

# ***ADiS***

## ***Modular control system***

### **Assembly manual**

*Version 1.00*



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## Revision history

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Document name: adis\_mh\_en\_101.pdf

| Revision | Date         | Changes by | Changes                                                   |
|----------|--------------|------------|-----------------------------------------------------------|
| 100      | 03. 01. 2012 | Říha Z.    | New document.                                             |
| 101      | 10. 11. 2016 | Říha Z.    | File name changed, chapter 6.2 added, minor text changes. |
|          |              | Mlejnek J. | Images done in vector image processor, template updated.  |
|          |              |            |                                                           |

## Related documentation

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1. Help tab in the PseDet section of the DetStudio development environment  
file: Psedet\_en.chm
2. **AD-CPUW2 – ADiS** Modular system central unit – Operation manual  
file: ad-cpuw2\_g\_en\_xxx.pdf
3. Data sheets for **ADiS** modular system modules  
file: ad-xxxxx\_d\_en\_xxx.pdf
4. Application note AP0007 – Communication in DIOCAN network  
file: ap0007\_cz\_xx.pdf
5. Application note AP0016 – Principles of RS485 interface usage  
file: ap0016\_en\_xx.pdf
6. Application note AP0025 – Communication in ARION network  
file: ap0025\_en\_xx.pdf
7. Application note AP0029 – Principles of CAN network usage  
file: ap0029\_en\_xx.pdf
8. Application note AP0037 – Principles of Ethernet network usage  
file: ap0037\_en\_xx.pdf
9. Application note AP0046 – Web server parametrization  
file: ap0046\_en\_xx.pdf

# 1 Introduction

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The base of the **ADiS** control system is the **AD-CPUW2** CPU module (or an older version, **AD-CPU167**). It comprises a dedicated control core, system memory, PSU, serial line circuits and Ethernet interface circuits (the older **AD-CPU167** CPU module does not contain Ethernet interface). Specific configuration of the **ADiS** control system depends on the specialised I/O modules that connect to the side of the CPU module.

- Basic features**
- Connects up to 16 I/O modules
    - 8-bit modules – up to 128 digital I/O signals
    - 16-bit modules – up to 256 digital I/O signals
  - Expansion with extension modules of the DIOCAN system
    - up to 1024 digital I/O signals
  - Expansion with extension modules for ARION (MODBUS) communication
  - RS485 communication network
    - (up to 32 stations, operating system property)
  - Ethernet communication network
    - number of stations virtually limitless

Thanks to its modularity and flexibility, **ADiS** is well suited for both simple and fairly complex solutions that require broad communication capabilities. Typically, ADiS is utilised in applications for extensive technological systems, heating system control, machinery control and special applications requiring monitoring and/or optimisation.

**AD-CPUW2** has a DualCPU type core. DualCPU features separate communication and processing sections – each section is served by a different core. The processors use an SPI bus to communicate with each other.

## 2 CPU modules

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Technical parameters are dependent on the **AD-CPUxxx** used and on the I/O modules connected to it. Further information on technical parameters of individual modules can be found in data sheets or in the **AD-CPUW2** operation manual.

The **ADiS** control system can be based on the older version of the CPU module – **AD-CPU167** – or on the newer version – **AD-CPUW2**.

**ADC-CAN** is a special CPU type that was designed to be used only for extending the number of digital I/O signals of modules using the system bus (see chapter “2.4 Internal buses”) via the CAN interface.

### 2.1 AD-CPU167

---

Detailed description of the **AD-CPU167** CPU module is in data sheet `ad-cpu167_d_en_xxx.pdf`. The module includes:

- RS232 interface,
- RS485 interface.

By using the **AD-ETHxxx** module made by the AMiT company, the system can be extended to include Ethernet interface.

By using the **AD-CAN** module made by the AMiT company, the system can be extended to include CAN interface.

By using the **AWEB**, the system can be extended to include a web server. **AWEB** can be connected to **ADiS** by using RS232/RS485 interface located directly on the **AD-CPU167** or via Ethernet (by connecting an **AD-ETHxxx** module).

### 2.2 AD-CPUW2

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Detailed description of the **AD-CPUW2** CPU module is in data sheet `ad-cpuw2_d_en_xxx.pdf` or in operation manual `ad-cpuw2_g_en_xxx.pdf`. The module includes:

- RS232 interface,
- RS485 interface,
- Ethernet interface,
- microSD card slot,
- web server.

By using the **AD-CAN** module made by the AMiT company, the system can be extended to include CAN interface.

**AD-CPUW2** can be extended by more Ethernet interfaces via the **AD-ETHxxx** module. Each Ethernet interface needs to belong to a different IP network. Only one of these interfaces can communicate out of the local network. However, using more Ethernet interfaces is useless for most applications.

*Note* The method of MicroSD card usage depends on the used operating system and on the programme in the communication processor. The MicroSD card usage options are described in the documentation on software equipment.

## 2.3 ADC-CAN

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**ADC-CAN** is a special CPU type that was designed to be used only for extending the number of digital I/O signals of modules using the system bus (see chapter 2.4) via the CAN interface. The **ADC-CAN** module has only the system bus, it cannot be connected to modules that use the extension bus. The module includes:

- CAN interface.

## 2.4 Internal buses

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To connect I/O or communication modules, there is an internal bus that further divides into the system bus and the extension bus.

**System bus** The system bus features 16 chip select signals – to address up to 16 modules – and an interrupt signal. All modules use the system bus, therefore, only 16 modules can be connected in a single **ADiS** system.

**Extension bus** Beside the system bus, some modules also use the extension bus. There are special processor pins routed to the extension bus:

- 16 digital signals                      port P2 CPU,
- 10 analogue signals                    port P5 CPU.

The modules that use the extension bus also contain an extension bus connector – the next module in the **ADiS** assembly can also use the extension bus. Modules that do not use the extension bus do not have an extension bus connector, therefore, the modules connected after it cannot access the extension bus. This leads to the necessity to connect the modules that use the extension bus right after **AD-CPUxxx** and only then connect the modules that do not use the bus.

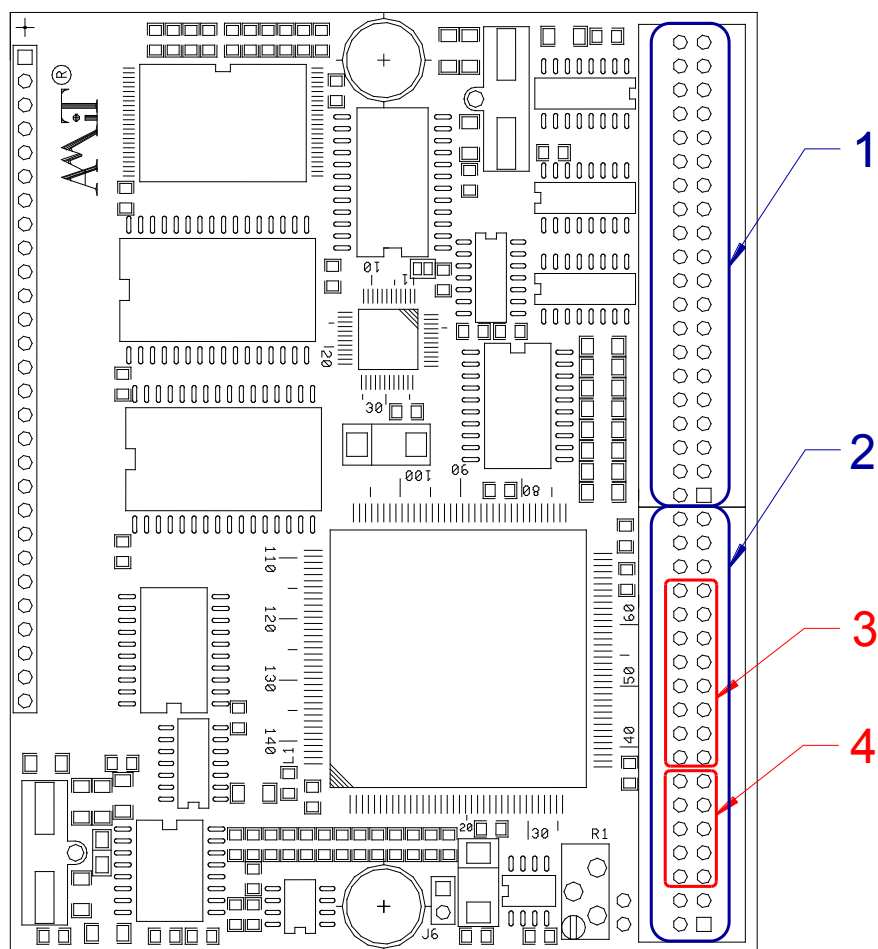


Fig. 1 – Location and description of the **AD-CPUxxx** module bus

Legend

| Number | Significance  |
|--------|---------------|
| 1      | System bus    |
| 2      | Extension bus |
| 3      | Port P2       |
| 4      | Port P5       |

## 3 Input/output modules

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Any of the AMiT company I/O modules with designation **AD-xxx** can be connected to the **AD-CPUxxx** unit. Specific module types along with their description can be found at [www.amitotion.com](http://www.amitotion.com). These generally include:

- I/O digital modules,
- I/O analogue modules,
- communication modules,
- special modules.

### 3.1 I/O digital modules

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These modules can extend the **ADiS** system capabilities to include:

- digital inputs,
- digital outputs – transistor/relay.

### 3.2 I/O analogue modules

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These modules can extend the **ADiS** system capabilities to include:

- analogue inputs – voltage/current,
- analogue inputs – for connecting resistive temperature sensors,
- analogue outputs – voltage/current.

### 3.3 Communication modules

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These modules can extend the **ADiS** system capabilities to include communication interfaces:

- RS232,
- RS485,
- CAN,
- Ethernet.

The communication modules that extend the **ADiS** system capabilities to include the RS232/RS485 interface cannot be used to communicate via the DB-Net system communication protocol. They are well suited for connecting HMI's to the **ADiS** control system, for connecting remote inputs/outputs of the ARION network or custom communication. These modules contain two serial interfaces that share system resources which means the communication running along them can interfere. Communication occurring on these interfaces need to be timed so as to prevent interference. A single communication interface can use only one communication protocol.

Detailed information on the CAN interface modules is in the application note AP0007 – Communication in DIOCAN network.

Modules with the Ethernet interface (just like Ethernet interface on **AD-CPUW2**) can be used to communicate through the DB-Net/IP system communication protocol and through the SNMP protocol. A single Ethernet interface can accommodate both communication through DB-Net/IP and SNMP protocols.

### 3.4 Special modules

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I/O modules that connect special signals and modules with enhanced properties:

- strain gauge inputs,
- IRC inputs.

## 4 Connecting modules to AD-CPUxxx

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The number of **AD-xxx** modules of the same type that can be connected is determined by the type of **AD-xxx** module as well as the order of the **AD-xxx** modules connected to the **AD-CPUxxx**.

All modules of the **ADiS** control system have a common signal that generates interrupts. Global interrupt can be caused by the following modules:

- **AD-CAN**,
- **AD-ETH10**,
- **AD-ETH100**,
- **AD-GAI8**,
- **AD-UART**,
- **AD-UART4**.

Modules **AD-FDI8** and **AD-AO8** can also generate interrupts but they require a different method. To generate the interrupt, they do not use a common signal but rather use port P2 on the extension bus (see Fig. 1 – Location and description of the **AD-CPUxxx** module bus). In general, the modules with the extension bus have their position pre-determined to some extent – they always need to be placed directly after the **AD-CPUxxx** module or after a module that is also connected through the extension bus. Of the modules the AMiT company have manufactured when this guide was created, this concerns the following: **AD-AI5**, **AD-AI8**, **AD-FAI8**, **AD-NI8**, **AD-FDI8** and **AD-AO8x**.

To operate, the aforementioned modules use either port P2 or selected pins of port P5 on the extension bus (see Fig. 1 – Location and description of the **AD-CPUxxx** module bus). Port P2 comprises 16 pins of the extension bus, port P5 comprises 10 pins. As soon as one of the modules mounts any of the port P2 or P5 pins, the same pin cannot be used by any other module. This is the reason why the number of modules using the extension bus is limited.

The information on count and position of **AD-CPUxxx** modules is in the data sheets of individual modules or in the table below. The table lists **AD-xxx** modules that were in production when this guide was created.

| Module           | Module position in the control system                                              | Max. count of modules in an assembly | Uses a port of the extension bus | Count of occupied pins |
|------------------|------------------------------------------------------------------------------------|--------------------------------------|----------------------------------|------------------------|
| <b>AD-AI5</b>    | After <b>AD-CPUxxx</b> or after a module that connects to it via an extension bus. | 2                                    | P5                               | 5                      |
| <b>AD-AI8</b>    | After <b>AD-CPUxxx</b> or after a module that connects to it via an extension bus. | 10                                   | P5                               | 1                      |
| <b>AD-AO8U</b>   | After <b>AD-CPUxxx</b> or after a module that connects to it via an extension bus. | 2                                    | P2                               | 8                      |
| <b>AD-AO8I</b>   | After <b>AD-CPUxxx</b> or after a module that connects to it via an extension bus. | 2                                    | P2                               | 8                      |
| <b>AD-CAN</b>    | No limitation.                                                                     | 1                                    | –                                | –                      |
| <b>AD-DI8A</b>   | No limitation.                                                                     | 16                                   | –                                | –                      |
| <b>AD-DI16A</b>  | No limitation.                                                                     | 16                                   | –                                | –                      |
| <b>AD-DO16</b>   | No limitation.                                                                     | 16                                   | –                                | –                      |
| <b>AD-ETH100</b> | No limitation.                                                                     | 4                                    | –                                | –                      |
| <b>AD-FDI8</b>   | After <b>AD-CPUxxx</b> or after a module that connects to it via an extension bus. | 2 <sup>1)</sup>                      | P2                               | 8                      |
| <b>AD-FAI8-A</b> | After <b>AD-CPUxxx</b> or after a module that connects to it via an extension bus. | 1                                    | P5                               | 8                      |
| <b>AD-GAI8</b>   | No limitation.                                                                     | 5                                    | –                                | –                      |
| <b>AD-GAO4U</b>  | No limitation.                                                                     | 16                                   | –                                | –                      |
| <b>AD-GAO4I</b>  | No limitation.                                                                     | 16                                   | –                                | –                      |
| <b>AD-IRC2</b>   | No limitation.                                                                     | 8                                    | –                                | –                      |
| <b>AD-NI8</b>    | After <b>AD-CPUxxx</b> or after a module that connects to it via an extension bus. | 10                                   | P5                               | 1                      |
| <b>AD-PDO8</b>   | No limitation.                                                                     | 16                                   | –                                | –                      |
| <b>AD-RDO5S</b>  | No limitation.                                                                     | 16                                   | –                                | –                      |
| <b>AD-TM2</b>    | No limitation.                                                                     | 16                                   | –                                | –                      |
| <b>AD-UART</b>   | No limitation.                                                                     | 16                                   | –                                | –                      |
| <b>AD-UART4</b>  | No limitation.                                                                     | 7                                    | –                                | –                      |

<sup>1)</sup> Possible to use more than one module. Interrupts can be generated only by modules that can access P2 port pins of the extension bus!

## 5 Connecting modules to ADC-CAN

The **ADC-CAN** module is used only to extend the I/O space via the CAN interface. It can be used to connect only digital I/O modules. These use only the system bus – they can be connected in any order.

Information on the types of modules that can be connected to the **ADC-CAN** is in the application note AP0007 – Communication in DIOCAN network. The list below states **AD-xxx** modules that were in production when this guide was created.

| Module                | Module position<br>in the control system | Max. count of modules in an<br>assembly |
|-----------------------|------------------------------------------|-----------------------------------------|
| AD-DI8A               | No limitation.                           | 16                                      |
| AD-DI16A              |                                          |                                         |
| AD-DO16               |                                          |                                         |
| AD-FDI8 <sup>1)</sup> |                                          |                                         |
| AD-PDO8               |                                          |                                         |
| AD-RDO5S              |                                          |                                         |

<sup>1)</sup> Without the option to generate process interrupts.

## 6 Significance of AD-xxx modules LEDs

### 6.1 LEDs on AD-CPUxxx

The significance of LEDs on **AD-CPUxxx** depends on the used operating system and on the programme in the communication processor.

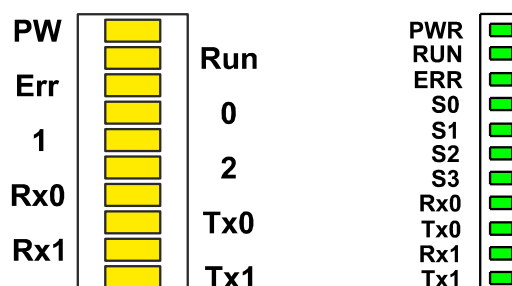


Fig. 2 – LEDs on **AD-CPU167** and **AD-CPUW2**

When using NOS operating system and an application created in DetStudio IDE, the significance is described in the documentation for DetStudio IDE.

### 6.2 LEDs on the AD-xxx I/O modules

On the **AD-xxx** I/O modules, there is a total of 4, 10 or 18 LEDs depending on the number of available inputs/outputs.

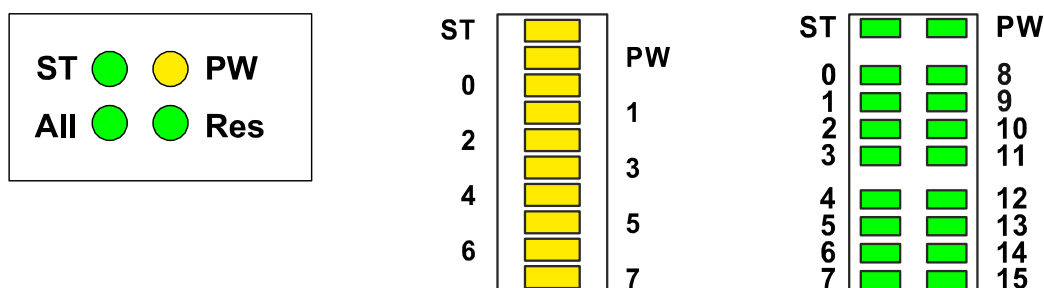


Fig. 3 – LEDs on the I/O modules

| LED description | LED            | Status                                           |                                                         |
|-----------------|----------------|--------------------------------------------------|---------------------------------------------------------|
|                 |                | LED on                                           | LED off                                                 |
|                 | <b>ST</b>      | <b>AD-CPUxxx</b> module is operating.            | <b>AD-CPUxxx</b> module is not operating.               |
|                 | <b>PW</b>      | Module supplied with power (from the inner bus). | Module is not supplied with power (from the inner bus). |
|                 | <b>0 to 15</b> | Corresponding input/output has voltage/current.  | Corresponding input/output has no voltage/current.      |
|                 | <b>All</b>     | All conversion results are available.            | Some conversion results are not available.              |
|                 | <b>Res</b>     | At least one conversion result is available.     | No conversion results are available.                    |

**Note** Module **AD-FAI** doesn't use the LED **ST**.  
Modules **AD-GAO4U** and **AD-GAO4I** do not use LEDs 0 to 7.

## 6.3 LEDs on communication modules

Number of LEDs depends on the module type.

**UARTx** Modules designated UARTx have 10 LEDs.

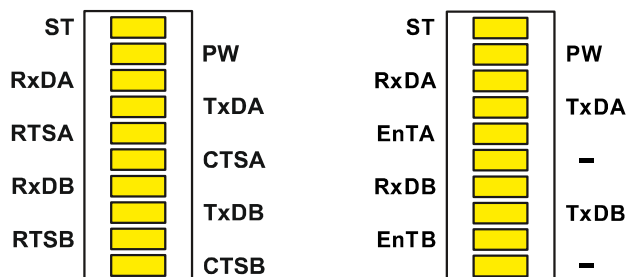


Fig. 4 – LEDs on UARTx modules

LED  
description

| LED         | Status                                                  |                                                                    |
|-------------|---------------------------------------------------------|--------------------------------------------------------------------|
|             | LED on                                                  | LED off                                                            |
| <b>ST</b>   | AD-CPUxxx module is operating.                          | AD-CPUxxx module is not operating.                                 |
| <b>PW</b>   | Module supplied with power (from the inner bus).        | Module is not supplied with power (from the inner bus).            |
| <b>RxDA</b> | Data received on interface A.                           | The module does not receive data on interface A.                   |
| <b>TxDA</b> | Data on interface A in logical 0.                       | Data on interface A in logical 1 or no transmission.               |
| <b>RxDB</b> | Data received on interface B.                           | The module does not receive data on interface B.                   |
| <b>TxDB</b> | Data on interface B in logical 0.                       | Data on interface B in logical 1 or no transmission.               |
| <b>RTSA</b> | RTS signal set on interface A.                          | RTS signal is not set on interface A.                              |
| <b>CTSA</b> | CTS signal set on interface A.                          | CTS signal is not set on interface A.                              |
| <b>RTSB</b> | RTS signal set on interface B.                          | RTS signal is not set on interface B.                              |
| <b>CTSB</b> | CTS signal set on interface B.                          | CTS signal is not set on interface B.                              |
| <b>EnTA</b> | Data transmitted on interface A (transceiver equipped). | Data is not transmitted on interface A (transceiver not equipped). |
| <b>EnTB</b> | Data transmitted on interface B (transceiver equipped). | Data is not transmitted on interface B (transceiver not equipped). |

**CAN** The significance of LEDs on modules with CAN interface is described in detached documentation. Namely, it is the application note AP0007 – Communication in DIOCAN network.



Fig. 5 – LEDs on modules with the CAN interface

**Ethernet** Modules with the Ethernet interface feature 4 LEDs.

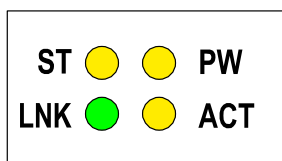


Fig. 6 – LEDs on modules with the Ethernet interface

| LED<br>description | LED        | Status                                           |                                                         |
|--------------------|------------|--------------------------------------------------|---------------------------------------------------------|
|                    |            | LED on                                           | LED off                                                 |
|                    | <b>ST</b>  | AD-CPUxxx module is operating.                   | AD-CPUxxx module is not operating.                      |
|                    | <b>PW</b>  | Module supplied with power (from the inner bus). | Module is not supplied with power (from the inner bus). |
|                    | <b>LNK</b> | Connected into the Ethernet network.             | Without Ethernet connection.                            |
|                    | <b>ACT</b> | Receiving/transmitting data.                     | The module is not receiving/transmitting data.          |

**Note** LED ACT is constantly on even if the module is not connected to Ethernet. In that case, the LED LNK is off.

## 6.4 LEDs on special modules

Number of LEDs depends on the special module type. LEDs on some of the modules have the same significance as with the I/O modules.

**AD-IRC2** Modules designated as **AD-IRC2** have 10 LEDs.

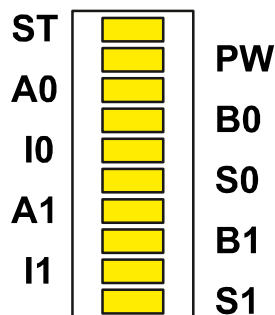


Fig. 7 – LEDs on **AD-IRC2**

| LED description | LED       | Status                                           |                                                         |
|-----------------|-----------|--------------------------------------------------|---------------------------------------------------------|
|                 |           | LED on                                           | LED off                                                 |
|                 | <b>ST</b> | <b>AD-CPUxxx</b> module is operating.            | <b>AD-CPUxxx</b> module is not operating.               |
|                 | <b>PW</b> | Module supplied with power (from the inner bus). | Module is not supplied with power (from the inner bus). |
|                 | <b>A0</b> | Signal A active on connector 0.                  | Signal A inactive on connector 0.                       |
|                 | <b>B0</b> | Signal B active on connector 0.                  | Signal B inactive on connector 0.                       |
|                 | <b>I0</b> | Signal I (index) active on connector 0.          | Signal I (index) inactive on connector 0.               |
|                 | <b>S0</b> | Position zero reached on connector 0.            | Position off the zero value on connector 0.             |
|                 | <b>A1</b> | Signal A active on connector 1.                  | Signal A inactive on connector 1.                       |
|                 | <b>B1</b> | Signal B active on connector 1.                  | Signal B inactive on connector 1.                       |
|                 | <b>I1</b> | Signal I (index) active on connector 1.          | Signal I (index) inactive on connector 1.               |
|                 | <b>S1</b> | Position zero reached on connector 1.            | Position off the zero value on connector 1.             |