Anybus® CompactCom B40–1

DESIGN GUIDE

HMSI-27-230 2.0 ENGLISH

Connecting Devices™

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Anybus® CompactCom B40–1 Design Guide

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1 Preface

1.1 About this Document

This document is intended to provide a good understanding of how to use the Anybus CompactCom B40–1.

The reader of this document is expected to be familiar with hardware design and communication systems in general. For additional information, documentation, support etc., please visit the support website at www.anybus.com/support.

1.2 Related Documents

Related documents

Document	Author
Anybus CompactCom 40 Software Design Guide	HMS
Anybus CompactCom M40 Hardware Design Guide	HMS
Anybus CompactCom Host Application Implementation Guide	HMS
Anybus CompactCom Network Guides (separate document for each supported fieldbus or industrial network system)	HMS

1.3 Document History

Summary of recent changes

Change	Where (section no.)
Added information on EtherCAT IN and OUT ports	3.3.3
Updated network interface schematics	C.3
Added recommended torque for assembly screws	2.4

Revision list

Version	Date	Author	Description
1.23	2015–09–03	KeL	Last FM version.
2.0	2016–03–10	KeL	Moved from FM to XML Misc. updates

1.4 Conventions

Unordered (bulleted) lists are used for:

- Itemized information
- Instructions that can be carried out in any order

Ordered (numbered or alphabetized) lists are used for instructions that must be carried out in sequence:

1. First do this,
2. Then open this dialog, and
    a. set this option...
    b. ...and then this one.

Bold typeface indicates interactive parts such as connectors and switches on the hardware, or menus and buttons in a graphical user interface.

```
Monospaced text is used to indicate program code and other
kinds of data input/output such as configuration scripts.
```

This is a cross-reference within this document: *Conventions, p. 4*

This is an external link (URL): www.hms-networks.com

ⓘ *This is additional information which may facilitate installation and/or operation.*

! This instruction must be followed to avoid a risk of reduced functionality and/or damage to the equipment, or to avoid a network security risk.

⚠ **Caution**
This instruction must be followed to avoid a risk of personal injury.

⚠ **WARNING**
This instruction must be followed to avoid a risk of death or serious injury.

1.5 Document Specific Conventions

- The terms “Anybus” or “module” refers to the Anybus CompactCom module.
- The terms “host” or “host application” refer to the device that hosts the Anybus.
- Hexadecimal values are written in the format NNNNh or 0xNNNN, where NNNN is the hexadecimal value.
- A byte always consists of 8 bits.
- All measurements in this document have a tolerance of ±0.20mm unless otherwise stated.
- Outputs are TTL compliant unless otherwise stated.
- Signals which are “pulled to GND” are connected to GND via a resistor.
- Signals which are “pulled to 3V3” are connected to 3V3 via a resistor.
- Signals which are “tied to GND” are directly connect GND,
- Signals which are “tied to 3V3” are directly connected to 3V3.

2 About the Anybus CompactCom B40–1

2.1 General Information

The Anybus CompactCom B40–1 concept is developed for applications where the standard Anybus CompactCom plug-in housing concept cannot be used. The brick consists of a board with network connectivity functionality, where the customer provides the physical network interface, including network connectors. There is also available an optional connector board providing network connectors and physical interface.

All network communication is directed through a pin connector from the brick to the host application board. This enables full Anybus CompactCom functionality for all applications without loss of network compatibility or environmental characteristics.

All dimensions expressed in this document are stated in millimeters and have a tolerance of ±0.10mm unless stated otherwise.

For general information about the Anybus CompactCom 40 platform, consult the Anybus CompactCom 40 Software and M40 Hardware Design Guides

2.1.1 Available Fieldbuses and Industrial Networks

- Ethernet POWERLINK
- PROFIBUS DPV1
- EtherNet/IP
- EtherCAT
- PROFINET
- Modbus TCP
- DeviceNet
- CC-Link

2.2 Footprints

2.2.1 Brick

The brick is connected to the host application board through the host application interface connector and a network interface connector. The footprint for the brick is shown in the picture below.

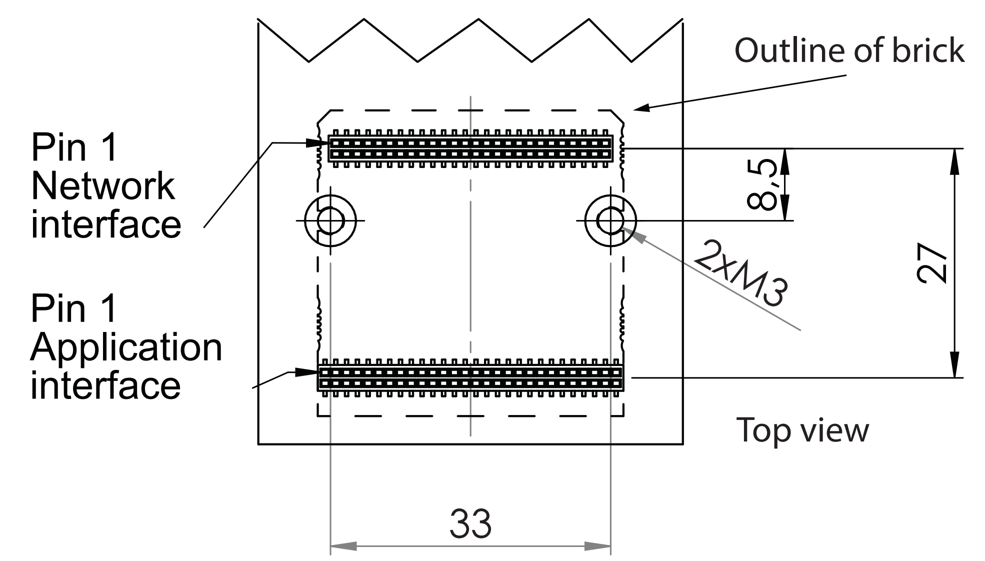

Fig. 1

The dashed outline show the outline and the size of the brick. The headers for the interfaces may be excluded and the brick soldered directly to the host application board.

Suggested components		
Header	Application interface	Samtec CLP-128-02-L-D (56 pin)
	Network interface	Samtec CLP-126-02-L-D (52 pin)
Stand-off (M3)	Pemnet SMTSO-M3-4-ET	

2.2.2 Network Connector Board

The network connectors are mounted on a separate connector board. The footprint for a connector board is shown in the figure below. This footprint is the same for all connector boards

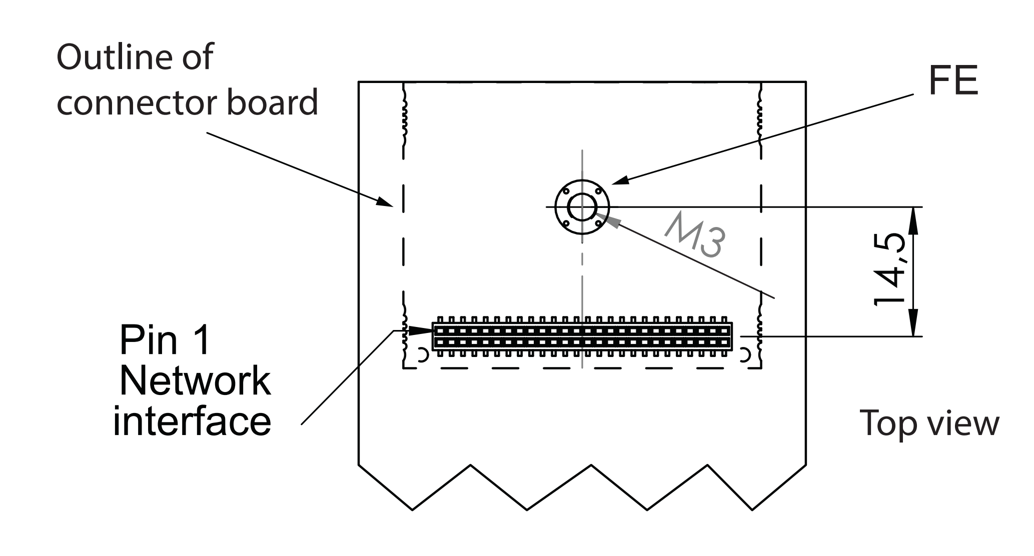

Fig. 2

The fastening screw must be connected to the functional earth (FE) of the host application.

Suggested components	
Header, network interface	Samtec CLP-126-02-L-D (52 pin)
Stand-off (M3)	Pemnet SMTSO-M3-4-ET

2.3 Height Restrictions

All dimensions are in millimeters

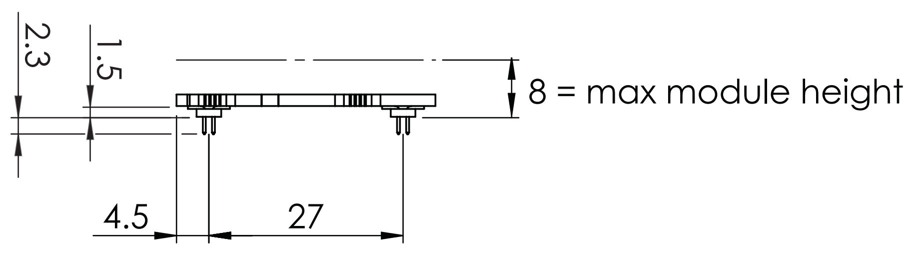

Fig. 3

The maximum height occupied by onboard components of the Anybus module is 8 mm. To ensure isolation, it is recommended to add an additional 2.5 mm on top of these dimensions.

2.4 Assembly

The brick and the connector board are mounted separately on to the host application board. The connector board has to be secured using a screw, joining FE (functional earth) on the connector board to FE on the host application board. The screw holes of the brick are not connected to FE, but to GND. The brick can be mounted without screws in a low vibration environment.

The brick can either be connected to the application board using headers, or soldered directly to the host application PCB.

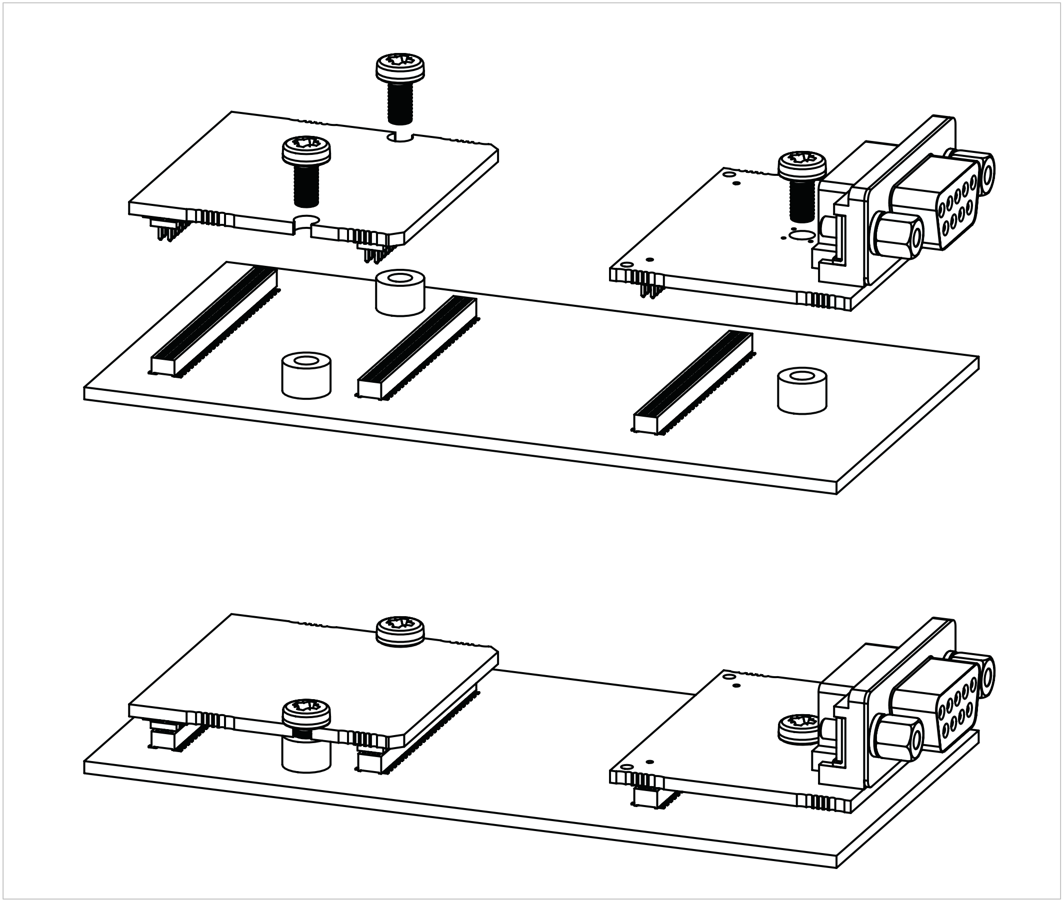

Fig. 4

Suggested components		
Header	Application interface	Samtec CLP-128-02-L-D (56 pin)
	Network interface	Samtec CLP-126-02-L-D (52 pin)
Stand-off (M3)	Pemnet SMTSO-M3-4-ET	

The screw standoffs are typically 4 mm tall. If the brick and connector board are to be soldered directly to the host application board, standoffs should be 2 mm tall. Outer diameter may be 6 mm max.

Recommended torque is 0.2 Nm. Locking paint kan be used to secure the screws against loosening.

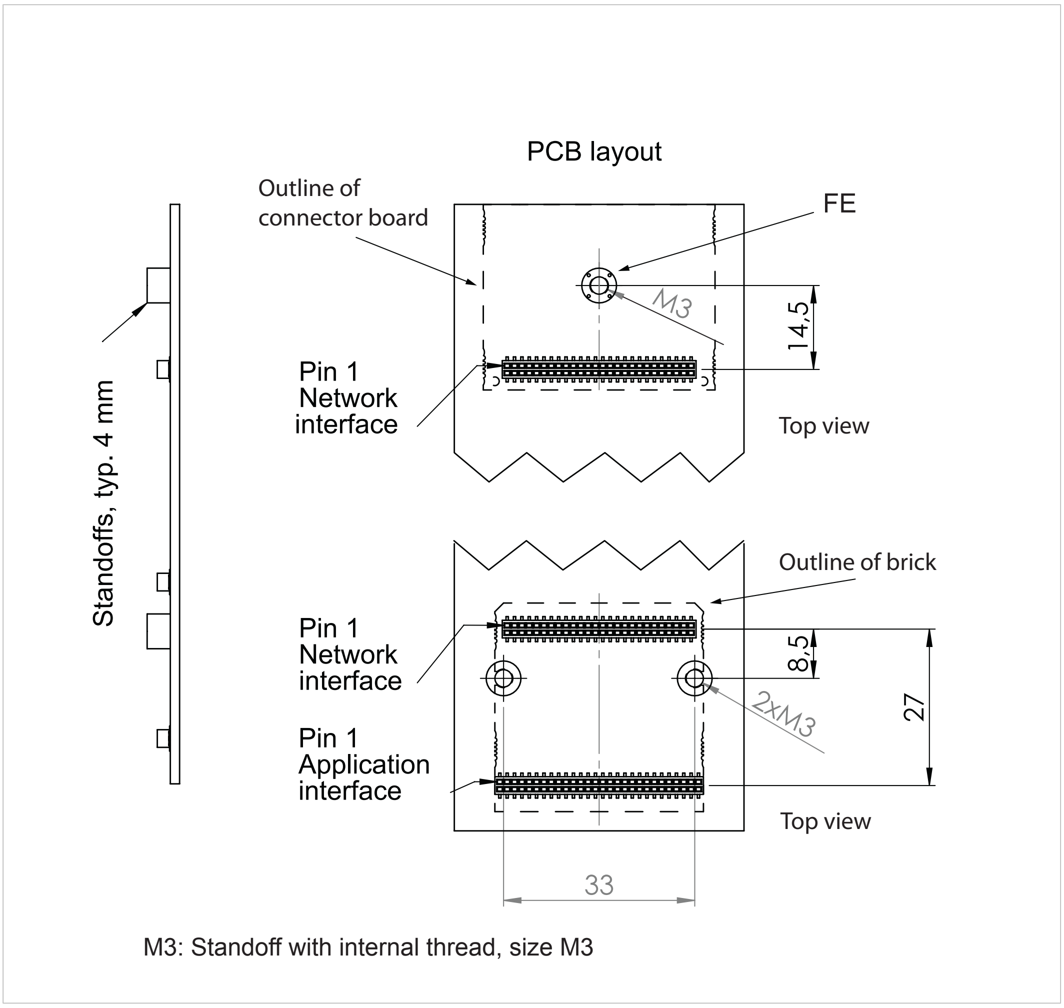
PCB layout
Outline of connector board
FE
M3
14,5
Pin 1 Network interface
Top view
Standoffs, typ. 4 mm
Outline of brick
Pin 1 Network interface
8,5
27
2xM3
Pin 1 Application interface
Top view
33
M3: Standoff with internal thread, size M3

Fig. 5

3 Connectors

3.1 General Information

The brick has two connectors that provides communication with the host application board. The host application connector provides an interface between the host application and the brick, while the network connector provides network access.

The signals from the brick network connector can be directly routed to the (optional) connector board, which carries a network connector(s) identical or similar to the ones on the corresponding brick module.

Examples on how to design the network access circuitry, when not using the connector board, are shown in *Design Examples, p. 35*.

3.2 Host Application Connector

The Anybus CompactCom B40–1 has a standard 1.27 mm 56 pin header surface mounted to the bottom side of the PCB as application interface connector.

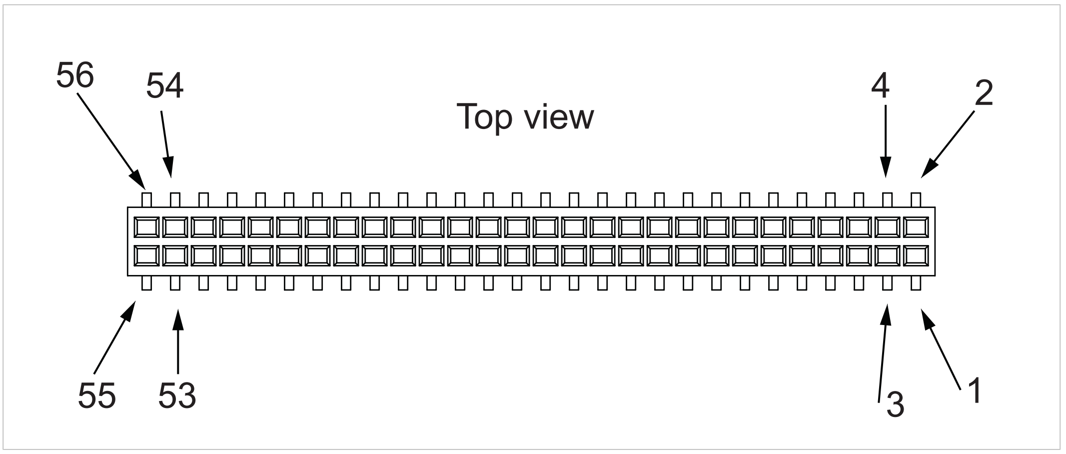

Fig. 6

The pictures shows the pinning of the corresponding connector on the host application seen from the top.

GND	2	1	3V3
A0/$\overline{\text{WEH}}$/DIP1_0	4	3	$\overline{\text{RESET}}$
A2/DIP1_2	6	5	A1/DIP1_1
GND	8	7	A3/DIP1_3
A5/DIP1_5	10	9	A4/DIP1_4
A7/DIP1_7	12	11	A6/DIP1_6
GND	14	13	A8/$\overline{\text{LD}}$/$\overline{\text{SS}}$
A10/DO/MISO	16	15	A9/SCLK
GND	18	17	A11/DI/MOSI
A13/ASM_TX	20	19	A12/ASM_RX
D6/DIP2_6	22	21	D7/DIP2_7
GND	24	23	D5/DIP2_5
D3/DIP2_3	26	25	D4/DIP2_4
GND	28	27	D2/DIP2_2
MD0	30	29	D1/DIP2_1
OM0	32	31	D0/DIP2_0
GND	34	33	OM1
$\overline{\text{CS}}$	36	35	OM2
$\overline{\text{IRQ}}$/PA	38	37	$\overline{\text{WE}}$/$\overline{\text{WEL}}$/CT
GND	40	39	$\overline{\text{OE}}$
$\overline{\text{LED4B}}$/D14	42	41	$\overline{\text{LED4A}}$/D15
GND	44	43	$\overline{\text{LED3A}}$/D13
LED2A/D11	46	45	$\overline{\text{LED3B}}$/D12
LED1A/D9	48	47	LED2B/D10
GND	50	49	LED1B/D8
TX/ASM_TX/OM3	52	51	RX/ASM_RX
MI0/SYNC	54	53	MI1
GND	56	55	3V3

Fig. 7

3.2.1 Application Connector Pin Overview

Depending on operating mode, the pins have different names and different functionality. Presented below is an overview of all pins except GND and 3V3.

The pin types of the application connector are defined in the table below. The pin type may be different depending on which mode is used.

Pin type	Definition
I	Input
O	Output
I/O	Input/Output (bidirectional)
OD	Open Drain
Power	Pin connected directly to module power supply, GND or 3V3

> **!** **Note**: The pin numbers of the Anybus CompactCom B40–1 (brick) host application connector are different from those of the Anybus CompactCom M40 (module) host application connector.

Pin	Signal Name					Type	Notes
	16-bit Mode	**8-bit Mode**	**SPI Mode**	**Shift Register Mode**	**Serial Mode**		
4	WEH	A0		DIP1_0		I	
5	A1	A1		DIP1_1		I	
6	A2	A2		DIP1_2		I	
7	A3	A3		DIP1_3		I	
9	A4	A4		DIP1_4		I	
10	A5	A5		DIP1_5		I	
11	A6	A6		DIP1_6		I	
12	A7	A7		DIP1_7		I	
13	A8	A8	SS	LD		I/O	
15	A9	A9	SCLK	SCLK		O, I	
16	A10	A10	MISO	DO		O, I	
17	A11	A11	MOSI	DI		I	
19	A12	A12			ASM RX	I	
20	A13	A13			ASM TX	O, I	
31	D0	D0		DIP2_0		I, I/O	
29	D1	D1		DIP2_1		I, I/O	
27	D2	D2		DIP2_2		I, I/O	
26	D3	D3		DIP2_3		I, I/O	
25	D4	D4		DIP2_4		I, I/O	
23	D5	D5		DIP2_5		I, I/O	
22	D6	D6		DIP2_6		I, I/O	
21	D7	D7		DIP2_7		I, I/O	
49	D8	LED1B	LED1B	LED1B	LED1B	O, I/O	
48	D9	LED1A	LED1A	LED1A	LED1A	O, I/O	
47	D10	LED2B	LED2B	LED2B	LED2B	O, I/O	
46	D11	LED2A	LED2A	LED2A	LED2A	O, I/O	
45	D12	LED3B	LED3B	LED3B	LED3B	OD, I/O	
43	D13	LED3A	LED3A	LED3A	LED3A	OD, I/O	
42	D14	LED4B	LED4B	LED4B	LED4B	O, I/O	
41	D15	LED4A	LED4A	LED4A	LED4A	O, I/O	
37	WEL	WE		CT		I	
39	OE	OE				I	
36	CS	CS				I	
38	IRQ	IRQ	IRQ	PA		O	
51	ASM RX	ASM RX	ASM RX	ASM RX	RX	I	
52	ASM TX / OM3	ASM TX / OM3	ASM TX / OM3	ASM TX / OM3	TX / OM3	I/O	Strapping input with internal weak pull-up during powerup. To configure OM3, use an external pull-up/pull-down of 1.0 to 2.2 kΩ. The pin changes to output after powerup
32	OM0	OM0	OM0	OM0	OM0	I	
33	OM1	OM1	OM1	OM1	OM1	I	
35	OM2	OM2	OM2	OM2	OM2	I	
54	MI0/ SYNC	MI0/ SYNC	MI0/ SYNC	MI0/ SYNC	MI0	O	Low at power-up and before reset release.
53	MI1	MI1	MI1	MI1	MI1	O	Connected to 3V

Pin	Signal Name					Type	Notes
	16-bit Mode	8-bit Mode	SPI Mode	Shift Register Mode	Serial Mode		
30	MD0	MD0	MD0	MD0	MD0	O	Connected to GND
3	RESET	RESET	RESET	RESET	RESET	I	

3.2.2 Power Supply Pins

Signal	Type	Pin	Description
GND	Power	2, 8, 14, 18, 24, 28, 34, 40, 44, 50, 56	Ground Power and signal ground reference.
3V3	Power	1, 55	3.3 V power supply.

3.2.3 LED Interface / D8–D15 (Data Bus)

Signal Name	Pin Type	Pin	Description, LED Interface	Description, Data Bus
LED1A / D9	O / I/O	48	LED 1 Indication A • Green	D9 Data Bus • "D9" in 16-bit data bus mode.
LED1B / D8	O / I/O	49	LED 1 Indication B • Red	D8 Data Bus • "D8" in 16-bit data bus mode.
LED2A / D11	O / I/O	46	LED 2 Indication A • Green	D11 Data Bus • "D11" in 16-bit data bus mode.
LED2B / D10	O / I/O	47	LED 2 Indication B • Red	D10 Data Bus • "D10" in 16-bit data bus mode.
$\overline{\text{LED3A}}$ / D13	OD / I/O	43	LED 3 Indication A • Green • Mainly used for link/activity on network port 1 on the Ethernet modules. Pin is open-drain to maintain backward compatibility with existing applications, where this pin may be tied to GND.	D13 Data Bus • "D13" in 16-bit data bus mode.
$\overline{\text{LED3B}}$ / D12	OD / I/O	45	LED 3 Indication B • Yellow or red, depending on network • Mainly used for link/activity on network port 1 on the Ethernet modules (yellow). Pin is open-drain to maintain backward compatibility with existing applications, where this pin may be tied to GND.	D12 Data Bus • "D12" in 16-bit data bus mode.
$\overline{\text{LED4A}}$ / D15	O / I/O	41	LED 4 Indication A • Green • Mainly used for link/activity on network port 1 on the Ethernet modules.	D15 Data Bus • "D15" in 16-bit data bus mode.
$\overline{\text{LED4B}}$ / D14	O / I/O	42	LED 4 Indication B • Yellow or red, depending on network • Mainly used for link/activity on network port 1 on the EThernet modules (yellow)	D14 Data Bus • "D14" in 16-bit data bus mode.

3.2.4 Settings / Sync

Signal Name	Type	Pin No.	Description
OM0 OM1 OM2 OM3 (ASM TX) (TX) (Used as TX or ASM TX after power up)	I I I I	32 33 35 52	Operating Mode Used to select interface and baud rate, see below.
ASM RX, RX ASM TX, TX (OM3)	I O	52	Serial/Safety Communication Used for serial/safety communication, depending on Operating Mode, see the Anybus CompactCom 40 HWDG for more information.
MI0 / SYNC MI1	O O	54 53	Module Identification MI0 and MI1 can be used by the host application to determine what type of Anybus CompactCom that is connected. SYNC On networks that support synchronous communication, a periodic synchronization pulse is provided on the SYNC output. The SYNC pulse is also available as a maskable interrupt using the IRQ signal.
MD0	O	30	Module Detection This signal can be used by the host application to determine that an Anybus CompactCom is inserted into the slot, see "Module Detection (MD0)" on page 19. The signals are connected directly to V_{SS} on the CompactCom.

Operating Modes

These inputs select the interface that should be used to exchange data (SPI, stand-alone shift register, parallel or serial) and, if the serial interface option is used, the operating baud rate. The state of these signals is sampled once during startup, i.e. any changes require a reset in order to have effect.

OM3	OM2	OM1	OM0	Operating Mode
0	0	0	0	Reserved
0	0	0		SPI
0	0	1	0	Stand-alone shift register
0	0	1	1	Reserved
0	1	0	0	Reserved
0	1	0	1	Reserved
0	1	1	0	Reserved
0	1	1	1	16-bit parallel
1	0	0	0	8-bit parallel
1	0	0	1	Serial 19.2 kbps
1	0	1	0	Serial 57.6 kbps
1	0	1	1	Serial 115.2 kbps
1	1	0	0	Serial 625 kbps
1	1	0	1	Reserved
1	1	1	0	Reserved
1	1	1	1	Service Mode

! These signals must be stable prior to releasing the $\overline{\text{RESET}}$ signal. Failure to observe this may result in faulty behavior.

Moduel Detection (MD0)

This signal is internally connected to GND, and can be used by the host application to detect whether a module is present or not. A low signal indicates that a module is present.

If not used, leave this signal unconnected.

Module Identification

These signals indicate which type of module that is connected. It is recommended to check the state of these signals before accessing the module.

MI1	MI0	Module Type
0	0	Active Anybus CompactCom 30
0	1	Passive Anybus CompactCom
1	0	Active Anybus CompactCom 40
1	1	Customer specific

0 = V_{OL}

1 = V_{OH}

On modules supporting "SYNC", MI0 is used as a SYNC signal during operation. MI0 should only be sampled by the application during the time period from power up to the end of SETUP state.

3.2.5 RESET (Reset Input)

Signal Name	Pin Type	Pin	Description
$\overline{\text{Reset}}$	I	3	**Reset** Used to reset the module.

The master reset input is active low. It must be connected to a host application controllable output pin in order to handle the power up sequence, voltage deviations and to be able to support network reset requests.

The brick does not feature any internal reset regulation. To establish a reliable interface, the host application is solely responsible for resetting the module when the supply voltage is outside the specified range.

There is no Schmitt trigger circuitry on this input, which means that the module requires a fast rise time of the reset signal, preferably equal to the slew rate of typical logical circuits. A simple RC circuit is for example not sufficient to guarantee stable operation, as the slew rate from logic 0 to logic 1 is too slow.

If the application, containing the B40, is designed in such a way that power from the network is used to power the complete application, the reset signal must be pulled to GND on the host application side.

! The rise time of the reset signal should be as fast as possible, and must not exceed 30 ns. The signal is not under any circumstances allowed to be left floating. Use a pull-down to prevent this.

Power Up

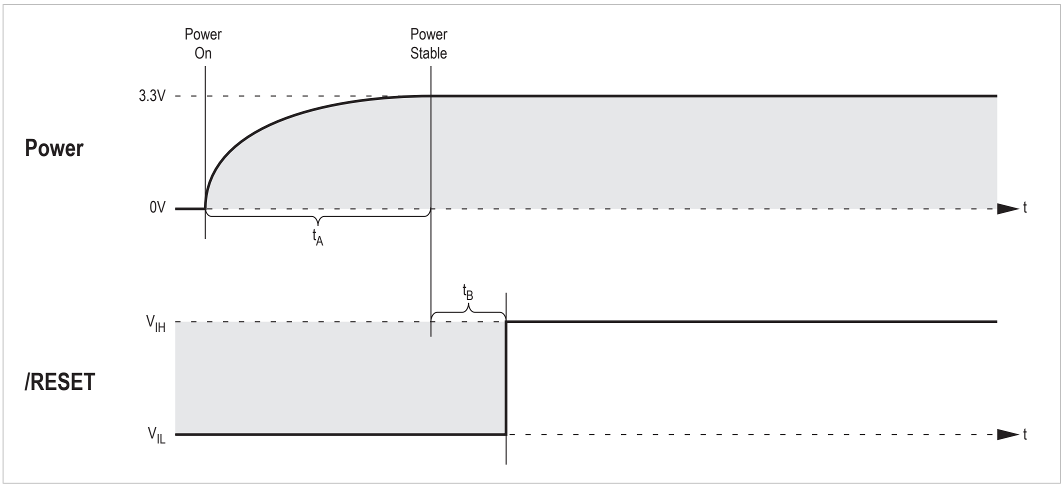

Fig. 8

Powerup time limits are given in the table below:

Symbol	Min.	Max.	Definition
t_A	-	-	Time until the power supply is stable after power-on; the duration depends on the power supply design of the host application and is thus beyond the scope of this document.
t_B	1ms	-	Safety margin.

3.2.6 Pin Usage in the Different API Modes

Please consult the Anybus CompactCom M40 Hardware Design Guide for more information.

> **!** The pin numbers of the Anybus CompactCom M40 host connector are different from those of the brick host connector.

3.3 Network Connector

The brick has a standard 1.27 mm 52 pin header surface mounted to the bottom side of the board as network interface.

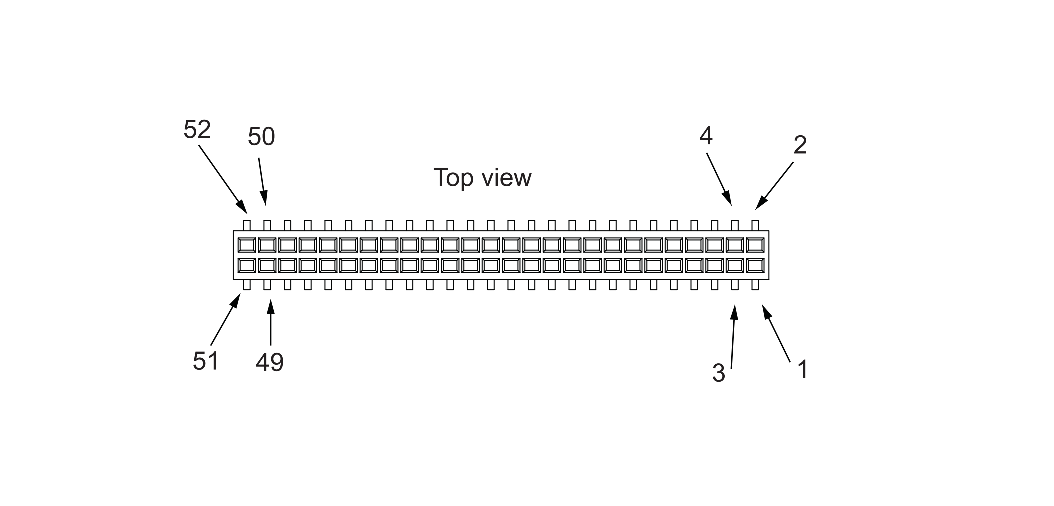

Fig. 9

The pinning of the network connector on the host application board, seen from the top.

Signal	Pin	Pin	Signal
GND	2	1	3V3
B_1CEN/SDA	4	3	B_1P/RXP
GND	6	5	B_1N/RXN
B_2CEN/SCL	8	7	B_2P/SDP
GND	10	9	B_2N/SDN
B_3CEN	12	11	B_3P/TXEN
GND	14	13	B_3N/TXDIS
B_4CEN/$\overline{\text{BUSP}}$	16	15	B_4P/TXP
GND	18	17	B_4N/TXN
NW_LED4A	20	19	NW_LED4B
NW_LED3A	22	21	NW_LED3B
NW_LED2A	24	23	NW_LED2B
NW_LED1A	26	25	NW_LED1B
GND	28	27	3V3
A_1CEN/SDA	30	29	A_1P/RXP
GND	32	31	A_1N/RXN
A_2CEN/SCL	34	33	A_2P/SDP
GND	36	35	A_2N/SDN
A_3CEN	38	37	A_3P/TXEN
GND	40	39	A_3N/TXDIS
A_4CEN/$\overline{\text{BUSP}}$	42	41	A_4P/TXP
GND	44	43	A_4N/TXN
C_RX	46	45	C_TX
$\overline{\text{C\_BUSP}}$	48	47	C_TXEN
GATE2	50	49	GATE1
GND	52	51	3V3

Fig. 10

3.3.1 Network Connector Pin Overview

Depending on network, the pins have different names and different functionality. Presented below is an overview of all pins except GND and 3V3. More detailed descriptions of the signals are described for each network/fieldbus version later in this section (*3.3*).

Pin	Signal Name				
	Ethernet based networks, Copper	**Ethernet based networks, fiber optic**	**DeviceNet, see section**	**PROFIBUS, see section**	**CC-Link, see section**
3	B_1P	B_RXP			
4	B_1CEN	B_SDA			
5	B_1N	B_RXN			
7	B_2P	B_SDP			
8	B_2CEN	B_SCL			
9	B_2N	B_SDN			
11	B_3P	B_TXEN			
12	B_3CEN				
13	B_3N	B_XDIS			
15	B_4P	B_TXP			
16	B_4CEN				
17	B_4N	B_TXN			
19	NW_LED4B	NW_LED4B	NW_LED4B	NW_LED4B	NW_LED4B
20c	NW_LED4A	NW_LED4A	NW_LED4A	NW_LED4A	NW_LED4A
21c	NW_LED3B	NW_LED3B	NW_LED3B	NW_LED3B	NW_LED3B
22c	NW_LED3A	NW_LED3A	NW_LED3A	NW_LED3A	NW_LED3A
23c	NW_LED2B	NW_LED2B	NW_LED2B	NW_LED2B	NW_LED2B
24c	NW_LED2A	NW_LED2A	NW_LED2A	NW_LED2A	NW_LED2A
25c	NW_LED1B	NW_LED1B	NW_LED1B	NW_LED1B	NW_LED1B
26c	NW_LED1A	NW_LED1A	NW_LED1A	NW_LED1A	NW_LED1A
29	A_1P	A_RXP			
30	A_1CEN	A_SDA			
31	A_1N	A_RXN			
33	A_2P	A_SDP			
34	A_2CEN	A_SCL			
35	A_2N	A_SDN			
37	A_3P	A_TXEN			
38	A_3CEN				
39	A_3N	A_TXDIS			
41	A_4P	A_TXP			
42	A_4CEN				
43	A_4N	A_TXN			
45			C_TX	C_TX	C_TX
46			C_RX	C_RX	C_RX
47				C_TXEN	C_TXEN
48			C_BUSP_N		
49			GATE1	GATE1	GATE1
50			GATE2	GATE2	GATE2

Ethernet based networks, using copper, are, at the moment, EtherNet/IP, PROFINET, Ethernet POWERLINK, EtherCAT and Modbus TCP. PROFINET IRT is an Ethernet Fiber Optic Network.

The LED signals are active high and are connected to respective LED via a resistor.

Pin Types

Pin type	Definition
I	Input
O	Output
I/O	Input/Output (bidirectional)
OD	Open Drain
Power	Pin connected directly to module power supply, 3V3 or GND

3.3.2 Power Supply Pins

Signal Name	Type	Pin No.	Description
GND	Power	2, 6, 10, 14, 18, 28, 32, 36, 40, 44, 52	Ground Power and signal ground reference.
3V3	Power	1, 27, 51	3.3 V power supply.

3.3.3 Ethernet Based Networks (Copper)

The industrial networks, that use Ethernet for communication, share hardware design. The firmware downloaded to the brick is different depending on network. Physically they use the same set of pins in a similar way. Bricks are available for the following Ethernet based networks: EtherNet/IP, EtherCAT. PROFINET, Ethernet POWERLINK and Modbus TCP.

The brick supports dual network ports, signal group A should be connected to the left port and signal group B to the right port on the connector board, looking at the front, see *Connector Board for Copper Based Ethernet, p. 29*

For EtherCAT, signal group A is used for the IN port and signal group B is used for the OUT port.

Signal Group	Signal Name	Type	Pin	Description
B	B_1P	I/O	3	First pair, positive signal
	B_1CEN	Power	4	Center tap voltage for first pair
	B_1N	I/O	5	First pair, negative signal
	B_2P	I/O	7	Second pair, positive signal
	B_2CEN	Power	8	Center tap voltage for second pair
	B_2N	I/O	9	Second pair, negative signal
	B_3P	I/O	11	Third pair, positive signal. Used for Gigabit Ethernet.
	B_3CEN	Power	12	Center tap voltage for third pair. Used for Gigabit Ethernet.
	B_3N	I/O	13	Third pair, negative signal. Used for Gigabit Ethernet.
	B_4P	I/O	15	Fourth pair, positive signal. Used for Gigabit Ethernet.
	B_4CEN	Power	16	Center tap voltage for fourth pair. Used for Gigabit Ethernet.
	B_4N	I/O	17	Forth pair, negative signal. Used for Gigabit Ethernet.
A	A_1P	I/O	29	First pair, positive signal
	A_1CEN	Power	30	Center tap voltage for first pair
	A_1N	I/O	31	First pair, negative signal
	A_2P	I/O	33	Second pair, positive signal
	A_2CEN	Power	34	Center tap voltage for second pair
	A_2N	I/O	35	Second pair, negative signal
	A_3P	I/O	37	Third pair, positive signal. Used for Gigabit Ethernet.
	A_3CEN	Power	38	Center tap voltage for third pair. Used for Gigabit Ethernet.
	A_3N	I/O	39	Third pair, negative signal. Used for Gigabit Ethernet.
	A_4P	I/O	41	Fourth pair, positive signal. Used for Gigabit Ethernet.
	A_4CEN	Power	42	Center tap voltage for fourth pair. Used for Gigabit Ethernet.
	A_4N	I/O	43	Forth pair, negative signal. Used for Gigabit Ethernet.

3.3.4 Ethernet Fiber Optic Networks

Ethernet fiber optic networks use more or less the same pins as copper based Ethernet networks. The brick supports PROFINET fiber optic network (PROFINET IRT).

The brick supports dual network ports, signal group A is be connected to the left port and signal group B to the right port on the connector board, looking at the front, see *Connector Board for Fiber Optic Ethernet, p. 30*.

If the Anybus CompactCom B40 connector board is not to be used, please study the design requirements for the Rx and SD channels, see*Rx Channel Design Requirements, p. 23* and *SD Channel Design Requirements, p. 24*. Furthermore, fiber optic connectors without metal are preferred in order to minimize EMC disturbance.

Signal Group	Signal Name	Type	Pin	Description
B	B_RXP	I	3	Rx, LVPECL positive signal
	B_SDA	I/O	4	SDA, I2C data
	B_RXN	I	5	Rx, LVPECL negative signal
	B_SDP	I	7	Signal Detect, LVPECL positive signal
	B_SCL	I/O	8	SCL, I2C clock
	B_SDN	I	9	Signal Detect, LVPECL negative signal
	B_TXEN	O	11	Tx enable TXEN is implemented as the inverse to TXDIS
	B_TXDIS	O	13	Tx disable
	B_TXP	O	15	Tx, LVPECL positive signal
	B_TXN	O	17	Tx, LVPECL negative signal
A	A_RXP	I	29	Rx, LVPECL positive signal
	A_SDA	I/O	30	SDA, I2C data
	A_RXN	I	31	Rx, LVPECL negative signal
	A_SDP	I	33	Signal Detect, LVPECL positive signal
	A_SCL	I/O	34	SCL, I2C clock
	A_SDN	I	35	Signal Detect, LVPECL negative signal
	A_TXEN	O	37	Tx enable TXEN is implemented as the inverse to TXDIS
	A_TXDIS	O	39	Tx disable
	A_TXP	O	41	Tx, LVPECL positive signal
	A_TXN	O	43	Tx, LVPECL negative signal

The differential signals Rx and Tx should be routed as differential pairs with a characteristic impedance of 100 Ω differentially.

Rx Channel Design Requirements

The Rx channel is designed for an optical transceiver output that has an AC coupled 100 Ω differential signal with 100-1000 mV amplitude, e.g. LVPECL (low voltage positive emitter coupled logic). Each line is terminated with 50 Ω to a common point with a potential of 1.2 V on the brick.

If a transceiver with a DC coupled output is used, series capacitors are needed to obtain desired signal levels for the brick. Below is a figure describing three different options to connect a transceiver output to an Rx channel on the brick:

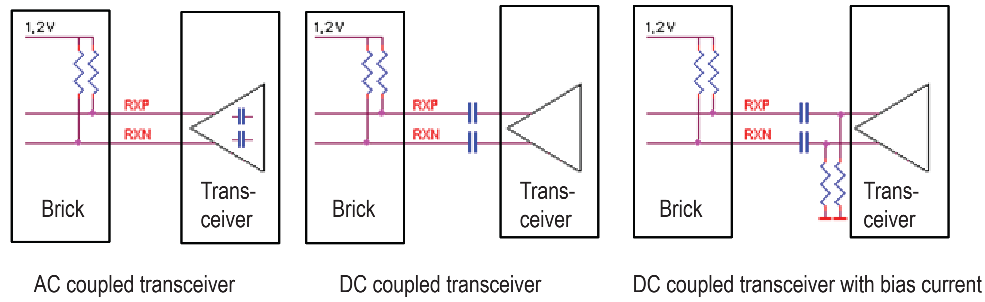

Fig. 11

The AC coupling capacitors typically have a value of 100 nF. Resistors draining bias current typically have a value of 150 Ω.

SD Channel Design Requirements

The SD (signal detect) channel is designed for a transceiver output that has a DC coupled differential output with 100-1000 mV amplitude. If a transceiver with LVTTL/LVCMOS output is used, the signal needs to be conditioned using a few resistors, to obtain desired signal levels for the brick.

Each line is pulled to GND by a 1.27 kΩ resistor on the brick.

Even if the transceiver has a single ended output and the other line is at a fixed reference potential, it is recommended to route SDN and SDP side by side all the way to the signal conditioning resistors. This will give the interference, collected by the transmission line, common mode characteristics, and it can thus be ignored by the differential input, instead of becoming a differential mode interference that would corrupt the signal.

Below is a figure describing three different ways to connect a transceiver output to an SD channel of the brick:

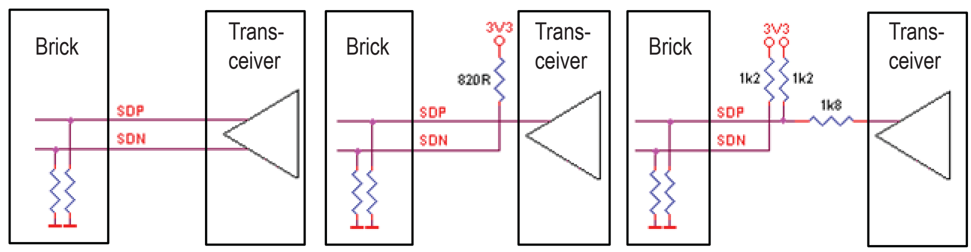

Fig. 12

In case a and case b, additional pull-down resistors will be required if the LVPECL outputs require a certain bias current (> 1 mA) to function.

3.3.5 DeviceNet

The Anybus CompactCom B40–1 DeviceNet communication interface uses the following pins:

Signal Name	Type	Pin	Description
C_TX	O	45	Tx
C_RX	I	46	Rx
C_BUSP_N	I	48	Bus power detection. Active low
GATE1	O	49	Low voltage MOS gate driver. For fieldbus isolated DC supply circuitry.
GATE2	O	50	Low voltage MOS gate driver. For fieldbus isolated DC supply circuitry.

Connector Board for CC-Link and DeviceNet, p. 31

3.3.6 PROFIBUS

The Anybus CompactCom B40–1 PROFIBUS DP-V1 communication interface uses the following pins:

Signal Name	Type	Pin	Description
C_TX	O	45	Tx
C_RX	I	46	Rx
C_TXEN	O	47	TxEnable
GATE1	O	49	Low voltage MOS gate driver. For fieldbus isolated DC supply circuitry.
GATE2	O	50	Low voltage MOS gate driver. For fieldbus isolated DC supply circuitry.

See*Connector Board for PROFIBUS, p. 28* for information about the optional connector board.

3.3.7 CC-Link

The Anybus CompactCom B40-1 CC-Link communication interface uses the following pins:

Signal Name	Type	Pin	Description
C_TX	O	45	Tx
C_RX	I	46	Rx
C_TXEN	O	47	TxEnable
GATE1	O	49	Low voltage MOS gate driver. For fieldbus isolated DC supply circuitry.
GATE2	O	50	Low voltage MOS gate driver. For fieldbus isolated DC supply circuitry.

See*Connector Board for CC-Link and DeviceNet, p. 31* for information about the optional connector board.

3.3.8 LED Indicators

The Anybus CompactCom 40 series supports four bicolored LED indicators.

LED name	Pin no.	Signal Name	Default color	Default Functionality
LED1A	26	NW_LED1A	Green	Network status
LED1B	25	NW_LED1B	Red	
LED2A	24	NW_LED2A	Green	Module status
LED2B	23	NW_LED2B	Red	
LED3A	22	NW_LED3A	Green	Link/Act for the left network port of connector board (looking at the module front)
LED3B	21	NW_LED3B	Yellow	
LED4A	20	NW_LED4A	Green	Link/Act for the right network port of connector board (looking at the module front)
LED4B	19	NW_LED4B	Yellow	

All LED outputs are active high and should be connected as shown in the picture below. The resistor values should be chosen to get even light between different LEDs.

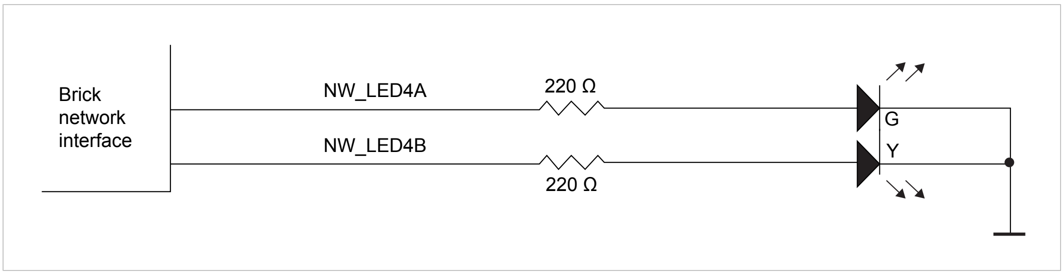

Fig. 13

A Dimensions

All dimensions are in millimeters, tolerance ±0.10 mm, unless otherwise stated.

A.1 Brick

The dimensions for the brick are given in the picture below.

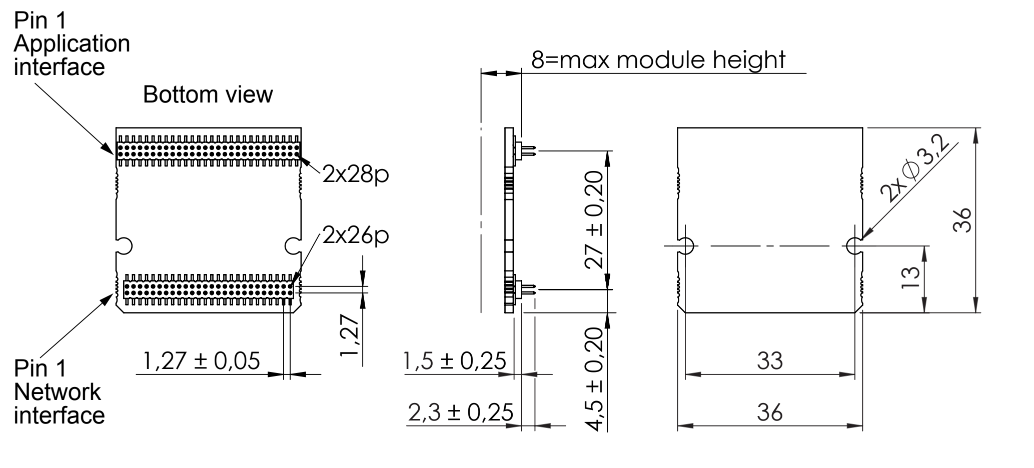

Fig. 14

A.2 Connector Board for PROFIBUS

The connector board for the PROFIBUS network interface carries a D-sub connector

!	If the connector board is mounted in an environment that is subject to vibration, please make sure to secure the network cable in such a manner, that the vibrations will not harm the D-sub connector.

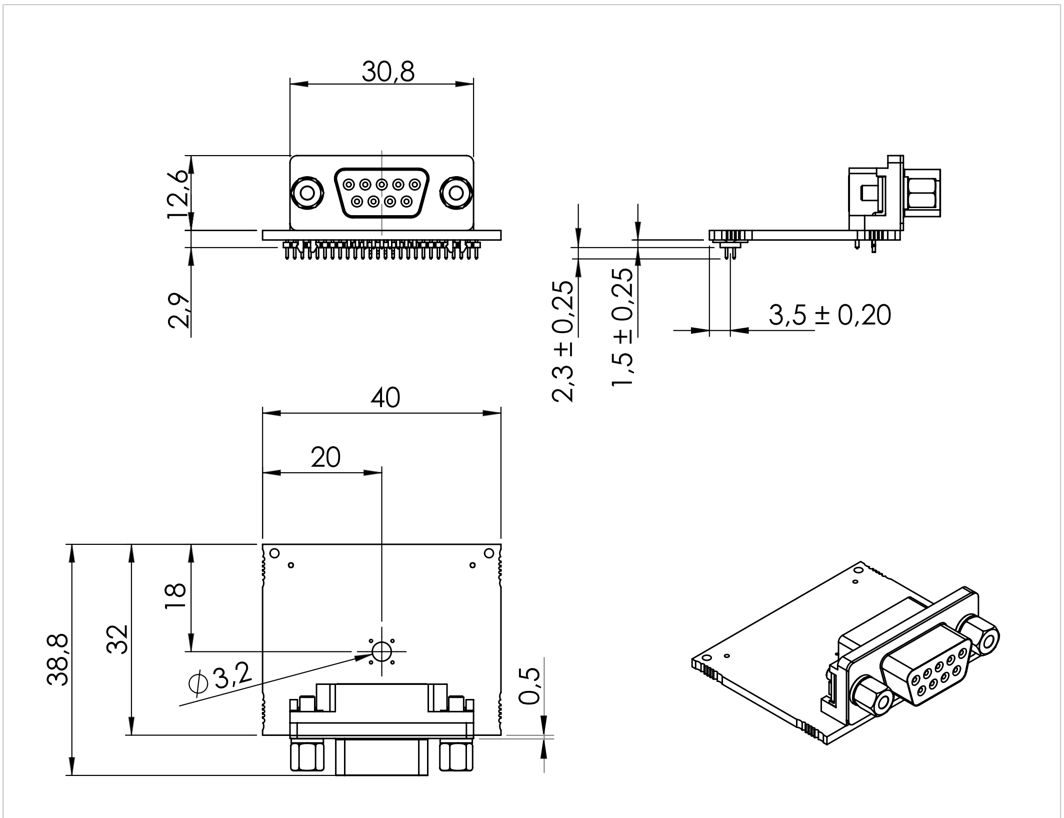

Fig. 15

A.3 Connector Board for Copper Based Ethernet

The connector board for the copper based Ethernet network interfaces carries two RJ45 connectors.

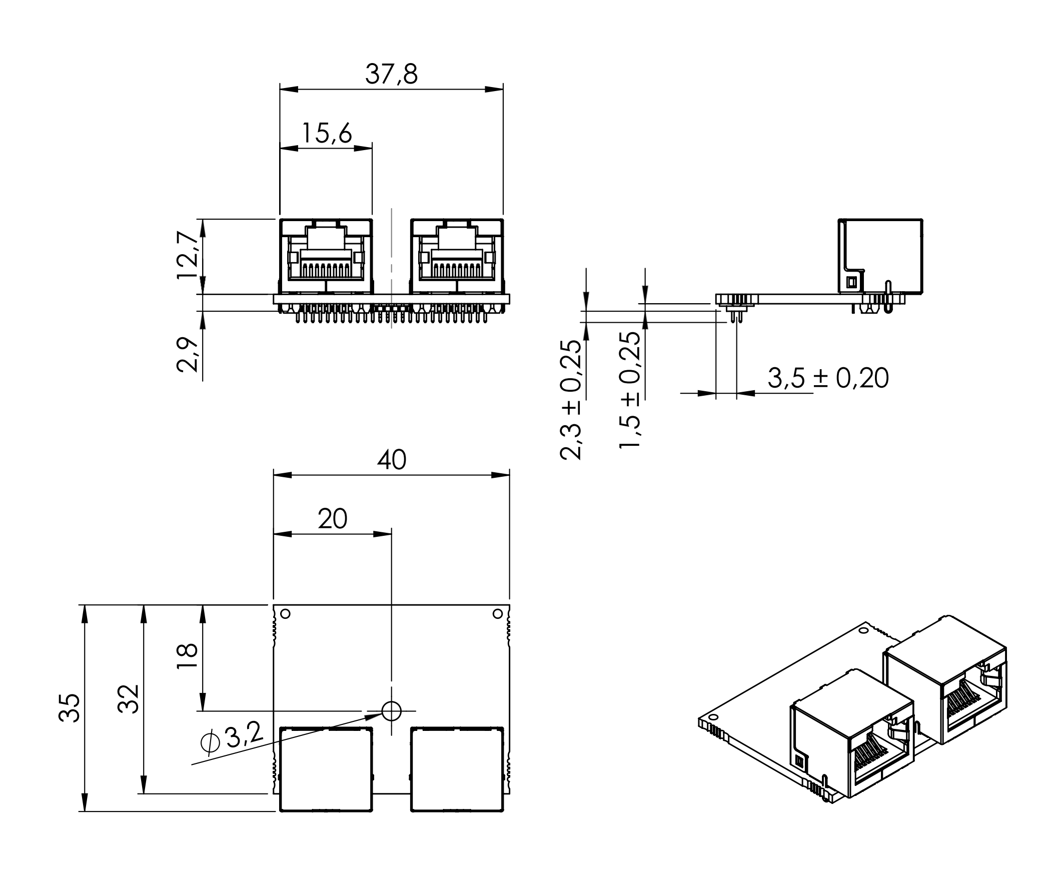

Fig. 16

A.4 Connector Board for Fiber Optic Ethernet

The connector board for the Fiber Optic Ethernet network interface carries two fibre optic transceivers.

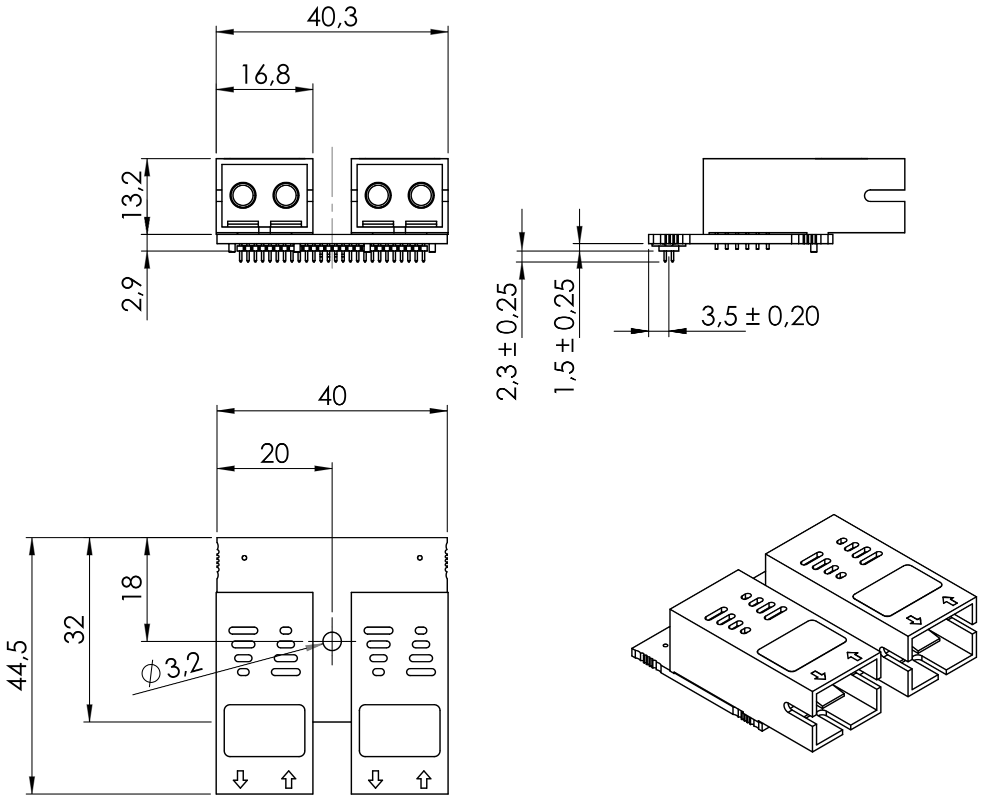

Fig. 17

A.5 Connector Board for CC-Link and DeviceNet

The connector board for the CC-Link and the DeviceNet network interfaces carry a pluggable screw terminal (5.08mm)

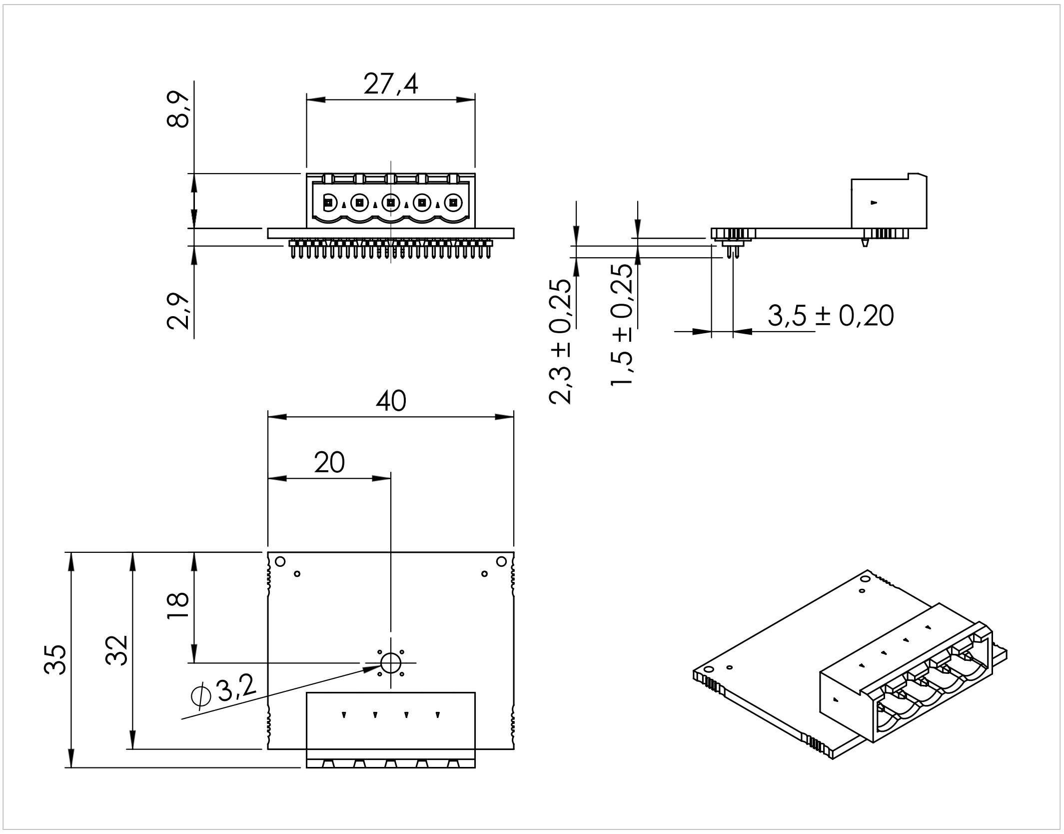

Fig. 18

A.6 Front Plate Restrictions

Customer applications that have a front plate with hole(s) for accessing the connector(s) of a connector board, must have the front plate placed at least 0.5 mm away from the connector board edge and must not reach further than 2.5 mm away from the connector board edge.

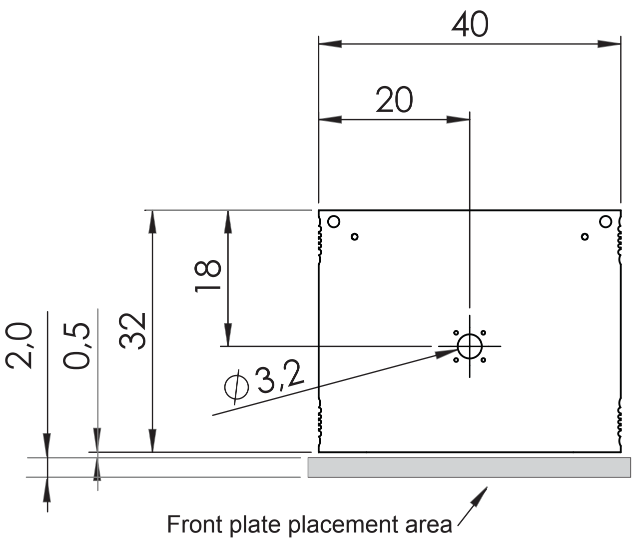

Fig. 19

B Technical Specification

B.1 Environmental

B.1.1 Operating

-40 to 85° C (-40 to 185° F)

B.1.2 Storage

-40 to 85°C (-40 to 185° F)

B.1.3 Humidity

5 to 95% non-condensing

B.2 Shock and Vibration

B.2.1 Shock

The Anybus CompactCom B40–1 is tested according to IEC 68–2–27

- half-sine 30 g, 11 ms, 3 positive and 3 negative shocks in each of three mutually perpendicular directions
- half-sine 50 g, 11 ms, 3 positive and 3 negative shocks in each of three mutually perpendicular directions

All Ethernet and fieldbus versions of the brick are tested for 30 g and 50 g.

Connector boards/interface cards are tested for 30 g.

B.2.2 Sinusoidal Vibration

The Anybus CompactCom B40–1 is tested according to IEC 68–2–6

Frequency range:	10–500 Hz
Amplitude 10–59 Hz:	0.35 mm
Acceleration 50–500 Hz	5 g
Sweep rate:	1 oct/min
	10 double sweep in each of the three mutually perpendicular directions

B.3 Electrical Characteristics

Operating Conditions

Symbol	Parameter	Pin Type	Max. (mA)
I_{OH} (NW_LEDx)	Output current, network LEDs	O	20

Anybus CompactCom 40

B.4 Regulatory Compliance

EMC Compliance (CE)

Since the Anybus CompactCom is considered a component for embedded applications it cannot be CE-marked as an end product.

However the Anybus CompactCom 40 family is pre-compliance tested in a typical installation providing that all modules are conforming to the EMC directive in this installation.

Once our customers end product has successfully passed the EMC test using any of the Anybus CompactCom B40–1 modules, our pre-compliance test concept allows any other interface in the product family to be embedded in that product without further EMC tests.

The EMC pre-testing has been conducted according to the following standards:

Emission: EN61000-6-4	EN55016-2-3 Radiated emission
	EN55022 Conducted emission
Immunity: EN61000-6-2	EN61000-4-2 Electrostatic discharge
	EN61000-4-3 Radiated immunity
	EN61000-4-4 Fast transients/burst
	EN61000-4-5 Surge immunity
	EN61000-4-6 Conducted immunity

Since all Anybus CompactCom B40–1 modules have been evaluated according to the EMC directive through above standards, this serves as a base for our customers when certifying Anybus CompactCom B40–1 based products.

C Design Examples

If the optional connector board is used, the signals from the network interface connector of the brick can be routed directly to the corresponding pins of the connector on the connector board. Section *C.2* shows an example PCB layout for this case.

This appendix also contains typical examples, of how to design the network interface, if the optional connector board is not to be used.

- *Ethernet Network Interface (Copper), p. 38*. All bricks for 100 Mb/s Ethernet based protocols, running on copper wire, use the same hardware.
- *Ethernet Network Interface (Fiber Optic), p. 39*
- *PROFIBUS Network Interface, p. 40*
- *DeviceNet Network Interface, p. 41*
- *CC-Link Network Interface, p. 42*

C.1 Recommendations

- The longer the distance between the Brick and the Connector board, the more important it is that single-ended signals as well as signal pairs are separated to maintain good signal integrity.
- All conductors should have a tighter coupling to a continuous ground plane than to any adjacent conductor (even to the partner signal of a signal pair). All signal pairs should have a differential impedance of 100 Ω ±10%.

  It is not recommended to separate network circuitry, e.g. Connector board, and Brick more than 400 mm. The distance should be kept shorter if the signals are adjacent to other interfering circuitry. Radiated interference from the signals between the Connector board and Brick may need to be taken care of by e.g. a metallic housing or encapsulating PCB copper planes if the routing distance is long.
- To avoid B40-1 connector pins penetrating the solder mask under the headers on the carrier board, thus creating short circuits, the following is recommended:
  - either use headers that are higher than 2.5 mm,
  - or do not design any vias or traces on top side of the PCB, where there is any risk for short circuits.

C.2 Example PCB Layout

This layout is suitable for a 4-layer board (1.6 mm) with layer stackup as indicated:

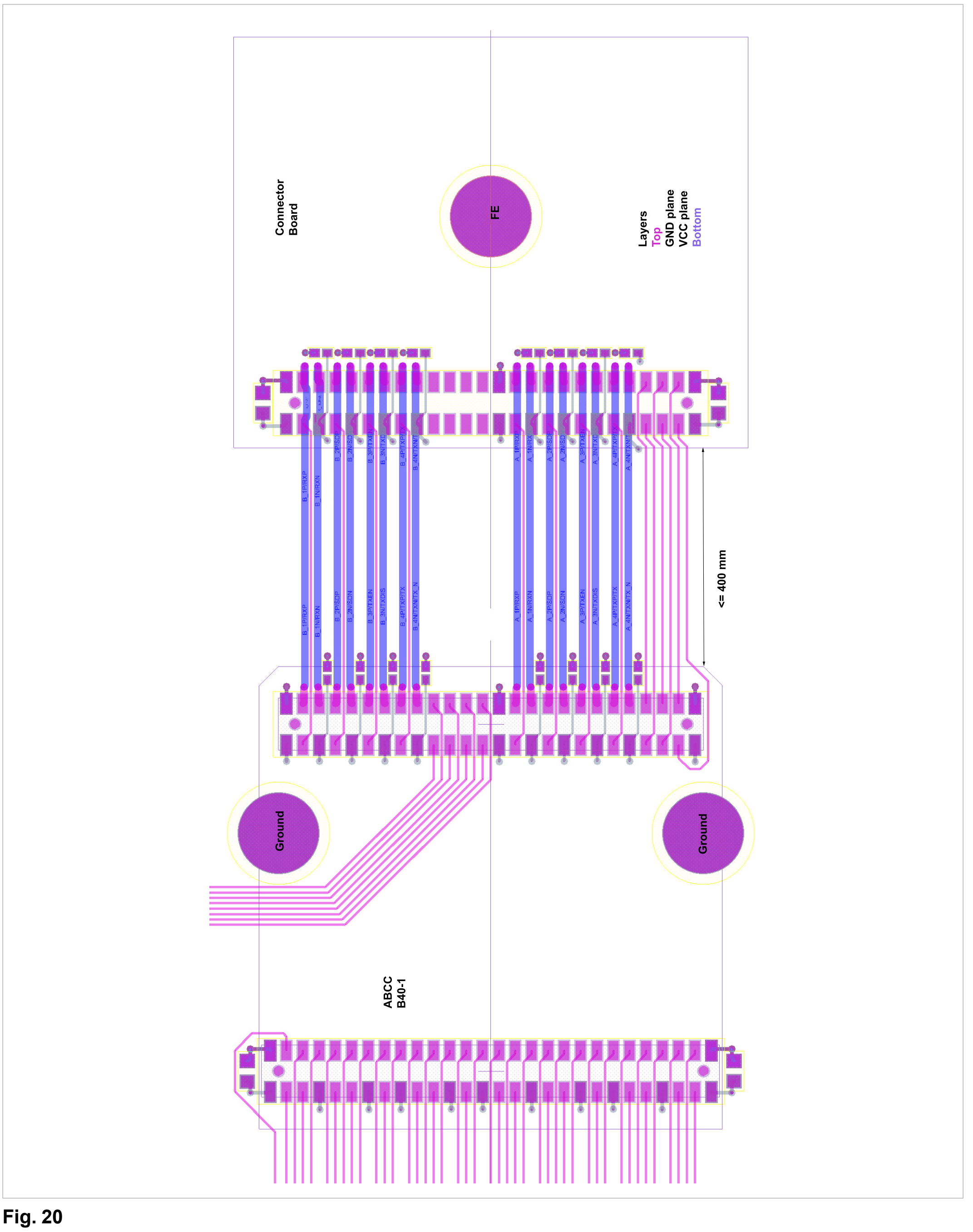

Fig. 20

If the pin headers are less than or equal to 2.6 mm tall, the footprint in the picture below is suggested for the headers, with via/route keepouts in between the pads. If the pin headers are higher no keepouts are needed.

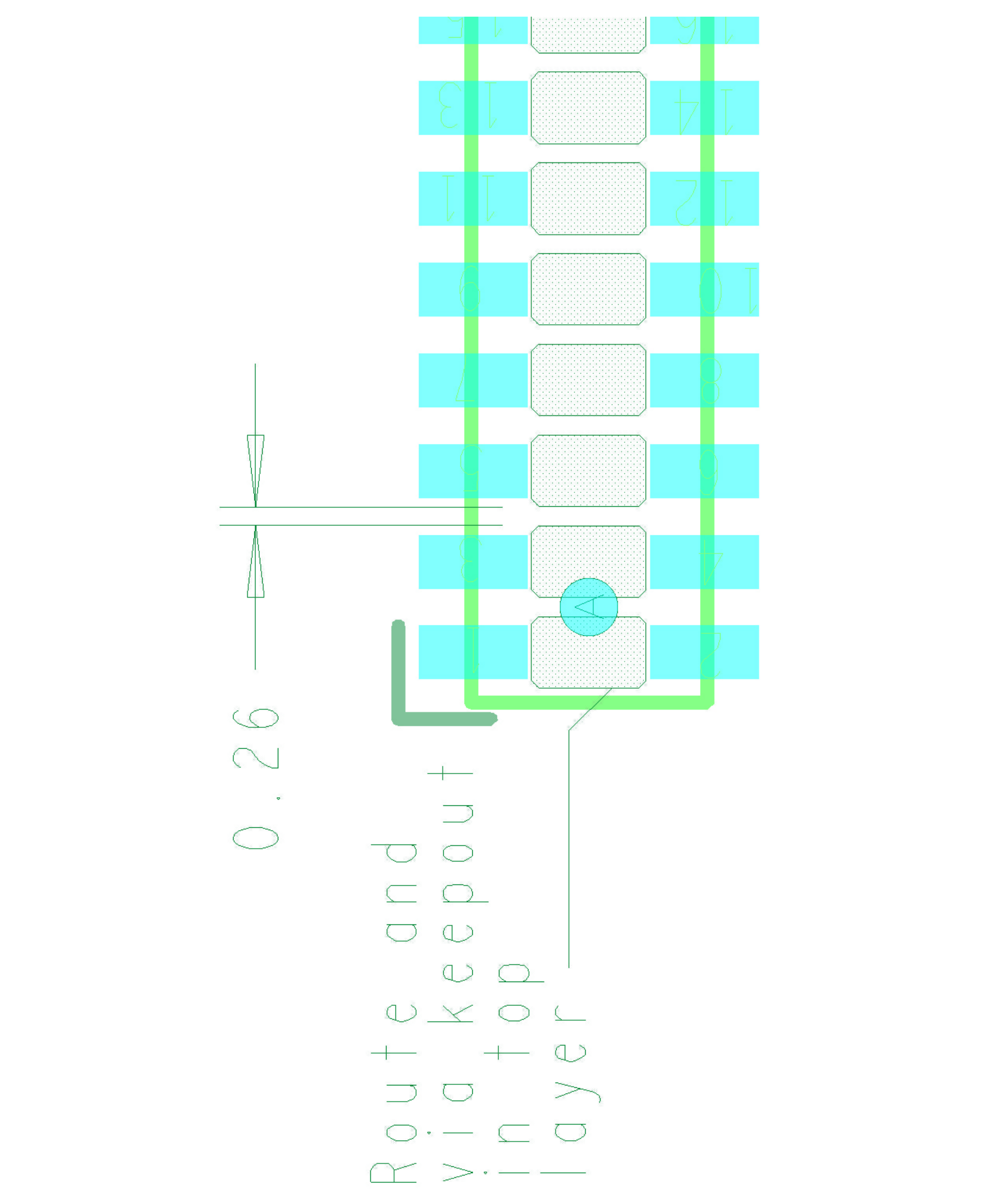

Fig. 21

C.3 Ethernet Network Interface (Copper)

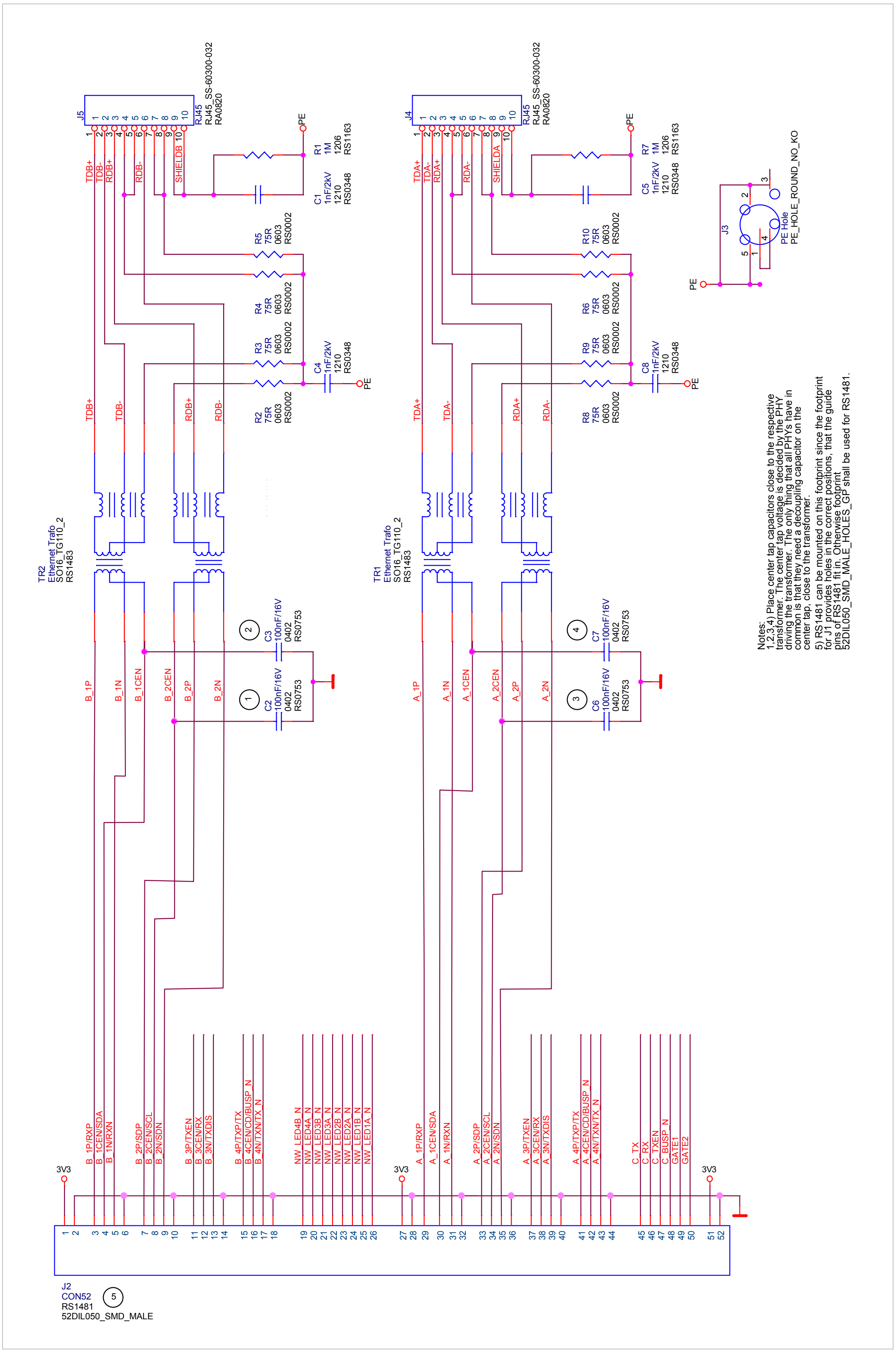

Fig. 22

C.4 Ethernet Network Interface (Fiber Optic)

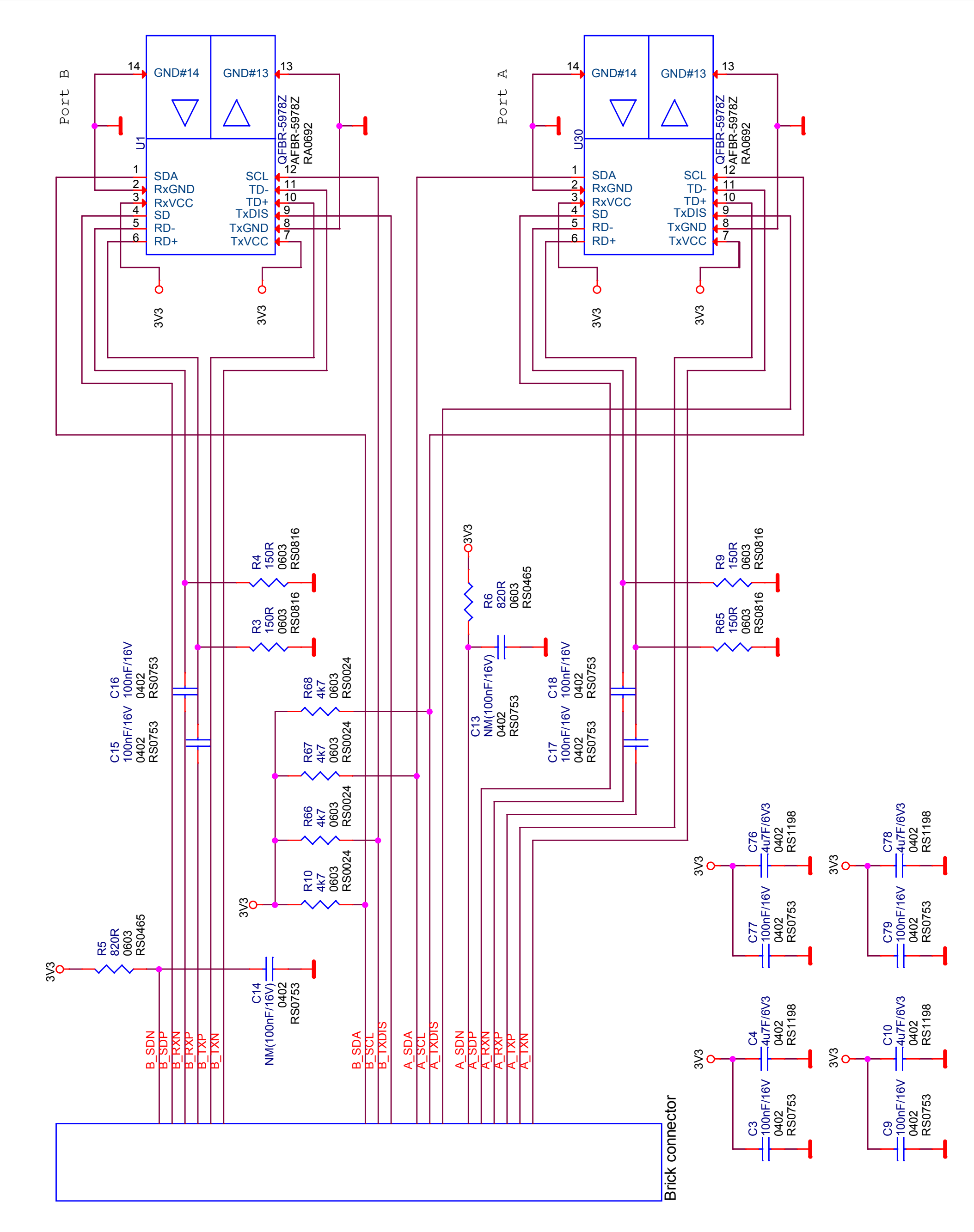

Fig. 23

C.5 PROFIBUS Network Interface

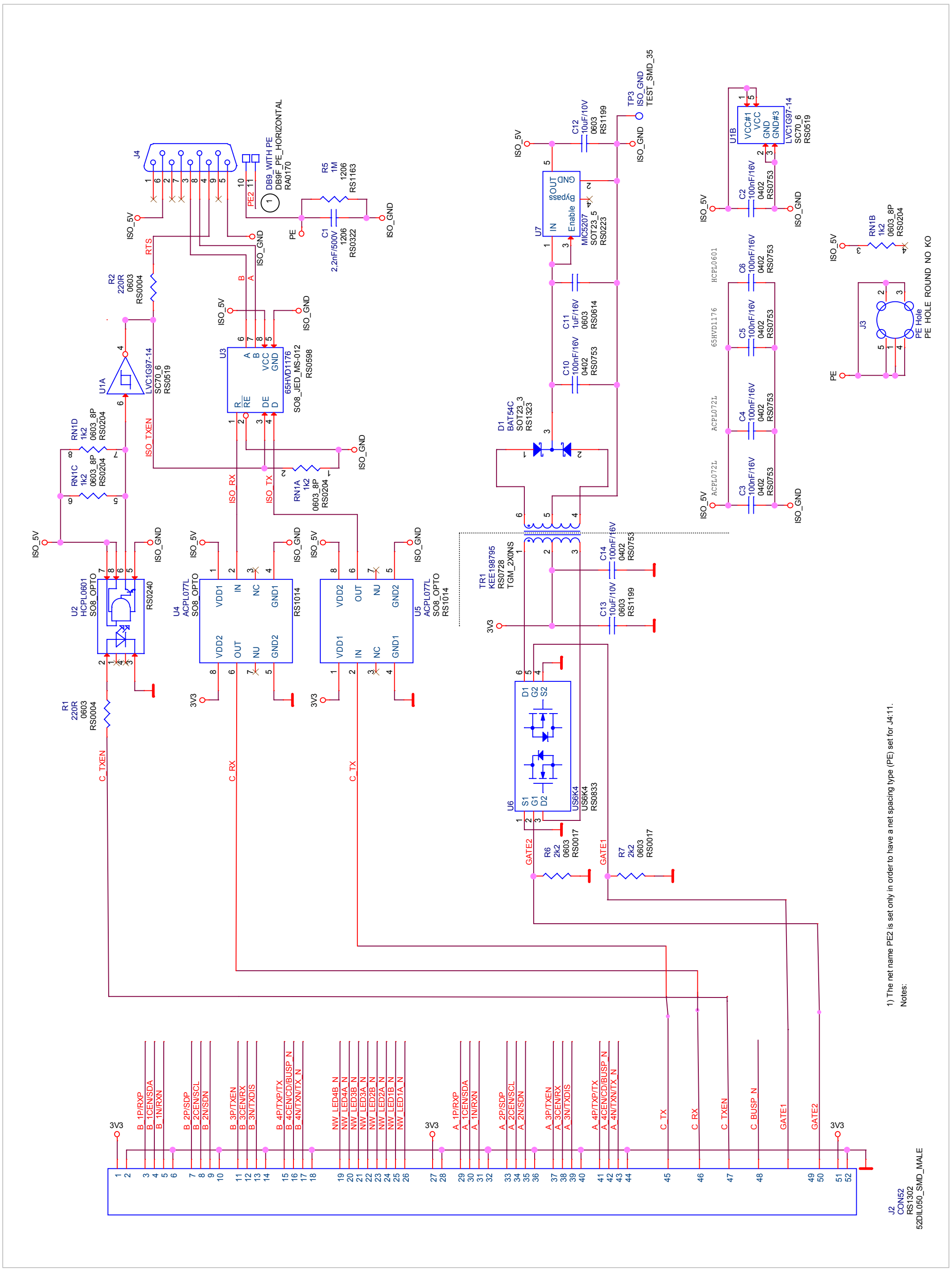

Fig. 24

C.6 DeviceNet Network Interface

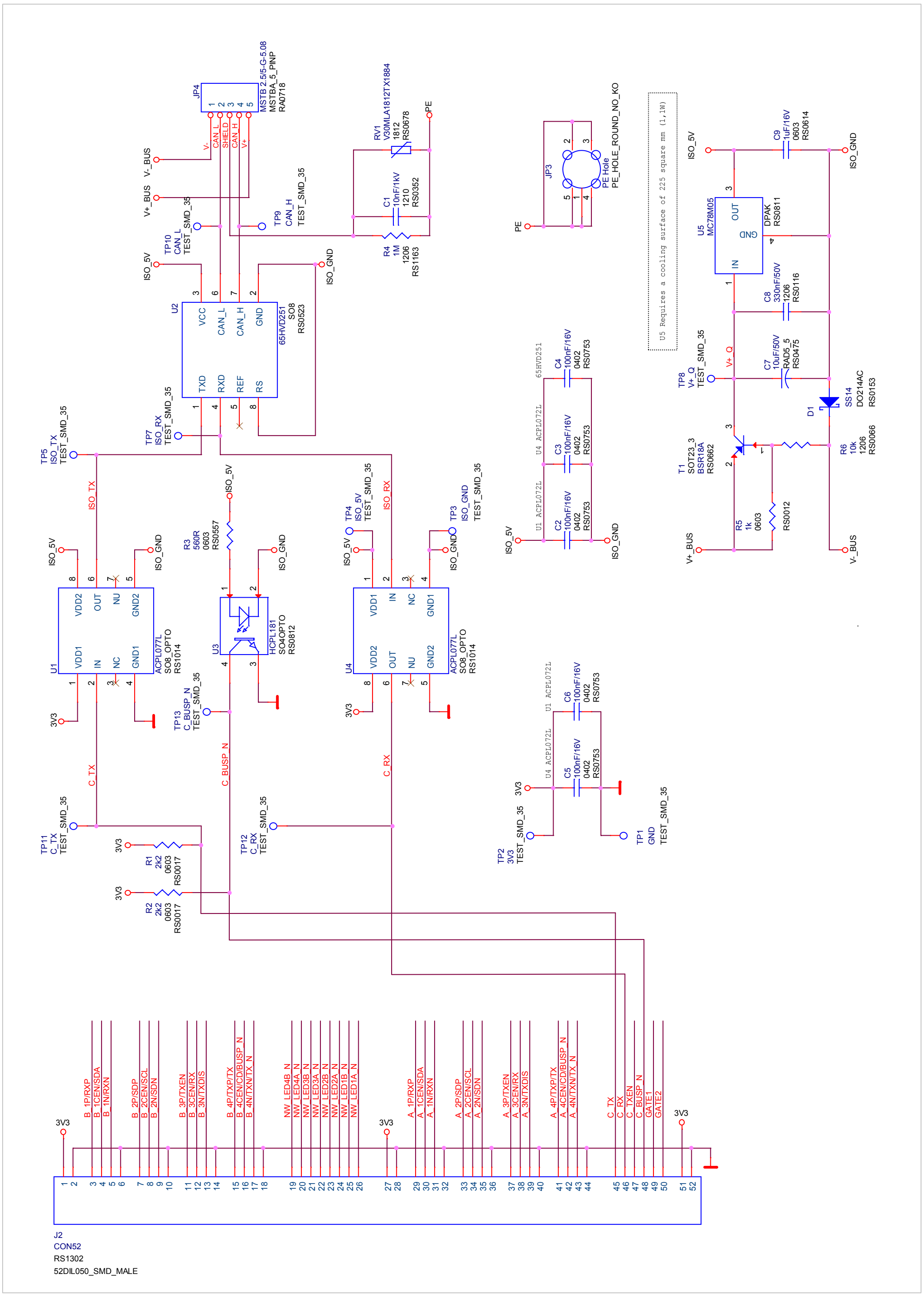

Fig. 25

C.7 CC-Link Network Interface

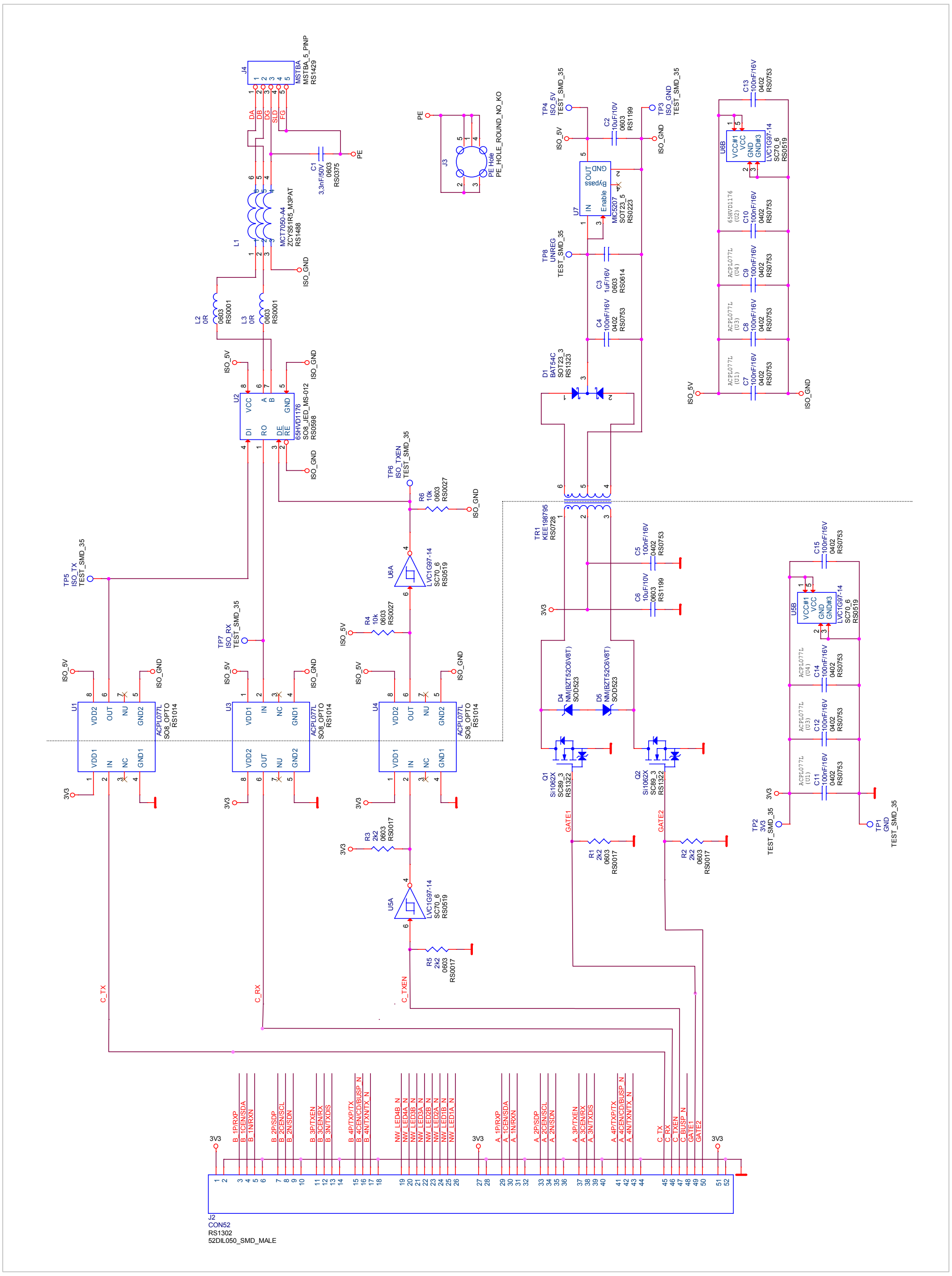

Fig. 26

D How to Disable Ethernet Port 2 (EtherNet/IP)

It is possible to disable Ethernet Port 2 on the Anybus CompactCom B40–1 EtherNet/IP.

- Do not connect signal group B
- Do not connect signals LED4A/B

For descriptions of signals see:

- *Network Connector Pin Overview, p. 20*
- *Ethernet Based Networks (Copper), p. 22*
- *LED Indicators, p. 26*
- *Ethernet Based Networks (Copper), p. 22*