|----------|
| Index | 18xx.04 |
| Name | Reserved |
| Description | - |
| Data Type | - |
| Access | - |
| PDO Mapping | No |
| Value Range | - |
| Default Value | - |

| | |
|---------------|-------------|
| Index | 18xx.05 |
| Name | Event Time |
| Description | - |
| Data Type | Unsigned 16 |
| Access | r/w |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 0 |

PDO mapping objects

The following table shows the PDO mapping entries. This is the same for all PDO. The mapping table is a linking index for entries of the object dictionary (e.g. data of digital outputs) and position in the PDO.

Sub-Index 0 gives the number of valid entries. The hipecs-CIO52 supports up to eight entries each PDO. In order to change the mapping, sub-index 0 has to be set to 0 (zero) first (inactive). Now the entries can be altered. If a new entry is mapped, the hipecs-CIO52 checks whether the entry is valid or not. Invalid entries result in an abort.

All eight sub-indexes are pointer to the entries. A value of 0 (zero) means no entry. The pointer's structure is:

| MSB | | LSB | |
|--------------|-------|-----------|--------|
| Byte3 | Byte2 | Byte1 | Byte0 |
| mapped index | | sub-index | Length |

Index and sub-index combined are the pointer; Length is the data length of the pointer's target in bit.

| | |
|-------------|--|
| Index | 160x/1A0x |
| Name | Receive-/Transmit-PDO Mapping Parameters |
| Description | - |
| Data Type | Array |

| | |
|---------------|-----------------------------|
| Index | 160x/1A0x.00 |
| Name | Number of indexes supported |
| Description | Number of mapped objects |
| Data Type | Unsigned 8 |
| Access | r/w |
| PDO Mapping | No |
| Value Range | - |
| Default Value | See table below |

| | |
|---------------|-----------------------------|
| Index | 160x/1A0x.01...160x/1A0x.08 |
| Name | Mapped object |
| Description | |
| Data Type | Unsigned 32 |
| Access | r/w |
| PDO Mapping | No |
| Value Range | - |
| Default Value | See table below |

Receive-PDO

The hipecs-CIOxxx¹⁾ uses this default configuration for Receive-PDO.

| Index | Entry | |
|--------------|----------|-----------------|
| Receive-PDO1 | | |
| 1600.00 | 0 | |
| Receive-PDO2 | | |
| 1601.00 | 4 | |
| 1601.01 | 64110110 | Analog output 1 |
| 1601.02 | 64110210 | Analog output 2 |
| 1601.03 | 64110310 | Analog output 3 |
| 1601.04 | 64110410 | Analog output 4 |
| Receive-PDO3 | | |
| 1602.00 | 0 | |
| Receive-PDO4 | | |
| 1603.00 | 0 | |

Transmit-PDO

The hipecs-CIOxxx¹⁾ uses this default configuration for Transmit-PDO.

| Index | Entry | |
|---------------|-------|--|
| Transmit-PDO1 | | |
| 1A00.00 | 0 | |
| Transmit-PDO2 | | |
| 1A01.00 | 0 | |
| Transmit-PDO3 | | |
| 1A02.00 | 0 | |
| Transmit-PDO4 | | |
| 1A03.00 | 0 | |

05) xxx: Number of the product

Specific Objects

Index 2000: Device Manufacturer

| | |
|---------------|--|
| Index | 2000 |
| Name | Device Manufacturer |
| Description | - |
| Data Type | Visible String |
| Access | r/o |
| PDO Mapping | No |
| Value Range | The maximum string length is 20 characters |
| Default Value | „FRENZEL + BERG“ |

Index 2009: Serial Number 64 Bit

This index contains the serial number of this device.

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

| | |
|---------------|-----------------------------|
| Index | 2009.00 |
| Name | Number of indexes supported |
| Description | - |
| Data Type | Unsigned 8 |
| Access | r/o |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 2 |

| | |
|---------------|----------------------------------|
| Index | 2009.01 |
| Name | Serial Number Low Double Word |
| Description | Bits 0...31 of the serial number |
| Data Type | Unsigned 32 |
| Access | r/o |
| PDO Mapping | No |
| Value Range | - |
| Default Value | - |

| | |
|---------------|-----------------------------------|
| Index | 2009.02 |
| Name | Serial Number High Double Word |
| Description | Bits 32...63 of the serial number |
| Data Type | Unsigned 32 |
| Access | r/o |
| PDO Mapping | No |
| Value Range | - |
| Default Value | - |

Index 2101: System Configuration

This index shows the current operating mode of the device.

| | |
|---------------|----------------------|
| Index | 2101 |
| Name | System Configuration |
| Description | - |
| Data Type | Unsigned 32 |
| Access | r/o |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 0 |

Index 2102: Remapping Enabled Info

This index shows, whether remapping the PDO is allowed or prohibited.

0 = remapping prohibited

1 = remapping allowed

| | |
|---------------|------------------------|
| Index | 2102 |
| Name | Remapping Enabled Info |
| Description | - |
| Data Type | Unsigned 8 |
| Access | r/o |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 1 |

Index 2103: Enabled Guarding Warning

This index enables an additional warning when Node-Guarding is used.

The CAN master is given an early report for an imminent Node-Guarding failure.

The warning is triggered when the Guard Time is up (Index 100C).

The NMT state remains unaffected.

| | |
|---------------|-------------------------|
| Index | 2103 |
| Name | Enable Guarding Warning |
| Description | - |
| Data Type | Unsigned 8 |
| Access | r/w |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 0 |

Index 2105: Internal Error Code

These are internal error messages of the CANopen controller.

| | |
|---------------|------------------------|
| Index | 2105 |
| Name | Internal Error Code |
| Description | - |
| Data Type | Unsigned 32 |
| Access | r/o |
| PDO Mapping | Yes |
| Value Range | - |
| Default Value | 0 (no error condition) |

Index 2110: Test Object

This index is for internal test purposes only. It possesses no function and is not to use.

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

| | |
|---------------|-----------------------------|
| Index | 2110.00 |
| Name | Number of indexes supported |
| Description | - |
| Data Type | Unsigned char |
| Access | r/o |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 1 |

| | |
|---------------|--------------------|
| Index | 2110.01 |
| Name | Range Check Object |
| Description | - |
| Data Type | Unsigned 16 |
| Access | r/w |
| PDO Mapping | No |
| Value Range | 100...1000 |
| Default Value | 500 |

Index 2180: CAN Restart Time

With this index, the restart time for the CAN communication in case of a Bus-Off error is defined. The value is set in milliseconds.

0 (zero) disables this function.

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

DS401: analog outputs

Index 5400: Analog Output Reset on Error

This index determines whether the outputs restore their original states after acknowledging and dealing with a critical error.

0 (zero) maintains the original states of index 6411.xx. In case of an error, the outputs are set according to indexes 6443 and 6444. After the error is dealt with, the states of index 6411.xx are restored.

1 and greater overwrites the outputs permanently. The original states are not restored, since index 6411.xx is overwritten with the safe-states of error handling.

| | |
|---------------|------------------------------|
| Index | 5400 |
| Name | Output Reset on Error Option |
| Description | - |
| Data Type | Unsigned 8 |
| Access | r/w |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 1 |

Index 5410: Analog Output Mode

This index determines whether the output values are given in millivolts or hexadecimal form.

0: values in millivolts
1...255: values in hexadecimal form

| | |
|---------------|---------------------------|
| Index | 5410 |
| Name | Analog Output Mode |
| Description | Scaling of analog outputs |
| Data Type | Unsigned 8 |
| Access | r/w |
| PDO Mapping | No |
| Value Range | 0...255 |
| Default Value | 0 |

Index 6411: Write Analog Output

With this index, the analog outputs are set.

| | |
|-------------|------------------------|
| Index | 6411 |
| Name | Write to analog output |
| Description | - |
| Data Type | Array |

| | |
|---------------|-----------------------------|
| Index | 6411.00 |
| Name | Number of indexes supported |
| Description | |
| Data Type | Unsigned 8 |
| Access | r/o |
| PDO Mapping | No |
| Value Range | - |
| Default Value | - |

| Volt | Value in 6411.0x |
|------|------------------|
| -10 | -10.000 (0xD8EF) |
| 0 | 0 |
| +10 | +10.000 (0x2710) |

| | |
|---------------|---------------------|
| Index | 6411.01...6411.xx |
| Name | Write analog output |
| Description | |
| Data Type | Integer 16 |
| Access | r/w |
| PDO Mapping | Yes |
| Value Range | 0x0000...0xFFFF |
| Default Value | 0 |

Index 6443: Analog Output Error Mode

With this is set, whether the outputs change to predefined states (index 6444) in case of an error.

| | |
|-------------|--------------------------|
| Index | 6443 |
| Name | Analog Output Error Mode |
| Description | - |
| Data Type | Array |

| | |
|---------------|-----------------------------|
| Index | 6443.00 |
| Name | Number of indexes supported |
| Description | |
| Data Type | Unsigned 8 |
| Access | r/o |
| PDO Mapping | No |
| Value Range | - |
| Default Value | - |

1 = output changes according to index 6444

0 = output does not change

| | |
|---------------|--------------------------|
| Index | 6443.01...6443.xx |
| Name | Analog Output Error Mode |
| Description | |
| Data Type | Unsigned 8 |
| Access | r/w |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 1 |

Index 6444: Analog Output Error Value

With this index, the error states for the outputs are predefined.

| | |
|-------------|---------------------------|
| Index | 6444 |
| Name | Analog Output Error Value |
| Description | - |
| Data Type | Array |

| | |
|---------------|-----------------------------|
| Index | 6444.00 |
| Name | Number of indexes supported |
| Description | |
| Data Type | Unsigned 8 |
| Access | r/o |
| PDO Mapping | No |
| Value Range | - |
| Default Value | - |

| | |
|---------------|---------------------------|
| Index | 6444.01...6444.xx |
| Name | Analog Output Error Value |
| Description | |
| Data Type | Integer 32 |
| Access | r/w |
| PDO Mapping | No |
| Value Range | - |
| Default Value | 0 |

Product related specific objects sorted by function

Direct link

Index 2EFF: Direct Link

With this index, a direct link between two CAN nodes is established.

There is no need for a master PLC in this case.

Attention:

This index is not to be used by the user! Automatic use, when using direct link!

| | |
|---------------|-------------|
| Index | 2EFF |
| Name | Direct Link |
| Description | |
| Data Type | Unsigned 32 |
| Access | r/w |
| PDO Mapping | No |
| Value Range | - |
| Default Value | - |

Internal test object

Index 2FF0: Compatibility Test Object

Only for manufacturer's internal use.

| | |
|---------------|---------------------------|
| Index | 2FF0 |
| Name | Compatibility Test Object |
| Description | |
| Data Type | Unsigned 16 |
| Access | r/w |
| PDO Mapping | No |
| Value Range | 10...1000 |
| Default Value | 100 |

Emergency messages

All possible emergency messages of this device have the same structure as follows:

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

EMY-Code: Error code according to DS301
 1001: Value of index 1001
 CIO-Code: Error code as unsigned 32-bit-value

| CIO-Code (hex) | Change | | Description |
|----------------|--------|-----|-------------------------------|
| | NMT | I/O | |
| 1000 0000 | X | X | Heartbeat Consumer Error |
| 2000 0000 | | | Node-Guarding Warning |
| 3000 0000 | X | X | Lifeguarding Error |
| 4000 0000 | | | CAN is in Error-Warning-State |
| 8000 0000 | X | X | Device was Bus-Off |

The Node-Guarding warning has to be activated with index 2103.
 If more than one error occurs, the messages are combined by using logic OR.
 Some errors have to change the NMT state and/or cause a change of the output states. This behavior depends on the settings of index 1029.

The ID for emergency messages is fixed to 0x80 + Node-ID.

List of emergency messages:

A defined Heartbeat-Producer was not able to send the Heartbeat telegram.

| Heartbeat Consumer Error | | | | | | | |
|--------------------------|----|----|----|----|----|----|----|
| 30 | 81 | 01 | 00 | 00 | 00 | 00 | 10 |

The master is not able to do a RTR on the node.

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

The Lifeguarding time is up.

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

The internal CAN module is in Error-Warning-State.

| CAN is in Error-Warning-State | | | | | | | |
|-------------------------------|----|----|----|----|----|----|----|
| 00 | 81 | 01 | 00 | 00 | 00 | 00 | 40 |

Successful return from Bus-Off.

| Return from Bus-Off | | | | | | | |
|---------------------|----|----|----|----|----|----|----|
| 40 | 81 | 01 | 00 | 00 | 00 | 00 | 80 |

I/O Mapping (quick reference)

| 4 analog outputs EDS file: hipecs_CIO-yyy.eds ¹⁾ | |
|--|-----------------|
| Mapping in object dictionary | |
| Index | mapped data |
| 6411.01 | Analog output 1 |
| 6411.02 | Analog output 2 |
| 6411.03 | Analog output 3 |
| 6411.04 | Analog output 4 |

| Default PDO Mapping | |
|---------------------|--|
| PDO | mapped data |
| RPDO2 | 6411.01 Analog output 1 6411.02 Analog output 2 6411.03 Analog output 3 6411.04 Analog output 4 |

05) yyy: Number of the product

History

| Version | Release date | Changes/Remarks |
|----------------|---------------------|--|
| V2.000_R000 | 02.05.2016 | Update Firmware New: index 2EFF (Direct Link) New: index 5410 (Analog Output Mode) |
| V2.000_R001 | 05.04.2017 | Release data sheet in new design |
| V2.000_R002 | 22.11.2019 | Update: voltage range selection updated |
| V2.000_R003 | 08.01.2020 | Update: weight of module (technical data) |

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