



**Design Guide**  
**COM-C**  
**Communication Module**

**Hilscher Gesellschaft für Systemautomation mbH**

**[www.hilscher.com](http://www.hilscher.com)**

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# 1 Introduction

## 1.1 About this Document

All OEM piggyback Modules of Hilscher GmbH are called COM (**C**ommunication **M**odules). These Modules provide a universal and easy to use fieldbus interface for integration on various host systems. Through the set of standard application interfaces and the same board dimensions in each COM family it is easy to switch between the different fieldbus systems, e.g. PROFIBUS DP, InterBus, CANopen, DeviceNet or Ethernet by changing the Module.

This manual describes only the hardware part of the Modules. The general application interface is common to all our COM Modules and CIF PC cards described in our Toolkit-Manual and the fieldbus related details are defined in our Protocol Interface Manuals.

A new generation of communication Modules exists named COMX Modules and offer beside field-bus communication also Real-Time Ethernet communication. The application interface is different (not compatible) compared to COM Modules. The COMX Modules are described in an own manual now. The following two tables give a comparison of both COM and COMX Modules.

### Comparison COM and COMX Modules

Basic differences between COM-C and COMX-C

|                       | COM-C              | COMX-C     |
|-----------------------|--------------------|------------|
| Processor             | EC1                | netX       |
| Host Interface        | 8 Bit              | 8 / 16 Bit |
| Dual-Port Memory size | 2 KByte or 8 KByte | 16 KByte   |
| USB Interface         | No                 | Yes        |

Table 1: Basic differences between COM and COMX

Comparison of supported protocols for COM-C and COMX-C

|                              | COM-C     | COMX-C                           |
|------------------------------|-----------|----------------------------------|
| AS-Interface Master          | supported | in preparation                   |
| CANopen Master               | supported | supported                        |
| CANopen Slave                | supported | supported                        |
| CC-Link Slave                | supported | supported                        |
| CompoNet Slave               | -         | in preparation                   |
| DeviceNet Master             | supported | supported                        |
| DeviceNet Slave              | supported | supported                        |
| InterBus Slave               | supported | not supported by netX technology |
| PROFIBUS DP Master           | supported | supported                        |
| PROFIBUS DP Slave            | supported | supported                        |
| SERCOS II                    | supported | not supported by netX technology |
| EtherCAT Master              | -         | supported                        |
| EtherCAT Slave               | -         | supported                        |
| EtherNet/IP Scanner (Master) | -         | supported                        |
| EtherNet/IP Adapter (Slave)  | supported | supported                        |
| Open Modbus/TCP              | supported | supported                        |
| POWERLINK Controlled Node    | -         | supported                        |
| PROFINET IO RT Controller    | -         | supported                        |
| PROFINET IO RT Device        | -         | supported                        |
| SERCOS III Master            | -         | supported                        |
| SERCOS III Slave             | -         | supported                        |

Table 2: Comparison of supported protocols for COM and COMX

## 1.2 List of Revisions

| Rev | Date       | Name       | Revision  |
|-----|------------|------------|---|
| 7   | 2009-10-01 | H. Hentsch | <p>COMX-CA-DP, COMX-CN-DP, COMX-CA-CO, COMX-CN-CO, COMX-CA-CO, COMX-CN-CO, COMX-CA-CCS and COMX-CN-CCS added</p> <p>Chapter 1 restructured</p> <p>Table <i>Basic differences between COM and COMX</i> and <i>Comparison of supported protocols for COM and COMX</i> added.</p> <p>Figure <i>Block Diagram of the COMX-C Modules</i> and explaining text added</p> <p>Section <i>Mechanical Dimensions of COM-A Modules</i>: M0400272 (update), M0900141 (new)</p> <p>Section <i>Mechanical Dimensions of COM-B Modules</i>: M0400282 (update), M0900151 (new), M0400291 (kept)</p> <p>Section <i>Mechanical Dimensions of COM-C Modules</i>: M0200373 (update), M0200463 (kept), M0300632 (update), M0400353 (update), M0400363 (update), M0600172 (update), M0900161 (new)</p> <p>Section <i>Mounting of COM-C Modules</i>: M0500081 (new), M0100084 (update), M0600121 (new), M0900102 (new), M0200402 (kept)</p> <p>Section <i>Mounting of COM-C Modules</i> expanded (4 bolt types)</p> <p>Section : SYNC Signals added</p> <p>Section <i>Signal Overview and Pinning of the Fieldbus Connector X2 on COM-CN</i>: Added that Pin 21 is used for isolation</p> <p>Section <i>Timing Diagram of the COMX-C</i>: Both tables updated and notes expanded</p> <p>Section <i>LEDs</i> divided into LEDs for COM and LEDs for COMX</p> <p>Subsections in <i>LEDs for COMX Modules</i> updated respectively added</p> <p>Section <i>Technical Data</i>: New modules added</p> |
| 8   | 2009-10-27 | H. Hentsch | <p>Section <i>Diagnostic Interface USB</i>:: USB interface circuit modified</p> <p>Temperature range for COMX Modules. -20 ... 65°C</p>   |
| 9   | 2009-11-11 | H. Hentsch | <p>Section <i>Fieldbus Connector X2 for Real-Time Ethernet</i>:</p> <ul style="list-style-type: none"> <li>- LED names changed to COM0 and COM1</li> <li>- <i>Figure 6</i> with example added</li> </ul> <p>Section <i>LEDs</i>:</p> <ul style="list-style-type: none"> <li>- <i>Figure 14: Example how to connect the LEDs COMX-CN Fieldbus</i> and</li> <li>- <i>Figure 15: Example how to connect the LEDs COMX-CN-RE</i> added</li> </ul> <p>Section <i>LEDs for COMX Modules</i> with references to signal COM0 and COM1 for all Real-Time Ethernet protocols</p>  |

Table 3: List of Revisions (Part 1)

Continued on next page.

| Rev | Date       | Name                   | Revision  |
|-----|------------|------------------------|---|
| 10  | 2010-07-13 | H. Hentsch             | <p><i>Table 2: Comparison of supported protocols for COM and COMX</i> updated: CANopen Slave, PROFIBUS DP Slave and DeviceNet Slave for COMX-C supported</p> <p><i>Table 9: Available COMX-C Modules</i> updated with COMX-C for Fieldbus Slaves</p> <p><i>Table 7: Usage of Bolt for COM Modules</i> updated</p> <p><i>Designation of the COM-C</i> expanded</p> <p>Section <i>Fieldbus Connector X2 for CANopen-Master/-Slave</i>: COMX-CN-COS added</p> <p>Section <i>Fieldbus Connector X2 for DeviceNet-Master/-Slave</i>: COMX-CN-DNS added</p> <p>Section <i>Fieldbus Connector X2 for PROFIBUS-Master/-Slave</i>: COMX-CN-DPS added</p> <p>Section <i>Fieldbus Connector X2 for CANopen-Master/-Slave</i>: Note 2 added</p> <p>Section <i>Fieldbus Connector X2 for PROFIBUS-Master/-Slave</i>: Note 2 added</p> <p>Section <i>Diagnostic Interface USB</i>: Note removed, because firmware now supports USB</p> <p><i>Table 74: Hardware Revision of COMX Modules with new USB Interface</i> updated</p> <p><i>Table 75: Hardware Revision of COMX Modules with old USB Interface</i> updated</p> <p>German text replaced by English text in the following drawings: M0500081, M0500084, M0600121, M0900141, M0900151, M0400353</p> <p>Section <i>SERCOS III Slave, CANopen Slave, DeviceNet Slave and PROFIBUS DP Slave</i> added with LED Description</p> <p><i>Table 38: Technical Data – Operating Condition</i>: COMX-Cx-COS, COMX-Cx-DNS and COMX-Cx-DPS added</p> |
| 11  | 2011-03-20 | H. Hentsch             | <p>Section <i>Mechanical Dimensions of COM-C Modules</i>: M0200373 updated to M0200374, M0200463 updated to M0200464. Tolerance of PCB thickness is 1.00 mm (-0,0 +0,2)</p> <p>Section <i>Type of Connector</i>: Headline 'Cheaper version' set to right position</p>   |
| 12  | 2011-06-10 | R. Göbel<br>H. Hentsch | <p>Separation of documents for COM and COMX.</p> <p>This manual contains the description for COM.</p> <p>COM-A and COM-B removed as they are to be discontinued.</p> <p>Section <i>Mechanical Dimensions of COM-C Modules</i>: Section updated, M0200374 updated, M0300632 updated</p> <p>Table 5: COM-CA-EIS and COM-CN-EIS added</p> <p>Section <i>Meaning of the Rotary Switch</i> added</p>   |

Table 4: List of Revisions (Part 2)

## 1.3 Technical Features

### Common Technical Features for COM-C

- Small footprint for the host connector with 50 mil grid
- Solid mechanical assembly and a massive connection to earth ground by metal blocks special design for the requirements of the Modules with fieldbus connector
- Two dowels for exact mounting of the Module on the host board
- Metal blocks can easily modified for special customer requirements
- Front panel can be mounted on the metal blocks that the modules have always the same front size and covers the fieldbus connector
- Easy to use dual-port memory interface, with additional serial and diagnostic interface
- Host interface is designed for 16 KByte address space of the dual-port memory with 8 bit bus width.
- 3.3 V power supply reduce power consumption
- Available in extended temperature specification

With the COM-C we have a much more compact form factor and additional technical features as the already established COM Modules.

- Extremely compact size 30 x 70 mm
- Available with angled and without fieldbus connector
- All fieldbus connectors are placed on one side, which is the edge side on the host board to reserves space
- 2.5 mm space below the Module available for SMD components on the host board

Now you can have only one type of base board (for each COM family) on stock and you can mount the requested fieldbus interface short before shipment to the customer. This gives much more flexibility and saves money even if you have same mechanical constraints (for each COM family) in comparison to our existing COM Modules. Therefore we have Modules with angled, straight and without fieldbus connectors:

- COM-CA COM-C Modules with angled fieldbus connector
- COM-CN COM-C Modules without fieldbus connector



## Description of COM Modules

All COM-C have a powerful processor and a complete fieldbus interface including isolated drivers and the connector according to the standard. The slave modules have additional rotary switches to set up the station address.

All boards require only a single stabilized 3.3 Voltage. All other voltages are created by DC/DC converter on the COM-C Module.

The access to the COM-C Module is through the dual-port memory which can be easily integrated as a static memory device. It has a non multiplexed 8 bit data bus with several control lines to the host system. Between the COM-C Module and the host system it is possible to generate interrupts for data handling.

Generally the firmware and the configuration data are stored permanently in FLASH memory by loading the data through the dual port memory or the serial diagnostic line.

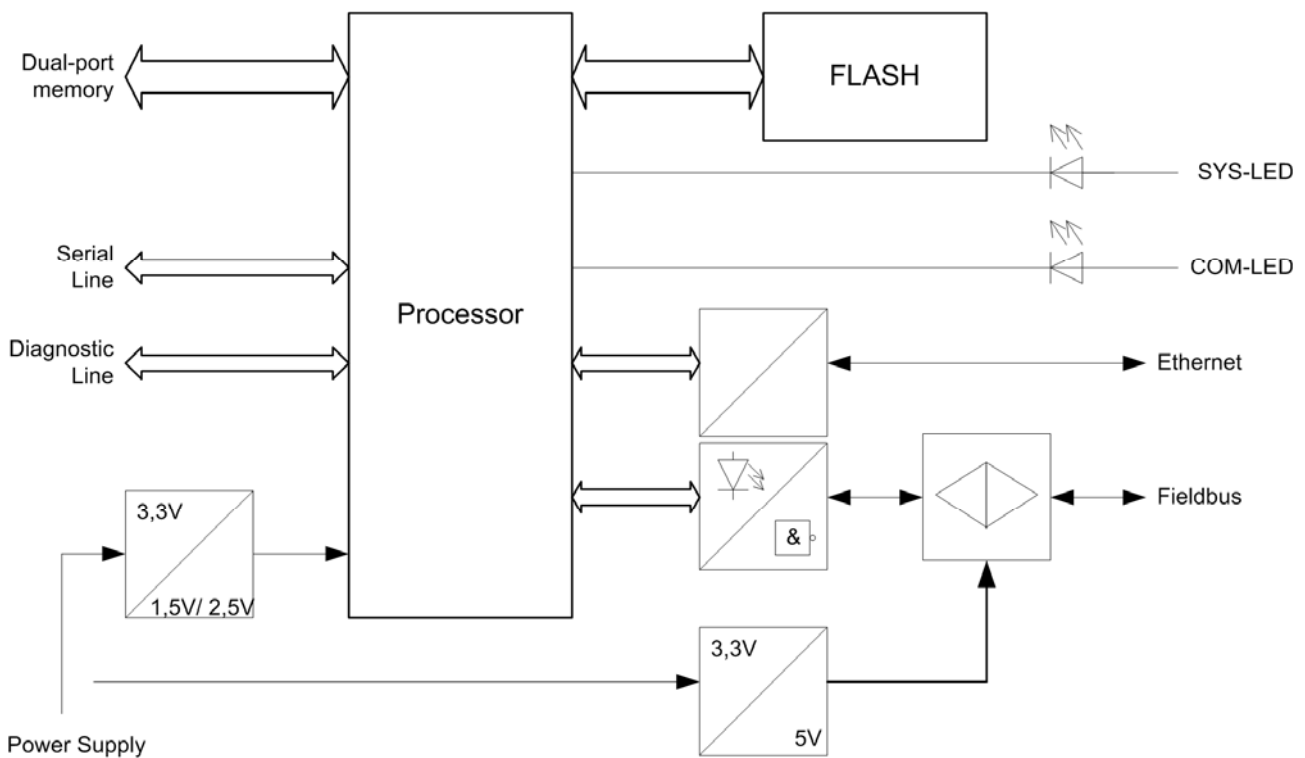


Figure 1: Block Diagram of the COM-C Modules

**Note:** The COM-CA-SCEB has only the special communication interface chip SERCON 816 on board. Programming of this chip must be done directly from the host application. The description of the communication interface chip SERCON 816 can be get from the 'SERCOS International'.

## 1.4 Legal Notes

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## 2 Type of COM-C Modules

The following table shows an overview about the availability of the different COM-C Modules.

| Module                                  | Fieldbus / Protocol | Type   | Connector |
|---|---------------------|--------|-----------|
| COM-CA-ASM                              | AS-Interface        | Master | angled    |
| COM-CA-COS                              | CANopen             | Slave  | angled    |
| COM-CA-COM                              | CANopen             | Master | angled    |
| COM-CA-CCS                              | CC-Link             | Slave  | angled    |
| COM-CA-DNS                              | DeviceNet           | Slave  | angled    |
| COM-CA-DNM                              | DeviceNet           | Master | angled    |
| COM-CA-EN                               | Ethernet            |        | angled    |
| COM-CA-EIS                              | EtherNet/IP         | Slave  | angled    |
| COM-CA-IBS                              | INTERBUS            | Slave  | angled    |
| COM-CA-DPS                              | PROFIBUS DP         | Slave  | angled    |
| COM-CA-DPM                              | PROFIBUS DP         | Master | angled    |
| COM-CA-SCEB                             | SERCOS              |        | angled    |
| COM-CN-ASM                              | AS-Interface        | Master | No        |
| COM-CN-COS                              | CANopen             | Slave  | No        |
| COM-CN-COM                              | CANopen             | Master | No        |
| COM-CN-CCS                              | CC-Link             | Slave  | No        |
| COM-CN-DNS                              | DeviceNet           | Slave  | No        |
| COM-CN-DNM                              | DeviceNet           | Master | No        |
| COM-CN-EN                               | Ethernet            |        | No        |
| COM-CN-EIS                              | EtherNet/IP         | Slave  | No        |
| COM-CN-DPS                              | PROFIBUS DP         | Slave  | No        |
| COM-CN-DPSNR<br>(NR = No Rotary switch) | PROFIBUS DP         | Slave  | No        |
| COM-CN-DPM                              | PROFIBUS DP         | Master | No        |

Table 5: Available COM-C Modules

## 2.1 Mechanical Dimensions

### 2.1.1 Common Mechanical Dimensions for COM-C Modules

After mounting the COM-CA Module parallel at a basis board the rotary switches, LEDs and the fieldbus connector are on the top side and are angled to the basis board. The edge of all front elements are in one layer which is 2.5 mm ahead of the edge of printed circuit board of the COM Module.

The COM-CN Module has to be used if the mechanical dimensions or order of the LEDs, switches and fieldbus connector doesn't fit. In that case you have to place these components directly on the motherboard and feed the signals to the connector X2 of the COM-CN Module.

---

**Note** Please take care on the isolation distance, because the optical isolation interface is on the Module!  
Especially for 12 MBit PROFIBUS the distance should as be less as possible.  
For Ethernet, the signal traces should run parallel and should have the same length.  
Please refer at the fieldbus standards for further information!

---

## 2.1.2 Mechanical Dimensions of COM-C Modules

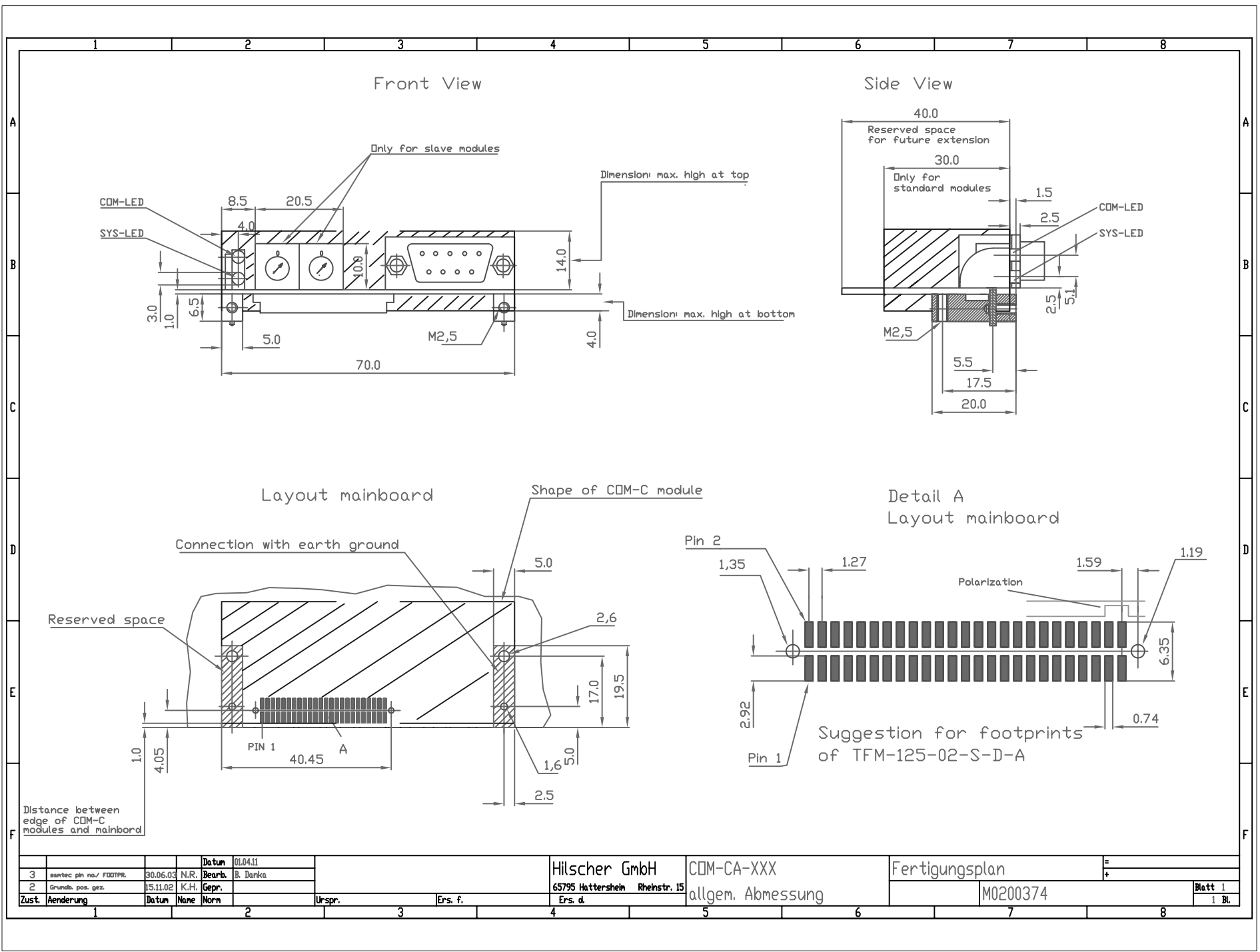
The COM-C Module has a board size of 30 x 70 mm. The maximum height of the components at the top side of the printed circuit board is 14.0 mm including the fieldbus connector. Keep the space of 14.0 mm above the top side free.

At the bottom side the maximum height is 4.0 mm, therefore you have 2.5 mm space for components on the host board below the Module. The power dissipation in that area should be less than 330 maw!

For further Module development please reserve additional 10 mm space behind the Module. There are a few larger fieldbus interfaces which do not fit on the small board space. In that case a second printed circuit board will be mounted on top of the Module and the 10 mm space is necessary for the connection with flex stripe between these boards.

The general dimensions of the COM-C Modules are shown on the following drawings:

- M0200374 General Mechanical dimension of COM-CA-XXX
- M0200464 Mechanical dimension of COM-CN-XXX
- M0300632 Mechanical dimension of light pipe of COM-CA-XXX
- M0400353 Mechanical dimension of Front Plate and Connector of COM-CA-XXX (part 1)
- M0400363 Mechanical dimension of Front Plate and Connector of COM-CA-XXX (part 2)



|       |                          |                |      |               |          |                                |         |                |         |
|-------|--------------------------|----------------|------|---------------|----------|--------------------------------|---------|----------------|---------|
|       |                          | Datum 01.04.11 |      | Hilscher GmbH |          | CDM-CA-XXX                     |         | Fertigungsplan |         |
| 3     | switec pin no./ FIDIPTR. | 30.06.03       | N.R. | Bearb.        | B. Danka | 65795 Hattersheim Rheinstr. 15 |         |                |         |
| 2     | Grundr. pos. gez.        | 15.11.02       | K.H. | Gepr.         |          | allgem. Abmessung              |         | M0200374       | Blatt 1 |
| Zust. | Änderung                 | Datum          | Name | Norm          | Urspr.   | Ers. f.                        | Ers. d. |                | 1 Bl.   |
| 1     |                          |                |      |               | 2        | 3                              | 4       | 5              | 6       |











## 2.2 Type of Connector

The connector X1 for the host interface is a 50 pins SMT female type with a grid of 1.27 mm. The COM-CN Modules have an additional fieldbus connector X2 with 30 pins of the same family.

The connector of the motherboard is the corresponding male type and can be ordered as follows:

In Germany                      FJH die Steckverbinder GmbH  
    Hinter dem Turm 7  
    D-55286 Wörrstadt  
  
    Germany  
    Tel. +49 (0) 67 32 / 93 27 -0  
    Fax +49 (0) 67 32 / 93 27 -27  
  
    Web: [www.fjh.de](http://www.fjh.de)  
    Email: [info@fjh.de](mailto:info@fjh.de)

50 pin. Box header            127 KA - 050 SB  
 30 pin. Box header            127 KA - 030 SB

World Wide                      SAMTEC  
    [www.samtec.com](http://www.samtec.com)

Cheaper version

50 pin. Connector            TFM - 125 - 02 - S - D - A            TFC - 125 - 02 - F - D - A  
 30 pin. Connector            TFM - 115 - 02 - S - D - A            TFC - 115 - 02 - F - D - A

**Note:**            Datasheet of SAMTEC TFM connector see next page!  
                          Please notice that the polarization of X1 and X2 is opposite to Pin 1!

The fieldbus connector on the Module is defined by the fieldbus standard as followed:

| Fieldbus     | Connector                             | Vendor                                     |
|--------------|---------------------------------------|--|
| AS-Interface | 2 pin, COMBICON, male<br>Grid 5.08 mm | ie. PHOENIX Contact<br>MSTBA2,5/2-5,08-G   |
| CANopen      | 9 pin, DSub, male                     | div. Vendor                                |
| DeviceNet    | 5 pin, COMBICON, male<br>Grid 5.08 mm | ie. PHOENIX Contact<br>MSTBA2,5/5-5,08G-AU |
| Ethernet     | 8 pin, RJ45, female                   | div. Vendor                                |
| PROFIBUS     | 9 pin, DSub, female                   | div. Vendor                                |
| InterBus     | 9 pin, DSub, male, female             | div. Vendor                                |
| CC-Link      | 5 pin, COMBICON, male<br>Grid 5.08 mm | ie. PHOENIX Contact<br>MSTBA2,5/5-G-AU     |

Table 6: Connector Types

Please use the same type of connector at the motherboard if you have chosen the COM-CN Module.





Four types of metal bolts are used. The following table lists the usage for each COM Module.

| COM    | Type                               | Left Side    | Right Side   |
|--------|------------------------------------|--------------|--------------|
| COM-CA | AS, CCS, CO, DN, DP, EN, IBS, SCEB | COM-CA-B20X5 | COM-CA-B20X5 |
| COM-CN | AS, CCS, CO, DN, DP, EN, IBS       | COM-CA-B20X5 | COM-CA-B20X5 |

*Table 7: Usage of Bolt for COM Modules*

The drawings for the bolts are shown on the following drawings:

- M0100084 Mechanical dimension of Bolt COM-CA-B20X5
- M0600121 Mechanical dimension of Bolt COM-CA-B31,5X5
- M0900102 Mechanical dimension of Bolt COM-CA-B24X5
  
- M0200402 Mechanical dimension how to assemble COM-CA-XXX on the mother board









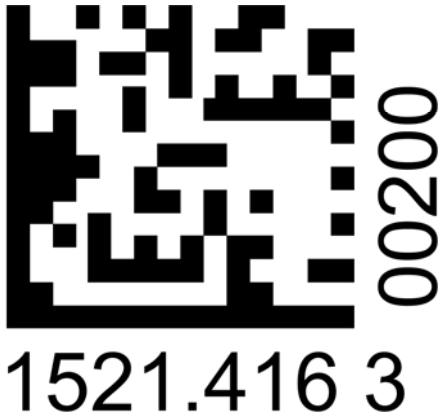


## 2.4 Designation of the COM-C

Each COM-C Module has a matrix code label. A matrix label contains 3 items:

1. Part number
2. Hardware Revision
3. Serial number

The figure shows part number 1521.416, hardware revision 3 and serial number 00200.



*Figure 3: Example Matrix Code label of COM-C Modules*

The label is normally glued on top of the main processor.

## 2.5 Meaning of the Rotary Switch

The following figure shows the meaning of the rotary switch for COM-CA-DPS, COM-CA-COS and COM-CA-DNS. The rotary switches are to set the bus address.

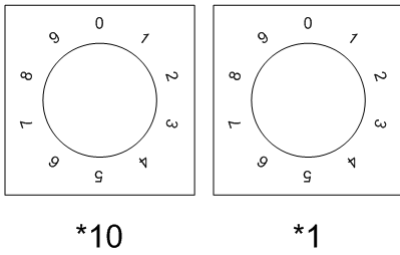


Figure 4: Meaning of the Rotary Switch

The following figure shows the meaning of the rotary switch for COM-CA-CCS and COM-CN-CCS. The left and the middle rotary switch are to set the bus address.

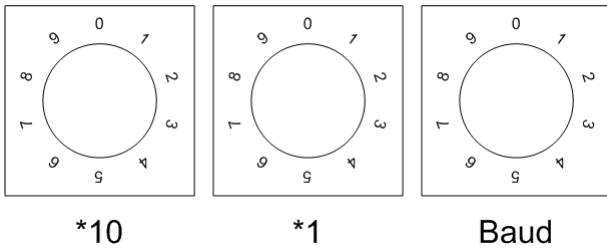


Figure 5: Meaning of the Rotary Switch of COM-Cx-CCS

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## 3 Host Interface

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**Attention!** All COM modules have an operation voltage of 3.3 V which reduces the power consumption. Therefore the voltage levels of the signals have to be not higher than 3.3 V otherwise the module will be damaged.

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The next sections show an overview of the signal pinning of the system connector.

### 3.1 COM Pinning of the System Bus Connector X1

| Pin | Signal                                   | Symbol | Type  |
|-----|--|--------|---|
| 1   | Word Interface, active low               | WIF#   | GND if D8 - D15 is available (16 bit),<br>left unconnected if not (8 bit) |
| 2   | Bus high enable (future use), active low | BHE#   | LVTTL Input   |
| 3   | Data line 15 (future use)                | D15    | LVTTL Input / Output  |
| 4   | Data line 14 (future use)                | D14    | LVTTL Input / Output  |
| 5   | Data line 13 (future use)                | D13    | LVTTL Input / Output  |
| 6   | Data line 12 (future use)                | D12    | LVTTL Input / Output  |
| 7   | Data line 11 (future use)                | D11    | LVTTL Input / Output  |
| 8   | Data line 10 (future use)                | D10    | LVTTL Input / Output  |
| 9   | Data line 9 (future use)                 | D9     | LVTTL Input / Output  |
| 10  | Data line 8 (future use)                 | D8     | LVTTL Input / Output  |
| 11  | Ground                                   | GND    |   |
| 12  | Power Supply                             | +3.3 V |   |
| 13  | Transmit Data, Serial line               | TXD1   | LVTTL Output  |
| 14  | Receive Data, Serial line                | RXD1   | LVTTL Input   |
| 15  | Request to Send, Serial line             | RTS1   | LVTTL Output  |
| 16  | Clear to Send, Serial line               | CTS1   | LVTTL Input   |
| 17  | reserved for future - don't connect      | -      |   |
| 18  | reserved for future - don't connect      | -      |   |
| 19  | Receive Data, Diagnostic line            | RX0    | LVTTL Input   |
| 20  | Transmit Data, Diagnostic line           | TX0    | LVTTL Output  |
| 21  | Reset, active low                        | RES#   | LVTTL Input; 10 k pull up   |
| 22  | Busy, active low                         | BUSY#  | LVTTL Output  |
| 23  | Interrupt, active low                    | INT#   | LVTTL Output  |
| 24  | Read, active low                         | RD#    | LVTTL Input   |
| 25  | Write, active low                        | WR#    | LVTTL Input   |
| 26  | Chip select, active low                  | CS#    | LVTTL Input   |
| 27  | Address line 13                          | A13    | LVTTL Input   |
| 28  | Address line 12                          | A12    | LVTTL Input   |
| 29  | Address line 11                          | A11    | LVTTL Input   |
| 30  | Address line 10                          | A10    | LVTTL Input   |
| 31  | Address line 9                           | A9     | LVTTL Input   |
| 32  | Address line 8                           | A8     | LVTTL Input   |
| 33  | Address line 7                           | A7     | LVTTL Input   |
| 34  | Address line 6                           | A6     | LVTTL Input   |
| 35  | Address line 5                           | A5     | LVTTL Input   |
| 36  | Address line 4                           | A4     | LVTTL Input   |
| 37  | Address line 3                           | A3     | LVTTL Input   |
| 38  | Address line 2                           | A2     | LVTTL Input   |
| 39  | Address line 1                           | A1     | LVTTL Input   |
| 40  | Address line 0                           | A0     | LVTTL Input   |

Table 8: COM Pinning of the System Bus Connector X1 (Part 1)

Continued on next page.

| Pin | Signal       | Symbol | Type                 |
|-----|--------------|--------|----------------------|
| 41  | Data line 7  | D7     | LVTTL Input / Output |
| 42  | Data line 6  | D6     | LVTTL Input / Output |
| 43  | Data line 5  | D5     | LVTTL Input / Output |
| 44  | Data line 4  | D4     | LVTTL Input / Output |
| 45  | Data line 3  | D3     | LVTTL Input / Output |
| 46  | Data line 2  | D2     | LVTTL Input / Output |
| 47  | Data line 1  | D1     | LVTTL Input / Output |
| 48  | Data line 0  | D0     | LVTTL Input / Output |
| 49  | Ground       | GND    |                      |
| 50  | Power Supply | +3.3 V |                      |

Table 9: COM Pinning of the System Bus Connector X1 (Part 2)



## 3.2 COM-CA-SCEB Pinning of the System Bus Connector X1

| Pin | Signal                                    | Symbol | Type   |
|-----|---|--------|--|
| 1   | Word Interface, active low                | WIF#   | GND if D8 - D15 is available (16 bit), left unconnected if not (8 bit) |
| 2   | Bus high enable, active low               | BHE#   | LVTTL Input  |
| 3   | Data line 15                              | D15    | LVTTL Input / Output   |
| 4   | Data line 14                              | D14    | LVTTL Input / Output   |
| 5   | Data line 13                              | D13    | LVTTL Input / Output   |
| 6   | Data line 12                              | D12    | LVTTL Input / Output   |
| 7   | Data line 11                              | D11    | LVTTL Input / Output   |
| 8   | Data line 10                              | D10    | LVTTL Input / Output   |
| 9   | Data line 9                               | D9     | LVTTL Input / Output   |
| 10  | Data line 8                               | D8     | LVTTL Input / Output   |
| 11  | Ground                                    | GND    |  |
| 12  | Power Supply                              | +3.3 V |  |
| 13  | reserved for future - don't connect       | -      |  |
| 14  | reserved for future - don't connect       | -      |  |
| 15  | reserved for future - don't connect       | -      |  |
| 16  | reserved for future - don't connect       | -      |  |
| 17  | Interrupt, active low                     | INT1#  | LVTTL Output   |
| 18  | reserved for future - don't connect       | -      |  |
| 19  | reserved for future - don't connect       | -      |  |
| 20  | reserved for future - don't connect       | -      |  |
| 21  | Reset, active low                         | RES#   | LVTTL Input; 10 k ... 30 k pull up                                     |
| 22  | Busy, active low                          | BUSY#  | LVTTL Output   |
| 23  | Interrupt, active low                     | INT0#  | LVTTL Output   |
| 24  | Read, active low                          | RD#    | LVTTL Input  |
| 25  | Write, active low                         | WR#    | LVTTL Input  |
| 26  | Chip select, active low                   | CS#    | LVTTL Input  |
| 27  | Address line 13 (reserved for future use) | A13    | LVTTL Input  |
| 28  | Address line 12                           | A12    | LVTTL Input  |
| 29  | Address line 11                           | A11    | LVTTL Input  |
| 30  | Address line 10                           | A10    | LVTTL Input  |
| 31  | Address line 9                            | A9     | LVTTL Input  |
| 32  | Address line 8                            | A8     | LVTTL Input  |
| 33  | Address line 7                            | A7     | LVTTL Input  |
| 34  | Address line 6                            | A6     | LVTTL Input  |
| 35  | Address line 5                            | A5     | LVTTL Input  |
| 36  | Address line 4                            | A4     | LVTTL Input  |
| 37  | Address line 3                            | A3     | LVTTL Input  |
| 38  | Address line 2                            | A2     | LVTTL Input  |
| 39  | Address line 1                            | A1     | LVTTL Input  |
| 40  | Address line 0                            | A0     | LVTTL Input  |

Table 10: COM-CA-SCEB Pinning of the System Bus Connector X1 (Part 1)

Continued on next page.

| Pin | Signal       | Symbol | Type                 |
|-----|--------------|--------|----------------------|
| 41  | Data line 7  | D7     | LVTTL Input / Output |
| 42  | Data line 6  | D6     | LVTTL Input / Output |
| 43  | Data line 5  | D5     | LVTTL Input / Output |
| 44  | Data line 4  | D4     | LVTTL Input / Output |
| 45  | Data line 3  | D3     | LVTTL Input / Output |
| 46  | Data line 2  | D2     | LVTTL Input / Output |
| 47  | Data line 1  | D1     | LVTTL Input / Output |
| 48  | Data line 0  | D0     | LVTTL Input / Output |
| 49  | Ground       | GND    |                      |
| 50  | Power Supply | +3.3 V |                      |

Table 11: COM-CA-SCEB Pinning of the System Bus Connector X1 (Part 2)

## 3.3 Signal Overview and Pinning of the Fieldbus Connector X2 on COM-CN

### 3.3.1 Fieldbus Connector X2 for AS-Interface-Master

Fieldbus connector X2 for COM-CN-ASM

| Pin | Signal                           | Symbol | Type                  | Pin at Fieldbus Connector COMBICON 2pin |
|-----|----------------------------------|--------|-----------------------|---|
| 1   |                                  |        |                       |   |
| 2   |                                  |        |                       |   |
| 3   |                                  |        |                       |   |
| 4   |                                  |        |                       |   |
| 5   |                                  |        |                       |   |
| 6   |                                  |        |                       |   |
| 7   |                                  |        |                       |   |
| 8   |                                  |        |                       |   |
| 9   |                                  |        |                       |   |
| 10  | AS-i, Receive Data               | ASI_RX | LVTTTL Input          | Note 1                                  |
| 11  | AS-i, Power Fail                 | ASI_PF | LVTTTL Output         | Note 1                                  |
| 12  | AS-i, Transmit Data              | ASI_TX | LVTTTL Output         | Note 1                                  |
| 13  | COM-LED, STA, Cathode yellow LED | STA#   | 4 mA Output           |   |
| 14  | SYS-LED, RUN, Cathode green LED  | RUN#   | 4 mA Output           |   |
| 15  | COM-LED, ERR, Cathode red LED    | ERR#   | 4 mA Output           |   |
| 16  | SYS-LED, RDY, Cathode yellow LED | RDY#   | 4 mA Output           |   |
| 17  | Ground                           | GND    |                       |   |
| 18  | Power Supply                     | +3.3 V |                       |   |
| 19  | Peripheral IO                    | PIO    | LVTTTL Input / Output |   |
| 20  | Don't use - needed for isolation |        |                       |   |
| 21  | Don't use - needed for isolation |        |                       |   |
| 22  |                                  |        |                       |   |
| 23  |                                  |        |                       |   |
| 24  |                                  |        |                       |   |
| 25  |                                  |        |                       |   |
| 26  |                                  |        |                       |   |
| 27  |                                  |        |                       |   |
| 28  |                                  |        |                       |   |
| 29  | AS-i + Bus line                  | AS-i+  | +24 V with AS-i       | 1                                       |
| 30  | AS-i - Bus line                  | AS-i-  | 0 V with AS-i         | 2                                       |

Table 12: Fieldbus Connector X2 for AS-Interface-Master

| Note | Information  |
|------|--|
| 1    | LVTTTL Signals could be only used without the hardware interface on the COM. Ask for special customer version. |

Table 13: Notes for Fieldbus Connector X2 for AS-Interface-Master

### 3.3.2 Fieldbus Connector X2 for CANopen-Master/-Slave

Fieldbus connector X2 for COM-CN-COM / COM-CN-COS

| Pin | Signal                           | Symbol  | Type                  | Pin at Fieldbus Connector DSub 9, male |
|-----|----------------------------------|---------|-----------------------|--|
| 1   |                                  |         |                       |  |
| 2   |                                  |         |                       |  |
| 3   |                                  |         |                       |  |
| 4   |                                  |         |                       |  |
| 5   |                                  |         |                       |  |
| 6   |                                  |         |                       |  |
| 7   | CAN, Receive Data                | CAN_RX1 | LVTTTL Input          | Note 1                                 |
| 8   |                                  |         |                       |  |
| 9   | CAN, Transmit Data               | CAN_TX1 | LVTTTL Output         | Note 1                                 |
| 10  |                                  |         |                       |  |
| 11  |                                  |         |                       |  |
| 12  |                                  |         |                       |  |
| 13  | COM-LED, STA, Cathode yellow LED | STA#    | 4 mA Output           | Note 2                                 |
| 14  | SYS-LED, RUN, Cathode green LED  | RUN#    | 4 mA Output           |  |
| 15  | COM-LED, ERR, Cathode red LED    | ERR#    | 4 mA Output           |  |
| 16  | SYS-LED, RDY, Cathode yellow LED | RDY#    | 4 mA Output           |  |
| 17  | Ground                           | GND     |                       |  |
| 18  | Power Supply                     | +3.3 V  |                       |  |
| 19  | Peripheral IO                    | PIO     | LVTTTL Input / Output |  |
| 20  | Don't use - needed for isolation |         |                       |  |
| 21  | Don't use - needed for isolation |         |                       |  |
| 22  |                                  |         |                       |  |
| 23  | CAN_H Bus line                   | CAN_H   | ISO 11898             | 7                                      |
| 24  |                                  |         |                       |  |
| 25  |                                  |         |                       |  |
| 26  | CAN Ground                       | CAN_GND |                       | 3                                      |
| 27  |                                  |         |                       |  |
| 28  |                                  |         |                       |  |
| 29  | CAN_L Bus line                   | CAN_L   | ISO 11898             | 2                                      |
| 30  |                                  |         |                       |  |

Table 14: Fieldbus Connector X2 for CANopen-Master/-Slave

| Note | Information  |
|------|--|
| 1    | LVTTTL Signals could be only used without the hardware interface on the COM. Ask for special customer version. |
| 2    | Yellow LED for COM-CN-COM / COM-CN-COS   |

Table 15: Notes for Fieldbus Connector X2 for CANopen-Master/-Slave

### 3.3.3 Fieldbus Connector X2 for DeviceNet-Master/-Slave

Fieldbus connector X2 for COM-CN-DNM / COM-CN-DNS

| Pin | Signal                                 | Symbol  | Type                  | Pin at Fieldbus connector COMBICON 5pin |
|-----|--|---------|-----------------------|---|
| 1   |  |         |                       |   |
| 2   |  |         |                       |   |
| 3   |  |         |                       |   |
| 4   |  |         |                       |   |
| 5   |  |         |                       |   |
| 6   |  |         |                       |   |
| 7   | CAN, Receive Data                      | CAN_RX1 | LVTTTL Input          | Note 1                                  |
| 8   |  |         |                       |   |
| 9   | CAN, Transmit Data                     | CAN_TX1 | LVTTTL Output         | Note 1                                  |
| 10  |  |         |                       |   |
| 11  | CAN, Power Fail                        | CAN_PF1 | LVTTTL Input          | Note 1                                  |
| 12  |  |         |                       |   |
| 13  | MNS-LED, active low, Cathode green LED | MNS_CG# | 4 mA Output           |   |
| 14  | RUN-LED, RUN, Cathode green LED        | RUN#    | 4 mA Output           |   |
| 15  | MNS-LED, active low, Cathode red LED   | MNS_CR# | 4 mA Output           |   |
| 16  | SYS-LED, RDY, Cathode yellow LED       | RDY#    | 4 mA Output           |   |
| 17  | Ground                                 | GND     |                       |   |
| 18  | Power Supply                           | +3.3 V  |                       |   |
| 19  | Peripheral IO                          | PIO     | LVTTTL Input / Output |   |
| 20  | Don't use - needed for isolation       |         |                       |   |
| 21  | Don't use - needed for isolation       |         |                       |   |
| 22  |  |         |                       |   |
| 23  |  |         |                       |   |
| 24  |  |         |                       |   |
| 25  |  |         |                       |   |
| 26  | Reference potential DeviceNet          | V-      |                       | 1                                       |
| 27  | CAN Low-Signal                         | CAN_L   |                       | 2                                       |
| 28  | Shield                                 | Drain   |                       | 3                                       |
| 29  | CAN High-Signal                        | CAN_H   |                       | 4                                       |
| 30  | +24V Power Supply DeviceNet            | V+      |                       | 5                                       |

Table 16: Fieldbus Connector X2 for DeviceNet-Master/-Slave

| Note | Information  |
|------|--|
| 1    | LVTTTL Signals could be only used without the hardware interface on the COM. Ask for special customer version. |

Table 17: Notes for Fieldbus Connector X2 for DeviceNet-Master/-Slave

### 3.3.4 Fieldbus Connector X2 for PROFIBUS-Master/-Slave

Fieldbus connector X2 for COM-CN-DPM / COM-CN-DPS

| Pin | Signal                           | Symbol    | Type                  | Pin at Fieldbus connector DSub-9, female |
|-----|----------------------------------|-----------|-----------------------|--|
| 1   | PROFIBUS, Receive Data           | PB_RX     | LVTTTL Input          | Note 1                                   |
| 2   |                                  |           |                       |  |
| 3   | PROFIBUS, Transmit Data          | PB_TX     | LVTTTL Output         | Note 1                                   |
| 4   |                                  |           |                       |  |
| 5   | PROFIBUS, Enable Bus Driver      | PB_ENB    | LVTTTL Output         | Note 1                                   |
| 6   |                                  |           |                       |  |
| 7   |                                  |           |                       |  |
| 8   |                                  |           |                       |  |
| 9   |                                  |           |                       |  |
| 10  |                                  |           |                       |  |
| 11  |                                  |           |                       |  |
| 12  |                                  |           |                       |  |
| 13  | COM-LED, STA, Cathode yellow LED | STA#      | 4 mA Output           | Note 2                                   |
| 14  | SYS-LED, RUN, Cathode green LED  | RUN#      | 4 mA Output           |  |
| 15  | COM-LED, ERR, Cathode red LED    | ERR#      | 4 mA Output           |  |
| 16  | SYS-LED, RDY, Cathode yellow LED | RDY#      | 4 mA Output           |  |
| 17  | Ground                           | GND       |                       |  |
| 18  | Power Supply                     | +3.3 V    |                       |  |
| 19  | Peripheral IO                    | PIO       | LVTTTL Input / Output |  |
| 20  | Don't use - needed for isolation |           |                       |  |
| 21  | Don't use - needed for isolation |           |                       |  |
| 22  | Reference potential              | DGND      |                       | 5  |
| 23  | Control                          | CNTR-P    | LVTTTL                | 4  |
| 24  |                                  |           |                       |  |
| 25  | Receive / Send Data-N            | RXD/TXD-N | RS 485                | 8  |
| 26  | Receive / Send Data-P            | RXD/TXD-P | RS 485                | 3  |
| 27  |                                  |           |                       |  |
| 28  |                                  |           |                       |  |
| 29  | Positive power supply            | VP        | + 5V                  | 6  |
| 30  |                                  |           |                       |  |

Table 18: Fieldbus Connector X2 for PROFIBUS-Master/-Slave

| Note | Information  |
|------|--|
| 1    | LVTTTL Signals could be only used without the hardware interface on the COM. Ask for special customer version. |
| 2    | Yellow LED for COM-CN-DPM / COM-CN-DPS   |

Table 19: Notes for Fieldbus Connector X2 for PROFIBUS-Master/-Slave

### 3.3.5 Fieldbus Connector X2 for Ethernet

Fieldbus connector X2 for COM-CN-EN

| Pin | Signal                           | Symbol | Type                  | Pin at Fieldbus connector RJ45 |
|-----|----------------------------------|--------|-----------------------|--------------------------------|
| 1   |                                  |        |                       |                                |
| 2   | Ethernet, Receive Data N         | EN_IN  | MAC Input neg.        | <i>Note 1</i>                  |
| 3   |                                  |        |                       |                                |
| 4   | Ethernet, Receive Data P         | EN_IP  | MAC Input pos.        | <i>Note 1</i>                  |
| 5   |                                  |        |                       |                                |
| 6   | Ethernet , Transmit Data N       | EN_ON  | MAC Output neg.       | <i>Note 1</i>                  |
| 7   |                                  |        |                       |                                |
| 8   | Ethernet, Transmit Data P        | EN_OP  | MAC Output pos.       | <i>Note 1</i>                  |
| 9   |                                  |        |                       |                                |
| 10  |                                  |        |                       |                                |
| 11  |                                  |        |                       |                                |
| 12  |                                  |        |                       |                                |
| 13  | LINK-LED, active low             | LNK#   | 4 mA Output           |                                |
| 14  | SYS-LED, RUN, Cathode green LED  | RUN#   | 4 mA Output           |                                |
| 15  | ERR-LED, active low              | ERR#   | 4 mA Output           |                                |
| 16  | SYS-LED, RDY, Cathode yellow LED | RDY#   | 4 mA Output           |                                |
| 17  | Ground                           | GND    |                       |                                |
| 18  | Power Supply                     | +3.3 V |                       |                                |
| 19  | Peripheral IO                    | PIO    | LVTTTL Input / Output |                                |
| 20  | Don't use - needed for isolation |        |                       |                                |
| 21  | Don't use - needed for isolation |        |                       |                                |
| 22  |                                  |        |                       |                                |
| 23  | Transmit Data +                  | TX+    |                       | 1                              |
| 24  | Transmit Data -                  | TX-    |                       | 2                              |
| 25  | Receive Data +                   | RX+    |                       | 3                              |
| 26  |                                  |        |                       |                                |
| 27  |                                  |        |                       |                                |
| 28  | Receive Data -                   | RX-    |                       | 6                              |
| 29  |                                  |        |                       |                                |
| 30  |                                  |        |                       |                                |

Table 20: Fieldbus Connector X2 for Ethernet

| Note | Information  |
|------|--|
| 1    | Ethernet Signals could be only used without the hardware interface on the COM. Ask for special customer version. |

Table 21: Notes for Fieldbus Connector X2 for Ethernet

### 3.3.6 Fieldbus Connector X2 for CC-Link-Slave

Fieldbus connector X2 for COM-CN-CCS

| Pin | Signal                              | Symbol   | Type         | Pin at Fieldbus Connector COMBICON 5pin |
|-----|-------------------------------------|----------|--------------|---|
| 1   |                                     |          |              |   |
| 2   | Receive Driver Enable               | RDENL#   | 8 mA Output  | Note 1                                  |
| 3   |                                     |          |              |   |
| 4   | CC-Link, Transmission period signal | SDGATEON | 12 mA Output | Note 1                                  |
| 5   |                                     |          |              |   |
| 6   | CC-Link, Transmission Data          | SD       | 4 mA Output  | Note 1                                  |
| 7   |                                     |          |              |   |
| 8   | CC-Link, Received Data (channel 1)  | RD1      | TTL Input    | Note 1                                  |
| 9   |                                     |          |              |   |
| 10  |                                     |          |              |   |
| 11  |                                     |          |              |   |
| 12  |                                     |          |              |   |
| 13  | COM-LED, STA, Cathode yellow LED    | STA#     | 4 mA Output  |   |
| 14  | SYS-LED, RUN, Cathode green LED     | RUN#     | 4 mA Output  |   |
| 15  | COM-LED, ERR, Cathode red LED       | ERR#     | 4 mA Output  |   |
| 16  | SYS-LED, RDY, Cathode yellow LED    | RDY#     | 4 mA Output  |   |
| 17  | Ground                              | GND      |              |   |
| 18  | Power Supply                        | +3.3V    |              |   |
| 19  |                                     |          |              |   |
| 20  | Don't use - needed for isolation    |          |              |   |
| 21  | Don't use - needed for isolation    |          |              |   |
| 22  |                                     |          |              |   |
| 23  |                                     |          |              |   |
| 24  |                                     |          |              |   |
| 25  |                                     |          |              |   |
| 26  | CC-Link, Data A                     | DA       |              | 1                                       |
| 27  | CC-Link, Data B                     | DB       |              | 2                                       |
| 28  | CC-Link, Data Ground                | DG       |              | 3                                       |
| 29  | CC-Link, Function Ground            | FG       |              | 5                                       |
| 30  | CC-Link, Shield                     | SLD      |              | 4                                       |

Table 22: Fieldbus Connector X2 for CC-Link-Slave

| Note | Information   |
|------|---|
| 1    | Signals could be only used without the hardware interface on the COM. Ask for a special customer version. |

Table 23: Notes for Fieldbus Connector X2 for CC-Link-Slave



## 3.4 Signals of the Host Interface

### 3.4.1 Power Supply of the COM-C Modules

Only a single 3.3 V operation voltage is needed for the COM-C Module. The voltage must be regulated and can have a tolerance of  $\pm 5\%$  (3.1 - 3.5 Volt) and must be connected twice to the system bus connector X1. To avoid EMI problems we suggested using bypass capacitors in the power supply path. All other special voltages required on the COM-C Module are generated by on board DC/DC converter.

A watchdog circuit on all COM-C Modules supervises the voltage and the microprocessor. If the voltage falls below the voltage reset level of typically 2.93 V (2.85 - 3.00 V) the COM-C are hold in reset state. If the voltage increases over the reset voltage level the COM-C Module begin with the power up sequence. To avoid problems with the power supply we recommended using a voltage of 3.3 V. So the operation will be in the safe range of voltage operation area and short voltage drops, spikes and noise will not produce any reset conditions.

### 3.4.2 RESET Signal

It is possible to reset the COM-C Module by the extra reset signal RES#. For operation of the COM-C Modules it is important to switch the signal RES# to high level. Then the COM-C Modules begins with the program execution and initialization. This power up time is different for each COM-C Module. Normally, the time is about less than two seconds. The COM-C Module is in reset state when the signal RES# has a static low level. To reset the COM-C Module the RES# signal must be low for more than 10  $\mu$ s.

---

**Note** During Reset all signals of the Dual-port memory are configured as inputs! The output level could be floating. If the host system needs a stable level a pull-up or pull-down resistor is required on the host board.

---

### 3.4.3 The Dual-port Memory Bus of COM

The communication for all input and output data and control commands between the COM-C Module and the host system are exchanged over the dual port memory with the same memory address map. The highest 1 KByte is reserved for the communication mailboxes and some control and parameter values. The rest of the Dual-port memory is divided into two data areas, an input and output process data. Please refer at the special documents of the data model and communication methods.

From host system side, the Dual-port memory looks like static RAM. The COM-C Modules have always an 8 KByte Dual-port memory even if the firmware doesn't need so much memory. Only a few signals are used to control the access to the Dual-port memory.

The maximum driving capability for the data lines is 4 mA.

To avoid data loss through simultaneous access at the same memory cell, it is necessary to use the BUSY# signal.

### 3.4.4 Address Bus and Data Bus

These signal lines contain the address bus lines A0 till A13 and data bus lines D0 up to D15 of the Dual-port memory. The address and data lines are non-multiplexed. Generally the COM devices use only an 8 Bit data bus (signals D0-D7) but the signals D8-D15, BHE# and WIF# are not connected.

The COM-CA-SCEB devices support additional data bus lines to drive a 16 Bit data interface. If your host interface can support 16 Bit you should connect the WIF# signal to ground. If not please let this uncommitted that 16 Bit modules will work in a compatible 8 Bit mode.

In case of a 16 Bit system you have to generate the BHE# and A0 signal according the following table.

| BHE# | A0 | Function         |
|------|----|------------------|
| 0    | 0  | word access      |
| 0    | 1  | access high byte |
| 1    | 0  | access low byte  |
| 1    | 1  | no access        |

Table 24: Function Table of the 16 Bit Decode Logic

### 3.4.5 Dual-Port Memory Control Lines

The user has to integrate the Dual-port memory by mapping the memory space of the Dual-port memory into the address range of the host system.

The access to the Dual-port memory is handled over the control lines write WR#, read RD# and Chip select CS# and could be like standard static RAM. All signals are low active.

### 3.4.6 Interrupt Line to the Host System

The signal INT# can be used to generate an interrupt at the host system when the COM-C Module writes into the special handshake cells of the Dual-port memory. These cells are used for synchronization of the COM-C Module and the host system and have some handshake bits. For detailed information see the special documentation for the Dual-port memory software protocol. The interrupt will be only cleared if the host reads a handshake cells.

### 3.4.7 Busy Line to the Host System

The signal BUSY# is used to insert wait states into an current access from host system to a COM-C module. When the signal is active the host must hold on the current transfer.

### 3.4.8 Interfacing to the Dual-Port Memory of COM-C

If you connect the host system to the Dual-port memory you have to know some details of the functional working of the used microcontroller EC1. Generally it works like a standard SRAM. To ensure the proper operation of the Ethernet and the PROFIBUS when the host systems generates very low speed accesses you have to consider the BUSY# signal.

To solve this problem, the external accesses to the EC1 Dual-port memory are internally synchronized to the EC1 memory cycle. This technique actually removes the possibility of the EC1 and the external interface accessing the Dual-port memory at the same time. The internal memory bus arbitration logic insures that this cannot happen. The external interface may have to wait for several EC1 memory cycles, but this is a short 80-145 ns compared to the 500 ns of the PC/ISA cycle. When the PC/ISA interface starts its access to the Dual-port memory, the request is synchronized, and the memory cycle to the Dual-port memory is completed during a normal EC1 memory cycle of 20.8 ns. The only additional requirement is that the write data has to be valid when the WR# strobe for the external memory access becomes active. Fortunately, this is the normal case.

---

**Note** It is not possible to switch the address line with active CE# and WR# or RD# lines (no burst access). The internal synchronization cycle is started only when CE# and WR' or RD# is going low.

---

The EC1 does have a busy signal to synchronize the external accesses to the Dual port memory. The BUSY# signal is a normally low signal that goes high once the Dual-port memory access has completed. It will remain high until the external cycle completes. If the external memory cycle is longer than 145 ns, then the BUSY# signal can just be ignored.

For further details please refer the following timing diagrams.

### 3.4.9 Timing Diagram of COM-C

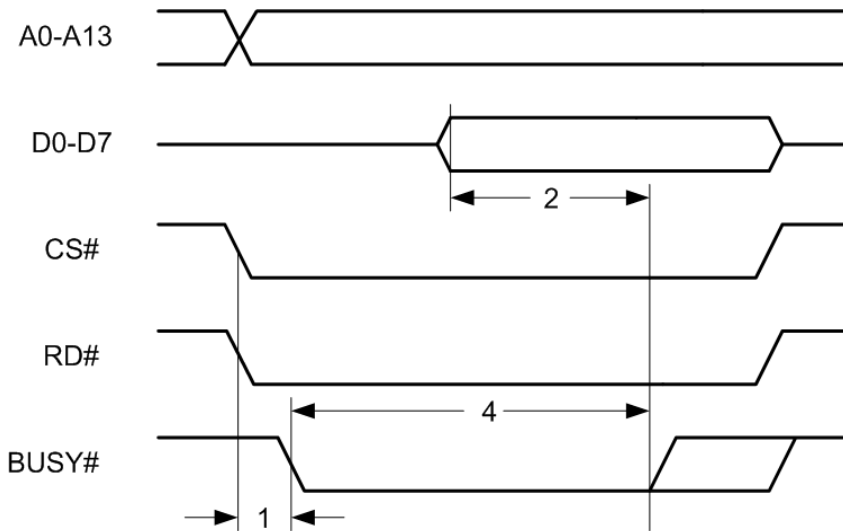


Figure 6: COM Timing Diagram of a Read Cycle at the Dual-Port Memory

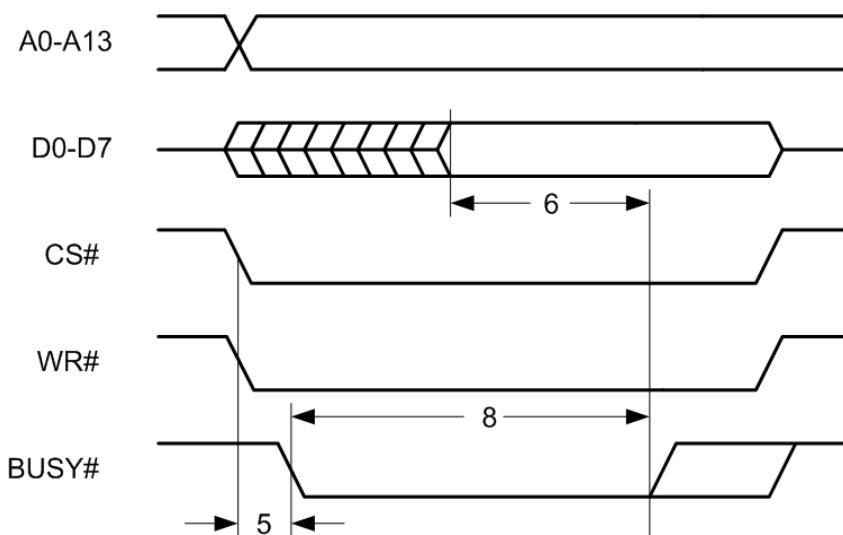


Figure 7: COM Timing Diagram of a Write Cycle at the Dual-Port Memory

Continued on next page.

| No. | Description  | Min. | Max.  | Units     |
|-----|--|------|-------|-----------|
| 1   | CS#, RD# low to BUSY# low  | 6    |       | ns        |
| 2   | Read Data available to BUSY# high  | 12   |       | ns        |
| 4   | BUSY# low width  | 0    | 3 - 7 | CLK Cycle |
| 5   | CS#, WR# low to BUSY# low  | 6    |       | ns        |
| 6   | Write Data setup time to BUSY high   | 26   |       | ns        |
| 8   | BUSY# low width  | 0    | 3 - 7 | CLK Cycle |
|     | CLK Cycle is 20.8 ns with 48 MHz CLK   |      |       |           |
|     | <b>Notes</b>   |      |       |           |
|     | Both CS# and RD# resp. CS# and WR# must be low to start a Dual-port memory cycle   |      |       |           |
|     | If the CS# signal is going low or held low the BUSY# signal goes also low  |      |       |           |
|     | Then after some clock cycle the BUSY# signal is released and going to high level   |      |       |           |
|     | It's not possible to change the address lines with holding low the RD# or WR# signal low   |      |       |           |
|     | The high level between two read and/or write cycles the RD# and WR# signals must be longer held at high level than two CLK Cycle (41.6 ns) |      |       |           |

Table 25: Symbols for COM Timing Diagram of a Read respectively Write Cycle at the Dual-Port Memory

### **3.4.10 Interfacing to the Dual-Port Memory for COM-CA-SCEB**

The connection of the COM-CA-SCEB can be done like for the other COM-C. The timing is a little bit different because of the used SERCON 816 protocol interface chip. Please ask for details of timing and wiring if necessary.

### **3.4.11 Timing Diagram of COM-CA-SCEB**

Ask for the special timing diagram of the COM-CA-SCEB Module if necessary.

### 3.5 Integration a COM-C Module into a Host System

The following picture shows an example for a connection of a COM-C Module directly to a microprocessor. The signal lines of the COM-C Module are directly connected to the microprocessor AM80C188ER which runs with 3.3 V. For other microprocessor families please check the bus timing and the control signals if additional glue logic is needed.

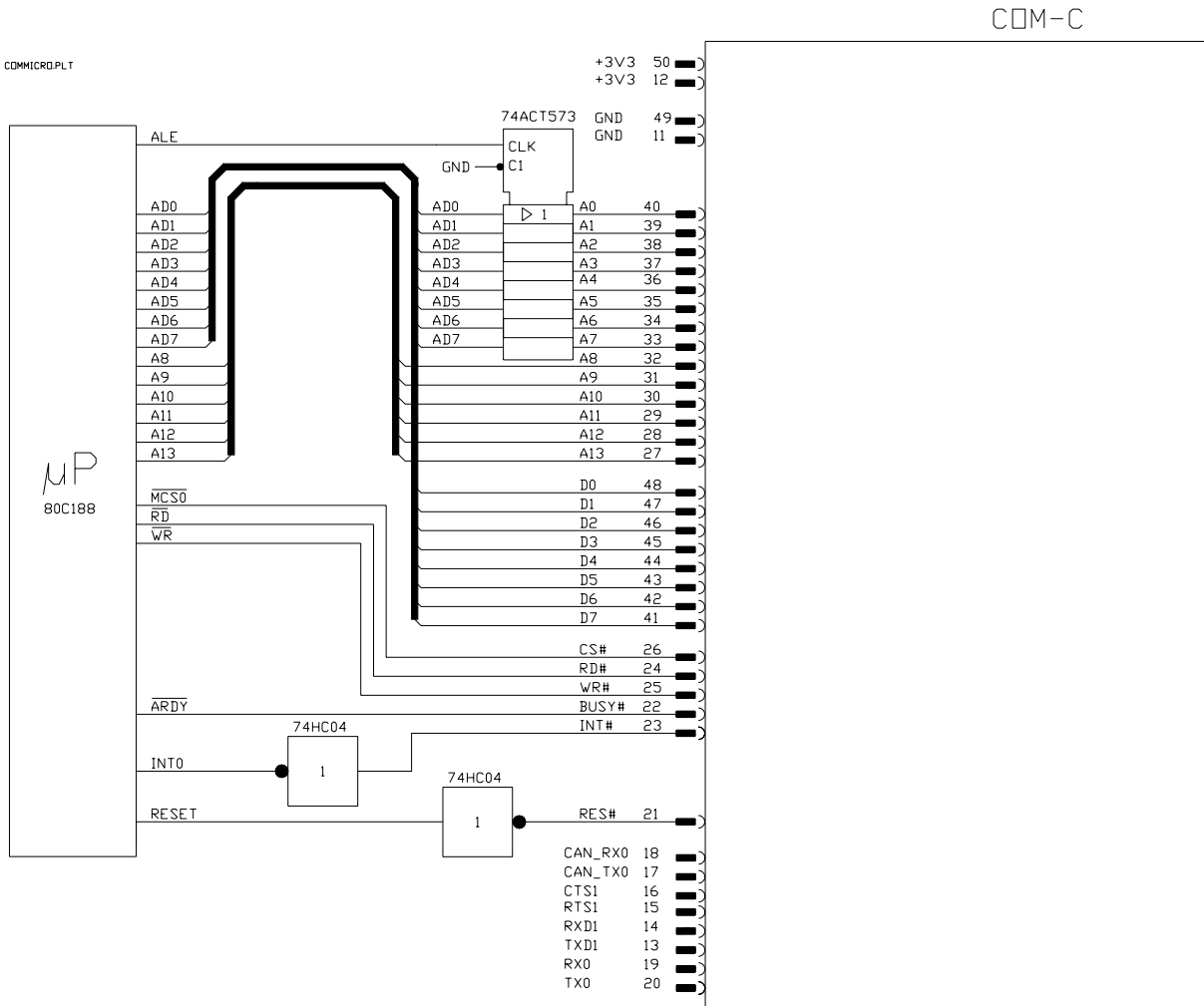


Figure 8: Connection Diagram of a COM-C Module with AM80C188ER Microprocessor

## 4 LEDs

To get a fast overview about the status of the Module and the Communication two duo color LEDs are placed on the Module respectively can be connected.

SYS defines the general status of the Module, means self test passed, firmware and configuration loaded. On the Module we are using the colors yellow for hardware and basic function oriented information like self test passed, firmware loaded. Green is used for application oriented functions like valid configuration loaded for that LED.

2nd Status LED shows communication errors or status and communication activities. If there is no definition in the fieldbus standard we use red for error and yellow for status. If there is a definition we use these for the functions and colors of that LED. For the Modules described in that revision of the manual it is only for DeviceNet the case.

The outputs can drive max. 4 mA. If this is too less an external driver should be placed before the LEDs.

The following schematic shows how to connect the LEDs.

In some cases the brightness of the LEDs of the duo color LEDs are so different that it makes sense to use different resistors to make it equal. This is shown as an example for the LED COM.

The following figure shows the example how to connect the LED for COM-CN-ASM, COM-CN-COM, COM-CN-COS, COM-CN-DNM, COM-CN-DNS, COM-CN-DPM, COM-CN-DPS and COM-CN-CCS.

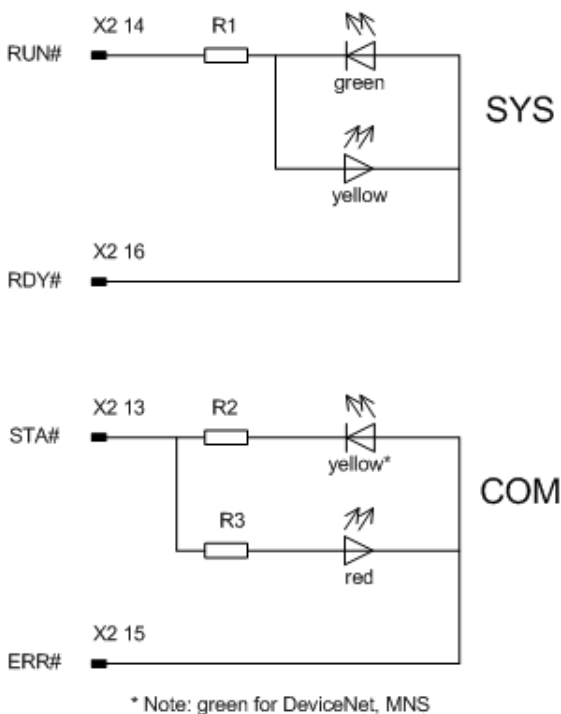


Figure 9: Example how to connect the LEDs COM-CN

This design is possible for all current COM modules except COM-CN-RE.



## 4.1 LEDs for COM Modules

### 4.1.1 Ethernet

The LEDs for Ethernet depends on the used firmware.

| LED | Color     | State                  | Meaning   |
|-----|-----------|------------------------|---|
| SYS | yellow    | Flashing cyclic at 1Hz | Device is in boot loader mode and is waiting for firmware download  |
|     | yellow    | Flashing cyclic at 5Hz | Firmware download is in progress  |
|     | yellow    | Flashing irregular (*) | Hardware or heavy runtime error detected  |
|     | green     | On                     | Communication is running, the device has established at least one connection  |
|     | green     | Flashing cyclic at 5Hz | No error in the configuration found, communication is stopped or ready for communication but no connection established. |
|     | green     | Flashing irregular (*) | Power Up: Configuration missing or faulty, device needs commissioning.  |
|     | -         | Off                    | Device has no power supply or hardware defect   |
| NET | green     | On                     | depends on used firmware  |
|     |           | Flashing               | depends on used firmware  |
|     | red       | On                     | depends on used firmware  |
|     |           | Flashing               | depends on used firmware  |
|     | red/green | Flashing               | depends on used firmware  |
|     | -         | Off                    | depends on used firmware  |

Table 26: LED Ethernet (COM)

(\*) 3 times fast at 5 Hz, 8 times between 0,5 Hz und 1 Hz

### 4.1.2 EtherNet/IP Adapter (Slave)

| LED | Color  | State                  | Meaning   |
|-----|--------|------------------------|---|
| SYS | yellow | Flashing cyclic at 1Hz | Device is in boot loader mode and is waiting for firmware download                                    |
|     | yellow | Flashing cyclic at 5Hz | Firmware download is in progress  |
|     | yellow | Flashing irregular (*) | Hardware or heavy runtime error detected  |
|     | green  | On                     | Slave in cyclic data exchange with the Master   |
|     | green  | Flashing cyclic at 5Hz | Slave has no cyclic data exchange with the Master   |
|     | green  | Flashing irregular (*) | Power Up: Configuration missing or faulty, device needs commissioning, Runtime: Host Watchdog timeout |
|     | -      | Off                    | Device has no power supply or hardware defect   |
| COM | yellow | On                     | A connection to the Ethernet exists   |
|     | yellow | Flashing               | The device sends/receives Ethernet frames   |
|     | red    | On                     | not used  |
|     | -      | Off                    | The device has no connection to the Ethernet  |

Table 27: LED EtherNet/IP Adapter (COM)

(\*) 3 times fast at 5 Hz, 8 times between 0.5 Hz and 1 Hz

### 4.1.3 AS-Interface Master

| LED | Color     | State                  | Meaning  |
|-----|-----------|------------------------|--|
| SYS | yellow    | Flashing cyclic at 1Hz | Device is in boot loader mode and is waiting for firmware download   |
|     | yellow    | Flashing cyclic at 5Hz | Firmware download is in progress   |
|     | yellow    | Flashing irregular (*) | Hardware or heavy runtime error detected   |
|     | green     | On                     | Communication is running, the device has established at least one configured fieldbus connection                         |
|     | green     | Flashing cyclic at 5Hz | No error in the configuration found, communication is stopped or ready for communication but no connection to any Slave. |
|     | green     | Flashing irregular (*) | Power Up: Configuration missing or faulty, device needs commissioning, Runtime: Host Watchdog timeout                    |
|     | -         | Off                    | Device has no power supply or hardware defect  |
| CH1 | green     | On                     | No configuration error, data exchange active   |
|     |           | Flashing               | Configuration error, data exchange active  |
|     | red       | On                     | Heavy system error or hardware failure   |
|     |           | Flashing               | AS-Interface power fail  |
|     | red/green | Flashing               | Project mode active  |
|     | -         | Off                    | No configuration found for the AS Interface channel  |

Table 28: LED AS-Interface Master (COM)

(\*) 3 times fast at 5 Hz, 8 times between 0,5 Hz und 1 Hz

#### 4.1.4 CANopen Master

| LED | Color  | State                  | Meaning  |
|-----|--------|------------------------|--|
| SYS | yellow | Flashing cyclic at 1Hz | Device is in boot loader mode and is waiting for firmware download   |
|     | yellow | Flashing cyclic at 5Hz | Firmware download is in progress   |
|     | yellow | Flashing irregular (*) | Hardware or heavy runtime error detected   |
|     | green  | On                     | Communication is running, the device has established at least one configured fieldbus connection                               |
|     | green  | Flashing cyclic at 5Hz | No error in the configuration found, communication is stopped or ready for communication but no connection to any CANopen Node |
|     | green  | Flashing irregular (*) | Power Up: Configuration missing or faulty, device needs commissioning, Runtime: Host Watchdog timeout                          |
|     | -      | Off                    | Device has no power supply or hardware defected  |
| COM | yellow | On                     | Device sends a telegram  |
|     | red    | On                     | Device has detected a communication problem to at least one CANopen Node   |
|     | -      | Off                    | Device is ready to receive or is receiving telegrams   |

Table 29: LED CANopen Master (COM)

(\*) 3 times fast at 5 Hz, 8 times between 0,5 Hz und 1 Hz

#### 4.1.5 CANopen Slave

| LED | Color  | State                  | Meaning   |
|-----|--------|------------------------|---|
| SYS | yellow | Flashing cyclic at 1Hz | Device is in boot loader mode and is waiting for firmware download                                    |
|     | yellow | Flashing cyclic at 5Hz | Firmware download is in progress  |
|     | yellow | Flashing irregular (*) | Hardware or heavy runtime error detected  |
|     | green  | On                     | Node is in state Operational  |
|     | green  | Flashing cyclic at 5Hz | Node is in state preoperational (respectively prepared)   |
|     | green  | Flashing irregular (*) | Power Up: Configuration missing or faulty, device needs commissioning, Runtime: Host Watchdog timeout |
|     | -      | Off                    | Device has no power supply or hardware defected   |
| COM | yellow | On                     | Device sends a telegram   |
|     | red    | On                     | Node has left the state Operational   |
|     | -      | Off                    | Device is ready to receive or is receiving telegrams  |

Table 30: LED CANopen Slave (COM)

(\*) 3 times fast at 5 Hz, 8 times between 0,5 Hz und 1 Hz

## 4.1.6 CC Link Slave

| LED | Color  | State                    | Meaning   |
|-----|--------|--------------------------|---|
| SYS | yellow | Flashing cyclic at 1Hz   | Device is in boot loader mode and is waiting for firmware download  |
|     | yellow | Flashing cyclic at 5Hz   | Firmware download is in progress  |
|     | yellow | Flashing irregular (*)   | Hardware or heavy runtime error detected  |
|     | green  | On                       | Slave in cyclic data exchange with CC-Link Master   |
|     | green  | Flashing cyclic at 5Hz   | No error in the configuration found, communication is stopped or ready for communication but the device has no cyclic data exchange with the CC-Link Master |
|     | green  | Flashing irregular (*)   | Power Up: Configuration missing or faulty, device needs commissioning, Runtime: Host Watchdog timeout   |
|     | -      | Off                      | Device has no power supply or hardware defect   |
| STA | yellow | On                       | Connection to CC-Link Master established  |
|     | red    | On                       | CRC error detected or station address not valid (valid is 1 ... 64) or baud rate not valid (valid is 0 ... 4)   |
|     |        | Flashing cyclic at 2.5Hz | Station address or baud rate setting was changed since the last network controller reset.   |
|     | -      | Off                      | No connection to CC-Link Master   |

Table 31: LED CC-Link Slave (COM)

(\*) 3 times fast at 5 Hz, 8 times between 0,5 Hz und 1 Hz

### 4.1.7 DeviceNet Master

| LED | Color     | State                  | Meaning  |
|-----|-----------|------------------------|--|
| SYS | yellow    | Flashing cyclic at 1Hz | Device is in boot loader mode and is waiting for firmware download   |
|     | yellow    | Flashing cyclic at 5Hz | Firmware download is in progress   |
|     | yellow    | Flashing irregular (*) | Hardware or heavy runtime error detected   |
|     | green     | On                     | Communication is running, the device has established at least one configured fieldbus connection                         |
|     | green     | Flashing cyclic at 5Hz | No error in the configuration found, communication is stopped or ready for communication but no connection to any Slave. |
|     | green     | Flashing irregular (*) | Power Up: Configuration missing or faulty, device needs commissioning, Runtime: Host Watchdog timeout                    |
|     | -         | Off                    | Device has no power supply or hardware defect  |
| MNS | green     | On                     | Device is online and has at least one connection in established state  |
|     |           | Flashing               | Device is online and has no connection in established state  |
|     | red       | On                     | Critical link failure; Device has detected a network error (duplicate MAC-ID or bus off)                                 |
|     |           | Flashing               | Connection timeout   |
|     | red/green | Flashing               | Communication faulted state  |
|     | -         | Off                    | Not powered, not online.   |

Table 32: LED DeviceNet Master (COM)

(\*) 3 times fast at 5 Hz, 8 times between 0,5 Hz und 1 Hz

### 4.1.8 DeviceNet Slave

| LED | Color     | State                  | Meaning   |
|-----|-----------|------------------------|---|
| SYS | yellow    | Flashing cyclic at 1Hz | Device is in boot loader mode and is waiting for firmware download                                    |
|     | yellow    | Flashing cyclic at 5Hz | Firmware download is in progress  |
|     | yellow    | Flashing irregular (*) | Hardware or heavy runtime error detected  |
|     | green     | On                     | Communication is running, the device has established one connection                                   |
|     | green     | Flashing cyclic at 5Hz | No error in the configuration found, ready for communication but no established connection            |
|     | green     | Flashing irregular (*) | Power Up: Configuration missing or faulty, device needs commissioning, Runtime: Host Watchdog timeout |
|     | -         | Off                    | Device has no power supply or hardware defect   |
| MNS | green     | On                     | Device is operational, online and connection is established   |
|     |           | Flashing               | Device is operational, online and connection is not established                                       |
|     | red       | On                     | Critical fault  |
|     |           | Flashing               | Minor fault   |
|     | red/green | Flashing               | Communication faulted   |
|     | -         | Off                    | Not powered, not online   |

Table 33: LED DeviceNet Slave (COM)

(\*) 3 times fast at 5 Hz, 8 times between 0,5 Hz und 1 Hz

### 4.1.9 InterBus Slave

| LED | Color  | State              | Meaning   |
|-----|--------|--------------------|---|
| UL  | green  | On                 | Protocol chip is supplied with power.                               |
|     |        | Off                | Reset. Protocol chip is not supplied with power.                    |
| RC  | green  | On                 | Communication to the IBS Master is possible.                        |
|     |        | Off                | Communication to the IBS Master is not possible.                    |
| BA  | green  | On                 | Master active, user data is exchanged                               |
|     |        | Flashing irregular | Communication is not possible, system operation is being monitored. |
|     |        | Off                | No user data is exchanged.  |
| RD  | yellow | On                 | The outgoing interface is disabled.                                 |
|     |        | Off                | The outgoing interface is not disabled.                             |
| TR  | green  | On                 | PCP communication, send or receive                                  |
|     |        | Off                | No PCP data is exchanged.   |

Table 34: LED InterBus Slave (COM)

### 4.1.10 PROFIBUS DP Master

| LED | Color  | State                   | Meaning   |
|-----|--------|-------------------------|---|
| SYS | yellow | Flashing cyclic at 1Hz  | Device is in boot loader mode and is waiting for firmware download  |
|     | yellow | Flashing cyclic at 5Hz  | Firmware download is in progress  |
|     | yellow | Flashing irregular (*)  | Hardware or heavy runtime error detected  |
|     | green  | On                      | Communication is running, the device has established at least one configured fieldbus connection                        |
|     | green  | Flashing cyclic at 5Hz  | No error in the configuration found, communication is stopped or ready for communication but no connection to any slave |
|     | green  | Flashing irregular (*)  | Power Up: Configuration missing or faulty, device needs commissioning, Runtime: Host Watchdog timeout                   |
|     | -      | Off                     | Device has no power supply or hardware defect   |
| COM | yellow | On                      | Device is holding the PROFIBUS Token and is able to transmit telegrams  |
|     | yellow | Flashing irregular (**) | Device is sharing the PROFIBUS Token with other Master devices in the PROFIBUS network                                  |
|     | red    | On                      | Device has found a communication problem to at least one PROFIBUS DP Slave or has detected a short circuit              |
|     | -      | Off                     | Device is not configured or has not received the Token permission on the PROFIBUS network                               |

Table 35: LED PROFIBUS DP Master (COM)

(\*) 3 times fast at 5 Hz, 8 times between 0,5 Hz und 1 Hz

(\*\*) between 0,5 Hz and 1 Hz

### 4.1.11 PROFIBUS DP Slave

| LED | Color  | State                  | Meaning   |
|-----|--------|------------------------|---|
| SYS | yellow | Flashing cyclic at 1Hz | Device is in boot loader mode and is waiting for firmware download  |
|     | yellow | Flashing cyclic at 5Hz | Firmware download is in progress  |
|     | yellow | Flashing irregular (*) | Hardware or heavy runtime error detected  |
|     | green  | On                     | Slave in cyclic data exchange with DP Master  |
|     | green  | Flashing cyclic at 5Hz | Slave has no cyclic data exchange with DP Master  |
|     | green  | Flashing irregular (*) | Power Up: Configuration missing or faulty, device needs commissioning, Runtime: Host Watchdog timeout             |
|     | -      | Off                    | Device has no power supply or hardware defect   |
| COM | yellow | On                     | Slave has received parameter data / configuration data from DP Master and has reached the state data exchange     |
|     | red    | On                     | Application program (communication mode: bus synchronous / device controlled) not longer synchronous to bus cycle |
|     | -      | Off                    | Slave has not reached the state data exchange   |

Table 36: LED PROFIBUS DP Slave (COM)

(\*) 3 times fast at 5 Hz, 8 times between 0,5 Hz und 1 Hz

### 4.1.12 SERCOS (optical)

| LED | Color  | State          | Meaning                                  |
|-----|--------|----------------|--|
| RDY | yellow | On             | Device is powered and not in reset state |
|     |        | Off            | Device is not powered or in reset state  |
| ERR | red    | On or Flashing | Communication errors detected            |
|     |        | Off            | No communication errors                  |

Table 37: LED SERCOS (COM)



# 5 Device Address

The COM-CA Slave Modules have the rotary switch to set up the device address on board. If the Module COM-CN is used for slave the address can be set by software over the dual-port memory.

**Note:** This feature is not available at the CC-Link Module COM-Cx-CCS, because the CC-Link Communication Controller allows only a direct connection of the address switches.

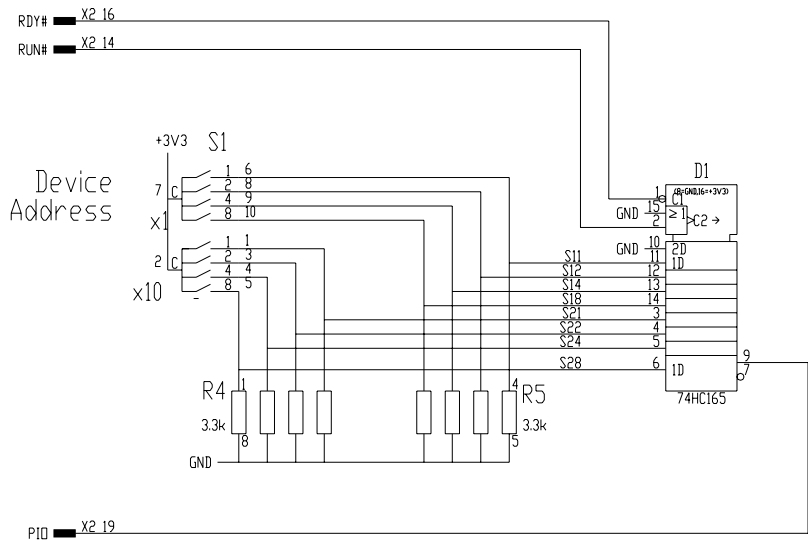


Figure 10: Schematic to read in the device address for COM-CN Slave Modules

## 6 Diagnostic Interface

### 6.1 Diagnostic Interface RS232C

The signals TX0 and RX0 are transmit and receive signals to use with an RS232C interface for diagnostic purpose.

Over this diagnostic line you can download a new firmware, configuration files or make only diagnostic during running communication.

The following schematic shows an example for the RS232C interface necessary on the host board. The module has not integrated drivers.

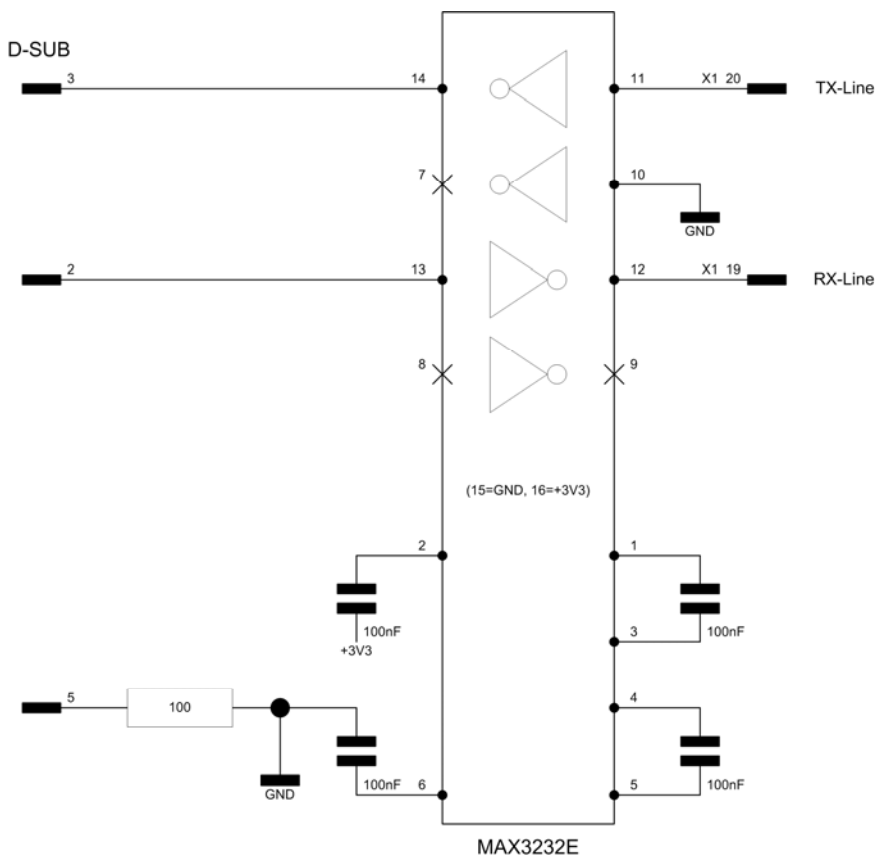


Figure 11: RS232C Interface Circuit for the Diagnostic Interface

## 7 Technical Data

| Operating Condition                  |                          |        | Minimum | Maximum |
|--------------------------------------|--------------------------|--------|---------|---------|
| Operating temperature [° C]<br>COM-C | Standard                 |        | 0° C    | +60° C  |
|                                      | Extended (Note 1)        |        | -20° C  | +70° C  |
| Storage temperature [° C]            | Standard                 |        | -25° C  | +70° C  |
|                                      | Extended                 |        | -40° C  | +85° C  |
| Operating voltage [V]                |                          | U1     | +3.1 V  | +3.5 V  |
|                                      |                          | U2     | 11.0 V  | 25.0 V  |
|                                      |                          | U3     | 29.5 V  | 31.6 V  |
|                                      |                          |        | Typical | Maximum |
| Operating current [mA]               | COM-Cx-ASM               | U1     | 280 mA  | 400 mA  |
|                                      |                          | U3     | 50 mA   | 70 mA   |
|                                      | COM-Cx-COS<br>COM-Cx-COM | U1     | 240 mA  | 400 mA  |
|                                      | COM-Cx-DNS               | U1     | 170 mA  | 300 mA  |
|                                      | COM-Cx-DNM               | U2     | 20 mA   | 55 mA   |
|                                      | COM-Cx-EN                | U1     | 310 mA  | 400 mA  |
|                                      | COM-Cx-DPM               | U1     | 340 mA  | 400 mA  |
|                                      | COM-Cx-DPS               | U1     | 300 mA  | 400 mA  |
|                                      | COM-Cx-IBS               | U1     | 450 mA  | 1150 mA |
|                                      | COM-Cx-CCS               | U1     | 400 mA  | 500 mA  |
| COM-CN-SCEB                          | U1                       | 550 mA | 700 mA  |         |

Table 38: Technical Data – Operating Conditions

**Note 1:** Modules for extended temperature for the module COM-C have the extension ‘-E’ in the module name. Currently the modules types COM-Cx-DPM-E and COM-Cx-COM-E are available for extended temperature range. For other types please contact us.

| <b>EMC</b> |  | <b>Generic Standard</b>                       | <b>Basic Standard</b>  |
|------------|--|---|--|
| Immunity   |  | EN 61000-6-2 (1999)<br>Industrial Environment | EN 61000-4-2<br>EN 61000-4-3<br>EN 61000-4-4<br>EN 61000-4-5<br>EN 61000-4-6<br>Details are listed in<br>chapter Product tests |
| Emission   |  | EN 61000-6-4                                  | EN55011  |

Table 39: Technical Data - EMC

| <b>Mechanical Dimensions</b> |  | <b>Minimum</b>    | <b>Maximum</b>                             |
|------------------------------|--|-------------------|--|
| Dimensions [mm]<br>COM-C     |  | 30 x 70 x 21.5 mm | 40 x 70 x 21.5 mm<br>for further extension |
| Weight                       |  | 35 gr.            | 40 gr.                                     |

Table 40: Technical Data – Mechanical Dimensions

## 7.1 Product Tests

| Immunity   |                |   |                                    |             |
|--|----------------|---|------------------------------------|-------------|
| Generic Standard   | Basic Standard | Test  | Test level                         | Error Class |
| EN 61000-6-2 (1999)<br>Industrial Environment<br>Replacement of EN 50082-2<br><br>EN61131-2(1994)+A11, A12<br>Programmable Controllers | EN 61000-4-2   | Electrostatic Discharge   |                                    |             |
|  |                | Air discharge   | $\pm 8\text{kV}$                   | A           |
|  |                | Contact discharge   | $\pm 4\text{kV}$                   | A           |
|  | EN 61000-4-3   | Radiated Immunity   | 10V/m<br>80-1000 MHz               | A           |
|  | EN 61000-4-4   | Burst   |                                    |             |
|  |                | Power supply lines (+24V only)                                    | $\pm 2\text{kV}$<br>fr = 5 kHz     | A           |
|  |                | Communication lines   | $\pm 1\text{kV}$<br>fr = 5 kHz     | A           |
|  | EN 51000-4-5   | Surge   |                                    |             |
|  |                | Power supply lines (+24V only)<br>Common mode (+24V / GND to PE)  | 1 kV<br>12 Ohm / 9 $\mu\text{F}$   | B           |
|  |                | Power Supply lines (+24V only)<br>Differential mode (+24V to GND) | 0.5 kV<br>2 Ohm / 18 $\mu\text{F}$ | B           |
|  |                | Communication lines (shielded)                                    | 1 kV<br>2 Ohm / 18 $\mu\text{F}$   | B           |
|  | EN 61000-4-6   | Conducted Immunity  |                                    |             |
|  |                | Power supply lines (+24V only)                                    | 10V<br>0,15-80 MHz                 | A           |
|  |                | Communication lines   | 10V<br>0,15-80 MHz                 | A           |

Table 41: Product Tests - Immunity

| Emission   |                |                    |   |             |
|--|----------------|--------------------|---|-------------|
| Generic Standard   | Basic Standard | Test               | Test level  | Error Class |
| EN 61000-6-4<br>Industrial Environment<br>Replacement of EN50081-2 | EN55011        | Conducted emission | 0,15-30 MHz   | A           |
|  | EN55011        | Radiated emission  | 30-1000 MHz<br>40/50 db ( $\mu\text{V}/\text{m}$ ) at<br>10 m | A           |

Table 42: Product Test - Emission

| Environmental Conditions |                   |   |  |             |
|--------------------------|-------------------|---|--|-------------|
|                          | Standard          | Test  | Test level   | Error Class |
|                          | IEC 60068-2-1 Ad  | Cold immunity<br>Min. operating temperature<br>standard<br>extended     | +0°C / 16h<br>-20°C / 16h                                | A           |
|                          | IEC 60068-2-2 Bd  | Dry heat immunity<br>Max. operating temperature<br>standard<br>extended | +60°C / 16h<br>+70°C / 16h                               | A           |
|                          | IEC 60068-2-3 Ca  | Humidity immunity<br>Operating humidity<br>standard<br>extended         | +60°C / 24h / 85%<br>+70°C / 24h / 85%<br>non condensing | A           |
|                          | IEC 60068-2-1 Ab  | Cold withstand<br>Min. storage temperature<br>standard<br>extended      | -25°C / 24h<br>-40°C / 24h                               | A           |
|                          | IEC 60068-2-2 Bb  | Dry heat withstand<br>Max. storage temperature<br>standard<br>extended  | +70°C / 24h<br>+85°C / 24h                               | A           |
|                          | IEC 60068-2-30 Db | Humidity withstand<br>Storage humidity                                  | +60°C / 24h / 95%<br>non condensing                      | A           |

Table 43: Product Tests – Environment Conditions

| Mechanical Tests |                     |           |  |  |
|------------------|---------------------|-----------|--|--|
|                  | IEC 60068-2-6<br>Fc | Vibration | 10-150 Hz<br>± 0.075 mm / 10<br>m/s <sup>2</sup> |  |
|                  | IEC 60068-2-27 Ea   | Shock     | 150 m/s <sup>2</sup> / 11ms                      |  |

Table 44: Product Tests – Mechanical Tests

| Safety |          |                          |              |                  |
|--------|----------|--------------------------|--------------|------------------|
|        | Standard | Test                     | Max. Voltage | Pollution degree |
|        | EN 60947 | Rated insulation voltage | 500 V        | 1                |
|        | UL94V0   | PCB-Material, Connectors |              |                  |

Table 45: Product Tests – Safety

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